Dear reviewer, dear Ivo,

We sincerely appreciate the feedback and thoughtful suggestions. Addressing the points you raised has helped us clarify our arguments and strengthen the paper. In particular, we have addressed the concern regarding the claim that the Karnali River is transitioning from a multi-branch to a single-branch system following the 2009 monsoon. Our response is highlighted in blue.

The article investigates the evolution of the Karnali fan over the past decades using data from historical surveys and remote sensing imagery. The authors discuss the implications of the fan evolution on ecosystems, which is a novel and important aspect. Furthermore, the authors present the first article (that I am aware of), which uses historical maps of the Karnali fan dating back to the 18th century, and hence adds to our understanding of the fan.

Main criticism

I have one major concern regarding the claim that the Karnali River transitioned from a multi-branch river to a single-branch river following the 2009 monsoon season. This statement is repeated from the title to the conclusion, but I cannot see sufficient evidence to support this transition. I am not convinced that the Karnali is a single-branch river for several reasons:

- Satellite images after 2009 show that the Eastern branch still carries water and is, thus, still an active channel. Please see the attached images of Oct. 2014-2021 as an example.
- Figure 6a shows that the Western branch had a lower water surface area between 2000-2009 than the Eastern branch between 2010-2020. It is not logical to argue that it transitioned to a single-branch river after 2009, when the low-flow partitioning is more balanced after 2009 than before.
- The analysis is based on imagery during low-flow conditions. Dingle (https://doi.org/10.1130/G46909.1 supplements) shows that normal to high flows overflow the plug, and that the Eastern branch still receives water during low flows despite the plug. Hence, the Eastern branch is active, and low flow conditions are insufficient to determine the activity of a branch.

Minor aspects

- Branch characteristics: The Eastern and Western branches have different channel characteristics, whereas the Eastern branch is composed of more but narrower braid channels. These narrower channels are more difficult to classify from 30m satellite imagery, which likely leads to an underestimation of the water surface area in the Eastern branch. It may be worth addressing this limitation in the discussion.
- Potential future evolution: The authors argue that with human interventions, the likelihood of future channel switches decreases (lines 245ff). I believe that this section needs more context. Dingle, 2017 (doi:10.1038/nature22039) shows that the gravel supply to the fan originates from the Siwaliks. The fan will not be blocked from its gravel supply unless a hydropower station is constructed at the mountain gauge. Upstream stations may reduce the flow rate (and hence transport capacity), which may lead to a decrease in gravel supply. However, increasing frequency and magnitude of intense rainfall may counteract and lead to increasing gravel supply (e.g. https://doi.org/10.3126/jalawaayu.v1i1.36448)

Additional thoughts:

- 2009 monsoon season: There is a book chapter on bifurcation switches in the Karnali fan by C. Cload called m*onsoon-driven changes to river bifurcations in Nepal* (DOI: 10.1201/9781003475378-6), which may be of interest.

- It may be worth assessing the variation of water surface area with flow (e.g. comparing multiple images during a year). This may be beyond the scope of the study, but I believe it would add depth to the article because it provides evidence about how sensitive medium to high flows are to bifurcation changes. Without any consideration of medium to high flows in the analysis, it should be clearly stated that the findings relate to low-flow conditions only.

I disagree with the authors that the Karnali transitioned to a single-branch channel and feel that the narrative of the article needs to be adjusted. Nonetheless, I believe that it is a valuable article because it improves our understanding of the channel evolution during low flow conditions, which prevails for most of the year and is important for ecosystems and communities. I would further like to highlight that the figure presentation is excellent.

Ivo Pink

**Response to major comments**

We would like to emphasize that we have not intended to claim that the Karnali River over its fan has turned into a single-channel system. Rather, we argue that the system shows a gradual shift toward a system where one channel is dominant and that this shift is still ongoing. Please also note this nuance from the second part of the manuscript title: “A gradual shift of the Karnali River from double to single branch”.

Our remote sensing analysis could indeed only consider low flow conditions because of cloud-cover during monsoon conditions. We are aware of and agree with the point that such analysis under low flow conditions has limitations and that extension to high flow conditions needs to be done with care. To support our arguments, we have analyzed newly available measured discharge data in detail.

In 2023, we installed two flow-depth monitoring stations in the downstream reaches of the Kauriala and Geruwa branches, approximately 30 km downstream of Chisapani. We have used these flow depth data to determine the daily discharge in the two branches over the period between November 2023 and March 2025. In addition, we analyzed Karnali discharge data at Chisapani (located right upstream of the Karnali bifurcation) over the same period. These water discharge data at Chisapani became available to us through the Department of Hydrology and Meteorology, Nepal. We analyzed the ratio of the discharge in the two branches as a function of the discharge at Chisapani. We found that the water share in the Geruwa branch ranges from 5% under low flow conditions to 20% under high flow conditions (Figure 1). These data cover high flow as well as low flow conditions.

Dingle et al. (2020) observed a value of approximately 50% of the Karnali discharge going into the Geruwa branch during a moderate monsoon discharge of about 4500 $m^3/s$ at Chisapani in August 2017. The analysis described above shows, for similar discharges, that this share has decreased to about 20% in the period 2023-2025 (Figure1). This indicates that the Geruwa branch now receives a smaller share of water than it used to in 2017. This supports the fact that the Geruwa discharge is declining not only under low flows but also higher flows. We emphasize that we have no information on temporal changes in discharge partitioning between the branches under more extreme monsoon conditions, and we will stress this in the revised manuscript.

Our other arguments are of a more qualitative nature, and relate to data on landcover and vegetation for the Geruwa floodplain. These data indicate a temporal reduction of floodplain surface sediment dynamics in the Geruwa branch. Bijlmakers et al.(2023) show that higher peak discharge at Chisapani corresponded to greater vegetation removal in the Geruwa floodplain until 2009. This correlation of vegetation removal with water discharge indicates that grassland cover may be used as a proxy for discharge through the extent of floodplain surface sediment dynamics . Since 2009 grassland area in the Geruwa floodplain has increased with time at the expense of bare substrate and water cover. We attribute this expansion of grassland cover to the temporal reduction of hydromorphodynamic activity (i.e., surface sediment reworking) in the Geruwa floodplain. We have observed this temporal increase in grassland cover during our field monitoring campaigns. Moreover, these observations have been confirmed in interviews with employees of the Bardia National Park authority and local residents. They have reported a temporal decline in flooded areas and increase of vegetation cover in the Geruwa floodplain.

We would like to emphasize also that the Geruwa branch no longer receives water during low flow conditions naturally. While this may have been the case until 2021, since 2022 Geruwa discharge during low flows results from human excavation activities. Without such intervention, the sediment plug would prevent any flow into the Geruwa during low flows.

We will add the above extra analyses to the manuscript, and will expand the discussion accordingly.

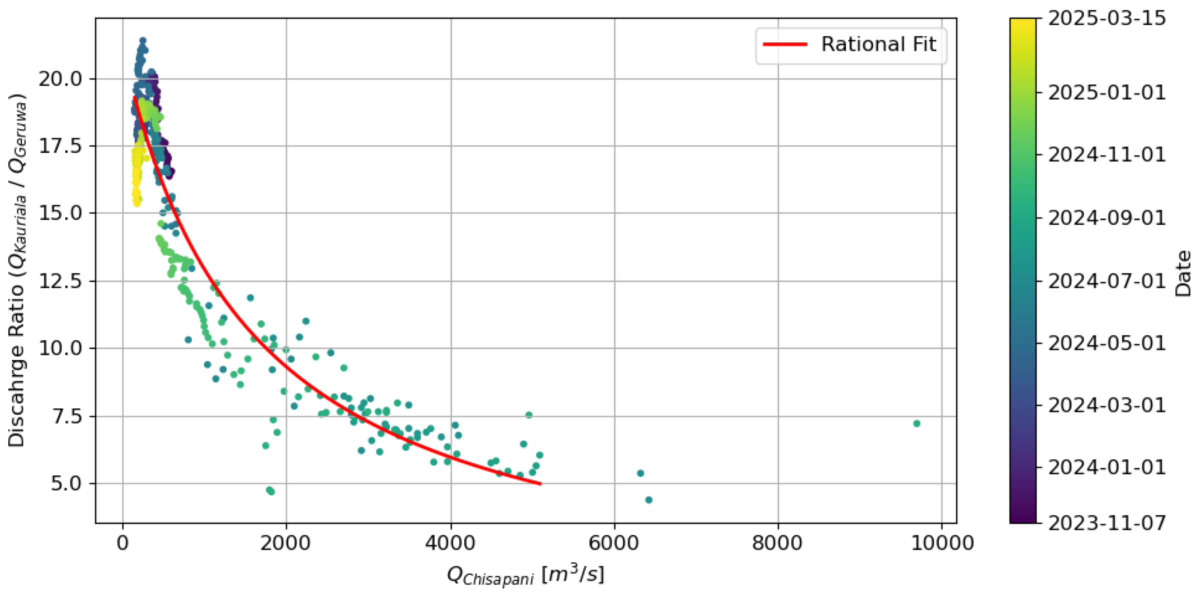


*Figure 1: Ratio of discharge of Kauriala to Geruwa plotted against the Chisapani discharge shows the variation in discharge partitioning between the two branches range from about 5% at low flows to about 20% under high flow conditions. Water discharge in the downstream branches has been computed from time series of measured flow depth at Sattighat bridge (Kauriala) and Kothiyaghat bridge (Geruwa), both approximately 30 km downstream Chisapani, measured between 7 Nov 2023 to 15 March 2025. Chisapani water discharge over the same period is determined from flow depth data provided by DHM, Nepal. Data includes 2024 monsoon cycle with a peak discharge close to 10,000 $m^3/s$.*

**Response to minor comments:**

While updating the manuscript we shall keep in mind the request for a more detailed description of the limitations or difficulties in the interpretation of satellite images for narrow channels, as well as the notes on human interventions.

**References**


Bijlmakers, J., Griffioen, J., and Karssenberg, D.: Environmental drivers of spatio-temporal dynamics in floodplain vegetation: grasslands as habitat for megafauna in Bardia National Park (Nepal), Biogeosciences, 20, 1113–1144, https://doi.org/10.5194/bg-20-1113-2023, 2023.

Dingle, E. H., Sinclair, H. D., Venditti, J. G., Attal, M., Kinnaird, T. C., Creed, M., Quick, L., Nittrouer, J. A., and Gautam, D.: Sediment dynamics across gravel-sand transitions: Implications for river stability and floodplain recycling, Geology, 48, 468–472, https://doi.org/10.1130/G46909.1, 2020.