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

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Thank you very much for all your comments. These comments will surely improve our study. The authors really appreciate it.

Referee Comment: On the title - the manuscript describes the development of a hazard map to be used by disaster managers. The impression I got from the title is the development of a model or system that predicts a storm surge from an incoming typhoon. Perhaps the term “early warning system” is not the best choice for the title, something in the line of risk or hazard analysis/planning maybe more appropriate.

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

Referee Comment: main text - you mentioned more than 6000 people lost their lives in Typhoon Haiyan, was all of that due to storm surge? It would appear so in the manuscript

Authors’ Change in the manuscript: Line 17 to 20 Storm surge imposes a major threat to the Philippine coastal areas, as manifested by Typhoon Haiyan (Fig. 1) on 8 November 2013. It is one of the main reasons for the high number of casualties due to the typhoon, with 6300 deaths, 1061 missing, and damages estimated at USD 2 billion (National Disaster Risk Reduction and Management Council, 2014).

Referee Comment: abstract - should be a summary of the whole article, yet no results were mentioned in that section, it appears more like an introduction

Authors’ Change in the manuscript: Line 2 to 25 Storm surge is the sudden rise of sea water generated by an approaching storm, over and above the astronomical tides. This event imposes a major threat to the Philippine coastal areas, as manifested by Typhoon Haiyan on 08 November 2013. It is one of the main reasons for the high number of casualties due to the typhoon, with 6300 deaths. It became evident that the need to develop a storm surge inundation map is of utmost importance. To develop these maps, the Nationwide Operational Assessment of Hazards under the Department of Science and Technology (DOST-Project NOAH) simulated historical tropical cyclones that entered the Philippine Area of Responsibility. The Japan Meteorological Agency (JMA) Storm Surge Model was used to simulate storm surge heights. The frequency distribution of the maximum storm surge heights was calculated using simulation results of tropical cyclones under a specific Public Storm Warning Signal (PSWS) that passed through a particular coastal area. This determines the storm surge height corresponding to a given probability of occurrence. The storm surge heights from the model were added to the maximum astronomical tide data from WXTide software. The team then created maps of inundation for a specific PSWS using the probability of exceedance derived from the frequency distribution. Buildings and other structures were assigned to a probability of exceedance depending on their occupancy category, i.e., 1% prob-
ability of exceedance for critical facilities, 10% probability of exceedance for special
occupancy structures, and 25% for standard occupancy and miscellaneous structures.
The maps produced show the storm surge-vulnerable areas in Metro Manila, illus-
trated by the flow depth of up to 4 meters and extent of up to 6.5 kilometers from the
coastline. This information can help local government units (LGUs) in developing early
warnings systems, disaster mitigation and preparedness plans, vulnerability assess-
ments, risk-sensitive land use plans, shoreline defense efforts, and coastal protection
measures. These maps can also determine the areas where to build critical, or at
least determine the level of protection of these structures should they be built in haz-
ard areas. Moreover, these will support the local government units’ mandate to raise
public awareness, disseminate information about storm surge hazards, and implement
appropriate counter-measures for a given PSWS.

Referee Comment: are there events where you can compare your simulated results
with actual inundation due to storm surge? If yes, it’ll be beneficial to include

Authors’ Response: Currently, we do not have validation for the simulated results with
actual inundation. But, we do have validation for the results of the JMA Storm Surge
Model.

Please see Fig. 1. 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. We believe that the
results of the JMA Storm Surge Model is sound and can be used for analysis.

Referee Comment: from the enumerated factors that determine a storm surge, wind
direction is vital, and in line with this, is it possible to show which storm path / track
produces significant storm surges in the area (is it to the north, south of the study
area?)

Authors’ Response: Please see Fig. 2. Here are the ten tropical cyclones that pro-
duced the highest storm surge heights for Metro Manila. As we can see, the tracks that
generated the highest storm surge heights can be found north of the study area.

Referee Comment: the authors mentioned that "PSWS 1 at 1 % probability of ex-
ceedance has higher flow depths compared to that of PSWS 2. This is not to be ex-
pected..." this is because of wind velocity used in the model are forecast winds. But the
authors also mentioned using winds from JMA best track archive, which is a reanalyzed
data, can this be explained further?

Authors’ Response: The wind speeds that were used in the JMA Storm Surge Model
are not forecast winds, but the wind speeds from the best track data of the JMA. To
clarify, the Public Storm Warning Signals are forecast wind speeds and were only used
in the study to categorize the tropical cyclones that hit a certain area, from PSWS 1, 2,
3, and 4. But the JMA best track data were used for the storm surge simulation.

Referee Comment: Figures - fig.2, are those simulated or from best track data?

Authors’ Response: These tracks are the ones simulated using the JMA Storm Surge
Model and used for this study. These tracks are also from the best track data of the
Japan Meteorological Agency.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 2, 6241, 2014.
Fig. 1. JMA Storm Surge Model Validation

Fig. 2. Tracks of tropical cyclones that generated the highest storm surge heights for Metro Manila