Toward the implementation of a cyclone-induced coastal hydrodynamics and marine inundation forecasting system for Reunion Island

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This paper presents the development, validation and performance of a modelling chain dedicated to cyclone-induced coastal hydrodynamics and marine inundation forecast for Reunion Island (Indian Ocean).

Usually, cyclone-induced inundation forecasting systems concern generalized overflowing, for which broad low-lying areas are affected and waves can be neglected (as for the US east coast). Reunion Island presents specific issues: (1) it is surrounded by fragmented fringing reefs that can generate considerable wave-induced setup (2) local marine inundations are due to overtopping only. Thus, it demands the development of dedicated models requiring limited computing resources in order to give results for different scenarios in a delay compatible with crisis management.

Beyond the implementation and optimization of classical wave and surge models (Wavewatch3 and MARS2DH) from 10km to 100m resolution, a method was developed to compute efficiently wave-induced setup and overtopping at the scale of the island. It is based on (1) a delimitation of homogeneous coastline segments regarding on morphological and exposition criteria (2) simulations of setup and overtopping for each segment with 1D cross-shore profiles of SWAN and SWASH models. For a pilot site at local scale, marine inundation is also calculated with a high resolution Non Linear Shallow Water equations model, comprising an explicit representation of the buildings and integrating overtopping discharge from SWASH profiles.

This chain was extensively tested for historical cyclones with high resolution analysed cyclonic wind and pressure fields from Meso-NH (with bogussing) atmospheric model. Comparisons were made against buoys, altimetry and tide gauge measurements as well as inundation extent observations. First results show that this chain can provide meaningful

information within a reasonable amount of time. In the next step, it will be tested with forecast scenarios, using ensemble cyclonic tracks.

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