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Hydrodynamics of the Po River-Delta-Sea system

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The hydrodynamics and the interaction between riverine and marine waters in the Po River-Delta-Sea (RDS) system (Italy) was investigated. Many of the hydro-dispersive phenomena evolving from the interaction of the different water bodies of the RDS system were described applying an unstructured 3D numerical model to a domain comprising the Po river branches, 7 coastal lagoons and the shelf sea. The model was successfully calibrated and validated for water levels, fluxes at the inlets and at the river branches, and water temperature and salinity observations. The use of such a comprehensive approach allows the characterization of the general hydrodynamics of all the components of the Po RDS system, of the water exchange between different water bodies as well as the Po river discharge distribution among all branches. The analysis of calculated coastal current patterns in the prodelta of two different years and during a flood event, confirms that the Po River is the main driver of the baroclinic coastal sea circulation. However, when strong winds occur (Sirocco and Bora) the surficial circulation of the shelf area is significantly modified. Generally, the lagoons of the Po RDS system can be considered hydro-dynamically active since their tidal prisms represent a relevant fraction of each lagoon's volume. The natural consequence is that the lagoons show an active flushing with water renewal times in the order of few days. The hydrodynamics is mainly forced by the tide and is locally enhanced by riverine inputs and wind. Where freshwater inputs are significant, they are responsible of the lagoons salinity patterns that show high spatial gradients (not all the lagoons are well mixed) and temporal variability. The variability of the freshwater discharges and the complex morphology of the Po RDS allows the presence of both marine and riverine environments.