SUPPLEMENTARY MATERIAL FOR:

Explaining trends and changing seasonal cycles of surface ozone in North America and Europe over the 2000-2018 period: A global modelling study with NO$_X$ and VOC tagging

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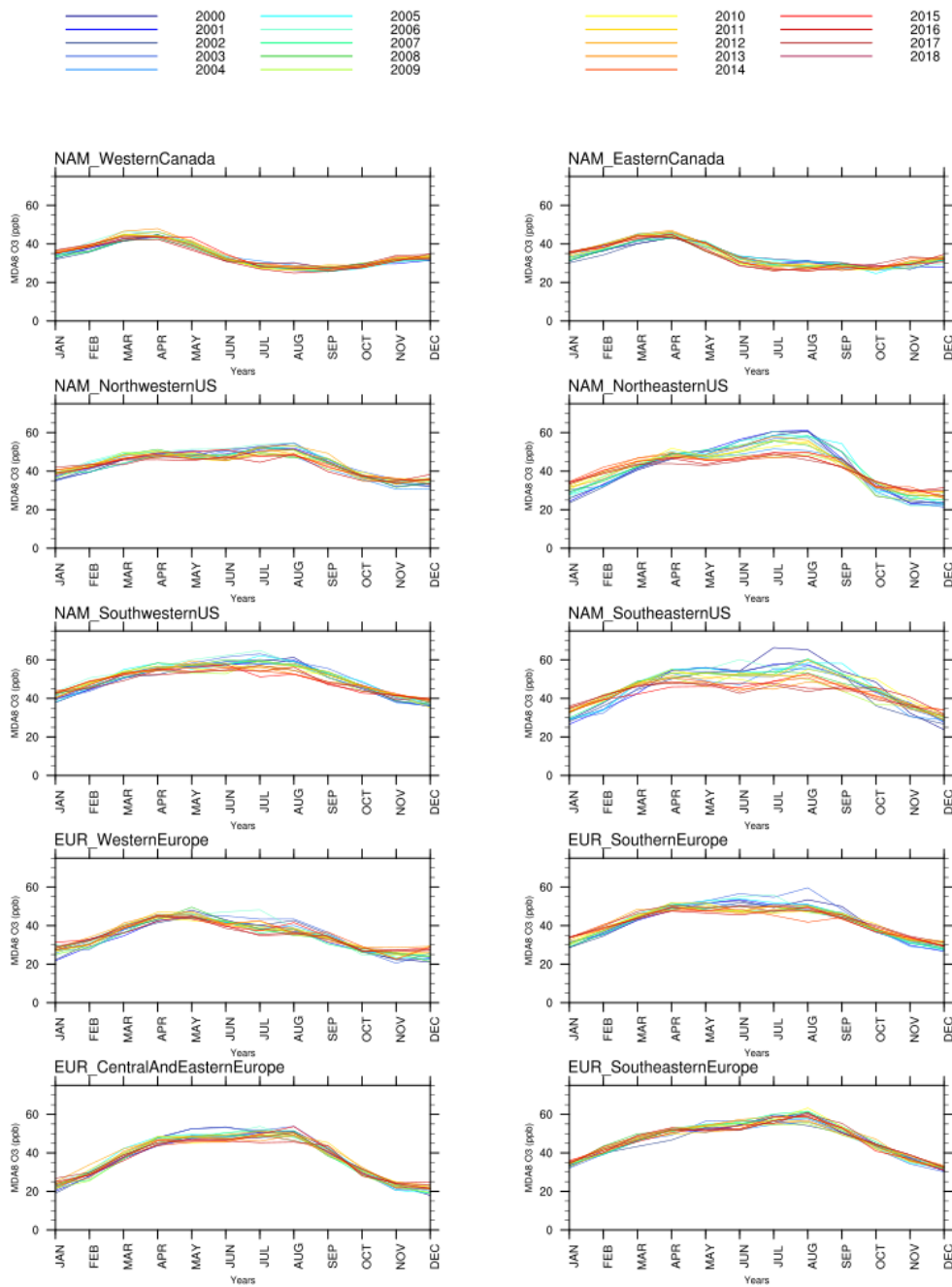
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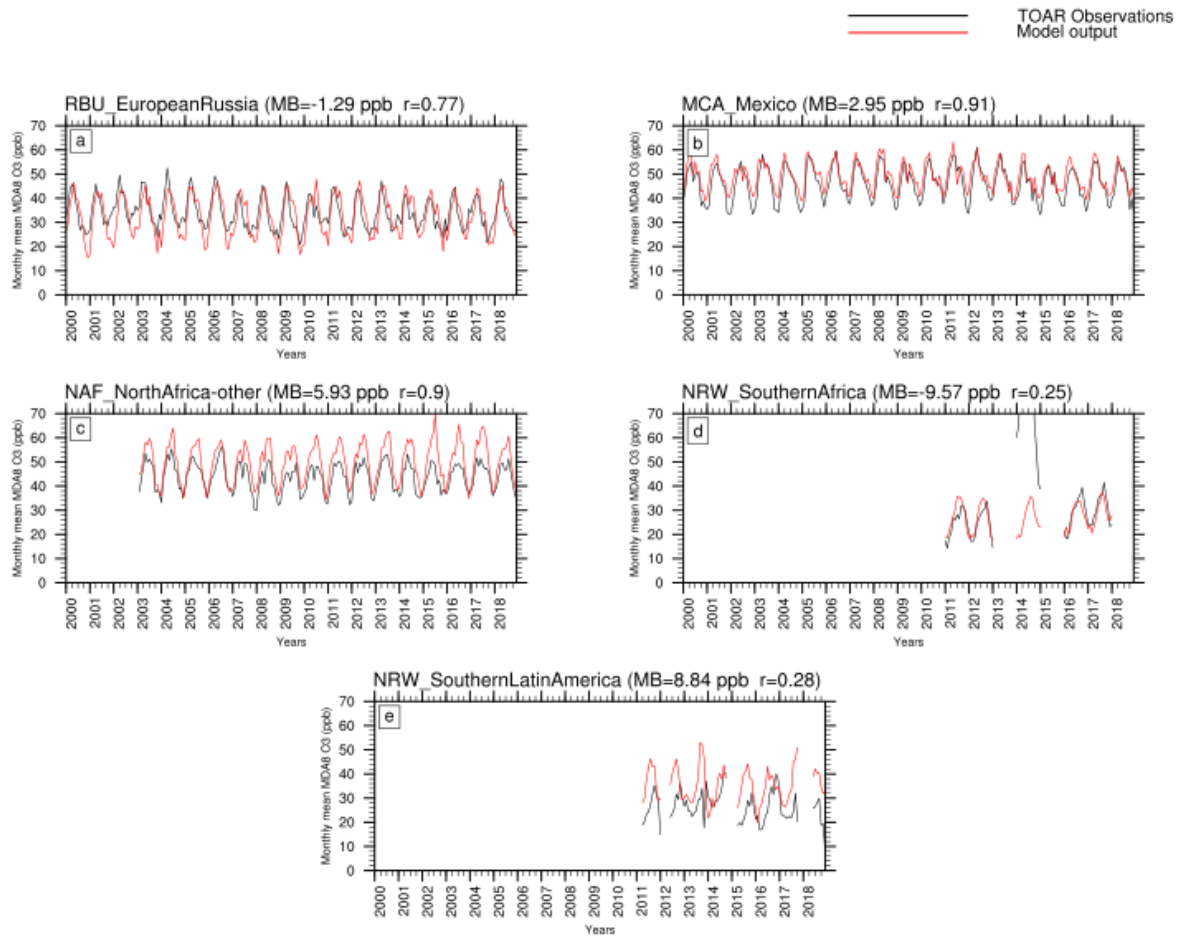
Figure S1: Time series of observed versus simulated monthly mean MDA8 O$_3$ for various receptor regions. Only rural stations data were utilized from the TOAR database and model output was fetched only for those gridcells where observations were available.

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Figure S2: Envelope plots for regional averaged MDA8 O₃ seasonal cycles for 2000-2018 for different receptor regions in North America and Europe. Model output was sampled from all gridcells within the geographic definition of each receptor region.
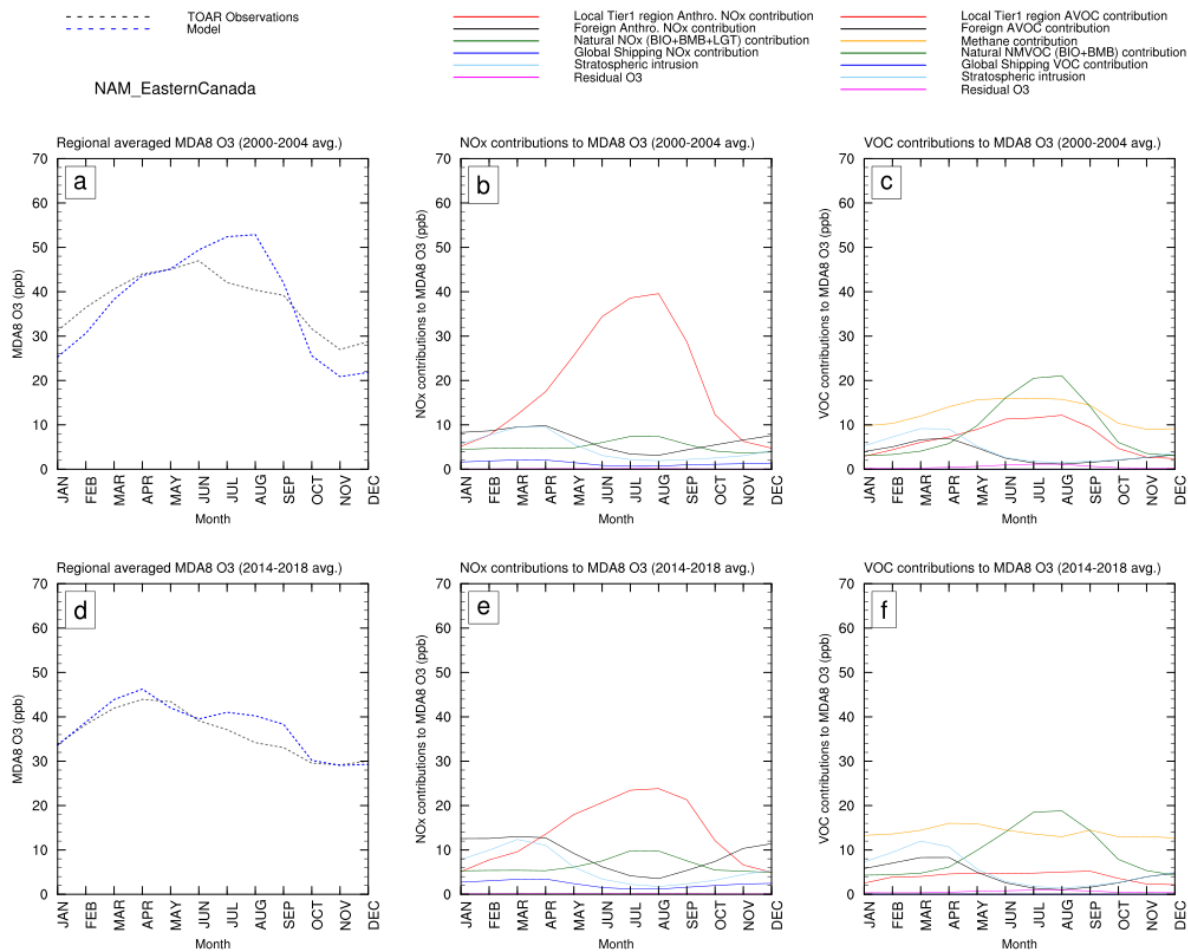
Figure S3: 5-year average MDA8 O₃ seasonal cycles for Eastern Canada for 2000-2004 (a) and 2014-2018 (b) along with their NOₓ (b,e) and VOC contributions (c,f).

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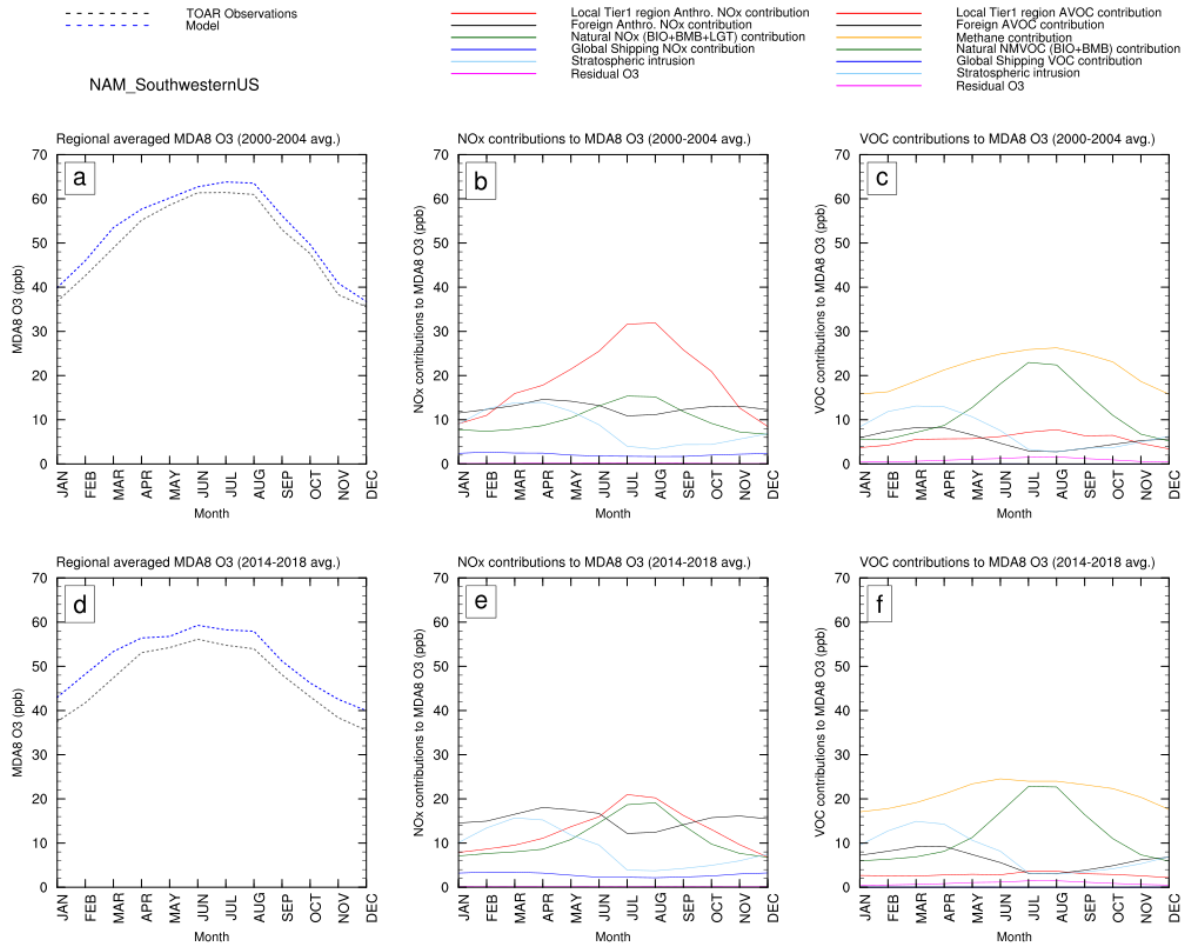
Figure S4: 5-year average MDA8 O₃ seasonal cycles for Southwestern US for 2000-2004 (a) and 2014-2018 (b) along with their NOₓ (b,e) and VOC contributions (c,f).

NAM_SoutheasternUS
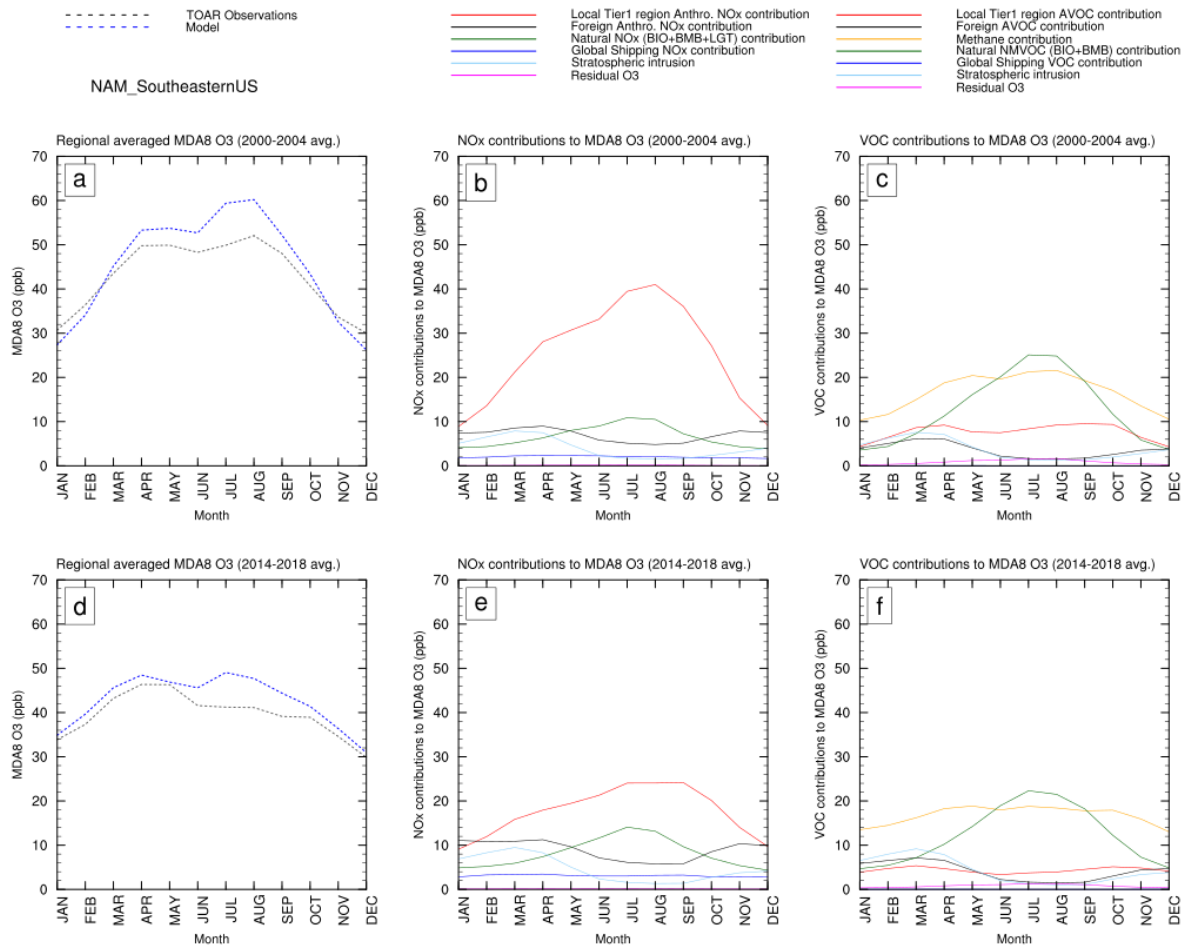
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Figure S5: 5-year average MDA8 O$_3$ seasonal cycles for Southeastern US for 2000-2004 (a) and 2014-2018 (b) along with their NO$_X$ (b,e) and VOC contributions (c,f).

Figure S6: 5-year average MDA8 O₃ seasonal cycles for Central & Eastern Europe for 2000-2004 (a) and 2014-2018 (b) along with their NOₓ (b,e) and VOC contributions (c,f).
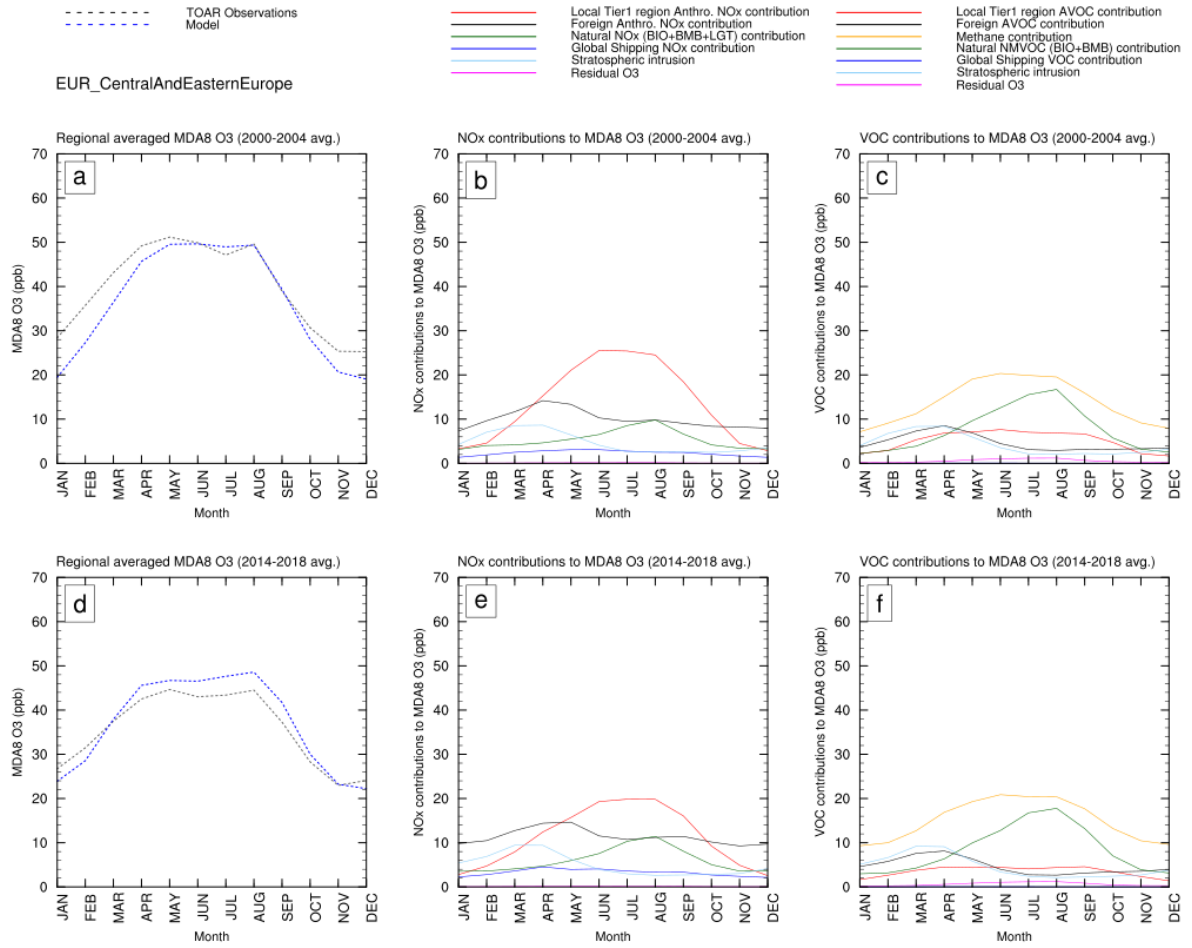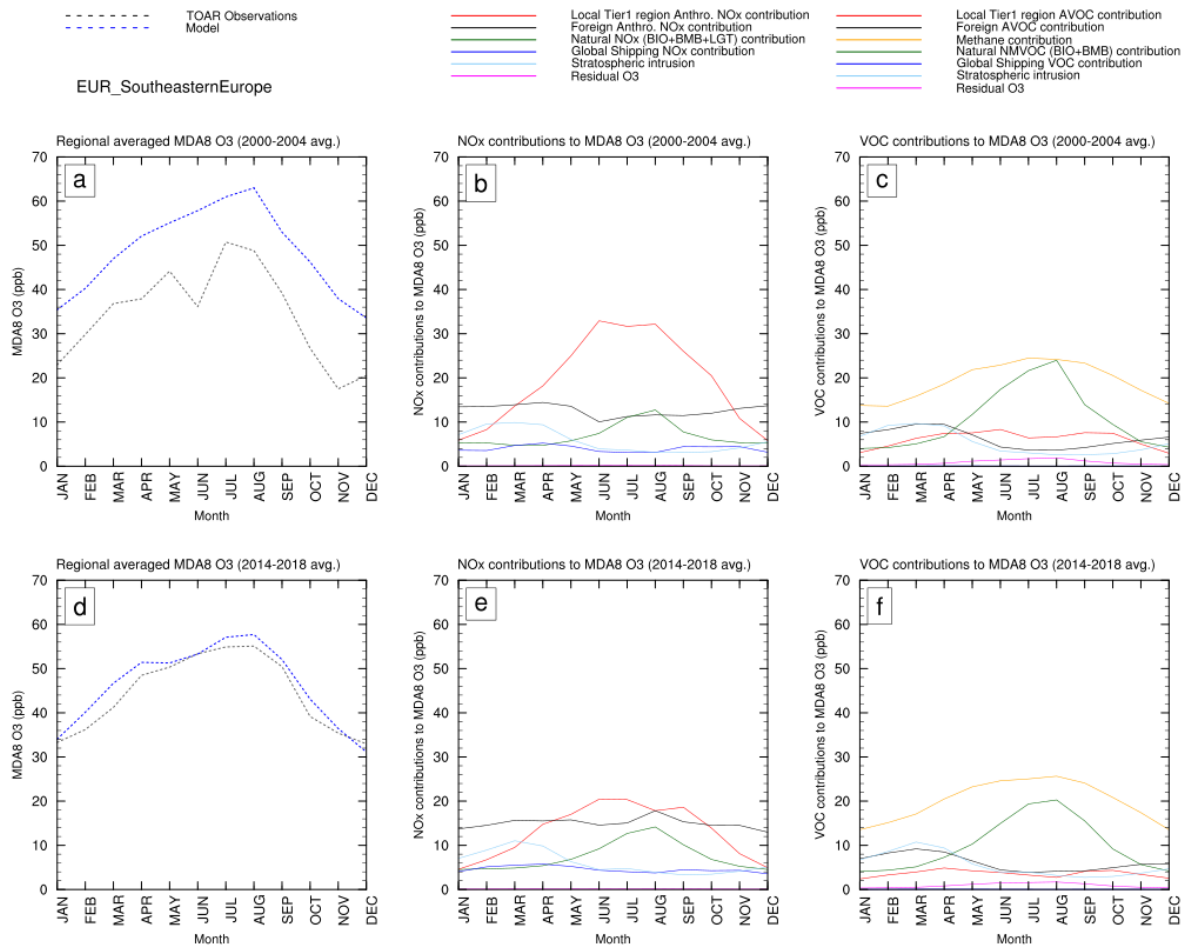
Figure S7: 5-year average MDA8 O₃ seasonal cycles for Southeastern Europe for 2000-2004 (a) and 2014-2018 (b) along with their NOₓ (b,e) and VOC contributions (c,f).
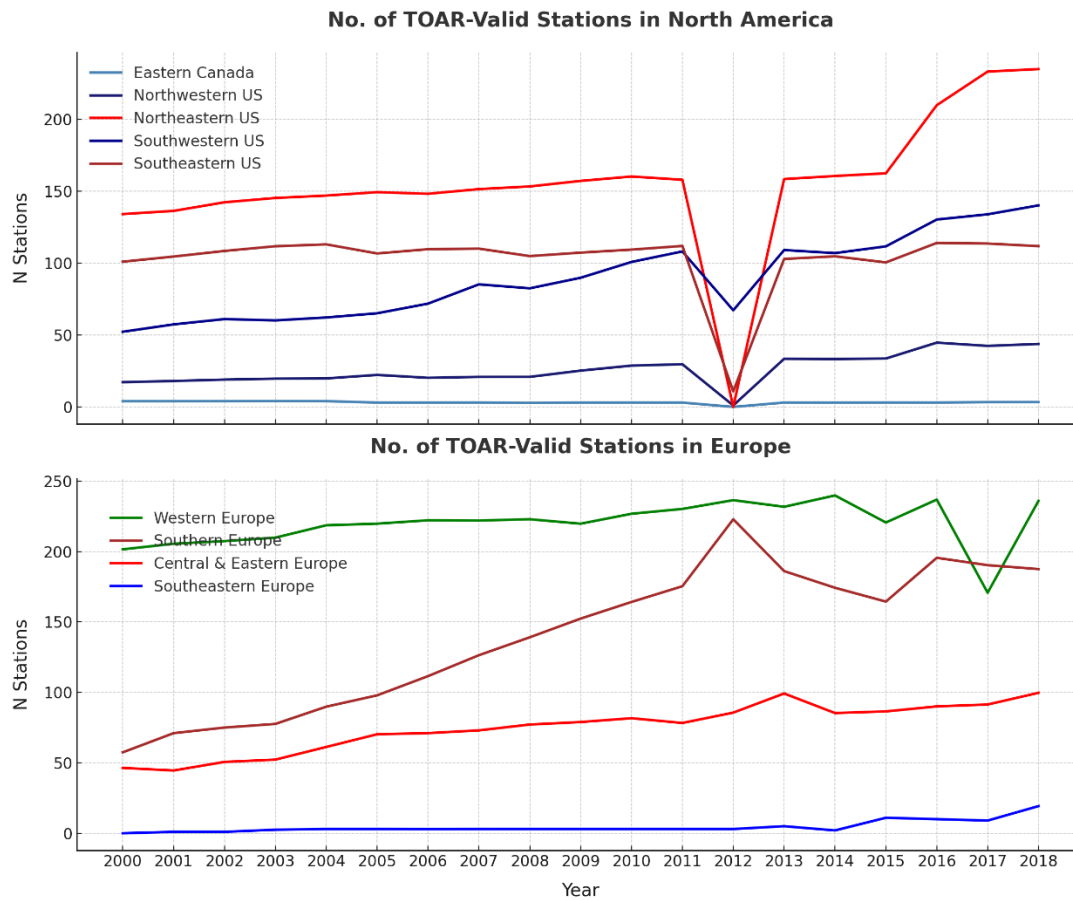
Figure S8: Average number of TOAR rural stations available per year within each receptor region for North America (top) and Europe (bottom) for the 2000-2018 period.

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70 **Table S1: Thiel-Sen trends in ppb/yr and their significance (shown in brackets) for Peak Season Ozone and its tagged source contributions for various receptor regions.**

Region	TOAR	Model	Local Ant. NOx	Foreign Ant. NOx	Natural NOx	Ship NOx	Local AVOC	Foreign AVOC	Methane	natural VOC	Ship AVOC	Strat.
Eastern Canada	-0.24 (1)	-0.35 (0.99)	-0.75 (1)	0.2 (1)	0.06 (0.97)	0.08 (1)	-0.32 (1)	0.09 (0.99)	0.02 (0.47)	-0.17 (0.89)	0 (0.33)	0.12 (0.99)
Northwestern US	-0.11 (0.82)	-0.11 (0.97)	-0.38 (1)	0.12 (1)	0.07 (0.95)	0.04 (1)	-0.15 (1)	0.02 (0.91)	0.03 (0.97)	-0.03 (0.97)	0 (1)	0.02 (0.38)
Southwestern US	-0.34 (1)	-0.25 (1)	-0.71 (1)	0.2 (1)	0.05 (0.91)	0.05 (1)	-0.25 (1)	0.11 (1)	-0.09 (1)	-0.12 (0.79)	0 (1)	0.13 (0.99)
Northeastern US	-0.43 (1)	-0.52 (1)	-0.94 (1)	0.17 (1)	0.13 (1)	0.06 (1)	-0.37 (1)	0.08 (0.99)	-0.11 (1)	-0.25 (0.97)	-0 (0.92)	0.12 (0.99)
Southeastern US	-0.47 (1)	-0.6 (1)	-1.07 (1)	0.17 (1)	0.11 (1)	0.08 (1)	-0.33 (1)	0.09 (1)	-0.16 (1)	-0.33 (0.99)	0 (0.94)	0.14 (1)
Western Europe	-0.13 (0.96)	-0.01 (0.22)	-0.26 (1)	0.06 (0.99)	0.06 (1)	0.12 (1)	-0.16 (1)	-0 (0.47)	0.08 (1)	0.07 (0.97)	0 (0.56)	0.04 (0.82)
Southern Europe	-0.04 (0.52)	-0.17 (0.98)	-0.51 (1)	0.07 (0.98)	0.06 (0.94)	0.16 (1)	-0.22 (1)	-0.02 (0.77)	0.01 (0.11)	0.01 (0.11)	0 (0.88)	0.04 (0.67)
Central & Eastern Europe	-0.43 (1)	-0.04 (0.47)	-0.27 (1)	0.1 (0.99)	0.07 (1)	0.07 (1)	-0.18 (1)	-0.02 (0.94)	0.1 (1)	0.09 (0.92)	0 (0.78)	0.01 (0.17)
Southeastern Europe	0.98 (0.99)	0.01 (0)	-0.57 (1)	0.29 (1)	0.22 (1)	0.05 (0.99)	-0.24 (1)	-0.02 (0.67)	0.23 (0.97)	0.01 (0)	0 (0.86)	0.06 (0.47)

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