

Roles of sea ice–surface wind feedback in maintaining contrasting modes of glacial Atlantic meridional overturning circulation and climate

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During the glacial period, climate varied on millennial-time scale between two contrasting modes. These climate changes are often associated with drastic reorganizations of North Atlantic sea ice and Atlantic meridional overturning circulation (AMOC). However, processes affecting the periodicity of AMOC and climate variability remain unclear. Here, through performing simulations with a comprehensive climate model, we show that sea ice and associated changes in surface winds play a key role in maintaining the contrasting modes of AMOC and climate. Experiments highlights the importance of the suppression of atmosphere-ocean heat exchange by sea ice in inducing a weakening of surface winds. The surface wind anomaly then causes a reduction of salt transport and weakens AMOC, which triggers further expansion of sea ice. Our results show that sea ice–surface wind interactions over the North Atlantic plays an important role in inducing the long periodicity of the climate variability.

Keywords: millennial time-scale climate variability, sea ice-surface wind interaction, AMOC