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Characteristics of the distribution of radioactive materials in Abukuma Mountains, Fukushima Prefecture

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INTRODUCTION

Accident of Fukushima-daiichi Nuclear Plant leads to loss of living life in Fukushima and surrounding regions. Science and Technology are imposed of a responsibility to solve the problem. Maps of radioactive materials are produced for extensive area around Fukushima area. The region have an individuality even it is small. To understand behavior of radioactive materials in the environment for coming decades, the monitoring focused on each region based on the understandings of the characteristics of land is necessary.

The radioactivity, dose rate and their spatial distribution in the Yamakiya district in Kawamata Town, Fukushima Prefecture, where is assigned to be the planned evacuation district, are measured to understand the heterogeneous distribution of radioactive materials. Simplified methods are attempted to get the results quickly with wide-area coverage.

METHODS

1) Dose rate survey by vehicle and by walking

GEORADIS RT-30 (gamma-ray spectrometer) is used to survey dose rate. Synchronized GPS is used to get location with dose rate. Calibration curve is created to convert dose rate inside of a car to one at 1 meter height outside of a car. In walking survey, RT-30 is fitted in the rucksack at 1 meter height and walk about small region.

2) Surface contamination density

NHJ2 by Fuji Electric Co., is used to measure surface contamination density (Bq/cm2). The measured values are compared to the result of measurement by HPGe detector, and confirm the performance of the method.

3) Radioactivity of the soil

HPGe detector provides very accurate result, however, it takes time for measurement. A cork borer is used to get and fill soil sample of 5cm depth to RIA tube, and gamma counter (Aloka ARC-500 and ARC-370M) are used to measure radioactivity for a large amount of soil samples

CHARACTERISTICS OF DOSE RATE AND RADIOACTIVITY

1) Dose rate survey in a scale of Abukuma Mountains

Dose rate survey by automobile were carried out on July and August, 2011, around Iitate and Kawamata districts. Not only main roads but also forestry road were driven to get details of the distribution of dose rate. A figure is attached to show the spatial distribution of dose rate. The figure shows characteristic distribution that may shows the migration of plume and heterogeneous disposition of radioactive materials.

2) Dose rate survey in a scale of small watershed

Walking survey with Gamma-ray spectrometer linked to GPS are carried out in small watersheds in Yamakiya district. The map of dose rate shows heterogeneous distribution patterns that may reflect soil particle size, effect of small topography, and redistribution of radioactive materials.

3) Characteristics of surface contamination density, deposition amount in different land cover

Radioactivity is measured at the ground of coniferous forest (Japanese cedar, red pine), broad-leaved deciduous forest, paddy field, and crop land. Radioactivity at the 0 to 10 cm depth is high at paddy field than cropland. Radioactivity at the litter layer is high in deciduous broad-leaved forest than coniferous forest. Radioactivity at soil layer in 0 to 5 cm depth is high in cedar forest. Multi-site measurements are planned to verify the results.

4) Radioactivity of domestic water

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Shallow groundwater is the main source of domestic water in Yamakiya district. Water from 13 wells are sampled and measured for radioactive materials. As a result, no samples show radioactive cesium over detection limit (<1Bq/L).

FINAL REMARKS

Spatial distributions of dose rate and radioactivity are measured for large and small spatial scales. Several simple methods are introduced and confirms the feasibility. At the JpGU meeting, we will present the monitoring results with comprehensive diagrams.

Keywords: accident of Fukushima Daiichi Nuclear Power Plant, Yamakiya district, Kawamata-machi, Fukushima Prefecture, dose rate mapping, radioactivity mapping, ununiformity