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Atlantic Water properties, transport, and water mass transformation north of Svalbard from one-year-long mooring observations

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North of Svalbard is a key region for the Arctic Ocean heat and salt budget as it is the gateway for one of the main branches of Atlantic Water to the Arctic Ocean. As the Atlantic Water layer advances into the Arctic, its core deepens from about 250 m depth around the Yermak Plateau to 350 m in the Laptev Sea, and gets colder and less saline due to mixing with surrounding waters. The complex topography in the region facilitates vertical and horizontal exchanges between the water masses and, together with strong shear and tidal forcing driving increased mixing rates, impacts the heat and salt content of the Atlantic Water layer that will circulate around the Arctic Ocean.

In September 2018, 6 moorings organized in 2 arrays were deployed across the Atlantic Water Boundary current for more than one year (until November 2019), within the framework of the Nansen Legacy project to investigate the seasonal variations of this current and the transformation of the Atlantic Water North of Svalbard. The Atlantic Water inflow exhibits a large seasonal signal, with maxima in core temperature and along-isobath velocities in fall and minima in spring. Volume transport of the Atlantic Water inflow varies from 0.7 Sv in spring to 3 Sv in fall. An empirical orthogonal function analysis of the daily cross-isobath temperature sections reveals that the first mode of variation (explained variance ~80%) is the seasonal cycle with an on/off mode in the temperature core. The second mode (explained variance ~ 15%) corresponds to a short time scale (less than 2 weeks) variability in the onshore/offshore displacement of the temperature core. On the shelf, a counter-current flowing westward is observed in spring, which transports colder (~ 1°C) and fresher (~ 34.85 g kg^{-1}) water than Atlantic Water ($\theta > 2$°C and $S_A > 34.9$ g kg^{-1}). The processes driving the dynamic of the counter-current are under investigation. At greater depth (~1000 m) on the offshore part of the slope, a bottom-intensified current is noticed that seems to covary with the wind stress curl. Heat loss of the Atlantic Water between the two mooring arrays is maximum in winter reaching 250 W m^{-2} when the current is the largest and the net radiative flux from the atmosphere to the ocean is the smallest (only 50 W m^{-2} compared to about 400 W m^{-2} in summer).