Earth Surface Dynamics Discussions

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Comment on esurf-2021-23

Anonymous Referee #2

Referee comment on "A 4000-year debris flow record based on amphibious investigations of fan delta activity in Plansee (Austria, Eastern Alps)" by Carolin Kiefer et al., Earth Surf. Dynam. Discuss., https://doi.org/10.5194/esurf-2021-23-RC2, 2021

Review on “A 4,000 year debris-flow record based on amphibious investigations

of fan delta activity in Plansee (Austria, Eastern Alps)”.

General comments

The submitted study shows the timing over 4000 years of debris flow events from transport-limited catchments, much of whose deposits extend into an adjacent Lake, creating subaqueous geomorphic field evidence by lacustric deposits. The knowledge of such a long time series is, besides geomorphological interest, also important in connection with positive trends in climate change, or land use, exposure, etc. and gives valuable insight to recent dynamics in the occurrence of debris flow events. The article is basically well written and understandable. The literature cited is up to date and, and here I focus exclusively on the presentation of an extraordinary time series of debris flow events, an important and pioneering contribution to the research community. Precisely because, at least to me, no comparably long historical review of debris flow events is known, a publication of such a time series requires precise information on uncertainties due to the applied methodology and a discussion of how to deal with it. Above all I recommend focusing on the creation and trend analysis of the surveyed frequency representation of such a long (and valuable) debris-flow time series, improving reliability of the time series. All terrestrial and bathymetric observations should be either shifted to a second paper or significantly shortened.

Specific major comments

The introduction to the study describes the need for knowledge of long-term time series, with the reader curious about this 4000-year survey. Interestingly, however, it talks about a combination of several geomorphological surveys in different depositional domains. First of all it must be noted that for the creation of the time series it is not comprehensible why on two selected fans a terrestrial and bathymetric evaluation is carried out, which is not related to the time series collected and analyzed due to lacustrine deposits at all. It is argued that the coupled study of debris flow systems on land and underwater will provide new insights into geomorphic expressions from the catchment to the depocenter provide? So what exactly are these new insights and how do they relate to a 4000 year time series? I was under the impression that it was more like two stories in one study. Whereby the terrestrial as well as bathymetric studies are mainly closer in the context of the already published article by Dietrich and Krautblatter (2017). By the way, since the onshore measurement is based on two LiDAR measurements within a year, the question arise how does one use this to elucidate the relationship between terrestrial and subaquatic deposition of recent debris flows? In other words, how and why should the rates differ from chance - based on the scarcity of data? My suggestion would therefore be that the authors refer, in the present article, more or exclusively to the survey of lake sediments and their statements in connection with debris flow frequency. Although the terrestrial and bathymetric investigation contains some interesting and further information, they seem to be dispensable for the creation of the 4000 years time series. It would be more exciting to focus on the time series of debris flows and find out how well you can determine the frequency based on sediment core analyses.

Concerning the lacustrine event deposits, I find the methodology for event type differentiation very exciting and comprehensible, also in the awareness that it is one of the rare opportunities to observe the process of debris flow in a relatively uninfluenced setting (which, by the way, is also well executed). Nevertheless, the following data processing raises questions.

My mainly concerns regarding this study relate primarily to the uncertainties of age dating. What uncertainties are there in the temporal determination? Which in the event detection? How do these affect the calculated frequency? The used age-depth model by Oswald et. Al (2021) is primarily showing ages cal year BP. Table S2 does not provide information on the uncertainties of the top layers or recent past. On the one hand, I would expect the deviations from the mean age dating to be given for each identified event in table S4 and, on the other hand, I would find it methodologically very exciting how to deal with these uncertainties when the stratification of different drill cores of the events is known and overlapping by the dating-uncertainties? How to assign the identified df deposits to a specific year? At least in the recent past a validation with e.g. dendrochronological dating would have been useful? This raises further the question whether all identified events can be used for a frequency analysis or for the classification of the four different phases based on different event rates? Is it possible to quantify the classification of the 4 phases by statitical test?

However, once the uncertainties of the event frequency is known a trend analyses should be conducted, showing if changes in the occurrence rate or deposition rate/a are distinct or covered within the uncertainty estimates?

Specific minor comments:

The shown correlation between precipitation and lake deposition is rather poor with respect to debris flow events, which can hardly be plausibly explained with precipitation data from a measuring station 7km away. Are there possibly better precipitation data (INAC?). However, the quality of the frequency series should be secured first.

When considering earthquake activity in relation to the event rate presented, correlations become apparent and are also discussed. Although it is argued that only the strongest shaking events, well above the local intensity of VI, produce a distinct postseismic landscape response in a lacustrine record, Figure 6 (Supplementary) in Oswald et al. (2021) shows intensities above VI for the 1930 Namlos earthquake. Can an increase (if the time series is valid) after 1930 really be ruled out due to higher sediment availability caused by the earthquake?