

*Supplement to*  
Version 8 of IMK/IAA MIPAS reactive nitrogen reservoir gases:  
Error estimates for N<sub>2</sub>O<sub>5</sub>

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July 28, 2026

In this document we present:

1. the definitions of the representative atmospheres used for the calculation of error budgets (Tab. S1).
2. the quantities which enter the error estimation calculations (Tabs. S2–S4).
3. the collection of the respective error budgets for FR data (2002–2004), which are listed in tables S5–S38 and depicted in figures S1–S34, and the respective error budgets for RR data (2005–2012), which are listed in tables S39–S72 and depicted in figures S35–S68 for the nominal observation mode, and shown in figures S73–S106 and listed in tables S73–S106 for the middle atmosphere observation mode.

The errors are presented as relative errors in percent, even if they are of additive nature, i.e., do not scale with the retrieved volume mixing ratio. They were calculated with respect to the average dinitrogen pentoxide profile that was calculated from the single geolocations which contribute to the respective representative atmospheres.

Table S1: Labels and definitions of the representative atmospheric conditions which were used to calculate the error budget for FR and RR nominal measurement mode data ( $\beta_{\max} = 95^\circ$ ) and RR middle atmosphere measurement mode data ( $\beta_{\max} = 98^\circ$ ).

| representative atmosphere label   | month(s) used | latitude range | solar zenith angle range |
|-----------------------------------|---------------|----------------|--------------------------|
| Northern polar winter day         | Jan, Feb      | 65° N – 90° N  | < 90°                    |
| Northern polar winter night       | Jan, Feb      | 65° N – 90° N  | > $\beta_{\max}$         |
| Northern polar spring day         | Apr           | 65° N – 90° N  | < 90°                    |
| Northern polar spring night       | Apr           | 65° N – 90° N  | > $\beta_{\max}$         |
| Northern polar summer day         | Jul, Aug      | 65° N – 90° N  | < 90°                    |
| Northern polar summer night       | Jul, Aug      | 65° N – 90° N  | > $\beta_{\max}$         |
| Northern polar autumn day         | Oct           | 65° N – 90° N  | < 90°                    |
| Northern polar autumn night       | Oct           | 65° N – 90° N  | > $\beta_{\max}$         |
| Northern midlatitude winter day   | Jan, Feb      | 40° N – 60° N  | < 90°                    |
| Northern midlatitude winter night | Jan, Feb      | 40° N – 60° N  | > $\beta_{\max}$         |
| Northern midlatitude spring day   | Apr           | 40° N – 60° N  | < 90°                    |
| Northern midlatitude spring night | Apr           | 40° N – 60° N  | > $\beta_{\max}$         |
| Northern midlatitude summer day   | Jul, Aug      | 40° N – 60° N  | < 90°                    |
| Northern midlatitude summer night | Jul, Aug      | 40° N – 60° N  | > $\beta_{\max}$         |
| Northern midlatitude autumn day   | Oct           | 40° N – 60° N  | < 90°                    |
| Northern midlatitude autumn night | Oct           | 40° N – 60° N  | > $\beta_{\max}$         |
| Tropics day                       | Apr           | 20° S – 20° N  | < 90°                    |
| Tropics night                     | Apr           | 20° S – 20° N  | > $\beta_{\max}$         |
| Southern midlatitude winter day   | Jul, Aug      | 40° S – 60° S  | < 90°                    |
| Southern midlatitude winter night | Jul, Aug      | 40° S – 60° S  | > $\beta_{\max}$         |
| Southern midlatitude spring day   | Oct           | 40° S – 60° S  | < 90°                    |
| Southern midlatitude spring night | Oct           | 40° S – 60° S  | > $\beta_{\max}$         |
| Southern midlatitude summer day   | Jan, Feb      | 40° S – 60° S  | < 90°                    |
| Southern midlatitude summer night | Jan, Feb      | 40° S – 60° S  | > $\beta_{\max}$         |
| Southern midlatitude autumn day   | Apr           | 40° S – 60° S  | < 90°                    |
| Southern midlatitude autumn night | Apr           | 40° S – 60° S  | > $\beta_{\max}$         |
| Southern polar winter day         | Jul, Aug      | 65° S – 90° S  | < 90°                    |
| Southern polar winter night       | Jul, Aug      | 65° S – 90° S  | > $\beta_{\max}$         |
| Southern polar spring day         | Oct           | 65° S – 90° S  | < 90°                    |
| Southern polar spring night       | Oct           | 65° S – 90° S  | > $\beta_{\max}$         |
| Southern polar summer day         | Jan, Feb      | 65° S – 90° S  | < 90°                    |
| Southern polar summer night       | Jan, Feb      | 65° S – 90° S  | > $\beta_{\max}$         |
| Southern polar autumn day         | Apr           | 65° S – 90° S  | < 90°                    |
| Southern polar autumn night       | Apr           | 65° S – 90° S  | > $\beta_{\max}$         |

In the following three tables S2–S4 we summarize the ingoing errors for the retrievals of  $\text{N}_2\text{O}_5$  in the FR NOM, RR NOM, and RR MA observation modes, respectively. In cases where no preceding retrievals in the MA observation mode were available for interfering gases (neither V5 nor V8), we used the uncertainties of the climatological database (Kiefer et al., 2002) for calculations of the error budgets.

Table S2: Assumed  $1\sigma$  uncertainties affecting the retrieval of  $\text{N}_2\text{O}_5$  (FR NOM)

| Type of Uncertainty                                 | Value / typical value <sup>1</sup>            | Source <sup>2</sup>                          | Propagation Method <sup>3</sup> |
|-----------------------------------------------------|-----------------------------------------------|----------------------------------------------|---------------------------------|
| noise (B band)                                      | 16 nW/(cm <sup>2</sup> sr cm <sup>-1</sup> )  | Kleinert et al. (2018)                       | G(16)                           |
| offset (B band)                                     | 2.5 nW/(cm <sup>2</sup> sr cm <sup>-1</sup> ) | Kleinert et al. (2018)                       | G(5;13)                         |
| gain random (B band)                                | 0.21%                                         | Kleinert et al. (2018)                       | P(21;23)                        |
| gain systematic (B band)                            | 1.03%                                         | Kleinert et al. (2018)                       | P(21;23)                        |
| spectral shift                                      | 0.00029 cm <sup>-1</sup>                      | preceding V8 retrieval (Kiefer et al., 2021) | P(7)                            |
| ILS                                                 | 3%                                            | Hase (2000, 2003)                            | P(7;14;15)                      |
| Temp., noise                                        | 0.24 - 1.04 K                                 | preceding V8 retrieval (Kiefer et al., 2021) | G(6)                            |
| Tang. alt., noise                                   | 35 - 79 m                                     | preceding V8 retrieval (Kiefer et al., 2021) | G(6)                            |
| Temp., spectral shift                               | 0.01 - 0.71 K                                 | preceding V8 retrieval (Kiefer et al., 2021) | P(17)                           |
| Tang. alt., spectral shift                          | 2 - 41 m                                      | preceding V8 retrieval (Kiefer et al., 2021) | P(17)                           |
| Temp., offset                                       | 0.05 - 0.39 K                                 | preceding V8 retrieval (Kiefer et al., 2021) | P(7)                            |
| Tang. alt., offset                                  | 8 - 24 m                                      | preceding V8 retrieval (Kiefer et al., 2021) | P(7)                            |
| Temp., ILS                                          | 0.03 - 1.26 K                                 | preceding V8 retrieval (Kiefer et al., 2021) | P(7)                            |
| Tang. alt., ILS                                     | 7 - 122 m                                     | preceding V8 retrieval (Kiefer et al., 2021) | P(7)                            |
| Temp., CO <sub>2</sub> intensities                  | 0.03 - 0.16 K                                 | preceding V8 retrieval (Kiefer et al., 2021) | P(7;26;27)                      |
| Tang. alt., CO <sub>2</sub> intensities             | 24 - 35 m                                     | preceding V8 retrieval (Kiefer et al., 2021) | P(7;26;27)                      |
| Temp., CO <sub>2</sub> broadening                   | 0.09 - 1.10 K                                 | preceding V8 retrieval (Kiefer et al., 2021) | P(7;28;29)                      |
| Tang. alt., CO <sub>2</sub> broadening              | 189 - 298 m                                   | preceding V8 retrieval (Kiefer et al., 2021) | P(7;28;29)                      |
| Temp., gain, syst.                                  | 0.30 - 0.79 K                                 | preceding V8 retrieval (Kiefer et al., 2021) | P(19)                           |
| Tang. alt., gain, syst.                             | 2 - 51 m                                      | preceding V8 retrieval (Kiefer et al., 2021) | P(19)                           |
| Temp., gain, random                                 | 0.05 - 0.15 K                                 | preceding V8 retrieval (Kiefer et al., 2021) | P(19)                           |
| Tang. alt., gain, random                            | 0.4 - 9 m                                     | preceding V8 retrieval (Kiefer et al., 2021) | P(19)                           |
| vmr(C <sub>2</sub> H <sub>2</sub> )                 | 2.98E-06 - 1.01E-05 ppmv                      | V5 retrieval (Glatthor et al., 2007)         | G(6)                            |
| vmr(CH <sub>3</sub> COOH)                           | 1.00E-24 - 2.01E-04 ppmv                      | database (Kiefer et al., 2002)               | P(7;11)                         |
| vmr(ClONO <sub>2</sub> )                            | 9.85E-06 - 8.20E-05 ppmv                      | preceding V8 retrieval (this paper)          | G(6)                            |
| vmr(COF <sub>2</sub> )                              | 7.02E-07 - 3.70E-05 ppmv                      | V5 retrieval (unpublished data)              | G(6)                            |
| vmr(CO <sub>2</sub> )                               | 7.56E-01 - 7.51E+00 ppmv                      | WACCM model calc. (Kiefer et al., 2021)      | P(20)                           |
| vmr(H <sub>2</sub> O <sub>2</sub> )                 | 3.03E-06 - 1.12E-04 ppmv                      | database (Kiefer et al., 2002)               | P(7;11)                         |
| vmr(HNO <sub>3</sub> )                              | 6.18E-05 - 4.78E-04 ppmv                      | preceding V8 retrieval (this paper)          | G(6)                            |
| vmr(HOCl)                                           | 2.12E-06 - 7.27E-05 ppmv                      | database (Kiefer et al., 2002)               | P(7;11)                         |
| vmr(NH <sub>3</sub> )                               | 7.18E-12 - 3.75E-05 ppmv                      | database (Kiefer et al., 2002)               | P(7;11)                         |
| vmr(NO <sub>2</sub> )                               | 3.09E-07 - 2.27E-04 ppmv                      | preceding V8 retrieval (Funke et al., 2026)  | G(6)                            |
| vmr(O <sub>3</sub> )                                | 3.13E-02 - 1.42E-01 ppmv                      | preceding V8 retrieval (Kiefer et al., 2023) | G(6)                            |
| vmr(SO <sub>2</sub> )                               | 5.84E-05 - 3.99E-04 ppmv                      | V5 retrieval (Höpfner et al., 2015)          | G(6)                            |
| vmr(acetone)                                        | 4.32E-07 - 8.48E-05 ppmv                      | V5 retrieval (unpublished data)              | G(6)                            |
| vmr(CF <sub>4</sub> )                               | 5.51E-06 - 1.33E-05 ppmv                      | database (Kiefer et al., 2002)               | P(7;11)                         |
| vmr(CFC-113)                                        | 2.17E-07 - 1.21E-05 ppmv                      | V5 retrieval (unpublished data)              | G(6)                            |
| spectroscopic data (N <sub>2</sub> O <sub>5</sub> ) | 5%                                            | Wagner and Birk (2003)                       | P(7)                            |

<sup>1</sup> For variable uncertainties typical values are reported. Some errors in Kleinert et al. (2018) are given in terms of  $2\sigma$ ; we have re-scaled them to  $1\sigma$ . <sup>2</sup> In some cases V5 data were used of which no journal publication is available. In these cases, reference to an earlier data version is made. <sup>3</sup> Temperature and tangent altitude errors due to noise, spectral shift, and offset are propagated separately. The notation is as follows: “G” refers to generalized Gaussian error propagation in a matrix formalism, while “P” refers to perturbation studies. The numbers in parentheses are the respective equation numbers in von Clarmann et al. (2022).

Table S3: Assumed  $1\sigma$  uncertainties affecting the retrieval of  $\text{N}_2\text{O}_5$  (RR NOM)

| Type of Uncertainty                                 | Value / typical value <sup>1</sup>             | Source <sup>2</sup>                          | Propagation Method <sup>3</sup> |
|-----------------------------------------------------|------------------------------------------------|----------------------------------------------|---------------------------------|
| noise (B band)                                      | 10 nW/(cm <sup>2</sup> sr cm <sup>-1</sup> )   | Kleinert et al. (2018)                       | G(16)                           |
| offset (B band)                                     | 1.5 nW/ (cm <sup>2</sup> sr cm <sup>-1</sup> ) | Kleinert et al. (2018)                       | G(5;13)                         |
| gain random (B band)                                | 0.21%                                          | Kleinert et al. (2018)                       | P(21;23)                        |
| gain systematic (B band)                            | 1.03%                                          | Kleinert et al. (2018)                       | P(21;23)                        |
| spectral shift                                      | 0.00029 cm <sup>-1</sup>                       | preceding V8 retrieval (Kiefer et al., 2021) | P(7)                            |
| ILS                                                 | 3%                                             | Hase (2000, 2003)                            | P(7;14;15)                      |
| Temp., noise                                        | 0.22 - 1.23 K                                  | preceding V8 retrieval (Kiefer et al., 2021) | G(6)                            |
| Tang. alt., noise                                   | 29 - 52 m                                      | preceding V8 retrieval (Kiefer et al., 2021) | G(6)                            |
| Temp., spectral shift                               | 0.01 - 0.10 K                                  | preceding V8 retrieval (Kiefer et al., 2021) | P(17)                           |
| Tang. alt., spectral shift                          | 1 - 15 m                                       | preceding V8 retrieval (Kiefer et al., 2021) | P(17)                           |
| Temp., offset                                       | 0.03 - 0.45 K                                  | preceding V8 retrieval (Kiefer et al., 2021) | P(7)                            |
| Tang. alt., offset                                  | 8 - 16 m                                       | preceding V8 retrieval (Kiefer et al., 2021) | P(7)                            |
| Temp., ILS                                          | 0.05 - 1.16 K                                  | preceding V8 retrieval (Kiefer et al., 2021) | P(7)                            |
| Tang. alt., ILS                                     | 8 - 113 m                                      | preceding V8 retrieval (Kiefer et al., 2021) | P(7)                            |
| Temp., CO <sub>2</sub> intensities                  | 0.03 - 0.18 K                                  | preceding V8 retrieval (Kiefer et al., 2021) | P(7;26;27)                      |
| Tang. alt., CO <sub>2</sub> intensities             | 26 - 34 m                                      | preceding V8 retrieval (Kiefer et al., 2021) | P(7;26;27)                      |
| Temp., CO <sub>2</sub> broadening                   | 0.14 - 1.47 K                                  | preceding V8 retrieval (Kiefer et al., 2021) | P(7;28;29)                      |
| Tang. alt., CO <sub>2</sub> broadening              | 198 - 252 m                                    | preceding V8 retrieval (Kiefer et al., 2021) | P(7;28;29)                      |
| Temp., gain, syst.                                  | 0.22 - 0.81 K                                  | preceding V8 retrieval (Kiefer et al., 2021) | P(19)                           |
| Tang. alt., gain, syst.                             | 1 - 49 m                                       | preceding V8 retrieval (Kiefer et al., 2021) | P(19)                           |
| Temp., gain, random                                 | 0.04 - 0.15 K                                  | preceding V8 retrieval (Kiefer et al., 2021) | P(19)                           |
| Tang. alt., gain, random                            | 0.2 - 9 m                                      | preceding V8 retrieval (Kiefer et al., 2021) | P(19)                           |
| vmr(C <sub>2</sub> H <sub>2</sub> )                 | 3.22E-06 - 9.55E-06 ppmv                       | V5 retrieval (Glatthor et al., 2007)         | G(6)                            |
| vmr(CH <sub>3</sub> COOH)                           | 1.00E-24 - 2.01E-04 ppmv                       | database (Kiefer et al., 2002)               | P(7;11)                         |
| vmr(ClONO <sub>2</sub> )                            | 9.99E-06 - 8.28E-05 ppmv                       | preceding V8 retrieval (this paper)          | G(6)                            |
| vmr(COF <sub>2</sub> )                              | 7.02E-07 - 3.79E-04 ppmv                       | V5 FR climatology (unpublished data)         | G(6)                            |
| vmr(CO <sub>2</sub> )                               | 7.56E-01 - 7.51E+00 ppmv                       | WACCM model calc. (Kiefer et al., 2021)      | P(20)                           |
| vmr(H <sub>2</sub> O <sub>2</sub> )                 | 3.03E-06 - 1.12E-04 ppmv                       | database (Kiefer et al., 2002)               | P(7;11)                         |
| vmr(HNO <sub>3</sub> )                              | 5.54E-05 - 4.51E-04 ppmv                       | preceding V8 retrieval (this paper)          | G(6)                            |
| vmr(HOCl)                                           | 2.12E-06 - 7.27E-05 ppmv                       | database (Kiefer et al., 2002)               | P(7;11)                         |
| vmr(NH <sub>3</sub> )                               | 7.18E-12 - 3.75E-05 ppmv                       | database (Kiefer et al., 2002)               | P(7;11)                         |
| vmr(NO <sub>2</sub> )                               | 2.03E-07 - 2.88E-04 ppmv                       | preceding V8 retrieval (Funke et al., 2026)  | G(6)                            |
| vmr(O <sub>3</sub> )                                | 2.48E-02 - 8.52E-02 ppmv                       | preceding V8 retrieval (Kiefer et al., 2023) | G(6)                            |
| vmr(SO <sub>2</sub> )                               | 5.95E-05 - 4.24E-04 ppmv                       | V5 retrieval (Höpfner et al., 2015)          | G(6)                            |
| vmr(acetone)                                        | 5.01E-07 - 8.07E-05 ppmv                       | V5 retrieval (unpublished data)              | G(6)                            |
| vmr(CF <sub>4</sub> )                               | 5.51E-06 - 1.33E-05 ppmv                       | database (Kiefer et al., 2002)               | P(7;11)                         |
| vmr(CFC-113)                                        | 2.26E-07 - 1.14E-05 ppmv                       | V5 retrieval (unpublished data)              | G(6)                            |
| spectroscopic data (N <sub>2</sub> O <sub>5</sub> ) | 5%                                             | Wagner and Birk (2003)                       | P(7)                            |

<sup>1</sup> For variable uncertainties typical values are reported. Some errors in Kleinert et al. (2018) are given in terms of  $2\sigma$ ; we have re-scaled them to  $1\sigma$ . <sup>2</sup> In some cases V5 data were used of which no journal publication is available. In these cases, reference to an earlier data version is made. <sup>3</sup> Temperature and tangent altitude errors due to noise, spectral shift, and offset are propagated separately. The notation is as follows: “G” refers to generalized Gaussian error propagation in a matrix formalism, while “P” refers to perturbation studies. The numbers in parentheses are the respective equation numbers in von Clarmann et al. (2022).

Table S4: Assumed  $1\sigma$  uncertainties affecting the retrieval of  $\text{N}_2\text{O}_5$  (RR MA)

| Type of Uncertainty                                 | Value / typical value <sup>1</sup>             | Source <sup>2</sup>                                 | Propagation Method <sup>3</sup> |
|-----------------------------------------------------|------------------------------------------------|-----------------------------------------------------|---------------------------------|
| noise (B band)                                      | 10 nW/(cm <sup>2</sup> sr cm <sup>-1</sup> )   | Kleinert et al. (2018)                              | G(16)                           |
| offset (B band)                                     | 1.5 nW/ (cm <sup>2</sup> sr cm <sup>-1</sup> ) | Kleinert et al. (2018)                              | G(5;13)                         |
| gain random (B band)                                | 0.21%                                          | Kleinert et al. (2018)                              | P(21;23)                        |
| gain systematic (B band)                            | 1.03%                                          | Kleinert et al. (2018)                              | P(21;23)                        |
| spectral shift                                      | 0.00029 cm <sup>-1</sup>                       | preceding V8 retrieval (Kiefer et al., 2021)        | P(7)                            |
| ILS                                                 | 3%                                             | Hase (2000, 2003)                                   | P(7;14;15)                      |
| Temp., noise                                        | 0.22 - 2.24 K                                  | preceding V8 retrieval (Kiefer et al., 2021)        | G(6)                            |
| Tang. alt., noise                                   | 27 - 47 m                                      | preceding V8 retrieval (Kiefer et al., 2021)        | G(6)                            |
| Temp., spectral shift                               | 0.004 - 0.11 K                                 | preceding V8 retrieval (Kiefer et al., 2021)        | P(17)                           |
| Tang. alt., spectral shift                          | 0.4 - 14 m                                     | preceding V8 retrieval (Kiefer et al., 2021)        | P(17)                           |
| Temp., offset                                       | 0.05 - 0.72 K                                  | preceding V8 retrieval (Kiefer et al., 2021)        | P(7)                            |
| Tangent altitudes, offset                           | 1 - 16 m                                       | preceding V8 retrieval (Kiefer et al., 2021)        | P(7)                            |
| Temp., ILS                                          | 0.08 - 0.78 K                                  | preceding V8 retrieval (Kiefer et al., 2021)        | P(7)                            |
| Tang. alt., ILS                                     | 0.5 - 83 m                                     | preceding V8 retrieval (Kiefer et al., 2021)        | P(7)                            |
| Temp., CO <sub>2</sub> intensities                  | 0.02 - 0.12 K                                  | preceding V8 retrieval (Kiefer et al., 2021)        | P(7;26;27)                      |
| Tang. alt., CO <sub>2</sub> intensities             | 20 - 35 m                                      | preceding V8 retrieval (Kiefer et al., 2021)        | P(7;26;27)                      |
| Temp., CO <sub>2</sub> broadening                   | 0.08 - 1.17 K                                  | preceding V8 retrieval (Kiefer et al., 2021)        | P(7;28;29)                      |
| Tang. alt., CO <sub>2</sub> broadening              | 14 - 242 m                                     | preceding V8 retrieval (Kiefer et al., 2021)        | P(7;28;29)                      |
| Temp., gain, syst.                                  | 0.26 - 0.48 K                                  | preceding V8 retrieval (Kiefer et al., 2021)        | P(19)                           |
| Tang. alt., gain, syst.                             | 0.3 - 32 m                                     | preceding V8 retrieval (Kiefer et al., 2021)        | P(19)                           |
| Temp., gain, random                                 | 0.05 - 0.09 K                                  | preceding V8 retrieval (Kiefer et al., 2021)        | P(19)                           |
| Tang. alt., gain, random                            | 0.06 - 6 m                                     | preceding V8 retrieval (Kiefer et al., 2021)        | P(19)                           |
| vmr(C <sub>2</sub> H <sub>2</sub> )                 | 0.00E+00 - 8.34E-08 ppmv                       | database (Kiefer et al., 2002)                      | P(7;11)                         |
| vmr(CH <sub>3</sub> COOH)                           | 1.00E-24 - 1.66E-06 ppmv                       | database (Kiefer et al., 2002)                      | P(7;11)                         |
| vmr(ClONO <sub>2</sub> )                            | 1.12E-05 - 8.03E-05 ppmv                       | preceding V8 retrieval (this paper)                 | G(6)                            |
| vmr(COF <sub>2</sub> )                              | 7.02E-07 - 3.79E-04 ppmv                       | V5 FR climatology (unpublished data)                | P(7;11)                         |
| vmr(CO <sub>2</sub> )                               | 7.56E-01 - 7.51E+00 ppmv                       | WACCM model calc. (Kiefer et al., 2021)             | P(20)                           |
| vmr(H <sub>2</sub> O <sub>2</sub> )                 | 3.03E-06 - 5.01E-05 ppmv                       | database (Kiefer et al., 2002)                      | P(7;11)                         |
| vmr(HNO <sub>3</sub> )                              | 5.99E-05 - 4.23E-04 ppmv                       | preceding V8 retrieval (this paper)                 | G(6)                            |
| vmr(HOCl)                                           | 2.12E-06 - 7.11E-05 ppmv                       | database (Kiefer et al., 2002)                      | P(7;11)                         |
| vmr(NH <sub>3</sub> )                               | 7.18E-12 - 1.57E-05 ppmv                       | database (Kiefer et al., 2002)                      | P(7;11)                         |
| vmr(NO <sub>2</sub> )                               | 1.19E-05 - 2.29E-04 ppmv                       | preceding V8 retrieval (Funke et al., 2026)         | G(6)                            |
| vmr(O <sub>3</sub> )                                | 2.97E-02 - 9.09E-02 ppmv                       | preceding V8 retrieval (López-Puertas et al., 2023) | G(6)                            |
| vmr(SO <sub>2</sub> )                               | 1.28E-05 - 5.92E-04 ppmv                       | database (Kiefer et al., 2002)                      | P(7;11)                         |
| vmr(acetone)                                        | 1.00E-24 - 2.44E-06 ppmv                       | database (Kiefer et al., 2002)                      | P(7;11)                         |
| vmr(CF <sub>4</sub> )                               | 5.51E-06 - 1.33E-05 ppmv                       | database (Kiefer et al., 2002)                      | P(7;11)                         |
| vmr(CFC-113)                                        | 1.26E-10 - 7.79E-05 ppmv                       | database (Kiefer et al., 2002)                      | P(7;11)                         |
| spectroscopic data (N <sub>2</sub> O <sub>5</sub> ) | 5%                                             | Wagner and Birk (2003)                              | P(7)                            |

<sup>1</sup> For variable uncertainties typical values are reported. Some errors in Kleinert et al. (2018) are given in terms of  $2\sigma$ ; we have re-scaled them to  $1\sigma$ . <sup>2</sup> In some cases V5 data were used of which no journal publication is available. In these cases, reference to an earlier data version is made. <sup>3</sup> Temperature and tangent altitude errors due to noise, spectral shift, and offset are propagated separately. The notation is as follows: “G” refers to generalized Gaussian error propagation in a matrix formalism, while “P” refers to perturbation studies. The numbers in parentheses are the respective equation numbers in von Clarmann et al. (2022).

Table S5: N2O5 error budget for Northern polar winter day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 5                | -124.23               | 33.26         | 17.97      | 1.81         | 19.63         | 7.51        | 46.93          | 23.48        | 44.12        | 67.78         | 44.51       | 81.09        |
| 8                | 25.34                 | > 100         | 77.44      | 6.75         | 83.37         | 55.95       | > 100          | > 100        | > 100        | > 100         | 25.69       | > 100        |
| 11               | 78.85                 | 25.75         | 19.34      | 1.87         | 22.98         | 13.31       | 25.71          | 32.14        | 50.81        | 75.97         | 15.81       | 77.60        |
| 14               | 6.64                  | > 100         | > 100      | 16.22        | > 100         | 98.00       | > 100          | > 100        | > 100        | > 100         | 84.94       | > 100        |
| 17               | 20.93                 | 47.40         | 80.76      | 10.22        | 61.42         | 31.91       | > 100          | 70.23        | > 100        | > 100         | > 100       | > 100        |
| 20               | 102.50                | 9.31          | 9.76       | 1.57         | 11.37         | 4.78        | 23.25          | 10.24        | 26.97        | 38.18         | 15.85       | 41.34        |
| 23               | 426.33                | 2.81          | 1.19       | 0.57         | 2.82          | 1.26        | 9.92           | 2.31         | 7.28         | 10.61         | 7.95        | 13.26        |
| 26               | 993.58                | 1.46          | 1.01       | 0.21         | 1.33          | 0.43        | 6.82           | 1.13         | 3.80         | 6.08          | 5.52        | 8.21         |
| 29               | 1674.17               | 0.98          | 0.59       | 0.11         | 0.88          | 0.42        | 6.01           | 0.78         | 2.77         | 4.53          | 5.11        | 6.83         |
| 32               | 1987.02               | 0.91          | 0.77       | 0.14         | 0.74          | 0.48        | 6.82           | 0.70         | 2.77         | 4.11          | 6.33        | 7.54         |
| 35               | 1720.52               | 1.04          | 1.44       | 0.28         | 0.83          | 0.71        | 8.63           | 0.86         | 3.75         | 5.42          | 8.02        | 9.68         |
| 38               | 1246.24               | 1.52          | 1.66       | 0.34         | 1.19          | 0.73        | 9.47           | 1.02         | 6.16         | 7.57          | 8.85        | 11.65        |
| 41               | 813.08                | 2.63          | 1.99       | 0.26         | 2.14          | 0.55        | 10.50          | 1.08         | 10.43        | 12.02         | 9.57        | 15.36        |
| 44               | 504.39                | 4.39          | 2.72       | 0.25         | 7.34          | 0.58        | 12.12          | 1.36         | 19.81        | 22.54         | 10.69       | 24.95        |
| 47               | 255.90                | 8.03          | 4.53       | 0.60         | 24.65         | 1.86        | 16.64          | 2.30         | 48.53        | 55.87         | 14.56       | 57.74        |
| 50               | 120.63                | 15.30         | 10.58      | 1.43         | 75.04         | 8.04        | 26.77          | 5.23         | > 100        | > 100         | 24.22       | > 100        |
| 53               | 49.76                 | 32.64         | 31.03      | 3.48         | > 100         | 33.11       | 56.46          | 14.44        | > 100        | > 100         | 57.34       | > 100        |
| 56               | 28.46                 | 50.68         | 64.08      | 6.38         | > 100         | 74.37       | > 100          | 28.63        | > 100        | > 100         | > 100       | > 100        |
| 59               | -70.44                | 18.93         | 29.59      | 3.15         | > 100         | 35.65       | 38.84          | 13.25        | > 100        | > 100         | 49.66       | > 100        |
| 62               | -78.34                | 16.83         | 31.69      | 2.95         | > 100         | 52.00       | 38.75          | 14.74        | > 100        | > 100         | 56.33       | > 100        |
| 64               | -141.74               | 8.36          | 20.65      | 1.71         | > 100         | 31.18       | 26.30          | 9.68         | > 100        | > 100         | 39.77       | > 100        |

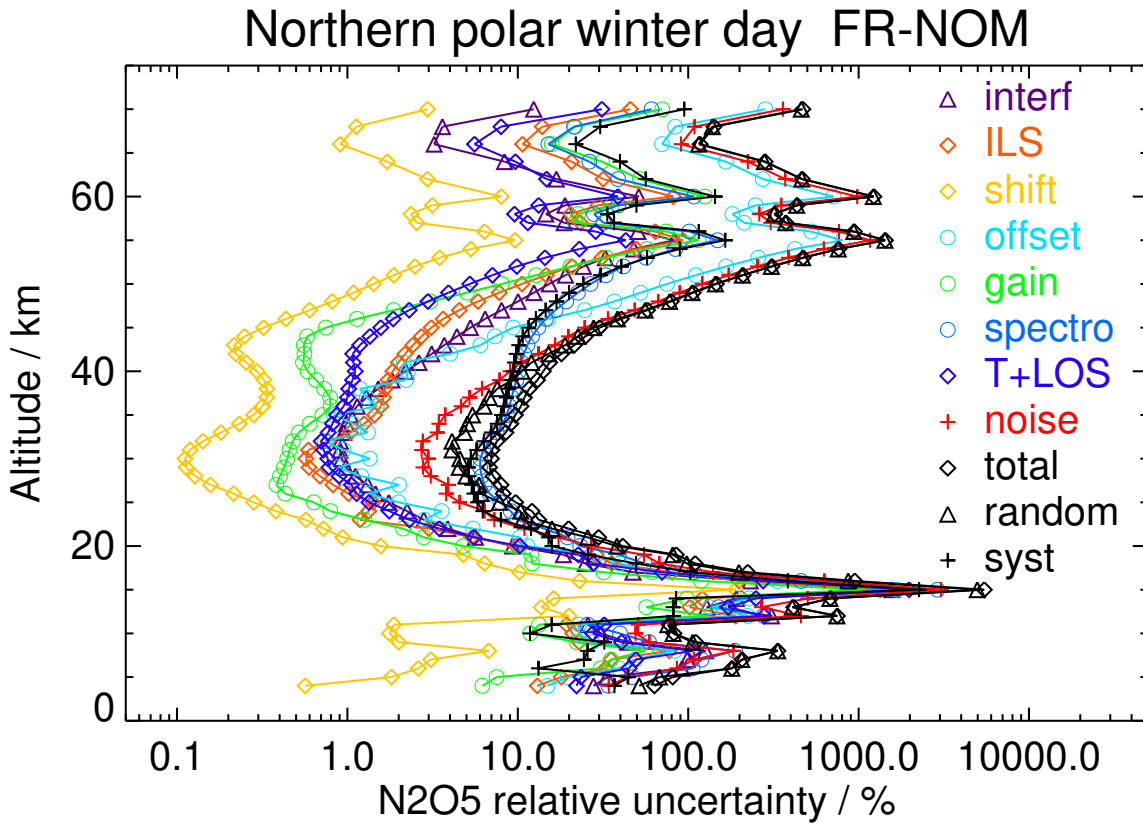


Figure S1: V8H.N2O5\_61 Northern polar winter day

Table S6: N2O5 error budget for Northern polar winter night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 5                | -103.46               | 39.34         | 26.62      | 2.15         | 26.41         | 17.19       | 64.92          | 30.00        | 60.31        | 88.80         | 64.18       | > 100        |
| 8                | 137.95                | 21.98         | 17.19      | 1.31         | 16.40         | 13.42       | 29.02          | 24.04        | 37.44        | 58.16         | 25.85       | 63.65        |
| 11               | 72.58                 | 35.47         | 32.94      | 1.34         | 25.49         | 20.14       | 35.40          | 38.13        | 57.71        | 94.24         | 23.60       | 97.15        |
| 14               | 11.61                 | 91.32         | > 100      | 9.55         | > 100         | 77.12       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 17               | 13.65                 | 84.25         | > 100      | 18.93        | 96.95         | 43.77       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 20               | 39.72                 | 25.37         | 20.16      | 3.09         | 25.82         | 8.87        | 48.98          | 31.81        | 75.18        | 95.86         | 40.97       | > 100        |
| 23               | 467.93                | 2.64          | 2.62       | 0.86         | 2.01          | 1.21        | 13.30          | 2.96         | 6.84         | 10.43         | 11.98       | 15.89        |
| 26               | 1438.58               | 1.03          | 1.16       | 0.27         | 0.68          | 0.28        | 6.27           | 1.03         | 2.60         | 4.84          | 5.17        | 7.08         |
| 29               | 2024.73               | 0.77          | 0.86       | 0.15         | 0.51          | 0.48        | 6.60           | 0.83         | 2.11         | 4.71          | 5.33        | 7.11         |
| 32               | 2202.79               | 0.75          | 0.74       | 0.12         | 0.48          | 0.67        | 7.36           | 0.68         | 2.20         | 4.89          | 6.12        | 7.83         |
| 35               | 1826.28               | 0.89          | 1.55       | 0.19         | 0.66          | 0.87        | 9.35           | 0.93         | 3.10         | 6.47          | 7.77        | 10.12        |
| 38               | 1150.04               | 1.45          | 1.81       | 0.37         | 1.01          | 0.97        | 9.88           | 1.20         | 5.91         | 7.84          | 8.95        | 11.90        |
| 41               | 646.48                | 2.90          | 1.81       | 0.37         | 2.13          | 0.81        | 10.20          | 1.31         | 11.84        | 13.21         | 9.40        | 16.22        |
| 44               | 320.75                | 6.20          | 2.96       | 0.40         | 10.74         | 0.84        | 12.80          | 1.74         | 29.10        | 32.40         | 11.29       | 34.31        |
| 47               | 176.78                | 10.55         | 4.12       | 0.78         | 29.92         | 1.57        | 15.27          | 2.53         | 64.12        | 72.21         | 12.80       | 73.34        |
| 50               | 84.43                 | 20.09         | 8.82       | 1.57         | 93.83         | 7.50        | 23.83          | 5.60         | > 100        | > 100         | 19.74       | > 100        |
| 53               | 28.70                 | 53.33         | 32.20      | 4.55         | > 100         | 46.85       | 63.06          | 20.19        | > 100        | > 100         | 60.38       | > 100        |
| 56               | 0.36                  | > 100         | > 100      | > 100        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 59               | 125.23                | 11.94         | 11.14      | 1.12         | > 100         | 9.63        | 17.40          | 7.43         | > 100        | > 100         | 19.93       | > 100        |
| 62               | 1.54                  | > 100         | > 100      | > 100        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 64               | 166.97                | 8.07          | 8.68       | 0.75         | > 100         | 13.11       | 13.88          | 6.06         | > 100        | > 100         | 18.64       | > 100        |

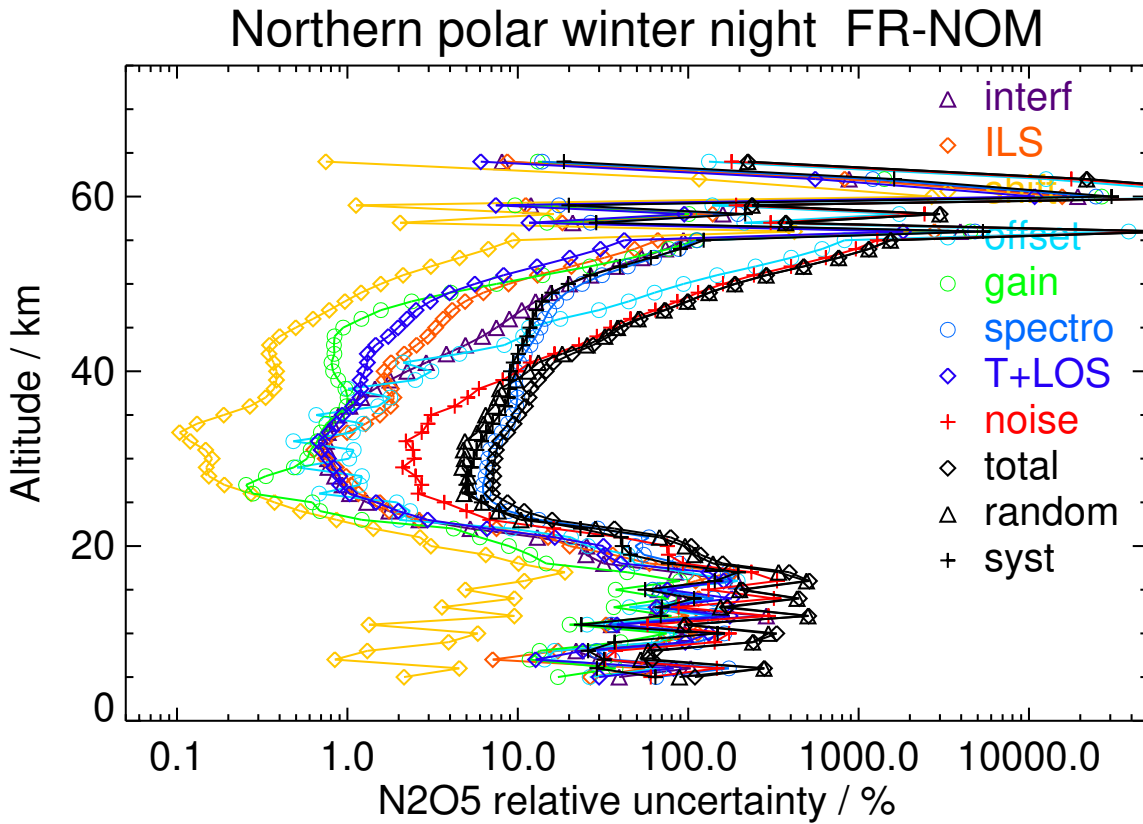


Figure S2: V8H\_N2O5.61 Northern polar winter night

Table S7: N2O5 error budget for Northern polar spring day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 68.31                 | 35.83         | 23.40      | 1.75         | 20.82         | 24.59       | 59.33          | 39.13        | 46.27        | 89.09         | 46.11       | > 100        |
| 11               | -31.27                | 52.75         | 45.68      | 4.03         | 43.67         | 19.49       | 67.29          | 57.27        | 95.59        | > 100         | 41.77       | > 100        |
| 14               | 20.47                 | 45.79         | 64.40      | 8.27         | 61.79         | 50.47       | > 100          | 87.98        | > 100        | > 100         | > 100       | > 100        |
| 17               | 80.08                 | 10.80         | 15.89      | 1.93         | 16.08         | 4.48        | 24.06          | 11.29        | 28.29        | 40.47         | 22.81       | 46.45        |
| 20               | 113.97                | 7.66          | 5.67       | 0.73         | 12.99         | 1.47        | 14.07          | 4.67         | 21.29        | 29.64         | 7.53        | 30.59        |
| 23               | 199.77                | 5.37          | 1.74       | 0.39         | 8.88          | 0.76        | 8.85           | 2.05         | 14.91        | 19.72         | 5.24        | 20.40        |
| 26               | 238.70                | 5.46          | 1.45       | 0.30         | 8.90          | 0.78        | 7.99           | 1.20         | 15.75        | 19.96         | 5.19        | 20.62        |
| 29               | 224.07                | 6.27          | 1.68       | 0.34         | 10.83         | 1.16        | 10.00          | 1.17         | 20.29        | 25.27         | 5.92        | 25.96        |
| 32               | 154.20                | 10.24         | 4.03       | 0.40         | 17.16         | 1.71        | 15.52          | 1.60         | 34.52        | 41.98         | 9.54        | 43.05        |
| 35               | 38.67                 | 40.01         | 11.29      | 1.77         | 69.99         | 3.78        | 32.17          | 4.79         | > 100        | > 100         | 14.44       | > 100        |
| 38               | 33.20                 | 43.82         | 6.21       | 2.17         | 83.67         | 3.63        | 15.85          | 4.30         | > 100        | > 100         | 8.65        | > 100        |
| 41               | 6.60                  | > 100         | 48.36      | 11.84        | > 100         | 30.95       | 89.57          | 22.20        | > 100        | > 100         | 73.19       | > 100        |
| 44               | 20.51                 | 76.75         | 25.81      | 5.78         | 66.98         | 4.98        | 29.68          | 9.11         | > 100        | > 100         | 30.99       | > 100        |
| 47               | 71.55                 | 22.60         | 5.73       | 1.98         | 60.96         | 2.32        | 10.18          | 2.59         | > 100        | > 100         | 8.83        | > 100        |
| 50               | 36.46                 | 39.21         | 15.12      | 4.19         | 87.55         | 7.14        | 21.84          | 5.89         | > 100        | > 100         | 22.01       | > 100        |
| 53               | -15.45                | 77.86         | 50.13      | 9.72         | > 100         | 16.52       | 57.44          | 18.20        | > 100        | > 100         | 64.49       | > 100        |
| 56               | -55.55                | 18.49         | 18.25      | 2.54         | > 100         | 10.08       | 16.56          | 6.55         | > 100        | > 100         | 23.03       | > 100        |
| 59               | -85.66                | 9.91          | 12.49      | 1.48         | > 100         | 14.37       | 11.51          | 4.86         | > 100        | > 100         | 19.76       | > 100        |
| 62               | -108.53               | 6.39          | 7.06       | 1.39         | > 100         | 19.53       | 9.64           | 4.63         | > 100        | > 100         | 20.43       | > 100        |
| 64               | -119.14               | 5.43          | 4.90       | 1.74         | > 100         | 22.89       | 9.11           | 5.20         | > 100        | > 100         | 22.54       | > 100        |

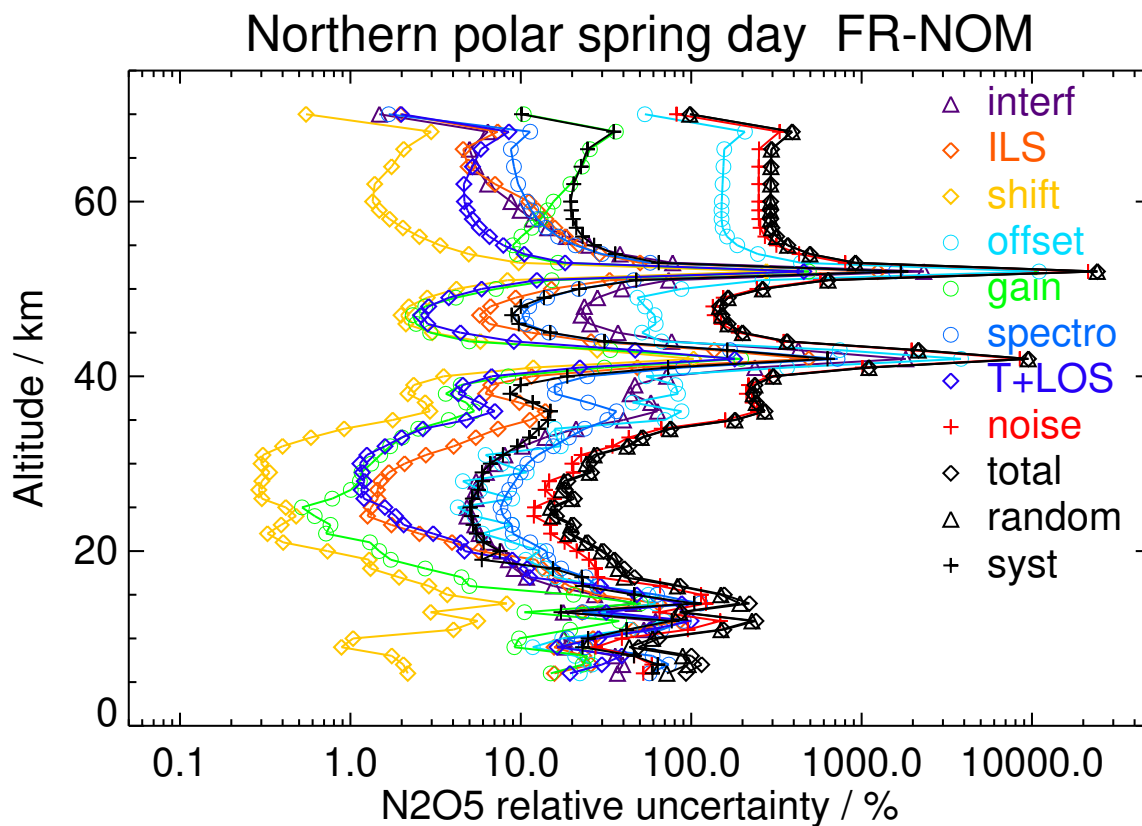


Figure S3: V8H\_N2O5\_61 Northern polar spring day

Table S8: N2O5 error budget for Northern polar spring night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 56.63                 | 42.79         | 21.87      | 1.83         | 26.81         | 27.16       | 83.49          | 45.23        | 59.34        | > 100         | 37.67       | > 100        |
| 11               | -23.25                | 66.36         | 46.36      | 6.00         | 61.32         | 30.90       | 98.28          | 74.21        | > 100        | > 100         | 67.70       | > 100        |
| 14               | 38.06                 | 24.89         | 25.90      | 4.35         | 32.82         | 17.44       | 42.02          | 41.58        | 66.47        | 97.73         | 32.45       | > 100        |
| 17               | 84.66                 | 10.38         | 15.73      | 2.38         | 15.15         | 3.21        | 25.07          | 10.93        | 27.61        | 39.23         | 23.92       | 45.95        |
| 20               | 147.84                | 6.02          | 4.08       | 0.65         | 9.97          | 1.43        | 11.11          | 3.91         | 16.99        | 22.97         | 7.39        | 24.13        |
| 23               | 258.20                | 4.25          | 1.09       | 0.36         | 6.95          | 0.68        | 6.99           | 1.53         | 11.99        | 15.42         | 5.05        | 16.22        |
| 26               | 330.80                | 4.08          | 0.56       | 0.19         | 6.60          | 0.56        | 6.25           | 0.90         | 11.95        | 14.74         | 5.12        | 15.61        |
| 29               | 334.97                | 4.43          | 1.43       | 0.22         | 7.48          | 0.86        | 7.88           | 0.81         | 14.57        | 17.78         | 6.11        | 18.80        |
| 32               | 240.94                | 6.88          | 2.18       | 0.26         | 10.83         | 0.92        | 8.47           | 0.85         | 23.48        | 27.23         | 7.28        | 28.18        |
| 35               | 185.12                | 8.76          | 2.57       | 0.35         | 13.71         | 1.20        | 8.69           | 0.92         | 34.27        | 38.28         | 7.67        | 39.04        |
| 38               | 102.23                | 14.82         | 3.60       | 0.69         | 25.16         | 1.90        | 10.95          | 1.42         | 70.30        | 76.48         | 9.22        | 77.03        |
| 41               | 45.08                 | 35.46         | 7.72       | 1.62         | 48.79         | 5.02        | 18.60          | 3.18         | > 100        | > 100         | 16.25       | > 100        |
| 44               | 9.08                  | > 100         | 47.35      | 12.26        | > 100         | 11.40       | 67.65          | 16.05        | > 100        | > 100         | 62.96       | > 100        |
| 47               | -2.74                 | > 100         | > 100      | 50.74        | > 100         | 55.32       | > 100          | 62.85        | > 100        | > 100         | > 100       | > 100        |
| 50               | 20.51                 | 70.46         | 19.57      | 6.13         | > 100         | 9.35        | 27.67          | 8.39         | > 100        | > 100         | 23.23       | > 100        |
| 53               | 43.61                 | 27.56         | 14.07      | 2.24         | > 100         | 5.74        | 16.31          | 4.82         | > 100        | > 100         | 15.88       | > 100        |
| 56               | 48.70                 | 21.14         | 17.89      | 1.74         | > 100         | 17.01       | 17.40          | 6.21         | > 100        | > 100         | 25.10       | > 100        |
| 59               | 57.33                 | 15.13         | 17.10      | 1.64         | > 100         | 28.28       | 17.94          | 7.21         | > 100        | > 100         | 33.27       | > 100        |
| 62               | 76.82                 | 9.51          | 11.25      | 2.03         | > 100         | 32.66       | 16.21          | 7.18         | > 100        | > 100         | 34.30       | > 100        |
| 64               | 90.71                 | 7.59          | 8.57       | 2.33         | > 100         | 33.78       | 14.94          | 7.21         | > 100        | > 100         | 34.25       | > 100        |

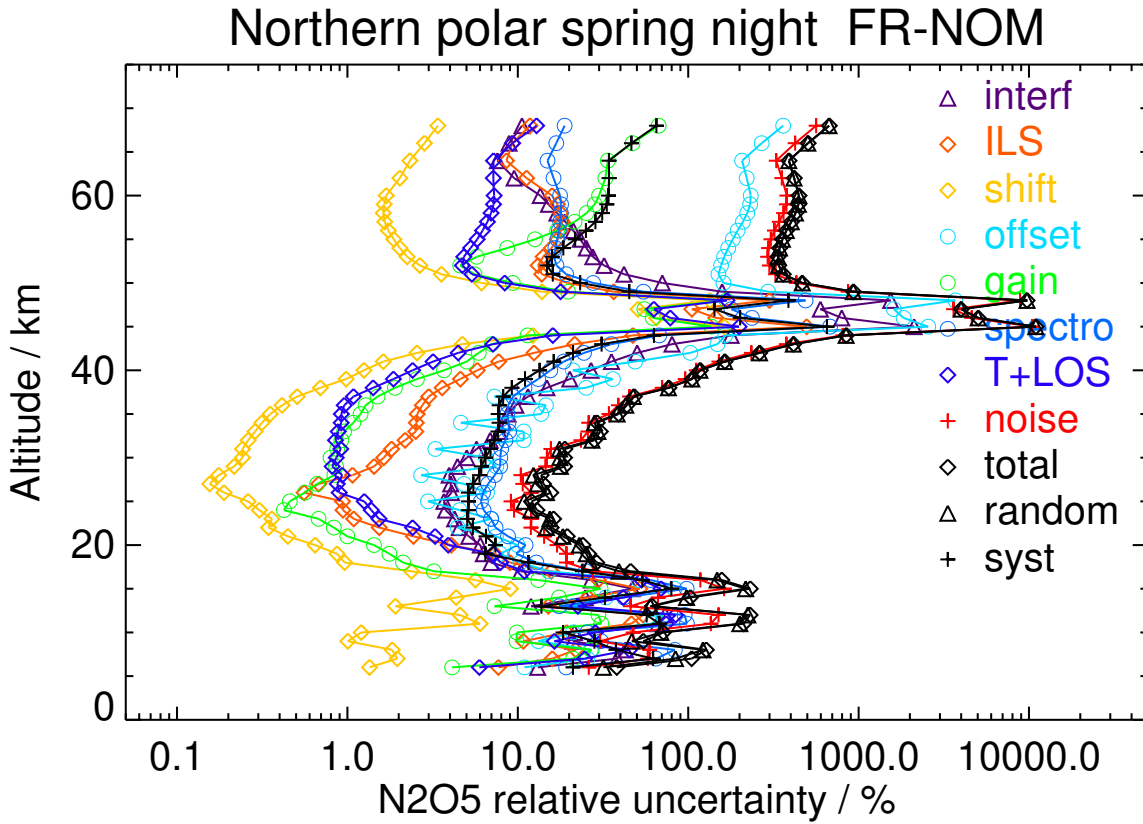


Figure S4: V8H\_N2O5\_61 Northern polar spring night

Table S9: N2O5 error budget for Northern polar summer day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | -36.17                | 91.18         | 56.74      | 6.77         | 67.92         | 78.75       | > 100          | 78.30        | > 100        | > 100         | > 100       | > 100        |
| 11               | 117.42                | 10.95         | 23.23      | 0.93         | 15.71         | 10.02       | 21.48          | 20.84        | 38.00        | 52.79         | 23.67       | 57.85        |
| 14               | 37.26                 | 21.17         | 35.39      | 3.54         | 45.14         | 26.96       | 54.58          | 56.16        | > 100        | > 100         | 38.67       | > 100        |
| 17               | 7.14                  | > 100         | > 100      | 29.95        | > 100         | 53.61       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 20               | 27.23                 | 29.66         | 29.05      | 2.75         | 40.40         | 9.14        | 26.22          | 30.17        | 99.63        | > 100         | 20.63       | > 100        |
| 23               | 43.21                 | 21.57         | 7.84       | 1.74         | 19.42         | 4.87        | 21.61          | 11.63        | 57.13        | 67.48         | 15.59       | 69.26        |
| 26               | 33.57                 | 34.40         | 6.31       | 2.58         | 22.27         | 3.64        | 21.85          | 11.11        | 83.33        | 95.96         | 8.67        | 96.35        |
| 29               | 36.82                 | 35.09         | 6.08       | 0.66         | 21.18         | 2.85        | 16.36          | 7.04         | 92.87        | > 100         | 8.56        | > 100        |
| 32               | 30.69                 | 48.12         | 8.01       | 1.80         | 28.30         | 3.60        | 20.24          | 5.75         | > 100        | > 100         | 11.27       | > 100        |
| 35               | 21.11                 | 69.24         | 12.77      | 3.15         | 44.30         | 4.83        | 22.77          | 5.69         | > 100        | > 100         | 15.76       | > 100        |
| 38               | -0.12                 | > 100         | > 100      | > 100        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 41               | 11.35                 | > 100         | 25.67      | 6.48         | > 100         | 17.34       | 40.91          | 12.66        | > 100        | > 100         | 40.22       | > 100        |
| 44               | 21.29                 | 65.69         | 18.37      | 4.52         | > 100         | 8.14        | 23.80          | 7.39         | > 100        | > 100         | 23.30       | > 100        |
| 47               | 32.42                 | 42.99         | 9.27       | 2.28         | > 100         | 5.03        | 15.13          | 4.49         | > 100        | > 100         | 13.03       | > 100        |
| 50               | 58.92                 | 23.38         | 5.11       | 1.20         | 38.80         | 3.25        | 8.74           | 2.42         | > 100        | > 100         | 8.25        | > 100        |
| 53               | 81.87                 | 13.53         | 5.10       | 0.57         | 66.18         | 2.64        | 7.93           | 1.75         | > 100        | > 100         | 7.54        | > 100        |
| 56               | 49.91                 | 18.18         | 14.44      | 0.84         | > 100         | 5.91        | 15.29          | 4.13         | > 100        | > 100         | 17.99       | > 100        |
| 59               | -0.16                 | > 100         | > 100      | > 100        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 62               | -41.09                | 13.91         | 19.96      | 3.24         | > 100         | 31.89       | 21.66          | 8.90         | > 100        | > 100         | 35.83       | > 100        |
| 64               | -47.53                | 12.07         | 11.37      | 4.50         | > 100         | 36.15       | 18.95          | 10.69        | > 100        | > 100         | 35.44       | > 100        |

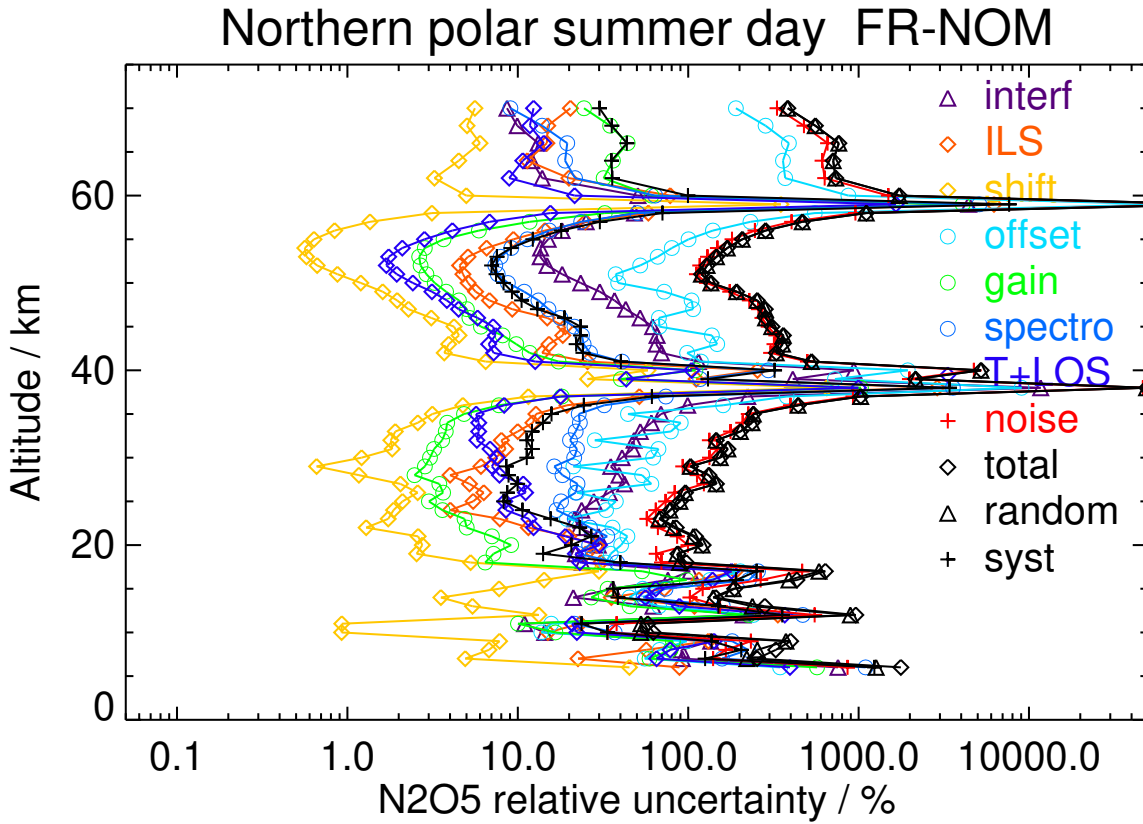


Figure S5: V8H\_N2O5\_61 Northern polar summer day

Table S10: N2O5 error budget for Northern polar summer night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | -75.32                | 49.09         | 19.41      | 3.65         | 40.24         | 38.77       | > 100          | 43.27        | 96.02        | > 100         | > 100       | > 100        |
| 11               | 113.89                | 11.00         | 20.12      | 0.95         | 16.96         | 7.46        | 30.61          | 18.84        | 40.56        | 51.59         | 33.84       | 61.70        |
| 14               | 45.65                 | 18.25         | 38.12      | 2.25         | 38.32         | 11.67       | 35.27          | 50.77        | 84.13        | > 100         | 35.89       | > 100        |
| 17               | 23.16                 | 32.64         | 22.73      | 6.34         | 66.10         | 13.54       | 80.07          | 58.68        | > 100        | > 100         | 74.86       | > 100        |
| 20               | 90.00                 | 9.27          | 6.60       | 0.64         | 12.66         | 2.99        | 10.67          | 10.50        | 30.69        | 37.35         | 8.41        | 38.28        |
| 23               | 144.26                | 6.72          | 2.57       | 0.70         | 5.58          | 1.37        | 8.81           | 3.85         | 17.13        | 20.35         | 7.55        | 21.70        |
| 26               | 242.58                | 4.95          | 0.71       | 0.50         | 2.59          | 0.29        | 5.83           | 1.91         | 11.52        | 13.29         | 5.08        | 14.23        |
| 29               | 288.86                | 4.64          | 1.39       | 0.11         | 2.01          | 0.82        | 6.56           | 1.17         | 11.74        | 13.15         | 6.11        | 14.51        |
| 32               | 242.55                | 6.26          | 2.06       | 0.28         | 2.63          | 1.00        | 7.89           | 0.95         | 16.80        | 18.57         | 7.23        | 19.92        |
| 35               | 176.05                | 8.51          | 3.03       | 0.39         | 4.06          | 1.39        | 10.20          | 1.14         | 27.04        | 29.17         | 9.25        | 30.60        |
| 38               | 87.32                 | 16.17         | 5.10       | 0.83         | 9.44          | 2.31        | 12.17          | 1.84         | 62.45        | 65.70         | 10.82       | 66.59        |
| 41               | 56.58                 | 24.09         | 4.47       | 1.12         | 23.23         | 3.30        | 12.46          | 2.69         | > 100        | > 100         | 11.07       | > 100        |
| 44               | 14.41                 | 99.92         | 20.78      | 4.37         | > 100         | 10.91       | 38.53          | 10.79        | > 100        | > 100         | 36.72       | > 100        |
| 47               | 54.65                 | 26.50         | 6.28       | 1.05         | 66.61         | 2.04        | 9.82           | 2.42         | > 100        | > 100         | 9.20        | > 100        |
| 50               | 43.53                 | 32.47         | 8.37       | 1.36         | 64.42         | 3.77        | 11.74          | 3.07         | > 100        | > 100         | 11.61       | > 100        |
| 53               | 7.21                  | > 100         | 63.88      | 5.22         | > 100         | 25.31       | 73.85          | 19.25        | > 100        | > 100         | 76.98       | > 100        |
| 56               | -9.68                 | 98.77         | 71.10      | 3.34         | > 100         | 28.31       | 63.51          | 19.04        | > 100        | > 100         | 81.59       | > 100        |
| 59               | -9.80                 | 81.56         | 90.33      | 5.62         | > 100         | 67.61       | 72.24          | 25.74        | > 100        | > 100         | > 100       | > 100        |
| 62               | 0.51                  | > 100         | > 100      | > 100        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 64               | 9.37                  | 68.69         | 55.30      | 20.21        | > 100         | > 100       | 83.61          | 51.32        | > 100        | > 100         | > 100       | > 100        |

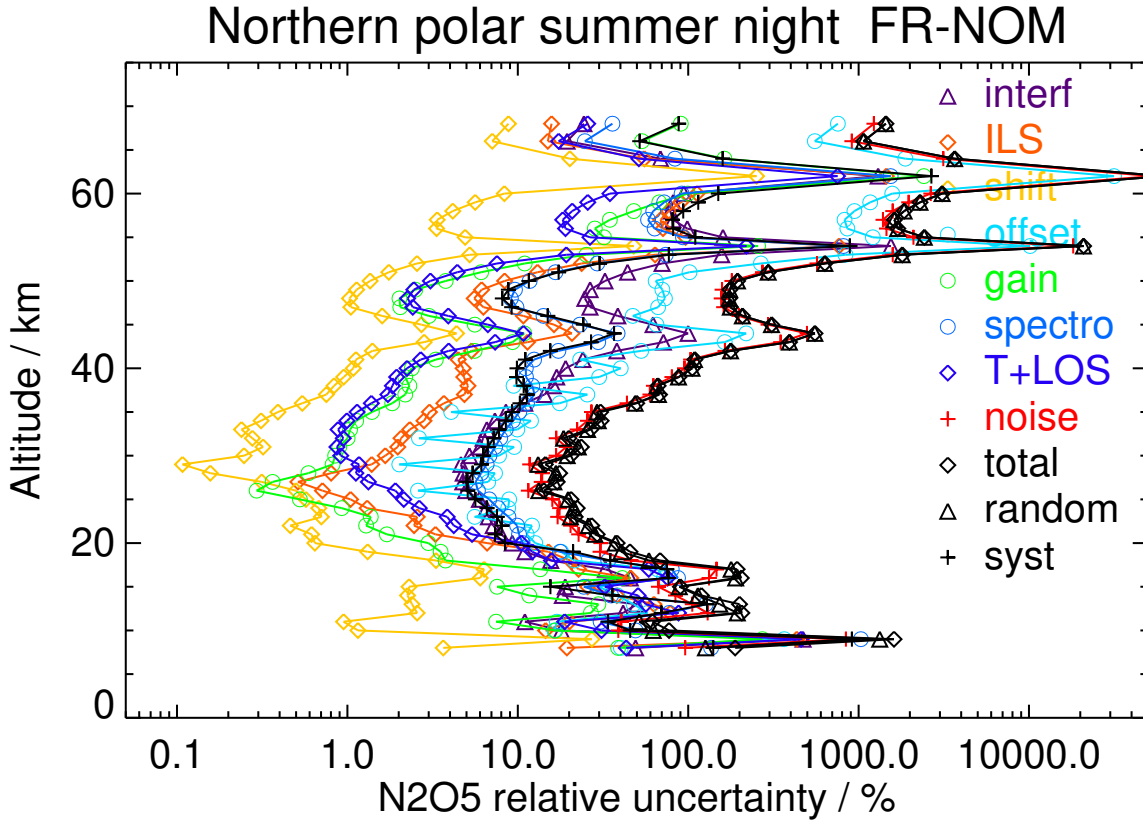


Figure S6: V8H\_N2O5\_61 Northern polar summer night

Table S11: N2O5 error budget for Northern polar autumn day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 96.59                 | 33.94         | 8.70       | 0.94         | 16.23         | 15.45       | 33.12          | 19.72        | 37.34        | 60.91         | 30.01       | 67.90        |
| 11               | -19.66                | 83.67         | 57.06      | 4.27         | 70.28         | 37.35       | 98.05          | 77.33        | > 100        | > 100         | 55.57       | > 100        |
| 14               | -45.17                | 38.44         | 26.10      | 1.56         | 30.18         | 20.21       | 56.45          | 29.38        | 57.63        | 91.96         | 48.93       | > 100        |
| 17               | 48.20                 | 33.16         | 23.32      | 1.24         | 31.16         | 10.70       | 33.34          | 22.42        | 52.76        | 78.59         | 30.86       | 84.43        |
| 20               | 101.10                | 8.58          | 7.39       | 0.75         | 15.29         | 3.68        | 15.25          | 8.76         | 26.05        | 34.80         | 12.37       | 36.94        |
| 23               | 270.72                | 4.42          | 1.80       | 0.33         | 6.68          | 1.47        | 13.39          | 3.03         | 12.05        | 16.53         | 11.41       | 20.08        |
| 26               | 771.57                | 2.04          | 0.77       | 0.22         | 2.77          | 0.41        | 7.29           | 1.37         | 5.70         | 7.58          | 6.53        | 10.01        |
| 29               | 1293.51               | 1.47          | 0.31       | 0.10         | 1.85          | 0.68        | 5.96           | 0.84         | 4.42         | 5.69          | 5.44        | 7.87         |
| 32               | 1266.76               | 1.64          | 1.06       | 0.14         | 1.81          | 1.00        | 8.43           | 1.02         | 5.44         | 6.63          | 8.12        | 10.48        |
| 35               | 850.11                | 2.43          | 2.34       | 0.42         | 2.53          | 1.24        | 12.07          | 1.39         | 9.23         | 11.09         | 11.37       | 15.88        |
| 38               | 478.52                | 4.59          | 3.55       | 0.69         | 4.05          | 1.36        | 14.72          | 1.83         | 18.82        | 21.18         | 13.35       | 25.03        |
| 41               | 218.75                | 10.86         | 5.38       | 0.93         | 10.46         | 1.10        | 17.76          | 2.70         | 44.96        | 48.58         | 15.56       | 51.02        |
| 44               | 79.08                 | 30.37         | 11.67      | 1.47         | 48.58         | 2.59        | 22.33          | 5.23         | > 100        | > 100         | 18.82       | > 100        |
| 47               | 29.03                 | 76.15         | 34.01      | 4.05         | > 100         | 9.93        | 35.09          | 14.93        | > 100        | > 100         | 37.91       | > 100        |
| 50               | 9.12                  | > 100         | > 100      | 13.83        | > 100         | 35.33       | 95.94          | 51.80        | > 100        | > 100         | > 100       | > 100        |
| 53               | -0.18                 | > 100         | > 100      | > 100        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 56               | -20.71                | 76.56         | 81.89      | 5.81         | > 100         | 80.36       | 53.94          | 30.99        | > 100        | > 100         | > 100       | > 100        |
| 59               | -29.91                | 49.47         | 63.94      | 4.26         | > 100         | 81.04       | 44.84          | 24.50        | > 100        | > 100         | 97.02       | > 100        |
| 62               | -89.88                | 15.40         | 24.50      | 1.51         | > 100         | 41.70       | 15.77          | 10.03        | > 100        | > 100         | 45.26       | > 100        |
| 64               | -125.95               | 10.66         | 19.08      | 1.13         | > 100         | 35.88       | 12.19          | 8.13         | > 100        | > 100         | 38.12       | > 100        |

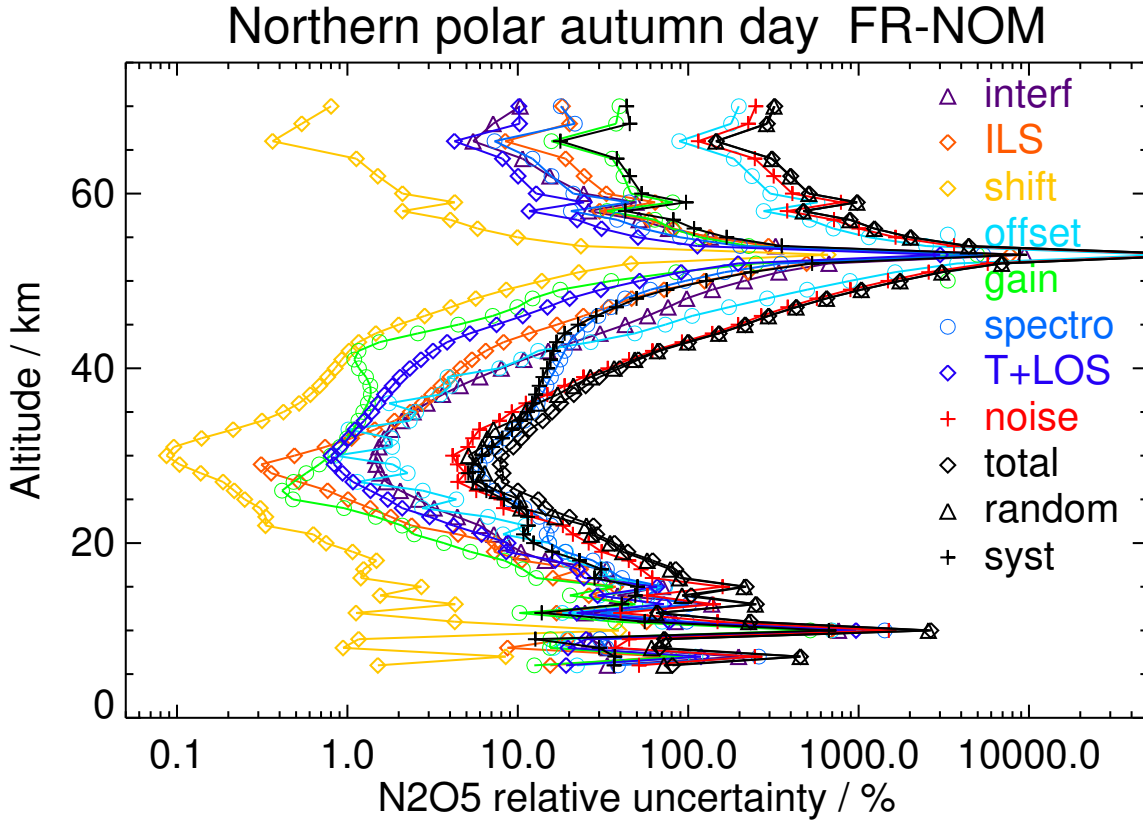


Figure S7: V8H\_N2O5\_61 Northern polar autumn day

Table S12: N2O5 error budget for Northern polar autumn night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 99.24                 | 25.07         | 8.05       | 0.78         | 15.14         | 14.70       | 30.40          | 19.33        | 34.01        | 53.09         | 27.84       | 59.95        |
| 11               | -28.36                | 60.04         | 27.24      | 3.52         | 46.38         | 23.97       | 83.63          | 50.30        | 96.46        | > 100         | 58.14       | > 100        |
| 14               | -29.48                | 77.10         | 16.46      | 1.78         | 46.33         | 36.69       | > 100          | 41.30        | 84.33        | > 100         | 94.77       | > 100        |
| 17               | 17.25                 | > 100         | 65.51      | 5.54         | 88.95         | 25.50       | 66.16          | 64.62        | > 100        | > 100         | 68.45       | > 100        |
| 20               | 62.43                 | 14.61         | 10.25      | 1.30         | 27.32         | 5.14        | 20.32          | 14.93        | 44.17        | 58.17         | 17.20       | 60.66        |
| 23               | 315.77                | 4.00          | 2.40       | 0.25         | 6.57          | 1.76        | 17.74          | 3.50         | 11.21        | 14.98         | 17.21       | 22.82        |
| 26               | 1062.57               | 1.55          | 0.74       | 0.22         | 2.32          | 0.32        | 6.29           | 1.21         | 4.47         | 6.04          | 5.75        | 8.34         |
| 29               | 1515.87               | 1.25          | 0.37       | 0.09         | 1.80          | 0.82        | 6.57           | 0.83         | 3.92         | 5.29          | 6.08        | 8.06         |
| 32               | 1485.97               | 1.37          | 0.99       | 0.13         | 1.74          | 1.04        | 8.50           | 1.04         | 4.65         | 6.26          | 7.93        | 10.10        |
| 35               | 1099.86               | 1.82          | 2.07       | 0.40         | 2.16          | 1.19        | 11.22          | 1.31         | 7.05         | 8.97          | 10.53       | 13.83        |
| 38               | 595.10                | 3.52          | 3.39       | 0.71         | 3.57          | 1.33        | 14.32          | 1.87         | 14.76        | 17.10         | 13.14       | 21.57        |
| 41               | 253.11                | 8.97          | 4.91       | 0.95         | 9.24          | 1.00        | 17.80          | 2.65         | 37.98        | 41.57         | 15.17       | 44.25        |
| 44               | 102.16                | 22.52         | 8.37       | 1.19         | 35.17         | 1.71        | 20.37          | 4.00         | > 100        | > 100         | 16.06       | > 100        |
| 47               | 69.69                 | 30.56         | 12.49      | 1.71         | 67.74         | 3.92        | 17.21          | 6.13         | > 100        | > 100         | 16.27       | > 100        |
| 50               | 69.48                 | 27.37         | 14.65      | 1.95         | > 100         | 3.98        | 14.29          | 7.30         | > 100        | > 100         | 17.31       | > 100        |
| 53               | 63.32                 | 27.47         | 20.69      | 2.27         | > 100         | 11.30       | 17.77          | 10.22        | > 100        | > 100         | 25.32       | > 100        |
| 56               | 49.85                 | 34.63         | 32.77      | 3.19         | > 100         | 26.68       | 26.88          | 16.42        | > 100        | > 100         | 43.32       | > 100        |
| 59               | 84.70                 | 21.26         | 22.91      | 2.10         | > 100         | 25.48       | 18.97          | 12.12        | > 100        | > 100         | 33.82       | > 100        |
| 62               | 12.54                 | > 100         | > 100      | 15.76        | > 100         | > 100       | > 100          | 89.96        | > 100        | > 100         | > 100       | > 100        |
| 64               | -20.23                | 84.01         | > 100      | 10.56        | > 100         | > 100       | 94.36          | 61.90        | > 100        | > 100         | > 100       | > 100        |

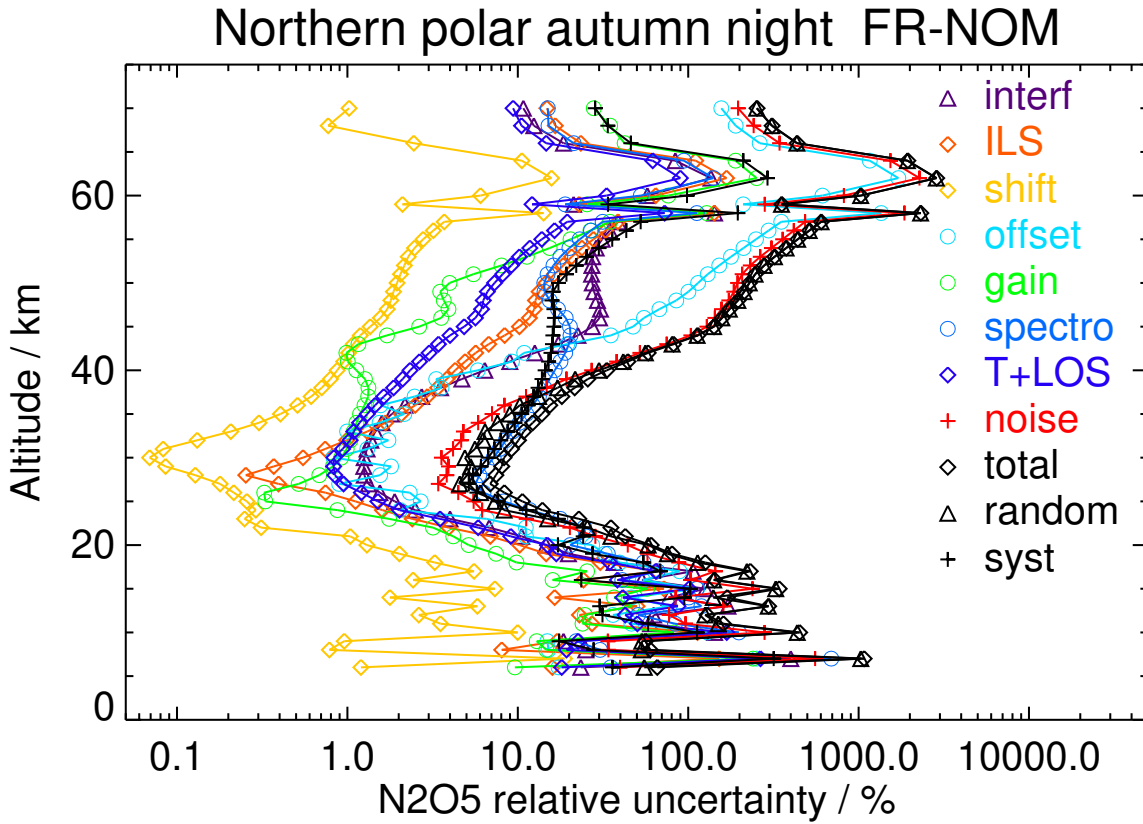


Figure S8: V8H\_N2O5\_61 Northern polar autumn night

Table S13: N2O5 error budget for Northern midlatitude winter day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 5                | -172.26               | 22.81         | 18.90      | 1.16         | 15.27         | 5.96        | 15.88          | 17.86        | 35.25        | 50.25         | 20.87       | 54.42        |
| 8                | 117.75                | 39.22         | 29.98      | 1.41         | 19.27         | 11.95       | 27.63          | 29.66        | 43.99        | 78.84         | 17.80       | 80.82        |
| 11               | 92.47                 | 20.44         | 23.42      | 1.41         | 20.82         | 11.56       | 25.13          | 30.87        | 47.01        | 71.33         | 15.55       | 73.00        |
| 14               | 17.31                 | 56.27         | > 100      | 8.82         | 98.65         | 41.24       | 89.36          | > 100        | > 100        | > 100         | 79.71       | > 100        |
| 17               | 26.33                 | 32.12         | 42.77      | 5.68         | 52.42         | 16.51       | 57.68          | 51.37        | > 100        | > 100         | 49.92       | > 100        |
| 20               | 97.47                 | 9.07          | 7.16       | 0.86         | 11.38         | 3.69        | 13.50          | 9.39         | 28.30        | 35.22         | 10.40       | 36.73        |
| 23               | 289.73                | 3.80          | 1.87       | 0.68         | 3.74          | 1.44        | 11.42          | 3.02         | 10.27        | 13.23         | 10.21       | 16.72        |
| 26               | 841.83                | 1.65          | 1.23       | 0.30         | 1.42          | 0.47        | 7.30           | 1.34         | 4.32         | 6.20          | 6.47        | 8.96         |
| 29               | 1567.10               | 1.01          | 0.54       | 0.18         | 0.78          | 0.48        | 5.66           | 0.78         | 2.84         | 4.17          | 5.05        | 6.55         |
| 32               | 1748.84               | 1.00          | 1.05       | 0.16         | 0.69          | 0.63        | 7.10           | 0.70         | 2.98         | 4.29          | 6.65        | 7.92         |
| 35               | 1282.72               | 1.31          | 1.98       | 0.23         | 1.03          | 1.16        | 9.56           | 1.04         | 4.64         | 6.36          | 9.03        | 11.05        |
| 38               | 675.88                | 2.41          | 2.24       | 0.37         | 2.14          | 1.19        | 11.38          | 1.47         | 10.52        | 11.93         | 10.81       | 16.10        |
| 41               | 333.95                | 5.51          | 3.04       | 0.36         | 4.18          | 1.14        | 12.15          | 1.54         | 22.47        | 24.18         | 11.34       | 26.70        |
| 44               | 164.67                | 12.04         | 6.85       | 0.83         | 17.54         | 1.07        | 13.30          | 2.78         | 53.45        | 58.16         | 12.63       | 59.52        |
| 47               | 70.52                 | 26.91         | 12.27      | 2.40         | 74.07         | 3.34        | 17.47          | 5.88         | > 100        | > 100         | 16.39       | > 100        |
| 50               | 35.11                 | 48.25         | 22.91      | 4.93         | > 100         | 12.30       | 27.75          | 11.43        | > 100        | > 100         | 27.13       | > 100        |
| 53               | 9.33                  | > 100         | 93.85      | 17.68        | > 100         | > 100       | > 100          | 44.56        | > 100        | > 100         | > 100       | > 100        |
| 56               | -27.38                | 47.87         | 37.04      | 6.06         | > 100         | 70.73       | 40.71          | 17.95        | > 100        | > 100         | 73.75       | > 100        |
| 59               | -65.99                | 18.12         | 19.27      | 2.66         | > 100         | 40.59       | 21.36          | 9.36         | > 100        | > 100         | 42.26       | > 100        |
| 62               | -67.65                | 16.62         | 23.09      | 3.26         | > 100         | 52.22       | 24.16          | 12.03        | > 100        | > 100         | 52.71       | > 100        |
| 64               | -224.71               | 4.25          | 8.51       | 1.14         | 94.64         | 17.24       | 10.79          | 3.69         | > 100        | > 100         | 20.33       | > 100        |

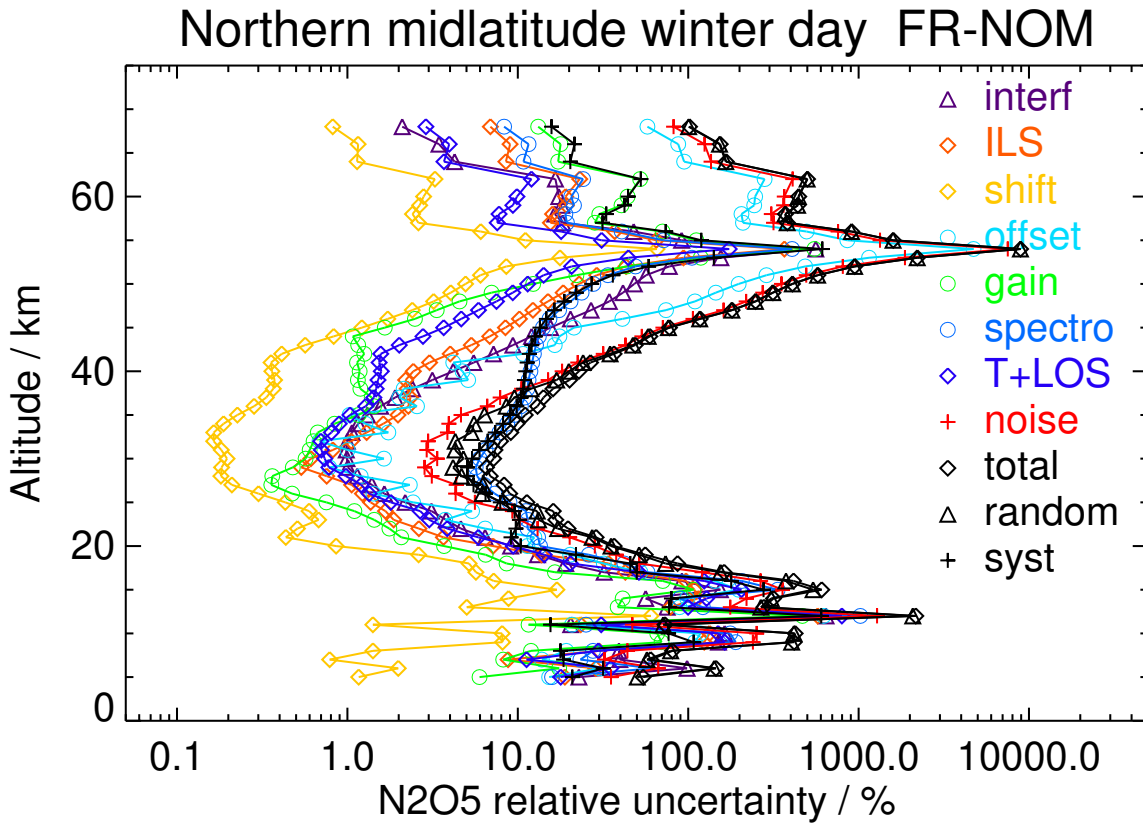


Figure S9: V8H.N2O5\_61 Northern midlatitude winter day

Table S14: N2O5 error budget for Northern midlatitude winter night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 5                | -97.65                | 56.60         | 26.98      | 2.51         | 29.33         | 10.10       | 47.10          | 26.36        | 70.17        | > 100         | 47.53       | > 100        |
| 8                | 105.78                | 39.19         | 20.94      | 1.43         | 18.75         | 14.95       | 19.85          | 22.88        | 45.99        | 73.91         | 11.06       | 74.73        |
| 11               | 85.77                 | 17.84         | 16.29      | 1.50         | 17.92         | 10.66       | 25.27          | 19.91        | 42.61        | 59.92         | 16.76       | 62.22        |
| 14               | 0.11                  | > 100         | > 100      | > 100        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 17               | 33.50                 | 24.45         | 38.98      | 4.61         | 42.21         | 15.81       | 64.12          | 39.31        | 91.58        | > 100         | 56.25       | > 100        |
| 20               | 141.56                | 5.96          | 5.77       | 0.71         | 7.46          | 2.38        | 10.79          | 6.35         | 17.90        | 23.44         | 7.63        | 24.65        |
| 23               | 328.08                | 3.09          | 1.65       | 0.41         | 2.31          | 1.04        | 8.84           | 2.19         | 7.45         | 9.56          | 8.12        | 12.54        |
| 26               | 763.81                | 1.68          | 0.64       | 0.26         | 0.85          | 0.33        | 6.21           | 1.14         | 3.89         | 5.19          | 5.67        | 7.69         |
| 29               | 1264.19               | 1.22          | 0.52       | 0.14         | 0.56          | 0.55        | 5.55           | 0.76         | 3.07         | 4.16          | 5.09        | 6.57         |
| 32               | 1457.06               | 1.23          | 0.95       | 0.17         | 0.66          | 0.66        | 6.67           | 0.68         | 3.41         | 4.50          | 6.30        | 7.74         |
| 35               | 1093.19               | 1.58          | 1.90       | 0.27         | 1.06          | 0.85        | 9.52           | 1.01         | 5.41         | 6.67          | 9.18        | 11.35        |
| 38               | 558.65                | 3.01          | 3.08       | 0.51         | 2.02          | 1.35        | 12.83          | 1.62         | 12.43        | 14.19         | 12.04       | 18.61        |
| 41               | 277.70                | 6.51          | 3.91       | 0.49         | 5.07          | 1.66        | 14.15          | 1.70         | 27.30        | 29.47         | 12.90       | 32.17        |
| 44               | 116.98                | 16.64         | 7.73       | 1.00         | 27.84         | 1.62        | 18.60          | 2.75         | 77.62        | 85.08         | 15.97       | 86.57        |
| 47               | 46.66                 | 39.80         | 15.92      | 3.34         | 96.98         | 5.03        | 26.43          | 6.98         | > 100        | > 100         | 20.03       | > 100        |
| 50               | 5.16                  | > 100         | > 100      | 31.78        | > 100         | 62.35       | > 100          | 70.36        | > 100        | > 100         | > 100       | > 100        |
| 53               | -27.39                | 52.07         | 35.31      | 5.56         | > 100         | 34.78       | 32.26          | 14.74        | > 100        | > 100         | 41.09       | > 100        |
| 56               | -54.72                | 23.51         | 21.63      | 3.07         | > 100         | 33.61       | 18.61          | 9.15         | > 100        | > 100         | 34.39       | > 100        |
| 59               | -72.31                | 16.40         | 19.31      | 2.14         | > 100         | 38.09       | 17.87          | 7.43         | > 100        | > 100         | 40.23       | > 100        |
| 62               | -110.95               | 10.15         | 12.42      | 1.61         | > 100         | 35.02       | 12.14          | 7.27         | > 100        | > 100         | 34.03       | > 100        |
| 64               | -92.58                | 11.50         | 15.44      | 1.34         | > 100         | 37.30       | 17.55          | 7.27         | > 100        | > 100         | 38.72       | > 100        |

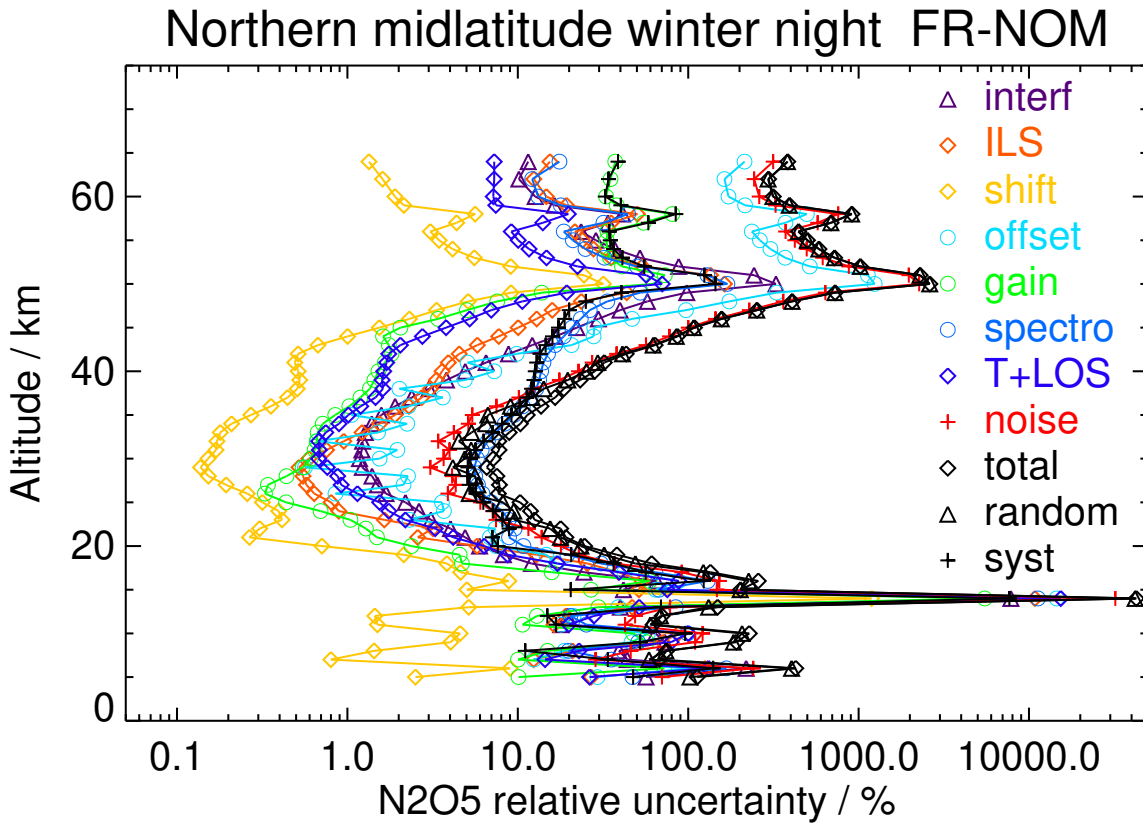


Figure S10: V8H.N2O5\_61 Northern midlatitude winter night

Table S15: N2O5 error budget for Northern midlatitude spring day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 67.08                 | 45.34         | 17.27      | 1.63         | 20.73         | 14.36       | 46.34          | 25.12        | 46.64        | 87.24         | 18.33       | 89.14        |
| 11               | -24.66                | 61.37         | 76.55      | 3.78         | 57.97         | 29.10       | > 100          | 84.47        | > 100        | > 100         | 47.49       | > 100        |
| 14               | 21.58                 | 50.37         | 50.57      | 3.45         | 60.60         | 34.99       | 89.57          | 67.81        | > 100        | > 100         | 59.14       | > 100        |
| 17               | 81.51                 | 11.17         | 13.76      | 1.85         | 17.65         | 5.07        | 24.62          | 12.36        | 30.08        | 43.48         | 20.69       | 48.15        |
| 20               | 173.23                | 5.03          | 3.26       | 0.44         | 10.02         | 1.58        | 10.84          | 4.45         | 16.39        | 21.56         | 8.95        | 23.34        |
| 23               | 344.44                | 3.36          | 1.21       | 0.42         | 6.11          | 0.52        | 6.97           | 1.71         | 10.39        | 13.36         | 5.61        | 14.49        |
| 26               | 556.26                | 2.55          | 0.78       | 0.27         | 4.42          | 0.49        | 5.30           | 0.89         | 8.06         | 9.76          | 5.07        | 10.99        |
| 29               | 663.82                | 2.35          | 0.75       | 0.19         | 4.03          | 0.80        | 6.23           | 0.69         | 7.99         | 9.50          | 5.98        | 11.23        |
| 32               | 508.01                | 3.35          | 1.83       | 0.17         | 5.48          | 0.84        | 8.45           | 1.04         | 11.75        | 13.69         | 8.28        | 16.00        |
| 35               | 275.71                | 5.78          | 3.02       | 0.29         | 9.84          | 1.25        | 11.05          | 1.53         | 23.68        | 26.59         | 10.93       | 28.75        |
| 38               | 64.66                 | 22.66         | 5.53       | 1.24         | 43.80         | 2.62        | 18.42          | 2.90         | > 100        | > 100         | 15.86       | > 100        |
| 41               | 19.55                 | 78.75         | 15.33      | 4.04         | > 100         | 10.42       | 19.45          | 6.27         | > 100        | > 100         | 17.95       | > 100        |
| 44               | 15.03                 | > 100         | 25.53      | 8.08         | 84.81         | 7.73        | 23.90          | 12.60        | > 100        | > 100         | 24.29       | > 100        |
| 47               | 19.49                 | 82.27         | 12.51      | 7.01         | > 100         | 8.21        | 23.59          | 8.24         | > 100        | > 100         | 18.13       | > 100        |
| 50               | 50.91                 | 27.53         | 6.40       | 2.72         | 72.39         | 4.65        | 12.37          | 3.96         | > 100        | > 100         | 11.09       | > 100        |
| 53               | 64.00                 | 18.85         | 7.86       | 2.03         | > 100         | 3.10        | 13.42          | 4.40         | > 100        | > 100         | 12.08       | > 100        |
| 56               | 40.17                 | 25.63         | 18.72      | 2.80         | > 100         | 17.43       | 25.29          | 8.72         | > 100        | > 100         | 30.10       | > 100        |
| 59               | 7.61                  | > 100         | > 100      | 13.93        | > 100         | > 100       | > 100          | 51.68        | > 100        | > 100         | > 100       | > 100        |
| 62               | -14.77                | 50.22         | 61.84      | 11.15        | > 100         | > 100       | 83.99          | 32.77        | > 100        | > 100         | > 100       | > 100        |
| 64               | -22.52                | 31.41         | 36.81      | 9.88         | > 100         | > 100       | 57.20          | 27.21        | > 100        | > 100         | > 100       | > 100        |

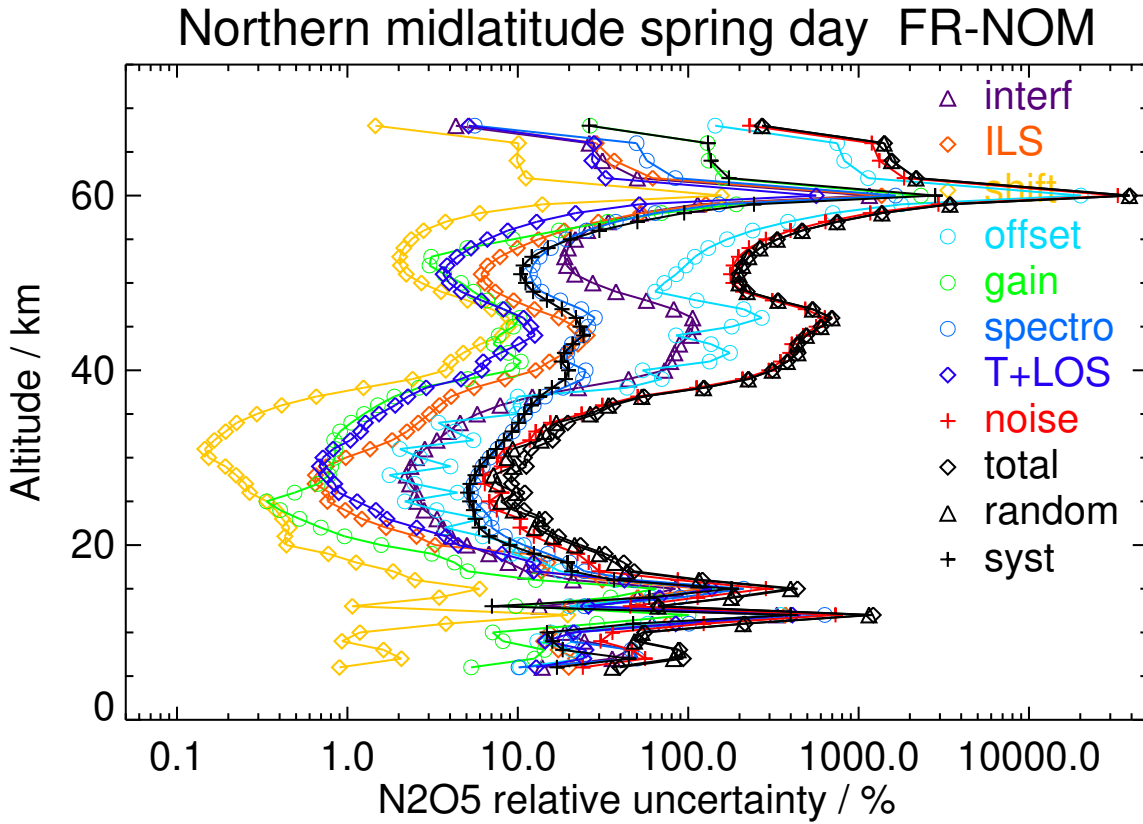


Figure S11: V8H\_N2O5\_61 Northern midlatitude spring day

Table S16: N2O5 error budget for Northern midlatitude spring night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | -9.18                 | > 100         | > 100      | 12.49        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 11               | 15.89                 | 98.60         | > 100      | 7.62         | 92.70         | 50.78       | > 100          | > 100        | > 100        | > 100         | 60.90       | > 100        |
| 14               | 36.15                 | 29.73         | 28.58      | 3.63         | 34.44         | 19.80       | 42.72          | 38.59        | 71.37        | > 100         | 22.73       | > 100        |
| 17               | 75.56                 | 11.40         | 20.88      | 2.76         | 16.34         | 5.07        | 30.25          | 14.83        | 31.41        | 45.05         | 30.96       | 54.66        |
| 20               | 178.49                | 4.85          | 3.35       | 0.45         | 8.03          | 1.38        | 9.80           | 3.90         | 14.24        | 18.95         | 7.50        | 20.38        |
| 23               | 362.08                | 3.07          | 0.83       | 0.49         | 4.90          | 0.57        | 6.35           | 1.67         | 8.79         | 11.12         | 5.59        | 12.45        |
| 26               | 617.31                | 2.22          | 0.53       | 0.25         | 3.48          | 0.28        | 5.31           | 0.91         | 6.53         | 7.94          | 5.11        | 9.44         |
| 29               | 776.19                | 1.95          | 0.61       | 0.18         | 3.17          | 0.57        | 6.00           | 0.60         | 6.38         | 7.62          | 5.80        | 9.57         |
| 32               | 735.27                | 2.26          | 1.14       | 0.22         | 3.46          | 0.62        | 6.73           | 0.66         | 7.80         | 9.08          | 6.55        | 11.20        |
| 35               | 672.77                | 2.38          | 1.37       | 0.18         | 3.69          | 0.85        | 7.12           | 0.74         | 9.32         | 10.53         | 7.01        | 12.65        |
| 38               | 453.96                | 3.20          | 1.40       | 0.18         | 5.71          | 1.12        | 8.78           | 1.07         | 15.52        | 17.09         | 8.56        | 19.11        |
| 41               | 199.99                | 7.44          | 3.11       | 0.41         | 10.92         | 1.84        | 11.17          | 1.40         | 31.98        | 34.82         | 11.17       | 36.57        |
| 44               | 79.40                 | 19.16         | 9.13       | 1.68         | 17.16         | 1.76        | 14.94          | 3.16         | 87.09        | 91.21         | 15.80       | 92.56        |
| 47               | 45.09                 | 34.95         | 8.65       | 3.17         | 95.24         | 3.44        | 17.89          | 3.99         | > 100        | > 100         | 15.82       | > 100        |
| 50               | 40.32                 | 34.85         | 7.86       | 3.89         | 87.19         | 5.61        | 18.63          | 5.37         | > 100        | > 100         | 15.16       | > 100        |
| 53               | 30.55                 | 39.13         | 13.64      | 4.85         | > 100         | 9.92        | 29.07          | 9.52         | > 100        | > 100         | 23.49       | > 100        |
| 56               | 13.63                 | 75.33         | 46.04      | 9.50         | > 100         | 52.27       | 79.64          | 25.69        | > 100        | > 100         | 79.49       | > 100        |
| 59               | 2.80                  | > 100         | > 100      | 44.18        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 62               | 2.08                  | > 100         | > 100      | 86.97        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 64               | 4.29                  | > 100         | > 100      | 52.45        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |

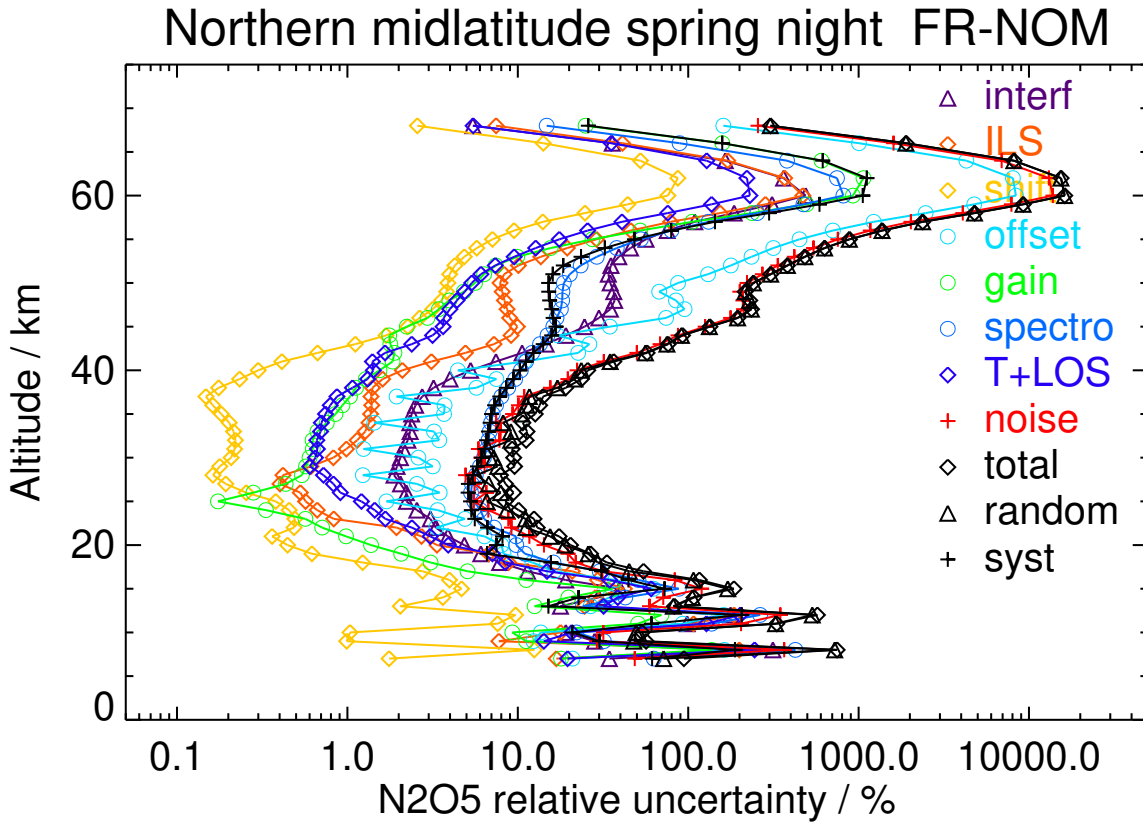


Figure S12: V8H\_N2O5\_61 Northern midlatitude spring night

Table S17: N2O5 error budget for Northern midlatitude summer day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 13.82                 | > 100         | > 100      | 15.30        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 11               | 144.24                | 12.11         | 13.35      | 1.68         | 13.85         | 8.36        | 18.26          | 18.38        | 33.93        | 48.26         | 9.14        | 49.11        |
| 14               | 59.43                 | 17.56         | 36.18      | 2.33         | 28.08         | 13.32       | 37.81          | 42.60        | 66.73        | 95.96         | 32.83       | > 100        |
| 17               | 17.04                 | 49.81         | > 100      | 9.76         | 80.76         | 27.18       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 20               | 113.27                | 7.84          | 7.61       | 0.76         | 9.54          | 3.42        | 14.48          | 10.43        | 26.00        | 33.22         | 10.66       | 34.89        |
| 23               | 277.73                | 3.66          | 1.70       | 0.61         | 3.04          | 0.81        | 7.83           | 2.70         | 9.93         | 11.85         | 7.31        | 13.92        |
| 26               | 559.62                | 2.21          | 0.94       | 0.30         | 1.51          | 0.24        | 5.40           | 1.18         | 5.52         | 6.45          | 5.26        | 8.32         |
| 29               | 732.28                | 1.85          | 0.60       | 0.06         | 1.27          | 0.64        | 5.79           | 0.69         | 5.03         | 5.67          | 5.74        | 8.07         |
| 32               | 547.96                | 2.74          | 1.82       | 0.08         | 1.90          | 0.90        | 8.60           | 0.98         | 7.88         | 8.80          | 8.65        | 12.34        |
| 35               | 239.29                | 6.23          | 2.77       | 0.44         | 4.50          | 1.53        | 11.77          | 1.79         | 20.63        | 22.34         | 11.73       | 25.24        |
| 38               | 57.72                 | 23.74         | 5.54       | 1.49         | 21.42         | 2.95        | 14.62          | 3.12         | 98.58        | > 100         | 12.61       | > 100        |
| 41               | 16.13                 | 83.65         | 16.09      | 3.87         | 65.08         | 11.38       | 27.89          | 7.61         | > 100        | > 100         | 21.05       | > 100        |
| 44               | 33.19                 | 42.86         | 7.29       | 2.74         | 61.81         | 5.45        | 13.36          | 4.10         | > 100        | > 100         | 10.66       | > 100        |
| 47               | 60.73                 | 24.52         | 2.91       | 1.44         | 68.24         | 2.79        | 9.18           | 2.07         | > 100        | > 100         | 6.97        | > 100        |
| 50               | 59.59                 | 23.22         | 3.79       | 1.61         | 45.77         | 2.90        | 9.91           | 2.53         | > 100        | > 100         | 7.31        | > 100        |
| 53               | 47.64                 | 24.06         | 5.70       | 1.68         | > 100         | 4.34        | 14.84          | 4.29         | > 100        | > 100         | 9.85        | > 100        |
| 56               | 36.90                 | 26.40         | 9.91       | 1.77         | > 100         | 12.03       | 23.18          | 6.96         | > 100        | > 100         | 19.55       | > 100        |
| 59               | 27.05                 | 30.56         | 25.75      | 4.09         | > 100         | 37.14       | 40.50          | 14.27        | > 100        | > 100         | 50.23       | > 100        |
| 62               | 22.12                 | 33.56         | 35.46      | 10.82        | > 100         | 74.62       | 58.41          | 24.11        | > 100        | > 100         | 87.72       | > 100        |
| 64               | 54.93                 | 13.59         | 14.04      | 5.78         | > 100         | 36.55       | 23.28          | 11.75        | > 100        | > 100         | 39.58       | > 100        |

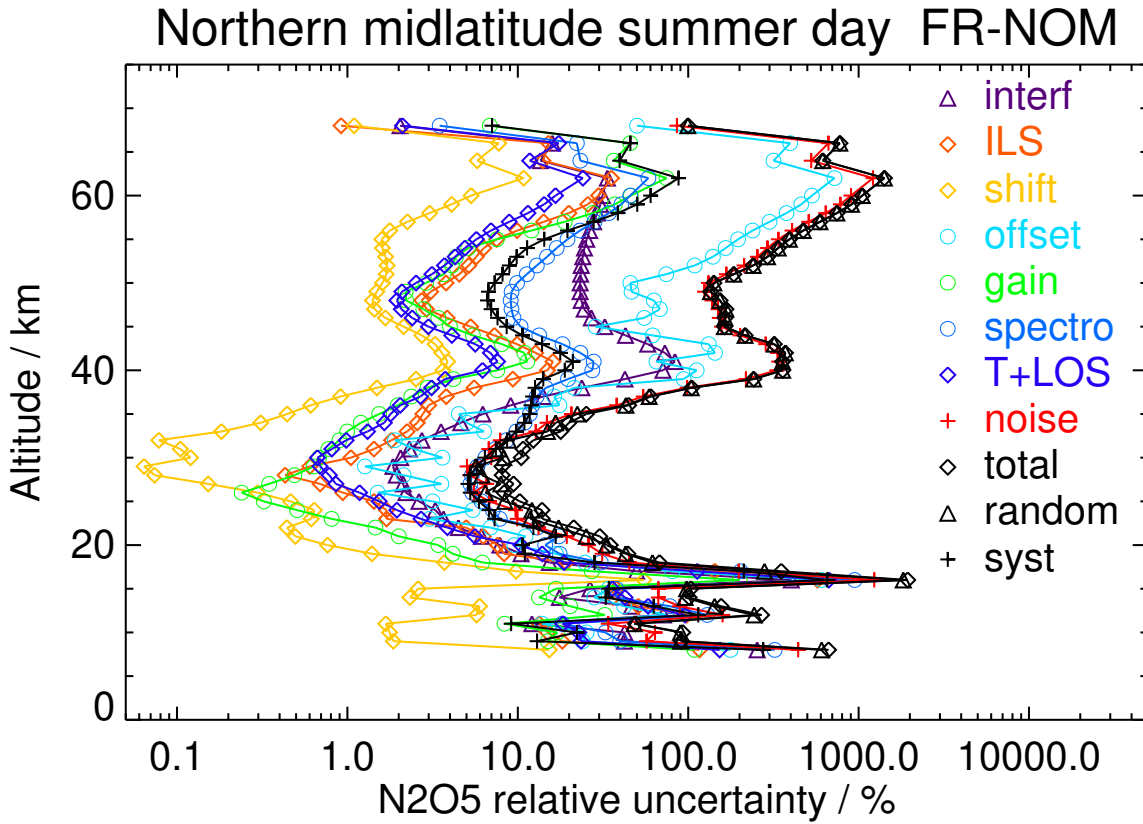


Figure S13: V8H\_N2O5\_61 Northern midlatitude summer day

Table S18: N2O5 error budget for Northern midlatitude summer night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 157.45                | 25.12         | 8.31       | 1.43         | 18.47         | 8.88        | 35.00          | 15.41        | 45.62        | 61.37         | 29.99       | 68.30        |
| 11               | 90.71                 | 20.72         | 19.45      | 1.79         | 22.40         | 17.28       | 42.54          | 27.07        | 55.57        | 82.53         | 20.76       | 85.10        |
| 14               | 11.84                 | 88.86         | > 100      | 6.79         | > 100         | 96.46       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 17               | 23.84                 | 35.59         | 89.73      | 4.79         | 59.23         | 24.84       | > 100          | 81.87        | > 100        | > 100         | > 100       | > 100        |
| 20               | 81.16                 | 10.84         | 9.36       | 0.85         | 13.32         | 5.18        | 15.42          | 15.51        | 35.37        | 45.41         | 8.77        | 46.25        |
| 23               | 250.59                | 4.11          | 2.34       | 0.67         | 2.99          | 0.91        | 9.65           | 3.20         | 10.61        | 12.93         | 9.01        | 15.76        |
| 26               | 545.81                | 2.32          | 0.71       | 0.40         | 1.05          | 0.25        | 5.60           | 1.53         | 5.37         | 6.42          | 5.35        | 8.35         |
| 29               | 830.11                | 1.69          | 0.36       | 0.09         | 0.61          | 0.38        | 5.31           | 0.83         | 4.23         | 4.81          | 5.22        | 7.10         |
| 32               | 884.14                | 1.75          | 0.91       | 0.18         | 0.63          | 0.51        | 6.24           | 0.69         | 4.74         | 5.25          | 6.23        | 8.15         |
| 35               | 802.35                | 1.89          | 1.24       | 0.12         | 0.76          | 0.71        | 6.97           | 0.77         | 6.01         | 6.52          | 7.00        | 9.57         |
| 38               | 562.21                | 2.55          | 1.46       | 0.14         | 1.25          | 1.02        | 8.18           | 1.07         | 9.87         | 10.54         | 8.11        | 13.30        |
| 41               | 259.27                | 5.37          | 2.45       | 0.30         | 3.84          | 1.33        | 10.68          | 1.61         | 22.29        | 23.58         | 10.44       | 25.79        |
| 44               | 91.75                 | 16.05         | 6.93       | 1.07         | 30.79         | 1.49        | 15.49          | 2.99         | 78.09        | 85.80         | 15.61       | 87.21        |
| 47               | 59.84                 | 25.25         | 5.62       | 1.82         | 66.89         | 2.32        | 13.12          | 3.00         | > 100        | > 100         | 12.51       | > 100        |
| 50               | 59.66                 | 24.13         | 3.16       | 1.78         | 53.98         | 2.32        | 10.69          | 2.80         | > 100        | > 100         | 8.52        | > 100        |
| 53               | 71.25                 | 16.45         | 3.90       | 1.13         | 97.85         | 2.62        | 10.73          | 2.98         | > 100        | > 100         | 7.75        | > 100        |
| 56               | 82.15                 | 12.25         | 4.29       | 0.65         | > 100         | 5.95        | 11.36          | 2.97         | > 100        | > 100         | 9.78        | > 100        |
| 59               | 95.19                 | 9.23          | 4.94       | 1.09         | > 100         | 10.21       | 11.58          | 3.18         | > 100        | > 100         | 13.08       | > 100        |
| 62               | 112.07                | 7.10          | 4.47       | 2.06         | > 100         | 14.05       | 10.37          | 3.92         | > 100        | > 100         | 15.17       | > 100        |
| 64               | 164.13                | 4.78          | 3.41       | 1.84         | > 100         | 11.48       | 7.17           | 3.42         | > 100        | > 100         | 11.81       | > 100        |

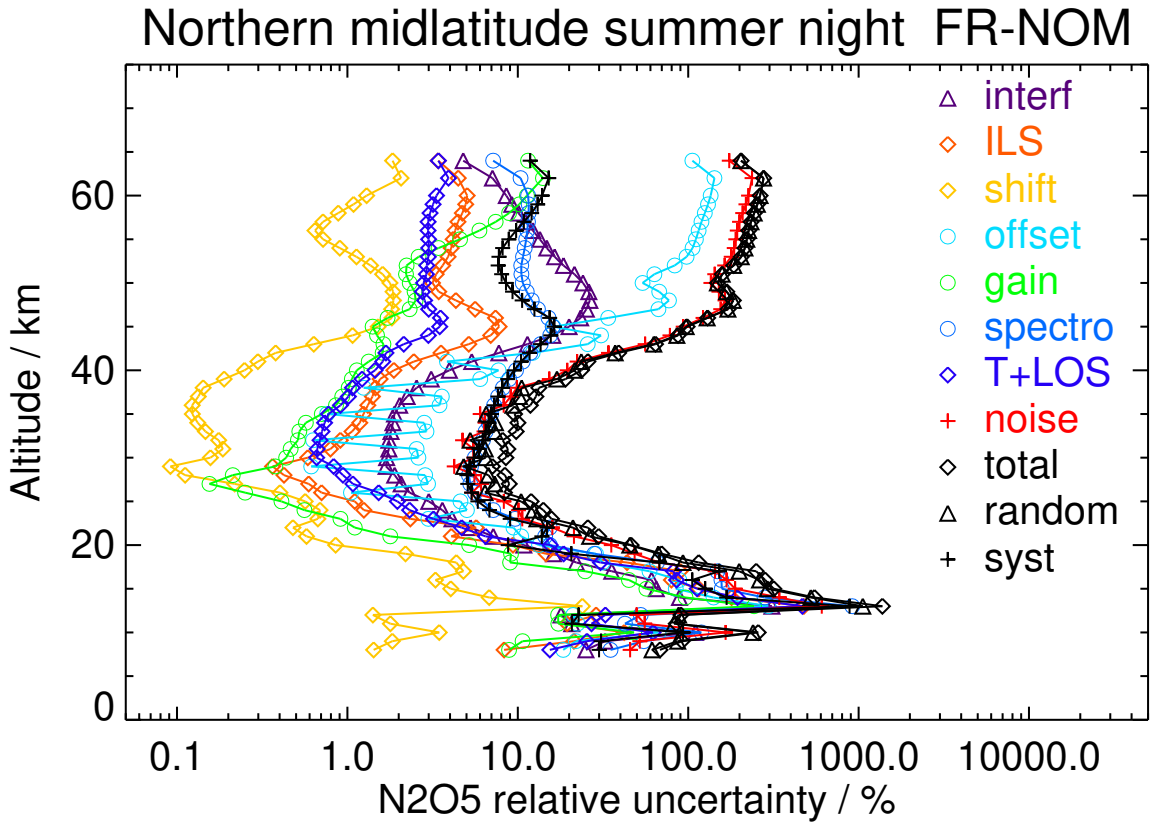


Figure S14: V8H\_N2O5\_61 Northern midlatitude summer night

Table S19: N2O5 error budget for Northern midlatitude autumn day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | -12.02                | > 100         | > 100      | 15.28        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 11               | 89.59                 | 18.96         | 14.07      | 1.13         | 20.38         | 8.86        | 24.48          | 16.99        | 47.39        | 61.70         | 19.46       | 64.70        |
| 14               | -6.22                 | > 100         | > 100      | 15.93        | > 100         | 98.69       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 17               | 29.14                 | 31.94         | 46.63      | 2.98         | 50.77         | 10.57       | 80.11          | 47.96        | > 100        | > 100         | 79.18       | > 100        |
| 20               | 118.48                | 7.42          | 5.57       | 0.48         | 11.14         | 2.54        | 12.17          | 9.57         | 23.21        | 29.85         | 10.20       | 31.55        |
| 23               | 322.59                | 3.37          | 2.89       | 0.59         | 3.76          | 1.07        | 11.39          | 2.73         | 8.89         | 11.85         | 10.54       | 15.86        |
| 26               | 787.80                | 1.71          | 0.73       | 0.38         | 1.43          | 0.19        | 5.59           | 1.29         | 4.29         | 5.39          | 5.29        | 7.55         |
| 29               | 1183.19               | 1.31          | 0.55       | 0.13         | 0.93          | 0.45        | 5.68           | 0.78         | 3.48         | 4.13          | 5.57        | 6.93         |
| 32               | 1161.59               | 1.47          | 1.46       | 0.14         | 1.00          | 0.56        | 7.71           | 0.85         | 4.27         | 4.89          | 7.75        | 9.17         |
| 35               | 749.12                | 2.18          | 2.41       | 0.18         | 1.66          | 0.75        | 10.33          | 1.32         | 7.61         | 8.40          | 10.47       | 13.43        |
| 38               | 356.87                | 4.46          | 2.86       | 0.24         | 3.31          | 1.32        | 11.89          | 1.82         | 18.72        | 19.83         | 11.95       | 23.15        |
| 41               | 108.08                | 15.53         | 5.23       | 0.76         | 14.62         | 2.03        | 16.87          | 2.67         | 67.30        | 71.01         | 16.31       | 72.86        |
| 44               | 16.96                 | > 100         | 36.58      | 7.39         | > 100         | 7.17        | 55.37          | 12.40        | > 100        | > 100         | 50.67       | > 100        |
| 47               | 24.14                 | 71.80         | 22.25      | 6.33         | > 100         | 5.26        | 32.47          | 9.73         | > 100        | > 100         | 29.83       | > 100        |
| 50               | 80.05                 | 20.09         | 5.68       | 1.94         | 65.52         | 2.20        | 11.91          | 3.21         | > 100        | > 100         | 10.35       | > 100        |
| 53               | 142.24                | 9.38          | 3.09       | 0.95         | 61.19         | 3.43        | 9.07           | 2.17         | > 100        | > 100         | 8.15        | > 100        |
| 56               | 176.46                | 6.60          | 3.13       | 0.61         | 66.35         | 5.88        | 9.18           | 2.06         | > 100        | > 100         | 9.58        | > 100        |
| 59               | 186.92                | 5.55          | 4.18       | 0.60         | 76.63         | 9.01        | 10.71          | 2.48         | > 100        | > 100         | 12.88       | > 100        |
| 62               | 221.59                | 4.28          | 4.66       | 0.80         | 79.48         | 11.38       | 10.61          | 2.85         | > 100        | > 100         | 14.72       | > 100        |
| 64               | 195.64                | 4.36          | 6.47       | 1.18         | 98.00         | 14.60       | 13.82          | 3.59         | > 100        | > 100         | 18.73       | > 100        |

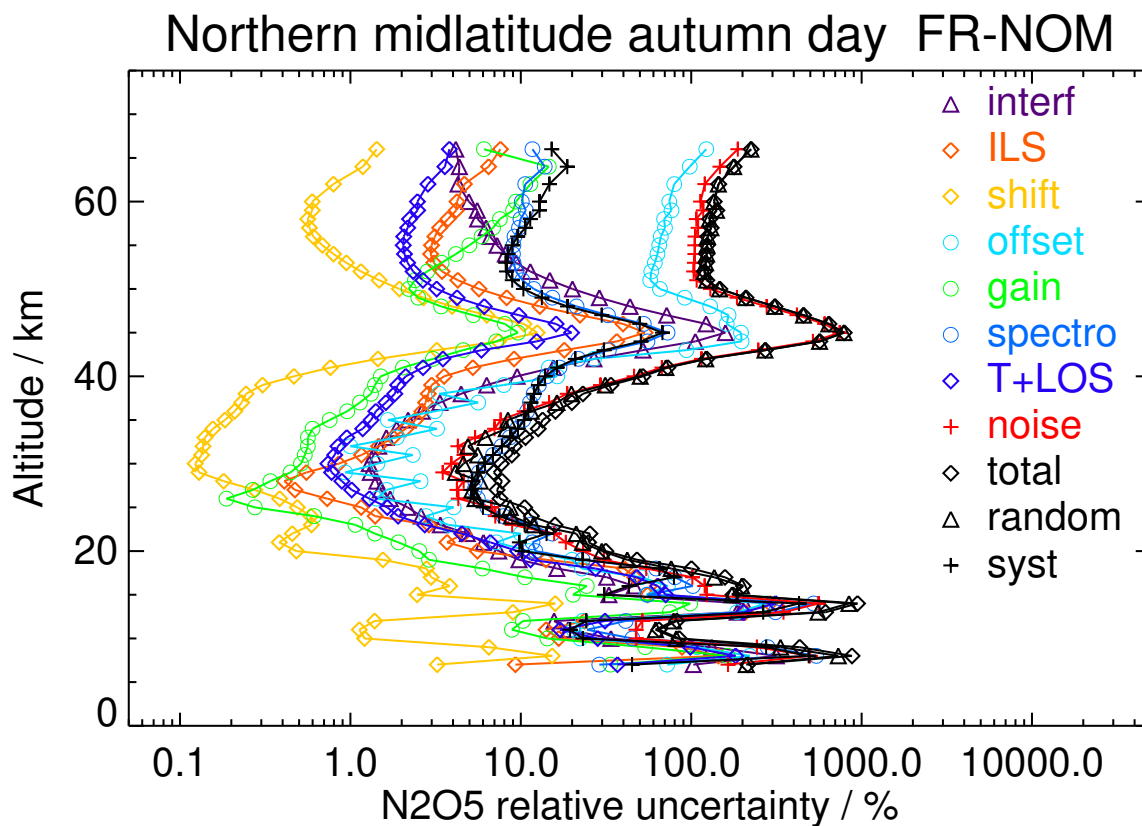


Figure S15: V8H\_N2O5\_61 Northern midlatitude autumn day

Table S20: N2O5 error budget for Northern midlatitude autumn night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 72.12                 | 52.97         | 21.42      | 1.21         | 20.20         | 15.73       | 55.59          | 24.66        | 46.24        | 95.74         | 24.34       | 98.78        |
| 11               | 29.67                 | 47.27         | 62.73      | 3.45         | 49.85         | 35.91       | > 100          | 58.46        | > 100        | > 100         | 34.29       | > 100        |
| 14               | -16.43                | 66.52         | 83.91      | 5.43         | 86.19         | 38.72       | > 100          | 76.28        | > 100        | > 100         | > 100       | > 100        |
| 17               | 51.09                 | 17.62         | 17.53      | 1.30         | 28.68         | 9.18        | 30.82          | 20.33        | 51.28        | 72.09         | 17.99       | 74.30        |
| 20               | 125.98                | 6.91          | 8.20       | 0.68         | 11.86         | 2.65        | 17.09          | 7.63         | 21.21        | 28.36         | 16.10       | 32.61        |
| 23               | 321.04                | 3.51          | 2.23       | 0.47         | 4.97          | 0.93        | 9.72           | 2.74         | 9.57         | 12.81         | 8.52        | 15.38        |
| 26               | 706.36                | 2.00          | 1.02       | 0.37         | 2.48          | 0.32        | 6.01           | 1.32         | 5.36         | 6.95          | 5.46        | 8.83         |
| 29               | 1066.96               | 1.53          | 0.41       | 0.16         | 1.85          | 0.55        | 5.80           | 0.79         | 4.43         | 5.46          | 5.51        | 7.75         |
| 32               | 1068.41               | 1.67          | 1.23       | 0.16         | 1.90          | 0.72        | 7.43           | 0.83         | 5.22         | 6.29          | 7.21        | 9.56         |
| 35               | 858.48                | 1.96          | 1.86       | 0.21         | 2.35          | 0.82        | 8.60           | 0.98         | 7.37         | 8.39          | 8.51        | 11.94        |
| 38               | 590.74                | 2.77          | 2.21       | 0.26         | 3.15          | 1.08        | 9.40           | 1.16         | 12.07        | 13.15         | 9.28        | 16.09        |
| 41               | 337.68                | 5.08          | 2.79       | 0.31         | 6.06          | 1.25        | 10.72          | 1.39         | 23.03        | 24.69         | 10.47       | 26.82        |
| 44               | 143.61                | 12.72         | 5.85       | 0.72         | 23.43         | 1.77        | 15.10          | 2.19         | 61.64        | 67.62         | 14.47       | 69.15        |
| 47               | 85.25                 | 20.41         | 7.32       | 1.60         | 40.80         | 1.96        | 16.56          | 3.11         | > 100        | > 100         | 15.60       | > 100        |
| 50               | 72.75                 | 22.07         | 7.64       | 2.09         | 78.10         | 3.35        | 16.90          | 3.91         | > 100        | > 100         | 15.27       | > 100        |
| 53               | 82.59                 | 16.32         | 7.93       | 1.77         | > 100         | 7.58        | 16.27          | 4.51         | > 100        | > 100         | 15.79       | > 100        |
| 56               | 75.74                 | 15.57         | 10.54      | 1.79         | > 100         | 15.18       | 19.94          | 5.86         | > 100        | > 100         | 22.38       | > 100        |
| 59               | 22.22                 | 46.59         | 41.56      | 5.71         | > 100         | 71.27       | 68.90          | 21.42        | > 100        | > 100         | 92.50       | > 100        |
| 62               | 39.33                 | 24.31         | 30.20      | 4.60         | > 100         | 67.34       | 48.46          | 17.14        | > 100        | > 100         | 76.91       | > 100        |
| 64               | 36.39                 | 24.23         | 33.94      | 5.19         | > 100         | 85.53       | 53.33          | 19.29        | > 100        | > 100         | 93.70       | > 100        |

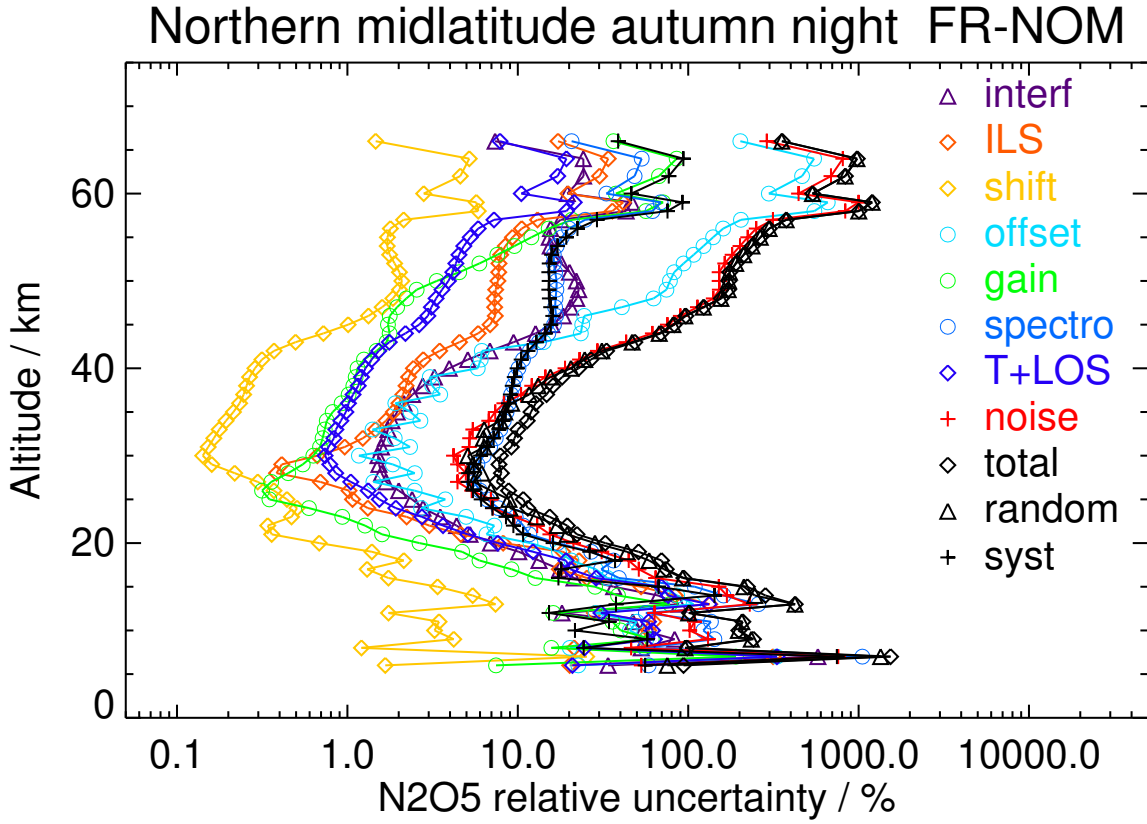


Figure S16: V8H\_N2O5\_61 Northern midlatitude autumn night

Table S21: N2O5 error budget for Tropics day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 137.10                | 14.71         | 4.77       | 1.17         | 10.11         | 6.88        | 15.15          | 6.65         | 26.51        | 36.51         | 5.83        | 36.97        |
| 11               | -10.04                | > 100         | 90.76      | 21.36        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 14               | 38.41                 | 34.60         | 20.80      | 7.30         | 42.02         | 41.89       | 37.98          | 37.73        | 83.90        | > 100         | 39.26       | > 100        |
| 17               | -37.11                | 54.68         | 14.46      | 3.72         | 53.70         | 18.98       | 40.34          | 27.71        | 98.15        | > 100         | 33.72       | > 100        |
| 20               | 51.72                 | 18.62         | 16.55      | 1.68         | 34.15         | 6.83        | 34.29          | 19.02        | 70.99        | 85.12         | 34.18       | 91.73        |
| 23               | 136.13                | 8.81          | 5.57       | 2.08         | 14.05         | 1.36        | 17.81          | 6.94         | 27.98        | 34.25         | 16.97       | 38.22        |
| 26               | 445.97                | 3.16          | 2.90       | 0.55         | 4.94          | 0.33        | 8.95           | 2.13         | 9.79         | 12.01         | 8.91        | 14.96        |
| 29               | 831.58                | 1.85          | 1.11       | 0.20         | 2.86          | 0.28        | 5.44           | 0.78         | 5.97         | 7.18          | 5.23        | 8.88         |
| 32               | 928.50                | 1.72          | 0.42       | 0.14         | 2.74          | 0.48        | 5.87           | 0.57         | 6.12         | 7.20          | 5.60        | 9.12         |
| 35               | 629.81                | 2.39          | 1.20       | 0.15         | 4.06          | 0.90        | 7.68           | 1.06         | 9.94         | 11.16         | 7.67        | 13.55        |
| 38               | 255.25                | 5.43          | 1.66       | 0.45         | 10.74         | 1.40        | 9.93           | 1.75         | 27.29        | 30.05         | 9.65        | 31.56        |
| 41               | 62.46                 | 23.04         | 2.14       | 1.86         | 44.31         | 3.59        | 10.01          | 2.38         | > 100        | > 100         | 8.01        | > 100        |
| 44               | 52.75                 | 27.59         | 3.77       | 2.76         | 26.97         | 3.24        | 10.71          | 2.36         | > 100        | > 100         | 8.69        | > 100        |
| 47               | 39.59                 | 39.22         | 4.61       | 3.22         | 95.05         | 4.73        | 12.52          | 2.87         | > 100        | > 100         | 8.29        | > 100        |
| 50               | -15.87                | 86.55         | 11.30      | 9.82         | > 100         | 11.06       | 50.68          | 13.07        | > 100        | > 100         | 43.72       | > 100        |
| 53               | -29.10                | 41.49         | 7.66       | 5.06         | > 100         | 7.73        | 38.74          | 9.33         | > 100        | > 100         | 32.72       | > 100        |
| 56               | -20.06                | 51.66         | 13.00      | 4.85         | > 100         | 31.17       | 63.56          | 14.32        | > 100        | > 100         | 59.17       | > 100        |
| 59               | -16.40                | 54.23         | 18.80      | 6.41         | > 100         | 72.67       | 86.91          | 19.86        | > 100        | > 100         | 98.59       | > 100        |
| 62               | -34.90                | 22.66         | 9.77       | 7.09         | > 100         | 54.77       | 45.83          | 11.53        | > 100        | > 100         | 64.51       | > 100        |
| 64               | -53.17                | 14.31         | 7.22       | 6.55         | > 100         | 45.72       | 31.19          | 8.80         | > 100        | > 100         | 50.63       | > 100        |

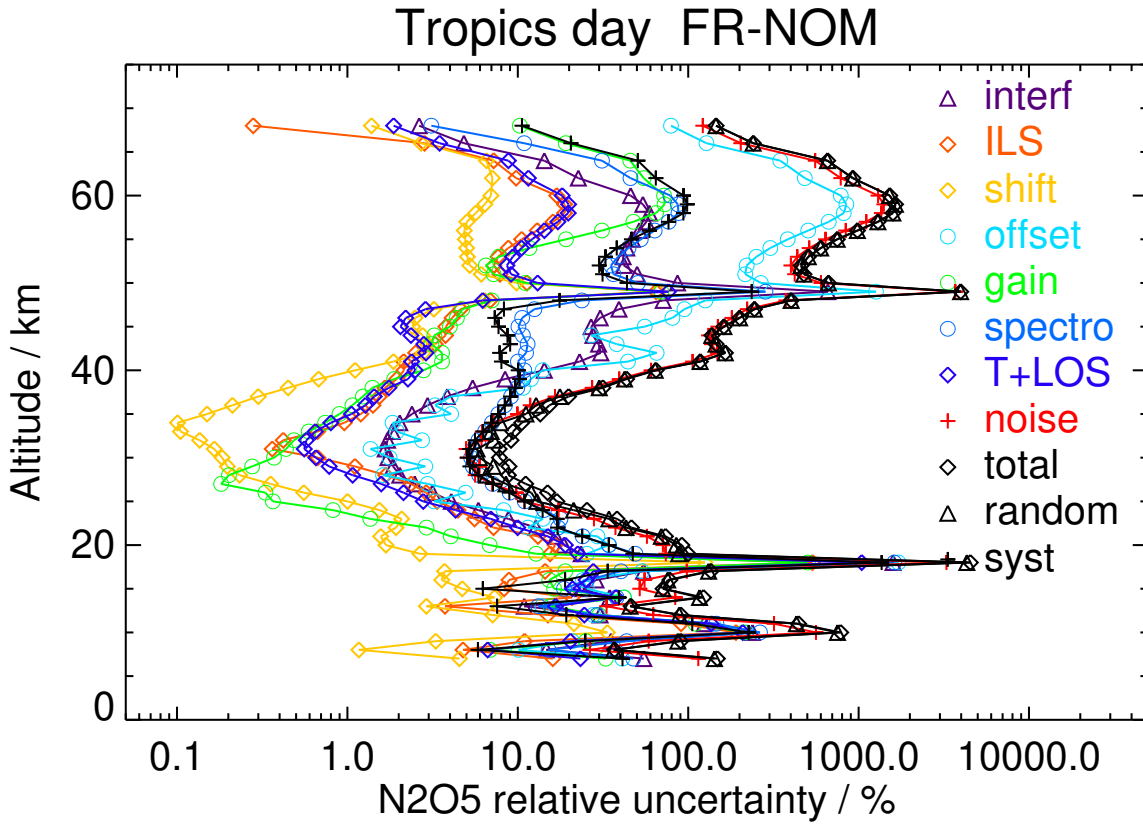


Figure S17: V8H\_N2O5\_61 Tropics day

Table S22: N2O5 error budget for Tropics night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 91.96                 | 15.65         | 3.80       | 0.96         | 8.93          | 6.28        | 13.74          | 7.38         | 23.93        | 33.88         | 6.90        | 34.57        |
| 11               | 15.99                 | 69.00         | 25.62      | 7.34         | 75.32         | 34.50       | 85.03          | 54.32        | > 100        | > 100         | 31.25       | > 100        |
| 14               | 11.58                 | > 100         | 27.95      | 15.26        | > 100         | 88.58       | > 100          | 73.25        | > 100        | > 100         | > 100       | > 100        |
| 17               | 4.84                  | > 100         | 75.29      | 22.97        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 20               | 10.10                 | > 100         | 74.41      | 5.91         | > 100         | 21.70       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 23               | 89.38                 | 13.79         | 8.74       | 4.46         | 23.89         | 3.13        | 25.74          | 12.88        | 45.54        | 56.00         | 25.17       | 61.40        |
| 26               | 380.61                | 3.75          | 3.42       | 0.62         | 6.16          | 0.60        | 11.45          | 3.08         | 11.91        | 14.76         | 11.36       | 18.63        |
| 29               | 895.13                | 1.73          | 1.42       | 0.20         | 2.86          | 0.15        | 5.91           | 0.98         | 5.75         | 7.04          | 5.71        | 9.06         |
| 32               | 1223.81               | 1.30          | 0.31       | 0.27         | 2.21          | 0.20        | 5.29           | 0.57         | 4.79         | 5.65          | 5.11        | 7.61         |
| 35               | 1419.76               | 1.06          | 0.25       | 0.15         | 1.90          | 0.47        | 5.38           | 0.53         | 4.52         | 5.13          | 5.33        | 7.40         |
| 38               | 1129.95               | 1.24          | 0.33       | 0.16         | 2.49          | 0.68        | 6.54           | 0.88         | 6.30         | 7.00          | 6.52        | 9.57         |
| 41               | 576.29                | 2.50          | 1.00       | 0.37         | 4.28          | 0.81        | 7.96           | 1.11         | 11.10        | 12.29         | 7.95        | 14.64        |
| 44               | 253.22                | 5.77          | 1.21       | 0.73         | 4.01          | 0.64        | 7.86           | 1.77         | 26.44        | 27.51         | 7.68        | 28.56        |
| 47               | 112.26                | 13.89         | 1.60       | 1.22         | 36.68         | 1.07        | 8.47           | 1.55         | 81.64        | 90.73         | 7.07        | 91.01        |
| 50               | 94.99                 | 14.40         | 2.05       | 1.70         | 38.80         | 1.35        | 10.80          | 2.30         | 94.94        | > 100         | 9.24        | > 100        |
| 53               | 81.78                 | 14.29         | 3.27       | 1.66         | 88.13         | 2.94        | 15.73          | 3.14         | > 100        | > 100         | 13.52       | > 100        |
| 56               | 41.75                 | 23.95         | 7.33       | 2.00         | > 100         | 15.90       | 29.95          | 6.38         | > 100        | > 100         | 29.03       | > 100        |
| 59               | -0.66                 | > 100         | > 100      | > 100        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 62               | -31.99                | 23.52         | 15.07      | 8.28         | > 100         | 57.45       | 44.00          | 13.48        | > 100        | > 100         | 66.77       | > 100        |
| 64               | -48.25                | 15.03         | 10.51      | 7.64         | > 100         | 46.43       | 31.21          | 10.37        | > 100        | > 100         | 51.85       | > 100        |

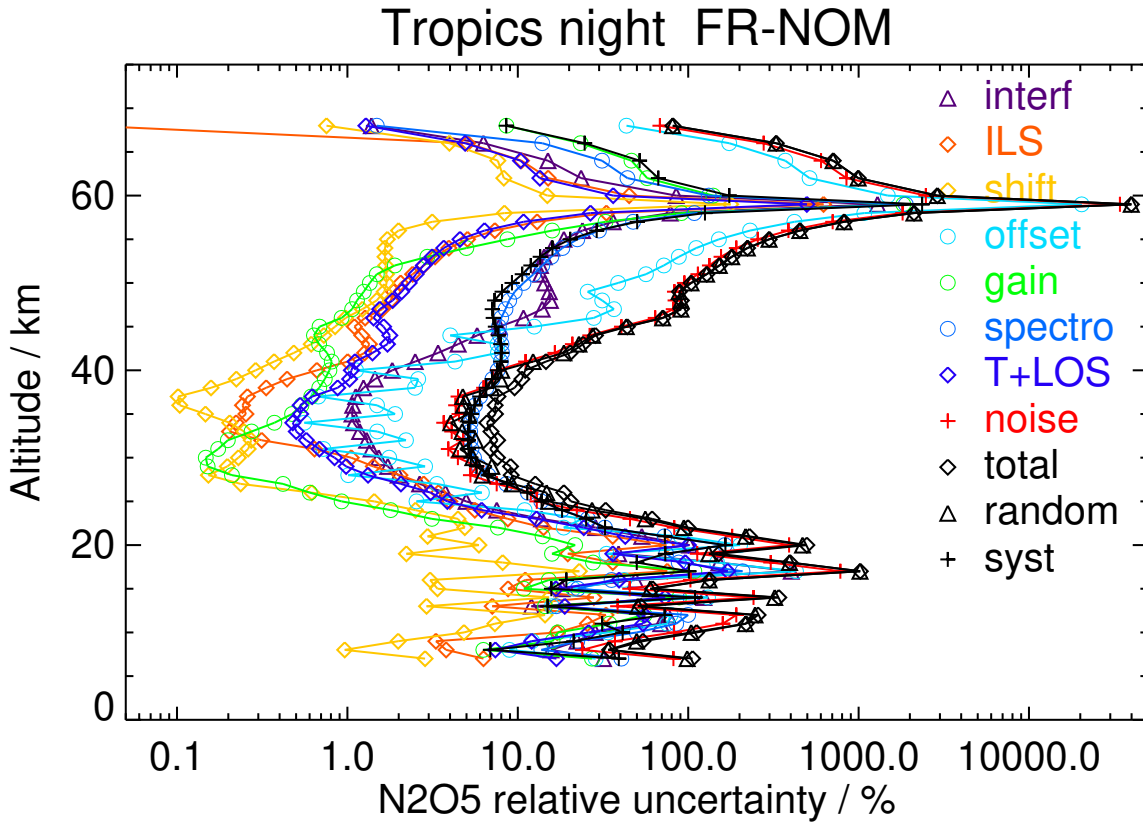


Figure S18: V8H\_N2O5\_61 Tropics night

Table S23: N2O5 error budget for Southern midlatitude winter day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 5                | -118.47               | 38.24         | 8.23       | 2.27         | 21.05         | 19.79       | 64.01          | 18.79        | 52.19        | 81.91         | 53.25       | 97.70        |
| 8                | 103.24                | 32.03         | 7.81       | 1.71         | 17.60         | 11.82       | 34.46          | 17.75        | 42.80        | 65.03         | 25.38       | 69.81        |
| 11               | 6.81                  | > 100         | > 100      | 21.86        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 14               | -29.78                | 32.25         | 46.08      | 3.09         | 48.69         | 24.61       | 93.37          | 61.06        | > 100        | > 100         | 69.68       | > 100        |
| 17               | 55.59                 | 16.88         | 12.47      | 1.20         | 24.94         | 9.97        | 36.27          | 20.83        | 50.12        | 67.62         | 29.19       | 73.65        |
| 20               | 99.25                 | 9.15          | 3.73       | 0.72         | 12.23         | 3.27        | 13.74          | 8.97         | 27.50        | 34.10         | 11.00       | 35.83        |
| 23               | 273.45                | 4.54          | 1.97       | 0.40         | 4.66          | 1.26        | 11.11          | 2.86         | 12.01        | 14.90         | 10.08       | 18.00        |
| 26               | 582.60                | 2.89          | 0.93       | 0.29         | 2.55          | 0.49        | 6.92           | 1.55         | 7.69         | 9.33          | 6.20        | 11.20        |
| 29               | 1011.60               | 1.93          | 0.34       | 0.16         | 1.55          | 0.60        | 5.55           | 0.94         | 5.66         | 6.68          | 5.07        | 8.39         |
| 32               | 1132.62               | 1.84          | 0.81       | 0.17         | 1.41          | 0.86        | 6.69           | 0.81         | 5.94         | 6.94          | 6.27        | 9.36         |
| 35               | 844.68                | 2.35          | 1.79       | 0.24         | 2.02          | 1.17        | 9.48           | 1.16         | 8.80         | 10.12         | 8.97        | 13.52        |
| 38               | 486.87                | 3.97          | 2.76       | 0.37         | 3.39          | 1.51        | 10.79          | 1.63         | 16.96        | 18.12         | 10.75       | 21.07        |
| 41               | 223.91                | 8.84          | 4.80       | 0.67         | 8.63          | 1.87        | 13.29          | 2.24         | 38.69        | 41.05         | 13.17       | 43.11        |
| 44               | 103.08                | 19.67         | 10.49      | 1.26         | 34.46         | 1.89        | 19.24          | 4.10         | 93.90        | > 100         | 18.37       | > 100        |
| 47               | 21.03                 | 89.16         | 45.00      | 7.37         | > 100         | 14.24       | 67.02          | 21.31        | > 100        | > 100         | 65.51       | > 100        |
| 50               | -22.81                | 73.58         | 43.23      | 7.02         | > 100         | 13.89       | 52.17          | 21.03        | > 100        | > 100         | 52.22       | > 100        |
| 53               | -36.92                | 38.61         | 31.64      | 4.06         | > 100         | 18.96       | 33.26          | 14.77        | > 100        | > 100         | 35.85       | > 100        |
| 56               | -46.69                | 27.89         | 30.33      | 3.44         | > 100         | 26.25       | 29.58          | 13.73        | > 100        | > 100         | 35.85       | > 100        |
| 59               | -89.99                | 13.85         | 20.13      | 2.20         | > 100         | 15.55       | 17.94          | 8.66         | > 100        | > 100         | 21.98       | > 100        |
| 62               | -65.55                | 17.23         | 26.21      | 3.27         | > 100         | 39.22       | 23.72          | 13.40        | > 100        | > 100         | 41.22       | > 100        |
| 64               | -84.77                | 13.06         | 23.95      | 2.67         | > 100         | 35.82       | 21.32          | 12.21        | > 100        | > 100         | 38.64       | > 100        |

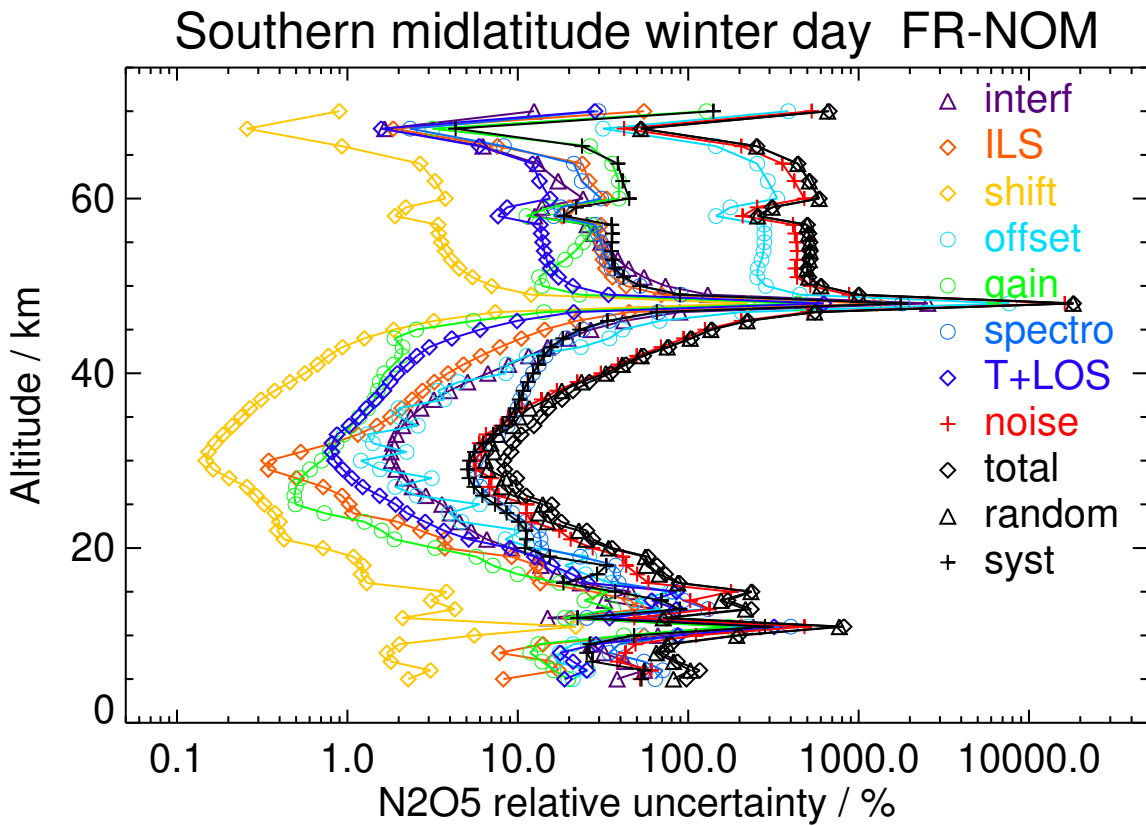


Figure S19: V8H\_N2O5.61 Southern midlatitude winter day

Table S24: N2O5 error budget for Southern midlatitude winter night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 5                | -96.23                | 52.02         | 14.92      | 1.97         | 20.95         | 9.58        | 51.08          | 20.98        | 50.62        | 87.23         | 38.26       | 95.26        |
| 8                | 99.59                 | 31.37         | 18.09      | 1.37         | 19.35         | 10.78       | 40.02          | 23.80        | 47.16        | 76.43         | 18.85       | 78.72        |
| 11               | 12.30                 | > 100         | > 100      | 8.84         | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 14               | 11.51                 | 95.44         | > 100      | 6.22         | > 100         | 56.57       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 17               | 32.01                 | 32.18         | 37.25      | 2.71         | 44.69         | 20.61       | 67.02          | 42.56        | 94.14        | > 100         | 64.98       | > 100        |
| 20               | 107.72                | 8.67          | 6.06       | 0.64         | 12.29         | 2.63        | 14.67          | 9.18         | 27.45        | 34.27         | 12.18       | 36.37        |
| 23               | 261.07                | 4.65          | 2.04       | 0.48         | 5.04          | 1.13        | 10.01          | 2.87         | 12.98        | 15.70         | 9.13        | 18.16        |
| 26               | 592.17                | 2.72          | 0.93       | 0.33         | 2.43          | 0.37        | 6.49           | 1.46         | 7.39         | 9.11          | 5.51        | 10.65        |
| 29               | 952.07                | 1.92          | 0.49       | 0.19         | 1.75          | 0.48        | 5.64           | 0.92         | 5.65         | 6.72          | 5.17        | 8.47         |
| 32               | 1064.29               | 1.83          | 0.98       | 0.17         | 1.78          | 0.72        | 6.97           | 0.78         | 5.93         | 6.98          | 6.61        | 9.61         |
| 35               | 766.10                | 2.42          | 2.13       | 0.24         | 2.70          | 0.96        | 9.65           | 1.12         | 9.35         | 10.67         | 9.31        | 14.16        |
| 38               | 448.41                | 4.08          | 2.97       | 0.40         | 4.22          | 1.17        | 10.74          | 1.51         | 17.69        | 18.92         | 10.84       | 21.80        |
| 41               | 213.67                | 9.03          | 4.43       | 0.67         | 10.06         | 1.46        | 12.72          | 2.00         | 40.02        | 42.50         | 12.86       | 44.41        |
| 44               | 130.13                | 15.23         | 6.23       | 0.90         | 26.79         | 1.57        | 13.80          | 2.58         | 74.35        | 80.83         | 13.52       | 81.96        |
| 47               | 80.66                 | 23.00         | 9.56       | 1.61         | 48.11         | 2.12        | 17.51          | 4.23         | > 100        | > 100         | 15.99       | > 100        |
| 50               | 30.02                 | 56.02         | 27.01      | 4.21         | > 100         | 10.15       | 43.07          | 12.62        | > 100        | > 100         | 37.13       | > 100        |
| 53               | -11.70                | > 100         | 84.11      | 8.66         | > 100         | 66.25       | > 100          | 37.84        | > 100        | > 100         | > 100       | > 100        |
| 56               | -30.53                | 42.98         | 39.23      | 3.46         | > 100         | 44.14       | 50.82          | 17.39        | > 100        | > 100         | 56.57       | > 100        |
| 59               | -9.96                 | > 100         | > 100      | 11.17        | > 100         | > 100       | > 100          | 73.08        | > 100        | > 100         | > 100       | > 100        |
| 62               | -47.11                | 24.64         | 33.46      | 3.72         | > 100         | 57.47       | 39.52          | 16.78        | > 100        | > 100         | 62.20       | > 100        |
| 64               | -57.60                | 20.08         | 30.53      | 2.60         | > 100         | 55.70       | 38.42          | 14.98        | > 100        | > 100         | 63.39       | > 100        |

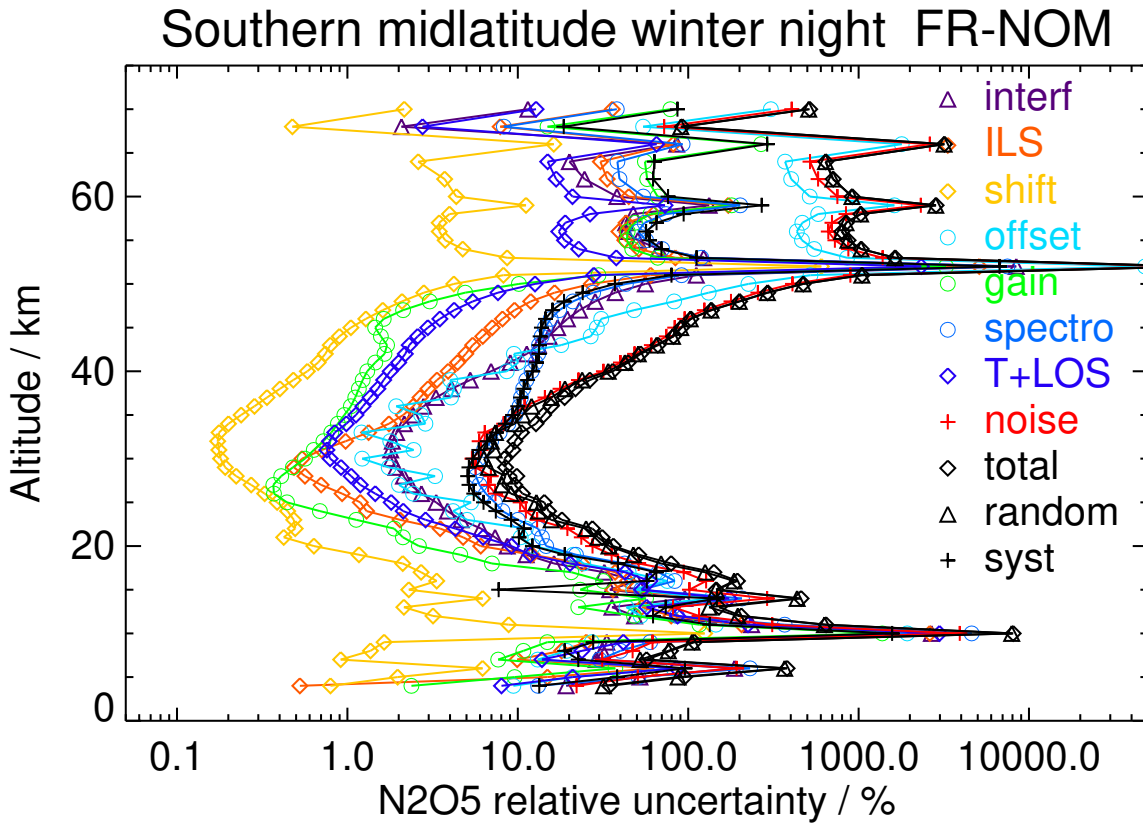


Figure S20: V8H.N2O5\_61 Southern midlatitude winter night

Table S25: N2O5 error budget for Southern midlatitude spring day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 92.59                 | 38.85         | 15.40      | 1.49         | 16.16         | 11.67       | 43.82          | 18.93        | 37.89        | 68.38         | 34.42       | 76.56        |
| 11               | 2.72                  | > 100         | > 100      | 43.31        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 14               | 29.98                 | 37.58         | 66.91      | 4.07         | 46.13         | 31.17       | 95.52          | 57.38        | 89.10        | > 100         | 87.25       | > 100        |
| 17               | 76.35                 | 12.16         | 13.74      | 1.58         | 18.90         | 8.10        | 21.15          | 15.74        | 34.22        | 49.98         | 11.45       | 51.27        |
| 20               | 177.97                | 4.90          | 5.81       | 0.61         | 8.60          | 2.51        | 12.10          | 4.80         | 15.15        | 21.53         | 8.58        | 23.18        |
| 23               | 336.83                | 3.16          | 1.66       | 0.41         | 4.92          | 0.61        | 7.87           | 1.90         | 9.07         | 11.97         | 6.48        | 13.61        |
| 26               | 569.26                | 2.28          | 0.70       | 0.31         | 3.20          | 0.39        | 5.94           | 1.03         | 6.33         | 8.18          | 5.07        | 9.62         |
| 29               | 770.25                | 1.88          | 0.66       | 0.16         | 2.64          | 0.54        | 5.99           | 0.68         | 5.57         | 6.97          | 5.48        | 8.87         |
| 32               | 641.08                | 2.49          | 1.76       | 0.16         | 3.56          | 0.80        | 8.33           | 0.86         | 7.98         | 9.91          | 7.62        | 12.51        |
| 35               | 299.19                | 5.05          | 4.08       | 0.30         | 8.14          | 1.21        | 14.76          | 1.83         | 19.24        | 23.04         | 13.04       | 26.48        |
| 38               | 108.52                | 13.35         | 6.19       | 0.74         | 22.22         | 2.46        | 17.84          | 2.44         | 59.51        | 66.15         | 14.37       | 67.69        |
| 41               | 40.23                 | 36.44         | 9.67       | 1.75         | 66.05         | 4.29        | 18.40          | 3.38         | > 100        | > 100         | 14.47       | > 100        |
| 44               | 15.93                 | 97.62         | 27.62      | 5.75         | > 100         | 9.42        | 34.35          | 9.16         | > 100        | > 100         | 28.66       | > 100        |
| 47               | 33.53                 | 45.76         | 15.89      | 3.94         | 69.83         | 4.30        | 16.48          | 6.46         | > 100        | > 100         | 17.10       | > 100        |
| 50               | 47.05                 | 31.57         | 10.92      | 3.18         | > 100         | 2.88        | 16.59          | 5.65         | > 100        | > 100         | 15.10       | > 100        |
| 53               | 30.88                 | 39.51         | 17.16      | 4.42         | > 100         | 9.09        | 30.96          | 10.73        | > 100        | > 100         | 26.65       | > 100        |
| 56               | 14.35                 | 72.09         | 34.20      | 8.06         | > 100         | 43.78       | 76.69          | 25.26        | > 100        | > 100         | 69.51       | > 100        |
| 59               | -2.25                 | > 100         | > 100      | 58.28        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 62               | -18.80                | 44.68         | 58.72      | 11.24        | > 100         | > 100       | 60.92          | 30.70        | > 100        | > 100         | > 100       | > 100        |
| 64               | -22.56                | 36.47         | 55.62      | 12.46        | > 100         | > 100       | 52.14          | 31.50        | > 100        | > 100         | 97.74       | > 100        |

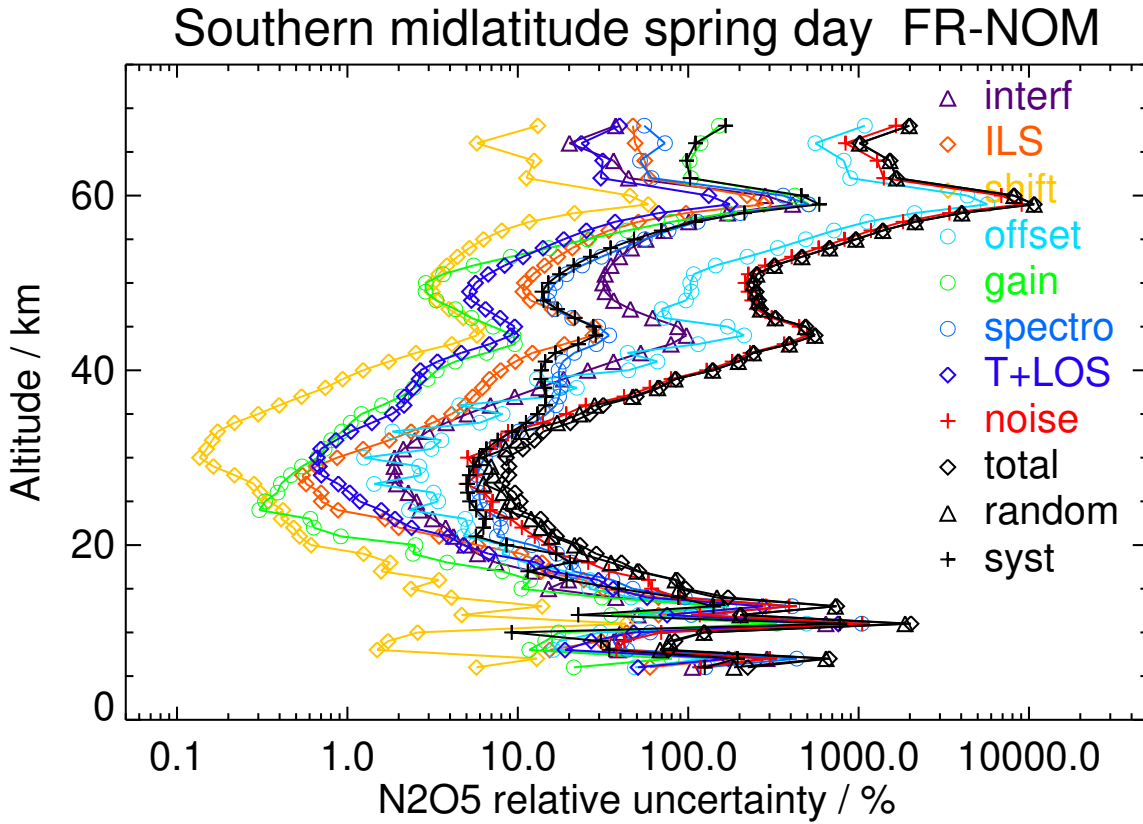


Figure S21: V8H\_N2O5\_61 Southern midlatitude spring day

Table S26: N2O5 error budget for Southern midlatitude spring night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 129.33                | 36.89         | 9.94       | 0.86         | 13.40         | 12.80       | 29.66          | 15.20        | 31.96        | 56.69         | 26.87       | 62.74        |
| 11               | -13.31                | > 100         | > 100      | 9.22         | > 100         | 44.32       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 14               | -26.97                | 39.48         | 94.25      | 3.47         | 50.11         | 36.05       | > 100          | 71.81        | > 100        | > 100         | > 100       | > 100        |
| 17               | 110.42                | 7.98          | 14.85      | 1.11         | 12.70         | 5.19        | 17.88          | 11.30        | 22.59        | 35.86         | 12.04       | 37.83        |
| 20               | 208.30                | 3.85          | 4.26       | 0.50         | 6.94          | 1.52        | 9.44           | 4.63         | 11.68        | 17.00         | 6.46        | 18.18        |
| 23               | 369.09                | 2.62          | 1.81       | 0.27         | 4.36          | 0.86        | 7.90           | 1.97         | 7.36         | 10.39         | 6.52        | 12.27        |
| 26               | 685.12                | 1.79          | 0.65       | 0.32         | 2.71          | 0.40        | 5.68           | 1.12         | 4.87         | 6.42          | 5.22        | 8.28         |
| 29               | 1013.78               | 1.43          | 0.41       | 0.13         | 2.20          | 0.64        | 5.58           | 0.63         | 4.25         | 5.42          | 5.27        | 7.56         |
| 32               | 1002.05               | 1.62          | 1.15       | 0.16         | 2.52          | 0.95        | 6.56           | 0.66         | 5.36         | 6.76          | 6.13        | 9.13         |
| 35               | 790.40                | 2.00          | 1.89       | 0.21         | 3.45          | 1.12        | 8.33           | 0.96         | 7.99         | 9.36          | 8.21        | 12.45        |
| 38               | 473.84                | 3.22          | 2.76       | 0.27         | 5.51          | 1.67        | 9.89           | 1.34         | 14.89        | 16.51         | 10.00       | 19.30        |
| 41               | 270.91                | 5.72          | 3.50       | 0.32         | 10.30         | 1.68        | 10.29          | 1.37         | 29.10        | 31.60         | 10.49       | 33.29        |
| 44               | 93.85                 | 16.98         | 9.84       | 1.10         | 34.56         | 3.55        | 16.15          | 2.82         | 86.69        | 95.43         | 16.43       | 96.83        |
| 47               | 65.08                 | 23.88         | 13.48      | 2.36         | 32.16         | 2.58        | 14.38          | 5.33         | > 100        | > 100         | 16.76       | > 100        |
| 50               | 75.62                 | 19.57         | 7.60       | 2.30         | 66.30         | 3.70        | 11.33          | 4.29         | > 100        | > 100         | 10.63       | > 100        |
| 53               | 48.67                 | 25.21         | 11.99      | 3.25         | > 100         | 8.03        | 19.51          | 7.23         | > 100        | > 100         | 17.19       | > 100        |
| 56               | 26.93                 | 38.15         | 20.52      | 4.95         | > 100         | 26.70       | 39.10          | 12.33        | > 100        | > 100         | 36.71       | > 100        |
| 59               | 43.23                 | 20.56         | 12.60      | 2.65         | > 100         | 29.95       | 26.78          | 7.61         | > 100        | > 100         | 32.69       | > 100        |
| 62               | 2.25                  | > 100         | > 100      | 71.24        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 64               | -0.89                 | > 100         | > 100      | > 100        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |

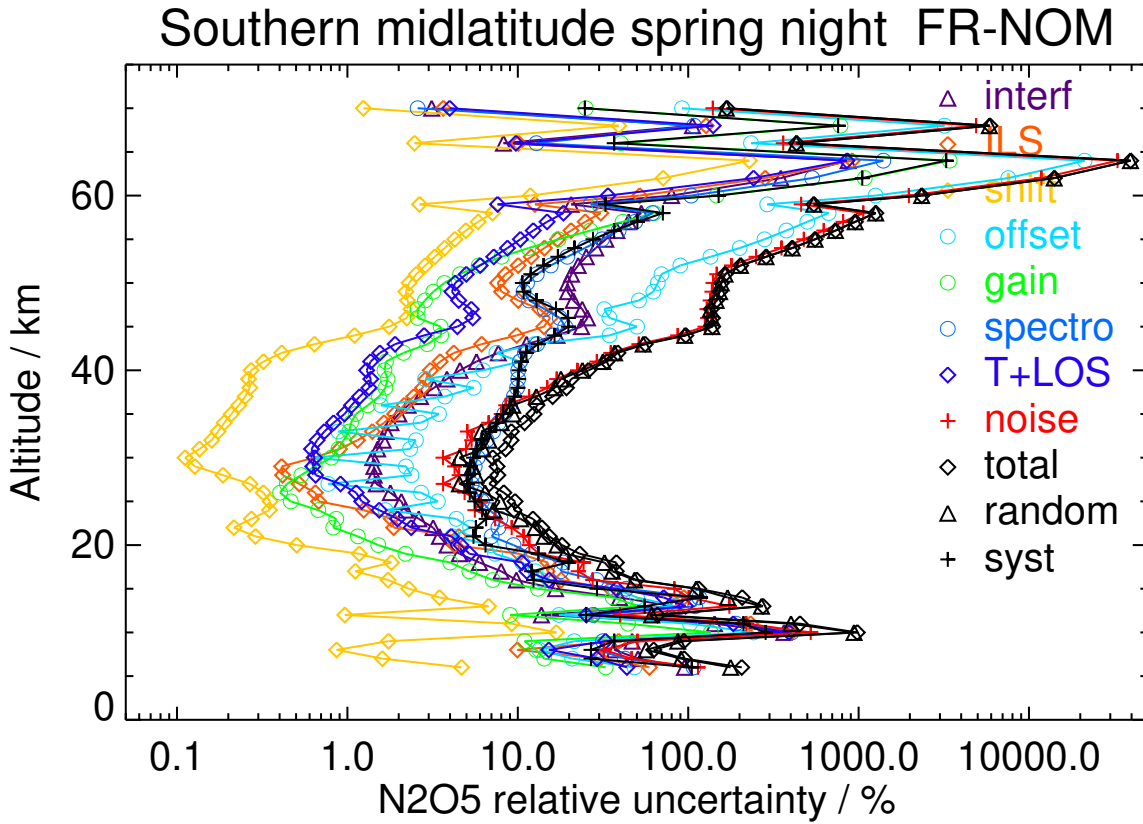


Figure S22: V8H.N2O5\_61 Southern midlatitude spring night

Table S27: N2O5 error budget for Southern midlatitude summer day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 5                | -207.95               | 16.07         | 16.60      | 0.78         | 10.85         | 7.04        | 29.97          | 12.96        | 27.30        | 43.58         | 24.77       | 50.13        |
| 8                | 157.28                | 26.69         | 16.75      | 0.75         | 11.54         | 11.51       | 30.60          | 16.94        | 29.85        | 57.29         | 9.57        | 58.08        |
| 11               | 47.36                 | 35.78         | 59.75      | 2.38         | 31.57         | 31.84       | 93.25          | 45.17        | 74.22        | > 100         | 16.77       | > 100        |
| 14               | -6.42                 | > 100         | > 100      | 13.37        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 17               | 50.42                 | 16.67         | 25.81      | 2.20         | 26.83         | 7.15        | 38.97          | 23.78        | 58.41        | 78.44         | 32.60       | 84.95        |
| 20               | 146.15                | 5.70          | 5.25       | 0.42         | 7.63          | 1.56        | 10.44          | 5.86         | 17.32        | 22.37         | 7.98        | 23.75        |
| 23               | 342.42                | 2.86          | 1.70       | 0.58         | 2.85          | 0.49        | 7.34           | 1.93         | 7.29         | 9.09          | 6.92        | 11.43        |
| 26               | 617.13                | 1.91          | 0.51       | 0.30         | 1.54          | 0.36        | 5.24           | 0.97         | 4.66         | 5.61          | 5.01        | 7.53         |
| 29               | 668.23                | 1.99          | 0.80       | 0.08         | 1.53          | 0.64        | 6.56           | 0.68         | 5.15         | 6.09          | 6.35        | 8.80         |
| 32               | 475.66                | 3.08          | 2.10       | 0.13         | 2.50          | 0.78        | 9.25           | 1.08         | 8.67         | 10.30         | 8.75        | 13.51        |
| 35               | 186.87                | 7.66          | 3.44       | 0.59         | 7.54          | 1.28        | 14.07          | 2.15         | 25.57        | 28.85         | 12.37       | 31.39        |
| 38               | 48.76                 | 26.76         | 6.02       | 1.59         | 30.89         | 2.91        | 16.61          | 3.35         | > 100        | > 100         | 12.31       | > 100        |
| 41               | 17.56                 | 69.32         | 10.16      | 3.47         | > 100         | 6.27        | 24.80          | 7.23         | > 100        | > 100         | 13.11       | > 100        |
| 44               | 19.41                 | 69.23         | 13.95      | 5.14         | > 100         | 6.50        | 24.55          | 7.28         | > 100        | > 100         | 16.90       | > 100        |
| 47               | 11.89                 | > 100         | 25.83      | 10.24        | > 100         | 9.75        | 43.00          | 14.49        | > 100        | > 100         | 38.24       | > 100        |
| 50               | 33.76                 | 40.91         | 5.44       | 2.83         | 91.61         | 4.24        | 15.48          | 4.92         | > 100        | > 100         | 13.21       | > 100        |
| 53               | 58.16                 | 18.96         | 4.85       | 1.22         | 95.79         | 4.37        | 11.86          | 3.69         | > 100        | > 100         | 8.30        | > 100        |
| 56               | 63.58                 | 14.51         | 6.94       | 1.12         | > 100         | 4.63        | 13.93          | 4.72         | > 100        | > 100         | 10.46       | > 100        |
| 59               | 69.05                 | 11.27         | 9.82       | 1.59         | > 100         | 9.00        | 15.97          | 5.07         | > 100        | > 100         | 16.68       | > 100        |
| 62               | 82.96                 | 8.24          | 9.25       | 2.92         | > 100         | 16.78       | 14.89          | 5.32         | > 100        | > 100         | 20.87       | > 100        |
| 64               | 88.39                 | 8.52          | 7.34       | 4.04         | > 100         | 21.01       | 13.74          | 6.93         | > 100        | > 100         | 22.32       | > 100        |

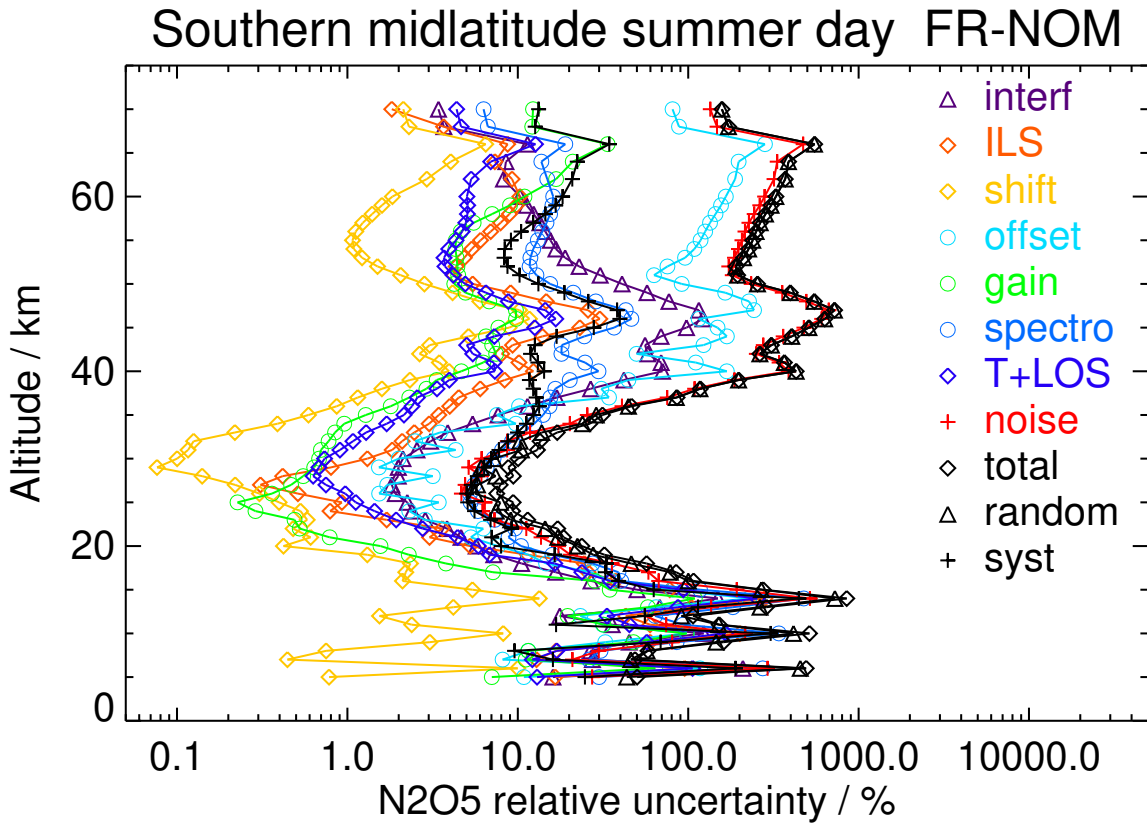


Figure S23: V8H.N2O5\_61 Southern midlatitude summer day

Table S28: N2O5 error budget for Southern midlatitude summer night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 5                | -149.10               | 22.77         | 10.33      | 1.25         | 13.92         | 12.06       | 21.32          | 10.47        | 34.85        | 49.25         | 17.86       | 52.39        |
| 8                | 20.79                 | > 100         | 90.85      | 10.13        | > 100         | 65.81       | > 100          | 99.04        | > 100        | > 100         | > 100       | > 100        |
| 11               | 95.36                 | 20.49         | 29.35      | 1.57         | 19.90         | 9.78        | 24.85          | 27.24        | 47.46        | 72.05         | 13.98       | 73.40        |
| 14               | 25.34                 | 40.90         | 97.53      | 4.32         | 64.54         | 34.53       | 82.52          | 88.25        | > 100        | > 100         | 13.23       | > 100        |
| 17               | 39.56                 | 21.65         | 59.12      | 4.08         | 35.90         | 13.15       | 61.74          | 43.08        | 82.28        | > 100         | 71.95       | > 100        |
| 20               | 103.61                | 8.26          | 6.60       | 0.90         | 11.04         | 3.28        | 11.76          | 10.35        | 26.44        | 33.43         | 8.49        | 34.49        |
| 23               | 303.78                | 3.30          | 2.28       | 0.60         | 3.28          | 0.83        | 7.79           | 2.36         | 8.80         | 10.80         | 7.42        | 13.10        |
| 26               | 533.04                | 2.24          | 0.63       | 0.33         | 1.83          | 0.45        | 5.37           | 1.17         | 5.64         | 6.71          | 5.10        | 8.43         |
| 29               | 686.98                | 1.94          | 0.50       | 0.10         | 1.54          | 0.69        | 5.63           | 0.70         | 5.18         | 6.05          | 5.41        | 8.11         |
| 32               | 701.61                | 2.10          | 1.16       | 0.16         | 1.75          | 0.73        | 6.39           | 0.62         | 5.97         | 6.91          | 6.19        | 9.28         |
| 35               | 567.52                | 2.49          | 1.36       | 0.15         | 2.46          | 0.84        | 7.27           | 0.81         | 8.45         | 9.60          | 6.90        | 11.82        |
| 38               | 363.92                | 3.52          | 1.57       | 0.29         | 4.22          | 1.37        | 8.54           | 1.15         | 14.70        | 16.27         | 7.77        | 18.03        |
| 41               | 135.96                | 8.91          | 2.83       | 0.79         | 13.91         | 1.89        | 11.75          | 2.02         | 43.25        | 46.90         | 9.90        | 47.94        |
| 44               | 53.64                 | 24.87         | 7.80       | 1.88         | 58.21         | 4.86        | 12.85          | 3.21         | > 100        | > 100         | 11.46       | > 100        |
| 47               | 43.33                 | 31.44         | 7.27       | 2.85         | 63.87         | 3.91        | 11.41          | 3.52         | > 100        | > 100         | 11.00       | > 100        |
| 50               | 52.70                 | 25.71         | 3.41       | 1.84         | 55.58         | 2.94        | 9.99           | 2.63         | > 100        | > 100         | 7.60        | > 100        |
| 53               | 53.48                 | 20.10         | 5.71       | 1.23         | 97.79         | 5.39        | 11.54          | 3.36         | > 100        | > 100         | 8.96        | > 100        |
| 56               | 38.85                 | 22.30         | 7.06       | 1.48         | > 100         | 9.02        | 18.25          | 5.17         | > 100        | > 100         | 13.26       | > 100        |
| 59               | 16.41                 | 43.84         | 51.01      | 7.65         | > 100         | 64.45       | 58.06          | 19.99        | > 100        | > 100         | 82.33       | > 100        |
| 62               | -7.06                 | 90.16         | > 100      | 38.13        | > 100         | > 100       | > 100          | 84.38        | > 100        | > 100         | > 100       | > 100        |
| 64               | -12.97                | 52.98         | > 100      | 29.92        | > 100         | > 100       | > 100          | 57.09        | > 100        | > 100         | > 100       | > 100        |

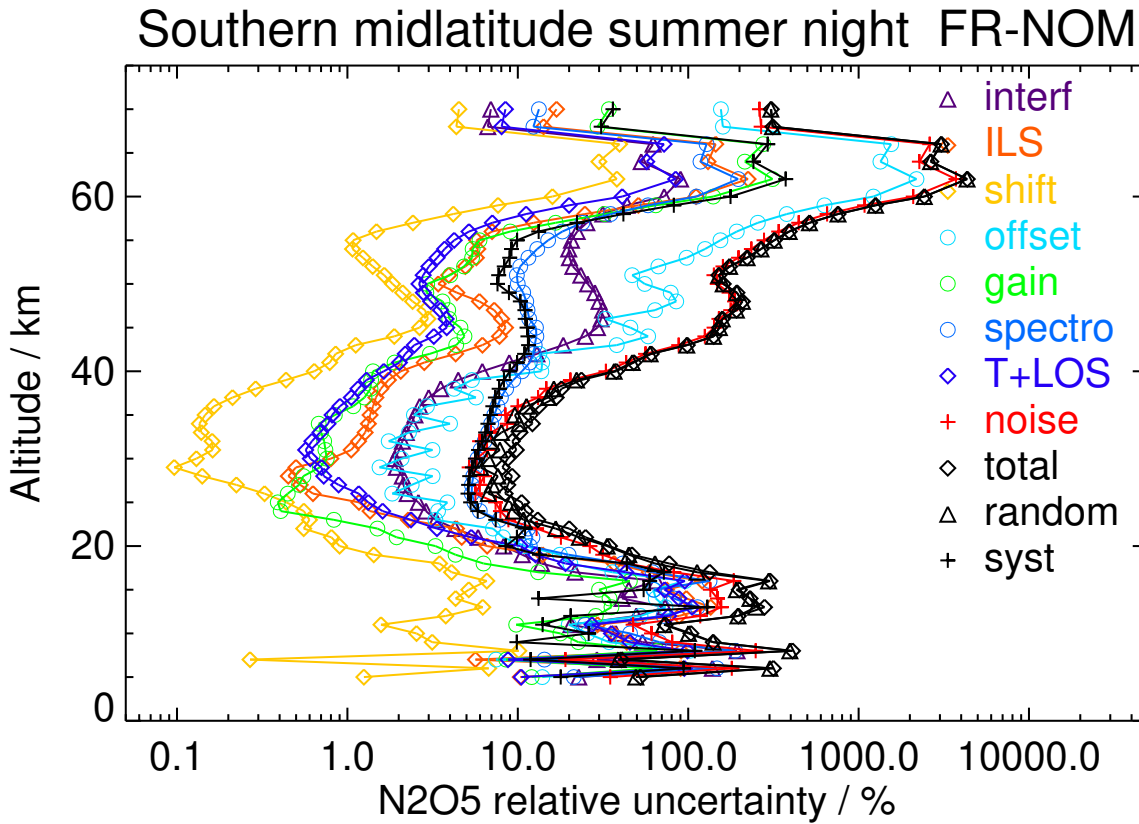


Figure S24: V8H.N2O5.61 Southern midlatitude summer night

Table S29: N2O5 error budget for Southern midlatitude autumn day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 5                | -91.20                | 47.56         | 23.09      | 1.24         | 19.67         | 2.32        | 34.17          | 24.65        | 44.71        | 72.51         | 41.31       | 83.45        |
| 8                | 43.39                 | 72.64         | 35.53      | 2.94         | 40.09         | 27.26       | > 100          | 44.59        | 88.94        | > 100         | 8.99        | > 100        |
| 11               | 11.62                 | > 100         | > 100      | 9.12         | > 100         | 81.00       | > 100          | > 100        | > 100        | > 100         | 83.33       | > 100        |
| 14               | 18.23                 | 57.13         | 61.49      | 6.97         | 77.21         | 32.85       | 95.73          | 81.66        | > 100        | > 100         | 25.02       | > 100        |
| 17               | 41.52                 | 20.75         | 30.25      | 3.91         | 32.25         | 10.94       | 49.92          | 26.62        | 63.44        | 88.00         | 44.75       | 98.72        |
| 20               | 129.70                | 6.81          | 4.27       | 0.44         | 11.22         | 2.91        | 16.73          | 6.64         | 21.09        | 27.00         | 15.45       | 31.11        |
| 23               | 390.59                | 2.96          | 1.17       | 0.54         | 4.44          | 0.88        | 8.68           | 2.26         | 8.44         | 10.67         | 8.28        | 13.51        |
| 26               | 918.98                | 1.54          | 0.62       | 0.18         | 2.22          | 0.27        | 5.64           | 1.08         | 4.45         | 5.53          | 5.47        | 7.78         |
| 29               | 1404.10               | 1.16          | 0.50       | 0.11         | 1.60          | 0.71        | 5.67           | 0.73         | 3.60         | 4.38          | 5.58        | 7.09         |
| 32               | 1387.83               | 1.31          | 1.28       | 0.16         | 1.56          | 0.85        | 7.68           | 0.81         | 4.20         | 4.94          | 7.71        | 9.15         |
| 35               | 951.66                | 1.86          | 1.97       | 0.28         | 2.12          | 1.27        | 9.96           | 1.19         | 7.01         | 7.95          | 10.00       | 12.78        |
| 38               | 472.95                | 3.54          | 2.47       | 0.30         | 4.40          | 1.74        | 12.15          | 1.65         | 16.31        | 17.59         | 12.18       | 21.39        |
| 41               | 185.75                | 9.95          | 4.26       | 0.41         | 10.76         | 2.48        | 14.93          | 2.01         | 42.55        | 45.36         | 14.77       | 47.71        |
| 44               | 79.80                 | 24.38         | 10.12      | 1.53         | 27.92         | 1.97        | 18.99          | 3.56         | > 100        | > 100         | 18.35       | > 100        |
| 47               | 64.20                 | 29.37         | 10.83      | 2.44         | 79.90         | 4.34        | 17.90          | 4.41         | > 100        | > 100         | 16.45       | > 100        |
| 50               | 57.31                 | 29.30         | 13.38      | 3.20         | > 100         | 6.41        | 21.89          | 6.33         | > 100        | > 100         | 20.17       | > 100        |
| 53               | 48.93                 | 29.31         | 17.89      | 3.75         | > 100         | 15.27       | 30.43          | 8.72         | > 100        | > 100         | 29.75       | > 100        |
| 56               | 36.24                 | 34.97         | 31.00      | 4.95         | > 100         | 34.78       | 47.78          | 13.56        | > 100        | > 100         | 55.37       | > 100        |
| 59               | 62.68                 | 18.07         | 19.38      | 2.49         | > 100         | 35.49       | 31.01          | 8.68         | > 100        | > 100         | 44.23       | > 100        |
| 62               | 36.22                 | 28.64         | 43.29      | 4.71         | > 100         | 86.22       | 58.98          | 18.67        | > 100        | > 100         | > 100       | > 100        |
| 64               | -153.13               | 6.04          | 12.49      | 1.34         | > 100         | 21.64       | 14.03          | 4.84         | > 100        | > 100         | 25.44       | > 100        |

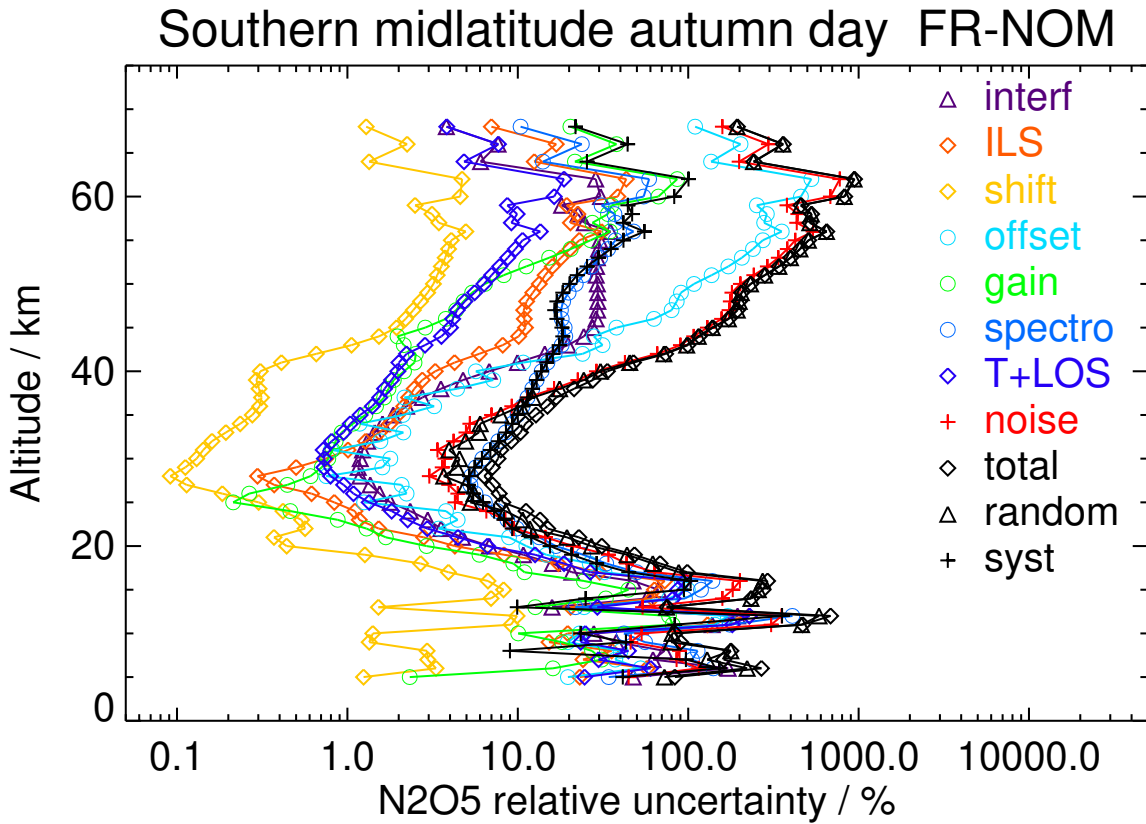


Figure S25: V8H.N2O5\_61 Southern midlatitude autumn day

Table S30: N2O5 error budget for Southern midlatitude autumn night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 108.77                | 28.62         | 11.74      | 0.67         | 12.42         | 7.38        | 33.34          | 12.98        | 28.60        | 52.03         | 23.61       | 57.13        |
| 11               | -47.42                | 32.75         | 45.34      | 1.74         | 30.82         | 14.54       | 53.34          | 48.45        | 64.47        | > 100         | 45.50       | > 100        |
| 14               | 9.90                  | > 100         | > 100      | 11.53        | > 100         | 82.51       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 17               | 36.76                 | 24.43         | 20.84      | 4.48         | 38.99         | 11.14       | 42.98          | 24.64        | 66.90        | 88.84         | 41.63       | 98.11        |
| 20               | 120.82                | 7.27          | 4.33       | 0.43         | 14.05         | 2.31        | 15.38          | 6.35         | 23.54        | 30.20         | 13.92       | 33.25        |
| 23               | 308.56                | 3.76          | 1.41       | 0.71         | 6.61          | 0.93        | 8.58           | 2.69         | 11.53        | 14.37         | 8.27        | 16.58        |
| 26               | 739.08                | 1.93          | 0.75       | 0.22         | 3.16          | 0.24        | 5.84           | 1.21         | 5.89         | 7.21          | 5.72        | 9.20         |
| 29               | 1151.78               | 1.39          | 0.58       | 0.15         | 2.12          | 0.63        | 5.58           | 0.70         | 4.52         | 5.45          | 5.44        | 7.69         |
| 32               | 1114.30               | 1.60          | 1.24       | 0.18         | 2.05          | 0.70        | 7.29           | 0.73         | 5.29         | 6.09          | 7.31        | 9.51         |
| 35               | 875.55                | 1.97          | 1.73       | 0.21         | 2.30          | 1.03        | 8.50           | 0.94         | 7.53         | 8.39          | 8.53        | 11.96        |
| 38               | 591.53                | 2.78          | 1.53       | 0.18         | 3.39          | 1.10        | 9.08           | 1.10         | 12.74        | 13.70         | 9.00        | 16.39        |
| 41               | 305.02                | 5.84          | 2.95       | 0.31         | 5.45          | 1.39        | 11.10          | 1.33         | 24.38        | 26.00         | 10.85       | 28.18        |
| 44               | 143.30                | 13.04         | 6.66       | 0.93         | 16.23         | 1.25        | 14.00          | 2.75         | 58.17        | 62.26         | 13.85       | 63.78        |
| 47               | 89.36                 | 20.30         | 7.56       | 1.70         | 54.93         | 1.66        | 14.29          | 3.34         | > 100        | > 100         | 13.12       | > 100        |
| 50               | 92.20                 | 17.60         | 6.23       | 1.72         | 59.51         | 3.66        | 13.12          | 3.37         | > 100        | > 100         | 11.13       | > 100        |
| 53               | 102.03                | 13.41         | 5.64       | 1.40         | 92.22         | 7.37        | 13.35          | 3.25         | > 100        | > 100         | 12.33       | > 100        |
| 56               | 83.46                 | 14.20         | 8.00       | 1.48         | > 100         | 13.70       | 16.06          | 4.06         | > 100        | > 100         | 18.66       | > 100        |
| 59               | 84.42                 | 12.71         | 10.24      | 1.36         | > 100         | 22.98       | 20.30          | 4.89         | > 100        | > 100         | 27.70       | > 100        |
| 62               | 42.49                 | 22.79         | 23.12      | 3.49         | > 100         | 65.17       | 43.73          | 12.17        | > 100        | > 100         | 72.46       | > 100        |
| 64               | 63.96                 | 13.77         | 16.81      | 2.67         | > 100         | 52.93       | 28.18          | 9.60         | > 100        | > 100         | 55.82       | > 100        |

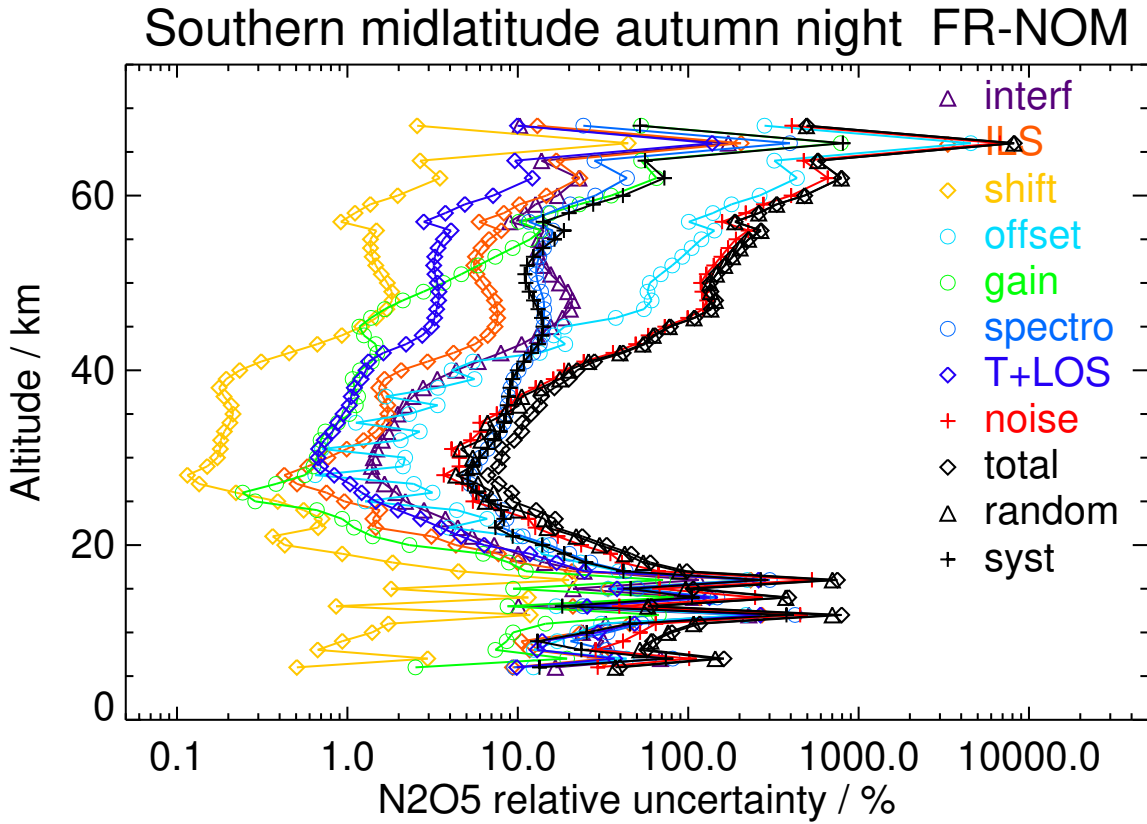


Figure S26: V8H\_N2O5\_61 Southern midlatitude autumn night

Table S31: N2O5 error budget for Southern polar winter day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 5                | 21.50                 | > 100         | 11.45      | 22.33        | > 100         | 31.46       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 8                | -56.37                | 64.23         | 31.99      | 5.65         | 52.13         | 13.15       | > 100          | 74.19        | > 100        | > 100         | 91.23       | > 100        |
| 11               | 80.18                 | 28.97         | 11.64      | 2.08         | 25.29         | 8.21        | 35.04          | 37.32        | 54.37        | 81.33         | 25.47       | 85.22        |
| 14               | -5.35                 | > 100         | > 100      | 15.50        | > 100         | 92.43       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 17               | 63.57                 | 20.94         | 12.49      | 0.94         | 19.00         | 2.89        | 26.99          | 25.07        | 54.54        | 68.60         | 24.29       | 72.77        |
| 20               | 15.44                 | 96.41         | 23.25      | 3.90         | 90.52         | 11.32       | 95.24          | 69.29        | > 100        | > 100         | 32.63       | > 100        |
| 23               | 94.86                 | 20.21         | 3.04       | 0.89         | 18.52         | 1.61        | 17.92          | 7.28         | 61.05        | 68.12         | 15.00       | 69.75        |
| 26               | 454.27                | 4.87          | 1.26       | 0.70         | 4.19          | 0.51        | 7.19           | 2.38         | 14.84        | 16.80         | 6.24        | 17.92        |
| 29               | 954.83                | 2.34          | 0.78       | 0.30         | 1.88          | 0.47        | 5.60           | 1.25         | 7.40         | 8.37          | 5.24        | 9.88         |
| 32               | 1240.23               | 1.73          | 0.58       | 0.15         | 1.35          | 0.56        | 6.48           | 0.94         | 5.96         | 6.75          | 6.20        | 9.16         |
| 35               | 1097.03               | 1.77          | 1.48       | 0.23         | 1.56          | 0.73        | 8.03           | 1.00         | 7.02         | 7.82          | 7.87        | 11.09        |
| 38               | 736.60                | 2.49          | 2.23       | 0.55         | 2.23          | 0.91        | 9.16           | 1.32         | 11.17        | 12.13         | 8.97        | 15.09        |
| 41               | 377.62                | 4.93          | 3.45       | 1.00         | 5.16          | 1.18        | 10.84          | 1.84         | 22.65        | 24.18         | 10.69       | 26.44        |
| 44               | 141.19                | 13.49         | 6.51       | 1.20         | 24.25         | 1.30        | 15.41          | 3.12         | 69.14        | 74.90         | 15.28       | 76.44        |
| 47               | 56.90                 | 30.84         | 9.47       | 2.24         | 66.57         | 2.90        | 18.18          | 5.28         | > 100        | > 100         | 17.88       | > 100        |
| 50               | 26.39                 | 58.93         | 11.80      | 4.19         | > 100         | 7.44        | 22.15          | 9.62         | > 100        | > 100         | 16.32       | > 100        |
| 53               | 12.34                 | > 100         | 25.30      | 8.33         | > 100         | 35.12       | 54.15          | 24.03        | > 100        | > 100         | 29.66       | > 100        |
| 56               | -0.63                 | > 100         | > 100      | > 100        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 59               | 18.82                 | 58.09         | 12.85      | 6.29         | > 100         | 36.85       | 34.04          | 15.60        | > 100        | > 100         | 34.54       | > 100        |
| 62               | -39.88                | 24.46         | 10.05      | 4.23         | > 100         | 31.79       | 24.10          | 11.95        | > 100        | > 100         | 27.00       | > 100        |
| 64               | -126.65               | 7.31          | 2.67       | 1.24         | > 100         | 11.79       | 7.14           | 4.16         | > 100        | > 100         | 11.11       | > 100        |

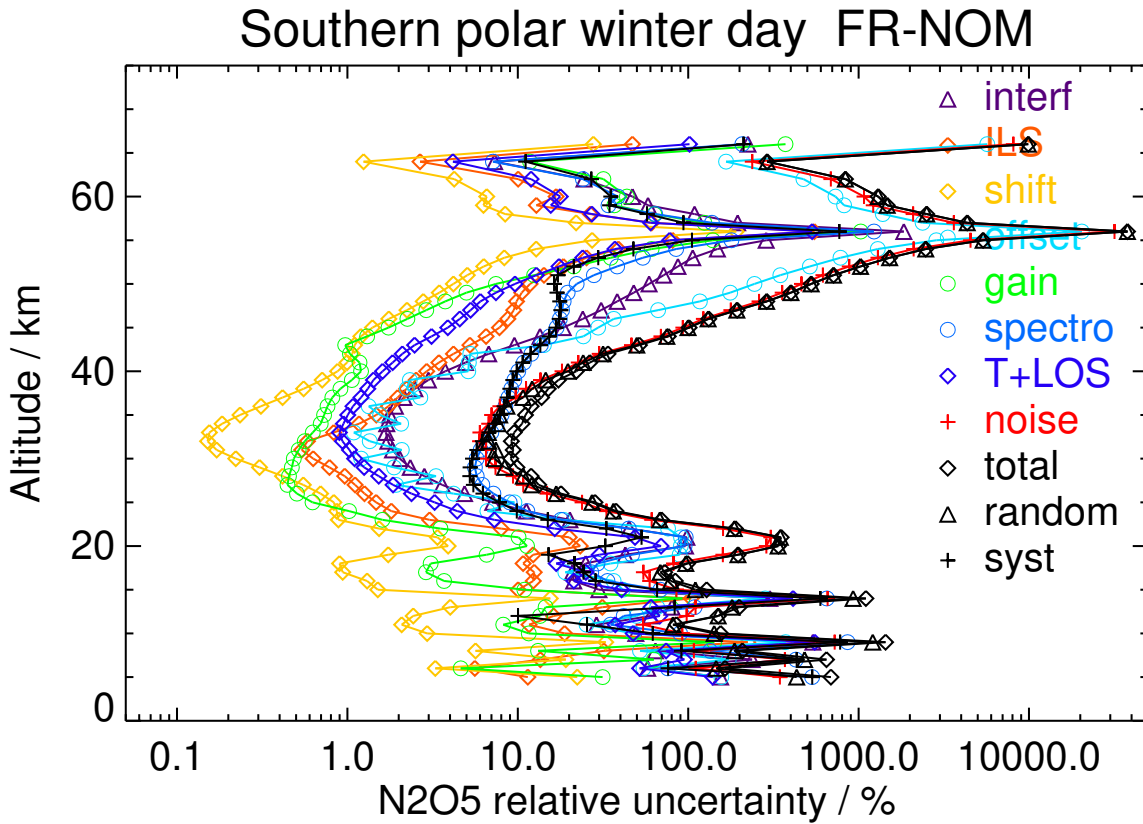


Figure S27: V8H\_N2O5.61 Southern polar winter day

Table S32: N2O5 error budget for Southern polar winter night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 5                | -141.09               | 16.25         | 9.69       | 1.75         | 16.58         | 6.66        | 64.81          | 19.70        | 36.75        | 54.96         | 59.99       | 81.36        |
| 8                | 80.52                 | 30.75         | 15.69      | 2.01         | 28.08         | 12.15       | 99.19          | 37.23        | 59.78        | > 100         | 30.00       | > 100        |
| 11               | 49.21                 | 43.02         | 29.54      | 2.85         | 39.52         | 27.21       | 89.84          | 62.74        | 84.36        | > 100         | 32.56       | > 100        |
| 14               | -7.08                 | > 100         | > 100      | 13.98        | > 100         | 89.40       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 17               | 47.02                 | 25.84         | 12.78      | 1.40         | 28.98         | 7.40        | 41.32          | 28.13        | 74.04        | 92.64         | 33.55       | 98.53        |
| 20               | 17.93                 | 75.53         | 18.86      | 3.89         | 78.57         | 11.74       | 77.43          | 48.19        | > 100        | > 100         | 59.67       | > 100        |
| 23               | 42.93                 | 43.65         | 6.83       | 1.62         | 38.93         | 4.74        | 48.57          | 14.77        | > 100        | > 100         | 38.83       | > 100        |
| 26               | 323.67                | 7.23          | 1.92       | 0.55         | 5.91          | 0.57        | 9.53           | 2.57         | 21.75        | 24.52         | 7.79        | 25.73        |
| 29               | 683.20                | 3.62          | 0.77       | 0.24         | 2.75          | 0.35        | 5.93           | 1.41         | 11.43        | 12.62         | 5.48        | 13.76        |
| 32               | 920.68                | 2.57          | 0.84       | 0.12         | 1.98          | 0.33        | 7.24           | 1.08         | 8.83         | 9.84          | 6.79        | 11.96        |
| 35               | 956.51                | 2.25          | 1.47       | 0.20         | 2.01          | 0.38        | 8.06           | 1.01         | 8.84         | 9.76          | 7.76        | 12.47        |
| 38               | 841.54                | 2.43          | 1.86       | 0.44         | 2.21          | 0.43        | 8.59           | 1.07         | 10.68        | 11.59         | 8.33        | 14.27        |
| 41               | 600.01                | 3.46          | 2.28       | 0.68         | 3.40          | 0.67        | 9.62           | 1.26         | 15.48        | 16.88         | 8.86        | 19.06        |
| 44               | 347.60                | 5.93          | 3.59       | 0.60         | 9.88          | 0.93        | 12.91          | 1.69         | 29.48        | 32.54         | 11.24       | 34.43        |
| 47               | 191.72                | 9.69          | 5.61       | 0.67         | 22.48         | 1.92        | 18.25          | 2.91         | 55.15        | 61.33         | 16.03       | 63.39        |
| 50               | 96.05                 | 17.02         | 10.27      | 0.96         | 74.42         | 3.18        | 30.32          | 6.58         | > 100        | > 100         | 27.66       | > 100        |
| 53               | 41.05                 | 34.50         | 25.28      | 1.58         | > 100         | 7.30        | 68.03          | 18.82        | > 100        | > 100         | 65.19       | > 100        |
| 56               | 13.26                 | 96.87         | 84.12      | 5.33         | > 100         | 38.91       | > 100          | 67.60        | > 100        | > 100         | > 100       | > 100        |
| 59               | -36.01                | 34.36         | 34.82      | 2.21         | > 100         | 21.08       | 86.78          | 25.76        | > 100        | > 100         | 88.06       | > 100        |
| 62               | -17.58                | 59.76         | 67.89      | 5.66         | > 100         | 78.08       | > 100          | 58.69        | > 100        | > 100         | > 100       | > 100        |
| 64               | 4.86                  | > 100         | > 100      | 22.78        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |

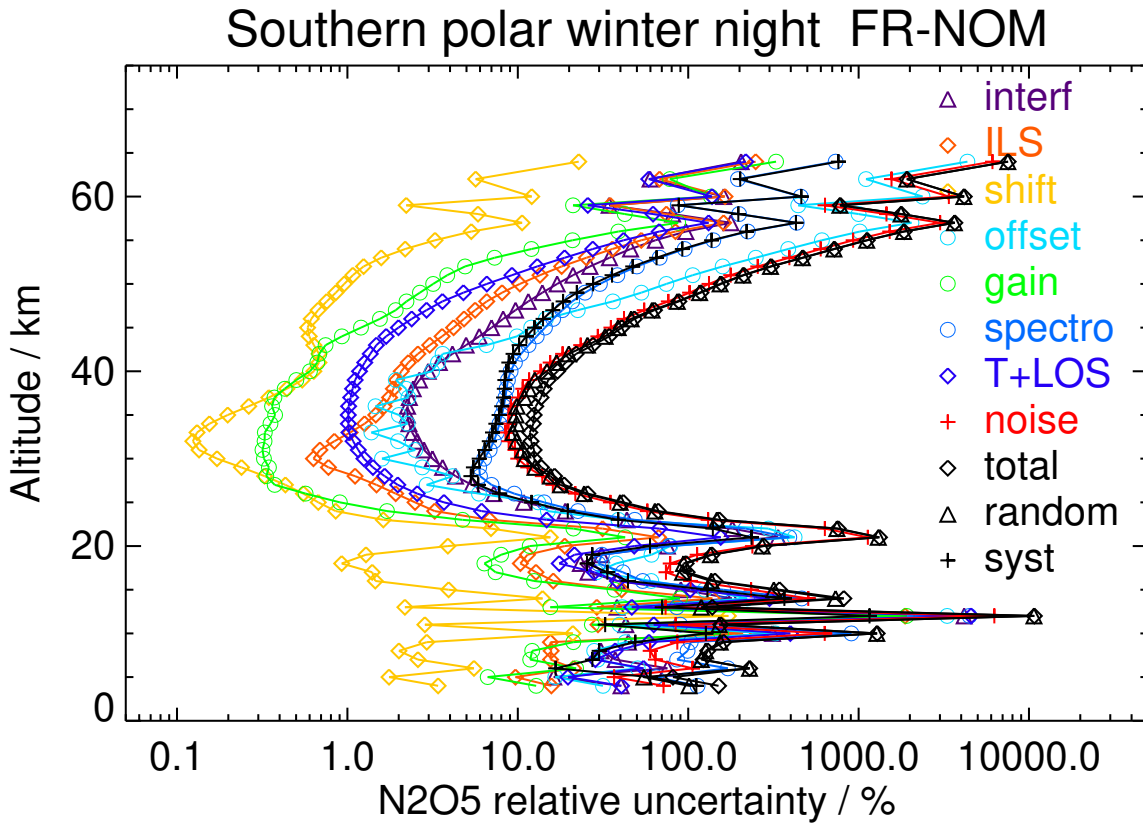


Figure S28: V8H.N2O5\_61 Southern polar winter night

Table S33: N2O5 error budget for Southern polar spring day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 60.35                 | 45.75         | 35.77      | 2.34         | 26.84         | 7.85        | 85.43          | 27.02        | 61.68        | 96.44         | 81.80       | > 100        |
| 11               | -1.04                 | > 100         | > 100      | > 100        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 14               | 8.20                  | > 100         | > 100      | 13.74        | > 100         | 77.80       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 17               | 83.96                 | 14.58         | 17.80      | 1.73         | 22.55         | 2.77        | 22.69          | 13.01        | 45.58        | 56.95         | 23.82       | 61.73        |
| 20               | 0.04                  | > 100         | > 100      | > 100        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 23               | 74.91                 | 15.22         | 4.11       | 1.30         | 23.54         | 1.08        | 12.25          | 4.03         | 46.73        | 55.90         | 5.63        | 56.18        |
| 26               | 103.02                | 11.58         | 2.33       | 0.68         | 17.96         | 0.79        | 11.01          | 2.17         | 35.07        | 42.31         | 5.38        | 42.66        |
| 29               | 53.62                 | 21.93         | 4.79       | 1.13         | 36.18         | 1.13        | 14.93          | 3.65         | 72.25        | 85.01         | 6.73        | 85.28        |
| 32               | 19.19                 | 67.47         | 17.61      | 3.06         | > 100         | 3.36        | 24.75          | 6.35         | > 100        | > 100         | 11.84       | > 100        |
| 35               | 16.44                 | 74.57         | 10.30      | 3.42         | > 100         | 3.70        | 32.72          | 5.87         | > 100        | > 100         | 11.96       | > 100        |
| 38               | 8.93                  | > 100         | 12.64      | 6.81         | > 100         | 6.22        | 37.60          | 10.14        | > 100        | > 100         | 18.78       | > 100        |
| 41               | 12.71                 | 98.41         | 17.03      | 5.27         | > 100         | 7.24        | 30.78          | 7.50         | > 100        | > 100         | 25.91       | > 100        |
| 44               | 38.86                 | 33.72         | 7.10       | 2.12         | 68.92         | 4.69        | 12.24          | 2.54         | > 100        | > 100         | 9.68        | > 100        |
| 47               | 30.47                 | 44.51         | 6.09       | 3.35         | 41.97         | 4.44        | 14.01          | 4.28         | > 100        | > 100         | 10.98       | > 100        |
| 50               | 31.01                 | 44.26         | 10.70      | 4.38         | > 100         | 3.64        | 20.93          | 6.07         | > 100        | > 100         | 18.56       | > 100        |
| 53               | 31.51                 | 35.59         | 14.23      | 2.91         | > 100         | 4.83        | 21.23          | 7.87         | > 100        | > 100         | 13.27       | > 100        |
| 56               | 36.71                 | 23.88         | 17.33      | 1.29         | > 100         | 6.33        | 23.43          | 8.62         | > 100        | > 100         | 15.45       | > 100        |
| 59               | 50.96                 | 14.81         | 11.57      | 2.85         | > 100         | 9.15        | 20.61          | 6.49         | > 100        | > 100         | 14.49       | > 100        |
| 62               | 71.62                 | 9.53          | 14.11      | 4.22         | > 100         | 14.09       | 21.97          | 7.69         | > 100        | > 100         | 19.35       | > 100        |
| 64               | 89.40                 | 7.83          | 13.95      | 4.61         | > 100         | 14.89       | 20.23          | 7.71         | > 100        | > 100         | 19.19       | > 100        |

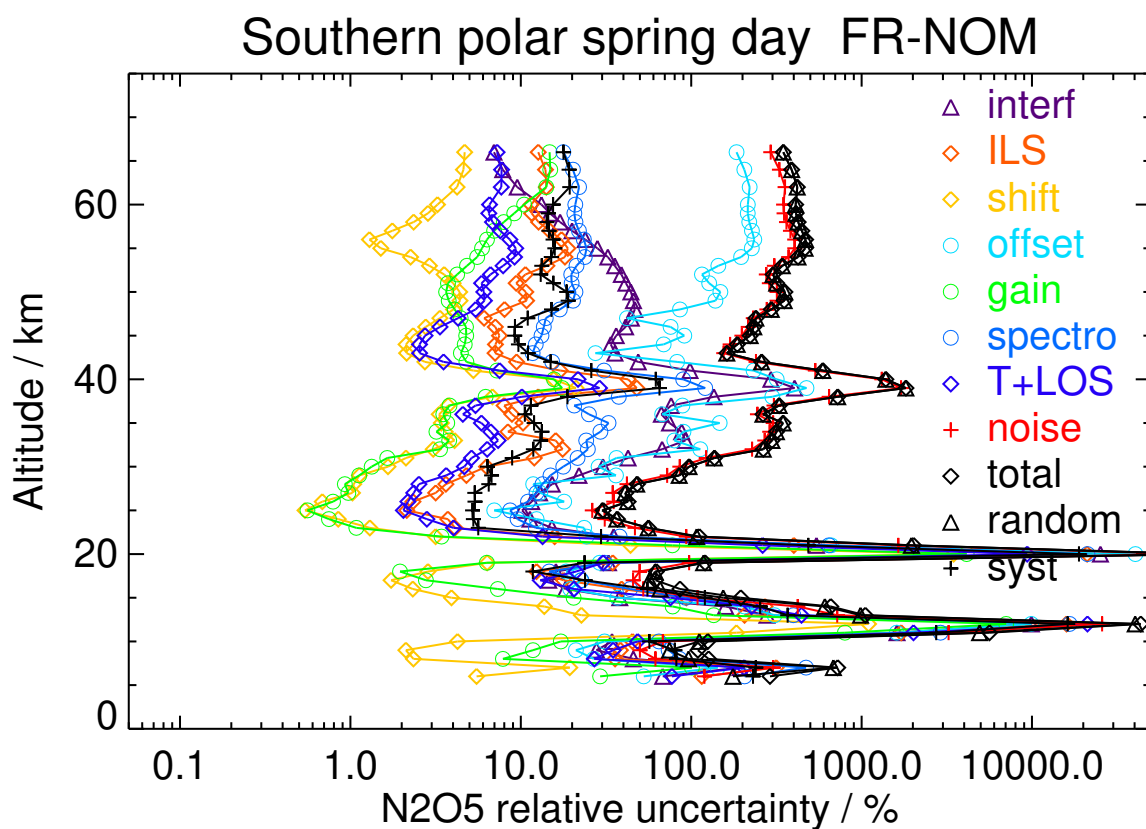


Figure S29: V8H\_N2O5\_61 Southern polar spring day

Table S34: N2O5 error budget for Southern polar spring night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 123.47                | 20.54         | 9.28       | 1.21         | 13.96         | 5.86        | 36.88          | 13.83        | 32.55        | 46.50         | 34.45       | 57.88        |
| 11               | -69.21                | 24.19         | 28.89      | 4.23         | 23.93         | 13.11       | 54.01          | 31.83        | 47.99        | 83.02         | 39.02       | 91.73        |
| 14               | -36.17                | 32.45         | 65.35      | 6.22         | 41.11         | 27.85       | 99.67          | 69.83        | 85.13        | > 100         | 90.50       | > 100        |
| 17               | 120.68                | 9.43          | 13.03      | 2.06         | 13.89         | 2.73        | 22.59          | 12.77        | 26.75        | 39.25         | 17.66       | 43.04        |
| 20               | 189.97                | 5.66          | 6.19       | 1.14         | 10.12         | 1.41        | 11.84          | 3.98         | 18.84        | 25.09         | 7.57        | 26.21        |
| 23               | 332.36                | 3.61          | 1.61       | 0.51         | 6.18          | 0.63        | 7.48           | 1.82         | 11.27        | 14.62         | 5.22        | 15.52        |
| 26               | 690.27                | 1.88          | 1.46       | 0.35         | 3.25          | 0.31        | 5.86           | 0.91         | 5.83         | 7.69          | 5.14        | 9.25         |
| 29               | 844.47                | 1.56          | 0.70       | 0.18         | 2.82          | 0.47        | 6.46           | 0.81         | 5.25         | 7.04          | 5.62        | 9.01         |
| 32               | 692.73                | 2.06          | 1.52       | 0.17         | 3.69          | 0.78        | 8.45           | 1.06         | 7.12         | 9.73          | 7.03        | 12.00        |
| 35               | 360.66                | 3.69          | 2.54       | 0.30         | 7.22          | 1.35        | 11.67          | 1.58         | 14.86        | 18.60         | 9.37        | 20.82        |
| 38               | 173.56                | 7.43          | 3.23       | 0.40         | 15.51         | 1.52        | 11.16          | 1.45         | 35.10        | 39.97         | 8.37        | 40.84        |
| 41               | 78.86                 | 16.77         | 5.01       | 0.76         | 36.20         | 2.25        | 12.74          | 1.72         | 89.23        | 98.36         | 8.56        | 98.74        |
| 44               | 23.44                 | 59.73         | 14.30      | 3.26         | > 100         | 7.65        | 27.31          | 5.28         | > 100        | > 100         | 17.42       | > 100        |
| 47               | 44.14                 | 32.25         | 5.90       | 2.72         | 39.99         | 3.02        | 13.53          | 3.65         | > 100        | > 100         | 10.16       | > 100        |
| 50               | 72.67                 | 19.23         | 4.02       | 1.96         | 66.87         | 1.90        | 10.06          | 2.94         | > 100        | > 100         | 8.18        | > 100        |
| 53               | 63.32                 | 18.17         | 4.91       | 1.74         | 95.37         | 3.98        | 11.77          | 4.24         | > 100        | > 100         | 9.08        | > 100        |
| 56               | 55.46                 | 16.99         | 7.04       | 1.48         | > 100         | 10.04       | 15.66          | 5.64         | > 100        | > 100         | 13.28       | > 100        |
| 59               | 50.68                 | 16.18         | 10.20      | 3.12         | > 100         | 16.18       | 21.46          | 7.45         | > 100        | > 100         | 21.18       | > 100        |
| 62               | 58.68                 | 13.22         | 15.61      | 4.95         | > 100         | 29.19       | 24.83          | 9.56         | > 100        | > 100         | 32.59       | > 100        |
| 64               | 53.08                 | 14.79         | 21.18      | 7.25         | > 100         | 39.95       | 31.08          | 13.12        | > 100        | > 100         | 43.16       | > 100        |

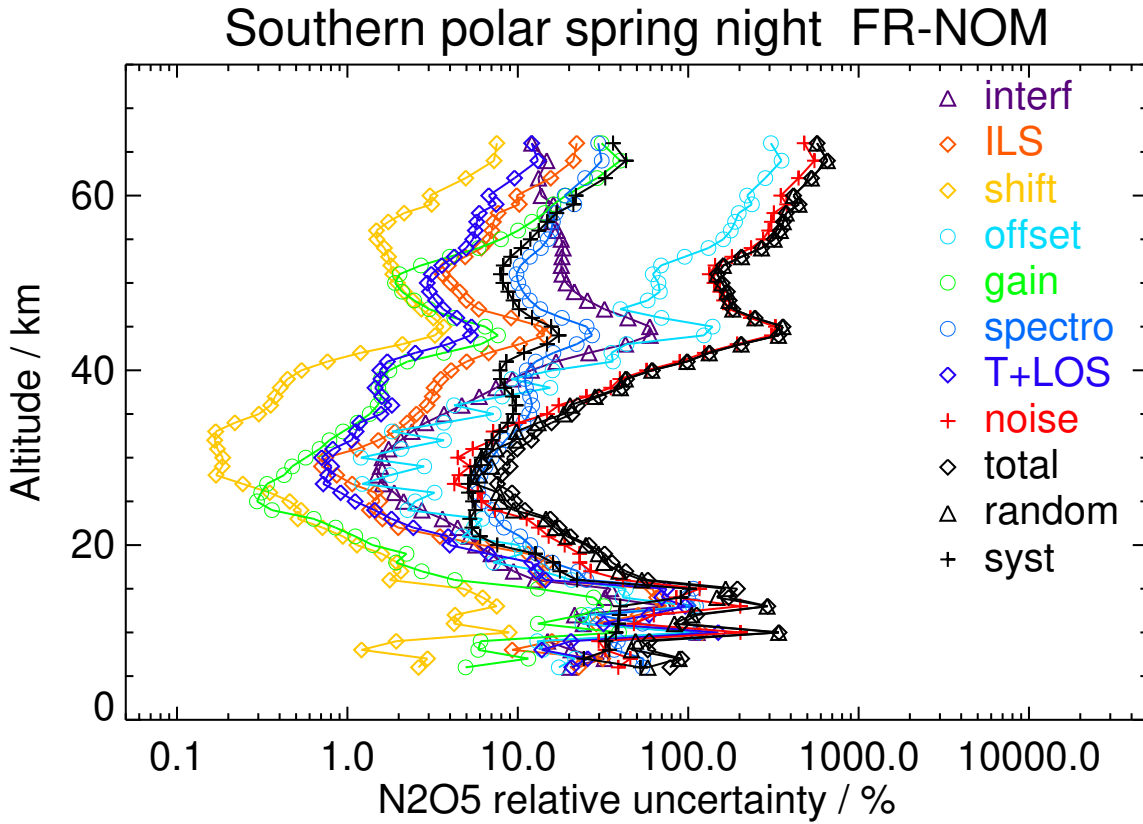


Figure S30: V8H.N2O5\_61 Southern polar spring night

Table S35: N2O5 error budget for Southern polar summer day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 5                | -79.73                | 50.85         | 25.61      | 2.33         | 28.95         | 10.05       | 37.54          | 22.12        | 73.18        | > 100         | 30.02       | > 100        |
| 8                | 137.64                | 27.72         | 26.02      | 1.04         | 13.95         | 10.86       | 19.75          | 19.88        | 35.28        | 59.84         | 14.43       | 61.56        |
| 11               | 76.80                 | 14.81         | 29.22      | 0.99         | 18.76         | 16.28       | 30.77          | 27.09        | 45.56        | 68.97         | 26.29       | 73.81        |
| 14               | -7.73                 | > 100         | > 100      | 14.74        | > 100         | 88.38       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 17               | -2.82                 | > 100         | > 100      | 27.88        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 20               | 11.75                 | 70.09         | 75.08      | 6.40         | 95.29         | 28.35       | 81.55          | 60.16        | > 100        | > 100         | 58.30       | > 100        |
| 23               | 9.07                  | 99.18         | 73.58      | 5.39         | > 100         | 13.51       | 87.86          | 47.16        | > 100        | > 100         | 89.12       | > 100        |
| 26               | 13.59                 | 83.09         | 19.59      | 6.55         | 80.82         | 5.67        | 31.13          | 21.60        | > 100        | > 100         | 21.06       | > 100        |
| 29               | 10.60                 | > 100         | 13.63      | 2.13         | > 100         | 5.93        | 40.58          | 20.54        | > 100        | > 100         | 29.41       | > 100        |
| 32               | 18.42                 | 78.04         | 15.24      | 4.10         | 92.88         | 2.65        | 21.66          | 8.75         | > 100        | > 100         | 18.18       | > 100        |
| 35               | 8.40                  | > 100         | 40.62      | 9.20         | > 100         | 6.61        | 42.08          | 15.48        | > 100        | > 100         | 43.00       | > 100        |
| 38               | -0.76                 | > 100         | > 100      | 94.91        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 41               | 17.87                 | 66.10         | 16.58      | 4.87         | > 100         | 4.68        | 18.94          | 8.05         | > 100        | > 100         | 19.22       | > 100        |
| 44               | 18.67                 | 67.29         | 13.06      | 4.63         | > 100         | 8.89        | 21.73          | 7.13         | > 100        | > 100         | 20.65       | > 100        |
| 47               | 14.73                 | 85.97         | 30.59      | 7.01         | > 100         | 6.15        | 25.42          | 12.33        | > 100        | > 100         | 33.85       | > 100        |
| 50               | 35.38                 | 37.16         | 9.08       | 1.99         | 95.81         | 3.26        | 12.79          | 3.96         | > 100        | > 100         | 11.96       | > 100        |
| 53               | 41.61                 | 25.89         | 6.84       | 1.15         | 94.86         | 7.89        | 16.25          | 4.61         | > 100        | > 100         | 14.39       | > 100        |
| 56               | 58.31                 | 14.76         | 9.17       | 0.86         | > 100         | 5.73        | 13.89          | 5.73         | > 100        | > 100         | 13.06       | > 100        |
| 59               | 83.02                 | 8.30          | 11.39      | 0.94         | 98.06         | 4.82        | 12.22          | 5.00         | > 100        | > 100         | 14.02       | > 100        |
| 62               | 126.15                | 4.29          | 7.87       | 1.34         | > 100         | 9.73        | 11.27          | 2.96         | > 100        | > 100         | 13.75       | > 100        |
| 64               | 152.76                | 3.86          | 4.21       | 1.85         | > 100         | 11.75       | 10.11          | 3.77         | > 100        | > 100         | 13.02       | > 100        |

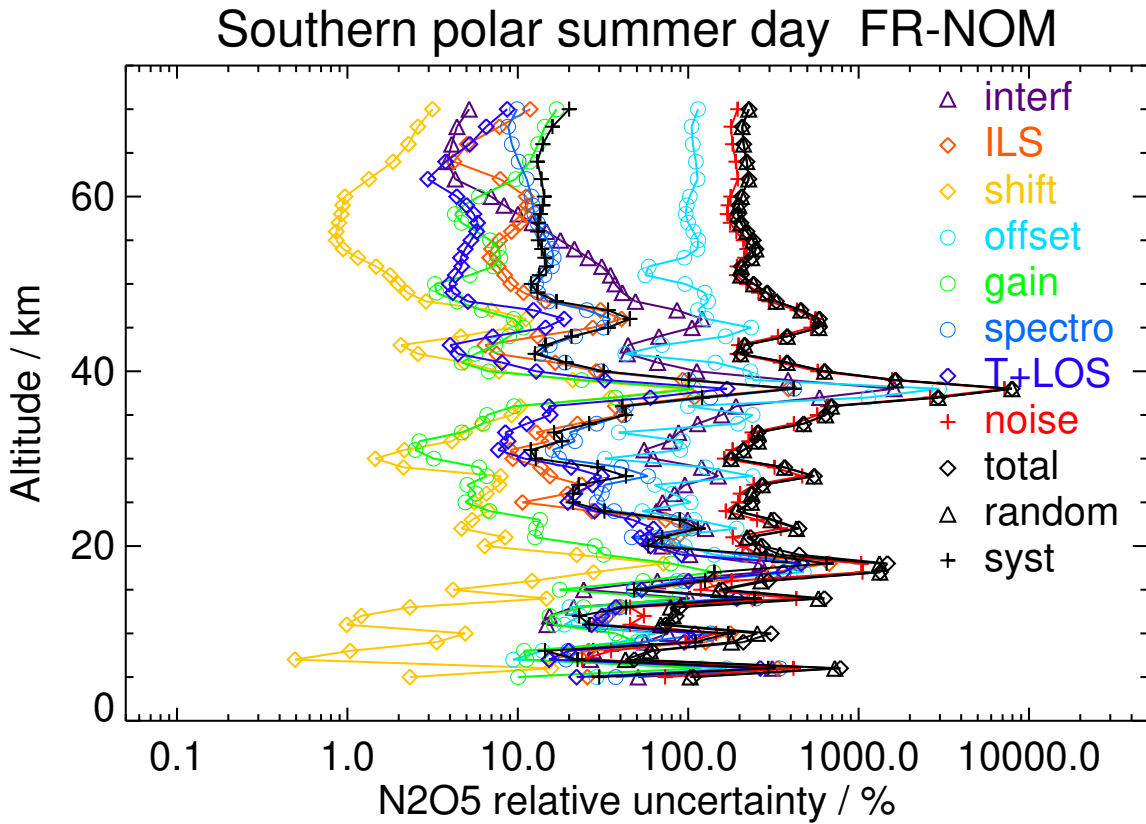


Figure S31: V8H.N2O5\_61 Southern polar summer day

Table S36: N2O5 error budget for Southern polar summer night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 5                | 8.31                  | > 100         | 27.84      | 15.70        | > 100         | 16.21       | 75.11          | 96.70        | > 100        | > 100         | 81.70       | > 100        |
| 8                | -41.53                | 76.29         | 42.44      | 4.37         | 50.41         | 47.72       | > 100          | 48.58        | > 100        | > 100         | > 100       | > 100        |
| 11               | 102.63                | 13.24         | 23.71      | 1.02         | 17.86         | 5.12        | 16.42          | 23.44        | 40.90        | 56.28         | 20.19       | 59.79        |
| 14               | 52.07                 | 15.74         | 24.31      | 2.18         | 33.69         | 14.87       | 33.14          | 38.86        | 74.84        | 98.67         | 25.97       | > 100        |
| 17               | 52.91                 | 14.57         | 25.36      | 4.58         | 28.50         | 5.91        | 39.48          | 24.80        | 65.88        | 80.89         | 41.15       | 90.76        |
| 20               | 130.46                | 6.40          | 7.88       | 0.80         | 8.55          | 1.88        | 7.89           | 6.88         | 21.21        | 26.06         | 7.80        | 27.20        |
| 23               | 236.23                | 4.07          | 1.91       | 0.51         | 3.69          | 0.66        | 6.27           | 2.29         | 10.76        | 12.75         | 5.69        | 13.96        |
| 26               | 296.52                | 3.95          | 1.32       | 0.36         | 2.46          | 0.66        | 6.02           | 1.45         | 9.53         | 11.00         | 5.67        | 12.38        |
| 29               | 298.62                | 4.36          | 1.80       | 0.17         | 2.28          | 1.06        | 6.99           | 1.06         | 11.34        | 12.81         | 6.56        | 14.39        |
| 32               | 259.91                | 5.80          | 2.51       | 0.28         | 3.03          | 1.21        | 8.14           | 0.90         | 15.73        | 17.54         | 7.57        | 19.11        |
| 35               | 166.83                | 8.93          | 3.83       | 0.45         | 6.11          | 1.59        | 11.29          | 1.17         | 28.91        | 31.67         | 9.80        | 33.15        |
| 38               | 76.74                 | 18.13         | 7.88       | 1.04         | 15.63         | 3.28        | 16.29          | 2.42         | 72.21        | 77.04         | 14.02       | 78.31        |
| 41               | 55.00                 | 24.36         | 7.49       | 1.22         | 33.42         | 4.53        | 14.81          | 3.02         | > 100        | > 100         | 14.53       | > 100        |
| 44               | 32.67                 | 43.62         | 9.22       | 1.79         | > 100         | 5.18        | 18.03          | 4.80         | > 100        | > 100         | 15.08       | > 100        |
| 47               | 28.61                 | 49.97         | 12.32      | 1.84         | > 100         | 4.94        | 16.90          | 4.26         | > 100        | > 100         | 16.36       | > 100        |
| 50               | 46.42                 | 30.52         | 7.99       | 1.06         | 68.83         | 3.23        | 12.43          | 2.65         | > 100        | > 100         | 11.49       | > 100        |
| 53               | 73.92                 | 15.20         | 6.03       | 0.39         | 75.87         | 3.04        | 10.07          | 1.76         | > 100        | > 100         | 9.00        | > 100        |
| 56               | 85.75                 | 10.72         | 6.74       | 0.52         | 93.79         | 6.02        | 10.17          | 2.03         | > 100        | > 100         | 10.58       | > 100        |
| 59               | 89.30                 | 8.57          | 8.43       | 0.86         | > 100         | 11.87       | 11.00          | 2.99         | > 100        | > 100         | 15.31       | > 100        |
| 62               | 94.53                 | 6.68          | 7.91       | 1.56         | > 100         | 19.76       | 12.06          | 4.80         | > 100        | > 100         | 21.06       | > 100        |
| 64               | 99.70                 | 6.33          | 6.02       | 2.10         | > 100         | 23.11       | 11.91          | 5.88         | > 100        | > 100         | 23.18       | > 100        |

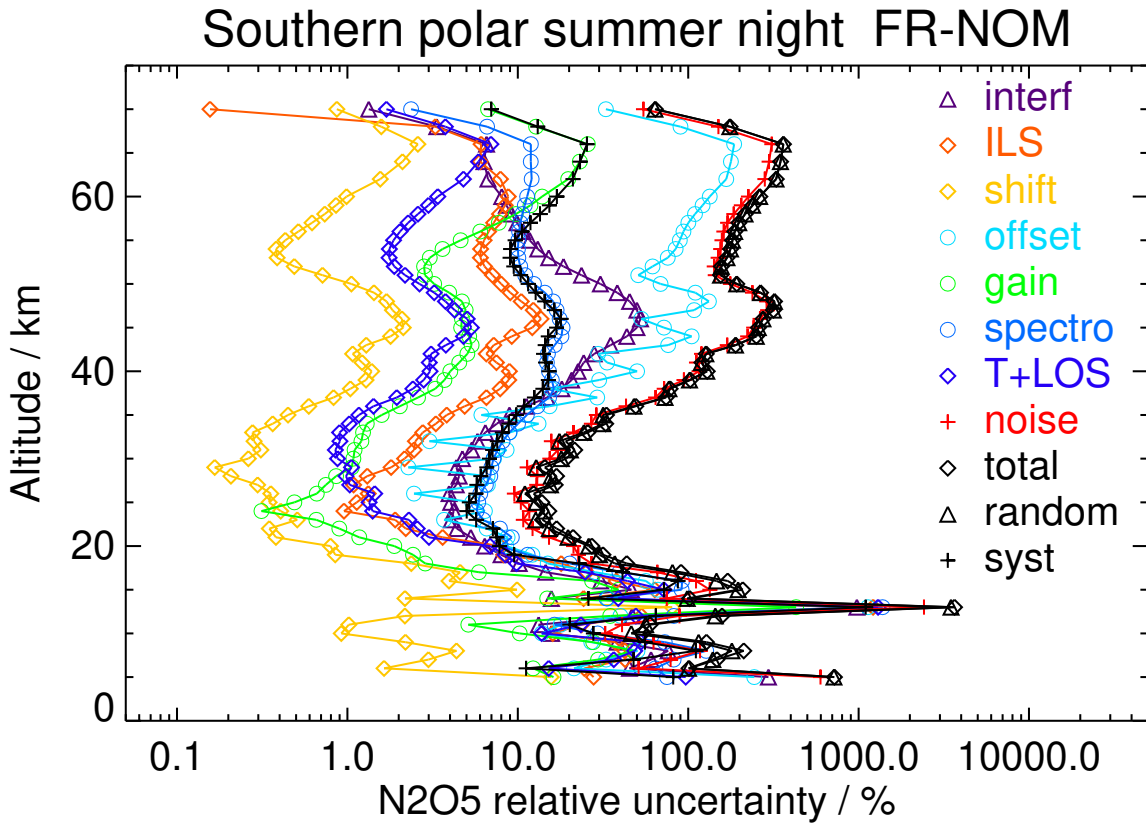


Figure S32: V8H\_N2O5.61 Southern polar summer night

Table S37: N2O5 error budget for Southern polar autumn day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 5                | -2.32                 | > 100         | > 100      | 31.32        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 8                | 37.72                 | 60.30         | 16.73      | 1.93         | 40.02         | 42.05       | > 100          | 61.89        | 85.46        | > 100         | 79.31       | > 100        |
| 11               | 4.10                  | > 100         | > 100      | 24.02        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 14               | -4.68                 | > 100         | 98.97      | 13.07        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 17               | 42.80                 | 23.88         | 15.36      | 1.60         | 34.61         | 7.65        | 30.56          | 19.26        | 59.00        | 77.71         | 28.48       | 82.77        |
| 20               | 112.86                | 8.44          | 2.20       | 0.46         | 16.04         | 3.09        | 18.87          | 6.10         | 27.31        | 34.61         | 16.88       | 38.50        |
| 23               | 385.81                | 3.39          | 0.95       | 0.26         | 5.66          | 0.65        | 9.59           | 1.93         | 10.42        | 12.80         | 9.24        | 15.79        |
| 26               | 816.52                | 2.03          | 0.34       | 0.13         | 2.81          | 0.47        | 5.38           | 0.94         | 6.15         | 7.30          | 5.17        | 8.95         |
| 29               | 1039.95               | 1.82          | 0.50       | 0.08         | 2.05          | 0.79        | 6.46           | 0.78         | 5.76         | 6.61          | 6.34        | 9.16         |
| 32               | 915.38                | 2.25          | 1.36       | 0.21         | 2.04          | 0.94        | 8.89           | 0.98         | 7.49         | 8.50          | 8.71        | 12.17        |
| 35               | 591.55                | 3.40          | 2.47       | 0.40         | 2.81          | 1.24        | 11.58          | 1.42         | 13.17        | 14.33         | 11.47       | 18.35        |
| 38               | 330.76                | 6.07          | 2.63       | 0.50         | 5.26          | 1.19        | 12.25          | 1.87         | 26.74        | 28.21         | 12.09       | 30.69        |
| 41               | 137.01                | 15.81         | 3.57       | 0.62         | 14.06         | 1.46        | 13.89          | 2.65         | 66.92        | 70.58         | 12.61       | 71.70        |
| 44               | 41.54                 | 53.83         | 14.45      | 2.17         | 67.33         | 4.20        | 22.31          | 7.10         | > 100        | > 100         | 20.94       | > 100        |
| 47               | 18.80                 | > 100         | 31.48      | 6.81         | > 100         | 15.21       | 30.55          | 14.38        | > 100        | > 100         | 38.90       | > 100        |
| 50               | 10.09                 | > 100         | 75.57      | 14.10        | > 100         | 23.83       | 66.50          | 31.05        | > 100        | > 100         | 87.67       | > 100        |
| 53               | 7.75                  | > 100         | > 100      | 18.73        | > 100         | 53.37       | > 100          | 51.93        | > 100        | > 100         | > 100       | > 100        |
| 56               | 4.02                  | > 100         | > 100      | 39.68        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 59               | -18.83                | 83.98         | 79.49      | 8.96         | > 100         | 86.89       | 60.12          | 36.00        | > 100        | > 100         | > 100       | > 100        |
| 62               | 2.63                  | > 100         | > 100      | 66.64        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 64               | 3.94                  | > 100         | > 100      | 48.82        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |

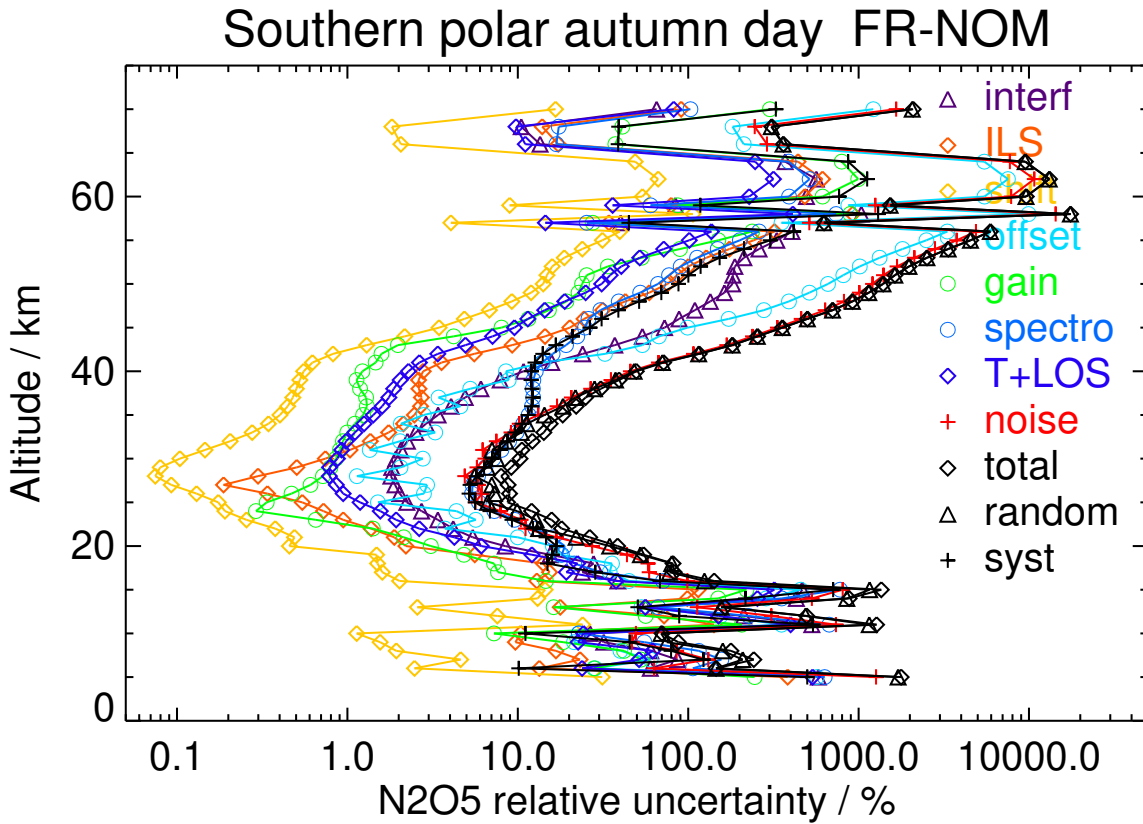


Figure S33: V8H.N2O5\_61 Southern polar autumn day

Table S38: N2O5 error budget for Southern polar autumn night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 5                | 25.30                 | 94.39         | 40.65      | 3.76         | 59.28         | 33.52       | > 100          | 61.81        | > 100        | > 100         | 35.24       | > 100        |
| 8                | 15.35                 | > 100         | 78.10      | 5.94         | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | 35.33       | > 100        |
| 11               | 45.62                 | 54.04         | 21.75      | 2.03         | 37.51         | 24.31       | 40.89          | 41.37        | 81.19        | > 100         | 16.69       | > 100        |
| 14               | 11.56                 | > 100         | 43.59      | 6.49         | > 100         | 57.64       | > 100          | > 100        | > 100        | > 100         | 51.55       | > 100        |
| 17               | 43.88                 | 22.78         | 15.63      | 1.86         | 33.48         | 9.33        | 37.80          | 23.90        | 67.53        | 86.57         | 32.24       | 92.38        |
| 20               | 71.68                 | 14.08         | 5.44       | 1.03         | 21.18         | 4.94        | 27.94          | 10.07        | 44.81        | 54.11         | 25.76       | 59.93        |
| 23               | 338.76                | 4.05          | 1.30       | 0.25         | 4.62          | 0.96        | 11.94          | 2.28         | 11.68        | 14.04         | 11.29       | 18.01        |
| 26               | 792.95                | 2.23          | 0.46       | 0.16         | 1.84          | 0.38        | 6.01           | 1.12         | 6.22         | 7.46          | 5.41        | 9.21         |
| 29               | 1119.32               | 1.83          | 0.40       | 0.09         | 1.20          | 0.61        | 6.30           | 0.84         | 5.41         | 6.19          | 6.05        | 8.66         |
| 32               | 1068.89               | 2.06          | 1.45       | 0.21         | 1.22          | 0.71        | 9.37           | 1.02         | 6.68         | 7.94          | 8.87        | 11.91        |
| 35               | 670.62                | 3.26          | 3.05       | 0.51         | 2.16          | 0.84        | 13.43          | 1.56         | 12.23        | 13.93         | 12.80       | 18.92        |
| 38               | 303.16                | 7.47          | 4.66       | 0.91         | 5.20          | 0.90        | 16.69          | 2.45         | 30.67        | 32.90         | 15.78       | 36.49        |
| 41               | 129.87                | 18.35         | 5.67       | 1.16         | 15.09         | 0.96        | 17.84          | 3.15         | 75.86        | 80.41         | 14.70       | 81.74        |
| 44               | 85.11                 | 27.96         | 6.37       | 1.13         | 42.23         | 1.67        | 15.07          | 3.68         | > 100        | > 100         | 10.82       | > 100        |
| 47               | 59.04                 | 36.42         | 10.37      | 2.01         | 90.43         | 3.91        | 16.53          | 5.87         | > 100        | > 100         | 14.81       | > 100        |
| 50               | 50.91                 | 37.52         | 16.97      | 2.55         | > 100         | 4.98        | 19.37          | 8.32         | > 100        | > 100         | 21.45       | > 100        |
| 53               | 45.87                 | 36.78         | 24.75      | 2.69         | > 100         | 12.71       | 24.40          | 11.22        | > 100        | > 100         | 31.24       | > 100        |
| 56               | 32.07                 | 50.18         | 43.26      | 3.90         | > 100         | 34.28       | 39.81          | 19.48        | > 100        | > 100         | 58.53       | > 100        |
| 59               | 4.48                  | > 100         | > 100      | 26.87        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 62               | -2.09                 | > 100         | > 100      | 59.45        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 64               | 48.64                 | 27.04         | 34.50      | 2.58         | > 100         | 67.84       | 37.16          | 18.37        | > 100        | > 100         | 75.08       | > 100        |

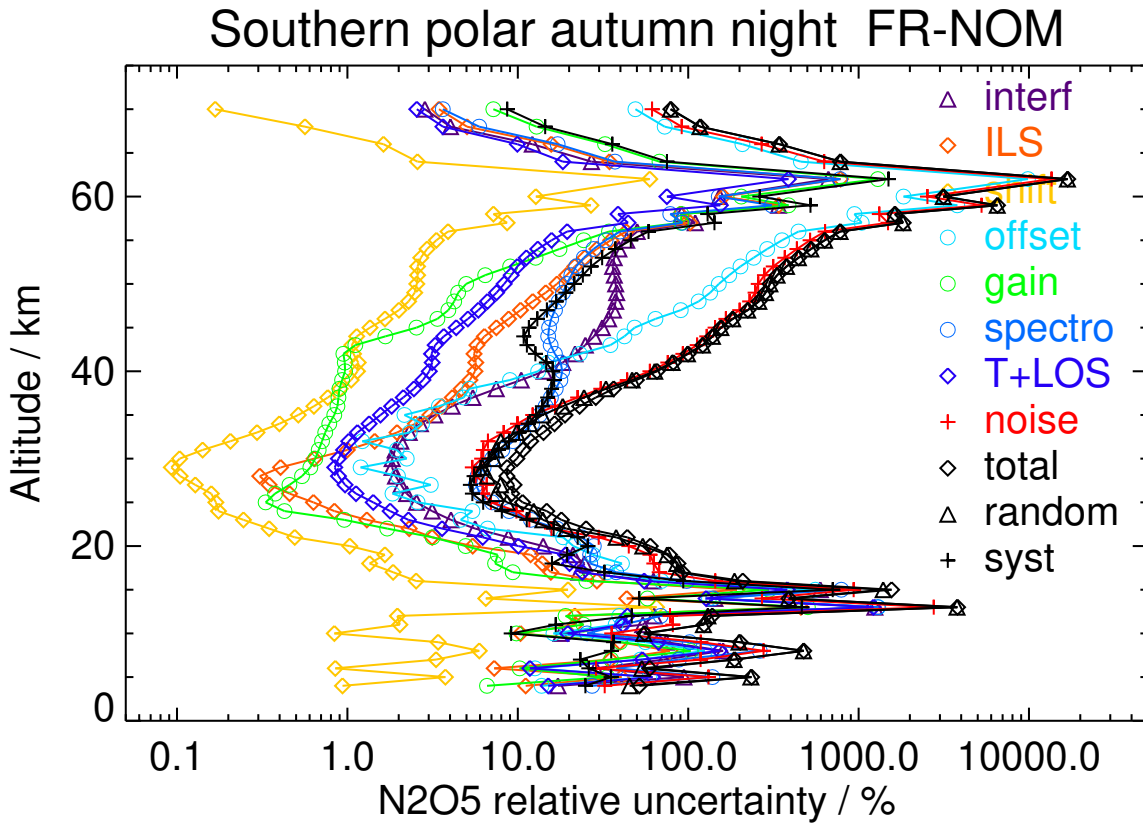


Figure S34: V8H\_N2O5.61 Southern polar autumn night

Table S39: N2O5 error budget for Northern polar winter day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | -0.10                 | > 100         | > 100      | > 100        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 11               | -39.37                | 49.12         | 25.18      | 2.39         | 25.64         | 34.21       | 36.16          | 56.92        | 86.24        | > 100         | 24.17       | > 100        |
| 14               | 9.43                  | > 100         | 98.02      | 5.64         | > 100         | 63.24       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 17               | 10.26                 | > 100         | > 100      | 4.45         | > 100         | 56.05       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 20               | 187.34                | 22.38         | 5.28       | 0.23         | 2.05          | 2.92        | 13.89          | 5.60         | 18.63        | 32.57         | 7.19        | 33.36        |
| 23               | 438.11                | 4.56          | 1.62       | 0.18         | 2.31          | 1.49        | 9.62           | 1.59         | 8.42         | 12.53         | 6.32        | 14.03        |
| 26               | 997.39                | 2.07          | 1.15       | 0.10         | 0.97          | 0.85        | 8.64           | 1.01         | 4.14         | 7.71          | 6.38        | 10.01        |
| 29               | 1902.52               | 2.50          | 0.72       | 0.12         | 0.64          | 0.46        | 6.30           | 0.74         | 2.71         | 5.43          | 5.05        | 7.42         |
| 32               | 2284.62               | 2.58          | 0.85       | 0.12         | 0.67          | 0.52        | 6.81           | 0.69         | 2.57         | 5.13          | 5.94        | 7.85         |
| 35               | 1944.69               | 3.57          | 1.47       | 0.10         | 0.90          | 0.68        | 8.41           | 0.75         | 3.65         | 5.87          | 8.15        | 10.04        |
| 38               | 993.16                | 8.08          | 1.83       | 0.12         | 1.68          | 0.99        | 12.88          | 1.24         | 8.64         | 12.91         | 12.17       | 17.74        |
| 41               | 462.66                | 18.57         | 2.24       | 0.07         | 3.73          | 0.99        | 15.12          | 1.69         | 21.94        | 29.72         | 13.93       | 32.83        |
| 44               | 202.06                | 39.18         | 5.34       | 0.21         | 15.43         | 1.38        | 17.44          | 2.51         | 56.34        | 70.91         | 16.14       | 72.72        |
| 47               | 60.21                 | > 100         | 33.16      | 1.22         | 95.92         | 8.04        | 31.32          | 7.92         | > 100        | > 100         | 38.22       | > 100        |
| 50               | -5.18                 | > 100         | > 100      | 15.89        | > 100         | > 100       | > 100          | 95.46        | > 100        | > 100         | > 100       | > 100        |
| 53               | -55.12                | > 100         | 45.49      | 1.26         | > 100         | 32.34       | 18.63          | 8.56         | > 100        | > 100         | 44.42       | > 100        |
| 56               | -116.33               | 30.35         | 18.88      | 0.44         | > 100         | 19.09       | 7.58           | 3.96         | > 100        | > 100         | 21.15       | > 100        |
| 59               | -223.00               | 8.27          | 9.27       | 0.16         | 73.30         | 11.49       | 4.37           | 2.27         | > 100        | > 100         | 13.29       | > 100        |
| 62               | -200.43               | 6.00          | 7.22       | 0.32         | > 100         | 17.81       | 4.55           | 3.01         | > 100        | > 100         | 15.19       | > 100        |
| 64               | -323.82               | 4.01          | 4.94       | 0.23         | 63.95         | 10.59       | 4.14           | 1.97         | 97.23        | > 100         | 10.48       | > 100        |

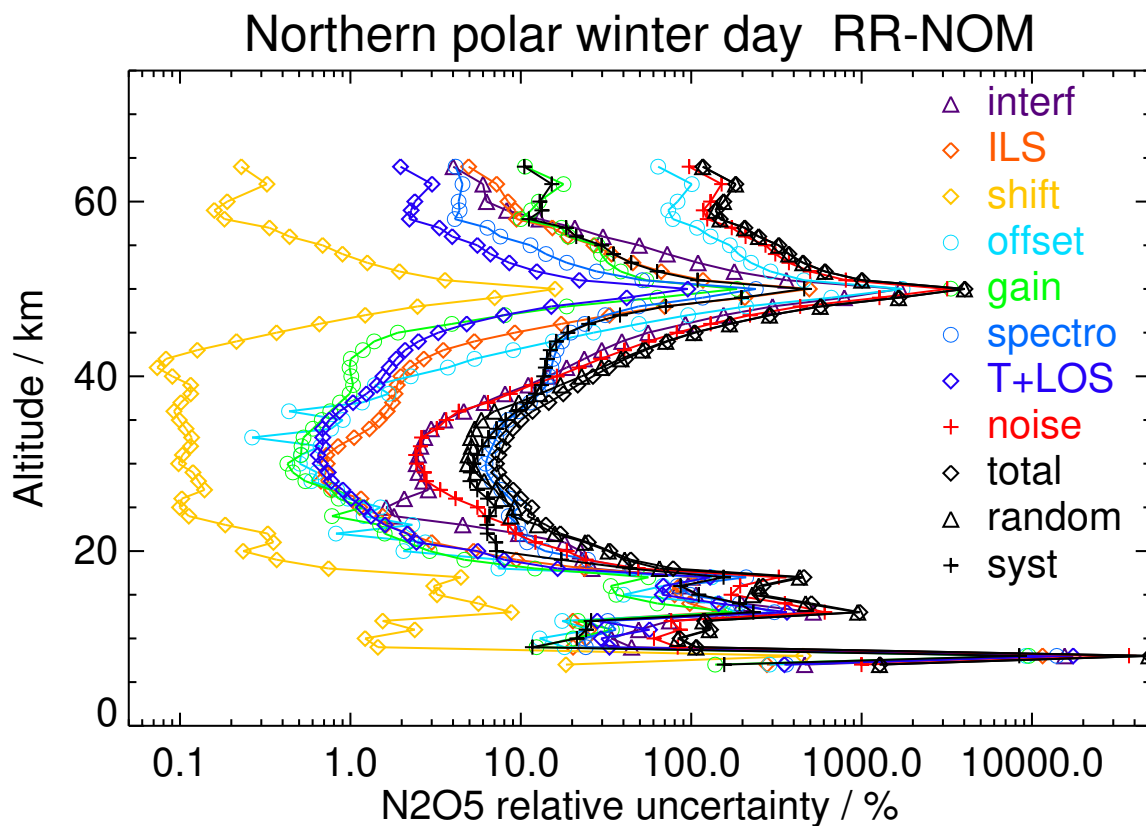


Figure S35: V8R\_N2O5\_261 Northern polar winter day

Table S40: N2O5 error budget for Northern polar winter night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 40.64                 | 31.67         | 19.80      | 0.99         | 29.38         | 13.92       | 39.04          | 39.76        | > 100        | > 100         | 26.22       | > 100        |
| 11               | -4.93                 | > 100         | > 100      | 16.35        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 14               | 17.20                 | > 100         | 36.83      | 2.45         | 59.22         | 31.40       | 81.29          | 86.01        | > 100        | > 100         | 73.50       | > 100        |
| 17               | 38.51                 | 31.57         | 23.76      | 1.39         | 26.76         | 11.52       | 34.33          | 30.47        | 93.06        | > 100         | 13.00       | > 100        |
| 20               | 90.68                 | 36.55         | 16.13      | 0.85         | 4.65          | 5.99        | 35.68          | 12.76        | 39.02        | 61.30         | 29.24       | 67.92        |
| 23               | 733.78                | 2.73          | 1.93       | 0.39         | 1.59          | 1.31        | 9.48           | 2.13         | 5.90         | 9.32          | 7.61        | 12.03        |
| 26               | 1855.89               | 0.91          | 1.44       | 0.12         | 0.37          | 0.59        | 6.75           | 0.94         | 1.92         | 5.33          | 5.01        | 7.31         |
| 29               | 2553.98               | 1.59          | 1.16       | 0.15         | 0.62          | 0.34        | 6.21           | 0.70         | 1.95         | 4.25          | 5.41        | 6.88         |
| 32               | 2581.66               | 1.97          | 1.37       | 0.28         | 0.58          | 0.45        | 6.88           | 0.69         | 1.81         | 4.49          | 6.11        | 7.58         |
| 35               | 1821.53               | 2.61          | 1.78       | 0.29         | 0.84          | 0.65        | 8.83           | 0.80         | 2.69         | 5.99          | 7.82        | 9.85         |
| 38               | 1138.12               | 4.81          | 1.68       | 0.18         | 1.35          | 1.10        | 10.97          | 0.89         | 5.09         | 10.40         | 8.24        | 13.27        |
| 41               | 776.24                | 8.84          | 1.05       | 0.08         | 1.94          | 0.72        | 9.99           | 0.83         | 9.17         | 14.61         | 7.38        | 16.37        |
| 44               | 597.86                | 10.25         | 0.94       | 0.11         | 3.15          | 0.59        | 9.16           | 0.76         | 14.27        | 18.93         | 6.78        | 20.11        |
| 47               | 420.11                | 9.58          | 1.11       | 0.17         | 7.78          | 1.03        | 10.48          | 0.96         | 24.90        | 28.76         | 7.60        | 29.75        |
| 50               | 238.16                | 11.06         | 3.08       | 0.40         | 22.21         | 3.83        | 15.25          | 1.75         | 55.38        | 61.81         | 11.03       | 62.79        |
| 53               | 137.52                | 20.25         | 7.52       | 0.77         | 60.08         | 12.24       | 23.19          | 3.36         | > 100        | > 100         | 18.47       | > 100        |
| 56               | 64.92                 | 61.78         | 22.28      | 2.14         | > 100         | 40.46       | 46.14          | 8.41         | > 100        | > 100         | 45.47       | > 100        |
| 59               | -75.56                | 51.12         | 22.29      | 2.46         | > 100         | 35.10       | 27.02          | 7.51         | > 100        | > 100         | 36.08       | > 100        |
| 62               | -57.99                | 58.69         | 40.98      | 5.12         | > 100         | 77.51       | 49.20          | 15.96        | > 100        | > 100         | 74.14       | > 100        |
| 64               | -173.13               | 16.01         | 15.64      | 2.12         | > 100         | 21.45       | 10.28          | 5.00         | > 100        | > 100         | 24.09       | > 100        |

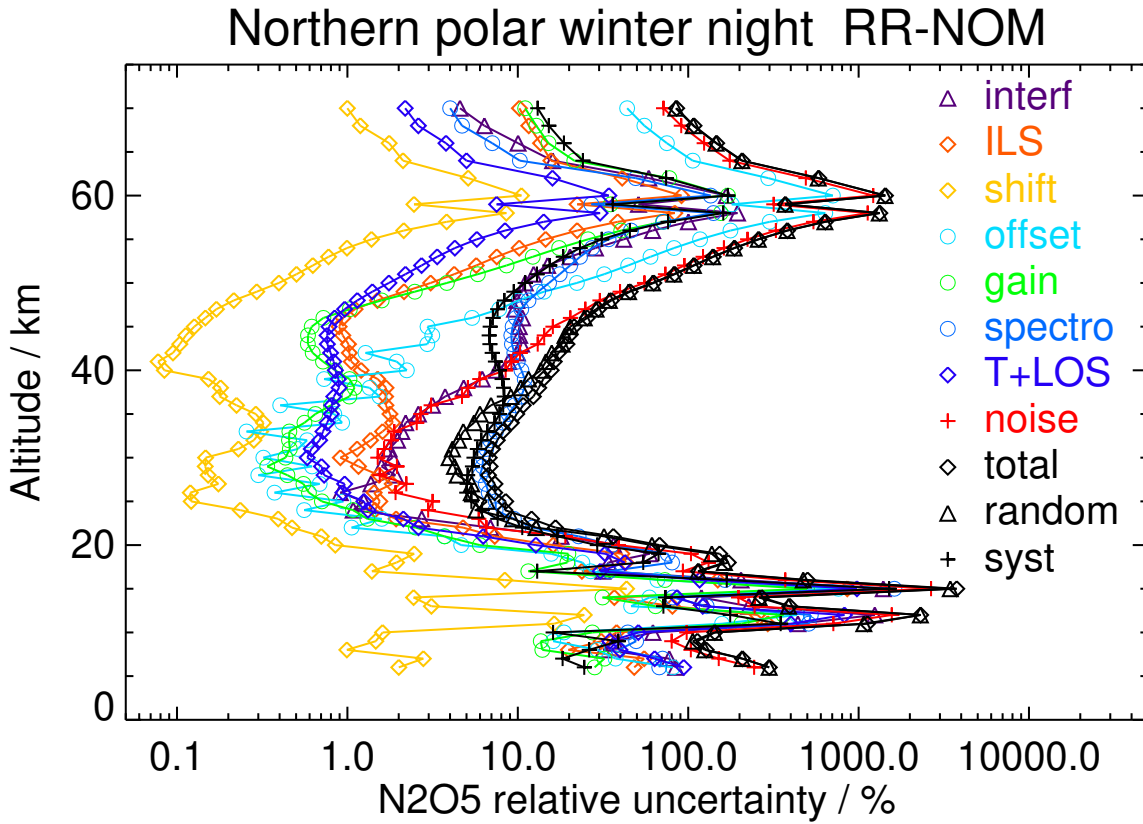


Figure S36: V8R\_N2O5\_261 Northern polar winter night

Table S41: N2O5 error budget for Northern polar spring day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 8.47                  | > 100         | 60.81      | 4.41         | 94.42         | 25.57       | > 100          | > 100        | > 100        | > 100         | 75.63       | > 100        |
| 11               | -3.33                 | > 100         | > 100      | 12.30        | > 100         | 64.25       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 14               | 11.00                 | 74.23         | 53.19      | 2.26         | 54.90         | 38.23       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 17               | 32.41                 | 38.63         | 7.00       | 0.42         | 15.51         | 9.10        | 33.22          | 28.82        | 87.02        | > 100         | 28.07       | > 100        |
| 20               | 73.49                 | 14.21         | 5.20       | 0.44         | 6.12          | 2.48        | 11.37          | 8.15         | 43.99        | 48.06         | 9.69        | 49.03        |
| 23               | 102.18                | 19.61         | 4.93       | 0.35         | 7.33          | 0.82        | 8.71           | 3.81         | 41.52        | 47.20         | 7.08        | 47.72        |
| 26               | 114.44                | 19.91         | 4.01       | 0.17         | 5.77          | 1.03        | 11.14          | 2.05         | 43.17        | 49.03         | 5.85        | 49.38        |
| 29               | 70.09                 | 34.68         | 5.20       | 0.59         | 9.84          | 1.68        | 14.50          | 3.05         | 85.41        | 93.84         | 6.24        | 94.05        |
| 32               | 35.79                 | 96.95         | 12.31      | 1.33         | 27.67         | 3.65        | 28.33          | 5.53         | > 100        | > 100         | 12.61       | > 100        |
| 35               | -18.36                | > 100         | 24.27      | 1.75         | 72.91         | 7.09        | 45.68          | 9.20         | > 100        | > 100         | 19.84       | > 100        |
| 38               | -45.91                | > 100         | 20.40      | 0.55         | 28.43         | 3.30        | 14.92          | 4.59         | > 100        | > 100         | 23.89       | > 100        |
| 41               | -27.33                | > 100         | 32.12      | 1.14         | 45.87         | 5.31        | 24.41          | 8.53         | > 100        | > 100         | 36.81       | > 100        |
| 44               | -29.87                | > 100         | 18.53      | 0.96         | 45.18         | 10.22       | 21.93          | 7.11         | > 100        | > 100         | 23.97       | > 100        |
| 47               | -2.34                 | > 100         | > 100      | 16.53        | > 100         | > 100       | > 100          | 80.15        | > 100        | > 100         | > 100       | > 100        |
| 50               | -8.33                 | > 100         | > 100      | 5.36         | > 100         | 45.43       | 48.29          | 22.44        | > 100        | > 100         | > 100       | > 100        |
| 53               | -25.22                | > 100         | 55.46      | 1.54         | > 100         | 10.82       | 17.96          | 8.44         | > 100        | > 100         | 53.72       | > 100        |
| 56               | -64.21                | 67.18         | 29.13      | 0.43         | > 100         | 12.42       | 8.68           | 4.74         | > 100        | > 100         | 30.85       | > 100        |
| 59               | -106.78               | 20.96         | 21.90      | 0.24         | 95.85         | 15.86       | 6.99           | 4.35         | > 100        | > 100         | 26.50       | > 100        |
| 62               | -136.05               | 6.41          | 21.41      | 0.34         | > 100         | 23.26       | 8.40           | 5.53         | > 100        | > 100         | 30.94       | > 100        |
| 64               | -135.34               | 4.29          | 23.58      | 0.49         | > 100         | 30.17       | 10.51          | 6.97         | > 100        | > 100         | 37.44       | > 100        |

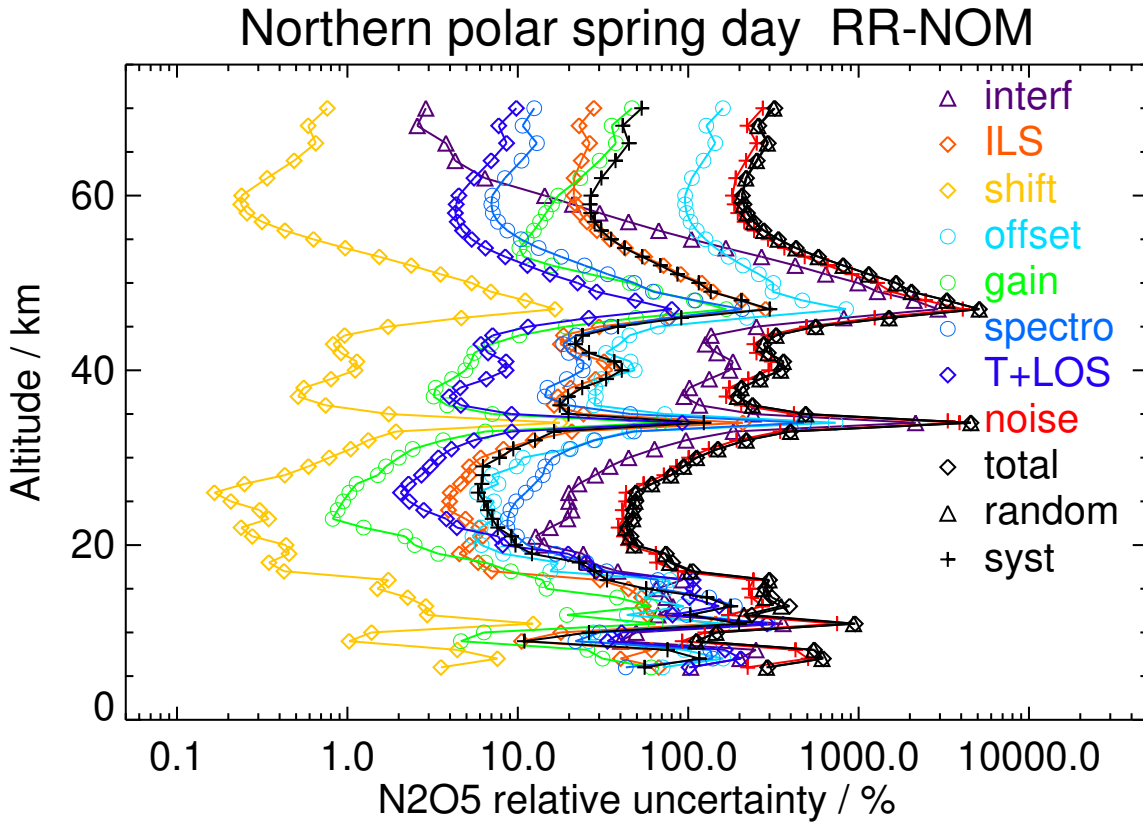


Figure S37: V8R\_N2O5\_261 Northern polar spring day

Table S42: N2O5 error budget for Northern polar spring night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 1.59                  | > 100         | > 100      | 46.36        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 11               | 29.44                 | 38.51         | 12.14      | 1.07         | 22.13         | 4.53        | 24.42          | 30.41        | > 100        | > 100         | 5.92        | > 100        |
| 14               | 31.75                 | 27.08         | 20.92      | 1.30         | 26.56         | 19.07       | 51.46          | 46.57        | 95.45        | > 100         | 49.97       | > 100        |
| 17               | 45.47                 | 31.66         | 8.21       | 0.51         | 20.19         | 4.90        | 20.21          | 26.47        | 71.82        | 87.66         | 9.13        | 88.14        |
| 20               | 115.04                | 9.65          | 2.53       | 0.34         | 3.37          | 1.74        | 10.52          | 8.04         | 30.04        | 33.36         | 8.90        | 34.52        |
| 23               | 212.59                | 7.97          | 2.52       | 0.14         | 4.39          | 0.48        | 6.14           | 1.68         | 21.48        | 23.65         | 5.63        | 24.31        |
| 26               | 236.48                | 7.78          | 2.39       | 0.10         | 2.82          | 0.78        | 6.81           | 0.93         | 20.51        | 22.47         | 6.13        | 23.29        |
| 29               | 196.90                | 10.07         | 1.86       | 0.18         | 3.96          | 0.94        | 7.52           | 0.92         | 31.22        | 33.41         | 6.09        | 33.96        |
| 32               | 131.24                | 21.86         | 2.89       | 0.31         | 8.34          | 1.38        | 9.89           | 1.35         | 51.79        | 57.41         | 6.62        | 57.79        |
| 35               | 49.03                 | 69.43         | 10.37      | 0.55         | 28.61         | 3.94        | 18.65          | 3.40         | > 100        | > 100         | 15.55       | > 100        |
| 38               | 15.00                 | > 100         | 67.66      | 1.65         | 96.52         | 11.05       | 76.97          | 15.52        | > 100        | > 100         | 95.63       | > 100        |
| 41               | -19.92                | > 100         | 43.52      | 1.98         | 69.84         | 6.53        | 47.36          | 12.04        | > 100        | > 100         | 60.82       | > 100        |
| 44               | 1.40                  | > 100         | > 100      | 29.07        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 47               | 19.64                 | > 100         | 30.31      | 2.71         | > 100         | 19.81       | 27.50          | 10.91        | > 100        | > 100         | 37.13       | > 100        |
| 50               | 19.30                 | > 100         | 56.50      | 2.77         | > 100         | 19.38       | 28.58          | 10.89        | > 100        | > 100         | 58.44       | > 100        |
| 53               | -3.88                 | > 100         | > 100      | 10.23        | > 100         | 95.65       | > 100          | 68.07        | > 100        | > 100         | > 100       | > 100        |
| 56               | -3.13                 | > 100         | > 100      | 10.79        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 59               | 22.08                 | > 100         | > 100      | 2.32         | > 100         | 83.67       | 48.75          | 26.03        | > 100        | > 100         | > 100       | > 100        |
| 62               | 34.30                 | 37.96         | > 100      | 2.74         | > 100         | 92.98       | 40.04          | 24.86        | > 100        | > 100         | > 100       | > 100        |
| 64               | 41.02                 | 18.75         | 98.04      | 3.04         | > 100         | 98.33       | 38.29          | 25.13        | > 100        | > 100         | > 100       | > 100        |

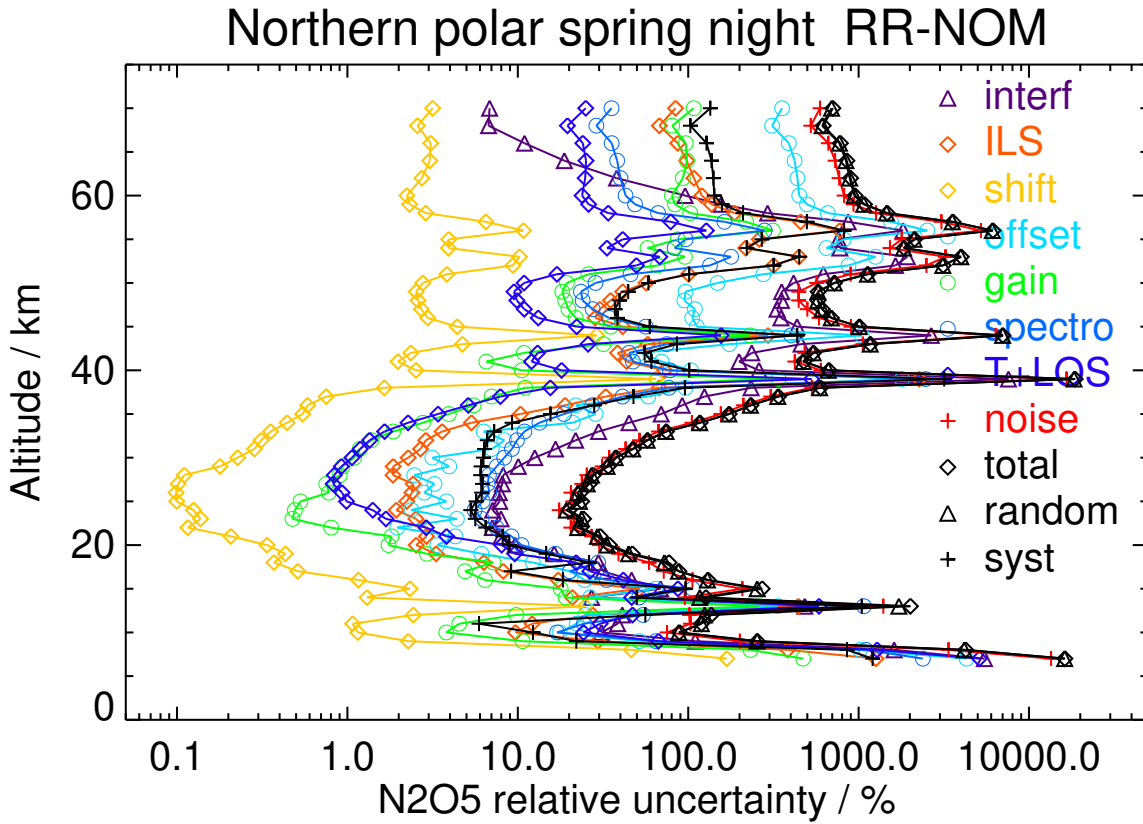


Figure S38: V8R\_N2O5\_261 Northern polar spring night

Table S43: N2O5 error budget for Northern polar summer day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 169.25                | 13.76         | 1.27       | 0.53         | 6.76          | 6.70        | 25.10          | 13.75        | 29.06        | 35.64         | 25.98       | 44.11        |
| 11               | 53.96                 | 24.81         | 31.83      | 1.55         | 15.77         | 6.21        | 34.17          | 21.71        | 65.30        | 84.71         | 25.42       | 88.44        |
| 14               | -20.99                | 39.54         | 33.37      | 2.94         | 23.73         | 18.50       | 56.62          | 57.59        | > 100        | > 100         | 50.78       | > 100        |
| 17               | -25.65                | 28.74         | 27.23      | 1.05         | 28.23         | 9.41        | 40.33          | 41.52        | > 100        | > 100         | 38.20       | > 100        |
| 20               | 22.68                 | 35.58         | 17.16      | 0.91         | 23.86         | 12.97       | 46.23          | 35.48        | > 100        | > 100         | 39.90       | > 100        |
| 23               | 21.12                 | 43.76         | 32.44      | 1.92         | 48.90         | 8.46        | 39.21          | 24.69        | > 100        | > 100         | 37.60       | > 100        |
| 26               | 15.74                 | 71.92         | 33.93      | 3.76         | 19.82         | 3.32        | 31.58          | 15.36        | > 100        | > 100         | 33.39       | > 100        |
| 29               | 35.91                 | 34.02         | 10.39      | 0.63         | 48.56         | 3.69        | 14.82          | 6.82         | > 100        | > 100         | 13.68       | > 100        |
| 32               | 16.23                 | > 100         | 17.41      | 2.99         | 81.79         | 4.89        | 25.53          | 9.57         | > 100        | > 100         | 21.30       | > 100        |
| 35               | -11.37                | > 100         | 24.30      | 3.31         | > 100         | 6.27        | 35.51          | 9.49         | > 100        | > 100         | 33.17       | > 100        |
| 38               | -10.85                | > 100         | 68.49      | 2.75         | > 100         | 7.68        | 34.39          | 10.49        | > 100        | > 100         | 68.73       | > 100        |
| 41               | -6.04                 | > 100         | > 100      | 4.38         | > 100         | 29.96       | 74.13          | 23.58        | > 100        | > 100         | > 100       | > 100        |
| 44               | -5.29                 | > 100         | 31.81      | 6.67         | > 100         | 23.69       | 63.21          | 20.08        | > 100        | > 100         | 39.41       | > 100        |
| 47               | 7.55                  | > 100         | 37.26      | 5.27         | > 100         | 31.66       | 47.28          | 22.18        | > 100        | > 100         | 46.84       | > 100        |
| 50               | 27.06                 | > 100         | 7.86       | 1.72         | 85.98         | 10.47       | 16.06          | 5.63         | > 100        | > 100         | 14.99       | > 100        |
| 53               | 34.64                 | > 100         | 17.84      | 1.94         | 53.01         | 9.06        | 14.82          | 4.27         | > 100        | > 100         | 22.13       | > 100        |
| 56               | 34.87                 | > 100         | 28.93      | 1.44         | > 100         | 7.60        | 17.05          | 4.43         | > 100        | > 100         | 31.42       | > 100        |
| 59               | 35.15                 | 21.07         | 34.09      | 0.74         | > 100         | 9.95        | 20.86          | 5.12         | > 100        | > 100         | 36.32       | > 100        |
| 62               | 49.07                 | 30.79         | 22.23      | 2.08         | > 100         | 19.59       | 22.89          | 7.58         | > 100        | > 100         | 30.82       | > 100        |
| 64               | 72.63                 | 26.03         | 13.28      | 2.24         | > 100         | 20.10       | 20.55          | 8.37         | > 100        | > 100         | 26.03       | > 100        |

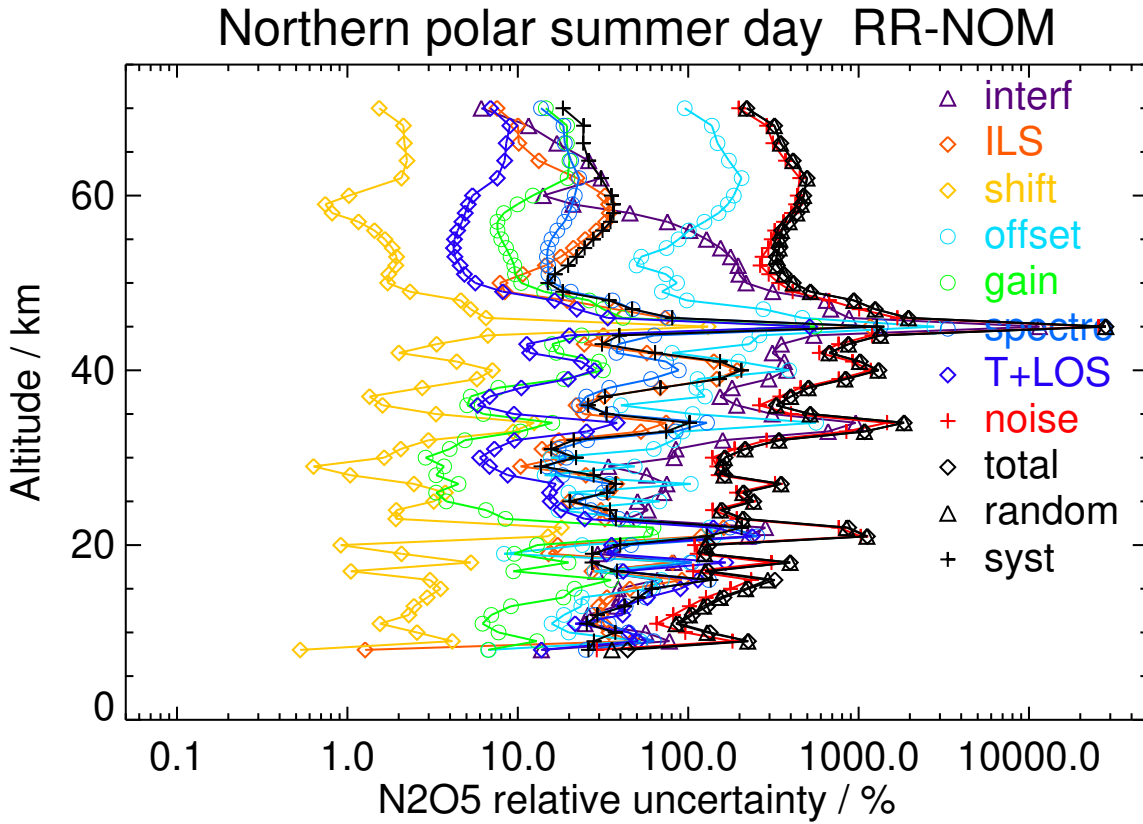


Figure S39: V8R\_N2O5\_261 Northern polar summer day

Table S44: N2O5 error budget for Northern polar summer night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 14               | -31.98                | 32.49         | 11.60      | 1.63         | 34.63         | 10.88       | 30.03          | 48.15        | > 100        | > 100         | 27.55       | > 100        |
| 17               | 16.55                 | 52.75         | 33.52      | 1.13         | 31.10         | 18.09       | 71.78          | 46.77        | > 100        | > 100         | 72.66       | > 100        |
| 20               | 104.52                | 8.56          | 3.06       | 0.20         | 2.46          | 2.17        | 15.23          | 11.98        | 29.71        | 34.00         | 13.99       | 36.76        |
| 23               | 189.12                | 4.84          | 2.85       | 0.18         | 5.33          | 0.68        | 6.43           | 2.31         | 21.41        | 22.95         | 6.21        | 23.78        |
| 26               | 268.69                | 4.48          | 2.75       | 0.09         | 2.33          | 0.41        | 5.67           | 1.21         | 13.84        | 14.97         | 5.85        | 16.07        |
| 29               | 327.34                | 3.80          | 2.08       | 0.13         | 4.43          | 0.71        | 6.10           | 0.88         | 15.79        | 17.08         | 5.88        | 18.06        |
| 32               | 240.07                | 6.95          | 3.83       | 0.29         | 6.21          | 0.92        | 9.44           | 0.96         | 21.32        | 23.94         | 8.60        | 25.44        |
| 35               | 123.20                | 17.49         | 6.99       | 0.42         | 13.06         | 1.59        | 12.21          | 1.49         | 44.10        | 49.90         | 11.55       | 51.22        |
| 38               | 62.68                 | 37.14         | 16.10      | 0.50         | 25.73         | 3.00        | 18.66          | 3.62         | 96.53        | > 100         | 22.32       | > 100        |
| 41               | 1.94                  | > 100         | > 100      | 12.19        | > 100         | 70.84       | > 100          | 72.67        | > 100        | > 100         | > 100       | > 100        |
| 44               | 12.20                 | > 100         | 20.57      | 1.65         | > 100         | 10.37       | 34.94          | 10.71        | > 100        | > 100         | 26.06       | > 100        |
| 47               | 13.06                 | > 100         | 15.83      | 1.39         | > 100         | 16.58       | 32.18          | 9.72         | > 100        | > 100         | 24.10       | > 100        |
| 50               | 14.01                 | > 100         | 38.44      | 2.27         | > 100         | 16.21       | 30.89          | 8.69         | > 100        | > 100         | 42.14       | > 100        |
| 53               | 31.02                 | > 100         | 27.64      | 1.11         | > 100         | 6.04        | 15.62          | 3.57         | > 100        | > 100         | 28.91       | > 100        |
| 56               | 39.52                 | 71.77         | 26.88      | 0.74         | > 100         | 6.60        | 14.16          | 3.42         | > 100        | > 100         | 28.47       | > 100        |
| 59               | 25.61                 | 39.89         | 42.84      | 0.93         | > 100         | 21.31       | 25.27          | 8.70         | > 100        | > 100         | 49.12       | > 100        |
| 62               | -25.70                | 31.27         | 33.83      | 1.79         | > 100         | 41.43       | 31.61          | 16.76        | > 100        | > 100         | 54.86       | > 100        |
| 64               | -47.92                | 19.70         | 13.34      | 1.52         | > 100         | 28.99       | 19.81          | 12.24        | > 100        | > 100         | 33.02       | > 100        |

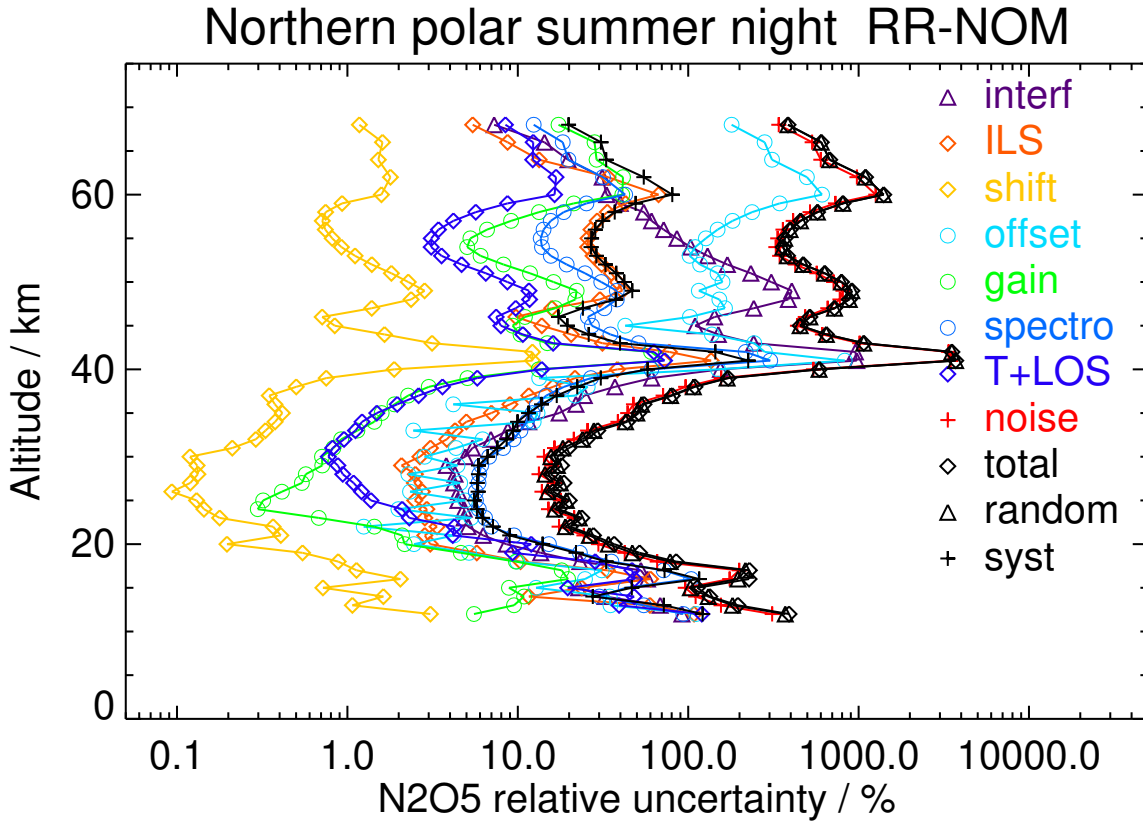


Figure S40: V8R\_N2O5\_261 Northern polar summer night

Table S45: N2O5 error budget for Northern polar autumn day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 69.43                 | 36.76         | 2.20       | 0.83         | 28.39         | 9.17        | 26.28          | 34.58        | 84.89        | > 100         | 27.86       | > 100        |
| 11               | 16.42                 | > 100         | 41.57      | 2.70         | > 100         | 14.72       | 78.64          | 90.83        | > 100        | > 100         | 42.72       | > 100        |
| 14               | -30.62                | 47.37         | 13.50      | 1.63         | 20.02         | 11.56       | 38.81          | 27.80        | > 100        | > 100         | 37.88       | > 100        |
| 17               | 35.99                 | 23.37         | 13.20      | 0.68         | 24.18         | 10.32       | 28.80          | 30.61        | 94.75        | > 100         | 22.29       | > 100        |
| 20               | 112.84                | 25.75         | 3.54       | 0.45         | 3.89          | 3.28        | 20.25          | 9.80         | 33.50        | 44.38         | 18.99       | 48.27        |
| 23               | 384.65                | 4.78          | 1.04       | 0.11         | 2.34          | 1.21        | 10.35          | 1.75         | 11.69        | 13.60         | 9.62        | 16.66        |
| 26               | 1026.45               | 1.13          | 0.47       | 0.07         | 0.80          | 0.23        | 5.59           | 0.98         | 4.86         | 5.41          | 5.36        | 7.62         |
| 29               | 1433.93               | 2.26          | 1.03       | 0.08         | 0.53          | 0.40        | 6.63           | 0.87         | 4.19         | 5.26          | 6.41        | 8.30         |
| 32               | 1131.92               | 4.37          | 1.71       | 0.14         | 1.09          | 0.58        | 9.30           | 1.15         | 5.98         | 7.88          | 9.22        | 12.13        |
| 35               | 726.82                | 8.84          | 2.80       | 0.11         | 2.18          | 0.65        | 11.35          | 1.33         | 10.82        | 14.73         | 11.03       | 18.40        |
| 38               | 398.11                | 19.02         | 3.31       | 0.17         | 3.72          | 0.60        | 12.54          | 1.54         | 21.93        | 29.96         | 11.40       | 32.06        |
| 41               | 216.15                | 33.45         | 3.37       | 0.13         | 6.95          | 0.96        | 11.97          | 1.76         | 44.70        | 56.86         | 9.50        | 57.65        |
| 44               | 73.47                 | 89.15         | 7.68       | 0.53         | 24.82         | 4.19        | 17.86          | 3.92         | > 100        | > 100         | 12.11       | > 100        |
| 47               | 1.92                  | > 100         | > 100      | 26.64        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 50               | -3.64                 | > 100         | > 100      | 17.28        | > 100         | 73.18       | > 100          | 78.53        | > 100        | > 100         | > 100       | > 100        |
| 53               | 22.71                 | > 100         | 69.64      | 2.69         | > 100         | 29.81       | 31.63          | 15.01        | > 100        | > 100         | 69.24       | > 100        |
| 56               | 47.71                 | > 100         | 43.29      | 1.08         | > 100         | 28.85       | 19.31          | 10.04        | > 100        | > 100         | 49.14       | > 100        |
| 59               | 62.73                 | 70.89         | 39.75      | 0.74         | > 100         | 33.45       | 17.84          | 10.44        | > 100        | > 100         | 49.53       | > 100        |
| 62               | 93.32                 | 18.85         | 31.86      | 0.59         | > 100         | 32.47       | 14.76          | 9.64         | > 100        | > 100         | 43.62       | > 100        |
| 64               | 111.80                | 9.69          | 28.71      | 0.60         | > 100         | 31.89       | 13.67          | 9.33         | > 100        | > 100         | 41.22       | > 100        |

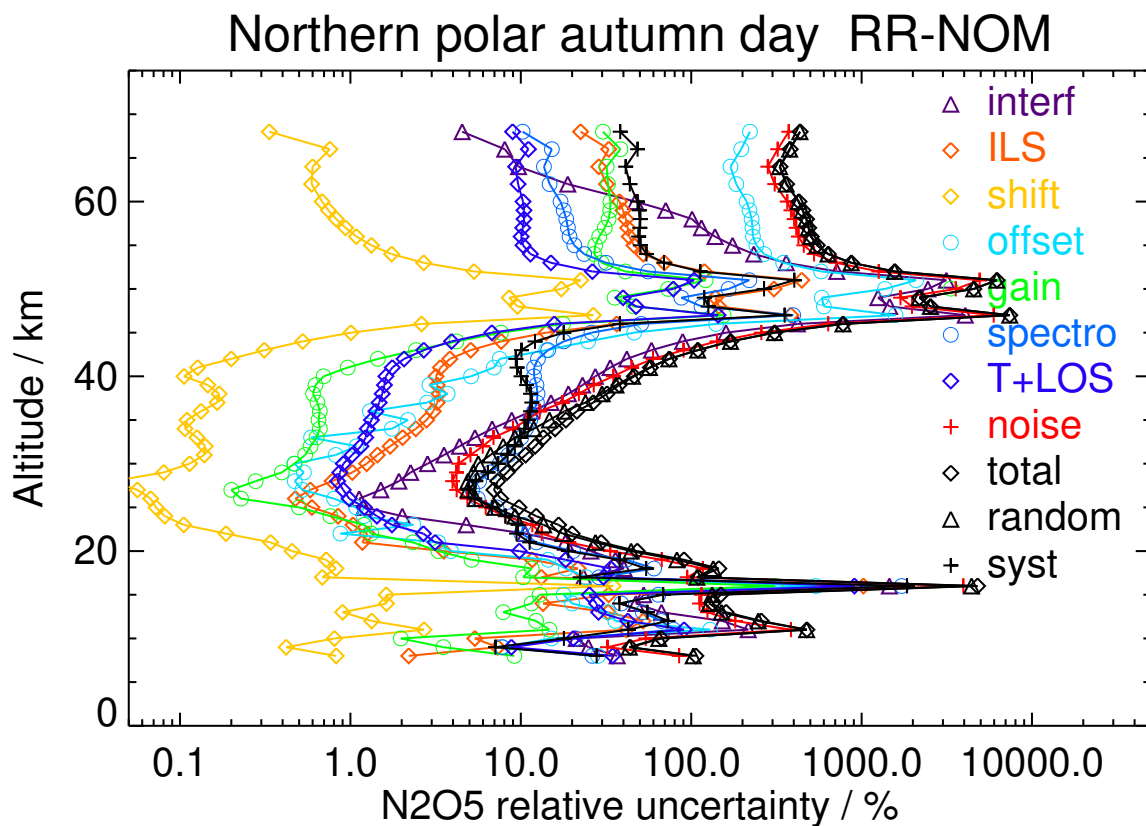


Figure S41: V8R\_N2O5\_261 Northern polar autumn day

Table S46: N2O5 error budget for Northern polar autumn night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | -40.70                | 61.84         | 0.26       | 1.82         | 43.55         | 6.41        | 39.28          | 47.62        | > 100        | > 100         | 39.78       | > 100        |
| 11               | -23.84                | > 100         | 37.66      | 2.05         | 87.40         | 16.56       | 54.94          | 68.18        | > 100        | > 100         | 44.26       | > 100        |
| 14               | -24.77                | 64.23         | 17.45      | 1.94         | 24.11         | 18.96       | 45.41          | 32.22        | > 100        | > 100         | 44.04       | > 100        |
| 17               | 30.94                 | 26.90         | 14.98      | 0.88         | 24.11         | 18.37       | 34.68          | 33.69        | > 100        | > 100         | 28.46       | > 100        |
| 20               | 108.92                | 29.84         | 4.25       | 0.45         | 3.72          | 4.51        | 20.33          | 10.16        | 34.10        | 47.54         | 19.02       | 51.20        |
| 23               | 346.43                | 5.63          | 1.20       | 0.15         | 2.69          | 2.23        | 11.57          | 1.94         | 13.05        | 15.73         | 10.28       | 18.79        |
| 26               | 926.15                | 1.00          | 0.65       | 0.11         | 0.83          | 0.79        | 5.79           | 0.98         | 5.38         | 6.19          | 5.28        | 8.14         |
| 29               | 1212.92               | 2.80          | 1.19       | 0.11         | 0.71          | 0.64        | 7.05           | 0.89         | 4.98         | 6.72          | 6.35        | 9.25         |
| 32               | 963.69                | 5.45          | 2.52       | 0.21         | 1.28          | 0.90        | 10.04          | 1.16         | 6.84         | 10.26         | 9.07        | 13.69        |
| 35               | 599.00                | 11.32         | 3.68       | 0.25         | 2.49          | 1.27        | 12.17          | 1.30         | 12.79        | 18.71         | 10.62       | 21.51        |
| 38               | 335.26                | 23.56         | 3.18       | 0.17         | 4.38          | 1.38        | 12.66          | 1.45         | 25.59        | 36.17         | 9.76        | 37.46        |
| 41               | 157.01                | 47.52         | 4.28       | 0.19         | 9.18          | 2.39        | 15.14          | 2.04         | 60.56        | 78.65         | 9.03        | 79.17        |
| 44               | 78.48                 | 87.62         | 8.54       | 0.55         | 21.40         | 5.21        | 16.00          | 3.13         | > 100        | > 100         | 10.59       | > 100        |
| 47               | 76.88                 | > 100         | 11.68      | 0.78         | 35.54         | 4.09        | 12.17          | 3.12         | > 100        | > 100         | 13.06       | > 100        |
| 50               | 52.52                 | > 100         | 24.37      | 1.32         | 83.85         | 4.66        | 18.15          | 4.93         | > 100        | > 100         | 25.33       | > 100        |
| 53               | 48.73                 | > 100         | 38.64      | 1.38         | > 100         | 13.92       | 22.23          | 7.14         | > 100        | > 100         | 39.92       | > 100        |
| 56               | 39.00                 | > 100         | 65.36      | 1.45         | > 100         | 37.31       | 31.95          | 13.13        | > 100        | > 100         | 72.51       | > 100        |
| 59               | 17.10                 | > 100         | > 100      | 2.73         | > 100         | > 100       | 81.30          | 41.45        | > 100        | > 100         | > 100       | > 100        |
| 62               | -17.18                | > 100         | > 100      | 3.09         | > 100         | > 100       | 89.74          | 57.24        | > 100        | > 100         | > 100       | > 100        |
| 64               | -32.75                | 44.13         | > 100      | 2.16         | > 100         | > 100       | 49.24          | 34.77        | > 100        | > 100         | > 100       | > 100        |

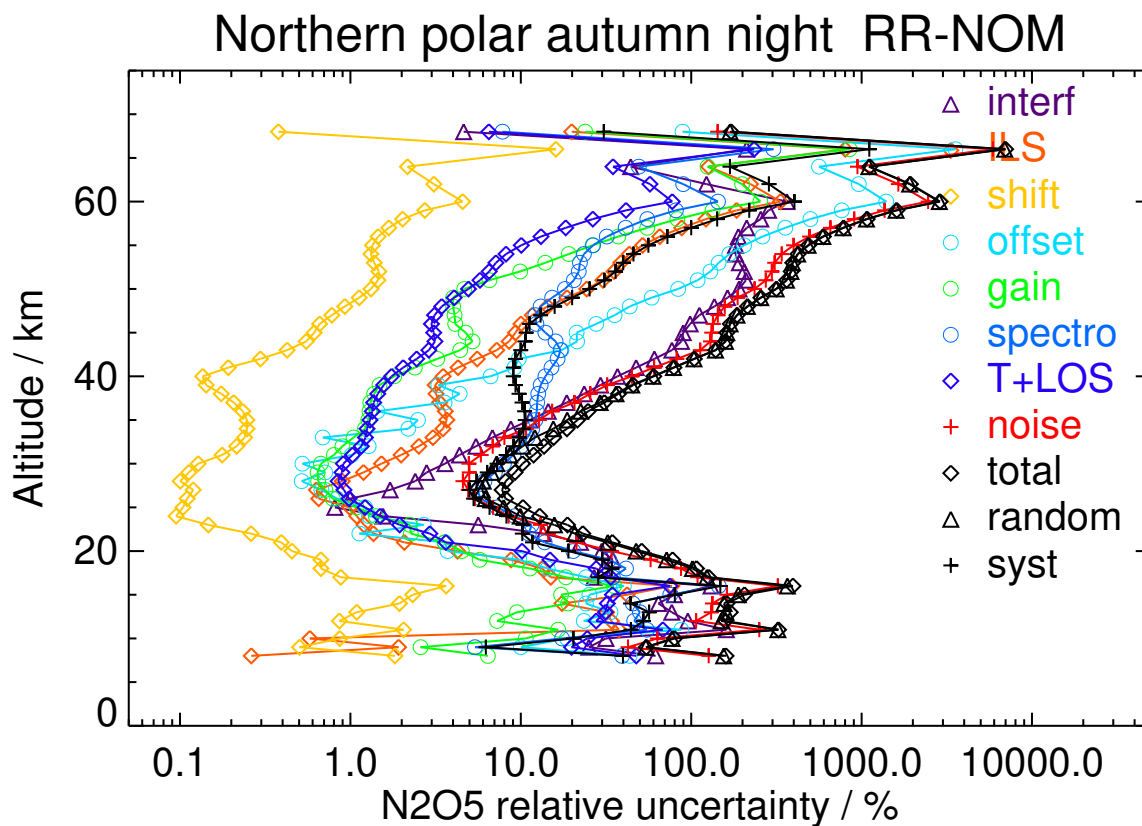


Figure S42: V8R\_N2O5\_261 Northern polar autumn night

Table S47: N2O5 error budget for Northern midlatitude winter day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 24.53                 | > 100         | 44.85      | 2.08         | 36.69         | 30.40       | 66.09          | 59.16        | > 100        | > 100         | 36.68       | > 100        |
| 11               | -13.58                | > 100         | 93.46      | 3.83         | 80.13         | 65.17       | > 100          | > 100        | > 100        | > 100         | 97.96       | > 100        |
| 14               | -14.24                | 69.54         | 64.31      | 3.07         | 74.94         | 60.99       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 17               | 3.75                  | > 100         | > 100      | 7.94         | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 20               | 134.85                | 9.71          | 4.46       | 0.35         | 5.15          | 3.17        | 12.61          | 7.06         | 25.51        | 29.97         | 10.60       | 31.79        |
| 23               | 262.46                | 6.31          | 2.16       | 0.35         | 1.73          | 1.90        | 12.51          | 3.08         | 15.18        | 18.15         | 10.86       | 21.15        |
| 26               | 1018.89               | 1.79          | 1.19       | 0.16         | 0.63          | 0.67        | 6.88           | 1.20         | 4.01         | 5.46          | 6.37        | 8.38         |
| 29               | 1895.83               | 1.17          | 0.70       | 0.16         | 0.48          | 0.44        | 5.30           | 0.77         | 2.64         | 3.52          | 5.06        | 6.16         |
| 32               | 2290.05               | 1.36          | 1.41       | 0.12         | 0.37          | 0.46        | 6.38           | 0.61         | 2.17         | 2.99          | 6.41        | 7.07         |
| 35               | 1515.31               | 3.14          | 2.01       | 0.22         | 0.97          | 0.62        | 9.05           | 0.89         | 4.02         | 5.65          | 9.07        | 10.68        |
| 38               | 636.00                | 6.35          | 2.77       | 0.19         | 2.46          | 0.94        | 12.96          | 1.38         | 10.95        | 13.70         | 12.54       | 18.57        |
| 41               | 233.71                | 19.04         | 4.76       | 0.15         | 6.24          | 1.09        | 15.48          | 1.78         | 33.59        | 40.14         | 13.60       | 42.38        |
| 44               | 85.36                 | 63.81         | 6.22       | 0.69         | 17.47         | 2.38        | 18.30          | 2.72         | > 100        | > 100         | 11.83       | > 100        |
| 47               | 41.10                 | > 100         | 13.02      | 1.83         | 52.16         | 7.88        | 22.87          | 5.88         | > 100        | > 100         | 12.03       | > 100        |
| 50               | 21.73                 | > 100         | 34.14      | 3.90         | > 100         | 16.26       | 32.76          | 13.66        | > 100        | > 100         | 21.54       | > 100        |
| 53               | 1.81                  | > 100         | > 100      | 34.29        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 56               | -30.29                | 92.97         | 41.30      | 1.53         | > 100         | 36.11       | 33.18          | 10.15        | > 100        | > 100         | 52.79       | > 100        |
| 59               | -62.86                | 36.60         | 25.05      | 1.38         | > 100         | 29.49       | 22.47          | 6.50         | > 100        | > 100         | 38.91       | > 100        |
| 62               | -89.60                | 17.33         | 21.82      | 1.74         | > 100         | 32.30       | 22.43          | 7.07         | > 100        | > 100         | 39.65       | > 100        |
| 64               | -271.60               | 3.53          | 9.23       | 0.63         | 65.76         | 13.57       | 7.83           | 2.79         | > 100        | > 100         | 16.13       | > 100        |

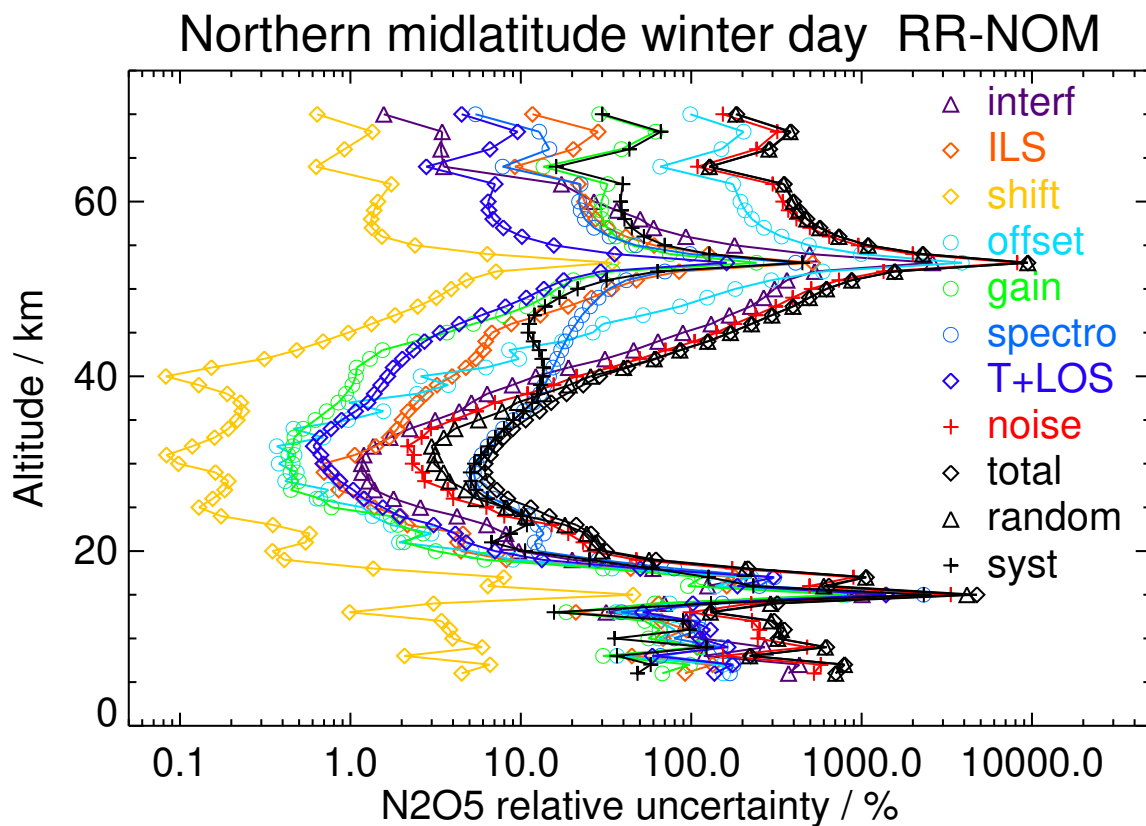


Figure S43: V8R\_N2O5\_261 Northern midlatitude winter day

Table S48: N2O5 error budget for Northern midlatitude winter night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 24.36                 | > 100         | 32.82      | 2.57         | 38.77         | 38.87       | 70.65          | 62.84        | > 100        | > 100         | 14.20       | > 100        |
| 11               | -15.54                | 90.73         | > 100      | 4.96         | 52.16         | 94.20       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 14               | -7.89                 | > 100         | > 100      | 5.50         | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 17               | -2.59                 | > 100         | > 100      | 10.21        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 20               | 97.68                 | 12.37         | 7.00       | 0.52         | 6.90          | 4.96        | 18.17          | 10.14        | 35.37        | 41.96         | 14.04       | 44.25        |
| 23               | 269.37                | 6.31          | 2.15       | 0.26         | 1.86          | 1.97        | 10.54          | 2.70         | 14.93        | 17.99         | 8.35        | 19.83        |
| 26               | 814.93                | 2.07          | 1.10       | 0.11         | 0.82          | 0.61        | 6.84           | 1.26         | 5.07         | 6.48          | 6.22        | 8.98         |
| 29               | 1459.58               | 1.30          | 0.87       | 0.16         | 0.69          | 0.45        | 5.64           | 0.79         | 3.50         | 4.56          | 5.20        | 6.91         |
| 32               | 1694.14               | 1.88          | 1.54       | 0.13         | 0.49          | 0.57        | 6.59           | 0.58         | 2.85         | 4.11          | 6.44        | 7.64         |
| 35               | 1196.39               | 4.02          | 1.99       | 0.23         | 1.18          | 0.77        | 8.42           | 0.79         | 4.93         | 6.97          | 8.33        | 10.86        |
| 38               | 562.20                | 7.70          | 2.40       | 0.19         | 2.69          | 0.97        | 11.06          | 1.16         | 11.56        | 14.56         | 10.90       | 18.19        |
| 41               | 221.01                | 20.93         | 4.52       | 0.15         | 6.39          | 1.23        | 12.46          | 1.65         | 32.65        | 39.64         | 12.37       | 41.53        |
| 44               | 77.28                 | 70.44         | 7.01       | 0.70         | 17.30         | 2.80        | 14.11          | 2.62         | > 100        | > 100         | 13.27       | > 100        |
| 47               | 52.17                 | > 100         | 8.00       | 1.36         | 32.21         | 3.53        | 16.88          | 3.97         | > 100        | > 100         | 12.57       | > 100        |
| 50               | 60.66                 | > 100         | 9.18       | 1.35         | 53.68         | 3.91        | 14.16          | 4.49         | > 100        | > 100         | 12.40       | > 100        |
| 53               | 73.61                 | 54.96         | 10.54      | 0.85         | 84.94         | 6.14        | 14.46          | 3.77         | > 100        | > 100         | 15.14       | > 100        |
| 56               | 86.18                 | 24.27         | 10.71      | 0.53         | > 100         | 11.01       | 15.67          | 3.66         | > 100        | > 100         | 18.22       | > 100        |
| 59               | 84.94                 | 28.97         | 12.58      | 1.01         | > 100         | 17.71       | 19.13          | 5.69         | > 100        | > 100         | 23.65       | > 100        |
| 62               | 85.89                 | 21.79         | 16.46      | 1.75         | > 100         | 26.31       | 22.76          | 9.42         | > 100        | > 100         | 30.16       | > 100        |
| 64               | 12.72                 | 96.83         | > 100      | 12.69        | > 100         | > 100       | > 100          | 67.25        | > 100        | > 100         | > 100       | > 100        |

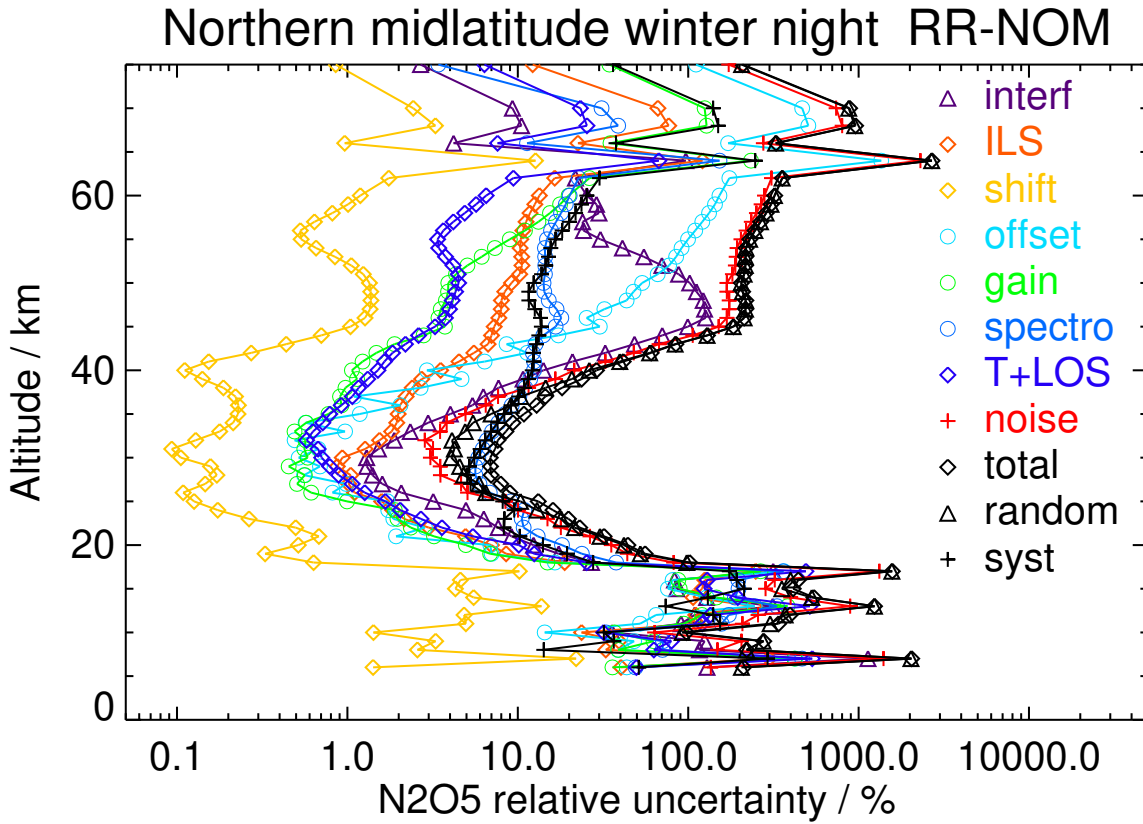


Figure S44: V8R\_N2O5\_261 Northern midlatitude winter night

Table S49: N2O5 error budget for Northern midlatitude spring day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | -26.47                | > 100         | 58.50      | 3.36         | 48.36         | 15.07       | 69.49          | 68.84        | > 100        | > 100         | 36.21       | > 100        |
| 11               | 44.16                 | 30.07         | 23.10      | 1.77         | 20.66         | 8.93        | 40.71          | 34.13        | 81.13        | > 100         | 17.93       | > 100        |
| 14               | 24.41                 | 38.11         | 26.81      | 1.52         | 39.55         | 23.04       | 66.64          | 61.28        | > 100        | > 100         | 50.90       | > 100        |
| 17               | 34.63                 | 23.37         | 12.56      | 0.89         | 21.82         | 8.99        | 40.84          | 32.61        | 92.95        | > 100         | 24.99       | > 100        |
| 20               | 143.54                | 7.04          | 4.33       | 0.36         | 3.51          | 2.12        | 13.76          | 6.06         | 24.09        | 27.49         | 11.64       | 29.86        |
| 23               | 376.83                | 3.74          | 1.12       | 0.14         | 1.12          | 0.55        | 6.44           | 1.54         | 9.98         | 11.20         | 5.90        | 12.66        |
| 26               | 638.31                | 1.93          | 1.16       | 0.08         | 1.28          | 0.49        | 5.45           | 0.92         | 7.38         | 8.12          | 5.10        | 9.59         |
| 29               | 792.42                | 2.03          | 1.72       | 0.08         | 0.77          | 0.50        | 6.17           | 0.70         | 6.27         | 7.13          | 5.91        | 9.26         |
| 32               | 709.35                | 3.58          | 2.33       | 0.18         | 1.60          | 0.61        | 7.41           | 0.71         | 7.79         | 9.12          | 7.36        | 11.72        |
| 35               | 358.81                | 11.01         | 3.75       | 0.38         | 4.56          | 0.92        | 11.09          | 1.11         | 17.81        | 22.00         | 10.72       | 24.47        |
| 38               | 55.22                 | 74.20         | 17.45      | 0.74         | 30.16         | 3.33        | 31.59          | 4.19         | > 100        | > 100         | 32.63       | > 100        |
| 41               | -1.64                 | > 100         | > 100      | 20.94        | > 100         | 68.02       | > 100          | 94.28        | > 100        | > 100         | > 100       | > 100        |
| 44               | -5.61                 | > 100         | 97.19      | 5.66         | > 100         | 23.31       | 78.36          | 26.97        | > 100        | > 100         | 70.64       | > 100        |
| 47               | 65.24                 | 72.04         | 7.86       | 0.96         | 26.10         | 2.95        | 9.23           | 2.89         | > 100        | > 100         | 6.30        | > 100        |
| 50               | 69.77                 | 76.33         | 5.13       | 1.16         | 37.51         | 4.12        | 10.00          | 3.42         | > 100        | > 100         | 7.80        | > 100        |
| 53               | 27.83                 | > 100         | 16.41      | 2.49         | > 100         | 7.45        | 27.76          | 8.85         | > 100        | > 100         | 23.33       | > 100        |
| 56               | -29.88                | 91.59         | 29.07      | 1.41         | > 100         | 20.70       | 31.11          | 8.45         | > 100        | > 100         | 40.04       | > 100        |
| 59               | -78.95                | 14.57         | 16.79      | 0.45         | > 100         | 16.72       | 15.31          | 4.56         | > 100        | > 100         | 25.54       | > 100        |
| 62               | -128.19               | 8.39          | 14.64      | 0.66         | > 100         | 18.33       | 13.25          | 4.73         | > 100        | > 100         | 24.96       | > 100        |
| 64               | -154.99               | 6.23          | 14.09      | 0.78         | > 100         | 19.33       | 13.07          | 5.03         | > 100        | > 100         | 25.35       | > 100        |

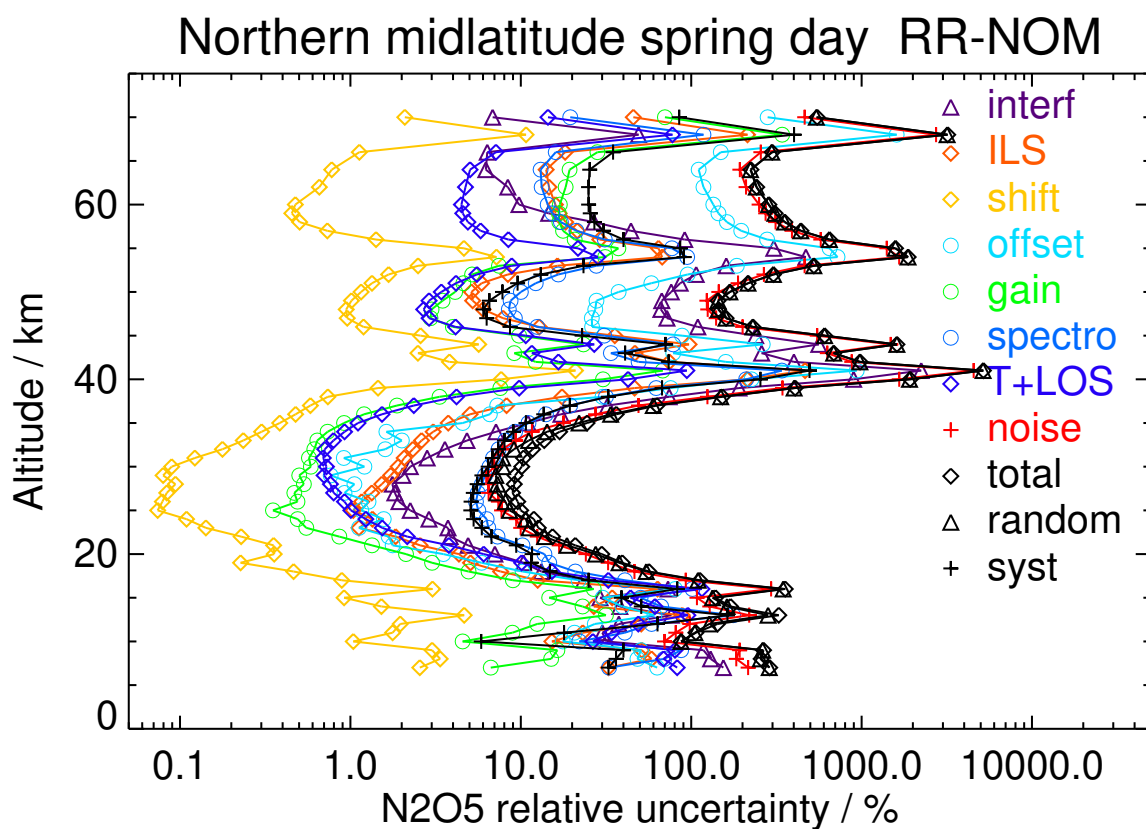


Figure S45: V8R\_N2O5\_261 Northern midlatitude spring day

Table S50: N2O5 error budget for Northern midlatitude spring night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 29.89                 | > 100         | 28.03      | 2.61         | 48.79         | 15.07       | 61.05          | 68.61        | > 100        | > 100         | 24.19       | > 100        |
| 11               | 27.29                 | 47.62         | 27.98      | 1.85         | 25.16         | 15.02       | 46.17          | 38.96        | > 100        | > 100         | 9.81        | > 100        |
| 14               | 12.83                 | 71.96         | 41.37      | 2.67         | 56.93         | 40.86       | 82.65          | > 100        | > 100        | > 100         | 52.09       | > 100        |
| 17               | 54.82                 | 14.44         | 11.17      | 0.62         | 13.45         | 6.36        | 25.64          | 20.59        | 56.34        | 66.29         | 20.40       | 69.36        |
| 20               | 151.33                | 6.93          | 3.80       | 0.35         | 3.28          | 1.95        | 12.71          | 5.47         | 22.04        | 25.09         | 11.16       | 27.46        |
| 23               | 357.42                | 3.76          | 1.39       | 0.12         | 1.28          | 0.46        | 6.21           | 1.61         | 10.39        | 11.59         | 5.70        | 12.92        |
| 26               | 572.96                | 2.36          | 1.50       | 0.06         | 1.36          | 0.47        | 5.69           | 0.91         | 7.94         | 8.84          | 5.30        | 10.30        |
| 29               | 761.85                | 2.06          | 1.26       | 0.10         | 0.90          | 0.51        | 5.78           | 0.72         | 6.63         | 7.36          | 5.54        | 9.21         |
| 32               | 758.95                | 3.39          | 2.08       | 0.11         | 1.30          | 0.58        | 7.04           | 0.67         | 7.23         | 8.66          | 6.72        | 10.96        |
| 35               | 551.08                | 7.20          | 2.78       | 0.16         | 2.49          | 0.76        | 8.40           | 0.80         | 11.43        | 14.18         | 8.19        | 16.37        |
| 38               | 282.54                | 13.96         | 4.24       | 0.17         | 4.97          | 1.09        | 11.74          | 1.24         | 24.04        | 28.69         | 11.53       | 30.92        |
| 41               | 125.14                | 29.71         | 8.94       | 0.24         | 10.92         | 1.35        | 15.46          | 2.16         | 58.51        | 67.16         | 15.53       | 68.93        |
| 44               | 76.39                 | 44.36         | 10.12      | 0.54         | 17.84         | 1.63        | 15.08          | 2.74         | > 100        | > 100         | 13.37       | > 100        |
| 47               | 40.79                 | > 100         | 10.62      | 1.44         | 36.90         | 4.90        | 18.87          | 4.86         | > 100        | > 100         | 14.54       | > 100        |
| 50               | 33.74                 | > 100         | 12.03      | 2.18         | 75.76         | 7.99        | 18.56          | 7.47         | > 100        | > 100         | 16.15       | > 100        |
| 53               | 33.67                 | > 100         | 22.38      | 1.79         | > 100         | 6.22        | 20.62          | 7.71         | > 100        | > 100         | 24.11       | > 100        |
| 56               | 27.72                 | > 100         | 44.32      | 1.07         | > 100         | 23.67       | 32.49          | 10.14        | > 100        | > 100         | 52.30       | > 100        |
| 59               | 36.74                 | 42.50         | 45.33      | 0.81         | > 100         | 37.12       | 32.73          | 10.74        | > 100        | > 100         | 61.04       | > 100        |
| 62               | 42.58                 | 28.05         | 50.68      | 2.19         | > 100         | 56.33       | 39.51          | 14.90        | > 100        | > 100         | 78.54       | > 100        |
| 64               | 47.48                 | 21.86         | 50.93      | 2.79         | > 100         | 63.75       | 41.77          | 16.81        | > 100        | > 100         | 84.12       | > 100        |

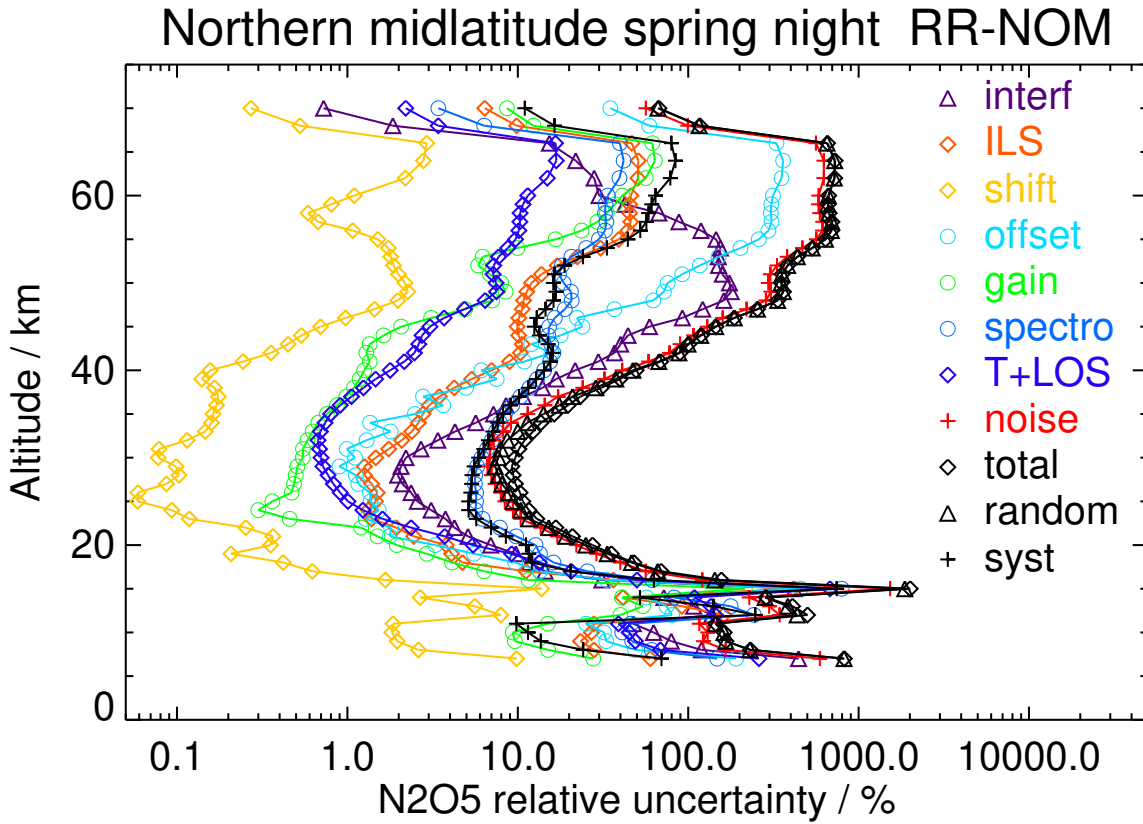


Figure S46: V8R\_N2O5\_261 Northern midlatitude spring night

Table S51: N2O5 error budget for Northern midlatitude summer day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 6.38                  | > 100         | > 100      | 10.50        | > 100         | 56.55       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 11               | 44.36                 | 22.26         | 28.31      | 1.61         | 24.90         | 12.29       | 38.52          | 39.74        | 80.69        | > 100         | 24.90       | > 100        |
| 14               | 11.51                 | 84.44         | 62.93      | 5.79         | > 100         | 67.59       | > 100          | > 100        | > 100        | > 100         | 98.56       | > 100        |
| 17               | -26.26                | 32.34         | 28.93      | 2.02         | 30.55         | 14.12       | 29.67          | 52.57        | > 100        | > 100         | 18.33       | > 100        |
| 20               | 51.80                 | 15.00         | 19.33      | 0.87         | 13.81         | 7.28        | 41.69          | 23.31        | 71.77        | 80.75         | 41.89       | 90.96        |
| 23               | 268.22                | 4.09          | 2.23       | 0.16         | 1.66          | 1.16        | 11.05          | 2.69         | 15.79        | 17.18         | 10.46       | 20.11        |
| 26               | 649.24                | 1.72          | 0.62       | 0.07         | 0.89          | 0.33        | 5.39           | 0.95         | 5.94         | 6.51          | 5.19        | 8.33         |
| 29               | 826.07                | 1.47          | 1.18       | 0.04         | 1.15          | 0.45        | 5.84           | 0.66         | 5.98         | 6.39          | 5.88        | 8.68         |
| 32               | 677.94                | 3.31          | 2.33       | 0.22         | 1.23          | 0.60        | 7.37           | 0.69         | 7.02         | 7.98          | 7.66        | 11.07        |
| 35               | 313.97                | 11.39         | 2.53       | 0.38         | 4.95          | 0.98        | 10.14          | 1.10         | 18.74        | 22.71         | 10.07       | 24.84        |
| 38               | 60.53                 | 53.36         | 5.29       | 0.51         | 27.77         | 1.94        | 13.64          | 2.00         | > 100        | > 100         | 11.24       | > 100        |
| 41               | 0.33                  | > 100         | > 100      | 84.84        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 44               | -3.55                 | > 100         | > 100      | 8.67         | > 100         | 39.13       | > 100          | 46.56        | > 100        | > 100         | > 100       | > 100        |
| 47               | 44.50                 | > 100         | 7.40       | 1.35         | 35.64         | 2.67        | 12.83          | 3.20         | > 100        | > 100         | 9.66        | > 100        |
| 50               | 70.10                 | 73.80         | 3.74       | 1.28         | 29.47         | 2.79        | 9.49           | 2.57         | > 100        | > 100         | 6.50        | > 100        |
| 53               | 71.33                 | 57.19         | 4.21       | 1.34         | 62.56         | 3.01        | 10.19          | 3.10         | > 100        | > 100         | 7.30        | > 100        |
| 56               | 53.53                 | 40.58         | 7.94       | 1.17         | > 100         | 8.82        | 15.54          | 4.73         | > 100        | > 100         | 14.11       | > 100        |
| 59               | 28.06                 | 29.52         | 22.13      | 1.11         | > 100         | 34.11       | 35.80          | 10.84        | > 100        | > 100         | 45.51       | > 100        |
| 62               | 7.80                  | > 100         | > 100      | 11.16        | > 100         | > 100       | > 100          | 57.62        | > 100        | > 100         | > 100       | > 100        |
| 64               | -2.73                 | > 100         | > 100      | 47.58        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |

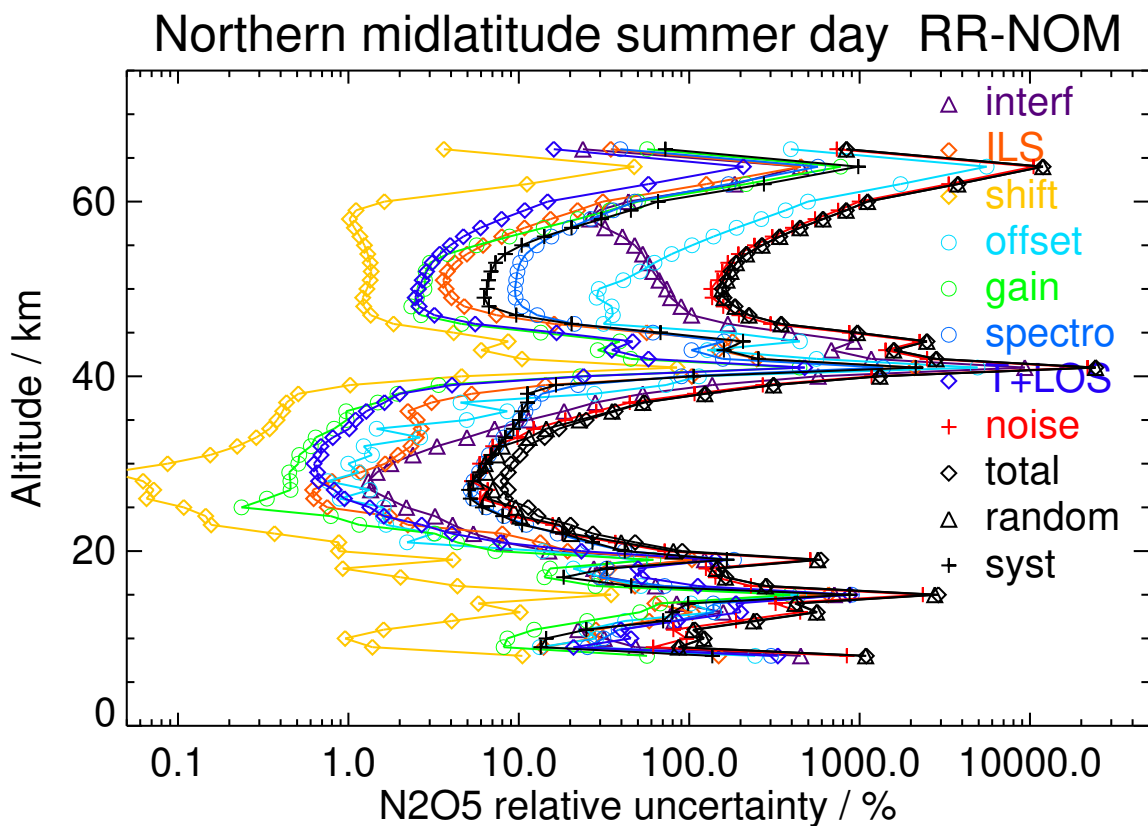


Figure S47: V8R\_N2O5\_261 Northern midlatitude summer day

Table S52: N2O5 error budget for Northern midlatitude summer night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | -6.03                 | > 100         | > 100      | 18.26        | > 100         | 54.06       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 11               | 39.05                 | 32.11         | 41.04      | 1.62         | 25.35         | 19.31       | 68.14          | 35.72        | 92.90        | > 100         | 41.19       | > 100        |
| 14               | -8.18                 | > 100         | > 100      | 7.14         | 85.55         | > 100       | > 100          | > 100        | > 100        | > 100         | 72.68       | > 100        |
| 17               | -33.53                | 23.62         | 15.02      | 1.01         | 21.13         | 14.52       | 23.99          | 43.27        | > 100        | > 100         | 12.66       | > 100        |
| 20               | 36.06                 | 21.58         | 31.55      | 1.45         | 16.91         | 8.58        | 56.25          | 27.17        | 95.94        | > 100         | 55.13       | > 100        |
| 23               | 223.46                | 5.23          | 1.55       | 0.22         | 1.95          | 1.44        | 11.87          | 3.11         | 17.31        | 18.80         | 11.51       | 22.04        |
| 26               | 596.56                | 1.81          | 0.77       | 0.09         | 1.22          | 0.33        | 5.24           | 1.10         | 6.88         | 7.47          | 5.07        | 9.03         |
| 29               | 817.62                | 1.50          | 1.02       | 0.07         | 1.09          | 0.30        | 5.54           | 0.75         | 5.85         | 6.34          | 5.47        | 8.37         |
| 32               | 965.54                | 2.33          | 1.34       | 0.04         | 0.85          | 0.33        | 5.85           | 0.61         | 4.90         | 5.67          | 5.88        | 8.17         |
| 35               | 855.71                | 4.28          | 1.82       | 0.13         | 1.67          | 0.39        | 7.02           | 0.66         | 6.74         | 8.29          | 7.14        | 10.94        |
| 38               | 472.29                | 6.85          | 2.00       | 0.20         | 3.29          | 0.54        | 9.26           | 0.98         | 13.49        | 15.67         | 9.23        | 18.18        |
| 41               | 194.27                | 15.37         | 4.86       | 0.12         | 7.88          | 0.70        | 12.45          | 1.57         | 35.64        | 39.98         | 12.32       | 41.84        |
| 44               | 84.33                 | 39.85         | 9.45       | 0.40         | 17.78         | 1.67        | 14.99          | 2.51         | 91.61        | > 100         | 15.58       | > 100        |
| 47               | 57.56                 | 85.94         | 8.12       | 1.29         | 25.46         | 1.91        | 13.56          | 2.81         | > 100        | > 100         | 11.93       | > 100        |
| 50               | 45.32                 | > 100         | 7.78       | 2.03         | 43.57         | 3.44        | 15.03          | 4.24         | > 100        | > 100         | 11.15       | > 100        |
| 53               | 40.05                 | 96.45         | 11.35      | 1.89         | > 100         | 4.15        | 20.16          | 5.74         | > 100        | > 100         | 14.95       | > 100        |
| 56               | 60.66                 | 30.39         | 10.86      | 0.75         | > 100         | 6.21        | 16.25          | 4.04         | > 100        | > 100         | 15.53       | > 100        |
| 59               | 77.89                 | 10.30         | 11.53      | 0.53         | > 100         | 9.62        | 15.05          | 3.93         | > 100        | > 100         | 18.08       | > 100        |
| 62               | 108.48                | 13.11         | 10.94      | 0.98         | > 100         | 12.19       | 12.95          | 4.35         | > 100        | > 100         | 18.79       | > 100        |
| 64               | 124.69                | 9.59          | 10.71      | 1.19         | > 100         | 13.40       | 12.27          | 4.79         | > 100        | > 100         | 19.16       | > 100        |

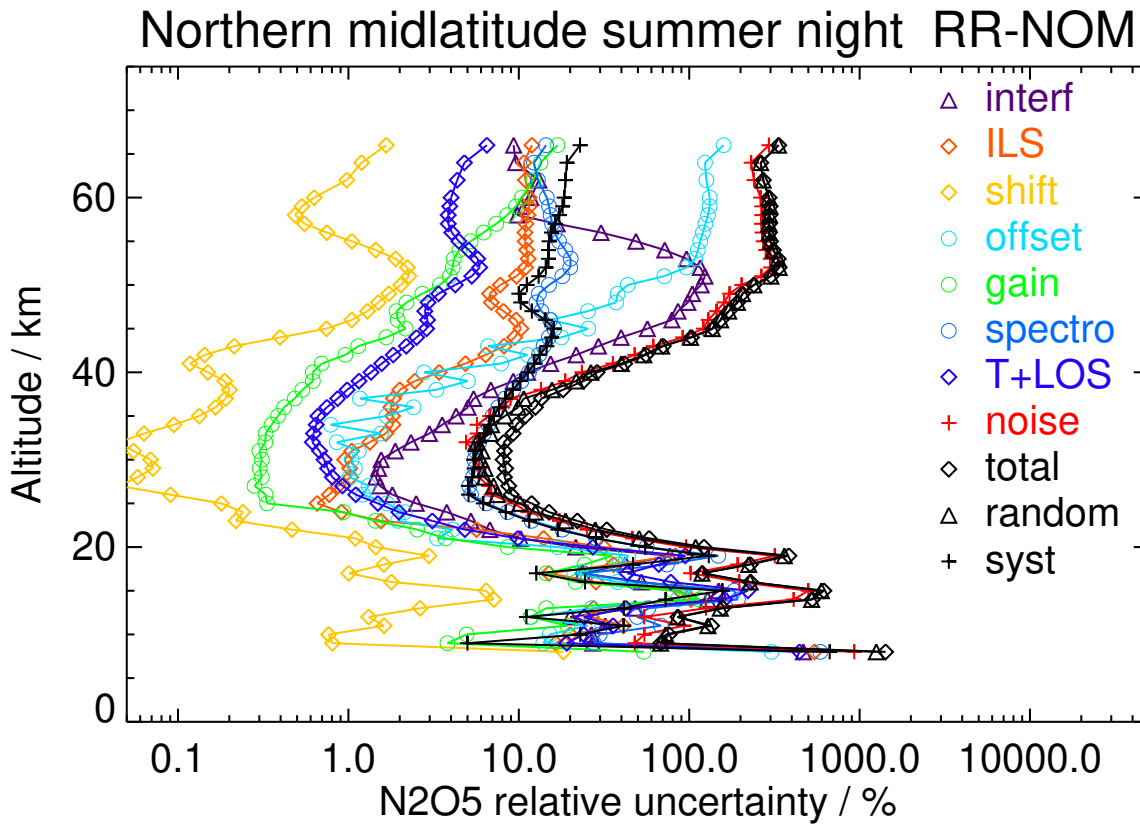


Figure S48: V8R\_N2O5\_261 Northern midlatitude summer night

Table S53: N2O5 error budget for Northern midlatitude autumn day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | -16.80                | > 100         | > 100      | 2.90         | > 100         | 19.64       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 11               | 67.43                 | 15.54         | 21.50      | 1.20         | 13.28         | 8.14        | 42.63          | 22.30        | 51.83        | 75.87         | 13.89       | 77.13        |
| 14               | 7.41                  | > 100         | 92.42      | 5.58         | > 100         | 86.36       | > 100          | > 100        | > 100        | > 100         | 91.04       | > 100        |
| 17               | -46.14                | 17.81         | 9.64       | 1.23         | 19.23         | 7.13        | 17.77          | 25.57        | 80.87        | 90.69         | 10.89       | 91.34        |
| 20               | 32.10                 | 31.40         | 27.03      | 2.13         | 22.73         | 10.42       | 61.70          | 32.56        | > 100        | > 100         | 59.50       | > 100        |
| 23               | 266.53                | 6.08          | 1.42       | 0.17         | 1.76          | 1.30        | 10.87          | 2.81         | 16.54        | 18.41         | 10.22       | 21.06        |
| 26               | 708.10                | 2.01          | 0.64       | 0.09         | 0.58          | 0.33        | 5.87           | 1.13         | 5.72         | 6.45          | 5.64        | 8.57         |
| 29               | 1122.58               | 1.57          | 0.92       | 0.07         | 0.72          | 0.36        | 5.55           | 0.78         | 4.89         | 5.39          | 5.50        | 7.70         |
| 32               | 1091.05               | 2.70          | 1.96       | 0.13         | 0.70          | 0.44        | 7.40           | 0.71         | 4.98         | 5.86          | 7.59        | 9.59         |
| 35               | 708.31                | 5.90          | 2.21       | 0.22         | 1.95          | 0.64        | 9.36           | 0.93         | 9.41         | 11.46         | 9.48        | 14.87        |
| 38               | 281.13                | 18.65         | 2.36       | 0.26         | 4.96          | 0.85        | 12.04          | 1.28         | 26.25        | 32.78         | 11.84       | 34.85        |
| 41               | 114.46                | 50.96         | 4.92       | 0.22         | 11.20         | 0.88        | 10.64          | 1.48         | 71.49        | 88.75         | 9.81        | 89.29        |
| 44               | 68.01                 | 84.85         | 11.32      | 0.72         | 20.10         | 1.84        | 11.48          | 3.35         | > 100        | > 100         | 12.73       | > 100        |
| 47               | 34.78                 | > 100         | 28.23      | 2.35         | 53.43         | 4.74        | 26.06          | 8.82         | > 100        | > 100         | 34.11       | > 100        |
| 50               | 58.82                 | > 100         | 14.88      | 1.74         | 57.76         | 3.54        | 19.99          | 5.73         | > 100        | > 100         | 22.08       | > 100        |
| 53               | 79.43                 | 58.54         | 11.14      | 1.16         | 79.26         | 4.12        | 18.28          | 4.68         | > 100        | > 100         | 19.17       | > 100        |
| 56               | 73.69                 | 38.26         | 15.28      | 0.83         | > 100         | 10.90       | 23.36          | 5.72         | > 100        | > 100         | 27.15       | > 100        |
| 59               | 63.87                 | 14.48         | 22.99      | 0.53         | > 100         | 21.47       | 30.93          | 7.83         | > 100        | > 100         | 40.93       | > 100        |
| 62               | 64.45                 | 10.43         | 30.06      | 0.96         | > 100         | 32.86       | 35.38          | 10.10        | > 100        | > 100         | 53.65       | > 100        |
| 64               | 67.33                 | 9.70          | 32.86      | 1.35         | > 100         | 38.03       | 36.27          | 11.24        | > 100        | > 100         | 58.76       | > 100        |

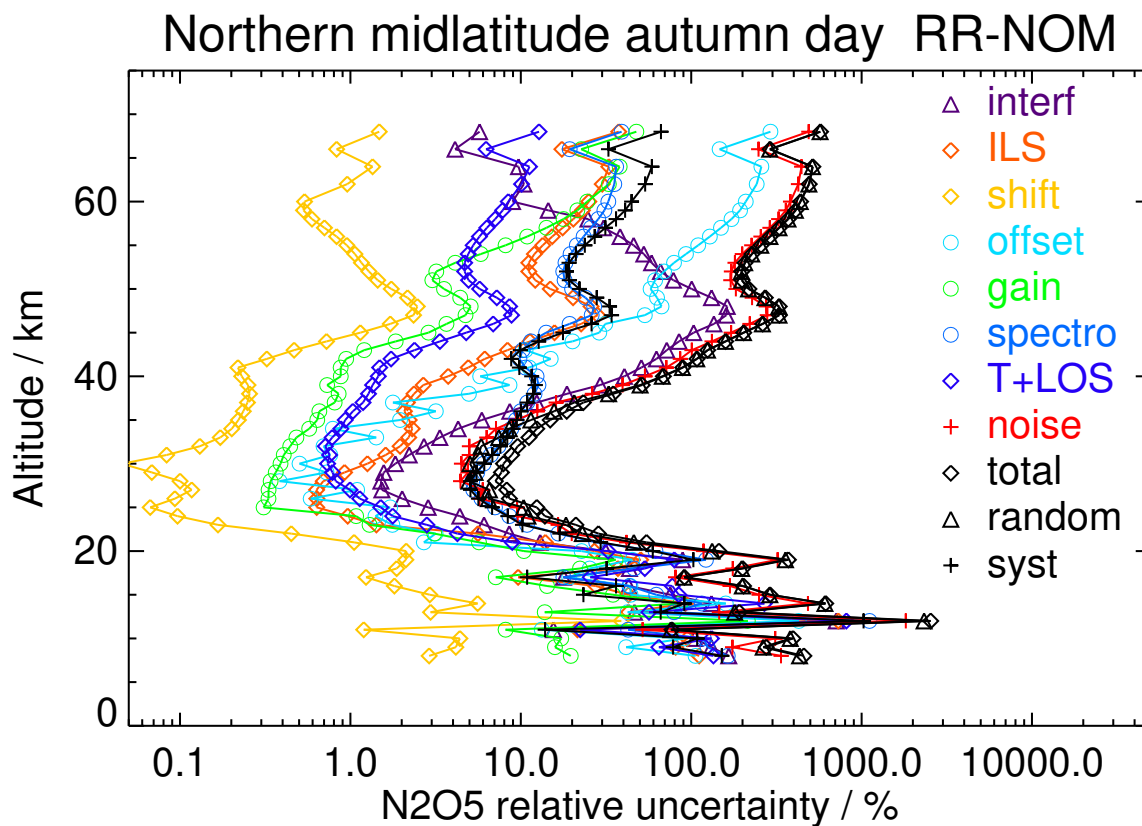


Figure S49: V8R\_N2O5\_261 Northern midlatitude autumn day

Table S54: N2O5 error budget for Northern midlatitude autumn night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 11.96                 | > 100         | > 100      | 7.12         | > 100         | 38.32       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 11               | 54.36                 | 21.36         | 28.88      | 1.62         | 14.73         | 9.58        | 49.92          | 26.75        | 62.55        | 92.11         | 15.39       | 93.39        |
| 14               | -13.11                | 75.29         | 57.95      | 3.47         | 62.91         | 57.92       | 95.45          | > 100        | > 100        | > 100         | 46.51       | > 100        |
| 17               | -42.10                | 19.13         | 19.24      | 1.11         | 18.58         | 11.51       | 34.57          | 30.31        | 83.36        | 99.39         | 20.01       | > 100        |
| 20               | 58.29                 | 17.64         | 17.76      | 1.14         | 10.98         | 6.08        | 38.87          | 15.72        | 62.31        | 70.99         | 37.24       | 80.16        |
| 23               | 265.86                | 6.34          | 1.74       | 0.17         | 1.87          | 1.63        | 10.78          | 2.77         | 15.85        | 18.16         | 9.74        | 20.60        |
| 26               | 664.61                | 2.14          | 0.72       | 0.08         | 0.84          | 0.46        | 5.62           | 1.12         | 6.39         | 7.15          | 5.34        | 8.93         |
| 29               | 1045.20               | 1.71          | 0.96       | 0.08         | 0.79          | 0.39        | 5.58           | 0.80         | 5.13         | 5.80          | 5.40        | 7.92         |
| 32               | 1116.08               | 2.67          | 1.67       | 0.08         | 0.71          | 0.47        | 6.76           | 0.70         | 4.89         | 5.82          | 6.85        | 8.99         |
| 35               | 924.25                | 4.65          | 2.02       | 0.10         | 1.52          | 0.61        | 7.68           | 0.76         | 7.20         | 8.85          | 7.85        | 11.82        |
| 38               | 660.17                | 7.68          | 1.87       | 0.10         | 2.15          | 0.69        | 8.41           | 0.85         | 10.96        | 13.71         | 8.44        | 16.10        |
| 41               | 388.25                | 14.98         | 3.05       | 0.06         | 3.26          | 0.61        | 9.70           | 1.08         | 20.33        | 25.64         | 9.80        | 27.45        |
| 44               | 180.65                | 30.87         | 6.57       | 0.29         | 7.15          | 0.88        | 12.78          | 1.75         | 48.07        | 57.85         | 13.35       | 59.37        |
| 47               | 73.49                 | 72.15         | 12.42      | 1.07         | 22.00         | 1.89        | 20.73          | 3.54         | > 100        | > 100         | 21.45       | > 100        |
| 50               | 42.67                 | > 100         | 15.12      | 2.21         | 68.70         | 4.46        | 28.88          | 6.53         | > 100        | > 100         | 27.96       | > 100        |
| 53               | 37.40                 | > 100         | 20.22      | 2.34         | > 100         | 8.45        | 35.70          | 9.03         | > 100        | > 100         | 34.56       | > 100        |
| 56               | 34.31                 | 92.33         | 34.65      | 1.88         | > 100         | 23.12       | 47.95          | 11.91        | > 100        | > 100         | 55.03       | > 100        |
| 59               | 35.60                 | 37.71         | 48.63      | 1.32         | > 100         | 40.53       | 55.58          | 14.84        | > 100        | > 100         | 76.16       | > 100        |
| 62               | 31.24                 | 17.59         | 77.61      | 2.47         | > 100         | 75.60       | 75.49          | 23.70        | > 100        | > 100         | > 100       | > 100        |
| 64               | 26.25                 | 21.72         | > 100      | 4.18         | > 100         | > 100       | 97.35          | 33.69        | > 100        | > 100         | > 100       | > 100        |

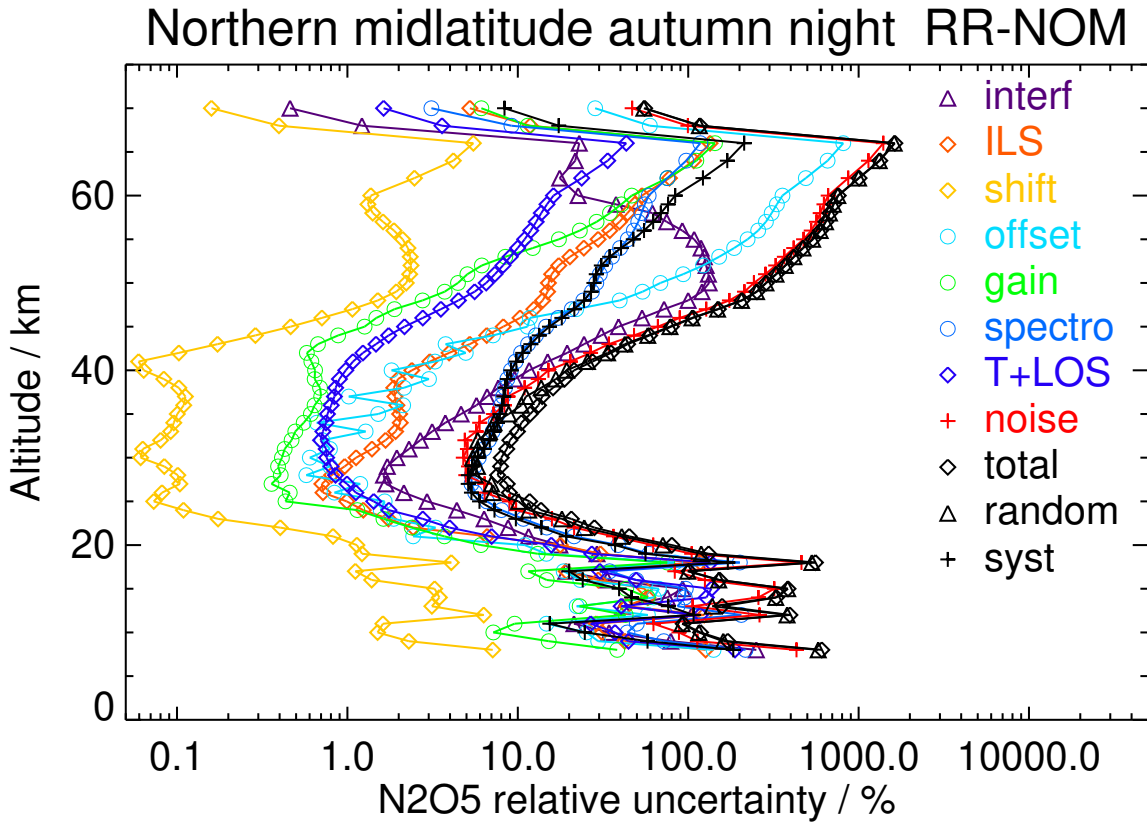


Figure S50: V8R\_N2O5\_261 Northern midlatitude autumn night

Table S55: N2O5 error budget for Tropics day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 11               | 38.30                 | 50.26         | 29.01      | 1.26         | 33.32         | 9.77        | 36.10          | 45.93        | > 100        | > 100         | 32.64       | > 100        |
| 14               | -5.72                 | > 100         | > 100      | 7.64         | > 100         | 83.69       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 17               | 3.15                  | > 100         | > 100      | 16.06        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 20               | 19.99                 | 49.03         | 33.52      | 1.60         | 21.69         | 26.37       | 50.15          | 36.51        | > 100        | > 100         | 43.82       | > 100        |
| 23               | 174.43                | 4.68          | 6.77       | 0.49         | 2.32          | 2.45        | 15.08          | 4.01         | 22.87        | 25.17         | 14.58       | 29.09        |
| 26               | 378.42                | 3.95          | 2.68       | 0.17         | 1.23          | 1.42        | 8.21           | 1.55         | 11.26        | 13.01         | 7.34        | 14.93        |
| 29               | 702.61                | 2.42          | 1.21       | 0.24         | 0.98          | 0.74        | 5.35           | 0.75         | 7.09         | 7.80          | 5.24        | 9.40         |
| 32               | 766.87                | 1.30          | 1.07       | 0.11         | 0.82          | 0.60        | 5.86           | 0.41         | 6.89         | 7.26          | 5.76        | 9.26         |
| 35               | 507.32                | 3.22          | 1.48       | 0.28         | 1.84          | 0.60        | 7.06           | 0.60         | 11.03        | 11.92         | 6.79        | 13.72        |
| 38               | 158.69                | 12.03         | 1.01       | 0.40         | 7.63          | 0.80        | 9.91           | 1.04         | 39.51        | 42.40         | 8.22        | 43.19        |
| 41               | 45.99                 | 51.07         | 7.14       | 0.54         | 27.32         | 7.07        | 13.62          | 2.11         | > 100        | > 100         | 9.55        | > 100        |
| 44               | 22.19                 | > 100         | 21.85      | 2.39         | 55.24         | 21.20       | 27.23          | 6.66         | > 100        | > 100         | 30.72       | > 100        |
| 47               | 71.75                 | 45.25         | 5.31       | 1.13         | 17.94         | 4.71        | 11.50          | 1.79         | > 100        | > 100         | 11.44       | > 100        |
| 50               | 78.86                 | 35.83         | 2.89       | 1.11         | 26.68         | 1.89        | 12.85          | 2.32         | > 100        | > 100         | 10.98       | > 100        |
| 53               | 76.45                 | 30.11         | 3.10       | 1.03         | 55.46         | 2.61        | 13.40          | 2.70         | > 100        | > 100         | 10.76       | > 100        |
| 56               | 52.92                 | 27.39         | 6.84       | 0.93         | > 100         | 5.31        | 21.09          | 3.80         | > 100        | > 100         | 17.44       | > 100        |
| 59               | 34.40                 | 20.95         | 15.50      | 0.80         | > 100         | 11.40       | 37.27          | 6.55         | > 100        | > 100         | 33.73       | > 100        |
| 62               | 13.81                 | 28.73         | 56.70      | 8.46         | > 100         | 45.02       | > 100          | 25.60        | > 100        | > 100         | > 100       | > 100        |
| 64               | 0.63                  | > 100         | > 100      | > 100        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |

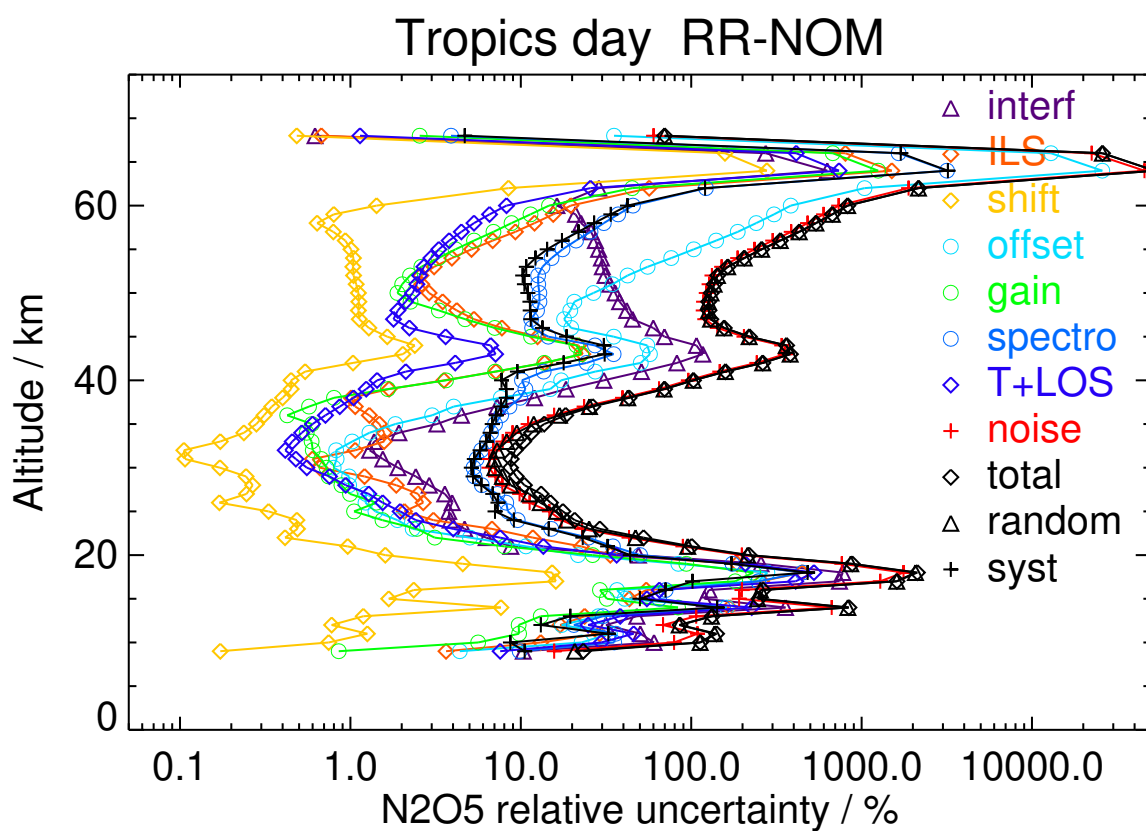


Figure S51: V8R\_N2O5\_261 Tropics day

Table S56: N2O5 error budget for Tropics night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 11               | 85.92                 | 22.92         | 14.17      | 0.46         | 13.88         | 4.87        | 16.74          | 20.77        | 47.19        | 60.22         | 15.95       | 62.30        |
| 14               | 32.73                 | 67.49         | 28.73      | 1.41         | 27.91         | 23.27       | 37.02          | 41.81        | > 100        | > 100         | 19.96       | > 100        |
| 17               | 25.66                 | 82.20         | 47.01      | 1.50         | 34.31         | 47.41       | 32.63          | 58.38        | > 100        | > 100         | 39.38       | > 100        |
| 20               | 8.02                  | > 100         | 84.49      | 3.97         | 52.93         | 78.69       | > 100          | > 100        | > 100        | > 100         | 76.62       | > 100        |
| 23               | 153.41                | 4.82          | 7.04       | 0.58         | 2.80          | 3.43        | 14.88          | 4.92         | 26.30        | 28.22         | 15.30       | 32.10        |
| 26               | 376.02                | 4.10          | 2.64       | 0.20         | 1.20          | 2.00        | 8.36           | 1.81         | 11.41        | 13.03         | 7.92        | 15.25        |
| 29               | 785.71                | 2.11          | 1.81       | 0.27         | 0.83          | 1.17        | 5.77           | 0.97         | 6.27         | 7.03          | 5.84        | 9.14         |
| 32               | 1246.13               | 0.81          | 0.60       | 0.26         | 0.52          | 0.93        | 5.25           | 0.63         | 4.27         | 4.63          | 5.20        | 6.96         |
| 35               | 1529.15               | 1.04          | 0.35       | 0.07         | 0.56          | 0.96        | 5.41           | 0.43         | 3.69         | 4.00          | 5.43        | 6.75         |
| 38               | 1142.54               | 1.67          | 0.34       | 0.15         | 1.01          | 0.99        | 7.22           | 0.69         | 5.63         | 6.07          | 7.23        | 9.44         |
| 41               | 485.33                | 4.88          | 0.50       | 0.10         | 2.41          | 1.86        | 10.06          | 1.12         | 14.04        | 15.25         | 10.03       | 18.25        |
| 44               | 162.85                | 14.47         | 3.91       | 0.37         | 7.14          | 5.00        | 12.92          | 1.47         | 46.40        | 49.34         | 13.71       | 51.21        |
| 47               | 88.73                 | 35.96         | 4.76       | 0.90         | 14.06         | 5.50        | 15.44          | 2.05         | 97.78        | > 100         | 15.13       | > 100        |
| 50               | 41.19                 | 67.93         | 5.80       | 2.06         | 50.73         | 4.64        | 24.83          | 4.88         | > 100        | > 100         | 20.64       | > 100        |
| 53               | 14.07                 | > 100         | 13.64      | 5.51         | > 100         | 14.17       | 58.45          | 14.70        | > 100        | > 100         | 46.46       | > 100        |
| 56               | 7.80                  | > 100         | 36.75      | 6.82         | > 100         | 31.82       | > 100          | 24.59        | > 100        | > 100         | 92.41       | > 100        |
| 59               | 4.73                  | > 100         | 96.15      | 5.00         | > 100         | 67.20       | > 100          | 44.32        | > 100        | > 100         | > 100       | > 100        |
| 62               | -5.98                 | 59.43         | > 100      | 14.67        | > 100         | 92.35       | > 100          | 56.69        | > 100        | > 100         | > 100       | > 100        |
| 64               | -10.09                | 36.03         | 91.55      | 13.68        | > 100         | 73.47       | > 100          | 45.51        | > 100        | > 100         | > 100       | > 100        |

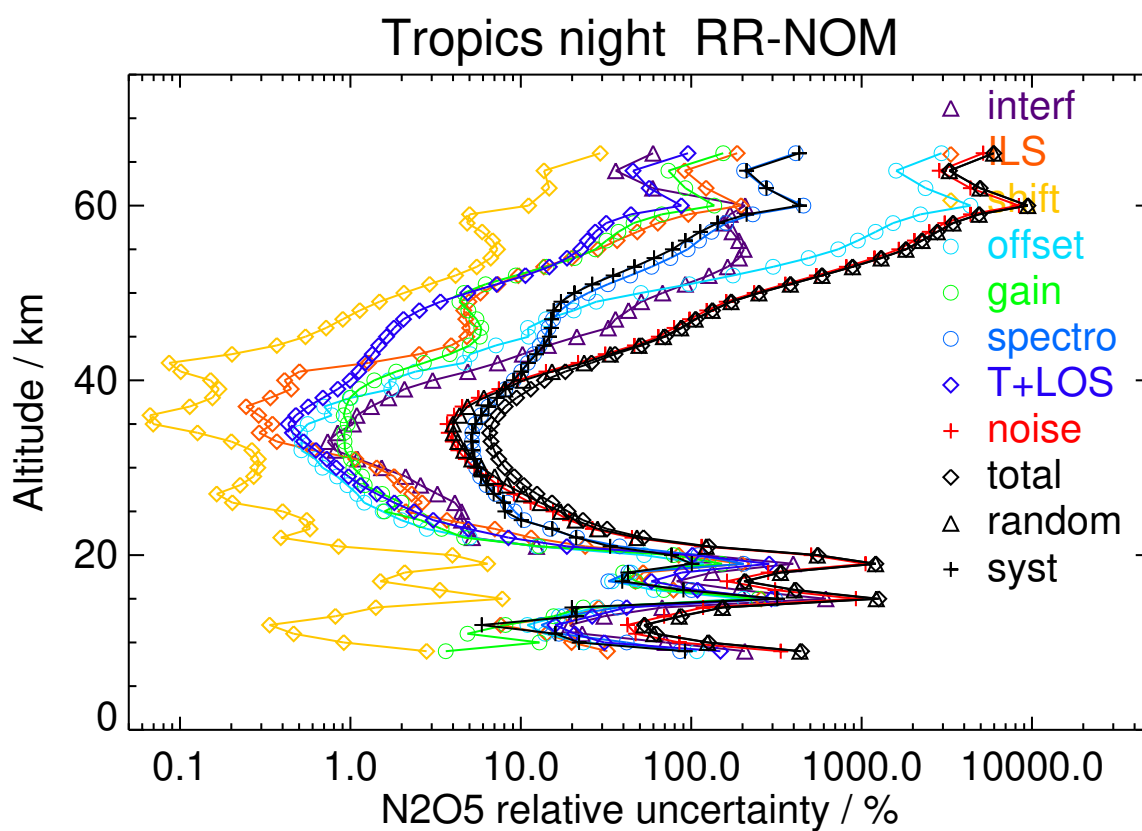


Figure S52: V8R\_N2O5\_261 Tropics night

Table S57: N2O5 error budget for Southern midlatitude winter day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 45.40                 | 48.86         | 16.57      | 1.28         | 22.03         | 9.96        | 41.96          | 35.72        | 81.85        | > 100         | 12.01       | > 100        |
| 11               | -20.86                | 73.54         | 69.93      | 4.08         | 42.14         | 35.45       | > 100          | 81.38        | > 100        | > 100         | > 100       | > 100        |
| 14               | -10.75                | 99.44         | 49.75      | 3.94         | 79.05         | 41.50       | > 100          | > 100        | > 100        | > 100         | 68.84       | > 100        |
| 17               | 21.29                 | 45.46         | 19.68      | 1.26         | 31.40         | 19.23       | 46.40          | 47.07        | > 100        | > 100         | 19.40       | > 100        |
| 20               | 77.55                 | 20.12         | 4.00       | 0.51         | 6.48          | 5.60        | 21.34          | 10.08        | 49.03        | 55.60         | 19.07       | 58.78        |
| 23               | 254.22                | 7.43          | 1.58       | 0.09         | 1.55          | 1.11        | 11.94          | 2.57         | 17.21        | 19.54         | 11.17       | 22.51        |
| 26               | 716.55                | 2.47          | 0.73       | 0.13         | 0.87          | 0.36        | 6.09           | 1.13         | 7.85         | 8.69          | 5.64        | 10.37        |
| 29               | 1027.03               | 2.35          | 0.52       | 0.04         | 0.53          | 0.52        | 6.15           | 0.84         | 6.53         | 7.18          | 5.99        | 9.35         |
| 32               | 882.23                | 4.24          | 1.14       | 0.07         | 1.11          | 0.80        | 7.85           | 0.90         | 8.76         | 10.04         | 7.72        | 12.66        |
| 35               | 677.40                | 7.32          | 1.38       | 0.08         | 2.00          | 0.93        | 8.08           | 0.94         | 13.24        | 15.48         | 7.88        | 17.37        |
| 38               | 404.87                | 13.77         | 2.83       | 0.09         | 3.49          | 1.12        | 9.79           | 1.31         | 23.75        | 27.94         | 9.60        | 29.54        |
| 41               | 161.66                | 36.52         | 9.16       | 0.24         | 10.17         | 1.75        | 17.50          | 3.25         | 62.34        | 73.48         | 18.09       | 75.67        |
| 44               | 78.61                 | 78.38         | 16.90      | 0.66         | 23.74         | 5.32        | 24.93          | 5.80         | > 100        | > 100         | 26.15       | > 100        |
| 47               | 25.55                 | > 100         | 47.79      | 2.25         | > 100         | 22.59       | 56.20          | 15.74        | > 100        | > 100         | 56.95       | > 100        |
| 50               | 5.07                  | > 100         | > 100      | 11.89        | > 100         | > 100       | > 100          | 84.79        | > 100        | > 100         | > 100       | > 100        |
| 53               | 0.29                  | > 100         | > 100      | > 100        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 56               | -10.21                | > 100         | > 100      | 4.51         | > 100         | 86.47       | > 100          | 65.80        | > 100        | > 100         | > 100       | > 100        |
| 59               | -28.26                | > 100         | > 100      | 1.71         | > 100         | 56.57       | 52.35          | 28.20        | > 100        | > 100         | > 100       | > 100        |
| 62               | -58.17                | 31.61         | 57.81      | 1.01         | > 100         | 45.37       | 25.59          | 16.09        | > 100        | > 100         | 68.66       | > 100        |
| 64               | -78.00                | 13.25         | 45.36      | 0.86         | > 100         | 42.40       | 18.90          | 13.00        | > 100        | > 100         | 57.74       | > 100        |

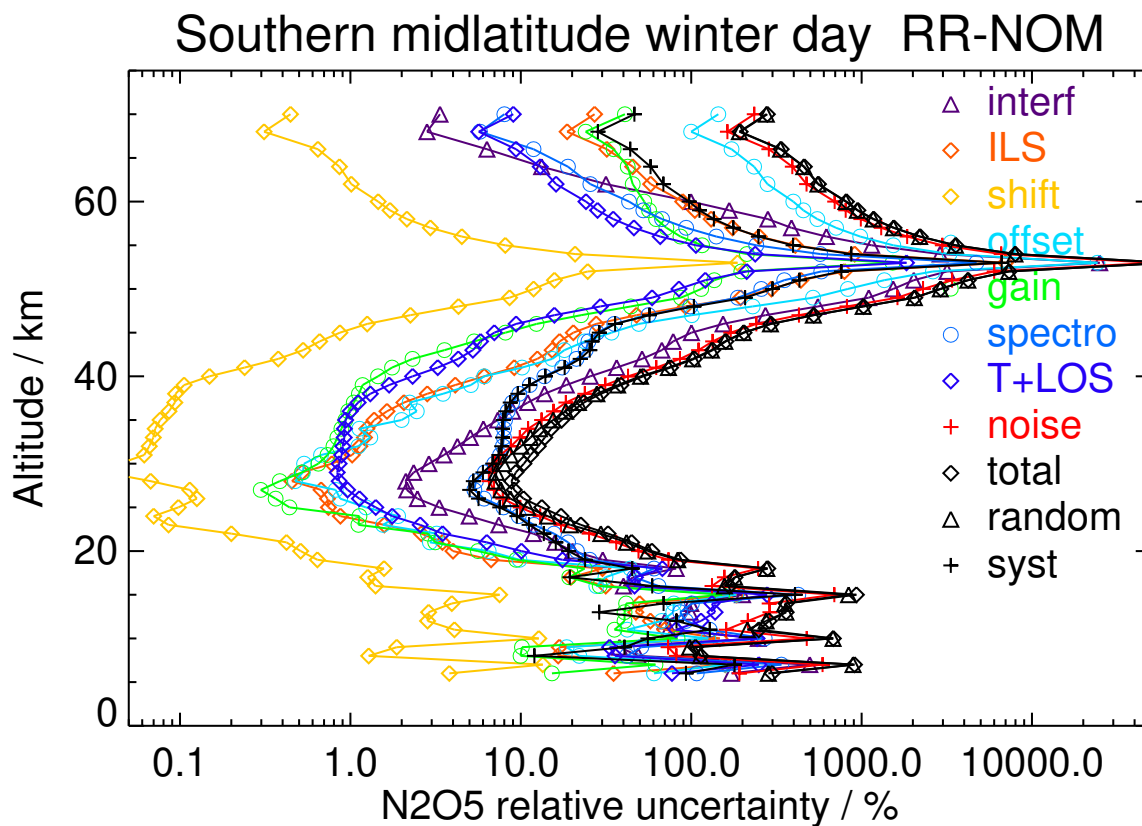


Figure S53: V8R\_N2O5\_261 Southern midlatitude winter day

Table S58: N2O5 error budget for Southern midlatitude winter night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 23.24                 | 98.46         | 35.70      | 3.25         | 43.74         | 24.96       | 81.56          | 71.64        | > 100        | > 100         | 29.67       | > 100        |
| 11               | -35.60                | 42.37         | 33.42      | 2.01         | 36.20         | 16.86       | 59.87          | 53.77        | > 100        | > 100         | 57.30       | > 100        |
| 14               | -6.49                 | > 100         | 87.80      | 6.75         | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 17               | 22.06                 | 43.95         | 26.08      | 1.18         | 35.28         | 23.36       | 47.70          | 52.95        | > 100        | > 100         | 16.45       | > 100        |
| 20               | 64.48                 | 22.39         | 4.92       | 0.71         | 9.73          | 5.56        | 19.29          | 14.42        | 59.03        | 66.80         | 15.91       | 68.67        |
| 23               | 193.21                | 9.90          | 2.18       | 0.17         | 2.41          | 1.98        | 16.08          | 3.18         | 23.95        | 27.19         | 14.69       | 30.90        |
| 26               | 674.34                | 2.64          | 0.50       | 0.08         | 0.64          | 0.28        | 5.84           | 1.03         | 7.59         | 8.33          | 5.58        | 10.02        |
| 29               | 906.39                | 2.74          | 0.87       | 0.05         | 0.65          | 0.53        | 6.45           | 0.81         | 7.56         | 8.31          | 6.27        | 10.42        |
| 32               | 678.45                | 5.54          | 1.25       | 0.09         | 1.00          | 0.75        | 8.74           | 0.97         | 10.76        | 12.36         | 8.61        | 15.06        |
| 35               | 469.68                | 11.01         | 1.92       | 0.08         | 1.96          | 0.71        | 8.99           | 0.92         | 17.49        | 20.98         | 8.75        | 22.73        |
| 38               | 340.95                | 17.06         | 3.58       | 0.07         | 3.14          | 0.57        | 8.78           | 1.22         | 26.26        | 31.68         | 8.83        | 32.89        |
| 41               | 180.85                | 31.50         | 7.81       | 0.19         | 7.58          | 0.88        | 12.61          | 2.64         | 53.57        | 62.85         | 14.06       | 64.40        |
| 44               | 54.60                 | > 100         | 22.94      | 0.75         | 33.28         | 5.11        | 30.92          | 8.35         | > 100        | > 100         | 34.91       | > 100        |
| 47               | 60.89                 | > 100         | 17.52      | 0.70         | 46.24         | 4.88        | 21.49          | 6.36         | > 100        | > 100         | 22.90       | > 100        |
| 50               | 94.78                 | 69.26         | 13.50      | 0.50         | 51.25         | 2.87        | 13.75          | 4.17         | > 100        | > 100         | 15.22       | > 100        |
| 53               | 118.47                | 49.15         | 14.06      | 0.41         | 64.48         | 5.15        | 12.67          | 3.78         | > 100        | > 100         | 15.64       | > 100        |
| 56               | 143.18                | 35.12         | 14.70      | 0.38         | 74.51         | 8.70        | 12.41          | 3.72         | > 100        | > 100         | 17.23       | > 100        |
| 59               | 162.16                | 23.98         | 15.95      | 0.42         | 82.59         | 11.79       | 12.81          | 4.14         | > 100        | > 100         | 19.60       | > 100        |
| 62               | 157.88                | 9.49          | 18.80      | 0.51         | > 100         | 17.79       | 14.67          | 5.34         | > 100        | > 100         | 25.18       | > 100        |
| 64               | 157.25                | 5.51          | 20.31      | 0.57         | > 100         | 21.25       | 15.61          | 6.07         | > 100        | > 100         | 28.51       | > 100        |

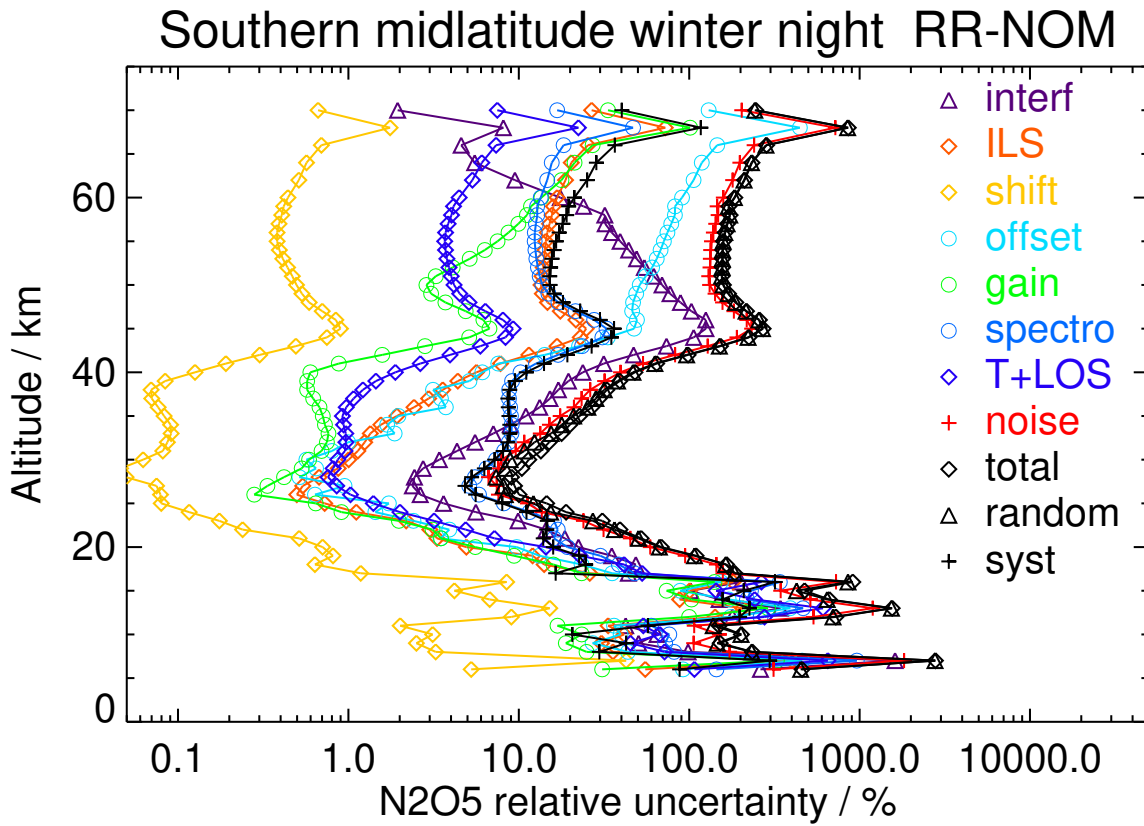


Figure S54: V8R\_N2O5\_261 Southern midlatitude winter night

Table S59: N2O5 error budget for Southern midlatitude spring day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 30.41                 | 92.77         | 34.74      | 3.06         | 34.53         | 15.08       | 68.32          | 55.94        | > 100        | > 100         | 34.70       | > 100        |
| 11               | 2.72                  | > 100         | > 100      | 27.39        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 14               | 15.38                 | 75.05         | 41.19      | 3.18         | 60.65         | 37.81       | 74.46          | > 100        | > 100        | > 100         | 54.10       | > 100        |
| 17               | 33.29                 | 24.96         | 32.92      | 1.10         | 23.88         | 12.33       | 54.15          | 35.36        | 96.09        | > 100         | 44.83       | > 100        |
| 20               | 288.34                | 4.25          | 4.28       | 0.14         | 2.14          | 1.86        | 10.03          | 3.04         | 10.81        | 14.52         | 7.76        | 16.46        |
| 23               | 493.35                | 3.36          | 1.84       | 0.14         | 0.85          | 1.06        | 6.26           | 1.26         | 7.35         | 9.24          | 5.10        | 10.56        |
| 26               | 769.08                | 2.41          | 0.91       | 0.07         | 1.01          | 0.49        | 5.38           | 0.75         | 5.23         | 6.26          | 5.05        | 8.05         |
| 29               | 934.75                | 2.81          | 1.32       | 0.07         | 1.05          | 0.46        | 6.09           | 0.66         | 5.22         | 6.44          | 5.85        | 8.70         |
| 32               | 758.43                | 4.53          | 2.07       | 0.21         | 1.09          | 0.54        | 7.75           | 0.66         | 6.60         | 8.70          | 7.40        | 11.42        |
| 35               | 403.74                | 10.27         | 1.87       | 0.24         | 3.38          | 0.85        | 9.10           | 0.89         | 15.37        | 19.11         | 8.69        | 21.00        |
| 38               | 113.01                | 37.71         | 4.85       | 0.33         | 11.92         | 1.88        | 15.67          | 1.68         | 60.07        | 72.32         | 14.78       | 73.81        |
| 41               | 20.86                 | > 100         | 39.95      | 1.13         | 57.38         | 7.04        | 37.10          | 6.70         | > 100        | > 100         | 45.79       | > 100        |
| 44               | 17.26                 | > 100         | 46.21      | 2.10         | 66.73         | 7.82        | 41.45          | 8.95         | > 100        | > 100         | 48.65       | > 100        |
| 47               | 25.58                 | > 100         | 22.03      | 2.47         | 52.11         | 6.70        | 29.34          | 7.41         | > 100        | > 100         | 27.15       | > 100        |
| 50               | 32.86                 | > 100         | 18.24      | 2.37         | 76.53         | 8.85        | 22.49          | 8.54         | > 100        | > 100         | 22.49       | > 100        |
| 53               | 29.23                 | > 100         | 22.78      | 2.36         | > 100         | 8.66        | 26.57          | 10.75        | > 100        | > 100         | 28.10       | > 100        |
| 56               | 14.30                 | > 100         | 52.55      | 3.23         | > 100         | 35.89       | 58.69          | 20.18        | > 100        | > 100         | 72.47       | > 100        |
| 59               | -13.75                | 73.45         | 56.39      | 2.22         | > 100         | 79.16       | 67.51          | 23.33        | > 100        | > 100         | > 100       | > 100        |
| 62               | -42.13                | 25.16         | 22.64      | 1.70         | > 100         | 46.53       | 25.51          | 13.71        | > 100        | > 100         | 48.31       | > 100        |
| 64               | -55.38                | 17.73         | 22.75      | 1.90         | > 100         | 45.36       | 21.15          | 14.48        | > 100        | > 100         | 44.80       | > 100        |

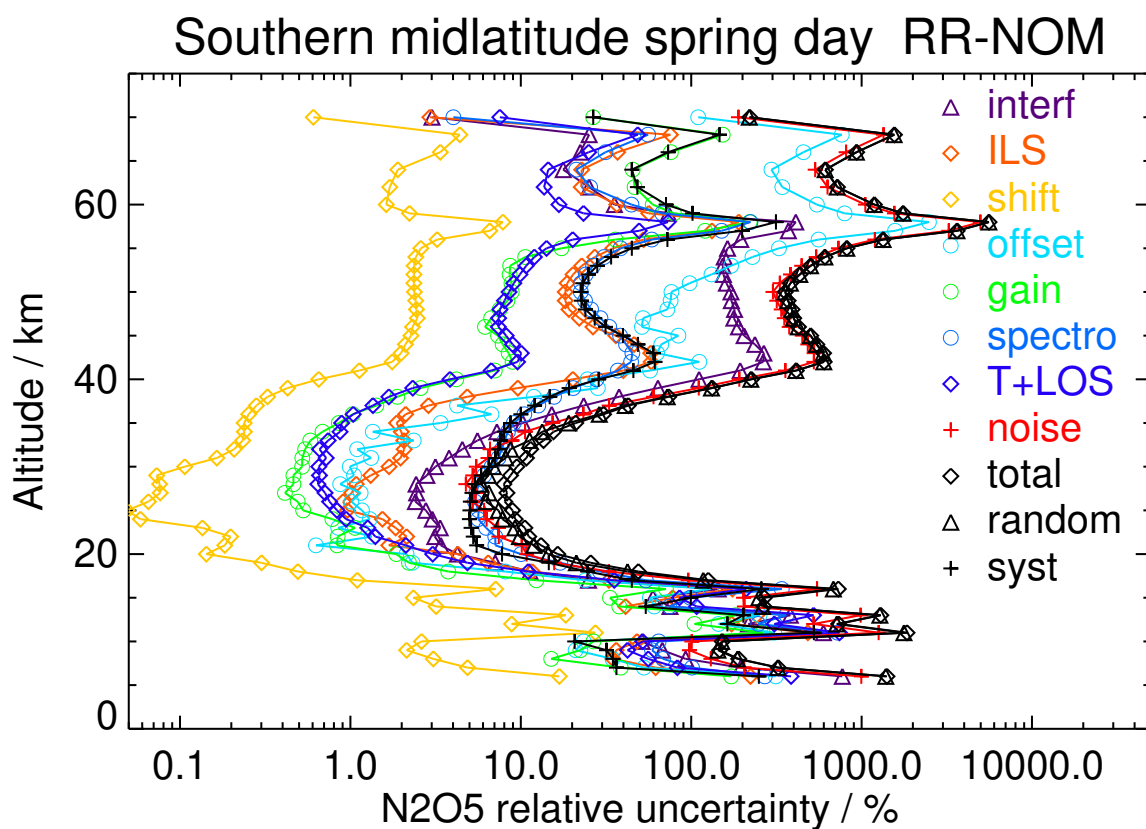


Figure S55: V8R\_N2O5\_261 Southern midlatitude spring day

Table S60: N2O5 error budget for Southern midlatitude spring night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 13.75                 | > 100         | > 100      | 5.25         | 72.13         | 28.06       | > 100          | > 100        | > 100        | > 100         | 85.22       | > 100        |
| 11               | -18.46                | 77.82         | 75.72      | 3.51         | 60.14         | 29.66       | > 100          | 95.77        | > 100        | > 100         | > 100       | > 100        |
| 14               | 17.29                 | 60.83         | 47.80      | 2.56         | 57.57         | 29.17       | 78.43          | 95.63        | > 100        | > 100         | 61.94       | > 100        |
| 17               | 31.41                 | 27.54         | 24.08      | 0.88         | 21.09         | 13.67       | 46.60          | 38.10        | > 100        | > 100         | 33.71       | > 100        |
| 20               | 197.13                | 6.62          | 7.26       | 0.23         | 3.35          | 2.28        | 13.74          | 4.82         | 17.66        | 22.43         | 11.57       | 25.24        |
| 23               | 391.31                | 4.27          | 2.42       | 0.13         | 1.07          | 0.67        | 6.37           | 1.56         | 10.03        | 11.76         | 5.57        | 13.01        |
| 26               | 675.50                | 2.49          | 1.40       | 0.10         | 0.95          | 0.52        | 5.50           | 0.92         | 5.88         | 6.99          | 5.12        | 8.66         |
| 29               | 991.66                | 2.54          | 1.92       | 0.22         | 1.00          | 0.56        | 6.06           | 0.73         | 5.03         | 6.83          | 5.23        | 8.60         |
| 32               | 1133.54               | 2.95          | 1.57       | 0.11         | 0.57          | 0.52        | 6.35           | 0.54         | 4.25         | 5.84          | 6.03        | 8.39         |
| 35               | 862.06                | 4.67          | 1.74       | 0.15         | 1.28          | 0.81        | 7.58           | 0.72         | 6.94         | 8.88          | 7.38        | 11.55        |
| 38               | 412.91                | 9.79          | 2.42       | 0.17         | 2.82          | 1.24        | 10.73          | 1.13         | 15.87        | 19.18         | 10.57       | 21.90        |
| 41               | 148.21                | 27.40         | 8.16       | 0.14         | 7.53          | 1.87        | 14.57          | 2.01         | 48.79        | 56.80         | 15.73       | 58.94        |
| 44               | 64.85                 | 64.12         | 15.22      | 0.62         | 16.64         | 1.59        | 16.72          | 3.50         | > 100        | > 100         | 19.72       | > 100        |
| 47               | 43.04                 | > 100         | 15.64      | 1.55         | 29.26         | 4.62        | 17.98          | 5.27         | > 100        | > 100         | 19.26       | > 100        |
| 50               | 65.71                 | 84.32         | 11.12      | 1.22         | 36.32         | 5.49        | 12.45          | 4.92         | > 100        | > 100         | 13.01       | > 100        |
| 53               | 94.57                 | 47.33         | 9.13       | 0.75         | 50.49         | 2.93        | 10.75          | 4.04         | > 100        | > 100         | 11.40       | > 100        |
| 56               | 106.90                | 27.74         | 10.67      | 0.47         | 71.75         | 5.61        | 11.26          | 3.64         | > 100        | > 100         | 13.91       | > 100        |
| 59               | 114.54                | 11.63         | 12.30      | 0.38         | 93.15         | 11.72       | 11.63          | 3.48         | > 100        | > 100         | 18.13       | > 100        |
| 62               | 118.27                | 9.07          | 14.99      | 0.80         | > 100         | 21.02       | 12.88          | 4.74         | > 100        | > 100         | 25.86       | > 100        |
| 64               | 116.87                | 8.38          | 17.40      | 1.17         | > 100         | 27.55       | 14.28          | 6.22         | > 100        | > 100         | 31.75       | > 100        |

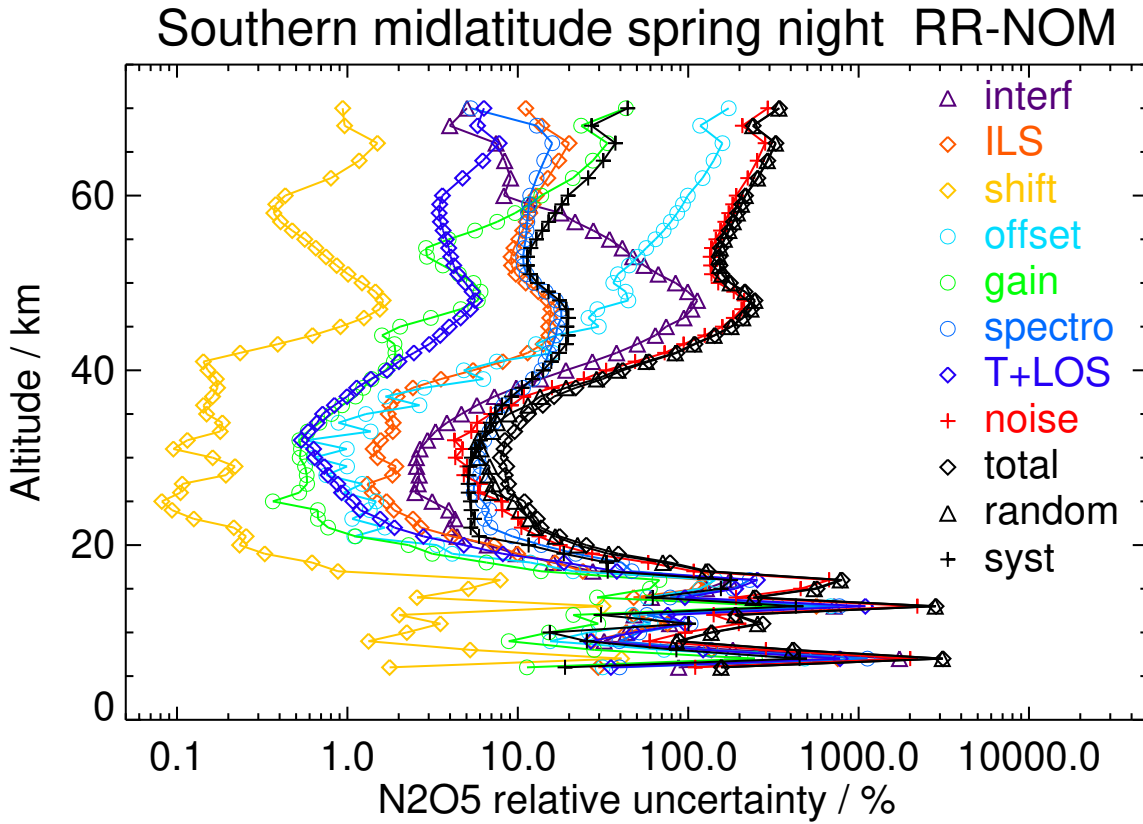


Figure S56: V8R\_N2O5\_261 Southern midlatitude spring night

Table S61: N2O5 error budget for Southern midlatitude summer day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 71.48                 | 44.85         | 25.70      | 1.50         | 13.49         | 7.23        | 38.88          | 22.65        | 51.53        | 86.74         | 8.03        | 87.11        |
| 11               | -6.23                 | > 100         | > 100      | 15.09        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 14               | 32.23                 | 29.81         | 27.67      | 1.74         | 31.37         | 19.49       | 48.06          | 51.49        | 96.23        | > 100         | 19.63       | > 100        |
| 17               | 24.57                 | 29.94         | 32.31      | 1.03         | 38.19         | 19.23       | 45.36          | 57.26        | > 100        | > 100         | 24.71       | > 100        |
| 20               | 100.29                | 8.14          | 5.65       | 0.36         | 6.58          | 3.09        | 15.97          | 10.37        | 33.06        | 39.09         | 8.87        | 40.08        |
| 23               | 258.25                | 4.21          | 1.88       | 0.20         | 2.03          | 0.64        | 9.91           | 2.58         | 15.25        | 16.89         | 8.83        | 19.06        |
| 26               | 593.04                | 1.85          | 0.99       | 0.07         | 1.02          | 0.50        | 5.22           | 0.90         | 6.10         | 6.75          | 5.05        | 8.43         |
| 29               | 700.96                | 1.47          | 2.20       | 0.05         | 1.82          | 0.49        | 6.61           | 0.76         | 7.08         | 7.68          | 6.77        | 10.24        |
| 32               | 474.66                | 4.01          | 4.06       | 0.41         | 1.27          | 0.43        | 9.54           | 0.94         | 9.04         | 10.23         | 10.17       | 14.43        |
| 35               | 176.52                | 15.79         | 4.17       | 0.52         | 5.28          | 0.52        | 11.52          | 1.43         | 28.65        | 33.55         | 11.18       | 35.37        |
| 38               | 34.91                 | 77.49         | 14.30      | 0.78         | 31.90         | 1.50        | 18.00          | 2.94         | > 100        | > 100         | 16.06       | > 100        |
| 41               | 6.46                  | > 100         | > 100      | 4.78         | > 100         | 18.62       | 70.81          | 23.33        | > 100        | > 100         | > 100       | > 100        |
| 44               | 44.92                 | 69.47         | 12.30      | 0.78         | 25.55         | 2.30        | 14.79          | 3.26         | > 100        | > 100         | 14.91       | > 100        |
| 47               | 48.33                 | 81.18         | 5.84       | 1.07         | 22.00         | 3.22        | 14.62          | 2.96         | > 100        | > 100         | 11.19       | > 100        |
| 50               | 52.58                 | > 100         | 3.46       | 1.35         | 31.12         | 6.02        | 14.50          | 3.59         | > 100        | > 100         | 10.94       | > 100        |
| 53               | 49.72                 | 82.29         | 10.86      | 1.19         | 68.26         | 6.90        | 16.66          | 4.47         | > 100        | > 100         | 16.67       | > 100        |
| 56               | 32.04                 | 75.52         | 32.42      | 1.28         | > 100         | 9.23        | 28.43          | 8.40         | > 100        | > 100         | 38.29       | > 100        |
| 59               | 13.72                 | 54.25         | 96.23      | 1.93         | > 100         | 34.77       | 74.89          | 20.69        | > 100        | > 100         | > 100       | > 100        |
| 62               | -20.16                | 72.62         | 70.06      | 4.58         | > 100         | 57.07       | 57.89          | 20.91        | > 100        | > 100         | 96.30       | > 100        |
| 64               | -39.46                | 34.38         | 35.51      | 3.60         | > 100         | 41.96       | 32.02          | 15.85        | > 100        | > 100         | 56.76       | > 100        |

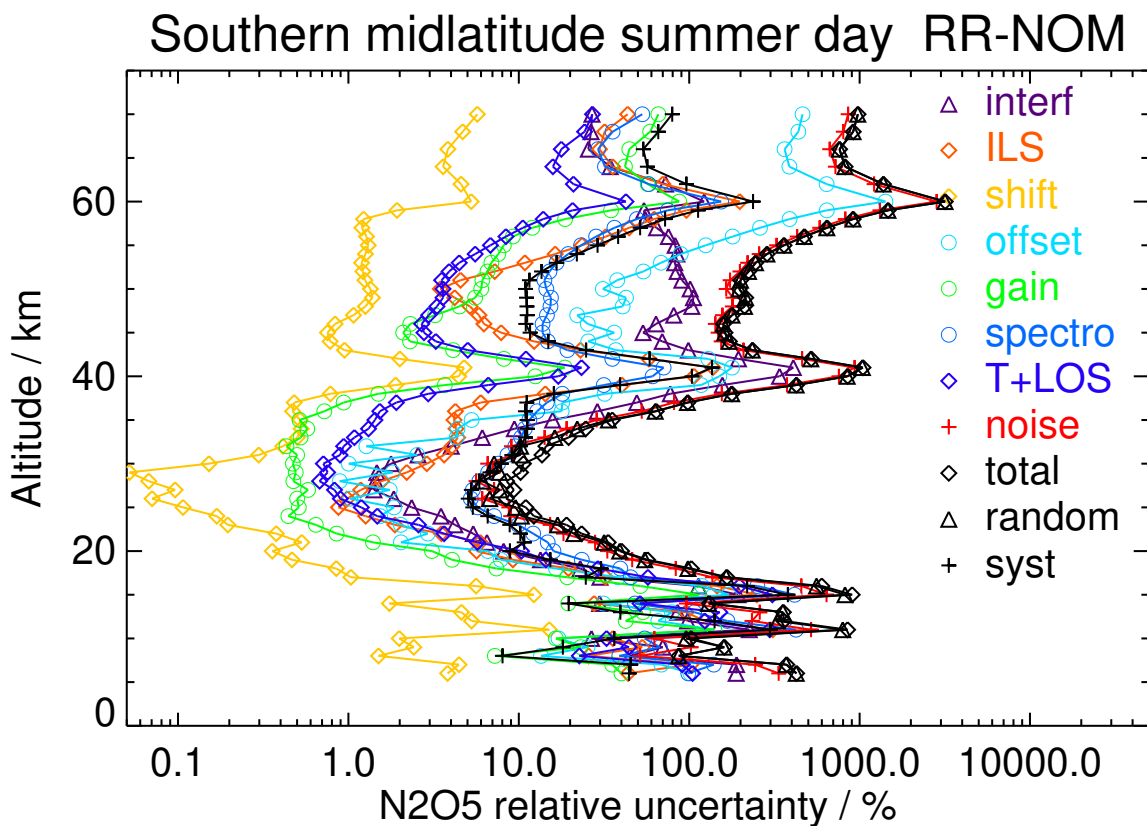


Figure S57: V8R\_N2O5\_261 Southern midlatitude summer day

Table S62: N2O5 error budget for Southern midlatitude summer night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 29.50                 | > 100         | 40.73      | 3.00         | 32.28         | 23.00       | 67.09          | 52.65        | > 100        | > 100         | 23.06       | > 100        |
| 11               | -23.51                | 56.70         | 55.32      | 2.08         | 47.20         | 23.75       | 45.20          | 75.89        | > 100        | > 100         | 39.53       | > 100        |
| 14               | 13.05                 | 74.78         | 87.01      | 5.17         | 81.46         | 71.78       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 17               | 30.40                 | 26.66         | 18.66      | 1.00         | 29.23         | 11.72       | 35.18          | 45.10        | > 100        | > 100         | 7.20        | > 100        |
| 20               | 89.96                 | 9.41          | 5.96       | 0.54         | 7.38          | 2.93        | 14.20          | 10.76        | 36.52        | 41.88         | 9.21        | 42.88        |
| 23               | 193.03                | 5.37          | 2.54       | 0.30         | 2.73          | 1.13        | 11.13          | 3.24         | 20.09        | 22.55         | 8.58        | 24.13        |
| 26               | 515.05                | 2.16          | 1.30       | 0.10         | 1.09          | 0.52        | 5.91           | 1.01         | 7.01         | 7.87          | 5.57        | 9.64         |
| 29               | 689.94                | 1.47          | 1.56       | 0.09         | 1.79          | 0.84        | 5.86           | 0.71         | 7.07         | 7.78          | 5.73        | 9.66         |
| 32               | 717.43                | 2.61          | 2.04       | 0.10         | 0.92          | 0.58        | 6.29           | 0.58         | 6.03         | 7.08          | 6.19        | 9.41         |
| 35               | 604.15                | 4.57          | 1.82       | 0.14         | 1.25          | 0.70        | 7.07           | 0.62         | 8.17         | 9.99          | 6.61        | 11.97        |
| 38               | 336.29                | 7.66          | 1.85       | 0.16         | 2.58          | 0.87        | 8.85           | 0.90         | 15.34        | 17.87         | 8.04        | 19.60        |
| 41               | 118.07                | 21.55         | 8.02       | 0.18         | 7.76          | 2.27        | 10.78          | 1.82         | 48.34        | 53.88         | 12.12       | 55.23        |
| 44               | 65.42                 | 50.79         | 8.29       | 0.72         | 14.65         | 2.63        | 9.94           | 2.32         | > 100        | > 100         | 10.28       | > 100        |
| 47               | 60.73                 | 66.22         | 4.40       | 1.01         | 15.49         | 2.58        | 10.87          | 2.37         | > 100        | > 100         | 8.05        | > 100        |
| 50               | 52.59                 | > 100         | 2.97       | 1.45         | 29.85         | 6.42        | 10.72          | 3.23         | > 100        | > 100         | 9.08        | > 100        |
| 53               | 64.76                 | 58.65         | 6.35       | 0.95         | 48.36         | 5.28        | 10.31          | 2.87         | > 100        | > 100         | 9.49        | > 100        |
| 56               | 59.20                 | 30.49         | 11.80      | 0.63         | 88.19         | 5.29        | 13.81          | 3.52         | > 100        | > 100         | 14.05       | > 100        |
| 59               | 41.04                 | 22.03         | 22.43      | 0.61         | > 100         | 17.26       | 22.67          | 5.56         | > 100        | > 100         | 29.02       | > 100        |
| 62               | 21.69                 | 77.26         | 59.05      | 4.38         | > 100         | 79.69       | 53.73          | 20.97        | > 100        | > 100         | 97.51       | > 100        |
| 64               | 8.34                  | > 100         | > 100      | 18.03        | > 100         | > 100       | > 100          | 83.17        | > 100        | > 100         | > 100       | > 100        |

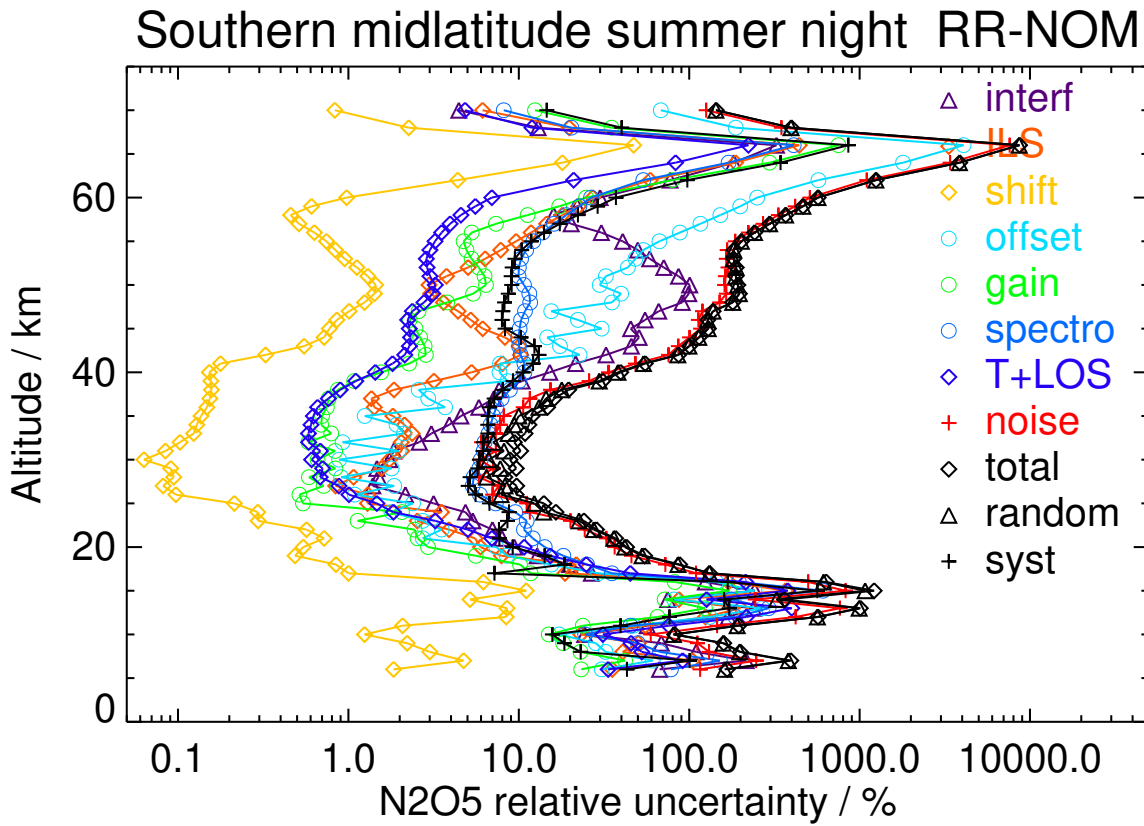


Figure S58: V8R\_N2O5\_261 Southern midlatitude summer night

Table S63: N2O5 error budget for Southern midlatitude autumn day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 46.50                 | 57.84         | 22.41      | 1.27         | 20.76         | 12.00       | 43.40          | 35.08        | 78.39        | > 100         | 15.45       | > 100        |
| 11               | -3.13                 | > 100         | > 100      | 26.83        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 14               | -1.42                 | > 100         | > 100      | 35.87        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 17               | 16.26                 | 49.71         | 30.58      | 1.55         | 39.63         | 27.60       | 65.06          | 68.49        | > 100        | > 100         | 33.07       | > 100        |
| 20               | 111.74                | 10.87         | 4.22       | 0.53         | 4.74          | 3.56        | 16.50          | 7.68         | 30.53        | 34.86         | 14.81       | 37.88        |
| 23               | 364.54                | 4.68          | 1.44       | 0.13         | 1.06          | 1.12        | 10.26          | 2.25         | 10.51        | 12.41         | 9.66        | 15.72        |
| 26               | 1006.92               | 1.49          | 0.54       | 0.11         | 0.78          | 0.36        | 5.51           | 1.02         | 4.70         | 5.38          | 5.27        | 7.53         |
| 29               | 1427.08               | 1.15          | 0.91       | 0.04         | 0.49          | 0.61        | 6.03           | 0.77         | 3.72         | 4.25          | 5.96        | 7.32         |
| 32               | 1336.52               | 2.11          | 1.73       | 0.13         | 0.73          | 0.86        | 7.85           | 0.79         | 4.47         | 5.43          | 7.84        | 9.54         |
| 35               | 867.35                | 4.95          | 2.36       | 0.19         | 1.67          | 1.20        | 10.03          | 1.03         | 8.26         | 10.16         | 10.05       | 14.29        |
| 38               | 428.60                | 11.38         | 3.08       | 0.16         | 3.17          | 1.47        | 12.56          | 1.41         | 18.27        | 22.04         | 12.60       | 25.39        |
| 41               | 162.88                | 34.54         | 6.72       | 0.14         | 7.43          | 1.86        | 16.07          | 2.16         | 53.07        | 64.12         | 16.30       | 66.16        |
| 44               | 39.64                 | > 100         | 22.88      | 1.22         | 34.53         | 10.24       | 29.54          | 7.01         | > 100        | > 100         | 30.62       | > 100        |
| 47               | 44.62                 | > 100         | 19.06      | 1.63         | 50.45         | 11.17       | 20.09          | 7.49         | > 100        | > 100         | 22.60       | > 100        |
| 50               | 60.86                 | > 100         | 17.20      | 1.43         | 71.18         | 7.19        | 16.23          | 7.35         | > 100        | > 100         | 20.34       | > 100        |
| 53               | 63.16                 | > 100         | 22.22      | 1.20         | > 100         | 8.21        | 18.62          | 8.18         | > 100        | > 100         | 24.94       | > 100        |
| 56               | 71.54                 | 76.74         | 25.82      | 0.76         | > 100         | 17.07       | 19.10          | 7.93         | > 100        | > 100         | 31.09       | > 100        |
| 59               | 78.72                 | 42.79         | 29.18      | 0.54         | > 100         | 26.43       | 19.42          | 8.07         | > 100        | > 100         | 38.59       | > 100        |
| 62               | 83.76                 | 13.97         | 33.98      | 0.72         | > 100         | 39.22       | 20.33          | 9.09         | > 100        | > 100         | 50.10       | > 100        |
| 64               | 85.70                 | 8.68          | 36.72      | 0.94         | > 100         | 47.20       | 20.89          | 9.94         | > 100        | > 100         | 57.41       | > 100        |

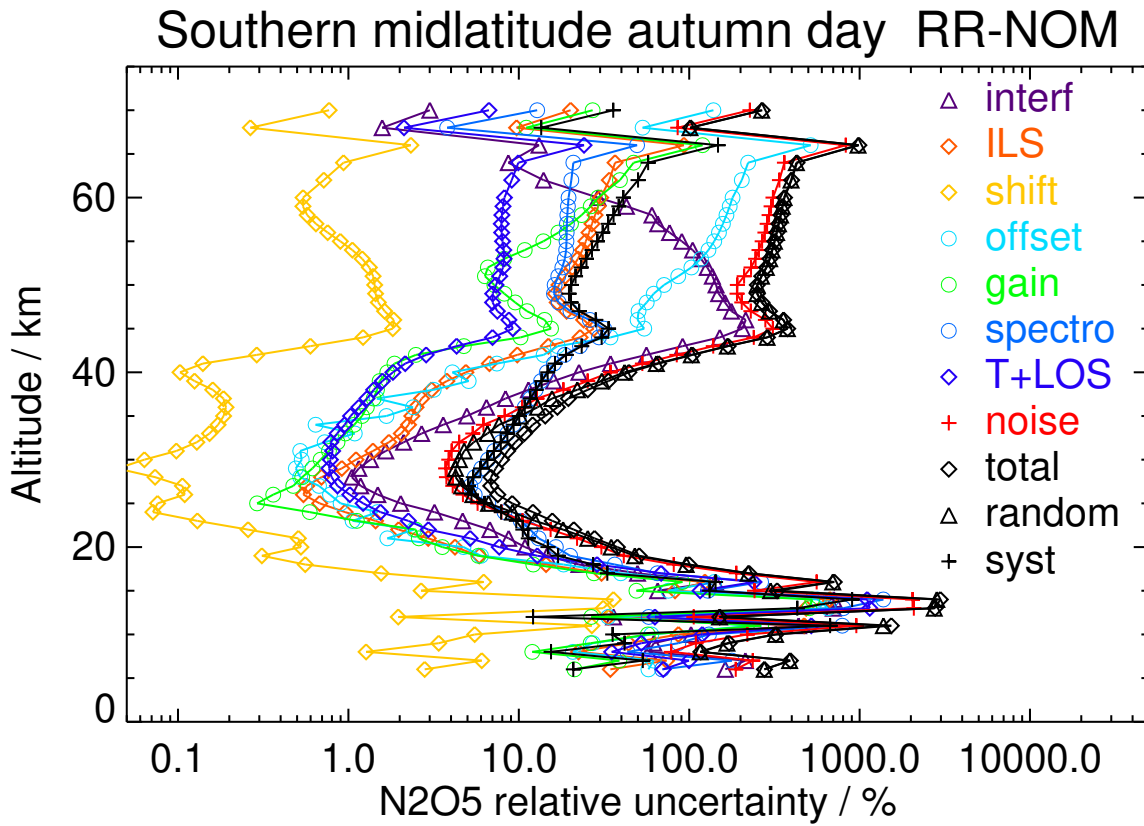


Figure S59: V8R\_N2O5\_261 Southern midlatitude autumn day

Table S64: N2O5 error budget for Southern midlatitude autumn night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 8                | 5.98                  | > 100         | > 100      | 12.87        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 11               | -20.19                | 66.54         | 64.04      | 3.10         | 57.10         | 38.01       | 88.34          | > 100        | > 100        | > 100         | 79.19       | > 100        |
| 14               | 6.24                  | > 100         | > 100      | 9.08         | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 17               | 47.10                 | 17.27         | 13.92      | 0.52         | 17.96         | 6.93        | 18.97          | 26.71        | 71.83        | 83.75         | 9.12        | 84.24        |
| 20               | 71.43                 | 16.72         | 6.95       | 0.74         | 9.41          | 4.29        | 22.21          | 14.02        | 48.87        | 56.20         | 18.86       | 59.28        |
| 23               | 335.71                | 5.05          | 1.61       | 0.11         | 1.48          | 0.90        | 9.44           | 2.25         | 12.34        | 14.27         | 8.60        | 16.66        |
| 26               | 803.18                | 1.81          | 0.60       | 0.08         | 0.57          | 0.35        | 5.57           | 0.98         | 5.22         | 5.96          | 5.28        | 7.96         |
| 29               | 1174.26               | 1.34          | 1.04       | 0.07         | 0.74          | 0.55        | 5.85           | 0.76         | 4.73         | 5.28          | 5.76        | 7.81         |
| 32               | 1101.63               | 2.58          | 1.68       | 0.12         | 0.52          | 0.65        | 7.42           | 0.73         | 4.96         | 5.88          | 7.47        | 9.51         |
| 35               | 818.05                | 5.18          | 2.26       | 0.14         | 1.05          | 0.82        | 8.47           | 0.83         | 7.97         | 9.83          | 8.55        | 13.03        |
| 38               | 540.56                | 9.53          | 2.37       | 0.11         | 1.56          | 0.87        | 9.28           | 0.98         | 13.10        | 16.51         | 9.25        | 18.93        |
| 41               | 295.83                | 20.54         | 3.73       | 0.09         | 2.95          | 0.79        | 10.30          | 1.29         | 26.91        | 34.27         | 10.12       | 35.73        |
| 44               | 174.04                | 34.46         | 5.75       | 0.29         | 6.23          | 0.93        | 9.31           | 1.84         | 51.32        | 62.43         | 9.29        | 63.12        |
| 47               | 117.87                | 61.92         | 7.81       | 0.67         | 15.97         | 2.21        | 9.84           | 2.91         | 82.87        | > 100         | 9.88        | > 100        |
| 50               | 59.56                 | > 100         | 14.27      | 1.60         | 65.95         | 4.20        | 17.91          | 6.38         | > 100        | > 100         | 17.55       | > 100        |
| 53               | 19.72                 | > 100         | 44.55      | 4.08         | > 100         | 19.13       | 51.84          | 18.56        | > 100        | > 100         | 56.38       | > 100        |
| 56               | -23.14                | > 100         | 45.90      | 2.12         | > 100         | 41.25       | 47.71          | 15.26        | > 100        | > 100         | 67.12       | > 100        |
| 59               | -54.84                | 36.00         | 23.74      | 0.59         | > 100         | 30.35       | 22.64          | 7.43         | > 100        | > 100         | 40.18       | > 100        |
| 62               | -82.50                | 14.26         | 19.59      | 0.70         | > 100         | 31.91       | 17.30          | 6.83         | > 100        | > 100         | 37.78       | > 100        |
| 64               | -99.66                | 9.16          | 18.33      | 0.82         | > 100         | 32.34       | 15.65          | 6.79         | > 100        | > 100         | 37.12       | > 100        |

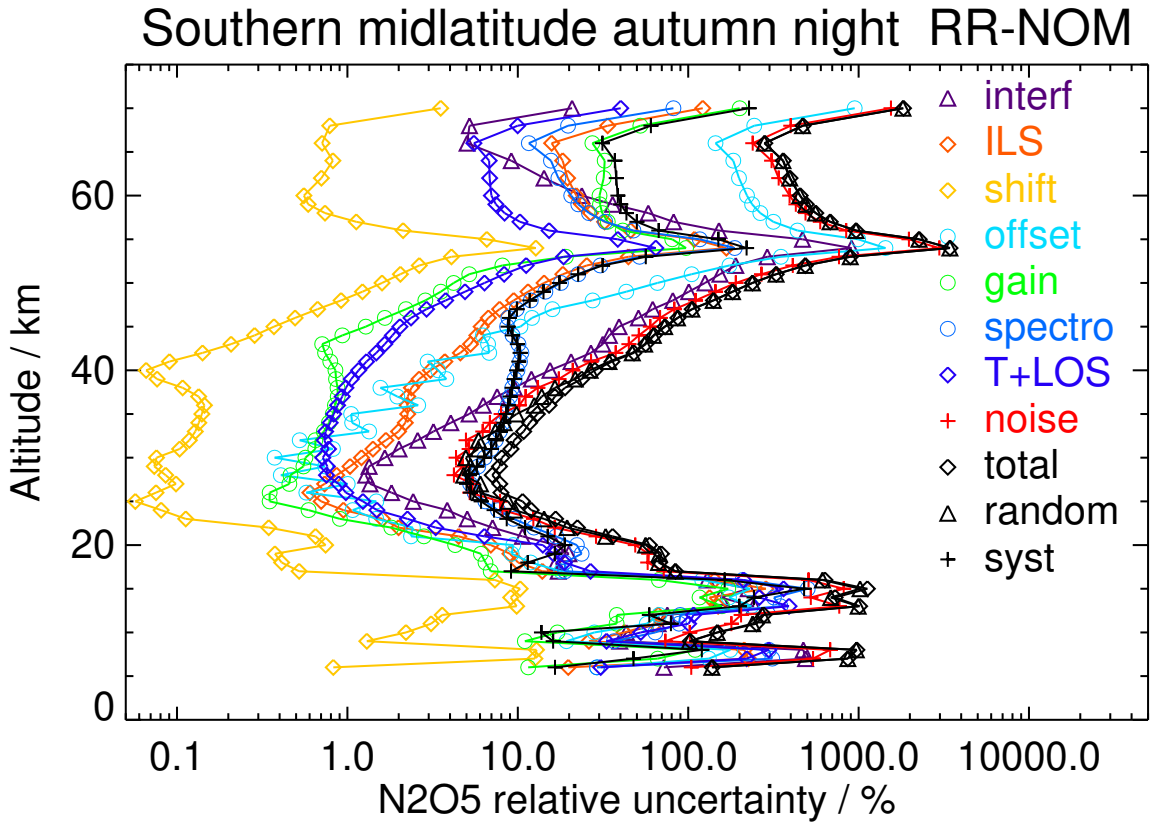


Figure S60: V8R\_N2O5\_261 Southern midlatitude autumn night

Table S65: N2O5 error budget for Southern polar winter day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 5                | -37.54                | 57.55         | 5.98       | 1.47         | 53.57         | 14.34       | 29.27          | 62.88        | > 100        | > 100         | 19.46       | > 100        |
| 8                | 45.13                 | 35.42         | 17.17      | 2.37         | 17.17         | 19.17       | 79.77          | 32.53        | 68.77        | > 100         | 49.53       | > 100        |
| 11               | -8.79                 | > 100         | 44.62      | 4.50         | 94.95         | 89.41       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 14               | -10.13                | > 100         | 46.29      | 3.89         | 67.02         | 65.96       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 17               | 94.40                 | 12.91         | 6.14       | 0.35         | 5.17          | 8.45        | 21.30          | 10.41        | 43.48        | 48.53         | 20.00       | 52.49        |
| 20               | 97.80                 | > 100         | 5.73       | 0.33         | 3.01          | 5.22        | 27.18          | 6.89         | 50.50        | > 100         | 23.10       | > 100        |
| 23               | 280.48                | 20.43         | 1.24       | 0.11         | 1.80          | 1.30        | 9.18           | 2.10         | 19.34        | 29.01         | 6.68        | 29.77        |
| 26               | 498.77                | 2.41          | 0.88       | 0.10         | 1.40          | 0.61        | 6.69           | 1.18         | 13.90        | 14.70         | 5.68        | 15.76        |
| 29               | 646.44                | 7.18          | 0.65       | 0.09         | 0.95          | 0.93        | 6.96           | 1.01         | 10.83        | 13.35         | 6.50        | 14.85        |
| 32               | 618.08                | 11.13         | 0.82       | 0.11         | 2.08          | 0.89        | 8.11           | 1.09         | 12.87        | 17.48         | 7.53        | 19.03        |
| 35               | 376.44                | 22.10         | 2.25       | 0.19         | 4.80          | 1.56        | 10.89          | 1.49         | 23.16        | 32.78         | 10.07       | 34.30        |
| 38               | 217.34                | 44.44         | 3.50       | 0.18         | 8.15          | 2.41        | 11.19          | 2.09         | 42.12        | 62.12         | 10.20       | 62.96        |
| 41               | 103.12                | 85.67         | 5.88       | 0.41         | 15.81         | 2.64        | 13.81          | 3.66         | 93.31        | > 100         | 10.62       | > 100        |
| 44               | 48.51                 | > 100         | 8.55       | 1.06         | 34.61         | 7.22        | 20.82          | 6.58         | > 100        | > 100         | 13.69       | > 100        |
| 47               | 50.79                 | > 100         | 5.42       | 1.21         | 46.42         | 7.92        | 16.75          | 5.56         | > 100        | > 100         | 12.78       | > 100        |
| 50               | 57.81                 | > 100         | 5.15       | 1.09         | 68.04         | 7.51        | 14.74          | 5.38         | > 100        | > 100         | 12.28       | > 100        |
| 53               | 47.48                 | > 100         | 11.65      | 1.34         | > 100         | 9.91        | 19.96          | 9.08         | > 100        | > 100         | 17.38       | > 100        |
| 56               | 26.61                 | > 100         | 33.50      | 2.32         | > 100         | 25.91       | 41.70          | 22.80        | > 100        | > 100         | 41.69       | > 100        |
| 59               | 22.67                 | > 100         | 51.74      | 2.47         | > 100         | 46.09       | 55.77          | 33.21        | > 100        | > 100         | 64.85       | > 100        |
| 62               | 64.29                 | 22.89         | 23.03      | 0.85         | > 100         | 24.89       | 22.69          | 14.12        | > 100        | > 100         | 31.86       | > 100        |
| 64               | 72.85                 | 12.92         | 22.22      | 0.80         | > 100         | 26.70       | 21.26          | 13.39        | > 100        | > 100         | 32.51       | > 100        |

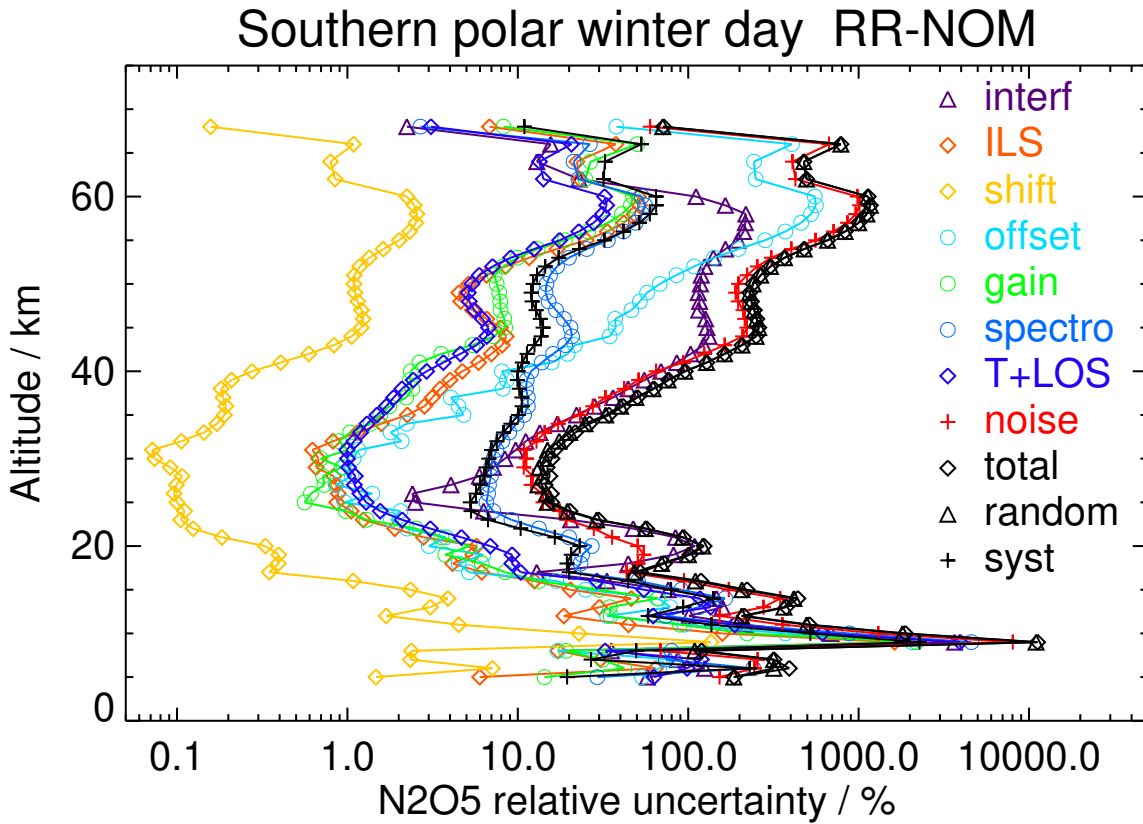


Figure S61: V8R\_N2O5\_261 Southern polar winter day

Table S66: N2O5 error budget for Southern polar winter night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 5                | -16.86                | > 100         | 44.75      | 5.05         | > 100         | 18.73       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 8                | 83.65                 | 22.23         | 22.50      | 2.01         | 11.38         | 9.96        | 74.89          | 23.56        | 40.42        | 67.83         | 66.55       | 95.03        |
| 11               | -22.23                | 81.11         | 35.17      | 2.48         | 39.85         | 26.78       | 99.05          | 77.25        | > 100        | > 100         | 37.26       | > 100        |
| 14               | -18.68                | 81.85         | 25.59      | 2.42         | 27.93         | 19.43       | 90.99          | 58.39        | > 100        | > 100         | 69.10       | > 100        |
| 17               | 55.39                 | 19.25         | 8.71       | 0.74         | 6.21          | 6.88        | 33.05          | 14.77        | 68.28        | 74.85         | 30.05       | 80.66        |
| 20               | 109.98                | 92.72         | 3.80       | 0.48         | 2.72          | 2.30        | 16.74          | 5.03         | 41.83        | > 100         | 12.16       | > 100        |
| 23               | 202.55                | 29.12         | 2.23       | 0.22         | 1.71          | 1.45        | 13.75          | 2.98         | 25.58        | 40.41         | 8.76        | 41.35        |
| 26               | 454.82                | 3.48          | 1.80       | 0.18         | 1.48          | 0.49        | 7.98           | 1.41         | 15.08        | 16.86         | 5.17        | 17.63        |
| 29               | 670.03                | 7.39          | 1.33       | 0.10         | 0.87          | 0.36        | 7.39           | 1.06         | 10.54        | 13.49         | 6.50        | 14.97        |
| 32               | 605.82                | 11.12         | 1.52       | 0.15         | 1.96          | 0.45        | 9.46           | 1.20         | 12.87        | 17.70         | 8.56        | 19.66        |
| 35               | 379.09                | 20.68         | 2.94       | 0.20         | 4.21          | 0.56        | 13.07          | 1.73         | 22.47        | 31.63         | 11.51       | 33.66        |
| 38               | 205.03                | 42.77         | 4.28       | 0.23         | 7.30          | 1.03        | 16.96          | 2.36         | 43.84        | 62.75         | 13.42       | 64.17        |
| 41               | 106.83                | 74.94         | 6.27       | 0.39         | 13.83         | 1.78        | 21.82          | 3.58         | 89.55        | > 100         | 14.99       | > 100        |
| 44               | 101.98                | 60.71         | 4.71       | 0.55         | 16.39         | 3.28        | 15.94          | 3.37         | 98.80        | > 100         | 11.49       | > 100        |
| 47               | 78.51                 | 77.37         | 7.88       | 0.78         | 30.86         | 4.73        | 21.19          | 5.52         | > 100        | > 100         | 17.46       | > 100        |
| 50               | 77.79                 | 90.83         | 13.02      | 0.81         | 54.19         | 4.75        | 26.28          | 8.00         | > 100        | > 100         | 24.17       | > 100        |
| 53               | 85.65                 | 76.40         | 16.97      | 0.85         | 81.98         | 4.29        | 28.46          | 9.31         | > 100        | > 100         | 28.44       | > 100        |
| 56               | 76.08                 | 66.32         | 24.20      | 1.11         | > 100         | 9.07        | 37.21          | 12.29        | > 100        | > 100         | 39.59       | > 100        |
| 59               | 56.92                 | 55.10         | 38.05      | 1.67         | > 100         | 19.58       | 56.08          | 18.28        | > 100        | > 100         | 62.27       | > 100        |
| 62               | 35.24                 | 32.66         | 71.56      | 3.10         | > 100         | 49.14       | > 100          | 32.59        | > 100        | > 100         | > 100       | > 100        |
| 64               | 22.26                 | 34.57         | > 100      | 5.41         | > 100         | 94.41       | > 100          | 54.89        | > 100        | > 100         | > 100       | > 100        |

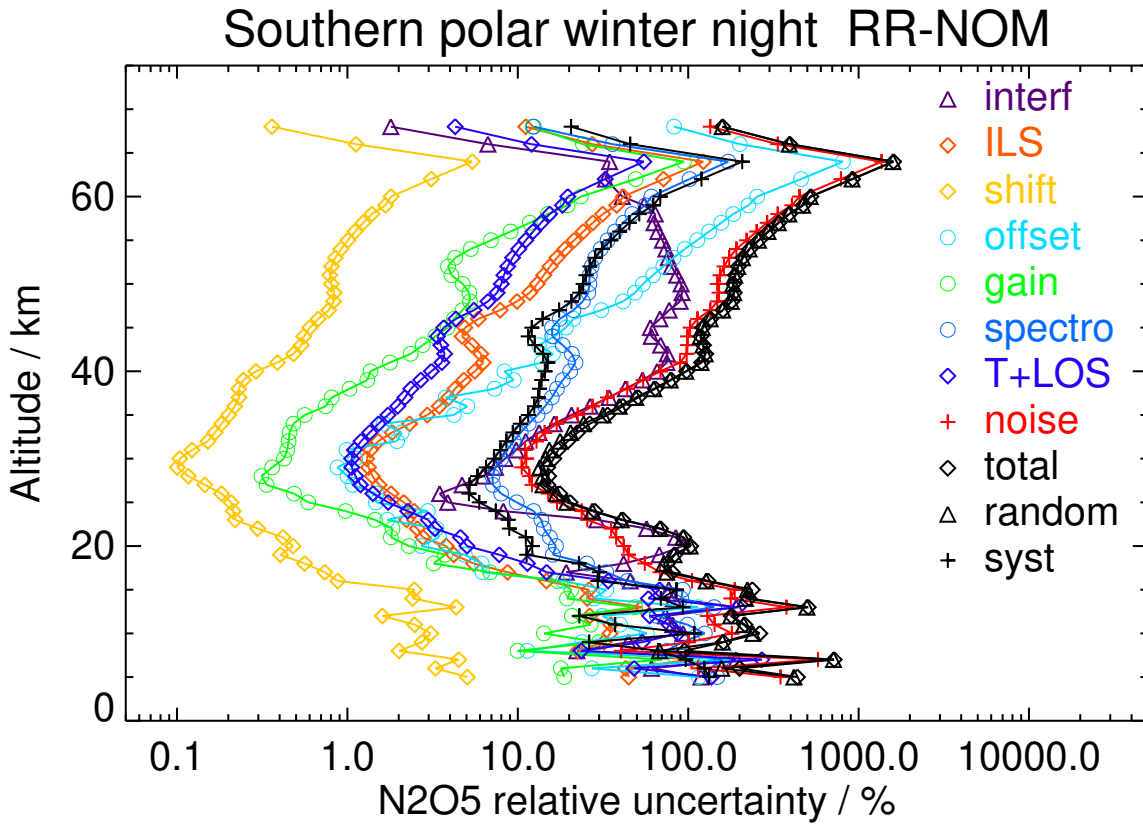


Figure S62: V8R\_N2O5.261 Southern polar winter night

Table S67: N2O5 error budget for Southern polar spring day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 5                | -24.25                | > 100         | 44.53      | 2.14         | 74.74         | 22.79       | 69.35          | 78.69        | > 100        | > 100         | 54.40       | > 100        |
| 8                | 67.36                 | 34.35         | 33.57      | 1.41         | 12.84         | 11.77       | 61.73          | 30.83        | 54.07        | 87.56         | 51.29       | > 100        |
| 11               | -5.14                 | > 100         | > 100      | 8.71         | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 14               | 19.06                 | 56.11         | 58.96      | 2.10         | 45.50         | 17.14       | > 100          | 67.71        | > 100        | > 100         | > 100       | > 100        |
| 17               | 85.93                 | 22.43         | 12.41      | 0.81         | 8.31          | 3.68        | 33.56          | 13.52        | 41.12        | 53.13         | 30.29       | 61.16        |
| 20               | 262.11                | 6.54          | 3.74       | 0.16         | 0.99          | 1.35        | 9.15           | 2.58         | 15.07        | 18.66         | 5.35        | 19.42        |
| 23               | 391.03                | 5.81          | 2.64       | 0.12         | 1.53          | 1.13        | 6.86           | 1.43         | 8.43         | 11.85         | 4.90        | 12.83        |
| 26               | 512.97                | 6.74          | 1.42       | 0.09         | 2.41          | 0.67        | 6.82           | 0.85         | 9.32         | 12.65         | 5.26        | 13.70        |
| 29               | 571.04                | 7.94          | 1.79       | 0.12         | 0.87          | 0.53        | 7.49           | 0.65         | 6.57         | 11.54         | 5.80        | 12.92        |
| 32               | 471.23                | 7.44          | 2.65       | 0.30         | 3.40          | 0.80        | 9.60           | 0.72         | 10.48        | 15.07         | 7.07        | 16.64        |
| 35               | 233.33                | 16.67         | 3.70       | 0.59         | 8.96          | 1.28        | 13.27          | 1.19         | 24.87        | 32.91         | 9.33        | 34.20        |
| 38               | 69.98                 | 49.25         | 6.23       | 0.71         | 29.90         | 2.20        | 18.83          | 2.37         | 93.41        | > 100         | 12.45       | > 100        |
| 41               | 3.56                  | > 100         | > 100      | 8.61         | > 100         | 26.11       | > 100          | 34.09        | > 100        | > 100         | > 100       | > 100        |
| 44               | -11.95                | > 100         | 42.80      | 4.14         | > 100         | 9.37        | 34.71          | 11.05        | > 100        | > 100         | 39.72       | > 100        |
| 47               | 71.91                 | 50.72         | 5.57       | 1.00         | 25.53         | 1.85        | 7.88           | 2.29         | > 100        | > 100         | 7.08        | > 100        |
| 50               | 79.26                 | 54.69         | 6.15       | 1.11         | 25.25         | 3.24        | 10.25          | 3.40         | > 100        | > 100         | 9.58        | > 100        |
| 53               | 57.23                 | 50.65         | 11.13      | 1.44         | 73.11         | 5.53        | 18.29          | 6.37         | > 100        | > 100         | 16.95       | > 100        |
| 56               | 35.57                 | 44.54         | 21.30      | 1.60         | > 100         | 9.56        | 31.65          | 10.83        | > 100        | > 100         | 28.70       | > 100        |
| 59               | -11.06                | > 100         | 73.50      | 3.53         | > 100         | 59.62       | 98.57          | 33.20        | > 100        | > 100         | 94.65       | > 100        |
| 62               | -70.42                | 19.98         | 16.90      | 1.43         | > 100         | 19.46       | 14.73          | 7.37         | > 100        | > 100         | 20.13       | > 100        |
| 64               | -101.02               | 13.22         | 16.06      | 1.51         | > 100         | 18.31       | 10.40          | 6.76         | > 100        | > 100         | 17.92       | > 100        |

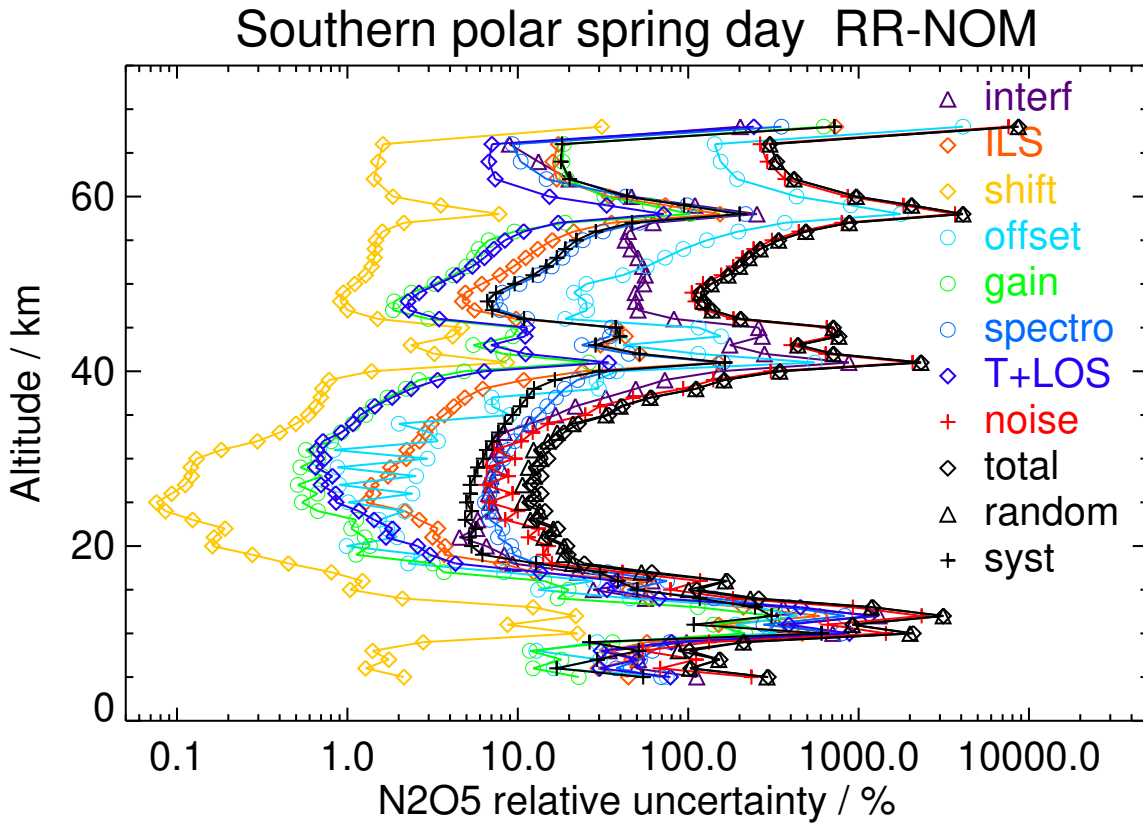


Figure S63: V8R.N2O5\_261 Southern polar spring day

Table S68: N2O5 error budget for Southern polar spring night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 5                | 15.71                 | > 100         | 52.83      | 5.54         | > 100         | 38.87       | > 100          | > 100        | > 100        | > 100         | 39.74       | > 100        |
| 8                | 86.21                 | 32.09         | 18.68      | 1.39         | 12.43         | 8.03        | 45.98          | 24.32        | 46.00        | 71.25         | 36.67       | 80.13        |
| 11               | 25.66                 | 59.28         | 30.52      | 1.99         | 46.83         | 23.08       | 45.29          | 88.49        | > 100        | > 100         | 19.29       | > 100        |
| 14               | 2.45                  | > 100         | > 100      | 24.10        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 17               | 114.30                | 16.29         | 9.21       | 0.42         | 7.84          | 2.86        | 21.49          | 9.57         | 30.75        | 40.45         | 16.83       | 43.81        |
| 20               | 333.02                | 5.13          | 2.05       | 0.16         | 0.64          | 0.91        | 8.28           | 2.09         | 11.74        | 14.76         | 4.97        | 15.57        |
| 23               | 467.87                | 5.28          | 1.05       | 0.11         | 1.28          | 0.71        | 6.35           | 0.89         | 6.87         | 9.67          | 5.09        | 10.93        |
| 26               | 646.07                | 5.37          | 1.24       | 0.09         | 1.90          | 0.80        | 6.54           | 0.77         | 7.55         | 10.31         | 5.36        | 11.62        |
| 29               | 748.38                | 5.54          | 1.31       | 0.11         | 0.58          | 0.92        | 7.00           | 0.56         | 5.04         | 8.74          | 5.64        | 10.41        |
| 32               | 670.01                | 5.45          | 2.09       | 0.25         | 2.49          | 0.79        | 8.24           | 0.65         | 7.59         | 10.98         | 6.80        | 12.92        |
| 35               | 387.33                | 10.27         | 2.88       | 0.31         | 5.50          | 1.48        | 10.23          | 0.87         | 15.07        | 20.10         | 8.66        | 21.88        |
| 38               | 140.68                | 24.90         | 4.87       | 0.40         | 15.06         | 2.35        | 17.24          | 1.74         | 46.92        | 56.65         | 13.00       | 58.12        |
| 41               | 46.29                 | 71.25         | 13.27      | 0.78         | 42.58         | 3.60        | 23.22          | 3.38         | > 100        | > 100         | 18.81       | > 100        |
| 44               | 23.69                 | > 100         | 20.94      | 1.98         | 77.75         | 7.84        | 20.87          | 4.62         | > 100        | > 100         | 21.14       | > 100        |
| 47               | 46.53                 | 90.27         | 9.38       | 1.65         | 40.33         | 4.89        | 10.56          | 3.14         | > 100        | > 100         | 10.17       | > 100        |
| 50               | 54.80                 | 91.41         | 8.26       | 1.65         | 40.04         | 6.00        | 12.38          | 4.87         | > 100        | > 100         | 11.04       | > 100        |
| 53               | 80.63                 | 37.34         | 6.36       | 0.87         | 55.38         | 3.29        | 11.02          | 4.01         | > 100        | > 100         | 8.72        | > 100        |
| 56               | 119.76                | 11.96         | 5.36       | 0.33         | 61.30         | 4.47        | 9.03           | 2.57         | > 100        | > 100         | 8.13        | > 100        |
| 59               | 142.80                | 9.66          | 5.83       | 0.31         | 71.82         | 7.71        | 9.34           | 2.54         | > 100        | > 100         | 10.44       | > 100        |
| 62               | 158.78                | 10.03         | 8.67       | 0.69         | 86.91         | 12.66       | 12.23          | 4.15         | > 100        | > 100         | 15.67       | > 100        |
| 64               | 167.17                | 8.72          | 11.22      | 0.94         | 93.95         | 15.48       | 14.58          | 5.39         | > 100        | > 100         | 19.06       | > 100        |

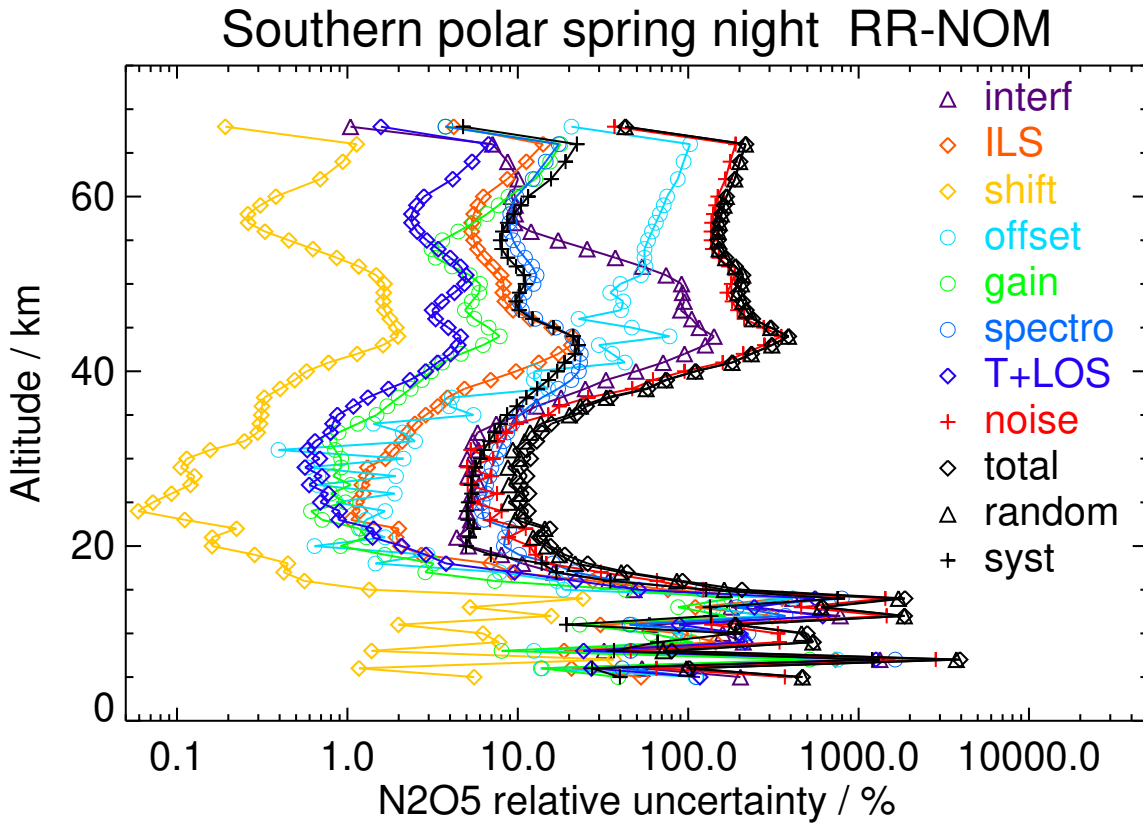


Figure S64: V8R\_N2O5.261 Southern polar spring night

Table S69: N2O5 error budget for Southern polar summer day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 5                | 12.78                 | > 100         | > 100      | 5.63         | > 100         | 50.58       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 8                | 70.49                 | 29.73         | 44.96      | 1.82         | 13.98         | 12.00       | 44.77          | 32.48        | 55.91        | 94.77         | 21.25       | 97.12        |
| 11               | 0.37                  | > 100         | > 100      | > 100        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 14               | -7.93                 | > 100         | > 100      | 5.12         | > 100         | 58.66       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 17               | -1.61                 | > 100         | > 100      | 30.84        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 20               | -1.74                 | > 100         | > 100      | 15.49        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 23               | 53.33                 | 24.34         | 15.71      | 0.81         | 8.95          | 3.21        | 13.57          | 7.06         | 49.06        | 57.50         | 16.28       | 59.76        |
| 26               | 114.29                | 10.23         | 4.21       | 0.39         | 12.82         | 1.30        | 9.80           | 2.46         | 41.47        | 45.44         | 6.79        | 45.94        |
| 29               | 92.13                 | 14.67         | 9.34       | 0.27         | 3.49          | 1.73        | 15.09          | 1.83         | 38.83        | 43.94         | 11.21       | 45.35        |
| 32               | 74.45                 | 25.16         | 8.26       | 0.98         | 22.28         | 1.77        | 17.41          | 2.19         | 65.92        | 76.04         | 8.51        | 76.52        |
| 35               | 27.80                 | > 100         | 13.67      | 1.47         | 77.77         | 2.63        | 23.53          | 4.09         | > 100        | > 100         | 14.01       | > 100        |
| 38               | 16.69                 | > 100         | 52.59      | 2.33         | > 100         | 6.08        | 28.73          | 7.94         | > 100        | > 100         | 50.41       | > 100        |
| 41               | 25.53                 | 88.77         | 39.59      | 1.46         | 84.75         | 8.89        | 24.21          | 6.57         | > 100        | > 100         | 43.28       | > 100        |
| 44               | 37.70                 | 81.86         | 7.82       | 0.78         | 56.38         | 3.78        | 18.68          | 3.94         | > 100        | > 100         | 13.31       | > 100        |
| 47               | 49.58                 | 87.27         | 4.33       | 0.49         | 39.41         | 3.37        | 11.33          | 2.54         | > 100        | > 100         | 7.38        | > 100        |
| 50               | 70.09                 | > 100         | 10.83      | 0.80         | 17.97         | 3.51        | 8.67           | 2.16         | > 100        | > 100         | 11.39       | > 100        |
| 53               | 55.79                 | > 100         | 23.87      | 1.11         | 48.01         | 4.38        | 11.68          | 3.68         | > 100        | > 100         | 24.19       | > 100        |
| 56               | 4.76                  | > 100         | > 100      | 9.66         | > 100         | 54.03       | > 100          | 57.07        | > 100        | > 100         | > 100       | > 100        |
| 59               | -16.54                | 48.05         | > 100      | 1.40         | > 100         | 25.93       | 44.25          | 15.96        | > 100        | > 100         | > 100       | > 100        |
| 62               | -17.54                | 83.02         | 50.92      | 5.14         | > 100         | 60.46       | 47.72          | 17.02        | > 100        | > 100         | 72.42       | > 100        |
| 64               | -17.67                | > 100         | 53.00      | 8.35         | > 100         | 88.52       | 54.47          | 31.42        | > 100        | > 100         | 85.95       | > 100        |

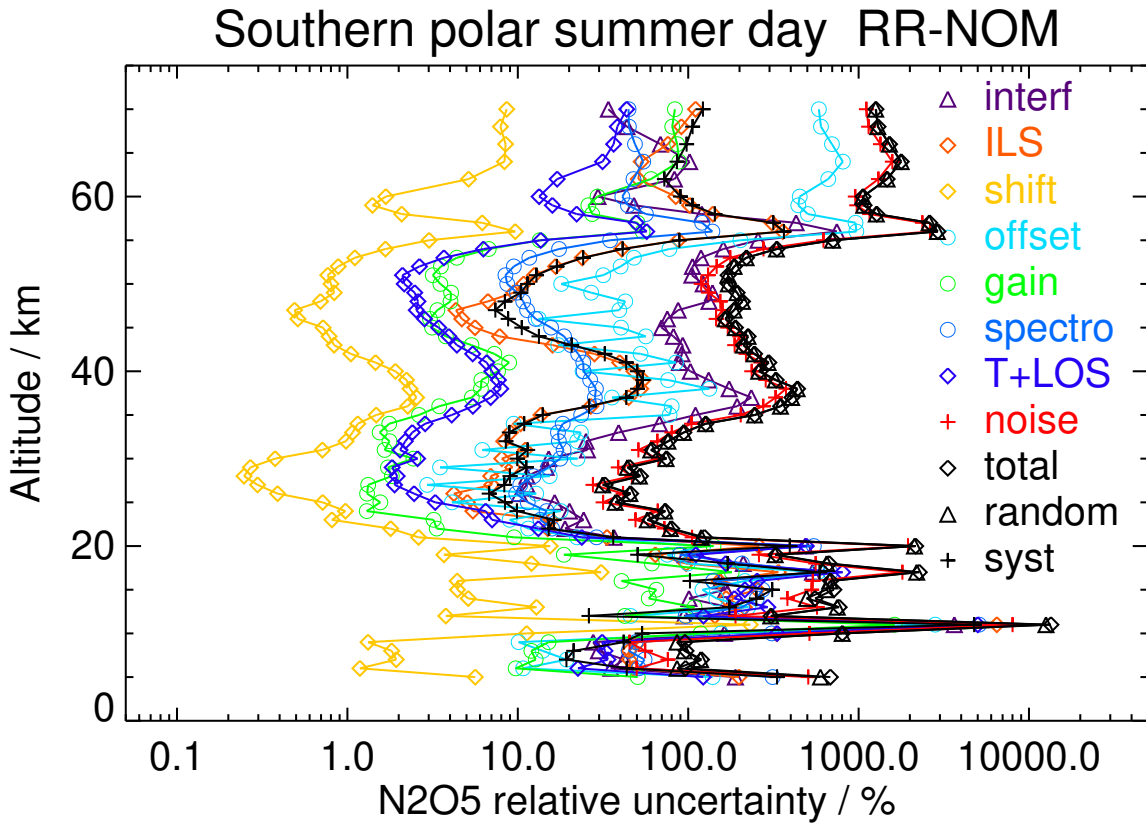


Figure S65: V8R\_N2O5.261 Southern polar summer day

Table S70: N2O5 error budget for Southern polar summer night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 5                | 2.79                  | > 100         | > 100      | 34.42        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 8                | -4.62                 | > 100         | > 100      | 28.79        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 11               | 10.56                 | > 100         | > 100      | 6.31         | 59.11         | 48.52       | > 100          | > 100        | > 100        | > 100         | 46.25       | > 100        |
| 14               | 14.23                 | 56.49         | 72.21      | 3.38         | 39.18         | 46.82       | > 100          | 82.24        | > 100        | > 100         | > 100       | > 100        |
| 17               | 51.74                 | 18.44         | 8.70       | 0.58         | 7.68          | 5.79        | 19.53          | 16.57        | 47.23        | 56.75         | 13.22       | 58.27        |
| 20               | 104.48                | 8.49          | 4.31       | 0.22         | 3.95          | 1.89        | 11.14          | 5.62         | 28.38        | 31.70         | 8.14        | 32.73        |
| 23               | 201.75                | 5.53          | 3.79       | 0.23         | 0.97          | 0.74        | 6.80           | 2.53         | 13.71        | 15.61         | 6.59        | 16.94        |
| 26               | 346.79                | 3.02          | 1.96       | 0.07         | 3.87          | 0.93        | 5.76           | 0.94         | 13.33        | 14.54         | 5.39        | 15.51        |
| 29               | 356.81                | 3.30          | 3.54       | 0.08         | 1.92          | 0.97        | 7.06           | 0.70         | 11.23        | 12.22         | 7.43        | 14.30        |
| 32               | 281.14                | 5.31          | 3.83       | 0.21         | 4.70          | 1.22        | 8.65           | 0.70         | 16.91        | 18.81         | 8.61        | 20.68        |
| 35               | 165.70                | 15.35         | 5.03       | 0.21         | 11.53         | 1.57        | 10.18          | 0.89         | 34.44        | 40.13         | 8.77        | 41.07        |
| 38               | 95.64                 | 29.20         | 12.24      | 0.39         | 20.93         | 2.94        | 14.58          | 1.89         | 65.87        | 75.76         | 16.27       | 77.48        |
| 41               | 30.25                 | 69.34         | 23.34      | 0.57         | 63.52         | 7.70        | 27.01          | 5.82         | > 100        | > 100         | 30.24       | > 100        |
| 44               | 46.99                 | 80.95         | 2.90       | 0.49         | 39.35         | 2.86        | 11.57          | 3.01         | > 100        | > 100         | 8.06        | > 100        |
| 47               | 47.35                 | 77.18         | 4.29       | 0.57         | 33.78         | 4.34        | 11.22          | 2.51         | > 100        | > 100         | 7.76        | > 100        |
| 50               | 46.25                 | > 100         | 14.92      | 0.90         | 30.52         | 5.17        | 11.56          | 3.43         | > 100        | > 100         | 17.08       | > 100        |
| 53               | 58.73                 | 73.88         | 19.29      | 0.66         | 55.68         | 4.18        | 11.31          | 3.65         | > 100        | > 100         | 20.48       | > 100        |
| 56               | 74.15                 | 32.77         | 18.44      | 0.33         | 74.67         | 6.33        | 11.37          | 3.24         | > 100        | > 100         | 19.79       | > 100        |
| 59               | 84.64                 | 7.29          | 14.75      | 0.23         | 99.84         | 10.85       | 11.91          | 2.65         | > 100        | > 100         | 18.10       | > 100        |
| 62               | 82.83                 | 17.45         | 11.32      | 0.79         | > 100         | 21.71       | 14.88          | 5.73         | > 100        | > 100         | 22.33       | > 100        |
| 64               | 74.59                 | 19.09         | 16.09      | 1.40         | > 100         | 32.24       | 18.76          | 10.06        | > 100        | > 100         | 32.20       | > 100        |

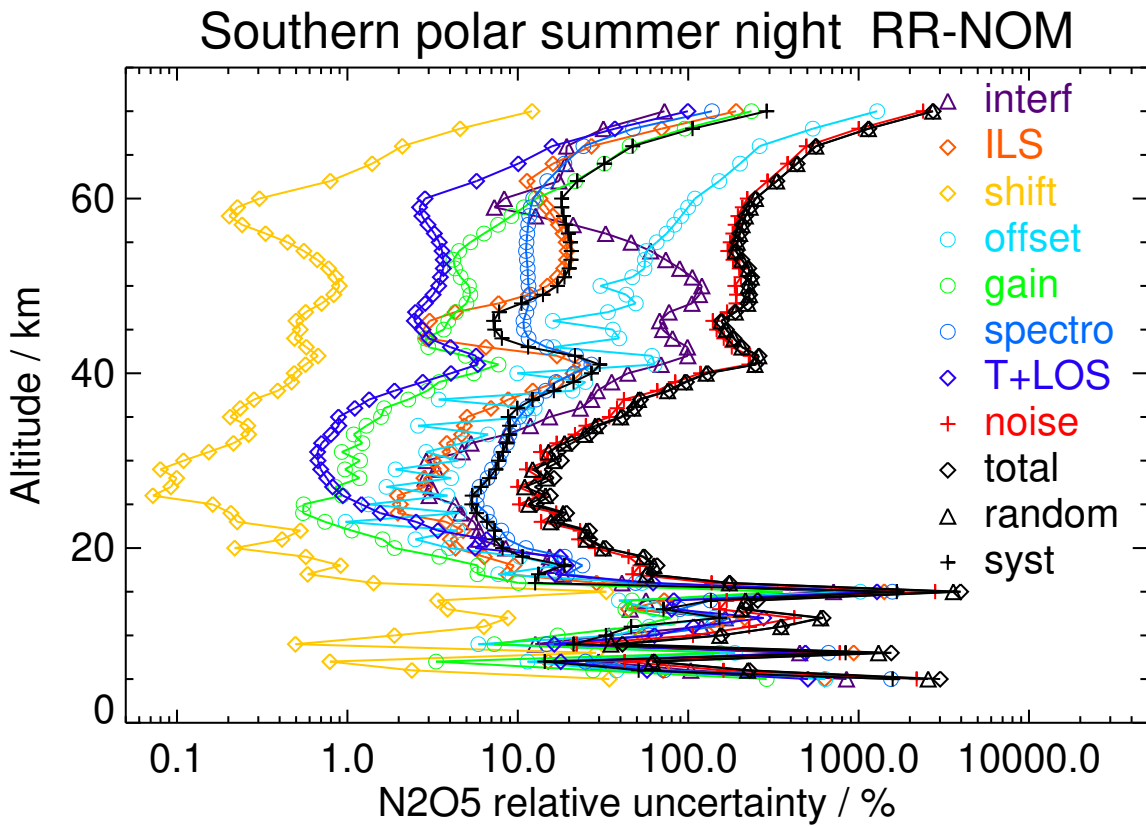


Figure S66: V8R\_N2O5\_261 Southern polar summer night

Table S71: N2O5 error budget for Southern polar autumn day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 5                | 36.18                 | 59.08         | 17.99      | 1.91         | 52.96         | 22.12       | 50.13          | 55.55        | > 100        | > 100         | 30.85       | > 100        |
| 8                | 41.23                 | 47.62         | 29.52      | 3.04         | 22.65         | 19.38       | 66.76          | 42.58        | 88.51        | > 100         | 37.53       | > 100        |
| 11               | 2.52                  | > 100         | > 100      | 16.93        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 14               | 15.34                 | 98.60         | 64.48      | 2.34         | 71.13         | 72.92       | > 100          | 97.27        | > 100        | > 100         | > 100       | > 100        |
| 17               | 19.37                 | 48.88         | 22.13      | 1.07         | 42.34         | 46.96       | 52.51          | 68.29        | > 100        | > 100         | 49.46       | > 100        |
| 20               | 78.67                 | 41.00         | 4.19       | 0.94         | 2.84          | 8.61        | 29.84          | 11.26        | 49.22        | 66.45         | 28.38       | 72.26        |
| 23               | 546.24                | 3.39          | 0.48       | 0.06         | 1.02          | 0.99        | 9.34           | 1.63         | 7.15         | 8.47          | 9.11        | 12.44        |
| 26               | 1187.60               | 0.77          | 0.41       | 0.06         | 0.87          | 0.54        | 5.32           | 0.88         | 4.92         | 5.42          | 5.07        | 7.43         |
| 29               | 1358.38               | 1.95          | 0.74       | 0.06         | 0.27          | 0.59        | 6.70           | 0.81         | 4.31         | 4.99          | 6.63        | 8.30         |
| 32               | 1171.41               | 3.33          | 1.05       | 0.09         | 1.07          | 0.79        | 8.54           | 1.05         | 6.33         | 7.50          | 8.48        | 11.32        |
| 35               | 694.25                | 7.75          | 2.33       | 0.09         | 2.46          | 1.06        | 11.80          | 1.41         | 12.48        | 15.22         | 11.74       | 19.22        |
| 38               | 331.59                | 18.25         | 3.61       | 0.12         | 4.67          | 0.92        | 14.38          | 1.96         | 28.51        | 34.51         | 14.18       | 37.31        |
| 41               | 154.83                | 41.07         | 4.22       | 0.22         | 10.20         | 3.04        | 13.57          | 2.72         | 66.81        | 79.46         | 12.61       | 80.45        |
| 44               | 74.34                 | > 100         | 6.66       | 0.49         | 26.44         | 11.31       | 13.59          | 4.92         | > 100        | > 100         | 14.63       | > 100        |
| 47               | 48.53                 | > 100         | 15.41      | 0.94         | 64.74         | 17.82       | 15.73          | 8.46         | > 100        | > 100         | 23.58       | > 100        |
| 50               | 32.01                 | > 100         | 41.31      | 1.83         | > 100         | 23.33       | 27.03          | 16.18        | > 100        | > 100         | 46.90       | > 100        |
| 53               | 6.51                  | > 100         | > 100      | 9.44         | > 100         | 87.88       | > 100          | 95.81        | > 100        | > 100         | > 100       | > 100        |
| 56               | -17.87                | > 100         | > 100      | 3.33         | > 100         | 76.05       | 67.97          | 41.99        | > 100        | > 100         | > 100       | > 100        |
| 59               | -28.76                | > 100         | > 100      | 2.10         | > 100         | 84.37       | 46.57          | 30.57        | > 100        | > 100         | > 100       | > 100        |
| 62               | -49.08                | 59.24         | 79.53      | 1.41         | > 100         | 79.94       | 30.12          | 21.22        | > 100        | > 100         | > 100       | > 100        |
| 64               | -62.28                | 31.21         | 68.09      | 1.27         | > 100         | 78.30       | 24.98          | 18.28        | > 100        | > 100         | 99.36       | > 100        |

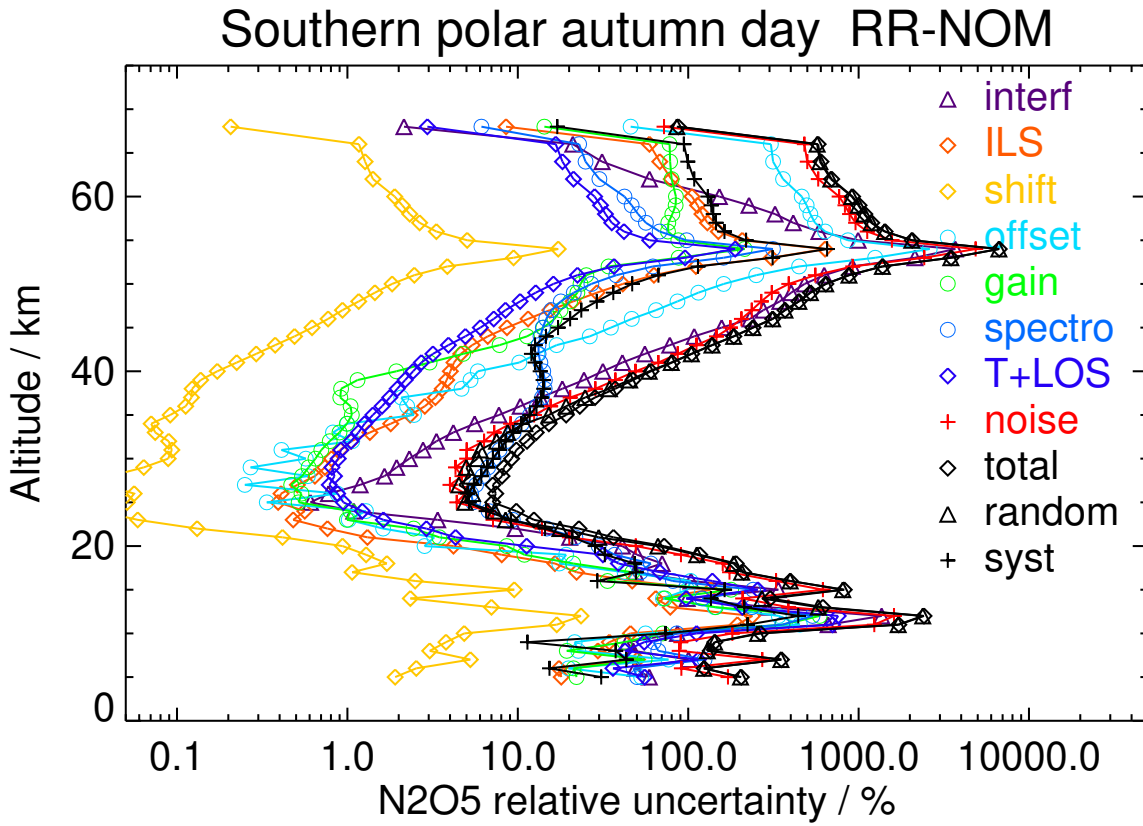


Figure S67: V8R\_N2O5\_261 Southern polar autumn day

Table S72: N2O5 error budget for Southern polar autumn night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 5                | -46.41                | 40.44         | 17.63      | 1.37         | 34.84         | 14.98       | 35.14          | 34.40        | > 100        | > 100         | 17.56       | > 100        |
| 8                | 59.33                 | 33.99         | 25.32      | 1.94         | 19.82         | 9.97        | 54.09          | 33.95        | 68.13        | 93.89         | 46.88       | > 100        |
| 11               | 8.36                  | > 100         | 79.37      | 6.99         | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | 83.43       | > 100        |
| 14               | 11.74                 | > 100         | 76.64      | 2.77         | 91.25         | 95.87       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 17               | 12.01                 | 72.13         | 38.23      | 1.38         | 63.08         | 39.54       | 72.55          | > 100        | > 100        | > 100         | 44.08       | > 100        |
| 20               | 58.00                 | 42.29         | 5.75       | 1.15         | 3.97          | 7.36        | 37.60          | 13.94        | 68.03        | 82.82         | 35.63       | 90.16        |
| 23               | 538.11                | 3.36          | 0.92       | 0.09         | 0.95          | 0.99        | 9.98           | 1.74         | 7.60         | 9.28          | 9.41        | 13.21        |
| 26               | 1166.77               | 0.79          | 0.54       | 0.04         | 0.82          | 0.28        | 5.37           | 0.88         | 5.13         | 5.56          | 5.16        | 7.59         |
| 29               | 1231.30               | 1.96          | 1.09       | 0.11         | 0.34          | 0.56        | 7.65           | 0.90         | 4.94         | 5.76          | 7.49        | 9.44         |
| 32               | 946.06                | 3.71          | 1.58       | 0.11         | 1.32          | 0.78        | 10.13          | 1.22         | 8.00         | 9.46          | 9.86        | 13.67        |
| 35               | 555.11                | 8.72          | 2.80       | 0.13         | 2.96          | 0.83        | 12.77          | 1.58         | 15.87        | 18.71         | 12.67       | 22.60        |
| 38               | 238.88                | 22.78         | 4.71       | 0.20         | 6.03          | 0.83        | 15.29          | 2.34         | 40.18        | 47.04         | 14.80       | 49.31        |
| 41               | 176.50                | 34.97         | 3.70       | 0.20         | 8.76          | 1.73        | 9.22           | 2.19         | 58.74        | 69.22         | 8.10        | 69.69        |
| 44               | 138.65                | 56.40         | 3.84       | 0.27         | 13.83         | 3.91        | 7.67           | 2.56         | 78.70        | 98.03         | 7.14        | 98.29        |
| 47               | 67.26                 | > 100         | 11.90      | 0.74         | 45.39         | 8.24        | 14.33          | 6.05         | > 100        | > 100         | 16.58       | > 100        |
| 50               | -3.96                 | > 100         | > 100      | 15.08        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 53               | -22.40                | > 100         | 83.44      | 2.78         | > 100         | 22.90       | 47.55          | 27.57        | > 100        | > 100         | 89.85       | > 100        |
| 56               | -7.97                 | > 100         | > 100      | 8.35         | > 100         | > 100       | > 100          | 92.54        | > 100        | > 100         | > 100       | > 100        |
| 59               | -25.28                | > 100         | > 100      | 2.98         | > 100         | 85.24       | 58.52          | 33.55        | > 100        | > 100         | > 100       | > 100        |
| 62               | -47.68                | 46.69         | 73.48      | 1.92         | > 100         | 70.37       | 37.16          | 20.72        | > 100        | > 100         | > 100       | > 100        |
| 64               | -59.29                | 25.67         | 64.13      | 1.75         | > 100         | 69.19       | 32.84          | 18.07        | > 100        | > 100         | 92.56       | > 100        |

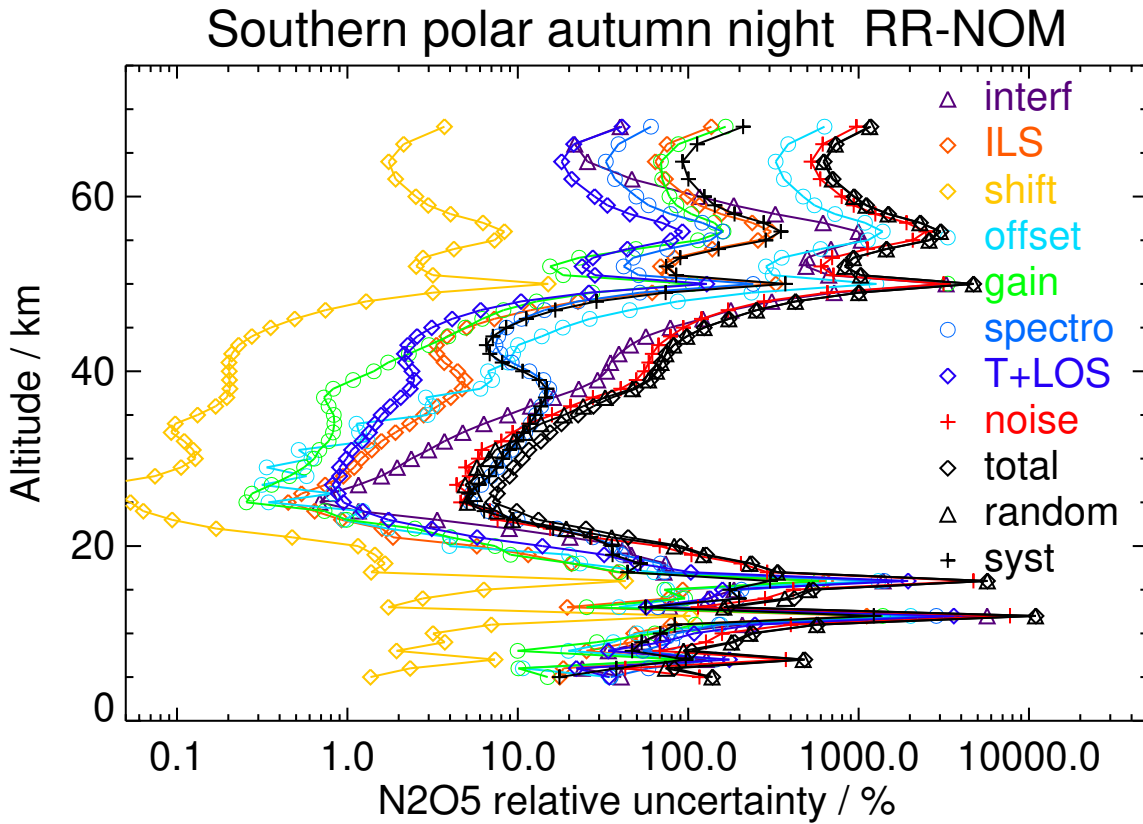


Figure S68: V8R\_N2O5\_261 Southern polar autumn night

Table S73: N2O5 error budget for Northern polar winter day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 14               | 164.91                | 44.07         | 11.57      | 0.49         | 11.34         | 12.16       | 13.49          | 6.30         | 37.81        | 61.28         | 15.77       | 63.27        |
| 17               | 48.80                 | 45.01         | 15.35      | 0.82         | 19.71         | 29.34       | 28.29          | 9.84         | 65.87        | 91.39         | 19.84       | 93.52        |
| 20               | 170.88                | 24.84         | 2.98       | 0.27         | 4.15          | 8.73        | 13.15          | 3.06         | 13.94        | 31.23         | 10.99       | 33.11        |
| 23               | 452.23                | 5.80          | 1.38       | 0.26         | 1.59          | 3.62        | 8.26           | 1.12         | 5.44         | 10.25         | 6.74        | 12.26        |
| 26               | 867.83                | 2.15          | 0.58       | 0.09         | 0.99          | 2.34        | 6.63           | 0.71         | 3.72         | 6.29          | 5.49        | 8.35         |
| 29               | 1311.75               | 3.23          | 0.66       | 0.11         | 0.87          | 1.58        | 6.17           | 0.64         | 3.47         | 6.13          | 5.21        | 8.04         |
| 32               | 1588.26               | 3.18          | 0.65       | 0.11         | 0.89          | 1.65        | 6.21           | 0.58         | 3.82         | 5.80          | 5.84        | 8.23         |
| 35               | 1352.33               | 4.66          | 0.30       | 0.05         | 1.07          | 1.65        | 8.53           | 0.72         | 5.61         | 8.30          | 7.84        | 11.42        |
| 38               | 751.70                | 10.36         | 0.34       | 0.06         | 1.84          | 2.03        | 12.33          | 1.12         | 12.03        | 17.05         | 11.06       | 20.32        |
| 41               | 354.64                | 26.08         | 0.51       | 0.13         | 5.26          | 2.30        | 15.91          | 1.56         | 29.70        | 40.65         | 14.09       | 43.02        |
| 44               | 149.58                | 56.90         | 2.45       | 0.21         | 22.81         | 3.86        | 21.68          | 2.52         | 80.00        | > 100         | 18.79       | > 100        |
| 47               | 42.05                 | > 100         | 13.21      | 0.59         | > 100         | 23.14       | 47.36          | 7.22         | > 100        | > 100         | 44.09       | > 100        |
| 50               | 12.39                 | > 100         | 49.31      | 1.98         | > 100         | 76.45       | > 100          | 21.24        | > 100        | > 100         | > 100       | > 100        |
| 53               | -5.45                 | > 100         | > 100      | 4.32         | > 100         | > 100       | > 100          | 43.28        | > 100        | > 100         | > 100       | > 100        |
| 56               | -0.17                 | > 100         | > 100      | > 100        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 59               | 26.87                 | 59.32         | 13.81      | 0.88         | > 100         | 11.78       | 43.95          | 7.03         | > 100        | > 100         | 34.40       | > 100        |
| 62               | 4.10                  | > 100         | > 100      | 6.17         | > 100         | > 100       | > 100          | 51.36        | > 100        | > 100         | > 100       | > 100        |
| 64               | -2.25                 | > 100         | > 100      | 11.85        | > 100         | > 100       | > 100          | 94.91        | > 100        | > 100         | > 100       | > 100        |

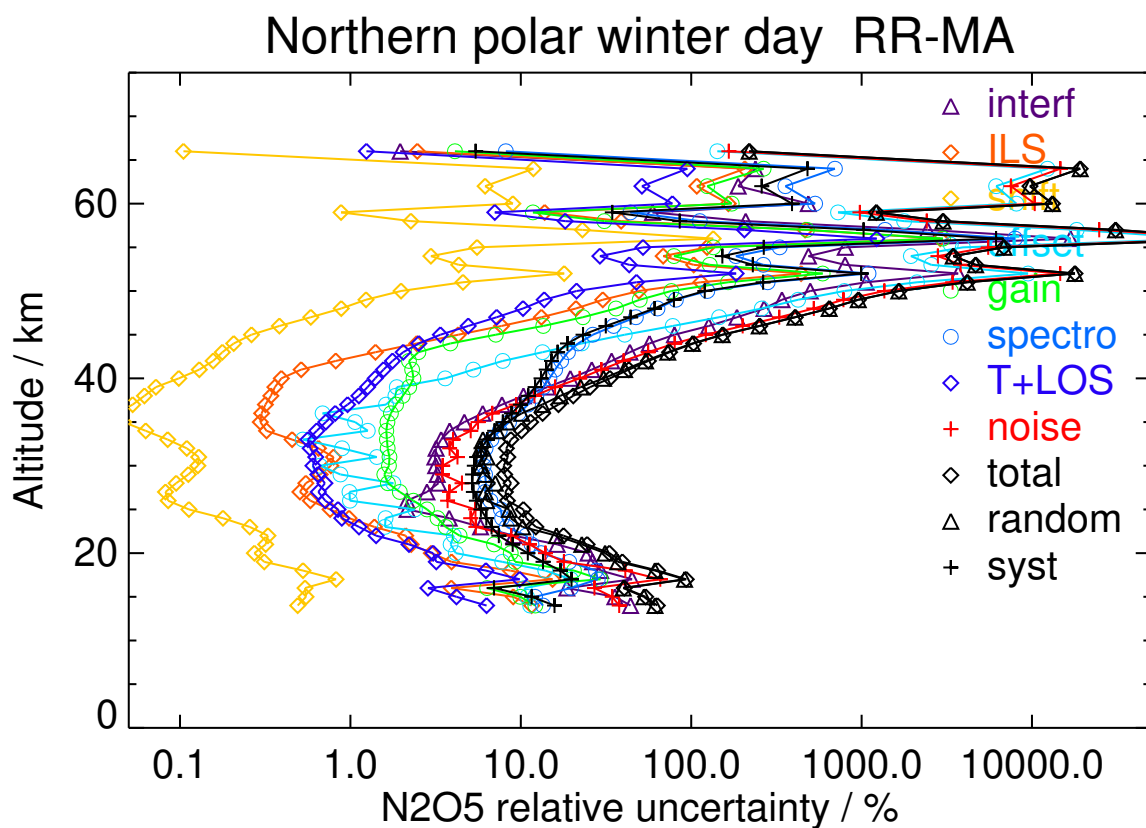


Figure S69: V8R\_N2O5\_561 Northern polar winter day

Table S74: N2O5 error budget for Northern polar winter night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 14               | 167.53                | 37.75         | 9.27       | 0.94         | 10.19         | 4.91        | 12.89          | 3.47         | 34.59        | 53.88         | 10.54       | 54.90        |
| 17               | 34.51                 | 51.81         | 15.95      | 1.33         | 50.53         | 25.80       | 49.79          | 15.21        | > 100        | > 100         | 26.66       | > 100        |
| 20               | 46.64                 | 73.11         | 9.40       | 1.12         | 16.53         | 22.12       | 39.98          | 12.50        | 65.17        | > 100         | 35.23       | > 100        |
| 23               | 320.61                | 9.00          | 4.35       | 0.45         | 2.58          | 4.21        | 18.19          | 3.24         | 12.49        | 18.93         | 16.24       | 24.94        |
| 26               | 1157.33               | 1.46          | 1.20       | 0.08         | 1.05          | 1.88        | 5.75           | 1.00         | 4.74         | 6.15          | 5.19        | 8.05         |
| 29               | 1397.61               | 3.33          | 0.66       | 0.10         | 0.92          | 1.57        | 7.77           | 0.94         | 4.79         | 7.47          | 6.59        | 9.96         |
| 32               | 1098.41               | 5.11          | 0.80       | 0.10         | 1.22          | 1.74        | 9.06           | 1.06         | 7.02         | 9.63          | 8.43        | 12.79        |
| 35               | 754.95                | 7.81          | 0.73       | 0.12         | 1.73          | 2.02        | 10.50          | 1.03         | 11.51        | 15.06         | 9.26        | 17.68        |
| 38               | 472.08                | 14.75         | 0.84       | 0.13         | 2.89          | 2.73        | 13.57          | 1.10         | 20.43        | 27.15         | 10.00       | 28.93        |
| 41               | 262.61                | 32.64         | 1.11       | 0.21         | 6.50          | 3.23        | 18.34          | 1.45         | 40.54        | 54.37         | 12.05       | 55.69        |
| 44               | 111.28                | 77.52         | 2.25       | 0.35         | 24.43         | 4.80        | 30.59          | 2.71         | > 100        | > 100         | 18.92       | > 100        |
| 47               | 41.89                 | > 100         | 5.49       | 0.85         | > 100         | 12.19       | 59.31          | 6.21         | > 100        | > 100         | 34.51       | > 100        |
| 50               | 6.32                  | > 100         | 48.52      | 5.66         | > 100         | 92.50       | > 100          | 35.63        | > 100        | > 100         | > 100       | > 100        |
| 53               | -35.84                | > 100         | 11.77      | 0.98         | > 100         | 18.24       | 47.50          | 5.59         | > 100        | > 100         | 26.64       | > 100        |
| 56               | -68.08                | 48.46         | 7.72       | 0.48         | > 100         | 10.96       | 13.96          | 2.39         | > 100        | > 100         | 10.90       | > 100        |
| 59               | -70.03                | 28.66         | 6.56       | 0.38         | > 100         | 7.58        | 11.49          | 1.97         | > 100        | > 100         | 8.24        | > 100        |
| 62               | -149.28               | 6.44          | 4.26       | 0.20         | > 100         | 6.19        | 7.06           | 1.19         | > 100        | > 100         | 5.43        | > 100        |
| 64               | -61.83                | 9.55          | 8.09       | 0.43         | > 100         | 10.04       | 16.53          | 2.60         | > 100        | > 100         | 11.32       | > 100        |

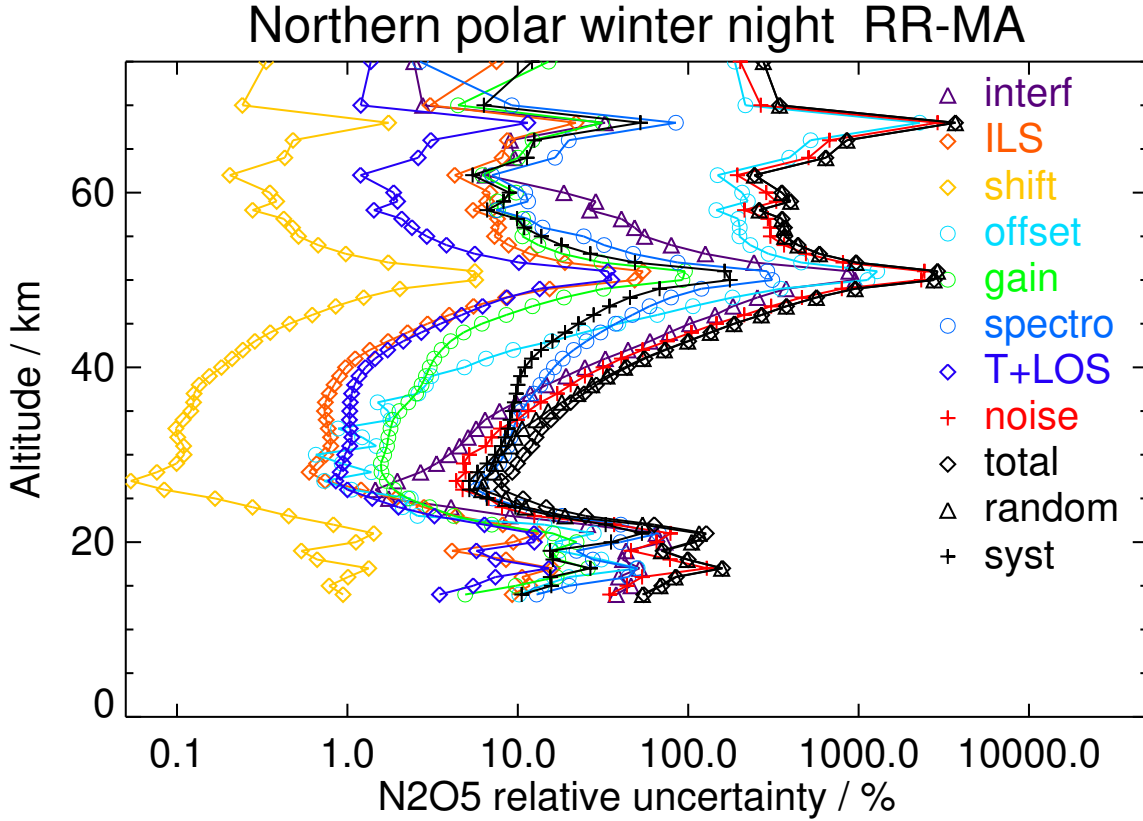


Figure S70: V8R\_N2O5\_561 Northern polar winter night

Table S75: N2O5 error budget for Northern polar spring day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 17               | 57.34                 | 25.02         | 5.62       | 0.84         | 27.97         | 15.02       | 33.12          | 12.77        | 73.05        | 84.54         | 33.40       | 90.90        |
| 20               | 86.30                 | 17.13         | 3.04       | 0.38         | 9.09          | 19.31       | 9.10           | 6.89         | 31.93        | 38.86         | 19.95       | 43.68        |
| 23               | 147.68                | 14.11         | 1.76       | 0.40         | 2.91          | 3.13        | 8.75           | 2.74         | 19.35        | 25.02         | 7.29        | 26.06        |
| 26               | 166.33                | 15.12         | 2.16       | 0.18         | 2.37          | 3.77        | 8.81           | 1.58         | 22.88        | 28.63         | 6.08        | 29.27        |
| 29               | 158.70                | 17.05         | 1.86       | 0.19         | 4.00          | 2.49        | 11.01          | 1.06         | 31.75        | 37.63         | 5.57        | 38.04        |
| 32               | 102.73                | 37.00         | 2.47       | 0.44         | 8.32          | 2.75        | 16.02          | 1.33         | 59.86        | 72.48         | 6.32        | 72.76        |
| 35               | 13.19                 | > 100         | 22.37      | 3.59         | 67.19         | 13.95       | 86.24          | 10.42        | > 100        | > 100         | 36.58       | > 100        |
| 38               | -56.83                | 74.47         | 4.23       | 0.51         | 15.90         | 6.02        | 9.36           | 1.77         | > 100        | > 100         | 9.85        | > 100        |
| 41               | -39.04                | 92.07         | 3.97       | 0.62         | 24.27         | 7.72        | 15.21          | 2.43         | > 100        | > 100         | 14.32       | > 100        |
| 44               | -26.08                | > 100         | 6.01       | 0.61         | 40.22         | 6.62        | 21.26          | 5.33         | > 100        | > 100         | 17.16       | > 100        |
| 47               | -22.84                | > 100         | 9.96       | 1.14         | 53.89         | 12.13       | 19.40          | 6.42         | > 100        | > 100         | 16.23       | > 100        |
| 50               | 1.32                  | > 100         | > 100      | 23.76        | > 100         | > 100       | > 100          | 92.81        | > 100        | > 100         | > 100       | > 100        |
| 53               | 26.99                 | > 100         | 12.70      | 1.19         | > 100         | 8.22        | 21.37          | 4.34         | > 100        | > 100         | 19.34       | > 100        |
| 56               | 52.77                 | 33.54         | 6.74       | 0.50         | > 100         | 3.66        | 14.26          | 2.34         | > 100        | > 100         | 11.81       | > 100        |
| 59               | 67.86                 | 13.46         | 4.63       | 0.27         | > 100         | 3.40        | 13.16          | 1.99         | > 100        | > 100         | 10.02       | > 100        |
| 62               | 72.86                 | 6.70          | 3.02       | 0.20         | > 100         | 5.62        | 14.07          | 2.17         | > 100        | > 100         | 10.37       | > 100        |
| 64               | 79.44                 | 5.75          | 2.18       | 0.31         | > 100         | 7.07        | 13.65          | 2.24         | > 100        | > 100         | 10.44       | > 100        |

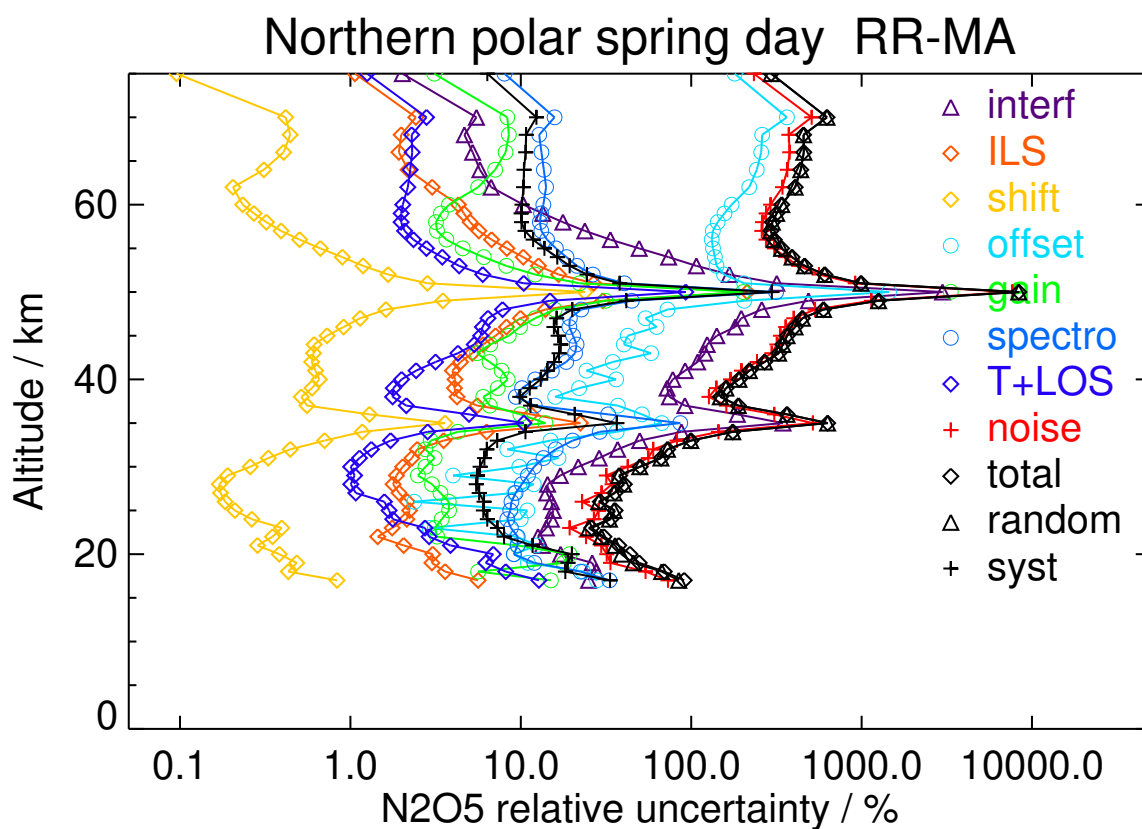


Figure S71: V8R\_N2O5\_561 Northern polar spring day

Table S76: N2O5 error budget for Northern polar spring night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 17               | 89.52                 | 18.10         | 3.80       | 0.50         | 17.76         | 8.07        | 20.66          | 7.72         | 46.83        | 54.61         | 20.51       | 58.33        |
| 20               | 118.54                | 12.51         | 2.47       | 0.29         | 6.34          | 15.06       | 6.75           | 5.07         | 22.71        | 27.65         | 15.87       | 31.89        |
| 23               | 234.39                | 7.22          | 0.62       | 0.29         | 1.96          | 2.81        | 6.63           | 1.91         | 12.07        | 14.62         | 6.62        | 16.05        |
| 26               | 285.43                | 6.86          | 1.04       | 0.11         | 1.61          | 2.20        | 6.09           | 1.06         | 13.17        | 15.25         | 5.89        | 16.35        |
| 29               | 262.45                | 7.56          | 1.33       | 0.09         | 2.70          | 1.38        | 6.86           | 0.80         | 18.92        | 20.86         | 6.21        | 21.77        |
| 32               | 189.95                | 14.36         | 1.67       | 0.23         | 4.77          | 1.53        | 8.55           | 0.81         | 31.58        | 35.41         | 7.18        | 36.13        |
| 35               | 61.06                 | 50.26         | 3.84       | 0.45         | 15.53         | 2.93        | 16.67          | 1.71         | > 100        | > 100         | 11.59       | > 100        |
| 38               | 20.35                 | > 100         | 13.58      | 1.65         | 48.58         | 20.07       | 37.87          | 5.37         | > 100        | > 100         | 36.82       | > 100        |
| 41               | 9.46                  | > 100         | 19.90      | 3.69         | > 100         | 41.22       | 66.42          | 10.13        | > 100        | > 100         | 70.03       | > 100        |
| 44               | 19.53                 | > 100         | 5.29       | 1.01         | 57.28         | 7.33        | 30.91          | 6.91         | > 100        | > 100         | 23.42       | > 100        |
| 47               | 9.11                  | > 100         | 18.52      | 2.60         | > 100         | 24.81       | 61.72          | 17.96        | > 100        | > 100         | 55.36       | > 100        |
| 50               | -13.67                | > 100         | 21.10      | 2.26         | > 100         | 17.58       | 35.41          | 9.60         | > 100        | > 100         | 34.03       | > 100        |
| 53               | -12.14                | > 100         | 30.92      | 2.37         | > 100         | 18.45       | 46.47          | 9.26         | > 100        | > 100         | 43.17       | > 100        |
| 56               | 6.90                  | > 100         | 59.36      | 3.13         | > 100         | 32.65       | > 100          | 17.20        | > 100        | > 100         | 91.95       | > 100        |
| 59               | 28.44                 | 45.46         | 13.65      | 0.48         | > 100         | 8.99        | 32.91          | 4.82         | > 100        | > 100         | 24.93       | > 100        |
| 62               | 62.15                 | 8.61          | 5.07       | 0.28         | > 100         | 5.32        | 17.47          | 2.61         | > 100        | > 100         | 12.17       | > 100        |
| 64               | 79.62                 | 5.40          | 3.26       | 0.36         | > 100         | 5.14        | 14.43          | 2.23         | > 100        | > 100         | 9.80        | > 100        |

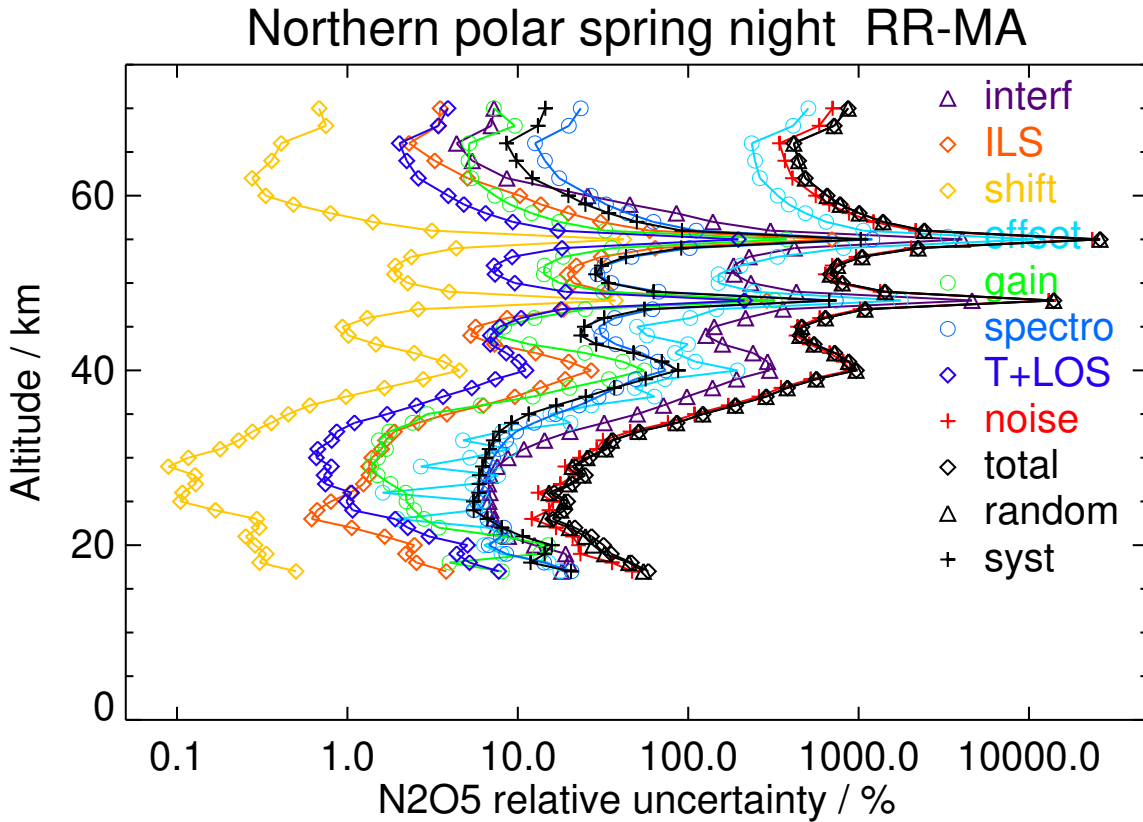


Figure S72: V8R\_N2O5\_561 Northern polar spring night

Table S77: N2O5 error budget for Northern polar summer day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 17               | 53.37                 | 32.94         | 9.14       | 1.63         | 25.53         | 20.55       | 26.30          | 9.57         | 89.03        | 99.72         | 31.80       | > 100        |
| 20               | -13.19                | > 100         | 23.29      | 2.71         | 59.14         | > 100       | 24.66          | 38.28        | > 100        | > 100         | > 100       | > 100        |
| 23               | 26.19                 | 47.98         | 5.09       | 1.12         | 19.08         | 10.73       | 31.86          | 14.40        | 92.76        | > 100         | 31.91       | > 100        |
| 26               | 8.02                  | > 100         | 37.81      | 3.68         | 48.01         | 50.35       | 55.37          | 34.01        | > 100        | > 100         | 70.69       | > 100        |
| 29               | 39.10                 | 36.48         | 8.90       | 0.61         | 10.59         | 2.70        | 10.17          | 4.08         | 76.43        | 85.80         | 11.35       | 86.55        |
| 32               | 16.52                 | > 100         | 18.45      | 1.82         | 34.08         | 7.48        | 20.50          | 4.83         | > 100        | > 100         | 20.48       | > 100        |
| 35               | -19.19                | > 100         | 11.51      | 1.63         | 39.61         | 3.86        | 13.50          | 3.23         | > 100        | > 100         | 13.15       | > 100        |
| 38               | -13.11                | > 100         | 25.17      | 1.59         | 71.66         | 9.82        | 23.55          | 6.09         | > 100        | > 100         | 30.54       | > 100        |
| 41               | -20.46                | > 100         | 6.97       | 0.69         | 51.24         | 10.72       | 16.23          | 3.93         | > 100        | > 100         | 15.52       | > 100        |
| 44               | 2.46                  | > 100         | 41.90      | 14.38        | > 100         | 40.23       | > 100          | 34.13        | > 100        | > 100         | 88.84       | > 100        |
| 47               | 30.70                 | > 100         | 3.34       | 0.53         | 38.76         | 5.13        | 14.38          | 4.87         | > 100        | > 100         | 11.11       | > 100        |
| 50               | 27.65                 | > 100         | 13.99      | 1.05         | 46.68         | 4.36        | 19.01          | 4.69         | > 100        | > 100         | 18.60       | > 100        |
| 53               | 26.21                 | > 100         | 22.18      | 1.19         | 66.36         | 4.10        | 19.30          | 3.53         | > 100        | > 100         | 25.56       | > 100        |
| 56               | 55.26                 | 32.90         | 11.34      | 0.46         | 61.53         | 2.77        | 10.88          | 1.56         | > 100        | > 100         | 14.14       | > 100        |
| 59               | 92.22                 | 7.01          | 5.53       | 0.14         | 67.89         | 1.79        | 8.42           | 1.09         | > 100        | > 100         | 8.64        | > 100        |
| 62               | 142.11                | 3.90          | 0.92       | 0.23         | 80.87         | 2.27        | 7.00           | 0.92         | > 100        | > 100         | 5.66        | > 100        |
| 64               | 170.91                | 4.38          | 2.44       | 0.32         | 87.77         | 4.24        | 6.42           | 1.03         | > 100        | > 100         | 6.56        | > 100        |

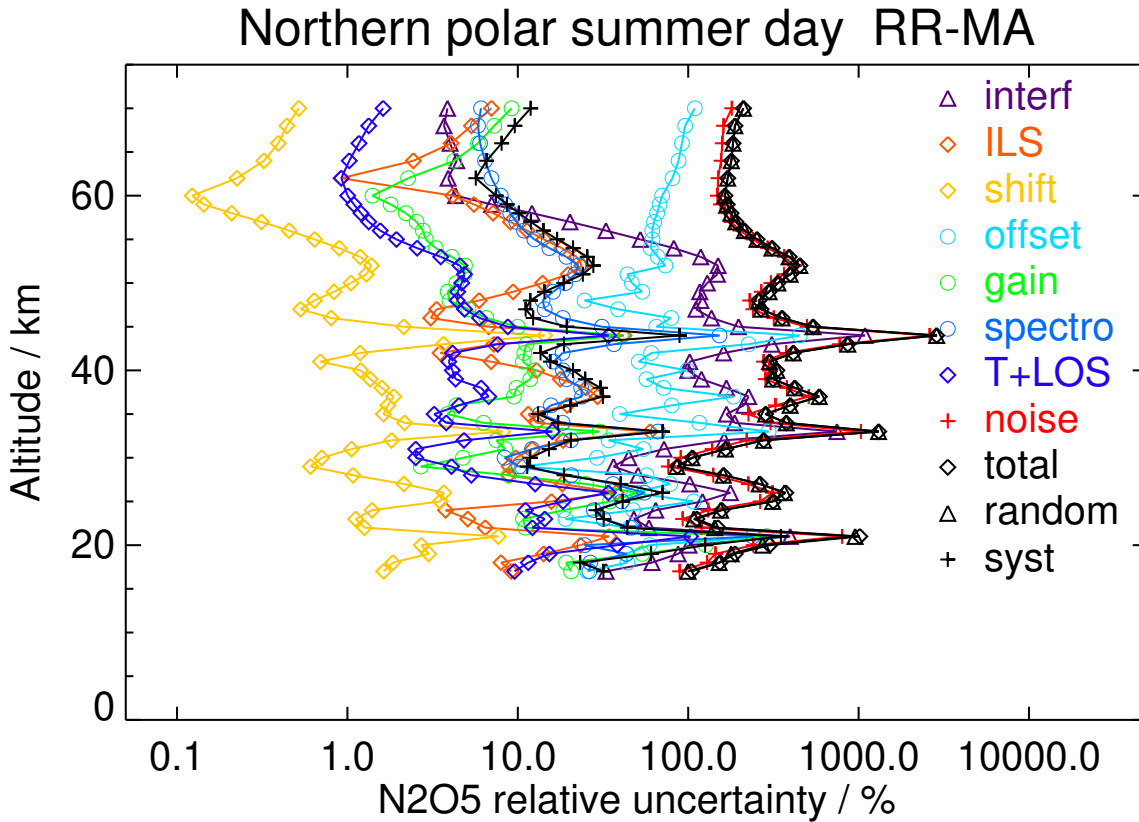


Figure S73: V8R\_N2O5\_561 Northern polar summer day

Table S78: N2O5 error budget for Northern polar summer night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 17               | 94.00                 | 16.75         | 2.70       | 0.68         | 15.25         | 13.62       | 16.43          | 5.39         | 47.66        | 53.64         | 20.00       | 57.25        |
| 20               | 81.57                 | 15.65         | 1.92       | 0.34         | 9.24          | 26.88       | 11.77          | 7.38         | 35.00        | 40.72         | 28.58       | 49.74        |
| 23               | 248.81                | 5.18          | 1.01       | 0.27         | 1.99          | 2.82        | 7.32           | 1.90         | 9.86         | 11.68         | 7.60        | 13.94        |
| 26               | 347.82                | 4.19          | 0.43       | 0.12         | 1.39          | 2.98        | 5.50           | 1.09         | 8.15         | 9.57          | 5.92        | 11.25        |
| 29               | 418.71                | 3.54          | 0.56       | 0.08         | 1.40          | 1.80        | 5.89           | 0.66         | 8.54         | 9.55          | 5.90        | 11.23        |
| 32               | 327.32                | 5.28          | 1.36       | 0.14         | 2.40          | 1.61        | 7.96           | 0.73         | 13.45        | 14.93         | 7.75        | 16.82        |
| 35               | 172.24                | 11.53         | 2.73       | 0.26         | 5.48          | 1.86        | 11.29          | 1.07         | 30.30        | 33.35         | 10.43       | 34.94        |
| 38               | 71.98                 | 28.20         | 3.69       | 0.37         | 14.73         | 5.18        | 17.42          | 1.64         | 83.85        | 90.14         | 16.24       | 91.59        |
| 41               | 26.92                 | 71.00         | 3.23       | 0.78         | 42.00         | 6.11        | 21.02          | 3.43         | > 100        | > 100         | 15.68       | > 100        |
| 44               | 4.43                  | > 100         | 14.61      | 3.70         | > 100         | 29.04       | 94.29          | 23.70        | > 100        | > 100         | 55.42       | > 100        |
| 47               | 27.11                 | 85.66         | 5.79       | 0.57         | 45.24         | 4.72        | 17.66          | 5.33         | > 100        | > 100         | 12.44       | > 100        |
| 50               | 39.73                 | 64.89         | 8.47       | 0.44         | 42.02         | 3.24        | 13.81          | 3.02         | > 100        | > 100         | 12.54       | > 100        |
| 53               | 56.79                 | 41.24         | 8.06       | 0.35         | 58.55         | 2.94        | 12.45          | 1.77         | > 100        | > 100         | 11.67       | > 100        |
| 56               | 63.27                 | 28.19         | 7.50       | 0.36         | > 100         | 3.25        | 14.24          | 1.76         | > 100        | > 100         | 11.89       | > 100        |
| 59               | 76.63                 | 12.09         | 5.00       | 0.27         | > 100         | 2.67        | 14.03          | 1.65         | > 100        | > 100         | 9.89        | > 100        |
| 62               | 99.34                 | 3.78          | 1.63       | 0.15         | > 100         | 3.93        | 12.43          | 1.53         | > 100        | > 100         | 8.10        | > 100        |
| 64               | 112.85                | 4.00          | 1.84       | 0.19         | > 100         | 5.67        | 11.53          | 1.58         | > 100        | > 100         | 8.60        | > 100        |

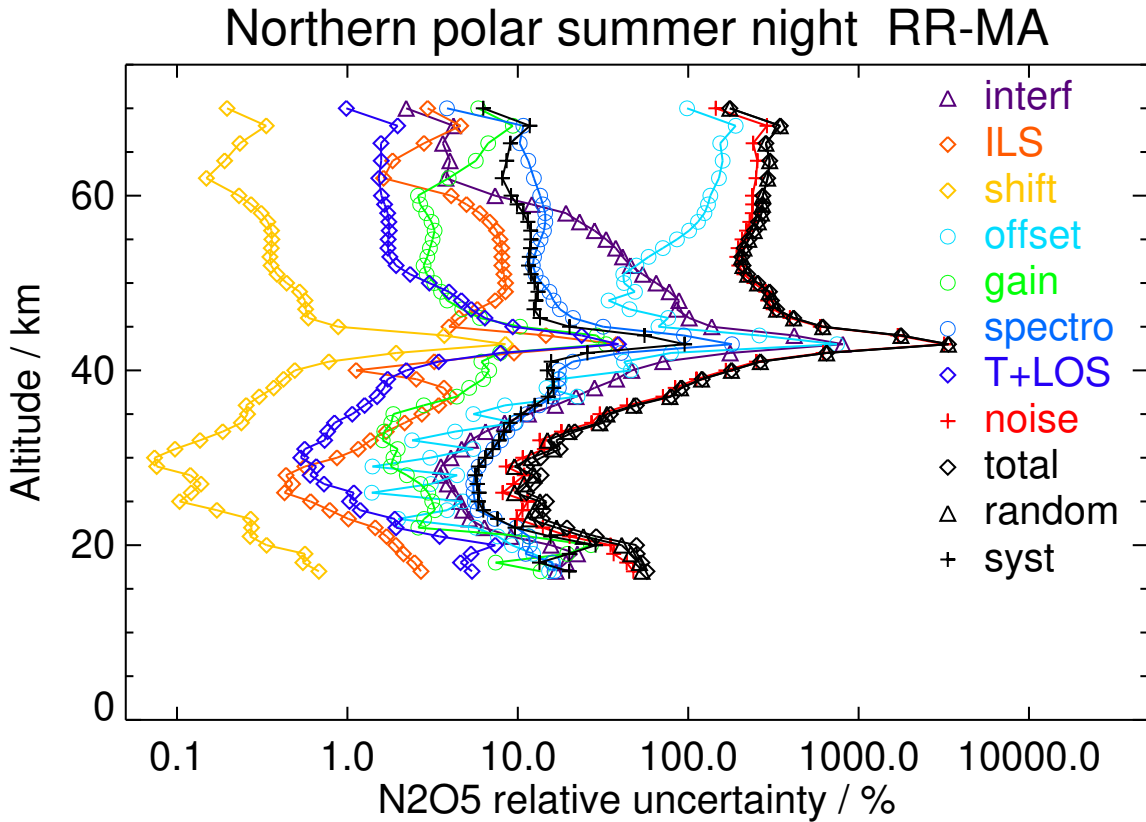


Figure S74: V8R\_N2O5\_561 Northern polar summer night

Table S79: N2O5 error budget for Northern polar autumn day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 17               | 31.02                 | 46.35         | 10.14      | 0.60         | 54.02         | 31.20       | 70.95          | 19.82        | > 100        | > 100         | 72.74       | > 100        |
| 20               | 109.14                | 26.64         | 3.13       | 0.28         | 6.55          | 19.39       | 14.53          | 6.66         | 24.07        | 38.13         | 22.79       | 44.42        |
| 23               | 402.59                | 6.17          | 1.23       | 0.27         | 1.17          | 2.98        | 9.23           | 1.79         | 7.20         | 10.17         | 9.31        | 13.79        |
| 26               | 866.83                | 1.10          | 0.80       | 0.11         | 0.77          | 2.38        | 5.39           | 0.88         | 4.58         | 5.32          | 5.53        | 7.68         |
| 29               | 1139.79               | 3.02          | 0.60       | 0.06         | 0.80          | 1.70        | 6.15           | 0.69         | 4.60         | 6.03          | 6.01        | 8.52         |
| 32               | 904.78                | 5.30          | 0.50       | 0.07         | 1.21          | 1.73        | 8.92           | 1.00         | 7.24         | 9.81          | 8.35        | 12.88        |
| 35               | 560.05                | 11.02         | 1.11       | 0.10         | 2.01          | 2.21        | 12.16          | 1.10         | 13.32        | 18.61         | 10.57       | 21.40        |
| 38               | 282.49                | 25.17         | 1.31       | 0.13         | 3.94          | 2.39        | 16.18          | 1.38         | 29.63        | 40.59         | 12.28       | 42.41        |
| 41               | 96.91                 | 70.74         | 1.69       | 0.26         | 11.88         | 3.91        | 24.36          | 2.44         | 94.50        | > 100         | 14.02       | > 100        |
| 44               | 45.01                 | > 100         | 2.84       | 0.55         | 29.63         | 5.86        | 23.02          | 3.40         | > 100        | > 100         | 8.66        | > 100        |
| 47               | 39.40                 | > 100         | 3.81       | 0.66         | 50.84         | 6.76        | 18.01          | 4.03         | > 100        | > 100         | 10.49       | > 100        |
| 50               | 20.56                 | > 100         | 12.12      | 1.71         | > 100         | 15.86       | 33.82          | 8.06         | > 100        | > 100         | 26.90       | > 100        |
| 53               | 3.43                  | > 100         | 99.04      | 12.00        | > 100         | > 100       | > 100          | 43.37        | > 100        | > 100         | > 100       | > 100        |
| 56               | 13.70                 | > 100         | 27.58      | 3.07         | > 100         | 24.56       | 63.67          | 9.82         | > 100        | > 100         | 53.75       | > 100        |
| 59               | 21.69                 | 71.60         | 17.19      | 1.83         | > 100         | 14.56       | 43.83          | 6.02         | > 100        | > 100         | 33.83       | > 100        |
| 62               | 23.18                 | 26.08         | 14.14      | 1.46         | > 100         | 13.30       | 44.42          | 5.65         | > 100        | > 100         | 30.70       | > 100        |
| 64               | 26.68                 | 16.07         | 10.92      | 1.13         | > 100         | 12.21       | 40.08          | 5.03         | > 100        | > 100         | 26.36       | > 100        |

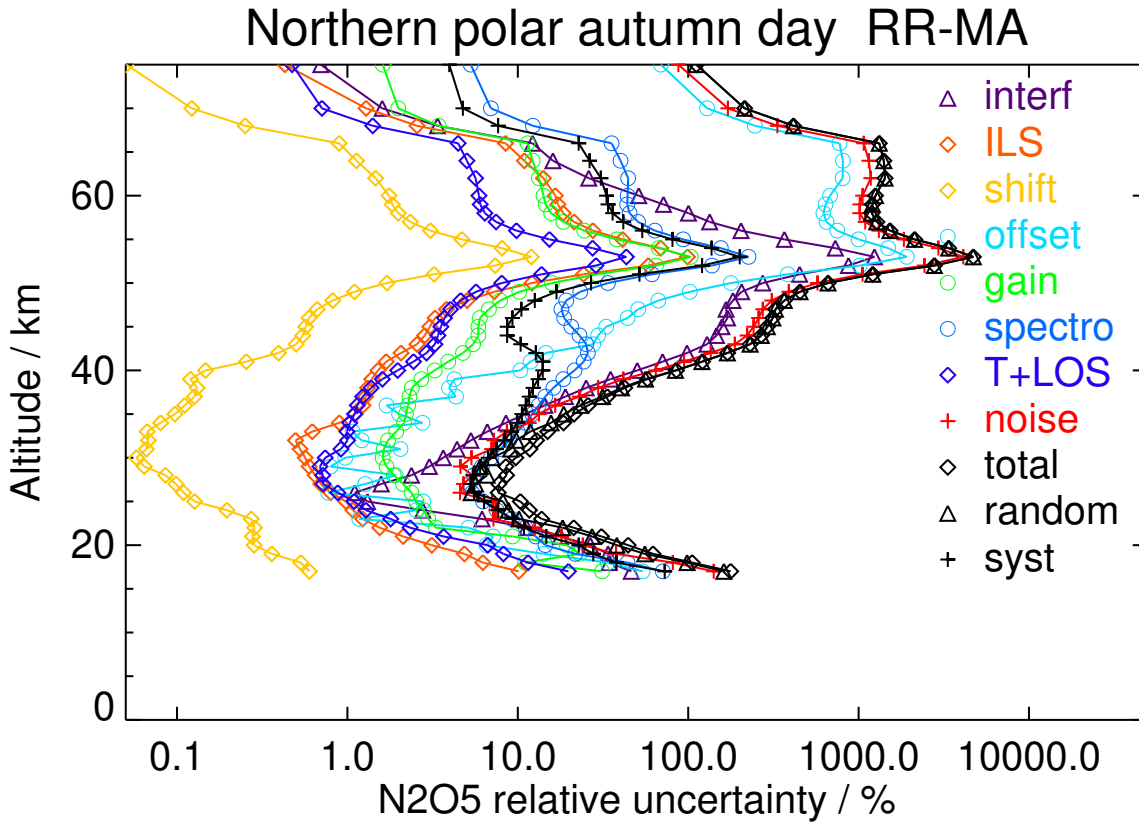


Figure S75: V8R\_N2O5\_561 Northern polar autumn day

Table S80: N2O5 error budget for Northern polar autumn night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 17               | 8.38                  | > 100         | 39.18      | 3.09         | > 100         | > 100       | > 100          | 78.75        | > 100        | > 100         | > 100       | > 100        |
| 20               | 100.12                | 22.81         | 1.84       | 0.30         | 6.23          | 20.64       | 13.93          | 6.86         | 24.89        | 35.73         | 23.92       | 43.00        |
| 23               | 400.32                | 5.72          | 1.06       | 0.25         | 1.34          | 2.93        | 9.67           | 1.85         | 7.58         | 10.11         | 9.81        | 14.09        |
| 26               | 855.26                | 1.17          | 0.61       | 0.08         | 1.01          | 2.12        | 5.25           | 0.87         | 5.12         | 5.71          | 5.40        | 7.86         |
| 29               | 999.92                | 2.97          | 0.29       | 0.04         | 1.17          | 1.55        | 7.05           | 0.80         | 5.81         | 7.02          | 6.90        | 9.84         |
| 32               | 630.82                | 6.47          | 0.88       | 0.10         | 2.02          | 1.79        | 11.80          | 1.37         | 11.30        | 13.78         | 11.35       | 17.85        |
| 35               | 286.27                | 17.93         | 1.93       | 0.09         | 4.25          | 2.81        | 16.61          | 1.69         | 28.32        | 34.29         | 16.01       | 37.84        |
| 38               | 145.75                | 39.84         | 1.74       | 0.16         | 8.08          | 4.16        | 14.78          | 1.72         | 61.75        | 74.25         | 13.89       | 75.54        |
| 41               | 93.97                 | 66.57         | 1.07       | 0.30         | 13.37         | 4.94        | 10.77          | 2.05         | > 100        | > 100         | 8.98        | > 100        |
| 44               | 42.36                 | > 100         | 2.40       | 0.52         | 34.97         | 6.30        | 16.33          | 3.76         | > 100        | > 100         | 10.36       | > 100        |
| 47               | 17.75                 | > 100         | 10.27      | 1.26         | > 100         | 10.25       | 32.45          | 9.36         | > 100        | > 100         | 22.30       | > 100        |
| 50               | 25.66                 | > 100         | 11.38      | 1.12         | > 100         | 10.98       | 23.55          | 6.20         | > 100        | > 100         | 21.65       | > 100        |
| 53               | 29.82                 | > 100         | 13.33      | 1.16         | > 100         | 12.24       | 23.01          | 4.57         | > 100        | > 100         | 23.22       | > 100        |
| 56               | 29.45                 | > 100         | 15.81      | 1.26         | > 100         | 13.86       | 25.54          | 4.38         | > 100        | > 100         | 25.76       | > 100        |
| 59               | 18.95                 | 91.71         | 25.77      | 1.92         | > 100         | 22.73       | 42.56          | 7.18         | > 100        | > 100         | 41.45       | > 100        |
| 62               | 17.82                 | 42.16         | 26.50      | 1.77         | > 100         | 24.00       | 48.93          | 8.19         | > 100        | > 100         | 43.97       | > 100        |
| 64               | 18.17                 | 27.57         | 24.64      | 1.52         | > 100         | 22.66       | 49.79          | 8.33         | > 100        | > 100         | 42.19       | > 100        |

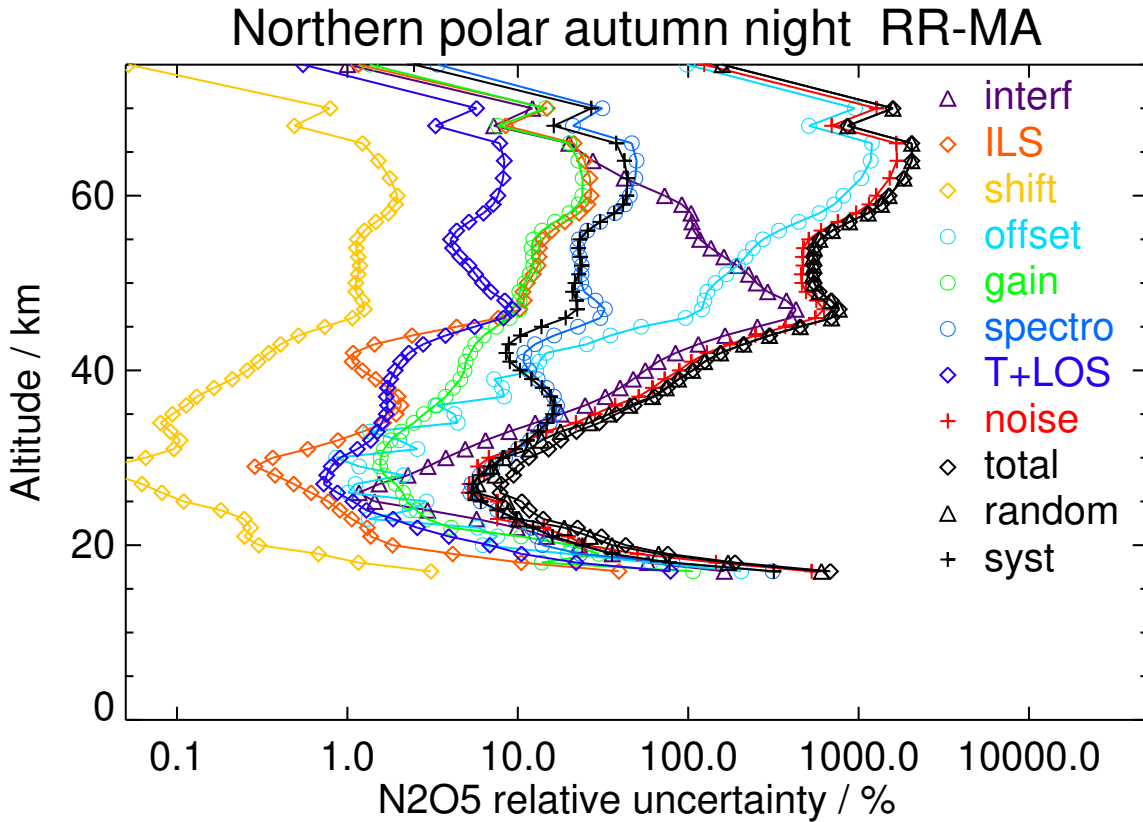


Figure S76: V8R\_N2O5\_561 Northern polar autumn night

Table S81: N<sub>2</sub>O<sub>5</sub> error budget for Northern midlatitude winter day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 14               | 55.39                 | 54.53         | 9.54       | 2.07         | 31.96         | 10.15       | 40.16          | 21.36        | > 100        | > 100         | 42.45       | > 100        |
| 17               | 15.28                 | 65.35         | 20.58      | 1.70         | 54.20         | 94.94       | 64.62          | 31.45        | > 100        | > 100         | 76.53       | > 100        |
| 20               | 128.84                | 12.96         | 2.97       | 0.48         | 6.43          | 6.78        | 19.57          | 4.47         | 20.61        | 28.34         | 17.01       | 33.05        |
| 23               | 378.50                | 5.19          | 0.92       | 0.13         | 2.50          | 3.48        | 8.11           | 1.53         | 7.93         | 11.07         | 7.39        | 13.31        |
| 26               | 705.00                | 2.58          | 1.03       | 0.11         | 1.58          | 2.40        | 5.89           | 0.86         | 5.39         | 7.09          | 5.50        | 8.98         |
| 29               | 967.80                | 2.12          | 0.49       | 0.13         | 1.36          | 1.80        | 5.69           | 0.63         | 4.94         | 6.13          | 5.43        | 8.19         |
| 32               | 1041.13               | 3.06          | 0.40       | 0.06         | 1.37          | 1.52        | 6.56           | 0.52         | 5.53         | 6.74          | 6.50        | 9.36         |
| 35               | 694.03                | 6.62          | 0.34       | 0.05         | 2.06          | 1.41        | 8.91           | 0.80         | 9.62         | 12.10         | 8.73        | 14.92        |
| 38               | 298.76                | 15.68         | 0.52       | 0.07         | 4.59          | 1.58        | 12.48          | 1.21         | 25.59        | 30.66         | 11.90       | 32.89        |
| 41               | 79.12                 | 71.33         | 3.17       | 0.29         | 16.39         | 3.82        | 20.95          | 2.15         | > 100        | > 100         | 19.60       | > 100        |
| 44               | -5.31                 | > 100         | 41.00      | 5.17         | > 100         | 42.85       | > 100          | 25.10        | > 100        | > 100         | > 100       | > 100        |
| 47               | -4.11                 | > 100         | 69.65      | 8.35         | > 100         | > 100       | > 100          | 46.58        | > 100        | > 100         | > 100       | > 100        |
| 50               | 25.11                 | > 100         | 15.86      | 1.62         | > 100         | 19.14       | 28.89          | 8.28         | > 100        | > 100         | 32.08       | > 100        |
| 53               | -3.41                 | > 100         | > 100      | 12.42        | > 100         | > 100       | > 100          | 56.25        | > 100        | > 100         | > 100       | > 100        |
| 56               | -41.71                | 74.16         | 10.39      | 0.89         | > 100         | 7.55        | 21.83          | 4.07         | > 100        | > 100         | 19.59       | > 100        |
| 59               | -52.81                | 32.05         | 6.89       | 0.57         | > 100         | 7.23        | 17.90          | 2.99         | > 100        | > 100         | 15.29       | > 100        |
| 62               | -63.09                | 8.24          | 4.18       | 0.44         | > 100         | 9.10        | 15.73          | 2.52         | > 100        | > 100         | 13.86       | > 100        |
| 64               | -68.30                | 5.97          | 3.33       | 0.46         | > 100         | 10.28       | 14.95          | 2.45         | > 100        | > 100         | 13.94       | > 100        |

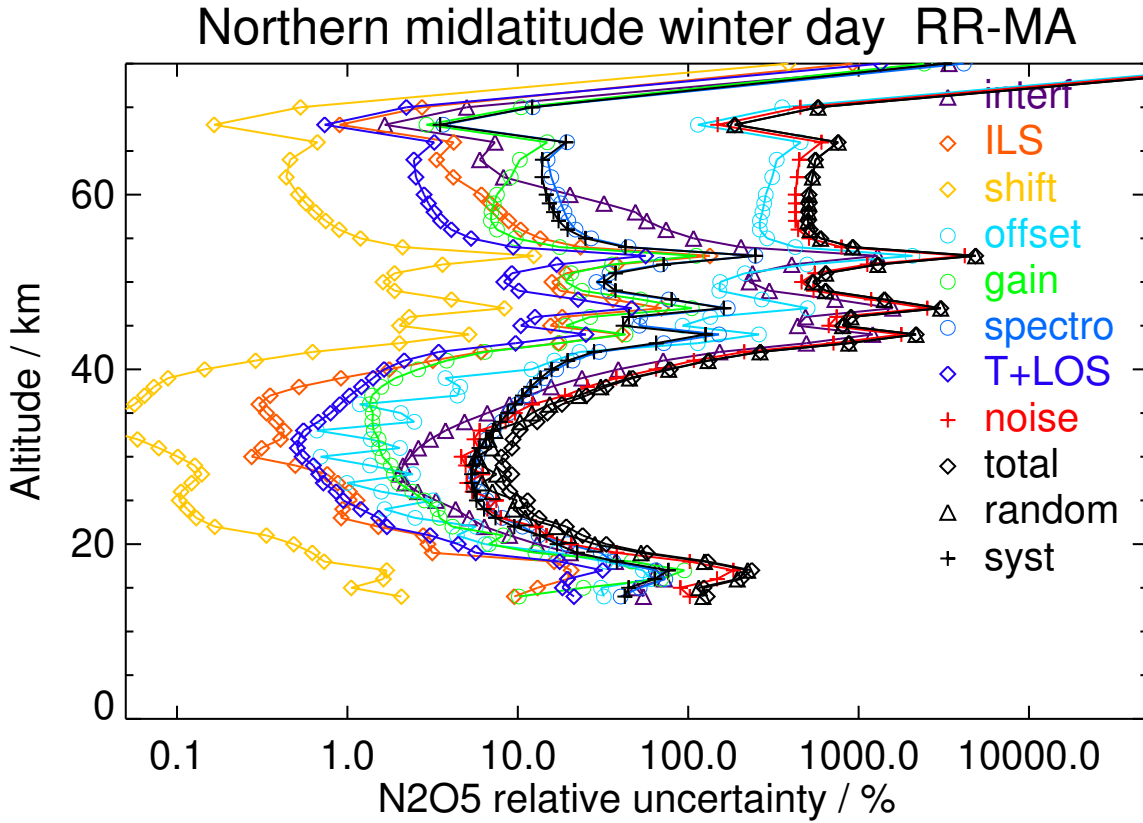


Figure S77: V8R\_N<sub>2</sub>O<sub>5</sub>\_561 Northern midlatitude winter day

Table S82: N2O5 error budget for Northern midlatitude winter night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 17               | 35.19                 | 34.30         | 7.57       | 0.90         | 28.25         | 25.05       | 37.06          | 10.98        | 73.01        | 95.54         | 18.89       | 97.39        |
| 20               | 123.05                | 12.94         | 3.05       | 0.43         | 8.80          | 9.03        | 16.87          | 4.07         | 22.25        | 30.82         | 13.51       | 33.65        |
| 23               | 289.29                | 6.58          | 1.88       | 0.23         | 4.57          | 4.56        | 9.25           | 1.77         | 11.71        | 15.77         | 8.09        | 17.73        |
| 26               | 605.05                | 3.21          | 1.42       | 0.18         | 2.61          | 2.60        | 6.25           | 0.94         | 7.10         | 8.98          | 5.98        | 10.79        |
| 29               | 898.57                | 2.37          | 0.57       | 0.13         | 1.96          | 1.77        | 6.06           | 0.61         | 5.86         | 7.26          | 5.63        | 9.18         |
| 32               | 887.07                | 3.67          | 0.51       | 0.05         | 2.09          | 1.38        | 7.12           | 0.59         | 7.06         | 8.56          | 6.91        | 11.00        |
| 35               | 589.53                | 7.96          | 0.70       | 0.11         | 3.03          | 1.24        | 8.79           | 0.78         | 11.92        | 15.00         | 8.34        | 17.16        |
| 38               | 300.72                | 15.90         | 0.76       | 0.09         | 5.30          | 2.31        | 11.42          | 0.98         | 25.81        | 31.11         | 10.80       | 32.93        |
| 41               | 126.12                | 44.60         | 2.08       | 0.39         | 11.86         | 5.59        | 16.04          | 1.37         | 67.01        | 81.64         | 15.78       | 83.15        |
| 44               | 8.84                  | > 100         | 20.12      | 4.75         | > 100         | 41.96       | > 100          | 15.87        | > 100        | > 100         | > 100       | > 100        |
| 47               | 15.03                 | > 100         | 12.10      | 2.52         | > 100         | 23.05       | 47.71          | 12.30        | > 100        | > 100         | 40.98       | > 100        |
| 50               | 39.56                 | > 100         | 8.33       | 1.07         | 90.48         | 12.98       | 20.33          | 5.23         | > 100        | > 100         | 21.07       | > 100        |
| 53               | 60.06                 | 67.36         | 7.62       | 0.67         | > 100         | 8.00        | 15.85          | 3.25         | > 100        | > 100         | 15.78       | > 100        |
| 56               | 63.36                 | 41.56         | 7.70       | 0.44         | > 100         | 6.64        | 16.56          | 2.86         | > 100        | > 100         | 15.34       | > 100        |
| 59               | 56.11                 | 24.11         | 8.22       | 0.31         | > 100         | 7.84        | 19.88          | 3.11         | > 100        | > 100         | 17.21       | > 100        |
| 62               | 45.93                 | 11.83         | 8.85       | 0.50         | > 100         | 12.27       | 25.68          | 3.81         | > 100        | > 100         | 21.14       | > 100        |
| 64               | 36.81                 | 12.68         | 10.36      | 0.87         | > 100         | 18.14       | 32.89          | 4.92         | > 100        | > 100         | 26.98       | > 100        |

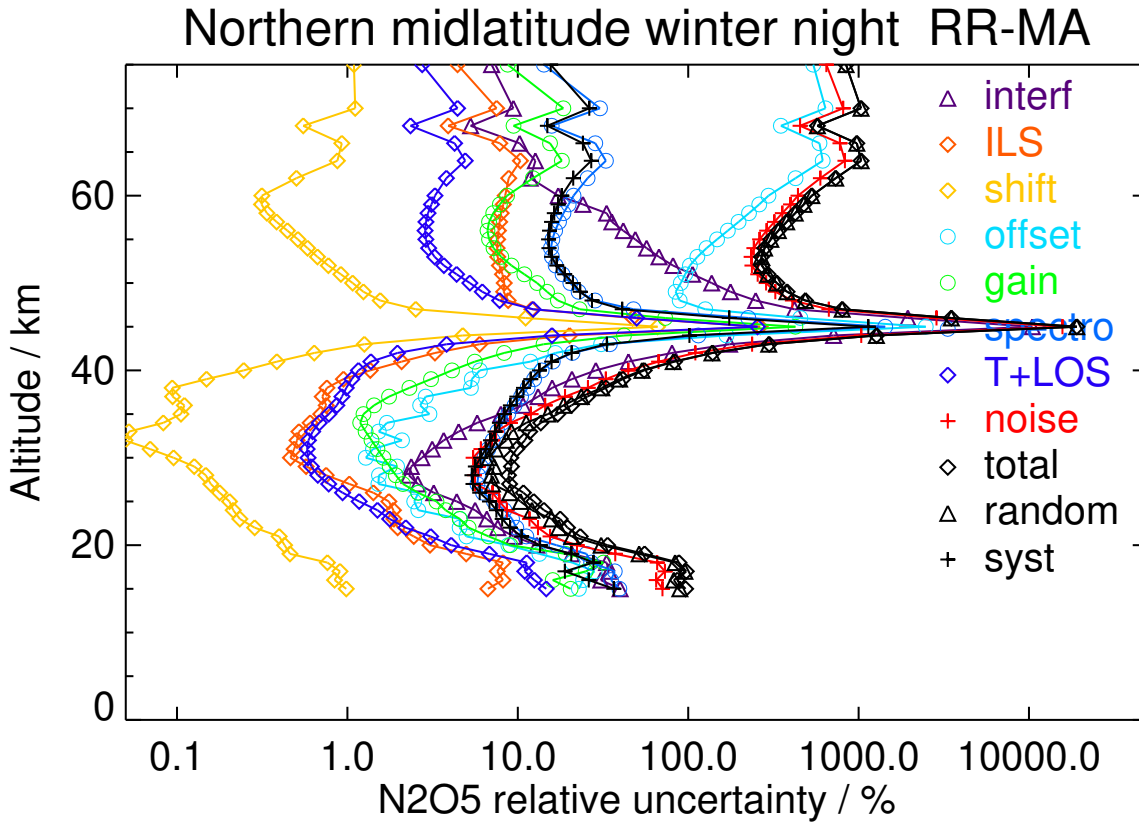


Figure S78: V8R\_N2O5\_561 Northern midlatitude winter night

Table S83: N2O5 error budget for Northern midlatitude spring day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 17               | 53.36                 | 26.14         | 4.51       | 0.79         | 30.57         | 24.31       | 38.62          | 13.10        | 82.85        | 95.11         | 41.38       | > 100        |
| 20               | 138.63                | 9.99          | 4.75       | 0.24         | 5.60          | 14.08       | 10.91          | 5.90         | 20.32        | 24.72         | 17.55       | 30.31        |
| 23               | 398.61                | 4.06          | 1.35       | 0.24         | 1.08          | 2.46        | 7.04           | 1.70         | 6.85         | 8.58          | 7.17        | 11.18        |
| 26               | 656.80                | 2.32          | 0.93       | 0.11         | 0.63          | 2.39        | 5.15           | 0.88         | 5.04         | 5.85          | 5.56        | 8.07         |
| 29               | 830.13                | 1.93          | 0.38       | 0.08         | 0.53          | 1.69        | 5.63           | 0.61         | 4.88         | 5.52          | 5.69        | 7.93         |
| 32               | 725.62                | 3.49          | 0.95       | 0.15         | 0.70          | 1.43        | 7.70           | 0.72         | 6.55         | 7.80          | 7.59        | 10.88        |
| 35               | 318.68                | 12.15         | 2.09       | 0.36         | 1.76          | 1.34        | 11.80          | 1.30         | 17.00        | 21.32         | 11.50       | 24.22        |
| 38               | 68.45                 | 55.51         | 3.51       | 0.36         | 9.12          | 4.15        | 22.17          | 2.40         | 88.61        | > 100         | 20.01       | > 100        |
| 41               | 3.78                  | > 100         | 61.90      | 8.02         | > 100         | > 100       | > 100          | 24.31        | > 100        | > 100         | > 100       | > 100        |
| 44               | 1.14                  | > 100         | > 100      | 24.48        | > 100         | > 100       | > 100          | 80.80        | > 100        | > 100         | > 100       | > 100        |
| 47               | 29.64                 | > 100         | 3.00       | 1.35         | 35.33         | 9.17        | 17.56          | 4.80         | > 100        | > 100         | 12.71       | > 100        |
| 50               | 30.74                 | > 100         | 4.02       | 1.91         | 65.97         | 11.34       | 20.62          | 6.10         | > 100        | > 100         | 18.90       | > 100        |
| 53               | 24.66                 | > 100         | 10.24      | 2.55         | > 100         | 12.40       | 31.59          | 7.41         | > 100        | > 100         | 26.98       | > 100        |
| 56               | -2.73                 | > 100         | > 100      | 19.96        | > 100         | 94.23       | > 100          | 59.54        | > 100        | > 100         | > 100       | > 100        |
| 59               | -23.36                | 38.60         | 14.10      | 1.60         | > 100         | 12.57       | 39.90          | 6.31         | > 100        | > 100         | 30.25       | > 100        |
| 62               | -41.71                | 11.57         | 6.34       | 0.46         | > 100         | 12.71       | 24.11          | 3.64         | > 100        | > 100         | 19.55       | > 100        |
| 64               | -55.50                | 9.26          | 4.11       | 0.54         | > 100         | 13.25       | 18.81          | 3.08         | > 100        | > 100         | 17.09       | > 100        |

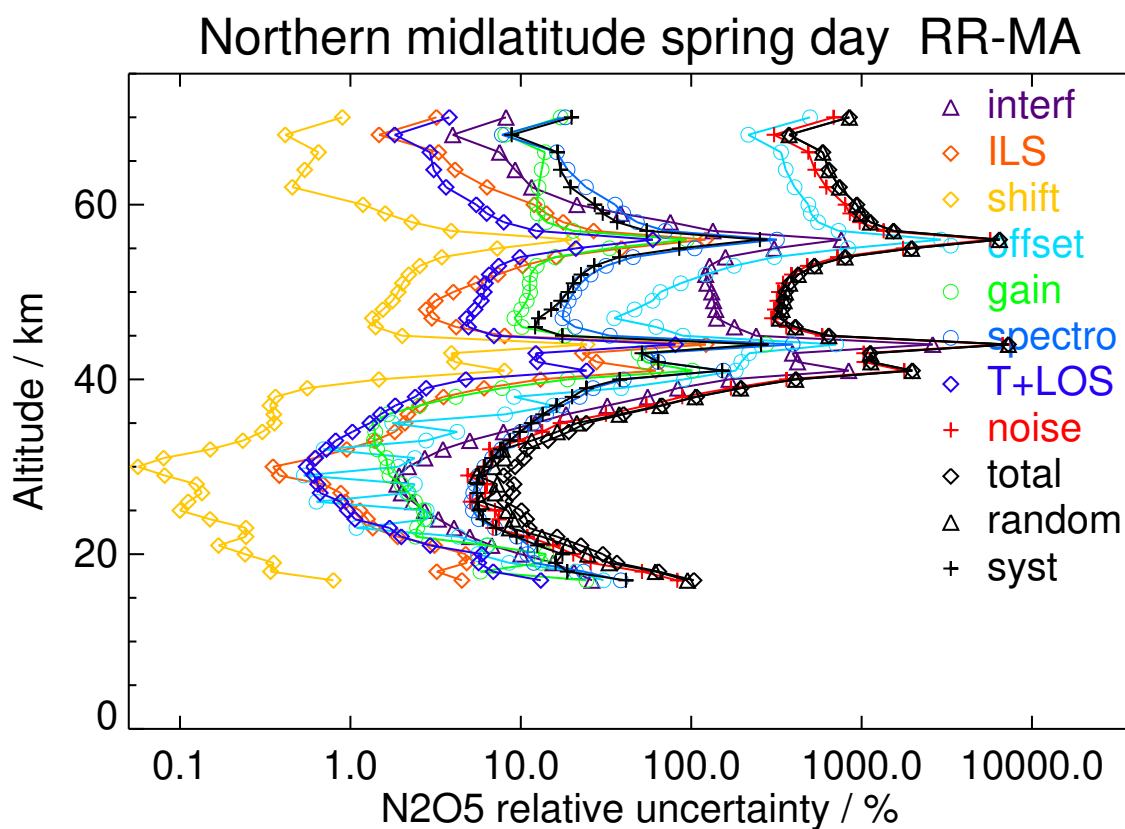


Figure S79: V8R\_N2O5\_561 Northern midlatitude spring day

Table S84: N2O5 error budget for Northern midlatitude spring night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 17               | 69.82                 | 20.26         | 3.78       | 0.62         | 22.50         | 12.42       | 30.53          | 9.67         | 61.70        | 70.74         | 30.24       | 76.93        |
| 20               | 130.88                | 10.59         | 3.73       | 0.22         | 5.71          | 14.71       | 8.83           | 5.47         | 21.05        | 25.58         | 16.49       | 30.43        |
| 23               | 314.17                | 5.34          | 1.25       | 0.28         | 1.48          | 2.80        | 7.01           | 1.83         | 8.66         | 10.79         | 7.16        | 12.95        |
| 26               | 513.19                | 3.08          | 0.98       | 0.11         | 0.95          | 2.29        | 5.50           | 0.97         | 6.75         | 7.93          | 5.52        | 9.66         |
| 29               | 668.83                | 2.51          | 0.51       | 0.09         | 0.94          | 1.60        | 5.95           | 0.65         | 6.54         | 7.52          | 5.66        | 9.41         |
| 32               | 629.63                | 4.23          | 0.52       | 0.08         | 1.24          | 1.58        | 6.95           | 0.64         | 8.28         | 9.83          | 6.55        | 11.81        |
| 35               | 445.68                | 8.78          | 0.97       | 0.13         | 1.88          | 1.52        | 8.37           | 0.68         | 13.05        | 16.39         | 7.50        | 18.02        |
| 38               | 265.35                | 14.54         | 1.12       | 0.11         | 3.25          | 2.19        | 10.52          | 0.86         | 24.26        | 28.90         | 9.65        | 30.46        |
| 41               | 120.37                | 27.50         | 1.60       | 0.30         | 7.67          | 4.43        | 14.25          | 1.29         | 59.01        | 65.97         | 13.14       | 67.26        |
| 44               | 24.13                 | > 100         | 4.99       | 1.20         | 42.78         | 11.95       | 36.03          | 5.38         | > 100        | > 100         | 24.18       | > 100        |
| 47               | 49.71                 | 84.23         | 2.02       | 0.65         | 24.47         | 6.15        | 13.91          | 3.31         | > 100        | > 100         | 10.19       | > 100        |
| 50               | 61.31                 | 67.64         | 3.03       | 0.75         | 32.73         | 5.40        | 12.05          | 3.20         | > 100        | > 100         | 10.73       | > 100        |
| 53               | 14.25                 | > 100         | 23.00      | 3.41         | > 100         | 22.63       | 50.86          | 13.17        | > 100        | > 100         | 48.67       | > 100        |
| 56               | -4.58                 | > 100         | 85.50      | 8.65         | > 100         | 65.84       | > 100          | 35.86        | > 100        | > 100         | > 100       | > 100        |
| 59               | -4.16                 | > 100         | 92.22      | 5.98         | > 100         | 72.36       | > 100          | 35.90        | > 100        | > 100         | > 100       | > 100        |
| 62               | -2.65                 | > 100         | > 100      | 5.81         | > 100         | > 100       | > 100          | 56.45        | > 100        | > 100         | > 100       | > 100        |
| 64               | -3.64                 | > 100         | 75.66      | 7.89         | > 100         | > 100       | > 100          | 44.10        | > 100        | > 100         | > 100       | > 100        |

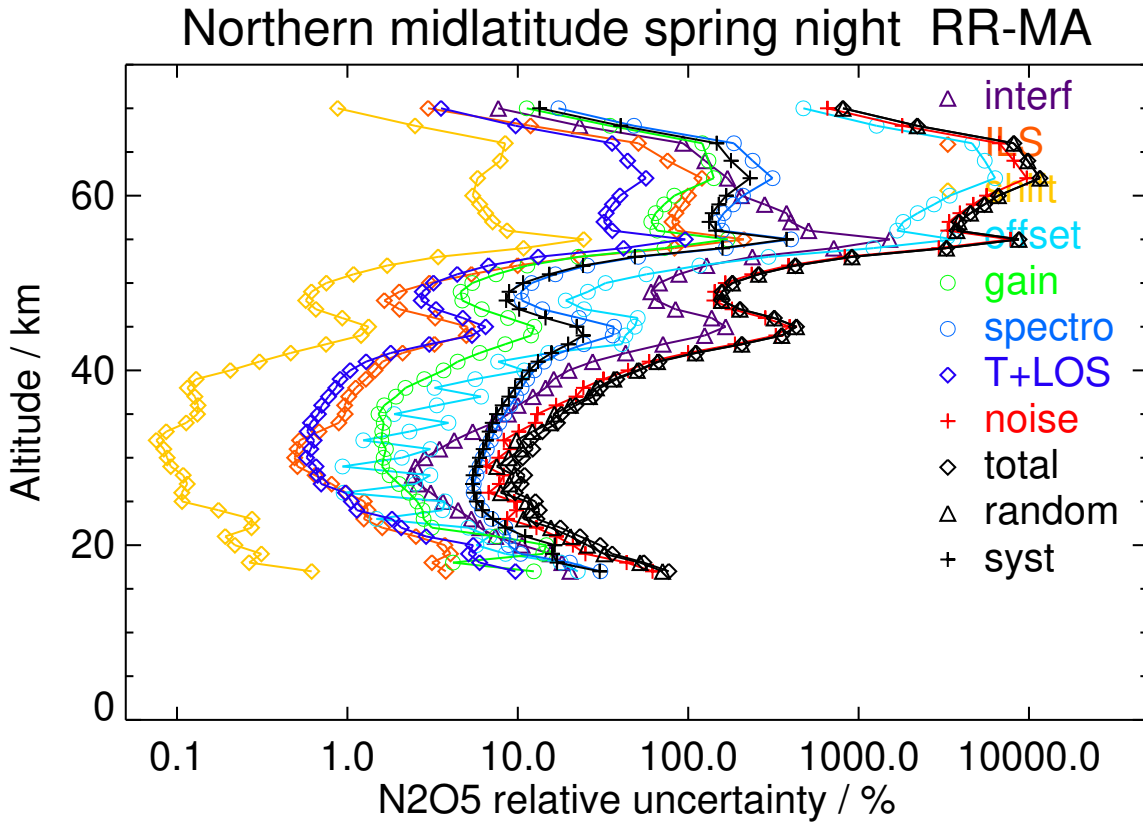


Figure S80: V8R\_N2O5\_561 Northern midlatitude spring night

Table S85: N2O5 error budget for Northern midlatitude summer day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 17               | 35.28                 | 42.35         | 5.22       | 1.88         | 42.07         | 42.41       | 60.01          | 19.65        | > 100        | > 100         | 67.48       | > 100        |
| 20               | 100.16                | 11.72         | 3.95       | 0.36         | 7.60          | 21.21       | 9.81           | 7.40         | 29.45        | 34.14         | 22.65       | 40.97        |
| 23               | 288.91                | 5.05          | 1.67       | 0.25         | 1.61          | 2.86        | 8.65           | 2.15         | 8.80         | 10.86         | 8.84        | 14.00        |
| 26               | 554.68                | 2.29          | 1.03       | 0.10         | 0.75          | 2.57        | 5.21           | 1.02         | 5.08         | 5.91          | 5.70        | 8.21         |
| 29               | 692.05                | 1.88          | 0.38       | 0.06         | 0.57          | 1.58        | 6.04           | 0.61         | 4.84         | 5.45          | 6.10        | 8.17         |
| 32               | 527.07                | 4.33          | 1.75       | 0.23         | 0.92          | 1.39        | 8.61           | 0.79         | 7.58         | 9.12          | 8.58        | 12.52        |
| 35               | 194.69                | 16.92         | 3.15       | 0.47         | 3.10          | 1.30        | 13.08          | 1.53         | 24.07        | 29.91         | 12.87       | 32.57        |
| 38               | 14.80                 | > 100         | 17.60      | 1.47         | 49.54         | 14.37       | 56.70          | 7.17         | > 100        | > 100         | 46.37       | > 100        |
| 41               | 14.53                 | > 100         | 13.22      | 1.31         | 55.91         | 20.54       | 30.53          | 5.27         | > 100        | > 100         | 27.44       | > 100        |
| 44               | 32.73                 | 80.39         | 2.25       | 0.53         | 26.63         | 3.48        | 15.69          | 2.52         | > 100        | > 100         | 8.06        | > 100        |
| 47               | 0.98                  | > 100         | 94.43      | 25.17        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 50               | 6.29                  | > 100         | 35.94      | 6.99         | > 100         | 31.76       | 88.04          | 18.65        | > 100        | > 100         | 64.60       | > 100        |
| 53               | 48.14                 | 62.75         | 6.12       | 1.11         | 61.38         | 3.31        | 13.06          | 2.46         | > 100        | > 100         | 10.43       | > 100        |
| 56               | 83.43                 | 21.25         | 3.49       | 0.67         | 70.92         | 2.21        | 10.07          | 1.47         | > 100        | > 100         | 7.64        | > 100        |
| 59               | 105.91                | 5.78          | 2.11       | 0.44         | 89.56         | 3.10        | 9.56           | 1.22         | > 100        | > 100         | 7.15        | > 100        |
| 62               | 130.42                | 4.92          | 1.95       | 0.18         | > 100         | 5.29        | 8.86           | 1.28         | > 100        | > 100         | 7.81        | > 100        |
| 64               | 144.24                | 4.62          | 2.93       | 0.17         | > 100         | 6.78        | 8.42           | 1.45         | > 100        | > 100         | 8.87        | > 100        |

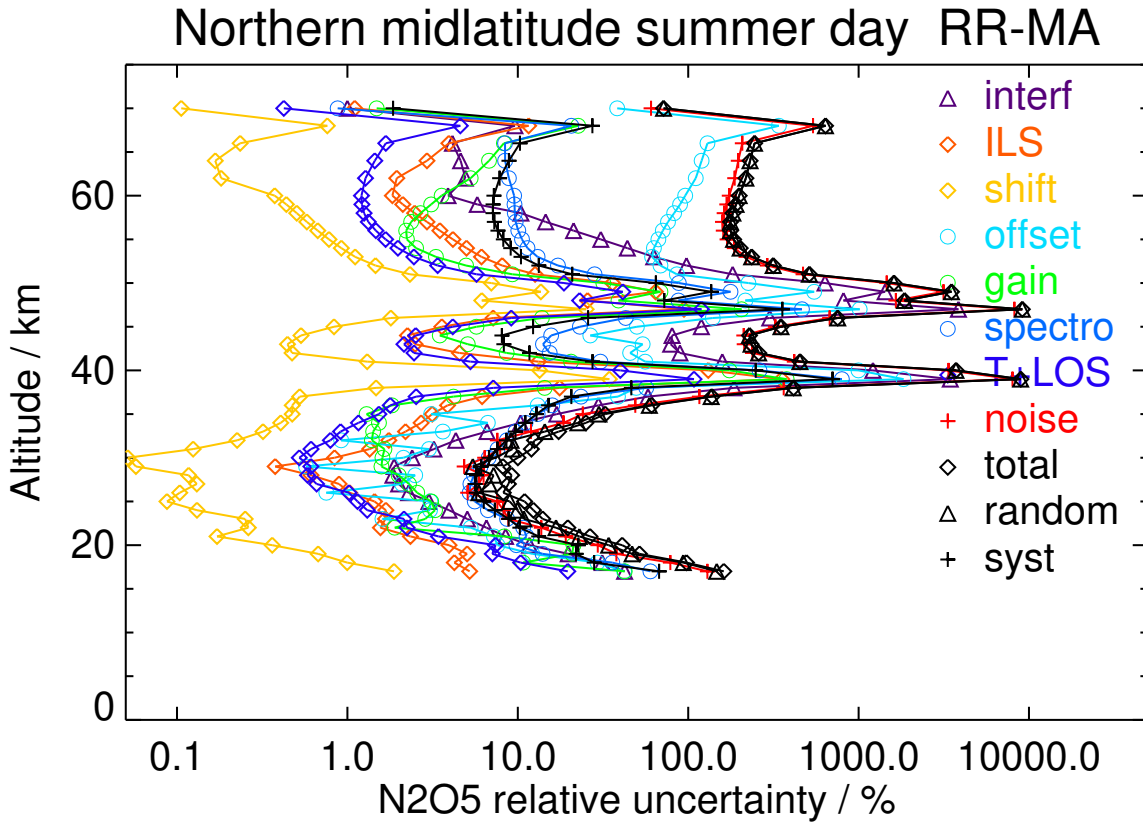


Figure S81: V8R\_N2O5\_561 Northern midlatitude summer day

Table S86: N2O5 error budget for Northern midlatitude summer night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 17               | 76.20                 | 19.79         | 2.68       | 0.86         | 19.06         | 14.81       | 17.21          | 8.71         | 59.80        | 67.20         | 20.34       | 70.21        |
| 20               | 37.45                 | 29.41         | 8.40       | 0.97         | 19.00         | 41.87       | 27.34          | 17.27        | 76.60        | 87.79         | 47.51       | 99.82        |
| 23               | 224.06                | 6.44          | 1.67       | 0.26         | 2.15          | 2.54        | 9.56           | 2.52         | 11.16        | 13.60         | 9.62        | 16.66        |
| 26               | 369.21                | 3.25          | 0.86       | 0.10         | 1.25          | 2.58        | 5.48           | 1.23         | 7.50         | 8.67          | 5.68        | 10.36        |
| 29               | 494.73                | 2.51          | 0.55       | 0.12         | 1.05          | 1.68        | 5.51           | 0.69         | 6.67         | 7.60          | 5.30        | 9.26         |
| 32               | 512.77                | 4.50          | 0.84       | 0.07         | 1.21          | 1.50        | 6.57           | 0.55         | 7.71         | 9.36          | 6.33        | 11.30        |
| 35               | 354.42                | 9.45          | 1.47       | 0.20         | 2.15          | 1.30        | 8.61           | 0.72         | 13.10        | 16.79         | 7.90        | 18.56        |
| 38               | 162.66                | 16.07         | 1.52       | 0.22         | 5.36          | 2.23        | 12.54          | 1.14         | 32.56        | 37.43         | 10.59       | 38.89        |
| 41               | 59.11                 | 36.03         | 2.52       | 0.32         | 16.08         | 6.24        | 15.77          | 1.67         | > 100        | > 100         | 12.95       | > 100        |
| 44               | 36.64                 | 70.84         | 2.36       | 0.53         | 27.79         | 3.39        | 14.82          | 2.49         | > 100        | > 100         | 9.32        | > 100        |
| 47               | 9.37                  | > 100         | 9.25       | 2.43         | > 100         | 23.64       | 56.01          | 12.95        | > 100        | > 100         | 40.28       | > 100        |
| 50               | 21.93                 | > 100         | 9.12       | 1.84         | 64.64         | 10.20       | 25.67          | 5.56         | > 100        | > 100         | 18.68       | > 100        |
| 53               | 56.92                 | 53.36         | 4.69       | 0.92         | 47.25         | 3.86        | 11.69          | 2.25         | > 100        | > 100         | 9.36        | > 100        |
| 56               | 92.02                 | 18.77         | 3.22       | 0.57         | 59.84         | 2.28        | 9.13           | 1.38         | > 100        | > 100         | 7.37        | > 100        |
| 59               | 95.27                 | 5.43          | 2.53       | 0.41         | 94.91         | 2.27        | 10.20          | 1.31         | > 100        | > 100         | 7.96        | > 100        |
| 62               | 93.66                 | 7.74          | 1.57       | 0.17         | > 100         | 4.95        | 11.50          | 1.55         | > 100        | > 100         | 9.51        | > 100        |
| 64               | 99.88                 | 7.51          | 2.98       | 0.30         | > 100         | 7.39        | 11.26          | 1.83         | > 100        | > 100         | 10.95       | > 100        |

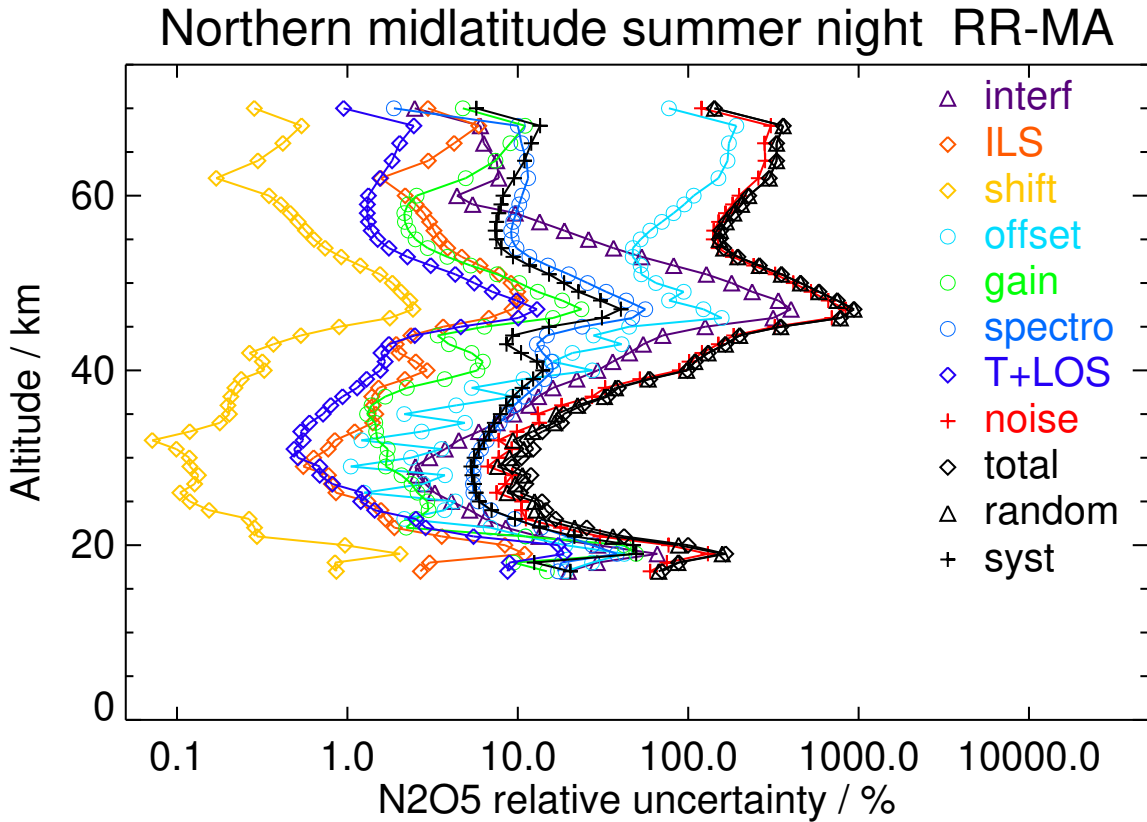


Figure S82: V8R\_N2O5\_561 Northern midlatitude summer night

Table S87: N2O5 error budget for Northern midlatitude autumn day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 17               | 45.22                 | 31.13         | 4.71       | 0.72         | 37.11         | 26.64       | 52.00          | 14.94        | > 100        | > 100         | 52.15       | > 100        |
| 20               | 84.06                 | 17.79         | 5.01       | 0.30         | 7.83          | 22.72       | 14.00          | 8.18         | 30.82        | 38.65         | 25.27       | 46.18        |
| 23               | 307.69                | 6.03          | 1.69       | 0.30         | 1.65          | 3.30        | 9.94           | 2.17         | 9.09         | 11.71         | 10.09       | 15.46        |
| 26               | 717.83                | 2.20          | 1.30       | 0.13         | 0.91          | 2.52        | 5.72           | 1.05         | 5.00         | 5.94          | 6.10        | 8.52         |
| 29               | 1124.71               | 1.74          | 0.74       | 0.11         | 0.71          | 1.65        | 5.30           | 0.61         | 4.03         | 4.68          | 5.43        | 7.17         |
| 32               | 1077.74               | 2.92          | 0.42       | 0.06         | 0.81          | 1.51        | 7.26           | 0.67         | 5.04         | 6.12          | 7.27        | 9.50         |
| 35               | 699.32                | 6.20          | 1.10       | 0.15         | 1.33          | 1.42        | 9.49           | 0.85         | 8.92         | 11.24         | 9.35        | 14.62        |
| 38               | 336.67                | 14.72         | 0.76       | 0.12         | 2.73          | 1.51        | 11.10          | 1.14         | 20.91        | 25.95         | 10.74       | 28.09        |
| 41               | 143.88                | 36.38         | 1.04       | 0.19         | 6.49          | 2.25        | 10.91          | 1.32         | 54.72        | 66.19         | 10.34       | 66.99        |
| 44               | 61.86                 | 84.55         | 2.92       | 0.52         | 16.96         | 5.12        | 11.83          | 2.01         | > 100        | > 100         | 9.16        | > 100        |
| 47               | 28.35                 | > 100         | 5.92       | 1.51         | 52.87         | 11.81       | 20.13          | 5.33         | > 100        | > 100         | 15.98       | > 100        |
| 50               | 33.01                 | > 100         | 6.59       | 2.05         | 90.42         | 11.32       | 21.01          | 5.45         | > 100        | > 100         | 17.73       | > 100        |
| 53               | 67.32                 | 51.20         | 4.30       | 1.20         | 87.52         | 4.86        | 12.74          | 2.57         | > 100        | > 100         | 10.87       | > 100        |
| 56               | 102.46                | 22.18         | 3.23       | 0.74         | 94.27         | 2.88        | 10.19          | 1.54         | > 100        | > 100         | 8.55        | > 100        |
| 59               | 122.20                | 9.36          | 2.66       | 0.51         | > 100         | 3.09        | 9.63           | 1.25         | > 100        | > 100         | 8.10        | > 100        |
| 62               | 130.87                | 3.22          | 2.18       | 0.33         | > 100         | 4.71        | 9.95           | 1.26         | > 100        | > 100         | 8.77        | > 100        |
| 64               | 136.29                | 2.86          | 1.93       | 0.26         | > 100         | 5.83        | 10.00          | 1.32         | > 100        | > 100         | 9.28        | > 100        |

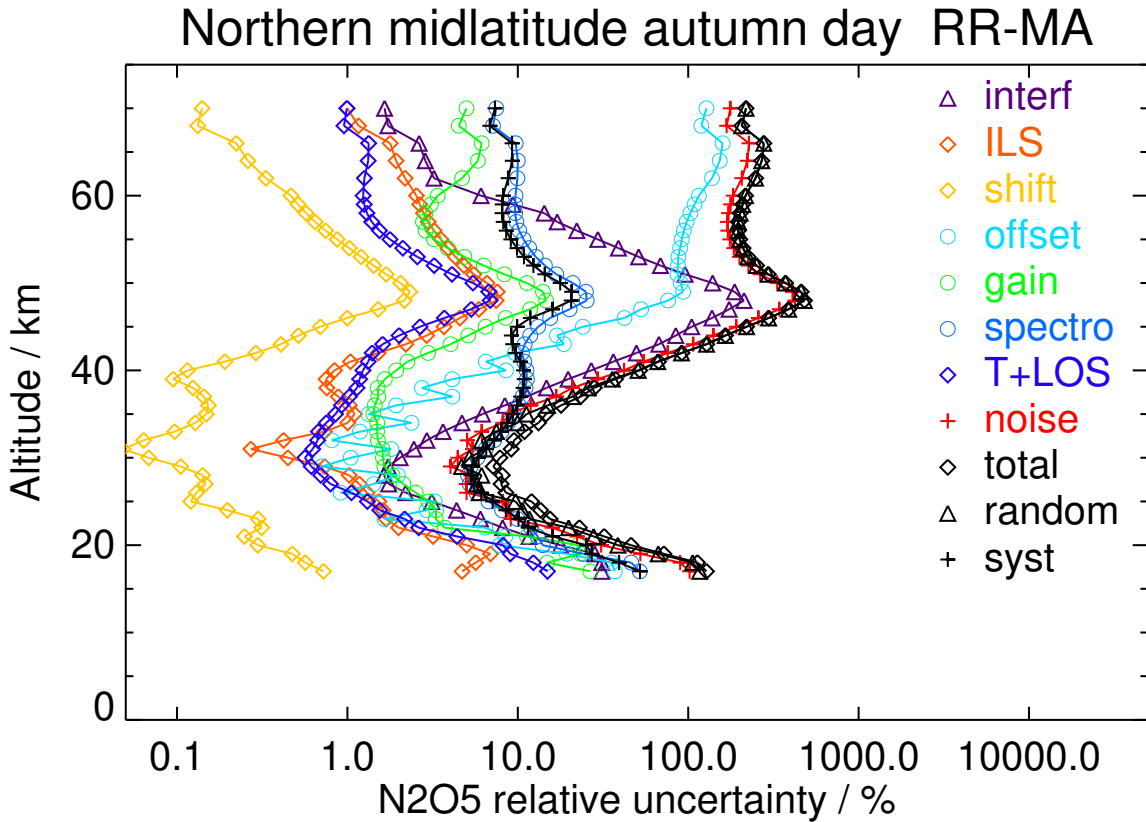


Figure S83: V8R\_N2O5\_561 Northern midlatitude autumn day

Table S88: N2O5 error budget for Northern midlatitude autumn night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 17               | 60.54                 | 22.22         | 3.62       | 0.77         | 26.43         | 21.93       | 33.20          | 11.31        | 73.96        | 84.22         | 35.96       | 91.58        |
| 20               | 107.83                | 13.97         | 4.96       | 0.25         | 6.34          | 18.69       | 14.45          | 6.54         | 23.98        | 30.39         | 22.64       | 37.89        |
| 23               | 361.18                | 5.14          | 1.50       | 0.29         | 1.49          | 3.42        | 8.50           | 1.90         | 7.44         | 9.80          | 8.82        | 13.18        |
| 26               | 738.15                | 2.21          | 1.04       | 0.12         | 0.86          | 2.53        | 5.40           | 0.94         | 4.62         | 5.54          | 5.82        | 8.03         |
| 29               | 1078.22               | 1.76          | 0.60       | 0.09         | 0.73          | 1.67        | 5.43           | 0.60         | 4.04         | 4.75          | 5.52        | 7.28         |
| 32               | 1092.71               | 2.88          | 0.20       | 0.04         | 0.86          | 1.58        | 6.70           | 0.61         | 4.90         | 6.05          | 6.65        | 8.99         |
| 35               | 892.40                | 4.87          | 0.52       | 0.06         | 1.16          | 1.41        | 7.57           | 0.63         | 7.04         | 8.87          | 7.49        | 11.61        |
| 38               | 589.90                | 8.35          | 0.40       | 0.05         | 1.82          | 1.46        | 8.88           | 0.81         | 12.13        | 15.11         | 8.60        | 17.38        |
| 41               | 318.60                | 16.68         | 0.67       | 0.15         | 3.35          | 2.34        | 10.74          | 1.05         | 25.06        | 30.57         | 10.26       | 32.25        |
| 44               | 127.76                | 41.35         | 1.88       | 0.41         | 9.13          | 4.33        | 13.76          | 1.58         | 69.53        | 81.74         | 12.67       | 82.71        |
| 47               | 86.95                 | 57.29         | 1.60       | 0.57         | 18.83         | 3.07        | 11.93          | 2.05         | > 100        | > 100         | 9.30        | > 100        |
| 50               | 106.24                | 43.85         | 1.39       | 0.58         | 30.24         | 3.07        | 9.61           | 1.94         | > 100        | > 100         | 7.66        | > 100        |
| 53               | 114.33                | 30.57         | 1.81       | 0.60         | 54.32         | 3.33        | 10.22          | 1.80         | > 100        | > 100         | 8.60        | > 100        |
| 56               | 101.40                | 22.28         | 2.57       | 0.60         | 98.95         | 3.72        | 13.06          | 1.85         | > 100        | > 100         | 10.97       | > 100        |
| 59               | 113.14                | 9.62          | 2.51       | 0.41         | > 100         | 3.62        | 12.64          | 1.54         | > 100        | > 100         | 10.52       | > 100        |
| 62               | 140.60                | 2.81          | 2.08       | 0.20         | > 100         | 3.80        | 10.81          | 1.21         | > 100        | > 100         | 8.94        | > 100        |
| 64               | 151.21                | 2.53          | 1.98       | 0.14         | > 100         | 4.26        | 10.32          | 1.16         | > 100        | > 100         | 8.57        | > 100        |

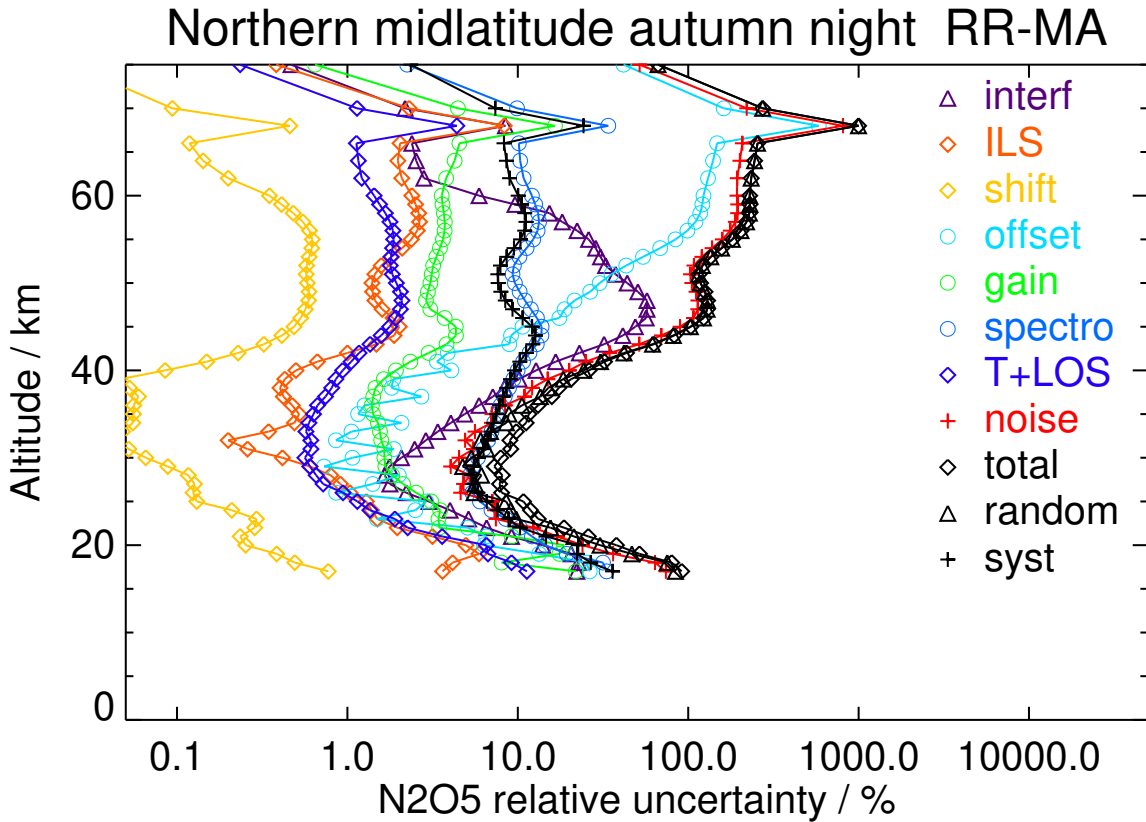


Figure S84: V8R\_N2O5\_561 Northern midlatitude autumn night

Table S89: N2O5 error budget for Tropics day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 17               | -6.13                 | > 100         | 81.13      | 10.38        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 20               | 31.08                 | 38.67         | 17.84      | 1.55         | 17.40         | 4.92        | 36.90          | 19.30        | 95.46        | > 100         | 36.98       | > 100        |
| 23               | 201.48                | 7.01          | 5.22       | 0.25         | 2.73          | 2.78        | 13.60          | 3.38         | 15.62        | 18.27         | 14.08       | 23.06        |
| 26               | 488.02                | 3.83          | 2.45       | 0.16         | 1.16          | 2.27        | 6.77           | 1.37         | 7.11         | 8.78          | 6.96        | 11.20        |
| 29               | 764.94                | 2.19          | 1.18       | 0.20         | 0.70          | 1.81        | 5.24           | 0.72         | 5.17         | 5.96          | 5.40        | 8.04         |
| 32               | 837.22                | 1.32          | 0.68       | 0.06         | 0.57          | 1.50        | 6.22           | 0.50         | 5.42         | 5.86          | 6.23        | 8.55         |
| 35               | 515.04                | 2.88          | 1.69       | 0.19         | 0.96          | 1.40        | 8.36           | 0.74         | 10.11        | 10.78         | 8.40        | 13.67        |
| 38               | 194.53                | 9.26          | 1.25       | 0.16         | 2.83          | 1.80        | 10.33          | 1.00         | 29.67        | 31.49         | 9.73        | 32.96        |
| 41               | 40.82                 | 61.42         | 5.51       | 0.54         | 14.45         | 9.77        | 16.64          | 1.97         | > 100        | > 100         | 17.23       | > 100        |
| 44               | 3.68                  | > 100         | 65.36      | 9.04         | > 100         | > 100       | > 100          | 25.26        | > 100        | > 100         | > 100       | > 100        |
| 47               | 29.61                 | > 100         | 5.48       | 1.92         | 31.38         | 6.63        | 20.29          | 3.72         | > 100        | > 100         | 17.55       | > 100        |
| 50               | 29.64                 | 93.33         | 8.07       | 2.95         | 60.18         | 4.52        | 25.33          | 5.04         | > 100        | > 100         | 21.96       | > 100        |
| 53               | 41.30                 | 54.99         | 9.29       | 2.35         | 97.46         | 3.45        | 22.05          | 4.23         | > 100        | > 100         | 20.28       | > 100        |
| 56               | 65.34                 | 23.08         | 6.89       | 1.28         | > 100         | 4.03        | 16.48          | 2.75         | > 100        | > 100         | 14.92       | > 100        |
| 59               | 79.36                 | 11.02         | 5.53       | 0.70         | > 100         | 5.34        | 15.24          | 2.26         | > 100        | > 100         | 13.70       | > 100        |
| 62               | 92.04                 | 3.97          | 4.08       | 0.31         | > 100         | 7.50        | 14.77          | 2.10         | > 100        | > 100         | 13.87       | > 100        |
| 64               | 105.36                | 3.75          | 3.19       | 0.44         | > 100         | 8.27        | 13.64          | 2.02         | > 100        | > 100         | 13.44       | > 100        |

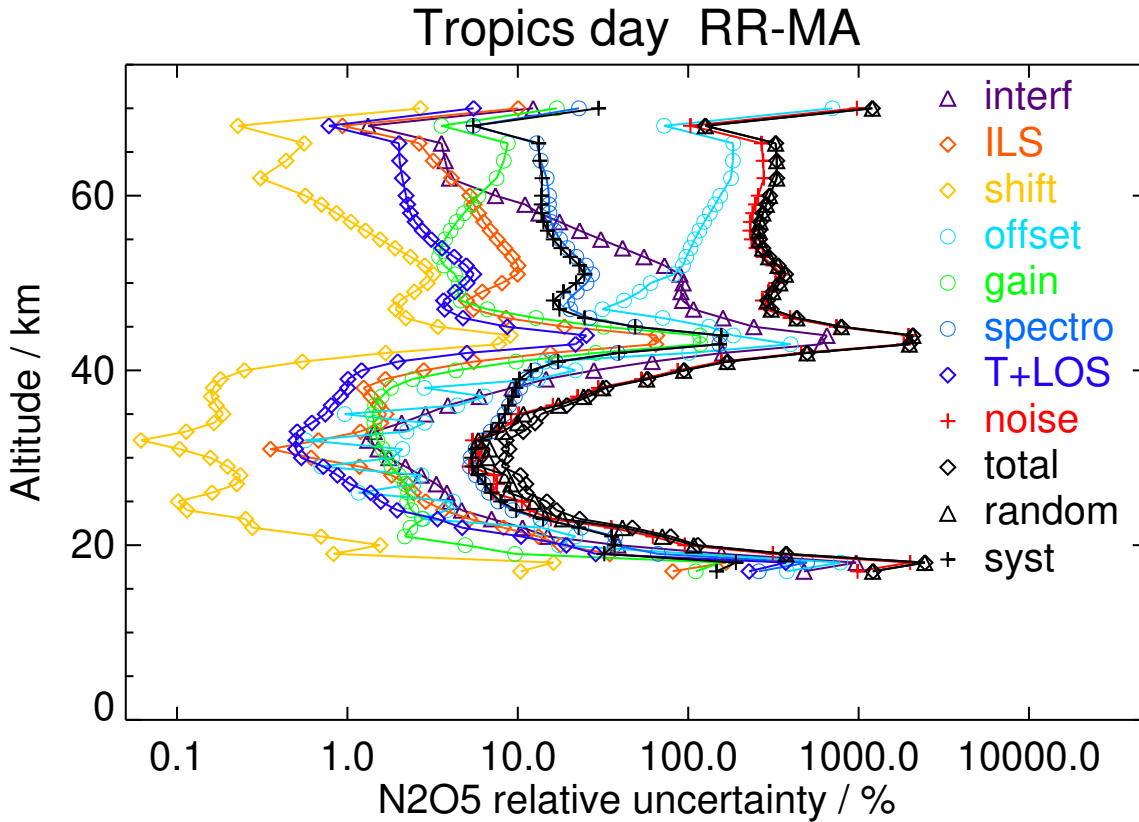


Figure S85: V8R\_N2O5\_561 Tropics day

Table S90: N2O5 error budget for Tropics night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 17               | -2.16                 | > 100         | > 100      | 29.55        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 20               | 31.69                 | 37.69         | 17.69      | 1.59         | 17.83         | 6.09        | 31.63          | 18.20        | 92.65        | > 100         | 29.59       | > 100        |
| 23               | 177.29                | 7.83          | 5.44       | 0.30         | 3.68          | 2.79        | 15.04          | 3.78         | 18.10        | 21.13         | 15.30       | 26.08        |
| 26               | 488.34                | 3.82          | 2.70       | 0.15         | 1.48          | 2.30        | 7.74           | 1.55         | 7.25         | 9.20          | 7.71        | 12.01        |
| 29               | 898.14                | 1.89          | 1.84       | 0.25         | 0.84          | 1.84        | 5.53           | 0.87         | 4.46         | 5.32          | 5.84        | 7.90         |
| 32               | 1370.83               | 0.81          | 0.69       | 0.19         | 0.58          | 1.52        | 5.15           | 0.55         | 3.36         | 3.74          | 5.28        | 6.47         |
| 35               | 1505.72               | 1.00          | 0.40       | 0.05         | 0.53          | 1.36        | 5.95           | 0.42         | 3.50         | 3.82          | 6.04        | 7.15         |
| 38               | 1084.22               | 1.71          | 0.12       | 0.09         | 0.76          | 1.35        | 7.64           | 0.66         | 5.51         | 5.95          | 7.69        | 9.72         |
| 41               | 518.06                | 4.79          | 0.22       | 0.06         | 1.66          | 1.95        | 9.65           | 0.97         | 12.69        | 13.82         | 9.67        | 16.87        |
| 44               | 185.95                | 12.92         | 1.83       | 0.36         | 4.90          | 4.01        | 12.29          | 1.39         | 39.41        | 41.93         | 12.58       | 43.78        |
| 47               | 51.48                 | 62.26         | 4.56       | 1.35         | 21.70         | 4.84        | 22.54          | 3.22         | > 100        | > 100         | 20.22       | > 100        |
| 50               | 51.90                 | 53.93         | 4.68       | 1.64         | 35.34         | 4.01        | 15.72          | 3.30         | > 100        | > 100         | 13.98       | > 100        |
| 53               | 53.73                 | 42.40         | 6.81       | 1.68         | 74.41         | 3.43        | 16.76          | 3.52         | > 100        | > 100         | 15.44       | > 100        |
| 56               | 34.72                 | 43.82         | 12.96      | 2.27         | > 100         | 6.77        | 29.60          | 5.43         | > 100        | > 100         | 27.03       | > 100        |
| 59               | 21.67                 | 41.77         | 21.70      | 2.51         | > 100         | 16.12       | 52.23          | 8.41         | > 100        | > 100         | 47.59       | > 100        |
| 62               | 22.26                 | 16.30         | 20.77      | 1.10         | > 100         | 26.08       | 57.24          | 8.54         | > 100        | > 100         | 54.45       | > 100        |
| 64               | 24.06                 | 15.87         | 19.04      | 1.56         | > 100         | 31.14       | 56.35          | 8.65         | > 100        | > 100         | 56.19       | > 100        |

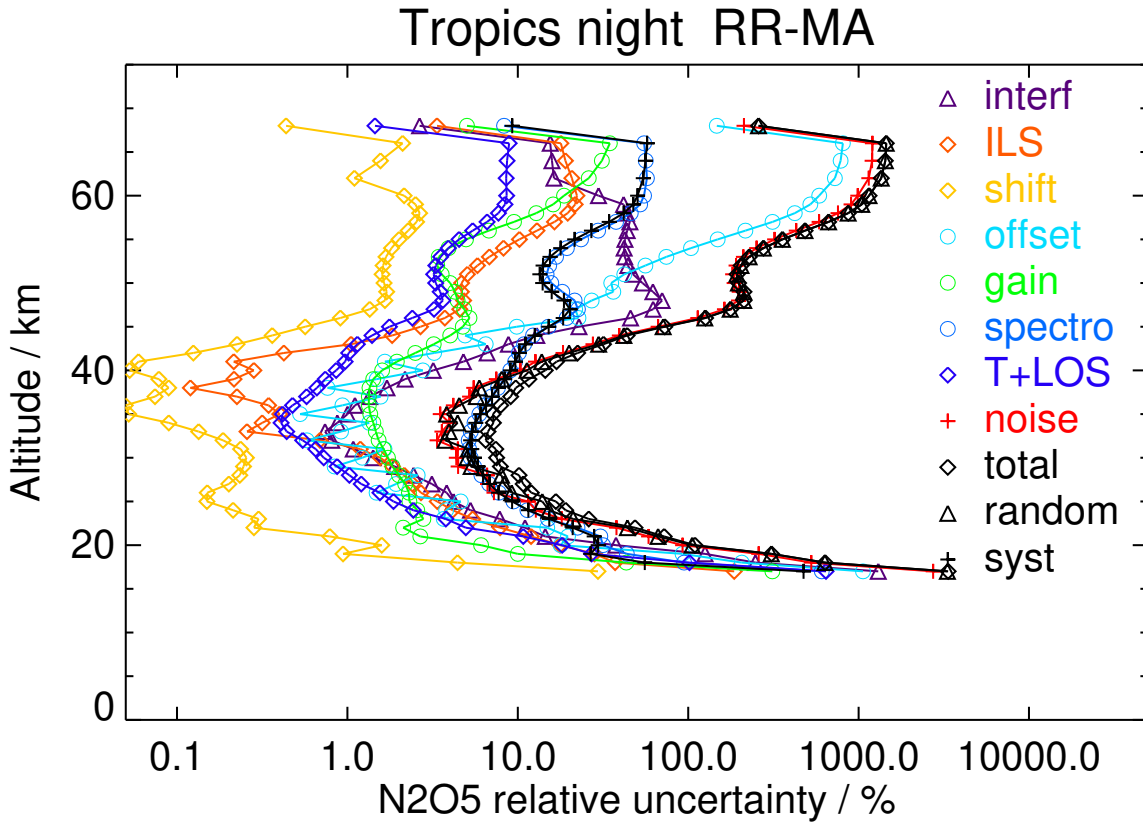


Figure S86: V8R\_N2O5\_561 Tropics night

Table S91: N2O5 error budget for Southern midlatitude winter day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 17               | 14.21                 | 97.46         | 64.83      | 8.57         | > 100         | 32.95       | > 100          | 69.79        | > 100        | > 100         | > 100       | > 100        |
| 20               | 140.47                | 12.64         | 3.60       | 0.32         | 3.57          | 12.94       | 10.54          | 4.45         | 14.43        | 21.09         | 15.73       | 26.31        |
| 23               | 407.55                | 4.71          | 1.32       | 0.25         | 2.14          | 2.73        | 7.65           | 1.68         | 7.37         | 9.66          | 7.64        | 12.32        |
| 26               | 822.29                | 2.37          | 1.16       | 0.12         | 1.60          | 2.19        | 5.82           | 0.96         | 5.19         | 6.51          | 5.80        | 8.72         |
| 29               | 1289.63               | 1.72          | 0.85       | 0.12         | 1.25          | 1.71        | 5.57           | 0.69         | 4.18         | 5.17          | 5.52        | 7.56         |
| 32               | 1404.24               | 2.55          | 0.33       | 0.06         | 1.20          | 1.58        | 6.71           | 0.69         | 4.43         | 5.70          | 6.58        | 8.70         |
| 35               | 981.75                | 4.73          | 0.80       | 0.15         | 1.69          | 1.44        | 8.94           | 0.90         | 7.03         | 9.23          | 8.53        | 12.57        |
| 38               | 333.37                | 14.78         | 1.80       | 0.25         | 4.76          | 2.11        | 15.43          | 1.79         | 22.68        | 28.14         | 14.59       | 31.70        |
| 41               | 83.02                 | 59.77         | 4.10       | 0.36         | 18.33         | 4.95        | 23.71          | 2.61         | 99.14        | > 100         | 20.39       | > 100        |
| 44               | 62.66                 | 72.79         | 3.40       | 0.52         | 23.73         | 4.46        | 14.72          | 2.08         | > 100        | > 100         | 7.28        | > 100        |
| 47               | 31.25                 | > 100         | 6.50       | 1.43         | 57.42         | 11.25       | 21.08          | 4.96         | > 100        | > 100         | 13.06       | > 100        |
| 50               | 2.16                  | > 100         | 89.71      | 28.12        | > 100         | > 100       | > 100          | 79.47        | > 100        | > 100         | > 100       | > 100        |
| 53               | 33.36                 | 98.96         | 6.24       | 1.90         | > 100         | 9.31        | 21.46          | 4.90         | > 100        | > 100         | 16.48       | > 100        |
| 56               | 55.75                 | 37.23         | 4.18       | 0.96         | > 100         | 6.47        | 15.29          | 2.82         | > 100        | > 100         | 11.44       | > 100        |
| 59               | 77.30                 | 14.47         | 3.21       | 0.53         | > 100         | 6.67        | 12.48          | 2.09         | > 100        | > 100         | 9.50        | > 100        |
| 62               | 96.99                 | 5.29          | 2.79       | 0.35         | > 100         | 8.32        | 11.20          | 1.87         | > 100        | > 100         | 9.43        | > 100        |
| 64               | 109.99                | 3.94          | 2.72       | 0.33         | > 100         | 8.91        | 10.47          | 1.78         | > 100        | > 100         | 9.49        | > 100        |

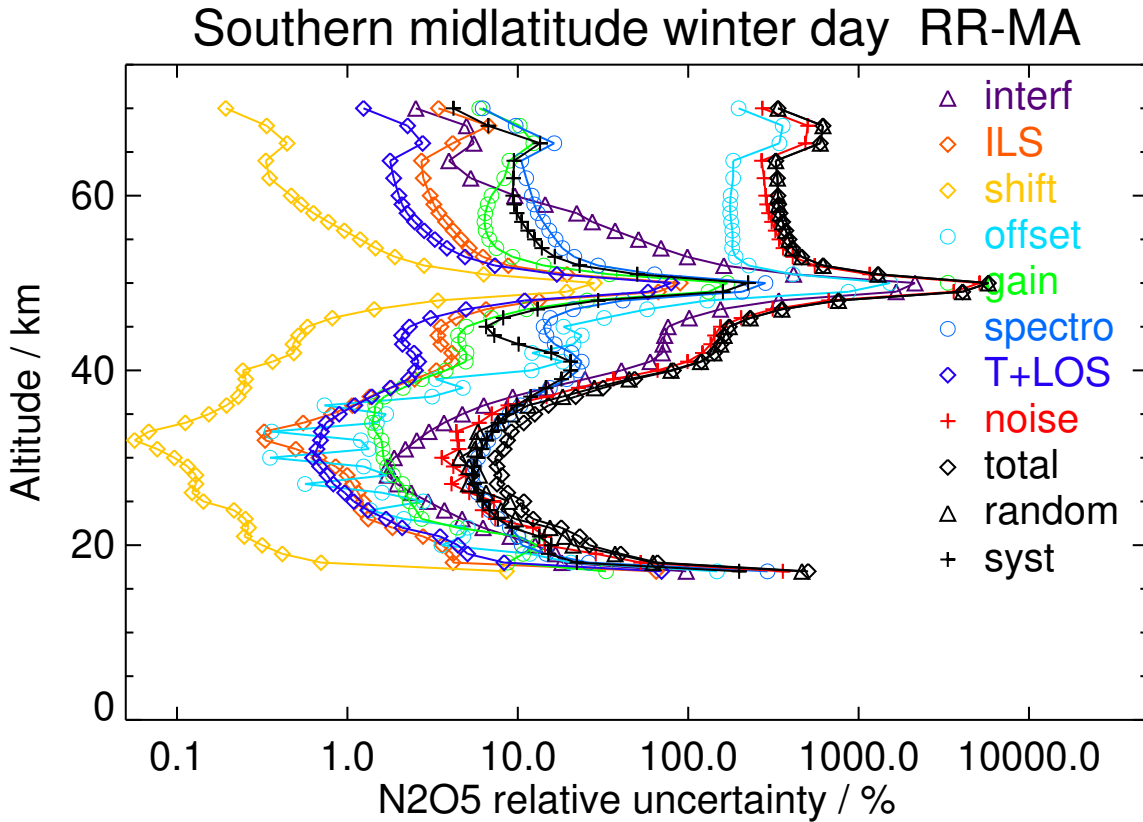


Figure S87: V8R\_N2O5\_561 Southern midlatitude winter day

Table S92: N2O5 error budget for Southern midlatitude winter night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 17               | 82.95                 | 18.41         | 5.47       | 0.54         | 21.60         | 8.01        | 21.51          | 7.65         | 55.57        | 66.08         | 11.94       | 67.15        |
| 20               | 104.97                | 18.31         | 4.57       | 0.42         | 5.11          | 14.27       | 13.01          | 5.76         | 22.32        | 31.57         | 17.04       | 35.87        |
| 23               | 328.43                | 6.30          | 1.55       | 0.28         | 2.53          | 2.92        | 9.30           | 2.06         | 10.18        | 12.97         | 9.13        | 15.86        |
| 26               | 656.97                | 3.14          | 0.74       | 0.11         | 1.86          | 2.38        | 5.38           | 0.93         | 7.11         | 8.42          | 5.39        | 10.00        |
| 29               | 859.38                | 3.11          | 0.59       | 0.09         | 1.71          | 1.67        | 5.82           | 0.68         | 7.04         | 8.25          | 5.63        | 9.99         |
| 32               | 820.45                | 5.11          | 0.33       | 0.07         | 1.81          | 1.60        | 7.18           | 0.75         | 8.65         | 10.68         | 6.71        | 12.61        |
| 35               | 559.54                | 9.22          | 0.71       | 0.08         | 2.57          | 1.60        | 9.01           | 0.85         | 13.72        | 17.39         | 7.89        | 19.10        |
| 38               | 278.10                | 18.87         | 1.31       | 0.18         | 5.12          | 2.24        | 12.28          | 1.27         | 29.80        | 36.34         | 10.42       | 37.81        |
| 41               | 94.38                 | 54.25         | 3.33       | 0.52         | 15.08         | 6.12        | 19.95          | 2.29         | 93.74        | > 100         | 17.63       | > 100        |
| 44               | 44.94                 | > 100         | 5.64       | 0.99         | 32.47         | 9.59        | 24.03          | 3.81         | > 100        | > 100         | 16.98       | > 100        |
| 47               | 18.83                 | > 100         | 11.30      | 2.39         | 96.77         | 18.38       | 38.96          | 9.11         | > 100        | > 100         | 27.16       | > 100        |
| 50               | 34.76                 | > 100         | 8.14       | 1.51         | 90.71         | 10.73       | 19.65          | 5.06         | > 100        | > 100         | 16.07       | > 100        |
| 53               | 30.54                 | > 100         | 11.37      | 1.70         | > 100         | 11.62       | 24.48          | 5.44         | > 100        | > 100         | 19.46       | > 100        |
| 56               | 29.50                 | 79.90         | 11.94      | 1.45         | > 100         | 11.92       | 28.86          | 5.27         | > 100        | > 100         | 20.80       | > 100        |
| 59               | 28.93                 | 48.25         | 11.32      | 1.17         | > 100         | 13.96       | 32.70          | 5.41         | > 100        | > 100         | 21.76       | > 100        |
| 62               | 31.47                 | 18.05         | 9.19       | 0.90         | > 100         | 17.26       | 33.15          | 5.32         | > 100        | > 100         | 21.39       | > 100        |
| 64               | 39.75                 | 11.16         | 7.00       | 0.76         | > 100         | 16.67       | 27.74          | 4.48         | > 100        | > 100         | 18.42       | > 100        |

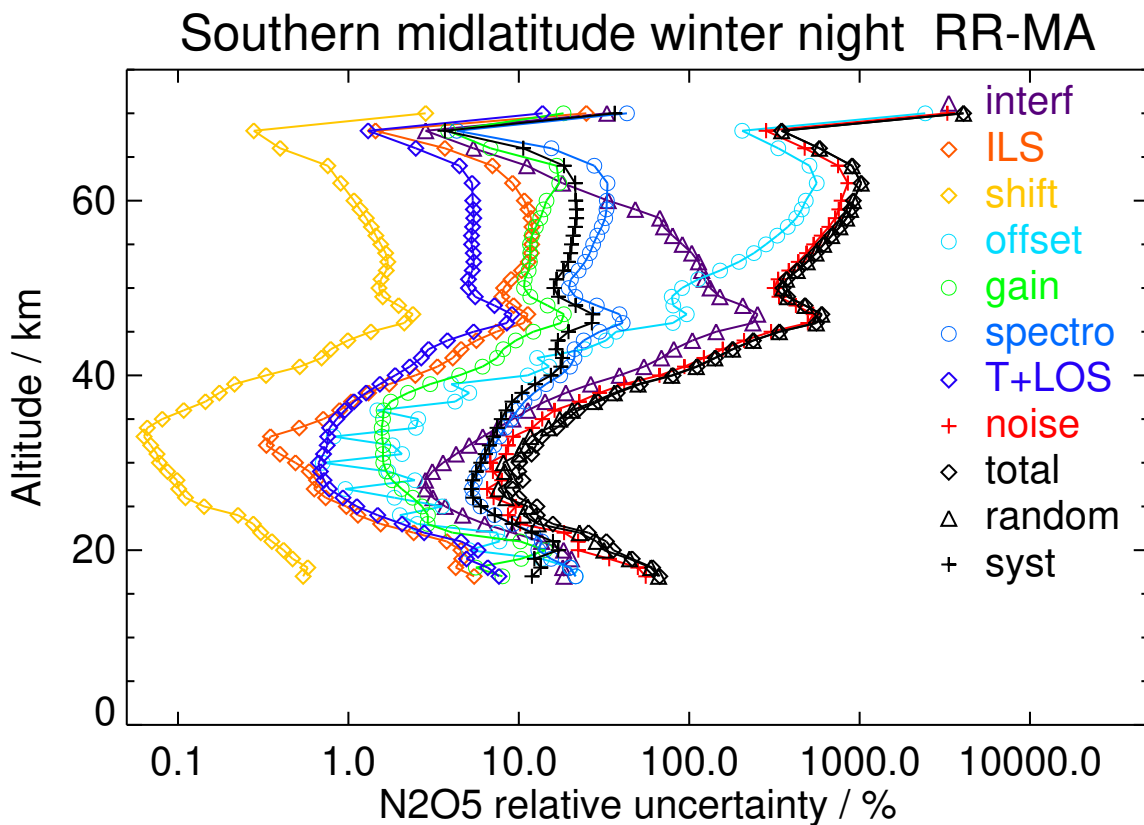


Figure S88: V8R\_N2O5\_561 Southern midlatitude winter night

Table S93: N2O5 error budget for Southern midlatitude spring day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 20               | 238.20                | 7.44          | 1.91       | 0.18         | 2.14          | 6.91        | 8.05           | 2.47         | 8.11         | 13.01         | 8.88        | 15.75        |
| 23               | 462.62                | 3.63          | 0.98       | 0.18         | 1.82          | 2.15        | 6.30           | 1.15         | 5.74         | 7.98          | 5.70        | 9.81         |
| 26               | 697.18                | 3.08          | 0.84       | 0.14         | 1.70          | 2.67        | 5.49           | 0.78         | 4.98         | 6.73          | 5.52        | 8.70         |
| 29               | 884.66                | 2.77          | 0.45       | 0.10         | 1.62          | 1.98        | 5.79           | 0.59         | 4.89         | 6.34          | 5.66        | 8.50         |
| 32               | 783.63                | 4.39          | 0.93       | 0.14         | 2.09          | 1.54        | 7.63           | 0.77         | 6.74         | 8.73          | 7.41        | 11.45        |
| 35               | 348.10                | 12.01         | 2.02       | 0.38         | 5.07          | 1.32        | 11.58          | 1.32         | 17.81        | 22.61         | 10.85       | 25.07        |
| 38               | 75.35                 | 54.85         | 3.50       | 0.38         | 23.16         | 2.78        | 20.54          | 2.18         | 93.17        | > 100         | 17.20       | > 100        |
| 41               | 14.92                 | > 100         | 17.79      | 2.42         | > 100         | 21.24       | 43.67          | 6.31         | > 100        | > 100         | 36.46       | > 100        |
| 44               | 13.17                 | > 100         | 13.43      | 2.33         | > 100         | 20.99       | 42.13          | 7.06         | > 100        | > 100         | 32.09       | > 100        |
| 47               | 26.61                 | > 100         | 2.51       | 1.28         | 58.67         | 6.17        | 19.95          | 5.10         | > 100        | > 100         | 13.90       | > 100        |
| 50               | 60.98                 | 69.54         | 1.36       | 0.84         | 37.00         | 5.52        | 10.10          | 3.07         | > 100        | > 100         | 9.32        | > 100        |
| 53               | 59.75                 | 54.58         | 2.40       | 1.06         | 75.14         | 5.71        | 13.25          | 3.32         | > 100        | > 100         | 11.95       | > 100        |
| 56               | 29.07                 | 75.17         | 7.04       | 2.10         | > 100         | 10.95       | 30.84          | 6.28         | > 100        | > 100         | 26.51       | > 100        |
| 59               | 0.24                  | > 100         | > 100      | > 100        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 62               | -16.29                | 29.80         | 10.53      | 2.30         | > 100         | 41.50       | 62.23          | 10.99        | > 100        | > 100         | 56.82       | > 100        |
| 64               | -22.17                | 21.59         | 8.87       | 1.91         | > 100         | 42.41       | 47.42          | 9.09         | > 100        | > 100         | 49.71       | > 100        |

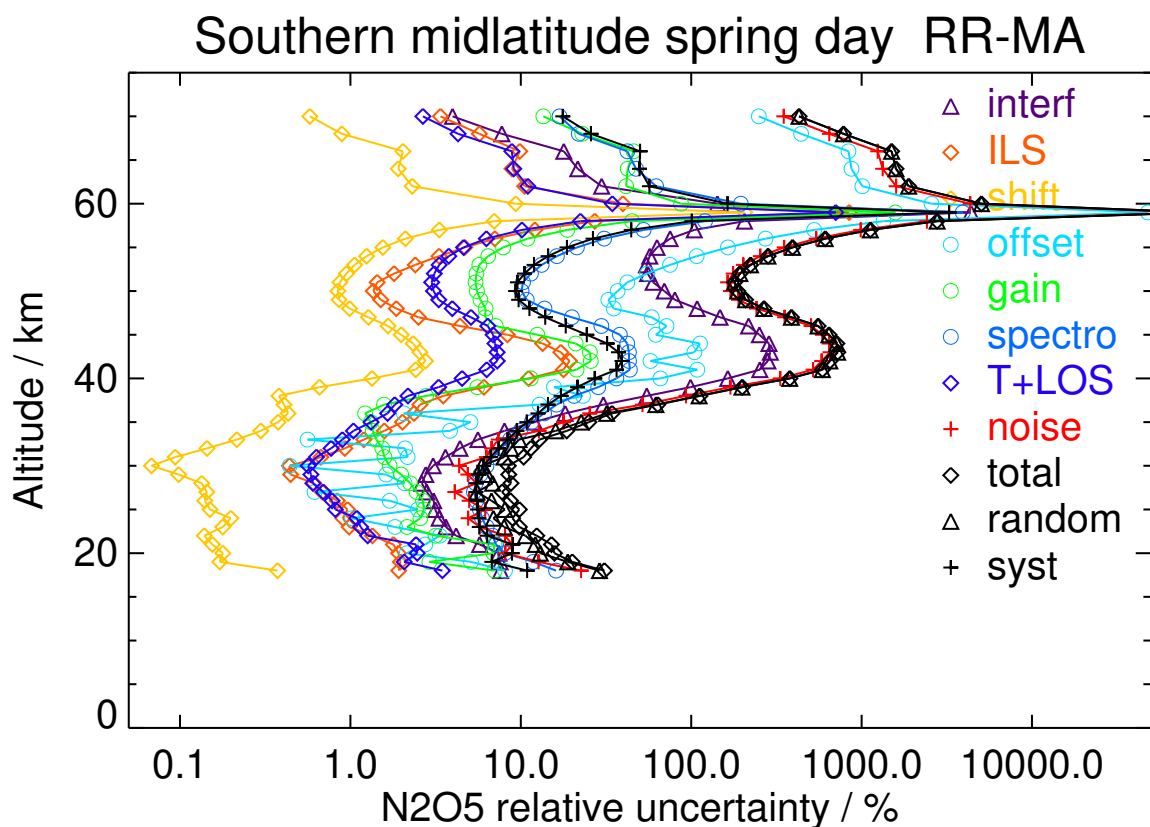


Figure S89: V8R\_N2O5\_561 Southern midlatitude spring day

Table S94: N2O5 error budget for Southern midlatitude spring night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 17               | 138.24                | 12.38         | 1.15       | 0.68         | 10.78         | 15.46       | 12.42          | 4.58         | 33.39        | 38.10         | 18.67       | 42.43        |
| 20               | 179.18                | 10.55         | 3.37       | 0.26         | 3.66          | 14.39       | 8.30           | 3.78         | 13.73        | 19.54         | 15.27       | 24.80        |
| 23               | 417.50                | 4.06          | 1.13       | 0.23         | 1.44          | 2.59        | 6.23           | 1.39         | 6.21         | 8.17          | 6.26        | 10.29        |
| 26               | 674.93                | 3.10          | 1.05       | 0.14         | 1.19          | 2.89        | 5.66           | 0.89         | 4.81         | 6.52          | 5.83        | 8.74         |
| 29               | 950.55                | 2.60          | 0.80       | 0.14         | 1.01          | 2.08        | 5.72           | 0.61         | 4.23         | 5.63          | 5.66        | 7.98         |
| 32               | 1032.62               | 3.37          | 0.52       | 0.09         | 1.09          | 1.70        | 6.50           | 0.61         | 4.74         | 6.51          | 6.20        | 8.99         |
| 35               | 888.59                | 4.67          | 0.67       | 0.11         | 1.41          | 1.33        | 7.16           | 0.63         | 6.54         | 8.46          | 6.99        | 10.97        |
| 38               | 518.51                | 7.95          | 0.48       | 0.11         | 2.59          | 1.34        | 9.45           | 0.92         | 12.90        | 15.60         | 9.23        | 18.12        |
| 41               | 205.32                | 18.44         | 1.24       | 0.17         | 6.61          | 2.63        | 13.23          | 1.29         | 36.24        | 41.41         | 12.95       | 43.38        |
| 44               | 64.48                 | 59.37         | 3.80       | 0.56         | 20.57         | 4.03        | 17.84          | 2.24         | > 100        | > 100         | 16.19       | > 100        |
| 47               | 18.16                 | > 100         | 5.89       | 1.78         | 80.23         | 15.86       | 31.50          | 8.88         | > 100        | > 100         | 25.71       | > 100        |
| 50               | 47.10                 | 90.86         | 1.90       | 0.98         | 47.25         | 9.66        | 11.35          | 4.16         | > 100        | > 100         | 12.30       | > 100        |
| 53               | 34.96                 | 94.46         | 4.57       | 1.69         | > 100         | 11.30       | 20.01          | 5.70         | > 100        | > 100         | 18.82       | > 100        |
| 56               | -4.33                 | > 100         | 48.18      | 13.37        | > 100         | 71.58       | > 100          | 42.13        | > 100        | > 100         | > 100       | > 100        |
| 59               | -36.84                | 25.39         | 5.33       | 1.26         | > 100         | 10.88       | 23.78          | 4.56         | > 100        | > 100         | 19.61       | > 100        |
| 62               | -57.29                | 8.77          | 3.65       | 0.63         | > 100         | 14.05       | 16.85          | 3.06         | > 100        | > 100         | 16.67       | > 100        |
| 64               | -63.95                | 7.95          | 4.46       | 0.68         | > 100         | 17.77       | 16.07          | 3.10         | > 100        | > 100         | 18.91       | > 100        |

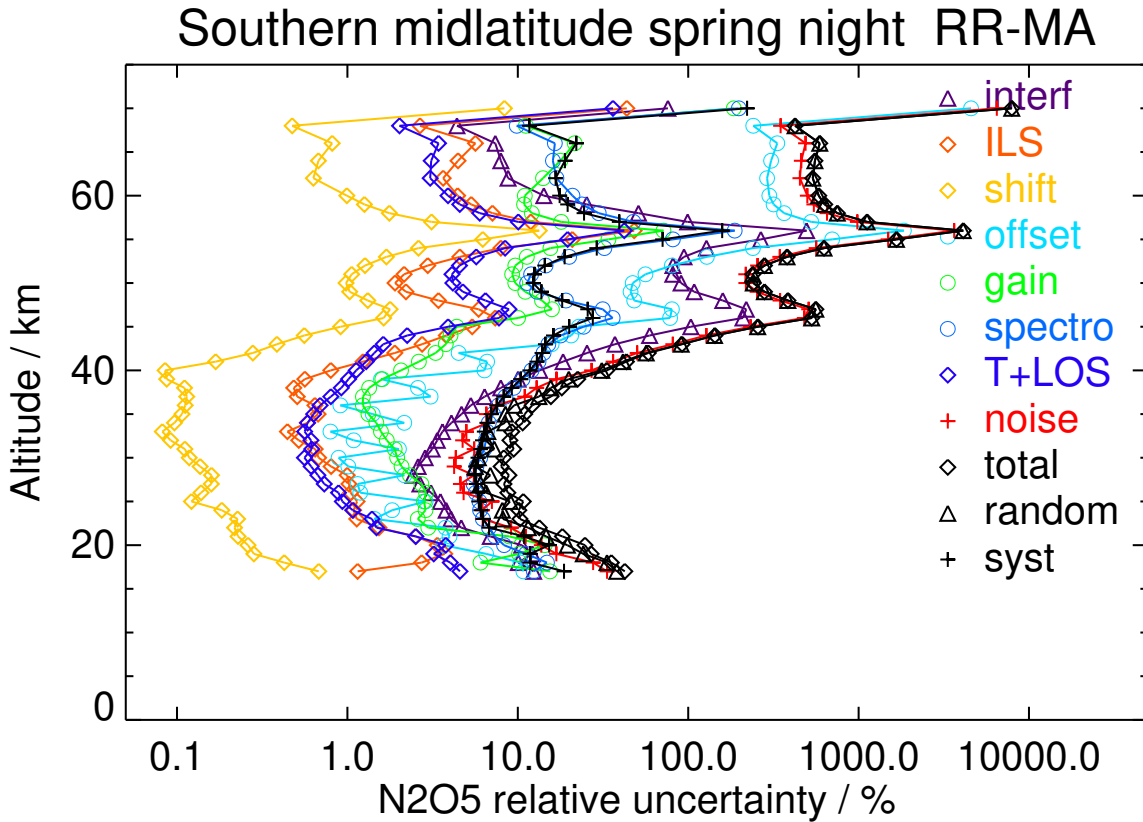


Figure S90: V8R\_N2O5\_561 Southern midlatitude spring night

Table S95: N2O5 error budget for Southern midlatitude summer day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 17               | 47.84                 | 29.92         | 3.25       | 1.31         | 27.42         | 21.29       | 18.46          | 11.11        | 75.86        | 88.22         | 23.44       | 91.28        |
| 20               | 87.91                 | 13.86         | 5.35       | 0.35         | 10.56         | 18.08       | 19.36          | 7.45         | 32.89        | 39.20         | 25.19       | 46.60        |
| 23               | 325.97                | 4.63          | 2.48       | 0.23         | 2.24          | 2.91        | 9.45           | 1.98         | 8.10         | 10.10         | 9.91        | 14.15        |
| 26               | 806.47                | 1.81          | 1.62       | 0.14         | 0.88          | 2.15        | 5.38           | 0.87         | 3.60         | 4.43          | 5.86        | 7.35         |
| 29               | 1089.18               | 1.04          | 0.32       | 0.06         | 0.59          | 1.52        | 5.83           | 0.50         | 3.10         | 3.57          | 5.91        | 6.91         |
| 32               | 859.20                | 2.35          | 1.43       | 0.23         | 0.74          | 1.42        | 8.20           | 0.69         | 4.65         | 5.61          | 8.25        | 9.98         |
| 35               | 399.16                | 7.29          | 1.79       | 0.39         | 1.65          | 1.22        | 11.01          | 1.12         | 11.61        | 14.21         | 10.78       | 17.83        |
| 38               | 120.66                | 25.80         | 1.35       | 0.22         | 5.92          | 2.21        | 13.10          | 1.56         | 44.34        | 51.99         | 12.01       | 53.36        |
| 41               | 40.46                 | 63.72         | 6.10       | 0.81         | 18.70         | 9.69        | 18.11          | 2.16         | > 100        | > 100         | 17.44       | > 100        |
| 44               | 4.29                  | > 100         | 35.45      | 5.56         | > 100         | 63.56       | > 100          | 20.09        | > 100        | > 100         | 73.29       | > 100        |
| 47               | 43.03                 | 86.20         | 1.79       | 0.78         | 22.63         | 4.99        | 11.49          | 2.25         | > 100        | > 100         | 7.84        | > 100        |
| 50               | 76.36                 | 54.22         | 2.71       | 0.81         | 20.35         | 2.32        | 8.81           | 1.40         | > 100        | > 100         | 7.11        | > 100        |
| 53               | 63.84                 | 47.93         | 4.97       | 1.26         | 52.48         | 2.38        | 11.70          | 1.94         | > 100        | > 100         | 10.08       | > 100        |
| 56               | 56.52                 | 32.18         | 5.82       | 1.38         | > 100         | 3.19        | 15.41          | 2.38         | > 100        | > 100         | 12.52       | > 100        |
| 59               | 43.92                 | 13.28         | 6.29       | 1.32         | > 100         | 6.26        | 23.16          | 3.29         | > 100        | > 100         | 17.94       | > 100        |
| 62               | 20.32                 | 34.43         | 8.75       | 1.02         | > 100         | 26.62       | 56.83          | 8.33         | > 100        | > 100         | 46.25       | > 100        |
| 64               | 11.07                 | 63.85         | 18.41      | 2.37         | > 100         | 68.69       | > 100          | 17.80        | > 100        | > 100         | 98.33       | > 100        |

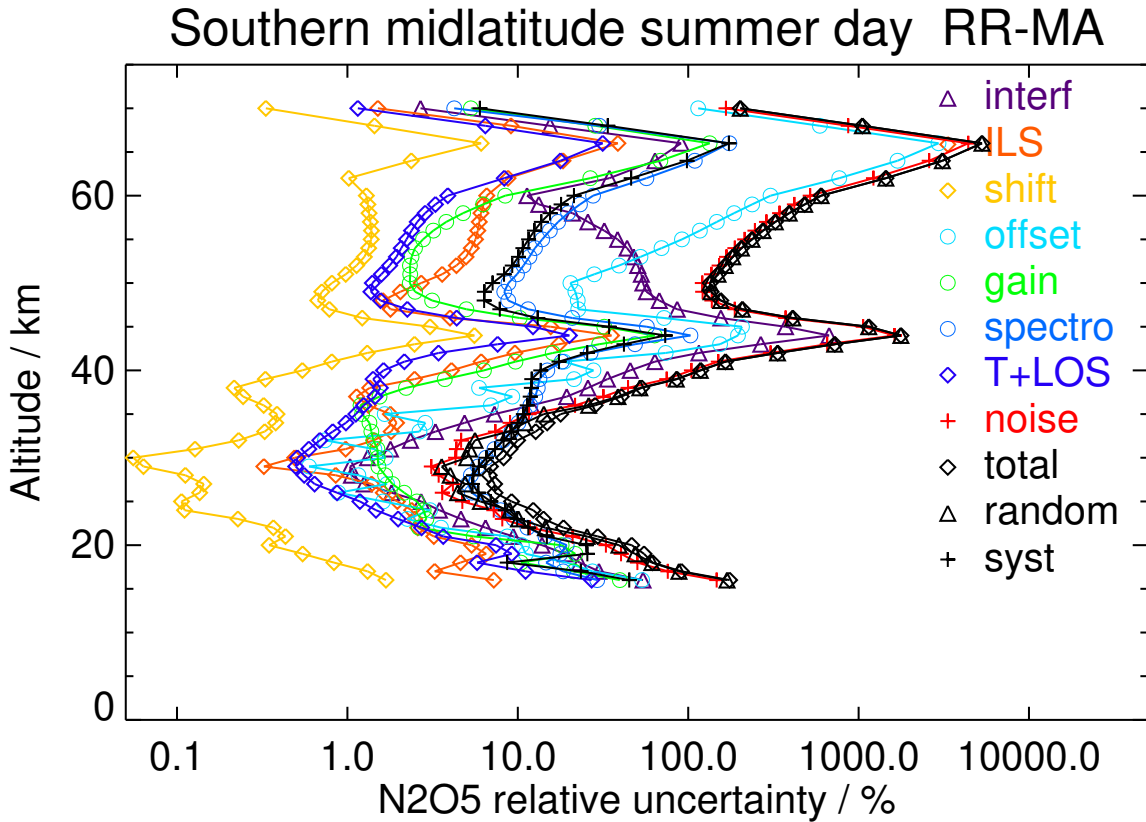


Figure S91: V8R\_N2O5\_561 Southern midlatitude summer day

Table S96: N2O5 error budget for Southern midlatitude summer night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 17               | 41.27                 | 38.14         | 5.04       | 1.35         | 35.67         | 36.33       | 36.43          | 15.74        | 98.15        | > 100         | 47.30       | > 100        |
| 20               | 67.45                 | 18.46         | 7.56       | 0.60         | 11.71         | 28.03       | 14.48          | 10.25        | 40.51        | 48.47         | 30.45       | 57.24        |
| 23               | 253.18                | 6.03          | 2.31       | 0.30         | 2.32          | 3.26        | 9.25           | 2.35         | 9.99         | 12.70         | 9.35        | 15.77        |
| 26               | 592.96                | 2.36          | 1.72       | 0.13         | 1.01          | 2.65        | 5.71           | 1.05         | 4.81         | 5.96          | 6.16        | 8.58         |
| 29               | 888.76                | 1.25          | 0.70       | 0.10         | 0.68          | 1.62        | 5.52           | 0.55         | 3.80         | 4.43          | 5.55        | 7.10         |
| 32               | 912.45                | 2.15          | 0.58       | 0.06         | 0.72          | 1.50        | 6.41           | 0.50         | 4.40         | 5.33          | 6.32        | 8.27         |
| 35               | 781.70                | 3.58          | 0.73       | 0.11         | 0.95          | 1.36        | 7.10           | 0.52         | 5.94         | 7.38          | 6.90        | 10.10        |
| 38               | 470.74                | 6.36          | 0.36       | 0.10         | 1.82          | 1.59        | 9.12           | 0.83         | 11.22        | 13.53         | 8.54        | 16.00        |
| 41               | 183.60                | 13.28         | 0.77       | 0.14         | 5.22          | 3.43        | 12.53          | 1.22         | 32.13        | 35.67         | 11.61       | 37.51        |
| 44               | 61.84                 | 47.55         | 2.74       | 0.57         | 17.68         | 5.24        | 15.09          | 1.99         | > 100        | > 100         | 11.71       | > 100        |
| 47               | 35.12                 | > 100         | 3.39       | 1.21         | 34.04         | 6.26        | 15.70          | 3.37         | > 100        | > 100         | 10.66       | > 100        |
| 50               | 47.72                 | 84.42         | 4.76       | 1.25         | 32.14         | 3.12        | 11.46          | 2.16         | > 100        | > 100         | 8.86        | > 100        |
| 53               | 78.50                 | 36.09         | 4.23       | 0.87         | 36.60         | 2.37        | 8.41           | 1.54         | > 100        | > 100         | 7.39        | > 100        |
| 56               | 87.51                 | 17.72         | 4.17       | 0.73         | 65.84         | 2.65        | 8.97           | 1.53         | > 100        | > 100         | 7.75        | > 100        |
| 59               | 51.04                 | 9.69          | 6.08       | 0.93         | > 100         | 6.07        | 17.10          | 2.71         | > 100        | > 100         | 13.88       | > 100        |
| 62               | -4.15                 | > 100         | 46.54      | 4.93         | > 100         | > 100       | > 100          | 38.96        | > 100        | > 100         | > 100       | > 100        |
| 64               | -34.27                | 21.61         | 6.10       | 1.06         | > 100         | 22.68       | 29.61          | 5.63         | > 100        | > 100         | 29.14       | > 100        |

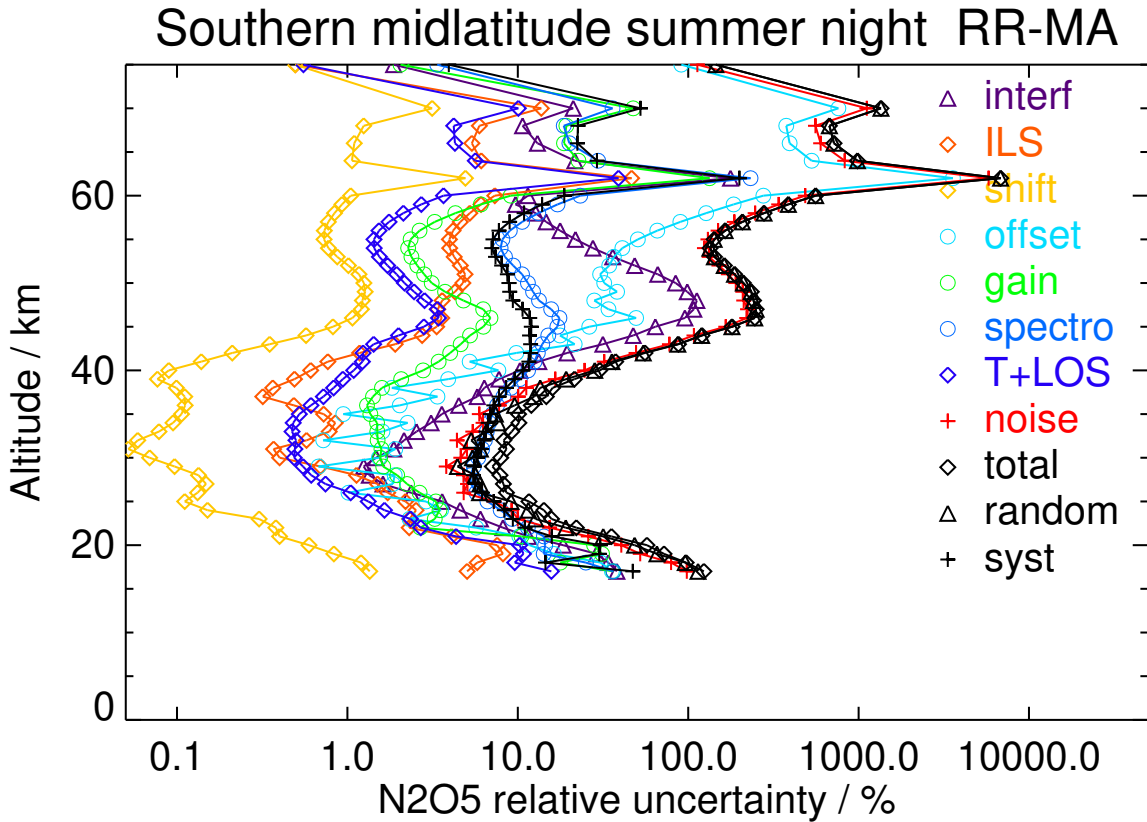


Figure S92: V8R\_N2O5\_561 Southern midlatitude summer night

Table S97: N2O5 error budget for Southern midlatitude autumn day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 20               | 83.48                 | 17.76         | 6.88       | 0.32         | 5.96          | 18.48       | 14.64          | 7.08         | 24.37        | 32.69         | 23.01       | 39.97        |
| 23               | 356.15                | 5.78          | 2.52       | 0.39         | 2.50          | 3.78        | 11.61          | 2.37         | 8.04         | 11.02         | 12.00       | 16.29        |
| 26               | 1018.90               | 1.70          | 1.50       | 0.16         | 1.23          | 2.55        | 5.67           | 1.00         | 3.69         | 4.66          | 6.18        | 7.74         |
| 29               | 1537.62               | 1.09          | 0.69       | 0.08         | 0.98          | 1.67        | 5.52           | 0.59         | 3.09         | 3.65          | 5.70        | 6.77         |
| 32               | 1492.16               | 1.84          | 0.25       | 0.08         | 1.10          | 1.47        | 7.22           | 0.69         | 3.82         | 4.57          | 7.28        | 8.60         |
| 35               | 964.93                | 4.56          | 0.98       | 0.15         | 1.76          | 1.29        | 9.35           | 0.86         | 6.78         | 8.54          | 9.36        | 12.67        |
| 38               | 496.81                | 11.02         | 0.87       | 0.12         | 3.26          | 1.50        | 10.85          | 1.08         | 14.56        | 18.70         | 10.78       | 21.58        |
| 41               | 194.92                | 30.63         | 1.28       | 0.23         | 7.71          | 3.25        | 13.57          | 1.49         | 41.49        | 52.29         | 13.54       | 54.02        |
| 44               | 55.43                 | 96.91         | 3.40       | 0.90         | 26.18         | 9.68        | 18.82          | 2.83         | > 100        | > 100         | 18.99       | > 100        |
| 47               | 26.66                 | > 100         | 5.75       | 2.09         | 66.82         | 11.06       | 21.74          | 5.75         | > 100        | > 100         | 14.49       | > 100        |
| 50               | -3.29                 | > 100         | 57.80      | 24.38        | > 100         | > 100       | > 100          | 58.49        | > 100        | > 100         | > 100       | > 100        |
| 53               | -27.39                | > 100         | 8.96       | 3.29         | > 100         | 13.47       | 25.40          | 7.51         | > 100        | > 100         | 18.71       | > 100        |
| 56               | -28.41                | 83.65         | 9.98       | 2.78         | > 100         | 13.55       | 30.19          | 7.17         | > 100        | > 100         | 22.79       | > 100        |
| 59               | -20.62                | 47.10         | 13.92      | 2.91         | > 100         | 20.86       | 47.18          | 9.73         | > 100        | > 100         | 36.61       | > 100        |
| 62               | 1.11                  | > 100         | > 100      | 33.28        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 64               | 20.00                 | 21.89         | 12.94      | 1.37         | > 100         | 31.57       | 56.23          | 10.24        | > 100        | > 100         | 47.61       | > 100        |

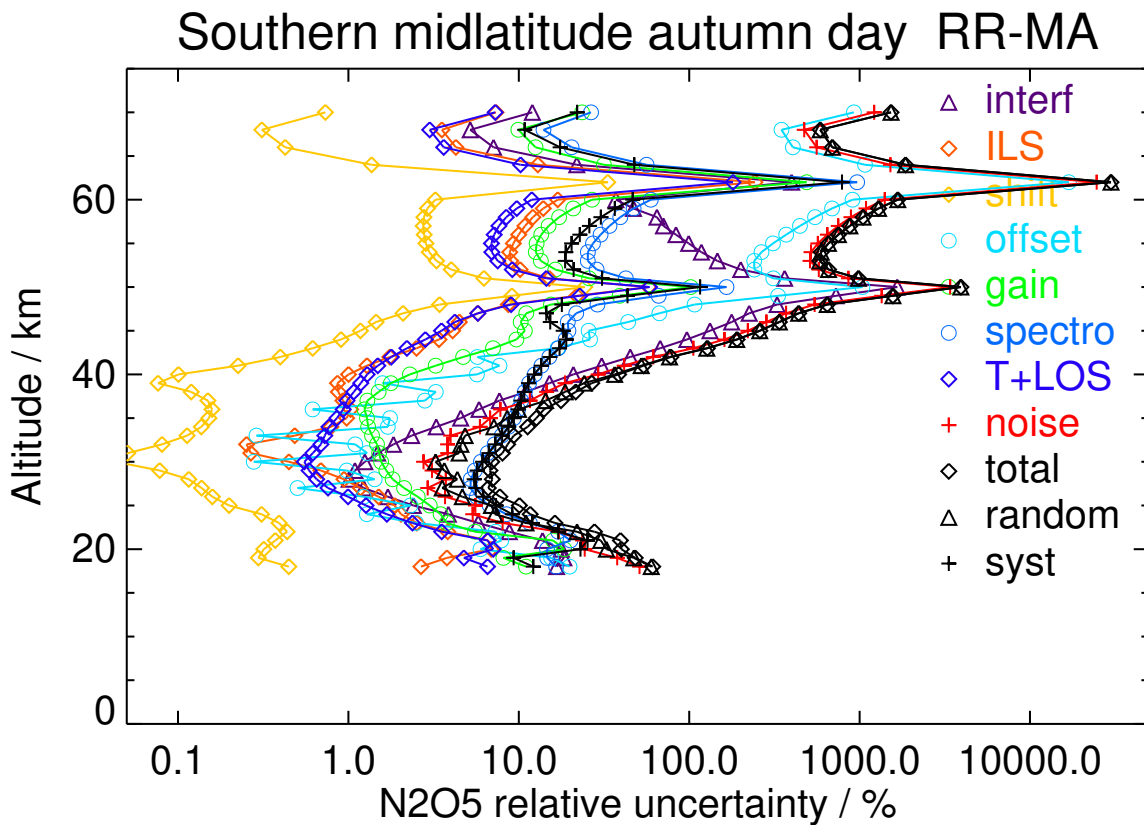


Figure S93: V8R\_N2O5\_561 Southern midlatitude autumn day

Table S98: N2O5 error budget for Southern midlatitude autumn night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 20               | 73.88                 | 20.75         | 5.77       | 0.34         | 6.84          | 21.46       | 14.73          | 8.14         | 28.52        | 38.36         | 24.44       | 45.48        |
| 23               | 308.40                | 6.35          | 2.18       | 0.36         | 2.67          | 3.48        | 11.35          | 2.41         | 9.16         | 12.10         | 11.68       | 16.82        |
| 26               | 859.11                | 1.98          | 1.24       | 0.14         | 1.37          | 2.57        | 5.49           | 1.00         | 4.35         | 5.28          | 6.02        | 8.00         |
| 29               | 1245.98               | 1.31          | 0.59       | 0.08         | 1.11          | 1.69        | 5.58           | 0.59         | 3.78         | 4.46          | 5.66        | 7.21         |
| 32               | 1194.76               | 2.30          | 0.19       | 0.06         | 1.29          | 1.41        | 6.80           | 0.65         | 4.76         | 5.63          | 6.83        | 8.85         |
| 35               | 891.61                | 4.86          | 0.57       | 0.08         | 1.76          | 1.33        | 7.86           | 0.66         | 7.26         | 9.07          | 7.84        | 11.99        |
| 38               | 597.05                | 8.76          | 0.45       | 0.07         | 2.58          | 1.46        | 8.73           | 0.79         | 12.13        | 15.32         | 8.67        | 17.60        |
| 41               | 316.84                | 18.62         | 0.66       | 0.16         | 4.52          | 2.23        | 10.85          | 1.08         | 25.14        | 31.80         | 10.59       | 33.52        |
| 44               | 123.87                | 42.44         | 1.69       | 0.42         | 11.34         | 3.91        | 14.07          | 1.70         | 71.19        | 83.98         | 12.84       | 84.95        |
| 47               | 74.12                 | 79.12         | 2.04       | 0.68         | 23.79         | 4.01        | 11.79          | 2.55         | > 100        | > 100         | 8.99        | > 100        |
| 50               | 43.42                 | > 100         | 4.36       | 1.68         | 76.13         | 7.55        | 16.23          | 4.87         | > 100        | > 100         | 12.80       | > 100        |
| 53               | 7.94                  | > 100         | 31.48      | 10.57        | > 100         | 37.75       | 93.17          | 26.87        | > 100        | > 100         | 76.41       | > 100        |
| 56               | -28.26                | 81.59         | 9.90       | 2.61         | > 100         | 11.93       | 28.99          | 7.33         | > 100        | > 100         | 24.38       | > 100        |
| 59               | -47.89                | 19.75         | 5.72       | 1.18         | > 100         | 9.25        | 18.49          | 4.25         | > 100        | > 100         | 16.27       | > 100        |
| 62               | -102.97               | 4.43          | 2.30       | 0.36         | > 100         | 6.31        | 8.90           | 2.05         | > 100        | > 100         | 8.71        | > 100        |
| 64               | -125.34               | 3.58          | 1.71       | 0.26         | > 100         | 6.26        | 7.45           | 1.76         | > 100        | > 100         | 7.91        | > 100        |

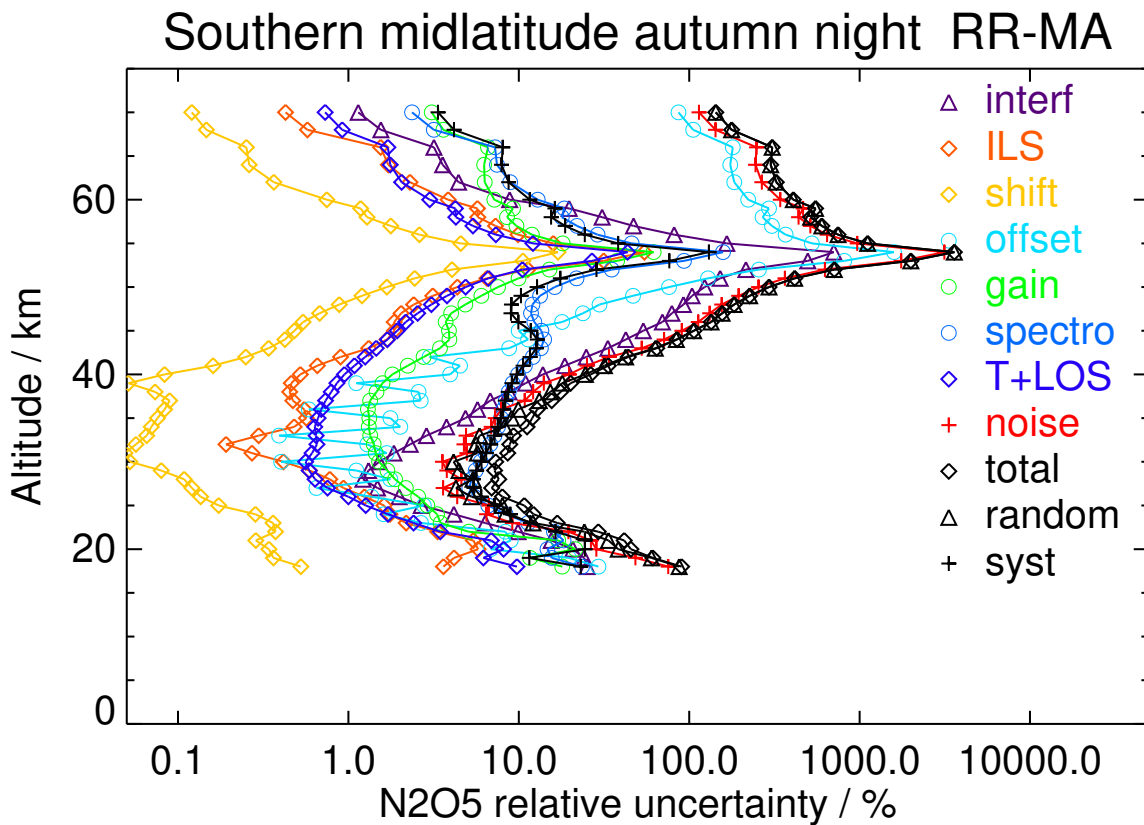


Figure S94: V8R\_N2O5\_561 Southern midlatitude autumn night

Table S99: N2O5 error budget for Southern polar winter day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 17               | 24.03                 | > 100         | 59.99      | 6.27         | > 100         | 15.65       | > 100          | 52.56        | > 100        | > 100         | > 100       | > 100        |
| 20               | 143.61                | 62.55         | 7.17       | 0.76         | 4.50          | 6.05        | 13.37          | 4.38         | 25.51        | 68.77         | 11.87       | 69.79        |
| 23               | 281.26                | 23.99         | 2.38       | 0.30         | 5.36          | 2.41        | 9.41           | 2.22         | 21.51        | 33.46         | 7.26        | 34.23        |
| 26               | 490.81                | 3.10          | 1.20       | 0.13         | 3.45          | 1.80        | 6.42           | 1.37         | 14.50        | 15.74         | 5.63        | 16.72        |
| 29               | 683.56                | 6.57          | 0.63       | 0.10         | 2.41          | 1.46        | 6.38           | 0.80         | 10.68        | 13.04         | 6.08        | 14.39        |
| 32               | 599.22                | 11.11         | 0.73       | 0.19         | 2.71          | 1.58        | 7.69           | 0.90         | 12.47        | 17.27         | 7.15        | 18.69        |
| 35               | 374.97                | 21.08         | 1.62       | 0.29         | 4.30          | 2.13        | 9.53           | 1.21         | 20.56        | 30.05         | 9.05        | 31.38        |
| 38               | 171.06                | 49.95         | 2.05       | 0.25         | 9.57          | 3.12        | 10.71          | 1.49         | 46.39        | 69.09         | 9.77        | 69.78        |
| 41               | 76.66                 | 99.39         | 2.71       | 0.66         | 21.53         | 3.50        | 12.59          | 1.60         | > 100        | > 100         | 9.29        | > 100        |
| 44               | 41.89                 | > 100         | 3.52       | 1.38         | 39.39         | 5.49        | 16.25          | 3.05         | > 100        | > 100         | 10.95       | > 100        |
| 47               | -1.94                 | > 100         | 76.75      | 36.05        | > 100         | > 100       | > 100          | 73.30        | > 100        | > 100         | > 100       | > 100        |
| 50               | -0.32                 | > 100         | > 100      | > 100        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 53               | 25.39                 | > 100         | 11.40      | 2.54         | > 100         | 9.38        | 23.10          | 4.00         | > 100        | > 100         | 19.74       | > 100        |
| 56               | 35.73                 | 52.39         | 8.97       | 1.30         | > 100         | 6.47        | 18.41          | 2.68         | > 100        | > 100         | 14.37       | > 100        |
| 59               | 27.35                 | 50.68         | 11.83      | 1.14         | > 100         | 8.59        | 26.26          | 3.67         | > 100        | > 100         | 19.14       | > 100        |
| 62               | 9.49                  | 89.81         | 33.49      | 2.71         | > 100         | 26.64       | 81.44          | 11.38        | > 100        | > 100         | 56.41       | > 100        |
| 64               | -11.54                | 59.05         | 27.60      | 2.83         | > 100         | 23.69       | 69.60          | 9.87         | > 100        | > 100         | 47.95       | > 100        |

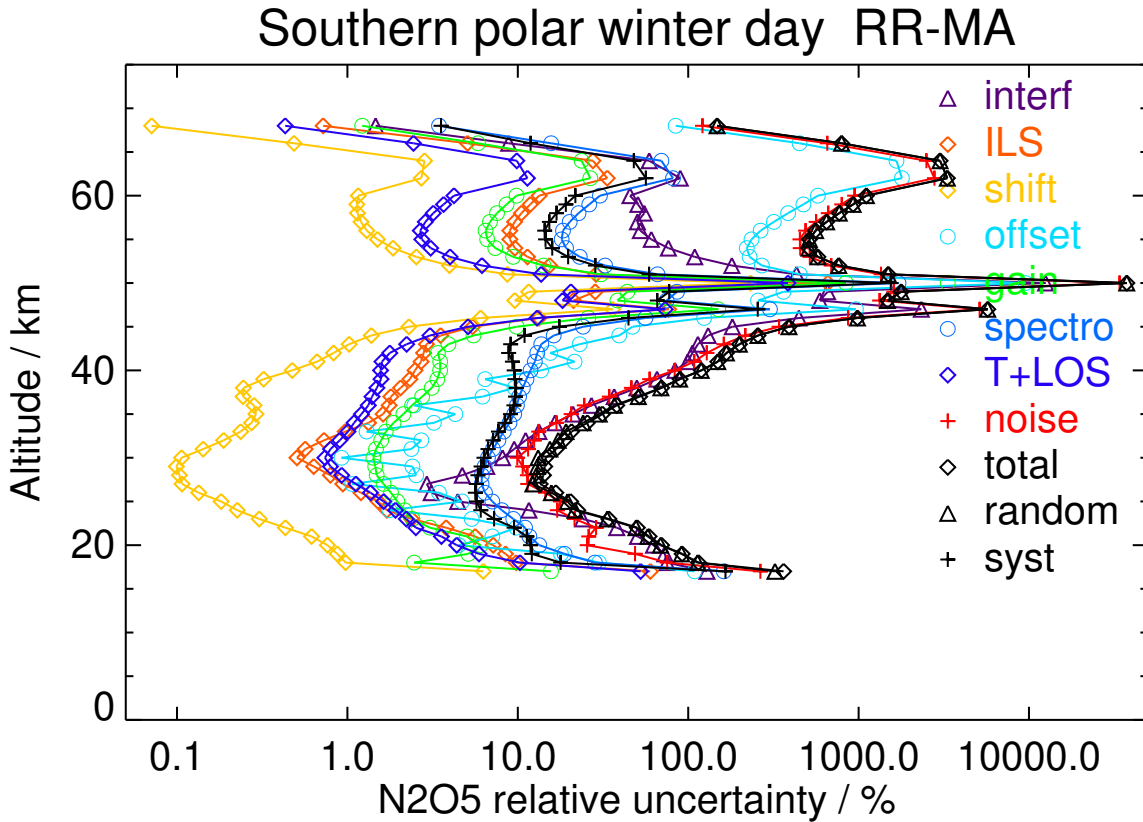


Figure S95: V8R\_N2O5\_561 Southern polar winter day

Table S100: N2O5 error budget for Southern polar winter night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 20               | 94.49                 | 78.54         | 9.60       | 1.01         | 11.95         | 7.10        | 19.03          | 6.63         | 42.20        | 91.26         | 17.70       | 92.96        |
| 23               | 259.67                | 20.96         | 2.90       | 0.37         | 7.43          | 2.73        | 9.09           | 2.26         | 23.91        | 33.33         | 7.69        | 34.21        |
| 26               | 426.82                | 4.16          | 1.02       | 0.12         | 4.59          | 1.89        | 6.31           | 1.23         | 16.56        | 18.18         | 5.29        | 18.94        |
| 29               | 528.95                | 7.81          | 0.77       | 0.14         | 3.48          | 1.50        | 6.50           | 0.76         | 14.10        | 16.76         | 6.06        | 17.83        |
| 32               | 441.74                | 13.80         | 0.74       | 0.14         | 3.94          | 1.65        | 7.78           | 0.90         | 17.07        | 22.65         | 7.00        | 23.71        |
| 35               | 258.37                | 27.40         | 1.65       | 0.21         | 6.57          | 2.37        | 10.23          | 1.27         | 29.96        | 41.51         | 9.12        | 42.50        |
| 38               | 140.25                | 54.17         | 2.01       | 0.26         | 11.84         | 3.24        | 10.51          | 1.25         | 56.72        | 79.68         | 8.39        | 80.12        |
| 41               | 69.11                 | > 100         | 3.02       | 0.72         | 23.64         | 4.41        | 13.93          | 1.64         | > 100        | > 100         | 8.70        | > 100        |
| 44               | 38.69                 | > 100         | 4.47       | 1.45         | 42.02         | 7.07        | 18.27          | 3.18         | > 100        | > 100         | 12.16       | > 100        |
| 47               | 48.71                 | 91.45         | 3.06       | 1.39         | 36.09         | 6.32        | 13.30          | 2.66         | > 100        | > 100         | 10.66       | > 100        |
| 50               | 82.76                 | 48.88         | 2.83       | 0.89         | 33.21         | 3.23        | 8.49           | 1.44         | > 100        | > 100         | 7.09        | > 100        |
| 53               | 66.89                 | 41.77         | 4.82       | 0.94         | 78.41         | 3.44        | 11.50          | 1.59         | > 100        | > 100         | 9.55        | > 100        |
| 56               | 46.18                 | 40.16         | 7.54       | 0.99         | > 100         | 5.19        | 18.26          | 2.19         | > 100        | > 100         | 14.58       | > 100        |
| 59               | 19.20                 | 68.93         | 17.77      | 1.59         | > 100         | 14.43       | 47.08          | 5.41         | > 100        | > 100         | 36.29       | > 100        |
| 62               | 0.75                  | > 100         | > 100      | 27.22        | > 100         | > 100       | > 100          | > 100        | > 100        | > 100         | > 100       | > 100        |
| 64               | -3.73                 | > 100         | 83.20      | 6.82         | > 100         | > 100       | > 100          | 31.98        | > 100        | > 100         | > 100       | > 100        |

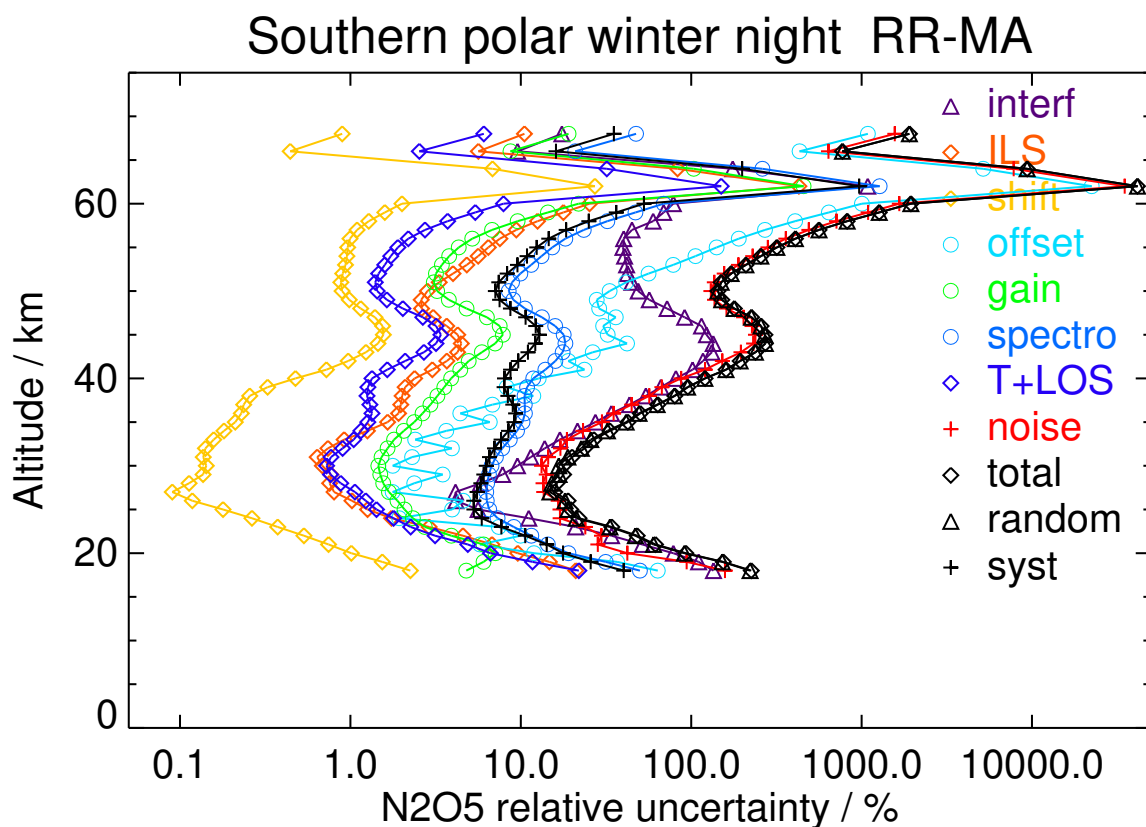


Figure S96: V8R\_N2O5\_561 Southern polar winter night

Table S101: N2O5 error budget for Southern polar spring day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 20               | 78.96                 | 29.67         | 5.57       | 0.95         | 9.71          | 6.79        | 9.92           | 4.54         | 37.13        | 49.74         | 8.71        | 50.50        |
| 23               | 106.00                | 25.82         | 3.34       | 0.34         | 10.24         | 3.86        | 8.58           | 1.39         | 30.47        | 41.94         | 6.54        | 42.45        |
| 26               | 117.74                | 37.39         | 3.42       | 0.36         | 10.15         | 4.10        | 8.56           | 0.96         | 27.97        | 48.45         | 6.19        | 48.85        |
| 29               | 70.69                 | 60.08         | 6.57       | 0.83         | 18.21         | 4.34        | 13.64          | 1.23         | 48.91        | 80.71         | 8.40        | 81.14        |
| 32               | 52.33                 | 77.58         | 8.88       | 1.03         | 27.30         | 3.78        | 13.07          | 1.62         | 73.93        | > 100         | 11.00       | > 100        |
| 35               | 36.54                 | > 100         | 5.52       | 1.59         | 45.57         | 7.77        | 13.99          | 2.11         | > 100        | > 100         | 11.08       | > 100        |
| 38               | 32.68                 | 97.15         | 8.50       | 1.25         | 57.00         | 12.68       | 14.07          | 2.47         | > 100        | > 100         | 16.23       | > 100        |
| 41               | -17.29                | > 100         | 15.51      | 2.03         | > 100         | 17.66       | 15.95          | 4.06         | > 100        | > 100         | 23.35       | > 100        |
| 44               | 9.40                  | > 100         | 19.59      | 4.80         | > 100         | 17.31       | 30.11          | 7.29         | > 100        | > 100         | 28.44       | > 100        |
| 47               | 23.27                 | > 100         | 9.21       | 2.92         | 69.61         | 10.64       | 18.88          | 4.52         | > 100        | > 100         | 14.67       | > 100        |
| 50               | 49.57                 | 66.73         | 6.05       | 1.70         | 37.15         | 5.72        | 13.19          | 2.54         | > 100        | > 100         | 11.40       | > 100        |
| 53               | 51.60                 | 39.46         | 6.58       | 1.60         | 67.58         | 4.10        | 17.35          | 2.54         | > 100        | > 100         | 14.82       | > 100        |
| 56               | 71.59                 | 13.56         | 4.82       | 0.93         | 92.27         | 3.42        | 14.74          | 1.84         | > 100        | > 100         | 11.91       | > 100        |
| 59               | 85.69                 | 6.54          | 3.82       | 0.59         | > 100         | 3.99        | 13.34          | 1.55         | > 100        | > 100         | 10.25       | > 100        |
| 62               | 81.71                 | 8.46          | 3.68       | 0.81         | > 100         | 7.41        | 14.77          | 1.85         | > 100        | > 100         | 10.78       | > 100        |
| 64               | 66.78                 | 11.23         | 4.65       | 1.52         | > 100         | 12.47       | 18.46          | 2.61         | > 100        | > 100         | 13.19       | > 100        |

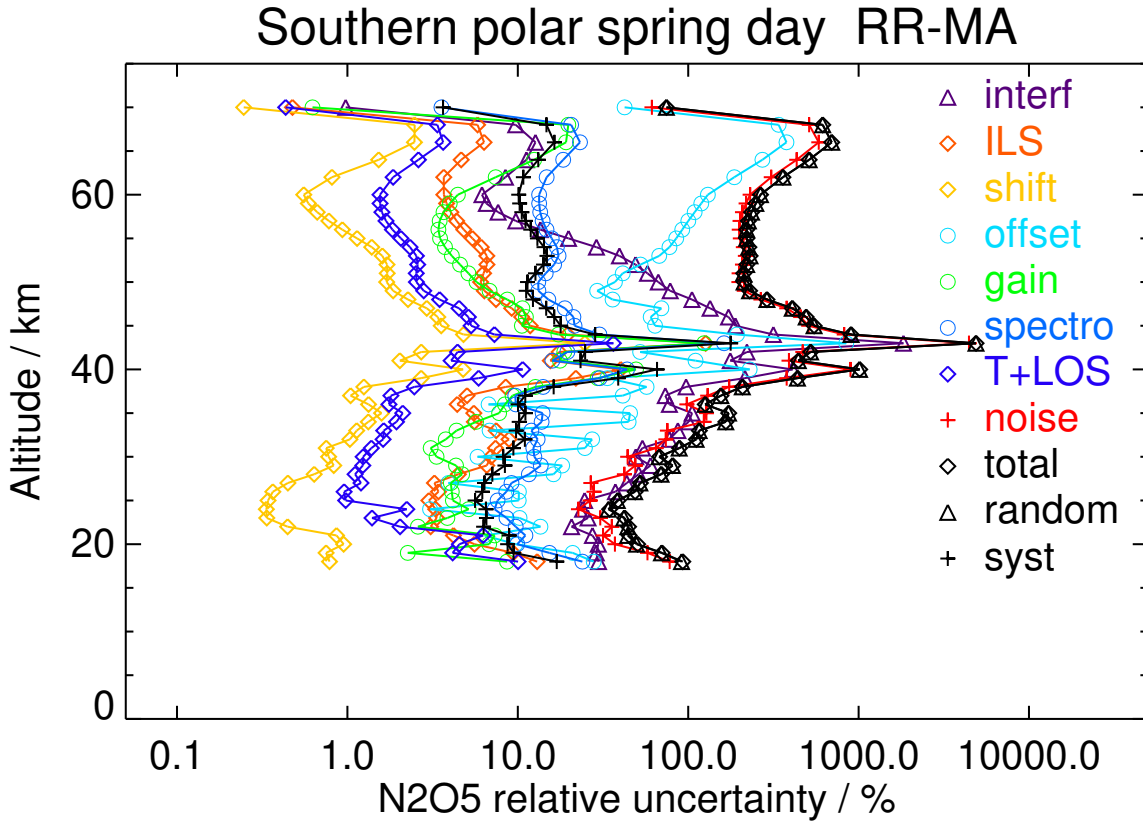


Figure S97: V8R\_N2O5\_561 Southern polar spring day

Table S102: N2O5 error budget for Southern polar spring night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 20               | 236.94                | 10.58         | 4.15       | 0.22         | 2.92          | 7.51        | 8.03           | 2.27         | 10.61        | 17.46         | 8.46        | 19.40        |
| 23               | 461.03                | 5.31          | 1.57       | 0.18         | 2.10          | 2.79        | 6.53           | 0.80         | 6.33         | 9.72          | 5.64        | 11.24        |
| 26               | 687.18                | 6.15          | 1.49       | 0.17         | 1.60          | 2.79        | 6.67           | 0.57         | 4.60         | 9.23          | 5.59        | 10.79        |
| 29               | 850.08                | 4.62          | 1.13       | 0.16         | 1.41          | 2.10        | 7.48           | 0.54         | 4.16         | 8.24          | 5.89        | 10.13        |
| 32               | 763.66                | 4.64          | 1.39       | 0.27         | 1.79          | 1.52        | 8.19           | 0.71         | 5.39         | 8.71          | 7.05        | 11.21        |
| 35               | 380.30                | 8.88          | 2.39       | 0.40         | 4.11          | 2.23        | 10.89          | 1.16         | 12.88        | 17.26         | 9.73        | 19.81        |
| 38               | 161.60                | 17.92         | 1.54       | 0.24         | 10.60         | 3.37        | 12.54          | 1.12         | 36.09        | 42.44         | 10.34       | 43.69        |
| 41               | 52.67                 | 49.82         | 3.92       | 0.72         | 33.15         | 8.04        | 16.44          | 1.99         | > 100        | > 100         | 15.07       | > 100        |
| 44               | 9.46                  | > 100         | 16.08      | 4.14         | > 100         | 21.43       | 58.58          | 10.06        | > 100        | > 100         | 41.46       | > 100        |
| 47               | 27.58                 | > 100         | 5.66       | 2.15         | 57.57         | 10.34       | 17.23          | 4.48         | > 100        | > 100         | 13.29       | > 100        |
| 50               | 63.18                 | 47.53         | 3.95       | 1.25         | 31.68         | 6.02        | 9.70           | 2.28         | > 100        | > 100         | 8.31        | > 100        |
| 53               | 62.69                 | 31.49         | 5.24       | 1.25         | 63.90         | 4.85        | 12.86          | 2.29         | > 100        | > 100         | 11.04       | > 100        |
| 56               | 44.29                 | 25.10         | 8.59       | 1.46         | > 100         | 6.29        | 21.41          | 3.01         | > 100        | > 100         | 18.18       | > 100        |
| 59               | 47.01                 | 12.90         | 8.73       | 0.93         | > 100         | 9.07        | 22.08          | 2.76         | > 100        | > 100         | 18.56       | > 100        |
| 62               | 49.27                 | 13.33         | 9.62       | 0.95         | > 100         | 15.91       | 23.17          | 2.98         | > 100        | > 100         | 19.91       | > 100        |
| 64               | 51.97                 | 12.61         | 10.39      | 1.43         | > 100         | 20.21       | 23.13          | 3.24         | > 100        | > 100         | 20.62       | > 100        |

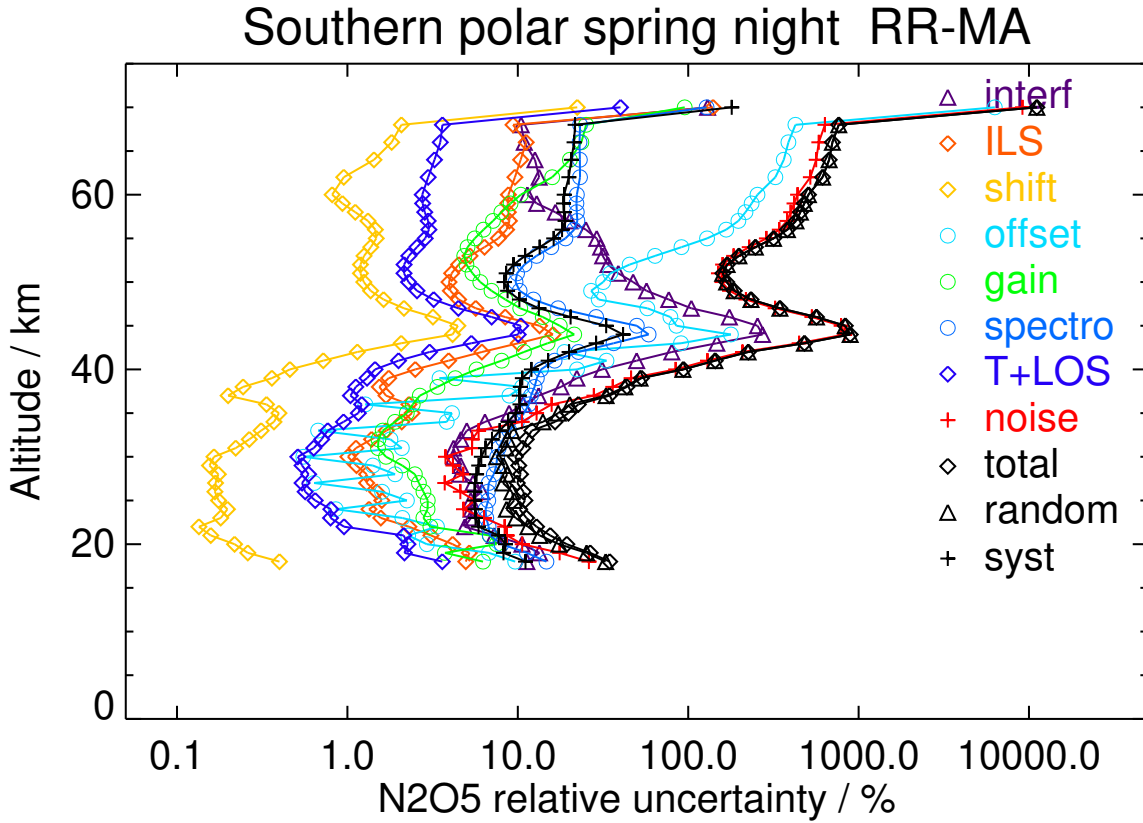


Figure S98: V8R\_N2O5\_561 Southern polar spring night

Table S103: N2O5 error budget for Southern polar summer day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 17               | 6.83                  | > 100         | 63.66      | 14.14        | > 100         | > 100       | > 100          | 79.74        | > 100        | > 100         | > 100       | > 100        |
| 20               | -6.05                 | > 100         | 22.83      | 10.93        | 89.84         | > 100       | 69.65          | 59.85        | > 100        | > 100         | > 100       | > 100        |
| 23               | 7.69                  | > 100         | 16.38      | 4.21         | 90.05         | 25.49       | 68.78          | 35.79        | > 100        | > 100         | 63.92       | > 100        |
| 26               | 42.11                 | 36.57         | 3.95       | 0.94         | 21.00         | 12.55       | 15.89          | 5.59         | 64.13        | 77.58         | 18.16       | 79.68        |
| 29               | 37.05                 | 35.05         | 9.86       | 0.91         | 29.92         | 2.89        | 13.05          | 3.27         | 91.05        | > 100         | 11.02       | > 100        |
| 32               | 30.64                 | 60.04         | 12.14      | 1.38         | 45.66         | 5.60        | 13.97          | 3.01         | > 100        | > 100         | 13.35       | > 100        |
| 35               | 24.70                 | 99.88         | 7.99       | 1.44         | 66.91         | 3.66        | 17.03          | 3.44         | > 100        | > 100         | 10.42       | > 100        |
| 38               | 26.55                 | 92.84         | 9.19       | 0.92         | 69.74         | 4.69        | 15.70          | 2.70         | > 100        | > 100         | 11.93       | > 100        |
| 41               | 11.16                 | > 100         | 28.39      | 4.54         | > 100         | 30.94       | 38.46          | 6.13         | > 100        | > 100         | 44.08       | > 100        |
| 44               | 40.46                 | 73.77         | 2.77       | 1.22         | 47.85         | 2.47        | 10.61          | 1.87         | > 100        | > 100         | 6.58        | > 100        |
| 47               | 36.64                 | 92.27         | 3.52       | 0.82         | 51.78         | 4.02        | 12.38          | 3.13         | > 100        | > 100         | 10.16       | > 100        |
| 50               | 21.21                 | > 100         | 16.90      | 1.54         | 82.23         | 5.10        | 21.93          | 4.29         | > 100        | > 100         | 21.24       | > 100        |
| 53               | 44.85                 | 66.87         | 11.90      | 0.94         | 42.38         | 2.48        | 10.80          | 2.07         | > 100        | > 100         | 14.17       | > 100        |
| 56               | 57.05                 | 32.97         | 10.40      | 0.74         | 57.05         | 2.35        | 10.79          | 1.86         | > 100        | > 100         | 12.93       | > 100        |
| 59               | 53.48                 | 12.34         | 8.96       | 0.44         | > 100         | 2.67        | 14.23          | 2.23         | > 100        | > 100         | 13.18       | > 100        |
| 62               | 40.88                 | 14.57         | 2.86       | 0.84         | > 100         | 10.86       | 23.69          | 3.66         | > 100        | > 100         | 18.15       | > 100        |
| 64               | 47.46                 | 16.58         | 6.33       | 1.42         | > 100         | 19.09       | 22.80          | 4.33         | > 100        | > 100         | 23.84       | > 100        |

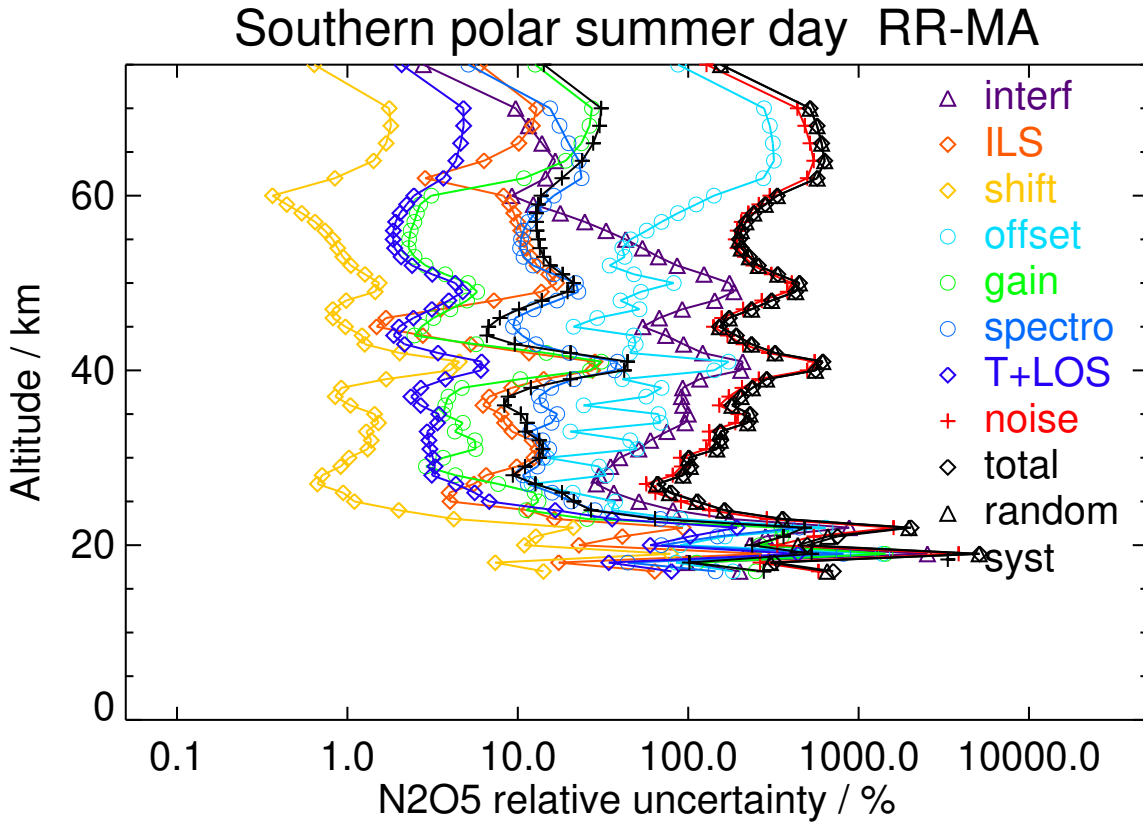


Figure S99: V8R\_N2O5\_561 Southern polar summer day

Table S104: N2O5 error budget for Southern polar summer night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 17               | 39.44                 | 34.13         | 6.70       | 2.48         | 33.65         | 55.55       | 34.13          | 14.57        | 98.49        | > 100         | 60.08       | > 100        |
| 20               | 116.03                | 11.15         | 2.41       | 0.38         | 4.93          | 17.21       | 8.72           | 4.57         | 16.39        | 21.95         | 18.30       | 28.58        |
| 23               | 292.48                | 4.62          | 1.16       | 0.23         | 3.03          | 2.06        | 7.43           | 1.63         | 8.70         | 10.73         | 7.39        | 13.03        |
| 26               | 544.25                | 2.62          | 0.63       | 0.09         | 2.21          | 2.57        | 5.19           | 0.76         | 5.99         | 7.14          | 5.58        | 9.06         |
| 29               | 588.84                | 1.98          | 0.48       | 0.05         | 2.50          | 1.65        | 6.23           | 0.50         | 6.87         | 7.79          | 6.23        | 9.97         |
| 32               | 512.92                | 3.13          | 0.96       | 0.14         | 3.35          | 1.64        | 7.00           | 0.56         | 9.52         | 10.78         | 6.96        | 12.83        |
| 35               | 352.01                | 7.23          | 1.31       | 0.14         | 5.30          | 1.55        | 7.86           | 0.62         | 16.07        | 18.57         | 7.75        | 20.12        |
| 38               | 213.28                | 13.41         | 1.48       | 0.15         | 8.99          | 2.68        | 10.36          | 1.00         | 29.75        | 34.11         | 9.99        | 35.54        |
| 41               | 64.70                 | 34.62         | 0.54       | 0.42         | 28.56         | 3.37        | 18.00          | 2.26         | > 100        | > 100         | 16.16       | > 100        |
| 44               | 23.62                 | > 100         | 2.81       | 0.91         | 75.53         | 6.35        | 21.08          | 5.13         | > 100        | > 100         | 12.20       | > 100        |
| 47               | 26.07                 | > 100         | 6.15       | 0.57         | 64.37         | 4.34        | 19.17          | 3.27         | > 100        | > 100         | 14.44       | > 100        |
| 50               | 83.90                 | 38.00         | 4.22       | 0.29         | 21.18         | 1.43        | 7.30           | 1.17         | > 100        | > 100         | 6.88        | > 100        |
| 53               | 62.78                 | 38.19         | 7.31       | 0.38         | 50.34         | 1.63        | 9.75           | 1.94         | > 100        | > 100         | 10.31       | > 100        |
| 56               | 13.04                 | > 100         | 34.66      | 1.76         | > 100         | 7.74        | 41.38          | 9.53         | > 100        | > 100         | 46.46       | > 100        |
| 59               | -33.94                | 20.63         | 10.23      | 0.59         | > 100         | 5.13        | 15.35          | 3.78         | > 100        | > 100         | 15.44       | > 100        |
| 62               | -51.45                | 8.64          | 2.33       | 0.36         | > 100         | 10.88       | 10.62          | 3.23         | > 100        | > 100         | 12.70       | > 100        |
| 64               | -56.35                | 9.09          | 2.49       | 0.53         | > 100         | 15.73       | 10.13          | 3.71         | > 100        | > 100         | 16.56       | > 100        |

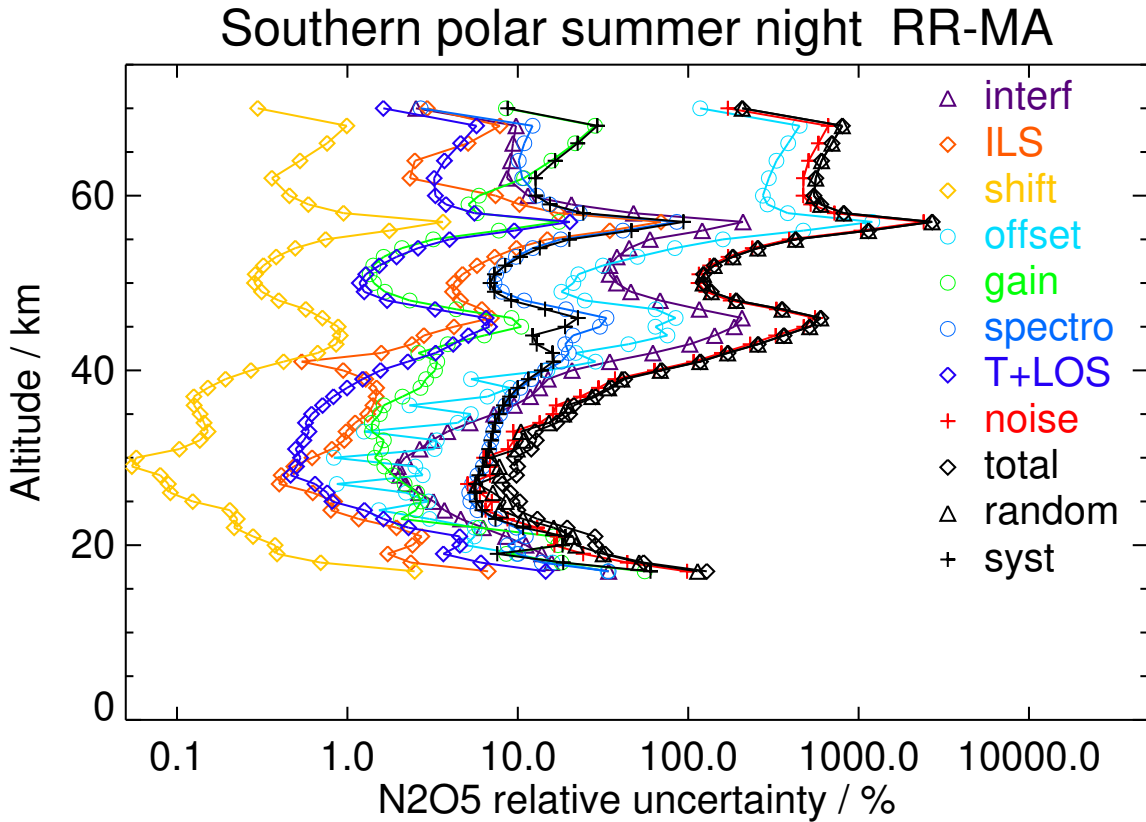


Figure S100: V8R\_N2O5\_561 Southern polar summer night

Table S105: N2O5 error budget for Southern polar autumn day. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 20               | 108.48                | 30.80         | 3.36       | 0.46         | 4.88          | 17.93       | 16.24          | 6.39         | 17.96        | 37.20         | 23.43       | 43.96        |
| 23               | 518.32                | 5.13          | 1.61       | 0.27         | 2.33          | 3.17        | 9.88           | 1.97         | 6.81         | 9.45          | 10.15       | 13.87        |
| 26               | 1178.96               | 1.02          | 0.69       | 0.09         | 1.47          | 1.92        | 5.18           | 0.78         | 4.36         | 5.02          | 5.34        | 7.33         |
| 29               | 1342.92               | 2.29          | 0.29       | 0.03         | 1.47          | 1.59        | 6.68           | 0.75         | 4.84         | 5.86          | 6.66        | 8.87         |
| 32               | 1127.87               | 4.04          | 0.26       | 0.04         | 1.68          | 1.58        | 8.63           | 0.93         | 6.68         | 8.45          | 8.38        | 11.90        |
| 35               | 670.11                | 9.13          | 0.94       | 0.09         | 2.43          | 2.01        | 11.68          | 1.15         | 12.55        | 16.07         | 11.45       | 19.73        |
| 38               | 329.27                | 20.62         | 1.74       | 0.12         | 4.44          | 2.76        | 14.63          | 1.46         | 27.73        | 35.21         | 14.17       | 37.95        |
| 41               | 135.96                | 47.93         | 2.24       | 0.29         | 10.80         | 4.41        | 16.49          | 2.20         | 72.71        | 88.18         | 15.04       | 89.45        |
| 44               | 76.50                 | 85.87         | 1.85       | 0.38         | 21.87         | 4.35        | 11.66          | 2.74         | > 100        | > 100         | 8.84        | > 100        |
| 47               | 49.81                 | > 100         | 2.41       | 0.51         | 48.89         | 5.13        | 13.35          | 3.65         | > 100        | > 100         | 8.71        | > 100        |
| 50               | 32.51                 | > 100         | 5.72       | 0.96         | > 100         | 9.22        | 20.93          | 5.18         | > 100        | > 100         | 15.41       | > 100        |
| 53               | 24.72                 | > 100         | 10.76      | 1.50         | > 100         | 14.20       | 28.30          | 6.43         | > 100        | > 100         | 23.75       | > 100        |
| 56               | 18.33                 | > 100         | 17.10      | 2.10         | > 100         | 20.74       | 39.02          | 8.60         | > 100        | > 100         | 34.08       | > 100        |
| 59               | 22.53                 | > 100         | 14.40      | 1.58         | > 100         | 17.18       | 32.71          | 7.18         | > 100        | > 100         | 28.03       | > 100        |
| 62               | 31.04                 | 26.31         | 9.95       | 0.93         | > 100         | 12.03       | 24.56          | 5.39         | > 100        | > 100         | 19.83       | > 100        |
| 64               | 40.44                 | 12.17         | 7.19       | 0.61         | > 100         | 8.84        | 19.12          | 4.21         | > 100        | > 100         | 14.73       | > 100        |

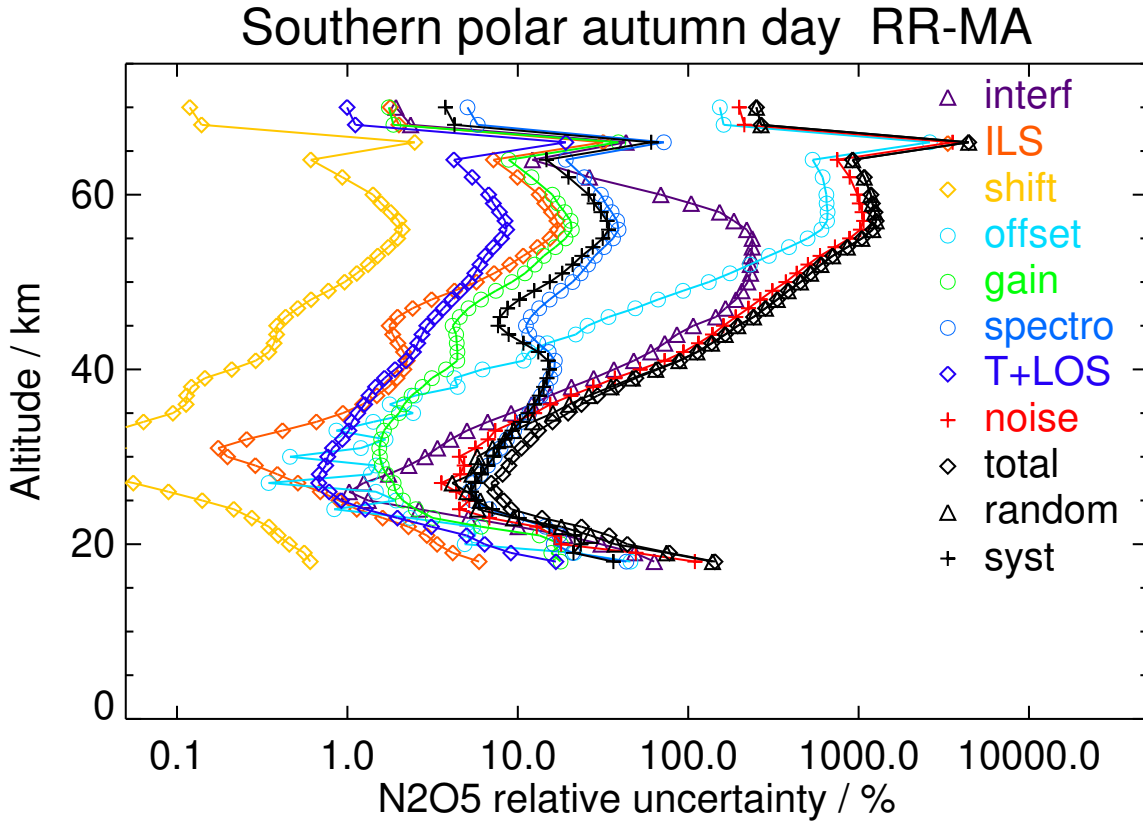


Figure S101: V8R\_N2O5\_561 Southern polar autumn day

Table S106: N2O5 error budget for Southern polar autumn night. All uncertainties are  $1\sigma$ .

| altitude<br>(km) | mean target<br>(pptv) | interf<br>(%) | ILS<br>(%) | shift<br>(%) | offset<br>(%) | gain<br>(%) | spectro<br>(%) | T+LOS<br>(%) | noise<br>(%) | random<br>(%) | syst<br>(%) | total<br>(%) |
|------------------|-----------------------|---------------|------------|--------------|---------------|-------------|----------------|--------------|--------------|---------------|-------------|--------------|
| 20               | 87.38                 | 30.76         | 4.67       | 0.61         | 6.04          | 19.84       | 26.58          | 8.78         | 23.34        | 41.61         | 31.54       | 52.22        |
| 23               | 521.86                | 4.74          | 1.80       | 0.25         | 2.37          | 2.97        | 10.07          | 2.10         | 7.18         | 9.74          | 10.14       | 14.06        |
| 26               | 1161.21               | 1.01          | 0.73       | 0.08         | 1.50          | 1.99        | 5.19           | 0.81         | 4.56         | 5.35          | 5.25        | 7.49         |
| 29               | 1287.00               | 2.07          | 0.26       | 0.04         | 1.46          | 1.61        | 7.10           | 0.78         | 5.19         | 6.29          | 6.88        | 9.33         |
| 32               | 940.77                | 4.16          | 0.49       | 0.05         | 1.88          | 1.61        | 9.65           | 1.06         | 8.25         | 10.08         | 9.19        | 13.64        |
| 35               | 536.00                | 9.78          | 1.06       | 0.13         | 2.96          | 2.07        | 12.09          | 1.26         | 15.99        | 19.31         | 11.84       | 22.65        |
| 38               | 263.59                | 22.10         | 1.83       | 0.18         | 5.49          | 2.57        | 13.90          | 1.50         | 35.29        | 42.34         | 13.31       | 44.38        |
| 41               | 101.64                | 61.29         | 2.50       | 0.33         | 14.14         | 3.81        | 15.38          | 2.55         | 98.57        | > 100         | 13.20       | > 100        |
| 44               | 18.30                 | > 100         | 6.38       | 1.17         | 91.93         | 14.05       | 31.00          | 11.04        | > 100        | > 100         | 19.37       | > 100        |
| 47               | 3.66                  | > 100         | 30.67      | 5.82         | > 100         | 67.81       | > 100          | 47.12        | > 100        | > 100         | 85.44       | > 100        |
| 50               | 16.44                 | > 100         | 9.96       | 1.81         | > 100         | 17.24       | 32.39          | 9.25         | > 100        | > 100         | 25.60       | > 100        |
| 53               | 18.17                 | > 100         | 12.99      | 2.03         | > 100         | 16.05       | 38.15          | 7.96         | > 100        | > 100         | 28.91       | > 100        |
| 56               | 21.13                 | > 100         | 12.77      | 1.85         | > 100         | 13.41       | 39.20          | 7.01         | > 100        | > 100         | 27.22       | > 100        |
| 59               | 16.50                 | > 100         | 16.26      | 2.26         | > 100         | 17.04       | 55.64          | 9.47         | > 100        | > 100         | 36.14       | > 100        |
| 62               | 9.41                  | 79.12         | 25.70      | 3.38         | > 100         | 31.37       | > 100          | 17.67        | > 100        | > 100         | 65.12       | > 100        |
| 64               | 5.56                  | 89.57         | 40.06      | 5.04         | > 100         | 56.24       | > 100          | 30.99        | > 100        | > 100         | > 100       | > 100        |

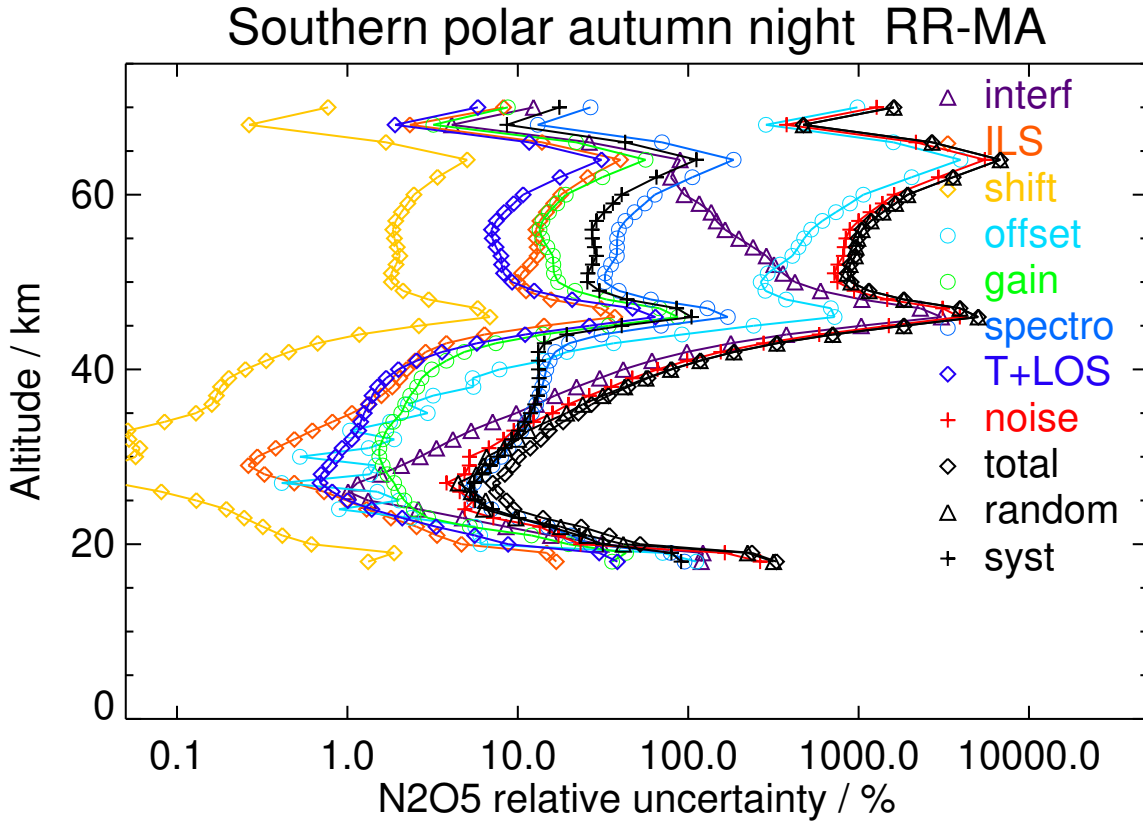


Figure S102: V8R\_N2O5\_561 Southern polar autumn night

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