
Modelling microplastic dispersal in a well-mixed estuary

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Abstract

Rivers and estuaries act as conduits of microplastic transport, linking terrestrial and marine environments. In densely populated catchments, microplastic pollution could impact human populations and natural ecosystems including through industry, domestic activities or direct exposure. The physical behaviour and movement of microplastics in estuaries and coastal areas is still a relatively unexplored area of research. An investigation into the dynamics of microplastic behaviour within estuarine systems will allow for a greater understanding of plastic retention and exportation to coastal and offshore environments. This study aims to combine high resolution modelling of estuarine processes with current and future projections of microplastic concentrations to determine local exposure levels, residence times and temporal variability.

The Conwy Estuary (UK) is a well-mixed macro-tidal, embayment type system connecting the Conwy catchment to the North Wales coast and Irish Sea – where waters are used for leisure and aquaculture. Microplastics derived from the catchment population, industry and agriculture are thought to flow into the estuary primarily from the Conwy River network. A D-Flow Flexible Mesh (D-Flow FM) model, a module of the Delft3D-FM suite, has been set up and validated for the Conwy Estuary and North-Wales coast in three-dimensions, showing highly accurate results both in and outside the estuary. The results of the model validation as well as preliminary plastic dispersal simulations and validations will be presented.

Keywords: microplastic, modelling, particle tracking, estuaries, well, mixed estuaries, D, Flow FM

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