Authors' Response for Revision_03
Preprint: https://egusphere.copernicus.org/preprints/2025/egusphere-2025-1977/)

We appreciate the editor and the anonymous referee for your time and constructive feedback. Our response to the minor revision is given below. Thank you for your continued support during the revision process.

RC: Referee Comment (in blue font); **AAR:** All Authors' Responses (in black regular font)
The modified texts in the revised manuscript are in *black italics.*

Detailed Response to Referee #1

RC: With the second round of reviews, the authors were able to clear up most of the ambiguities and significantly supplemented and improved the manuscript.

AAR: Thank you for your positive remarks.

RC: However, one point remains unclear: the authors write that the inversion focuses on near-field influences on observations and cite a large number of papers that use localization. I have two problems with this: on the one hand, the authors themselves do not use localization, at least not as far as I can see. On the other hand, none of the papers cited present analytical inversions. To clarify: localization is important in an ensemble Kalman filter, where I have spurious noise due to the low-rank representation in the ensemble, which I want to suppress far away from the observation. In an analytical inversion, localization is simply not necessary.
I would now accept the paper if this last point were clarified.

AAR: Yes, our inversion design does not suffer from artificial truncation or localization: the authors, in the previous response, attempted to clarify the R01's concern in the second review, seeking clarification on the possibility of *'extreme localization'*. The present study's inversion, by design and its reliance on a high-resolution forward model, focuses on capturing near-field influences on observations, as detailed in the methodology section, which is important for regional/sub-scale flux estimations. We consider this aspect a significant strength of the estimation method we employed. A part of the citations used refers to a similar approach employed in other studies through analytical minimization of the Bayesian cost function, which addressed near-field influences effectively (e.g., Pillai et al., 2016; Ye et al., 2020; and Kuhlmann et al., 2020). At the same time, the authors emphasized the benefits of target approaches elsewhere in which localizations were necessary to reduce the spurious noise from far-field signals.

To clarify further and avoid misinterpretations, we refined our statement and excluded the citations of studies using targeted localization employed in other contexts of previous studies. The manuscript is revised as follows:

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"*For robust flux estimations at regional and sub-regional scales, it is widely accepted that increasing reliance on near-field sensitivity minimizes the ill-posed solutions (Nesser et al., 2024; Munassar et al., 2023; Ware et al., 2019; Pillai et al., 2012; and Gerbig et al., 2006). "*

We hope that the above statements help clarify the concern. Thank you for your consideration.

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