

## Assimilation of the MODIS Snow Cover Fraction Data Set through the Coupled Data Assimilation Research Testbed and the Community Land Model

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The Data Assimilation Research Testbed (DART) is being extended to support the Community Land Model (CLM 4.0), which is the first effort linking DART and a land surface model. The coupled DART and CLM4.0 provides several ensemble-based data assimilation methods to assimilate observations of land-based quantities such as snow cover, soil moisture, and soil temperature. A freely available ensemble of reanalysis data created by DART and the Community Atmospheric Model (CAM4.0) is used as the meteorological forcing for each CLM ensemble member. This induces spread in the CLM ensemble during a spin-up phase and helps maintain spread during the assimilation. The advantages and disadvantages of using this methodology will be discussed.

As the first application of the coupled DART and CLM framework, this work is focused on assimilating the Moderate Resolution Imaging Spectroradiometer (MODIS) snow cover fraction data. The 0.05° MOD10C1 data were preprocessed by binning up to 0.94°×1.25° to match the model grid. Results show that the coupled DART and CLM tends to adjust the snow water equivalent (SWE) fields where the largest snow variability exists. The assimilation within this framework is properly reducing the Root Mean Square Error of SWE at each assimilation step. The effectiveness of the assimilation is further assessed by evaluating the 24-hour forecasts against the observations before they are assimilated. Further explorations are made to choose the best localization value for CLM4 snow data assimilation through perfect model experiments. A series of different error variance values for MODIS observation data sets are applied to test the sensitivity of the data assimilation system to observation error variance.

**Keywords:** Snow Cover Fraction, Snow Water Equivalent, Data Assimilation, Ensemble Kalman Filter