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Reply on RC2

Drew C. Pendergrass et al.

Author comment on "Continuous mapping of fine particulate matter ($PM_{2.5}$) air quality in East Asia at daily 6□ × □6□km^2 resolution by application of a random forest algorithm to 2011–2019 GOCI geostationary satellite data" by Drew C. Pendergrass et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2021-273-AC2, 2022

Reviewer's comments on manuscript titled "Continuous mapping of fine particulate matter ($PM_{2.5}$) air quality in East Asia at daily 6×6 km^2 resolution by application of a random forest algorithm to 2011–2019 GOCI geostationary satellite data" by **Drew C. Pendergrass et al.**

In this paper, the authors presented results of estimating PM2.5 by using RF from the gap-filled GOCI AOD product. The objective of this paper is very clear, which intends to demonstrate the ability and also obstacles of deriving PM2.5 from satellite-derived AOD products by using machine-learning techniques. In general, the presentation of this paper is very clear and sound, however, the technique and approach used in this study have been widely used. In addition, an important aspect of this study, i.e., the gap-filled GOCI AOD, is not discussed in detail. The contents of this paper are of great importance, especially due to the crucial role of deriving surface PM2.5 concentration with continuous spatial coverage in air quality monitoring, the method used is not innovative but the results are significant and sound enough.

- Response: We thank the reviewer for their comments. We also have added new material expanding on our approach to use information encoded in AOD missingness in the introduction (lines 88-89; 93-97), the innovativeness of which we believe was not sufficiently clear in the original draft.

Comments/suggestions:

- Line 263-265. This statement seems does not have data to backup. it is strongly suggested to include the data/figures. And, the gap-filled GOCI AOD is a crucial base for deriving a continuous map of PM_5 concentration in this study. It really deserves a paragraph to describe how well the gap-filled GOCI AOD performed.

Response: We thank the reviewer for pointing out this issue. As noted in a response to the first reviewer, we added a paragraph discussing the ability of the gap-filled AODs, together with a length scale parameter, to accurately predict $PM_{2.5}$ without introducing new bias (lines 290-296). We also added a new supplemental figure S1 which shows

predicted and observed $PM_{2.5}$ on days with and without AOD retrieval, demonstrating how our methodology recovers observed $PM_{2.5}$ distributional differences when AOD retrieval fails.

- Line 270. The labels in these figures need to be redone. It is suggested to add "a" and "b" respectively for each figure.

Response: We have added letter labels to all figures in the paper and modified captions accordingly.

- Line 350. The labels in these figures are confusing. Labels are added only in the third figure, but lines in the other two figures have different colors, it is suggested to add labels to other figures as well, Also, explain them in the caption.

Response: We have added color coded legends to all panels of figures 5 and 8 and modified captions to clarify the terms we use in the legends.

- Line 290-310. The challenge in predicting NAAQS exceedances is well presented in this paragraph. And the authors mentioned that several attempts were made but no improvement was seen. Part of the problem could be non-equal sampling in the different PM2.5 ranges, it is suggested to try to train RF in training datasets that have a roughly equal- number of samples in different PM2.5 ranges. Secondly, GOCI AOD performance has been well documented in the validation studies. What about carrying out bias correction for GOCI AOD for different ranges of AOD before training?

Response: The reviewer is correct to point out that more could be attempted to resolve the NAAQS prediction issue. We have added a discussion of what we might try in future work to lines 553-557.