Atmos. Chem. Phys. Discuss., 13, C11881–C11887, 2014
www.atmos-chem-phys-discuss.net/13/C11881/2014/

Atmospheric Chemistry and Physics Discussions

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

E. Journet et al.

emilie.journet@lisa.u-pec.fr

Received and published: 4 February 2014

The authors would like to thank the reviewer whose constructive comments have allowed us to improve the quality of the manuscrit. Below you will find our response to the questions of the anonymous referee 2.

Response to the major comments:

Major comment 1 : "I find "New" in the title as not very practical, the database will remain new may be for some time."

We prefer to keep the term "New" in the title to indicate that the database contrary to previous ones does not restrict itself to current dust source region. The main motivation

for this work is to be able to infer the mineralogy for dust over periods that span hundred of thousand years and study the glacial/interglacial. We have added one sentence in the abstract of the paper to indicate why we deem the word “new” apply to this database that required a lot more work than mapping only the dust region for present climate.

Major comment 2 :“When database is mentioned, are its elements: gridded data, descriptive information or a combination of two? If gridded, what is the resolution in the database not of displayed maps) of the information addressed in p. 23950? Is for example the soil color classification also gridded information”

The database is a compilation of descriptive data available in the literature. The data relates to a respective soil samples. These data are: the type of soil, the location of the sample, the soil texture, the mineralogical information and the soil color. The HWSD (harmonized world soil database) which underlies this work has a resolution of 1km and is global.

Major comment 3 :“Furthermore, it would be clearer for a reader if a table texture vs. clay/silt/sand fraction is shown.”

Soil texture refers to the relative proportion of the different soil textural classes: sand, silt and clay. Soil textural class refers to particles ranging between specified size limits.

Major comment 4 :“In general, the whole paragraph 1-18 could be more clearly written so that the procedure applied in this study could be reproducible”

This comment is very well taken; we propose a more clearly written paragraph: “Only data that met all three criteria were retained. The database compiles quantitative information on the mineralogical composition of the clay and/or the silt fractions of soil samples, and associated metadata including the source of the mineralogical information. The geographic coordinates of the soil samples are given; either obtained directly from the source publication or inferred from the description of the general location of the soil sample. The soil sample texture (relative proportion of clay, silt and sand fractions)

ACPD
13, C11881–C11887, 2014

was also compiled; when this information was lacking, we used the mean texture of the FAO soil units given in the HWSD. The standard method of determining soil texture involves wet sieving, and thus results in the loss of soluble minerals such as calcite or gypsum. When size-resolved estimates were not available, we therefore included the total calcite and gypsum content of the bulk soil (< 2 mm) sample. Iron oxides and hydroxides (hematite and goethite respectively) occur in very small quantities in most soil and their abundance is rarely quantified. We used the fact that the presence of iron oxides in the soil results in a distinctive red or yellow coloration (Torrent et al., 1983), together with a compiled soil sample color (according the Munsell Soil Color Chart designation: Munsell Color Company, 1995). The hematite and goethite content can then be then inferred from the soil color according the relationship established by Torrent et al. (1983) and by Fontes and Carvalho(2005)."

Major comment 5 :"p. 23949, lines 24-25: By describing criteria applied to generate the database, the authors formulate quite unclear description: 3. the information could be associated with a specific FAO soil unit, even if the authors used an alternative classification in the original study. It needs explanation in more details"

We propose a simpler sentence to make this part of the text easier to grasp: "3. The information is compiled for soil samples which can be identified according to the FAO soil classification"

Major comment 6 :"p. 23950, line 2: How mean and standard deviations of data on the mineralogical composition are specified? Any reference and/or description of the procedure?"

No standard deviation and average are computed for the establishment of the database. We removed this erroneous sentence.

Major comment 7 :"p. 23952, line 8: the total amount of gypsum is divided equally between the silt and the sand fractions Why sand is included here since previously only silt and clay were considered. Is the proposed division done subjectively or based

ACPD
13, C11881–C11887, 2014

on a published reference?"

Most of gypsum is found in the coarser fraction. We chose to attribute half of the total gypsum in the silt fraction (considering that the other half is in the sand fraction), and no gypsum in the clay fraction. This division is not based upon a published reference.

Major comment 8 :"p. 23953, line 2: The HWSD grid is then aggregated onto a regular grid with a resolution of 0.5*0.5. From the point of view of potential users, it is not understandable why the authors degrade the resolution of their new database when the input data to their procedure provides much finer information. If there is no the technical obstacle, I strongly recommend authors to provide a high resolution database. The important reason for that is that many current dust models have resolutions finer than 0.5 deg, and in few years some models will achieve resolutions higher than 10km. would the database be public so that it could be available to wider dust modelling research community?"

The resolution of 0.5°*0.5° corresponds to what is the state of the art for the present IPCC work (Intergovernmental Panel on Climate Change). Hence it is appropriate for global models. We understand the reviewer recommendation and we are working on a method to produce the database at any resolution that can be used up to very resolved models 0.1°x0.1° globally for instance. We will make this data available for the groups that request it.

Major comment 9 :"p. 23953, paragraph on the top: To my opinion, only CASE 2 is relevant for the database implementation. Therefore, I would propose that the authors show modeling examples only using CASE 2."

The relevance of CASE 1 versus CASE 2 really depends on the goal of the investigator. We made the choice to illustrate our findings with CASE 1 but all cases have been studied, documented and we produced figures for each of them. Hence they will be made available upon request. We are also envisaging to have a web site to display all results.

ACPD
13, C11881–C11887, 2014

Major comment 10 :“p. 23953, line 27: 2.7 Validation of the mineralogical maps This subsection should be removed, there is anyway no any database validation presented here, nor later what the authors should mention.”

This section has been removed.

Major comment 11 :“p. 23957, line 21: The mineralogical composition of airborne dust is broadly similar to that of the clay fraction of the soil. Is this because clay particles have longer lifetime?”

This is right. Near source regions, the mineralogical composition will reflect the mixture of clay and silt with a high content in quartz, whereas away from source, the silt fraction diminishes rapidly and the composition is much more similar to the one of the clay fraction.

Major comment 12 :"Figure 4-8 show fractions of several but not all considered minerals (e.g. feldspars, kaolinite). I suggest that the percentages of not shown minerals are also displayed."

We made the choice to show just one example for the clay fraction, one for the silt fraction and one example for a mineral found in the both fractions to have a good information maps/minerals without flooding the reader with all the maps of the different minerals. All maps are available upon request as we indicated above. In addition, Fig. 11 illustrates the global average content for each mineral in the clay fraction of soils.

Major comment 13 : "Because of large interest for iron content, I also suggest that a map with estimated total iron in soil is shown."

The components of the total iron in soil are shown respectively in Figure 8a which shows total iron content in the clay fraction, and in Figure 8d that shows goethite content in the silt fraction of soil which is the only iron-containing mineral in this textural class. We can’t show total iron in the bulk soil since we don’t have the mineralogy of the sand fraction of the soils.

ACPD
13, C11881–C11887, 2014

Major comment 14 :"The Images for mineral fractions in soils are too small.

We expanded the images contained in Figures 4 through 8."

Response to others comments:

Comment 1: “p. 23946, line 25: specify if is 2 μm radius or diameter. “

This limit corresponds to a diameter, it is the classical limit used in soil science according to AFNOR standards.

Comment 2: “p. 23947, lines 14-15: Quartz and Feldspars are present in all size fractions of soils. They are present in only minor amounts in the clay fraction, but are abundant in the silt fraction. Indicate a reference, if existing”

The following references have been now included in the paper: Rahn, K. A.: Silicon and aluminum in atmospheric aerosols: crust-air fractionation?, Atmos. Environ., 10, 597-601, 1976. Chatenet, B., B. Marticorena, L. Gomes, and G. Bergametti, Assessing the microped size distributions of desert soils erodible by wind, Sedimentology, 43, 901, 1996.

Comment 3:“p. 23948, line 19: Replace average iron content with estimated iron content”

The change was made

Comment 4:“p. 23950, lines 6-7: The soil texture (abundance of clay, silt and sand size fractions) was taken from the original publication. . . I suppose abundance refers to fractions. Reformulate then. It is not clear from which original publication is taken. Please clarify.”

We reformulated this sentence as follows: “We also compiled the soil sample texture (relative proportion of clay, silt and sand fractions)”

Comment 5:“p. 23951, line 8: Analysis of the available data shows that the amount of

ACPD
13, C11881–C11887, 2014

CaCO3 in the clay and silt fractions is linearly related to the clay/silt content of the soil (Fig. 2). Show reference if available."

We now indicate the reference in the text: Claquin, T., Schulz, M., and Balkanski, Y. J.: Modeling the mineralogy of atmospheric dust sources., J. Geophys. Res., 104, 22243-22256, 1999.

Comment 6:"p. 23952, line 24: hematite, goethite and iron Please be more specific when mention iron (iron oxide or else?)"

We have replaced iron by "elemental total iron"

Comment 7:"p. 23956, line 13: Please show regions within the map in Fig 9"

We added rectangles delimiting the regions on Figure 1.

Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/13/C11881/2014/acpd-13-C11881-2014-supplement.pdf

---

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 23943, 2013.