

Atmos. Chem. Phys. Discuss., referee comment RC1  
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## Comment on acp-2022-617

Anonymous Referee #1

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Referee comment on "Aerosol optical depth regime over megacities of the world" by Kyriakoula Papachristopoulou et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-617-RC1>, 2022

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**Summary:** Large cities with large concentrations of population are facing serious environmental challenges. This study investigates the spatial and temporal characteristics of aerosol states in megacities using up-to-date spaceborne aerosol retrievals (AOD and Dust Optical Depth - DOD) with fine spatial resolution ( $0.1^\circ \times 0.1^\circ$ ). The author found that the spatial and temporal variability of AOD is closely related to the population agglomerations and the adoption of emission policies, which also is of significance for assessing the effectiveness of air pollution emission regulations.

I have some general and minor comments (please see below) which should be addressed prior to publication.

### General comments:

- **Line 128-131: The author first mentioned the use of the MIDAS dataset with high resolution to analyze the spatial and temporal variability of AOD, and this dataset appears several times in the paper, so I think it is necessary to give specific details about MIDAS when it first appears.**
- **As the author mentioned in the paper, a uniform pixel-based approach is applied for all cities. However, because different cities are located at different latitudes, increasing the uncertainty of pixel size in the east-west direction. Maybe the author could implement a distance conversion based on the relationship between latitude and pixel size to ensure that the city-centric division of space remains consistent? Based on the same thoughts, to reduce uncertainty, is it more reasonable to express the single measure of the AOD gradients in terms of distance as well?**
- **Line 191-195: Why did the author construct the daily AOD time-series for urban domain by calculating the AOD median rather than AOD mean?**

minor comments<sup>1/4</sup> □

- **Line 99: Replace "surface-based" with "ground-based".**
- **Line 206: Add title number "2.6", and "Intra-annual" should be replaced by "intra-annual".**
- **Line 217: Add title number "2.7", "Intra-annual" should be replaced by "intra-annual".**
- **Line 227: Replace the title number "2.6" with "2.8".**
- **Line 322: Punctuation is in red**
- **Line 440: Note the order in which the abbreviations of Ground Based (GB) appear.**
- **Figure 17 and figure 18 Figures 17, 18 seem to lack the serial numbers "(a)" and "(b)".**
- **There is a spelling error in the header of table A1 and "Agglomiration" should be changed to "Agglomeration".**