Earth Surface Dynamics Discussions

Earth Surf. Dynam. Discuss., author comment AC2
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Reply on RC2

Lena Katharina Schmidt et al.

Author comment on "Suspended sediment and discharge dynamics in a glaciated alpine environment: Identifying crucial areas and time periods on several spatial and temporal scales in the Ötztal, Austria" by Lena Katharina Schmidt et al., Earth Surf. Dynam. Discuss., https://doi.org/10.5194/esurf-2021-85-AC2, 2022

Dear Ronald Pöppl,

Thank you very much for your helpful comments and thoughts on our manuscript. In the following, we will provide detailed responses to all of your general and specific comments.

General comments:

1) Results sections contain a lot of data interpretation and discussion content, which should be moved to the discussion section. Moreover, concluding remarks are presented in the results sections (not appropriate).

Response: Thank you, we agree and will resolve these issues.

2) The introduction is a bit minimalistic. More could be said about the importance of this topic, also in water and sediment management contexts. The importance of connectivity is mentioned in the introduction, but not addressed in the rest of the paper?!

Response: Thank you for this comment. We agree and will add a respective paragraph. With regard to your note on connectivity, the paragraph you are referring to aims to give an overview of expected or possible future changes in high alpine environments and mentions connectivity for the sake of completeness. Yet we do not address future changes themselves in this study, but hope to provide a good basis for future studies by analyzing the recent past. In this, assessing changes in connectivity is not within the scope of this manuscript. We will rephrase this section to prevent any misunderstandings and to make it more clear.

3) Outlook/perspectives are missing.

Thank you for pointing this out. Yes, our paragraph providing an outlook / perspective is a bit short (L565ff). We will extend this paragraph and provide more information on possible fields of application and future research tasks.

4) Very unusual heading titles in the results section.

Response: Thank you, we will rephrase the headings.

5) No spaces between numbers and units, and no commas in large numbers have been used.

Response: Thank you for pointing this out. We will scan through our manuscript and correct numbers and units accordingly.

Specific comments:

1) Lines 160-165: Temporal resolution of automatic sampler probing? Criteria for sampling time (event-based)?

Response: We assume you are referring to the time it takes for one sample to be collected and the time lag to the next sample? In this case, the collection of one 1 L sample takes about 1.5 minutes and we specified that two samples must be at least 30 minutes apart. For the event-based sampling, we programmed the logger to calculate the absolute difference between the present turbidity measurement and the measurement 30 minutes before for each time step. This difference had to be greater than a threshold we had determined empirically based on past turbidity recordings beforehand. As a second criterion, the present turbidity needed to be higher than the moving average of the turbidity of the last 10 days. This was designed to function as a seasonally adjusted threshold, because intra- and interannual differences can be very large. So, in simple terms, the rise in turbidity needed to be steeper than the empirical threshold and the absolute level of turbidity needed to be higher than the moving average of the past 10 days. We will update our manuscript and extend the information on the sampling scheme used within the framework of this study.

2) Line 196: Why "3 mm"? Why not 4, 5 or 7?

Response: Thank you for this question. We agree that any exact threshold here will we arbitrary to some degree. As we pointed out in out Responses to reviewer I (who suggested a 12.7 mm threshold as commonly used in RUSLE), the identification of precipitation events is intricate. Our precipitation data are point measurements at the gauge in Vent and we know that precipitation within the almost 100 km² catchment above the gauge can be highly variable and is affected by the topography. On the one hand, this is reflected in the precipitation gradient (e.g. L113f.) of about 5% per 100m. Assuming this would be applicable to individual events, a 12.7 mm precipitation event in front of the Vernagtferner glacier at about 2850 m elevation would correspond to about 6.7 mm at the gauge in Vent at roughly 1900 m. This is also reflected in the differences in mean annual

precipitation (L303ff: "The mean annual precipitation recorded close to the Vent gauge is 666 mm while areal precipitation of the whole catchment is estimated between 1200 and 1500 mm, and for the 11.4 km² Vernagtferner sub-catchment […] even 1525 to 1900 mm are reported"). Thus, we can generally expect the precipitation measured in Vent to be a lower bound of precipitation falling in the entire (sub-) catchment. Adding to this, considering the possibility of rain on snow events and fluvial erosion, we doubt that the Renard threshold can be meaningful here. Instead, we used the hydrograph shape as additional information (as described in L198f) and used the low threshold of 3mm. We will improve the explanations.

3) Lines 209-210: "Therefore, we did not classify the events with respect to precipitation events." … possible implications?

Response: Thank you for this comment. We will add a short sentence on the implication (i.e. that we cannot make a point on how the importance of precipitation events changes in space.)

4) Lines 229- 231: Is this assumption valid? More susceptible to erosion: yes, but unfrozen?

Response: This assumption derives from the paper of (Li et al., 2021). We agree that ground no longer covered by snow can still be frozen, thus of course this assumption is a simplification. Yet we believe it is okay to make this assumption, considering the bigger picture (of the almost 800 km² study area and averaging over 17 years) and as we explicitly state that we consider the snow free area as **potentially** erodible (which implies uncertainty). We will add this to the discussion.

5) Page 14: Move Fig. 8 below the para in which it is mentioned in the text.

Response: Thank you, we will do that.

Li, D., Overeem, I., Kettner, A., Zhou, Y., and Xixi, L.: Air Temperature Regulates Erodible Landscape, Water, and Sediment Fluxes in the Permafrost□Dominated Catchment on the Tibetan Plateau, Water Resour. Res., 57, doi: 10.1029/2020WR028193, 2021.