## Evaluation of Theory and Observations for AMSR Retrieval of Soil Moisture and Vegetation Characteristics over Land

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The EOS/Aqua AMSR-E multichannel microwave radiometer, operating in the 6.9 to 89 GHz range, provided nine years of global observations from June 2002 to September 2011. AMSR-E is followed by a similar AMSR2 instrument, launched on the GCOM-W satellite in May, 2012. In the U.S., data from AMSR-E and AMSR2 are processed at the AMSR Science Investigator-led Processing System (SIPS) facility in Huntsville, AL, where AMSR refers here to both AMSR-E and AMSR2. AMSR data processing over land will yield a multi-decadal record of soil and vegetation characteristics of value to hydrology and climate studies. The SIPS soil moisture retrieval algorithms are based on a land radiative transfer model whose coefficients and ancillary data are adjusted to match observations and theory as closely as possible at the AMSR spatial scale, while accommodating the spatial and temporal variabilities of soil surface roughness, vegetation cover, and surface temperature. Recent analyses have compared different algorithms and examined the sensitivities of the various AMSR channels to soil moisture and vegetation opacity. Results of some of these analyses are described in this presentation.

One of the soil moisture retrieval algorithms used is the Normalized Polarization Difference (NPD) algorithm, which uses primarily the 10.7 GHz vertical (V) and horizontal (H) channels of AMSR. These channels are less contaminated by Radio Frequency Interference (RFI) than the lower frequency channels at 6.9 GHz. The NPD algorithm to retrieve soil moisture  $m_v$  can be described by the following equations:

$$m_{v} = m_{v}^{dry} + a_{1} \left( NPD - NPD^{dry} \right) \exp\left(a_{2}g\right)$$
$$g = b_{0} + b_{1} \log\left(NPD^{dry}\right)$$
$$NPD = \frac{TB_{v} - TB_{H}}{TB_{v} + TB_{H}}$$

where,  $m_v^{dry}$  and  $NPD^{dry}$  refer to the values of  $m_v$  and NPD corresponding to climatologically driest conditions at the given location. The *a* and *b* coefficients are derived initially from radiative transfer theory (point scale) and then are tuned for best match to observations at the AMSR footprint spatial scale. The NPD algorithm has the unique feature of avoiding the need for dynamic ancillary data to correct for variability in surface temperature and vegetation water content (VWC). However, there may potentially be a penalty to be paid for this in reduced sensitivity to soil moisture. This trade-off has been the focus of recent study, and results will be presented here.