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AMOC instability during the Last Inerglacial

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Multiple evidences from the analysis of satellite, in-situ and proxy data show that the climate is already changing toward a warmer Earth System due to our emissions of CO2 into the atmosphere. However, the magnitude and the extent of changes remain difficult to predict. A change in the ocean thermohaline circulation and its consequences for climate, such as drought, regional sea-level and ocean carbon uptake remain under debate as this circulation has been long thought to be stable during warm Earth periods – Interglacials. However, recent high-resolution reconstructions of carbon isotopes ($\delta^{13}C$) from the deep North Atlantic challenge this idea of stability and point toward abrupt modifications in the ocean interior biogeochemistry and/or ocean thermohaline circulation during the Last Interglacial (LIG, 125ka – 115ka).

Our model simulation of the LIG reproduces the observed magnitude and timescale of the reconstructed variations of $\delta^{13}C$, highlighting crucial dynamical changes in two regions of the North Atlantic deep-water formation (south of Greenland and south of Svalbard). These regions are found to drive the variations in the strength of the Atlantic Overturning Circulation (AMOC) when the Arctic sea-ice extent is perturbed.

Our study suggests that the AMOC may have experienced great instability phase during some parts of the LIG. The water mass geometry reorganization from the warm onset at 125ka to the glacial inception at 115ka could also have greatly impacted the distribution of carbon in the interior Ocean. Changes in sea-ice cover either south of Svalbard or in the Southern Ocean seem to play a determining role. However, in our global warming context, our study suggests that the mechanisms responsible for the LIG AMOC instability of the LIG may not occur by the end of the century if the Arctic sea-ice retreats from the high latitudes of the North Atlantic as projected by climate models.