Geophysical Research Abstracts
Vol. 15, EGU2013-2137, 2013
EGU General Assembly 2013

Evaluation of AMSR-E Soil Moisture products and model simulations against observations from a Tibetan SMTMS network

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Soil moisture is a key parameter in the land-atmosphere interactions over the Tibetan Plateau (TP), which plays an essential role in the Asian monsoon processes. Validation of satellite observed and/or modeled surface soil moisture is a particularly challenging work due to the scale issues. Additional challenge in this area is the harsh environment and heavy workload to establish a Soil Moisture and Temperature Measurement System (SMTMS) network.
In this presentation, a multi-scale soil moisture and temperature monitoring network, consisting of 55 SMTMS stations, has been established in central TP within a $1^\circ \times 1^\circ$ area. Firstly, the station-averaged surface soil moisture data from the network are employed to evaluate four retrieved products from the Advanced Microwave Scanning Radiometer–Earth Observing System (AMSR-E), including the National Aeronautics and Space Administration (NASA) standard soil moisture product, the Japan Aerospace Exploration Agency (JAXA) standard soil moisture product, and both the C-band and X-band soil moisture products developed using the land parameter retrieval model (LPRM). The statistic metrics indicate that none of four AMSR-E products provides reliable estimates in the unfrozen season, in terms of the mission requirement of the root mean square error (RMSE) < 0.06 m3m-3. These algorithms either much overestimate soil moisture or much underestimate it, although some of them can reflect the soil moisture dynamic range, indicating that the retrieval algorithms have much space to be improved for the cold semi-arid regions. Then, the station-averaged soil moisture observations are used to evaluate four modeled outputs by the Global Land Data Assimilation System (GLDAS). These land surface models (LSMs) are Community Land Model (CLM), Noah model, VIC model and MOSAIC model. The statistic results indicate that four GLDAS models tend to systematically underestimate the surface soil moisture (0–5 cm) while well simulate the soil moisture for 20–40 cm layer. In comparison with the satellite surface soil moisture products, three among the four models give low RMSE and BIAS values, but still falling out of the acceptable range. The causes for the modeling biases in this cold region were discussed.