

Particle tracking in the eastern Irish Sea

Judith Wolf (1), Karen Amoudry (1), Hazel Phillips (2), and Jenny Brown (1)

(1) National Oceanography Centre, Marine Systems Modelling, Liverpool, United Kingdom (jaw@noc.ac.uk), (2) Liverpool University, Liverpool, UK

The unstructured grid finite volume community ocean model (FVCOM) has been applied to the west coast of the UK, in order to examine the circulation and transport in the eastern Irish Sea. Tides, freshwater river discharge and meteorological forcing for the year 2008 were used to force the baroclinic hydrodynamic circulation.

The hydrodynamics of the Irish Sea are largely governed by the semidiurnal tide, which has a tidal range reaching 10m at Liverpool in the eastern Irish Sea. Tidal currents reach 1 ms^{-1} over the majority of the area, which means that much of Irish Sea is vertically well-mixed throughout the year period, with a few areas affected by seasonal stratification, such as the cyclonic gyre in the deep channel off Ireland in the western Irish Sea which experiences thermal stratification in summer. In Liverpool Bay, horizontal density gradients, created through freshwater influence from estuaries along the coastline interact with the strong tidal current to produce a phenomenon known as strain-induced periodic stratification (SIPS).

There are water quality concerns due to the tendency to eutrophication, as the area is often exposed to industrial pollution and excess nutrients from effluent waters and rivers. There is also concern about the fate of radioactive materials discharged from the Sellafield nuclear reprocessing plant since 1952. In addition to the present discharges from the site, it has been estimated that it is likely that all of the americium and plutonium and around 10% of the caesium entering the Irish Sea were originally assimilated into deposits of silt and mud sediments; this material may be regarded as a considerable potential source of radionuclides. Determining suspended sediment pathways in this region is important in order to identify potential areas vulnerable to deposition of radioactive material, particularly as radionuclide uptake onto sediments takes place in the offshore 'mud patch' before returning to the coast to be deposited in saltmarshes.

A particle tracking experiment has been carried out in order to examine advection and dispersion of particles released at different levels in the water column. The particle tracking has been carried out using the FVCOM offline particle tracking software, using multiple particle releases at select locations. The results are used to identify possible fates of suspended sediment and associated pollutants.