Earth Surface
Dynamics
Discussions

Interactive comment on "A new methodology exploring the record of snow avalanches in lake sediments" *by* Laurent Fouinat et al.

Anonymous Referee #1

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General Comments: The paper by Fouinat et al. explores a CT-based methodology for identifying snow avalanche deposits in lake sediments. To this end, the authors use an alpine lake with well-developed avalanche paths as their study test site. In general, the methodology is sound; however, as discussed below under "specific comments," this reviewer thinks the authors can improve their verification analyses and subsequently, the method's usefulness for other studies. This improvement includes the addition of detailed grain size measurements and measured organic matter (via LOI 550C or similar).

Unfortunately, the paper suffers also from very poor grammar, sentence structure, and organization. Without rewriting the paper myself – which is beyond the scope of this reviewer's expected work – the paper is not acceptable without a major edit to improve its readability.

Specific Comments (in order of paper not in order of importance or significance): 1. Introduction AND Background: this entire section requires significant development, referencing, and editing. For example, provide a better background on the dynamics of avalanches including the different types. What is a wet avalanche? 2. Line 76: the first sentence says "few remain known" and then you say there are "several studies"? requires editing. 3. Line 81 beginning with "These coarse particles...": requisite to this study is the clear demarcation of processes that generate coarse sediment deposits in lake sediments. Run-off, avalanches, debris flows, IRD...It is important to develop this section now, because later in the paper you discuss the presence of large gravel in flood deposits. Meanwhile, in the Line 81 section you seem to dismiss large gravel in flood deposits. Why the contradiction? Also, why is organic matter diagnostic of avalanche deposits? Did you measure organic matter via LOI 550C or equivalent? 4. Line 127: final sentence seems out of place? 5. Lines 149-154: Grain size! Where is the grain size data? Sampling interval? Show the data? it seems that grain size data would be required data to show and discuss for comparison to the "remote sensing" CT method. Verification is key to this methodologies usefulness. 6. Line 150: No grain size pretreatments!? Organics are a huge part of this core according to your discussion below...if so, they will introduce a false "grain size." Generally, pretreatments consist of organic removal, carbonate removal, and biogenic silica removal...BUT, at the very least, organic removal is expected. Explain and justify. SHOW the real, measured non-CT grain size data. 7. Line 151-154: Show the data. 8. Line 154.5: Organic matter is an important part of your discussion yet you have not actually measured organic matter? Use a simple analysis such as LOI 550C to determine the percent organic matter in your core for verifying the CT-scan estimate. Show the data. 9. Lines 159-161: Prove that these events are normally graded. As it reads, it seems these event's origin is arbitrarily defined. Show the grain size data. How did you define these events without any quantitative measurements? Are these layers simply based on visualization? Again, grain size, organic matter, >2mm grain size counts, etc...show the data. You require a completely new figure showing the core photograph versus it

physical data...show the CT data later OR in comparison to the physically measured data, such as grain size and organic matter. 10. Line 165: How were these facies defined? Can you better prove that thesis facies exist suing more than visual data? Can you plot these facies on one of your strat column figures. 11. Lines 168-170: Show us the proof for these normally graded turbidites. Grain size? 12. Lines 171-172: what are typical avalanche deposits? how are they not considered instantaneous like the flood event layers? 13. Line 173: "from the torrent"...what? 14. Line 174-175: Seems to contradict what you said earlier about gravel in flood deposits? so, multiple processes can co-occur? flood, debris flow? this makes the signal complex. How do you resolve this complexity with what you infer as "pure" avalanche deposits? 15. line 193: angular? The short transport paths support angular particles for any mass transport process. 16. Lines 216-218: nice verification method but why not more comparison depths? Key to this paper is proving that your "remote sensing" CT technique is an acceptable substitute for more time consuming physical sediment analyses. 17. Line 219: why no LOI 550C to verify these CT estimates??? 18. Line 264: seems like this could be more robust via a lot of more comparison depths? 19. Line 275: strangely worded? Do you mean gravel in between flood event layers or in the middle of a flood event layer?? 20. Lines 313-316: Seems redundant? 21. Figure 2: make sure the images match the figure captions.

Technical Corrections: Too many to correct. I leave it to the authors to seek an independent editor.