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Drivers of freshwater (co)variability in the Arctic Ocean and subarctic North Atlantic

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Significant freshwater changes have recently been observed both in the Arctic Ocean and the subpolar North Atlantic. To investigate possible links, we compared the liquid freshwater content of the subarctic North Atlantic with the sum of liquid and solid freshwater content of the Arctic Ocean from observations between 1990 and 2013. We found a distinct anti-correlation of the freshwater anomalies in these two regions with anomalies of almost the same magnitude.
An analysis of freshwater fluxes from the global Finite Element Sea ice Ocean Model (FESOM) and the Common Ocean-ice Reference Experiment version 2 (CORE-II) atmospheric forcing data set suggests that the observed freshwater variations resulted from changing freshwater transports. Variations in the Arctic freshwater export to the North Atlantic are found to be most important for the total freshwater content variability of the upper Arctic Ocean and for the liquid freshwater content variability of the western SANA. The eastern SANA freshwater content seems to be mainly influenced by the exchange with the subtropical North Atlantic.
Furthermore these changes are correlated with large-scale atmospheric pressure and circulation patterns. Thereby the export from the Arctic Ocean through the Canadian Arctic Archipelago is associated with different patterns than the export through the Fram Strait and Barents Sea Opening. We propose, that the recently observed rapid changes in the SANA and upper Arctic Ocean freshwater content resulted from an interplay of these different driving patterns causing parallel changes in the freshwater export on both sides of Greenland.
According to the present phase of the decadal alternations of the atmospheric variability and our freshwater content time series, the fresh water that accumulated in the Arctic Ocean during the previous decades started to be released into the SANA. This release might continue in the following years and could have the potential to impact the Atlantic Meridional Overturning Circulation and the oceanic heat release to the Arctic atmosphere and sea ice.