

## ***Interactive comment on* “Sensitivity of modeled snow stability data to meteorological input uncertainty” by Bettina Richter et al.**

### **Anonymous Referee #2**

Received and published: 25 April 2020

In their manuscript "Sensitivity of modeled snow stability data to meteorological input uncertainty", the authors perform a sensitivity analysis of modeled snow stability data and indices to uncertainties in the meteorological forcing data. For this purpose, the widely used snow cover model SNOWPACK is forced with disturbed meteorological input data implementing different bias scenarios on the single meteorological parameters resulting in 14000 simulations.

### General Comments

The manuscript is very well written, and it presents valuable insight in snow stability modeling and its sensitivity to meteorological forcing data. Besides some minor issues, the presented methods are well explained and the manuscript fits well in the scope of NHESS. It represents an important and profound step towards more knowledge and

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trust in using snow cover models in operational avalanche forecasting. I list some minor general comments and suggestions and specific remarks in the following.

I understand that this is a model sensitivity study and the model has been validated in other studies. However, I would highly appreciate if you could add some model validation for your presented case study to get a better understanding of the model performance especially with respect to the model's sensitivity to forcing errors. As I understand, you have some observed profiles available, maybe directly at the WFJ site? You could add a validation plot in Sect. 2.2 (e.g. accompanying Fig. 1?) for the undisturbed reference run after averaging the SNOWPACK layers as described there. I see that you perform kind of validation by comparing the results to avalanche activity and AAI, but it would be very valuable to have a direct comparison to measurements, in the best case even within the uncertainty range figures (Figs. 3 and 5). In addition, you should add modeled snow depth from the reference run to Fig. 2 (which I assume is observed snow depth, information should be added to the Fig. caption). All this would bring the findings of the impacts of forcing uncertainty on modeled snow stability in better context to reality and build more trust in the models to be used in operational forecasting.

I think the bias/disturbing procedure to produce the disturbed meteorological forcings within the given ranges needs some more explanation. Specifically: at what time scale are the errors applied? Is it a constant offset applied to the time series for a scenario or does it have some time variability within the scenario? This should then be referred to in L. 301-306.

### Specific Comments

At some points in the manuscript you use "snow height", but mostly "snow depth". Please use "snow depth" consistently.

L. 15: "... sensitive to precipitation..."

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L. 55: You state: "However, only a few studies have so far assessed the uncertainty of snow cover models." I would rather change this to, e.g., "However, only a few studies have so far assessed the impact of forcing uncertainty on the performance of snow cover models." because there are many studies available in literature which assess the performance and uncertainty of snow cover models in general.

L.105: "For the sensitivity analysis, we introduced uncertainties to the meteorological input." This sentence could be removed here, as you explain this in the next sections.

L. 150: I suggest to remove the sentence "For each scenario, 14,000 simulations were performed." here, as the number of simulations is explained in the following section 2.4. You could instead extend the last sentence of 2.4 (L. 170), e.g. like "... for each of the three applied scenarios."

L. 274 "Precipitation influences weak layer and slab properties." instead of "Precipitation influences weak and slab properties."

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Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2019-433>, 2020.

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