

Dissolved inorganic carbon and sulfur isotopic compositions in the Alakananda-Bhagirathi rivers in Himalayas

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Dissolved inorganic carbon isotopes and sulfur isotopes were analysed for the present study in samples collected from Alakananda-Bhagirathi rivers in Himalayas in India. Dissolved Inorganic Carbon (DIC) is a major component of river waters and is derived from rock weathering, atmospheric input and biological activities. To distinguish the sources of HCO_3^- in river waters is essential to estimate the amounts of CO_2 consumed from atmosphere during rock weathering and to understand the biogeochemical cycling of carbon. One of the more reliable methods adopted to understand the different sources of DIC in rivers, is the measurements of carbon isotopes in DIC, since the fractionation factors between the different carbonate species in dissolved river water and gaseous CO_2 are well established. In the present study, we observe that river water samples show highly depleted $\delta^{13}\text{C}_{\text{DIC}}$ which, indicate the importance of carbonate rock weathering and bacterial respiration as the major processes for the dissolved inorganic carbon. The river waters also show appreciable change in dissolved sulfate concentrations. Similar to the variations in total dissolved sulfate, sulfur isotopic ratios ($^{34}\text{S}/^{32}\text{S}$) also show variations indicating to the different sources for dissolved sulfate. In general, the samples in the present study show slightly higher positive enrichments of $\delta^{34}\text{S}$ (mostly around $5\pm 1\%$) for dissolved sulfate concentrations below $200\ \mu\text{mol l}^{-1}$ whereas, samples having dissolved sulfate concentrations above $>200\ \mu\text{mol l}^{-1}$ have slightly lower $\delta^{34}\text{S}$ enrichments (mostly around $2\pm 1\%$). This shows that the lower $\delta^{34}\text{S}$ values were obtained in samples where dissolved SO_4^{2-} originated from oxidation of sedimentary sulfides and the higher $\delta^{34}\text{S}$ values originated from dissolution of gypsum.