Current advances on the bed morphology modeling of the Gironde estuary

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The Gironde estuary, in France, requires more and more attention due to many human activities in this zone. Under the combined action of tidal currents and river flow rate, large amounts of sediments can be transported, which induces severe bed evolution and thus affects human and industrial activities or navigation. For instance, severe sedimentation and sand bank migration have been observed in the central part of the estuary where EDF (Electricité de France) exploits a power plant. These morphodynamic evolutions may affect the thermal diffusion from the outflow of the power plant. Therefore, numerical tools have been built to predict these bed evolutions over a time-scale of a decade.

Previously, the developed numerical strategy embedded two models: a large model covering the whole estuary and a local model covering the central part of the estuary: about 20 km up- and downstream the power plant (Chini and Villaret, 2007). The large model was only used to compute hydrodynamics and its results were then introduced as boundary conditions for the local model. Hydrodynamics, sediment transport and bed evolutions were finally computed on this local model. The hydrodynamics is computed by Telemac 2d whereas the sediment transport and the bed evolutions are calculated by Sisyphe. The motivation of this embedded model strategy was to reduce the computational time by only calculating the bed morphology in the needed zone. However, this strategy induces additional uncertainties concerning the boundary condition required for the sediment transport equation. Indeed, a concentration level must be specified when the flow enters the domain whereas this concentration value is free otherwise.

A solution, as proposed in this contribution, is to concurrently compute the sediment transport and the bed morphology on the large model. It is performed a new large model including a better description of the bathymetry and a finer mesh (Huybrechts et al. 2010.) In parallel, different developments have been introduced into the numerical tools: dynamic prediction of the friction coefficient and definition of a correction factor for the advection velocity taking into account that the largest part of the sediment is transported near the bed. As test case, these developments will be illustrated on the Gironde estuary.

Chini N., Villaret C. 2007: Numerical modeling of the bed evolution downstream of a dike in the Gironde estuary, *Proceedings of the River, Coastal and Estuarine Morphodynamics Conference.*

Huybrechts, N., Van A.-L., Hervouet, J.M. and Villaret, C. (2010) “Refined hydrodynamic modelling of the Gironde estuary, France”, accepted abstract *ICCE 2010* Shanghai.