Evaluation of SMOS Level 3 soil moisture products using International Soil Moisture Networks

Qiuosheng Wu, Ph.D.
Department of Geography, Binghamton University, Binghamton, NY 13902

Methodology

Validate SMOS Level 3 products over continental U.S. by using soil moisture monitoring stations from International Soil Moisture Network (ISMN)

Direct node-to-site comparison

Detect combinations of site and satellite nodes with good global statistics and representative dynamics

Global comparison between different networks

Contributing Networks:

- Atmospheric Radiation Measurement (ARM)
- Automated Weather Data Network (AWDN)
- Cosmic-ray Soil Moisture Observing System (COSMOS)
- Illinois Climate Network (ICN)
- Soil Climate Analysis Network (SCAN)
- SNOTEL
- US Climate Reference Network (USCRN)

Monitoring Stations:

- More than 700 stations across the U.S.
- Near real time (NRT) with hourly sampling data
- Represent a variety of conditions across the U.S.
- Soil moisture at different depth, soil temperature, air temperature, precipitation, etc.

SMOS Soil Moisture Products

- Level 3 data products: 3-day global product on EASE grid of 25 km resolution
- Time span: 1/1/2010-12/31/2012
- Data extraction
- Nearest nodes located less than 25 km from the monitoring sites
- Ascending and descending orbits were processed separately

Soil Moisture and Ocean Salinity (SMOS) Mission

- Launched on November 2, 2009 by European Space Agency (ESA)
- First dedicated soil moisture satellite mission
- Global observations of soil moisture over the Earth
- L-band (1.4GHz/21cm) passive microwave
- Mission objective: accuracy of 4% volumetric soil moisture, spatial resolution of 35-50 km and revisit time of 1-3 days
- Crossing times 6AM and 6PM local time for ascending and descending orbits

Results

Scatter plots of soil moisture retrievals from SMOS versus in situ measurements

Time series plots of soil moisture retrievals from SMOS versus in situ measurements

Conclusions

- Statistics show an underestimation of the soil moisture from SMOS Level 3 products compared to in situ measurements
- SMOS meet the mission requirement of 0.04 m3/m3 over bare soil and/or low vegetation areas
- Differences are observed over many sites and need to be addressed
- Overall, SCAN and USCRN networks perform better than ARM, COSMOS and SNOTEL
- Statistics show similar results for both ascending and descending orbits

References