Geophysical Research Abstracts
Vol. 20, EGU2018-9508, 2018
EGU General Assembly 2018

Transport in a temperate wide shelf during the summer

Eugenio Ruiz (1), Jonathan Sharples (1), and Jo Hopkins (2)
(1) University of Liverpool, United Kingdom , (2) National Oceanographic Centre, United Kingdom

We address the problem of how water is transported through the interior of a wide shelf sea, in the context of the seasonality of nutrient supplies from the open ocean to the shelf and the ability of the shelf to export carbon back towards the open ocean. Our focus is on the central Celtic Sea and the adjacent NE Atlantic Ocean. We calculated the Ekman, Stokes and total transport in the surface, pycnocline and bottom layers at a site in the Central Celtic Sea. ADCP and CTD time series from a mooring and wind data from a surface buoy between June and December 2014, were used to assess transport and hydrographic variability in the water column. Baroclinic velocities were calculated by subtracting the depth-averaged velocity at each time step. Three layers were distinguished throughout the period based on a change of 0.02 kg m-3 and 0.015 kg m-3 from bottom and surface density, respectively. The total transport in each layer was calculated for each time step and averaged every 50 hours (4 M2 periods). The total transport was separated into Eulerian and Stokes components, where the Eulerian transport consists of the integrated velocities within the mean thickness of each layer for every 50 hour period, and Stokes transport results from the variability in the thickness of the layers. Ekman transport was calculated by averaging surface density and wind stress every 50 hours. In addition, Empirical Orthogonal Function (EOF's) analysis was performed on the baroclinic velocities and salinity measurements for each sampling period. Our results indicate that average transport in summer in the surface mixed layer is south-eastward (towards the shelf break), and north-westward (into the shelf interior) in the bottom mixed layer. Removal of the Ekman contribution results in north-eastward and south-westward transports in the surface and bottom layer, respectively, indicating a strong influence of wind stress on the transports at the Central Celtic Sea site. Analysis of the Stokes transport indicates that on average water in the pycnocline layer is being transported off shelf in the south-westward direction and on shelf in the surface and bottom layer. The first mode of the EOF analysis indicates a flow in the surface layer opposite to the flow in the bottom layer similar to the Ekman transport. The second mode shows a flow in the pycnocline that is opposite to the direction of the flow in the mixed and bottom layer as the Stokes transport; this transport is consistent with mean flows generated by an internal tidal wave propagating across the shelf from the shelf edge. Results from EOF's analysis suggest that the Ekman and Stokes transport account for about 65 and 15%, respectively, of the variability in the transport at the Central Celtic Sea.