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Temporal statistical analysis and predictive modelling of drought and flood in Rundu–Namibia

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Abstract

Namibia is a semi-arid country characterized by the alternation of long drought periods and short episodes of intense rain, which often causes great stress to plants, animals and people. Thus, a deep understanding of the spatio-temporal distribution of rainfall is required to minimize their negative impacts, affecting food security. The temporal occurrence of drought and rainy events in the North East of Namibia (Rundu area) is described and studied for a series of monthly rainfall from 1940 until 2015. Inter-arrival times analysis is conducted to model the occurrence of extreme (high and low) rainfall events through a Poisson Point Process (PPP). Adapting the definitions of drought and flood to the water demands of crops in Rundu, it is deduced that the average inter-arrival time for droughts is smaller than for rainy years, presenting 3 and 10 years respectively. Results of PPP are presented on Lorenz Curves for different study cases (more than one, two and three events per time unit). From the PPP results it can be extracted that the probability of suffering a drought in a period of 5 years in Rundu is approximately 70%, while this likelihood is only 40% for floods. Considering the occurrence of three or more events in a time period of 10 years, the probability is almost 50% for drought and less than 10% floods. Point Process (PP) analysis demonstrates that Poisson Distribution can be used to model the occurrence of drought and floods in Rundu area, being especially precise to model the presence of one event in periods between 1 and 10 years.

Keywords Crop production · Drought · ENSO · Flood · Food security · Lorenz curve · Namibia · Poisson point process · Rainfall