

Response to comments

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“Glaciation’s topographic control on Holocene erosion at the eastern edge of the Alps

By Jean L. Dixon, F. von Blanckenburg, Kurt Stüwe, and Marcus Christl

Marco G. Jorge

I find the manuscript very interesting and look forward to its final version. Below, please find some comments and proposed edits that may help improving the manuscript.

Thank you to Marco Jorge for his detailed comments that help improve the clarity of our manuscript.

-- Introduction --

Page 2, Sentence L3-5. Suggest rephrasing. Second clause does not preclude first clause.

Reworded.

L7. Perhaps, the transition to glacial buzzsaw concept is not properly backgrounded by previous sentence.

We have reworded this text to clarify.

L13. Suggest rephrasing for flow with previous sentence. E.g., first say that glacial landscapes can be preserved . . ., influencing. . .

To transition to the next sentence, we have changed to “Glacial processes significantly alter landscapes, and therefore leave a lasting topographic legacy that ...”

L15. Widely glaciated mountain belts?

We have changed to “in modern mid- and high-latitude mountain belts”.

L16. References missing.

This sentence refers to the previous paragraph, which is well cited.

L18. Rephrase: not all glaciers are. . .

Changed

L25. Complete “Climate’s influence on . . .

“Climate’s influence on mountain belt erosion”

— Section 2.3, Digital Terrain Analysis —

Page 4, L31. Suggest mentioning that SRTM is 1 arc-second, instead of 80 m grid (dependence of cell size on latitude).

Thank you. We have clarified this point in the text.

Page 5, L4-5. This remark, specifically the last sentence, is too precise, or off what would be reasonable to discuss based solely on the differences in the topographic metrics. Basin slope gradient average is not indicative of local scale morphometry independently of DEM cell size and an average gives no information about spatial variation. Either remove or rephrase and extend this discussion by adding more information (references?).

Grid-scale influence on mean slope values have been previously recognized and discussed by a number of authors. Here, we provide a reference to Zhang and Montgomery (1994).

(Table 2: refer that slope gradient values are averages)

Done

Which parameters were used for stream and catchment delineation? Was a flow accumulation threshold used? I presume from Fig 1 that delineation was based on the location of sampling sites (basin outlet). I believe it is important to justify location of sampling sites as well as its influence on basin delineation and morphometry.

We clarify that catchments were delineated upstream of sample points.

— Section 3, results and discussion —

The message would be clearer and the manuscript a better read if the discussion was separated from the results; there would be less back and forth. The discussion would benefit from the inclusion of further morphometrics (e.g., of elevation dispersion). In instances, the conclusions within the discussion overshoot what would be reasonable to conclude from the presented data (see below). I think that it is important to include an evaluation of lithology as a conditioning factor of the observed differences in erosion rates (even if it is null).

We have separated Results and Discussion sections, and agree that this change makes a significant improvement to the readability and clarity of the manuscript.

Page 5, L11. which lowland basin catchments? In the Styrian Basin?

Clarified.

L22. Rephrase. “these data” refers to both mean elevation and slope gradient but this sentence and following sentences address slope only.

We have specified that we are referring to the DEM scale.

L23. Whereby → where

Changed to, ‘such that’

L23, 24. The described relationship between mean slope and erosion rates does not imply non-linear relationship. Perhaps reword results.

This text has significantly changed

Page 6, L11-13 (paragraph’s last sentence) Recommend rephrasing. Remove first clause and reword last clause.

Thank you. This sentence was unclear. We have reworded.

L16-21. *This is too simplistic. For example, note that glaciated catchments generally are higher in elevation and non-glaciated catchments vary widely in mean elevation (Table 2) (differences in potential energy).*

We have noted this wide variation in mean elevation.

L25. *segmenting* → *segmented*

Changed.

L23-36. *Too simplistic and somewhat confusing. Differences in average elevation between basins and elevation-slope relationships within basins are different things. Why should the relative location of the steepest slopes be positively related to basin average slope gradient? Justification for interpreting that to be signal of past glacial sculpting is insufficient.*

The distinct patterns of local mean slopes with binned elevation persist regardless of whether you compare the same elevations between basins, or the distribution of slope within some nondimensional value of relief within the basin.

Page 7, L11. *'However' should be preceded by semi-colon.*

Changed.

L14-16. *Is the abundance of slopes $>35^\circ$ in gradient a good proxy for frost cracking? Address it directly.*

We have reworded this section.

L24, 25 (Sentence). *Explain; and what are area-normalized stream gradients? (area of what?)*

We have significantly improved our description of these figures and metrics.

L26, 27 (Sentence). *Add reference. Last paragraph. What is the authors' take on this discussion?*

We cite Legrain in the previous sentence, and here indicate that their results are only applicable to non-glaciated portions of the Eastern Alps.

Page 8, L5-7. *It was referred before that Legrain et al., 2015 looked at non-glaciated basins. Does "previously suggested" refer to Legrain et al., 2015?*

Changed.

— Conclusions — Page 9, L1. *"Repeated" meaning supporting previous studies? → Add references*

Here, we refer to multiple sets of data presented in this study, not to previous work.

Page 10, L2, 3. *Not clear where these values are from; add references?*

Data presented without references are from this study. We cite Legrain et al., 2015 for their background erosion rates.