Development of a Gridded North American Monthly Snow Depth and Snow Water Equivalent Dataset for GCM Validation

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Validation of GCM snow cover has been hampered by a lack of reliable gridded estimates of snow water equivalent at continental scales. To address this gap, a snow depth analysis scheme developed by Brasnett (1999) and employed operationally at the Canadian Meteorological Center (CMC), was applied to generate a 0.3 degree lat./long. grid of monthly mean snow depth and water equivalent for North America for validating GCM snow cover simulations for the AMIP II (Atmospheric Model Intercomparison Project) period (1979-1996). Approximately 8000 snow depth observations/day were obtained from US cooperative stations and Canadian climate stations for input to the analysis (Fig. 1). The first-guess field used a simple snow accumulation, aging and melt model driven by 6-hourly values of air temperature and precipitation from the European Centre for Medium-range Weather Forecasting (ECMWF) ERA-15 Reanalysis with extensions from the TOGA operational data archive. A discussion of the methodology is presented in Brown *et al*. (2001).

Extensive validation 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 SWE (Fig. 2). 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 over the western cordillera (Fig. 3). The dataset successfully captured interannual variability in snow cover extent and SWE during the November to April period, but was less successful in the May-October period when the snowline was located over data sparse regions of NA. Overly rapid melt of snow in the spring contributed to this problem at high latitudes. The validation results will be published in Brown *et al*. (2002).

References:

Brasnett, B., 1999: A global analysis of snow depth for numerical weather prediction. *J. Appl. Meteorol*., **38**, 726-740.

Brown, R.D., B. Brasnett and D. Robinson, 2001: Development of a gridded North American daily snow depth and snow water equivalent dataset for GCM validation. Proceedings, 58th Eastern Snow Conference, Ottawa, Ontario, May 14-17, 2001, 333-340.

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Foster, D.J.Jr., and R.D. Davy, 1988: Global snow depth climatology. USAF Environmental Technical Applications Center, USAFETAC/TN-88/006, 48 pp.

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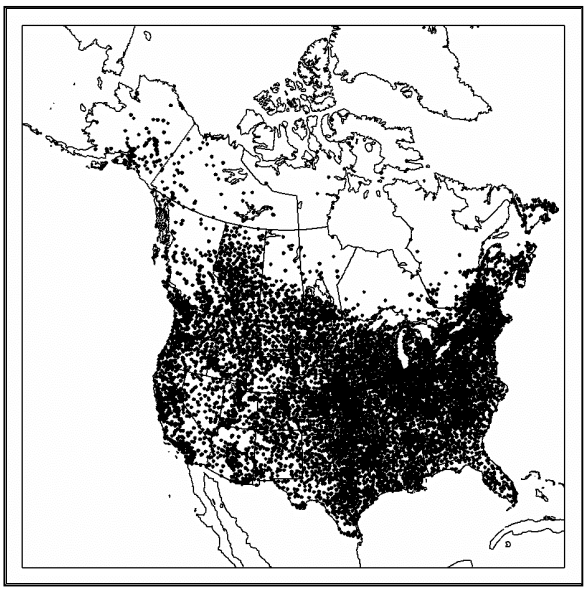

Figure 1: The daily snow depth network available for the analysis.

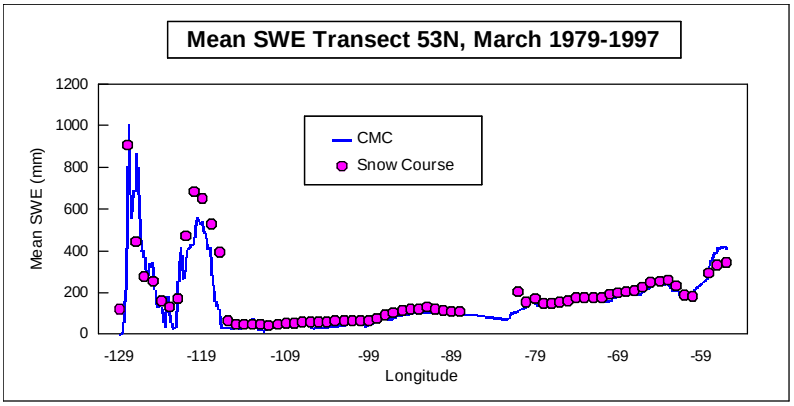

Figure 2: Comparison of mean March SWE from the CMC analysis with snow course observations along an east-west transect at 53 degrees N.

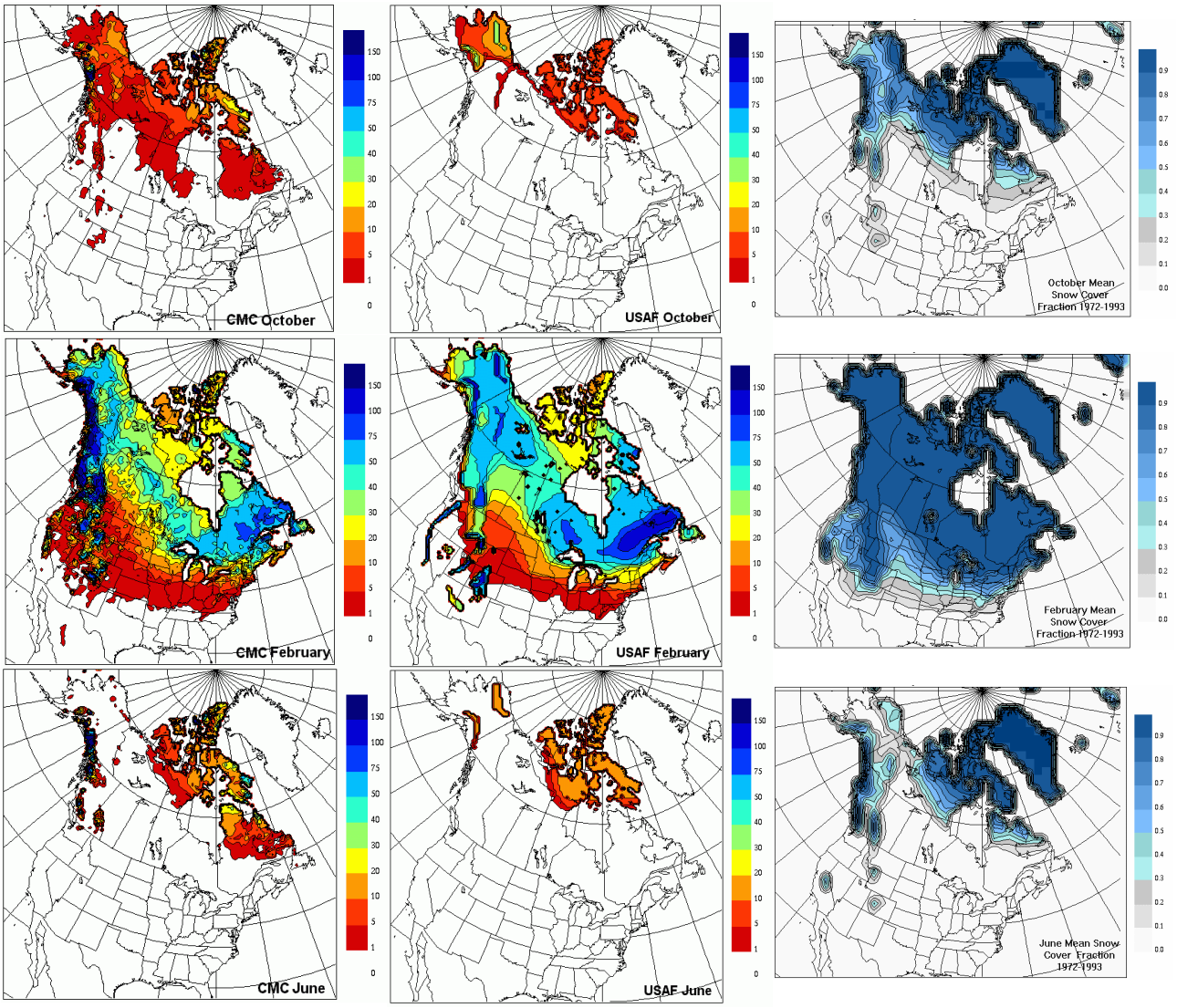

Figure 3: Comparison of mean snow depths (cm) for the CMC (1979-1996) and Foster and Davy (1988) snow depth climatologies for October, February and June. Mean snow cover percent for the 1972-1993 period from the NOAA weekly dataset is shown on the right.