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Observation of internal wave breaking on the deep ocean seafloor and associated mixing

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Small-scale diapycnal mixing participates to the circulation of the abyssal ocean, and is known to be intensified near the sea-floor, where internal tides are generated and eventually break. Parametrization of this bottom-intensified mixing in global circulation models still needs to be improved, and this requires observations. Such processes are characterized by :
- a high level of turbulence, requiring high sampling rate measurements;
- intermittency, requiring a large number of samples;
- and vertical inhomogeneity, requiring a large number of instruments.
To satisfy these constraints, we chose to focus on temperature measurements, by means of innovative and versatile instruments, the High Sampling Rate Thermistors developed at the NIOZ. These autonomous sensors have been successfully used over the last decade in several deep seas and oceans, over a large variety of topographic features (seamounts, banks, trenches, ridges). Typically, one hundred sensors are mounted on a steel cable, moored at the ocean bottom, and measure temperature every second for month- or year-long durations. In the presence of weak stratifications, the 1mK resolution of the sensors is particularly useful. This original dataset gives an insight to phenomena occurring in the abyssal oceanic boundary layer, where tidal and higher frequency internal waves of large amplitude are systematically observed. It also provides via Thorpe scale analysis a quantitative estimation of turbulent dissipation and diffusivity. When averaged in space and time, these quantities confirm that, despite intermittency, vertical turbulent fluxes remain fairly high close to sloping boundaries due to internal wave breaking and subsequent re-stratification.