Preliminary validation analysis of the GlobSnow2 database over Eastern Canada

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ABSTRACT

The European Space Agency (ESA) Data User Element (DUE) funded GlobSnow-2 project released a Version 2.0 dataset for the Northern Hemisphere in 2013. Intended for climate research purposes, this dataset provides information on two essential snow parameters: snow water equivalent (SWE) and areal snow extent (SE). Here, we present an analysis of the SWE data product for a 30-year period (1980-2009).

Keywords: Snow, passive microwaves, validation, Eastern Canada

INTRODUCTION

The GlobSnow2 (Takala *et al.*, 2011) SWE estimates are retrieved from the time series of measurements by a suite of different space-borne passive microwave sensors (SMMR-Nimbus7, SSM/I-DMSP-F8,11,13 and SSMIS-DMSP-F17). SWE values are estimated by combining inversions using a simplified radiative transfer model (HUT), constrained with a background field of kriged weather station snow depth measurements. We compare the GlobSnow2 SWE data (SWE_{GS}) against systematic ground-based measurements of SWE (SWE_{gb}) acquired 3 to 7 times per winter by Hydro-Québec, Environment Canada, the Ministère de l'Environnement du Québec, and intensive observations acquired during specific short period field campaigns (a north-south transect across Quebec conducted for International Polar Year in 2008, and measurements near James Bay acquired between 2003-2009).

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METHODS

Both datasets (SWE_{GS} and SWE_{gb}) are matched in space (EASE-Grid, spatial resolution of 25 x 25 km) and time (daily) scale, avoiding coastal areas and large lakes to avoid mixed pixel effects. If several ground-based measurements fall within the same GlobSnow pixel the same day, they are averaged. Over the Eastern Canada area (under 58°N), this unique database includes 33 793 matched measurements throughout the study period (Figure 1). However, this analysis focused on data below 150 mm of measured SWE since GlobSnow applied a threshold of 150 mm SWE in the processing of their data, and even if SWE measurements below 150 mm account for 55% of our samples.

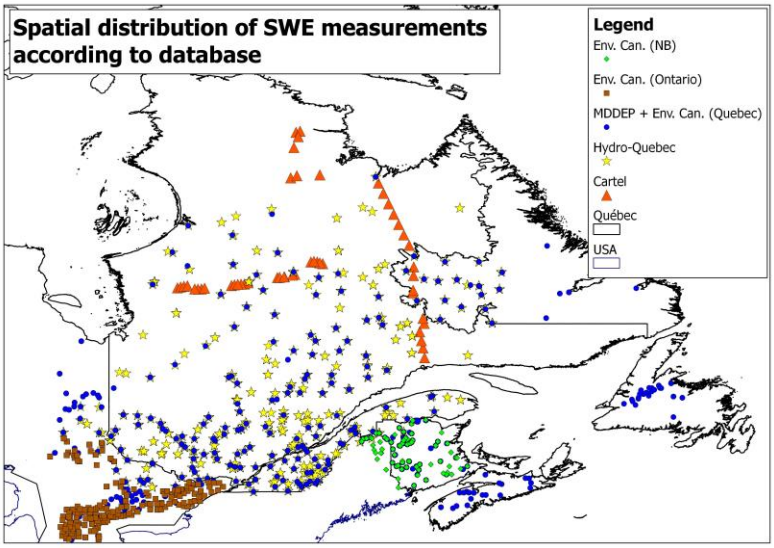

Figure 1. Map of the spatial distribution of SWE measurements used for the validation.

PRELIMINARY RESULTS

Results show a systematic underestimation of SWE_{GS} compared to SWE_{gb}: mean root mean square difference (i.e. unbiased root mean square error) of 50.9 mm (58%) and a bias (SWE_{gb} – SWE_{GS}) of 23.6 mm. This difference between SWE_{GS} and SWE_{gb} varies according to two main factors:

- the bias increases during the end of the winter period (likely due to the problem of wet snow in the satellite microwave measurements);

- and the difference is sensitive to the land cover over the analyzed latitudinal transect from the arctic tundra to boreal forested area (where the error is the highest) and to southern open areas;

This analysis shows that the GlobSnow2 SWE database does not reach the accuracy required for hydrologic simulation purposes in this forested studied area, neither to a mean global trend analysis over the period analyzed. We show that the observed trend in the measured maximum winter SWE can differ from the trend derived from the GlobSnow2 database.

REFERENCES

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