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Decadal predictability of extreme fresh water export events from the Arctic Ocean into the Nordic Seas and subpolar North Atlantic

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Abrupt fresh water releases originating in the Arctic Ocean have been documented to affect ocean circulation and climate in the North Atlantic area. Therefore, in this study, we investigate prospects for predicting such events up to one decade ahead. This is done in a perfect model setup by a combination of analyzing a 500 year control experiment and dedicated ensemble experiment aimed at predicting selected 10 year long segments of the control experiment. The selected segments are characterized by a large positive or negative trend in the total fresh water content in the Arctic Ocean.

The analysis of the components (liquid fresh water and sea ice) reveals that they develop in a near random walk manner. From this we conclude that the main mechanism is integration of fresh water in the Beaufort Gyre through Ekman pumping from the randomly varying atmosphere. Therefore, the predictions from the ensemble experiments are on average not better than a damped persistence predictions.

By running two different families of ensemble predictions, one starting from the 'observed' ocean globally, and one starting from climatology in the Arctic Ocean and from the observed ocean elsewhere, we conclude that the former outperforms the latter for the first few years as regards liquid fresh water and for the first year as regards sea ice.

Analysis of the model experiments in terms of the fresh water export from the Arctic Ocean into Nordic seas and the subpolar North Atlantic reveals a very modest potential for predictability.