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Tidal Mixing, Scattering, and Reflection on the East Tasman Slope

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During January-March 2015, the NSF TTIDE Experiment investigated deep-mixing processes on the eastern slope of Tasmania. A well-focused semi-diurnal baroclinic tidal beam generated on the Macquarie Ridge south of New Zealand transits the Tasman Sea and impinges on this slope. The objective of TTIDE is to identify the various small-scale processes associated with tidal shoaling, dissipation, and reflection on the slope and to assess the potential role of such processes in the general circulation of the ocean.

Guided by initial glider reconnaissance and numerical simulations, arrays of moorings were deployed at a southern (reflective-supercritical) site and a northern (dissipative-critical) region. Supplemental experiments T-BEAM and T-SHELF mapped the incoming tidal beam and quantified its signature on the continental shelf. Shipboard surveys using LADCPs and a fast-profiling CTD indicate elevated mixing regions 1-300 m above the slope at depths of 500-2200 m. Locally generated semi-diurnal and topographically-trapped diurnal tides are also dissipating on the slope. These intense deep-mixing events occur even though the majority of the incoming tidal energy appears to be reflected northeastward, back into the Tasman Sea. In addition to the “criticality” of the mean slope, small-scale 3-D topographic features on the slope strongly influence on the nature of the nonlinear phenomena associated with mixing processes and the depth distribution of the resulting mixing. A more complete picture of this tidally forced slope and shelf will emerge as TTIDE data are synthesized.

