The Atlantic Water Boundary Current in the Eastern Arctic: Composition, Transport, Variability, and Dynamics

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The overall goal of this study is to obtain a quantitative description of the water mass composition, kinematics, and dynamics of the Atlantic water boundary current in the eastern Arctic Ocean over an annual cycle, in order to elucidate the role of the current in regulating the Arctic system.

Recent results

Our project is entitled the Atlantic Water Inflow Experiment (ATWAIN), which is an international collaboration between six institutions: Woods Hole Oceanographic Institution (WHOI), Institute for Marine Research in Bergen, Norway, Norwegian Polar Institute, University of Svalbard, University of Tromsø, and Institute of Oceanology Polish Academy of Sciences. Together, we deployed eight moorings across the Atlantic water (AW) boundary current near 30°E (Figure 1a) for a one-year period, from September 2012 to September 2013. WHOI provided four of the offshore moorings in the array (Figure 1b). Unfortunately, the mooring on the upper slope was lost (presumably destroyed by fishing activity), and the motorized profiler on the offshore-most mooring malfunctioned. However, the rest of the moorings returned full datasets (including all four WHOI moorings), and the lateral coverage across the AW boundary current is still excellent. In addition to the mooring work, we carried out two shipboard hydrographic/velocity surveys in the region surrounding the array, one during the deployment cruise and the other during the recovery cruise. At this point the processing of the shipboard conductivity-temperature-depth (CTD) data and vessel mounted ADCP data is completed. The calibration and processing of the mooring data are still ongoing.

During the deployment cruise, we occupied two transects across the AW boundary current. Taking the AW to be within the density range 27.70–27.97 kg/m^3 and warmer than 2°C (following Rudels et al. 2005), the transport of the current during the first occupation was 1.7 ± 0.5 Sv, and for the second occupation it was 1.5 ± 0.4 Sv. These are consistent with one another, but smaller than the 3.0±0.2 Sv estimated by Beszczynska-Möller et al. (2012) using data from the Fram Strait mooring array west of Spitsbergen (for the same definition of Atlantic water). It suggests that some of the warm water entering the Eurasian Basin through Fram Strait does not continue in the boundary current. One possibility is that the current is hydrodynamically unstable and consequently diminishes in transport as it flows eastward, much like the Pacific water boundary current in the Canadian Basin (von Appen and Pickart 2012). This notion is supported by the observation of an anti-cyclonic eddy of Atlantic water offshore of the boundary current during the deployment cruise. The eddy is evident as the detached lens of warm water in Figure 1b. Based on our measurements, the eddy had a width of 25-30 km and a maximum rotational speed of 10-15 cm/s. Although the highest velocities were in the Atlantic layer, the eddy had a significant barotropic component. At this point it is unknown how common these features are, but the data from the year-long mooring array should shed light on this.

There are currently no publications from this project. A manuscript is in preparation describing the results of the deployment cruise.

Bibliography

Beszczynska-Möller, A., Fahrbach, E., Schauer, U., Hansen, E., 2012: Variability in Atlantic water temperature and transport at the entrance to the Arctic Ocean, 1997-2010. *ICES J. Mar. Sci.,* **189**, doi:10.1093/icesjms/fss056.