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Modelling freshwater induced shut-down and recovery of the THC: how much atmosphere does it take?

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Glacial Heinrich events are characterised by massive discharges of icebergs into the North-Atlantic which occurred during the last glacial period and are considered to lead to an extreme reduction if not shut-down of the thermohaline circulation (THC). The resultant global impact can be confirmed by various climate records: During Heinrich events North Atlantic climate records exhibit a slow cooling terminated by an abrupt warming a few centuries later. While a meltwater induced THC shut down and the corresponding North Atlantic cooling have been simulated successfully by all types of climate models, the termination of these events is highly dependent on the model used .

The objective of this paper is to study the response of the thermohaline circulation to a Heinrich event and to identify processes which lead to the subsequent abrupt warming.

For these purposes meltwater experiments are conducted under glacial conditions with the global, coupled atmosphere-ocean-sea ice model ECBilt-Clio. As to time scale and global signals (North Atlantic cooling, bipolar see-saw) the simulations agree well with climate reconstructions of typical Heinrich events. By decoupling the different atmospheric feedbacks separately, their influence on the THC variability is investigated.