Transport phenomena of graded sediments in tidal environments

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A long-term morphodynamic model simulating the ontogenesis and evolution of a tidal lagoon has been undergoing a continuous improvement in order to enrich its predictive ability and assess the relative importance of different factors, of both natural and anthropogenic origin, in defining the equilibrium configuration of such systems. A significant step forward in this direction is achieved by introducing the possibility to extend the analysis from uniform to graded sediments. In the latter case the representation of long-term phenomena is conceptually the same as for a sediment characterized by a single granulometric class, as far as it concerns the temporal averaging and the splitting of the transport in a dispersive component (mainly given by tidal action) and an eulerian residual convective component (resulting from rivers, long-shore currents, and asymmetry between flood and ebb flow fields). The horizontal sediment budget, however, is now coupled with a sediment budget among the different granulometric classes in the bottom, and precisely in a "mixing layer" whose thickness has to be properly defined. This new enhancement of the model allows, beside a more precise description of the morphodynamic processes, a certain number of further investigations. As a first point, it makes it possible to study the effect of the initial stratigraphic conditions on the genesis and evolution of the tidal basin, thus obtaining some informations about the persistence of "geological memory" in the system. Another matter, of environmental interest rather than strictly morphodynamic, concerns the possibility of creating "auxiliary classes" among the grainsize classes in order to label and track contaminated sediments, providing a prediction tool and a decisional support in case of environmental accidents. Such a sediment tracking could also be used to distinguish the sediments according to their fluvial or maritime origin, defining in this way a criterion for the classification of the various morphological features which can be found within the system.
A sensitivity analysis of the main parameters is under way.