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A modelling study of co-variability of the two-branched Atlantic water inflow to the Arctic Ocean

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Variability of the Arctic climate system depends on oceanic heat transport with the Atlantic water streaming towards the Arctic Ocean in two branches, through the deep Fram Strait and the shallow Barents Sea. The relative strength of these branches and the partition of temperature anomalies between them determine the amount of heat lost by the Atlantic water to the atmosphere before entering the Arctic Ocean and the amount of heat available for interactions with the sea ice and other water masses within the Arctic Ocean. Recent studies indicate that air-sea interactions in the Barents Sea area influence not only the fate of the Barents Sea branch but also affect the Fram Strait branch. We investigate this phenomenon using a pan-Arctic coupled ice-ocean model run for the period 1979-2004 and forced with daily atmospheric data from the ECMWF. The model has been previously used to study several aspects of the Arctic climate system, the mean circulation in the Barents Sea in particular. We will report on co-variability of volume and heat fluxes in the Arctic slope current north of the Barents Sea and in the area of a westward outflow from the Barents Sea over the slope to the south of Bear Island. The results, which are based on monthly-mean model output data, verify positively a recent finding by Norwegian researchers that the co-variability of the Arctic slope current and the slope current in the western Barents Sea outflow area is quite strong, especially in winter, and that wind forcing over the northern Barents Sea shelf is instrumental in driving this co-variability. We will also show that details of the wind-driven oceanic circulation anomaly are somewhat model- or period-dependent and elucidate mechanisms which link the Arctic slope current variability to anomalies of the surface wind stress over the Barents Sea.