Geophysical Research Abstracts
Vol. 14, EGU2012-6260, 2012
EGU General Assembly 2012

Assessing catchment response to land use change with consideration of discharge uncertainty: case study in west Kenya

J. Juston
Sweden (juston@kth.se)

There has been much emphasis in recent years on the need to recognize inherent uncertainties in linking data and models in hydrological studies. This recognition needs to be extended to assessment of hydrological impacts of land use change. Deforestation in headwater regions of the Mara River basin in west Kenya is an issue of international concern, as flows from these regions are crucial to the downstream Serengeti ecosystem, as well as to increasing rural populations. The purpose of this study was to analyze long-term discharge records (1964-2008) from two ∼700-km2 sub-basins of the Mara (Nyangores and Amala Rivers), both descending from highlands of the Mau escarpment. Reference time series for deforestation and degradation in these basins were established from available Landsat, AVHRR and MODIS satellite data. Uncertainties in the stage-discharge relationships (i.e. rating curves) at the two gauging stations were analyzed with Bayesian Markov Chain Monte Carlo analysis. These uncertainties were interpreted and propagated to credibility bands in discharge time series, which were in turn used as the basis for three subsequent analyses. Uncertain flow duration curves were developed to assess changing basin responses in consideration of uncertainties. Annual discharge responses were evaluated in a Budyko framework to assess relative influences of climate and/or land cover change on observed shifts. Lastly, a conceptual rainfall-runoff model was applied to track changes in water cycling in these basins over time and with consideration of discharge uncertainties. The emerging picture was that 1) both basins experienced about 15% net deforestation since 1972, 2) shifts in historic flow regime were moderate but robust in consideration of uncertainties, 3) some of these shifts may have resulted from variable climatic forcing, and 4) water cycling in the basin seems to have changed over time as judged by distinct temporal shifts in some hydrological model parameters. This suite of methods seemed to provide meaningful insights for these two study basins and should therefore be of interest for other studies as well.