# Author's response

Dear reviewer and associate editor,

We appreciate the positive feedback by the reviewer and associate editor regarding our manuscript - *Separating and Quantifying Facility-Level Methane Emissions with Overlapping Plumes for Spaceborne Methane Monitoring*.

Please see the point-by-point response as follows.

## Response to Reviewer

- *"I thank the authors for their acknowledgements and for their new corrections, which now address the concerns I raised in the previous reviews.*

  **Response:** Thanks for the approval and thanks again for the precious suggestions.

- *I have only one remaining point: the one regarding the effective wind for the application of the IME method (lines 185-188). The answer of the authors is a bit unclear regarding this. They start to agree that there is a difference between "the geostrophic wind driving the LES simulation" and "the effective wind for IME". However, then, they simply state " Similar to Varon et al. (2019), we derived the IME effective wind using the 10 m wind speed. " without, first, explaining how they derive the reference value for the effective wind (the fitted one) allowing to establish the relationship "Ueff = 0.55logU10 + 0.62 for UNSEP, and Ueff = 0.64logU10 + 0.94 for SEP". Varon et al., 2018 use the knowledge of the sources in the simulations to derive Ueff as Ueff =QL/IME in a set of reference cases. Do the authors conduct such a computation ?*

  **Response:** We derive the effective winds using two simple Monte Carlo simulations. Similar to Varon et al. (2019), we generate large sets of plumes with varying emission rate $q$, 10 m wind speed $U10$. We then calculated the plume characteristic length $L$ and the $IME$ using the detected plume pixels by two methods. Given the definition $Ueff = QL/IME$, we fit the parameters a and $b$ for $U_{eff} = a \times \log U_{10} +$

*b* to the generated datasets for each method, as shown in Figure 1. We will add a brief description in the next revision.

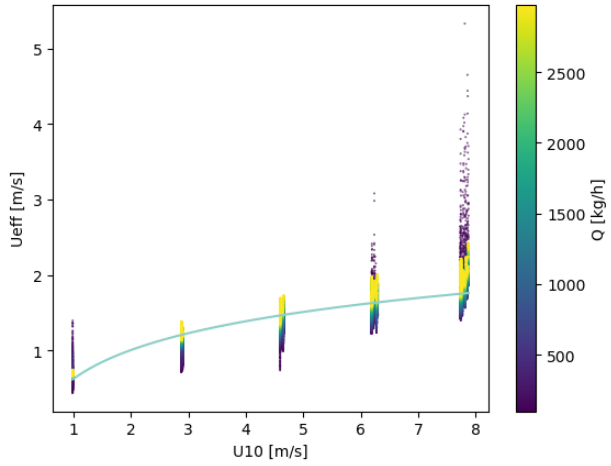


Figure 1 Ueff and 10 m wind speed.

- *This point about the definition of reference Ueff values and of their fit with a linear function of logU10 gets even more critical than before since the discussion about section 3.3 has pushed for a "recalibration" of Ueff for SEP, which led to a strong improvement of the results in this section, but which is a bit unclear to me. In practice, what does this recalibration correspond to ?*

  **Response:** The reason why the parameters for effective winds differ is that factors such as the plume pixel detection method may underestimate the IME by excluding plume pixels with low concentration. The relation of emission rates *Q* with respect to *Ueff*, *IME* and *L*. If we focus only on fitting *Ueff,* it needs to be fitted for different pixel-detecting methods respectively. As the pixel-detecting process such as the Gaussian plume weighting dilutes the plume image and decreases *IME/L* compared to the thresholding method; as result, the fitted slope and bias of *Ueff* for SEP are higher than those for UNSEP.

  To name this approach “recalibration” in the previous response may be linguistically misleading. Our focus is to fit the parameters of the *Ueff* function separately for each detection method.

- *I also add few minor suggestions for the abstract:- line 8: complement "of the IME method" by something like " when applied without such a separation "*

  **Response:** Thanks for the suggestion. We will add it in the next revision.

- *- line 11: complement " the proposed method " by something like " the application of the proposed separation method together with the IME quantification approach "*

  **Response:** Thanks for the suggestion. We will add it in the next revision.

- *- line 14: try to modify/complement " the more precise single-point source quantifying algorithms, the IME method, " to say (if you want) that IME is currently, probably, one of the most precise single-point source quantification algorithm when tackling high resolution images with turbulent plumes, but to avoid making this statement too general (when considering images of plumes at mesoscale, the IME approach does not appear to be the most precise approach)"*

  **Response:** Thanks for the suggestion. We will modify the text accordingly in the next revision.