Geophysical Research Abstracts
Vol. 19, EGU2017-14251, 2017
EGU General Assembly 2017

Enhanced agricultural drought monitoring using a soil water anomaly-based drought index in south-west India

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In India, agriculture accounts for roughly 17% of the GDP and employs around 50% of the total workforce. Especially in the western part of India, most of the agricultural fields are non-irrigated. Hence, agriculture is highly dependent on the monsoon in these areas. However, the absence of rainfall during the monsoon season increases the occurrence of drought periods, which is the main environmental factor affecting agricultural productivity. Rainfall is often not accessible to plants due to runoff or increased rates of evapotranspiration. Therefore, knowledge of the soil moisture state in the root zone of the soil is of great interest in the field of agricultural drought monitoring and operational decision-support. By introducing soil moisture, retrieved via active or passive microwave remote sensors, the gap between rainfall and the subsequent response of vegetation can be closed.
Agricultural droughts are strongly influenced by a lack of water availability in the root zone of the soil, making anomalies of the Advanced Scatterometer (ASCAT) soil water index (SWI), representing the water content in lower soil layers, a suitable measure to estimate the water deficit in the soil. These anomalies describe the difference of the actual soil moisture value to the long-term average calculated for the same period. The objective of the study is to investigate the usability of soil moisture anomalies for developing an indicator that is based on critical thresholds, which finally results in a classification with different drought severity levels. In order to evaluate the performance of the drought index, it is compared to the Integrated Drought Severity Index (IDSI), which is developed at the International Water Management Institute in Colombo, Sri Lanka and to rainfall data from the Indian Meteorological Department (IMD). Overall, first analyses show a high potential of using SWI anomalies for agricultural drought monitoring. Most of the drought events detected by negative SWI anomalies correspond to IDSI drought events and also to reduced precipitation during that time.