Geophysical Research Abstracts
Vol. 14, EGU2012-11704, 2012
EGU General Assembly 2012

Detecting the hydrological impacts of forest cover change in tropical mountain areas: need for detrending time series of rainfall and streamflow data.

A. Molina (1), V. Vanacker (2), E. Brisson (3), and V. Balthazar (2)

(1) Soil Science of Tropical and Subtropical Ecosystems, Büsgen-Institute, Georg-August-Universität Göttingen, Germany (amolina@uni-goettingen.de), (2) Earth and Life Institute, University of Louvain, Louvain-la-Neuve, Belgium, (3) Division of Geography, KU Leuven, Leuven, Belgium

Interactions between human activities and the physical environment have increasingly transformed the hydrological functioning of Andean ecosystems. In these human-modified landscapes, land use/-cover change may have a profound effect on riverine water and sediment fluxes. The hydrological impacts of land use/-cover change are diverse, as changes in vegetation affect the various components of the hydrological cycle including evapotranspiration, infiltration and surface runoff. Quantitative data for tropical mountain regions are scarce, as few long time series on rainfall, water discharge and land use are available. Furthermore, time series of rainfall and streamflow data in tropical mountains are often highly influenced by large inter- and intra-annual variability.

In this paper, we analyse the hydrological response to complex forest cover change for a catchment of 280 km^2 located in the Ecuadorian Andes. Forest cover change in the Pangor catchment was reconstructed based on airphotos (1963, 1977), LANDSAT TM (1991) and ETM+ data (2001, 2009). From 1963, natural vegetation was converted to agricultural land and pine plantations: forests decreased by a factor 2, and paramo decreased by 20 km^2 between 1963 and 2009. For this catchment, there exists an exceptionally long record of rainfall and streamflow data that dates back from the ‘70s till now, but large variability in hydrometeorological data exists that is partly related to ENSO events.

Given the nonstationary and nonlinear character of the ENSO-related changes in rainfall, we used the Hilbert-Huang transformation to detrend the time series of the river flow data from inter- and intra-annual fluctuations in rainfall. After applying adaptive data analysis based on empirical model decomposition techniques, it becomes apparent that the long-term trend in streamflow is different from the long-term trend in rainfall data. While the streamflow data show a long-term decrease in monthly flow, the rainfall data have a trend of increasing and then decreasing precipitation amounts. These results suggest that the land use changes had an important impact on the total water yield of the catchment. Interestingly, the effect of reforestation in the upper part of the catchment with its associated decrease in water yield seems to be dominant over the effect of deforestation in the lower part of the basin.