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Climate of the Past Discussions

Interactive comment on "The reconstruction of paleo wind directions for the Eifel region (Central Europe) during the period 40.3–12.9 ka BP" *by* S. Dietrich and K. Seelos

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The aim of this paper is to evidence variations in the wind dynamics between about 40 and 13 ka BP using high resolution grain size data from the continuous laminated core of the Dehner dry Maar lake in the Eifel. Within this record, the occurrence of dust storms from the NE are inferred from variations in the amount of high carbonate detrital clastic component (20-63 μm) that are thought to be produced by the reworking and transport of carbonate silts from a calcareous massif located to the NE of the core (Devonian Kalkmulde). After a detailed introduction focusing mainly on palaeowind reconstructions from data and computer models for Western and Central Europe, it

is composed by the following parts: I - Methodology (Lithology and stratigraphy and description of the Radius wind direction module) II - Presentation of the results and discussion III - Summary of the main conclusions. This manuscript appears as and original contribution even if a paper by Seelos et al., focusing on the reconstruction of wind systems and dust storms events based on the ELSA stack over the 133 ka, is presently in press in GRL. Even if the paper is properly organised and presented, some major questions arise from this manuscript and the interpretations need to be revised and completed before publication.

CP evaluation question list:

Does the paper address relevant scientific questions within the scope of CP? : (YES) Does the paper present novel concepts, ideas, tools, or data? : (YES) Are substantial conclusions reached? (YES-NO: see report) Are the scientific methods and assumptions valid and clearly outlined? : (YES-NO: see report) Are the results sufficient to support the interpretations and conclusions? : (? see report) Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results): (YES) Do the authors give proper credit to related work and clearly indicate their own new/original contribution? (YES-NO: see report) Does the title clearly reflect the contents of the paper? (YES) Does the abstract provide a concise and complete summary? (YES) Is the overall presentation well structured and clear? (YES) Is the language fluent and precise? (YES) Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? (YES) Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? (NO) Are the number and quality of references appropriate? (NO: see report) Is the amount and quality of supplementary material appropriate? (NO supplementary material provided)

Main questions: Point 1 - Origin of the carbonate silts? The authors assume that detrital carbonate grains (silts) from the 20-63 μm fraction can be used as a proxy for Northeast winds directions because a carbonate massif (Devonian " Kalkmulde")

is located at the Northeast of the coring site. This is, in my opinion, an oversimplified vision of the reality. Indeed, no data concerning the lithology of these carbonates grains are provided in the paper to demonstrate the link between the carbonates of the dust and those from the Devonian bedrock (petrography, geochemistry and (or) micropalaeontological arguments are needed). In addition, there is no discussion of the production processes of silt sized carbonate dust from calcareous bedrock (P. 2163 / L 28-29). Indeed some experimental studies have demonstrated that calcareous rocks, as chalk for example, submitted to freeze-thaw alternations produce mainly carbonate granules (a few millimetres in diameter) rather than silt sized calcareous dust (Lautridou, 1987). The production of silt-sized carbonate grains by aeolian abrasion of the outcropping limestone relief has to be supported by a real discussion and more complete data. Finally, according to some works concerning dust transport in China and Asia (Vandenberghe, 2009), and especially from the analysis of the various grain size classes that are transported by modern dust storms, we know that fine to coarse silt particles (20-63) can be transported in suspension during dust storms events over distances of about a few hundred km. As the Dehner dry Maar is located at less than 70 km from the Meuse river valley and at about 250 km from the North Sea coast it is not possible to exclude that these areas could have represent sources for carbonate. In that case, the main wind responsible for deflation and dust transport would have been from NW (especially during storms). Indeed as it has been demonstrated, dried river beds (periglacial braided systems) represent major dust sources for loess (see Smaley et al., 2009), the fine carbonate grains could also come from fluvial systems located to the west of the Maar . . . In addition, an other Devonian massif containing limestones and carbonated schist (Ardennes) is located at $\pm$100 km to the west of the Maar, and could have been a source for carbonate silts. Finally, if we look to the Belgium or North France loess sequences the LGM loess are characterised by a typical calcareous facies (up to 15-20%) the origin of which can't be find at the NE according to the location of the source areas but at the NW (Eastern Channel / North Sea basin).

Secondary questions: (P. 2158 / L. 16) "the first time period during MIS 3 (40,3-36 ka

BP) is controlled by relatively warm climate": this is a very unusual conclusion!, as this part of the record is characterised in ice records by the occurrence of very well marked stadial events such as the one located before GIS8 (between ca. 38 and 40 ka). P. 2158 / L. 24): please cite Hatté et al., 1998 at that place. (P. 2161 / L. 16): what is the distance of the nearest carbonate source to the west? (P. 2161 / L. 24-25): what is the process at the origin of the reworking of the fine particles from the Triassic sandstone (Buntsandstein)? (P. 2161 / L. 24-25) (P. 2160 / L. 20): the conclusion concerning "an increase in eastern winds during the H events" is not really clear from this paper (see comments about Fig. 3).

Point 2 - comparison with loess records As they are dealing with dust and aeolian processes, the author should also use the information that have been produced from the loess records located in the area and especially those from the Rhine loess area located at the east of the Dehner dry Maar (ex. Nussloch, Mainz-Weisenau, Tönchesberg . . .). Indeed, both the records are located in the same climatic context and are influenced by the same sedimentary sources. Indeed the loess record from Nussloch shows also a strong enhancement in dust accumulation after GIS 8 at about 35-32 ka (c.f. Antoine et al., 2009). In addition H4 event is well recorded in loess sequences even if the thickness of the corresponding loess unit is markedly thinner than that deposited after 35 ka. The author should explain why the main change recorded in loess records after GIS 2 (strong decease in the grain size index and of the median, change in the facies between Hesbayen and Barbantian loess units) in western European loess sequences (and in GRIP dust) is apparently not recorded in the Maar lake record.

Point 3 - Age model and dating Why do the author use uncalibrated radiocarbon ages whereas the age model is based on the correlation with the GRIP or N GRIP records? In addition the author should take care to the choice of the Greenland chronology that can induce important differences in the ages of the main events. For example, GIS2, which is clearly older than 21 ka in North GRIP (using the GICC 05 from North Grip, Andersen et al., 2007 CP) ($\pm$ 23.5 ka BP).

Point 4 - Correlation between H events and Easterly winds According to Fig. 3, H1 is characterised by high East wind values whereas H2 and H4 exhibit markedly lower values. How could you explain these strong discrepancies in the response?

Illustrations: The main problem is the over reduction of the figs that are highly difficult to read in their present shape. As there is no special limitation in size in CP online publication the whole figs should be enlarged. Figure 1: This fig. should be replaced by a "real geological map" showing the main geological formations and the accurate outcropping area of the carbonate (Kalkmulde). It must be also enlarged to a larger area including the loess cover and other possible carbonate sources.

Fig. 2 = Enlarge / presently not informative

Fig. 3: (idem: enlarge) + Contrary to what is announced in the caption "common process between . . .", the proposed correlation between the East-wind record from the Maar and the N Grip dust index is not so clear. Indeed, H1 is characterised by high East wind values whereas H2 and H2 exhibit markedly lower values . . .

Fig. 4: Compared to the loess record that exhibits $\pm$ 15-20 % of carbonates during the same period (22-24 ka), the percentage of carbonate in the extremely low in the DML sequence: how can you explain this strong discrepancy?

References: add the ref. that are necessary to the discussion of the relations with data from the loess record.

Conclusion In conclusion, I think that this paper can be published after a moderate revision taking in account the preceding observations and suggestions, especially concerning the demonstration of the origin of the fine carbonate fraction in the Dehner dry Maar.

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Ref.: Antoine, P., Rousseau, D.D., Moine, O., Kunesch, S., Hatté, C., Lang, A., & Zöller, L. (2009) - Evidence of rapid and cyclic eolian deposition during the Last Glacial in European loess series (Loess Events): The high-resolution records from Nussloch (Germany). Quaternary Science Reviews 28, 2955–2973. Vandenberghe, J. (2009) - Grain size of loessic sediment: a powerful proxy for process identification. Loess Fest 2009, Novi Sad, abstracts. Hatté, C., Fontugne, M., Rousseau, D.D., Antoine, P., Zöller, L. Tisnéra-Laborde, N., and Bentaleb, I., (1998). δ13C Variations of loess organic matter as a record of the vegetation response to climatic changes during the Weichselian. Geology 26 (7), 583-586. Smalley,I., O'Hara-Dhand, K., Wint, J., Machalett,B., Jary, Z., Jefferson, I. (2009) - Rivers and loess: The significance of long river transportation in the complex event-sequence approach to loess deposit formation. Quaternary International, 198, 7-18

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