



Future extreme water levels and floodplains in Gironde Estuary considering climate change

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Within THESEUS European project, an overflowing model of Gironde Estuary has been used to evaluate future surge levels at Le Verdon and future water levels at 6 specific sites of the estuary : le Verdon, Richard, Laména, Pauillac, Le Marquis and Bordeaux. It was then used to study the evolution of floodplains' location and areas towards 2100 in the entire Estuary. In this study, no breaching and no modification in the elevation of the dike was considered.

The model was fed by several data sources : wind fields at Royan and Mérignac interpolated from the grid of the European Climatologic Model CLM/SGA, a tide signal at Le Verdon, the discharges of Garonne (at La Réole), the Dordogne (at Pessac) and Isle (at Libourne).

A simplified mathematical model of surge levels has been adjusted at Le Verdon with 10 surge storms and by using wind and pressure fields given by CLM/SGA. This adjustment was led so that the statistical analysis of the global signal at Le Verdon gives the same quantiles as the same analysis driven on maregraphic observations for the period [1960 ; 2000]. The assumption used for sea level rise was the pessimistic one of the French national institute for climate change: 60 cm in 2100.

The model was then used to study the evolution of extreme water levels towards 2100. The analysis of surge levels at Le Verdon shows a decrease in quantiles which is coherent with the analysis of climatologic fields. The analysis of water levels shows that the increase in mean water levels quantiles represents only a part of sea level rise in Gironde Estuary. Moreover this effect seems to decrease from the maritime limit of the model towards upstream.

Concerning floodplains, those corresponding to return periods from 2 to 100 years for present conditions and 3 slices [2010; 2039], [2040; 2069] and [2070; 2099] have been mapped for 3 areas in Gironde Estuary : around Le Verdon, at the confluence between Garonne and Dordogne, and near Bordeaux.

Concerning the evolution of floodplains in Gironde Estuary, taking into account IPCC scenario A1B, under the same assumptions, it appears that the impact of the climate change on the quantiles of water levels in floodplains depends on the sea level rise over the period considered ([2010; 2039], [2040; 2069], [2070; 2099]) and that areas which are not flooded today for weak return periods become submerged towards 2100. The neighborhood of Le Verdon undergoes a negative impact only in the medium and long term. For the period [2010; 2039], a small reduction of floodplains can be observed in quantiles of water levels for all return periods. Under those assumptions, in the area of Bordeaux, significant effects would be felt along the road RN230 towards 2100. The effects of the discharges and dike breaching will have to be studied in order to precise these results.