



Dynamic surface-groundwater interactions in the semi humid environment of the Lake Tana sub-basin, Ethiopia: A case of Fogera floodplain

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Abstract

Understanding surface and groundwater interactions is important for water balance modeling and water resources management. Existing water balance models in the Lake Tana sub basin refer groundwater contribution as minor or negligible. These assumptions possess neither empirical soundness nor the statistical evidence to substantiate the arguments. For understanding the dynamic interactions of the groundwater and the surface waters, shallow groundwater level was observed at weekly time step for the two dry seasons of the 2014 and 2015 years; in thirty-two abandoned wells distributed over the floodplain (500 sq. km) adjacent to the lake. The study area lies in tropical monsoon climate, where the rainfall dominated by the Inter tropical convergence zone (ITCZ). Vertisols (black cotton soil) is the major and dominant soil type in the Fogera floodplain. Vertisols is known for its low saturated hydraulic conductivity.

A 10 meters level difference was observed between the lake and the farthest observation well located at 20km from the lake, based on which a hydraulic gradient of 0.0005 was determined. This showed that the shallow groundwater is generally flowing to the lake; but the flow volume is as low as 0.000025m/day per square meter area of the aquifer. This indicates that the drainage to the Lake is a small term in the water balance of the plain; which is attributed to the very low saturation hydraulic conductivity of the soil (0.5m/day). The soil moisture content depleted in soil column above the groundwater level, during the dry seasons was about 730mm based on the observed moisture profile in the vadose zone and the depth of the groundwater table. This volume of water had recovered during the wet seasons as recharge from the rainfall and flooded waters. This indicates that for average and above average rainfall years, the Fogera plain will flood irrespective of flooding from rivers occurs or not.

Key words: Lake Tana, groundwater level, Fogera floodplain, Ethiopia