The Norröna Project: An International Collaboration for Sustained Studies of the Meridional Overturning Circulation Between Denmark, the Faroes, and Iceland.

PIs: T. Rossby[1], and C. Flagg[2]
[1]University of Rhode Island, Kingston, RI
[2]Stony Brook University, Stony Brook, NY

The long-range objective of this project is to measure directly the exchange of water, heat, and salt between the northeast Atlantic and the Nordic Seas between Scotland, the Faroes, and Iceland. The approach is very simple: to install an acoustic Doppler current profiler (ADCP) in the hull of the high-seas ferry Norröna that operates between Denmark, Torshavn in the Faroes, and Seyðisfjörður, Iceland. The 75 kHz ADCP, which reaches to > 500 m in the Faroe-Shetland Channel (FSC) and to the bottom over the Iceland-Faroe ridge (IFR), has been collecting data since March 2008. Collection in the FSC is year-round, but limited to the summer months for the IFR due to high swell conditions in winter that lead to the drawdown of bubbles under the vessel. Two papers have been published and two others are in preparation.

Recent results

The most significant result to emerge from the program, so far, is the different exchange patterns between the Atlantic and the Nordic Seas than previously understood, with ~0.5-1.5 Sv (1 Sverdrup = 10^6 m^3 s^{-1}) less inflow in the FSC for st < 27.8 kg m^{-3} and ~1 Sv more over the IFR. The differences are in part due to lack of adequate coverage of southward flow in the western FSC and using measured transport in the Faroe Current north of the Faroes as a proxy for the IFR inflow. These issues are discussed in the Childers et al. (2014) paper. This paper also confirms previously noted ~0.8 Sv variation in seasonal inflow in the FSC with a maximum in winter. The very high level of eddy activity in both regions underscore the need for these flux measurements to be made on a sustained and repeated basis. Another major contribution (Rossby and Flagg 2012) is the estimate of heat and salt flux, respectively. Although these were based on historical temperature and salinity data in the ICES database, they are the most accurate such estimates to date. These will soon be further improved thanks to the installation of an automated expendable bathythermograph (XBT) instrument system called AXIS (autonomous expendable instrument system). Starting in September 2013, the project has been measuring the thermal structure of both the FSC and the IFR with XBTs deployed on a monthly basis. This instrument greatly improves the ability to resolve highly structured systems (fronts and eddies) for which there are not other observing capabilities. In a paper in preparation, we will report new and improved estimates of heat flux based on these XBT data. They will be useful as very accurate constraints on allowable atmospheric heat losses in the Nordic Seas. We also expect to start operation of a thermo-salinograph shortly. This is needed to identify the various water masses between Scotland and Iceland and their variability over time.

Online data

All data collected by this project are publically available at the project website: http://po.msrc.sunysb.edu/Norrona

Bibliography

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