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Discussions

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Interactive comment on "Linking tundra vegetation, snow, soil temperature, and permafrost" *by* Inge Grünberg et al.

Anonymous Referee #2

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This paper uses two years of topsoil temperature, snow, and active layer data from six vegetation types within a heterogeneous Low Arctic landscape in the northwestern Canadian Arctic to evaluate the relationships among these variables – vegetation, snow, soil temperature, and active layer depth. With changes in arctic vegetation being readily observed, there needs to be a greater understanding of how vegetation influences snow dynamics, ground temperature, and ultimately active layer depth and permafrost. Several papers in the literature do exist on this topic, however, the results collectively are not incredibly clear and consistent, and more data and analyses are needed. With a soil temperature dataset as robust as the one from this study, there are unlimited ways to analyze the data, and everyone will have their own opinion on how best to do that. The analysis presented here is generally a fine one, and is infor-

mative, and therefore I will not give opinions on other ways in which the analysis could have been done, but rather will provide some constructive comments on the existing analysis. The following are some general, more specific, and some minor editorial suggestions: 1) State the depth of the data loggers in the Abstract 2) Line 28 – Low Arctic is commonly capitalized, and change the "an" to "a" 3) Line 37 - You mention that tussock tundra is commonly found in depressions, which is not always my experience, and I'm not sure how widespread that it. Certainly not on the exposed hilltops, but more often I think that tussock tundra is found on mesic slopes, as opposed to more saturated lowland positions. 4) Line 40 – should be "active layer thickness at the end of summer" 5) Line 88 – "gasses" should be "grasses" 6) Lines 139-140 – since you use "summer" here, I was wondering if you should define your seasons first. Also wondering if there is a better way of stating this – e.g. average topsoil temperature was more than 5 degrees C lower than air temperature. 7) Lines 140-142 – how were these values determined, i.e. the -5 and +7 degrees C differences? 8) Line 148 – Assuming that you smoothed the data prior to defining the seasons? Did smoothing remove all spikes in the data such that the winter and summer temperature thresholds yielded continuous seasons, i.e. were there any days within winter or summer that fell outside of the threshold temperatures? 9) Lines 153-154 – I understand how the slopes for fall and spring might work directionally as cooling and warming respectively, but I would imagine that the peak warm and cool days with fall somewhere in the middles of summer and winter respectively, and therefore the slopes would not be very informative for these seasons. 10) Lines 157-158 – Would the day when temperatures first drop below 0.5 degrees C be the beginning of the freezing period in autumn? 11) Line 168 – remove the comma after "those" 12) Line 181 – by "date of thawing" do you mean first date, end date, or both? 13) Line 199 – give the actual temperature ranges 14) Lines 263-264 – with regard to the relationship between October soil temperatures and active layer depth, I have a hard time believing that Oct. temperatures can influence active layer depth – more likely the other way around maybe? 15) Figure 8 – I'm not sure that this figure is very useful. If vegetation is influencing snow depth, than it's

very likely that snow depth in one year will be related to snow depth the next year. You might considering removing this. 16) Figure 7– you discuss these relationships a lot, but I don't see any statistical analyses on them (with the exception of panels (a) and (f)). Are these significant relationships across and within vegetation types? Also, if these relationships are considered to be causal, then snow depth should be on the x-axis, as it is driving the other variables (again, except panels (a) and (f)). 17) Figure 11 – same as Figure 7 with regard to the statistical analyses (except panel (a)). Axes are fine in this figure as active layer depth is the assumed dependent variable. 18) Line 327 – remove the word "temperature." 19) Lines 332-334 – examples of where relationships are being discussed with no statistical analyses 20) Finally, with regard to the Discussion and Conclusions, the vegetation may indeed have an effect on active layer depth, through its effect on snowpack, as vegetation is effecting the snowpack, which is driving snowmelt and spring/summer temperature regimes.

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