Nat. Hazards Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/nhess-2018-349-AC2, 2019

Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Study of the threshold for the POT method based on hindcasted significant wave heights of tropical cyclone waves in the South China Sea" *by* Zhuxiao Shao et al.

Zhuxiao Shao et al.

szx0617@163.com

Received and published: 4 June 2019

Replies to comments by referee #2

Thank you for your comments on our manuscript entitled "Extreme significant wave height of tropical cyclone waves in the South China Sea" (Ref: nhess-2018-349). These comments are all valuable and very helpful for improving our paper. We appreciate that we have a chance to revise the manuscript as you suggested and to resubmit our manuscript after addressing all comments point by point. We hope that the improved manuscript will meet your approval. The main corrections in the manuscript and responses to comments are shown as follows:

Printer-friendly version

Discussion paper

General response: Thank you for your evaluation of our research. As suggested, some contents in the manuscript have been rewritten to show our ideas more concisely. Some repetitive information was deleted to clearly show the core relevance, results and impacts of our work. In the manuscript, the long paragraph was rephrased and divided into two or three paragraphs. In addition, figures and tables appear in appropriate locations to break up the text. In Fig. 1, the study region with the 22 study sites is shown. The SCS is the largest and deepest marginal sea in the western Pacific Ocean. In this area, the tropical cyclone always drives the storm wave, and the number of tropical cyclones is sufficiently large. Thus, the extreme significant wave height can be assessed in a tropical cyclone. To further improve the quality, proofreading and language editing have been completed by American Journal Experts.

(1) Response: As suggested, we have rephrased the manuscript to make it stricter and to present some of the contents in greater detail. We try to show our research more clearly to enable its application to other works. (2) Response: As suggested, we have rephrased the paper to present our ideas more concisely. In the SCS, Shao et al. (2018a) compared the AM method with the POT method. Due to a fixed time window (i.e., one year), the independence and number of samples cannot be guaranteed. In a tropical cyclone, the influence of this fixed time window is further exacerbated, even if the return period is close to the size of the database. Compared with the AM method, the POT method is a natural sampling method without additional limitations. When the threshold is suitable, the POT method can guarantee the representativeness and number of extreme samples. However, the process of threshold selection is relatively complex. Shao et al. (2018a) and Liang et al. (2019) analysed the sensitivity of the return significant wave height to the threshold. The researchers found that a suitable threshold should be determined within the stable threshold range. However, a unique threshold cannot be directly selected. To determine a unique threshold, Shao et al. (2018a) defined the largest threshold within the common stable threshold range as the suitable threshold, and Liang et al. (2019) proposed the use of an ATSME. The ATSME selects the largest threshold within the stable threshold range as the suitable threshold for

diïňĂerent return periods. In this paper, we further studied the sensitivity with the characteristic of tropical cyclones. We want to present a concept linking the assessment with this characteristic in a tropical cyclone-dominated area. We analysed the track and intensity influences of tropical cyclones on the extreme wave at the targeted location and studied the distribution of the sample with the sensitivity. To validate the high sample in the distribution for extrapolation, we estimated the asymptotic tail approximation and estimation uncertainty. As mentioned, it is interesting to study the location of the distribution deviating from a Rayleigh-type to some GEV forms. Thank you for your suggestion. This concept is significant, and we may research this topic in our future studies. ïĄň See the manuscript P. 3, lines 19-22; P. 4, lines 1-10: "Shao et al. (2018a) compared the annual maxima (AM) method (Tawn, 1988) with the POT method. The AM method is an easy sampling method that does not require additional work, as the method directly extracts the annual maximal significant wave height for extrapolation. However, the AM method has limitations in a fixed time window (i.e., one year), which cannot guarantee the independence and number of samples. The annual maximal significant wave height obtained from neighbouring years may originate from the same extreme wave; some maximal significant wave heights may be neglected (i.e., the annual maximal significant wave height may be smaller than some unselected maximal significant wave heights in other years), resulting in an insufficient number of samples, especially for a relatively long return period. In a tropical cyclone, the AM method's limitation is further exacerbated, even if the return period is close to the database size. The annual frequency, intensity and track of recorded tropical cyclones greatly vary, and corresponding waves have obvious differences. Shao et al. (2018a) found that the minimal sample may be much less than the maximal sample, and the minimal sample may be too small to represent the extreme wave (i.e., the minimal sample in the AM method is obviously smaller than the extreme sample in the POT method)." ïĄň See the manuscript P. 4, lines 10-21: "Compared with the AM method, the POT method is a natural sampling method without additional limitations. When the threshold is suitable, the POT method can guarantee the representativeness and number of extreme

samples. However, the threshold selection process is relatively complex. Shao et al. (2018a) and Liang et al. (2019) analysed the sensitivity of the return significant wave height to the threshold. The researchers found that the suitable threshold should be determined within the stable threshold range (i.e., a threshold range corresponding to a range of stable return significant wave heights). Based on this conclusion, Shao et al. (2018a) defined the largest threshold within the common stable threshold range as the suitable threshold, and Liang et al. (2019) proposed an Automated Threshold Selection Method based on the characteristic of Extrapolated significant wave heights (the acronym is ATSME). The ATSME employs the diïňĂerences in extrapolated significant wave heights for neighbouring thresholds as the diagnostic parameters to identify the uniquely stable threshold range via an automated method and selects the largest threshold within the stable threshold range as the suitable threshold for diïňĂerent return periods." (3) Response: As suggested, we explained the corresponding content regarding the track and intensity in the manuscript. The track and intensity of tropical cyclones affect the sample at the targeted location. When the track of the tropical cyclone is close to the study site and the intensity of the tropical cyclone is strong, the corresponding wave is sufficiently strong to represent the extreme wave at the study site. In contrast, when the track is far or the intensity is weak, the corresponding wave is insufficiently strong. However, it is difficult to determine the extreme sample through the track threshold and intensity threshold. A combination of track and intensity is relatively complex. In this study, we use a fixed distance to identify the initial database at the study site. When the distance between the centre of the tropical cyclone and the study site is within 300 km, hourly significant wave heights simulated during this tropical cyclone are adopted as the initial database at the study site. This fixed distance allows some small samples (the corresponding track is far, or the intensity is weak) to be extracted. Thus, other analyses are needed to identify the extreme sample from the sample, such as the sample distribution with the sensitivity of the return significant wave height. We will continue to study the assessment in the tropical cyclone. We hope that we will discover a combination of track threshold and intensity threshold, or

the results of this paper can stimulate more scholars to pay attention to this topic. ïĄň See the manuscript P. 19, lines 15-19: “Consequently, the results of this study present a concept linking the assessment of extreme significant wave heights with the characteristics of tropical cyclones in a tropical cyclone-dominated area. The sample at the targeted location is affected by the track and intensity of the tropical cyclone. Future studies are suggested to promote the assessment of extreme significant wave heights in a tropical cyclone. For example, the threshold may be determined directly through a combination of track threshold and intensity threshold.”

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2018-349, 2019.

Printer-friendly version

Discussion paper