

We appreciate the thorough review of our manuscript and the constructive feedback provided by Adrien Favillier. Here, we address each comment and reference the changes in the revised manuscript. We are pleased that the reviewer recommends this work be published in NHESS after the appropriate revisions are addressed. We've posted the responses below for timely discussion and will provide a complete revised manuscript after receiving comments from other reviewers and the editor.

Comment:

First of all, as a non-native speaker, some paragraphs, especially related to the numerous abbreviations (although necessary), remain complex and sometimes not fluent enough to clearly understand the developed idea at the first reading. Revising the manuscript with the aim to make it clearer and easy/fluent to read would be great, especially for non-native speakers.

Response:

We revised the writing to be more succinct and accessible throughout the manuscript.

Comment:

Second, there is a major mistake in the Wit formula (2) which partially distorts the results. At the difference of Kogelnig-Mayer et al. (2011), in the 4-Steps procedure developed by Favillier et al. (2017, 2018), the weighted sum of the first term is not multiplied by the total of growth disturbance of the year t . To use the Wit threshold initially defined in Favillier et al. (2017, 2018), please use the formula presented at the pages 93 and 14, respectively, of these articles. Otherwise, please define new thresholds that could represent your range of values. At the end, results should be nearly the same as you had the opportunities to work with many cross-sections.

Response:

Thanks for the careful attention to detail on this equation. Fortunately, this was simply a typo in the equation in the manuscript. We used the eqn. from Favillier et al. (2017, 2018) in the analysis, but accidentally inserted the R_t term from the Kogelnig-Mayer et al. (2011) eqn. in the manuscript. Equation (2) revised to reflect this.

Comment:

L.60-66: According to the table title, Table 1 appears incomplete (21 references over the 42 existing studies with more than one avalanche path). Precisely, what were your selection criteria? Please either clarify the caption or add the missing references.

Response:

We included only the initial studies using a dataset with more than one avalanche path. In other words, if a study used the same dataset again in subsequent work, then, instead of repeating this in the table, we omitted it. We revised the table caption to clarify this.

Comment:

L.124-126 (Table 2): Please, modify "n" for "Trees (n)" or "Nb. of trees (n)" in order to be clearer that "n" is for the number of sampled trees per path.

Response:

2nd column in Table 2 changed to "Trees (n)".

Comment:

L.167: As you mainly worked with dead trees, how did you deal with? Did you take account of their year of death? Did you take account of the forest age structure of the path to suspect past high magnitude event that partially destroyed the forest?

Response:

Yes, we took into account the death year. We did not quantify or relate any death dates to avalanches that fell outside of observed avalanche mortality events. We assigned C-1 events to trees that were known to

be killed by an avalanche impact, in place trees with earlywood growth for the year of the observed avalanche event.

Comment:

L.197-204: This comparison makes sense in a general methodological point of view (how much growth disturbance are we missing using core instead of cross-section).

However, it does not match the main aims of the article and, accordingly, complexify the reading. I suggest removing the comparison and the related paragraphs, but to discuss the advantages/limits to work with cross-sections in the Discussion section. On the one hand, knowing all the growth disturbances strengthen the reliability of your reconstructions. On the other hand, cross-sections are usually taken out from dead trees, so you cannot really assess the age structure of the in-place forest. Moreover, it is time consuming to process in comparison to cores, as you will have to carefully analyze the whole section. Lastly, it is an exceptional situation, as in Europe, we are mostly working on living trees in protection forest.

Response:

We believe that the results of this analysis in examining cores vs. cross-sections align with the objectives of the article. Determining the value of using cross-sections was central to the original sampling design which distinguishes this study from previous dendro-avalanche research. The exercise must be mentioned in the Methods section because we present values on the comparisons in the Results and then the Discussion. Lastly, we provide this comparison to simply quantitatively illustrate the difference in using cross sections vs. cores and do not in any way discount any studies that use cores.

Regarding the “age structure of the in-place forest”: we did not sample/process GDs to identify stand replacing large magnitude avalanche events using age structure cohort recruitment methods, similar to those used in fire or other ecological studies. The stems sampled from mixed subalpine forests were of great variation in ages. All the forests we worked in across the northern Rockies have mixed age structure due to varied disturbances, so quantifying a stand age structure is usually not possible, or all that informative relative to the growth disturbance information provided by cross-sections. Appropriately, we offer no unsubstantiated conjecture relating previous large magnitude events to the age structure of trees sampled in the paths. While it can be more time consuming to process cross-sections vs. cores, we utilized the opportunity to collect cross-sections for a more complete perspective and ability to identify GDs with greater confidence.

Regarding the last sentence in the comment: we were also constrained from sampling trees within a "protected forest" as a U.S. National Park prohibits wood collection on its lands except in the case of permitted research.

Comment:

L.299 (Fig. 3): In my opinion, the term "event" is not really suitable as it refers to crossdated growth disturbances and not to a reconstructed avalanche event. Responses, as mentioned in the figure title, could fit.

Response:

X-axis title for Panels (a) and (b) changed to “Classification of Each Response” to fit with the Y-axis title.

Comment:

L.327-328 (Fig. 5): The name of the Y-axis and the captions are not really clear. I suggest replacing “Avalanche path” by “Avalanche event.”

Response:

The Y-axis title should read “...Avalanche Paths” as it currently stands. This figure highlights the number of avalanche paths in which an avalanche event occurred in any given year. We revised the figure caption to be clearer.

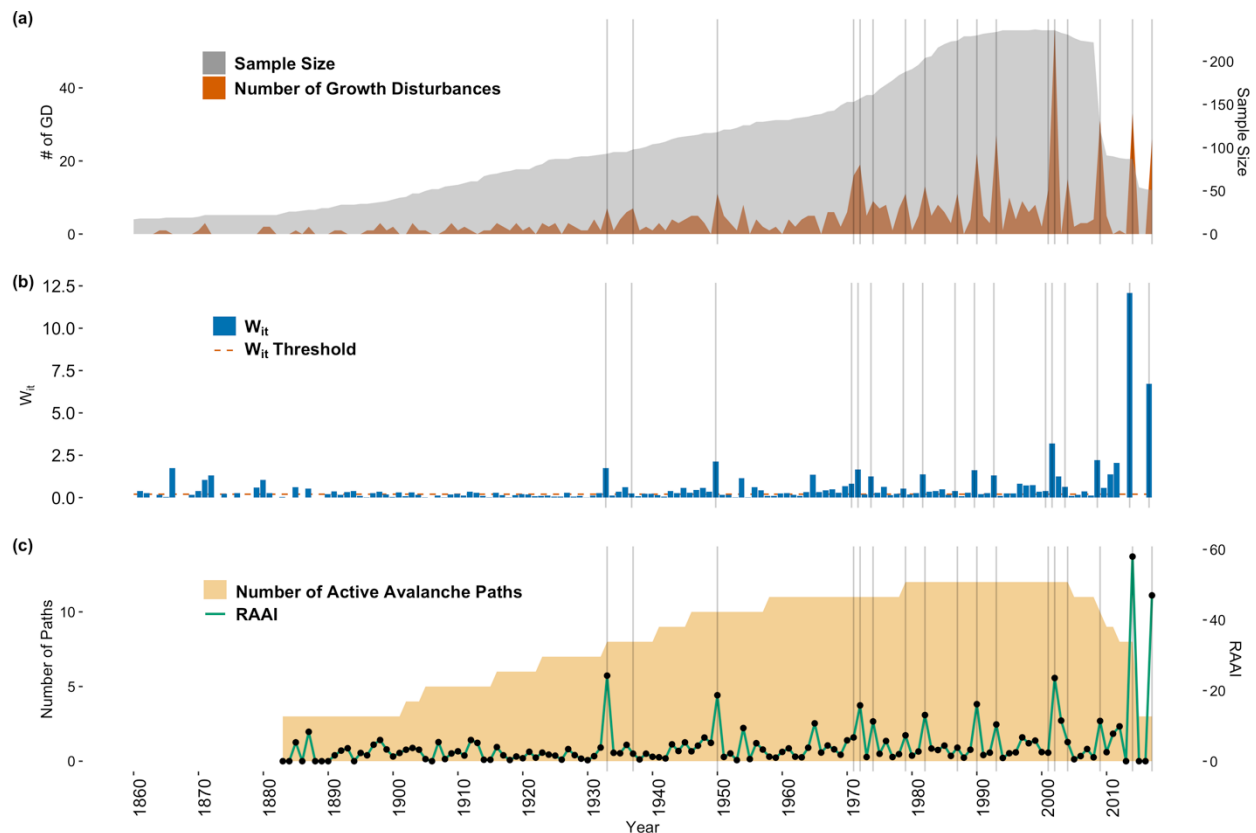
Comment:

L.380 (Fig. 8): Graphs (a) and (c) could deserve a secondary axis for (a) the sample size and (c) the number of avalanche path. It would be easier to read. Here is the R-code I use to plot a secondary axis:

```
ylim.prim <- c(0, max(Growth Disturbances, na.rm = T)) # Primary axis: distance to zero
ylim.sec <- c(0, max(Sample Size, na.rm = T)) #Secondary axis: distance to zero
b <- diff(ylim.prim)/diff(ylim.sec)
#Computing multiplicative coefficient a <- b*(ylim.prim[1] - ylim.sec[1]) #Distance to zero
ggplot(data, aes(x=Years))+ geom_line(aes(y = Growth Disturbances))+ #Primary axis
geom_line(mapping = aes(y = a+Sample Size*b))+ #Secondary axis scale_y_continuous(sec.axis =
sec_axis( . - a)/b, name = "Sample Size"))
```

Response:

First, thank you very much for the R-code. We greatly appreciate it. We contemplated, at length, adding a secondary axis for these exact plots prior to submission. We typically use one primary axis for ease of interpretation. However, in this case we feel the secondary axis might be appropriate. As such we revised the figure explicitly note the secondary axis for panels (a) and (c) in the new caption for Figure 8.



Comment:

L.432–433: What is the purpose of this comparison? I suggest removing it to simplify the manuscript.

Response:

We removed this sentence as it did not fit within the context of this paragraph.

Comment:

TECHNICAL COMMENTS Please, carefully revise the manuscript to tackle the typos. Most of them are located in the figure references in the text (extra brackets).

Response:

We corrected the typos throughout the manuscript.