The Dynamics of Abyssal Mixing and Interior Transports Experiment (DynAMITE)

PIs: R. Curry and K. Polzin
Woods Hole Oceanographic Institution, Woods Hole, MA

This field program refined our knowledge of the structure and strength of the buoyancy gain part of AMOC – an Abyssal Upwelling Cell (AUC) that transforms the densest waters in the Atlantic (Antarctic Bottom Water, AABW, and Nordic Seas Overflow Waters) into warmer, lighter density classes (North Atlantic Deep Water, NADW) – and the circulation through the interior western basin that results. Conducted over a two-year time span, the DynAMITE field measurements included an array of moored profiling CTDs and current meters deployed down the southeast flank of Bermuda Rise and a microstructure/finescale survey to measure diapycnal mixing over the Mid Atlantic Ridge (MAR) and in the basins between the MAR and Bermuda.

In 2013/2014, processing and analysis of the 12-MMPs (moored profilers) and 18-VACMs (current meters) and MicroCats from the array were completed. These revealed the presence of a vigorous jet transporting an order 10 Sv of cold limb water masses (spanning depths 1500-4800 m) equatorward near the 4600 m isobath (Figure 1). Its volume transport is uncertain because the width of the jet was not resolved by the moorings: a nominal width of 60 km produces a mean equatorward transport of 10 Sv, while widths of 10 and 100 km yield mean transports of 2 and 18 Sv respectively. Our ideas about the structure, strength, and mechanisms driving this particular branch of the cold limb flows through the interior subtropical basin are based upon consideration of both historical observations and recent measurements.

Recent results

- A distinct interior flow feature conveys cold limb waters as a topographically steered current connecting the deep Gulf Stream in the vicinity of the New England Seamounts to the deep western boundary current (DWBC) south of Cape Hatteras via Bermuda Rise.
- The flows are appreciably strong, persistent in flow direction and location (tied to the 4500-5000 m isobaths), but the flow strength varies between quiescent and energetic periods on timescales of a few months.
- The mechanisms driving the mean transport may be related to alteration of the deep Gulf Stream's stratification (PV) where it runs into, over, and through the New England Seamounts.
- The temporal structure of the interior flows is subsequently modulated by the dynamics of planetary waves and/or mesoscale eddies interacting with the steep topography of Bermuda Rise.
- These persistent interior flows have consequences for the downstream AMOC variability through their contributions to DWBC volume transport and through alteration of PV distributions, stratification and water mass characteristics.
- The time scales for propagation of signals via this pathway may be considerably shorter than those associated with eddy-driven recirculation gyres, i.e., 5-10 years rather than decades.

Project website: http://www.whoi.edu/science/PO/dynamite/

Bibliography

Polzin, K., A. C. Naveira Garabato, T. N. Huussen, B. M. Sloyan and S. Waterman, 2014: Finescale parameterizations of turbulent dissipation. *J. Geophy. Res.: Oceans*, **119**, 1029, doi:10.1002/2013JC008979.