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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Developing an early warning system for storm surge inundation in the Philippines" *by* J. Tablazon et al.

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The authors would like to thank you for your comments. These comments will surely improve our study. We are very glad to submit our responses.

Referee Comment: The title is misleading as the paper describes a vulnerability assessment of some areas of Metro Manila to storm surge instead of developing an early warning system as the title suggests. I suggest changing the title to reflect paper contents and limiting the entire paper as a vulnerability assessment paper.

Authors' Change in the Manuscript: Edited title Probabilistic storm surge inundation maps for Metro Manila based on Philippine Public Storm Warning Signals

Referee Comment: Include a map showing location of observation points. Some observations points are very close to each other, some separated by less than the length of the surge model grid and likely less than the scale of storm surges. If I understood the method right, surge height at adjacent observation points for the same surge/typhoon were counted separately in the frequency distribution tables. What effect would this have in the calculation of the exceedance curves if essentially a single surge event is counted multiple times.

Authors' Response: Please see Fig. 1. The observation points are not separated by less than the length of the surge model grid, since the JMA Storm Surge Model only allows the distance between two observation points to be at least one minute resolution.

Yes, they are counted separately in the frequency distribution tables. However, it must be noted that since the observation points are separated by at least one minute resolution, each observation points also yield different storm surge height values.

Authors' Change in the Manuscript: 1.Remove Table 4 and insert the new figure as Figure 4 2.Figure 4. Specified observation points of Metro Manila. 3.Adjust Figure numbers as well as Table numbers

Referee Comment: The number of storms that produced PSWS#4 in Manila is only 2. How reasonable can an exceedance probability curve for PSWS#4 be created based on only 2 storms?

Authors' Change in the Manuscript: Add this paragraph on Page 11, after Line 13 The results for PSWS 4 is inconclusive, because of the low number of tropical cyclones that fell into this category during the time span covered in this study. Only two PSWS 4 tropical cyclones was raised in Metro Manila from 1971 to 2013. Hence, the probability of exceedance derived from this data set cannot be reliable. The result for PSWS 4 simply insufficient to draw any meaningful conclusion.

Referee Comment: The tides were simply added to the results of the surge model to come up with the storm tide. How significant is the tide and surge interaction to the final surge height?

Authors' Change in the Manuscript: Add after the last sentence of Page 9, Line 23 The tide height was incorporated into the time series storm surge height produced by JMA Storm Surge Model to become the base input for FLO-2D. Although it was the simplest method, discrepancies in the observed and the simulated results might be discerned, since the tidal and storm surge interaction was not considered. Another study might suffice to investigate the relationship between the two, since a tide-surge interaction can influence the generation of higher harmonics and eddie formation in the current field (Lynge, et al., 2013), which might have influenced the result of the final height and thereof the inundation created using the flood model.

Add in references: Lynge, B. K., Hjelmervik, K. and Gjevik, B.: 2013. Storm surge and tidal interaction in the Tjeldsund channel, northern Norway. Ocean Dynamics, Springer. doi: 10.1007/s10236-013-0625-1.

Referee Comment: No attempt was made to validate the JMA surge model for Manila Bay. Sea level monitoring data is available for Manila Bay and it is straightforward to compare model surge heights with actual sea level data. My concern is that storm surge heights are highly influenced by bathymetry of the adjacent coastal waters. The model uses the ETPO 2 minute bathymetry database. In Manila Bay, that is equivalent to about a 3km grid resolution. I recommend doing a comparison of the model surge height with actual sea level data to validate the model. If it does not correlate, then perhaps a refinement to the model (using better bathymetry data for instance) may be needed before it can be used for the analysis.

Author's Response: Please see Fig. 2. An attempt was made to validate the results produced by the JMA Storm Surge Model. This figure shows the forecast results of the JMA Storm Surge Model coupled with tide data from WXTide for Typhoon Pedring

(Nesat) of 2011 for Manila Bay using ensemble forecasting. Basically, this figure only shows the difference between the model results using different tracks, considering possible track changes. The results of the model were compared to the actual sea level data from the National Mapping and Resource Information Authority of the Philippines. Evidently, the result of the ensemble average agrees well with the actual sea level data. To address the comment, we believe that the results of the JMA Storm Surge Model is sound and can be used for analysis.

Referee Comment: Maybe include a discussion on the significance of using a PSWS based early warning system instead of using forecasted storm tracks? The PSWS is based solely on wind speeds forecasted for a specific area. It does not give information about storm track direction, and probable wind directions, parameters important for storm surge forecasting.

Authors' Response: It is included in the PSWS discussion that according to the Philippine Atmospheric, Geophysical, and Astronomical Services Administration, the PSWS given to a certain region is based on the intensity, size of circulation, forecast direction, and speed of the tropical cyclone.

Referee Comment: I think the paper provides very important information about potential storm surge impact areas in Metro Manila and has enough merit for publication. However, I would strongly recommend that aside from addressing comments above, the authors provide a more detailed discussion of how the surge model is setup, how it is linked to the inundation model and do a validation experiment with sea level time series data available for the area.

Authors' Response: Please see the change in the manuscript below. For the validation experiment, please see the discussion for Fig. 2.

Authors' Change in the Manuscript: Add another paragraph in Section 2.3 in Page 6 To simulate an inundation output using FLO-2D flood model, the input data wave height (water level elevation) as a function of time for the coastal grid element is required

(Tsunami Warning Centre Reference Guide, 2007). This water level height is one of the outputs produced by JMA Storm Surge Model. The time series charts provided by each of the JMA model observation points were plotted into its corresponding shorelines, creating a base water level elevation necessary for FLO-2D inundation. Time series charts were adjusted to incorporate the tide data derived using WXTide.

Add in references: Tsunami Warning Centre Reference Guide: 2007. US Indian Ocean Tsunami Warning System (US IOTWS). pg.17.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 2, 6241, 2014.

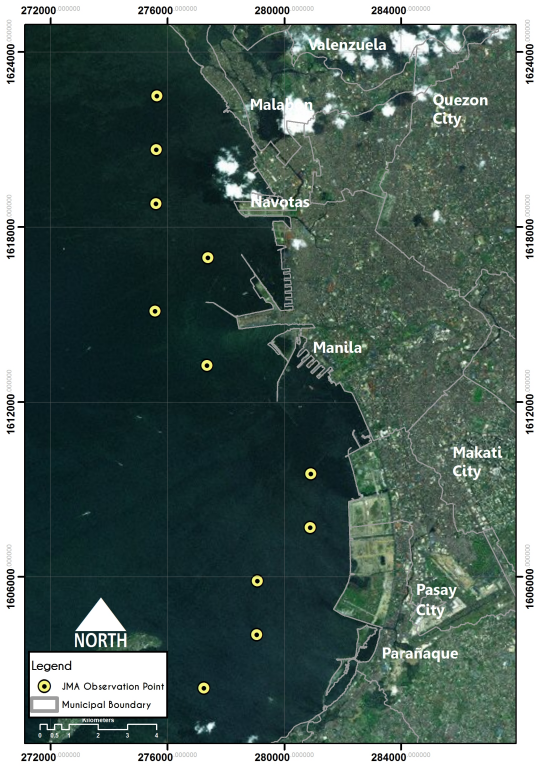

Fig. 1. Specified observation points of Metro Manila.

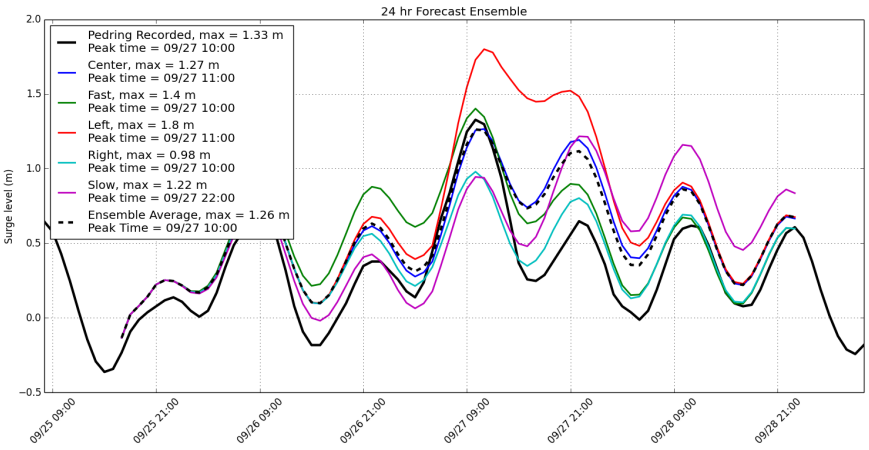

Fig. 2. JMA Storm Surge Model Validation