Geophysical Research Abstracts,
Vol. 10, EGU2008-A-06771, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-06771
EGU General Assembly 2008

Use of Generalised Linear Models (GLMs) to analyse the Spatial and Temporal Precipitation patterns in Kyoga basin within the Upper Nile

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Over the recent years the availability of precipitation records in Uganda has significantly decreased for various reasons. This means that stochastic models are needed to infill and extend observed data sets to generate inputs for hydrological models. A relatively sparse rain gauge network in Kyoga basin (only 89 sites for 56,000 km2) has been used to develop several stochastic climate models within the Generalised Linear Modelling (GLM) framework, to reproduce spatial and temporal patterns of precipitation by fitting occurrence (logistic) and amounts (gamma) models. The GLM framework allows the parameters of the logistic and gamma models to be related to spatial and seasonal covariates, and to describe large scale climatic systems such as the ENSO. Hence, multi-site rainfall over a region can be generated stochastically as a function of the dominant seasonal, climatic and geographic controls. The model parameters are fitted to observed daily rainfall using a log-likelihood method. In the Kyoga application, model performance is highly dependent on the representation of the rainfall characteristics that influence typical temporal and spatial precipitation pattern within the equatorial region of the Upper Nile. The results obtained so far reveal that acceptable models can be developed when fitted to climatic regions within the Kyoga basin, if there is a substantial number of a site with relatively complete records. Generally, for such regions, GLMs were able to reproduce regional monthly and annual statistics, and can be used to generate acceptable rainfall data sets for hydrological studies. However, the methodology fails to reproduce the spatial properties of the data set over the Kyoga basin as a whole, and fails to reproduce site specific characteristics

in regions with sparse and incomplete data sets. Ways forward for modelling rainfall in Uganda are discussed. Key Words: Precipitation, Generalised Linear Models.