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Reducing uncertainty in dispersal predictions: validation of particle tracking model with drifter data.

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Lagrangian Particle Tracking Models (PTMs) have a wide range of applications in the marine environment, from predicting the dispersal of microplastics to larval transport. In two decades computational power have increased exponentially allowing PTMs to move from probabilistic approaches (e.g. advection and random walk) to more deterministic methods (e.g. including animal behaviour and buoyancy).

Validation of hydrodynamic models simulating oceanographic processes has allowed confidence in their accuracy at simulating mean-flow fields (i.e. at the order of tens of metres and minutes). However, methods to validate PTMs appear less developed due the complexity of biophysical process interactions; for example, wind and wave combined impact on surface currents and larvae behaviour such as vertical and horizontal swimming.

Here, we use a novel set of data representing the travel of drifters in the Irish Sea during summer 2021. The experiment aim is to reduce the near surface flow uncertainty influencing particle dispersal (i.e. larvae, microplastics and pollutant). Data were collecting using a range of drifters designs released in coastal, estuarine and offshore locations of a tidally dominate shelf-sea (Irish Sea): 1) variation of drogue depth between 1m and 5m; 2) variation of period from tidal cycles to spring-neap cycles; and 3) some with reduced “windage” designs (no drogue and minimal exposure above surface).

The results allowed us to measure the difference of dispersal between PTM created associated to high-resolution 3D hydrodynamic model and data collected. The validation of a deterministic PTM created will be presented, with a discussion of wind and wave impact on surface current flow and uncertainty of the PTM. For example, we find some scales of oceanographic processes that affect transport, such as turbulent eddies and waves, were not resolved - and yet our predictions broadly matched observations.