

Understanding Regional Circulations That Modulate Heavy Precipitations in the Kulfo Watershed

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Abstract : Analysis of precipitation time series is a fundamental undertaking in meteorology and hydrology. The extreme precipitation scenario of the Kulfo River watershed is studied using wavelet analysis and atmospheric transport, a lagrangian trajectory model. Daily rainfall data for the 1991-2020 study periods are collected from the office of the Ethiopian Meteorology Institute. Meteorological fields on a three-dimensional grid at 0.5o x 0.5o spatial resolution and daily temporal resolution are also obtained from the Global Data Assimilation System (GDAS). Wavelet analysis of the daily precipitation processed with the lag-1 coefficient reveals some high power recurred once every 38 to 60 days with greater than 95% confidence for red noise. The analysis also identified inter-annual periodicity in the periods 2002 - 2005 and 2017 - 2019. Back trajectory analysis for 3-day periods up to May 19/2011, indicates the Indian Ocean source; trajectories crossed the eastern African escarpment to arrive at the Kulfo watershed. Atmospheric flows associated with the Western Indian monsoon redirected by the low-level Somali winds and Arabian ridge are responsible for the moisture supply. The time-localization of the wavelet power spectrum yields valuable hydrological information, and the back trajectory approaches provide useful characterization of air mass source.

Keywords : extreme precipitation events, power spectrum, back trajectory, kulfo watershed

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