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Horizontal mapping of near-seafloor vertical mixing in the central valley of the Mid-Atlantic Ridge

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In the open ocean, the largest vertical mixing rates are found in deep-ocean canyons of mid-oceanic ridge systems. It is currently unclear, which physical mechanisms control the intense turbulent dissipation in deep ocean canyons. Recent studies point to a potential role of hydraulic jumps, which have been observed in shallow water studies.
To be able to resolve rapid horizontal transitions in mixing rates associated with hydraulic jumps, high-resolution horizontal fields of near-seafloor turbulent kinetic energy dissipation were obtained in August 2010 in the central valley of the Mid-Atlantic Ridge near 37°N, using a microstructure velocity shear sensor aboard the autonomous underwater vehicle AUV Abyss. The campaign was complemented by “classical” lowered and mooring-based density and velocity measurements. In the deep ocean above complex bathymetry AUV-based measurements are thought to be far more efficient in resolving spatial patterns of mixing than the commonly used free-falling or lowered turbulence probes. During several dives within the central valley the AUV made multiple crossings over a deep sill –characterized by unidirectional bottom-intensified flow - separating two basins below 1800 m.
Here we present preliminary results of the measurement campaign. The raw velocity shear data shows a high degree of noise caused by high-frequency vibrations of the AUV. We demonstrate that much of the noise can be removed with established filter techniques relying on simultaneous velocity shear and acceleration measurements (Goodman et al. 2006). After noise-reduction, we are able to show that regions of elevated high-frequency shear signals largely coincide with high-freqeuncy temperature variations (the latter being insensitive to AUV vibrations). In such regions the temperature and shear spectra have similar characteristics. This suggests that the deep ocean AUV-based velocity shear measurements are indeed sensitive the dissipation of turbulent kinetic energy. The horizontal length scale of regions with elevated dissipation rates ranges between 30 meter and 900 meter. The areas are found vary in time – possibly caused by the varying flow field.