**Modeling Rainfall-Induced Soil Moisture Effects on Ambient Dose Rates in Fukushima Forests**

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The Fukushima Daiichi Nuclear Power Plant accident, triggered by the Great East Japan Earthquake in March 2011, caused widespread contamination of forested areas with radioactive materials. Among the released radionuclides, cesium-137 (Cs-137), with its long half-life, has remained a primary contributor to elevated ambient dose rates in forests over the long term. Recent studies (e.g., Nakanishi et al., 2023) have shown that rainfall increases soil moisture, which attenuates gamma rays emitted from Cs-137 in the soil, leading to a temporary decrease in dose rates. This variation poses challenges in accurately analyzing long-term trends in ambient radiation levels.

The objective of this study is to model the effect of rainfall-induced soil moisture fluctuations on ambient dose rates in forests and to clarify the mechanisms behind these changes. Continuous monitoring of meteorological parameters, soil moisture, and ambient dose rates has been conducted since April 2024 at two sites—Iitoi and Fuyuzumi—located approximately 40 km northwest of the Fukushima Daiichi NPP. These sites were selected for their contrasting forest structures due to thinning treatments, providing an opportunity to evaluate the impact of forest density on rainfall infiltration and soil water dynamics.

Results showed that, following rainfall, soil moisture in the thinned plots increased from 33.1% to 35.0%, and ambient dose rates decreased significantly from 0.90 μSv/h to 0.75 μSv/h. In contrast, the control plots exhibited a decrease in soil moisture from 28.6% to 25.5%, with dose rates remaining around 0.85 μSv/h. These findings indicate that forest density affects both rainfall interception and soil evaporation, which in turn influence temporal variations in ambient dose rates.

Additionally, a simplified version of the model was applied to data from ten other monitoring sites with periodic observations. This enabled the estimation of long-term trends in ambient dose rates after correcting for the effects of rainfall. The outcomes of this study provide a valuable tool for assessing long-term radiation exposure due to Cs-137 and offer critical insights for future forest management and resident return policies.

**Reference**

Nakanishi, M., Onda, Y., Takahashi, J., Kato, H., Iida, H., Takada, M. (2023) Changes in air dose rates due to soil moisture content in the Fukushima prefecture forests, *Environmental Pollution*, 334, 122147,DOI:10.1016/j.envpol.2023.122147