Delineation of Recharge Areas of Karst Springs of a Mountainous Catchment Using $\delta^{18}O$; a Case Study of Bringi Watershed, Kashmir Himalaya, India

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Water samples collected from precipitation, stream water and springs were analyzed for $\delta^{18}O$ to delineate the recharge areas of karst springs of Bringi watershed, Kashmir Himalayas. The data generated indicated a strong spatial and seasonal (Bimonthly) variation in $\delta^{18}O$ values of water samples. The spatial and temporal variability of $\delta^{18}O$ of precipitation was dominantly controlled by temperature, altitude and amount effects. The stream waters were more depleted than low level precipitation due to their headwaters at higher altitudes. The melting and fractionation of snow pack releases more depleted waters to streams during spring and enriched waters in late summer and autumn. Springs were isotopically depleted both spatially and temporally as compared to that of precipitation. The recharge altitude estimated by using bimonthly $\delta^{18}O$ trend of precipitation gave an uncertain range of altitudes. Thus, precipitation may not be the dominant mechanism for groundwater recharge. The closeness of the $\delta^{18}O$ composition of groundwater and stream water indicates that the catchment stream was the major contributor of groundwater recharge. The recharge areas of the springs were best obtained by plotting $\delta^{18}O$ of the stream against the corresponding altitude and were calculated to be 1995m, 2234m and 32716 m amsl for Achabalnag, Kokernag and Kongamnag respectively. The recharge areas of the karst springs need to be conserved as the springs are more vulnerable to anthropogenic contamination.

Key words: Recharge, springs, Karst, Himalaya