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Conceptualization of groundwater-surface water interaction with evidence from environmental isotopes and hydrogeochemistry in lake Babati Basin in Northern Tanzania

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Abstract

The holistic management of water resources is attainable with evidence-based planning constructed on reliable hydrological information. However, data paucity, especially in sub-Saharan Africa, leads to a significant knowledge gap regarding surface water and groundwater interactions, leaving considerable uncertainty to support relevant decisions. This study combined hydrogeochemistry and environmental isotopes to explore the connections between the surface water and groundwater in the data scarce catchment of Lake Babati Basin in northern Tanzania. The results showed that: i) Lake Babati receives groundwater influx from recently recharged aquifers endowed in the pyroclastic formation in the lake basin; ii) the lake is not well mixed as presented by the heterogenous hydrogeochemistry and confirmed by the differences in the isotopic composition of deuterium and oxygen – 18 at different locations within it; iii) the deep wells located near the lake abstract a mixture of recently recharged water, deep aquifer waters and lake water with enriched isotopic compositions; and iv) the hydrogeochemistry and isotopic data reveal the presence of a hydraulic connection between the lake and deep wells. The findings of this study demonstrate that the catchment, the groundwater system, and Lake Babati are interlinked and, therefore, require the implementation of integrated water resources management to enhance sustainable development.