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Projecting Changes in Tanzania Rainfall for the 21st century

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A Non-Homogeneous hidden Markov Model (NHMM) is developed using a 40-years record (1950-1990) of daily rainfall at eleven stations in Tanzania and NCEP-NCAR re-analysis atmospheric fields of a number of meteorological variables. The following atmospheric fields (latitude from 25°S to 25°N and longitude from 25°E to 75°E), respectively of Temperature at 1000 hPa (T1000), Geopotential Height at 1000 hPa (GPH1000), Meridional Winds (MW850) and Zonal Winds (ZW850) at 850 hPa, and Zonal Winds at the Equator (ZWE) from 10 to 1000 hPa, are identified how the best ensemble of atmospheric variables that allow the accurate downscaling of the seasonal regime of daily rainfalls in Tanzania. The model directly considers seasonality through changes in the driving variables thus addressing the question of how future changes in seasonality of precipitation can be modeled. The NHMM is then used to predict future rainfall patterns under a global warming scenario (RCP8.5), using predictors from the CMCC-CMS simulations from 1950-2100. The future downscaled simulations from NHMM, with predictors derived from the simulations of the CMCC-CMS CGM, in the worst conditions of global warming, as simulated by RCP8.5 scenario, indicate that, in the XXI century, Tanzania may be subjected to: (1) a slight decrease in the number of wet days and seasonal rainfall amount in MAM and JJAS, but not in OND; (2) a reduction of annual total rainfall amount; (3) an intensification of frequency and intensity of extreme rainfall, as identified by 90th, 95th and 99th percentiles.