Response to Anonymous Referees

Dear Editor,

Thank you very much for the constructive feedback from you and the reviewers. We have addressed all the reviewers' comments. Please find a point-by-point reply below.

Kind regards

Ting Zhang

Response to First Referee

In this study, the authors conducted a comprehensive investigation of the driving factors behind compound flooding in coastal cities using a combination of hydrodynamic modeling and mathematical statistics. Their research yielded insights into the impact of rainfall and tidal levels on compound flooding, as well as the contributions of different types of floods to compound flooding. The conclusions of this study are novel and have positive implications for risk management. The chosen topic also aligns with the scope of the journal "Hydrology and Earth System Sciences.", I have several suggestions and recommendations that would help enhance the manuscript.

Specific comments

1. It is necessary to indicate whether there are tide prevention facilities in the study area and how this factor is considered in the model.

Response: Thank you for your suggestion. Indeed, the issue of flood control facilities is a significant factor in our research. A tidal gate has been installed at the river outlet in the study area. We will include detailed descriptions of the flood control facilities and model settings in the model construction section. Specifically, a tidal gate with a total net width of 24 meters is installed at the river outlet. In the model, the design tide level is set outside the gate. The operational rule is set such that when the tide is receding and the water level inside the gate is higher than the water level outside the gate, the gate is opened to discharge water. The gate status is checked every hour to determine if adjustments are needed.

2. In the "Model construction and validation" section, a one-dimensional and two-dimensional hydrodynamic coupling model was constructed, but the analysis of flood severity primarily relied on flood volume, with limited analysis on indicators such as flood area and flood depth. This aspect needs to be supplemented.

Response: Thank you for your feedback. We will include a detailed analysis of flood area and flood depth in the results section. Although using flood area or flood depth alone is not suitable for calculating impact index, these data are indeed necessary for comprehensive analysis to provide a more thorough assessment of compound flood impact.

3. The paper only mentioned the length of the original data but did not elaborate on the sample data situation for constructing the Copula function.

Response: Thank you for your suggestion. We will include details on sample selection methods and specific data in the methodology section. Specifically, we calculate the maximum values of rainfall for different durations (1h, 3h, 6h, 12h, 24h) each year, using the minimum value in the set of maxima as the threshold. We select rainfall events exceeding this threshold. If there are multiple events exceeding the threshold in a single day, only the largest one is chosen. For each selected rainfall sample P, the highest tide level value Z on the same day is identified as the tidal sample. In this study, the rainfall thresholds for 1h, 3h, 6h, 12h, and 24h are 36mm, 56mm, 58mm, 66mm, and 78mm, respectively. The final number of samples for each duration is 48, 39, 49, 49, and 52, respectively.

4. The paper is lengthy, and to be concise, compressing the research methods section would be helpful. For example, common formulas in Correlation and Copula.

Response: Thank you very much for your suggestion. We will reorganize the methodology section based on your advice. For example, commonly used correlation formulas will be provided through citations rather than detailed explanations in the text.

5. In the section "Spatial interaction of drainage units," the analysis of the interaction forces between different drainage units is not highly relevant to the main theme of this paper.

Response: We appreciate your suggestion. The original aim was to identify the key areas for flood control and disaster mitigation management by analyzing the hydraulic connections of different drainage units. We will consider reorganizing this section or removing it from the study based on the comments from multiple reviewers and the editor.

6. In section 4.4 "Causes and prevention measures of floods in drainage units," flood prevention measures should not be discussed in the research results. It is suggested to elaborate on them in the discussion section.

Response: Thank you very much for your suggestion. We have moved the discussion of flood control measures to the discussion section, where we will elaborate on specific prevention and control measures for different causes of flooding.

7. The conclusion needs further refinement.

Response: We will further refine and summarize the conclusions of this study.

Technical comments

L11: The word "Currently" is repeated.

Response: Thank you for your feedback. The errors have been corrected.

L31: Change "in this year" to a specific year.

Response: Following the suggestion, the date has been revised to 2023.

Figure 1: Mark all drainage outlets in the figure.

Response: We will revise Figure 1 to include all drainage outlets.

Table 1: Explain why the RMSE of the edge distribution function corresponding to the optimal tidal level for 3h is not the best.

Response: For the 3-h duration, although the RMSE of the edge distribution function corresponding to the optimal tide level is not ideal, the difference from the minimum value is minimal. It is common to encounter this phenomenon when using multiple evaluation metrics. It is necessary to consider the research question and select the main evaluation indicator. In this study, we prioritize AIC as the main evaluation indicator. Relevant explanations will be added to the methodology section.

L430-431: What is the specific relationship? It needs to be clarified.

Response: In the discussion section, we explore the relationship between total rainfall, rainfall peak, peak time, and the severity of flooding. Specifically, we observe that higher average rainfall intensity and peak coefficient lead to larger flood volumes. Rainfall events with larger peak values tend to be more destructive compared to those with earlier peak times. We will further elucidate this relationship by considering combined scenarios of rainfall and tide level.

L457-459: Drainage unit 14 appears in both cases simultaneously, please verify.

Response: It has been verified that the Dt of drainage unit 14 is close to 1. L458-460 has been modified as follows: "For DU15 to DU16 and DU18 to DU22 in Fig. 12(b), Dt values are around 0.5, which indicates that flooding is the result of the 460 combined effects of rainfall and tides."

L460-461: Same as above.

Response: This part has been modified as follows: "In spatial terms, the Dt values for DU15 to DU16 and DU18 are greater than those for DU19 to DU22 ."

L508-509: This is an observation, not a conclusion.

Response: The sentence can be rephrased as "The trend of FP corresponds to the total flooding volumes of the FP_S2, FP_S3, and FP_S4 stages."

Figure 14: The discussion of the causes of sudden changes is crucial.

Response: Thank you for your feedback. The main reason is the influence of the tidal gate control, which we will delve into in the discussion section.

L520-522: This should be in the Methods section.

Response: Thank you very much for your feedback. We will move this content to Section 3.6.