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Towards the implementation of L-band Soil Moisture Brightness Temperatures in the Canadian Land Data Assimilation System (CaLDAS)

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The Canadian Land Data Assimilation System (CaLDAS) currently runs in Environment Canada (EC) operations and provides the initial conditions for soil moisture and soil temperature to the High-Resolution Regional Deterministic Prediction System (HRDPS). Errors in screen-level temperature and dew-point temperature are used to analyze soil moisture and soil temperature. The observational gap in soil moisture is being alleviated by significant advances in remote sensing technologies specifically dedicated to the measurement of soil moisture. The Soil Moisture and Ocean Salinity (SMOS) satellite was launched by the European Space Agency (ESA) in November 2009 and has been providing global coverage of near-surface soil moisture every 3 days. In January 2015, the Soil Moisture Active Passive (SMAP) satellite was launched by NASA, and similar to SMOS, is equipped with a passive radiometer measuring the soil emission in the highly sensitive L-band frequency.
The land-surface modeling component within CaLDAS has been coupled to the CMEM (Community Microwave Emission Modeling Platform) microwave radiative transfer model to allow for the assimilation of L-band brightness temperatures (TB). This study reports upon a series of pre-operational experiments exploring how best to combine the traditional screen-level variables with the more direct measurements of soil moisture provided by SMOS and SMAP for a better analysis of the soil moisture state. The study period will be the warm season periods for 2014 and 2015 over North America. Analyzed soil moistures will be compared against in-situ monitoring networks, but the principal focus will be upon the impacts in numerical weather prediction (NWP) mode.
EC's Regional Deterministic Prediction System (RDPS), with 10 km grid spacing, is the principal NWP guidance used by Meteorological Service of Canada forecasters in the 1-2 day range. CaLDAS will be run assimilating different configurations of screen-level data and SMOS/SMAP TBs to generate a series of analyzed soil moistures. Short-range (48-h) forecasts from the RDPS will be conducted using these soil moistures as initial conditions and the impacts upon near-surface temperature, dew-point temperature and precipitation will be quantified. The goal is to finalize an optimal configuration for operational implementation in 2017.