Abstract

The study assessed the potential of enhancing rainfall through weather modification. The specific objectives were aimed at determining the seasonal wind pattern; investigation of the temporal and spatial variation of atmospheric aerosols; identification of the cloud types and simulation of the effects of cloud seeding on precipitation. The study focused on enhancing rainfall during the months of October -November -December which constitute the short rain season due to the easiness of its prediction. The datasets used included observed rainfall (1971 -2010), National centers for environmental prediction (NCEP) global wind reanalyses (1971 -2010), Moderate resolution Imaging Spectro-radiometer (MODIS) aerosol optical depth and mass concentration (2005 and 2006 October -November -December (OND), Advanced Very High Resolution Radiometer sensor (AVHRR) satellite imagery (316th Julian) and initial and boundary conditions from the Global Model for Europe (GME). Rainfall anomaly index, time series analysis, composite wind analysis, HYbrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT), object oriented image classification and Consortium Of Small scale Modelling (COSMO) model simulation were used to achieve the objective. The 2005 and 2006 OND season were picked to represent the dry and wet years respectively during the OND season. These two years were subjected for further analysis. The pentad rainfall distribution indicated peak values mid-season during both dry and wet years. HYSPLIT backward trajectory indicated that most aerosols were continental in origin during dry year and oceanic origin during wet year. The low level winds were observed along the equator to be dominantly north easterlies with maximum wind speeds of 4.9 ms'1 during dry season and south-easterlies with maximum wind speeds of 6ms'1 during the wet OND season. The aerosol optical depth (AOD550) and mass concentration were found to have higher values and highly variable during the wet rainfall season than dry rainfall season. It was noted that strato type of clouds dominated over Lodwar, Marsabit and Wajir during dry OND season while Kakamega Kisumu and Makindu were dominated by cumulo type of clouds during wet OND season. The error matrix based on training and testing analysis showed that the overall accuracy for dry and wet OND season image classification exceeded 90% with kappa coefficient of over 0.8. COSMO Model simulation results indicated that "V cloud seeding with intermediate Cloud Condensation Nuclei (CCN) concentration lead to significant increase in total accumulated precipitation. However high'CCN concentration was noted to have a reduced effect on accumulate precipitation. The study concluded that there was a possibility of enhancing rainfall through cloud seeding if adequate knowledge of dominant wind pattern; temporal and spatial variability of atmospheric aerosols and distribution of cloud types. This information would be used to form basis of feasibility and experimental studies on clouds atmosphere interaction effects on precipitation. This would go a long way towards achievement of Kenya's vision 2030.