

Response to Reviewer 2

Reviewer #2:

This paper presents valuable post-event field survey datasets and hydrodynamic model validation for the destructive 2017 Typhoon Hato storm surge flood across the highly-urbanized Pearl River Estuary. Overall, the work is well-structured and delivers meaningful observational evidence, yet several textual inconsistencies, methodological gaps and presentation defects need revision before formal publication.

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. Table 1 lists 2024 remote-sensing imagery and national ocean product statistics. Since Typhoon Hato occurred in 2017, explicitly explain how these late-period datasets support the 2017 disaster reconstruction, or remove irrelevant entries if they are not actually used in analysis.

Response:

Thank you for your careful reviewing. We have carefully rechecked the data sources listed in Table 1. The 2024 remote sensing imagery was not used in the analysis and has therefore been removed from Table 1. For the National Ocean Product Statistics, the data year has been corrected from 2024 to 2017, as the 2017 statistics were used to provide the national marine economic context for evaluating the economic impact of Typhoon Hato.

2. In Section 2.3, the reliability classification framework (Table 2) for field-survey evidence lacks quantitative threshold definition. Please add measurable criteria to distinguish “reliable”, “less reliable” and “reference-only” field indicators, rather than purely descriptive qualitative descriptions.

Response:

Thank you for your valuable comment. We agree that the reliability classification of field survey evidence should include measurable criteria rather than relying solely on qualitative descriptions. Accordingly, we have revised Table 2 by retaining the

original three-level reliability framework while introducing quantitative criteria based on the estimated vertical uncertainty of field indicators. Details are as follows:

To quantify the water depth and inundation areas caused by storm surge, the survey of the submerged area generally involves three methods: searching for drifting objects, identifying residual inundation traces, and conducting interviews with local residents. In this study, these complementary methods were jointly used to assess the reliability of the reconstructed storm-surge inundation extent (Table 3). First, inundation edge points were identified based on multiple field indicators, including the accumulation of floating objects, such as dead tree branches transported to the edge of inundated areas, information provided by coastal residents regarding whether inundation occurred, and residual inundation traces on coastal buildings. To reduce subjectivity in the interpretation of these field indicators, their reliability was assessed according to both the estimated vertical uncertainty and the degree of independent corroboration. Evidence with a vertical uncertainty of ≤ 0.10 m was classified as reliable when the inundation trace was clearly identifiable and supported by at least two independent indicators or cross-checked by multiple investigators or respondents. Evidence with a vertical uncertainty of >0.10 – 0.20 m was classified as less reliable, whereas evidence with a vertical uncertainty of >0.20 m or without a reasonably quantifiable uncertainty was classified as reference only. These thresholds were adopted as operational criteria for this study, following established practices for evaluating uncertainty and reliability in post-event high-water-mark surveys (Koenig et al., 2016; Feaster and Koenig, 2017; Dottori et al., 2013). Similar multi-level reliability assessment approaches have been applied in recent post-event tsunami surveys by considering measurement accuracy, cross-checking, and field conditions (Yuhi et al., 2024). After the edge points were determined, their longitude, latitude, and elevation were measured using RTK and other surveying techniques (Fig. 4). Based on the positions of the edge points, plane survey grids were established. Survey grids were densely distributed in coastal areas containing residential areas, schools, ports, and aquaculture facilities, with the distance between adjacent survey points generally less than 300 m. The investigation team

determined inundation depth by measuring residual inundation traces in inundated residential areas and recorded the observations in a storm-surge inundation survey form. Finally, interviews with local residents were conducted to further cross-check and revise the reconstructed inundation extent and depth. (Line 158-180 in the revised manuscript)

Table 3. Determination of the reliability of the storm surge inundation investigation.

Reliability level	Quantitative criteria	Field-evidence criteria
Reliable	Vertical uncertainty ≤ 0.10 m	Clearly identifiable field evidence, supported by at least two independent indicators or cross-checked by multiple investigators/respondents
Less reliable	$0.10 \text{ m} < \text{vertical uncertainty} \leq 0.20 \text{ m}$	Directly observed or reported evidence with limited independent corroboration, incomplete traces, or local ambiguity
Reference only	Vertical uncertainty > 0.20 m, or uncertainty cannot be reasonably determined	Indirect information, personal recollection, or ambiguous traces without sufficient independent corroboration

The references added are as below:

[1] Dottori, F., Di Baldassarre, G., and Todini, E.: Detailed data is welcome, but with a pinch of salt: Accuracy, precision, and uncertainty in flood inundation modeling: OPINION, *Water Resour. Res.*, 49, 6079–6085, <https://doi.org/10.1002/wrcr.20406> , 2013.

[2] Feaster, T. D. and Koenig, T. A.: Field manual for identifying and preserving high-water mark data, U.S. Geological Survey Open-File Report 2017-1105, 67 p., <https://doi.org/10.3133/ofr20171105>, 2017.

[3] Koenig, T. A., Bruce, J. L., O'Connor, J. E., McGee, B. D., Holmes, R. R., Jr., Hollins, R., Forbes, B. T., Kohn, M. S., Schellekens, M. F., Martin, Z. W., and Peppler, M. C.: Identifying and preserving high-water mark data, U.S. Geological Survey Techniques and Methods, book 3, chap. A24, 47 p., <https://doi.org/10.3133/tm3A24>, 2016.

[4] Yuhi, M., Umeda, S., Arita, M., Ninomiya, J., Gokon, H., Arikawa, T., Baba, T., Imamura, F., Kumagai, K., Kure, S., Miyashita, T., Suppasri, A., Kawai, A., Nobuoka, H., Shibayama, T., Koshimura, S., and Mori, N.: Dataset of Post-Event Survey of the 2024 Noto Peninsula Earthquake Tsunami in Japan, *Sci Data*, 11, 786, <https://doi.org/10.1038/s41597-024-03619-z> , 2024.

- Table 3 provides surge and tide-level records for tidal stations, yet it lacks clear definition of storm-surge variables. Clarify whether the “Surge (cm)” column represents residual storm-surge component or absolute water-level readings, and double-check unit consistency across the whole table.

Response:

Thank you for your suggestion. We have clarified the definition of the “Surge (cm)” variable in Table 3. It represents the **residual storm surge component**. To avoid ambiguity, “Surge (cm)” has been revised to “Storm surge residual (m)” in Table 3, and the caption has been revised to “Maximum storm surge residual and tidal levels at each tidal station during Typhoon Hato on August 23”. Furthermore, to ensure consistency in units throughout the manuscript, all water-level measurements in Table 3 have been converted from centimeters (cm) to meters (m). Details are as follows:

Table 5. Maximum storm surge residual and tidal levels at each tidal station during Typhoon Hato on August 23.

Observation station (point)		Maximum storm surge		Maximum tide level		Warning water level (m)
		Time	Storm surge residual (m)	Time	Tidal level (m)	
1	Huizhou	10:00	1.20	10:24	4.45	4.40 (Red)
2	Chiwan	13:00	2.03	12:51	5.59	4.87 (Red)
3	Yantian	10:00	1.29	09:44	4.21	4.12 (Red)
4	Huangpu	16:00	1.94	15:00	2.73	2.61 (Red)
5	Hengmen	14:00	2.15	14:00	2.94	2.36 (Red)
6	Zhuhai	12:00	2.79	12:00	6.14	4.67 (Red)
7	Sanzao	13:00	2.16	13:00	2.48	2.26 (Orange)
8	Shanwei	12:00	1.18	11:49	3.04	2.97 (Yellow)

- When interpreting simulation-observation mismatches in Discussion section, the authors point out small-scale topography and coastal-structure limitations of regional hydrodynamic models. It is suggested to add one short paragraph discussing which specific local defense facilities (seawalls, groins) most likely cause those spatial deviations.

Response:

Thank you for your suggestion. We have systematically discussed the sources of

simulation-observation mismatches in the Discussion section, and added a separate point regarding local coastal defense facilities as follows:

Third, coastal defense structures may contribute substantially to spatially heterogeneous discrepancies. Seawalls and coastal dikes can restrict, redirect, or confine floodwaters, thereby locally controlling whether water propagates inland or remains within the coastal zone. Consequently, differences between their actual and modelled crest elevations, structural continuity, openings, and conditions may shift the simulated inundation boundary. Groins can likewise alter nearshore flow patterns and water-level distributions, thereby affecting the pathways through which coastal floodwaters reach adjacent shorelines. Because such structures are often much smaller than the spatial resolution of regional hydrodynamic models, their hydraulic effects may not be adequately resolved. (Line 339-345 in the revised manuscript)

5. While the paper reports good overall agreement, Figure 6 shows notable deviations in some areas (e.g., Yantian, Bao'an). The authors attribute these to topographic uncertainties and simplified parameterization (lines 257–263), but this explanation remains qualitative. I recommend a more systematic discussion: could these discrepancies be due to the absence of pluvial or fluvial contributions in the extracted simulation results?

Response:

Thank you for your valuable comment. We have carefully rechecked the simulation results presented in Figure 6. We also clarify that Yantian and Bao'an are not included in the numerical simulation results, therefore, no simulated–observed discrepancy is evaluated for these two areas in Figure 6.

The hydrodynamic modelling framework used in this study is an integrated compound flood model that incorporates coastal flooding, fluvial flooding, and pluvial flooding processes, which has already mentioned in the Numerical simulation Section. Therefore, the discrepancies between simulated and observed inundation characteristics are unlikely to be caused by the absence of fluvial or pluvial contributions in the extracted simulation results.

We acknowledge that the discussion on deviations is insufficient. Therefore, we have revised Lines 257–263 accordingly to provide a more systematic explanation of these discrepancies. Details are as follows:

Such discrepancies may stem from several sources of uncertainty. First, uncertainties in rainfall, river discharge, and boundary conditions can affect the timing and magnitude of pluvial and fluvial flooding. Uncertainties in topographic and bathymetric data may further modify local flow pathways and determine whether low-lying areas are inundated. Second, model parameterization and land-surface representation can introduce additional discrepancies, as simplified hydraulic parameters and incomplete representations of buildings and drainage infrastructure may not fully resolve local flow processes. Third, coastal defense structures may contribute substantially to spatially heterogeneous discrepancies. Seawalls and coastal dikes can restrict, redirect, or confine floodwaters, thereby locally controlling whether water propagates inland or remains within the coastal zone. Consequently, differences between their actual and modelled crest elevations, structural continuity, openings, and conditions may shift the simulated inundation boundary. Groins can likewise alter nearshore flow patterns and water-level distributions, thereby affecting the pathways through which coastal floodwaters reach adjacent shorelines. Because such structures are often much smaller than the spatial resolution of regional hydrodynamic models, their hydraulic effects may not be adequately resolved. Fourth, the wetting–drying threshold can influence the identification of marginally inundated cells, particularly near the simulated flood boundary. Finally, uncertainties in field observations may also contribute to the observed–simulated discrepancies, owing to incomplete spatial coverage and the difficulty of accurately delineating inundation boundaries after floodwaters have receded. (Line 334–348 in the revised manuscript)

6. Grammatical errors and typographical mistakes appear throughout the text. For example, “The simulated and observed inundation extents was presented in Figure 5” contains subject-verb disagreement; Table 4 shows “51,5424.4” with incorrect thousands separators for economic loss values. Please conduct full manuscript

proof-reading and standardize numeric formatting for all tables and main-text figures.

Response:

Thank you for your careful review. We have carefully proofread the entire manuscript and corrected grammatical errors, typographical mistakes, and inconsistencies in numerical formatting. For example, the subject–verb agreement error in the sentence “The simulated and observed inundation extents was presented in Figure 5” has been corrected to “The simulated and observed inundation extents were presented in Figure 5”. In addition, the incorrect thousands separator in Table 4 has been corrected, and numerical formats throughout the manuscript, including tables and figures, have been standardized.

7. Several in-text citations miss proper punctuation and formatting. For example, reference citations like “(Yang et al., 2019). These findings demonstrate...” should maintain consistent punctuation style across the whole manuscript; please standardize all in-text citation formatting following NHES template requirements.

Response:

Thank you for your reminding. We have carefully checked and standardized all in-text citations throughout the manuscript to comply with the NHES template requirements, ensuring consistent punctuation and citation formatting.

8. The informal phrase “storm water” repeatedly appears in Section 3.1, this should be replaced by the standard term.

Response:

Thank you for your valuable comments. We acknowledge that "storm water" is an informal term and may cause confusion. Therefore, we have revised the relevant sentence to make it more professional and clear. The revised sentence is as follows:

The maximum storm surge occurred 1–2 h after the astronomical high tide of the day. Thus, the peak storm surge was superimposed on the astronomical tide, resulting in a substantial increase in water levels near the Pearl River Estuary and evident

exceedance of the warning water level. (Line 201-203 in the revised manuscript)

9. Some references (e.g., Du et al., 2024a,b) are cited but not clearly distinguished in the text; ensure proper differentiation when citing multiple works from the same author/year.

Response:

Thank you for your valuable comments. We have carefully reviewed all citations of multiple works by the same authors published in the same year and revised them to ensure clear distinction in the text. For instance, the citation to the compound flood modelling framework has been revised from "Du et al. (2024)" to "Du et al. (2024a)" to distinguish it from the related study by Du et al. (2024b) cited elsewhere in the manuscript.

10. Line 185: Table 5 caption refers to "Hato typhoon storm surge" - be consistent with "Typhoon Hato" throughout.

Response:

Thank you for your suggestion. We have revised the caption of Table 5 from “Hato typhoon storm surge” to “Typhoon Hato” to ensure consistent terminology throughout the manuscript.