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Use of Daily Rainfall Data in Reliable Rainfall Risk Assessment for Rain-Fed Farming in the Nuba Mountains of Sudan

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Abstract

Rain-fed farming in the Nuba Mountains of the Sudan contributes substantially to the country's agricultural crop production and constitutes a cornerstone of food security for the local population. However, widely variable inter- and intra-seasonal rainfall makes rain-fed farming risky in this region. To mitigate these risks, this study provides risk statements for the rain-fed sector by calculating the probability of rainfall-induced events of agricultural importance. Additionally, the reliability of these events was assessed by determining changes of rainfall amount and the events themselves over time.

Long-term daily rainfall records (60 years) from two weather stations, Kadugli and Rashad, were provided by the Sudan Meteorological Authority. The daily data were summarised into annual rainfall amounts by the INSTAT+ software. The same software was applied to calculate rainfall-induced events such as the date of start and end of growing season for each year. Subsequently, daily and annual rainfall amounts as well as events were checked for possible monotonic trends from 1950 to 2009 and 1970 to 2009 by Mann-Kendall tests.

In Kadugli, there was no evidence for any change in rainfall amount over time. In contrast, annual rainfall data for Rashad indicated a negative trend ($p < 0.001$) of about -3 mm per year over the 60 year period. However, a statistically significant trend could not be observed for this station between 1970 and 2009. For Rashad, an increase of low rainfall events (>0.85 mm to ≤ 3 mm) by 15 days coincided with a decline in the number of medium daily rainfall classes (>10 mm to ≤ 20 mm) by 4 days over the period from 1970 to 2009. This increase may be of concern since low rainfall events do not contribute to the crop water balance and therefore may hamper rainfed farmers' crop production. Calculations of the lengths of the growing season based on specific starting dates did not indicate statistically significant changes at either site suggesting that these results could be used as the basis for planning purposes for the next years.

The results of our study are designed to contribute to a better assessment of crop management risks under rainfed farming.

Keywords: East Africa, food security, growing season, Mann-Kendall tests, rainfall-induced events