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Understanding the heterogeneous global climate imprint of Dansgaard-Oeschger Events and Heinrich Events - mapping out the anomalies

Content

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The climate of the last glacial period was dominated by abrupt Dansgaard-Oeschger Events where climate changed between mild and cold phases, probably related to changes in the Atlantic Ocean circulation. During some cold phases, ice sheets formed massive armadas of icebergs which further influenced both the ocean and atmosphere. In some areas, the climate response of Heinrich and Dansgaard-Oeschger Events are more and less extreme versions of the same pattern, but as we move further away from the North Atlantic and downwind areas, the response becomes more heterogeneous.

In a series of three contributions (by Rasmussen, Halkjær, and Melcher, respectively), we explore the heterogeneous global climate imprint of Dansgaard-Oeschger Events and Heinrich Events using a combination of palaeoclimate data and model data from a version of the CCSM4 model which exhibits self-sustained (i.e. unforced) Dansgaard-Oeschger Events, on top of which we forced Heinrich-type freshwater events. The dynamics of Dansgaard-Oeschger Events has previously been analyzed using a 3x3-degree version of the model in Vettoretti et al [2022], where it was shown that the atmospheric CO₂ content controls whether the model operates in an oscillatory regime as well as how CO₂ controls the duration of the mild interstadial periods. Here, we use a 1x1-degree model run similar to that of Vettoretti and Peltier [2018] but apply freshwater forcing to selected stadial periods to emulate the effect of Heinrich Events. We compare the model data to the speleothem data set gathered by Corrick et al. [2020] and selected ocean-sediment and ice-core records.

We present maps of the modelled climate anomalies between the different glacial climate states and compare to those of Menviel et al. [2020]. We also compare the model response to the signals found in selected speleothem and ocean-sediment records and discuss similarities and differences.

References

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