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Title: Heavy snow loads in Finnish forests respond regionally asymmetrically to projected climate change
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Referee #2

We are pleased with the positive feedback and constructive comments of this Referee. Our replies to the comments are given in "Italics" after the comments given in the beginning of this document.

General comments
I liked the paper a lot. It was concise and well written. Topic is highly interesting, and it has also practical importance when thinking about forestry and how prepare the forestry sector to probable changes in the winter climate and extreme weather events. The method used is valid and enough attention has been paid to use a set of climate scenarios; especially the bias correction has been done with plenty of thought and effort. In Introduction there was material that belongs to Material and methods. On the other hand, aims of the work have not been given clearly in Introduction. This study is built on earlier FMI work. Most of the earlier works referred are Finnish. It would be interesting to hear about earlier work done on this subject also in other parts of the world, if any. Also the importance of the topic could be broadened by telling about the snow damages internationally. Terms "forest damage" and "snow damage" could be defined, what sort of damages are we talking about. There are also more detailed snow accumulation / unloading models available. Could you add a short explanation of these models in the paper?

We are thankful for these many suggestions which could be used to improve the paper, particularly the Introduction section.

Specific comments

Page 2 You talk about effects of temperature on the processes. How does the moisture affect? Effects of forest management options: tell more about these. There is something wrong with the logic of the sentence on lines 14-16. Effect of soil frost: did you discuss about this in this paper also?

Thank you for these comments. Soil frost was not discussed nor studied in this paper.

Line 24: would be -> will be?

Ok

Line 28: please check the word order in a sentence beginning "We use:::"

We will check it.

Lines 30-31: please tell a bit more about the RCPs.

Ok

Page 3
Line 9: Historical simulations? Explain better.

Historical simulations refer to simulations over historical time period with historical forcing data (emissions/concentrations/land-use change).

Line 30: Delta-change method does not tell anything if reader is not familiar with this term. Explain more.

Thank you for this comment. Surely an explanation should be included. Basically, in the delta-change method the distribution is only shifted so that the mean corresponds to the observed value and optionally also the variability can be corrected similarly.

Lines 10 and 11: so here you could tell a bit more about RCPs.

Yes, and I think this is a better place for that than the introduction section.

Page 4: There is good discussion about humidity effects here, but perhaps it should be in Discussion?

The discussion here is used to justify the selected approach in correcting the simulated relative humidity values.

Line 20: your winter period is from November to March. How well can you compare the results to earlier work, when normally the winter period is from December to February?

We chose to show the projected changes in weather variables over this extended winter period because the snow damages are not restricted to the December-February period. In Finland, the projected warming is most pronounced in midwinter, but in general November and March are projected to warm only slightly less than the traditional winter months (i.e. December, January and February). Anyway, you are right, the projected changes for the December-February period would be mostly just slightly strengthened compared to the November-March period.

Page 5 Line 7: other transformations? Please list.

The possible snow load type transformations are:
- *Change of dry snow into wet snow (due to rain or melting)*
- *Change of frozen snow into wet snow (due to rain or melting)*

- *Change of wet snow into frozen snow (due to freezing)*

Line 13: what do you mean "on average rather well"?

The correlation coefficient was 0.82 for the total snow load over four 30-year periods.

Line 22: reference to this information of riming efficiency? Do you feel that possibility to use e.g. 3h data would improve the results at all? Perhaps in case of wet snow and unloading the processes may be rather fast. And did I understand correctly that daily precipitation was divided evenly during the day? This may also have some effect, because for sure the precipitation intensity (and other conditions during snow fall) affect. Check that you have covered this type of discussions in the paper.

Yes, you have understood correctly. We feel that the possibility to use e.g. 3 hourly data would improve the results a lot but mainly in individual cases. Based on our earlier work, we feel that the broad-scale climatological characteristics over a long time period are fairly similar nevertheless daily or hourly data is used.

Page 6 Do you have any observational data to compare the simulation results with? I understand this work is mostly about scenarios, but reliability of the modelling method should be discussed somehow and relate this to some data. If this kind of discussion is found e.g. in the earlier papers referenced, please make this clear.

We have this kind of discussion in our earlier paper, although the amount of observational data is limited.

Line 26: Sentence beginning "However, the:::" is complicated and should be rephrased.

Thank you for this comment.

Page 7 Paragraph on lines 3-6 belongs to Discussion, together with other uncertainty–discussion?

We disagree with this because inspecting the model-based uncertainty in the projected change is one of the main objectives of this study and the results of that inspection thus clearly belong into a Results section. Unlike other uncertainty sources related to this study, this is the only one that we study quantitatively. However, as you noted in your general comments, the aims of this work should be presented more clearly in the Introduction section.

Line 23: Please check the word order of the sentence beginning "Most uncertain:::".

We will check it.

How does the tree species and other forest characteristics affect? You mention that they affect, but discussion could be expanded.

This discussion can be expanded.

This would also be a good place to discuss about the model you use, and other snow accumulation / unloading models (some sort of comparison in terms of processes and time resolution, for example).

This is a good idea.

Page 8 This page has discussion that is rather long. There is some repetition when comparing to Introduction and parts of the text are rather speculative. So please consider shortening here. Especially part beginning from line 25 is a bit disconnected.

We agree that this part of the discussion can be compressed and shortened.

Page 11 Reference list seems adequate. I did not go through it in detail, so please make sure once more that it is in accordance with the journal instructions.

We will check it once more.

Page 14 Values in Table 2 are given with too much precision.

We can leave out the second decimal.

Technical corrections

Page 2 Line 20: a dot is missing

Thank you for noting this. Well done from the referees as both of them noticed this same error.