Dear reviewer,

Thank you for your constructive feedback. We have worked on the two main comments you have pointed out. Our response is listed in blue.

This manuscript investigates the gradual transition of the Karnali River fluvial fan system from a long-lived double-branch configuration to a single dominant channel. The study addresses an important and timely topic in fluvial geomorphology and river–fan dynamics, particularly in large Himalayan rivers where natural processes still dominate over engineering control. Overall, the manuscript is well written, and presents a possible explanation for Karnali River based on multiple datasets. However, I still have two major questions that need to be addressed.

1. The paragraphs are very short and lack clear logical flow, making the manuscript feel like a compilation of disconnected information. I suggest restructuring the paper around a coherent framework, such as scientific hypothesis → evidence → discussion → conclusion. Meanwhile, the Discussion section should be strengthened with more mechanistic explanations, as the current presentation of information is somewhat confusing.
2. The authors suggest that the river shift may be related to the 2009 monsoon season. Such as heavy 2009 monsoon season formed a sediment 'plug' in the upstream reach of the Geruwa branch. I think that this evidence appears relatively weak. Could the authors provide additional evidence to support this hypothesis?"

In addition to the above, there are some minor issues that I also suggest the authors consider.

Line 16-25. Could more recent literature be added here to highlight the significance of your study?

Line 40-51. At interannual timescales, human activities and climate change are the dominant drivers of river change; however, in certain regions or during extreme events, abrupt tectonic activity (such as earthquakes) and short-term sea-level fluctuations can also significantly influence river systems.

Line 61. Which natural factors are included here? These have not been specified earlier in the manuscript.

Line 143-144. This sentence should appear in the Discussion section.

Line 156-159 This is just a simple description; I would rather know more about the underlying mechanisms.

Line 187 "Sinuosity and Braiding Indices and Sinuosity Dynamics for". Should the first letter be capitalized?

Line 206-208 This is a good hypothesis, but how can it be tested? Is there any new evidence to support it?

Line 210-249 the Discussion section is overall too simplistic, merely ruling out some possible factors. I hope you can build on your results to provide more mechanistic insights.

Line 250-260. Could this be written as one or two paragraphs? There's no need for so many separate paragraphs.

Response to Comment 1

Observations on the gradually declining discharge in the eastern Geruwa branch on the fluvial fan of the Karnali river system have motivated this study. Following our response to Reviewer 1, we would like to emphasize that our research is exploratory and has been guided by the following questions rather than by a hypothesis. The research question that our study has aimed to answer is:

> What are the causes of the flow partitioning at the river bifurcation on the Karnali fluvial fan to increasingly disfavor its eastern Geruwa branch since 2009?

To answer this question, we formulated the following sub-questions:

A. How has the flow partitioning at the Chisapani bifurcation on the Karnali fluvial fan developed over the past centuries?
B. How do the hydrogeomorphic characteristics of the Karnali fluvial fan compare to those of other fluvial fans in the Himalayan foothills, in particular the Koshi fluvial fan in eastern Nepal?*
C. Does the monsoon-dominated hydrograph at Chisapani (located right upstream of the bifurcation) show deviations from its regular variability?
D. What role have water intakes had on the flow partitioning between the two branches of the fluvial fan?
E. What role have the embankments along the two branches of the fluvial fan had on the flow partitioning?
F. What role has the elevated land to the east of the Karnali River and downstream of the Chisapani bifurcation had on the flow partitioning?
G. What can explain the *gradual* decline of the flow discharge into the Geruwa since the 2009 season?

*We have chosen for a comparison of the Karnali and Koshi fluvial fans as the latter is one of the most studied systems in this region.

Following this reviewer and Reviewer 1's comments, we have done some additional analyses that provide more clarity and evidence to our concluding hypothesis. We refer to our response to Comment 2 below.

We will adjust the Introduction section to include this information and make the paper more coherent.

Response to Comment 2

We agree on your point that evidence in support of our hypothesis has limitations. This point was also raised by the first reviewer.

Following your and the first reviewer's suggestions, we have investigated remotely sensed data of the area in more detail. We have analyzed satellite images and global DEM data sets from before and after 2009. We have considered SRTM 30m Global DEM data, which represents earth surface elevation from 2000, as well as the composite Copernicus 30m Global DEM collected over the period 2011-2013. Most of the Copernicus data for the Karnali fluvial fan stems from 2011. These two DEM data sets are the only ones available to us.

In addition to DEM data, we have analyzed Landsat images from 2000, 2009 (before the monsoon season), and 2011 to extract land cover and stream network information, both under low discharge conditions at Chisapani (Figure 1).

In 2000, the Geruwa branch carried a significant portion of the water discharge, and under low flow conditions at least two channels supplied water to the eastern Geruwa branch from an outer bend at Dolphin Point in the upstream Karnali River (Figure 1A). By 2009 (yet before the double monsoon peak), a new eastern channel has formed near the eastern fan boundary (Figure 1B). In 2011, this eastern channel supplying water to the Geruwa branch ceased to exist (Figure 1C). Under low flow conditions, only one channel still supplies water to the Geruwa branch, and it has narrowed since 2009. As a result, a large part of the Chisapani water discharge is transported through the Kauriala branch.

The disappearance and decline of the eastern channels between 2009 and 2011 reflect the decline of river discharge into the Geruwa branch, which seems to be associated with sediment deposition in the channel taking off from the outer bend at Dolphin point.

We have computed the difference in surface elevation between the composite Copernicus DEM (2011-2013) and the SRTM DEM (2000) (Figure 1D-E). In 2011 the upstream zone of the Geruwa branch has become elevated compared to 2000 (Figure 1E). Our domain of interest is unvegetated, which implies that DEM surface elevation data reflecting canopy elevation for vegetated areas does not affect estimates. Sediment deposition between 2011-2013 and 2000 and the resulting elevation difference across the upstream region of the Geruwa branch seem to have restricted the water discharge into the Geruwa branch.

In addition, we have analyzed grain size distributions of the bed surface sediment. To this end, we have determined surface grain-size distributions from images taken at various locations along the fluvial fan (Figure 2). We have used Segmenteverygrain (Sylvester et al., 2025) , a python-based tool, to determine surface sediment grain size from the images. The results indicate that the surface sediment across the outer bend at Dolphin Point and the upper reach of the Geruwa branch consists of a large amount of boulders compared to other locations.

The increase in bed level and boulder deposition across the upstream end of the Geruwa branch underline our hypothesis that a self-reinforcing mechanism was triggered (a) where boulders carried during peak flood discharge are deposited right downstream of the Karnali outer bend across the upstream end of the Geruwa branch; (b) deposited boulders, unable to move further downstream under these peak discharges, increase riverbed level across the upstream Geruwa branch, (c) this subsequently reduces the flow entering this branch; (d) this reduced flow limits the further transport of boulders into the Geruwa branch and (e) enhances further boulder deposition in the subsequent flood season.

We will include the above information in the manuscript.

Our response to additional comments:

Comment 3. Line 16-25. Could more recent literature be added here to highlight the significance of your study?

We will include relevant literature in the updated manuscript.

Comment 4. Line 40-51. At interannual timescales, human activities and climate change are the dominant drivers of river change; however, in certain regions or during extreme events, abrupt tectonic activity (such as earthquakes) and short-term sea-level fluctuations can also significantly influence river systems.

Thank you for your comment. We agree that human activities, climate change, and also extreme events influence river morphodynamics. We will add this information in the introduction.

Comment 5. Line 61. Which natural factors are included here? These have not been specified earlier in the manuscript.

The natural factors include hydrology, topography and geology. We will update the manuscript.

Comment 6. Line 143-144. This sentence should appear in the Discussion section.

Agreed, we will update the manuscript.

Comment 7. Line 156-159 This is just a simple description; I would rather know more about the underlying mechanisms.

Indeed, the explanation on why bifurcation stability is not a closed topic was brief. We will expand the manuscript and explain remaining challenges more clearly:

1. Nonlinear morphodynamic feedbacks

The stability of river bifurcations is controlled by strongly nonlinear feedbacks between flow partitioning, sediment transport, and channel bed level. Perturbations in discharge or sediment supply can trigger self-reinforcing adjustments (e.g. preferential channel deepening), making bifurcation behavior sensitive to boundary conditions and initial states (Blom et al., 2024; Bolla Pittaluga et al., 2003; Wang et al., 1995).

2. Scale dependence and long adjustment times

Bifurcation dynamics emerge from processes acting across multiple spatial and temporal scales, from bar-scale sediment sorting to basin-scale sediment supply and base-level change. It remains difficult to distinguish transient responses from long-term stable configurations as bed level adjustments often span decades to centuries (Bolla Pittaluga et al., 2015; Kleinhans et al., 2008).

3. Anthropogenic modification of bifurcation dynamics

Engineering interventions such as dams, groynes, dredging, and bank fixation strongly modify flow and sediment regimes at bifurcations. Consequently, observed stability may reflect active management rather than intrinsic morphodynamic behavior, complicating the interpretation of stability in both natural and regulated river systems (Kleinhans et al., 2013; Mendoza et al., 2019).

Comment 8. Line 187 “Sinuosity and Braiding Indices and Sinuosity Dynamics for”. Should the first letter be capitalized?

Not necessarily, yet this is done to clarify that we use the first letters of the indices also as acronyms.

Comment 9. Line 206-208 This is a good hypothesis, but how can it be tested? Is there any new evidence to support it?

Thank you for your comment. We refer to our response to Comment 2 for extra analyses providing additional evidence. In future research we expect that numerical modelling may shed added light on the mechanism and the validity of the hypothesis. Nevertheless, this is a data-scarce environment and data-scarce case, which would hinder researchers in deciding whether the numerically modelled case sufficiently replicates the real world case.

Comment 10. Line 210-249 the Discussion section is overall too simplistic, merely ruling out some possible factors. I hope you can build on your results to provide more mechanistic insights.

We have done additional analyses to provide more evidence to support our hypothesis. We refer to our response to Comment 2, and we will update the manuscript accordingly.

Comment 11. Line 250-260. Could this be written as one or two paragraphs? There’s no need for so many separate paragraphs.

We will update the manuscript.

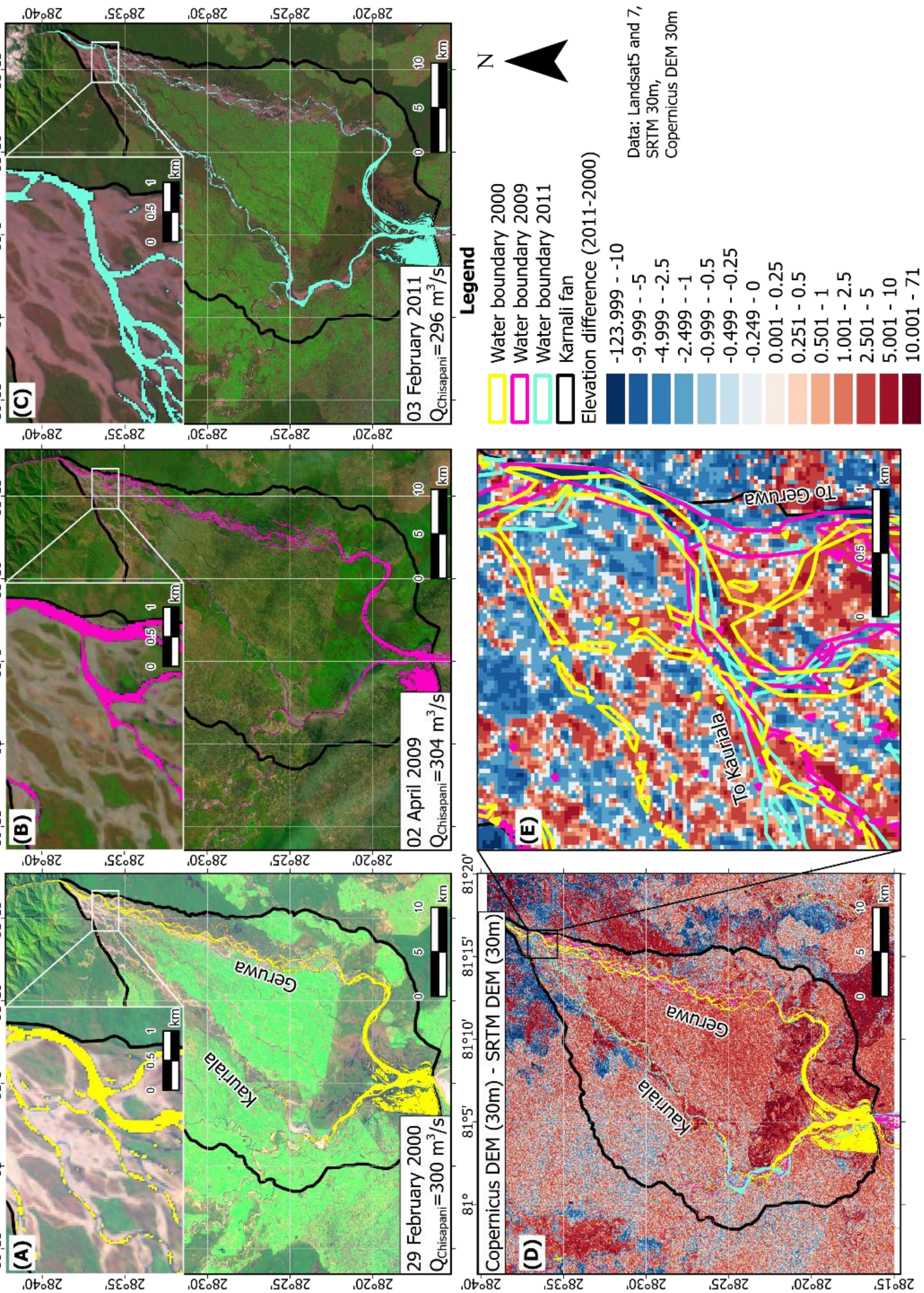

Figure 1: Wetted surface area indicating river channels across the Karnali fluvial fan in the years (A) 2000, (B) 2009, and (C) 2011. Data relate to low flow conditions: 300 m^3/s in 2000, 304 m^3/s in 200, and 296 m^3/s in 2011. The inset at the top-left corner of each map shows the Dolphin point bend right upstream of the Geruwa branch, where the flow partitions between the Geruwa and Kauriala branches. (D) Difference in surface elevation across the Karnali fan between 2011-2014 (Copernicus DEM) and 2000 (SRTM DEM); (E) Inset of the elevation difference map at Dolphin point region or upstream end of the Geruwa branch with river channel outlines for the years 2000, 2009, and 2011.

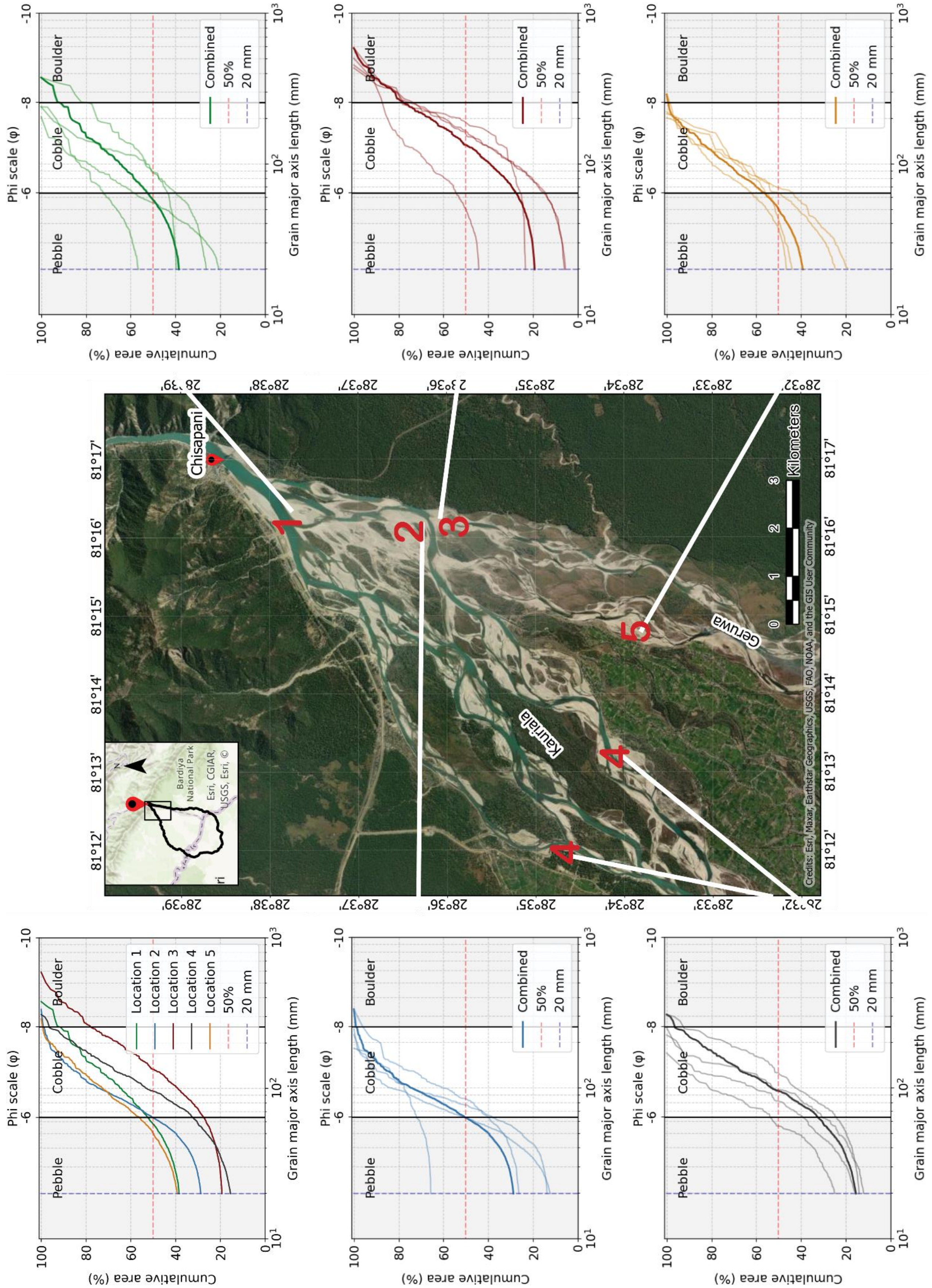

Figure 2: Grain size distributions of the surface sediment obtained from image analysis at various locations across the Karnali fluvial fan. Only grains with a major axis length larger than 20mm could be distinguished.

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