

Review of the manuscript *Schweizer, J., Mitterer, C., Techel, F., Stoffel, A., and Reuter, B.: On the relation between avalanche occurrence and avalanche danger level, The Cryosphere Discuss.*, <https://doi.org/10.5194/tc-2019-218>

The paper is of high scientific quality. It brings forward important quantitative results on the occurrence of snow avalanches in the Eastern Alps, and provides an important analysis and discussion of the implications for assessment and forecasting of avalanche danger. The study uses a unique and rich data set on observed avalanches and regional avalanche danger estimates, in order to reduce a critical knowledge gap that has limited the development of objective procedures for determining the avalanche danger level. The publication of the paper will contribute to improved workflows, standards and eventually better avalanche forecasting products in the future.

My recommendation to the editors is to publish the paper, after addressing the points below (minor revisions).

The language, figures and tables are generally of high quality and easy to read. The structure is easy to follow, and the balance between data, results and discussion is well suited for a publication. However, I recommend improving readability by splitting many long complex sentences into shorter sentences.

One aspect I was missing was an analysis and/or discussion of the general transferability of the results to other parts of the world, especially where terrain or climate conditions differ from the Davos region. One could assume that not only the total size of the study area matters, but rather the size of avalanche terrain area. Some terrain is not able to produce larger avalanches, while other types of terrain produce many large avalanches. Some climates produce many large natural avalanches, while others less so. If the authors could add these aspects to the discussion, it may be easier for the readers or future studies to generalise, add to, or test the results.

Now follows specific comments, with reference to line numbers in the manuscript:

#7 Add size of study area, number of avalanche observations and number of regional danger assessments.

#13 Could the sentence ending in "...given day" be improved by adding "an danger level" at the end?

#15 Could the sentence be improved by replacing "may allow revisiting" by "suggest reworking of"?

#18 Add "according to our data" after "km²"

#24 Improve the sentence starting with "For these..."

#35 Improve flow (order of words) of sentence

#35-38: May also use the EAWS description "Avalanche danger is a function of snowpack stability, its spatial distribution and avalanche size" (https://www.avalanches.org/wp-content/uploads/2019/07/general-assembly-oslo_minutes_EAWS.pdf)

#50-51 This description should be updated. The latest EAWS matrix specifically accounts for size (<https://www.avalanches.org/standards/eaws-matrix/>)

#75 Explain if the size of the area of avalanche observations is equal to the size of the forecasting region

#75 Add a short description of how these observations were obtained. Information is provided in the discussion chapter, but it would be logical for the reader to learn about the data upfront. Did the observations cover the entire 360 km²? The entire winter season? All seasons with the same rigorousness?

#107 Could replace "In other words, on" by "On average,"

#109 Add a sentence at the beginning of the paragraph, about why the work described in the paragraph was carried out. E.g., “The forecasting data were scrutinized, in order to adjust danger levels to the most realistic values.”

#126 Replacing “Moreover, there were also days, 17 in total” with “This was also the case for 17 days” could improve the readability

#165 Add a descriptor for the values, probably “median values”

#175 Replace “for” by “to”

#277 Replace “to” by “of”

#289 Since the Eckerstorfer et al. study, the number of Sentinel-1 satellites has doubled with 1B in orbit. Thus, the statement of too poor temporal resolution is less valid today. I suggest to add this information to the sentence.

#305 Spell out what is meant by “the potential impact”

#374 Terrain usage probably also decrease from level 2 to 3, as well as from 3 to 4. It would be useful to add references, if these exist, on the differences in terrain usage between danger levels 1, 2, 3 and 4.

#377 Explain in more detail how you arrive at the number 10.

#384-389 I find parts of this paragraph unfinished. I would recommend arguing or substantiating why you make the statements “need to” and “should not”. I would also recommend to put the sentence “The actual locations...” into context (e.g. the wordings of the NA/CMAH and EADS wrt. spatial distribution).

Rune Engeset, 3 October 2019.