Development of a Gridded North American Snow Depth and Water Equivalent Dataset for GCM Validation— Results with an Enhanced Snowpack Model

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EXTENDED ABSTRACT

At the 2001 ESC meeting in Ottawa, preliminary results were presented of a high resolution (1/3 degree) gridded snow depth data set for North Amerca based on the operational snow depth analysis scheme employed at the Canadian Meteorological Centre (CMC) (Brown *et al*., 2001). The analysis was based on an extensive network of daily snow depth observations (~8000 stations) that covered much of the contiguous United States and southern Canada. The analysis was run over the 1979–1996 AMIP II period to provide information for evaluating GCM snow cover simulations. The analysis was determined to provide a substantially improved monthly snow depth climatology for North America, but Brown *et al*. (2001) concluded that an improved snow aging scheme was required to provide realistic estimates of gridded snow water equivalent.

A poster presented at the 2002 ESC meeting showed results from a second run of the historical snow depth analysis over North America using a more detailed snowpack model that took into account mixed precipitation, rain-melt, warm and cold snow aging, and mass loss from sublimation and blowing snow. The model was optimized for the various snow-climate classes defined by Sturm *et al*. (1995), and the snow-climate classes used as input to the historical analysis. Evaluation of the historical analysis with independent *in situ* and satellite data revealed that the gridded dataset was able to successfully capture the important features of the North American snow cover climate such as continental-scale variation in snow cover extent (SCE) and snow water equivalent (SWE) (see example in Figure 1). The snow depth climatology revealed a number of improvements over the Foster and Davy (1988) product, namely an improved representation of the snow line in June and October, and a more realistic spatial distribution of snow accumulation over the western cordillera.

The dataset successfully captured interannual variability in SCE and SWE during the November to April period, but was less successful in the May–October period when the snowline was located over northern data-sparse regions. Overly rapid melt of snow in the spring contributed to this problem at high latitudes. The gridded snow depth and SWE dataset represents an important new source of information for the evaluation of climate and hydrological models, satellite algorithm development, and climatological applications. For example, the CMC SWE dataset is currently being used to investigate discrepancies in SWE retrievals between SMMR and SSM/I over the Canadian prairies (Derksen *et al*., 2002). The monthly snow depth and estimated SWE

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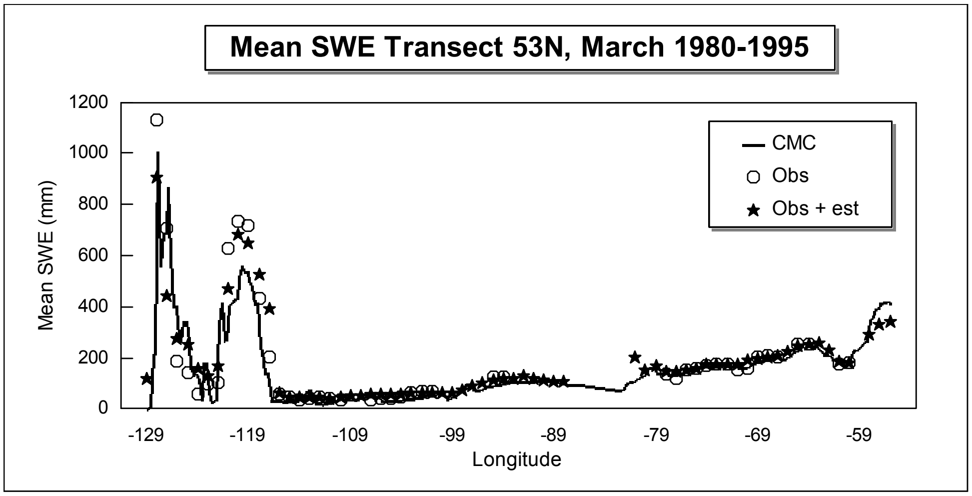
climatologies are available for downloading from the Canadian Cryospheric Information Network (http://www.ccin.ca). Further details of this work are provided in Brown *et al*., (2002).

Keywords: snow depth, snow water equivalent, North America



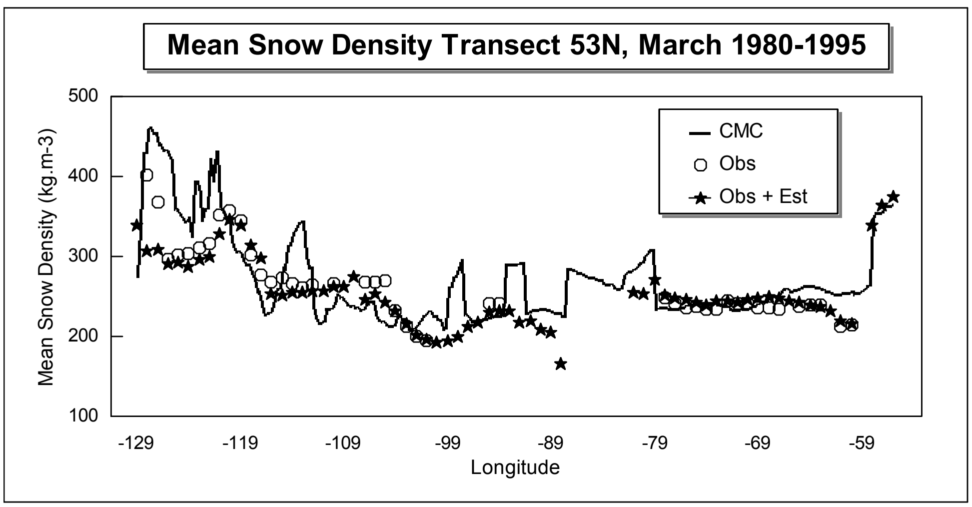


Figure 1: Comparison of observed and estimated mean monthly SWE and snow density along latitude 53ºN for the month of March. The solid line is the CMC analysis; the open circles are SWE values from snow course observations; and the stars are SWE observations including SWE estimates from Braaten (1997).

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