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Imprint of rapid global climate transitions on Northern Europe 15.000-10.000 BP

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The climate transition from the LGM (∼21-17kyr BP) into the Holocene is characterized by rapid climate shifts from the LGM to the warm period Bølling-Allerød (14.7-12.7kyr BP) and the cold period of the Younger Dryas (∼12kyr BP). These abrupt changes are triggered by non-linear internal feedbacks within the climate system (e.g. ice-ocean-atmosphere interactions). While these rapid shifts are detected globally, regional imprints as reconstructed from multi-proxies differ substantially in their timing or magnitude. Recent results from well dated isotopes in alkenones - which were trapped in annual varves - even suggest a temporal de-coupling between changes in temperature and hydrological variables over central Europe. This could indicate and confirm earlier suggested changes in the position of Atlantic sea-ice extent, changes in atmospheric circulation and wind direction over Europe following the rapid shifts.

To better understand the spatiotemporal regional response on global rapid climate shifts, global simulations at ∼100 km horizontal resolution (T85) are performed with an interactively coupled atmosphere-land component set of the Community Earth System Model CESM1 using prescribed SST/ice from a previous transient simulation. As the climate transition is accompanied by rapid sea-level rise and glacial isostatic rebound of previously ice covered land areas, realistic boundary conditions such as ice sheets and land-sea-fraction (sea-level rise) need to be set for the simulation. This is e.g. important for the broad low-laying transgression areas in the North Sea region and the appearance of the initial phases of the Baltic Sea.

Our first step is hence to evaluate the sensitivity of the simulation to two different topographies and ice-sheets over Northern Europe and North America. The PMIP3 standard topography and ice sheets by Peltier (2004) (ICE5-G) are replaced regionally by the GLAC chronology (Tarasov et al, 2012, and in prep) derived from data-calibrated glaciological modelling.