Effective Rainfall - A Proxy for Identifying Meteorological Drought

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Abstract:

India predominately depends on rainfall for its agricultural water requirements. Effective rainfall (ER) is the amount of water needed for crop cultivation without any external water supply support. Hence, ER calculation is necessary for irrigation management. Besides crop water management, ER can also aid in understanding extreme hydrological analysis. This study aims to find the suitability of employing ER as an alternative for meteorological drought severity identification. In this study, one of the most widely used ER calculation methods, the USDA-SC (Smith) method, was employed to calculate ER from 2011 to 2020 throughout India. The Standard Precipitation Index (SPI-3) at 3 months intervals was used to validate the suitability of ER for assessing the drought. Four test sites were selected that cover different climate conditions of India to validate the using ER in alternative to drought. This study reveals that ER values accord with SPI-3 values in all most all 118 months. The ER was classified into 5 classes: extreme drought, moderate to severe drought, normal rainfall, severe wet, and extreme wet to assess the severity of drought. Out of 118 months of the study period, a total of 4, 2, 6 and 5 months fall into extreme drought class in Kundala (Odisha), Mallapur (Telangana), Morbi (Gujarath), and Kishangarh Urf Pharwahi (Punjab), respectively. There are no extreme wet months in Mallapur and moderate to severe drought months in Morbi. This signifies that Mallapur might be experiencing normal rainfall, and Morbi not having drought-prone months during the study period. In the overall analysis, 2011, 2012, 2013, and 2018 were dry years with low ER values. Further, ER can even identify the wet places apart from only severe to extreme dry places. The advantage of using ER as a drought indicator is that it not only classifies the drought character but also gives the magnitude of the available portion of rainfall.

Keywords: Effective Rainfall, SPI-3, Meteorological drought, Extreme hydrological analysis