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Imprint of North-Atlantic abrupt climate changes on European loess sediments during the last glaciation – a modeling study

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The European loess sequences of the last glacial period (approx. 100-15 kyr BP) show periods of strong dust accumulation alternating with episodes of reduced (or no) sedimentation, allowing soil development. For the main loess sedimentation period, between approx. 40 and 15 kyr BP, data indicate a close correlation between these variations and the rapid climate changes in the North Atlantic: the Dansgaard-Oeschger (DO) and Heinrich (H) events. We use numerical modeling to investigate the relationship between the North-Atlantic abrupt changes and the sedimentation variations in Europe. The main question is : by which mechanism(s) the DO and H events could have produced changes in the dust cycle intensity as important as indicated by the loess data. As a first step in answering this question, we have estimated the changes induced by the DO and H events in dust emission in Western Europe, and analyzed the role of the different relevant climate factors (wind, precipitation, surface conditions), as well as the dust emission seasonality. We have used simulations with the atmospheric general circulation model (AGCM) LMDZ, and the SECHIBA land-surface model embedded in the AGCM. It appeares that vegetation has been a key factor responsible for stadial-interstadial variations in dust emission in Western Europe. To continue this work, we will perform full dust-cycle simulations, employing the LMDZ AGCM, coupled with the ORCHIDEE model for the land surface conditions, and with the INCA module for aerosol transport. This will allow us to analyze in detail the changes of dust cycle intensity induced in Europe by the North-Atlantic millennial variations, and make possible a comparison to the loess sedimentation data.