

## Answers to the reviewers

"Concerning the in-flight accuracy of the instrument, no experiment has been performed allowing an intercomparison with a reference instrument. This could be the subject of future work. " It will be useful to add the following sentence to the main text.

>> This information has been added in the conclusion of the manuscript, together with a new summary of the in-lab and in-flight precision of the instrument.

"These suggestions have been taken into account for the revision of the manuscript." It is rather difficult to judge to what degree these have been realized.

>> This refers to the following suggestions of RC2:

*"The paper presets results of source flux estimates but does not describe if these are useful. Are the estimates sufficiently robust (small enough error) to be of practical use? A discussion section (and possibly a motivating section in the introduction) that lays out the measurement need in terms of total error (perhaps a percentage or perhaps a total value) is needed.*

*During revision, the authors should look for clarity in what they wish to use as a title and what to emphasize in the abstract. At the outset, the paper has focus on instrumentation, but in the end claims the focus is on flux estimation technique, while the bulk of the results focus on case study applications. I caution that the lack of specific development of the estimation technique make the claim that there is method development difficult to argue. The bulk flux estimate from a mass balance method was not developed, and the error budget not described. While I do suggest the error budget be added during revision, it is also wise to ensure the text focuses toward the comparative nature of the results.*

*To this end care is needed as, for instance in the conclusion (L497-501) appears to suggest the technique itself was devised here. This is overstating the matter. Re-phrase sections like this to highlight that it is the combination of the sensor, the UAV platform, and the application of a mass balance method when used together that represent a measurement system. The essential new work done here, to my mind, is in all three areas: using a newly developed sensor designed for UAV work, using data from the sensor to drive a mass balance calculation (albeit, without error characterization), and then testing it in pragmatic cases that illustrate possible wide application."*

Concerning the first point, the referee asked for a discussion about the required precision of the estimates. We believe that the motivations for the development are already detailed in the introduction, showing that there is a need for top-down emissions monitoring technologies able to operate at the scale of an industrial site, at moderate costs and over short periods of time. A comparison with current top of the art technologies in the discussion section shows that our method is among the most precise methods to monitor this type of emissions scenarios. The achieved precision is currently sufficient for the needs of our partners in the oil and gas industry (TotalEnergies) who have chosen to apply it at a large scale to monitor the emissions of multiple sites worldwide.

Concerning the second point about what is emphasized as the main aspects of our study, it has been chosen to highlight the fact that the combination of the newly developed instrument, with a monitoring protocol and a data analysis approach constitutes a complete monitoring system which is the novelty of our approach. To this end, changes have been brought to the formulation of the title, the abstract has been reworked and changes have been brought to the conclusion. For instance, sentences describing the modelling approach as a development have been reworked, or the title now describes the method as a measurement system using UAV-based concentration monitoring.