Geophysical Research Abstracts
Vol. 17, EGU2015-14392, 2015
EGU General Assembly 2015

Roughness parameter optimization using Land Parameter Retrieval Model and Soil Moisture Deficit: Implementation using SMOS brightness temperatures

Prashant K. Srivastava (1,2,3), Peggy O'Neill (1), Dawei Han (3), Miguel A. Rico-Ramirez (3), George P. Petropoulos (4), Tanvir Islam (3,5,6), Manika Gupta (1,7)

(1) NASA Goddard Space Flight Center, Greenbelt, Maryland, USA, (2) Earth System Science Interdisciplinary Center, University of Maryland, Maryland, USA, (3) Department of Civil Engineering, University of Bristol, Bristol, United Kingdom, (4) Department of Geography and Earth Sciences, University of Aberystwyth, Wales, UK, (5) NOAA/NESDIS Center for Satellite Applications and Research, College Park, Maryland, USA, (6) Cooperative Institute for Research in the Atmosphere, Colorado State University, Colorado, USA, (7) GESTAR/Universities Space Research Association, Columbia, Maryland, USA

Roughness parameterization is necessary for nearly all soil moisture retrieval algorithms such as single or dual channel algorithms, L-band Microwave Emission of Biosphere (LMEB), Land Parameter Retrieval Model (LPRM), etc. At present, roughness parameters can be obtained either by field experiments, although obtaining field measurements all over the globe is nearly impossible, or by using a land cover-based look up table, which is not always accurate everywhere for individual fields.

From a catalogue of models available in the technical literature domain, the LPRM model was used here because of its robust nature and applicability to a wide range of frequencies. LPRM needs several parameters for soil moisture retrieval – in particular, roughness parameters (h and Q) are important for calculating reflectivity. In this study, the h and Q parameters are optimized using the soil moisture deficit (SMD) estimated from the probability distributed model (PDM) and Soil Moisture and Ocean Salinity (SMOS) brightness temperatures following the Levenberg–Marquardt (LM) algorithm over the Brue catchment, Southwest of England, U.K.. The catchment is predominantly a pasture land with moderate topography. The PDM-based SMD is used as it is calibrated and validated using locally available ground-based information, suitable for large scale areas such as catchments. The optimal h and Q parameters are determined by maximizing the correlation between SMD and LPRM retrieved soil moisture. After optimization the values of h and Q have been found to be 0.32 and 0.15, respectively. For testing the usefulness of the estimated roughness parameters, a separate set of SMOS datasets are taken into account for soil moisture retrieval using the LPRM model and optimized roughness parameters. The overall analysis indicates a satisfactory result when compared against the SMD information.

This work provides quantitative values of roughness parameters suitable for large scale applications. The methodology could be used in absence of field-based observations. The approach looks promising for improving the soil moisture retrievals from microwave missions in space such as SMOS, SMAP, or AMSR-E/2.

Keywords: SMOS, Roughness Parameters, LPRM, Probability Distributed Model, Soil Moisture Deficit