

## **A soil moisture data assimilation system for SMOS and SMAP**

Rolf Reichle<sup>a</sup>, Gabrielle De Lannoy<sup>a,b</sup>, Clara Draper<sup>a,b</sup>, and Qing Liu<sup>a,c</sup>

<sup>a</sup>*NASA Goddard Space Flight Center, Global Modeling and Assimilation Office, Greenbelt, MD, USA,  
Rolf.Reichle@nasa.gov.*

<sup>b</sup>*GESTAR, Universities Space Research Association, Columbia, MD, USA.*

<sup>c</sup>*Science Systems and Applications, Inc., Lanham, MD, USA.*

The Soil Moisture Ocean Salinity (SMOS) mission launched in 2009 and the Soil Moisture Active Passive (SMAP) mission scheduled for launch in 2014 are specifically designed to provide global estimates of near-surface soil moisture (in the top 5 cm of the soil column).

In this paper, we use observations of L-band (1.4 GHz) microwave brightness temperature from SMOS in a land-only data assimilation system to generate a prototype of the Level 4 Surface and Root Zone Soil Moisture (L4\_SM) product under development for SMAP.

The assimilation system consists of an ensemble Kalman filter (EnKF) and the NASA Catchment land surface model. The Catchment model is driven with surface meteorological forcing data from the NASA GEOS-5 atmospheric analysis system, with precipitation corrected towards gauge-based observations. The system provides global surface and root zone soil moisture estimates at a horizontal resolution of 9 km every three hours.

We assess the performance of the assimilation system by validating the SMOS-based soil moisture assimilation results against independent in situ measurements. Our results indicate that the SMAP L4\_SM root zone soil moisture data product will meet its accuracy requirement (RMSE < 0.04 m<sup>3</sup>/m<sup>3</sup> after removal of the long-term mean bias).

We further assess the system performance by analyzing data assimilation diagnostics, including the observations-minus-forecast residuals and the soil moisture and temperature increments. These diagnostics are critical for the calibration of the model and observation error parameters that are needed in the assimilation system.