Multi models approach to assess coastal exposure to marine inundation within a global change context

Low-lying coastal areas are often exposed to marine inundation inducing human and economic damage. Exposure to such events is likely to increase in the coming century due to a predicted sea level rise and storminess modifications (IPCC 2007). The ANR MISEEVA project aims to asses the shore vulnerability (present and 2100) to coastal flooding in the "languedoc" area (Southern France) using a numerical modeling approach.

Modeling strategy

➢Coastal flooding resulting from storm surge and waves is simulate by a package of three component models implemented in nested grids covering the offshore, coastal and nearshore regions.

➢Storm surge and tide are simulated by the unsteady shallow-water model MARS developed by IFREMER (Lazure and Dumas 2008) using 4 nested grids (mesh of 5km to 50m)

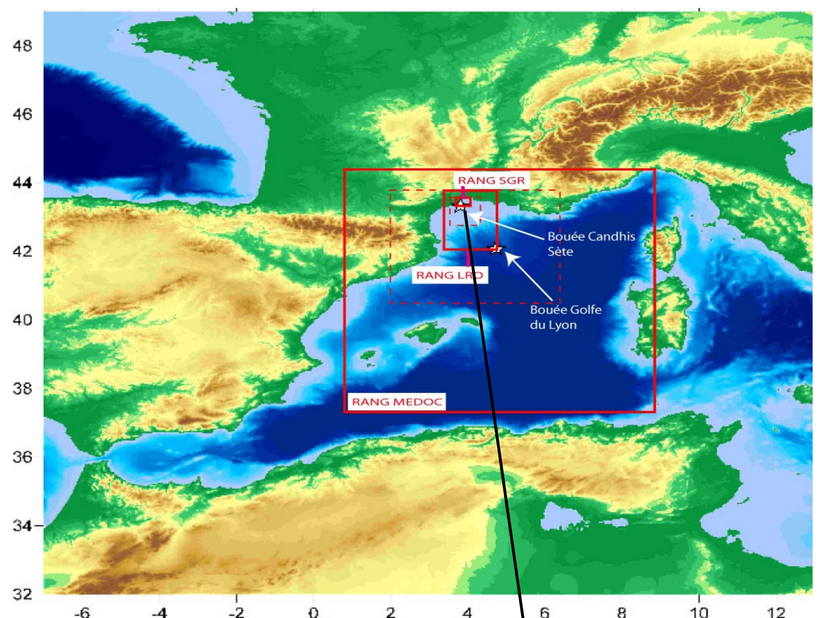
➢SWAN is used to the wave generation and propagation (4 nested grid: mesh of 5 km to 20m)

➢Surf zone processes and run-up are modeled by Surf-WB, developed by Bordeaux and Montpellier universities (Marche et al. 2007), using the outputs of MARS (water level) and SWAN (spectra) and a computational grid mesh of 2m. Surf-WB is a wave-by-wave code that solves the unsteady shallow-water system of equations and it incorporates well-balanced bore-capturing schemes for 2D wetting and drying processes.

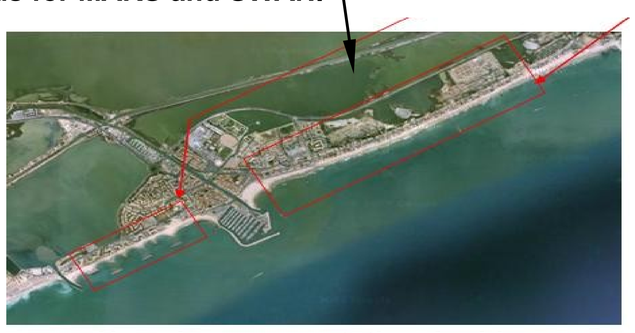
Climate change hypothesis

➢**Sea level rise**: two hypothesis are considered in 2100. The average value of 0.35m given by IPCC (2007) for the A2 socioeconomic scenario and the value of 1m proposed by Ramstorf (2007).

➢**Storms:** studies in the occidental Mediterranean (like IMFREX 2003) suggest a slight decrease in the storm frequency but the trend is no significant. Therefore, we consider the actual historical reference storm (November 1982) as a likely centennial storm in the coming century.



Nested grids for MARS and SWAN.

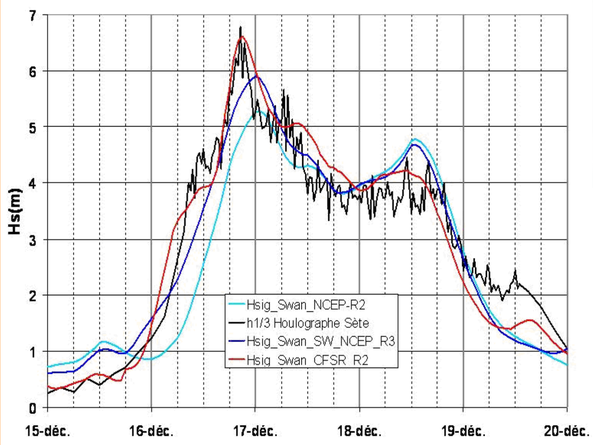


Nearshore computational grid.

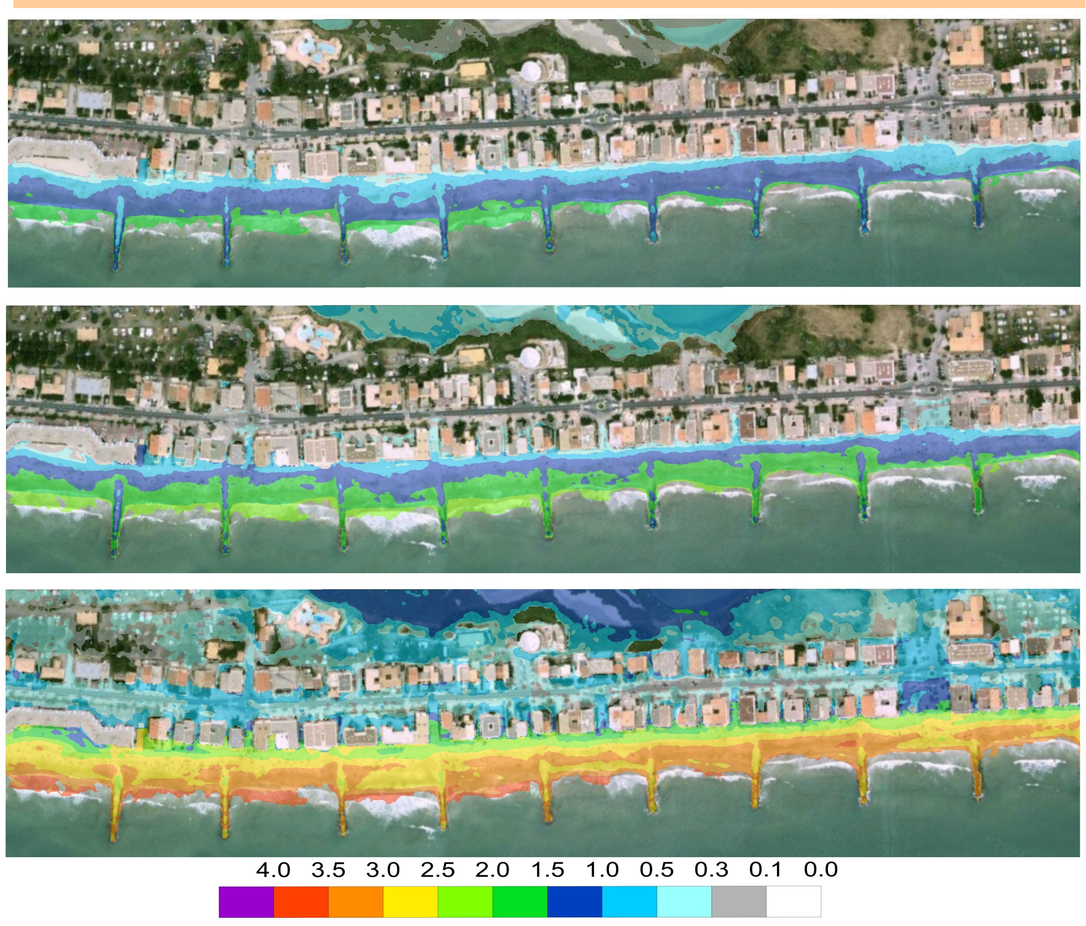
Input data

➢Wind and atmospheric pressure fields : several sources were tested. Best results are obtained with NCEP-R2 and CFSR re-analysis.

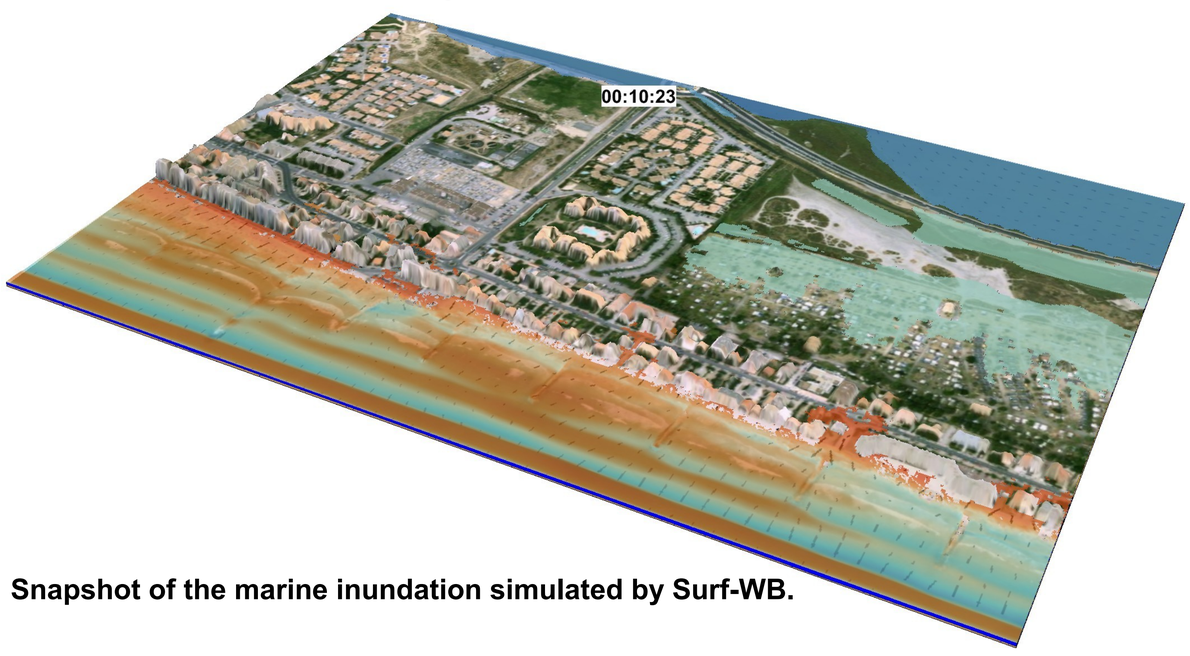
Bathymetry/topographic data: 3 main sources were used. GEBCO for the offshore. Provided by the SHOM (French hydrographic survey) for coastal zone. A DEM (building and coastal defense works) was constructed for the nearshore using LIDAR data.



Wave validation at Sète buoy.



Maximal water height (m) in the inundation area : top, at the present ; middle with a 0.35m of sea level rise ; bottom with 1m of sea level rise.



Snapshot of the marine inundation simulated by Surf-WB.

> Results of this modeling are the base document that allow to evaluate possible damages of assets at stake in the coastal zone and adaptation capacity in the coming century and draw a picture of possible futures depending on different hypotheses of protection and development strategy (Vinchon et al, 2010).

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