

General comments

I really enjoyed reading this manuscript. It provided scientific value, by analysing forecast and snow/weather model data in a thorough and novel manner with the view of providing applied value to avalanche risk forecasting and management. It applies decision tree analysis to avalanche problems, based on simulated snow and weather properties. The data are abundant, documented, structured and relevant, the analysis and methods are well described and pertinent to the problem, and the focus on the avalanche problems adds significant new knowledge to the research and operational communities. The presentation of the results is adequate and the discussion clear and to the point. In general, the figures and tables are easy to read. It could add value to discuss the results in a more generalised context, please consider if any of these points are relevant based on your data and analysis: How may the results be transferable to other warning services and other climatic settings? How would the results be if the four (five) EAWS problems were used instead of the more detailed North American types? What about using the forecaster name/ID and the day number in his/her forecasting period as variables, was this tested?

I recommend publication of the paper, after minor revision addressing the detailed comments below.

Detailed comments (p refers to page number and # to line number)

p2#35 In the introduction, it could be mentioned that the utility of snow model data in operational forecasting is to a certain extent hampered by the quality and representativeness of input weather data. If a weather model or weather station fails to catch a precipitation event, this error will propagate to the snow model simulation and it may linger on for a long period.

p3#22 Explain why this period (winter months with dry snow avalanche as primary concern) is chosen. Consider adding more details about the study area, e.g. latitude, tree line altitude and elevation interval or hypsometry.

p3#16 Consider adding “and time period” to the sub-title

p4Fig1 The sentence “Grid points used before the 2017 model update are shown with circles and grid points used after the update are shown with squares.” in the caption makes limited sense to the reader at this stage in the text. Could you explain better?

p11#25 Could you add a summary of selected variables? It may improve the reader’ ability to catch up in the text.

p12#4-5 It is not only precipitation controlling weak layer and slab formation events, thus this sentence could be moderated or elaborated a bit more. And to what extent are other relevant variables verified, such as temperature gradients, wind, humidity, density, grain size, etc?

p15 Fig6 Please describe what BT and BTL are in the caption.

p18#8 The sentence is missing a word, maybe “we” in front of “found”?

p18#20 Was it as low as 0.4?

p21#22 Please specify what is referred to as “these trees” (left branch ... left branch)

p22#15 Sparse or lacking field observations from high elevation, especially during periods with poor weather or visibility, could be another factor supporting the use of heuristics by forecasters. Another points that could be brought into the discussion is that the forecasters find it difficult to distinguish

storm slab and wind slab, and the two problems may coexist in different parts of the terrain according to how wind-affected the snow it is. Another point concerns the cornice problem, which is partly the effect of the terrain – suggesting snow and weather variables are less relevant when defining the problem.

p22#27 It could be noted that how well precipitation from NWP models agree with observations could vary significantly, according to weather situation, topography, type of models etc.

p24#5 Consider adding something like “, entry and exit” after “presence”

p24#6 Missing “as” after “such”?

p24#11 Could be other reasons than forecasting practice, e.g. lack of information, incomplete process understanding, or the fact that fading out may generally be a more gradual and slow process than the onset of problems. Here it would be interesting to include data on which forecaster produced the forecast, as individuals may enter and remove problems in different ways - or it may even differ according to day number in the forecasting period the forecaster is on duty. This could be something to consider bringing into the discussion.

References:

- Several references are missing a description of where the paper is published, please add this information:
 - Bellaire, S. and Jamieson, J. B.: On estimating avalanche danger from simulated snow profiles, 2013, 154-161.
 - Giraud, G.: MEPPRA: an expert system for avalanche risk forecasting, 1992, 97-104.
 - Milbrandt, J. A., Bélair, S., Faucher, M., Vallée, M., Carrera, M. L., and Glazer, A.: The Pan-Canadian High Resolution (2.5 km) Deterministic Prediction System, Weather and Forecasting, 31, 1791-1816, 2016.
 - Müller, K., Engeset, R., Landrø, M., Humstad, T., Granan, E., and Thorset, H.: Avalanche Problem Solver (APS) - a decision support system for forecasters, 2018, 1131-1135.
 - Pozdnoukhov, A., Matasci, G., Kanevski, M., and Purves, R. S.: Spatio-temporal avalanche forecasting with Support Vector Machines, 5/1/2015, 11, 367-382, 2011.
 - Yokley, L., Hendrikx, J., Birkeland, K., Williams, K., and Leonard, T.: Role of synoptic atmospheric conditions in the formation and distribution of surface hoar, 2014 2014, 622-627.
- Some references are difficult to understand how to retrieve, please add a better description or an appropriate URL or DOI
 - European Avalanche Warning Services: Typical avalanche problems, Munich, Germany, 2017.
 - Faucher, M.: Technical note for High Resolution Deterministic Prediction System version 4.2.0, 2016.
- Please refer to the final publication, rather than the discussion paper
 - Techel, F., Ceaglio, E., Coléou, C., Mitterer, C., Morin, S., Purves, R. S., and Rastelli, F.: Spatial consistency and bias in avalanche forecasts - a case study in the European Alps, Nat. Hazards Earth Syst. Sci. Discuss., 2018, 1-37, 2018.
 - <https://nhess.copernicus.org/articles/18/2697/2018/>