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Variability of the Atlantic water properties and oceanic fluxes in the entrance to the Arctic Ocean - causes and consequences.

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The Atlantic water (AW) progressing northward through Fram Strait is the only oceanic source of heat for the Arctic Ocean. During last two decades the extraordinary warm Atlantic inflow resulted in a prolonged period of the increased input of thermal energy into the Arctic Ocean, triggering a discussion if and how a warmer ocean might have contributed to the recently observed thinning of Arctic sea ice. 15-year long observations by the moored array in the northern Fram Strait (1997-2012) show that propagation of the warm anomalies into the Arctic Ocean can be traced as a series of successive events, advected from the North Atlantic and modified along the way northward due to ocean-atmosphere interactions. Two strong warm anomalies were observed in 1998/99 and from 2004 to late 2006 when AW temperature reached the record high values. More recently the extremely high AW temperatures were observed in winter 2011/2012.

However, an increase in temperature of the AW entering the Arctic Ocean was found to be followed by the phase-shifted warming in the southward recirculation of AW, which takes place in and directly north of Fram Strait. Therefore variability of the heat flux into the Arctic Ocean is significantly decoupled from the maximum temperatures in the AW inflow. Moreover, oceanic fluxes vary strongly on monthly to decadal time scales and variability of the AW volume transport through Fram Strait (and its upstream splitting between the Fram Strait and Barents Sea Opening) is mostly controlled by the large-scale and local atmospheric forcing. Estimations of the heat flux through Fram Strait reveal an increase of order 10 TW between late 90s and early 2000s. Most of this heat is lost to the atmosphere directly north-east of Fram Strait where a retreat of the sea ice cover observed in the last decade suggests an increased ocean-atmosphere heat flux.

In this study we analyze variability of volume and heat fluxes through Fram Strait in the period of 1997 to 2012 in relation to different internal and external forcings, including large scale atmospheric circulation, local winds, ocean-atmosphere heat fluxes and air temperature variability. The potential effects of observed changes on the Arctic Ocean Boundary Current and the interior of the Arctic Ocean are also addressed.