Nat. Hazards Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/nhess-2017-34-AC1, 2019

Natural Hazards and Earth System Sciences
Discussions
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EGU

Interactive comment on "Meso-scale Simulation of Typhoon Generated Storm Surge: Methodology and Shanghai Case Study" *by* Shuyun Dong et al.

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Received and published: 10 December 2019

1. Anonymous Referee #1 1.1 Meso-scale simulations have some advantage for the numerical study. You need to describe why you choose this method.

Reasons for choosing meso-scale method were explained in the introduction. We have added another statement in the second paragraph that justifies our approach with reference to the argument made by Ogie et al. (2019) for the need of less resource and data intense approaches to flood modelling in mega-cities.

1.2 The detail description about numerical model setup is positively necessary.

A new section (3.2.4) has been added describing the major model parameters, including density, horizontal eddy viscosity, Coriolis forcing, tidal potential, sea wall and

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boundary conditions, and other parameters. We have also added a Table that shows they model parameters to illustrate how the model was configured.

1.3 As an explanation of storm surge model in chapter 3, description about typhoon wind model is recommended. Sample plot of wind & pressure field generation is recommended. In addition, I wonder how does the typhoon field move for each 6 hours interval?

As for the typhoon field, the input data, best track data from CMA Tropical Cyclone Centre, were recorded every 6 hours. However, the wind and pressure field was calculated at 1 hour intervals. We have added this to section 3.4 lines 237-238.

1.4 You need to explain more about blending of simulated typhoon wind field and ECMWF dataset.

Reasons for blending of simulated wind field and ECMWF data was explained in the last paragraph on Page 9, and the approach and formula of such blending has been described in Page 10.

We have added a new figure that illustrates comparison of the two models against observed data (New Fig 1) and this shows how much better the Holland model is compared to the Young and Sobey.

1.5 Furthermore, you need to explain why you choose typhoons Winnie & Wipha. You suggested just two observation station data. I think there are much more tidal station and wave station data available.

Reasons for choosing Winnie and Wipha have already been explained on Page 11 and 12. There are more tide stations that recorded storm surge level during Winnie and Wipha than for other typhoon and provide the best data to calibrate simulation results. Other stations are either too far away from typhoon tracks or data were not available at the time we collected data.

1.6 You need to classify water level data to tide and storm surge component. After

finishing well simulation of tide component, you can suggest comparison of surge simulation result.

The model was validated based on the other two tide gauge stations, Location of these two stations is updated in fig 2. Tide simulation results are added on page 15-17. Comparison of surge simulation result was discussed on page 19-20.

1.7 Generally, more figures are needed to explain the simulation result.

We have added 5 new figures providing additional details of the modelling outputs. Fig 1 is added to show simulated results from Holland model and Young & Sobey model. Based on comparison in our case study, Holland model show that the model is in good agreement with the actual observation. Figure 2 shows typhoon tracks relative to Shanghai. Fig 4 is added to show the simulation results of tide component. We have added an enlarged image of the mesh around Shanghai in Figure 3. Fig 5 and 6 are added to show the output from the Holland model at 1 hr intervals and compared against observed data in terms of wind speed and direction. More results from HI-TSSM are added from page 23-24 to demonstrate the simulated results along the south bank of the reclamation project around Hengsha Island. Fig 9 is added to show the location of the survey line and six survey points along the south bank, and distribution of water level at the survey points during two selected typhoon.

1.8 There is no figure and information for inundation modelling. You mentioned Shanghai coastline has been set to 6.37m above MSL. In this study, simulated maximum water level was recorded under the 5m from Figure 3.

The key point is that the tide gauge stations are not on the sea wall. But our simulated max water level at the tide stations is in line with the observed data. Even though the observed water level was under 5m, Shanghai still suffered inundation. That means surge height increased between the tide stations and sea enough to overtop the wall. Our Figure 7 is showing our modelling has simulated surge well when compared to observed data at the stations.

1.9 I cannot understand horizontal axis description in the Figure 3. What time does that mean? And I cannot find surge height clearly in this figure.

Axis are time stamp from the simulation – New figure 7 reformatted

1.10 You need to suggest observed inundation trace map with figure 4. The figure 4 shows just result of simulation.

Observed inundation trace maps for the selected typhoon events are not available. Inundation modelling is validated based on the observed data. We stress that our model is designed to be used in city planning. Although there are a lot of meteorological and hydrological models that could be used for forecasting and hindcasting, they are not suitable for planning purpose due to the computational power required and insufficient data.

1.11 If the purpose of this research is introduction of meso-scale modelling's advantage, this conclusion does not have scientific distributions.

We have clarified the conclusion with a focus on advantages of meso-scale modelling, deleted other un-related parts.

1.12 I recommend you suggest spatial distribution of the storm surge and wave distributions. You still do not suggest any meaningful analysis from this figure 3,4.

Further description on simulation results has been provided on Page 23-25.

1.13 A lot of sentences of manuscript need corrections by a native English speaker.

Quality of all the figures have been improved and further proofreading will be done before publishing.

1.14 Many part of previous work and model description are repeated in the article.

Descriptions on previous work and model in this paper have been simplified, with repetition removed.

1.15 Some sentences in conclusion are repeated at the abstract. Use other expression.

Changed the expressions in conclusion, and revisited the purpose of this paper.

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