Pathways to the Denmark Strait Overflow: A Lagrangian Study in the Iceland Sea

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About half of the overflow water entering the North Atlantic Ocean from the Nordic Seas originates from the Denmark Strait overflow. The Denmark Strait overflow water is also the densest component of North Atlantic deep water. It was previously thought that the dense water upstream of the overflow originated from Atlantic water that was modified along its path through the Nordic (and Arctic) Seas (Mauritzen 1996) finally being transported to Denmark Strait in the East Greenland Current. More recent observations suggest that there may be an alternative source in the Iceland Sea, with a pathway to the Strait along the northern shelf of Iceland in the North Icelandic Jet (Våge et al. 2011), and a complicated circulation in the narrow region just upstream of Denmark Strait (Våge et al. 2013). Model studies (Köhl et al.; 2007; Köhl 2010) suggest that both pathways may be a source and alternate depending on the wind forcing around Iceland. This has potential implications for the stability of the Denmark Strait overflow under future atmospheric conditions.

This project aims to elucidate the circulation upstream of the Denmark Strait sill. In July 2013 a total of 26 floats (13 one-year floats and 13 two-year floats) from the Institute of Marine Research (IMR) in Bergen, Norway were deployed in the Iceland Sea, along with six sound sources. The RAFOS deployments were spread out over the interior Iceland Sea and the Greenland and Iceland slopes. Another PI at IMR deployed two profiling Argo floats, and the data will be made publically available. In May 2014, 11 of the scheduled 13 floats surfaced, two appear to be lost. An additional 26 floats (20 from WHOI and six from IMR) were deployed in July 2014. The deployment plan was based on the data available from the surfaced floats and focused more on the slopes and less on the interior basin, where several floats are still expected to reside. One seeming malfunctioning sound source was replaced and another Argo float was deployed. At this point, all the fieldwork associated with the project is done.

The second part of the project consists of a model collaboration with Armin Köhl at the University of Hamburg. The high resolution (1/12°) model run used for the study described by Köhl 2010 will be extended to the end of the experimental part of this project, using the atmospheric forcing that was observed during this period. This will allow us to compare the model and the float trajectories and to assess the interannual variability.

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