

Interactive comment on “Topographic disequilibrium, landscape dynamics and active tectonics: an example from the Bhutan Himalayas” by Martine Simoes et al.

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Received and published: 5 February 2021

I enjoyed reading the manuscript by Simoes et al. It summarizes the controversies around the enigmatic high-elevation low-relief landscapes in Bhutan. Based on geomorphometric analysis of river profiles and drainage divides, the authors emphasize the role of divide migration in shaping the low-relief regions and conclude that existing denudation rates should be reevaluated given these dynamics.

Overall, the manuscript is well written, although lengthy at times. Figures have a high quality, but could be simplified and better annotated for better readability (see comment below). The number of figures seems adequate, but some of the plots appear in very

C1

similar form twice (for example Fig. 7a and the map in Fig. 8). This could be avoided. The methods are sound and described in a way that they are reproducible. In parts, the results are intermingled with interpretations which would be better placed in the discussion (e.g. 502-506).

As reviewer #1 notes, I also find it difficult to see how the results of this study corroborate or contradict the findings of the studies by Adams et al. Moreover, I find it difficult to follow why other concepts of tectonic rejuvenation (Duncan et al. 2003) are dismissed, based on the grounds that there is an absence of a coherent wave of incision. Shouldn't it be expected that such a coherent wave is missing given that drainage divide mobility may be a process that prevails throughout this landscape?

The observation that catchments downstream of knickpoints are expanding is intriguing, but the mechanism that generates the expansion remains unclear. The studies by Struth et al. (2019) and Giachetta and Willett (2018) are referenced in this context, but these studies show examples where expansion happens downstream of areas with internal drainage and that were integrated in the flow network. Are endorheic basins a possible explanation for the preservation of these landscapes? And if not (which is quite likely given the humid climate), what could be an alternative interpretation? An hypothesis that might be brought forward could be the availability of sediments mobilized from the alluvial plains upstream that would act as tools accelerating incision downstream which would propagate towards the divides.

I find it difficult to read some of the figures. The combination of a grayscale depiction of topographic relief (which is quite printer-unfriendly), and colored networks makes some maps really busy and difficult to read. The colored stream networks (e.g. in Fig. 2c and 5) have variations in blue and green that are quite subtle or not resolved by my printer. Consider to label the river profiles in the plots rather than using a legend.

In addition to above major comments, I have numerous minor comments listed below:
29: Remove "indeed". In general, the text contains numerous filler words, which could

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be avoided.

35: Remove "first-order". I have seen this term a couple of times in this manuscript, but I don't know what it actually means in most contexts. For example, in line 63, I don't understand the term "first-order consistency".

253: the term "rather relative" is quite vague, as is the term "rather similar" in line 256.

394: remove 'long-distance'

395: migrate upstream in response

395: what do you mean by 'common process'.

396: perhaps rephrase "are expected to cluster in transformed coordinates".

411: , however,

419: Consider shortening this sentence: These complementary methods enable a more careful assessment of divide migration direction and drainage network reorganization.

424: Perhaps rephrase: Based on visual interpretation of longitudinal and chi profiles, we identify three profile types of major rivers in Bhutan.

425: Avoid the term 'simple'. Rather write that these profiles are concave upward with no remarkable knickpoint.

426: Remove 'rivers like'

433: 'intermediate characteristics' is a bit vague.

441: above 3800 m

456: Not sure what "better organized" means

459: Remove 'clearly' twice

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462: Remove 'first-order'

465: You may better write "analyze the geometry of". The dynamics will be inferred from the geometry.

476: The sentence is vague: rivers compare well and are colinear to the very first-order. I am also not sure what you mean by 'first order' as used in the next sentence. In addition, this part mixes observations (or results) and interpretation.

479: On which basis do you judge that a knickpoint chi-value is discordant from another. Consider providing quantitative evidence. One possible way to report these differences in chi values could involve calculating the necessary change in area required so that the locations of knickpoints are the same in chi space. This would allow readers to appreciate the differences in knickpoint locations and would provide a way to eventually exclude or consider divide dynamics as potential mechanism that creates the differences in knickpoint locations.

497: remove words like "clearly"

502: this paragraph should be better placed in the discussion

549: Avoid the term "dramatic" (which is found several times in the manuscript).

550: While expansion is the right term, I don't like the term contraction is this context, because it implies that there are processes that exert a stringent force. I would rather use "specific pattern of drainage area loss and expansion".

565: Better place this sentence in the discussion.

640: Such summaries are generally helpful. However, you may consider moving it to the beginning of the discussion, also.

645: robustly? Robust in statistics usually means insensitive to outliers. I am not sure what it means here.

C4

659: remove "whatever the dimensions of their drainage basins"

691: replace "the classical" with "known"

692: replace "more generally speaking" with "in general"

699: rephrase to avoid "dramatic"

756: what are "stable soils"? There is no Fig. 3g.

835: This assertion of an "absence of a coherent wave" needs better quantitative justification, as mentioned above. And given that divide dynamics are an important process, isn't that what you would expect irrespective of the absence or presence of a large-scale tectonic or climate signal?

Interactive comment on Earth Surf. Dynam. Discuss., <https://doi.org/10.5194/esurf-2020-105>, 2020.