

WATER BALANCE MODELING FOR THE EVALUATION OF SURFACE WATER RESOURCES

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EXTENDED ABSTRACT

In this study various lumped water balance models have been evaluated for the estimation of monthly runoff in Yermasoyia watershed, Cyprus. A GIS model of the Yermasoyia watershed was built for the estimation of the necessary geomorphological and other features of the basin such as mean elevation, stream network, watershed area, vegetation cover, and land use. Three water balance models have been developed as proposed by Abulohom et al (2001), Giakoumakis et al (1991), and Thornthwaite (1948) modified by Alley (1984). These models require as input data, mean monthly areal precipitation and potential evapotranspiration. Data from four meteorological stations have been used for the hydrological years 1986-1998. The areal precipitation has been estimated using the methods of Thiessen polygons, the arithmetic mean, and the precipitation gradient method. Areal potential evapotranspiration was calculated using six empirical methods based on temperature, precipitation, and solar radiation. The potential evapotranspiration methods used were the Thornthwaite, Blaney-Griddle, Turc, Hargreaves, Kharuffa, and Jensen-Haise. The average basin wide temperature was estimated using the temperature lapse rate. The monthly runoff was simulated using the three water balance models and combinations of the methods for the estimation of areal precipitation and potential evapotranspiration. In this sense, eighteen sets of input data were produced and used for each water balance model simulation. The water balance models were calibrated and validated using the split sample test. The models were calibrated for six hydrological years (October 1986 – September 1992), and validated for the period October 1992 to September 1998. The calibration was performed using the Simplex optimization method using the model efficiency (Nash and Sutcliffe, 1970) as the objective function. Various statistical tests were performed in order to find the best simulation. The calibration and validation results show that the Abulohom water balance model is the most efficient model in simulating the runoff hydrograph and runoff volume from Yermasoyia watershed irrespective the PET estimation method used. The other two models severely under-estimate the runoff volume and fail to simulate low flows, which are important for the reservoir management and operation.

Key words: water balance modeling, lumped models, potential evapotranspiration, areal precipitation, surface runoff, Cyprus