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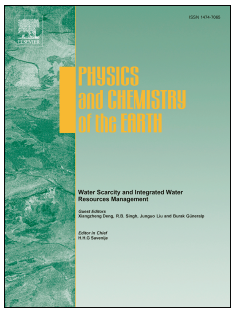

Assessment of water availability for competing uses using SWAT and WEAP in South Phuthiatsana catchment, Lesotho

Motlatsi Maliehe, Deogratias M.M. Mulungu

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Assessment of water availability for competing uses using SWAT and WEAP in South Phuthiatsana catchment, Lesotho

Motlatsi Maliehe and Deogratias M.M. Mulungu*
University of Dar es Salaam, College of Engineering and Technology
Department of Water Resources Engineering
P.O. Box 35131 Dar es Salaam, Tanzania

*Corresponding Author email: dmulungu@udsm.ac.tz; deorgm@yahoo.co.uk

Abstract

The study assessed the quantity of surface water in the South Phuthiatsana catchment, estimated flows in ungauged catchments using Soil and Water Assessment Tool (SWAT) and allocated the resources in the catchment using Water Evaluation And Planning (WEAP) model. SWAT model was calibrated from 1979 to 2001, the *p-factor* was 65%, *r_factor* 0.58, NS 0.59 and R^2 0.59 for calibration and for validation from 2002 to 2013, the *p-factor* was 57%, the *r_factor* was 1.34, the NS was 0.52, and R^2 was 0.66. The results show the water balance as: 26% of precipitation form streamflow, 41% of the total flow comes from baseflow, while surface runoff accounts for 59%, 14% of precipitation percolates to shallow aquifer, 1% percolates to deep aquifer and 68% of precipitation is lost through evapotranspiration. The WEAP model was calibrated using CG024 and CG084 stations and historical demands. For CG024 calibration (1972 – 2002) NS was 0.72 and R^2 was 0.84 and for validation (2003 – 2014) the NS was 0.73 and R^2 was 0.74. For CG084 calibration (2007 – 2011) NS and R^2 were 0.55 and 0.64 and for validation (2012 – 2014) the NS and R^2 were 0.63 and 0.89 respectively. Two scenarios were evaluated. First for the reference scenario, the Metolong industrial demands of 1.46 Mm^3 and environmental demands of 2.29 Mm^3 were both not met. Secondly, for the irrigation expansion scenario, increasing irrigation land by 12.3%, a total of 4.44 Mm^3 demands were not met (irrigation accounts for 65.65% of the unmet). Therefore, the study recommends an irrigation plan for the catchment. The irrigation plan has to include: irrigation systems designed for the site, meteorological stations and an irrigator's association with experts forming part of the board.

Keywords: South Phuthiatsana catchment; SWAT model; Uncertainty; Water availability; Water demands; WEAP model