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Simulating coastal flooding during Xynthia through an improved static inundation method

J.-F. Breilh, E. Chaumillon, and X. Bertin
UMR 7266 LIENSs-CNRS, Université de La Rochelle, France (jbreil01@univ-lr.fr)

Storm surges and associated marine flooding are responsible for the largest human and material losses caused by storms. In France, the Xynthia storm (2/28/2010) induced a major flooding in the coastal plains of the central part of the Bay of Biscay, causing over 40 deaths and massive material damages.

Data from airborne laser measurements, obtained in 2010 by the French national institute of geography are used to produce a high resolution Digital Terrain Model. The storm surge associated with Xynthia storm was previously hindcasted using a modeling system, coupling the circulation model SELFE with spectral wave model WWMII and validated with hydrodynamic measurements obtained during the storm. The results show a strong amplification of the storm surge in estuaries, where it locally exceeds 2.0 m in the large shallow areas. Coastal water levels extracted from the storm surge modeling system are used to flood the DTM, taking into account the topographic barriers and connections with the ocean and the flooding period.

The results in terms of flooded areas are validated against observations (aerial photographs, satellite images) realized immediately after the storm. The analysis of the results shows that taking into account space-variable water levels originating from the modeling system improves flooding predictions, compared with water levels originating from a single measurement. Further improvements are locally obtained computing surge overtopping volumes by means of empirical formulae. These simulations are useful to determine areas with major risks and hazards and will help for future planning of urbanization and sizing of sea defenses structures.