Daily Continental Scale Snow Water Equivalent Data for North America

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ABSTRACT

Existing continental scale snow water equivalent (SWE) datasets are inadequate to meet many of the societal and scientific needs, such as understanding the impact of warming climate on cold region water cycle. Here, we present the preliminary result of our efforts to model the continental scale daily SWE over North America using a methodology called Blender. Blender is similar in theory to SWE reconstruction and is formulated as a mass-and-energy constrained optimization problem. The general methodology merges remote sensing observation of snow cover fraction with model outputs from land simulation models. Blender utilizes the MODIS cloud gap filled snow covered area (MODIS-CGF) to constrain the optimal estimate of snowfall, SWE, air-temperature, and ground-heat flux generated by Noah-MP simulations. The compute routine is implemented in Julia using Julia for Mathematical Optimization and interior point line-search algorithms. In the current setup we use results from Snow Ensemble Uncertainty Project (SEUP) which used the NASA Land Interface Systems Framework (LISF) running Noah-MP model simulations forced by Modern Era Retrospective Analysis for Research and Applications (MERRA-2) data at a nominal spatial resolution of 0.05 degrees (~5 km). The 0.5 km resolution MODIS-CGF snow cover dataset is resampled to 0.05 degrees SEUP resolution for the final Blender run to generate a daily SWE map of North America. Our future goal is to generate a higher resolution (~1 km) daily SWE map of North America for a 20-year period, spanning water years 2002 and 2021.

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