

Interactive comment on “An observationally-constrained estimate of global dust aerosol optical depth” by David A. Ridley et al.

Anonymous Referee #4

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The study combines estimates of AOD from satellite and sun-photometer (AERONET) observations. The authors evaluate the statistical uncertainty of dust AOD calculated from model simulations against in-situ observations. The manuscript is well written and scientifically sound.

General comment:

Why do you scale the model AOD from regional to global (page 8 & 9, Eqn 3)? The general scaling approach does not consider the regional variability in soil properties (determining dust emission fluxes), meteorological drivers, size distributions (affecting AOD and life time), etc. What is the motivation for ignoring these factors despite knowing that they affect on dust concentrations and dust properties? Are the results after

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scaling still representative? Please consider including some words on how meaningful the scaling approach is.

Related to that, can global averages of dust AODs considered as an appropriate measure for model skills with regard to dust distribution? Regional errors may equal out and thus a global average may be misleading. As also pointed out in the result section, dust varies strongly with regions and depends on the model skills for the regions.

Furthermore, on the one side you are arguing with global averages of AOD (i.e. abstract and conclusion), on the other side you are suggesting that regional means are the more appropriate measure. It sounds somewhat inconsistent. Please clarify.

Specific comments:

p4 l11 remove parenthesis for reference Kok et al.

p4 l24 remove parenthesis for reference Albani et al.

p5 l7 remove parenthesis for reference Gong, 2003

p5 l14 remove parenthesis for reference Fast et al., 2006

p5 l14 remove parenthesis for reference Barnard et al., 2010

p7 l4 "man" should be "main"

p7 l19 should be MERRAero to be consistent

p9 l14 It appears a bit odd to me to have one of the co-authors cited as "personal communications". Maybe omit the "personal communication" part and only provide the "manuscript in preparation" part?

p9 l23 "Eqn. 3" to be consistent

p9 l27 "Eqn. 1" to be consistent

p11 l30 As the naming of the regions are erroneous on the figures (see below), please

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check if it's correct in the text.

p13 l1 Please consider shifting "(the Gulf of Oman)" to line 26 where the Kyzyl Kum region was mentioned first.

Fig. 1 something went wrong with assigning geographical names to the numbering of the areas. Area number 5 is definitely not the Atlas Mountain region. Maybe confound with the Adrar des Iforas Mountain region? Similarly, the Bodele Depression covers the Sudan, too. Please clarify.

Fig. 7, 9, 10 Base on the numbering issue appearing in Fig. 5, there may be a consequent mis-naming of the Atlas region. Please check.

Fig. 7, 9, 10 Taklamakan

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