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Climate of the Past Discussions

Interactive comment on "Modeling dust emission response to MIS 3 millennial climate variations from the perspective of East European loess deposits" *by* A. Sima et al.

A. Sima et al.

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Dear Referee,

Thank you very much for your comments and helpful suggestions. Our detailed answers are below, and a revised version of the text and figure captions is included as a supplement.

1. Page 147, lines 10-13. I would encourage a more detailed description of the identified dust sources. In addition, those areas are also indicated as deposition areas – is there any relevant information that could be provided in the respect e.g. grain size?

The introduction (partly rewritten to better distinguish the results from Sima et al. (2009) and the actual manuscript) starts now with this paragraph:

"In Europe, a west-east eolian corridor was formed in glacial times between the British and Fennoscandian ice sheet to the north and the relatively high mid-latitude European relief (including the Alpine glacier) to the south (Fig. 1). Vast areas along this corridor are generally flat (below 200m altitude), with the geological substratum mostly represented by relatively easily erodible Tertiary or Cretaceous rocks (Asch et al., 2005), and have periodically been subject to strong dust deflation under glacial climate conditions. Deflatable material with a large range of grain sizes was made available by a variety of mechanisms acting at local or regional scales, at timescales from seasonal to millennial and orbital: the exposure of the continental shelf due to sea-level lowering, grinding of rocks by ice sheets and glaciers, frost weathering, fluvial erosion by periglacial rivers, eolian erosion by strong glacial winds, accentuated by a reduced vegetation cover in a much colder and dryer climate than today. Particularly rich in easily deflatable sand and silts were the exposed continental shelves and the periglacial outwash plains, as well as the periglacial river valleys, mostly dried-out outside the snowmelt period. Part of the material deflated in these source areas has accumulated in the south of the eolian corridor, forming a loess belt at about 50°N latitude. Some of the deposition areas, located in a relief context allowing dust remobilization, could have been "secondary dust sources".

More detailed information about source-characteristic grain-size distributions is not easy to find or deduce from the available deposition data. In the search for detailed climate records, recent studies have focused on loess sequences from exceptionally thick deposits (as Nussloch, in Germany, or Dolni Vestonice, in the Czech Republic), formed in a relief context particularly favorable to accumulation, and allowing very little dust remobilization. For "secondary sources" (deposit areas where part of the dust can be remobilized), our simulations suggest that one should look at loess deposits in open areas as those from northern France, Belgium, southern Poland or northwestern Ukraine. Such deposits are quite thick, and we suppose they were even thicker if the generally low relief didn't allow remobilization. Loess sequences from these areas have been intensely studied, but many of the studies are not easily accessible (on paper only, in national publications, in the respective languages). Identifying the sequences which could be representative for remobilization areas, summarizing the grain-size information and putting it in an accessible form for the large scientific community would be a very useful, but also difficult task (far beyond the purpose of this paper).

2. Page 151, line 15. The clay fraction is often referred to based on a different size boundary. Please explain this.

The particle size distributions have been determined using a Beckman-Coulter LS 230 laser particle sizer (LPS). Owing to the flat shape of the clay particles, the percentage of the 2 μm (clay) grain-size fraction determined by this method is generally lower than that obtained by the classical method (sieving and sedimentation). The LPS boundary for clay particles (and for the other grain-size classes) has thus to be adjusted for each loess profile, using a sequence of test samples (for details, see for example Antoine et al., 2009, Quat. Sci. Rev.). The calibrated clay upper limits, site-dependent, that have been found for this method are 4.6μm at Stayky (Ukraine) and Nussloch (Germany), 6 μm at Dolni Vestonice (Czech Republic).

Your remark points us to the fact that the exact upper limit of the clay fraction is not relevant in the respective context: what we mean is “fine particles” in general. Thus, instead of introducing the explanation above, we preferred to replace “4.6 microns” by “a few microns”.

Please also note the supplement to this comment:
http://www.clim-past-discuss.net/9/C411/2013/cpd-9-C411-2013-supplement.pdf

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