Geophysical Research Abstracts
Vol. 21, EGU2019-10332, 2019
EGU General Assembly 2019

Global Near-Real-Time Drought Monitor Using Integrated SMOS and SMAP Soil Moisture Data

Sara Sadri, Ming Pan, Eric Wood, and Rajat Bindlish
Princeton University, Civil and Environmental Engineering, Princeton, United States (sadri@princeton.edu)

Soil moisture is an essential climate variable for numerical weather prediction and climate projections because it is a culmination of many hydrological processes capturing available water, from incoming precipitation and throughfall to evapotranspiration and drainage processes. A global representation of soil moisture conditions can, therefore, help improve the forecasting of droughts and floods globally. While there are several globally used soil moisture indices, none of them directly use soil moisture data in a near-real-time capacity and as an operational tool. Both ESA's Soil Moisture Ocean Salinity (SMOS) and NASA's Soil Moisture Active Passive (SMAP) missions are interested in a global monitoring product that monitors the near-surface soil moisture in terms of probability percentiles for dry and wet conditions. Recently, a prototype of such a product has been implemented, by the authors, for the contiguous US, using SMAP only: soil moisture data from SMAP at both level 3 (5 cm) passive radiometer retrievals (SPL3SMP) and level 4 (root-zone) assimilated product (SPL4SMAU) was fit to beta distributions. In this study, we develop a near-real-time global soil moisture index based on the integrated SMOS and SMAP's near-surface SPL3SMP data. The integrated data have an increased global revisit frequency (1 day) and period of record from 2011 to the present that would be unattainable by either one of the satellites alone. Monthly statistical distributions for near-surface soil moisture are developed for each model grid cell at 36 km resolution. We checked the reliability of the integrated SMAP and SMOS data for representing the entire distribution of the soil moisture for each grid and compared the results with the global soil moisture index from the Variable Infiltration Capacity (VIC) model. Following Sadri et al. (2018), to make predictions more meaningful and accurate, we omitted some grid cells from our analysis when their data failed one or more reliability checks: (1) the Kolmogorov–Smirnov (KS) test for beta-fitted long-term (1979-2018) and short-term (2011-2018) VIC with 95% confidence, and (2) good correlation (defined by monthly average minus monthly standard deviation) between beta-fitted VIC and beta-fitted integrated SMAP and SMOS. The Mean Distance (MD) metric used by Sadri et al. (2018) for the CONUS drought index monitor is used here in global context, assuming a VIC index at 36 km resolution as the ground truth. Furthermore, we compare the integrated SMAP and SMOS global drought index with those from VIC and in-situ data from the International Soil Moisture. Five locations in the world, from UNESCO's subregions in South America, Africa, Asia, and North America were selected for in-depth analysis. From North America, the entire ecoregion of the Canadian Prairies is studied. Since SMAP data can be retrieved and maps can be generated in near-real time, it is very promising that a SMAP drought index product can be implemented operationally. This study is a step toward soil moisture prediction over land for global food security and drought early warning, policy, and agricultural crop planning.