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Atmospheric Chemistry and Physics Discussions

# *Interactive comment on* "Coarse and Giant Particles are Ubiquitous in Saharan Dust Export Regions and are Radiatively Significant over the Sahara" *by* Claire L. Ryder et al.

**Anonymous Referee #1**

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Overall, the manuscript provides significant information and makes a valuable contribution to desert dust research. Ryder et al. reveal the radiative effect of the "forgotten" coarse dust mode that is not taken into account either in remote sensing retrievals or global models, as it concerns its specific impact on the extinction (and consequently on radiation). I believe that the paper is ready for publication and I provide at the following paragraphs only my suggestions for its improvement:

One limitation of the study concerns the methodology followed to retrieve aerosol extinction from the measured size distributions. Mie scattering codes are inadequate for this type of extinction simulations, due to the fact that desert dust is non-spherical by



its nature at all particle modes. The impact of non-sphericity on extinction might not be that high in shortwave, however this statement has not been proven yet using realistic particle shapes, it is only a feeling that the community has at the moment since there are no scattering simulations for non-spherical particles that cover all sizes and specrum (this requires a vast amount of computing resources for processing all particle sizes). However, and as the authors mention already, calculations for spherical particles are still of high importance for the scientific community, since these results are comparable to global model simulations, where non-sphericity is not taken into account as well. I suggest though that the authors would add some sentences on the need to further study the impacts of non-sphericity based on more realistic representations of mineral particle shapes (e.g., to add information on the related paragraph such as if the authors intent to run such a study in the future, if yes, is there any information on non-sphericity from the campaigns mentioned in the manuscript etc).

One second suggestion is to use the lidar extinction retrievals from FAAM. The FAAM lidar is a backscatter system at 355 nm but for Saharan dust we are well aware of the lidar ratio so as to estimate an extinction profile from the backscatter retrievals. This is a valuable information for the shortwave range, since we all consider that dust extinction and backscatter have negligible spectral dependence in this spectral range. The FAAM lidar profiles can add an extinction closure in this beautiful work so as to increase its reliability.

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