Tropentag, September 17-19, 2013, Stuttgart-Hohenheim

"Agricultural development within the rural-urban continuum"

Investigation of Rainfall Characteristics in Sub-Saharan Africa and their Implications for Rain-Fed Agriculture

Matthias Beyer, Markus Wallner, Lisa Bahlmann, Max Billib

Leibniz University Hannover, Insti. of Water Resources Management, Hydrology and Agricultural Hydraulic Engineering, Germany

Abstract

Ninety percent of the rural population in sub-Saharan Africa is dependent on rain-fed agriculture. Considering the highly variable yields (in both space and time), the study of rainfall and its characteristics is crucial to understand local dynamics and develop region-specific adaptation strategies. Rainfall characteristics, *e.g.* beginning and end of the rainy season, number and length of dry/wet spells, number of extreme events or rain per wet day are impacting yields of crops. The aim of this work is to analyse rainfall characteristics and evaluate their impact on the yield of the main staple crop maize, using an agricultural model.

The analysis of rainfall characteristics for each season is carried out for the Upper Zambezi River Basin for the time period 1998 to 2010. A soil plant atmosphere system model (DAISY) is set-up on a cell by cell basis to simulate maize yields from rain-fed agriculture. The model is forced and calibrated using the satellite-based rainfall estimates TRMM-3B42v6 which were bias-corrected prior to this analysis; other meteorological data is obtained from the global dataset ERA-Interim. Finally, a Self-Organising Map (SOM) is utilised in order to identify rainfall characteristics showing a strong impact on agricultural outputs as well as to investigate region-specific patterns.

Results imply a significant spatio-temporal variability of both rainfall characteristics and resulting maize yields. The characteristics having the highest impact on yields are identified as the duration and number of dry spells as well as the duration of wet spells. In general, the north/northeast of the Upper Zambezi (sub-catchments Upper Zambezi, Kabompo and northern part of Barotse) experience longer rainy seasons and less dry spells. These parts also receive more extreme events affecting yields negatively. On the contrary, in the south/southwestern areas (Namibian and Angolian parts as well as the south of Barotse sub-catchment) less favourable conditions are observed in most of the years resulting in very low yields. The results of this study enable decision-makers and agricultural planners to develop appropriate adaptation strategies on a high spatial resolution.

Keywords: Agriculture, rainfall characteristics, satellite-based rainfall estimates, SOM, sub-Saharan Africa

Contact Address: Matthias Beyer, Leibniz University Hannover, Insti. of Water Resources Management, Hydrology and Agricultural Hydraulic Engineering, Epiweg 7, 30453 Hannover, Germany, e-mail: beyer@iww.uni-hannover.de