

EGU22-10612

<https://doi.org/10.5194/egusphere-egu22-10612>

EGU General Assembly 2022

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Modelling of sediment transport pattern in the estuary of the Piave River

Antonia Menzione and Marco Mancini

POLITECNICO DI MILANO, CIVIL AND ENVIRONMENTAL ENGINEERING, MILANO, Italy (antonia.menzione@polimi.it, marco.mancini@polimi.it)

Over the last decades numerous models for sediment transport prediction have been proposed with application to fluvial transport or littoral transport. However, the morpho-dynamic interactions that occur at the river mouth are still largely unexplored given different concurring phenomena, deriving from both river hydraulics and marine hydrodynamics. Knowing the magnitude of these phenomena is important to analyse and predict sediment discharge and deposition, erosion and potential effects on biological processes. The paper investigates the possibility to assess the behaviour of suspended sediment pattern at river mouth using numerical models and satellite images, providing a platform for the prediction of the effect of climate change in estuarine morpho-dynamic.

For this purpose, the hydrodynamic model (TELEMAC-2D) and the sediment transport model (SISYPHE) are coupled and their simulated suspended sediment maps are compared with the satellite Sentinel 2 images of SSC (suspended solid concentration) supporting the advection diffusion model coefficients calibration.

TELEMAC-2D, a module of TELEMAC, solves the Saint-Venant equations and allows to evaluate the depth of the water, the depth-averaged tidal currents and the velocity components. Based on the outputs of the hydrodynamic simulation, the SISYPHE module simulates the transport of the fine sediments by calculating the erosion / sedimentation fluxes, concentration in the water column and layer thickness of deposited fine sediments using the Krone and Partheniades formulation, as well as the bedload flux calculated as a function of the friction and the bed shear stress. The estimate of suspended solids from remote sensing data is performed based on the relationship between SSC and spectral reflectance.

The case study in consideration is the estuary of the River Piave (3000 sq km), which flows from the eastern Italian Alps to the North Adriatic Sea. The impacts and influence of the different drivers (fluvial current, tidal currents, etc.) on the concentration, dispersion pattern and deposition of sediment are discussed.