The NASA Soil Moisture Active Passive (SMAP) Mission - Science and Data Product Development Status

E. Njoku[1], D. Entekhabi[2], P. O'Neill[3], T. Jackson[4]

[1]*Jet Propulsion Laboratory, Pasadena, CA*
[2]*Massachusetts Institute of Technology, Cambridge, MA*
[3]*NASA Goddard Space Flight Center, Greenbelt, MD*
[4]*USDA ARS Hydrology and Remote Sensing Laboratory, Beltsville, MD*

ABSTRACT

The Soil Moisture Active Passive (SMAP) mission, planned for launch in late 2014, has the objective of frequent, global mapping of near-surface soil moisture and its freeze-thaw state. The SMAP measurement system utilizes an L-band radar and radiometer sharing a rotating 6-meter mesh reflector antenna. The instruments will operate on a spacecraft in a 685 km polar orbit with 6 am/6 pm nodal crossings, viewing the surface at a constant 40-degree incidence angle with a 1000-km swath width, providing 3-day global coverage.

Data from the instruments will yield global maps of soil moisture and freeze/thaw state at 10 km and 3 km resolutions, respectively, every two to three days. The 10-km soil moisture product will be generated using a combined radar and radiometer retrieval algorithm. SMAP will also provide a radiometer-only soil moisture product at 40-km spatial resolution and a radar-only soil moisture product at 3-km resolution. The relative accuracies of these products will vary regionally and will depend on surface characteristics such as vegetation water content, vegetation type, surface roughness, and landscape heterogeneity.

The SMAP soil moisture and freeze/thaw measurements will enable significantly improved estimates of the fluxes of water, energy and carbon between the land and atmosphere. Soil moisture and freeze/thaw controls of these fluxes are key factors in the performance of models used for weather and climate predictions and for quantifying the global carbon balance. Soil moisture measurements are also of importance in modeling and predicting extreme events such as floods and droughts.

The algorithms and data products for SMAP are being developed in the SMAP Science Data System (SDS) Testbed. In the Testbed algorithms are developed and evaluated using simulated SMAP observations as well as observational data from current airborne and spaceborne L-band sensors including data from the SMOS and Aquarius missions. We report here on the development status of the SMAP data products. The Testbed simulations are designed to capture various sources of errors in the products including environment effects, instrument effects (non-ideal aspects of the measurement system), and retrieval algorithm errors. The SMAP project has developed a Calibration and Validation (Cal/Val) Plan that is designed to support algorithm development (pre-launch) and data product validation (post-launch). A key component of the Cal/Val Plan is the identification, characterization, and instrumentation of sites that can be used to calibrate and validate the sensor data (Level 1) and derived geophysical products (Level 2 and higher).
