Geophysical Research Abstracts
Vol. 17, EGU2015-9862, 2015
EGU General Assembly 2015

Observations of seasonal exchange in the Celtic Sea slope region from underwater gilders

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Between June 2012 and January 2013, four underwater gliders, profiling to a maximum depth of 1000m, occupied a transect between 47.6°N, 10.3°W and 48.4°N, 9.3°W, perpendicular to the Celtic Sea continental slope. Due to the significant and well-documented internal tide activity in this region and the relatively slow through-water speed of gliders it is first demonstrated that the chosen sampling methodology minimised aliasing of the internal tide. Gliders were flown along a repeat transect and care was taken to ensure that each location was sampled at a different phase of the tide on repeat occupations. Through monthly averaging of the transect data, the effects of the internal tide are minimised and the lower frequency processes made visible. In this presentation we highlight the importance of the lower frequency variability in contributing to cross-slope exchange.

Analysis of monthly averaged glider transect data suggests two distinct regimes; 1) Summer, June – October, when the surface water was temperature stratified and, 2) Winter, from October to January, when the seasonal thermocline was mixed down to below the depth of the shelf break (200 m). During the stratified summer months a well-defined shelf break salinity front limits the exchange of water between the ocean and the shelf, preventing the spread of the more saline, sub-surface ocean water (centred at ∼150m) onto the shelf. Nevertheless, some cross-slope flow is identified during these months: an intermediate depth salinity minimum (centred at ∼600m) is observed to upwell (from 600m to 200-300m) up the slope, sometimes continuing onto the shelf. As the stratification is eroded during the winter months, subsurface upwelling switches to downwelling, and the intermediate depth salinity minimum (∼600m) retreats away from the slope region removing it as a potential source of oceanic water on the shelf. Downwelling near to the slope does however allow for an intrusion of the shallower high salinity water onto the shelf reducing the control of the shelf break salinity front, although it has not been ascertained whether this extends further onto the shelf than the shelf break region.