Subgridding High Resolution Numerical Weather Forecast in the Canadian Selkirk range for local snow modelling in a remote sensing perspective

First, we would like to thank the reviewer for his or her valuable feedback and comments which greatly helped improve the manuscript. We have revised the document according to the reviewer's minor comments. The present document summarizes our answer to the Referee report document. The original comments are in red, the reviewer's comments are in green. and our final answer is in blue. Moreover, the english was proofread after the science and technical corrections were made to the manuscript.

Comments about the point-to-point response

"l. 79: Why not also including the melt season?
The global objective of this work is to provide a realistic first guess of the snowpack structure in the
context of SAR remote sensing signal inversion algorithm development. At relevant frequencies (Ku-
band, X-band, C-band), the snowpack becomes opaque to microwaves when wet. This is why the
study focuses on the accumulation period."
It would be worth mentioning in the text.

This information has been added to the manuscript (now l. 112 in the revised manuscript)

"Figure 2: I assume a typo ("VWS" for "VW")
Wind speed is referred to as VW everywhere in the SNOWPACK / MeteoIO /Alpine3D documentation.
It stands for Velocity of Wind, as described in the official SMET format specification (https://meteoio.slf.ch/doc-release/SMET_specifications.pdf). This acronym was used everywhere in the manuscript out of homogeneity with the official specification."
The VWS acronym has not been corrected to VW ("VWS parametrized").

The VWS acronym the reviewer is referring to in Fig 2 stands for "Virtual Weather Stations", this is why we missed it in the first round of revision. This is obviously unclear to the reader, so the figure has now been modified and the acronym has been removed. We apologize for the misunderstanding.

"l. 263: The observed altitudinal temperature gradient is the reflect of the lapse rate chosen for TA
downscaling (l. 137). There is no proof here it is realistic.
This line has been rephrased as : First, the lapse-rate applied for TA downscaling and spatialization respects the general rule of thumb that TA should get colder with elevation."

The new formulation is also not very satisfactory. The fact that temperature decreases with elevation
is not a result, but simply the direct consequence of the chosen lapse-rate.

This sentence has been rephrased to :
First, as a direct consequence of the applied lapse-rate for TA downscaling and spatialization, the general rule of thumb that TA should get colder with elevation is respected.
(l. 300 in the revised manuscript)

“l. 270: What is the reason for simulating the snowpack in forested areas (in a remote sensing perspective), if the forest snow processes, which have a strong impact on the snowpack, are not represented?
We agree with the reviewer that there is limited interest in simulating the snowpack in forested areas in a remote sensing perspective. The difficulty of accurately modelling both the snowpack and radiative transfer under trees and snow makes for a particularly challenging problem. However, we have chosen to tackle the entire elevation range within our study area out of completeness, in order to assess how the subgridding framework is performing on the entire domain of the simulation.”
This point remains quite unclear to me. As far as I understand, authors consider somehow “virtual open terrain” below treeline to cover a full elevation range. It should be more explicitly stated in the manuscript, together with motivations for doing so

We do not consider “virtual open terrain” for forested areas. We use the basic scheme for forest processes in SNOWPACK, and each forested cell according to the land-use classification is initiated with canopy information. However, we acknowledge the fact that forest-snow processes are a complex and the basic scheme in SNOWPACK is making a rough estimation of the reality. We added the following sentence in the Alpine3d paragraph of section 3.1 HRDPS subgridding and Alpine3D simulations:

Alpine3D uses a DEM and a land-use layer to properly initiate each SNOWPACK cell. Depending on the land-use category each cell falls into, canopy information is provided for forested cells in order to represent snow interception and forest snow processes.
(l. 166 in the revised manuscript)

“l. 271-272: “The wind erosion effect on the snowpack is also well represented, as dominant winds are blowing from the South / South-West. As a result, the south aspect profiles show more defragmented grains (dark green) on the surface”. I am not sure I understand this cause-consequence. As far as I understood, wind-induced snow transport is represented by a precipitation multiplier. Consequently, associated effects of snowdrift on snow microstructure are not represented.Or am I missing something? Please clarify.

The word “erosion” here has not been used appropriately by the authors and is certainly the cause of the misunderstanding. Lines 271 - 274 in the original manuscript have been modified as such: The wind effect on the snowpack is also well represented in the simulations. Indeed, dominant winds are blowing from the South / South-West, and as a result southern slopes are affected by stronger winds (fig. 7). In the SNOWPACK model, grain type is a function of dendricity and sphericity, two parameters governed by the temperature gradient within the snowpack. As the surface temperature is altered by surface winds, precipitation particles (lime green) on the south aspects tend to metamorphose faster into decomposing and fragmented precipitation particles (dark green) than in the northern aspects, especially in the alpine.”
The grain type could be affected by many other parameters. In the present state, this conclusion is not sufficiently backed..
The paragraph on the influence of wind on grain defragmentation has been removed from the manuscript.

Comments about the track change manuscript

Abstract
All comments were taken into account as suggested by the referee

Introduction
All comments were taken into account as suggested by the referee

Study Area
All comments were taken into account as suggested by the refereee

The Numerical Weather Predictions downscaling processing chain design
All comments were taken into account as suggested by the referee

Results
Figure 10 is not so easy to read: in particular, what are the x axis legends? Pixels “names”? Maybe the authors could think of a more “reader-friendly” figure conveying the same message
The figure x-axis corresponds to HRDPS cell names. We improved the figure’s caption and description to give the reader a better understanding how what is shown in the figure. However, we kept it as boxplot because in our opinion this is the best way to show the increase of SWE spatial variability among each HRDPS cell throughout the season. The figure description has been modified as such:
Boxplot of the SWE modelled by the subgridding framework within each HRDPS cell in the early season and in the end of the season. The labels on the x-axis correspond to each HRDPS cell ID. The box spans the interquartile range (IQR), the line represents the median,

and the whiskers extend to the minimum and maximum value within 1.5 times the IQR. Outliers have been removed.

All other comments were taken into account as suggested by the referee

Discussion

All comments were taken into account as suggested by the referee

On unit choice for SWE: SWE was indeed written in cm (no mistake there). The unit was switched to mm to conform with a more commonly used unit.

Conclusion

All comments were taken into account as suggested by the referee