
Author replies to the comments by Anonymous Referee #1:

We would like to thank Referee #1 for the time she/he has invested into the review of our manuscript. Her/his comments and suggestions have really helped to improve our manuscript. Thank you very much!

Please note: page and line numbers in the updated manuscript might not be the same as in the previously submitted version due to changes in the text as well as due to utilization of a different latex template. The relevant changes in the manuscript are highlighted in red, all removed text is struck through.

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Referee comment:

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This paper presents a modified version of a previously published one dimensional snow model that accounts for canopy influences on snow processes. Although the paper does not add anything fundamentally new to the discourse on snow modeling since the authors mostly just assembled model bits that have already been published, it does constitute credible incremental research that is worth publication. My primary concern is that it is not clear from the data presented that this model substantially improved simulations over the previous version. Since that is the main point, it would be valuable on figures 10 and 11 to show the model results without the modifications (also the associated statistics in table 2).

Answer by the authors:

We thank Referee #1 very much for this valuable comment. Referee #1 is right, it would really be interesting in this context to show the changes between the previous model version (ESCIMO.spread (v1)) and the newly developed ESCIMO.spread (v2). We have followed the reviewer's suggestion and have added the performance of the previous model version to figure 10 and also to table 2 (figure 11 and table 3 in the updated manuscript). However, as the canopy functionality has been added as a new feature in the new model version, it is not possible to show the performance of the previous version with respect to a simulation of inside canopy snow conditions in figure 11 and table 2 (figure 12 and table 3 in the updated manuscript). A discussion of differences in the model results of both versions has been added to the results section (last paragraph of page 19 – first paragraph of page 20) in the updated version of the manuscript.

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Referee comment:

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Eq 13. Does this represent the average wind speed in the canopy? Is it only valid for the part of the canopy above the "canopy reference level" (which I assume is the same as the zero plain displacement height?). Is the wind speed zero below the canopy reference level? Presumably this is equation is only valid away from the canopy edge?

Answer by the authors:

Referee #1 is right, u_c in ESCIMO.spread (v2) represents the average wind speed inside the forest canopy in the respective time interval of 3600s. However, the "canopy reference level" in the equation does not equal the "zero displacement height", but any height in the canopy which the wind speed is calculated for using the exponential function of Cionco (1978). In ESCIMO.spread (v2) this reference level is assumed to be $0.6 * \text{plant height}$, meaning that we take a calculated wind speed for this level as a representative value for inside canopy conditions. Calculating wind speed for a height below this reference level results in lower values of wind speed, however not necessarily zero. We do not see any indication for this equation being only valid away from the canopy edge.

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Referee comment:

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All the time series figures: Please consider making the y-axis scales better match the maximum values being shown; Figures 6, 8, and 9 have ranges about twice as large as needed – Figure 11 is ok because it matches the companion figure, Figure 10. Also, it would be nice to see plots of predicted vs. observed to better see the range of scatter and whether there are any systematic biases, which I think are really important in evaluating a model.

Answer by the authors:

We thank the reviewer for pointing this out. We followed the referee's suggestion and have adjusted the y-axis in all plots to better match the minimum and maximum values of the data. For figure 10 and 11 (now figure 11 and 12) we also followed the referee's comment to keep the y-axis similarly scaled to allow better comparison. However, due to the inclusion of the model results achieved with ESCIMO.spread (v1) (as requested by Referee #1, see first comment) we had to rescale the y-axis here as well. We also found the suggestion to include scatter plots very beneficial and have included scatter plots that show the simulations vs the observations for the most important model results (see figure 10 and 13 in the updated manuscript). Thanks again, this was a very fruitful comment.

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Referee comment:

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While the three evaluation metrics used are ok, I typically like to see something like root mean square error or relative difference, which I think are more meaningful and are easier to interpret than indices that do not really tell me how good predictions are in general; the index of agreement might do this and I am just not as familiar with that statistic.

Answer by the authors:

This is a very good point, we have followed Referee #1's suggestion to include the root mean square error into the performance tables (see table 1-3) and also into the model itself. We have also updated the abstract, the conclusions and the results section with respect to a discussion of root

mean square errors. Thanks again, including this efficiency criterion has really improved the manuscript!