Nat. Hazards Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/nhess-2020-46-RC1, 2020

Natural Hazards and Earth System Sciences
Discussions
Open Access
EGU

Interactive comment on "Quantifying processes contributing to coastal hazards to inform coastal climate resilience assessments, demonstrated for the Caribbean Sea" *by* Svetlana Jevrejeva et al.

Anonymous Referee #1

Received and published: 9 April 2020

Jevrejeva et al., assess coastal impact of waves, storm surges and sea level rise in the Caribbean region, with a focus on coastal impacts in the eastern Caribbean islands (St Vincent and the Grenadines). The proposed methodology can aid in decision-making about coastal adaptation strategies, especially in these small island developing states. This work addresses relevant scientific questions and of interest to the NHESS journal's audience. Although I'm positive, a few issues should be addressed before accepting this work, which I have summarized below.

The main challenge to estimate the vulnerability of the Lesser Antilles is linked to the very contrasting morphologies of these small islands, which influence the submersion

Printer-friendly version

Discussion paper

dynamics significantly along the coastline (see for example Duvat et al. 2019). An accurate bathymetry is a key factor in this region. The authors used GEBCO, which has a resolution of the order of the kilometer and a very low precision in shallow water. In this context, could the authors explain what is the accuracy/representativeness of their model's outputs and their vulnerability index estimate?

Duvat, V., Pillet, V., Volto, N., Krien, Y., Cécé, R., & Bernard, D. (2019). High human influence on beach response to tropical cyclones in small islands: Saint-Martin Island, Lesser Antilles. Geomorphology, 325, 70-91.

In the same way, how can the authors be sure that the changes in the non-tidal residuals (section 4.4) during Hurricane Tomas and Ivan were mainly caused by the inverse barometer effect and not due to the model's low resolution (wind+bathymetry)?

Comparisons with measurements are too qualitative. The buoys used for validation seem to be very far from the cyclone tracks. Could the authors please comment on this?

Line 175: the radius of maximum winds for Ivan could be estimated from the HURDAT Re-analysis dataset (https://www.aoml.noaa.gov/hrd/hurdat/Data_Storm.html)

How are the inputs from rivers and rainfall incorporated into the model grid? (boundary conditions?). What about other factors that contribute to total water levels such as vertical land movement (tectonic/seismic activity and anthropic) and wind waves (setup and runup) ? Could the authors provide more details/discussions on that? What are the consequences on their results of not considering these important processes?

The literature review seems poor, I suggest to enlarge it looking at the recent advances in this region. In addition, there is no scientific comparison/discussion in respect of recent storm surge research.

Among others:

Zahibo, N., Pelinovsky, E., Talipova, T., Rabinovich, A., Kurkin, A., & Nikolkina, I.

(2007). Statistical analysis of cyclone hazard for Guadeloupe, Lesser Antilles. Atmospheric research, 84(1), 13-29.

Krien, Y., Dudon, B., Roger, J., & Zahibo, N. (2015). Probabilistic hurricane-induced storm surge hazard assessment in Guadeloupe, Lesser Antilles. Natural Hazards & Earth System Sciences Discussions, 3(1).

Krien, Y., Dudon, B., Roger, J., Arnaud, G., & Zahibo, N. (2017). Assessing storm surge hazard and impact of sea level rise in the Lesser Antilles case study of Martinique. Natural Hazards & Earth System Sciences, 17(9).

Kennedy, A. B., Gravois, U., Zachry, B. C., Westerink, J. J., Hope, M. E., Dietrich, J. C., ... & Dean, R. G. (2011). Origin of the Hurricane Ike forerunner surge. Geophysical Research Letters, 38(8).

The vulnerability definition that is used by the authors remains vague. Please, elaborate more on the concepts of risk, exposure, vulnerability... In the last section, a Coastal Vulnerability Index (CVI), based on the methodology used by Thieler and Hammar-Klose (1999) is presented, gathering six variables : geomorphology; coastal slope; shorline erosion/accretion/ relative slr; mean tide and mean wave. However, geomorphology is not considered in the study, slr is constant for all the study region (1.8mm/yr), no justification/references is given for the choice of the shoreline changes (between -1.0 and +1.0m yr-1), so only mean weight height and tidal range provide relevant information to compute the CVI. The same observation is made concerning the choice of the CVIPP from OE210, where the human interventions at the coast and the coastal geomorphological factors are ignored. At the end, what is the meaning of this vulnerability index (figure 11)?

Minor comments:

The figures 1 and 11 are not well constructed neither clear for understanding. For example, in Figure 1 : the names of countries and the names tide gauge stations are

missing...

L217 : please correct : Is the comparison made with Pointe-à-Pitre tide gauge located in Guadeloupe or with the Port au Prince tide gauge located in Haiti ?

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2020-46, 2020.