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## **Comment on acp-2021-427**

Anonymous Referee #1

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Referee comment on "Input-adaptive linear mixed-effects model for estimating alveolar lung-deposited surface area (LDSA) using multipollutant datasets" by Pak Lun Fung et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-427-RC1>, 2021

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Review

### **Input-adaptive linear mixed-effects model for estimating alveolar Lung Deposited Surface Area (LDSA) using multipollutant datasets**

by Fung et al.

The authors observed Lung Deposited Surface Area (LDSA), which is an indicator of the adverse effects of nanoparticles on human health, in urban sites and their backgrounds, and explained their behavior and characteristics along with other parameters. As an important works of the authors, furthermore, they demonstrated to better estimate the LDSA concentrations from several widely monitored atmospheric and meteorological parameters, and characterize the statistical relationship with other parameters, by applied advanced statistical methods that combined automated input variables selection techniques with random effects. In the current that attracts public attention to the human effects of finer particles, new methods and results that better estimate this indicator, which may be better represented them than mass concentrations, from currently widely monitored parameters, have can be important implications to satisfy strong social demands in the near future.

The evaluation of the model and its usefulness are extremely and convincingly written in this manuscript. However, I have some confusion concerns and questions regarding the interpretation of observed LDSA and some indicators analyzed by the authors. I hope the authors find my comments below useful. Therefore I would recommend the paper for publication after these clarifications.

Specific comments:

Line 48-49: Clear information of particle size is misleading to the reader, because their information for particle deposition on the lungs has greater uncertainty by their various properties and also their mechanisms can be complex contribute. it necessary to clearly that these values are reference values.

Line 183-: How calibrations and corrections were made to compare the observations at several sites?

Table 1: Table 1: As the authors have described, previous studies of LDSA may have different target for deposition areas, which can lead to very different values. it should be clarified reviewed previous data from many sites.

Line 330-: The contributed factors of the observed LDSA are discussed based on the time-series variations and the conclusions discussed in the previous studies observed at the same point. The characteristics of LDSA observed in this study should be more clearly based on the BC concentration data and analyzed backward trajectories, for example the effects of traffic and heating or the effects of long-distance transportation etc.

Figure 4: Sufficient evidence is needed to explain that the value increased from the background is LDSA caused only by particles emitted in urban. In particular, it is unlikely that particles observed in background site will be observed in urban site as well without increase or decrease. Do previous studies, in particular, fully explain the long-term observations in this study?

Line 368-: The importance and implications of the ratio of LDSA to some of the parameters shown here are need to more clear.

In particular, LDSA, which is measured by diffusion charge, is based on the relationship that the amount of charge measured is proportional to about 1.1 power of the particle size. On the other hand, PM2.5 and PINC are proportional to the 1st or 2nd power of the particle size, so in theory these three parameters are explained only by the different dimensions for diameter. Moreover, the trend of diurnal variation in the ratio of LDSA to some components seems to be inconsistent with the relationship with the factors of LDSA explained in the previous section. This reason seems to be due to the fact that, for example, BC is a mass-based concentration, whereas LDSA is different, as mentioned earlier. Therefore, LDSA may potentially not have a linear relationship with PM2.5 and BC concentrations in theoretical, but does it affect the model constructed by these complex regressions?

Line 418-: The estimation results that showed different performance depending on the variables selected were clearly explained. Is it possible to quantitatively discuss the contribution of the parameters involved in LDSA, especially with some of the coefficients shown in Table 5?