

Interactive comment on “Modeling the impact of wintertime rain events on the thermal regime of permafrost” by S. Westermann et al.

Anonymous Referee #2

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This manuscript presents modeling results of the effects of rain on snow on soil thermal regime under a warming scenario. The presented modeling is inspired/guided by observations in the Ny Alesund, Spitsbergen.

The manuscript is well written, fluent, technically correct, but not surprising. However, this manuscript highlights the importance of the rain on snow that has been discussed in earlier papers but has not received as much attention as it probably deserves. In conclusion, although not very exciting, this manuscript describes in detail the potential and important effects of rain on snow on permafrost and as such deserves to be published.

Below I have listed a number of minor comments that should be addressed prior to publication.

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Page 1699, Row 27: In this context the publications of Ming-Ko Woo and his coauthors should be at least acknowledged if not further discussed. (Marsh and Woo, 1984, WRR; Marsh and Woo, 1984, WRR; Woo and heron, 1981, AAR; and Woo and Xia, 1996, Nordic Hydrology). Also Grenfell and Putkonen, 2008, WRR, document a severe rain on snow in Arctic Canada.

1700, 5: Also Putkonen et al, 2009, EOS.

1700, 13: “Drift” should be “current”

1704, 28: Replace “the onset bedrock at this depth” with “that bedrock is found at this depth”

Pages 1703-1704: I am afraid that the detailed derivation of thermal properties may give a bit of a misleading picture of the system. First, many of the methods applied are empirical and may or may not work well in this setting. Second, frost heave is well known phenomenon in this area and will effectively throw off many of the above values as ice lenses will form within the soil.

I do not suggest that the calculations presented in this paper cannot be done, but I suggest that we may not know the exact values of the thermal properties and resulting temperatures as well as the mathematics may imply.

1706, 18-22: It is unclear how critical these assumptions are as no justification is given for them. If this paper is a proof of concept type of analysis then it may suffice to say that such ratios are typical (the statement needs to be backed up by a reference).

1707, 8: It is unclear if the snow is settling in the model as I understand that the density is increasing which would imply settling. This is obviously important for the heat conduction through the snow pack.

1710, 12: Change “weighting” to “weighing”

1718, 16: Remove “a”

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