



Uncertainty in the estimation of water budget from reanalysis products: Evaluation in Upper Blue Nile river basin

Marika Koukoula, Efthymios Nikolopoulos, Zoi Dokou, and Emmanouil Anagnostou
Department of Civil and Environmental Engineering, University of Connecticut, Storrs, CT, USA
(marika.koukoula@uconn.edu)

Africa is a continent generally characterized by sparse hydrologic observations while at the same time in need for efficient management of water resources to enhance food and water security in the area. Upper Blue Nile basin's hydrology plays a significant international role, being the headwaters of the Blue Nile Basin, where it contributes about 60% of the total annual flow of the Nile. Improved understanding and managing water resources in a sustainable manner requires at the very least an adequate characterization of hydrological fluxes (precipitation, streamflow and evapotranspiration) and states (soil moisture) at monthly and annual scale. Water resources reanalysis (WRR) products provide a unique opportunity to advance understanding of hydrologic processes at regions where in situ information is sparse or nonexistent. However, these products are also associated with uncertainty related to the various uncertainty sources in the forcing dataset and modeling schemes involved. Understanding and evaluating uncertainty is therefore imperative for advancing application of these products in water resources.

In this study we present a comprehensive evaluation and intercomparison of water cycle components derived from state-of-the-art water resources reanalysis (WRR) products associated with different LSMs, meteorological forcing and precipitation datasets in the Upper Blue Nile basin in Ethiopia. The objective is to evaluate uncertainty and identify the most suitable combination of Land Surface Model (LSM) and precipitation forcing to represent the dynamics of water cycle components in the Upper Blue Nile basin. To this scope, evaluation is carried out for a dataset produced through NASA's Land Data Assimilation System (LDAS) at regional (FLDAS) scale and the latest version (tier 2) of the global WRR product of the EU Earth2observe project. Precipitation, evapotranspiration (ET), streamflow and terrestrial water storage were evaluated against daily precipitation from rain gauges measurements, remote sensing derived ET, in-situ streamflow observations and the NASA Gravity Recovery and Climate Experiment (GRACE) product, respectively.

Results from this analysis highlight the current strengths and limitations of available WRR datasets in analyzing the hydrological cycle and dynamics of East Africa. This analysis shows that the WRR products which provided better representation of the streamflow, exhibited the poorest performance in ET representation. The results presented in this study would recommend that the representation of the water cycle components from different reanalysis products is affected mainly by the differences in the schemes that the various LSMs use and not by variations of precipitation forcing.