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The phasing of atmospheric and environmental response to Dansgaard-Oeschger events from highly resolved multi-component Greenland aerosol records

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During the last glacial period a series of millennial scale rapid warming events with subsequent cooling is well documented in the proxy record throughout the Northern Hemisphere (NH). It is widely assumed that these so called Dansgaard-Oeschger (DO) events are linked to an increase in the Atlantic Meridional Overturning Circulation (AMOC), which leads to warming of the Northern Hemisphere and a cooling of the Southern Hemisphere. Furthermore changes in the atmospheric circulation such as shifts in the Inter Tropical Convergence Zone (ITCZ) and the westerlies. However, the trigger, detailed mechanisms and progress of these events are still not completely understood.

Here we present annually to multi-annually resolved multi-component aerosol records from both the NGRIP and NEEM ice cores from Greenland spanning the last glacial period and the early Holocene. Using a probabilistic approach, we investigate the relative timing of the warming onsets and terminations of the different aerosol species and the respective lengths of the transitions and warm events in the different aerosols, where different aerosol species reflect different circulation patterns and geographical distinct source regions. Within uncertainties, we do not find any systematic differences in either the timing or the lengths of the warming transitions between the investigated aerosol species. Because ice core aerosol records are a result of emission, transport and deposition processes, their variability can be interpreted in terms of changing atmospheric circulation influencing the transport, changing precipitation rate influencing deposition of aerosol en route as well as changes in source processes. We try to separate these effects and discuss these results with regard to possible changes in the position of the ITZC and moisture availability over the North Atlantic.