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CHARACTERISING VARIOUS EBB-TIDAL JET STRUCTURES OBSERVED IN UK ESTUARIES THROUGH IDEALISED MODELLING

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Ebb-tidal jet governs the circulations of nutrients, pollutants, and sediment within a tidal inlet system and its adjacent beaches. At Montrose Bay, Scotland, UK, the horizontal structure of its ebb-tidal jet is strongly influenced by the configuration of its shoreline and tidal forcing. In this study, ebb-tidal jet structure and dynamics under various inlet configurations are studied through an idealised numerical modelling approach using D-Flow FM of Delft3D FM. We began by developing an idealised Montrose model that simplifies the shoreline, bathymetry, and tidal forcing of the real-field condition. The developed idealised model showed good agreement when compared to the real-field model.

Further, three additional inlet scenarios were constructed by varying the shoreline, bathymetry, and tidal forcing parameters. These scenarios explored the effects of headland presence, inlet position, and tidal current orientation on flow patterns and surface plume formation. The simulations revealed distinct ebb-tidal jet structures and dynamics across the four scenarios, which were subsequently analysed. The modelled surface plume formations showed a qualitative similarity with satellite observations of analogous UK estuary inlets, providing preliminary validation for the model. This research highlights the potential of combining remote sensing and numerical modelling to improve our understanding of tidal inlet hydrodynamics and their ecological implications.