

Interactive comment on “Toward an Observation-Based Estimate of Dust Net Radiative Effects in Tropical North Atlantic Through Integrating Satellite Observations and In Situ Measurements of Dust Properties” by Qianqian Song et al.

Anonymous Referee #3

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The manuscript provides a comprehensive assessment of the direct radiative effect (DRE) of Saharan dusts over the tropical North Atlantic region. The merged A-Train satellite products and several in situ dust measurements are used to constrain the radiative fluxes and dust microphysical and optical properties in the calculations. The SW DRE obtained in this study agrees with the previous assessments over the same region. By combining a radiation transfer model and ERES-measured OLR, a significant positive LW DRE of dust is found, which has a great implication for aerosol models

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that traditionally do not consider aerosol LW radiation in a sophisticated manner. The manuscript also explores the sensitivities of dust DRF to its size distribution, refractive index, and shape, shedding light on the parameter choice for dust modeler. Overall, the manuscript is well written and is suitable for ACP. I only have some minor comments as below.

- 1) Only 5% pixels are cloud free in the analysis region and season. Such a small occurrence would make readers wonder to what extent the dust DRE calculated in this study contribute to the dust all-sky radiative forcing in this region. I can see that dust radiative forcing in cloudy sky is complicated and beyond the scope of this study, but it is still helpful to discuss the possible influence of different types of clouds at different levels on the dust radiative forcing at both TOA and surface.
- 2) How is the dust DRE sensitive to the altitude of dust layer? It is a non-trivial question for the longwave radiation. Also, the analysis region is away from the source region, so there should be some variability of the dust layer height.
- 3) Would dust outflows over the North Pacific exhibit similar DRE as the values reported in this study?
- 4) Fig. 7 and 9. Hard to distinguish lines in those figures. Please consider using color plots.
- 5) L84, is it supposed to be [Zhang et al., 2016]? Also Xu et al. [2017, AE] is relevant here and should be cited as well.
- 6) The title is a little bit wordy. Suggest to remove “Through Integrating Satellite Observations and In Situ Measurements of Dust Properties”

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