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Title: Initialization of snow in the Canadian Seasonal to Interannual Prediction System

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Abstract:

The seasonal snow cover has a significant impact on climate, the water cycle, and the biogeochemical cycle. A key variable to describe the seasonal snow cover is the snow water equivalent (SWE), which represents the water mass per unit area of the snowpack. We investigate the representation of snow, and in particular SWE, in the Canadian Seasonal to Interannual Prediction System (CanSIPS) data-constrained assimilation runs that have been providing initial conditions for Environment Canada's coupled model-based operational seasonal forecast since December 2011. CanSIPS is a two-model forecasting system that combines ensemble forecasts from the Canadian Centre for Climate Modeling and Analysis coupled climate models CanCM3 and CanCM4. These two models share a common ocean, land surface and sea ice components but differ in their atmospheric component. SWE, like other land surface variables, is initialized from the response of the land model to meteorological conditions in the data-constrained atmospheric model that takes place while the coupled model is running. Each ensemble member (10 for each model) is initialized by a separate assimilation run which give rise to an ensemble spread in the SWE initial conditions. We compare the forecast SWE initial conditions obtained through this procedure with ground-based data sources and global reconstructions. The ability of these initialized values to capture the observed geographical distribution, seasonal cycle, and interannual variability as well as the factors governing the evolution of SWE and its ensemble spread in terms of the mass and thermal budgets for snow are assessed.

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