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Interactive comment on "Application of machine learning techniques for regional bias correction of SWE estimates in Ontario, Canada" *by* Fraser King et al.

Anonymous Referee #2

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This very interesting paper of King, et al. compares different methods for reducing the bias between in situ measurements of SWE and the gridded SNODAS estimates for the region of Ontario. The correction methods include simple mean bias subtraction, linear regression and machine learning methods. The paper is very well written and it is worth to be published after some minor changes. Some comments and recommendations:

First of all and most important the applied machine learning methods are not described at all and references are missing. I don't think that all readers of this journal are familiar with Decision Trees (DT) and Random Forest (RF) methods. Therefore a short description should be included, especially explaining the RF model in more detail, which shows

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Discussion paper

the best results, and what's the difference to the DT models. Related to that comment, it doesn't make too much sense to mention on page 5 (line 30) that you run the model with a forest size of 100 trees and tree depth of 15, when you don't explain what that parameter mean.

Additionally, there are some points which are not clear to me and which should be clarified before publishing the paper: You didn't explain how you handled the scaling issue when you compare point data and gridded data (up- or downscaling?). Since you could identify a change in the bias between the first and the second half of the period, it would be reasonable to split the analysis into these two periods and fit different models and take 2 different means separately for each period.

On page 3 you specify the 383 locations with in situ measurements. In line 14-15 you write that an average SWE is estimated taken from 10 fixed sampling stations. What does this mean? Is this the average SWE for Ontario estimated from 10 stations, or is this the average for each of the 383 stations taken from the 10 surrounding stations?? Page 5: You should mention that the period of 1981-2010 is used for calculating the climatology, which is not clear. Also, you should explain why you have used the difference between the precipitation estimates from NRCAN and the SNODAS! It would be interesting to see the results if you would include actual meteorological observations as predictors (for example available at: https://data.noaa.gov/dataset/dataset/global-surface-summary-of-the-day-gsod, provided by the National Centers for Environment Information). I could imagine that in that case the importance of these variables would not be neglectable and could further improve the bias correction.

Page 7: When you write in 3.2.1 about mean bias, I suppose that this mean bias is calculated as the average of the mean bias of all stations? Similar to that I'm a bit confused about what you write on page 8 regarding SLR. I was assuming that you fit a regression model for each station individually. But that seems to be not the case, otherwise I could not understand why there should be a bias overcorrection. It would be nice if you could clarify this, whether you fitted separate models for each station

or not. Although you wrote in the beginning that you took 75% for training, you didn't mention if all the calculated verification measures refer to the remaining 25% testing period.

In the legend of Figure 2 you write Lower and Upper. Shouldn't it be southern and northern?

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