



Long-term monitoring of water quality and suspended sediment transport in the Gironde fluvial-estuarine system (MAGEST program)

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With its 625 km², the Gironde Estuary (S-W France) is one of the largest European estuaries in terms of surface area and annual mean discharges. The Gironde Estuary is characterised by a pronounced turbidity maximum zone (TMZ) resulting from the asymmetry of the tidal wave when propagating upstream, coupled to density residual circulation. The seasonal variability of suspended particulate matter (SPM) of estuarine waters is remarkably high, with values ranging between 0.1 and 10 g/L. The main parameters controlling SPM transport in and out of the Gironde estuary are river flow and tidal currents, modulated by tidal range. The Gironde estuary is estimated to contribute to 60% of the input of fine sediments to the continental shelf of the Bay of Biscay. Although this system drains one of the less urbanized/industrialized watersheds in Europe, it is polluted by heavy metals, preventing oyster and mussel production within the estuary.

In a context of long-term environmental changes, i.e. climate and population growth, the development of a long-term monitoring program of the fluvial-estuarine system of the Gironde had thus appeared essential for addressing current and future water-quality issues and evaluations. The objectives of the MAGEST (MArel Gironde ESTuary) network since 2005 is to establish a reference database of four key parameters (temperature, salinity, turbidity, dissolved oxygen) to improve the knowledge of the Gironde estuary functioning, encompassing the aspects of hydrology, sediment dynamics and biogeochemistry. In this communication, we describe the MAGEST network, one of the first operational continuous monitoring systems in European estuaries. The detailed analysis of time series covering the first 5 years of continuous monitoring shows that temperature gives a similar response in the four stations of the network, the maximum values being recorded in summer. Salinity and turbidity are more variable among the stations depending of their localization. Salinity varies following the longitudinal estuarine gradient, but local effects of urban impact are also visible at intratidal timescales. Turbidity varies in response to the dynamics of resuspension-deposition cycle, superimposed to large fluctuations due to the seasonal shift of the TMZ from the upper to lower estuary that can be related to threshold values of river flow. In addition to these general patterns, the time-series had allowed to highlight inter-annual variability in relation with the local meteorology; 2005 and 2006 being rather dry and hot, at the difference of the following years. One of the instrumented stations, located in the fluvial section, had also offered the opportunity to investigate the impact of a dam rupture, 80 km upstream, on turbidity. Through these examples, we illustrate to what extent such a long-term monitoring is of valuable interest to better understand the functioning of a fluvial-estuarine system, to extract potential tendencies in addition to interannual variability and to register the possible effects of human activities and of changing climate on water quality and turbidity.