Geophysical Research Abstracts
Vol. 19, EGU2017-17858, 2017
EGU General Assembly 2017

Seasonality in the cross-shelf physical structure in a temperate shelf sea

Eugenio Ruiz-Castillo
University of Liverpool, Liverpool, United Kingdom (ruizc@liverpool.ac.uk)

The Celtic Sea represents a transition zone between saline open ocean Atlantic water and fresher waters of the Bristol Channel. The convergence, circulation and exchange of these waters are key to understanding the nutrient cycling on the shelf. The mean annual contribution of salinity to density is thought to be relatively small, however seasonality in fresh riverine input helps to modify horizontal density gradients that drive shelf-wide circulation patterns and important cross-shelf transports. Here we describe the seasonal influence of the fresher coastal waters and heat input on the hydrography of the Celtic Sea. CTD data from 9 oceanographic cruises, obtained in the period between March 2014 and August 2015, were used in the analysis. In the early part of the year (winter), when the rate of surface heating is low and the riverine discharge is a maximum, the salinity differences are important in determining the density structure. The haline horizontal gradient is strengthened in winter by the input of fresher water from the Bristol Channel. In spring the atmospheric heat input generates an homogeneous warm layer in the upper 30 m which allows to remove the temperature gradient terms in the horizontal pressure gradient force. Therefore the pressure gradient force, which depends on the salinity gradient, is balanced by the frictional terms in the vertical. This leads to opposite flows in the bottom and surface layers. Analogous to estuarine circulation, fresher waters appear to be transported offshore in the surface layer and relatively high salinity waters are transported onshore in the deeper water. The displacements of the salinity contours indicate upper offshore and bottom onshore flows of 1 km/day. In the upper layer, an onshore flow with high salinity waters occurs when the horizontal pressure gradient is weakened following the low outflow from the Bristol Channel. In winter, enhanced winds and heat loss mix the water column. Through these mechanisms the properties of the water masses along the Celtic Sea are redistributed and mixed. The Celtic Sea dynamics can be explained using the estuarine circulation theory.