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Discussions

Interactive comment on "Automatic monitoring of the effective thermal conductivity of snow in a low Arctic shrub tundra" *by* F. Domine et al.

Anonymous Referee #3

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General Comments

This paper describes a carefully designed and executed experiment which successfully acquired time series of needle probe snow effective thermal conductivity (Keff) measurements. A series of post-processing steps convincingly isolates the most accurate sampling periods for measurements with and without convection, which allows robust error analysis and a clear determination of needle probe Keff underestimation compared to other techniques. While relatively high uncertainty and bias no doubt exist in needle probe measurements compared to more advanced techniques, this study has shown a practical approach for use in remote areas, with the added benefit of providing time series measurements. This is a rigorous study, and the paper is clearly written. I suggest only editorial corrections and these clarifications:

1. Page 1637 line 21: I'm sure there is a good practical reason but why during the 2012/13 season were the needle probes not inserted into the vertical profile earlier in the season? Could the removal of the snow block to insert the probes be avoided simply by inserting the probes earlier?

2. Page 1638 line 22: "We found that using the cooling curve added little value to our data, so our work focused on treating the heating curve." I suggest adding a short explanation to clarify this statement. Did the cooling curves add little value because the results were similar to the heating curves? Or was there some ambiguity in the interpretation of the cooling curves based on the procedure outlined in Figure 3?

3. Page 1639 line 28: briefly describe the measurement of specific surface area (SSA). I assume these were integrating sphere and laser measurements? Not clear what a "parallelepipedic" density cutter looks like...

4. Page 1641 line 5: I suggest adding further details on the manual analysis of the heating curves. Specifically, the separation of convection from non-convection cases is not clear. How was the "best time interval" selected?

5. Page 1650 line 21: Discussion of meteorological differences between years (previous paragraph) and metamorphic conditions would be strengthened by more quantitative information on the snow microstructure profiles, especially at the needle probe locations through both seasons. Can SSA information be added to Figures 4, 5, and/or 6? Only three manual measurement periods were conducted through the 2 seasons, so some supposition is necessary but were the changes in Keff through January to April 2013 (not observed in 2014) due to the changing vertical position of the needle probes relative to the total snowpack depth (and related metamorphic processes due to increased late season snow depth) which remained comparatively consistent in 2014?

Editorial Comments

Page 1635 line 5: change to "...that it is meant to..."

Page 1637 line 6: not clear what is meant by "forest tundra". Are you referring to forest patches surrounded by tundra or the forest to tundra transition?

Page 1640 line 2: change to "...cleanly breaking..."

Page 1642 line 11: change to "...to ensure measurement quality..."

Page 1642 line 21: correlation coefficient = r; coefficient of determination = Rˆ2

Page 1645 line 21: incorrect reference to Figure 8.

Page 1645 line 25: instead of referring to depth hoar as 'very soft' I suggest using a term like 'low density'. Instead of 'hard' depth hoar, would it be correct to describe it as "icy depth hoar" or depth hoar mixed with melt/refreeze clusters in 2013-14?

Page 1647 line 15: suggest modifying 'almost systematically' to 'systematically'.

Page 1648 line 26: is the 29% additive from the terms in this and the previous sentence? If so, there appears to be a rounding error.