Response to RC2

Dear Editors and Reviewers:

We would like to express our sincere gratitude to you for sparing your precious time to provide valuable and constructive comments on our manuscript entitled Study on Critical Rainfall for Flash Flood Disasters in Small Watersheds of the Three Gorges Reservoir Area: A Case Study of Futian Small Watershed in Wushan County, Chongqing (Manuscript ID: egusphere-2025-3833). These comments have played a crucial role in improving the quality of our manuscript and optimizing the research design.

We have carefully studied and analyzed all the reviewers' comments one by one, and clearly recognized that the original manuscript has several deficiencies in methodology description, research design rigor, result verification and logical flow. Adhering to the rigorous and realistic scientific research attitude, we have conducted a comprehensive and systematic revision of the manuscript. Below are our point-by-point responses to the reviewers' comments:

Major Points:

The aim of the study indicates that four methods will be compared. However, in the methodology section, only the Floor Area Model is described... How were the outcomes of the other methods acquired? The authors do not justify how the Area Flood model was parameterized... I do not understand why 10 out of 19 flooded events were randomly selected... The regression analysis between inundation depth and cumulative area suddenly appears in the results... I cannot follow how the conclusions are related to the methodology and results. In the current status the study is hard to follow and understand.

Response:We highly appreciate your comments on the overall structure, methodological completeness, and logical flow of the manuscript. After in-depth reflection, we fully agree with your views that the original manuscript had serious flaws in these aspects, making it difficult for readers to understand. We have revised the structure and content of the entire manuscript.

Incomplete methodology: We have provided comprehensive and detailed descriptions of all four methods in Section 1.3 (Research Methods). Specifically, Section 1.3.2 elaborates on the hydrodynamic model method, while Section 1.3.3 systematically presents the principles, data sources, and calculation steps of the three statistical methods (Multi-station Extremum Averaging Method, Regional Critical Rainfall Method, and Probability Distribution Method).

Unclear model parameterization: A new subsection entitled

"Model Parameter Settings" has been added to Section 1.3.2. It details the basis for determining hydraulic roughness (Strickler coefficient) and runoff coefficient (SCS-CN), and specifically explains how to dynamically adjust CN values according to the antecedent moisture condition (AMC) of each event, thereby providing sufficient justification for the model parameterization process.

Unclear reasons for selecting 10 out of 19 events: The logic for event selection has been clearly explained in Section 1.2 (Data Sources and Processing). We divided the 19 events into 10 calibration events (for model construction and parameter calibration) and 9 validation events (for independent evaluation of model performance). This is a standard "calibration-validation" approach aimed at avoiding model overfitting and testing its generalization ability, which has been clearly stated in the manuscript.

Unclear purpose of regression analysis: In the "Critical Rainfall Determination Process" in Section 1.3.2, a specific step (③ Construct Regression Model) is included to elaborate on the purpose and method of regression analysis. That is, by establishing a quantitative relationship between "rainfall-inundation depth", the critical rainfall corresponding to a specific inundation depth (disaster level) is inversely derived. In this way, the regression analysis is pre-explained in the methodology section rather than appearing abruptly in the results.

Confusing logical flow: The logical line of the entire manuscript has been reorganized to follow a clear thread: the introduction presents the research objectives→the methodology section elaborates on the "calibration-validation" design and the specific operation of the four methods→the results section first presents the calculation results of the four methods, then conducts comparative analysis to derive the recommended critical rainfall, followed by validation→the conclusion and discussion section summarizes the findings and reflects on the research. We believe the revised manuscript has a clear logic and is easy to understand.

Minors:

Figure 1. You should fill the blank space with the elevation map and outline the borders of the Futian Small watershed. Now it looks isolated.

Response:Thank you very much for your valuable suggestions on optimizing the charts. We have adopted your opinions as follows:

Revised Figure 1: We have redeveloped Figure 1. The new chart uses a Digital Elevation Model (DEM) as the base map, which intuitively displays the topographic relief characteristics of the study area. It also clearly marks the watershed boundaries, river networks and relevant stations, eliminating the sense of isolation and significantly enriching the information content.

Table 1: This table could be more representative as a graphic showing the events and their duration.

Response:We sincerely appreciate the reviewer's thoughtful suggestion to present the information in Table 1 graphically. While we agree that visual representations can enhance interpretability, we have opted to retain the tabular format for two key reasons.

First, Table 1 includes multiple heterogeneous variables—such as casualty counts, economic losses, and affected crop areas—that vary substantially in scale and unit. Representing all these dimensions simultaneously in a single graphic would likely introduce visual clutter or risk misinterpretation.

Second, as outlined in the methodology section, the primary focus of this study is to establish the relationship between hydrological processes (i.e., precipitation and inundation depth) and critical rainfall thresholds. The disaster impact data in Table 1 serve mainly to support event selection and contextual validation rather than as core analytical variables. Nevertheless, they provide essential background on the severity and scope of each flood event, which strengthens the credibility of our threshold analysis.

For these reasons, we believe the current tabular format best preserves the completeness and clarity of this contextual information while avoiding unnecessary complexity in visualization.

L145: It doesn't explain how these coefficients will be used.

Response: Thank you for your valuable comments. We have explicitly added the following sentence at the beginning of Section 1.3.1:"Surface hydraulic roughness(expressed by the Manning-Strickler coefficient) and surface runoff coefficient (based on the SCS-CN method) are two key input parameters for simulating the surface runoff process in the FloodArea model." We have also provided explanations for these two key parameters.

L157: What about the description of the other methods?

Response: Thank you for your valuable comments. We have supplemented detailed descriptions of the three statistical methods in Section 1.3.3.

L159: You should add the reference.

Response: Thank you for your valuable comments. We have added the citation to the official technical document of its developer company when the model is first mentioned (Geomer, 2003).

L173:179: This is methodology. Please move it to the methods section.

Response: Thank you for your valuable comments. We have moved this paragraph from Section 2.1 "FA Simulation" in the original manuscript to Section 1.3.2 "FloodArea Model Simulation Method" in the revised version and integrated it therein.

L157: You should describe how the methods will be compared.

Response: Thank you for your valuable comments. We have added a comparison of the calculation results of each method in Section 2.3. Then we adopted the "minimum value" principle to adjust and optimize the results of the four methods, selecting the minimum critical rainfall value among the four methods as the recommended flash flood critical rainfall for the corresponding duration. Subsequently, we used the rainfall data of 9 verification events to test the recommended critical rainfall. Verification results show that the recommended critical rainfall indicators successfully triggered early warnings for all 9 verified flood events (i.e., the rainfall amount of at least one duration exceeded the threshold), with a hit rate of 100%.

We would like to express our sincere gratitude again for the valuable comments provided by the reviewers.We look forward to your further review.

Sincerely yours

The Authors

December 24, 2025