

Suitability of Satellite-Based Data for Groundwater Modelling in Southwest Nigeria

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Abstract : Numerical modelling of groundwater flow can be susceptible to calibration errors due to lack of adequate ground-based hydro-metrological stations in river basins. Groundwater resources management in Southwest Nigeria is currently challenged by overexploitation, lack of planning and monitoring, urbanization and climate change; hence to adopt models as decision support tools for sustainable management of groundwater; they must be adequately calibrated. Since river basins in Southwest Nigeria are characterized by missing data, and lack of adequate ground-based hydro-meteorological stations; the need for adopting satellite-based data for constructing distributed models is crucial. This study seeks to evaluate the suitability of satellite-based data as substitute for ground-based, for computing boundary conditions; by determining if ground and satellite based meteorological data fit well in Ogun and Oshun River basins. The Climate Forecast System Reanalysis (CFSR) global meteorological dataset was firstly obtained in daily form and converted to monthly form for the period of 432 months (January 1979 to June, 2014). Afterwards, ground-based meteorological data for Ikeja (1981-2010), Abeokuta (1983-2010), and Oshogbo (1981-2010) were compared with CFSR data using Goodness of Fit (GOF) statistics. The study revealed that based on mean absolute error (MEA), coefficient of correlation, (r) and coefficient of determination (R^2); all meteorological variables except wind speed fit well. It was further revealed that maximum and minimum temperature, relative humidity and rainfall had high range of index of agreement (d) and ratio of standard deviation (rSD), implying that CFSR dataset could be used to compute boundary conditions such as groundwater recharge and potential evapotranspiration. The study concluded that satellite-based data such as the CFSR should be used as input when constructing groundwater flow models in river basins in Southwest Nigeria, where majority of the river basins are partially gaged and characterized with long missing hydro-metrological data.

Keywords : boundary condition, goodness of fit, groundwater, satellite-based data

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