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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "A regional spatio-temporal analysis of large magnitude snow avalanches using tree rings" *by* Erich Peitzsch et al.

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GENERAL COMMENTS

In this article, the authors aim to reconstruct the snow avalanche activity over the two last centuries and at a regional scale. They used dendrogeomorphic technics and its last methodological developments to reach this goal. Through the careful analysis of 647 trees within 12 studied avalanche paths (one of the widest sampling in the discipline), the authors successfully reconstructed 49 events between 1866 and 2017 and thus derive recurrence interval at relevant scales both for hazard planning and climate change related research. In addition to the newest data provided for this part of

the world (last ones were published in 1979-85, at the "regional scale" and 2008 at the path scale), the authors propose relevant questions and solutions on how to combine snow avalanche chronologies derived from tree-rings at path scale to a regional snow avalanche activity, with specific focuses about the sampling strategy and the expansion to lower spatial scale. The availability of the data is appreciated.

From a global point of view, this article is well written and matches international standards. This work, its results and their discussion deserve to be published in NHESS. However, some corrections and clarifications preclude from a publication of this paper.

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.

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.

SPECIFIC COMMENTS Finally, several additional remarks are listed below:

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.

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.

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?

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, complexifie 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.

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

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.”

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"))

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

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).

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