

Reviewer 2:

General comment:

This paper introduces a climate model diagnosis package that focuses on evaluation of aerosol and cloud related quantities, and applies it to U.S. DOE's E3SM. They find that the recent version of E3SM, v2, reasonably reproduces observed aerosol and cloud properties such as number concentrations of aerosol particles and cloud droplets. They also further investigated potential causes of differences in some simulated quantities comparing to that observed and suggest a direction to improve cloud microphysics schemes.

The aerosol and cloud are known for the biggest uncertainty in the climate modeling thus it is very important to establish standardized methods and comprehensive toolkits for the evaluation, which this study is aiming for and documented about. With that, this paper's scope fits well with that of the GMD journal. The manuscript is also well-written and well-organized. The code and data well prepared for being reused via code sharing (e.g., github) and archiving (i.e., DOI from zenodo), contributing to the open-science effort of the community. I have only a few technical suggestions as listed below and recommend accepting the paper after the suggestions being considered.

We would like to thank the reviewer for taking the time to review this paper and providing helpful comments to improve the paper. The comments are repeated below in black with our reply in blue.

Specific comments:

Figure 1: What is the units for the color shading? Can it be included in the plot for clarity?

Thank you for the comment. We have added the shading label (AOD@550nm) in the plot. The unit of AOD is 1 so it is not added.

Line 142-144: Were the NetCDF files generated following the CF-convention? If so, describing that would be plus.

Thank you for the comment. We currently do not use the CF-convention for the variable names. We will add it in the future update plan of ESMAC Diags.

Figures 6 and 7: Some of whiskers in the box-and-whisker plots are off the chart, I am curious if it would be worth to adjust y-axis range to include the top whiskers. In particular, Figs. 6a and 7c.

Thank you for the comment. Some aerosol variables have long tails in their distribution and adjusting y-axis to include the top whiskers will degrade the visual comparison between model and observations. We added the numbers of the top whiskers in the plot captions if they are out of the chart.

Figures 9, 10, and 12: What are the units for the color shadings? Can it be included in the plot for clarity?

Thank you for the comment. We added the units on the plots.

I wonder if the authors could describe little bit more details about how the model simulation data was prepared and fed to the package. This is important because it could improve applicability of the tool for diverse models beyond E3SM.

Thank you for the comment. We have added the following description in the text (lines 310-313):

“We also provide the source code of data preparation for observations and model output, and a detailed instruction on how to run the code. Users can revise the code to process their own observational data or model output. All the information is available in the ESMAC Diags github repository.”

For other ESMs, we just need to extract (or calculate) similar variables and save as similar file format to be fed into the package. We have documented it in the README file which is available in the github repository.