

Spatiotemporal variations of K-40 in atmospheric fallout caused by volcanic eruptions: A case study for Kyushu Island, Japan

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In the previous study, we evaluated the atmospheric impact of the eruptive activity of Sakurajima volcano, one of Japan's most active volcanoes located in southern Kyushu Island, on the atmospheric environment of Kagoshima City next to the volcano (around 10 km west), based on the amount of K-40 in atmospheric fallout measured in environmental radiation monitoring [1]. In Kagoshima City, there is a good correlation between volcanic ash fallout caused by Sakurajima volcano eruptions and K-40 fallout in atmospheric fallout, demonstrating that K-40 is an effective tracer for understanding the dynamics of erupted volcanic ash in the air.

In this study, we focused on atmospheric fallout monitoring data from various locations in Kyushu Island, where many active volcanoes, including Sakurajima Volcano, are concentrated, and evaluated and verified the relationship between K-40 fallout levels and volcanic activity of active volcanoes in the region (Fig. 1). The monitoring data were referred to the Environmental Radiation Database [2] in the same way as the previous study.

In Miyazaki City, located approximately 80 km east-northeast of Sakurajima Volcano, K-40 fallout tends to increase during active periods of Sakurajima Volcano, indicating that the volcanic ash from Sakurajima Volcano affects the atmospheric environment at Miyazaki City. Additionally, abnormally high K-40 fallout was observed in February and April 2011, which could be attributed to the large eruption of Shinmoedake volcano, located approximately 50 km west of Miyazaki City.

Furthermore, abnormal K-40 fallout amounts were confirmed at various locations, likely related to significant Aso volcano and Unzen volcano eruptions. At observation points east of erupted volcanoes, an increase in K-40 amount in atmospheric fallout could be attributed to incoming volcanic ash.

The K-40 fallout in atmospheric fallout measured through environmental radiation monitoring can serve as supplementary data for evaluating the ashfall area and deposition amount of volcanic ash and thus constitute valuable information for assessing the scale and ashfall-related environmental impacts of explosive volcanic eruptions.

[1] Kikawada and Hirose (2024) *J. Environ. Radioactiv.*, **278**, 107471.

[2] Nuclear Regulation Authority,
“Environmental Radioactivity and Radiation in Japan”
<https://www.kankyo-hoshano.go.jp/data/database/>



Fig. 1 Map of Kyushu Island.

The location of active volcanoes and monitoring points for environmental radiation monitoring are shown with closed triangles and closed circles, respectively.