



Modelling marine litter dispersal in the North Sea

J. van der Molen, T. Maes, L. Fernand, and P. Kershaw

CEFAS, Environment and Ecosystems, Lowestoft, United Kingdom (johan.vandermolen@cefas.co.uk)

Negligible harmful effects of marine litter on the coastal and marine environments is one of the high level descriptors of Good Environmental Status (GES) of the European Marine Strategy Framework Directive (MSFD). Assessments of GES require spatial information on the quantities and types of litter in the marine environment. Here, to inform such assessments, a particle tracking model was used in combination with the three-dimensional hydrodynamics model GETM (www.getm.eu) to simulate transport pathways and potential accumulation areas of litter with a number of types of schematised floating or sinking characteristics in the North Sea. Model runs for which particles were released at regular intervals from river mouth locations identified typical transport pathways for litter discharged by rivers. Model runs with instantaneous releases of particles with a uniform spatial distribution suggested potential accumulation areas. The results indicated a marked difference in transport pathways between buoyant and sinking particles, as buoyant particles are much more influenced by hydrographic fronts, which tend to be limited to the surface mixed layer. The magnitude of (positive or negative) buoyancy was found to be much less important than the sign. For the riverine sourced model particles, a substantial number ended up on beaches within 200 km from the source. Particles from rivers, grouped by geographic proximity, that remained in the water followed distinct pathways aligned with the residual circulation. The general position and direction of these pathways compared well with experimental tracks obtained from ARGOS drifters. For the particles released with a uniform spatial distribution, floating particles displayed a higher level of accumulation than sinking particles, the distributions of which were more diffuse. Floating particles accumulated (i) on hydrographic fronts, in particular the high salinity gradient marking the Region of Fresh Water Influence (ROFI) of the continental rivers, (ii) in the gyre in the Skagerrak, and (iii) in the central North Sea. Sinking particles accumulated in deeper areas (Oyster Grounds, Norwegian Trench). Further work will include analysis of and comparison with field observations of litter.

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