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Towards ensemble flood forecasting for tropical cyclones: combining high-resolution hydrodynamic simulations with machine learning techniques

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Operational forecasting systems form a pillar of preparedness strategies for disastrous cyclone-induced flood events by providing early warnings several hours or days ahead. Ensemble forecasting has become common practices for cyclone track and intensity (see e.g., Bonnardot and Quetelard, 2016), and recent advances have shown how to produce probabilistic information for wave heights (see e.g. Lecacheux et al. (2018) with application at Reunion Island, Indian Ocean). In this communication, we aim at going a step further by studying the feasibility of providing not only information offshore but also inland, namely in terms of flood responses induced by the forthcoming cyclone. Yet, a major limitation relates to the necessary use of numerical hydrodynamic models, whose computation time cost can be very high (several hours), which appears to be hardly compatible with the time requirements (i.e. quasi real time) for an efficient emergency planning. To overcome the computation time burden, we propose to rely on a classification-based machine learning technique (namely random forest) to rapidly relate the offshore cyclone-induced sea conditions with the temporal probability of flooding on key sectors (fire station, key roads for evacuation, etc.) in the city without resorting to the expensive-to-evaluate numerical model. We apply this approach to the Sainte-Suzanne city (Reunion Island) and show how to combine ensemble track and intensity forecasts, regional coastal hydrodynamic simulations, onshore flooding simulations and classification-based random forest to produce a map of flooding probability over the course of the cyclone event Dumile (2012).

References

Bonnardot F. and Quetelard H., 2016: An integrated tool for forecasting tropical cyclone and induced flood. 32st Conf. on Hurricanes and Tropical Meteorology – 2016.
Lecacheux S., Bonnardot F., Rousseau M., Paris F., Pedreros R., Lerma A.N., Quetelard H., Barbary D., 2018. Probabilistic forecast of coastal waves for flood warning applications at Reunion Island (Indian Ocean) In: Shim, J.-S.; Chun, I., and Lim, H.-S. (eds.), Proceedings from the International Coastal Symposium (ICS) 2018 (Busan, Republic of Korea). Journal of Coastal Research, Special Issue