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Sensitivity of fresh water and ice contents in the Arctic, their transports towards the North Atlantic Ocean and their linkage to atmospheric variability, to ocean and atmospheric model resolution.

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Earth System Models participating in the PRIMAVERA Project are used to see the effect of atmospheric and ocean resolution on fresh water and ice content over the Arctic Ocean. Furthermore the interaction between atmospheric variability and ice concentration over the Arctic Ocean when using different atmospheric and ocean model resolution is also analyzed. In a two-ways causality effect we analyze how ice causes atmospheric response and visceversa. Two concrete processes are analyzed: a) The modulation of the North Atlantic Oscillation (NAO) sign caused by sea ice variations in Barents Sea (as Koenigk et al. 2016) and b) modulation of sea ice transport from the Arctic towards the North Atlantic across the Fram strait driven by the Sea Level Pressure (SLP) gradient over the Fram strait.

A systematic behavior across simulations is found: less fresh water and ice concentration is shown in high atmospheric resolution compared with coarser resolution simulations.

By grouping the models in ensembles of high (0.25 degrees) and low (1 degree) ocean resolution, we found that the correlation sign between sea ice concentration over the Central Arctic, the Barents/Kara Seas and SLP over the Northern Hemisphere is similar to observations in the higher ocean resolution ensemble, although the amplitude is underestimated. In contrast, the low-resolution ensemble shows opposite ice-SLP correlation patterns compared to observations. In general, high ocean resolution simulations show more similar results to observations than the low-resolution simulations, thus implying a systematic behavior of the atmospheric response to ocean resolution.

In turn, models with low ocean resolution tend to exhibit a stronger linkage between the SLP gradient over the Fram strait and the ice export from the Arctic towards the North Atlantic, than the models with high ocean resolution. This might be due to an intensified surface roughness in the coarser ocean resolution models that intensifies the ice drift towards the south. In turn changes in atmospheric resolution did not show a systematic behavior regarding the role of the SLP gradient on the sea ice transport across the Fram strait.