2012 Project Summary

Analysis of Eddies, Mixing, and Dense Overflows at the Iceland-Faroe Ridge in the Northern Atlantic Ocean Observed with Seagliders.

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Analysis of 17,000+ hydrographic profiles made during our 3-year NSF-sponsored deployment of Seagliders at the Iceland-Faroe Ridge forms the core of this project. N.L. Beaird, graduate student under this grant, is carrying out much of the work, in collaboration with PIs Rhines and Eriksen. In addition to hydrography the data returned includes vertically averaged horizontal velocity, surface velocity, fine-scale vertical velocity, oxygen and bio-optics. The sections between Iceland and Faroes, transverse sections crossing the Ridge, and sections within the Faroe-Bank Channel provide many portraits of the dense overflows entering the Atlantic (and accounting for roughly ¾ of the total overflow volume).

**Recent Results**

(1) Intense mixing of at the Faroe-Bank Channel exit is captured in hydrography and vertical velocity fields, and has been compared with turbulence-probe observations of Dr. Ilker Fer. As the dense plume converts into Iceland-Scotland Overflow Water (ISOW, the intermediate water mass lying between Labrador Sea Water and Denmark Strait Overflow Water in the North Atlantic Deep Water parfait) it is perturbed by intense, tall eddies likely arising from instability of the polar front.

(2) Quantitative measurement of the overflow transport between Iceland and Faroes has not yet been achieved (historically estimated to be 1 Sverdrup). However many encounters with that overflow water, a thin 25-100m thick layer draped over the southern flank of the Ridge, and estimates of turbulence levels within the layer, are being examined to understand both the path of the dense water, its dilution through mixing, its fragmentation into (and by-) tall mesoscale eddies, and its rapid sinking to ~2500m depth soon after leaving the ridge slope. In common with remarkable spreading of the Denmark Strait Overflow Water across the base of the 800 km-wide Labrador Sea, this ISOW coats the bottom of the Iceland Basin rather than remaining as a concentrated deep boundary current.

(3) Such observations are aimed at improving climate models, which cannot resolve mixing, and thin, narrow dense plumes of circulation (nor the mesoscale eddies that interact with them). A separate initiative has been the analysis of subpolar Atlantic water-mass transformation in three couple climate models by H.Langehaug of Univ. of Bergen, in collaboration with T.Eldevik and the PIs. These calculations provide a link between observations of in situ mixing and the parameterized mixing in global climate models. A key element in the multi-century runs of these coarse-resolution models is the rapid entrainment of less-dense waters into the northern overflows, which occurs abruptly at the Greenland-Scotland Ridge. Ongoing exchange of students and PIs with University of Bergen has been a valuable component of this program.
Bibliography