Biogeosciences

Discussions

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comment

Interactive comment on "The growth of shrubs on high Arctic tundra at Bylot Island: impact on snow physical properties and permafrost thermal regime" *by* Florent Domine et al.

Anonymous Referee #2

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GENERAL COMMENTS

This is an interesting study demonstrating that shrub cover can have a strong effect on snowpack properties, with potentially important impacts on soil temperature regime and permafrost thaw. By focusing on snow-shrub interactions, the study is suitable for Biogeosciences and should appeal to its wide readership. However, to be worthy of publication, these issues should be addressed:

1- The structure needs to be improved, with a sub-section of the Results dedicated to the modelling effort (which is currently presented alongside the discussion). Conversely, there is currently a lot of interpretation incorporated in the results, and many paragraphs could be moved to the discussion.

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Discussion paper

2- Statistical tests should be used to highlight differences in snow properties among vegetation types (see specific comments for suggestions); if not, the authors should respond as to why this is not feasible.

3- The research question(s) should be clearly defined, instead of "This work attemps to contribute to some of these questions" (line 86). In that paragraph, you should define your questions and hypotheses rather than list the measurements you have taken. These research themes could then become subheadings in the next sections (esp. results and discussion), which would greatly enhance the flow and clarity.

4- The presentation of figures should be uniformised (gridlines, text size, plot titles, etc); the clarity of some could be improved (see specific comments)

SPECIFIC COMMENTS

Results 3.1 and Table 1: Have you tested for significant differences? It does not look like it from your methods and no statistics are reported. At line 169, you write "...only that fully covered with willows shows a significantly higher value than the other sites" – which you cannot say unless you have tested for it! You should perform a statistical test that would contrast the effects of vegetation type (polygons, hummocks, shrubs) on snowpack height. Because of the hierarchical nature of your measurements (nested within plots and locations), you could do this with a mixed-effects model, using "plot within location" as nested random effects. Because you have only two years of measurements you should include "year" as a fixed effect, and if you add an interaction with vegetation type it could provide further insight into your discussion of different patterns in different years.

The previous comment applies to Table 2 and comparisons of snow thermal characteristics. Why not perform an ANOVA or a rank-based test (you have even ranked the data already!) to try and highlight differences between vegetation types (Herbs, Willows, Hummocks)?

The paragraph discussing differences in years (starting at line 187) would be more appropriate to the discussion. Same goes for lines 211-227 and 248-255. The results section should focus on comparing values between shrub and herb tundra plots and reporting your model outputs, and then the discussion should be structured as to explain these results based on your understanding of the processes and your additional observations (particularly warm day, recent snowstorm, etc).

In the discussion, you skate over very quickly the potentially opposite effects of shrubs on soil temperature in the summer (line 383). It would be good to see this addressed in more detail so as to nuance your modelling results and general conclusions on permafrost thaw. (I see that the other reviewer has suggested the same thing and suggested references, so I will not expand further here.)

Figure 5. It would be worth adding a horizontal line at the height of 25 cm, which is the threshold you mention for shrub effects on snow properties. Please remove the gridlines from the figures.

TECHNICAL CORRECTIONS

Reference formatting needs to be checked and made consistent throughout; many citations still have brackets when authors' names are used in the active voice (e.g. [. . .] than that measured by (Myers-Smith and Hik,2013), [. . .]). You also need a space after the semi-colon when citing multiple studies.

Latin names of plant species, when referred to for the first time, should be followed by the authority (e.g. Salix richardsonii Hook.)

Line 21: Salix richardsonii should be italicised

Line 38-39: Incorrect sentence: replace with something like "are also known to be, or suspected of being, modified by shrubs"

Line 61-76 should be a single paragraph

Line 93: delete "see map on"

Lines 198 and 201: do not capitalise "Alpine"

Table 2: The caption says "the lowest seven values are in bold and the highest 5 values are in italics" – but this is not the case. Again, I think a statistical test would be more appropriate than a qualitative observation of the table.