

Interactive comment on “Multidisciplinary distinction of mass-movement and flood-induced deposits in lacustrine environments: implications for Holocene palaeohydrology and natural hazards (Lake Ledro, Southern Alps, Italy)” by A. Simonneau et al.

Anonymous Referee #2

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The manuscript of Simonneau et al., about “Multidisciplinary distinction of mass-movement and flood-induced deposits in lacustrine environments: implications for Holocene palaeohydrology and natural hazards (Lake Ledro, Southern Alps, Italy)”, provides a reconstruction of frequency of flood layers and mass-movement based on a laminated lacustrine record from Northern Italy. This reconstruction is mostly based on sedimentological and organic matter proxies. The methodological part of this paper about the identification of flood and mass-movement is interesting as well as the part

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about mass-movement chronicle compared to the Iseo record. But the part other parts of the manuscript are too much speculative (part 5.2 and the beginning of the part 5.3, see major comment 9 and 10) or not related to the scientific question (part 5.3.1, 5.3.2, 5.3.3, 5.3.4, 5.3.5, see major comment 8), there are also some structural problem in the manuscript with not enough sedimentological data (see major comment 2 and 3) and methodological problem about flood chronicle (see major comments 4, 11). When we take into consideration all these major comments (see below) I propose to reject this manuscript for publication in *Climate of the Past*.

My major comments are focused on 11 points of the manuscript:

1/ What is the effect of alluvial plain on the flood record? Flood event record in the sediment core at a precise location was probably not the same in the past when the alluvial plain was located beyond its present position.

2/ In this paper there are not sedimentological description of background sedimentation, why this sedimentation was laminated or not? Do you have smear slide in these units to precisely describe the lamination and the difference between both sedimentation?

3/ The QOP description have to be moved in the methodological part.

4/ Why the authors take into consideration events > 1,5 cm for light coloured SE and 1 cm for dark-coloured SE? Any sedimentological argument for that? The thickness of flood deposit could be influenced by the land use : a flood of 0,5 cm during a period of low land use and a flood of 3 cm during a period of high land use could be related to the same amount of precipitation. Thus if the authors take in consideration only flood > 1 cm this limit is not related to an amount of precipitation and the flood chronicle cannot directly compared to other climatic proxies.

5/ What is the resolution of the seismic data? The authors correlate 5 cm thick SE to seismic reflector, thus do you have a sufficient high resolution to make this type of

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correlation? Moreover, P3217L17 : If the SE 1 was too thin (12cm) to be correlated to seismic reflector, I think that all light coloured events cannot be identified in seismic data because they ranging between (1,5 and 13cm) P3214L18, thus how did you define your correlation between sediment and seismic? For example how an event of 5 cm thick (event 5) can be identified in seismic?

6/ Please clearly indicate in the manuscript the SE indexation between number (light) and letter (Dark).

7/ It is not clear in seismic profile, if mass-movement are triggered from the Eastern part of the lake or not, i.e. the eastern part of the Lake have probably a sediment accumulation lower than the rest of the lake because furthest from the main source of sediment, thus this part was probably less unstable. Clarify this question.

8/ The main part of the discussion (section 5.3) is for me not related to the scientific question about Holocene palaeohydrology and natural hazards. This part discuss about environmental changes on the watershed and not about the chronicle of flood or mass-movement events as suggest by the Title. If environmental changes are need to understand flood chronicle (with a discussion about variation of thickness or petrographic content of deposits) Ok, but it was not presented like this in the paper. Moreover flood frequency is studied in detail in another paper in the same issue that consider all events (Vanni re et al. submitted), I'm not sure that this part of the manuscript bring more information than the other manuscript on this topic. Finally if this paper the flood > 1 cm were studied thus the flood chronicle was biased see above main comment number 4.

9/ Part 5.2 : This part is very very confusing with a lot of non-scientific approximation:
a/ As you demonstrate by your correlation in figure 3 the thickness of flood event was not constant over the deeper part of the basin, moreover the author's argue also that hyperpycnite at a given location is linked to many parameters (P3219L18-19). Thus it is not correct to calculate a mean thickness of a flood event over a part of the lake basin

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or at least to associate this value to an uncertainty probably bigger than the calculated value. b/ P3320L27 author's make another big assumption, with a relation between the amount of rAP in a flood deposit and the amount of material from the watershed. This relation was not demonstrated in the paper. c/ in figure 9 the author's try to estimate the proportion of sheet vs gully erosion, but in this case we cannot considerate the same density: the density of soil was very low in the first mm and strongly increase with the depth, thus if the watershed was submitted to sheet or gully erosion the density vary strongly probably more than a factor 2 (i.e.: more deeper was the erosion more dense was the soil), thus add an uncertainty to this estimation. d/ The erosive zone was defined by author's as controlled by two process (slope $>30^\circ$ and gullying) ok but what is the type of soil eroded litter, leptosol, cambiosol, these differents soils have of course an implication on the model (density of these types of soil was not the same). > thus as no uncertainty are integrated in this model in relation to the previous cited assumption the eroded area calculated cannot be rigorous. If the author's test the sensitivity of this model their probably find a huge uncertainty Moreover the result of the present model are compared to a study by Raclot and Albergel (2006) that describe eroded material in relation to runoff in Tunisia, I'm not sure that these authors are in agreement to compare runoff in Tunisia (with a very specific climate and vegetation) to this high elevated area in Italia.

10/ Part 5.3. : Based on this very hypothetic estimation of eroded material the author's estimate in this part an amount of precipitation! The model for estimation of precipitation has to be further developed in this part before to be used. Erosional susceptibility (E_s) estimated by De Ploey vary by factor 10 for grassy surface (0.05-0.005s²/m²) and also by a factor 10 for forested surface (0.5-0.05 s²/m²) thus for a homogenous surface the calculated precipitation vary by a factor 10. If the surface is not homogenous E_s vary by a factor 100. Thus with the uncertainty of estimated eroded volume (see above comment) and the uncertainty of E_s the calculated amount of precipitation are not credible. In spite of that authors calculate an amount of precipitation by event of more than 1,6 meters (more than two times the volume received today in one year)

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and deduce from this result that snowmelt erosion was a main process! But the authors have not considered that their model is completely false... To make this type of model the authors have to calibrate its model at least with instrumental data on a long time period. This part has to be completely removed.

11/ P3222L11-13 : the relation between the thickness of flood-deposit, the river discharge and the rain intensity was not directly related, its depend on eroded material on the watershed, on human activity. . . this relation is site-dependent and the authors have not demonstrate the relation in this study.

Minor comments:

Abstract is too long and could be reduced by half. Method : specify the localisation where the different analysis was done. P3209L11: Flash-flood is a type of flood, is it really flash-flood in this watershed? P3209L20 : Beug, 1964 : Do you have a more recent reference for today climatology/meteorology in this area? P3211L2 : specify the grain size analysis resolution P3211L5 : Which type of soil horizon were sampled, do you sample also the litter? P3211L6 ; How do you sample the river bed , it's better to carry sediment during flash flood events with a sediment trap, because how are you sure that this sediment was 1/ transport during flash flood and 2/ end its transport in the lake? P3212L12 : indicate which part of the deposit was sample for QOP analysis P3212L21 : what is the mean velocity taken to convert twt in meter? Any argument for that do you measure P-waves? P3213L12 : Sedimentary Events P3214L8 : I do not see an inverse grading for events presented in figure 4 P3214L14-19 : Do you have any reason to compare dark events thicker than 1 cm to light event thicker than 1.5 cm? why not have kept the same limit? Give also the mean grain size and density of this both group of deposit. P3215L29 : make also a regression line for light events. P3218L28 : If the lake level have an effect on slope-instability, please add the curve of lake level on Figure 8. P3219L7-9 : If you observed successively inversely and normally graded event please show the data in figure 4, because from the current version of this Figure we do not clearly see that. P3219L13-16 : If this event (J) is remarkable add the picture

and grain size data of this event in figure 4. P3222L1 : lithic, rendzic and leptosol (62% of the catchment area) are not well develop soil

Figure 3: Photos at the left side are too small. Where are (b) and (c) in the figure?

Figure 4 : It would be much better to display all the grain size data in a contour plot. Plotted in such a way it allows the reader to see the evolution of grain size variability in all size fractions. Please indicate in the caption and in the figure which event was dark and light. D is it a light event? It is darker that event G but it is under light title. Where is the base of the event 4.

Figure 5 : plot soil and river bed with different marker on the part A. Reduce the size of the marker or make a small zoom on the origin of the figure.

Figure 6 : What is red square? Plot also a regression line for light coloured events

Figure 7 : Please indicate an error for the age of seismic event

Figure 8 : add the lake level curve

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