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Towards the understanding hydrodynamics of Mansar Lake, Jammu and Kashmmir, Western Himalayas, India through Isotopic and chemical approcahes

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Abstract: An attempt has been made to study the isotopic and chemical characteristics of the Mansar lake, a natural lake located in the Western Himalayan foothill of Jammu and Kashmir, India to understand the hydrodynamics of Mansar Lake. The local precipitation, groundwater (springs and open well) and the lake water samples from different depth were collected and analysed for $\delta^{18}O$, $\delta^{2}H$ and major ions. The depthwise variation of temperature, pH, electrical conductivity, dissolved oxygen, hardness, alkalinity, $\delta^{18}O$ and $\delta^{2}H$ show that lake water mixes completely during the months of January and February and remains stratified in the remaining months. The $\delta^{18}O$ of lake water varied from +1 ‰ to +4 ‰ in epilimnion part and +1.1 ‰ to +2.6 ‰ in hypolimnion zone. The weighted mean average of $\delta^{18}O$ of rainwater was -6.8 ‰ and average groundwater $\delta^{18}O$ -5.3‰. The slope of meteoric water line developed for lake is 4.7, which is less than the Global Meteoric Water Line, indicate evaporative enrichment of lake water. The d-excess values for the lake water are observed in range of -15‰ and 0 ‰. The enrichment of lake water$\delta^{18}O$ and less d excess clearly reveals that lake water has undergone significant evaporative fractionation. The evaporative enrichment implies that residence time of lake water is more due less inflow and outflow. The enrichment of $\delta^{18}O$ of hypolimnion zone water reveals insignificant interaction between lake and groundwater.

Chemical analysis of lake water reveals that the; Ca and Mg account 70% to 85% of the cations and HCO_3 accounts for 77% to 91% of the total anion, and equivalent ratio of Ca:Mg varies from 0.45 to 6.4. The average $(Ca+Mg)/HCO_3$ equivalent ratio of 1.04, major contribution of (Ca+Mg) to total cations and high (Ca+Mg)/(Na+K) ratio indicate that, weathering of calcareous sandstone and mudstone of the Siwalik group is the primary source of major ions in the water. Phosphate concentration more than 0.03 mg/l shows that the lake has been entered into eutrophic stage. Chemical and isotopic data reveals that source of lake water is local precipitation

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