The authors present an interesting study on the effect of tropical cyclone compound flood to Haikou City using hydrodynamic modelling. The paper is well written and organized. I believe the paper will be publishable with some minor revisions and additions.

In more general terms:

- The English needs some proof reading, please refer to the specific term below.

We have reorganized the manuscript and carefully revised each section. The results and conclusion sections were largely re-written.

- The authors entitle the manuscript "Assessing tropical cyclone compound flood risk using hydrodynamic modelling: a case study in Haikou City, China", emphasizing the method of “hydrodynamic modelling”, then the advantage and disadvantage of the method should be discussed.

We re-wrote the method section to explain the advantage and disadvantage of the hydrodynamic modelling method:

Line 92: This method has the advantage of observing the spatiotemporal dynamics of rainfall and storm surges during TCs (Gori et al., 2020b; Orton et al., 2020). However, assessing the compound flood risk by constructing a coupled model is not commonly used in current studies on compound flood hazards, mainly because the simulation of compound flooding involves multiple driving condition settings and requires combining multiple physics-based models.
References:


- The authors do not discuss the function of seawall – which is crucial on the extent of flooding area caused by sea hazard. I recommend some discussion of this topic in the paper.

It is because we are interested in compound flooding effect. To cope with the influence from seawall. We collected the information of the construction standard of seawall and compared it with the high-resolution (5 m) DEM of Haikou, finding that the effect of seawall can be reflected by the DEM roughly. In the future, we would import more accurate seawall data in the overland flooding model. We have included a discussion in the paper:

Line 202: The high-resolution topography of study area is imported in the model, and it can roughly reflect the effect of seawall.

- The authors should add to the literature review and discussions more detail previous literature looking at the copula function of compound flooding (e.g. Lin-Ye, et al., 2016; Zhang et al., 2021), since it is the future research of your work.

Min Zhang; Zhijun Dai; Tjeerd J Bouma; Jeremy Bricker; Ian Townend; Jiahong Wen; Tongtiegang Zhao; Huayang Cai; Tidal-flat reclamation aggravates potential risk from storm impacts, Coastal Engineering, 2021, 166: 103868.


Thanks for pointing to these papers. We rephrased the sentence as follows:
Copula is a kind of function connecting joint distributions and marginal distributions (Lin-Ye et al., 2016). Zhang et al. (2021) calculated the overtopping occurrence by determining the correlations between tidal levels and wave heights based on copula function. In recent years, copula function has been confirmed to model and describe the dependence between flood variables and express compound flood risk (Zellou and Rahali, 2019). Xu et al. (2019) employed copula function to investigate the bivariate return period of compounding rainfall and storm tide events, finding that joint probability analysis can reveal more adequate and comprehensive risk about compound events than univariate analysis.

References:


In more specific terms:

For a 100-year TC event, the inundation area with a depth above 1.0 m increases by approximately 2.5 times when compared with a 5-year TC event. Comparing single-driven flood (storm tide flooding and rainstorm inundation) and compound flood hazards shows that simply accumulating every single-driven flood hazard to define the compound flood hazard may cause underestimation.
For future research on compound flooding, the copula function can be adopted to investigate the joint occurrence of storm tide and rainstorm to reveal the severity of extreme TC flood hazards.

Thus, it is important to investigate the compound flood risk during TCs to comprehend flood hazards in coastal cities better.

Due to global warming, sea-level rise, land subsidence, and urban expansion,

Both studies showed that there would be an increase in compound flood risk in coastal cities in the future.

Lian et al. (2017) identified the major hazard-causing factors of compound flooding and classified the floodplains into tidal, hydrological, and transition zones in Haikou City.
For example, based on the recorded storm tide from 49 tide gauges and daily precipitation from 4890 rainfall stations in Australia, we rephrased the sentence as follows:

For example, based on the recorded storm tide from 49 tide gauges and daily precipitation from 4890 rainfall stations in Australia,

However, for many coastal regions in the world, it is difficult to obtain sufficient recorded data that can be used to analyze the mechanism of TC compound flooding from storm tide and rainfall.

For example, Yin et al. (2021) constructed a storm surge model to simulate the storm tide derived from 5000 synthetic TCs to estimate TC-induced coastal flood inundation.

For example, Yin et al. (2021) constructed a storm surge model to simulate the storm tide derived from 5000 synthetic TCs to estimate TC-induced coastal flood inundation.

Reference:


It is an effective method to model the flood extent and inundation depth, and
this method has generally been applied in research on single-driven flood hazards

Line86, we rephrased the sentence as follows:

It is an effective method to model the flood extent and inundation depth, and this method has generally been applied in research on single-driven flood hazards

98-99-> has been widely applied to build storm-surge numerical models

Line98, we rephrased the sentence as follows:

Delft3D Flexible Mesh (DFM), developed by Deltares, Netherland, has been widely applied to build storm-surge numerical models for research on storm surge because of its capability of simulating 2D and 3D shallow water flow

100-101-> It integrates Delft3D-FLOW model suites and uses flexible unstructured grids, convenient for partial

Line100, we rephrased the sentence as follows:

It integrates Delft3D-FLOW model suites and uses flexible unstructured grids, convenient for partial grid refinement

103-> characterizing extreme sea levels,

Line101, we rephrased the sentence as follows:

A recent study on compound flooding utilized this model to simulate storm surges for characterizing extreme sea levels,

107-> Therefore, it is feasible to simulate storm surge and rainfall-runoff based on DFM to assess compound flooding.

Line107, we rephrased the sentence as follows:

Therefore, it is feasible to simulate storm surge and rainfall-runoff based on DFM to assess compound flooding.
This study investigates the compound effect of flooding from storm tide and rainstorm during TCs to understand compound flooding in Haikou better. We set up a storm surge model and overland flooding model based on the DFM model to simulate the floodplain under TC events.

We select 66 TC events that influenced Haikou to explore the probability distribution of storm tide, further selecting 5 TC events that correspond to the 5-, 10-, 25-, 50-, and 100-year return periods, respectively.

Haikou is frequently affected by TCs and rainstorms from June to October. The annual rainfall is around 1660 mm.

Storm tide flooding caused by TCs is one of the main natural hazards in Haikou, roughly three storm surges have occurred in Haikou every year in recent decades.

For example, during Typhoon Kalmaegi (2014), a total of 219.8 mm (24h)
For example, during Typhoon Kalmaegi (2014), a total of 219.8 mm (24h) of precipitation were produced and the highest tide level reached 4.3 m in Haikou.

Delft3D Flexible Mesh (DFM), developed by Deltares in 2011, is a practical unstructured shallow water flow calculation model.

It can be used for ocean hydrodynamic and surface runoff numerical simulations.

In this study, the DFM model was established to calculate the hydraulic boundary conditions needed to estimate the overland flow boundary and simulate the overland inundation during the TCs period (Gori et al., 2020b).

Reference:

The minimum mesh grid size is 100 m, and the maximum mesh grid size is 12000 m. The astronomical tide is simulated by importing the phase.
The minimum mesh grid size is 100 m, and the maximum mesh grid size is 12000 m. The astronomical tide is simulated by importing the phase and amplitude of tidal constituents (Q1, P1, O1, K1, N2, M2, S2, and K2) extracted from the global tidal model (TPXO8.0).

194- The storm surge model is validated against the measured astronomical tide

Line192, we rephrased the sentence as follows:

The storm surge model is validated against measured astronomical tides and storm tides (astronomical tide plus storm surge).

208-212- We collect the inundation data of TC1415 and conduct fieldwork in Haikou to validate this model. The overland inundation model can be approximately validated by comparing the inundation map of TC1415 with measured inundation area and depth.

Line208, we rephrased the sentence as follows:

We collect the inundation data of TC1415 and conduct fieldwork in Haikou to validate this model. The overland inundation model can be approximately validated by comparing the inundation map of TC1415 with measured inundation area and depth.

217- Therefore, 66 TCs from 1960 to 2017 are selected

Line218, we rephrased the sentence as follows:

Therefore, 66 TCs from 1960 to 2017 are selected in this study (Figure 2), and we construct typhoon wind fields and simulate the storm tide of these TCs.

240-241- which equals 1/P, to investigate the possibility of an extreme storm tide. The corresponding TC events in 5-, 10-, 25-, 50-, and 100-year return periods can be found to

Line240, we rephrased the sentence as follows:

We replace P with storm tide return periods (T), which equals to 1/P, to investigate the possibility of an extreme storm tide. The corresponding TC events in 5-, 10-, 25-, 50-, and 100-year return periods can be found to compare the compound flood hazards with different storm tides.
We utilize the TC1415 event also to validate the overland flooding model. 

Furthermore, the distribution of simulated inundation area is also consistent with the actual flood distribution. Hence this overland flooding model has a good capacity for modelling and demonstrating TC flood hazards.

For a 100-year TC event, the inundation area with a depth above 1.0 m increases by approximately 2.5 times compared with a 5-year TC event.

This study investigates the compound effect of flood hazards by studying the probability distribution of highest storm tides during TCs.
Copula function has been confirmed to model and describes the dependence between flood variables and express compound flood risk.

In recent years, copula function has been confirmed to model and describe the dependence between flood variables and express compound flood risk (Zellou and Rahali, 2019).

Reference:

Although this study is limited to Haikou City, we confirmed that it is available for other coastal cities to adopt the methodology of coupling two hydrodynamic models to quantitatively assessing compound flooding risks.