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Assessment of drought in Southern Rajasthan using meteorological indicator

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ABSTRACT

Drought is one of the important phenomena of climatic variable situation. Drought haunts the agriculture and economy of the country. The monthly precipitation data were used to calculate the Standardized Precipitation Index (SPI) for the drought assessment in the southern part of Rajasthan. The SPI were calculated for the multi time series of 1, 2, 3, 6, 9 and 12 month to identify the drought year and duration of drought. The SPI analysis showed that the year 2002 was the worst affected by the drought condition in all the stations. The SPI-1 and SPI-3 can be used for short and medium term drought monitoring, respectively, while the SPI-12 was good for the longer term drought assessment in the study area.

Key words : Drought, SPI, Meteorological indicator

Natural hazards are extreme events and drought from one of the extreme ends of hydrological cycle. Drought is a recurring climatic event, which brings significant water shortage, environmental degradation, economic losses and adverse social consequences. The perception of drought is different for different people. To the hydrologist, it suggests below average water level of surface water, reservoirs, lakes, streams and rivers and fall in ground water level. To the meteorologist, drought is a situation when rainfall deviates appreciably (25 %) below normal for an extended period. To the agriculturist, it means the amount of soil moisture and rainfalls are inadequate during the growing season to support healthy crop growth to cause maturity and cause extreme water stress. It is a major natural hazard affecting large areas and millions of people every year. It is a major factor of uncertainty that continuous to haunt Indian agriculture and economy.

Many drought indices have been used over the globe to monitor and forecast drought. Drought indices assimilate thousands of bits of data on rainfall, snow packs, stream flow and other water supply indices into a comprehensive big picture. There are several indices *viz.* Palmer Drought Severity index (Palmer, 1965), Crop Moisture Index (Palmer, 1968), Surface Water Supply Index (Shafer and Dezman, 1982), that measures how much precipitation for a given period of time has deviated from historically established norms. Although none of the measure indices is inherently superior to the rest in all circumstances, some indices are better studied than others for certain uses. For example Palmer Drought Severity Index (PDSI) has been widely used by the US department of agriculture, but the Palmer is better when working with large areas of uniform topography. Western states with mountainous terrain and the resulting complex regional microclimates, find it useful to supplement Palmer values with other indices such as surface water supply index (SWSI), which takes snow pack and other unique conditions into accounts.

McKee *et al.* (1993, 1995) developed the Standardized Precipitation Index (SPI) based on precipitation only to quantify precipitation deficit on multiple time scales. Some processes are rapidly affected by atmospheric behavior; such as dry land, agriculture and the relevant time scale is a month or two. Other processes have longer time scales, typically several months, such as the rate at which major reservoirs or aquifers are or large natural bodies of water rise and fall and the time scale of these variations is on the order of several years.

Many researchers in drought studies have used the SPI for drought analysis. Bussay *et al.* (1999) and Szalai and Szinell (2000) assessed the utility of SPI for describing drought in Hungry, Lanna *et al.* (2001) recently used the SPI to investigate the pattern of rainfall over Catalonia, Spain, Hughes and Sounders (2002) studied drought climatology for Europe based on multi timescales SPI values, Ji and Petres (2003) have used the SPI for assessing vegetation response to drought, Mishra and Desai (2005) analyzed the spatial and temporal drought in Kansabati river basin, India using SPI.

METHODOLOGY

Classification of SPI:

The SPI is a statistical indicator evaluating the lack or surplus of precipitation during a given period of time as a function of long term "normal precipitation to be expected during that period. It is calculated using a continuous long term series of historic monthly precipitation record. Shorter and longer time scales may