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# Short-wave contributions in the storm surge associated with Xynthia, February 2010, western France

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This study aims to hindcast and analyze the storm surge caused by Xynthia, a mid-latitude storm that severely hit the central part of the Bay of Biscay on the 27-28th of February 2010. This storm surge locally exceeded 1.5 m and peaked at the same time as a high spring tide (Bertin et al., 2012). A new storm surge modeling system was applied, based on the unstructured-grid circulation model SELFE (Zhang and Batista, 2008) and the spectral wave model WWM II (Roland et al., 2008). These two models are fully coupled and parallelized and share the same grid and domain decomposition. The modelling system was implemented over the North-East Atlantic Ocean and the space was discretized using an unstructured grid with a resolution ranging from 30 km in Deep Ocean to 25 m in near shore zones. Such a fine resolution was required to properly represent the surf zone. The modelling system resulted in tidal and wave predictions with errors of the order of 2 and 15%, respectively. The storm surge associated with Xynthia was also well predicted along the Bay of Biscay, with root mean square errors of the order of 0.10 m. Numerical experiments were then performed to analyze the physical processes controlling the development of the storm surge and revealed firstly that the wind caused most of the water level anomaly through an Ekman setup process. The comparison between a wave-dependant and a quadratic parameterization to compute wind stress showed that the storm surge was strongly amplified by the presence of steep and young wind-waves, related to their rapid development in the restricted fetch of the Bay of Biscay. The gradient of wave radiation stress contributed to the whole storm surge by about 0.05 to 0.10 m at the available tide gages. Nevertheless, these gages were located in sheltered harbors and modeling results showed that wave-induced setup locally exceeded 0.5 m in areas more exposed to ocean waves. The unstructured grid is currently being extended inland to simulate the flooding associated with Xynthia.

Keywords: Xynthia, storm surge, coastal flooding, unstructured grid model, wave setup, friction velocity.

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