

RESEARCH INTERESTS:

A first topic of my research focuses on tidal basin morphodynamics and geomorphology.

I developed a numerical model which aims at describing hydrodynamics and wind waves generation and propagation within shallow microtidal basins.

Such a numerical approach confirmed the prominent role of wind waves in resuspending bottom sediments in shallow tidal basins. Based on this results a conceptual stability model has been proposed which indicates that the intertidal landscape in shallow basins is organized into a bimodal distribution of bottom elevations, with the two peaks corresponding to salt marshes and tidal flats, and few areas lying at intermediate elevations. The model shows that this bimodal distribution of elevations, in shallow waters, is mainly related to wind wave shear stress.

A sediment transport model has been developed to be coupled to the wind wave-tidal model. The sediment transport model considers a bi granular mixture of both cohesive and non cohesive sediments and describes resuspension, deposition and related bottom evolution in term of elevation and composition.

Following a considerably different approach the research activities also focused on the analysis of the processes that govern the formation and evolution of tidal networks using an experimental apparatus developed in the laboratory of the Department ICEA (formerly Department IMAGE). The experiments allowed us to understand the mechanisms of formation of networks and their response to cycles of raising and lowering of the mean sea level. The future development of this line of research concerns the analysis of the effects of the cohesion of the sediment and the presence of vegetation. In parallel to these activities, conceptual (numerical and/or analytical) models have been developed for studying the long-term evolution of tidal environments considering the effect of vegetation and climate change.

The further topic of the research aims at analyzing levee stability conditions and flood wave propagation within the river network and over the adjacent rural and urban areas, as a consequence of levee failure due to levee-breach formation and development, as a consequence of surface erosion by flow overtopping or levee underseepage.