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Characterization of the influence area of the North Adriatic major rivers by means of passive tracers modeling

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The work here presented investigates, by means of a finite element model, the dynamics of different water masses of riverine origin in the coastal area, identifying the plume spreading and the areas of influence of each freshwater source. The implementation is focused on the North Adriatic Sea where the main freshwater supply of the whole basin is provided.
The modeling tool used is SHYFEM 3D (Shallow water Hydrodynamic Finite Element Model), a primitive equation model running on unstructured grids, specifically suitable for reproducing highly complex morphologies like fragmented coastlines, embayments and estuaries.
An effort is made, from a modeling point of view, to reproduce, on the different spatial scales, the main processes characterizing the estuarine and the coastal hydrodynamics. The challenge consists in simulating the whole physics and in reaching the needed high temporal and spatial resolution.
The zones of influence of the North Adriatic rivers are defined simulating the fate of different passive tracers released at each estuary.
Seasonal variations and specific meteorological conditions are discussed defining the preferential patterns of estuarine waters.
The investigation zooms on the identification of the horizontal and vertical structure of river plumes, water stratification and turbulent mixing.
From a first evaluation of results the importance of the discharge amount in defining the river area of influence is evident. The Po river discharge can characterize areas offshore in some periods of the year, while the waters of other rivers (Tagliamento, Isonzo, Piave, Brenta and Adige) are more confined alongshore. There is not an evident mixing of different river waters along the coast, but the freshwater of all rivers determines a continuous pattern of thermo-haline currents along the North Adriatic littoral. Local effects of wind forcing can also affect the river water fate enhancing the plume spreading in specific cases.
The implementation of 3D models computing passive tracers can play an important role also in further investigations of sediment dynamics of estuarine origin in the coastal area, marking their provenience.