



Ocean-shelf interaction and exchange (Fridtjof Nansen Medal Lecture)

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A brief review will be given of physical processes where shallow shelf seas border the deep ocean, including waves that travel and propagate responses around the ocean boundary. Some implications for ocean-shelf exchange of water and its physical and biochemical contents will be discussed, along with an outline of some studies estimating these exchanges. There will be an emphasis on the north-west European shelf edge.

A recent study is the project FASTNet: “Fluxes across sloping topography of the North East Atlantic”. This aims to resolve seasonal, interannual and regional variations. Novel and varied measurements have been made in three contrasting sectors of shelf edge: the Celtic Sea south-west of Britain, the Malin-Hebrides shelf west of Scotland and the West Shetland shelf north of Scotland. Previous studies established the existence of flow along the continental slope in these areas, more persistently poleward in northern sectors. Modelling aims to diagnose and estimate the contribution of various processes to transports and to exchange along and across the slope.

Estimates obtained so far will be presented; overall transport from drifters and moored current meters; effective “diffusivity” from drifter dispersion and salinity surveys; other estimates of velocity variance contributing to exchange. In addition to transport by the along-slope flow, possible process contributions which may be estimated include internal waves and their Stokes drift, tidal pumping, eddies and Ekman transports, in a wind-driven surface layer and in a bottom boundary layer.

Overall estimates of exchange across the shelf edge here are large by global standards, several m^2/s (Sverdrups per 1000 km). However, the large majority of this exchange is in tides and other motion of comparably short period, and is only effective for water properties or contents that evolve on a time-scale of a day or less.