EGU21-8724
https://doi.org/10.5194/egusphere-egu21-8724
EGU General Assembly 2021

Meltwater driven abrupt climate changes in the North Atlantic simulated in a Heinrich Stadial 1 background

Yvan Romé, Ruza Ivanovic, and Lauren Gregoire
University of Leeds, School of Earth and Environment, ICAS, Leeds, United Kingdom of Great Britain – England, Scotland, Wales (eeymr@leeds.ac.uk)

Heinrich stadial 1 is one of the most enigmatic episodes in the study of the last deglaciation. Following the Lamospheric forcing increased driving the vast ice sheets over North America and Europe to melt. Yet, the climate in the North Atlantic remained cold for another 6000 years before eventually switching to a warm interstadial state in an event referred to as the Bolling warming. If there is now a consensus on the central role of the Atlantic Meridional Overturning Circulation (AMOC), the mechanisms at stake are still highly debated, which is a real challenge when it comes to reproducing such behaviour in climate models.

We studied this period looking spest Glacial Maximum (LGM, ~21 thousand years ago), orbital and atcifically at the feedback between the climate and the freshwater released from melting ice. From a transient record of meltwater discharge across the last deglaciation derived from the GLAC1D ice sheet reconstruction, we produced General Circulation Model (GCM) simulations of the LGM climate with different freshwater forcing. More precisely, we examined three notable melting events that happened during the early deglaciation: a local minimum of discharge at the LGM, a peak in meltwater discharging the North Atlantic signal and a peak in meltwater discharging in the Arctic signal. The three experiments generated very different patterns in AMOC and in North Atlantic climate, including alternatively warm, cold and oscillating regimes depending on the forcing.

These results provide a good framework to analyse further the relationship between abrupt climate changes and meltwater discharge and to highlight the key parameters to trigger climate transitions in state-of-art climate models in the context of the last deglaciation. It is also a great opportunity to describe some mechanisms at stake with salt oscillations in the Atlantic, sea-ice cover and deep-water formation sites feedback and shifts in the subpolar gyre during interstadial-stadial transitions.