

## ***Interactive comment on “Modelling past and future permafrost conditions in Svalbard” by B. Etzelmüller et al.***

**Anonymous Referee #3**

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### General comments

This paper describes a relatively simple yet effective model to predict past, current and future ground thermal conditions in Svalbard. The authors use a straightforward and effective method to calibrate their transient heat flow model using recorded ground temperatures and ground surface temperatures from boreholes and air temperature records from nearby climate stations. The results are well presented and provide useful insight into the magnitude and timing of ground temperature variations on Svalbard. Also insightful was the use of the sensitivity analysis to examine the effects of long term changes in seasonal air temperatures on ground temperatures and active layer thickness. The section “Uncertainties and Sensitivity” in the discussion section provide a measure of the limitation of the model and in turn the model outputs by outlining

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specific uncertainties in model parameters and climate scenarios.

**Specific comments** It would be interesting to include in section 3.3 Ground Temperature, a more thorough description on the N-factors employed in this study. It would be valuable to see the period of time over which the ground surface temperature and air temperatures were collected on which the N-factors used in this study were calculated. If they have been calculated using more than one year of data what is the range of values?

**Comments on figures** The majority of the figures are well drawn and easy to understand. The only figure that requires any modification is figure 1. The general layout of the map is good but the titles and the symbols are tightly packed together making them difficult to understand. In addition, some of the place names are printed below these symbols; it would increase the value of the map to spread out the place names.

**Technical comments** These are some comments to help correct some sentence and grammar errors.

Pg 1879 line 18; change “further” to furthermore”.

Pg 1879 line 23; change “an” to “a”.

Pg 1879 line 25; change “over” to “of”.

Pg 1880 line 1; there is no need to include “(some cm)”.

Pg 1880 line 12; change “longer” to “long”.

Pg 1880 line 17; change “means” to “mean”.

Pg 1882 line 3; remove “-“.

Pg 1882 line 8; instead of using “moisture” maybe use “wetter” or “ increased summer ground moisture. . .”.

Pg 1882 line 13; change “On” for “At” and “is” for “was”.

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Pg 1883 line 14; is there a reference for the geothermal heat flux value?

Pg 1884 line 19; some slight changes to this sentence could help clear up the intended meaning. For example, "thermal conductivity and bedrock density values were selected from published literature. ...".

Pg 1885 line 1; instead of "is" maybe "has been".

Pg 1885 line 14; instead of using "Past Development" as a section heading 4.1 a more specific title could be "Historical ground thermal regime" or something similar.

Pg 1886 line 3; section 4.2 could use a slightly more focused title.

Pg 1887 line 14; a more specific heading could be "Sensitivity to changes in seasonal air temperature".

Pg 1891 line 7; does temperature variability refer to air temperature?

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Interactive comment on The Cryosphere Discuss., 4, 1877, 2010.