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Hydrogeochemical similarities and groundwater-surface water interactions for the karst hydrological system of northwest Rwanda

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Abstract

The groundwater of karst environments is vulnerable to pollution due to its heterogeneous nature and can be completely depleted due to its strong connection to surface water when predominantly driven by natural and anthropogenic factors. This particular landscape is the main source of drinking water in different parts of the world. Karst Hydrological of Rwanda hosts surface and groundwater resources. Moreover, groundwater is the main source of domestic water use in that area. The surface water is threatened by drying of crater lakes, changes of other lakes, and obstruction of sinkholes swallowing water from streams and runoff. Those problems may have direct and long-term impacts on groundwater recharge. The information on the hydrogeological characteristics of surface and groundwater, groundwater-surface water interaction, was limited. This study investigated the hydrogeochemical characteristics, similarities, and interactions of surface groundwater. To understand long-term impacts of surface water challenges on groundwater when are connected, statistical analyses and Piper diagram were used to achieve the objectives. The results showed a strong correlation among spring waters, reflecting similarity in the water origins. The Piper diagram classified the water as bicarbonate water ($HCO^{-}3$, Ca^{2+}, Mg^{2+}). The analysis of variance between surface water and groundwater did not show significant differences at the 0.05 level, which explains a relationship. The results showed a strong similarity and interaction between surface and groundwater. The findings of this study are important for water managers in consideration of future management since current problems on surface water may affect groundwater and community depending on that resource.

Keywords

Bicarbonate aquifer; Correlation coefficient; Hydrochemistry; Karst hydrology; Piper plot