

Interactive comment on “A new data set of soil mineralogy for dust-cycle modeling” by E. Journet et al.

Anonymous Referee #1

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This paper describes a new database of soil mineralogy using much more information than Claquin 1999 and Nickovic 2012. In addition, it shows results from a global model simulation of dust that incorporates this new mineralogy datasets to provide context of dust mineralogical compositions in the air and the dust aerosol optical properties based on this composition. Soil mineralogy is important for estimating dust aerosol radiative effect and climate forcing. I certainly appreciate the large effort the authors had made to put together such a dataset, which can also be applied to the future climate scenario in anticipation of the land-use change in the future. I recommend publication of this manuscript after my comments below are addressed.

1. Comparisons with other datasets: The comparison with Claquin 1999 was shown in section 4.1 and Figure 14. To me, by looking at Figure 14, that the mineralogical C10390

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composition from this work and the work by Claquin is significantly different for all 17 soil types, and yet, the authors think they are not that different (see section 4.1). I think the difference should be better, more quantitatively assessed and some explanations offered. There is no comparison with Nickovic 2012 at all in the text – why?

2. Difference between airborne and soil composition: It is quite informative that the authors take one step further to show the model simulation of airborne-dust mineral composition and compare that with the soil composition. But the explanation for the differences in composition between the airborne dust and soil was that the airborne dust was from the dust source area whereas the soil composition was for all soils. This is not convincing and not helpful. You should compare the soil composition in the dust source areas, since you know where they are as the model uses them, and then compare that with the airborne dust.

3. Evaluation of dust aerosol single scattering albedo: It is not clear how the dust optical properties were calculated (dust particle size distributions, particle shape, complex refractive indices for different sizes). The resulting single scattering albedo (Fig. 16) should be compared with available measurements, such as AERONET at dust-dominated sites and some aircraft measurements (e.g., SAMUM). Although SSA from AERONET is a retrieved quantity, not directly measured, but comparisons is needed to see the degree of agreement (or disagreement).

4. Some clarifications are needed. See below.

Specifics:

Page 23948, line 6: remove the comma (,) after (2006).

Page 23949, line 20-21: This sentence has been said previously (page 23946). Probably the previous sentence should be revised to avoid repetition.

Page 23949, line 24-25: This criterion is confusing – did you associate your information with the FAO soil unit, as you said in the previous section, or use the “alternative

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classification”? What is the alternative classification?

Page 23950, line 21: “fare” -> “far”

Page 23951, line 16: It is not clear how RR and RF are determined from the Munsell color. How did you determine the soil color patterns? Is there a database on Munsell soil color so you can apply the relationship between RR, RF, and the Munsell color to estimate the hematite and goethite content globally?

Page 23951, line 23: Are you saying you are using the FAO soil units (total 211), not the “alternative classification” as you mentioned before?

Page 23951, last paragraph: I am confused about these numbers of soil units: Total 211 soil units, 92 of which the composition is determined and 18 of which the composition is assumed, that gives a total of 110, not 120 (line 26 on page 23951), soil units with composition information. Then there should still be 111 soil units, not 90 (line 1 on page 23952) out of 211 total for which there is no information on composition. Please check the numbers.

Page 23952, line 8: “divided equally” – should it be “divided proportionally” to make more sense?

Page 23953, line 1: “with that soil unit in the HWSD database” – replace this phrase with “with the soil unit corresponding to the HWSD database”.

Page 23953, line 3: Fig. 3 is not a mineralogical map. It is the % of soils with mineralogy.

Page 23953, line 7: 92 soil units? What is that number from?

Page 23954, line 7 and line 14-15: These sentences are contradictory. Is the highest illite amount in the NH high and mid-latitudes (line 7) or in the east and south of the Sahara (line 14-15)?

Page 23954, Fig. 6 should be mentioned in this paragraph. It is currently not referred

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anywhere.

Page 23955, line 13: Is illite “iron-rich”? I thought illite is non-absorbing therefore it is iron-poor. But I could be wrong. Just want to clarify.

Page 23965 line4: Change “China” to “East Asia”, as Mongolia has large desert area as well.

Page 23965, line 6-9, dust transport: Dust from Africa can be transported to the South-east US via transatlantic route, and it can also be transported to western North America via transpacific route, as several observation and modeling papers indicated. Since you are not doing transport in this paper, this sentence can be deleted.

Page 23956, line 12: Sahara and Sahel definition: 0-20N is too wide for Sahel. Such defined region contains Sahara in the north and Savanna in the south, in addition to Sahel. If you have to use straight lines to define Sahel, 10N-16N is more correct. Definitely the Sahel northern border is not beyond 18N and the south border not much below 10N.

Page 23956, line 27: What is the definition of “free iron”?

Page 23958, line 1-3: As mentioned earlier, you should compare the composition in the soil at the dust source locations with that of airborne dust.

Page 23958, line 5, CASE 0, 1, and 2: What are the fundamental differences among the cases? Which case map you would recommend to use for global modeling?

Page 23958, line 23: now there is another number, 124, for soil units. What is this number? How many soil units you actually provide the information for? Should keep the number straight and consistent.

Page 23959, line 4: “We have chosen not to normalize the distribution of individual minerals to 100%...”. But in Fig. 14 you showed the total 100% of mineral contents in each soil types (Fig. 14b)! On the contrary, the compositions do not add up to 100% in

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Claquin's work (Fig. 14a).

Page 23959, line 7: feldspars is not shown in Fig. 14 at all.

Page 23959, line 11: Confusing - you just said that quartz is the major components of the silt-sized fraction. But now it is only a small fraction of the mass? Does it mean that silt is only a small fraction of the dust mass?

Page 23959, line 12: What is the standard of being "similar"? I see that the calcite content is about 20% in "this work" for soil type 13 but only about 5% in Claquin's work. Are they similar?

Page 23959, line 7-15: This comparison with Claquin is confusing. It seems to me that the composition are significantly different between this work and Claquin's in every soil types shown in Figure 14. The difference should be better presented and explained. What about Nickovic's dataset?

Page 23960, line 16: What is "R ratio"?

Page 23960, line 17: define "omega 0".

Fig. 4: Add country lines on 4b to be consistent with 4a.

Fig. 14: what are the 17 soil types?

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