

Predictions of the brightness temperature using the coupled land surface-radiative transfer models

Kwon, Y.¹, Toure, A. M.^{2,3}, Yang, Z.-L.¹, Rodell, M.²

yhkwon@utexas.edu

1. Jackson School of Geosciences, The University of Texas at Austin, Austin, TX

2. Hydrological Sciences laboratory, Code 617, NASA GSFC, Greenbelt, MD

3. Universities Space Research Association (USRA), Columbia, MD

Snow cover modulates energy and water fluxes at the surface due to its thermal and hydrologic characteristics (e.g., high albedo, low thermal conductivity and water holding capacity). Furthermore, given the fact that the snowpack is one of the most important freshwater reservoirs, understanding its spatial and temporal variations is crucial for hydrologic and climate studies. It has been demonstrated that radiance assimilation (RA), which assimilates passive microwave (PM) brightness temperature (T_b) observations directly into the land surface model (LSM), can be used to improve snow water equivalent (SWE) estimates compared to the assimilation of T_b -based SWE retrievals. In a RA, a radiative transfer model (RTM) is used as an observational operator to predict T_b observations. This study is a preliminary study that aims to assess the performance of the coupled LSM/RTM. In this study, the Community Land Model version 4 (CLM4), a state of the art, distributed, physically based LSM, was coupled with two different RTMs, the Microwave Emission Model for Layered Snowpacks (MEMLS) and the Dense Media Radiative Transfer - Multi Layers model (DMRT-ML), to predict T_b of the snowpack. The effects of the atmosphere and vegetation on T_b at the top of the atmosphere were considered. The coupled models were evaluated for non-vegetated and vegetated areas using the data from the Ground-Based Passive Microwave Radiometer (GBMR-7) and Polarimetric Scanning Radiometer (PSR). T_b was also modeled at the continental scale and validated against the Advanced Microwave Scanning Radiometer-Earth Observing System (AMSR-E) T_b observations.

Keywords: Snow cover, Radiance assimilation, Passive microwave brightness temperature, Land surface model, Radiative transfer model