Interactive comment on “Estimation of mineral dust longwave radiative forcing: sensitivity study to particle properties and application to real cases over Barcelona” by M. Sicard et al.

Anonymous Referee #3
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This paper deals with SW and LW radiative calculations applied over Barcelona. The paper is very interesting and well written. The sensitivity study (Fig 7 and discussion) and comparison with CERES (Fig 8 and discussion) are especially impressive.

My main suggestion for improvement is a more comprehensive review and comparison with existing literature. Some references are given but many of them are not discussed. In addition to the references given by another reviewer, I would recommend that references (and discussion where possible) are included of the following papers (AND references therein):

Balkanski, Y.; Schulz, M.; Claquin, T. & Guibert, S. Reevaluation of Mineral aerosol radiative forcings suggests a better agreement with satellite and AERONET data Atmos. Chem. Phys., 2007, 7, 81-95


Zhang, L.; Li, Q. B.; Gu, Y.; Liou, K. N. & Meland, B. Dust vertical profile impact on global radiative forcing estimation using a coupled chemical-transport-radiative-transfer model Atmos. Chem. Phys., 2013, 13, 7097-7114


With respect to ‘rather complete review of MD microphysical and optical properties’, I recommend inclusion of (if the authors deem these appropriate - and see also references in these papers):

Ahmed, A.; Ali, A. & Alhaider, M. Measurement of atmospheric particle size distribution
during sand/duststorm in Riyadh, Saudi Arabia Atmos. Environ., 1987, 21, 2723-2725


Sokolik, I.; Andronova, A. & Johnson, T. C. Complex refractive index of atmospheric dust aerosols Atmos. Environ., 1993, 27, 2495-2502

Sokolik, I. & Toon, O. Incorporation of mineralogical composition into models of the radiative properties of mineral aerosol from UV to IR wavelengths J. Geophys. Res., 1999, 104, 9423-9444

Balkanski, Y.; Schulz, M.; Claquin, T. & Guibert, S. Reevaluation of Mineral aerosol radiative forcings suggests a better agreement with satellite and AERONET data Atmos. Chem. Phys., 2007, 7, 81-95


Minor comments:

Page 8535, line 17: revise (english)

Page 8535-8536: I suggest to remove the entire discussion of sea salt. I think it is not needed and out of the scope of this paper. This space would be better used to review literature on dust.

Page 8541, line 7: aerosol cooling effect: cooling of what? surface/atmosphere/Earth?

Page 8542, line 17: ‘refined compared’ this is unclear, please revise

Page 8545, line 7: ‘aerosol emission’. This is correct but has not been mentioned before. Please explain.

Page 8545, line 13: ‘the more radiation will be reflected’. I think this is not true. In my opinion, what is seen here is a temperature effect. The lower the aerosol layer, the higher its temperature, and therefore the higher its emission.

Page 8550, line 14: the total atmospheric forcing. What is the physical meaning of this? Can this be measured? Please explain the importance of this quantity in some detail.

Page 8551: It would be nice if the discussion on heating/cooling rates would be expanded. Can you explain why the peak of the SW heating rate is at such high altitude? (given that most dust occurred below 6 km?) Perhaps it is worth adding averaged dust profiles (if available).

Figures: Another reviewer made a comment that the paper is also on the SW effect. I think it would be a great shame to remove all SW info from this paper. On the contrary, where possible I would expand the discussion to include SW (e.g. to show in figure 5 and figure 6 also to the SW part of the spectrum.). Perhaps the sensitivity study (Fig 7 and discussion) can be expanded to include an extra figure for the SW?