

Earth Syst. Sci. Data Discuss., referee comment RC2
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Comment on **essd-2021-426**

Anonymous Referee #2

Referee comment on "Full-coverage 250 m monthly aerosol optical depth dataset (2000–2019) amended with environmental covariates by an ensemble machine learning model over arid and semi-arid areas, NW China" by Xiangyue Chen et al., Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2021-426-RC2>, 2022

High-resolution with full spatial coverage AOD dataset is important for air pollution-related studies, especially for bright surfaces. The authors have done a lot of work to generate a 250 m AOD dataset in arid and semi-arid areas in northwestern China. However, my biggest concern is the spatial resolution of current developed dataset since it is not clear how to generate the 250 m AOD dataset with two much coarse-resolution MAIAC AOD (1 km) and MxD08 (1 degrees) as main predictions although there are some high-resolution auxiliary data. It sounds incredible and I don't find any downscaling approach or descriptions in the paper.

Below are some other specific comments:

The authors are suggested to summarize previous published studies focusing on multi source AOD dataset fusion or AOD gap filling using different models to rich the Introduction since a lot of related work have been done.

Section 2.3: MxD08 AOD product is too coarse in the spatial resolution (1 degrees) to be used for comparison in such a small study region. I suggest using the MxD04 product with a high resolution 3 or 10 km.

Section 2.4: Please clarify the version and level of AERONET data, and the number of the stations (also suggest adding them in Figure 1) used in the study.

In addition, the author should highlight the novelty of their study and the differences compared to previous studies.

Lines 273-288: It is not clearly how to train and validate the model. Please clarify what are the inputs to the model, and what is the real/true value for target? What are the training samples and verification samples? Are they independent of each other?

Figure 4: I don't see much differences compared with 1km AOD, and I think the authors need show the advantages of 250m data set, e.g., may zoom in the image by looking at the AOD distributions at urban areas.

Lines 341-353: The results are pretty similar among different AOD products and difficult to distinguish the difference, and more quantitative comparison results are needed.

Sections 3.2 and 3.3: It is recommended to calculate the monthly and seasonal long-term trends and statistical significance by removing the seasonal cycles to have a look at how AOD changes throughout the study area since AOD data for nearly 20 years are available.