



A Lagrangian study of the influence of a canyon on an alongslope current

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The European slope current is a poleward flow which traces the shelf edge from the Bay of Biscay to the Faeroe-Shetland Channel and beyond. Along its path, this current encounters a variety of bathymetric environments, differentiated by slope steepness and level of topographic complexity, in particular due to indentation by canyons. In one region, the Malin shelf to the north of Ireland and west of Scotland, persistent intrusions of oceanic water occur onto the shelf. It has been suggested that these intrusions result from a tendency for the slope current to depart from the slope, and that the reason for this departure is bathymetric. The slope in this region is relatively smooth, however it changes in orientation and is indented by two significant canyons near to the source of the intrusions. The response of the slope current to these topographic features is considered here.

A purely geostrophic flow must follow isobaths. When the curvature of the topography is too great, flow becomes ageostrophic and may cross isobaths, stretching the water column vertically and inducing cyclonic vorticity. In this study, a Lagrangian approach was taken, in which a dye tracer, fluorescein, was injected into the slope current upstream of the canyons and used to track the behaviour of a tagged water column as it encountered the topography in its path. The dye injection was mid-slope, at a depth of 181 m in a water depth of 625 m, and 10 km upstream of the southernmost canyon. Dye was followed for 4 days as it advected alongslope at a mean speed of 0.13 ms^{-1} , a relatively weak flow for this site, while repeated transects were made across it using a free-fall turbulence profiler. Rather than following isobaths around the heads of the canyons, the dye-tagged water took a more direct route across them. The dye-laden part of the water column stretched by around 50%, comparable to the proportional change in bottom depth, but this stretching was in large part reversed downstream and the dye resumed its alongslope flow. It appears that the weak slope current was able to pass over this pair of canyons and resume its alongslope trajectory without significant disruption to its path.