Results from the Dynamics of Abyssal Mixing and Interior Transports Experiment (DynAMITE)

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The densest waters in the Atlantic, i.e. Antarctic Bottom Waters (AABW) and Denmark Strait Overflow Waters (DSOW), undergo diapycnal transformation into warmer, lighter density classes, the Lower North Atlantic Deep Waters (LNADW), that is remarkable for its amplitude (7-8 Sv). DynAMITE is an investigation of the processes underlying this upward transfer of mass and buoyancy gain, the Abyssal Upwelling Cell (AUC), which is important to closing budgets of mass, heat and tracers in the AMOC.

Combining a moored array down Bermuda Rise with microstructure measurements between the Mid-Atlantic Ridge (MAR) and Bermuda, DynAMITE has mapped the structure of vertical diffusivities, and revealed a surprisingly vigorous lateral circulation (order 10 Sv) through the basin interior between 20°- 38°N. These deep flows are primarily driven by turbulent mixing and vortex stretching along the MAR and deep Gulf Stream, with secondary contributions from recirculation adjacent to the western boundary. The upwelling inflates deep layer transports, enhancing northward penetration of AABW properties, and boosting the DWBC flows by 10-15 Sv near Cape Hatteras. Mixing weakens the stratification resulting in two massive reservoirs of low potential vorticity waters – an abyssal analog to water masses formed by convective processes and buoyancy loss at high latitudes. This experiment highlights the important role that the MAR plays in the AUC contribution to the MOC, and in setting the deep layers in motion.