We would like to thank the reviewer for the comments and suggestions to our manuscript. In the following, we answer to the reviewer's comments and indicate the changes in the manuscript that were implemented according to the recommendations. The comments are in black. Our answers are in blue.

Referee #1:

The manuscript titled "Development and deployment of a mid-cost CO_2 sensor monitoring network to support atmospheric inverse modeling for quantifying urban CO_2 emissions in Paris" is generally well written and scientifically justified. We recommend it to be published after addressing the following points.

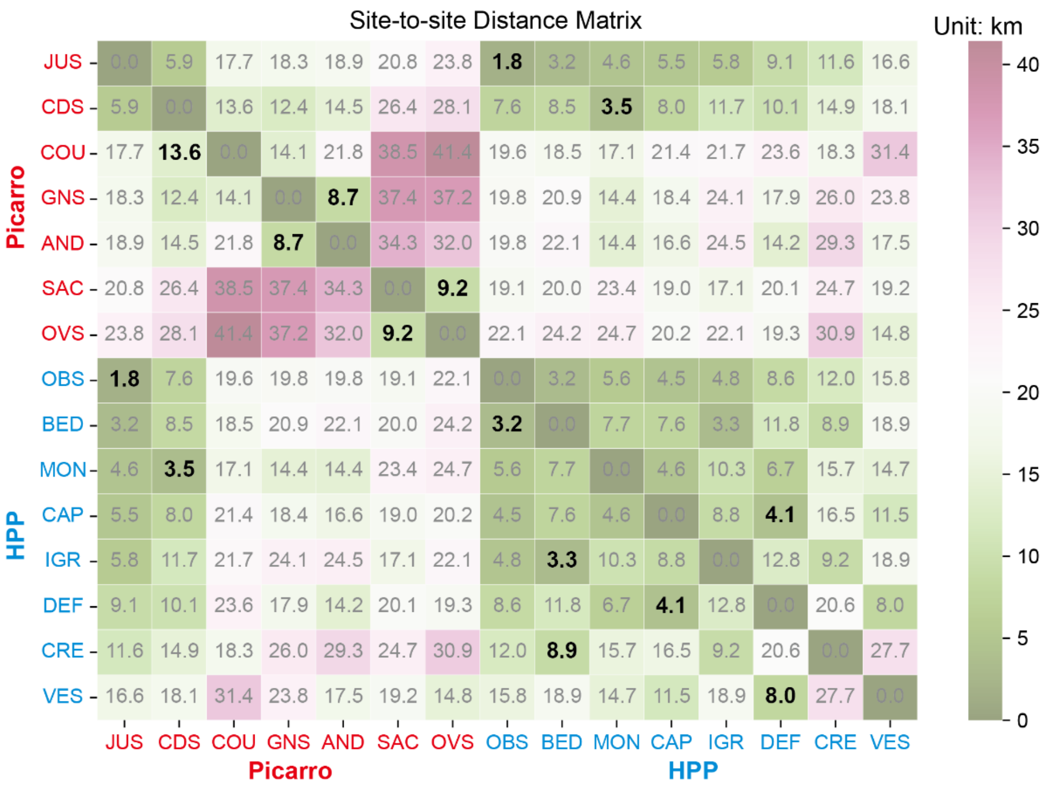
It would be helpful to have additional discussion of the spatial density of the network. The reader can deduce this from Figure 1, but average distance to the nearest site would be helpful to include in Section 2.4. How does the spatial density of the HPP network compare to the density of the Picarro network? How does the HPP spatial density compare to the previous studies of similar moderate-cost sensor networks (i.e. Wu et al., 2016; Turner et al., 2016)?

Response:

We thank the referee for the positive comments on our manuscript and the valuable suggestion concerning the spatial density of the network. The following figure shows the distances between sites in kilometers for the real urban CO_2 monitoring network containing 15 sites in this study. The average distance to the nearest site in the CRDS Picarro network is 8.7km, while for the HPP network, it is 4.9 km. In the combined CRDS Picarro and HPP network, this average distance reduces to 6.1 km. Both Wu et al. (2016) and Turner et al. (2016) conducted observing system simulation experiments (OSSEs) using pseudo-measurement networks. Wu et al. (2016) evaluated the potential of inversion with networks consisting of 10, 30, 50, or 70 stations. In Turner et al. (2016), the pseudo-measurement network included 34 sites at roughly 2 km spacing covering an area of roughly 400 km^2. Therefore, the real HPP network with 8 sites used in this study has a lower spatial density compared to the pseudo-measurement networks analyzed in the two previous OSSE studies.

We have added the following sentences in section 2.4 and Figure S5 in the supplement:

"Figure S5 shows the distances between stations in kilometers for the CO_2 monitoring network in this study. The average distance to the nearest site in the CRDS network is 8.7km, while for the HPP network, it is 4.9 km. In the combined CRDS and HPP network, this average distance reduces to 6.1 km."



Site (km)	JUS	CDS	COU	GNS	AND	SAC	OVS	OBS	BED	MON	CAP	IGR	DEF	CRE	VES	Average
Picarro	5.9	5.9	13.6	8.7	8.7	9.2	9.2									**8.7**
HPP								3.2	3.2	4.6	4.1	3.3	4.1	8.9	8	**4.9**
Picarro +HPP	1.8	3.5	13.6	8.7	8.7	9.2	9.2	1.8	3.2	3.5	4.1	3.3	4.1	8.9	8	**6.1**

Figure S5. Site-to-site distance in kilometers. The distances to the nearest site for each site are highlighted in bold black font (read by rows) and are summarized in the table.

P and p are used seemingly interchangeably for pressure. (Eq 1 uses P, but p is used frequently in the text and other figures).

Response:

Modified. We have used P consistently in the text, equation, figure and table.

Figure 1 and Figure 2 emphasize the hardware of the sensor and the data infrastructure. These are important to include but might be better to be included in the SI than the main text as the figures contain a lot of details that are not necessarily central to the main points of the paper.

Response:

The photos and flowcharts in Figure 1 and Figure 2 are closely linked with Sections 2.1, 2.2, and 2.3 of the main text. They provide a visual representation of the assembly components and calibration process for the mid-cost instrument. Therefore, we prefer to keep them in the main manuscript as they could offer additional clarity and detail to complement the textual description of the instrument development. These visual demonstrations may facilitate readers in better understanding the information presented in the text.

Figure 6 is too small to read comfortably, especially the text.

Response:

Following the suggestion from Reviewer #3, panel (b) with the modeling data was omitted, and the aspect ratio of the figure was adjusted. We also bolded the font for an improved reader experience.

Figure 8: Add some break / distinction between the Picarros and HPPs

Response: Added as suggested.

Figure 9: Please consider flipping the direction of the difference (site - JUS), so that lower than JUS values are negative. Currently this figure gives the impression of elevated concentrations outside of the urban center. Alternatively, clarify in the figure caption that the difference is JUS minus other sites. Same note for figure S9.

Response:

As suggested, we have clarified it both in the figure captions and main texts. The current order of the subtraction is intended to show that CO_2 concentrations at urban sites are generally higher than those at suburban sites. Note that Figure S9 has become Figure S12 in the revised manuscript.

Figure 9: "The CO_2 differences are calculated as JUS minus the other stations."

Figure S12: "The CO_2 differences are calculated as the other stations minus SAC."

Main text: "Figure 9 shows the observed (green left panels) and modeled (yellow right panels) afternoon CO_2 mole fraction differences between JUS and the other stations, averaged as a function of wind speed and direction from July 2020 and December 2022. The CO_2 differences are calculated as JUS minus the other stations. Additionally, Figure S12 presents a similar comparison, but with CO_2 differences of other stations minus SAC."

Page 9, line 9: Could the author(s) comment or speculate on the variable sensor performance? Is this a difference in sensor hardware or experimental condition?

Response:

There are many reasons for the varying performance of HPP instruments, making it difficult to specifically determine and explain the exact causes. For instance:

Firstly, as for the HPP sensor itself, although they are the same model, minor differences in the sensor production process, including the quality of raw materials (e.g., electronic components), manufacturing, quality control, and so forth, may lead to variations in the performance and stability of the sensors.

Secondly, when integrating the HPP sensor with components such as the solenoid valve, micro-pump, membrane filter, and battery into the HPP measurement unit, even with the same design, minor variations in manual production and operational techniques can result in slight changes during the production process. These variations may also lead to differences in the performance of the instruments.

Thirdly, during the sensor laboratory tests presented in section 2.1, different HPP sensors exhibit varying fits for temperature and H_2O, as well as different residual errors (see Figure S3 and Table 3). This is also among the reasons why different HPP instruments have varying accuracy.

Page 1, line 14: ambiguous pronoun reference (Its)

Response: Change from "Its measurements" to "These dense measurements".

Page 1, line 16: Missing word (should be "to separate")

Response: Corrected as suggested.

Page 1, line 28: should be "prospects for"

Response: Corrected as suggested.

Page 1, line 33: "spatial and temporal variations" of what? Emissions?

Response: Change to “spatial and temporal variations in emissions”.

Page 3, line 15: “in dimensions” is redundant

Response: Deleted.

Page 3, line 21: a SHT75 -> an SHT75

Response: Corrected.

Page 12, line 33 “on-going” -> “ongoing”

Response: Corrected.