Reply to the Editor

We thank the Editor for his comments. Please find our replies and how we plan to revise the manuscript in blue below.

I have read your submission and am starting the review process. I have two points that I suggest addressing during the revision.

This study is biased towards Swiss avalanches, which is fine, but should be acknowledged. For example, layering and the prevalence of avalanches that fail on old snow layers varies throughout the world. In Switzerland or Colorado USA, old snow avalanches dominate. In California USA or coastal British Columbia Canada, avalanches mostly involve the new snow.

Our study refers to the Swiss Alps, as stated in the title of our manuscript. We will further elaborate on the representativity of our study and describe that the selected sites cover different climate zones in the Swiss Alps in the Discussion section.

Flat sites are a poor representation of avalanche starting zones. Why weren't virtual slopes, as in Mayer et al. (2023), used? How was the shortwave & longwave radiation balance, which is critical for facet growth, adjusted to steep north facing slopes? Was any comparison performed between the SNOWPACK profiles at the flat sites and in avalanche starting zones? If the snowpack is consistently shaded throughout the winter, one can still expect facet formation under warming, maybe even increases with the thinner snowpack, given the negative radiation balance. Similarly, won't melting occur much earlier and more frequently on the flat study plots than in the starting zones?

We agree that analyzing slope simulations would provide added value for understanding future avalanche activity. Nevertheless, we cannot generally agree that flat sites are a poor representation of avalanche starting zones. For instance, Jamieson et al. (2007) have demonstrated that trends of stability indices from flat field study plots are useful for forecasting dry-snow slab avalanches in surrounding terrain. Moreover, data from SNOWPACK simulations at flat fields proved to be useful input for numerical models of avalanche forecasting (e.g. Pérez-Gullién et al., 2022). Typically, during peak winter (December to February), snow profiles from flat study plots are fairly representative of the snow stratigraphy on west-, north- and east-facing slopes. During this period, these slopes and flat sites receive relatively little incoming shortwave radiation, resulting in similar faceting processes. As the season progresses, differences in radiation become increasingly important. Towards spring, south-facing slopes experience earlier snow melt and thus earlier transition to stable dry-snow and unstable wet-snow conditions compared to north-facing slopes due to differences in incoming radiation. The stratigraphy of flat fields can then be assumed to lie somewhere in between these two extremes. Therefore, we believe that our analysis of avalanche activity based on flat field stratigraphy captures the general trend in future avalanche activity in the Swiss Alps.

In the Discussion section, we will acknowledge that our projections are based on flat field simulations and that future studies could refine these results considering different slope aspects. Herein, it is also important to note that modeled dry-snow instability is most sensitive to precipitation (Richter et al., 2020), which does not vary between aspects apart from the crucial snow redistribution by wind. Accounting for snow drift when analyzing future changes may be very challenging, as climate projections of wind are typically very uncertain.

References

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