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Analysis of Rainfall Variability and Trends for Better Climate Risk Management in the Major Agro-ecological Zones in Tanzania

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Abstract

Managing climate risk in agriculture requires a proper understanding of climatic conditions, regional and global climatic drivers, as well as major agricultural activities at the particular location of interest. Critical analyses of variability and trends in the historical climatic conditions are crucial in designing and implementing action plans to improve resilience and reduce the risks of exposure to harsh climatic conditions. However, in Tanzania, less is known about the variability and trends in the recent climatological conditions. The current study examined variability and trends in rainfall of major agro-ecological zones in Tanzania using station data from ten locations i.e. Hombolo, Igeri, Ilonga, Lyamungu, Naliendele, Mlingano, Tumbi, and Ukiliguru which had records from 1981 to 2020 and two locations, Dodoma and Tanga, having records from 1958 to 2020. The variability in annual rainfall was high in Hombolo and Tanga locations (CV 28 %) and low in Igeri (CV = 16 %). The OND season showed the highest variability in rainfall (34 % to 83 %) as compared to the MAM (26 % to 36 %) and DJFMA (20 % to 31 %) seasons. We found increasing and decreasing trends in the number of rainy days in Ukiliguru and Tanga respectively, and a decreasing trend in the MAM rainfall in Mlingano. The trends in other locations were statistically insignificant. We assessed the forecast skills of seasonal rainfall forecasts issued by the Tanzania Meteorological Authority (TMA) and IGAD (Intergovernmental Authority on Development) Climate Prediction and Application Center (ICPAC). We found TMA forecasts had higher skills compared to ICPAC forecasts. However, our assessment was limited to MAM and OND seasons due to the unavailability of seasonal forecasts of the DJFMA season issued by ICPAC. We also examined the influence of teleconnection phenomena, i.e. the El Nino Southern Oscillation(ENSO) and the Indian Ocean Dipole (IOD) on the variability and predictability of seasonal rainfall in Tanzania. Our analyses showed that ENSO and IOD phases on seasonal rainfall variability are weak and decrease from north to south of Tanzania. However, the Sea Surface Temperature anomalies (SSTa) in the Tropical Indian Ocean correlated strongly with the OND season rainfall in the northern part of Tanzania.

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