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# *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.

**Noumonvi Yawu Sena et al.**

g.sena@cerfo.qc.ca

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Dear reviewer, I would like to thank you for the good reviews you made for this article. I have answered each of your questions and contributed relevant and essential answers for the understanding of the article. Question 1. In Sena et al (in review) the authors introduce a spatially explicit estimate of snow water equivalent across northeastern Québec and Labrador. This reconstruction may be useful but I do have some questions about the data used to construct the model applied in this study. I would also like to call attention to there being significant overlap in some sections with an earlier manuscript (Sena et al [2019]) which includes whole sections of the snow data description being



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nearly wordfor-word replicated from the earlier paper. This issue is quite glaring and surprising to see in a manuscript under consideration. Answer1 The paragraph entitled "Snow data describing the snow water equivalent data" has been corrected (page 5 and 6, line 23-25) Question 2 In situ data is not summarized or shown on a map so it is difficult to surmise which regions are represented well. Likewise, it is difficult to know whether elevation bands, ecotypes and climate regions (coastal vs continental) are sampled appropriately by the data. The authors in Sena et al (2019) do present a map and it reveals huge swaths of land, particularly in eastern Labrador which have no SWE measurements included. This includes the Torngat Mountains where the authors are extrapolating from sea level to 1600+ m a.s.l. with no SWE observations within hundreds of kilometres of these sites. This is highly problematic to include these regions in the study in the absence of validation. Answer2 The in-situ data sites used in this study were added to Figure 1. In eastern Labrador, where the number of sites for measuring snow water equivalent is low (3 stations in total), the methodology adopted based on variographic analysis cannot be applied neither at the regional scale (10 km x 10 km) nor at the local scale (300 m x 300m) (see Figure 2). In the first part, at the regional scale, a multi-polynomial regression is developed as a function of the metavariables (U1,U2 ,U3 ,U4) and the mean annual maximum of the SWE of the all stations over the entire study area to estimate the snow water equivalent (for more details on the physiographic metavariables (for more informations, consulted Sena et al, 2015). At the local scale (300 m x 300 m), the resampling method was applied to the estimate obtained at the regional scale (10 km x 10 km). Question 3 The authors do not present their prediction errors which undoubtedly will be tremendously large in the areas that lack contemporary snow information. I find it difficult to see how this product is an improvement over reanalysis in many of the areas lacking snow survey information. Answer3. In paragraph 2.3.2 Local scale (page 8 line 13 -15 ), the statistical evaluation indices used, such as (determination coefficient (R2), BIAIS, relative mean squared error (RMSE), and Nash-Sutcliffe efficiency) are presented in Table 1, and thus the prediction errors of all models, all delineated zones explained at the regional and local





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scales are presented in each figure. The same applies to the prediction error of the general model at the regional scale (Fig. 3) and at the local scale (Fig. 9). Question 4 Significant inter annual variability in snow cover occurred over the past 20 years so the authors need to test the assumption that this is not introducing extra error into the predictions when they are grouping together data with different periods. There are some stations on the map from Sena et al (2019) that have not been active for decades. Answer4 As mentioned in Section 2.2, of all historical data from snow stations in the study area, only those stations with an observation period of ten years or more are included in the study. For this study, we have assumed that the snow phenomenon is stationary during the observation period of ten years or more. Taking into account the interannual variability would be another challenge, which can be the subject of a later study taking into account this interannual variability of observation. This choice is not retained in this work. Question 5 I am not presently sure I understand how the authors are determining SWE from weather stations that are only currently recording snow depth? As a final note. The authors seemingly mention a lot of place names in Québec while largely avoiding the same for Labrador. I found the place names were a bit overwhelming overall, especially in the absence of a reference map. As such, consistency would be desired. Answer5 As mentioned in the snow data paragraph 2.2 , the study focuses on the water equivalent of snow, which is a physical parameter of snow cover. For this purpose, only the snow surveys of the study area were taken into account. It is important to remember that the snow survey stations measure only the physical parameters of the snow cover, which are: snow depth, snow density and snow equivalent on the ground. Reference names have been added

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