

## ***Interactive comment on “Numerical Investigation of Typhoon Waves Generated by Three Typhoons in the China Sea” by Qing Shi et al.***

### **Anonymous Referee #4**

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This paper summarizes the results of the wave simulations for three almost simultaneous typhoons in the China Sea by comparing and contrasting the results for three different sources for the input wind field. Simulation results were compared with coastal buoy observations and satellite data of wave height and the range of applicability for simulations from each wind field was determined. Also, the maximum footprints of wind field were compared with the Best-Track data and a combination of Typhoon wind field from Holland methods with one of the wind fields was used to modify the underestimation of wind speed close to the center of typhoons as observed for the three used wind field. Although some interesting results were presented regarding examining the accuracy of wind fields and the blending approach with the Holland method, the paper obviously lacks a coherent research outline and a scientific story and with the present

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form cannot be recommended for publication in the Ocean Science. The authors need to apply major modifications to change the paper to the appropriate form for publishing in this journal. Followings are more details about the issues with the paper in the present form that need to be addressed by the authors:

Overall comments The major problem of the manuscript is that no appropriate research question considering the background of typhoon wave modeling in the China Sea was asked and the innovation and scientific merit of the research is not clearly specified. The authors claim that that the difference between their research and previous studies is that in the new study three simultaneous typhoons were considered in the comparison of a single typhoon in other studies. However, the authors failed to elaborate on the differences in simulation for single and three-typhoon waves. In fact, there shouldn't be any difference in the simulation of waves generated by a single typhoon with three typhoons. The simulation approach is the same and the same sources for wind fields are used. The main complexity would be the generated wave field and the interaction of different wave systems generated by different typhoons that the authors again failed to investigate.

A scientific paper needs a proper discussion section (could be embedded in other sections) to apply the results in the context of a broader scientific contribution. Simulation of a wave model with different wind fields and evaluating the results to find the validity of each wind field is an interesting observation. However, this is only the result part of the paper and is not actually a scientific contribution. The authors only compared wind and wave results from different sources and did not include any further scientific analysis. The discussion could be on the spectral pattern of typhoon-generated waves during the effect of three typhoons (as an example please see Allahdadi, M. N., Chaichitehrani, N., Allahyar, M., and McGee, L.: Wave Spectral Patterns during a Historical Cyclone: A Numerical Model for Cyclone Gonu in the Northern Oman Sea, *Open Journal of Fluid Dynamics*, 7, 131, <https://doi.org/10.4236/ojfd.2017.72009>, 2017) or interaction of swell waves generated by each hurricane and their effect on the wind input/whitcapping dis-

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sipation in the model ( example: van der Westhuysen, A. J., Zijlema, M., and Battjes, J. A.:Nonlinear saturation-based whitecapping dissipation in SWANfor deep and shallow water, Coast. Eng., 54, 151–170) or other modeling related issues that can used the present modeling results based on the authors' selection.

If the authors claim that their innovation is evaluating different wind fields used in wave modeling, still they need some level of discussions about the wind fields, their complexity during the three simultaneous typhoons, and the technical reasons that the wind data do not present a high accuracy wind field during the typhoon events. One thing that can helpful for the discussion is comparing the wind timseries from each typhoon with timesries of observed winds at the buoys like the buoys used in this paper or even NDBC buoys if the data are available in the study area by establishing scatter plots and supporting them with the model performance statistics.

The introduction part of the paper is not coherent and was not appropriately outlined. This just a list of simulation works or verifying wind data that are not necessarily related to each other and are not narrowed down to get to the main research question. Please consider rearranging the introduction based on really relevant papers that could appropriately introduce the main research question of the paper.

Some important details about model setup and configuration are missing.

The text is not clear at many parts. Some sentences are incomplete, some technical terms were selected wrongly, and many grammatical and verbal errors are found. Please fix these problems in the modified version of the paper (more details will be presented below).

Details Ln 9, 13,40: Different words were used for representing ERA wind field(ERA, ERA-I, and ERA-Interim) please be consistent and use only one of them throughout the paper. Ln 20, 21: “root mean square of the blended wind field was 0.223 m lower than that of the CCMP” : do you mean the root mean square of the simulated wind field by each of these wind fields? Please modify the sentence Ln 25: you need to

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elaborate more on “complicated” and present more information about how the three-typhoon wave field and why is it complicated. Ln 26: Generation of Typhoon although it has some pre-conditions that make it more likely in the summer, is basically a random process. Why three-typhoon events happen almost every year in the China Sea? What conditions cause them to happen together? You need to add some clarifications here Ln 29 and 59,60: What do you mean by the “evolution laws” ? Do you mean the “wave evolution process”? Ln 35: what do you mean by: plane distribution”? Shouldn’t it be:” spatial variations”? Ln 40: what do you mean by” the same set of altimeter and buoy data”? the same as what data? Ln 44, 56: Please be consistent with using WW3 or WWIII. Also, for the first use of this acronym in the text use the full word: WAVEWATCHIII. Ln 47-50: If the study of Shao et al(2018) is a modeling study, please mention it and present more details including the numerical model; that was used in this study. Ln 60-62: The authors did not present any details about the kind of investigation that should be implemented in the case of three-typhoon events. What has been done specifically in this research to fulfill a part of this investigation? Entire manuscript: too much use of the word “pertaining”. In some cases, even the selection of this word is not appropriate. Ln 80: what do you mean : “wave increase and decrease”? do you mean” wave generation and dissipation”? Ln 80: please change: control equation” to “governing equation” Ln 92: k is not the unit vector. It is actually the wave number vector. The magnitude of the vector is  $k=2\pi/L$  in which L is the wave length. Ln 100, 101: Sds,mud is the dissipation term to include the effect of wave-mud interaction. Sediment dissipation for sand sediments is included in ds,b

Section 2.1. The author need to include more details about the SWAN model type and the setup used for the simulation. The followings should be addressed in the test: What version of SWAN is used? Is it based on a structured or unstructured model? What wind input and whitecapping approaches were used in simulations and why? What kind of boundary conditions were used and from which source? If no boundary condition is used present proper reason(s) or references(s).

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Ln 117: The spatial resolution of the ETOP1 bathymetry data is about 1600-1800meters depending on the latitude which makes it suitable only for modeling purposed in the offshore areas where the depth gradients are not important. Since in the present study, several coastal buoys is used for model verification, higher accuracy bathymetry data may be required. Have you checked for such data?

Ln 119-132: please add a table to the manuscript summarizing all three wind fields used in this study with information about: spatial resolution, temporal resolution, and the association that handles the data.

Section 2.3 title: please change the title to:” Modeling area and setup”

Ln 142: change “range of calculation: to “modeling area”

Ln 144: change “ topography” to “bathymetry”

Section 2.3 : Please either add a table showing buoy characteristic (coordinates and water depth) Figure 1 or 2: mark the approximate location of the South China Sea, Yellow Sea, and East China Sea on one of these figures. Figure 1: for each typhoon of 2015, mention the start and end date on the figure or in the manuscript. Ln 150-151: how did you choose the spectral characteristics of the model? Please elaborate more and add appropriate references. Ln 150: Regarding the extensive modeling area and the relatively large directional resolution of the model(10 degrees), the simulation results may be affected by the garden sprinkling effect(GSE). Have you done any sensitivity study on the directional resolution to check the model results for this effect? Ln 151-152: what about whitecapping dissipation? Did you include this term? Ln 153: what are the value of timestep and the number of computational iterations used in the SWAN model? Ln 155: Same as the main model, for the nested model some details about the model setup should be mentioned. General comments about the caption of figures with multiple panels: all the caption should be written below the main figure and the panels should be mentioned with a,b,c,.. within the same caption not separately. While the panels are marked with a,b,c, ... Equations (13) and (14): parameter n was

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not defined. Ln 175: what is “fragmentation”? Ln 166-167: this sentence is not clear. How the orthogonal representation of the coastline caused inaccuracy at the coastal buoy? Was a curvilinear SWAN model used in the simulation? It has not been mentioned anywhere in the manuscript. Ln 171-178: The reasons that are presented for lower accuracy of simulations at buoys in the South China Sea compared to the Yellow sea are very general and cannot be verified without knowing the water depth at each buoy and their distance from the shoreline. We know that simulation results at the coastal buoys are not generally as accurate of offshore buoys. Aside from refraction and other shallow water effects, two more important effects degrade modeling results at coastal buoys: interpolation of wind data with land and the “Slanting fetch” effect (please see: Allahdadi, M.N., He, R., Neary, V.S., 2019. Predicting ocean waves along the US east coast during energetic winter storms: sensitivity to whitecapping parameterizations. *Ocean Science* 15, 691–715. <https://doi.org/10.5194/os-15-691-2019>). The authors need to appropriately discuss and mention these reasons and present related references. Ln 180-183: These sentences are not clear. Please elaborate more. Ln 196: “trajectory point” can be changed to “observation point”

Ln 207-209: These sentences need to be modified for clarity Ln 230: What is “B(1980)”? Ln 253-245: describe how K values for different typhoons were calculated? If there is any formulation please include it. Ln 60: add snapshots of the blended wind field and the unmodified wind field to show wind speed contours and wind vectors for two cases Ln 300: change “trajectory points” to “observation tracks” Table 3: combine all the results for different days into one scatter plot (satellite-model) with statistical values instead of the table. The table is not very useful when you separate different days. Ln 313: do you mean correlation coefficient of simulated waves? Ln 345: what do you mean by “moving track of typhoon”?

I hope these comments are helpful for improving the revised paper.

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