The authors thank the reviewers for a very detailed reading of the paper and substantive comments that have clearly improved the research and its presentation. Below are the original comments in blue color and italics and our responses below them.

 # Anonymous Referee #3
Received: 08 October 2024

1. *The title mentions both pluvial and compound flooding, yet the study primarily focuses on pluvial flooding. The scope of compound flooding, including the interaction of coastal drivers like storm surge, is not adequately addressed. The title and introduction should better reflect the actual scope of the study.*
   We appreciate the reviewer's feedback regarding the title and the scope of the study. We acknowledge the need to better align the title and introduction with the study's focus. The primary objective of our study is to simulate the extreme pluvial flooding caused by Hurricane Ida, which, as noted in the original manuscript (lines 16, 21, 75), was primarily a pluvial event, and also to improve COAWST to incorporate rain and drain rates. While we explored potential compound flooding through sensitivity analyses, the primary focus remains on pluvial flooding. To reflect this more clearly, we have revised the title to make the study's scope clearer while acknowledging the potential for compound flooding considered in our sensitivity tests.

2. *The single-parameter drainage rate approach, while practical, limits the model's generalizability and accuracy across different events. The authors should provide a stronger justification for this method, considering more detailed models that include spatially varying land cover and urban infrastructure.*
   We acknowledge the limitation of using a single-parameter drainage rate. While this approach simplifies the model, it has shown to be effective in replicating flood patterns during intense rainfall events, as demonstrated by the alignment of our model outputs with high-water mark (HWM) observations. Additionally, the model can incorporate spatially varying drainage rates based on storm water system capacity and can be refined in future versions to improve generalizability across different events, as mentioned in the future work section.

3. *The sensitivity experiments involving shifting storm tracks do not account for changes in rainfall intensity or spatial distribution. This idealized approach oversimplifies the relationship between storm track variation and its impact on pluvial flooding. A discussion of these limitations should be included.*
   We agree the sensitivity experiments are simplistic, but they serve the purpose of demonstrating our model and exploring potential worse cases in spatial and temporal storm variations. Also, we have now improved the temporal shift by also shifting the storm surge. We have modified the text to acknowledge this simplicity, stating:

   > "These experiments are simplistic and true variations and uncertainties in storms can affect a wide range of storm characteristics including intensity and spatial distribution of rainfall. However, a comprehensive study of Ida forecasting uncertainties is beyond the scope of this paper."

4. *The manuscript's discussion of compound flooding is unclear, particularly in the context of storm surge, high tide, and coastal interactions. These aspects are not fully explored in the results, and the study seems to focus solely on pluvial flooding. The authors should either adjust the scope or provide more detailed analysis of compound flood scenarios.*
   We appreciate the reviewer's feedback regarding the detailed discussion on compound scenarios. We improved the compound flood scenarios context by adding a figure, an explanation of how the scenarios were conducted, and more discussion of the results.

5. *The need for event-specific calibration for the drainage rate method poses a challenge for practical application, particularly in data-scarce regions. More discussion is needed on the calibration process and how it could affect the model's reliability in broader applications.*
   We value your concern about the calibration process, and the scarcity of the available observed data for validation as we acknowledged in the original manuscript (line 435). To improve the robustness of the validation procedure, we add another rainfall event (29th September 2023), which we have more HWMs available for calibrating the model. More information about the event is added as a supplementary and the comparison plots have updated to include all data points available on both storms. This way we believe the calibration is more general, and with future increase in data availability (as mentioned in line 435 of the original manuscript), this robustness can be improved dramatically. In the original manuscript Line 411, we noted that according to the calibration and drain rates, our model may be more applicable to the extreme rain events and likely has lower accuracy or need for new running for weaker rain events.

6. *The claim that urban flood flow speeds reach up to 4 m/s seems high for the grid resolution used. The authors should justify this finding with a discussion on the limitations of their spatial resolution in capturing detailed street-level flow dynamics.*

   We appreciate the reviewer's comment. The observed flow speeds over 1m/s are found in areas with steeper slopes around 20 degrees (see Figure 2 for the DEM). For the flow speeds more than 3m/s, the regions have even steeper slopes. However, we acknowledge that the grid resolution used may not fully capture street-level details, as noted in the limitations section ("the moderate ~50-meter spatial resolution may overlook finer-scale variations in flooding. Potential future improvements to mitigate these limitations are discussed in Sect. 4.").

7. *The authors should provide more context on how these values were selected and their physical relevance, especially in representing urban stormwater systems.*
   The selected drain rates (6 mm/hour, 13 mm/hour, and 19 mm/hour) are based on physical reasoning and model calibration using high-water marks (HWM) from observed storm events (details in the supplementary material). Basically, the candidate values ranged all the way up to 44mm/hour (storm water system capacity of NYC), and the ones that lead to the best results are presented in the manuscript. We added this explanation to the manuscript as well.

8. *The authors should discuss the implications of using such limited number of high-water marks for model validation, particularly in relation to spatial variability in urban flooding.*
   We acknowledge the limitation of using a small number of high-water marks (HWMs) for model validation, especially regarding spatial variability in urban flooding. While the HWMs used represent all available data from Hurricane Ida, their spatial distribution may not fully capture the areas of maximum inundation. To mitigate this limitation, we included an additional less intense rainfall event from September 29, 2023, in the supplementary material, which provided more observed flood values (HWMs) and allowed for a more comprehensive validation. This approach helps strengthen the overall assessment of the model's performance across different spatial and rainfall conditions.

9. *The authors mention a 70 mm/hour rainfall rate but do not provide context on how this compares to return period values (e.g., from NOAA Atlas 14). A comparison to historical rainfall events would provide readers with a clearer understanding of the extremity of the event.*
   Change made. 70 mm/hour rain intensity or 2.76 inch/hour corresponds to a rain event with 50-year return period based on NOAA Atlas14 at 'NEW YORK JFK INTL' station. The explanation added to the section: "Ida's rain averaged across the Jamaica Bay watershed was 71 mm (2.8 inches) over 3 hours, which corresponds to a 10-year return period (between 5 and 25 years) based on NOAA Precipitation Frequency Data Server (Station ID 30-5803). However, the maximum intensity (Figure

3) reached 70 mm/hour, or a one-hour rain event with a 50-year return period (2.76 inch/hour) based on the same NOAA data (National Weather Service)."

10. *The boundary conditions for storm surge are not clearly explained. If the authors are only simulating coastal flood propagation without directly modeling storm surge, this should be clarified to avoid misleading the reader.*

    We do use the spatially varying wind stress and barometric pressure in both model domains as atmospheric forcing (as stated in lines 158 and 176 of the original version of the manuscript). We understand the reviewer's concern of miscommunication, so we added additional explanation about how we impose storm surge in the model:

    > "Additionally, subtidal water levels calculated from observations at the NOAA tide gauges at Sandy Hook (NJ; NOAA station 8531680) and Kings Point (NY; NOAA station 8516945) (Figure 2c) were added to the boundaries in New York Bight and western Long Island Sound, respectively. In addition, we simulate the influences of local wind stress and barometric pressure changes on the regional storm. This combination of boundary conditions and in-domain forcing allows for a more accurate representation of both local and regional storm surge effects."

11. *The use of uniform rainfall across the watershed is a significant limitation. A more detailed analysis using spatially varying rainfall inputs, or a discussion on how this uniform approach affects model results, would improve the manuscript.*

    We would like to clarify that our model does indeed incorporate spatially and temporally varied rainfall inputs, as mentioned on lines 127 and 179 of the original manuscript.
    These inputs were specifically chosen to reflect the variability in rainfall across the watershed to enhance the accuracy of our model results.

12. *The manuscript claims to model storm surge but does not appear to include wind stress or pressure fields. This limits the realism of the coastal component of the flood model. A discussion on how these factors could be incorporated would strengthen the study.*

    We would like to clarify that our model does indeed incorporate spatially varied wind stress and pressure fields as part of the meteorological forcing, which we have already mentioned in line 176 of the original manuscript.

13. *The manuscript uses a single CN value (90) for the entire urban area, which oversimplifies land cover and antecedent conditions. The authors should compute a weighted average CN or provide more justification for using a uniform value.*

    We appreciate the reviewer's feedback and have updated our hydrological analysis. Instead of applying a uniform CN value of 90, we recalculated a weighted average CN of 93.95. This was determined by using CCAP land cover data, which was already provided in our paper, and soil classification data from the USDA-NRCS Web Soil Survey and the Jamaica Bay Coastal Zone Soil Survey. The soils in the area primarily fall under Hydrologic Soil Group C, reflecting moderate infiltration rates. This updated CN calculation provides a more accurate estimate of the region's runoff potential during Hurricane Ida. We added these data to the manuscript:

    > "To reflect the spatial variability in urban and non-urban areas, a weighted CN of 93.95 is derived based on the land cover categories (C-CAP data, Figure 2d) and soil data from USDA-NRCS Web Soil Survey (U.S. Department of Agriculture; Cronshey, 1986)."

Cronshey, R.: Urban hydrology for small watersheds, 55, US Department of Agriculture, Soil Conservation Service, Engineering Division1986.
Web Soil Survey: https://websoilsurvey.nrcs.usda.gov, last access: 2024.