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SEDIMENT MOBILITY AND RECENT MORPHOLOGICAL CHANGES IN A MESOTIDAL SYSTEM: THE ARCACHON LAGOON

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The Arcachon lagoon is a mesotidal embayment in the south coast of the bay of Biscay. Its total surface is about 174 km² at high tide, where 65% is formed of tidal flats. From the period of the oldest reliable bathymetric map (1865), the sediment budget estimated for 126 years showed sedimentary accretion within tidal flats, which rarely exceeded +0.5m, whereas the main distributary channels connected to the tidal inlet experienced net erosion of a few meters (L'Yavanc, 1995). Thus, these relatively low values suggest that the general residual morphology of the lagoon is stable and almost unchanged in the long term (Allard et al., 2010).
Recent studies attempted to link intertidal morphology with short-term hydrodynamics and sediment dynamics, showing that stormy wind waves cause erosion of several cm (Sottolichio et al., 2008). Additionally, tidal flats experience erosion and accretion of several dm at the seasonal scales (Ganthy et al., 2013). These new results are consistent with the most recent observations made by end-users of the lagoon, suggesting relative infilling of the channels and relative increase of turbidity in the inner waters. This suggests that a mobile stock of surficial fine sediment is available in the lagoon, which is able to be exchanged between the tidal flats and the channels, depending on the hydrodynamic conditions. However, there is still little knowledge on this stock and on trends of sediment mobility in the lagoon.
In this work we show a set of unpublished data on physical forcings, sediment dynamics and bathymetry of the lagoon, covering a recent period starting in 1993. We emphasize on morphology data from LiDAR, SPOT and Quickbird images. The aim is to discuss recent changes on morphology and their link with the mobility of the surficial sediment under natural and anthropogenic effects (including channel dredging works).

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A SYNTHESIS OF TRENDS OF THE TURBIDITY MAXIMUM IN THE GIRONDE ESTUARY. LESSONS FROM PROCESS-BASED NUMERICAL MODELLING, LONG-TERM AND HIGH-FREQUENCY IN SITU MONITORING

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Estuaries are complex coastal systems under constant evolution, where habitats are submitted to natural and anthropogenic pressures,, these latter including channel dredging, sand excavation, embankment and land reclamation. The Gironde estuary is well documented, but little attention has been paid to recent morphological evolution (last 40 years), including links between bathymetry, hydraulic regime and sediment transport patterns. In addition, a key issue is to grade the basic mechanisms promoting fine sediment trapping. This was achieved by a 3D numerical model which simulated in academic situations: i) the formation of the turbidity maximum under tidal asymmetry effect only and ii) the stability of the suspended mass budget due to density stratifications in the lower estuary. The comparison with satellite imagery shows that the model reproduces well the geometry of the real turbidity maximum at different seasons. In the lower estuary, the lateral suspended sediment flux from the main navigation channel to the eastern bank promotes the transfer of sediment towards the downstream part of the estuary and the escape of sediment through the mouth.
As for the long term, the morphological evolution of the Gironde estuary over 41 years (1953-1994) has been studied by the analysis of bathymetry with GIS. Results show that the zone of maximum volume of deposited sediment has migrated continuously towards the upstream sections of the estuary, which is coherent with the decrease of summer river flow and the upstream shift of the turbidity maximum toward the riverine sections.
Finally, the variability of turbidity in the upper estuary since 2005 is analysed by high frequency records of turbidity. The dependence of turbidity on tidal range and river flow are investigated. In particular, the relationship between turbidity and river discharge follows an hysteresis patterns during these transition periods.