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Three dimensional dynamics of baroclinic tides at the Celtic Sea shelf break: on the results of in-situ observations and numerical modelling

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The three-dimensional dynamics of baroclinic tides in the shelf-slope area of the Celtic Sea were investigated numerically and using observational data collected on the 376-th cruise of the R/V "Discovery" in June 2012. The time series recorded at a shelf-break mooring showed that semi-diurnal internal waves were accompanied by packets of internal solitary waves with maximum amplitudes up to 105 m, the largest internal waves ever recorded in the Celtic Sea.

The observed baroclinic wave fields were replicated numerically using the Massachusetts Institute of Technology general circulation model. A fine-resolution grid with 115 m horizontal and 10 m vertical steps allowed the identification of two classes of short-scale internal waves. The first class was generated over headlands and resembles spiral-type internal waves that are typical for isolated underwater banks. The second class, generated within an area of isolated canyons, revealed properties of quasi-plane internal wave packets. The observed in-situ intensification of tidal bottom currents at the shelf break mooring is explained in terms of a tidal beam that was formed over supercritical bottom topography.