Reviewer 3

I have also sent a list of editorial suggestions that are not of interest for the open discussion directly to the authors.

We thank Richard Essery for his helpful comments and corrections, which we will take into account when revising the manuscript.

The site is sometimes abbreviated as "WFJ" and sometimes "the WFJ" - pick one.

We use "WFJ" consistently now.

page 2660: Not much space would be required to quote the Richards Equation and the van Genuchten water retention curve here for the benefit of the general reader.

We will include both in the revised manuscript.

page 2665: If the cylinder is inserted horizontally into the snow, "60 cm long" would be a better description than "high".

The cylinder is inserted vertically. To clarify the text here, we revised it as (a colleague informed us that the cylinder is 55 cm high):

> Density is determined by taking snow cores using a 55 cm high aluminium cylinder with a cross-sectional area of $70\,cm^2$ inserted vertically into the snowpack. The snow core is then weighted using a calibrated spring.

page 2675: Is "dependence of thermal conductivity on density" intended?

We are sorry to have caused confusion here, but it is indeed intended to say that the thermal conductivity is dependent on density. We revised this sentence as:

> The latter influences the snow temperature through the thermal inertia of dense snow layers and through the strong density dependence of thermal conductivity (e.g., Calonne et al., 2011).

Figures 6 and 8: The captions should note that the temperature axes are staggered to avoid overlap. Some of the broken line styles are impossible to distinguish; longer dashes might help.

We will adjust the figures according to the suggestions.

Figure 12: The bucket and RE results look surprisingly similar, with little response to the spring wetting apparent. Is this just due to the colour scale?

We changed the colour scale, in particular to be able to plot the observed grain sizes into the same figure, which required more contrasting colours. This was a suggestion by another reviewer. See Figure 1. Now, by eye it can also be seen that the bucket scheme is associated with larger snow grains in the snow melt season, due to the generally higher LWC compared to the Richards Equation. In the model, the wet snow grain growth rate depends on LWC (Lehning et al., 2002a), based on experimental work by Brun (1989).

References

Brun, E. (1989), Investigation on wet-snow metamorphism in respect of liquid-water content, *Ann. Glaciol.*, *13*, 22–26.

Lehning, M., P. Bartelt, B. Brown, C. Fierz, and P. Satyawali (2002a), A physical SNOWPACK model for the Swiss avalanche warning Part II: Snow microstructure, *Cold Reg. Sci. Technol.*, *35*(3), 147–167, doi:10.1016/S0165-232X(02)00073-3.

Yamaguchi, S., K. Watanabe, T. Katsushima, A. Sato, and T. Kumakura (2012), Dependence of the water retention curve of snow on snow characteristics, *Ann. Glaciol.*, *53*(61), 6–12, doi: 10.3189/2012AoG61A001.
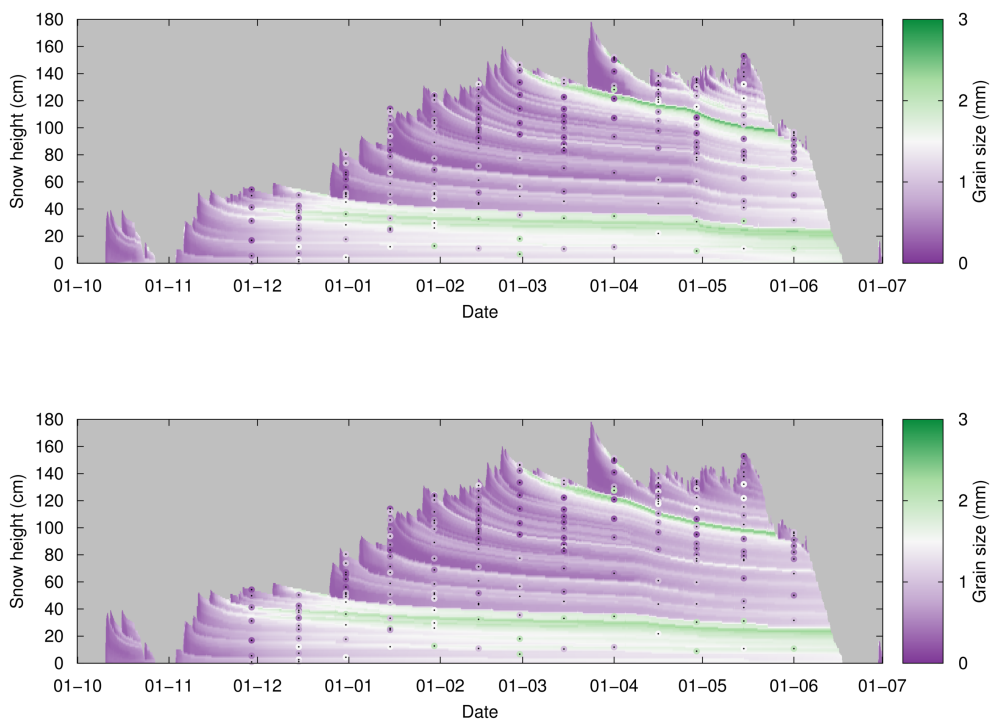
Figure 1: Grain size (mm) for the snow height-driven simulation with the bucket scheme **(a)** and with Richards equation using the *Yamaguchi et al.* (2012) water retention curve and arithmetic mean for hydraulic conductivity (RE-Y2012AM, **(b)**), for the example snow season 2014. Dots with a black center point indicate observed grain sizes reported from the biweekly snow profiles, where the black center point is located in the middle of the observed layer.