

Reviewer's Comments

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Observation and modelling of snow at a polygonal tundra permafrost site:
spatial variability and thermal implications

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General comments:

The paper highlights results from a field campaign carried out in order to assess the performance of the SNOWPACK model to simulate arctic snow conditions. A focus was made on the thermal conductivity and modifications to SNOWACK (wind compaction, vegetation and vapor flux) have shown improvements in snow simulations by SNOWPACK.

This paper address a major problem in arctic snow simulations where most models and not well adapted, which leads to significant biases in snow microstructure, which in turn creates problems for the radiative transfer community. For the past years, several efforts were made to improve and adapt snow models to arctic conditions, but the success was limited. This paper thus represent a major step forward, that will certainly help numerous scientific communities 9rmeote sensing, ecology, hydrology, ...).

I recommend this paper for publication in The Cryosphere, after minor revisions detailed below.

Specific comments:

- Last paragraph of introduction: the paragraph simply describes the various section of the paper. Typically, such paragraph can be found in theses, but I think it is not relevant here. I would remove this paragraph, which would reduce the introduction (already quite long).
- Figure-1 should include coordinates.
- The use of NIR to calculate the ratio of DH with respect to snow depth should be more detailed. Photos are simply showed with explanation on the method used to distinguish DH. Was the calculation made automatically, or was a threshold applied on reflectance?
- Section 2.2.1: More details is needed regarding the spatial representativity of the SR50 measurements. Authors mention that small differences can be due to local scale variability, but a quantification should be done. Typically, the spatial variability is caught within 30-35m (1m spacing) in open tundra environments. What was the variability around the site? How does the average depths around the site compare to the SR50 measurements? This should be clarified, especially since SNOWPACK is forced on observed depths by the SR50 (section 2.4).
- Section 2.4: the authors are well aware of the sensitivity of SNOWPACK to uncertainties in meteorological forcing data. Many products exist, the authors should justify why using ERA-interim rather than other meteorological products... Also, it is mentioned that a comparison with in-situ meteorological stations showed that ERA is 'suitable'...this should be clarified.
- Page 10, last sentence. Can you please clarify that you adjusted only the VEG...and not VAP...so that VEG would account for VAP+VEG processes?

- Section 7.4.: there needs to be a discussion on meteorological forcing uncertainties... The resolution of ERA is quite large compared to a single site.
- On the pdf, the figures are general poor quality-resolution such as would be a simple printscreen. Please ensure high resolution on final version as some axis are hard to read