

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2022-617

Anonymous Referee #2

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-RC2>, 2022

The manuscript by Papachristopoulou et al., "Aerosol optical depth regime over Megacities of the world", presents a study to investigate the spatial and temporal variability of urban aerosol state of 81 cities with population over 5 million, relying on daily satellite-based aerosol optical depth data. The focus and objectives of this study were quite straightforward and, probably at least partly for that reason, no actual problem points or weaknesses could be found in the approach and analysis. Because of this, my comments are also general or specific but minor. But of course, it should be mentioned in favor of the manuscript that the description and analysis was quite thorough, and these results bring useful information about the spatial and temporal variability of aerosols in the context of Megacities. I consider the topic and results of this manuscript to fit the scope of ACP and think it could be published if the minor comments below are addressed.

Line 146, here you mention about the number of days or seasons required for seasonal or annual means. Nine days out of 30 or three seasons out of four sound like somewhat loose limit. In place where there is a strong seasonal variability, it likely has a significant impact in the monthly mean whether the nine days of the month are in the very beginning or in the end of the month. Could you describe how did you arrive at these limits, and whether you tested more strict ones and the influence of these in the results.

Line 287, you write "... revealed that the 4x4 pixels area is a domain well fitted ...". How it was "revealed", could you describe your analysis/conclusions in somewhat more detail.

Line 345, your finding that the city of Los Angeles resulted in different trend than overall western US was interesting. How about the results in the Figure 16, did they perhaps give a similar indication that also in the scale of city center vs surrounding area, a similar difference in the trend was found? Related to Los Angeles (LOSA), is there a reason why it was not included in the Figure C1b?

Line 410, I would think that the large interannual variability in North America, most notably in Atlanta is related to the significant impact by biogenic aerosols, discussed in many papers (one of the best known is Goldstein et al. 2009). Could you elaborate on this matter.

REFERENCES

Goldstein, A. H., Koven, C. D., Heald, C. L., and Fung, I. Y.: Biogenic carbon and anthropogenic pollutants combine to form a cooling haze over the southeastern United States, *P. Natl. Acad. Sci. USA*, 106, 8835–8840, 2009.