Master's Project on

Exploring self-sustained oscillations of the AMOC in an ocean model

The Atlantic Meridional Overturning Circulation (AMOC) is an important component of the global climate system. It is thus thought that during past ice ages the AMOC played a major role in abrupt temperature variations in the North Atlantic region known as Dansgaard-Oeschger Events (or DO-Events), that further also had impacts on global climate. Yet, to this day the trigger of these events remains elusive. From this, it emerged that these climate oscillations might instead be self-sustaining and thus not requiring an apparent trigger mechanism.

This Master's project aims to explore self-sustained AMOC oscillations as an explanation for DO-Events. For this, the ocean component of the Bern3D Earth system model of intermediate complexity will be used, which is a highly computationally efficient model that allows for systematically testing many model configurations. First studies suggested, that the occurrence of self-sustained oscillations is strongly dependent on the climatic and oceanic boundary conditions and specific parameterizations in the model. As such, the focus of this project will be the exploration of various boundary conditions and parameterizations in the model through a number of sensitivity tests. This will allow for identifying the climate regime where the AMOC is at or close to an unstable state exhibiting such self-sustained oscillations, which might even inform us on the future evolution of this crucial constituent of the climate system.

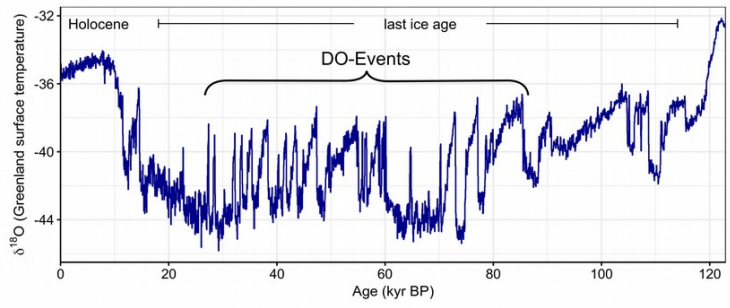

Figure 1: *Greenland atmospheric surface temperatures ($\delta^{18}O$) showing the abrupt warming events during the last ice age.*

Project tasks:

- Getting familiar with software and computational facilities (linux, fortran, computing cluster) and the Bern3D model.
- Exploring the effect of different climatic and oceanic boundary conditions and parametrizations (e.g., vertical diffusivity) on the AMOC stability.
- Identifying the regime where the AMOC exhibits self-sustained oscillations, and characterization of a generic oscillation cycle, including global teleconnections.
- Comparison to paleoclimatic and paleoceanographic reconstructions.

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References:

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