

## ***Interactive comment on* “On realistic size equivalence and shape of spheroidal Saharan mineral dust particles applied in solar and thermal radiative transfer calculations” by S. Otto et al.**

### **Anonymous Referee #3**

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#### General Comments:

This article presents informative new results on the effects of non-spherical dust particles and coarse particles on the shortwave and longwave radiative balance. I recommend the article is published subject to minor revisions, which are mostly clarifications and additions to the abstract and conclusions.

#### Specific Comments:

The abstract is a nice summary of the article but has a weighting towards the non-spherical results – it would be beneficial to include some more information on the nice results presented in the paper regarding the effects of the large particles.

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The advances and different methodologies presented in this paper compared to Otto et al. (2009) should be emphasized more, especially towards the end of the introduction – i.e. if it is the case that the present work uses an AR which varies with particle size, and that the work includes the effect in the IR, this should be explicitly stated towards the end of the introduction to avoid confusion. For example, it would be useful to move or replicate the paragraph on page 29205 lines 8-12 to the introduction to emphasize this.

The notation the authors use for radiative forcing is presented in equation 1, and is opposite to the conventional definition of forcing, where a net warming of the earth-atmosphere system (TOA forcing) is represented by a positive number (e.g. IPCC reports). The way that forcing is calculated in equation 1 means that a positive forcing results in a net cooling of the earth-atmosphere system. I would urge the authors to follow the notation of IPCC in order to avoid confusion and misinterpretation of their results.

As a point of interest, it would be interesting to comment how the spherical vs non-spherical forcings might be affected by different solar zenith angles, or when considered as a diurnal average, rather than just with an overhead sun as calculated here.

The conclusion is a nice summary of some of the implications of the work and further areas of study, but would benefit from including a short summary of the key results presented in the main part of the article.

Technical Corrections:

Page 29193 line 13: replace “These” with “This”.

Notation is not consistent throughout the article for 1) the asymmetry parameter is defined with ASP earlier in the paper (e.g. page 29194 line 3) and later referred to as g. 2) the notation for aspect ration is also variable – beginning with AR and later switching to ASR (e.g. page 29200 line 1). Notations should be changed to be consistent

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throughout the article.

Page 29195 line 8 – ‘But these authors assumed constant ARs for each model particle.’ It is not clear to me what is meant by this – I assume it means that AR is constant for all particle sizes? Please clarify this sentence in the article. Likewise, in the following sentence it would be clearer to say that AR varies with particle size, if this is what is meant. This wording is also used at various other points in the article (e.g. page 29197, line 24). It would be clearer to reword this description in all cases from ‘each model particle’ to become ‘each particle size’ or something similar.

Page 29195, paragraph starting line 1 – this paragraph is interesting, but is it strictly of relevance to the article?

Page 29204, lines 3 to 7 – so in the ocean case does the dust reach down to 1.15km? Please clarify this.

Page 29211, lines 27-29 – This sentence is not clear – do you mean uncertainty in solar irradiance measurements due to the surface albedo data?

Page 29217, line 16 – I believe ‘in the infrared’ is missing at the end of the line?

Page 29218, line 5 – change ‘validate’ to ‘extend’ or similar – other days of data will not validate this data but would put it into a wider context.

Figure 12 and 13 – These are busy figures showing a lot of useful detail. I am struggling to see all the lines clearly as the figures are – I suggest separating the left and right figures within both fig 12 and fig 13 into two separate figures each to create four overall larger, clearer plots.

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Interactive comment on Atmos. Chem. Phys. Discuss., 10, 29191, 2010.

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