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Comprehending Meteorological Drought in the Tons River Basin, India: A Spatio-Temporal Assessment of Variability and its impact on water resources

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Meteorological drought, a climatic phenomenon with long-term precipitation deficits, significantly affects water resources, agriculture, and ecosystems in a region with monsoon rainfall. Precipitation is becoming more variable over space and time, and hydroclimatic extremes are occurring in all types of climates, more in a warming climate. The Tons River basin (one of the Ganges' major sub-basins) frequently experiences drought, which has a negative impact on agriculture, water resources, health, and food security, leading to out-migration from the region. The basin frequently experiences meteorological drought, primarily occurring during the monsoon months with more regional variability. In the present study, an attempt has been made to analyze the seasonal precipitation variation and characteristics of the meteorological drought in the Tons River basin over space and time in the Tons River basin. The study made use of $0.25^\circ \times 0.25^\circ$ Daily Gridded Rainfall Data obtained from the India Meteorological Department for the duration from 1991 to 2024. The coefficient of variation, standardized precipitation index (SPI), and the Mann-Kendall test have been calculated to understand the pattern. Furthermore, to assess the effect of meteorological drought on surface water resources, regression analysis has been used. Surface water bodies have been extracted from the Landsat Satellite images using a convolutional Neural Network.

The current study demonstrates that the Tons River basin was characterized by a severe meteorological drought in 2007-2008, 2009-2010, 2010-2011, and 2015-2015, out of which 2007-2008, had a more severe meteorological drought. Furthermore, the basin experienced 19 years of meteorological drought over a 34-year span between 1991 and 2024, ranging from moderate to severe drought. The results also reveal that drought intensity varies over space in the river basin. The study also demonstrated that surface water resources are also being affected by the extremely low precipitation. This spatio-temporal analysis of the rainfall pattern and the meteorological drought provides significant insights for policymakers and other stakeholders to enhance resilience to drought in the Tons River basins.

VAT

Session

Precipitation and Hydrological Models: Extreme precipitation events

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