AOGS 2005

Stable Isotopic Composition of Precipitation in Kumaun Himalaya, Uttaranchal, India: Relationship with Meteorological Conditions

S.P. RAI[1], BHISHM KUMAR[1], RM. P. NACHIAPPAN[1] and S.V. NAVADA[2]
[1]*National Institute of Hydrology, Roorkee – 247 667 (UA), India*
[2]*Isotope Division, Bhabha Atomic Research Centre, Mumbai – 400 085, (MS) India*

The variation in the stable isotopic ratios of precipitation in the catchment areas is key to many hydrological applications. The local variations such as altitude and seasonal effects find more applications in regional hydrological studies than the global scale variations such as latitude and continental effects. The variation in the altitude effect of precipitation in different geographical region is to be established before using stable isotopes ($\delta^{18}O$ - δD). This variation is important particularly in mountainous area, where altitude varies greatly, to find out the origin and source of springs, seepages and leakage from reservoir/lakes.

The precipitation samples were collected from 4 stations set up at different altitudes in the Kumaun Himalaya. All the necessary precautions were undertaken to avoid evaporative enrichment during collection and storage. The water samples of springs and lake were collected for the isotopic study. The collected samples were analysed by Stable Isotope Ratio Mass Spectrometer at Isotope Division, Bhabha Atomic Research Centre, Mumbai, India. The rainfall data were collected for 100 years along with the other meteorological data such as temperature, humidity and sunshine hours from Nainital for the available period.

The oxygen and hydrogen isotope ratios of rainfall in the Nainital Lake Catchment are investigated and (i) the altitude effect in stable isotope ratios is estimated (ii) the effect of secondary evaporation of the falling raindrops for this hilly terrain evaluated, and (iii) multiple regression model with meteorological variables to generate oxygen isotopic composition of rainfall is developed. The $\delta^{18}O$ -δD relationship in the local rainfall during monsoon season exhibited (i) a distinct seasonal effect with a slope of 7.6 (ii) the observed mean altitude effect was – 0.32 $^{0}/_{oo}$ in case of $\delta^{18}O$ and – 2.5 $^{0}/_{oo}$ in case of δD (iii) secondary evaporation of rainfall increases the oxygen isotope ratios and directly proportional to the vertical distance traveled by raindrops through air. A multiple regression model is developed with monthly mean values of temperature, relative humidity and rainfall as independent variables and monthly $\delta^{18}O$ of rainfall as dependent variable. The Nainital lake and surrounding springs isotopic results are compared with the rainfall.