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Abrupt shift of the Atlantic Ocean circulation induced by atmospheric blocking

Patrick Scholz (1,2), Monica Ionita (1,2), Gerrit Lohmann (1,2), Mihai Dima (1,3), and Matthias Prange (2)

(1) Alfred Wegener Institute, Paleoclimate Dynamics, Bremerhaven, Germany (patrick.scholz@awi.de), (2) MARUM – Center for Marine Environmental Sciences, University of Bremen, Bremen, Germany, (3) Bucharest University, Faculty of Physics, Bucharest, Romania

Fram Strait sea ice export from the Arctic represents a key source of fresh water for the North Atlantic. Although it may have strong influence on the ocean circulation, its causes and consequences are not yet fully understood. Using a global ocean-sea ice model with an increased resolution over the Arctic, here it is shown that enhanced blocking activity over Greenland during the 1962-1966 period favors sea ice accumulation in the Arctic, whereas during the 1967-1971 period, when this blocking configuration is weak, the associated intense sea ice export trough Fram Strait reduces the Labrador Sea salinity and weakens the AMOC. These results indicate that AMOC shifts toward weak states, as the one emphasized here in the 1970s, may be induced by rapid sea ice flushes from the Arctic, after periods of enhanced blocking activity over Greenland. They imply also that an important part of the atmosphere-ocean dynamics at mid- and high latitudes requires a proper representation of the Fram Strait and associated sea ice transport as well as synoptic scale variability such as atmospheric blocking, which is a challenge for current coupled climate models.