<u>Response to Reviewers' Comments</u>

Title: Suspended sediment dynamics in an urban, mountain catchment in Nepal
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We are thankful to the reviewers for their valuable comments on our manuscript. Below we respond to the comments and questions raised. Modifications and improvements are incorporated in the revised manuscript as mentioned below for each of the comments. For easy visualization, the responses to the reviewers' comments are provided below, and changes in the manuscript are in the track change form. Line numbers are used to refer to the changes made in the manuscript.

<u>Response to Comments from Reviewer #2</u>

Comment-R1: This manuscript presents a high-frequency, event-based analysis of suspended sediment transport in the Nakkhu River, a rapidly urbanizing catchment in Kathmandu Valley, Nepal. The study is both timely and important, as monsoon-driven flooding in Nepal has been intensifying in recent years, causing significant damage to populations and the economy. The growing population and rapid urbanization of the Kathmandu Valley further underscore the need for research of this kind. The authors use six months of rainfall data combined with field sampling and optical backscatter sensors during the 2023 monsoon to examine how rainfall intensity, antecedent moisture conditions, and human disturbances such as mining shape sediment responses.
I find the work well-executed and appropriate for HESS. The study addresses an important research gap in a region where monsoon flooding is worsening and sediment-related hazards carry serious socio-economic consequences. The focus on the Kathmandu Valley, one of the most densely populated and rapidly urbanizing areas in the Himalayas, makes this contribution particularly relevant.

I agree with the concern raised in RC1 that the discussion remains quite general in places. In addition to the points raised there, I would encourage the authors to include a brief discussion of what these findings mean for stakeholders involved in flood risk management and sediment monitoring in the Kathmandu Valley. Connecting the results to practical implications for preparedness and planning even briefly ,would significantly strengthen the paper's applied relevance.
Response-R1: Thank you for the encouraging words. We have added the brief discussion in the Conclusion and Implication section.

P25/L561-566
The concentration of sediment transport within a few intense monsoon events highlights the need for flood preparedness and infrastructure planning to account for short-duration storms that can rapidly mobilise sediment and alter channel conditions. It also demonstrates the importance of high-frequency monitoring, since low-frequency observations may miss hazardous sediment pulses that are critical for sediment-risk assessment and early response planning. The identification of mining zones and disturbed foothill areas as key sediment source areas further provides a basis for prioritising erosion control, slope stabilisation, and regulation of extractive and urban development activities.

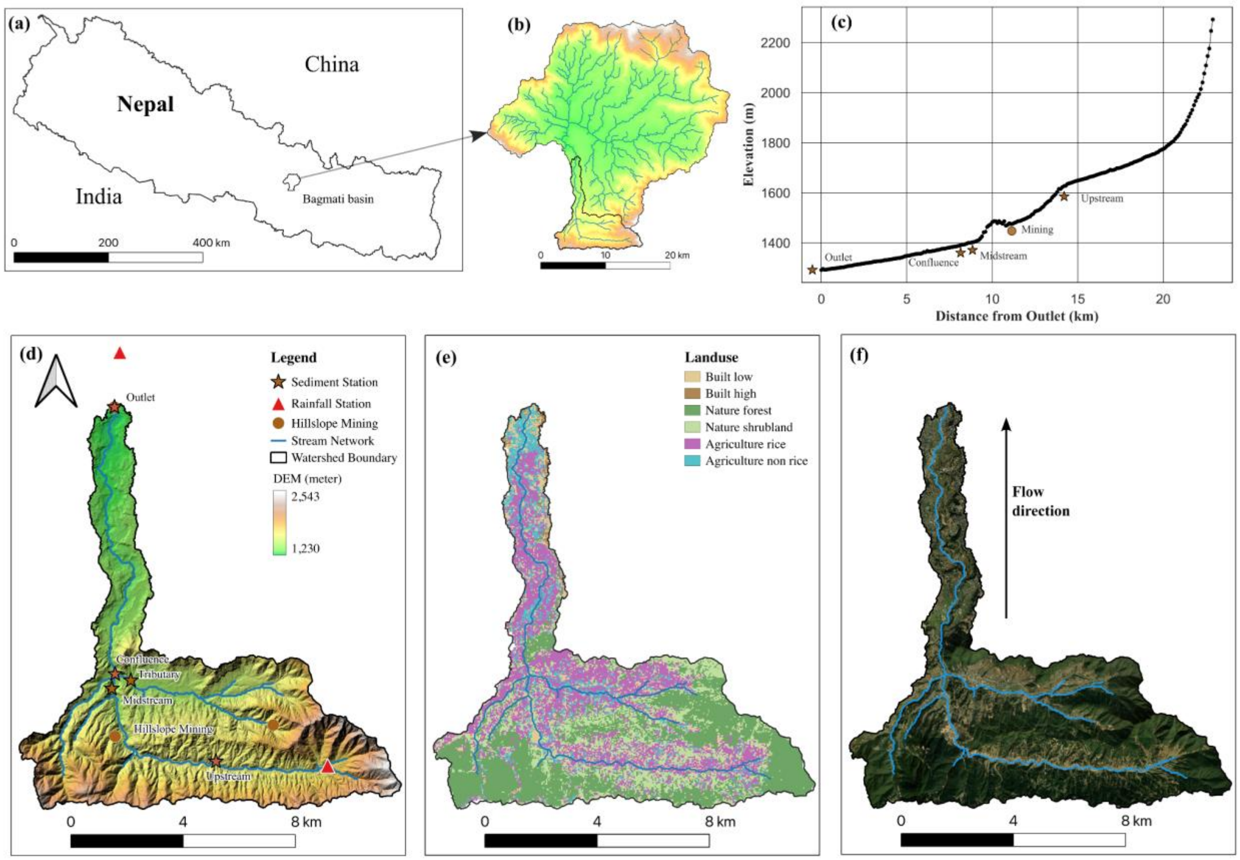
Comment-R2: **Line 19:** Please spell out "SSC" (suspended sediment concentration) at first use in the abstract to ensure accessibility for readers unfamiliar with the abbreviation.
Response-R2: Thank you for your suggestion. We agree with you and have revised accordingly.

Comment-R3: **Line 61:** The extent of damage caused by the flood event could be described more clearly. Additionally, referencing other major flood events in Nepal such as the Melamchi and Kagbeni floods would help build a stronger foundation for the motivation of this research and demonstrate a broader pattern of flood related hazards in the region.
Response-R3: Thank you for your suggestion. We have revised the sentence as per your comment. While major flood events such as the Melamchi and Kagbeni floods highlight the broader flood and sediment-related hazards in Nepal, they occurred in different geomorphic settings and were beyond the scope of this study, which focuses on urban sediment dynamics in the Kathmandu Valley.

P3/L65-68
This growing vulnerability was further demonstrated during the September 2024 flood, which was triggered by record-breaking rainfall and resulted in fatalities, caused widespread landslides, inundated settlements, damaged infrastructure (i.e. roads, bridges, buildings, and riverbank protection structures), and extensive channel alteration and sediment deposition along river corridors and floodplains (Lamichhane et al., 2025).

Comment-R4: **Line 80:** The description of the study area would benefit from additional detail. Including satellite imagery or a map that shows the direction of river flow relative to the valley would provide useful spatial context.
Response-R4: Thank you for this suggestion. We have revised the description of the study area as per your comment. In addition, we have revised Fig. 1 by adding a satellite image of the study catchment (Fig. 1f) with the stream network overlaid and the general flow direction indicated. We have also revised the study area section.

Revised Fig. 1



Comment-R5: **Figure 1:** Building on the above, incorporating satellite imagery into this figure would help orient readers. It would also be helpful to clearly show which stations were used for monitoring. As a minor point, the land use color choices could be improved, the current color appears predominantly green, making it difficult to distinguish categories such as rice, non rice, nature forest!

Response-R5: Thank you for these helpful suggestions. We have revised Fig. 1 accordingly. A satellite image has been added (Fig. 1f) to provide additional spatial context for the study area. The locations of the rainfall stations, sediment monitoring stations/synoptic sampling sites, and active hillslope mining areas are now clearly identified in Fig. 1(d). We have also revised the land-use color scheme in Fig. 1(e) to improve the distinction between vegetation classes, particularly rice, non-rice agriculture, and natural forest.

Comment-R6: **Line 105:** Please state the monitoring time period explicitly, including the start and end months and total duration, so the reader does not have to piece this information together from later sections.

Response-R6: Thank you for your suggestion. We have mentioned the study period in Section 2.2.

P6/L121

We collected high-resolution rainfall, discharge, and SSC data from May to October 2023.

Comment-R7: **Line 152:** This information would be better placed in Section 2.2, where data collection is first introduced.

Response-R7: Thank you for your suggestion. We have mentioned the study period in Section 2.2.

P6/L121

We collected high-resolution rainfall, discharge, and SSC data from May to October 2023.

Comment-R8: **Lines 153, 168, and 228–229:** The manuscript states that 7 flood events were "excluded due to unreliable SSC measurements," which implies they were entirely removed from the analysis in section 3.1. However, Section 2.5 describes estimating SSC for these events using the sediment rating curve and incorporating them into the total sediment load calculations. It would help to clarify that these events were excluded from the event-scale hysteresis analysis but were still included in the sediment load estimates. As currently written, the language is inconsistent and may confuse readers about the full scope of the dataset.

Response-R8: We agree that the original wording could be interpreted as implying that the seven events were removed from all analyses. This was not the case. The seven events were excluded only from the event-scale analysis because reliable continuous SSC measurements from the OBS sensor were unavailable. However, SSC for these events was estimated using the SSC-discharge rating curve and included in the continuous sediment load calculations. We revised the text to clarify this distinction.

P8/L173-174

During the whole study period, between May 2023 and October 2023, there were 16 flood events, out of which we observed 9 flood events with reliable continuous measurements of backscatter and retained for event-scale analysis.

P9/L189-193

For all other periods, including non-event periods and seven flood events where reliable SSC estimates from the OBS sensor were unavailable, SSC was estimated using an SSC-discharge rating curve (Fig. 3(b)). This rating curve was derived from manual water sample SSC measurements and corresponding discharge data (Walling, 1977) and was applied to discharge records during periods when reliable OBS measurements were unavailable, ensuring comprehensive sediment load calculations across both event and non-event periods.

P11/L251-253

The remaining 7 events were excluded due to unreliable SSC measurements from the OBS sensors; however, their sediment loads were estimated using the SSC-discharge rating curve and later included in the total sediment load calculations.

Comment-R9: **Figure 9:** The field photographs in this figure are very effective at conveying the physical and human impacts within the catchment.

Response-R9: Thank you for your positive feedback.