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Atmospheric Chemistry and Physics
Discussions

Interactive comment on "Comprehensive tool for calculation of radiative fluxes: illustration of shortwave aerosol radiative effect sensitivities to the details in aerosol and underlying surface characteristics" *by* Y. Derimian et al.

Anonymous Referee #2

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This paper presented a computational tool to calculate the direct aerosol radiative effect by accounting for the detailed spectral and angular scattering properties of aerosol and surface reflectance. Using this tool, they evaluated the instantaneous and diurnally averaged radiative efficiencies of five aerosol models over different surface types. Furthermore, they carried out sensitivity tests on how different treatment of surface reflectance, aerosol particle shape, and aerosol phase function affect the instantaneous and diurnal averaged aerosol radiative effect.

I found the large positive radiative forcing over the northern Sahara surprising. As

shown in Fig. 7, the daily averaged aerosol radiative efficiencies at the top of the atmosphere is about 15 Wm-2tau-1 for a mixture of dust and biomass burning aerosols when surface albedo is about 0.3. As indicated in Fig. 13, the TOA radiative effect reaches to about 20 Wm-2 in central Egypt, where the AOT is about 0.2 to 0.3, the surface albedo is about 0.3, and the SSA (440 nm) is about 0.88. This indicates that the aerosol type responsible for this large positive radiative effect has a radiative efficiency 3 to 4 times larger than the dust and biomass burning mixture presented in Fig. 7. In the western and northern part of Western Sahara, the direct aerosol radiative effect also reaches to about 15 Wm-2, where the AOT is about 0.5, the surface albedo is about 0.3, and the SSA (440 nm) is about 0.88. I would think this case closely resemble the dust aerosol model presented in Fig. 7, which always has a negative radiative efficiency. Can you explain why your calculated radiative effect is positive? Authors indicated that the low SSA and high albedo cases encounter in the northern Africa was not included in their theoretical calculations, I would suggest that authors extend their calculation to include these high albedo and low SSA cases to support the very large positive aerosol radiative effect obtained in Fig. 13.

There are quite a few AERONET sites in northern Africa. I would suggest the authors to compare their POLDER/PARASOL retrieved AOT/SSA with the AERONET retrievals. I understand there will be some differences due to temporal and spatial mismatches, nonetheless the comparison will still be helpful.

Minor comments:

Page 6, line 29, typo "incudes".

Page 6, line 30, should be "a set of".

Page 6, line 31, what is the spectral resolution used for the aerosol complex refractive index.

Page 7, line 1, what parameters are used for the aerosol vertical distribution?

Page 7, line 3, typo “In”, should be “It”.

Page 8, line 24, should be “one of these advancements”.

Page 9, line 1, I think it reads better if you structure your sentence like this “the radiative effect calculation strategy described above is”.

Page 10, line 31-32, I am surprised that only Angstrom exponent is used to classify dust aerosols, why not also using fraction of non-spherical particles?

Page 11, line 12, should be “Note that”.

Page 12, line 27, poor sentence structure.

Page 14, line 8, should be “than”.

Page 14, line 24, I suggest using “magnitude” instead of “strength”.

Page 15, line 13, I suggest start a new paragraph for Figure 7 to increase readability.

Page 15, line 18-20, the diurnal averaged radiative efficiency switches signs when the surface albedo is 0.2, not clear which mixed aerosol type you are referring here.

Page 20, line 27, typo “free” should be “three”.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 33445, 2015.