The Cryosphere
Open Access
Discussions

EGU

Interactive comment on "Multi-scale spatialization of snow water equivalent (SWE) according to their spatial structures in eastern Canada" *by* Noumonvi Yawu Sena et al.

Anonymous Referee #2

Received and published: 26 February 2021

There are two major issues that are not technical issues, but presentation. First, the submission is clearly not written by a native English speaker and not edited. The second and third sentences of the abstract are identical and this type of repetition occurs throughout the manuscript (see page 5). Terms including spatialize, physiographic regional factors, ubacs, etc. are not English terms and not defined. The writing is extremely rough making the work almost impossible to understand. An example is the presentation of the study goal "this study proposes to spatialize the SWE according to the structures of spatial variability of SWE. The main objective of this study is to develop a multi-scale spatialization approach by taking into account the structures delineated in the spatial variability analysis of the SWE at both scales (local and regional) by Sena et

al. (2015). Second the manuscript depends heavily on an earlier manuscript (Sena et al. 2015). Sena et al. (2015) is written in French and thus is not readily accessible for reference the target audience. Adequate information is required for this manuscript to be an independent submission. For example, there is no map of the validation stations and the physiographic regional factors are never defined (instead generic variables are used).

It was difficult to perform a proper technical review due to the writing challenges and limited information provided in this manuscript. The following technical issues were identified.

1. SWE and snow covered area are used interchangeably and it is not clear which is which. 2. The snow validation data set should be rewritten. Lead with a mapped set of stations that were used (move the second paragraph to the first). What was the time period? Then describe the sampling methods and the differences across the various networks. 3. It is not clear what the 10x10 km scale and 300 x 300 m scales mean. In part of the manuscript, it appears that there might have been an interpolation from the station data to a grid. 4. Section 2.3 needs to be written. The figure is not a standalone figure and the variables need to be defined. 5. What are the physiographic metavariables ($\partial \text{İ} \text{Ś} \text{Ĺ} 1, \partial \text{İ} \text{Ś} \text{Ĺ} 2, \partial \text{İ} \text{Ś} \text{Ĺ} 3, \partial \text{İ} \text{Ś} \text{Ĺ} 4$) and how were they calculated? 6. It is not clear that a step-wise linear regression is appropriate. Sena et al. (2015) used non-parametric methods. It does not appear that data were held back for validation purposes. 7. Section 3.1.2 is not a validation of the results, but a summary of the variogram metrics. This summaries would be best provided in a Table. 8. In section 3.1.3, the stepwise linear regression does not provide information about the explanatory variables and the difference in model performance for equations (5) to (9) is not reported. 9. Section 3.14 figures could be condensed by putting figures b and c together. Again, create a table of results rather than writing out in tabular form. Figure 8a, b, and c are identical and appear to be the same as Figure 7. 10. Section 3.2 leads with "At the regional scale (10 km x 10 km), the SWE spatialization was performed in each of the delimited

structure." It is not clear what analysis was conducted. The entirety of section 3.2 both at the local and regional scale seem to describe how much SWE there is where without any support. There is a tremendous amount of granularity that does not seem to be supported in many of the regions. In region A there are either 8 or 18 stations (both numbers were given) and region C has three stations. 11. The conclusions clearly indicate that there are physical factors that drive these variations but they are never described in the body of the text. In the conclusion, it is suggested that the authors have insights to what those physical features are "At the local scale (300 m x 300 m), these zones were segmented into small homogeneous SWE structures corresponding to the roles of slope morphology, vegetation height, slope, solar radiation and distance to lakes in accumulating and retaining snow on the ground." This is extremely valuable and important as compared to the average annual maximum values. 12. The conclusions introduce new information. The finding that "The adapted methodology and the results of this work offer several perspectives that can contribute to the study of the spatial variability of snow in a context of climate change." is not correct because there is no metric that would change due to a changing climate.

13. Table 1 does not match the statistics that are reported. 14. Units are missing in the nugget and variance; axes on various figures (Figure 3) are not labeled. Scatterplots should have the same size on the x and y-axis. Figure 3 has 3 subfigures but only (a) and (b) are labeled.

Overall, the methods could not be fully evaluated due to the deficiencies with the discussion. The findings appear to show spatial variability that is not warranted by the analysis. There is not compelling evidence that the kriging improves the models. The concept of variations that are driven at two different scales is reasonable and worthy of exploring, but the resulting models needed to be validated and the physical drivers of those models need to be identified at both scales and differentiated between scale.