Multi-isotopic approach for monitoring on atmospheric deposition in forests in Japan

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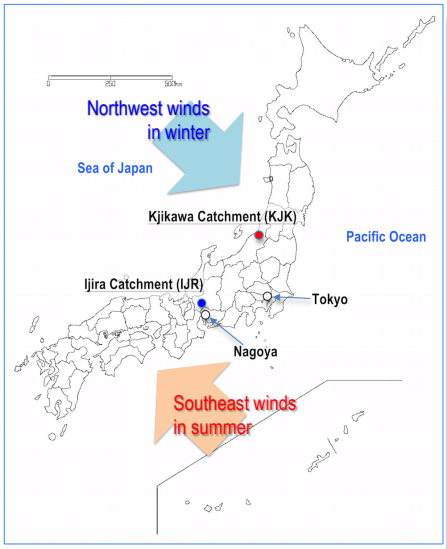
Background and objectives

- Elemental/ionic analyses have been carried out mainly to monitor the atmospheric deposition and its effects on forest ecosystems.
- To obtain traceable information on elemental flow in forest ecosystems, we applied multi-isotopic analyses to the existing samples collected for the Long-term Monitoring Program on Transboundary Air Pollution and Acid Deposition by the Ministry of the Environment of Japan.

Concluding remarks

- Asian monsoon climate, such as northwest seasonal winds in winter, contribute to changes of emission sources for atmospheric deposition in the forests of Japan.
- Multi-isotopic data will be a powerful tool to identify possible sources of air pollutants deposited on forest ecosystems in Asia.
- Biogeochemical processes can be discussed more precisely with the multi-isotopic information.



- Water samples (rainwater (RF), soil solutions (SS), and stream water(SW/RW)) were collected in two forest catchments.
- The similar trials are applied to other existing monitoring samples, too (such as lake water, rainwater in high mountains, etc.).

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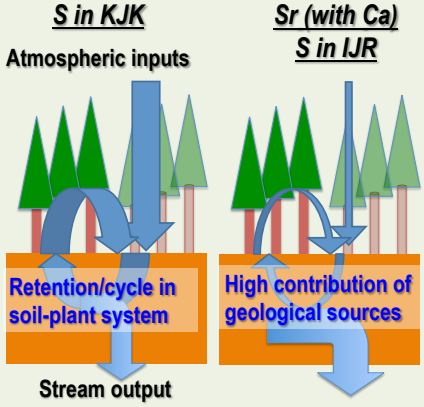
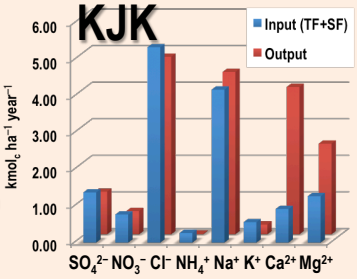
Suggested flows of the elements

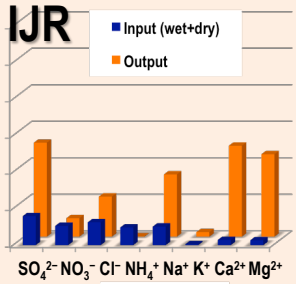


Results

Material budget

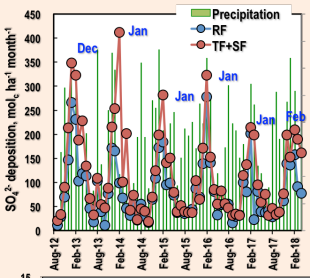
- SO_4^{2-} output exceeded the input at IJR.
- Ca^{2+} and Mg^{2+} outputs exceeded the inputs at both sites.

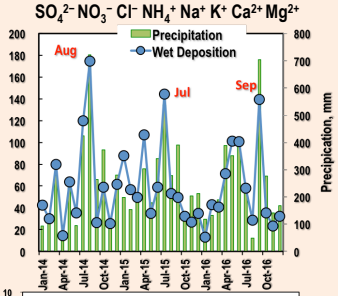




SO_4^{2-} deposition

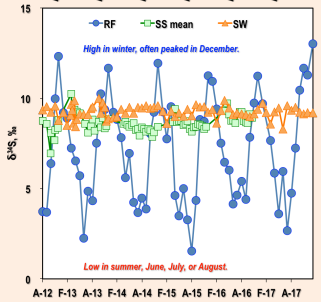
- High in winter at KJK, suggesting effects of seasonal winds.
- High in summer at IJR due to effects of the Chukyo Industrial Area including Nagoya.

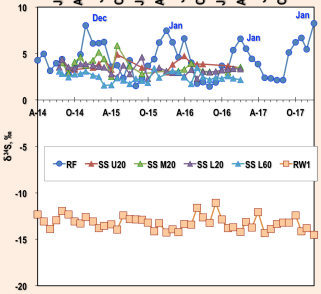




S isotopic ratio ($\delta^{34}S$)

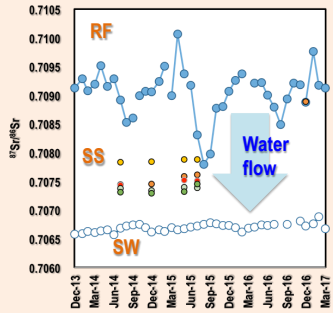
- High in winter in RF at both sites, suggesting effects of transboundary air pollutants.
- S is once retained in soil-plant system, and then released at KJR.
- S in RW at IJR has another source than atmospheric S, which is the cause of the budget discrepancy.

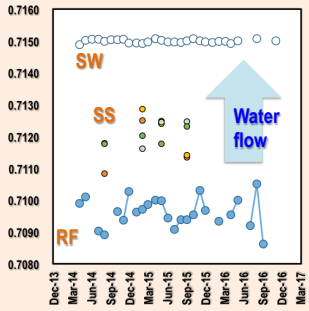




Sr isotopic ratio ($^{87}Sr/^{86}Sr$)

- Slightly higher in RF in spring, suggesting effects of Asian dust (soluble dust component, 0.711).
- SW is strongly regulated by rock weathering. Geology is quite different between the sites.





The deuterium excess (d-excess) value ($\delta^2H - 8 \times \delta^{18}O$) of the H_2O

- High values in winter indicate effects of water vapor from Sea of Japan, suggesting transport of air mass from the Asian Continent to the both sites.
- The water is well homogenized within the catchments, and then flowed into the stream/river.
- The hydrological process may also contribute to the stability of $\delta^{34}S$ values in the stream at KJK.