

Interactive comment on “Modeling dust as component minerals in the Community Atmosphere Model: development of framework and impact on radiative forcing” by R. A. Scanza et al.

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Review on the paper entitled: “Modeling dust as component minerals in the Community Atmosphere Model: development of framework and impact on radiative forcing”, by R. A. Scanza et al., for publication in Atmos. Chem. Phys.

General comments:

The study is a first attempt at modeling global mineralogy of dust. It is focused on

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building the framework required to carry mineral tracers and on synching them with radiative codes. This paper presents important model developments and a complete discussion on what are the impacts on the simulation of radiative forcing. Simulations performed with CAM4 and CAM5 model versions are presented and discussed to point out the improvement and the limits of the model developments. The paper is well-written and I recommend its publication in Atmos. Chem. Phys. Before its publication, I only have minor comments which are reported below. The main comments are related to the simulated vs observed mineral dynamic range, the optical properties used in this study, and the optimizations presented for the different simulations.

(In case the authors have any comments or questions, they can contact me at benoit.laurent@lisa.u-pec.fr).

Specific comments:

p.17760: A table gathering optical properties or at least a discussion on the values used would be useful to complete table 3.

p.17762: The authors made a great effort to perform several simulations and to present them as clearly as possible. Nevertheless, CAM4-t and CAM5-t simulations result of several optimizations from the initial versions that make difficult the understanding of the impact of each optimization on the results. This could be explained more in detail.

In table 4, CAM4-m and CAM4-mH seem to correspond, for instance, to the same simulations (FSDBAM, Kok (2011), and table 3) if the prescription of Hematite is not indicated. Please add a column in the table or add a comment in the caption.

p.17766, 17767 and 17768: The authors point out that the models overestimate the dynamic range in mineral mass fraction close to source areas (Fig. 4), and do not capture the dynamic range far away from the dust sources, as it is for instance the case for K/I surface concentrations (Fig. 5) and deposition (Fig. 7 and 8). Kaolinite and Illite being clay minerals, they seem to be distributed in the same aerosol bins at

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the emission. If these two minerals are transported and deposited in the same way in the model, the simulated K/I ratio should thus stay constant from their emission in desert source areas and during their atmospheric transport and deposition. Does the K/I ratio, generally encountered in the main desert soil from which dust is emitted, show a dynamic range as large as the one observed in the dust surface concentration and dust deposition? If not, this may also partly explain the model difficulty to reproduce the K/I variability observed far away from emission areas. The point of view of the authors on this would be appreciated in their answer and/or added in the paper.

p.17771: A discussion on the imaginary and real parts mentioning the values used should be added.

p.17777 l.25-p.17778 l.1: The interpretation of the figures is a little bit tricky. Please rephrase to make it more understandable.

p.17778: Uncertainties in mineral optical properties are mentioned. The presentation of the values used could be interesting.

Technical corrections:

p.17753 l.2: Please add (CESM) after "Community Earth System Model"

p.17755 l.5: Saltation process is mentioned but not the sandblasting process.

P.17755 Eq.1: It is the normalized mass distribution which is presented. If M_{ij} refers to a mass fraction, a mass term is missing in this equation.

p.17756 l.3: The sum of the mass fractions is equal to 99.9% and not to 100%.

Table 1: The sum is not equal to 100% at least for the Zg, Zo and ST soil types. Please check.

p.17756 l.3 and p.17763 l.6: Please use the same writing for the mass fractions. The sum of the mass fractions is not equal to 100%.

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p.17763 l.12: Please write "Cwiertny et al. (2008)" instead of "(Cwiertny et al., 2008)".

p.17766 l.3: Please add "in aerosols" after "The spatial distribution of minerals".

Table 5: Replace "Isreal" with "Israel" in the Location column.

p.17769 l.18: Add a space between "533" and "nm".

p.17771 l.15: "imaginary and real parts" instead of "imaginary and real portions".

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 17749, 2014.

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