Geophysical Research Abstracts, Vol. 8, 04785, 2006
SRef-ID: 1607-7962/gra/EGU06-A-04785

Mesoscale modelling of precipitation systems in West Africa and the generation of rainfall amounts for the rainy season 2002

A. Krüger, M. Kerschgens

Institute of Geophysics and Meteorology, University of Cologne, Germany
(akrueger@meteo.uni-koeln.de / Fax: +49 221 470-5161)

The effect of interactions between Earth's surface and the atmosphere on fresh water availability is investigated within the joint research project IMPETUS (an integrated approach to the efficient management of scarce water resources in West Africa). Explorations are conducted for a river catchment in Benin by means of simulations with the non hydrostatic Mesoscale model FOOT3DK (Flow Over Orographically Structured Terrain, 3-dimensional, Köln Version).

Possible effects of successive land degradation are investigated by sensitivity studies, taking into account that land use change effects on precipitation for a specific region should be based on an integrated consideration of the interactions between surface processes, atmospheric forcing and precipitation systems.

Considering one dimensional studies using FOOT3DK identifies soil water content, vegetation cover, and albedo as being the most critical surface properties with respect to rainfall. Applying a change of roughness length (-50%), vegetation (-50%), albedo (+15%) and initial soil water (-66%), calculations with 3-D model simulations for a 48 hour episode shows a reduction of precipitation within 52% of the model domain. Compared to observed values for the rainfall episode the area-averaged rainfall decreases by 2.4 mm. Extreme values vary from plus 32 mm to minus 55 mm. The overall result of complex modelling sensitivity studies dealing with stepwise surface degradation is a uniform negative trend of area-averaged rainfall. It shows values between 4 and 5 mm accompanied by a tendency toward stronger (in particular negative) extremes of local rainfall throughout the model domain.

As a whole the studies of land surface and rainfall systems interaction for the Haute Vallée de l'Ouémé (HVO) strongly support the hypothesis of a growing risk of rainfall decrease as a result of land use change. The impact of anthropogenic changes on future seasonal rainfall is assessed in a statistico-dynamical downscaling approach. It benefits from the thorough identification of observed rainfall types and their contribution to the annual rainfall in 2002. Finally this procedure allows for an evaluation of the modelled climate and provides a data base for spatially distributed meteorological data.