Satellite soil moisture products and their application to drought monitoring

Jifu Yin[1, 2], Xiwu Zhan[2], Jicheng Liu[1, 2], Christopher R. Hain[1, 2],
Weizhong Zheng[3], Michael B. Ek[3] and Martha C. Anderson[4]
[1] ESSIC/CICS, University of Maryland College Park, College Park 20740, MD, USA. [2] NOAA NESDIS Center for Satellite Applications and Research, College Park 20740, MD, USA. [3] NOAA/NCEP Environmental Modeling Center, College Park 20740, MD, USA. [4] USDA-ARS, Hydrology and Remote Sensing Laboratory, Beltsville 20704, MD, US.

Satellite soil moisture data products have been generated since more than a decade ago. However, none of these satellite soil moisture data products has been used operationally in numerical weather prediction models because of their accuracy or reliability issues. A climatologically consistent and qualitatively reliable global soil moisture product for NCEP Global Forecast System (GFS) has been generated from NOAA-NESDIS Soil Moisture Product System (SMOPS) recently. SMOPS scales the soil moisture data products from Soil Moisture Ocean Salinity (SMOS) satellite of European Space Agency, Advanced Scatterometer (ASCAT) on EUMETSAT's Metop-A and Metop-B satellites, AMSR2 of JAXA's GCOM-W1, GPM/GMI and SMAP of NASA to the climatology of the Noah land surface model of GFS, and merges them to a blended global soil moisture data product. Meanwhile, an Ensemble Kalman filter (EnKF) data assimilation algorithm is being implemented for numerical weather prediction models such as GFS and NUWRF to assimilate the satellite soil moisture data products via NASA's Land Information System (LIS).

Additionally, combining with the microwave soil moisture (SM) data to improve the SM status monitoring skill is crucial to well understand agricultural drought. Here we characterize a new technique to develop a real time blended drought index (BDI) by merging the retrievals from thermal remote sensing of evapotranspiration along with the remotely sensed and land surface modeling SM, and in turn improve drought monitoring skill using the optimal signals. Validation with other drought indices shows that the BDI can reasonably track the time evolution of agricultural drought patterns. The results offer a viable approach for addressing the issues that merging remotely sensed SM retrievals to improve agricultural drought estimation is hampered by the uncertainty propagation of satellite data rescale-match and quality control. Based on the on-line land surface model and real time satellite land surface temperature and soil moisture, the BDI can highlight timely high spatial resolution drought monitoring, which is essential for decision-making and in turn reducing drought risk and influence.