

ESTIMATING GROUNDWATER RECHARGE IN SEMI-ARID ENVIRONMENTS USING SOIL MOISTURE BALANCE

Murtala A. Gada and Ganiyu O. Salawu

Department of Geography, Usmanu Danfodiyo University, Sokoto
Nigerian Defence Academy, Kaduna

Corresponding Author's email: gada.abubakar@udusok.edu.ng



Abstract

Groundwater recharge estimation under different climatic conditions can be achieved using daily soil moisture balance. In semi-arid areas, crucial factors such as bare soil evaporation and crops transpiration are traditionally incorporated in the model. This paper estimated groundwater recharge in the Sokoto Basin, which is a semi-arid environment using the soil moisture balance approach. Meteorological data (rainfall and temperature), crop and soil data for years were obtained from and used in calculating soil moisture balance. Actual evapotranspiration was estimated based on the readily and total available water parameters which depend on soil properties and the effective roots depth, taking into account the near surface soil storage on days following heavy rainfall. Runoff on the other hand was estimated as a function of the daily rainfall intensity and the antecedent soil moisture condition. The findings revealed that recharge occurs during the peak rainy season through the period of main crop growth. Also, actual evapotranspiration accounts for the highest water budget, followed by runoff and then recharge, with about 70%, 20% and 10% respectively. Soil moisture balance model is thus a reliable approach for potential recharge estimation in semi-arid environments.

Keywords: Soil moisture; Water balance; Recharge; Crop development; Semi-arid