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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Simulation of storm surge inundation under different typhoon intensity scenarios: Case study of Pingyang County, China" *by* Xianwu Shi et al.

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This work focuses on Simulating storm surge-induced inundation under different typhoon intensity scenarios. Although the results are within the scope of NHESS, scientific discourses on the coastal storm surge are insufficient. My suggestion is a major revision. Response: Thanks for your comments. We substantially revised the paper based on these comments.

Comments: It seems the "wave setup" is excluded in your modeling results. In my opinion, the "wave setup" is sometimes dominating the storm surge. The effect of "wave setup" is more significant than "air pressure" and even "wind stress", depended on

the bathymetry. The "wave setup" effects are important to storm surge simulation and should be included in the manuscript. Response: Thanks for your suggestion. I agree with your opinion that the "wave setup" is a very important factor in storm surge simulation."wave setup" is a phenomenon that wave breaking in nearshore cause the water level rising. In the study area of Pingyang County, the elevation of the underwater terrain at the front of the seawall is between -0.2 to -0.6m, and the slope of the front beach is slow about 1/500 to 1/1000. In the storm surge and wave simulation of typhoon intensity with 915hpa, the water depth at the front of the seawall is about 8.0∼8.20m, and the corresponding effective wave height is about 4.3∼4.5m, which indicate that the waves in nearshore will not be broken. In other typhoon scenarios, the waves are basically not broken. Even if some large waves break before the embankment, preliminary analysis shows that the wave setup is about 0.1∼0.5m, which is less than 10% of the maximum storm surge and is still a small amount. Therefore, "wave setup" effects was not included in this study. Thanks very much for the valuable comments made by the reviewers. We will consider the impact of wave setup in the further study.

2. The authors concluded that the scenario with the most intense typhoon (915 hPa) had the most adverse track, however, many previous studies indicated that the "size" of the hurricane (typhoon) is the main factor for storm surge height and coastal inundation extent. Response: Thanks for your comments. For a single storm surge event, I agree that the "size" of the typhoon is an important factor for storm surge height and coastal inundation extent. The coastal inundation caused by typhoon-induced storm surge is associated with typhoon parameters including track, intensity and typhoon size. In this study, radius of maximum wind speed which is the radius from the typhoon's center to the position where the maximum wind speed occurs was used to indicate the "size" of the typhoon, and the central pressure was used to indicate the typhoon intensity. The typhoon track was set based on the analysis of historical typhoon events who caused the most serious storm surge in Pingyang County. From the perspective of typhoon intensity, this paper use an empirical relationship between this two factors as shown in Section 4.3 to calculate the value of Rmax. Thus the typhoon intensity and size was

set to perform the storm surge simulation in Pingyang County.

3. Additionally, the typhoon size is inversely proportional to the typhoon intensity if the Jelesnianski typhoon model was used. This phenomenon should be discussed in the manuscript. Response: Thanks for your suggestion. The typhoon size has a strong connection to the typhoon intensity. As described above, radius of maximum wind speed was used to indicate the “size” of the typhoon. Collecting the historical radius of maximum wind speed data measured in the northwest Pacific hurricane records (2001-2016) from the Joint Typhoon Warning Center (Wang et al, 2020), it can be seen that the radius of maximum wind speed is inversely proportional to the central pressure difference. In this study, the empirical relationship below was used to calculate the value of Rmax: $R=R_0-0.4(P_0-900)+0.01(P_0-900)^2$ where P_0 is the central air pressure (hPa), R is the radius of maximum wind speed, and R_0 is an empirical constant. The recommended value is 40. The Rmax and typhoon intensity also presents a negative correlation in this formula.

4. Many previous studies revealed that using a combination of parametric typhoon model and reanalysis wind produce is more suitable for storm surge and storm wave modeling. I supposed this method is also adequate for assessing the coastal inundation. Response: Thanks for your comments. Accurate wind forcing is an important prerequisite of storm-surge and inundation simulations. A combination of parametric typhoon model and reanalysis wind produce is more suitable for storm surge and storm wave modeling for a large scale area, parametric typhoon model is used to drive the storm surge numerical model in the area influenced by typhoon, and reanalysis wind produce is need outside of typhoon. In this study, the track of Typhoon Saomai was selected as the designed typhoon track. The designed typhoon track was translated to a position in the middle of Pingyang County and then translated to the sides by a distance of 0.25 times the radius of maximum wind speed, until the track combination that maximized the storm surge in each coastal area of Pingyang County was determined. Pingyang County is completely located within the areas of the radius

of maximum wind speed, and seriously affected by typhoon. the parametric typhoon model is enough to drive the storm surge model, and the validated results show that both the water level and storm surge obtained from the storm surge simulation are highly consistent with the actual measurements.

Please also note the supplement to this comment:
https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2019-425/nhess-2019-425-AC4-supplement.pdf

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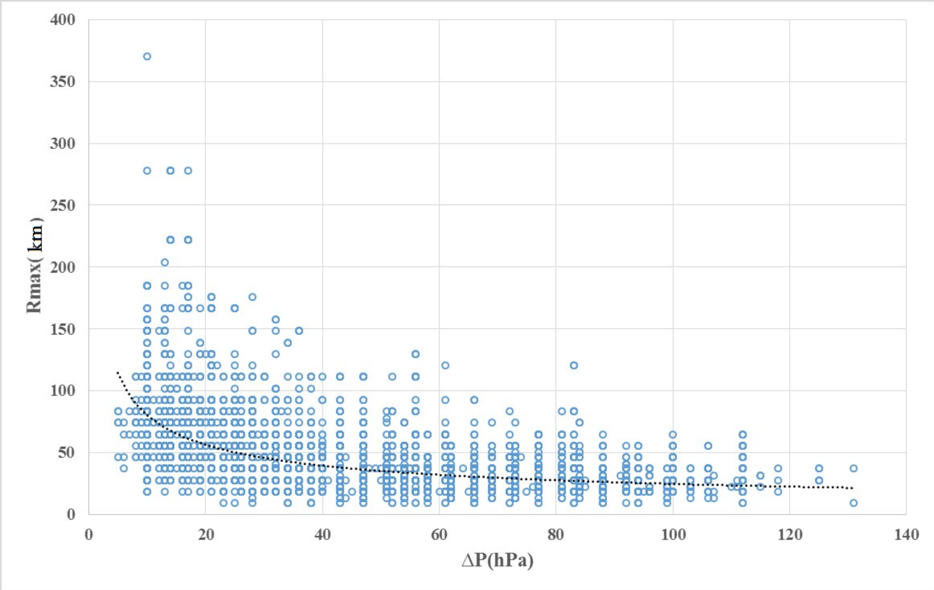

Fig. 1. The relation between the central pressure difference (∆ðİŚČ) and the radius of maximum wind speed(Rmax)