

Geosci. Model Dev. Discuss., referee comment RC2
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Comment on gmd-2021-288

Anonymous Referee #2

Referee comment on "Estimating aerosol emission from SPEXone on the NASA PACE mission using an ensemble Kalman smoother: observing system simulation experiments (OSSEs)" by Athanasios Tsikerdekis et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2021-288-RC2>, 2022

Main comments:

This paper describes an ensemble of OSSEs to estimate the top-down constraints on aerosol emissions based on observations provided by SPEXone. While the experimental setup and the scientific results are interesting, the paper needs improvement before publication. In particular, the english should be checked throughout. Additionally, the text needs to be more concise and some sections are unclear.

Minor comments:

- Abstract: please shorten the abstract, which currently reads more like a conclusion.
- L168-170:

The use of the term analysis for 1 cycle and posterior for several ones here makes little sense. Please find another terminology.

- L177: And what impact did you find?
- L187: "[...] a unique distribution to drive the emissions[...]"<->

"has a distinct prior emission distribution"

- L188:

Should remove that sentence. This is confusing. What is the approach used to generate the prior error correlations? Please describe clearly.

- L193:

The mean and the standard deviation of the distribution (or the ensemble), not of the perturbations

- L195:

Please better explain the rationale here.

- Section 3.2:

The whole section is not clear. It needs to be rewritten entirely. Please utilise equations rather than long sentences wherever appropriate. This will greatly facilitate the reading and the understanding of the so-called "prior correction" approach (currently unclear).