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MAG38-P01 Room:Convention Hall Time:May 26 18:15-19:30

Revisiting research on the vertical transport of radioactive nuclide from Fukushima Nuclear Accident

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We observed spectrum of gamma rays at the summit of Mt. Fuji by means of germanium (Ge) detector (Micro-Trans-SPEC, ORTEC Ltd. Co.) from July to August of 2014. The detector was installed on the second floor of the first building of Mt. Fuji Weather Station. The second floor is made of the plywood covered with a vinyl and carpet over the H-steel. The roof and wall are made of the H-steel covered with the plywood. The weight of the detector equipped with data logging and battery is 6.8 kg. The Ge crystal which is cylindrical with a length of 40 mm and a diameter of 50 mm is electrically cooled. The detection efficiency is 13 %. Measurable energy of gamma rays ranges from 0 to 3 MeV for 8192 channels. Fig. 10 shows energy spectrum from 0 to 3 MeV versus the number of accumulated counts for one month. All of line spectrum in Figure 1 originated from natural radionuclide, while a continuous spectrum, namely a background, originated from cosmic rays and Compton scattering of measured gamma rays. Fig. 11 shows total counts from July to August of 2014, just one month, and total counts for one day on August 1, 2014. The counts of Cs134 with 605 keV are below the background for one day data, while the counts of the Cs134 are extremely slightly beyond the background for one month data. Magnified spectrum from 600 to 800 keV is shown in Fig. 12. A half-life and main photon energies of Cs137 and Cs134 are 30.2 and 2.06 years and 662 and 605 keV (Emission rate: 85.1 and 97.6 %), respectively. In this study, we investigate these line spectra to identify Cs137 and Cs134. The counts of Cs134 with 605 keV is almost equal to those of the background, whereas line spectra of Cs137 with 662 keV are clearly found. From the spectrum analysis by means of MAESTRO-32, the net counts of Cs137 and Cs134 are 20425 ± 443 and 434 ± 457, respectively. Therefore, extremely small amount of Cs134 originating from Fukushima Nuclear Accident was transported into the summit of Mt. Fuji. On the other hand, the most of Cs137 originates from nuclear tests in the 1950s to 1960s, because the ratio of Cs134 to Cs137 60 years later is 3.0×10^{-9} : 1, assuming all counts of Cs137 spectra originates from nuclear tests.

Keywords: Fukushima Daiichi nuclear disaster, Radioactive material, Germanium detector

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MAG38-P02 Room:Convention Hall Time:May 26 18:15-19:30

Modeling of downward percolation and prediction of concentration of the radionuclide in soil by ADE

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By the accident at the Fukushima First Nuclear Power Plant on March 11, 2011, the damage that surrounding environment was polluted by radioactive materials occurred. Cs-137 stuck in a ground surface soaks into soil and percolates downward. The underground migration of the radionuclide keeps being studied. The advection diffusion equation (ADE) is proposed as one of the models of downward percolation of the radionuclide in soil by Walling and He. This model has been used most, because it is simpler than other ones. However, There is also the report that we cannot express migration in porous medium such as soil by ADE. This is caused by the fact that differences in soil properties of each land have an influence on the downward percolation of the radionuclide. However, it takes considerable amounts of labor to propose the model included all complicated processes of such various environmental factors. In this study, by having a viewpoint different from such a model, we propose a more versatile model by improving the ADE model that used most.

For this ADE model, Robin boundary condition is used. Robin boundary condition is that the inflow and outflow of the radionuclide on a boundary surface does not happen. So, it is the downward percolation model while keeping the total volume of the concentration fixedly. However, it is difficult to think that the inflow and outflow in a ground surface do not happen at all. So in this study, by aiming at Robin boundary condition, we improve the ADE model. We derive the analysis solution when we use ADE as governing equation and Robin boundary condition that was generalized as condition at a boundary surface. From this, we propose the new ADE model including the case that the inflow and outflow happen in a ground surface. Here, we compare our model with the data of concentration of Cs-137 in Fukushima soil to inspect the validity of this new model. Then, we get the result that our model follow the date well.

Keywords: Advection Diffusion Equation, Downward percolation in soil, The accident at the Fukushima First Nuclear Power Plant, Radioactive Cesium

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MAG38-P03 Room:Convention Hall Time:May 26 18:15-19:30

Correlation-research about fluctuations of the air dose rate and weather conditions

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Pacific Ocean off the coast earthquake of magnitude 9.0 occurred on March 11, 2011. Fukushima Daiichi Nuclear Power Station has meltdown By the earthquake and tsunami, and Surrounding environment is contaminated with radioactive materials. International Nuclear Event Scale of the Fukushima Daiichi Nuclear Power Station accident is the level 7 (serious accident). Accident of the same level is the second case since the Chernobyl nuclear power plant accident that occurred in Ukraine on April 26, 1986. The Cs-134 and Cs-137 are radioactive material released by accident increased significantly the spatial dose rate that indicates the radiation dose per unit time space, a lot of the people who lived around the Fukushima Daiichi nuclear power station were no longer able to live in the place. There is a lot of land where decontamination work has not started yet in an area around the Fukushima Daiichi nuclear power station.

Released radioactive materials take atmospheric condition turbulent flow, do advection and stick to a ground level in the atmosphere. After depositing in a ground level, radioactive materials are floating by atmospheric condition turbulent flow and deposit again to other places. Radioactive materials repeat such process. The weather condition influences such process deeply. The model of the prediction which indicates attenuation of the new spatial dose rate which considered its weather condition is needed.

In this study, we refer to the correlation that the weather conditions and fluctuation of the air dose rate which is considered the radioactive decay.

To determine the correlation coefficients between the fluctuations of the air dose rate and various weather conditions in considering the periodicity obtained by the spectral analysis. As a result, it became clear that there is a strong negative correlation between the fluctuation of the air dose rate and the soil water. This result may be the trigger which makes new methods that can estimate exposure risk.

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MAG38-P04 Room:Convention Hall Time:May 26 18:15-19:30

Development of the radio-aerosol generation system using spray drying method

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A large amount of radioactivity was discharged in the FDNPP accident. The radionuclide was transported through the atmosphere in a gas and aerosol forms and deposited to the grand and vegetation. The aerosol consisting radionuclides deposited to the vegetation mainly in dry deposition mechanism. After the deposition, the foliar uptake could happen and the radionuclide likes cesium would be absorbed into the vegetation. The foliar uptake process has higher absorption speed than the root uptake process. The radiocesium deposition through the foliar uptake has great influence when we evaluate the amount of radioactivity deposition to the environment.

There are some preceding studies for radionuclide foliar uptake with attaching stable element solution on the leave. Changing the vegetation species, time of cleansing after the deposition and chemical constitution of solution, the foliar uptake process has understood gradually. However, these experiments using solution wouldn't reprise the dry deposition process. Madoz-Escande et al. generated cesium oxidation aerosols and studied the foliar deposition process [1]. In the FDNPP, radiocesium was transported in sulfate aerosl form [2], so the data of oxidation aerosols is not suit for evaluation the deposition in this accident. For evaluation of deposition amount of radiocesium to vegetation, an experiment system simulated the accident condition is demand

The aim of our research is observing the behavior of dry deposition and foliar uptake of radiocesium in sulfate aerosols. We need to generate radio-aerosol artificially in a controllable environment and attach aerosols on the leaf directly. A radio-aerosol generation system was developed using spray drying method. Solution contained radiocesium was send to a nozzle by a syringe pump and spraying by a high speed air flow. The spray was generated in a relatively high temperature chamber and micro-droplet was drying quickly. The micro size solid aerosols consisting radiocesium were generated. In our poster, we explain the chamber condition, the shape of spray, aerosol physical property and yield.

[1]C.Madoz-Escande, et al., Journal of Environmental Radioactivity, 73 pp49-71, (2004)

[2] N. Kaneyasu, et al.,Environmental Science & Technology, 2012, 46 (11), pp 5720?5726

Keywords: radio-aerosol, cesium, foliar uptake, spray drying method

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Atmospheric Radio-Sr and -Cs Depositions at Mt. Haruna

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The authors have collected atmospheric deposition samples at an isolated mountain located at the northwestern corner of the Kanto plain and measured ^{90}Sr and the radio-Cs. This observation was started as a comparison with the similar deposition observation in Tsukuba situated on the ground surface. The chosen site is therefore located as high altitude as in the free troposphere, in which the aeoliain dust is transported and it would be one of the main constituents of the deposition sample. Nevertheless, the data obtained there could be served unintentionally for the investigation of the pollution of the atmospheric environment by the Fukushima Daiichi Nuclear Power Plant (FDNPP) accident.

At Mt. Haruna (Takasaki, Gunma, 36?28'N, 138?52'E, 1,370m above sea level), monthly ^{90}Sr and ^{137}Cs deposition observations have been performed. The observation started at the end of 2006. Precipitation samples were filtered by a sieve of 2 mm mesh and 100 μm mesh to remove fallen leaves, wooden piece, large particles in size, etc. and processed to concentrate the whole sample. The desiccated sample was subjected to γ-spectrometry with a Ge detector to measure radio-Cs. Sr-90 was then measured by 2 π gas-flow β-counter after that strontium carbonate was radiochemically separated and radio-equilibrium was attained. Each analytical process was quality-controlled by using the reference fallout sample that was prepared by the Meteorological Research Institute.

Monthly ^{137}Cs deposition in March, 2011 was 14$\pm$0.5 kBq/m^2 which is 5 to 6 orders of magnitude higher than the level before the FDNPP disaster. However, this amount was approximately 60% of that observed at the MRI, Tsukuba. The cumulative ^{137}Cs deposition at Mt. Haruna was 18.8 kBq/m^2 for the year 2011, which was also approximately 70% of that in Tsukuba. Almost the same amount of ^{134}Cs was simultaneously deposited with ^{137}Cs. Thus, the total cesium deposition at Mt. Haruna reached about 40 kBq/m^2. It was revealed that the current observation site had a relatively lighter pollution than those found in Tsukuba. Although Mt. Haruna was found within the so-called hotspot region distributed over northern Gunma, and heavier radio-Cs pollution (60-100 kBq/m^2-level) was observed around Lake Haruna by the airborne observation mapping conducted by the MEXT. The current observation site might avoid pollution of wet deposition because of higher altitude than cloud layer height. On the other hand, monthly ^{90}Sr deposition in March, 2011 was as small as 3.11$\pm$0.03 Bq/m^2, which was about 1/4500 of the deposited ^{137}Cs amount. This ^{90}Sr deposition was also approximately 60% of the value in Tsukuba. Deposition observations at Mt. Haruna confirmed that the pollution impacts of ^{90}Sr are relatively minor compared with radio-Cs over the Kanto district.

Keywords: the Fukushima Daiichi Nuclear Power Plant accident, Radioactive deposition, Strontium, Cesium, Resuspension

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Sedimentation processes of radioactive Cs contaminated soil in storage reservoirs in Iwaki, Fukushima prefecture

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The Great East Japan Earthquake (M 9.0) and subsequent tsunami, which occurred along the eastern coast of Japan on March 11, 2011, caused the accident in Fukushima Daiichi nuclear power plant. As a result, large amount of radionuclides were released from the nuclear power plant and caused radioactive contamination in forest, soil and reservoir. It is recognized that the cause of the contamination is mainly due to the radioactive cesium (Cs), because of the relatively long half-lives and the released amounts

The attenuation of the actual radiation dose in the evacuation-directed zones in Fukushima prefecture has been greater than that predicted form physical half-lives of ^{134}Cs and ^{137}Cs (Nuclear Regulation Authority, Japan (NRA), 2013). The radiation dose in Fukushima is related to the abundance of radioactive Cs accumulation per unit area (radioactive Cs inventory). Therefore, the attenuation of the radioactive dose were most likely attributable to (1) desorption of radioactive Cs from soils to natural water and the subsequent diffusion and/or (2) erosion and transport of the contaminated soils to downstream. The distribution coefficients (Kd) determined from 137Cs concentrations of suspended particles and the solutions in some rivers in the affected area has been reported to be 105-106 (mL/g), which indicates that radioactive Cs was hardly desorbed to the solution (Sakaguchi et al. 2015; Nagao et al. 2013). Consequently, the former scenario is more plausible to explain the monitoring results.

It has been documented that the transports of the soil particles with radioactive Cs were accompanied with the natural water current. Then, it is expected that radioactive Cs tend to accumulate in the places where the retentions of water current occur. In terrestrial environment, one of such places is strange reservoir. Aoi et al. (2014) suggested that radioactive Cs in the catchment area had been eroded and continuously deposited in the storage reservoir. Their study suggested that the reservoirs possibly play role of a sink for radioactive Cs.

Fukushima Prefecture Government (2013) investigated the 134+137Cs concentrations of the bottom sediment of 1640 reservoir in Fukushima Prefecture. The results 134+137Cs concentrations was weakly correlated with the air dose rate. On the other hand, even the space dose rate is the same in each district, the cesium concentrations of sediment varied 3-4 orders, which indicates that the functions of the storage reservoir as sinks for are depending on not only ambient air doses but also the sedimentation processes in each catchment of the reservoir.

The continuous observations of the deposition of radioactive Cs into the reservoir is essential to understand the storage function of radioactive Cs in reservoirs for the future use of the storage reservoir and for the prediction of the migration of radioactive Cs in the local terrestrial environment. The aim of the study is characterize the sedimentation processes of contaminated soils contaminated by radioactive Cs by means the sediment traps in two reservoirs in Iwaki City, Fukushima prefecture.

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MAG38-P07 Room:Convention Hall Time:May 26 18:15-19:30

Behavior and migration of radiocesium in brackish water: A case study of the Matsukawa-ura lagoon, Fukushima, Japan

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Radionuclides were released into the environment associated with the Fukushima Daiichi Nuclear Power Plant (FDNPP) disaster. Radiocesium (Cs), released from FDNPP and deposited on the land, will migrate to the ocean through the surface runoff. In this study, we intended to determine the geochemical transport of Cs in the system of river - estuary - ocean in Matsukawa-ura Lagoon, northern Fukushima, Japan as a model area. Samples were collected in the study area from September 2013 till now. Sinking particle sampling was involved in the installation of sediment traps from November 26 to December 19, 2013. Surface sediment Cs-137 in the Matsukawa-ura showed apparent spatial and temporal variations, therefore, time series of the weighted average sediment Cs-137 was used in the following discussion. It was speculated that some natural purifying processes affected the sediment Cs in the Matsukawa-ura because the observed effective half-life of Cs-137 in the sediment was shorter than the theoretically physical half-life. Sinking particles were re-suspended in the Mastukawa-ura and transported to the ocean by tidal pumping because total sinking particle flux and particulate Cs-137 export flux in the mouth were larger than those in the inner lagoon. It is suggested that re-suspension in the lagoon and transport to the ocean of particles were important natural purifying processes for Cs in Matsukawa-ura. In water samples, particulate Cs-137 was significant relative to dissolved Cs-137 in the river; in contrast, dissolved Cs-137 was dominate in brackish water. So, it is found that the outflow of the dissolved phase is important in the material cycle of Cs because the dissolved abundance ratio increases in brackish water. The enrichment behavior of dissolved Cs-137 in the brackish water could be attributable to particle desorption. It is suggested seawater exchange with lagoon water desorbed Cs and outside seawater contribute a natural purifying effect in the Matsukawa-ura.

Keywords: Radiocesium, Blackish water

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Multiple synchrotron radiation X-ray analyses of radioactive microparticles emitted from the Fukushima Nuclear Accident

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The Fukushima Daiichi Nuclear Power Plant (FDNPP) accident occurred in 2011 is the largest nuclear incident since the 1986 Chernobyl disaster and has been rated at the maximum level of 7 on the International Nuclear Event Scale. Large amounts of radioactive materials were released into the environment during the accident. Although more than 4 years have passed since the accident, the radioactive materials emitted from the FDNPP have been detectable in the environment. However, little is known about the physical and chemical natures of radioactive materials released during the early stages of the accident. We previously found spherical aerosol microparticles ($\sim$2 μm, diameter) containing radioactive Cs in aerosol samples collected on March 14th and 15th, 2011, in Tsukuba[1)]. These radioactive microparticles have been commonly called “Cs-balls” . Synchrotron radiation (SR) X-ray microbeam analysis revealed the detailed chemical nature of the Cs-balls in a nondestructive manner, resulting in better understanding of what occurred in the plant during the early stages of the accident[2)]. SR-μ-X-ray fluorescence (XRF) analysis of the Cs-balls detected U as a nuclear fuel and various heavy elements derived from fission products (FPs) of the fuel. In addition, SR-μ-X-ray absorption near-edge structure (XANES) and SR-μ-X-ray diffraction (XRD) analysis revealed that the Cs-balls are glassy materials.

This study aims to demonstrate a hypothesis that water-insoluble radioactive materials similar to the Cs-ball had been extensively emitted to the environment from the FDNPP. We then focused on sediments in a swimming pool near FDNPP to find out radioactive microparticles. Total six spherical radioactive microparticles were separated from a sediment collected at an outdoor swimming pool located in Namie Town, Fukushima Prefecture, Japan. The SR experiments were carried out at BL37XU, a hard X-ray undulator beamline of SPring-8, Japan Synchrotron Radiation Research Institute (JASRI).

Gamma-ray spectra of the six particles detected both ^{134}Cs and ^{137}Cs in each particle with activity ratios of $\sim$1 (decay corrected as of March 2011). It is thus confirmed that these particles are radioactive ones derived from the FDNPP accident. SR-μ-XRF analysis of the particles detected the following 13 heavy elements: Mn, Fe, Zn, Rb, Zr, Mo, Ag, Sn, Sb, Te, Cs, Ba and Pb. In addition, U was detected in one of the particles, which was further confirmed by U L_3-edge XANES analysis. We conclude that the U fuel, FPs, and components of the reactors are very likely the sources of the elements identified within the six radioactive microparticles, although further investigation will be needed to confirm their sources. We assume that, because these elements could have originated from multiple sources, they were melted together during the accident and eventually formed spherical microparticles. SR-μ-XANES spectra of Fe, Zn, Mo, and Sn K-edges for the individual particles revealed that they were present at high oxidation states, i.e., Fe^{3+}, Zn^{2+}, Mo^{6+}, and Sn^{4+} in the glass matrix, confirmed by SR-μ-X-ray diffraction analysis. These chemical natures of the six radioactive microparticles separated from the sediment collected in Fukushima Prefecture are in good agreement with those of the Cs-ball, the radioactive aerosol particle collected in Tsukuba after the FDNPP accident, revealed in our previous investigation[2)]. This study thus suggested a high possibility that water-insoluble glassy radioactive microparticles containing U fuel and FPs were emitted from the FDNPP and fell to a widespread area over the East Japan. In addition, we concluded that these radioactive microparticles in the glassy state may remain in the environment longer than those emitted as water-soluble aerosol particles containing the radioactive Cs.

1) K. Adachi et al.: *Scientific Reports* **3**, 2554 (2013)
2) Y. Abe et al.: *Analytical Chemistry* **87**, 8521-8525 (2014).

Keywords: Fukushima Daiichi Nuclear Power Plant accident, Radioactive material, Synchrotron radiation X-ray analysis, aerosol

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Altitude dependent radioactive contamination in the mountain area of Tochigi and Fukushima prefectures

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Introduction

During the accident of Fukushima Dai-ichi Power Plant (FDNPP), the discharged radionuclides into the air were transported to the wide area of Eastern Japan and contaminated land and marine environments. For the plain areas where most population resides, the horizontal distribution contamination has been surveyed intensely. On the other hand, in the mountain areas where less populated, the studies were limited. Airborne surveys conducted by the Ministry of Education, Culture, Sports, Science, and Technology, have mapped the contaminated are in Eastern Japan widely, but the obtained horizontal resolution is relatively low, i.e., the horizontally averaged value from a diameter ranging between 300 and 1,500 m underneath the aircraft.

We measured the altitude and horizontal distribution of ambient gamma dose-rate (GDR) in mountain areas of Tochigi and Fukushima prefectures on foot by use of a portable gamma ray detector carried along. With the results, the contamination patterns are categorized and the possible mechanisms that formed them are proposed.

Results and Discussion

Instrumentation used in the survey is described in Kaneyasu and Hososhima (2015). According to the altitudinal distribution of ambient GDR and the location where the contamination is intense, we classified the contamination pattern into four categories.

[Type A] In Nikko-Kirifuri mountainous area, ambient GDR distributions have same altitudinal pattern showing the maxima around 900-1400 m (ASL). In particular, sharp peaks were observed at approx. 1,040-1,080 m ASL at Mt. Nakimushi-yama, Kirifuri Highland, Mt. Gassan, and Mt. Bizen-tateyama. This area is about 20km in width and located approx. 120 km north of the central part of Tokyo and 160 km southwest of FDNPP. The variance of GDR is large at the GDR peaks. A hypothesis on the formation mechanism is presented in the separate presentation in the oral session (Kaneyasu and Hososhima, 2015).

[Type B] In Aso-Maenikko mountain area, the altitudinal distribution pattern of GDR is vague and showed constant value with small variance.

[Type C] In Mt. Takahata-yama and Mt. Gonta-kurayama (located in the southern end of Oh-u mountain range), the contamination intensity was intermediate, and any particular altitudinal distribution pattern was not observed.

[Multiple types integrated and other formation mechanism] In Abukuma mountain range, which is located closer to the FDNPP, several patterns are identified. Sharp peaks in the altitudinal distribution of GDR exist in Mt. Kamakura-dake and Mt. Yomogida-dake (Type A). The mountain ridge between Mt. Kittoya-san Mt Futatsuya-san, significantly high GDR values were observed (similar to Type A). However, the south-southwest face of Mt. Futatsuya-san (the opposite side from the FDNPP), the GDR was smaller one order of magnitude than the ridge and had constant values with small variance (Type B). In the other mountains in Abukuma mountain range, the ridge of the mountains were often contaminated intensely. In some mountains, Type A contamination were observed with an additional contamination localized in the upper part of valleys.

Simple dichotomy paradigm of dry and wet deposition is not enough to explain the formation of these various types of distribution. We presume that Type A is caused by cloud/fog deposition (Kaneyasu and Hososhima), Type B is the result of dry deposition, and Type C is formed by wet deposition. In Abukuma mountain range, where is close to the FDNPP, the integration of Type A, B, and C may have occurred in many mountains due to the arrivals of several waves of radionuclides in the form of clouds, aerosol state (dry deposition), and precipitations, followed by the modification due to experiencing 'weathering effect'.

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Keywords: cloud/fog deposition, occult deposition, altitude dependent radioactive contamination, ambient gamma dose-rate

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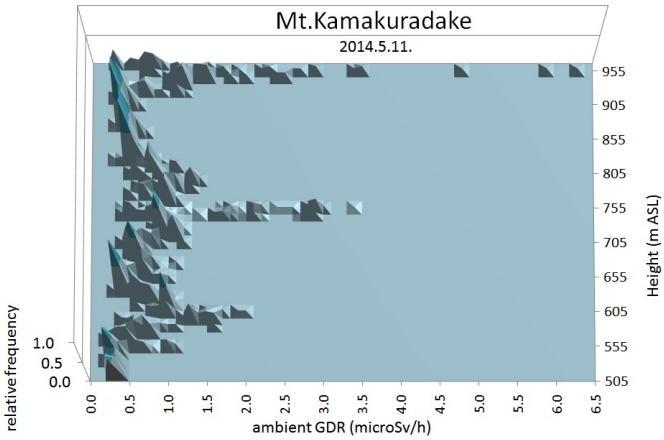

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The distributions and behavior of radiocaesium according to grain sizes in sediments after the FDNPS accident

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The Fukushima Dai-ichi Nuclear Power Station (FDNPS) accident in March 2011 led to releases of large amounts of artificial radionuclides including ^{134}Cs and ^{137}Cs (radiocaesium) into the environment (ocean, atmosphere and land). As of February 2015, based on TEPCO's monitoring data, ^{137}Cs activities in seawater had exponentially decreased more than 10 times compared to the activities before the FDNPS accident. However, the activities in sediments have decreased more slowly than those in seawater and they have had large fluctuations. Some controversy remains about the radiocaesium transition process from seawater to sediments and its behavior after accumulation. In soil and sediments, the radiocaesium activities for finer grain sizes tend to be higher because specific surface areas of smaller grains are larger (e.g. He and Walling, 1996). Therefore, it is necessary to consider the differences of grain size composition in sediments in order to compare distributions of lateral and vertical radiocaesium activities and inventories in coastal sediments, which are commonly of several grain sizes. This study was aimed at elucidating spatial variation and the behavior of radiocaesium activities and inventories for different grain sizes in sediments collected in the Fukushima coastal area in May 2014.

The sediments were divided into four classes based on grain sizes using several mesh sizes: granules (grain size larger than 2 mm); very coarse to coarse sand particles (1 to 2 mm); coarse to very fine sand particles (0.063 to 1 mm); and silt particles (smaller than 0.063 mm). Radionuclides were measured for each grain size class using high-purity gamma ray spectrometry and then corrected to the sampling date.

In collected sediments, the only artificial radionuclides detected were radiocaesium. In the surface layer of sediments (0-5 cm), the percentage ranges were: granules, 0 to 23 %; very coarse to coarse sand particles, 0 to 39 %; coarse to very fine sand particles, 38 to 98 %; and silt particles, 0 to 46 %. The^{137}Cs activities for coarse to very fine sand particles and silt particles ranged from 8.5 to 609 Bq kg^{-1}-dry and 18 to 1487 Bq kg^{-1}-dry, respectively and the latter particle activities were higher than those for the former particles in most layers. The ^{137}Cs inventories for coarse to very fine sand particles ranged from 972 to 3285 Bq m^{-2} and those in the water depth range of 100 to 150 m were highest. The ^{137}Cs inventories for silt particles ranged from 1387 to 31321 Bq m^{-2} and they decreased with increasing water depth.The fractions of ^{137}Cs inventories in the uppermost layer of sediments (0-3 cm) to those in the surface layer of sediment (F'$_{0-3}$) for coarse to very fine sand particles and silt particles were 0.33 to 0.88 and 0.24 to 0.77, respectively. The F'$_{0-3}$ values for silt particles were lower than those for coarse to very fine sand particles. It appeared that silt particles more easily adsorbed radiocaesium that had been transported to a deep sediment layer compared to coarse to very fine sand particles.

He, Q., and Walling, D., E. (1996) Journal of Environ. Radioact, 20 (2), 117-137.

Keywords: radiocaesium, Fukushima coastal area, marine sediment, grain size, FDNPS

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Evaluation of wide area inventory and migration rate of radioactive caesium based on USLE model

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The radioactive contaminations which flowed out from the Fukushima nuclear power plant first due to the Great East Japan Earthquake are still contained great amounts in the soil around the nuclear power plant, and it causes serious concern over the health of inhabitants. In this study, for the prediction of the migration dynamics of radioactive caesium deposited on the soil around the nuclear power plant, the time-spatial variation of deposition and washoff ratio of ^{137}Cs up to the present was calculated based on the soil erosion rate obtained from the USLE and the initial ^{137}Cs inventory obtained by the airborne monitoring. The parameters needed for calculation of USLE were determined from the observation results obtained from the study sites established in the Fukushima prefecture. The estimation results from the calculation were compared with the measurements of ^{137}Cs washoff ratio obtained from the rivers around the nuclear power plant. As the result, calculated ^{137}Cs washoff rate was approximately underestimate than the measured rate however was consistent qualitatively. And in the view of landuse, in the catchment of Abukuma river, the ratio of washoff from the paddy was large in the early period from the accident, however, as time goes on, the ratio of washoff from the paddy has decreased and the ratio of other landuses has increased.

Keywords: the Great East Japan Earthquake, Fukushima nuclear power plant accident, caesium 137, USLE, soil erosion, migration of radioactive contamination