

## Response to RC2

- The objective of this paper is to develop a quantitative framework for assessing future typhoon-related hazards under climate change. The study uses Super Typhoon Hagibis (2019) as a case study and adopts an event-based storyline approach, integrating high-resolution atmospheric, hydrological, and storm surge models. It employs multi-model, multi-initial-condition ensemble experiments to represent both structural and internal uncertainties. Future hazard changes are evaluated under +2 K and +4 K warming scenarios, aiming to provide a comprehensive risk assessment.

Despite the richness of the data and the ensemble framework employed, the manuscript lacks clarity, focus, and sufficient scholarly rigor to warrant publication in its current form. Significant revisions are required to address the key structural, logical, and academic issues outlined below.

### **Response:**

We thank the reviewer for the careful and constructive assessment of our manuscript. We appreciate the recognition of the ensemble framework and integrated modeling approach. In response to the concerns regarding clarity, focus, and scholarly rigor, we have substantially revised the manuscript to improve its structure, logical flow, and transparency. Specific revisions addressing the structural and academic issues are detailed in our responses to the individual comments below.

### **Major Comments**

#### **1. Lack of logical coherence**

While the manuscript introduces a robust and ambitious modeling framework, the logical flow connecting the research objectives, methodology, and conclusions is often unclear. Transitions between sections are weak, and key modeling decisions (e.g., the selection of the case study, ensemble member pruning) are insufficiently explained, making it difficult for the reader to follow the scientific reasoning.

### **Response:**

We acknowledge that the description of the methodology was not sufficiently clear in the original manuscript. In response, we have revised the Methods section to improve clarity, with particular emphasis on the procedure for selecting the five representative cases from the initial ensemble (pruning) in line 121-127. We believe that this revision has improved the overall readability and logical flow of the manuscript.

## 2. Excessively lengthy and redundant descriptions

The manuscript contains lengthy and repetitive descriptions that obscure the core message. For example, Sections 1 and 2 contain overlapping discussions on the benefits of high-resolution modeling and ensemble approaches. The text would benefit greatly from streamlining to improve readability and clarity.

### **Response:**

We acknowledge that parts of the Introduction and Methods sections contained overlapping explanations, particularly regarding the advantages of high-resolution modeling and ensemble approaches.

In response, we have carefully streamlined the manuscript by removing repetitive discussions and consolidating overlapping content. The revised text now presents the motivation and methodological framework in a more concise and focused manner, improving readability and clarity while preserving essential scientific context. We believe that these revisions have significantly enhanced the overall coherence and accessibility of the manuscript.

## 3. Insufficient review of prior literature

Although a few relevant studies are cited (e.g., Kanada et al., 2021; Takayabu et al., 2015), the literature review is shallow and fails to clearly position the current work within the broader research context. Notably, several recent studies that use storyline or ensemble methods for typhoon risk assessment are omitted or only briefly mentioned.

### **Response:**

In the revised manuscript, we have expanded the Introduction to better situate our study within the broader research context. Specifically, we now discuss pioneering storyline-based studies such as Lynn et al. (2009) and Lackmann (2015). We have also incorporated recent multi-case integration experiments (e.g., Gutmann et al., 2018; Wu et al., 2025) and clarified their strengths and limitations in relation to the present study.

## **Minor Comments**

### 1. Undefined abbreviations

Abbreviations such as *NHRCM* and *GSM* appear without proper definition (e.g., in Sections 2.1–2.2). These should be clearly defined upon first use for reader comprehension.

### **Response:**

All model abbreviations (e.g., NHRCM, GSM, SuWAT, GeoClaw, MATSIRO, CaMa-

Flood, RRI, and 1K-DHM) are now clearly defined at their first occurrence in the manuscript. The text has been revised accordingly to improve clarity and reader comprehension.

## 2. **Lack of quantitative definitions**

Key terms like "*high resolution*" and "*super typhoon*" are not quantitatively defined.

The absence of such definitions reduces scientific precision. For example:

- What grid spacing constitutes "high resolution" (e.g.,  $\leq 60\text{km}$ )?

### **Response:**

We have revised the manuscript to provide quantitative definitions for key terms. Specifically, model resolution categories are now clearly defined in terms of horizontal grid spacing (e.g., 5–25 km for high-resolution models and  $<5$  km for convection-permitting models). These revisions improve scientific precision and clarity.

- What is the threshold wind speed or classification for a "super typhoon"?

### **Response:**

We have revised the Abstract to refer simply to "Typhoon Hagibis (2019)" and removed the term "super typhoon" to avoid unnecessary terminology in the summary. The definition of super typhoon is provided in line 59.

- Citation formatting errors

Some references, such as in paragraph 40, do not follow standard citation formats. These should be carefully reviewed and corrected according to journal guidelines.

### **Response:**

We have revised the citation formatting throughout the manuscript in accordance with the journal guidelines. In particular, non-standard journal abbreviations (e.g., SOLA) have been removed.

- **Misleading section title: "Discussion and Conclusion"**

In paragraph 260, the section is titled "Discussion and Conclusion," yet no substantial discussion is presented. A proper Discussion section is expected to interpret findings, compare them with previous research, and examine implications or limitations. Currently, the section functions as a conclusion only.

### **Response:**

We appreciate this comment. In response, we have separated the "Discussion and Conclusion" section into distinct Discussion and Conclusion sections. In the

Discussion section, we have added a more detailed discussion of the limitations of the present study and potential directions for future research.

- **Inaccurate use of the term “Multi-model”**

In paragraph 2 6 5 , the authors refer to their use of meteorological, hydrological, and coastal models as a “multi-model” approach. However, since these models serve **different functions**, the more appropriate term would be **“coupled modeling framework.”** The term “multi-model” generally applies to the use of multiple models serving the **same purpose** to capture structural uncertainty.

**Response:**

We appreciate this comment. In the present study, each component of the system (meteorological, hydrological, and coastal models) employs a multi-model approach to represent structural uncertainty within each modelling stage. In addition, as pointed out by the reviewer, these components are integrated into a coupled modeling framework. We have clarified this point by explicitly using the term “coupled modeling framework” in the revised manuscript (line 362).