Title: Comparison of the imaginary part of the atmospheric refractive index structure parameter and aerosol flux based on different measurement methods
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The manuscript investigates various aspects related to aerosol vertical transport flux measurements. The authors compare different measurement methods for determining aerosol vertical transport flux, focusing on the validation and mutual agreement among these methods. The study introduces the concept of the atmospheric equivalent refractive index structure parameter (AERISP) and its imaginary part, which is crucial for understanding aerosol concentration fluctuations. The authors propose using the light-propagated large-aperture scintillation to determine the imaginary part of the AERISP. They conduct experiments on the campus of the University of Science and Technology of China to compare AERISPs obtained through different methods and examine the aerosol vertical transport fluxes derived from these measurements.

The experimental results demonstrate good agreement between the imaginary parts of the AERISPs obtained by different methods. The authors also observe consistent trends in aerosol vertical transport fluxes, although some differences exist.

Overall, this manuscript contributes to the improvement of aerosol flux measurements and provides valuable insights into the existing methods. The research questions are well-addressed, and the experimental approach is appropriate. However, this manuscript lacks some of the key information, and a better presentation of this manuscript, in terms of English writing and paper structure, would greatly enhance the manuscript's impact.

Major issues:

1. Line 58-59: Some of the terminologies are a bit confusing. It seems like the atmospheric equivalent refractive index (AERI) and the atmospheric equivalent refractive index structure parameter (AERISP) were not mentioned in Yuan et al. (2015). Is AERISP the same as more commonly used refractive index structure parameter (RISP)? If the authors can elaborate the broadness of these two variables based on the literature, it will certain help the audience understand the whole concept better.
2. Line 65-70: There are a few sub-questions regarding to this part. 1) It is not very clear how the similarity theory is utilized here; 2) Some of the arguments seem strong and would require more references to support. For example, “It is assumed that the aerosol concentration variations follow the same pattern as the scalar

motion", I would like to see authors explain if this argument is an "assumption" or it is observed fact, which should be supported by references.

3. Line 76-92: The purpose of this paragraph is unclear. It shows a lot of details in methodology. It would be much better for the authors rewrite this paragraph focusing on setting up the argument or summarizing research gaps.
4. Line 93: Could the authors provide the definition of the imaginary part of the AERISP?
5. Line 104-107: It is a big part of this work to compute the aerosol vertical transport flux. If I understand correctly, the aerosol flux is calculated by combining 1 Hz visibility and 10 Hz ultrasonic anemometer data, which requires to "downgrade" 10 Hz vertical velocity fluctuation to 1 Hz. By doing so, the aerosol flux only contains the eddy with frequency lower than 1 Hz, in other words, any turbulent eddy, whose frequency is higher than 1 Hz, is automatically eliminated. This brings the argument that if this technique would lose a big part of turbulence information. If the authors can comment on this, that will be great.
6. Line 127-128: Is the equivalent refractive index n_eff = n_equ from Eq. (1)? Please clarify it.
7. Eq. (2): It seems like S(0) is a complex number. If so, the imaginary part of Eq. (1) should be written as $\frac{2\pi}{\eta^3}\int Re[S(0)\frac{dN}{dD}dD]$. Furthermore, the imaginary part of S(0) goes to the real part (i.e., $Re(n_{que}) = n_m - \frac{2\pi}{\eta^3}\int Im[S(0)\frac{dN}{dD}dD]$Re(n)), is that right?
8. Line 136: Please provide more information on the relation between the aerosol extinction coefficient and visibility. At least provide related reference.
9. Line 139-140: The relation between temperature and the real part of the AERI as well as the real part satisfying "2/3" law are not convicting. Consider elaborate more on the arguments.
10. Eq. (5): Please define $D_{n,Im}(r)$
11. Line 163-165: Please consider rephrase this sentence. Five "of"s make this statement hard to follow.
12. Eq. (6): Please define W, D_r, D_j, J_1 and nu. The first integral ($\int_0^L dx$) seems odd. Is this equal to L?
13. Line 262-263: The displacement height is not necessarily equal to the height of the buildings or canopies. A more sophisticated method should be used here to estimate the height of displacement.
14. Please list the details of all the instruments used in this work. For example, the model names of wind speed, direction, temperature, humidity sensors, and sonic anemometer.

15. Line 289: The selection of study periods seems arbitrary. Are there any reasons for this time?
16. Line 421-423: The estimation of AERISP is more accurate during the convective period. I'm wondering if the authors only show the comparison during daytime, how the results would look like.

Minor issues:

1. Line 99-103: "However, the conventional …… and aerosol mass concentration (Ren et al., 2020)". The sentence is way too long to follow. Please consider rephrase it.
2. Line 117-118: "caused by the fluctuation of the refractive index caused by the fluctuation of temperature" Please rephrase.
3. Figure 1: Please add scales and orientation in (a). Please consider change the color of letters and add scales and orientation as well. If authors can mark the distances between each of these three points, it would be a lot nicer.
4. Line 418: "Fig. 7a" should be Fig. 7b.
5. Line 645: "Figure 8(a,)"
6. Line 649: "and (b) the imaginary part and (b) aerosol flux" Please rephrase.