Atmos. Meas. Tech. Discuss., referee comment RC1
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Comment on amt-2022-231

Anonymous Referee #2

Referee comment on "In situ particle sampling relationships to surface and turbulent fluxes using large eddy simulations with Lagrangian particles" by Hyungwon John Park et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2022-231-RC1, 2022

Title: Numerical experiments of in situ particle sampling relationships to surface and turbulent fluxes through Lagrangian coupled large eddy simulations

Authors: Park et al.

Summary:

Aerosol particle fluxes measured from past field campaigns or recorded in the literature show significant variations and inconsistent results. Different methods of flux calculations add additional uncertainty to the retrieved aerosol particle fluxes. Given those highly-varying results, one following question is: How representative are our **point /moving-in situ measurements** for the true aerosol particle fluxes over the sampled areas? This manuscript tries to tackle this fundamental problem by quantifying the uncertainty introduced by different sampling strategies, instrumentation, retrieval methods using the LES outputs as truth. Specifically, the authors investigate the following questions: Does the approach we adopted to sample the aerosol particle fluxes (i.e.., sampling areas, sampling instruments, retrieval methods, and stability of the PBL) have a significant impact on the final retrieved surface aerosol particle fluxes? If so, how large uncertainty is introduced by each step to the final retrieved surface fluxes? The author found that all these factors influence the final retrieved aerosol particle fluxes, with their associated uncertainties varying substantially.

There are so many exciting findings in their results. For example, they found that different directional alignments for flux sampling (stream-wise, span-wise, and diagonal direction, Figure 6) introduce different uncertainties to the estimated aerosol particle fluxes (Figure 8). Such information is extremely useful when planning a future field campaign.

Besides the authors' comprehensive answers to the fundamental questions mentioned above, the more significant merit of this manuscript is that they provide a general framework to test new measuring techniques, sampling strategies and their related uncertainty quantification. Such a framework is of great value for future field campaigns, both in achieving the scientific goal of those campaigns and reducing human resources and cost.

It is a pleasure to read such a comprehensive study, I recommend a minor revision for this paper.

The only moderate problem that I found is that the URL to their code repo seems not correct. The authors might need to replace it with the correct one.

Below is a list of minor to moderate comments identified in the current manuscript.

Recommendation:

Minor revision

General comments:

- Codes on Github is not accessible: The URL for the codes used in this study jumps to the webpage: https://github.com/RichterL, and I cannot find the NTLP model there. If you decide to use Github as the code repo, please also attach a license (e.g., GPLv2/v3) to it.

Specific comments:

- Interpretation of Figure 9:

In Figure 8, we generally see the uncertainty grows with height. For example, Figure 8(c)-(d) shows shapes of upside-down triangles. Figure 9 shows the inferred surface fluxes from Figure 8 by using Equations (6)-(7). In Figure 9(c)-(d), the uncertainty shapes are no longer upside-down triangles. In Figure 9(c), the level with maximum uncertainty is now at \frac{z}{z_{inv}} = 0.7. Can you explain why this is the case? Same question for Figure 9(d).

- The schematic figure for your deployment of stationary and moving probes (L390-400): It would be great if you can provide a schematic figure showing the locations of the probes. For the moving probe, you can draw it as a moving line with its arrow head indicating its moving direction. Please also mark the direction of flow.

- Calculation related to ogive probes.
  - L 394: “at a user-defined speed of 50m/s”. Is there any justification for using this speed 50m/s? What is the normal speed of planes in the field campaign?
  - In Figure 10, you show the ogive curves for the moving probe in stream- and span-wise directions. I assume those calculations are based on a speed of 50m/s. Is it possible to calculate another two lines using a speed either higher or lower than 50m/s?. This will enable readers to know how moving speed affects the convergence rate.

- Figure 13: the highly varying predictive ranges of flux at high levels (\frac{z}{z_{inv}}>0.9): Compared to the low level where the oscillation of flux range is of small amplitude, the flux range changes dramatically at high levels. Is it due to your LES setting, e.g., too few vertical levels in high altitudes, or low model top? Any explanation for this feature?

Technical corrections:

L383: “A common technique in field measurements, an ogive curve O_g_{wc}(f_0) represents a running integral…”: broken sentence?