

Monitoring the Water Balance of Small Reservoirs in Semi-arid Regions from Space

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Multipurpose small reservoirs (surface from 1 to 100 ha) have crucial roles for many livelihoods in rural areas of semi-arid regions like Northern Ghana, Southern Burkina Faso and Zambia. The correct representation of the hydrological functions of the small reservoirs is important for regional (hydro-) climate models and scaling out the intervention. The application of remote sensing techniques to provide meteorological and physical parameters (surface area and volume) over the water surface, where field-based information is rarely available due to logistical and technical constraints, will greatly improve the understanding of the water balance and hydrology of small reservoirs. Open water evaporation as an important component of small water bodies hydrology, remains a difficult and complex process to measure or estimate mainly due to the fact that the required meteorological parameters are rarely measured over these small water surfaces.

In this study the trends in water surface fluctuations, and thereby water storage in small reservoirs in the Upper East Region (UER) of Ghana were examined. This was done using Radarsat-2 and Landsat-8 datasets from November 2012 till April 2014. Assuming minimal seepage condition during the observation period (when these reservoirs were not used), the water balance of small reservoirs was parameterized to estimate evaporation losses and compared with evaporation estimates from numerical methods based on ground-based (land-based) measurements. The measurements from the field using an Eddy Covariance (EC) System over the water surface correlates very well with the satellite measurements using time series of satellite observations and the numerical (evaporation aerodynamic and energy balance) methods. The results show a great potential for using a combination of Sentinel-1 and Sentinel-2 data sets for operational management of small reservoirs to enhance food production with enhanced irrigation scheduling.

Keyword: *Small Reservoirs, Evaporation, Water balance, Sentinel-1, Sentinel-2, Semi-arid, Food Security.*