Application of environmental isotopes to groundwater recharge studies in a semi-arid fractured crystalline basement area of Dodoma, Tanzania

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Abstract
The distribution of ^{18}O and ^{2}H in various water sources indicates that groundwater recharge is due to local rainfall occurring within the basins. Groundwater recharge takes place under a bypass flow mechanism and matrix diffuse flow and is 3% and 2% of the long-term mean annual rainfall of 550 mm for the Makutapora and Hombolo basins, respectively. Chloride mass balance indicates that 60% and 40% of the total groundwater recharge takes place through macropores and matrix flow, respectively. Sporadic variations in ^{18}O, ^{2}H and chloride among adjacent boreholes suggest existence of a discrete fractured aquifer and/or dominance of local recharge. The relationship between $\delta^{2}H$ and chloride indicates that groundwater salinization is due to the leaching of surficial and soil salts during high intensity rainfall, which causes high surface runoff and flash floods. It has been concluded that the isotopic and chemical character of groundwater in fractured semi-arid areas may provide the most effective complementary means of groundwater recharge assessment and therefore is very useful in the management of the water resources.