Answer to Editor

Léo Viallon-Galinier   Pascal Hagenmuller   Nicolas Eckert

> Many thanks for your revisions.
>
> As you an see the reviewers acknowledge that you have adequately addressed their comments, although they remain somewhat unconvinced on certain aspects such the target resolution with 24 AE segments and the relevance of new snow depth. I do not require that you make fundamental changes, different opinions are Ok in my view. Nevertheless, I will give you the opportunity to further improve the manuscript by possibly considering their comments. I also made suggestions, see the annotated manuscript. After you resubmit I will accept the paper.
>
> Best regards, Jürg Schweizer.

We are really thankful to Jürg Schweizer for the time dedicated to this paper for the edition process and for providing constructive feedback and useful suggestions.

We took into account the different comments reported in the attached PDF, as well as the reviewer's comments to revise the manuscript. We agree we made some assumptions in this study that will need to be exceeded in the future, with the help of different methods or alternative datasets for instance. However, we hope we correctly identify them, with the help of the reviewers, and acknowledge clearly these limitations in the text.

Answer to Simon Horton comments

Léo Viallon-Galinier   Pascal Hagenmuller   Nicolas Eckert

General comments

> The revised manuscript has resolved many of my concerns and clarified the objective and limitations of the study.

We are really thankful to Simon Horton for the time dedicated to review this paper. The constructive comments helps improving the paper during the different review steps.

> I still find the presentation of variable importance with the Gini values in Fig. 5 misleading. The bars show the total importance value for a group of variables, but then the interpretation in the text accounts for the number of members in each group, which results in variables discussed as being "important" (e.g., snow depth variations, weak layer depths) having smaller bars in the figure than groups of variables that are not discussed. Importance values are reported in the text for some but not all groups, such as 13.6% for dry snow stability and 3.6% for weak layer depth, but no values are reported for the new snow amounts which are discussed as being important throughout the manuscript. It would be nice for the manuscript to more clearly present these results, such as modifying Fig. 5 to show an average value for a group (importance value for a group divided by the number of variables), reporting more numbers in the text to make stronger comparisons, or perhaps other methods used to make the claim new snow depth was important.

We decided to provide the Gini importances because this is a very common approach with the Random Forest (RF) method. However, in the present case, the interpretation of the importance of variables provided by this method have to be handled with care because the computation of Gini importance from RF method is only valid for independent predictors, which is absolutely not the case here. We remind this in different paragraphs of the manuscript (section 2.6.4 and 3.3) as well as in the different review answers. Then, we only provide these Gini importance for illustration of the results at higher resolution than permitted by the other method, to check the variable importance regarding to current knowledge and to highlight the limitations of this method for the estimation of variable importance.

On one hand, the summed importance variable for each group, could be seen as the overall importance of the group, if we consider the different groups are sufficiently independent. On the other hand, the number of variables gives an idea of the complexity of the group (increase in complexity in the RF trees, as well as the complexity of the interpretation due to the number of highly correlated variables). Therefore, we believe that both are of interest. In any case, neither the absolute values of Gini importance nor the average value is fully mathematically justified as soon as variables are not independent two by two.

Therefore, we keep Figure 5 only because this method is very commonly used with random forests [e.g. Sielenou et al., 2021; Mayer et al., 2022] and allow for a first easy overview of the variable importance but the values have to be handled with care as there is a lot of correlation between variables and even between the groups of variables. We are now more precise on this goal and the objective of the part of the result section concerning the Gini importance :
However, absolute values have to be taken with care as this analysis method is strictly valid only when the different variables are independent, which is far from the case we have here. We thus provide this analysis to check the main results according to previous knowledge and because of the popularity of this method, but the detailed results are of limited interest due to the presented limitations of this method in our study case.

Technical comments

> I have two other technical comments.
>
> - Line 157: I assume this addition is for wet avalanches only? "...in a potential wet avalanche."

As these two variables are relevant for both dry and wet snow avalanche activity, we moved this sentence to the introductory paragraph.

> - Why are not all the scores described in Sect. 2.3.2 listed in Table 3? Would be helpful to move all equations from the text into the table (specificity, balanced precision, etc.).

We moved all equations into Table 3 as suggested.

Answer to Frank Techel comments

Léo Viallon-Galinier   Pascal Hagenmuller   Nicolas Eckert

> Dear authors

> Thank you for revising the manuscript.

We are really thankful to Frank Techel for the time dedicated to review this paper and for providing a very interesting, constructive and helpful feedback.

> Following are some minor typos or recommendations:
>
> - l48: change "become then" to "became"
> - l117: there is an "i" too much
> - l159: I am not sure whether two plurals are correct in "stability indices values".
> - l176: I suggest adding a reference to the description of the filtering in Sect 2.2. at the end of the brackets ", as explained in Sect. 2.2", or similar
> - l177: replace "ones" with "situations"
> - l415: add an "s" to "path"

We took into account all these typos/recommendations in the revised manuscript.

> - l59/60: consider removing "could increase the interpretability of the algorithm results and"

For the sentence line 59 and 60 we believe that such preprocess of data to produce relevant stability indices could both reduce the complexity of the algorithm and therefore increase the interpretability.

> Kind regards,

> Frank Techel