



## **Evolution of surge levels inside of the Seine Bay : interactions between tide and surge levels during Johanna and Xynthia storms**

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Within the Technical Commission for the Study and the Evaluation of Maritime Submersions in the Seine Estuary (CTeeSMES), which aim is to improve the collective knowledge on physical processes related to maritime surge levels, a numerical model of the Atlantic French Coast based on TELEMAC2D was used to study the evolution of surge levels from the ocean to the harbour area of Le Havre and evaluate the interactions between tide and surge levels in the Seine Bay.

The numerical model was specifically calibrated on JOHANNA and XYNTHIA storm events, which respectively occurred in March 2008 and in February 2010.

To calibrate the global signal (tide + surge levels), measurements available on 18 outputs of the Atlantic coast were used to optimize the coefficient for wind influence and for bottom friction. Maritime boundary conditions were provided by the North East Atlantic Atlas (LEGOS). Winds and pressure fields were CFSR data.

Once the numerical model had been calibrated both for tide and surge levels, it has been possible to draw the evolution of surge levels from the ocean to Le Havre (quai Meunier) and then to compare the signal obtained at each point of the Seine Bay with that obtained without taking into consideration tide for each event. That also allowed to evaluate the contribution of interactions between tide and surge levels inside of the Seine Bay for Xynthia and Johanna events, but also for other events in the slice [1979-2010] and considering climate change towards 2100 with IPCC5 scenarios.

It appears that instantaneous interactions between tide and surge levels nearly reach 50 % of the global surge levels and can sharply influence the evolution of surge levels in the Seine Bay depending of the moment (high tide or low water) at which the storm occurs.