

Preliminary Results from Oxygen and Hydrogen Isotopic Investigation of Groundwaters from Gangetic Doab Region, North India

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Abstract

Preliminary results from Oxygen and hydrogen isotopic ($\delta^{18}\text{O}$ and δD) investigation of the shallow Groundwaters from Gangetic Doab Region in North India, undertaken as a part of a National Programme on Isotope fingerprinting of Waters of India (IWIN), are reported. The broad objectives of this component of the study are to: (i) isotopically characterize the groundwaters; (ii) understand the influence of regional hydrometeorological factors on isotopic composition; and (iii) isotopically differentiate the groundwater zones within seemingly homogeneous hydro-meteorological region.

For the purpose of this study, the Gangetic Doab region is sub-divided into four regions (States of West Bengal, Bihar, Uttar Pradesh and Uttarakhand) located along the SE-NW trajectory of regional monsoon-winds, originating from the marine source region (Bay of Bengal- BOB) and travelling towards Uttarakhand in its distant end.

The average values of $\delta^{18}\text{O}$ and δD of ground waters is found to progressively decrease from $\delta^{18}\text{O} = \sim -5\text{‰}$ and $\delta\text{D} = \sim -32\text{‰}$ in West Bengal (SW extreme of wind trajectory) to $\delta^{18}\text{O} = -7\text{‰}$ and $\delta\text{D} = -42\text{‰}$ in Uttarakhand (NW extreme of the wind trajectory). This progressive depletion of ^{18}O and D in the groundwater with increasing distance from primary vapour source region (BOB) seems to mimic to an extent the continental effect, normally seen in rainwater. The composite $\delta^{18}\text{O}$ - δD regression line for ground waters in the Gangetic Doab region has a slope (~ 6.6) less than the slope (~ 8) of Global Meteoric Water Line (GMWL), and that of the limited precipitation data available from the few stations in this region. This suggests that the rainwater in the entire region undergoes considerable evaporation before forming the part of groundwater.

The average d -excess ($=\delta\text{D} - 8 * \delta^{18}\text{O}$) of groundwaters from the states of West Bengal, Bihar and Uttar Pradesh have much lower values ($\sim 6\text{‰}$) compared that of groundwaters in Uttarakhand ($\sim 13\text{‰}$). The lower value of average d -excess for the states in the southeastern states of the region suggests that rain/surface water undergoes considerable evaporation before it forms part of groundwater. The higher value of d -excess in the NW part of the region suggests that the groundwater in this region does not undergo considerable evaporation.