10th Alexander von Humboldt International Conference
Addis Ababa | Ethiopia | 18 – 20 November 2015
AvH10-12

Characterization of the Regional Variability of Seasonal Water Balances within the Omo-Gibe River Basin, Ethiopia

Adanech Yared Jillo (1), Murugesu Sivapalan (), Solomon Seyoum Demissie (), and Alberto Viglione ()

(1) Ethiopian Institute of Water Resources, Addis Ababa University, Addis Ababa, Ethiopia (adanechyared@yahoo.com), (2) Department of Civil and Environmental Engineering and Department of Geography, University of Illinois at Urbana-Champaign, Urbana, Illinois, USA (sivapala@illinois.edu), (3) Ethiopian Institute of Water Resources, Addis Ababa University, Addis Ababa, Ethiopia (solomon.demissie@gmail.com), (4) Institute of Hydrology and Water Resources Management, Vienna University of Technology, Vienna, Austria(alviglio@gmail.com), (5) Depart of Civil, Addis Ababa Institute of Technology,Addis Ababa University, Addis Ababab, Ethiopia(dhasfaw@gmail.com)

Characterization of the Regional Variability of Seasonal Water Balances within the Omo-Gibe River Basin, Ethiopia

A. Y. Jillo1, M. Sivapalan2, 3, S. S. Demissie1, A. Viglione4, C. MacAlister5, and D. H. Asfaw1, 6

1 Ethiopian Institute of Water Resources, Addis Ababa University, Ethiopia
2 Department of Civil and Environmental Engineering, University of Illinois at Urbana-Champaign, Urbana, Illinois, USA
3 Department of Geography, University of Illinois at Urbana-Champaign, Urbana, Illinois, USA
4 Institute of Hydrology and Water Resources Management, Vienna University of Technology, Vienna, Austria
5 International Development Research Center, Canada
6 Depart of Civil, Addis Ababa Institute of Technology, Ethiopia

Correspondence to: A. Y. Jillo (adanechyared@yahoo.com)

Abstract
Characterization and understanding of the hydrological variability in Ethiopia are important to improving existing capabilities for forecasting short-term and long-term droughts and floods and for sustainable water management. In this study we focus on the Omo-Gibe River Basin, which is the second most important basin of Ethiopia in terms of water availability. Because of the scarcity of runoff data in the region, the characterization of the spatial variability has adopted approaches similar to the runoff Prediction in Ungauged Basins (PUB). Our analysis consists of the following two parts: (1) rainfall-runoff modeling of ten catchments for which runoff data are available and (2) regionalization of the water balance components in the Omo-Gibe River Basin by model parameter transfer to ungauged catchments. The objective is to characterize and improve understanding of the spatial variation in seasonal water balances in the Omo-Gibe River Basin. We analyzed the water balances of 21 catchments in the basin using an HBV light conceptual model of catchment hydrology with a single linear reservoir. We calibrated the model against observed stream flow time series, and it showed good performance for calibrated catchments, with a result for all 10 of r2 and Reff > 0.6. After some more regionalization efforts, we could use the calibrated parameters to predict stream flows in ungauged catchments of the Omo-Gibe Basin. Seasonal water balance varies greatly across the basin, with precipitation regimes, changing from north to south from “seasonal” to “precipitation spread throughout the year, but with a definite wetter season”. We regionalize seasonal water balance into two different regions according to the similarity of physical controls leading to similar seasonal balance. The main leading control in the Omo-Gibe Basin is the precipitation regime, rather than humidity. In the northern 14 catchments, precipitation and evaporation are out of phase, and in the 7 southern catchments they are in phase. More than 5 catchments are related to signatures of interest that are not clearly accounted for in the regionalization but can be considered measures of their hydrological functioning. These signatures have large, distinct patterns. Large amounts of water exit region 1 catchments as stream flow, indicating a variable flow regime, while a more damped response and catchments have contributed a higher base flow. But large amounts of evapotranspiration exit from region 2 catchments, indicating little variation in flow regime; this is the result of the damping effects of large amounts of storage and can arise from insistent rainfall and/or the dominance of groundwater contributions to stream flow.

Keywords. Omo-Gibe River Basin, HBV-Light Model, Parameter Regionalization, Flow Prediction to Ungauged Catchments, Hydrology, Seasonal Water Balance and Signature of Catchment Response.