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Modeling the freshwater system of the Arctic and North Atlantic oceans

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Observations from recent decades show significant salinity anomalies in the Arctic and the Subpolar North Atlantic oceans. The evolution of their freshwater budgets has been the focus of many studies, most of which suggest a link between them. Despite these efforts, the nature and the significance of this link is still disputed, and so are the driving forces behind it.
Our aim was to simulate the freshwater system of the Arctic and the Subpolar North Atlantic oceans and to assess the role of wind stress in shaping it. For this we used the Max Planck Institute Earty System Model and ran model experiments in its original fully coupled configuration, and in the partially coupled configuration of the so called Modini-method with prescribed wind forcing. We analyzed the evolution of the distribution and the fluxes within this freshwater system and compared our results between model configurations.
Our results showed that although there is a significant bias in modeled freshwater content (overestimation in the Arctic Ocean, underestimation in the Nordic Seas and in the Subpolar North Atlantic Ocean in comparison with observational data), anomalies in recent decades are similar to those derived from observations. The bias is somewhat reduced and the anticorrelation between the freshwater content of the Arctic and the Subpolar North Atlantic is also higher in the partially coupled runs with prescribed wind forcing. We suggest that this improvement is due to the role of wind stress in shaping their freshwater reservoirs.