

The Diapycnal and Isopycnal Mixing Experiment: 2012 Status Report

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The Diapycnal and Isopycnal Mixing Experiment in the Southern Ocean (DIMES) was designed as a multi-pronged US and UK CLIVAR effort to measure and to better understand diapycnal mixing and along-isopycnal eddy transport in the Antarctic Circumpolar Current (ACC), because these processes together appear to play a key role in the Meridional Overturning Circulation (MOC) (Gille et al, 2007). The project represents an unusual effort to evaluate simultaneously the roles of diapycnal and isopycnal mixing, and the program has benefited from close collaboration between observationalists, theoreticians and modelers. Fieldwork for DIMES began in early 2009 and will continue into 2014.

Preliminary assessments of microstructure and tracer data indicate that diapycnal diffusivities are about an order of magnitude greater in Drake Passage than they are over the abyssal plain in the southeastern Pacific, where they are of order $10^{-5} \text{ m}^2 \text{ s}^{-1}$ as is typical of the open ocean elsewhere. Preliminary trajectories have been determined for acoustically-tracked RAFOS floats, and these generally show a consistent float pattern between the surface (as determined from altimetry) and the $\gamma_n = 27.9 \text{ kg m}^{-3}$ surface on which many of the floats were deployed. Float data are being analyzed in order to constrain along-isopycnal diffusivities in the region; formal uncertainties are large, given the slow convergence of dispersion statistics. Thus, the float trajectories are analyzed together with a high resolution model of the DIMES region forced at the boundaries with a state estimate. Preliminary results suggest that the along-isopycnal diffusivities upstream of Drake Passage did not exceed $600 \text{ m}^2 \text{ s}^{-1}$ along the $\gamma_n = 27.9 \text{ kg m}^{-3}$ surface.

The DIMES program continues. The in situ measurement program for tracer and microstructure will continue into 2014 with additional ship time scheduled primarily aboard the British Antarctic Survey research vessel James Clark Ross, in order to accurately determine the enhanced diapycnal mixing there, and where and how it is occurring. In the US, follow on proposals have been developed to support continued participation in the tracer/microstructure sampling program and to extend the modeling and analysis effort, including a plan to assimilate DIMES observations into the Southern Ocean State Estimate.

Further information about DIMES is available from <http://dimes.ucsd.edu>. The web site is managed by the CLIVAR & Carbon Hydrographic Data Office (CCHDO), which also manages data archiving. Data from the initial cruises are available on the DIMES web site, though some remain password protected for internal use only. The DIMES project has discussed with CCHDO and with the Internal Wave Driven Mixing CPT how to develop a consistent, non-proprietary data format for the DIMES microstructure data.