

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2021-73

Anonymous Referee #2

Referee comment on "Observation and modeling of the historic "Godzilla" African dust intrusion into the Caribbean Basin and the southern US in June 2020" by Hongbin Yu et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-73-RC2>, 2021

This study uses multiple satellite retrievals, ground-based observations, and GEOS global aerosol transport model to characterize a historic African dust event in June 2020. Compared with climatological geopotential height in June, the anomalous strength and northern shift of NASH together with Azores low contributes to the four-day accumulation of the dust near the African coast. Although the GEOS model can reproduce the historic dust event to some extent, it substantially underestimates AOD and aerosol extinction profiles compared with MODIS and CALIOP. The manuscript is well written, and results are clearly presented and well discussed. This study is a valuable contribution to understanding the synoptic factors favoring extreme dust events and improving model performance in simulating dust emission and transport. I only have minor comments and recommend publication after they have been answered.

General Comments:

What could cause the anomalous synoptic condition favoring extreme dust events like this one? Is it just due to natural variability, looking at the time series of the geopotential height in Fig. 12d? Or we might expect stronger and/or more frequent dust events in the future due to global warming? I also wonder if the reduction of anthropogenic emissions (i.e., greenhouse gases and aerosols) during COVID could play a role here. It is probably out of the scope for this study, but I would love to hear the authors' opinions on this. Such discussions could benefit future studies.

It is very rare for African dust to make it into the tropical eastern Pacific. I wonder which factors could play a major role here, the anomalous NASH or stronger AEJ? In Fig. 12, the high-pressure system over the western Africa in June, 2020 greatly extends to the Gulf of Mexico compared with 1980-2019 climatology.

Specific comments:

Line 87, evolved to evolve?

Figure 3 and 16, it might be better not to use black color for the background?

Figure 4, please add labels for the panels (e.g., a-h). It would be better to add a brief description for what is shown in color map (Fig. 4a).

Figure 5, it would be better to change the latitude/longitude marks for CALIOP aerosol extinction curtains to be consistent with Fig. 13, 14, and 17.

Figure 17, please add labels for the panels.