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Observing mixing in the Faroe Bank Channel overflow with gliders

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Cold, dense water from the Nordic Seas flows out into the North Atlantic across the Iceland-Scotland Ridge underneath the warmer Atlantic water. About a third of the overflow volume passes through the Faroe Bank Channel (FBC), a narrow passage with a sill depth of 840 m. The current velocity in the Channel is high (on the order of 1 m/s), and the highly variable flow is dominated by oscillations with a period of 2-3 days. In order to study the mixing and entrainment of the overflow in detail and at a time scale resolving the mesoscale oscillations, a field campaign was undertaken in 2012. Apart from repeat sections with CTD-LADCP and Vertical Microstructure Profiler (VMP), two Slocum electric gliders were deployed, one of them equipped with a MicroRider turbulence package. A total of 104 dives that reached into the plume (with bottom temperatures $\leq 3^{\circ}$C) were completed, 69 of which with the MicroRider glider.

The in situ observations from May-June 2012 show that the mesoscale variability strongly influences the overflow plume in terms of hydrographic structure, transport, and turbulence. CTD data from the two gliders complemented the shipboard survey and highlighted the temporally and spatially varying distribution of intermediate water which sometimes is found between the light Atlantic water and the dense waters originating in the Nordic Seas. The presence or absence of intermediate water and the various degrees to which its signal is removed by the vigorous mixing in the plume and at the turbulent interface complicates the view of this system, but can also help shed light on the circulation and the mixing in the Channel.

Profiles of turbulent dissipation rate inferred from the turbulence measuring glider and the VMP on average agree very well above about 300 m above the seabed, but the glider-derived dissipation rates are systematically about a factor of two larger inside the plume and interface. The good agreement in the upper part of the water column shows that gliders can be very useful as platforms for turbulence measurements. Glider operations in the FBC are challenging because of the strong currents, but allow a sampling strategy not possible by shipboard surveys alone.