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Interactive comment on "Field survey of the 2017 Typhoon Hato and a comparison with storm surge modeling in Macau" *by* Linlin Li et al.

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We thank reviewer 1 for the valuable suggestions. In this revised version, we have made changes according to the suggestions and comments and highlighted where those changes are made. The point-by-point replies to the comments are below. General comments: In general, the MS is well prepared and written. After minor revision, I recommend the immediate publication of the paper considering that another similar typhoon Mangkhut (No 1822) occurred in 2018, which again affected the Macau city. These two cases could be inter-compared to explore many interesting phenomena and physical insights to help the local government to do a better countermeasure against such typhoon disasters. Author's response: Thank you for your encouraging comments. Your suggestion of making comparison between Typhoon Hato (2017) and

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Discussion paper

Typhoon Mangkhut (2018) is very important. Both Typhoons were rare and record-breaking events in terms of their extreme wind speeds and wide-spreading coastal flooding they caused in the Pearl River Delta region. Actually, immediately after Typhoon Mangkhut (2018), some of our co-authors did another post-typhoon field survey and obtained the first-hand flood parameters in the same area in Macau. The comparison between these two typhoons and their associated physical phenomena is on-going and will be discussed in a future paper. Comment 1: Lines 70-73. This is an interesting point. In general, the maximum storm surge occurs before the typhoon landfall. Hence, the worst scenario is the high tide occurs several hours before the typhoon landing. Ref.: Lai, F., Liu, H. (2017) Wave setup properties in the surge-wave coupled simulation: A case study of Typhoon Khanun. IUTAM symposium on storm surge modelling and forecasting, Procedia IUTAM, 25, 111-118. Author's response: We respect the point that the maximum storm surge generally occurs before the typhoon landfall. However, we also feel that the timing of maximum surge and typhoon landfall depends on many other factors, for example, location of the study area relative to the typhoon track, typhoon size, etc. In the case of Typhoon Hato, the maximum surge indeed occurs before the typhoon landfall, but it is only $\sim$20 minutes before the landfall and did not exactly coincide with the peak tide on that day. Hence, Typhoon Hato could have caused worse flooding if the landing time was $\sim$10:00 AM. To demonstrate this, we simulated a scenario that shifts the landfall time 3 hours earlier than the real case. It shows that the water depth could be 0.2-0.5 m deeper than the real case.

Comment 2: Lines 104-112. Interesting to see that inundation mainly occurred in the west part of the Macau Peninsula. This, on one hand, is caused by the low-lying topography in the west as mentioned by authors. On the other hand, the southeast region is directly facing the Pacific Ocean and typhoon attack which, in my mind, may suffer more severe wave actions comparing to the west region of the peninsula (though its elevation may be higher than west region). According to Fig 3(a), there is a S-N directed breakwater located in the southeast, which may protect the southeast region to some extent. Could authors specify these more in detail? As for northeast region,

it may be protected/shadowed by the islands located in the east. Any descriptions about Figs 3(c) and 3(d)? Author's response: Yes, the elevation difference between the west and the east part of the Macau Peninsula is the key reason why these two areas experienced different flood levels. The elevation in the Inner Harbour area is only 1-2 m above the mean sea level (MSL). In contrast, the elevation in the southeast is 4-6 m above MSL, and northeast is 3-4 m above MSL. The N-S directed object shown in Fig 3(a) is one of the three bridges connecting the Macau Peninsula with the island to the south, not a breakwater. So the water can pass through the bridges underneath. We apologize for the confusion and we added the text "Bridge" in Fig 3(a) to avoid the confusion. For the northeast part of the Macau Peninsula, the newly reclaimed islands do play a protective role. We add more descriptions about Fig 3(c) and 3(d) in the manuscript: When tracing the watermarks along the two major streets: Avenida de Almeida Ribeiro and Ruo Do Gamboa, we observe that, as the seawater penetrated inland, the inundation depth gradually decreased from $>$ 2 m to $\sim$1 m (Fig 3c-d). Comment 3: Lines 124-125. Could authors add Takagi's survey data of Macau in Fig 3a, just for comparison? Author's response: To avoid confusion, we plotted a separate figure for Takagi's survey data instead of adding them to Fig 3a. The figure is plotted with the same colour scale of Fig 3a and added as a supplementary Figure S3.

Comment 4. Fig 4(c) is not mentioned in the context. Author's response: We added it in the third paragraph of Section 3 Numerical simulation. Comment 5. For section 4.3. Just a suggestion. According to IPCC, the intensity of typhoon will also increase, accompany with the SLR. Hence, authors may apply the scenario under which the typhoon intensity is enhanced together with different SRL. Author's response: Thanks for the suggestion. We are conducting such scenarios now. The result will be discussed in a future paper since the focus of current paper is presenting the field survey result and validating the numerical model package. Comment 6. Lines 269-270. This may be not suitable since according to IPCC, the frequency and intensity of future typhoon is increasing. Hence, the worst-case scenario of future typhoon should be more severe than typhoon Hato. Author's response: We acknowledge the possibility that more

severe and intense typhoons could happen in future with the changing climate. However, the objective of the numerical experiments is mainly to show the effects of tidal level and SLR on coastal inundation and we believe using Typhoon Hato's atmospheric condition as a benchmark scenario can well serve the purpose. Comment 7. In conclusion, please point out clearly that the inner harbor area is the most fragile region which could be inundated even under the lowest tidal level. For this, immediate attentions/engineering actions should be took by the local government. Author's response: Thanks for the suggestion. We have repeated this key point in both the result and conclusion sections.

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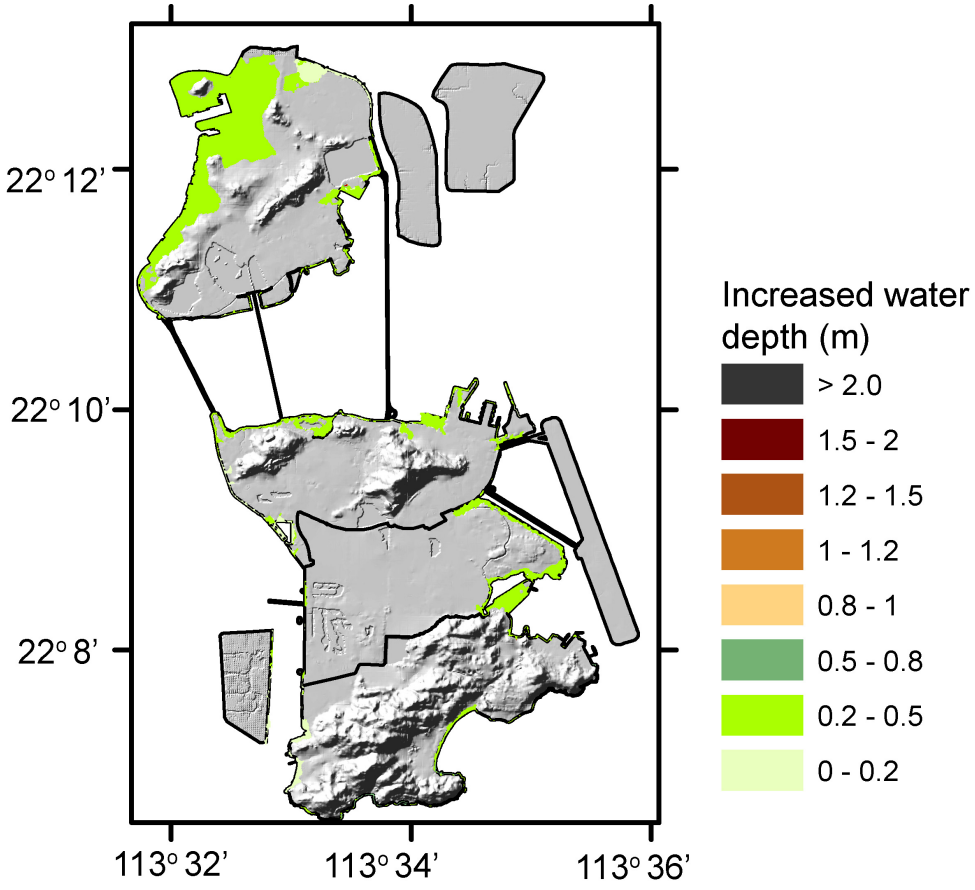

Fig. 1. A map showing the difference between the maximum inundation during the benchmark scenario (Figure 5a) and the peak tide on the day of Hato's landfall

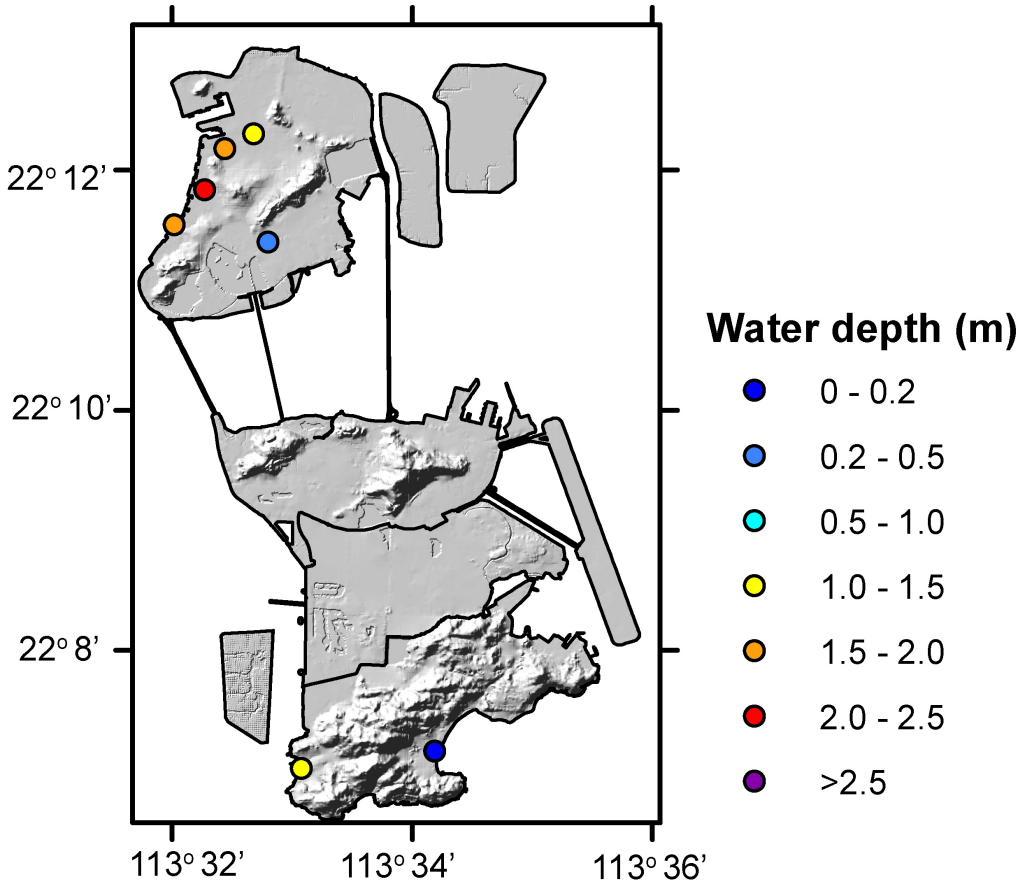

Fig. 2. Figure S3. The inundation depths surveyed by Takagi et al. (2018)