Geophysical Research Abstracts
Vol. 14, EGU2012-11232, 2012
EGU General Assembly 2012

Assessing and managing water scarcity within the Nile River Transboundary Basin

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The Nile Basin is the main source of water in the North Eastern Region of Africa and is perhaps one of the most critical river basins in Africa as the riparian countries constitute 40% of the population on the continent but only 10% of the area. This resource is under considerable stress with rising levels of water scarcity, high population growth, watershed degradation, and loss of environmental services. The potential impacts of climate change may significantly exacerbate this situation as the water resources in the Nile Basin are critically sensitive to climate change (Conway, Hanson, Doherty, & Persechino, 2007). The motivation for this study is an assessment of climate change impacts and adaptation potential for floods and droughts within the UNEP project "Adapting to climate change induced water stress in the Nile River Basin", supported by SIDA. This project is being carried out as collaboration between DHI, the UK Met Office, and the Nile Basin Initiative (NBI). The Nile Basin exhibits highly diverse climatological and hydrological characteristics. Thus climate change impacts and adaptive capacity must be addressed at both regional and sub-basin scales. While the main focus of the project is the regional scale, sub-basin scale modelling is required to reflect variability within the basin. One of the major challenges in addressing this variability is the scarcity of data.

This paper presents an initial screening modelling study of the water balance of the Nile Basin along with estimates of expected future impacts of climate change on the water balance. This initial study is focussed on the Ethiopian Highlands and the Lake Victoria regions, where the impact of climate change on rainfall is important. A robust sub-basin based monthly water balance model is developed and applied to selected sub-basins. The models were developed and calibrated using publicly available data. One of the major challenges in addressing this variability within the basin is the scarcity of spatial data and the results for the Kagera sub-basin show that it is important to represent the spatial distribution of the hydro-geographic characteristics such as rainfall, soil type, etc., in order to develop a reasonable representation of the water balance. These initial results show that the changes in the water balance and flow regime under climate change exhibit large uncertainty. From an examination the flow duration curves, however, there seems to be a consensus, based on an ensemble of climate projections, that flows will increase slightly the short term (2011-2030) and decrease significantly in the long term 2080-2099. The large uncertainties together with the natural variability in the Nile suggest that there is a strong need to maximise adaptive capacity with the region.