

ACP review of:

Radiative Examination of Developing African Easterly Waves and Saharan Dust Interactions: Comparative Insights from Reanalysis and NASA Airborne Observations

By Ruby W. Burgess and Mayra I. Oyola-Merced

General Comments:

This paper reveals important information regarding the limitations of using reanalysis data to characterize the interactions between African Easterly Waves (AEWs) and Saharan dust, but the paper states that “Our primary objective is to perform a radiative examination of the interactions between AEWs and Saharan Dust during the intensive observation period (IOP).” A radiative examination was performed for dust aerosol profiles in terms of their heating rates, but a radiative examination between AEWs and Saharan dust was not done since this would require an evaluation of the impact of the dust on clouds, and as stated on p. 19, this was not done. That is, cloud-aerosol interactions were not studied. The title of this paper should be changed to reflect the actual content of the paper; something like “Radiative Heating Rate Errors Inherent in Reanalysis Data Used to Evaluate Saharan Dust Associated with African Easterly Waves”. And the objective of the paper could be restated accordingly; something like “Our primary objective is to perform an examination of radiative heating rates within Saharan dust plumes associated with AEWs during the intensive observation period (IOP).” The scope of the research when mentioned elsewhere in the paper should be changed accordingly.

Other than this, the paper is well written and well organized, and the heating rate errors associated with the reanalysis data represent an important discovery. I recommend publication pending minor revisions as indicated above and below.

Major comments:

1. Line 102: Lidar systems measure the aerosol backscatter, and from backscatter infer the extinction coefficient. So, a reference indicating how the 532 nm aerosol extinction coefficient was calculated from the backscatter would be prudent here.
2. Lines 115-116: Suggest using “volume extinction coefficient” rather than mere “extinction coefficient” to avoid confusion with the mass extinction coefficient used in Eq. 1.
3. Equation 3: It would be instructive to briefly note that the first two terms tend to dominate the heating rate magnitude, with the first term in brackets predicting radiative exchange with the boundary layer (and thus is generally a heating term) while the second term predicts radiative exchange with the top of atmosphere and thus for longwave radiation predicts cooling to space.
4. Lines 386-389: This sentence states: “The primary objectives include assessing the accuracy of reanalysis in depicting aerosol radiative properties, **understanding the influence of aerosol heating rates, especially from Saharan dust, on AEW development**, and evaluating the impact of aerosol assimilation on model representation.” The section in bold font does not appear

correct since it was not shown how heating rate errors involving Saharan dust affect the development of AEWs.

5. Lines 424-426: This last sentence under “Conclusions” is an overstatement (similar to comment #4 above). For example, the approach taken was not “comprehensive” since the potential impact of dust aerosol-cloud interactions on AEW development was not accounted for.

Technical comments:

1. Lines 116-117: “each of the five bins” => “each of the five size-bins”?
2. Line 242: Two incidences where “second panel Fig. 2” => “third panel Fig. 2”?
3. Line 248: “fourth and fifth panel, Fig. 2” => “sixth and seventh panel, Fig. 2”?
4. Line 264: “650 hPa” => “550 hPa”?
5. Lines 365-367: The last part of this sentence appears to be missing.