Author Response for "Multi-physics ensemble modelling of Arctic tundra snowpack properties", Woolley et al. (V2)

The authors would like to thank the editor and both reviewers for the time taken to review the revised manuscript. Our responses to the minor comments are in blue, modified text is in italics and reviewer comments are in black.

Reply to comments from the editor:

Line 84: Low-density snow is commonly snow with a density < 150 kg/m3. I suggest you define what you mean by low-density snow, and low-density depth hoar layers.

We thank the editor for outlining our use of 'low-density snow' and 'low-density depth hoar' interchangeably and understand how this could lead to confusion. We have modified the manuscript by separating the two phrases (outlined in the examples below and modified throughout the manuscript):

Line 66: *Basal vegetation (shrubs and sedges) modifies temperature gradients within the snowpack by reducing compaction and enhancing snow metamorphism, which promotes the formation of depth hoar (Domine et al., 2016; Domine et al., 2022).*

Line 348: *Measured profiles of density exhibit the typical structure of Arctic snowpacks: low-density basal layers …*

We have also modified our use of 'high-density snow' and 'high-density wind slab' throughout the manuscript for clarity.

Line 133: hard hardness (not finger hardness).

Changed.

Line 355 (and elsewhere): The preferred date format in TC is 15 January 2018 (instead of 15th January 2018). In addition, with reference to line 58 and to avoid any misconception, it is not the case in Alpine snow covers that density always increases with increasing snow depth (please see the example attached). Also, models can handle this, although not always perfectly.

Dates have been changed to the preferred format.

Thank you for outlining this misconception and for providing the example. We have changed the sentence on Line 53 to avoid this:

*Despite showing reasonable agreement in their simulation of snow depth and SWE of Arctic snowpacks (Barrere et al., 2017; Gouttevin et al., 2018; Krinner et al., 2018; Domine et al., 2019; Royer et al., 2021; Krampe et al., 2021; Lackner et al., 2022) both models **often** simulate profiles of increasing density with snow depth because both Crocus and SNOWPACK were originally developed to simulate alpine snow.*

References:

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