

# ***Interactive comment on “Impact of satellite viewing swath width on global and regional aerosol optical thickness statistics and trends” by P. R. Colarco et al.***

## **Anonymous Referee #1**

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The manuscript studies the impact of satellite swath width on the global and regional AOD statistics and trends. The study uses the MODIS AOD climatology as the baseline, and then re-samples AOD from this baseline with different strategies (such as MISR and CALIOP). The manuscript concludes that “future aerosol satellite missions having significantly less than full-swath viewing area unlikely to sample the true AOT distribution well enough to determine decadal-scale trends or to obtain the statistics needed to reduce uncertainty in aerosol direct forcing of climate”.

Overall, the manuscript is well written and the contrast analysis between ‘sampling-then-average’ vs. ‘average-then-mask’ is revealing. The manuscript has 18 figures

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and looks into several important issues (such as AOD trend, cross-scan bias in AOD, etc.). I would recommend the manuscript be accepted after several minor but important revisions. Below are specific comments.

1. The analysis presented here focuses primarily on the issues related to spatial sampling, but assumes that AOD retrieval quality don't change with swath width (or inherently sensor capability). It is ok to make such assumption, but is a good idea to acknowledge such important assumption upfront (preferably in the abstract). Currently, view-angle artifacts are mentioned in the abstract. But sensors with limited spatial coverage may have different (likely higher) accuracy in AOD retrievals and the manuscript is not considering this in the analysis.

2. Similar like temperature, extreme events are part of the climatology. The manuscript looked into how well the min and max of AOD differ due to the spatial sampling bias, which is very good. However, some discussion is needed in section 4, as ultimately the comparison needs to be made for PDF of AOD.

3. In section 4, the width of swath is recommended as an important factor to be considered in the future mission planning for studying aerosol forcing. However, as mentioned in the introduction of the paper, aerosol forcing estimate requires knowledge of both particle composition (single scattering albedo) and particle size, and in some many cases, the vertical profile of these parameters as well. So, it is good to mention these important factors in the discussion. It is important to study if the spatial coverage of AOD is still the first-order cause of the forcing uncertainty, given that most global models constrained by satellite data have also made good progress in the last decade toward simulating the climatology of AOD.

4. The contextual biases over the ocean were briefly discussed in the end of the manuscript, but other studies have found such contextual bias over the land (Hyser et al., AMT, 2011) and over the coastal regions (Anderson et al, Tellus, 2013). It is recommended to include these studies in the discussion as well.

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