Geophysical Research Abstracts
Vol. 12, EGU2010-1378, 2010
EGU General Assembly 2010


# Deep ocean exchange with west-European shelf seas

John M. Huthnance, Jason T. Holt, and Sarah L. Wakelin
NERC Proudman Oceanographic Laboratory, Liverpool, United Kingdom (jmh@pol.ac.uk, +44-(0)151-7954801)

We review mechanisms and studies of exchange between the north-east Atlantic and the adjacent shelf sea. Well-developed summer upwelling and associated filaments off Portugal and north-west Spain give exchange O(3 $m^2$/s per unit length of shelf). Prevailing westerly winds further north drive exchange O(1 $m^2$/s). Poleward flow along most of the upper slope has associated secondary circulation O(1 $m^2$/s), meanders and eddies. Eddies are shed from slope waters into the Bay of Biscay, and local exchanges occur at shelf spurs and depressions or canyons (e.g. dense-water cascading of order 1 $m^2$/s). Tidal transports are larger, but their reversal every six hours makes exchange largely ineffective except where internal tides are large and non-linear, as in the Celtic Sea where solitons carry water with exchange O(1 $m^2$/s). These various physical exchanges amount to an estimated 2-3 $m^2$/s per unit length of shelf, between ocean and shelf. A numerical model estimate is comparable: 2.5 x $10^6$ $m^3$/s onto and off the shelf from Brittany to Norway. Mixing controls the seasonal thermocline, affecting primary production and hence fluxes and fate of organic matter. Specifically, $CO_2$ take-up by primary production, settling below the thermocline before respiration, and then off-shelf transport, make an effective shelf-sea "pump" (for $CO_2$ from the atmosphere to the deep ocean). However, knowledge of biogeochemical fluxes is generally sparse, giving scope for more measurements, model validation and estimates from models.