

## ***Interactive comment on “Small-scale variation of snow in a regional permafrost model” by K. Gisnås et al.***

### **Anonymous Referee #1**

Received and published: 25 January 2016

This paper is focused on an important topic about sub-grid variability of ground temperatures caused by small-scale effects of snow and its corresponding (re-) distribution. The manuscript presents a simple empirical model approach to map permafrost distribution in Norway. The authors have performed a careful validation based on an impressive dataset of temperature loggers, boreholes and ALS data. They are able to show convincingly that sub-grid variability is very crucial when mapping permafrost using a model approach on a very large scale. The authors conclude that including their sub-grid procedure is enlarging the permafrost distribution of Norway from about 4% to 8%, which means about a doubling of the total permafrost area, which is known from current permafrost models.

Minor Comments:

C2869

Page 6662, line 24: what means in this paper: ground temperatures (MAGT) -> in which depth please define!

Page 6662, line 25: Citations: please add 'eg' because there are hundreds of such studies showing this effect.

Page 6663, Line 12: The effect of sub-grid variation is not only important in high latitudes but also in high altitudes. Please add.

Page 6663, Line 17: I would suggest to write this sentence in a more general sense, because accumulation season can be very different in different latitudes and under different climate conditions (eg tropics).

Page 6666, Line 9: ... seven search vectors. Do the authors not mean eight search vectors?

Page 6666, Line 21: accumulation season January to March. Is this justified for whole Norway?

Page 6666, Line 22: What is about wet snow? Insert please a short reasoning why you do not discuss wet snow deposition. Humidity, temperature and radiation conditions can influence the deposition of snow and the possibility of snow transport considerably (eg wet or dry snow deposition or formation of 'firnspiegel' in spring preventing further redistribution of snow).

Page 6667, Line 6-13: This approach is not really physically-based and therefore in strong contrast to the other used approaches, where the authors try to be as physically-based as possible?

Page 6668, Line 1: What means thermal conductivities if you have also convective transport of water and air? Please specify or better use another expression like 'apparent thermal conductivities', which you have to define beforehand!

Page 6669, Line 12: MAGT means always the temperature at the top of permafrost?

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Page 6669, Line 21: à instead of á

Page 6670, line 11: you mean that the logger measures really the surface temperatures? Please be more precise and define depth of temperature sensors.

Page 6676, line 5-8: A table would be more clear.

Page 6678, line 4: This depends strongly from the snow and the surface processes if snow can blown away easily or not (see already comment above)! This approach should then be probably more process-based.

Page 66679, line 15: . . . and of course the roughness of the surface eg coarse material.

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Interactive comment on The Cryosphere Discuss., 9, 6661, 2015.