The Upstream Sources of the Denmark Strait Overflow

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The aims of this project are to quantify the upstream sources of the Denmark Strait Overflow Water (DSOW) and relate the variability in the different sources to that observed at the sill. To accomplish this we are using time series data provided by four institutions, who together deployed 12 moorings spanning the strait 200 km north of the sill from Aug 2011 – Aug 2012, plus a mooring at the sill itself. The first objective is to quantify a newly discovered pathway of dense water in the central portion of the strait, known as the separated East Greenland Current (sEGC). This pathway was recently revealed in a number of shipboard crossings and is thought to be a free-jet located between the boundary currents on the Greenland slope (the shelfbreak East Greenland Current) and the Iceland slope (the North Icelandic Jet, NIJ). The mooring data will allow us to quantify the structure, transport, and dynamics of the sEGC over a yearlong period. Following this, the second objective is to produce the first strait-wide picture of the time-varying pathways transporting dense water into the Denmark Strait, and how the transport is partitioned between the three overflow pathways. Once this is established, the third objective is to elucidate the dynamics of the upstream circulation system and assess how this impacts the transport and hydrographic variability at the sill. The aim is to determine if the ubiquitous synoptic scale variability of the DSOW at the sill is driven by upstream fluctuations in any of the pathways, and/or if hydraulic processes at the sill influence the upstream circulation. The final objective of the study is to devise a sparse mooring array that could be implemented in the future to optimally monitor the upstream sources of DSOW over interannual to decadal time scales.

This two-year project began in September 2014. Preliminary results show that the sEGC is a robust feature discernable throughout the year in the mooring record, although the current is often partially merged with the neighboring NIJ. The water masses in the two EGC branches are distinct from those in the NIJ branch, confirming that there are two sources of overflow water. In addition, the data suggest that while the total transport of the DSOW remains constant throughout the year the relative contribution of the two sources varies significantly on both synoptic and seasonal time scales.