Reviewer 1:

Summary: This study shows deep research on the surface flux estimates from different numerical approaches and compares the observation, eddy covariance, simulated instrumentation and the theoretical flux-profile method results have been provided, turbulent transport impact on aerosol particles found has estimated. This article could be accepted after minor revisions.

L14: MABL(marine atmospheric boundary layer) first-time appearance should add the full name.

Thank you for catching this acronym introduction before the full name. We have now added the full name in the abstract.

L31: Coarse mode aerosols have many influences focusing on lighting and also growth larger contribute to air pollution, related reference also includes the following articles:

Pan, Z., Mao, F., Rosenfeld, D. et al. Coarse sea spray inhibits lightning. Nat Commun 13, 4289 (2022). https://doi.org/10.1038/s41467-022-31714-5.

Lee, S.-H., Gordon, H., Yu, H.,Lehtipalo, K., Haley, R., Li, Y., &Zhang, R. (2019). New particle formation in the atmosphere: From molecular clusters to global climate.Journal of Geophysical Research:Atmospheres,124, 7098–7146. https://doi.org/10.1029/2018JD029356

Wu, Hao & Li, Zhanqing & Jiang, Mengjiao & Liang, Chun-Sheng & Zhang, Dongmei & Wu, Tong & Wang, Yuying & Cribb, Maureen. (2021). Contributions of traffic emissions and new particle formation to the ultrafine particle size distribution in the megacity of Beijing. Atmospheric Environment. 262. 118652. 10.1016/j.atmosenv.2021.118652

We agree on the additional motivating factors for the study of coarse mode aerosol particles. We have added these references to the introduction in line 29-30.

L53：Atmospheric stability is a key parameter impact on particle transport, using Monin–Obukhov stability theory (MOST) has many progress the related reference: Irwin JS and Binkowski FS. Estimation of the Monin-Obukhov scaling length using on-site instrumentation. Atmos Environ 1981; 156: 1091–4.

Srivastava P and Sharan M. An analytical formulation of the Monin–Obukhov stability parameter in the atmospheric surface layer under unstable conditions. Bound-Layer Meteor 2017; 165: 371–84.

Thank you for these references. We agree that atmospheric stability (through MOST) has been a critical backbone for detailed analysis on particle transport. This reason is our primary motivation to explore the sensitivities of sampled net aerosol flux through different stability conditions (unstable, neutral). We have added these references in line 55-56.

L58: “other field-based studies” many launched in the atmospheric boundary layer found that interaction between aerosol exists in the atmospheric boundary layer, could relate to:

Li Z, Guo J and Ding A et al. Aerosol and boundary-layer interactions and impact on air quality. Natl Sci Rev 2017; 4: 810–33.

Lauros J, Sogachev A and Smolander S et al. Particle concentration and flux dynamics in the atmospheric boundary layer as the indicator of formation mechanism. Atmos Chem Phys 2011; 11: 5591–601.

Thank you for these references. These examples of additional field-based studies strengthen the overall message of the importance in capturing the vertical distribution of aerosol particles. We have added these references in line 60.

L101: direct numerical simulation(DNS) and other models also can simulate flux measurements has a high correlation to the aerosol turbulence interaction(ATI).

Chen S, Yau MK and Bartello P et al. Bridging the condensation–collision size gap: a direct numerical simulation of continuous droplet growth in turbulent clouds. Atmos Chem Phys 2018; 18: 7251–62.

Eaton JK and Fessler JR. Preferential concentration of particles by turbulence. Int J Multiph Flow 1994; 20: 169–209.

Li D,Wei A and Luo K et al. Direct numerical simulation of a particle-laden flow in a flat plate boundary layer. Int J Multiph Flow 2016; 79: 124–43.

WeiW, Zhang H andWu B et al. Intermittent turbulence contributes to vertical dispersion of PM2.5 in the North China Plain: cases from Tianjin. Atmos Chem Phys 2018; 18: 12953–67.

Thank you for providing these references. We have added them to the manuscript as examples of numerical models that explore flux measurements and their correlation to the aerosol turbulence interactions in line 103-104.

L153: “while K(xp) is the average subgrid momentum diffusivity obtained from the LES model, interpolated to the particle location”, this parameter should provide more methods or pathways to explain how to get it.

We have now provided more detail on the pathways to obtain the interpolated subgrid momentum diffusivity K(xp), which is used through a trilinear method. This is amended in lines 155-156.

L214: the concentration vertical distribution of aerosol has rare research, but we can find some evidence based on some UAV measurements, such as:

Mehta, Manu & Khushboo, Richa & Raj, Rahesh & Singh, Narendra. (2020).

Spaceborne observations of aerosol vertical distribution over Indian mainland

(2009-2018). Atmospheric Environment. 117902. 10.1016/j.atmosenv.2020.117902.

Kemppinen, Osku & Laning, Jesse & Mersmann, Ryan & Videen, Gorden & Berg, Matthew. (2020). Imaging atmospheric aerosol particles from a UAV with digital holography. Scientific Reports. 10. 16085. 10.1038/s41598-020-72411-x.

Thank you for providing these references. We have modified the manuscript to include this detail of UAV measurements capturing vertical concentration profiles in line 218-219.

L338: “The disaggregation technique employed here demonstrates the importance of areal coverage and directional sampling when calculating aerosol mass flux”, the aerosol mass flux method and parameter setting in L286, and the reference?

We believe this comment is asking for clarity regarding the disaggregation technique sentence in line 338, and to what extent it is tied to the method mentioned in the literature cited in L286. Our sampled flux method is very similar to that of both Suhring et al. (2019) and Hutjes et al. (2019), in that we take horizontal sub-regions and compute the local net flux for each sub-region. We have repeated the citations from line 286 to line 343.

L495: “a horizontal average over the entire domain” how to deal with the surface layer and the ABL?

In the context of the theoretical flux-profile method, we believe the reviewer is interpreting the “horizontal average over the entire domain” as an average throughout the entire vertical extent. The flux-profile analysis considers the horizontal average over the entire domain for a **single vertical gridpoint** (see Fig 11(a): LES legend for resolution detail), including into the surface layer.