Detailed responses to Reviewer #3

The authors would like to thank the reviewer for their constructive comments and suggestions for improving the manuscript. Detailed responses are provided below in blue, and the manuscript has been revised accordingly.

This paper evaluates the use of low-cost non-dispersive infrared (NDIR) CO_2 sensors for long-term atmospheric monitoring in rural agricultural environments. The authors developed a data-processing framework that corrects errors caused by automatic baseline correction and environmental influences, particularly temperature and pressure, improving the agreement with reference-grade instruments. The study is important as it applies sensor correction and QA/QC procedures to non-urban applications. However, it is unclear how some of the corrections were derived, as well as which sensor data are presented, that make this manuscript not publishable in its current form. I recommend review once the points below are addressed.

Re:

The authors would like to thank the reviewer for their comments, we have made major revisions to the method section to address how the various corrections were derived.

Major comments

1) The derivation of temperature and pressure corrections are one of (if not *the*) main results of this work. However these are just presented in Section 2.4.2 as Equations (3) to (6). No detail is provided on how the coefficients in these equations were determined, how the authors came to decision of applying linear corrections in some cases, exponential corrections in others. It should be made clear to the reader how these were derived. This section should be significantly expanded to allow readers and sensor users to perform the same corrections.

Re:

Additional subsections 2.4.2.1 and 2.4.2.2 are now included to address these comments as detailed below.

2.4.2.1 Pressure correction methodology

In the absence of a controlled laboratory experiment similar to that reported by Gaynullin et al. (2023), we leveraged the co-location measurements to derive corrections for the effects of two major environmental factors, pressure and temperature, on the LC NDIR CO_2 measurements. The LC AG-S8 device deployed at the urban site was used to derive the pressure-correction parameters. To minimise the confounding influence of high temperatures on the LC CO_2 response, only measurements from the winter period (15 January-15 February 2025) were used to develop the pressure-correction algorithm.

The ratio of the offset-corrected LC CO_2 measurement to the reference CO_2 measurement was calculated and related to the normalised pressure, P/P_0 where P_0=1012mbar and P uses the hourly pressure data described in section 2.2. The CO_2 offset was determined from the mean difference between a subset of the LC AG-S8 and reference measurements obtained under conditions close to the selected standard conditions (pressure=1012±2mbar and temperature=20±1°C). For applications where co-located reference measurements are unavailable, an approximate offset may instead be estimated, where a significant factory bias is evident, from the difference between the lowest observed raw LC NDIR CO_2 value and the Northern Hemisphere background CO_2 mixing ratios during the corresponding study period (Pétron et al., 2026).

A linear relationship was observed between the LC-to-reference CO_2 ratio and P/P_0, with the regression describing the pressure-dependent correction factor. Figure 3(a) shows the relationship between the LC/reference CO_2 ratio, P/P_0, and ambient temperature. The fitted expression (*K* in Figure 3 (a)) is analogous to the compensation coefficient described by Gaynullin et al. (2023). The pressure-corrected CO_2 mixing ratios, $\chi_{CO2}^{reference}$, is therefore defined as

$$\chi_{CO2}^{reference} = \left(\frac{\chi_{CO2}^{offsetcorr}}{K}\right) + offset\ (at\ P_0) \tag{1}$$

where

$$K = 1.05 * \left(\frac{P}{P_0}\right) - 0.08 \tag{2}$$

and $offset\ (at\ P_0)$ is expected to zero for an ideal calibrated device, in the case of the device used in this study,

$offset\ (at\ P_0) = -0.02 - 0.031 * \chi_{CO2}^{offsetcorr}$, with P_0= 1012 mbar (Figure S5)

The offset (at P_0) is obtained by fitting a linear model to the difference between $\chi_{CO2}^{reference}$ and $\left(\frac{\chi_{CO2}^{offsetcorr}}{K}\right)$ at $P=P_0$=1012mbar where *K*=0.97 for a range of $\chi_{CO2}^{offsetcorr}$ spanning low to high mixing ratios. The correction is formulated such that, at the ambient pressure ($P= P_0$), the pressure-corrected LC measurement approaches the reference CO_2 measurement i.e., $\chi_{CO2}^{Pcorr} = \chi_{CO2}^{reference}$. An optimised version of Eq. (1) was used to generate the pressure corrected CO_2 mixing ratios as formulated in Eq. (2).

$$\chi_{CO2}^{Pcorr} = \left[\frac{1}{\left(1.05*\left(\frac{P}{P_0}\right)-0.08\right)} * \chi_{CO2}^{offsetcorr}\right] + \left(-0.02 - 0.031 * \chi_{CO2}^{offsetcorr}\right) \qquad (2)$$

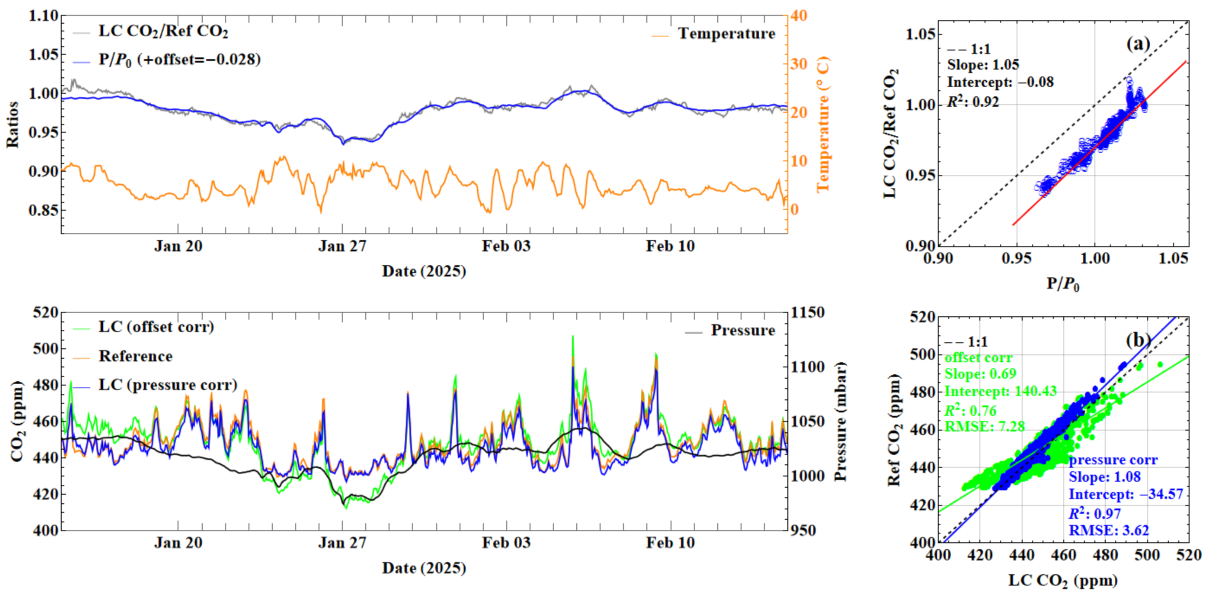

Figure 3. Pressure effect and correction for the LC AG-S8 CO_2 sensors. (a) Pressure dependence, expressed as P/P_0 and $\chi_{CO2}^{LC}/\chi_{CO2}^{refr}$, at the urban site (15 January–14 February 2025). (b) Uncorrected and pressure-corrected sensor data compared with the reference.

Figure 3(b) shows the comparison of the input CO_2 and pressure-corrected CO_2. As the temperature remained relatively low (<10 °C), with limited diurnal variability, pressure was identified as the environmental parameter most strongly associated with the observed the LC/reference CO_2 ratio variability, as indicated by the strong correlation in Figure 3(a). The correction approach yields a compensation expression that depends on both pressure and CO_2 mixing ratios, as it is derived empirically from real-world measurements in which the CO_2 mixing ratio varies with pressure. Applying the pressure correction substantially improved the agreement, with R^2 increasing from 0.69 to 0.97 and the RMSE decreasing from 7.3 to 3.6 ppm, Figure 3 (b). Analysis of the residual dependence of the uncorrected CO_2 reading with the pressure for the analysis shows the error associated to approximately 0.5 ppm $mbar^{-1}$ about five times that reported by Müller et al., 2020.

2.4.2.2 Temperature correction methodology

Two sets of correction parameters were derived for the two variants of the low-cost (LC) AirGradient CO_2 sensor used in this study: the AG-S8 and AG-Sunrise.

For the long-term co-location deployments at the rural and urban sites, measurements from the urban co-location were used to derive a generic temperature correction, which was subsequently applied to the LC AG-S8 devices at both locations. To minimise overfitting whilst adequately representing the two temperature extremes, subsets of the summer (17-24 August 2023) and winter (29 November-6 December 2023) measurements from the urban co-location site were used to derive the temperature correction.

The first step involved calculating the ratio of the pressure-corrected LC CO_2 measurement to the corresponding reference CO_2 measurement and examining its dependence on the absolute sensor temperature (K). Figure 4(a-b) shows that the relationship between these variables is non-linear. A power-exponential function provided the best representation of the temperature dependence of the CO_2 sensor sensitivity, resulting in the correction described by Eq. (3):

$$\frac{\chi_{CO2}^{Pcorr}}{\chi_{CO2}^{Tcorr}} = \left[A_{S8} + \left(B_{S8} * C_{S8}{}^{sensorT}\right)\right] \quad (3)$$

Here, χ_{CO2}^{Pcorr} and χ_{CO2}^{Tcorr} represent the pressure-corrected and temperature-corrected CO_2 mixing ratios, respectively, and $sensorT$ is the sensor temperature expressed in kelvin. The optimal fit parameters for the LC AG-S8 sensor used in this study were $A_{S8} = 0.95$, $B_{S8} = 4.40 \times 10^{-5}$ and $C_{S8} = 1.03$ (Fig. 4e).

The LC AG-Sunrise nodes used in the network deployment were corrected using the same functional form given in Eq. (3), with parameters derived specifically for this sensor variant. The temperature-correction results for the four nodes during their laboratory co-location (12-20 June 2024) are presented in Fig. S6 and Table S1. The daytime temperature-dependent biases observed in the LC AG-Sunrise measurements, which were particularly evident between 18 and 20 June 2024 (Fig. S6a), were substantially reduced after accounting for the temperature dependence (Fig. S6b). Across the four nodes, the RMSE decreased from approximately 7.5-12 ppm for the pressure-corrected measurements to 2.7-3.9 ppm following combined pressure and temperature correction (Fig. STxxc). The approximately 10 ppm bias evident during the warmer summer period was largely removed following temperature correction (Fig. Txxd). Consequently, the RMSE decreased from 7.3 ppm for the pressure-corrected measurements to 2.2 ppm following combined pressure and temperature correction (Fig. 4e). Based on this analysis, the magnitude of the temperature effect, estimated from the residual difference between the pressure-corrected and pressure-temperature-corrected data, was 0.6 ppm K^{-1}.

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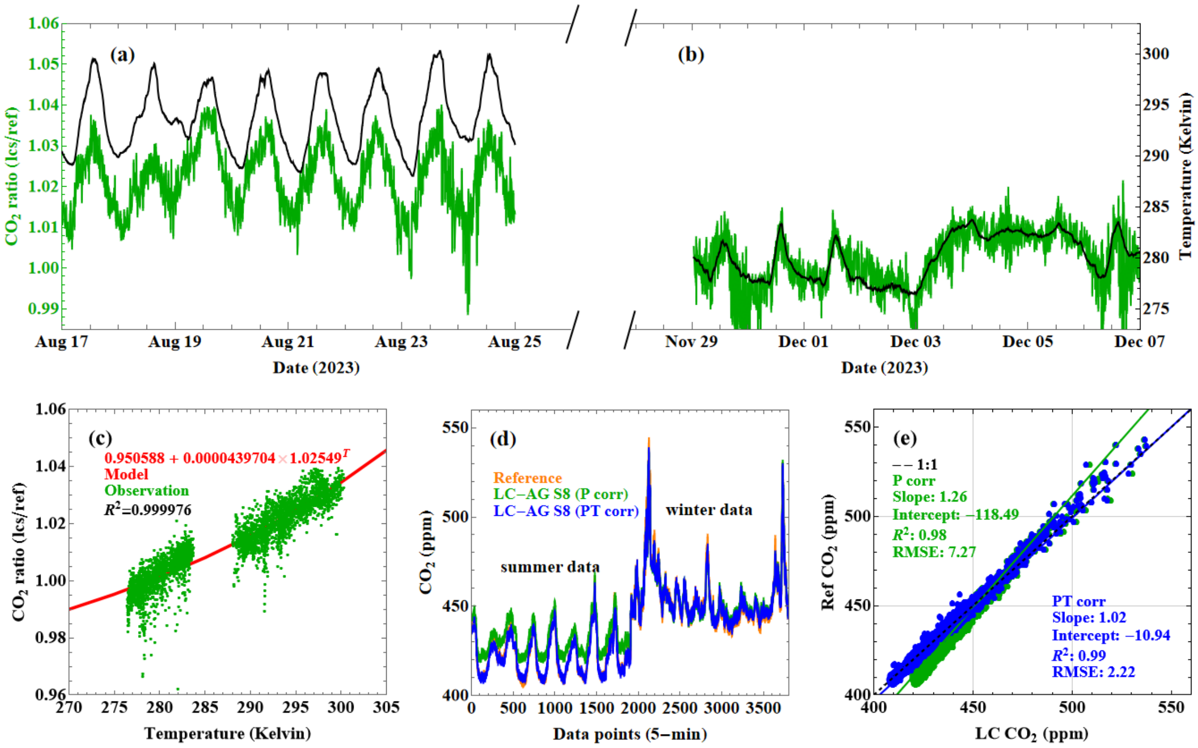

Figure 4. Temperature effect and correction for LC AirGradient S8 CO2 sensors. (a–b) CO_2 ratio (X_sensor/X_ref) and temperature during selected summer (17-24 August 2023) and winter (29 November-6 December 2023) periods at the urban site, (c) observed versus modelled temperature dependence, (d) pressure- and temperature-corrected CO_2 relative to the reference, and (e) scatter plot of the data in (d).

Line 255: similar to the point above, no detail is provided on how the ABC correction is derived and applied to the data. The authors do the describe what ABC is and the issues associated with it, but I could not find anywhere in the text describing how the authors correct for obvious step changes in the raw sensor data introduced by ABC.

Re:

A new subsection 2.4.1.1 is now included to address this as detailed below

2.4.1.1 ABC step-change correction

Step correction was required only for the rural AirGradient (AG) LC device. No evidence of step changes was observed in the AG S8 deployed at the urban site, nor was step correction required for the Magic K33 or AirGradient Sunrise devices, both of which had automatic baseline correction (ABC) deactivated (Table 1).

As major step changes occurred infrequently in the LC AirGradient S8 sensors used in this study, they were identified through manual inspection of scatter plots of the co-located measurements. Periods during which the ABC was triggered were identified by examining the co-location data in short batches (approximately 2 weeks) against measurements from the reference instruments. A batch was considered indicative of an ABC trigger when the coefficient of determination (R^2) was low (< 0.6) and two distinct clusters were evident in the scatter plot (Fig. 2b). The associated step change was then identified as an abrupt shift in the measured CO_2 mixing ratio (around 11:00 on 13 August, Fig 2a). For each step change, its position in the time series and magnitude were determined. The magnitude was estimated as the difference between the CO_2 concentration at the occurrence of the step and the subsequent CO_2 measurement. Two corresponding lists were then constructed: the positions of the identified steps (*posco2i*) and their respective magnitudes (*stepco2i*).

To illustrate the correction procedure, consider a list of raw CO_2 records. Suppose that step changes are identified at positions

posco2i={100,121,335},

with corresponding magnitudes

stepco2i={10,-13,8} ppm.

A cumulative offset is calculated to account for the persistence of each step change. The correction is implemented as follows:

1. A *delta CO2* array of length is initialised with zeros.
2. An offset of 0 ppm is assigned to observations 1-99.
3. Following the first step, an offset of +10 ppm is assigned to observations 100-120.
4. Following the second step, the cumulative offset becomes ppm -3 ppm (+10-13) and is assigned to observations 121-334.
5. Following the third step, the cumulative offset becomes +5 ppm (+10-13+8) and is applied from observation 335 to the end of the record.

The resulting *delta* CO_2 time series is subtracted from the raw CO2 measurements to obtain the step-corrected CO_2 concentrations. Thus, rather than correcting each step independently, the procedure accounts for the cumulative effect of successive changes in the instrument baseline.

Step changes were observed only to a limited extent and occurred in one device (AirGradient LC-S8) deployed at the rural site. Figure 2 shows an example of the step-correction procedure for this instrument.

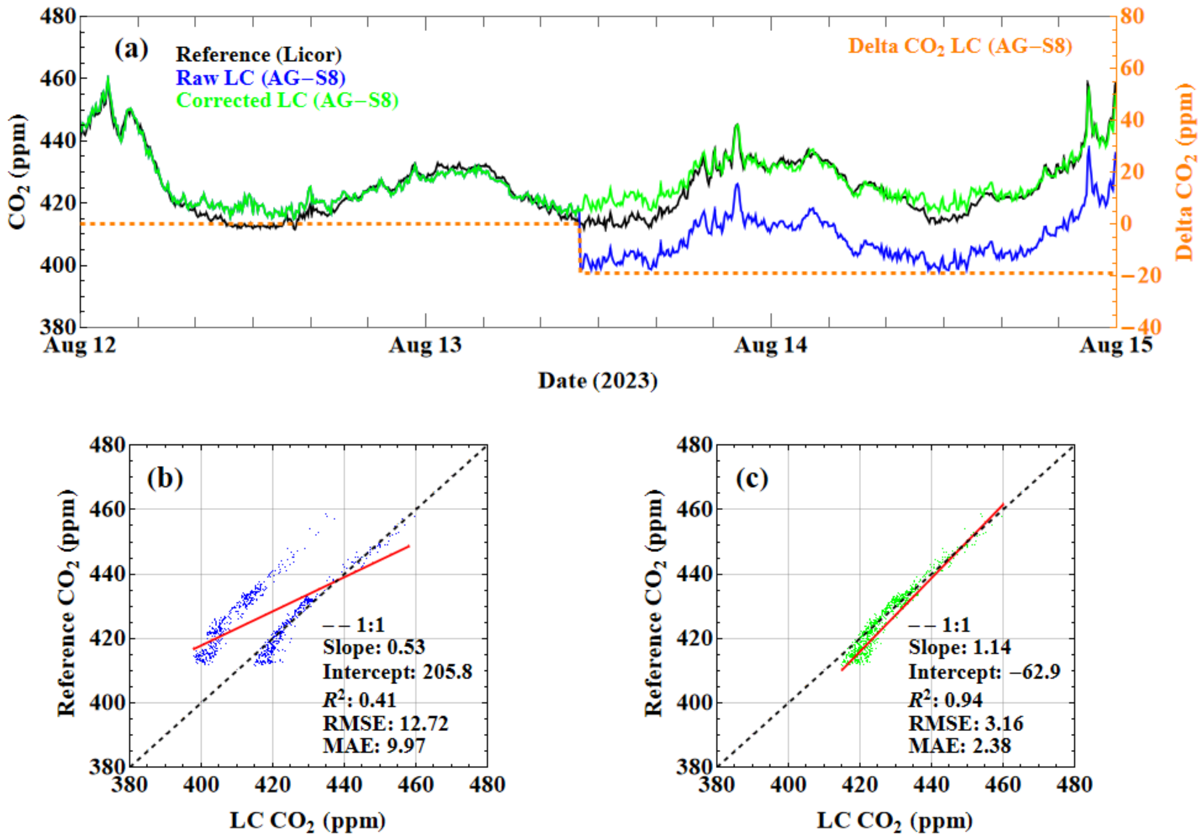

Figure 2. Comparison of LC AirGradient S8 CO_2 measurements with the reference instrument, illustrating the effect of step correction. (a) Time series showing the identified step changes and their magnitudes; (b) uncorrected LC CO_2 measurements against the reference measurements; and (c) step-corrected LC CO_2 measurements (following correction for the ABC step) against the reference measurements.

Line 277: similarly, this linear scaling is not described anywhere in the text. Figure 6: similarly, the baseline drift correction is not described.

Re:

The following description for the scaling has been included in Section 2.3.

"Scale corrections for the LC AG S8 devices were derived from collocation measurements conducted at rural and urban sites between 1 and 18 August 2023. The resulting correction parameters were applied throughout the deployment period. A similar approach was adopted for the LC AG Sunrise devices within the network, using laboratory collocation measurements from all four devices conducted between 12 and 20 June 2024."

The following new subsection for the baseline drift has been included in the revised manuscript. This is described below:

2.4.1.2 Baseline drift correction

Whilst we did not observe baseline drift in our study when the ABC was deactivated, long-term drift is expected to introduce error into the measurements. Users should therefore characterise this drift by detrending the data prior to applying the environmental correction framework (section 3.3) presented in this work.

For devices deployed as part of a network, users can correct for baseline drift using the approach described by Müller et al. (2020). This method exploits periods of minimal horizontal CO_2 gradients and a well-mixed boundary layer to derive time-dependent offset corrections relative to the nearest reference CO_2 measurement within the network. In the absence of a reference instrument, a modified version of this approach can be used, whereby an LC NDIR device is deployed away from local emission sources and at an elevated location (>20 m), with the remaining network devices referenced to this sensor. Any gradual intrinsic drift in the reference LC device can then be corrected by comparing monthly mean CO_2 mixing ratios with hemispheric background CO_2 measurements from (Mauna Loa for the north and American Samoa for the south) over the corresponding study period (Pétron et al., 2026).

Line 500: similar comment as line 255, the reader is not told how to correct for step changes.

Re:

Thank you for this comment. The "step changes" referred to here is in fact the ABC effect, the statement has been modified to clarify this.

"To ensure robust data processing, we recommend either disabling the ABC functionality or, where ABC remains active, correcting for any erroneous step changes using the approach described in this study prior to data analysis."

2) The discussion of the pressure correction appears, at the same time, too detailed and overly simplistic. I do not think Eq. (1) and (2) are needed for the reader to appreciate how ambient pressure affects number density. A reference to previous work on the subject (e.g., Gaynullin et al., https://www.mdpi.com/1424-8220/23/5/2872, Müller et al.

https://amt.copernicus.org/articles/13/3815/2020/amt-13-3815-2020.pdf)

should suffice.

While the authors correctly identify the effect of pressure on number density, there is also an effect of ambient pressure of line broadening that is not considered (see the Gaynullin paper above). Differentiating the magnitude of the two separate pressure effects is probably beyond the scope of the manuscript, but the additional effect of line broadening should be mentioned.

On a related note, the pressure correction derived in this work should also be compared to previous studies. Muller et al. (https://amt.copernicus.org/articles/13/3815/2020/amt-13-3815-2020.pdf) found the effect of pressure on the sensor measurements to be rather small (~ 0.1 ppm hPa-1). It would be useful (for future comparisons) if the authors could quantify the pressure and temperature effects from their work in a similar manner.

Re:

We appreciate the reviewer suggestions, we have removed Eq 1-2 and added the following paragraph to section 2.4.2. The quantification of the pressure effect has been included in the new subsection 2.4.2.1

"Previous studies have demonstrated that variations in pressure can affect the observed mixing ratios if not adequately accounted for (Müller et al., 2020; Gaynullin et al., 2023). In addition, pressure-induced spectral broadening can affect the accuracy of LC NDIR devices. However, this effect is generally smaller than that associated with pressure-dependent changes in number density. For most applications, correcting for the latter is therefore considered sufficient (Gaynullin et al., 2023)."

3) The main figures depicting timeseries (and text therein) are way too small to be readable or interpretable. Also it is never clear which sensors the plotted data originated from. The study used two distinct sensor systems (Magic Box and Air Gradient). The authors should revise the captions for every figure and state clearly where the data plotted came from. Currently it only says "LCS CO2 data", which is not particularly useful.

Re:

Thank you for the observation, the texts have now been modified to specify the specific device been discussed and all instances of LCS has been changed to LC. All the figures has been regenerated to make texts more readable.

4) Similarly to point 3), the conclusions only apply to some of the sensors tested (Air Gradient) and not to others (Magic Box). The authors should provide more details on what conclusions apply to which sensor system, and also comment on the limitations they have identified.

Re:

The following has been added to the conclusion paragraph:

"Episodes of extremely high RH can adversely affect the performance of NDIR CO_2 sensors, particularly when sensor housings are poorly ventilated, as observed for the Magic Sunrise CO_2 devices. This can result in anomalously high CO_2 measurements, especially at remote rural sites where high-RH conditions are more prevalent. In contrast, well-ventilated designs, such as the LC Airgradient S8 and Airgradient Sunrise CO_2 devices, demonstrate that NDIR sensors can reliably capture the large temporal variability in CO_2 concentrations characteristic of rural environments."

5) There is a lack of quantification to some of the statements in the text:

Lines 410-411: can the authors add some stats to back up the "excellent agreement"?

Re:

We appreciate the feedback. The paragraph has been modified to read:

However, as illustrated in Figure 10 (b-d), the LC Airgradient S8 data corrected for pressure and temperature effects from the rural site show very **good** agreement with the reference measurements, both in terms of absolute values (**see statistics in section 3.3**) and temporal trends.

Lines 427-440: phrases such as "daytime errors (…) were substantially reduced", "short duration enhancement", "stronger influence" are of little use if not backed up by quantitative figures.

6) Section 3.5: why are the internal RH readings from the two Magic Boxes in Fig 10 very different from the reference ambient RH, whilst they seem to agree much better with the reference value in Fig 11? Is this just an effect of temperature? If so, it would help to show the air temperature too. The reference ambient RH at the two sites are very similar (slightly higher at the rural site, but similar range), so it is difficult to understand why the agreement with the internal readings is so different.

Re:

This figure has been revised to include temperature and moved to the Supplementary Information (Fig. S4). The following statements have been included in section 3.5 to explain the observations.

"Apart from small daytime differences of approximately 5 °C observed at the urban site, the internal temperature was comparable to the ambient reference temperature during this period (Fig. S4 a). In contrast, the lower relative humidity measured inside the LC Magic boxes indicates substantially drier conditions relative to the ambient environment."

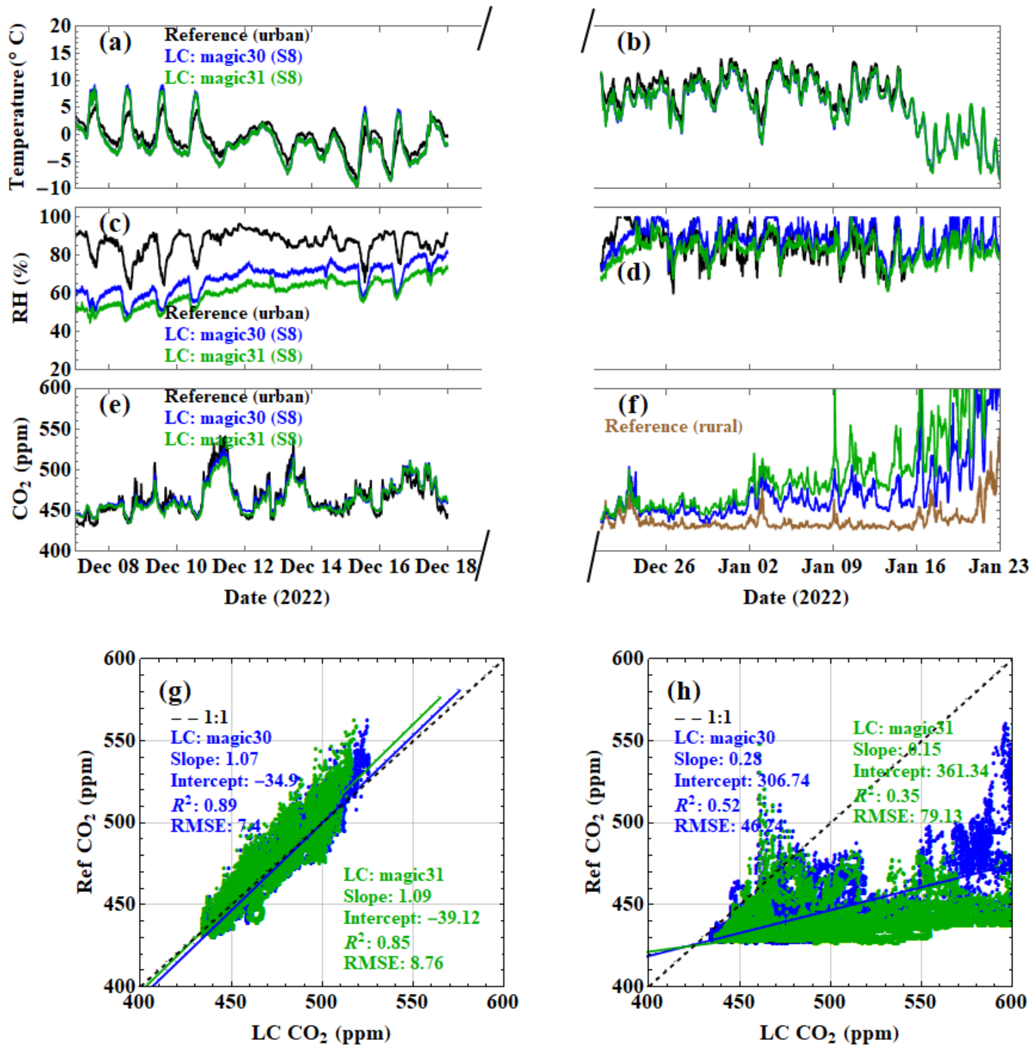

Figure S4. Comparison of paired LC Magic-K33 units with the reference instrument during urban and rural deployments. (a, b) temperature, (c, d), RH, (e, f) CO_2 and (g, h) CO_2 time series at the urban (7-18 December 2022) and rural (20 December 2022-22 January 2023) sites, respectively.

7) There should be a discussion section in which the results of this paper are compared to previous studies (e.g., the two references in point 2 above).

Re:

We have now included the section 3.4.1.1 to address this comment

3.4.1.1 Comparison of collocation assessment to other studies

Based on the pressure-corrected measurements, the LC AirGradient S8 and AirGradient Sunrise sensors (Sections 3.2 and 2.4.2.2) are capable of measuring ambient CO_2 mixing ratios with an accuracy of approximately 5 ppm. This performance suggests that the sensors can reliably resolve changes in CO_2 mixing ratios exceeding 15 ppm, representing an improvement over the 30 ppm resolution reported by Müller et al. (2020). The performance of the LC AirGradient S8 therefore supports its application in both urban and rural environments, including locations where CO_2 mixing ratios may periodically reach substantially higher values than those typically observed in urban environments.

To facilitate a direct comparison with Gaynullin et al. (2023), we also evaluated the performance of our correction method using the mean absolute percentage error (MAPE) for the LC AirGradient S8 deployments. This metric expresses the measurement error relative to the observed CO_2 mixing ratio. The MAPE ranged from 0.86 % for the urban deployment, where CO_2 mixing ratios were approximately 410–550 ppm, to 1.5 % at the rural site, where CO_2 increased from background levels to approximately 1000 ppm. These errors are lower than those reported by Gaynullin et al. (2023) for their one-dimensional compensation method. However, they are higher than the −0.02 % error reported for the two-dimensional compensation method at 800 ppm, while the lower MAPE obtained for our urban deployment (0.86 %) is comparable to the 0.83 % error reported at a CO_2 mixing ratio of 3000 ppm.

Minor comments

Line 1: Surely the title should read “Evaluating low-cost NDIR CO_2 **sensors** for atmospheric observation**s** in rural settings”?

Re:

Title of the revised manuscript has been modified as suggested.

Line 16 (first occurrence) and throughout the manuscript

(e.g., lines 92, 152, 165): the authors use “LCS NDIR CO2 sensors” and “LCS CO2 sensors” repeatedly. However the “S” in LCS already contains the word “sensor”, so the formula does not quite read correctly. I suggest the authors revise this throughout to “low-cost CO2 sensors” or, more simply, “CO2 sensors”.

Re:

All instances of LCS have been replaced by LC as recommended by the reviewer.

Line 24: long sentence. Add comma after “summer”: “… in summer***,*** were obtained when compared to a…” Lines 27/28: move “15 ppm” to later in the sentence to improve flow: “… which is more than three times the typical change in the urban environment **(15 ppm)**.” Section 2.1: the information about the two sites is very minimal. Can the authors provide geographical coordinates for the rural site, as well as information such as distance from the nearest urban centre? It would also be useful for readers not familiar with either site to add information on the dominant CO2 sources and processes at both locations.

Re:

The correction suggested for L24, L27-28 have been effected.

A new reference (D'Acunha et al., 2026, https://doi.org/10.1111/gcb.70796) that details the rural site have been added to Section 2.1. The first paragraph now reads of this section

"This study was conducted at two sites (one rural and one urban) to assess the potential of LC CO_2 sensors in rural environments. The rural site was a managed arable farm in Stretham, near Ely, UK (D'Acunha et al., 2026), where LC CO_2 nodes were deployed alongside a reference-grade CO_2 analyser at a height of 1.5 m. The observed variability in local atmospheric CO_2 mixing ratios was primarily driven by biological processes, including crop respiration and photosynthetic CO_2 uptake, as well as peat soil respiration following harvest."

In addition, a map of the network of four LC Airgradient Sunrise deployment at the rural site has been included in the Supplementary Information (Fig. S7).

Figure S7. Map showing the distribution of the network of four LC AirGradient Sunrise at the rural site.

Line 98: it should read "Figure 1**b**". Lines 115-118: it would be useful to add the distances of each airport from the two sites, to better put these locations into context.

Re:

Both information have been added in the revised manuscript.

Line 119: the section title should read "2.3 Low-Cost CO2 Sensor Nodes **and reference instrument**".

Thank you for this, the correction has been effected in the updated manuscript.

Line 125: do the authors mean Section 2.4.1?

Yes we do, this has been corrected, thanks.

Line 127: long sentence that needs breaking up. "…for a period of 12 days at the urban site (7 to 18 December 2022)**. The** nodes were then deployed at the rural site …".

This correction has been effected in the revised manuscript.

Line 129: I think this strictly classifies as an adjustment or correction, not a calibration. Change "calibrated" to either "adjusted" or "corrected".

We have changed this to "corrected", thanks.

Line 148: Add "as the": "… to reduce power demand in the sensor system, **as the** S8 average current is…"

The suggestion has be implemented.

Lines 153-161: Please describe how the Licor was calibrated. What standards were used, how often, *etc*.

Re:

The following statement has been added to Section 2.3

Span and zero calibrations of the reference analysers were performed at the beginning of each deployment using certified 400 ppm CO_2 in N_2 and synthetic air (<1 ppm CO_2), respectively. The calibration gas standards were supplied by BOC Ltd and were traceable to national standards.

Line 160: change "instrumentations" to "instrumentation" (singular).

This has been effected, thanks.

Line 161: change "platform" and "type" to "platform**s**" and "type**s**" (plural).

These corrections have been effected.

Table 1: add an extra column with the number or sensor nodes used in each deployment.

Table 1 has been updated as shown below

Table 1. Summary of the sensor system, CO_2 type and configuration, form, number of devices and duration of deployment of study.

Sensor system	OEM CO_2	ABC Active	Deployment period	Deployment type	Number of device
Magic	K33	No	December 2022-Jan 2023	Collocation (urban and rural)	2
AirGradient	S8	Yes	May 2023-February 2025	Collocation (urban and rural)	2
AirGradient	Sunrise	No	August-September 2024	Network (rural)	4

Line 177: the authors should either provide a reference or a brief description of how the detrending should be performed.

A new subsection 2.2.1.2 is now included to address this.

Line 178: the way “section 3.3” appears makes it look like the detrending is described in section 3.3, but instead the authors mean that the measurement framework is presented in that section. I would suggest changing it as follows: “Users should therefore characterise this drift by detrending the data prior to applying the environmental correction framework presented in this work (**S**ection 3.3)”.

The suggested change has been effected in the new subsection 2.4.1.2 describing baseline drift correction

Line 188: there is an extra space between the words “impact” and “sensor”.

This has been corrected, thanks.

Line 195: Plab is defined but never used in the rest of the text

This text is no longer used in the revised pressure correction subsection.

Line 219: change to “…represent**s** mixing ratio**s** for…” Line 225-226: move “IR-high and IR-low” to later in the sentence for better flow: “An NDIR sensor measures CO2 concentrations by comparing two infrared (IR) signals from the same IR source at two distinct wavelengths **(IR-high and IR-low)**”

Re:

The author appreciate the reviewer’s comments in this. The sentence has been reworded as suggested.

Line 253: It would be useful to point the reader to where exactly in Figure 2 they should be looking at. Is it around 12:00 on Sept 20th in panel a? Lines 278-282: this section was very confusing. The author should state that which metrics being mentioned here are from the application of the full correction protocol, and which ones from the linear scaling. Figures 3, 4, 5, 7, 8, S1 and S2: are data from a single sensor system? Do similar plots for every sensor system deployed exist? It would be useful to show data from all sensors in each time series, like the authors have done in Fig 9. The same applies to Taylor’s diagrams: are these metrics from just one sensor system? Or an average of the performance of the many systems tested and/or deployed?

Re:

Thanks for the comment.

L253 has been updated to reflect the revised analysis (2.4.4.1) included to describe the step correction approach.

The principal figures presented in the manuscript are based on measurements from the LC AirGradient S8 devices, for which an extended dataset was available, enabling a more robust long-term assessment of sensor performance. The figure captions have now been revised to clearly identify the devices represented and discussed in the corresponding text.

The LC Magic K33 devices were included primarily to demonstrate the limitations associated with poorly designed sensor enclosures. Consequently, presenting additional performance statistics like the Taylor diagram for this platform, analogous to those reported for the LC AirGradient S8, would provide limited additional insight and would not materially affect the main conclusions of the study. Similarly, the network deployments cannot be evaluated using the same statistical approach because they were not designed as co-location experiments and therefore do not provide an appropriate basis for direct sensor-to-reference comparisons.

Lines 466 and 469: surely these two vales of RH (80 % and 75 %) are meant to be the same?

Re:

We appreciate the feedback. This has been corrected to read 80% in both cases.

Supplementary Material

Line 2: Surely the title should read “Evaluating low-cost NDIR CO_2 **sensors** for atmospheric observation**s** in rural settings”?

Re:

This has been updated as suggested.