Responses to Reference Report #3

The authors present new technological methods utilized for determining warning water levels, as well as the procedure and results of this determination in Zhifu District, Yantai City, Shandong Province, China. This study discovered the existing marine disaster prevention capacities of coastal areas by analyzing the spatial distribution patterns of warning water levels in 259 shore sections in China, and recommend changes for future warning water level evaluations based on their findings. Notably, this assessment can serve as a scientific reference for encouraging the redetermination of warning water levels in China's coastal areas, thereby improving their marine disaster prevention and protection capabilities. In summary, it is a topic of interest to the researchers in the related areas. This is a carefully done study and the findings are of much considerable interest. I recommend this manuscript to be published in NHESS. My detailed comments are as follows:

Response: We greatly appreciate your kind help in reviewing the manuscript and all constructive comments. We substantially revised the paper based on these comments.

1. The "Discussion" section needs to be improved. For example, sea level rise under the effects of global warming exhibits an accelerating trend and may potentially be irreversible. The impact of the ongoing sea level rise on the rise in severe water levels has to be covered in more detail and depth.

Response: Thanks for your suggestion. According to your advice, the section of Discussion has been modified in the revised manuscript, by adding some explanations of the impact of ongoing sea level rise on the rise in severe water levels.

4.discussion

Line 282-288：

Several studies highlighted that global sea-level rise would continue accelerating in the 21st century as a consequence of climate change (Church and White, 2011; Hay et al., 2015). In fact, coastal flooding hazard has been increasing on a global scale in recent decades, a trend expected to continue as a result of climate change(Maria et al., 2022). In the past 40 years, sea level in the coastal China seas has increased significantly, with the rate of 3.4 mm/a, higher than the global average from 1993-2018(3.25mm/a)（Ministry of Natural Resources of China, 2021; IPCC,2021）. In the IPCC Sixth Assessment Report, the latest monitoring and simulation results indicate that the current rate of Global mean sea level rise from 2006 to 2018 is accelerating (3.7mm/a) and will continue to rise in the future, showing an irreversible trend(Zhang et al., 2021; IPCC,2021). Regional relative sea level rise is an important driving factor affecting extreme still water levels. The continuous rising sea level has led to an increase in extreme water levels in coastal areas of China(Qi et al., 2019), which can have an impact on the determination of warning water levels. Additionally, changes in storminess may have an important role in modifying the frequency and magnitude of water level extremes (Lowe et al., 2010; Woodworth et al., 2011). Future work about re-determining the warning water level should take these abovementioned issues into consideration.

The references added in the revised manuscript are as below:

1) Maria, F.C., Marco, M.: Extreme-coastal-water-level estimation and projection: a comparison of statistical methods, Nat. Hazards Earth Syst. Sci., 22: 1109–1128, https://doi.org/10.5194/nhess-22-1109-2022, 2022.

2) Ministry of Natural Resources of China: 2021 China Sea Level Bulletin, Ministry of Natural Resources of China, Beijing, China, 2021. (in Chinese).

3) Zhang, T., Yu, Y.Q., Xiao, C.D.: Interpretation of IPCC AR6 report: monitoring and projections of global and regional sea level change, Climate Change Research, 17(6), 12–18, https://doi.org/10.12006/j.issn.1673-1719.2021.231, 2021.(in Chinese)

4) IPCC: Climate change 2021: The physical science basis. Contribution of working group I to the Sixth Assessment Report of the IPCC, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 2021.

5)Qi, Q.H., Cai, R.S., Yan, X.H.: Discussion on climate change and marine disaster risk governance in the coastal China seas, Marine Science Bulletin, 38(4), 361–367, https://doi.org/10.11840/j.issn.1001-6392.2019.04.001, 2019.

2. In the "Discussion" section, more detailed explanations of the advantage, limitation of the technological method used in this study could be presented.

Response: Thanks for your suggestion. According to your advice, the section of Discussion has been modified in the revised manuscript. More detailed explanations of the advantage and limitation of the technological method used in this study have been presented in the section of Discussion.

In the revised manuscript, the Discussion have been modified as below:

4. Discussion

The warning water level is mainly used for storm surge prewarning, and it is crucial to decision-making and mitigation measure design. This study proposed a newly approved quantitative method for determining the four-color warning water level, which includes the calculation formula of the HWL at the typical return period, the classification method of the shore section based on its importance and coastal county unit，and the quantitative calculation formula of the correction value of the warning tide level corresponding to wave exposure degree, surge protection facility construction standard and the shore section importance level. Compared with the method used for calculating the one-single-value warning water level in the mid-1990s, the method of calculating the four-color warning water level used in this study is more reasonable, mainly in the following aspects: (1) It proposed the description of the warning water level classification corresponding to the four levels of marine disaster emergency response levels, and the determination results of the four-color warning tide level are more helpful for the storm surge prewarning; (2) The calculation of correction values has been improved, by replacing qualitative calculation method with quantitative calculation method, especially proposing the method of calculating the wave run-up which is an important decisive element for the correction values; (3) In the process of calculating the four-color warning water level, the verification of the approved results are strengthened, to determine whether the approved warning water level is suitable based on the statistical analysis of historical storm surge disasters and the corresponding tidal heights.

Our results about the spatial distribution of four-color warning water level, have been preliminarily applied to storm surge disaster prevention and mitigation in coastal areas of China. Several studies focused on the storm surge prewarning application methods for the newly approved four-color warning water level, corresponding to a refined shore section (Fu et al., 2017). However, limited by the data availability, it is not considered that the influence of storm surge disaster loss factors on the calculation of warning water level. The Correlation between storm surge disaster losses and the highest tide water exceeding the warning water level has not been established.

The precision of the warning water level directly affects the accuracy of the storm surge prewarning results, thereby affecting the objectivity of emergency strategies and decision-making for storm surge disaster mitigation. With the rapid development of China's coastal society and economy, storm surge protection facilities, population density, and coastal development conditions have also been changing. Therefore, the warning water level needs to be updated according to the actual conditions of the coastal areas in time, When it is not compatible with the storm surge prevention and mitigation. At the same time, in order to meet the needs of the increasingly refined storm surge disaster prevention and mitigation plans, the scale of warning water level assessment should be changed from coastal counties to coastal towns and communities.

Several studies highlighted that global sea-level rise would continue accelerating in the 21st century as a consequence of climate change (Church and White, 2011; Hay et al., 2015). In fact, coastal flooding hazard has been increasing on a global scale in recent decades, a trend expected to continue as a result of climate change (Maria et al., 2022). In the past 40 years, sea level in the coastal China seas has increased significantly, with the rate of 3.4 mm/a, higher than the global average from 1993-2018(3.25mm/a)（Ministry of Natural Resources of China, 2021; IPCC,2021）. In the IPCC Sixth Assessment Report, the latest monitoring and simulation results indicate that the current rate of Global mean sea level rise from 2006 to 2018 is accelerating (3.7mm/a) and will continue to rise in the future, showing an irreversible trend (Zhang et al., 2021; IPCC,2021). Regional relative sea level rise is an important driving factor affecting extreme still water levels. The continuous rising sea level has led to an increase in extreme water levels in coastal areas of China(Qi et al., 2019), which can have an impact on the determination of warning water levels. Additionally, changes in storminess may have an important role in modifying the frequency and magnitude of water level extremes (Lowe et al., 2010; Woodworth et al., 2011). Future work about re-determining the warning water level should take these abovementioned issues into consideration.