Earth Surface Dynamics Discussions

Earth Surf. Dynam. Discuss., referee comment RC2
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Comment on esurf-2022-63

Anonymous Referee #2

Referee comment on "Evolution of an Alpine proglacial river during seven decades of deglaciation quantified from photogrammetric and LiDAR digital elevation models" by Livia Piermattei et al., Earth Surf. Dynam. Discuss.,
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In their manuscript, Piermattei et al. examine morphological changes of a proglacial river in the Kaunertal, Austria, using remotely sensed imagery that spans 66 years between 1953 and 2019. Using publicly available historical aerial imagery, they construct orthoimages and digital elevation models using structure from motion photogrammetry. They combine these data sets with UAS derived orthoimages and DEMs as well as LiDAR derived ALS data to investigate volumetric changes of six river reaches over 19 epochs. Exploiting this impressive data set, the authors gain interesting and valuable insight into the dynamics of proglacial areas. Also grounding on hydrological data, they find that river sediment loads are likely increasing in connection with elevated runoff contribution from melting Gepatschferner glacier. The authors further investigate the contribution from lateral sediment storage to the channel segments and shed light on the propagation of signals by subdividing the reaches into smaller segments.

The data and results presented in this very well written manuscript address a topic that is interesting for a broad range of readership and clearly merits publication in ESURF. Below, I have outlined some general points and a number of specific issues, all rather minor in nature, that should be addressed before the manuscript can be accepted for publication.

General comments

As stated above, the manuscript is very well written, which is especially true for the excellent introduction. However, some of the aspects touched upon in the introduction, e.g. the “peak water” effect and how it will change the future behaviour of a proglacial

river, or the aspect of connectivity, do not find their way into the discussion. It would be desirable to shed light on these aspects in the discussion.

Furthermore, the relevance of the study for the sediment management of large reservoirs in the alps could be highlighted more pronouncedly in the manuscript, as the study contributes important insight into this direction.

Specific comments

- L31-33: The authors might want to highlight their contribution to a better understanding of high-mountain sediment dynamics more precisely here.
- L58: Hock et al., 2019
- L95-109: I recommend rephrasing this section and focus this part of the introduction more clearly towards outlining the aims and underlying hypothesis of the study.
- L97-98: This sentence seems misplaced here, consider moving towards the discussion or conclusion.
- L112-113: repetition of L98-99, consider deleting here or in the introduction.
- L118-119: "outlet of the Gepatsch reservoir"? I guess the authors want to refer to the outlet of the Fagge into the reservoir?
- L132-133: "Günther; Patzelt, Gernot (2015)"? This reference does not appear in the list of references.
- L147: Altmann et al., 2020
- L161: The reference to Pfeifer et al. 2014 is also not included in the references.
- Table 1: The values for mean floodplain and mean channel slope seem very high here. Is there any chance that the unit is not degrees as given, but in percent? Furthermore, compared to the mean channel slope, the floodplain slope of some reaches is very high. I think the readers would appreciate details on how the floodplain slope was calculated here.
- L217: Figure order?
- L224-226: The discrepancies between floodplain and channel slope would suggest that channel incision into the deposits is also a source of sediments in this setting.
- L277-278: You might want to either use "spatio-temporal" or "spatial-temporal"
- L296: Missing information seems to be rather highlighted as a hatched area than an oblique line?
- L296-297: So, the unit of the color scale ($m^3\ yr^{-1}$) does not apply to the epochs 2012-07, 2012-09, and 2012-10? I would think it would be good to somehow make this also clear in the figure itself.
- Figure 6b: If I understand the figure correctly, the size of the reaches changes over time? Would be interesting to see the sediment balance normalized to the respective reach area.
- L321-323: Might there be a way to also show this graphically? Maybe use filled circles when the reach is included in the net balance, and open circles if not?
- L351: There is no explanation of how the trend analysis was done. Is this based on an ordinary least squares regression?
- L362-363: use Greek letter for sigma as before

- L364-365: As the authors pointed out in L265-266, volumetric mass loss might also be associated with melting of dead ice in the proglacial area, most likely in lateral moraines. This effect is certainly very difficult to quantify, but might be addressed in a short statement in the discussion.
- L371-381: This is a very interesting and important analysis. Certainly, the difference between net volume changes with or without the river channels depends on the water area of the river reach, as you point out here. It would be interesting to see if and how Fig. 6a would change with such an analysis.
- L374-377: Might this be an error and the authors rather want to refer to Fig. 9 in this section?
- L377-381: This is certainly an interesting development, but it requires clear water conditions that are rare in a glacier-fed stream.
- L390: You might want to add a reference to Fig. 6 here?
- L408: superscript missing
- L413: impacted instead of "is driven by"?
- L413-414: Consider rephrasing, unclear what the increasing trend refers to.
- L420: In my view, it would be good to refer to the river reaches as "R1" to "R6". But this is the only instance in the manuscript where this is done. Consider harmonizing.
- L425-430: In this section a thorough comparison between the data presented here and the work of Baewert and Morche (2014) would be interesting. Here the authors find aggradation in all (but one) river reaches. Baewert and Morche (2014), however, find widespread aggradation following this August 2012 event. While this is certainly related to the different data sets used that result in different survey periods and areas, a comparison is interesting, as it also underlines the dynamics of the proglacial area in this setting.
- L430-439: Certainly, the work of Anderson an Shean (2021) is very close to the presented study and deserves attribution here. But there are numerous studies from the European Alps that also deserve a reference here, e.g. Lane et al. 2016 (and other works from Stuart Lane's group), and the works of Carrivick et al., or Baewert and Morche already cited at other places in the manuscript.
- L437: Can the bedrock be seen in the orthophotos, or is this additional field evidence?
- L480: use m3 instead of cubic meters here?
- L490: Either use L.P. or LP here.

References

Lane, S.N., Bakker, M., Gabbud, C., Micheletti, N., Saugy, J.-N.: Sediment export, transient landscape response and catchment-scale connectivity following rapid climate warming and Alpine glacier recession, Geomorphology, 277, 210–473 227, doi:10.1016/j.geomorph.2016.02.015, 2016.