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

Sophie Lecacheux, Rodrigo Pedreros, François Paris, Eric Chateauminois, Alexandre Nicolae Lerma, David Barbary, Soline Bielli, Olivier Bousquet, François Bonnardot, Hubert Quetelard, et al.

To cite this version:

Sophie Lecacheux, Rodrigo Pedreros, François Paris, Eric Chateauminois, Alexandre Nicolae Lerma, et al.. Toward the implementation of a cyclone-induced coastal hydrodynamics and marine inundation forecasting system for Reunion Island. International Coastal Symposium 2016, Mar 2016, Sydney, Australia. hal-01261494

HAL Id: hal-01261494

https://hal-brgm.archives-ouvertes.fr/hal-01261494

Submitted on 25 Jan 2016

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L’archive ouverte pluridisciplinaire HAL, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d’enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.
Toward the implementation of a cyclone-induced coastal hydrodynamics and marine inundation forecasting system for Reunion Island

Lecacheux S. 1, Pedreros R. 1, Paris F. 1, Chateauminois E. 1, Nicolae-Lerma A. 1
Barbary D. 2, Bielli S. 2, Bousquet O. 2, Bonnardot F. 3, Quetelard H. 3, Dupont T. 3

1 BRGM, 3 avenue Claude Guillemin 45060 Orléans, France. s.lecacheux@brgm.fr, r.pedreros@brgm.fr, f.paris@brgm.fr, e.chateauminois@brgm.fr, a.nicolaelerma@brgm.fr.
2 Laboratoire de l’Atmosphère et des Cyclones, Unité Mixte 8105 CNRS/Météo-France/Université de La Réunion, Sainte-Clotilde, Réunion. david.barbary@meteo.fr, soline.bielli-bousquet@univ-reunion.fr, olivier.bousquet@meteo.fr.
3 Direction Régionale de Météo-France pour l’Océan Indien, 50 boulevard du Chaudron, BP 4, 97491 Sainte-Clotilde cedex. francois.bonnardot@meteo.fr, hubert.quetelard@meteo.fr, t.dupont@meteo.fr

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.

This work is supported by the French National Research Agency within the SPICy project (http://spicy.brgm.fr).