Nat. Hazards Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/nhess-2020-274-AC1, 2020


Natural Hazards and Earth System Sciences
Discussions
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# *Interactive comment on* "Examining the operational use of avalanche problems with decision trees and model-generated weather and snowpack variables" *by* Simon Horton et al.

**Simon Horton et al.**

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Received and published: 28 October 2020

*A nice manuscript. When I saw the title of this paper, I was really looking forward to read it, since it promised to give insights to a decision making aid of assessing avalanche problems in operational services. It was interesting and confirmative to see, that the decision trees you derived from snow and weather data follows at least some intuitive, physical understandable rules and has some parallels to the decision aid we use in operational service, which is based on expert opinion only.*

*Furthermore, you nicely showed that contextual information such as presence or absence of other avalanche problems have a great influence on the appearance of an*



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*avalanche problem as well. This fact should be considered in future decision aid developments, which should – as you suggest – combine data driven approaches, as you have undertaken in your study, and expert opinions.*

*The next step in my eyes would be to conduct similar studies in other context, e.g. other countries, forecast services or with different definitions of avalanche problem types. Anyway, thanks for breaking the ice into this direction.*

*I propose hereby some minor revisions as listed below. Since I see this piece of work as very relevant I encourage the authors to undertake the suggested revisions.*

**Thank you for the positive review. We would be excited to see similar analysis done in other regions and contexts so we can learn difference perspectives of how avalanche problems are used and work towards improvements that make them more consistent, accurate, and understandable.**

*Specific comments*

*Page 2, Line 2: "Problems are assessed by answering four questions:. . ." I'm not sure, whether the questions you mention address only avalanche problems. In my eyes, the questions describe the approach of the conceptual model of avalanche hazard assessment. Accordingly, you should say "Avalanche hazard is assessed by . . .."*

**Done.**

*Page 2, Line 7-10: The four references you mention here do not really refer to guidelines for applying avalanche problems. Klassen, 2014 gives a very general and qualitative description of the problem types, Lazar, 2012 shows how danger ratings patterns on specific avalanche problem types, Müller, 2016 and 2018 describes a conceptual and an operational approach of avalanche hazard assessment. None, of these studies*

*directly addresses the assessment of avalanche problems. Therefore, I suggest to reformulate this part. By the way, up to my knowledge, no direct decision making aids or guidelines for applying avalanche problems are published so far. At SLF, we have an internal guideline (see below), which is, however, not published and I guess there are more internal guidelines existing.*

**Thank you for sharing this internal guideline, it is very interesting to see the structure of these simple expert-based rules as well as the footnotes that highlight special consideration (e.g. specific rules about when to use both new snow and wind slab).**

**We have updated our discussion about these existing papers and made it clearer that there is no published guidelines for assessing avalanche problems.**

*Page 3, Line 22: Why do you exclude early and late season? They would probably be interesting for wet snow and gliding snow avalanche problems? This needs more explanation. Probably, you have to adapt on page 4, line 3 as well.*

**The primary reason for omitting these time periods is limitations in our data sets (there are few hazard assessments prior to 1 December and we are missing NWP forcings for some of the spring months). We provide a better explanation of this limitation in our methods and mention in the Discussion section that studying spring conditions would be an interesting addition.**

*Page 12, Line 7ff: In the decision tree for storm slabs, TSS is appearing, which is a bit surprising for me. Do you have any explanations of this? You did not mention in the text.*

**We missed this description in the text and added a brief explanation of this split when discussing the storm slab tree. In general temperature related vari-**

**ables were a common distinguisher between storm and wind slab problems, with storm slabs more common at warmer temperatures (air temperature was also the top split in the wind slab tree with only weather and snowpack variables). In this specific case, the TSS split is beneath a HN72 > 16 cm split, so the main reason for this split could be to distinguish cases when the forecaster may have assessed a dry loose problem instead of a storm slab problem because there was lots of low density snow. We could have provided this level of detailed interpretation for every split for every tree, but decided such detailed interpretations were not needed to support our main arguments.**

*Page 19, Figure 7: In the bars at the lower end of the figure one cannot always read the "Surf", "Act" and "Dorm" notations. Maybe, they are better described in a legend.*

**We cleaned up the overlapping labels and corrected some other hard to read text in our figures.**

*References: please complete the information; many references are not clear where they were published (see comment of Rune Engeset for more detail)*

**We updated our references to complete their publication locations and DOI/URL details.**

*Page 31-34, Appendix C: The figures are to small to read, make them bigger or increase resolution.*

**We increased the size of the appendix figures.**

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