We would like to thank Ding Li for the comment as well as for the suggested papers. Our responses (in blue) for each comment (in black) are provided below.

Authors' response to CC

This document employs two distinct methods, Maximum Likelihood Estimation (MLE) and Deep Neural Networks (DNN), to integrate pixel-level uncertainties in the fusion of three Aerosol Optical Depth (AOD) products. The result is an improved hourly AOD dataset compared to individual AOD products, evident in its superior validation against ground-based AERONET AOD over East Asia. The approach meticulously addresses potential sources of errors and various challenges, positioning the resulting dataset to provide high-precision hourly Aerosol Optical Depth (AOD) products. Moreover, the article maintains a coherent logical flow and is enriched by visually appealing charts, rendering it an outstanding paper.

Major comments:

1. The amount of data is a barrier to machine learning models. Can we consider all types when there are not many AERONET sites in eastern Asia? It would be interesting to see a discussion on how the model performance varied with different volumes of data. Did the model performance improve with more data? If the data volume was a limitation in this study, it would be worth discussing how future work could overcome this. Are there plans to gather more data or use techniques like data augmentation?

Thank you for the comment. We have done a preliminary deep learning model training with a 6-month dataset. Since the inputs for the deep learning model (each original AOD products) are highly correlated to the output of the training model, the result was comparable to the one in the manuscript. However, more data in the future may include a greater number of high AOD data to train, therefore can mitigate the remaining underestimation of DNN AOD. The future work regarding the data size is included in the conclusion.

2. For MLE (235 line): Based on this analysis, the bias of each AOD product was subtracted according to the NDVI value, selected aerosol type, and observation time. For DNN (245 line): This involved standardization of the NDVI, hour, and aerosol type index. Both models have taken into account the parameters mentioned above. However, in the figures presented in this document, there is an absence of accuracy analysis for diverse parameter combinations, with the focus solely on overall data analysis. Enhancing the article's significance can be achieved by incorporating analysis results for various parameter combinations and providing explanations for the observed outcomes.

Thank you for the comment. Figure CC1 suggests the bias analysis of the two fused AOD products (MLE and DNN). We found out that the bias of the products was effectively mitigated after fusion. However, we thought the improved results are obvious, so did not include the figure to the manuscript.

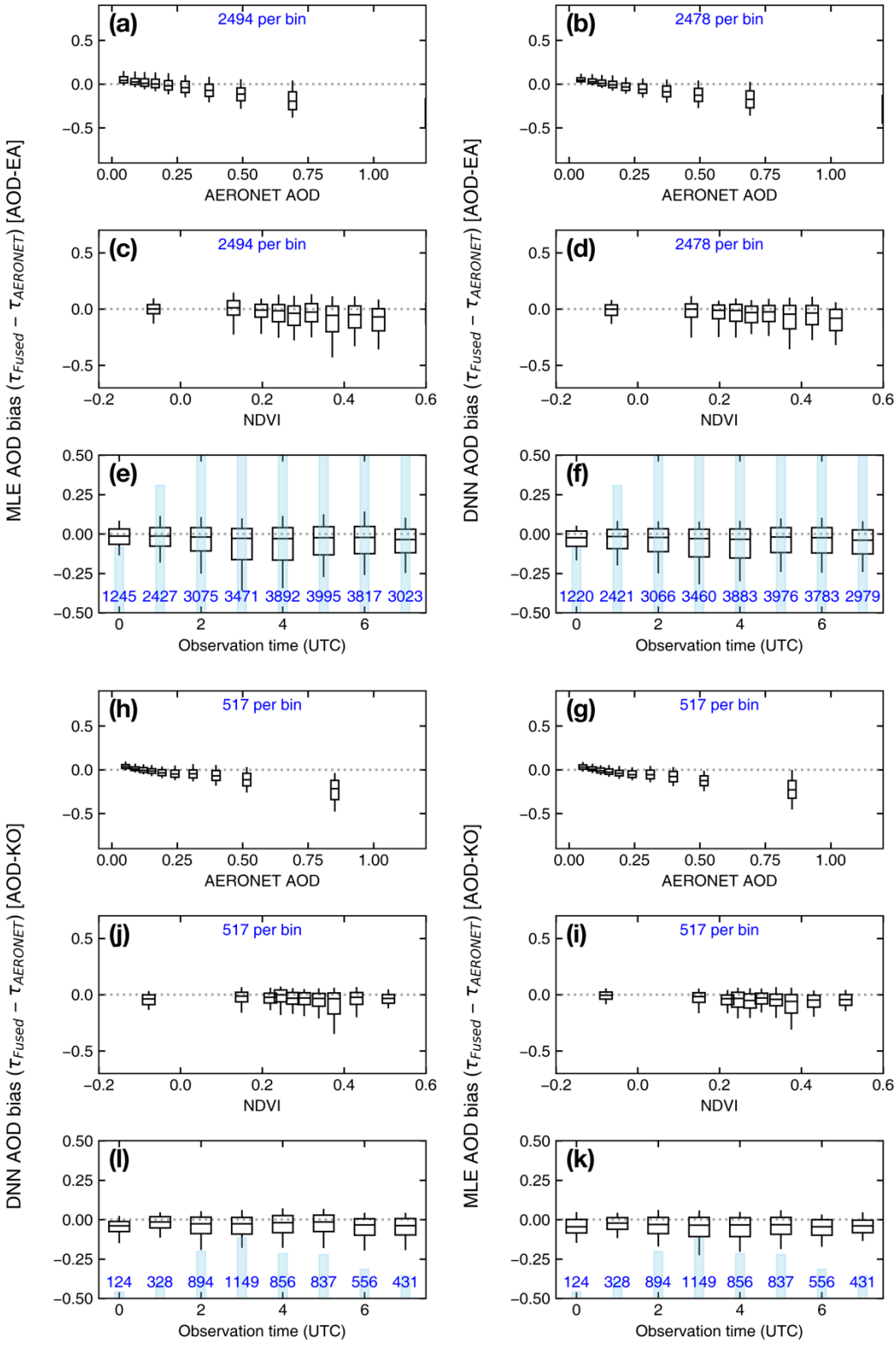

Figure CC1 AOD bias of MLE and DNN AOD relative to AERONET AOD, NDVI, selected aerosol type, and observation time. Whisker ends correspond to the 10th and 90th percentiles of the bin. Box ends correspond to the 25th and 75th percentiles. Horizontal lines in each box indicate bin median.

Numbers and bar plots in blue indicate the number of collocated AOD points in each box–whisker.