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Spatiotemporal Evaluation of Remote Sensing Derived Soil Moisture Deficit for the Sugarcane Crop: A Case Study for the Indo-Gangetic Basin

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This study focuses on the estimation of soil moisture deficit from root zone soil moisture information derived from remotely sensed passive microwave surface soil moisture data for a period of fifteen years (2002 to 2016) for the Indo-Gangetic basin. The remote sensing datasets used to estimate soil moisture deficit are Advanced Microwave Scanning Radiometer for EOS (AMSR-E) and Advanced Microwave Scanning Radiometer - 2 (AMSR-2) by JAXA and NASA. As India is an agrarian country, it is one of the largest producers of sugarcane at the global level and hence, this is the test crop considered for this work. The Indo-Gangetic basin has numerous culturable command areas with dynamic meteorological patterns, soil type, land use and land cover, agricultural practices, water and crop management with different sources of irrigation. Rain-fed irrigation is the primary source of water for crop production in this basin. Sugarcane crop is characterised by specific root depth, crop water requirement, crop length and crop phenology. In India, meteorological parameters primarily, precipitation, temperature and evapotranspiration and the meteorological seasons define the agricultural season (irrigation to harvesting). Here, an interrelationship between soil moisture deficit (at varying depth) and meteorological parameters, precipitation based meteorological indices (Rainfall Anomaly Index, Standardized Precipitation Index and Effective Drought Index), ground-based crop indices (crop yield index, crop area index and crop production index) is analysed at the annual and seasonal scale. The study indicates the paramount effect of the aforementioned factors on soil moisture deficit variable. The temporal variation of soil moisture deficit being served as a proxy for crop water requirement and the model developed from the same provides vital information for an efficient irrigation scheduling, sustainable water resource management for increased crop production and developing crop insurance schemes and policies at the basin level.