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Turbulent mixing over a shelf sea bank: linking physics to fish

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The interaction between stratified flow and topography has previously been seen to generate enhanced vertical mixing both locally and far field by breaking of an intensified wave field close to the generation point and from waves propagating energy away from the source. Here we present a new series of measurements made during the summer of 2008 that includes transect data from a Scanfish towed CTD that provides a snapshot of the vertical density structure and distribution of chlorophyll over the Celtic Sea from beyond the shelf break to 250km onshelf. The transect supports previous findings of a persistent level of primary production identifiable as a subsurface chlorophyll maximum (SCM). Intensification of chlorophyll is seen at the shelf break region and provides a biological indicator of mixing. Similarly, we identify a high concentration of chlorophyll over Jones Bank 200km from the shelf break in 120m depth. Measurements from an array of acoustic current profilers, thermistor stings and a turbulence profiler reveal that the shallow sloping bank and strong tides regularly interact to produce hydraulic jumps in the lee of the bank during spring periods identifying Jones Bank as a mixing hotspot. The energy dissipated during these events act to erode the base of the strong thermocline and result in a vertical flux of nutrients into the stable, stratified environment. We suggest that it is the spring-neap modulation of this process which promotes intensified mixing over the bank. Nutrient measurements made during the experiment reveal that the ever changing mixing environment has significant influence on the phytoplankton community at the bank and is likely the key component in promoting enhanced biological production.