Characterization and trend detection of meteorological drought for a semi-arid area of Parbhani district of Indian state of Maharashtra

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ABSTRACT. Drought is one of the adverse natural hazards especially in arid and semi-arid regions regarding water resources management. Under the conditions of global warming and climate change, the investigation of drought severity and its trend in arid and semi-arid regions is of primary importance. Therefore, in this study, drought severity assessment and trend detection were carried out using different meteorological drought indices like Standardized Precipitation Index (SPI) and Standardized Reconnaissance Drought Index (RDIstd) for a semi-arid area of Parbhani district of the Indian state of Maharashtra. The results showed that SPI and RDIstd behave similarly to detect drought severity except for some slight deviation in detecting moderate and normal drought severity. Out of 37 years (1983 to 2019), SPI showed 1 severe drought year, 6 moderate drought years, 22 normal years, 4 moderate wet years, 3 very wet years and 1 extremely wet year while RDIstd showed 1 severe drought year, 5 moderate drought years, 23 normal years, 4 moderate wet years, 3 very wet years and 1 extremely wet year. One severe drought year was observed on the basis of both SPI and RDIstd indices. On the basis of weekly data analysis, the frequency of drought, normal and wet week was found to be 70.58, 15.90 and 13.51% respectively. It is revealed that the short term weekly rainfall analysis provides clear picture of frequent occurrences of drought episodes at the study area as compared to longer (monthly or annual) time scale. For identifying a statistically significant trend, a non-parametric test (Mann-Kendall) and parametric test (Linear regression) were used. At an annual scale, no significant either increasing or decreasing trend was found in the case of precipitation, SPI, RDIstd except potential evapotranspiration (PET) and temperature. Both the tests showed a statistically significant decreasing trend of PET at 0.1 level of significance (α) which would reduce water loss through...
evapotranspiration and minimize drought severity. At monthly time scale, both the tests indicated statistically decreasing trend for June month in the case of SPI (i.e., increasing drought severity) at \( \alpha = 0.01, 0.05 \) and 0.1 which indicated increment in shortage of precipitation at early monsoon period and hence, increase in delay of early sowing of Kharif seasonal crops. For November month, both the tests showed an increasing trend of SPI and RDIstd (i.e., decreasing drought severity) at \( \alpha = 0.1 \). In the case of PET, both the tests did not show any statistically significant trend at any month.

Key words – Drought, SPI, RDIstd, Mann-Kendall test, Linear regression test.