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Effects of waves on water dispersion in a semi-enclosed estuarine bay

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The bay of Saint Jean de Luz – Ciboure is a touristic destination located in the south west of France on the Basque coast. This small bay is 1.5km wide for 1km long. It is semi-enclosed by breakwaters, so that the area is mostly protected from waves except in its eastern part, where wave breaking is regularly observed over a shallow rock shelf. In the rest of the area the currents are generally weak. The bay receives fresh water inflows from two rivers. During intense raining events, the rivers can introduce pollutants in the bay. The input of pollutants combined with the low level dynamic of the area can affect the water quality for several days. To study such a phenomenon, mechanisms of water dispersion in the bay are investigated.

The present paper focuses on the effects of waves on bay dynamics. Several field experiments were conducted in the area, combining wave and current measurements from a set of ADCP and ADV, lagrangian difter experiments in the surfzone, salinity and temperature profile measurements. An analysis of this set of various data is provided. It reveals that the bay combines remarkable density stratification due to fresh water inflows and occasionally intense wave-induced currents in the surfzone. These currents have a strong influence on river plume dynamics when the sea state is energetic. Moreover, modifications of hydrodynamics in the bay passes are found to be remarkably correlated with sea state evolutions. This result suggests a significant impact of waves on the bay flushing.

To further analyse these phenomena, a three dimensional numerical model of bay hydrodynamics is developed. The model aims at reproducing fresh water inflows combined with wind-, tide- and wave-induced currents and mixing. The model of the bay is implemented using the code MOHID , which has been modified to allow the three dimensional representation of wave-current interactions proposed by Ardhuin et al. [2008b] . The circulation is forced by the wave field modelled with the code WAVEWATCHIII . A first confrontation between model results and in situ observations is provided, showing a reasonable agreement.

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