

Interactive comment on “Evaluation of long term Northern Hemisphere snow water equivalent products” by Colleen Mortimer et al.

Anonymous Referee #3

Received and published: 20 January 2020

General comments

The authors conducted a thorough analysis of various publicly-available SWE products. Continental SWE datasets based on reanalysis products, land surface modeling, and passive microwave satellite data are evaluated against (in-situ transect) snow course measurements. The standalone passive microwave-based datasets seem to perform poorly relative to the snow course measurements and the other SWE products. Although no ‘best’ dataset is identified, the product ensembles that contained Crocus or MERRA performed better.

The authors have provided a sufficiently explanatory literature review for readers who may be unfamiliar with SWE estimation techniques. This effort will benefit researchers who utilize SWE products as ancillary information in their models and help them un-

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derstand the uncertainty associated with these products.

The paper is well-written and requires only minor modifications.

Specific comments

- a) It would be helpful to add a figure showing the geolocation of the snow course data in Section 2.1. It will add topological context to the analysis.
- b) Please add quantitative and/or qualitative information regarding the uncertainty or tentative precision of the snow course measurements used for evaluation in Section 2.1. A quantitative measure of uncertainty for each of the three datasets would be sufficiently descriptive.
- c) Increasing the size of individual stereographic maps will improve the visual clarity of the figures.
- d) Please highlight in the conclusion (Line 341) that this analysis is for continental performance evaluation and may/may not apply to small regional or local domains.

Technical corrections

Abstract – A ‘0.1’ increase in correlation does not seem very significant. Please provide justification of the significance of this increase in correlation using additional analysis (such as hypothesis testing). This analysis can be included as a separate paragraph in Section 3.3. If no justification exists, then it would be advisable to remove the sentence from the abstract.

Line 32 – Please define which seasonal forecasts the authors are eluding to. Being specific will make the discussion more accessible to the reader.

Line 38 – Please define the difference between ‘snow depth’ and ‘surface snowfall’ measurements.

Line 40 – It isn’t clear what ‘coarse’ grid cells means. Can you quantify what you mean

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by 'coarse'?

Line 83 – Replace evaluation with evaluate.

Line 110 – Rephrase the sentence to highlight the difference between using separate brightness channels versus spectral difference for SWE estimation.

Line 162 – Please add an appropriate reference for the EASE2 grid.

Line 220 – Please elaborate briefly on what the 'acceptable' uncertainty is for SWE. Please be specific in terms of quantitative (rather than qualitative) values of SWE uncertainty.

Line 225 – GlobSnow also underestimates SWE above values $> \sim 130\text{mm}$. This statement needs to be included here.

Line 239 – Figure 3g shows $> 70\text{mm}$ rather than $> 60\text{mm}$ as the pivot point.

Line 266 – contain is written twice.

Figure – 1: Extra 'E' in AMSR-E in caption.

Figure – 3: a) Please define how Figure 3 was developed in the main text. Is the binning based on average SWE values for each grid cell or the average of bi-weekly values for all snow courses? b) The term 'retrieval' is used in the caption. This term does not apply to all the different SWE datasets being evaluated. Please change the sentence from 'retrieval performance versus reference SWE' to 'Performance of SWE datasets versus reference SWE measurements' c) The figure labels for subplots f and g do not match the caption labels.

Figure – 4: In the text, a bi-weekly time step is specified while the caption describes a ten day time step. Please clarify this contradiction.

Figure – 6: The figure title can be removed since the caption and labels are self-explanatory.

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Data availability There seems to be a typing error in the data availability description. The NASA AMSR-E operational dataset is mentioned twice.

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2019-258>, 2019.

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