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Spatial analysis of drought occurrence in the Parambikulam-Aliyar river basin, Tamil Nadu

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ABSTRACT : The identification and characterization of droughts are of great importance in water resources planning and management. In the present study, the standardized precipitation index (SPI) was employed to investigate the spatial characteristics of meteorological drought in the Parambikulam-Aliyar basin, Tamil Nadu. The basin was divided into 97 grid-cells of 5×5 km and monthly rainfall data for the period 1972–2011 from 28 rain gauge stations were used for spatial interpolation of rainfall using the ArcGIS. Occurrence of drought categories and cumulative drought severity were then assessed from the estimated gridded SPI values calculated from gridded rainfall at each grid and maps of spatial variation of drought characteristics were developed. The analysis of the SPI suggests that the basin had suffered severe and extreme drought in the 1970s and 1980s. The spatial extent of drought category showed that moderate and severe drought was more in the central and northern parts of the basin; while extreme drought was high in the southern parts of the basin. Drought severity map at 5 year return period indicated that the annual cumulative drought severity was high in the southern and northern parts of the basin. The results of this study can be used for identifying drought vulnerable areas, developing drought preparedness plan and mitigation strategies within the basin.

KEY WORDS : Drought severity, GIS, Rainfall, Return period, SPI

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Drought is a disastrous natural phenomenon that has significant impact on socio-economical, agricultural, and environmental spheres. Drought is a normal feature of climate, it occur in virtually all climatic zones, such as high as well as low rainfall areas and its occurrence appears inevitable. Drought places huge demands on rural and urban water resources, and enormous burdens on agricultural and energy production. In general, drought is defined as the water scarceness due to insufficient precipitation, high evapotranspiration and over-exploitation of water resources or a combination of these parameters (Bhuiyan, 2004). Timely determination of the level of drought and identifying most vulnerable areas will assist the decision making process to reduce the impacts of droughts. Drought indices have been commonly used to define drought conditions and it is a function of several hydro-meteorological variables. Drought indices provide decision makers with information on drought severity and can be used to trigger drought contingency plans, if they are available.

Drought is a frequent phenomenon in India, affecting some part or the other of the country. More than 100 districts spread over 13 states of India have been identified as drought prone districts, out of these, about 8 districts occur in the Tamil Nadu (Gupta *et al.*, 2011). The western regions of Tamil Nadu (Coimbatore and Tiruppur districts) have suffered with severe droughts at many times in the past. The present study was carried out in the Parambikulam-Aliyar basin spread over drought prone districts of Coimbatore and Tiruppur, Tamil Nadu. The aim of this study is (i) to investigate the occurrence of drought categories, (ii) to analysis the spatial pattern of drought severity for identifying the drought affected zones within the study area.

METHODOLOGY

Study area and data used :

Parambikulam-Aliyar-Palar basin (referred as PAP basin) is located in the south western part of the Peninsular India covering areas in Kerala and Tamil Nadu States (Fig.A). Parambikulam – Aliyar basin is drained by west flowing rivers *viz.,* Valayar, Koduvadiaru, Uppar, Aliyar and Palar (tributaries of Bharathapuzha river) and Parambikulam, Solaiyar and Nirar (tributaries of Chalakudi river). They are grouped into 4 sub