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Investigating ice sheet instabilities and abrupt climate change with a fully coupled ice sheet - climate model

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High concentration in ice-rafted debris (IRD) in sediment cores from the North Atlantic suggests episodic massive ice sheet destabilisations through the last glacial period (Heinrich events). If the freshwater flux induced by these events would alter the thermohaline circulation, the causal link between ice sheet destabilisation and rapid climate changes deduced from the oxygen isotopic ratios in Greenland ice cores has yet to be found.

In this study, we use the model of intermediate complexity iLOVECLIM fully coupled to the ice sheet model GRISLI to investigate the potential of ice sheet-climate interactions in shaping rapid climate change during the late marine isotope stage 3 (40 - 20 kaBP). To this aim we perform sensitivity studies in which we impose ad-hoc freshwater flux scenarios in different oceanic basins and quantify their impact on ice sheet surface mass balance, computed thanks to an online dynamical downscaling of temperature and precipitation. We also make use of the new implementation of an analytical grounding line flux computations following Schoof (2007) and Tsai et al. (2015) to quantify the impact of sub-shelf basal melting rate on Kara-Barents ice sheet dynamics in the coupled model.