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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Predicting the mineral composition of dust aerosols – Part 2: Model evaluation and identification of key processes with observations" *by* J. P. Perlwitz et al.

Anonymous Referee #1

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This study addresses modeling and validation aspects of dust mineral composition. The subject of the research is crucially important for better understanding the multiple roles of dust in climate system. The authors conduct the analysis using global model with nudged wind fields and exploit the available observations and soil databases. They test two clear hypotheses about the mineral emission fractions. The main problem is that the observational base is relatively poor both for soil parameters database, which uses observations with insufficient spatial resolution, and for aerosol observation that are sporadic in time and space. However, we have to admit that this is the best available information at a time. It is important to start working in this direction. The global

approach has advantage, as it allows incorporating available observations all over the world. However, it is low resolution and is very poorly supported by observations in the Southern Hemisphere. Similar regional studies have to be encouraged in future. The minor comments are given below.

Comments:

I would suggest the authors once more report their emission scheme. It would be more convenient for a reader to have this information just in the text but not in the references.

P 3, 25-30: It sounds like the most important assumptions are semi-hypothetical. Could you elaborate on this and add explanations.

P 4, 1-10: Dust particles will be processed in the atmosphere both microphysically and chemically. You have to clearly discuss this and mention what model actually accounts for.

P 4, 20: I do not think it is good idea to nudge winds at all levels assuming, e.g., that the surface flow is strongly controlled by the topography and it is different in the GISS ModelE and NCEP reanalysis. I would nudge in the boundary layer. Is nudging coefficient altitude dependent? Please elaborate on this issue.

P 4, 25: Aerosol optical depth is the most important observed/retrieved characteristic. There should be some comparison included.

P 5, 3: Change “will be” to “are”

P 5, 5-10: MMT covers the entire world but how many observations they really had to build those mineralogical fields?

P 5, 10-15: Is there any physical bases why we can assume that iron oxides are equally abandoned in clay and silt fractions? Could you please clarify this issue.

P 5, 20-25: Is it observations from one place used to verify the distribution of minerals over the size bins? Please comment on this and clarify in the text.

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P 5, 25-26: Please clarify the sentence about “gravitational setting”.

P 6 10-15: It is not empirically based, it is just an assumption. Could you explain.

P 6, 18-21: Please clarify both about the constrain and about transformation of mineral fractions.

P 6, 22-25: Please justify this assumption.

P 7, 14-16: Does this emitted mass in your model produces reasonable dust optical depth? It would be useful to mention this in the text.

P 9, 6-25: XRD and SEM have a disadvantage to be more sensitive to the particle surface layer that could be affected by coating.

P 14, 21-25: Isn’t it directly follow from our assumptions for the SMF and AMF emissions?

P 15, 15-17: It would be useful to take more about how atmosphere could process dust particles.

P 18, 20-25: It would be useful to discuss what physical processes could affect this ration. E.g., it can not change within one size bin, I believe.

P 21, 13-20: What does control the emission of small particles? Is it availability of clay fraction in the soil layer or it is hydrodynamic entrainment that is less effective for small particles? Please explain.

P 23, 13-17: Aging of dust is an important process especially for iron oxides. Do you account for it?

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 3577, 2015.