

Multi-isotopic approach to evaluate effects of transboundary air pollution on forest ecosystems of central Japan

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Japanese Islands have been influenced by transboundary air pollution from the Asian Continent. In particular, the central Japan is known as the area in which high deposition amounts of acid substances have been reported. Both northwesterly seasonal winds in winter and high precipitation amounts contribute to the high deposition in the area. To evaluate transboundary air pollution on forest ecosystems in central Japan, we applied multi-isotopic analyses to rainwater, soil solution, and river water in two forest catchments, namely Kajikawa (KJK) and Ijira (IJR) in the Sea of Japan side and Pacific side, respectively. In this presentation, we mainly introduce results of S isotopic ratio and H and O isotopic ratios of H₂O in the environmental waters, while other isotopic analyses, including Pb, Sr, and NO₃⁻, have been applied to the same samples. The peak SO₄²⁻ deposition amounts were observed in winter and summer at KJK and IJR, respectively. It has been suggested that IJR in the Pacific side was strongly influenced by domestic emissions in Chukyo Industrial Area near Nagoya, while KJK in the Sea of Japan side was influenced by transboundary air pollution. However, according to the multi-isotopic analyses, a slight different view was suggested. The $\delta^{34}\text{S}$ values of SO₄²⁻ in rainwater increased in winter at both KJK and IJR, suggesting that S sources in winter were different from those in summer. It has been well known that sea salts (+20.3‰) and Chinese coals (mean, +6.6‰) contributed higher $\delta^{34}\text{S}$ values in winter in the Sea of Japan side, while oils imported from the Middle Eastern countries mainly used in Japan have lower isotopic values (mean, -2.7‰). Moreover, d-excess values ($\delta^2\text{H} - 8 \times \delta^{18}\text{O}$) in rainwater increased in winter also at both KJK and IJR, suggesting that winter precipitations at both sites were derived from water vapor of the Sea of Japan. Seasonal changes of these isotopic values suggested that not only KJK but also IJR was certainly influenced by transboundary air pollution due to northwesterly winds in winter. We are going to present results of soil solution and river water, too.

Keywords: Sulfur, Hydrological process, Buffering mechanism, Recovery from acidification