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Interactive comment on "Major dust events in Europe during marine isotope stage 5 (130–74 ka): a climatic interpretation of the "markers"" *by* D.-D. Rousseau et al.

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Dear Joe, First of all thanks for the review and the comments. We will use the discussion phase to reply some of your comments. This paper has a long history, which made its submission postponed, contrary to what was originally planed. However the results and interpretation have been presented as posters and orals long before the submission this year in CP. I also decided to remain with the original labeling from the pioneer work to refer to the investigations performed on the same locality, Dolni Vestonice (DV), by Czech colleagues in the sixties. In fact this paper is also testing the original hypothesis proposed to interpret the deposition of the so-called "Markers".

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To follow your suggestion, the used labeling of the units will be clarified in the revised version. About point 1, we deliberately used the clay fraction from the grain size because it corresponds to the maximum size of mineral aerosols that could be taken into account for a modeling purpose. On figure 5, one can notice that there are differences in the clay content with lower values in the Eolian silts (ES) than in the Marker silts (MS). There are also differences in the low field magnetic susceptibility values. You point out that the highest carbonate content in ES compare to MS could be inherited from the chernozem overlying them. Based on this single parameter, this could be a possible explanation. However, when considering the spectrocolorimetric parameters L* and FDS, one can see that this is not the case. This is the reason why, compare to the paper published in QSR (Antoine et al 2013), I included these parameters in the present study to differentiate the two types of unit. As mentioned in the paper, Debret et al (2011) provide a very useful review of this powerful method. To sum up, L* is a fundamental parameter describing the brightness (total reflectance) of the sediment studied indicating the carbonate content. FDS on the contrary distinguishes the nature/composition of the sediment and in the band used, the amount of goethite. One can then notice differences between MS and ES.

In point 2, you are requiring to providing more discussion about the eolian deposition of the MS and ES. We acknowledge that presently we do not have modeling experiment about these particular events. However George Kukla described MS as continent-wide dust storms, referring to observed modern dust storms in Europe, while nothing was proposed for the other ES eolian deposits. Considering the sedimentological parameters used and presented in figure 5 we assume demonstrating the difference between both deposits. Furthermore the IRSL dates, obtained from the DV sequence, support within the error bars the correlation with events identified in the Greenland ice cores and in North Atlantic cores. At that point, the sedimentological parameters indicating a difference between MS and ES, the correlation with the NALPS record provides a way to discriminate between MS and ES. As Boch et al (2011) indicate, the Alps are climate sensitive. These authors present a composite record from speleothem sampled in four

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different caves located in the northern rim of the Alps, an area which is presently under north-westerlies supplying moisture from the Atlantic. Interestingly, as these records are particularly well dated, they show that the speleothems continue to grow during some cold intervals, characterizing the availability of enough moisture supply, i.e. precipitation, for the speleothem to grow, while showing a hiatus during other cold intervals. The latter, based on the U/Th dates measured, correspond to North Atlantic cold events C19, C20, C22 and part of C24. Fig. 7 shows the correlation between the DV sequence units, the Greenland records, and the NALPS speleothem composite record. ES are correlated with NALPS intervals during which deposition the speleothems continue to grow thanks to the moisture supply yielded through the northwesterly winds. On the contrary, MS are correlated with the "no records" in NALPS composite, corresponding highly probably to the lack of moisture supply, due to a strong reduction of the westerly circulation.

In point 3, once more the grain size is indeed providing useful information but the careful cleaning of the section allows to observing precisely the contacts between the different units. The sharp contact at the base of the MS has been evidenced in all the sections where markers have been described, and not only at Dolni Vestonice. It indicates the abrupt switch between two different ecosystems represented by the grassy chernozem and the arid eolian MS. Focusing on the two types of fine-grained units during marine isotope stage 5, we did not want to compare them with the upper part of the sequence which relates to a totally different context corresponding to glacial conditions and described in Antoine et al (2013). Concerning the fined grained material preserved in European loess sequences, modeling studies, see Sima et al. 2009 and 2013 in press in CP, indeed suggest that the fine material has a more regional origin, up to about 1000 km, in agreement with your proposal. This is supported by unpublished Rare Earth and major isotope studies of samples from a longitudinal transect from Brittany towards Ukraine (paper in preparation). Finally the higher FDS values in ES than in MS also supports increased moisture supply in the former than in the latter.

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In point 4, as mentioned in the previous comment, the source of the fine material is not local, but our modeling studies show that the dust emission requires particular conditions at the source, including the availability of erodible material due to reduce or lack of vegetation, wind speed at the ground level above a 7m/s threshold, lack of snow cover. The similar d13C values indicate some dry conditions at the source but not as strong as in full glacial conditions.

In point 5, we placed the date values with the error bars on the Greenland ice cores curves to support our correlation of the identified units with the Greenland and North Atlantic records. Of course the dating method prevent very precise dating contrary to the U/Th dates that speleothems release. Knowing that, we restricted the dating interpretation of these particular events to the peaks in the Greenland cores, and therefore we propose in fact a maximum durations for these units, which could have been even shorter.

Interactive comment on Clim. Past Discuss., 9, 2235, 2013.