

Chemical Composition of Rainwater in the North Western Himalayan Mountain Region of India

Suresh Tiwari¹ and Deewan Singh²

¹*Indian Institute of Tropical Meteorology, Pune, New Delhi Branch*

²*Prof. Ram Nath Vij Marg, R-Block, New Rajinder Nagar, New Delhi-60, India*

Precipitation chemistry in the western Himalayas (India) is discussed on wet sample data collected during June to October in 2006 and 2007. The volume weighted pH ranged from 5.16 to 6.36, indicating alkalinity of precipitation with mean pH of 5.68 ± 0.26 . The observed acidic precipitation events, based on pH values, were only 18% but the alkaline to acid ions ratio is 1.05, suggesting the effective neutralization of acidic components of rainwater by alkaline components. The sum of average ionic composition was $\sim 159 \mu\text{eqL}^{-1}$. Dominant cations in rainwater samples was Ca^{2+} (19%) followed by Na^{+} (14%). Cl^{-} was maximum among the anions (17%) followed by SO_4^{2-} (16%). The ratio of $[(\text{NO}_3^{-} + \text{Cl}^{-}) / \text{SO}_4^{2-}]$ was 1.03, indicating that acidic nature was a result of HNO_3 and HCl . The ratios $\text{NH}_4^{+} / \text{NO}_3^{-}$ and $\text{NH}_4^{+} / \text{SO}_4^{2-}$ were 0.79 and 0.53, pointing to the dominance of atmospheric NH_4NO_3 and $(\text{NH}_4)_2\text{SO}_4$. Significant correlation was observed between SO_4^{2-} and NO_3^{-} ($r=0.60$; $P<0.0001$), indicating their origin from similar sources. Observed equivalent ratios of acidic species ($\text{SO}_4^{2-} + \text{NO}_3^{-}$) to neutralizing agents ($\text{Ca}^{2+} + \text{NH}_4^{+}$) were found to be less than unity, confirming that the acidic species are always counterbalanced by neutralizing agents. The correlation matrix and principal component analysis were applied to identify factors influencing the ionic strength in rainwater.