Sun. May 26, 2019

[J] Poster | H (Human Geosciences)：H-GG Geography

5:15 PM - 6:30 PM JST | 8:15 AM - 9:30 AM UTC | Poster Hall International Exhibition Hall8, Makuhari Messe_15

[H-GG02] Use, change, management of natural resources and environment: Interdisciplinary perspectives

convener:Yoshinori OTSUKI(Institute of Geography, Graduate School of Science, Tohoku University), Gen Ueda(Graduate School of Social Sciences, Hitotsubashi University), Takahisa Furuichi(Graduate School of Science, Hokkaido University), Toru Sasaki(Miyagi University of Education)

[HGG02-P01] Preliminary magnetic biomonitoring results of the spatial distribution of atmospheric particulate matter in Muroran, Japan

*Hiroki Shibata[1], Kazuo Kawasaki[1] (1.University of Toyama)

[HGG02-P02] Social Foundations of Entomophagy and Its Transformation: A Case Study of Ina City, Nagano Prefecture

*Naoki Kobayashi[1] (1.National University Corporation Kanazawa University)

[HGG02-P03] Cost sharing and free water policy in semi-arid rural Kenya

*Gen Ueda[1] (1.Graduate School of Social Sciences, Hitotsubashi University)

[HGG02-P04] Importance of the stories as the background of nature understanding: an example in the Visayas, the Philippines

*Takashi Ito[1] (1.Faculty of Education, Ibaraki University)

[HGG02-P05] Hydrogeomorphological and environmental geographical land condition of groundwater use areas along the coast of Lake Victoria, west Kenya

*Yoshinori OTSUKI[1] (1.Institute of Geography, Graduate School of Science, Tohoku University)

[J] Poster | S (Solid Earth Sciences)：S-TT Technology & Techniques

5:15 PM - 6:30 PM JST | 8:15 AM - 9:30 AM UTC | Poster Hall International Exhibition Hall8, Makuhari Messe_33

[S-TT44] Airborne surveys and monitoring of the Earth

convener:Shigekazu Kusumoto(Graduate School of Science and Engineering for Research, University of Toyama), Takao Koyama(Earthquake Research Institute, University of Tokyo), Yuji Mitsuhata(AdvancedIndustrial Science and Technology), Shigeo Okuma(Geological Survey of Japan, National Institute of Advanced Industrial Science and Technology (AIST))

[STT44-P01] Development of an optical remote sensing technique for volcanic surface phenomena observation to estimate hyperspectral data from multispectral data

*Tetsuya Jitsufuchi[1] (1.National Research Institute for Earth Science and Disaster Resilience)

[STT44-P02] Geomagnetic total intensity change before and after the eruptions at Shinmoedake volcano in 2018 detected by aeromagnetic surveys

*Takao Koyama[1], Takayuki Kaneko[1], Takao Ohminato[1], Atsushi Watanabe[1], Fukashi Maeno[1] (1.Earthquake Research Institute, University of Tokyo)

[STT44-P03] Droneborne resistivity mapping for a shallow ground investigation

*Yuji Mitsuhata[1], Tishiyuki Yokota[1] (1.AdvancedIndustrial Science and Technology)

[STT44-P04] Improvement test and field application applicability of airborne electromagnetic survey using drone

*Youichi Yuuki[1], Akira Jomori[2], Atsuyoshi Jomori[2], Takashi Kondoh[2] (1.Oyo corporation, 2.NEOSCIENCE)

[STT44-P05] Special Techniques for Airborne Laser Scanning Using Unmanned Helicopters

*Tomoya Hayakawa[1], Mio Kasai[2], Junro Imai[3], Akihiko Tani[4], Takatoshi Mikami[4] (1.NIPPON KOEI CO., LTD., 2.Hokkaido University Institute of Earth Surface Processes and Land Management, 3.YAMAHA MOTORCYCLE CO., LTD., 4.Obihiro Development and Construction Dept., Hokkaido Regional Development Bureau)

[J] Poster | M (Multidisciplinary and Interdisciplinary)：M-AG Applied Geosciences

5:15 PM - 6:30 PM JST | 8:15 AM - 9:30 AM UTC | Poster Hall International Exhibition Hall8, Makuhari Messe_46

[M-AG41] Dynamics of radionuclides emitted from Fukuchima Dai-ichi Nuclear Power Plant in the environment

convener:Yoshio Takahashi(Department of Earth and Planetary Science, Graduate School of Science, The University of Tokyo), Kazuyuki Kita(Faculty of Science, Ibaraki University), Yuichi Onda(Center for Research on Isotopes and Environmental Dynamics, University of Tsukuba), Daisuke Tsumune(Central Research Institute of Electric Power Industry)

[MAG41-P01] Discovering U particle with Zr from CsMP emitted from Unit 1 of FDNPP using synchrotron radiation X-ray analyses

*Hikaru Miura[1], Yuichi Kurihara[2], Masayoshi Yamamoto[3], Aya Sakaguchi[4], Kazuya Tanaka[2], Shogo Higaki[5], Yoshio Takahashi[5] (1.Central Research Institute of Electric Power Industry, 2.JAEA, 3.University of Kanazawa, 4.University of Tsukuba, 5.The University of Tokyo)

[MAG41-P02] Atmospheric re-emission of radio-cesium with bioaerosols and trial for estimateing their emission flux

★Invited Papers

*Kazuyuki Kita[1], Naho Hayashi[1], Koutaro Minami[1], Mao Kimura[1], Yasuhito Igarashi[1,7], Kouji Adachi[2], Teruya Maki[3], Atsuyuki Sorimachi[4], Ishizuka Masahide[5], Jun Furukawa[6], Kazuhiko Ninomiya[8], Atsushi Shinohara[8], Olivier Masson[9] (1.Graduate School of Science and Engineering, Ibaraki University, 2.Meteorological Research Laboratory, 3.Kanazakwa University, 4.Fukushima Medical Univeristy, 5.Kagawa University, 6.Tsukuba University, 7.Kyoto University, 8.Osaka University, 9.IRSN)

[MAG41-P03] The effect of canopy interception processes on radiocesium and dissolved matter concentrations in throughfall

*Tomoki Shinozuka[1], Hiroaki Kato[2], Satoru Akaiwa[1], Yuichi Onda[2] (1.College of Geoscience, School of Life and Environmental Sciences, University of Tsukuba, 2.Center for Research in Isotopes and Environmental Dynamics, University of Tsukuba)

[MAG41-P04] Effects of RCs concentration and dissolved organic matter on RCs migration in soil under flowing condition

*Takahiro Tatsuno[1], Shoichiro Hamamoto[1], Naoto Nihei[1], Taku Nishimura[1] (1.Deptartment of Biological and Environmental Engineering, Graduate School of Agricultural and Life Sciences, University of Tokyo)

[MAG41-P05] Behavior of dissolved radiocesium in the decay degree of organic matter of deciduous broad-leaved trees

*Yoshito Sasaki[1], Tadafumi Niizato[1], Katsuaki Mitachi[2], Satomi Ito[1], Takayoshi Watanabe[1] (1.Japan Atomic Energy Agency , 2.ATOM TRANSPORT SERVICE CO., LTD)

[MAG41-P06] Effect of Coarse Organic Matter on the Dissolved Radioactive Cesium Concentration in Stream Water from headwater catchment

*Satoru Akaiwa[1], Hiroaki Kato[2], Tomoki Shinozuka[1], Yuichi Onda[2] (1.College of Geoscience, School of Life and Environmental Sciences, University of Tsukuba, 2.Center for Research on Isotopes and Environmental Dynamics, University of Tsukuba)

[MAG41-P07] Eight-year monitoring study of radiocesium transfer in forest environments after the FDNPP accident

*Hiroaki Kato[1], Yuichi Onda[1], Zul Hilmi Saidin[1], Momo Kurihara[1], Tomoki Shinozuka[2], Satoru Akaiwa[2] (1.Center for Research in Isotopes and Environmental Dynamics, University of Tsukuba, 2.College of Geoscience, School of Life and Environmental Sciences, University of Tsukuba)

[MAG41-P08] Seasonal change of radiocaesium and its factor in the forest catchment contaminated by the Fukushima Dai-ichi Nuclear Power Station Accident

★Invited Papers

*Shota Kambayashi[1], Tatsuo Aono[1], Hiroki Hamajima[1], Hiroyuki Takahashi[1], Mitsuru Yamamura[2], Yutaka Yamada[1] (1.National Institute of Radiological Sciences, National Institutes for Quantum and Radiological Science and Technology, 2.Japan Conservation Engineers & Co.,LTD Inc.)

[MAG41-P09] Research of discharge radioactive Cs-bearing microparticles from a small forested catchment

*Satoshi Hadano[1], Shoichiro Hamamoto[1], Naoto Nihei[1], Taiga Okumura[1], Toshihiro Kogure[1], Taku Nishimura[1] (1.The University of Tokyo)

[MAG41-P10] Estimating impacts of direct release and riverine discharge on oceanic ^{137}Cs derived from the Fukushima Dai-ichi Nuclear Power Plant accident by an regional ocean model

★Invited Papers

*Daisuke Tsumune[1], Tsubono Takaki[1], Kazuhiro Misumi[1], Yutaka Tateda[1], Yuichi Onda[2], Michio Aoyama[3] (1.Central Research Institute of Electric Power Industry, 2.Center for Research in Isotopes and Environmental Dynamics, University of Tsukuba, 3.Institute of Environmental Radioactivity, Fukushima University)

[MAG41-P11] FNPP1 accident derived radiocaesium and tritium in Fukushima coast through the end of 2018

*Michio Aoyama[1], Yasunori Hamajima[2], Yayoi Inomata[2], Yuichiro Kumamoto[3], Tsubono Takaki[4], Daisuke Tsumune[4] (1.Institute of Environmnetal Radioactivity, Fukushima University, 2.Institute of Nature and Environmental Technology, Kanazawa university, 3.Japan Agency for Marine-Earth Science and Technology, 4.Environmental Science Research Laboratory, Central Research Institute of Electric Power Industry)

[MAG41-P12] Radiocesium in the swash zones off the coast of the Japan Sea

*Hyoe Takata[1], Mutsuo Inoue[2], Natsumi Kudo[1], Yuhei Shirotani[1] (1.Marine Ecoloy Research Institute, 2.Kanazawa Univ.)

[MAG41-P13] Numerical simulation of Cs-137 activity in the North Pacific using two atmospheric deposition fluxes estimated by atmospheric chemical transport models

*Tsubono Takaki[1], Kazuhiro Misumi[1], Daisuke Tsumune[1], Michio Aoyama[2], Katsumi Hirose[3] (1.Central Research Institute of Electric Power Industry, 2.Fukushima University, 3.Sophia University)

[MAG41-P14] Seasonal deposition of radiocesium in wooden houses from summer to winter seven years after the Fukushima nuclear accident

*Ryo Takakura[1], Katsumi Shozugawa[1], Mayumi Hori[1], Motoyuki Matsuo[1] (1.Graduate school of arts and sciences, the university of Tokyo)

[J] Poster | H (Human Geosciences)：H-GG Geography

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[H-GG02] Use, change, management of natural resources and environment: Interdisciplinary perspectives

convener:Yoshinori OTSUKI(Institute of Geography, Graduate School of Science, Tohoku University), Gen Ueda(Graduate School of Social Sciences, Hitotsubashi University), Takahisa Furuichi(Graduate School of Science, Hokkaido University), Toru Sasaki(Miyagi University of Education)

In this session, the situation and history of use, changes and management of natural resources and environment from various regions under diverse socio-economic and natural conditions are reported. Findings from local-scale fieldwork and feedbacks on their methodology and/or research concepts are particularly encouraged to be shared and discussed. A variety of research topics are covered through both human-ecological and earth-scientific perspectives, including local knowledge of natural resources and environment, environmental and climatic history, environmental geography, environmental degradation through resource use and/or management, effects of climate change, related socio-economic changes and adaptation for livelihood security, political ecology, and issues for overcoming gaps in linking between local and broader-scale (national, regional and global) studies.

[HGG02-P01] Preliminary magnetic biomonitoring results of the spatial distribution of atmospheric particulate matter in Muroran, Japan

*Hiroki Shibata[1], Kazuo Kawasaki[1] (1.University of Toyama)

[HGG02-P02] Social Foundations of Entomophagy and Its Transformation: A Case Study of Ina City, Nagano Prefecture

*Naoki Kobayashi[1] (1.National University Corporation Kanazawa University)

[HGG02-P03] Cost sharing and free water policy in semi-arid rural Kenya

*Gen Ueda[1] (1.Graduate School of Social Sciences, Hitotsubashi University)

[HGG02-P04] Importance of the stories as the background of nature understanding: an example in the Visayas, the Philippines

*Takashi Ito[1] (1.Faculty of Education, Ibaraki University)

[HGG02-P05] Hydrogeomorphological and environmental geographical land condition of groundwater use areas along the coast of Lake Victoria, west Kenya

*Yoshinori OTSUKI[1] (1.Institute of Geography, Graduate School of Science, Tohoku University)

Preliminary magnetic biomonitoring results of the spatial distribution of atmospheric particulate matter in Muroran, Japan

*Hiroki Shibata[1], Kazuo Kawasaki[1]

1. University of Toyama

Magnetic biomonitoring techniques have been shown to be rapid, cost-effective and useful methods for investigating spatial distribution of air pollution. However, a few studies have been reported such magnetic monitoring in Japan due to: a) lots of volcanos that supply great amount of magnetically-enhanced fly ashes; and, b) the dense population that cause huge amounts of magnetic noise. Here we report environmental magnetic results for the materials deposited on *Sasa kurilensis*, or dwarf bamboo, around the city center of Muroran, Japan. The dust on the leaves are wiped and analyzed their rock magnetic properties. Detailed rock magnetic and low temperature analyses show clearly that the main magnetic minerals in the dust are single to pseudosingle domain magnetite and/or partially oxidized magnetite, and the magnetic mineralogy on leaves' surface is consistent throughout the study area. Much higher saturation isothermal remanent magnetization intensity is observed at eastside of the heavy and chemical industrial area in the city and the local wind had generally come from west to east direction. These results indicate that magnetic biomonitoring using the leaves of dwarf bamboo can be a rapid, non-destructive and cost-effective method for studying the spatial distribution of atmospheric particulate matter derived from local industrial activities even in Japan.

Keywords: Environmental magnetism, Dwarf bamboo, Atmospheric particulate matter, Japan

Social Foundations of Entomophagy and Its Transformation: A Case Study of Ina City, Nagano Prefecture

*Naoki Kobayashi[1]

1. National University Corporation Kanazawa University

For its nutritional value and so on, insect is receiving attention as a new food resource around the world now. There is food security issues behind the growing interest in Entomophagy. The culture of Entomophagy still survive in a few areas at the present, however, many people in the whole country had the habit of eating insect in the old days in Japan. The author researched a specific example of Entomophagy held in Ina city, Nagano prefecture and analyzed it with regard to the relationship between Entomophagy and local communities. The findings are described as follows.

The research revealed that many people have the habit of eating insect at the present in study area. Also, they recognize insect is the local food and Entomophagy is local food culture of Ina. However, Entomophagy is less popular nowadays especially in the young generation. Furthermore, the method for obtaining insect has changed. There are changing tendency of working patterns, aging and decrease of population behind the change of Entomophagy in the study area.

Paying attention to the relationship between Entomophagy and local communities, people concerned about Entomophagy is different by each insect. Many people hunted, cooked and ate insects which can hunt easily on their own self. However, a few people hunt insects, which need skills or specialized tools to hunt, and to share with other residents or to sell wholesale to retail store. Furthermore, the difference of supplier and attribute of subjects, management of insect resource is different by each insects. In summary, it can be said that the way of relationship between Entomophagy and local people is different among each insect. Also the shape of Entomophagy has been changing in various contexts or perspectives as time goes on.

The research revealed that some changes occurred in Entomophagy of Ina.

The changes are about,

1) The amount of insect and insect products which from other cities are increasing.

2) In part of distribution, the role of retail store is getting bigger.

3) The number of people eating insect and the demand of each insect is decreasing.

Furthermore, the changes occurred to the people concerned about Entomophagy. These changes are connecting to the decreasing insects and people who hunt insect.

Today, it can be said that the culture of Entomophagy has been succeeded. But thinking the risk of Entomophagy in Ina region, such as the decrease of demand of insects or the unstainable supply of insect resources from other regions, the solutions to these problems are required. When it comes to attempting these problems, individual plans fitting each insect are needed, because the supply network of them and their stakeholder in the region are different to each other.

Keywords: Entomophagy, Food culture

Cost sharing and free water policy in semi-arid rural Kenya

*Gen Ueda[1]

1. Graduate School of Social Sciences, Hitotsubashi University

In Kilembwa and Kangii, rural areas of Machakos County, Central Kenya, the Government laid the waterworks in 1975, and the Mwala Water and Sanitation Company is now managing it. This waterworks has repeated a stop and restoration in the face of the high pumping cost from the Athi River, and it has a limit in water supply area. Therefore, local people are still depending on boreholes, reservoirs, sand dams, and water scooped from the bed of seasonal rivers. This situation will not change with the installation of a new water supply system (gravity-fed) planned by the Government.

The waterworks and boreholes with support of NGO, JICA, etc. in the study area have supplied water with the cost sharing principle, especially after the water sector reform by 2002 and the 2016 Water Acts. On the other hand, in 2013 and afterwards, the transfer of water supply authority from the National to County governments progressed, and in Machakos, the Governor and Members of County Assembly (MCAs) established many new boreholes towards the general elections in 2017, beginning to supply people free water. This study reports water uses among the people, the relation between cost sharing water provision and free water policy, and the influence of politicization of water provision on its socio-economic sustainability, especially focusing on the following two points.

(1) Catchment areas of water sources and water use
Many existing studies do not consider that water may be used for a productive purpose. This study therefore selected sample households supposing competition between domestic water use and water supply for dairy cattle. It conducted a household random sampling (20%) in 16 Kilembwa villages with the waterworks network nearby and comparatively many dairy cooperative members, and in 9 Kangii village with no waterworks and few cooperative members. It conducted around 200 interviews with these sampled households and cooperative members in the area.

(2) The influence of County free water policy on cost sharing principle of existing boreholes
An NGO-supported borehole with cost sharing principle started to operate in 2009, but it was suspended due to accounting problem of its water committee. The County Government, with an initiative of a local MCA, took over and rehabilitated it, and is supplying people free water from 2017. Views of the local administrative officers and water committee members on this free water policy are in disagreement: some are in the skeptical opinion which casts doubt on the financial strength after the next elections, and others credited the positive statement that understands and supports the policy as encouraging water supply to the poor and avoiding the accounting problem.

Since the cost sharing borehole supported and established by JICA in 2013 was located in the neighborhood of the above-mentioned rehabilitated county borehole with free water, the number of its users decreased, and in spite of water abundance, it stopped operating in 2017 after the vicious circle of a pump fuel financial deficit, a lowering utilization level, and rising "salt" concentration.

The study found some cases in which an NGO and church institution refused to make free their water provision despite the request by the County Government and a ruling party MCA, and a case where the same request resulted in refusal and interruption of an NGO borehole development. This is because they

tried to secure socioeconomic sustainability of water supply and avoid politicization of borehole provision by those in power.

Keywords: Domestic water supply, rural areas, Kenya

Importance of the stories as the background of nature understanding: an example in the Visayas, the Philippines

*Takashi Ito[1]

1. Faculty of Education, Ibaraki University

What kind of a perspective on nature do the children acquire through nature experiences, exchanges with families and surrounding people, and books or media? In this study, I conducted interviews via Skype for tens of young people (generally in their twenties) living in the Visayas region, the Philippines, and collected examples of how or what kind of a perspective on nature get during their childhood. Here, I introduce the tentative results regarding the understanding and experience of people in the Visayas, Philippine against the moon, rain, and forests.

Moon: Regarding the image of the moon surface, they have no common understanding like a rabbit for Japanese. There was also a case who have no experiences to pay attention to the pattern on the moon surface during childhood. On the lunar eclipse, there is a folktale that the sea serpent called Bakunawa ate the moon, but the popularization of the folktale is not high (about half). On the other hand, only the sentence of Gikaon sa Bakunawa (eaten by Bakunawawa) survives. There are cases where that word is used in the scene that people went home without notice or things went missing. The full moon was treated as a negative. They have experiences threatened as “monsters or ghosts become active at night of full moon, so you should go home early."

Rain: The impression of rain is so different from the Japanese. They had a very positive impression against rain, especially during their childhood. Rain is a blessing and a gift from the sky to cool their body. In the rain, most of the people played becoming muddy, running around with friends, washing the body as a natural shower. After returning home, about 70% of people experienced being urged to drink plenty of water after taking shower and changing clothes. On the other hand, against too heavy rain, some people had the habit of cutting clouds or rain grains with “the scissors” made with fingers also remained.

Forest: About the forest, they have a feeling of awe and respect. This is because of the sense that the forest is the place where something other than human beings. In the forest, they do not make noise and they do not point anything by a finger to pay tribute or to avoid disturb something else. Also when they enter into the forest, especially when they pass through beside a big tree, the chant of tabi tabi po (Excuse me) still remains as a habit

Of course in the Philippines, as in Japan, school education treats moon, rain, and forest as part of natural science. On the other hand, we also should keep in mind that indigenous ideas such as those introduced here have penetrated and people in the Visayas are deeply affected. In particular, we should consider being sufficient consideration when implementing natural research or natural education programs in the Visayas as a field.

Keywords: Philippines, Visayas, Nature, Stories, Folktales, Legends

Hydrogeomorphological and environmental geographical land condition of groundwater use areas along the coast of Lake Victoria, west Kenya

*Yoshinori OTSUKI[1]

1. Institute of Geography, Graduate School of Science, Tohoku University

The objectives of this presentation are to show and discuss about hydrogeomorphological and environmental geographical condition, supported groundwater resource used by drilled wells, of coastal areas of Lake Victoria, Kenya. Settlements in the areas are situated on the fluvial-colluvial lowlands and gentle slopes between the Rangwa composite caldera and the circular, outer Gwasi Hill, in the former Suba district (Homa Bay County).
The lowlands consist mainly of fluvio-colluvial deposits corresponding to principal aquifer, which has high permeability coefficient (1.0E-5 to 1.0E-6 m/s). In the vicinity of the groundwater observation points, water table depth exists 10 to 15 m below the current river bed (dissected valley bottom), approximately 25 m below the surface.
Environmental geographical conditions which are able to maintain the groundwater environment and use as described above will be shown in the presentation.

Keywords: groundwater use, hydrogeomorphology, environmental geography, Lake Victoria, Kenya

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[S-TT44] Airborne surveys and monitoring of the Earth

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Airborne surveys are useful to better understand the whole and/or the detailed structures of the Earth and their variations. They can be implemented from a traditional manned and newly-developed unmanned aircraft to efficiently map very large or remote areas with difficult access. We invite studies on theory, instrumentation, processing, modeling or inversion and applications of airborne surveys.

[STT44-P01] Development of an optical remote sensing technique for volcanic surface phenomena observation to estimate hyperspectral data from multispectral data

*Tetsuya Jitsufuchi[1] (1.National Research Institute for Earth Science and Disaster Resilience)

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[STT44-P05] Special Techniques for Airborne Laser Scanning Using Unmanned Helicopters

*Tomoya Hayakawa[1], Mio Kasai[2], Junro Imai[3], Akihiko Tani[4], Takatoshi Mikami[4] (1.NIPPON KOEI CO., LTD., 2.Hokkaido University Institute of Earth Surface Processes and Land Management, 3.YAMAHA MOTORCYCLE CO., LTD., 4.Obihiro Development and Construction Dept., Hokkaido Regional Development Bureau)

Development of an optical remote sensing technique for volcanic surface phenomena observation to estimate hyperspectral data from multispectral data

*Tetsuya Jitsufuchi[1]

1. National Research Institute for Earth Science and Disaster Resilience

Under the “Promotion Project for Next Generation Volcano Research B2:Development of remote sensing techniques for volcano observation, subtopic 2-2: Development of remote sensing techniques for surface phenomena of volcano”, the National Research Institute for Earth Science and Disaster Resilience (NIED) have been conducting a development of a visible multiband camera system to estimate hyperspectral data from multispectral data. This system consists of a 6 bans multi-band camera system and a spectrum estimation software that estimates dense spectrum information from sparse spectrum information from multi-band camera system. Modeling the relationship between hyperspectral data and multispectral data of igneous rock using multivariate analysis method, we have developed a spectrum estimation algorithm to estimate hyperspectral data from multispectral data for igneous rock sample. In this study, multiple regression analysis was applied to the hyperspectral and multispectral image data obtained by experiments of the volcanic rock samples, and we found this method can be used to estimate three hundred or more bands hyperspectral data from six bands multispectral data. We also develop the six band (six eyes) multi camera system for prototype of multi-band camera system for measuring the multispectral data required from our spectrum estimation algorithm. In this presentation, we descrive multivariate analysis results of hyperspectral and multispectral image data of six species volcanic rock samples for realizing a spectrum estimation algorithm and demonstrate hardware of six band (six eyes) camera system for our prototype of multi-bans camera system.

Keywords: hyperspectral image, multispectral image, multiple regression analysis, visible remote sensing, igneous rock

Geomagnetic total intensity change before and after the eruptions at Shinmoedake volcano in 2018 detected by aeromagnetic surveys

*Takao Koyama[1], Takayuki Kaneko[1], Takao Ohminato[1], Atsushi Watanabe[1], Fukashi Maeno[1]

1. Earthquake Research Institute, University of Tokyo

As previous reports, so far, we have conducted aeromagnetic survey six times at Shinmoedake volcano after the 2011 eruption, and detected geomagnetic total intensity change by remagnetization due to cooling of lava in the main crater. According to a rate of change, thermal diffusion may be the main cause of cooling process.
Shinmoedake erupted again in March, 2018 and lava of 14Mm3 volume was accumulated in the main crater.
After the eruption, we conducted aeromagnetic survey again by using an unmanned helicopter. The geomagnetic total intensity change from the first survey in May 2011 is about 800 nTpp. Supposing a single dipole by magnetization of lava in the crater, a magnetic dipole moment is about 81MAm2. This value is bigger by 10MAm2 than a value inferred from a rate of change due to cooling of 2011 lava. Thus, this change is caused by magnetization of 2018 lava, which is abruptly cooled down at the surface and enhanced remagnetization.
Comparing the change of geomagnetic field in 2018 with one in 2011, however, a rate of change becomes about half. Supposed rock magnetization of 2018 lava is the same with one of 2011, a part of lava must demagnetize. It indicates that, at the 2018 events, the 2011 lava in the crater may be heated and some portions of it demagnetize.

Keywords: aeromagnetic survey, Shinmoedake

Droneborne resistivity mapping for a shallow ground investigation

*Yuji Mitsuhata[1], Tishiyuki Yokota[1]

1. AdvancedIndustrial Science and Technology

Electromagnetic (EM) induction methods must be the powerful tools to map a resistivity distribution for the estimation of salinity and clay contents in soil and ground in civil engineering, environmental and agricultural investigations of shallow ground and soil. Usually, EM instruments are carried with hands and the measurement is carried out by walking to cover a survey area. However, it is not an efficient strategy for large survey areas. For such a situation, we propose a droneborne resistivity mapping.

We have applied a droneborne resistivity mapping in paddy fields and farms. To acquire good-quality data, we took care about the offset between a drone and an EM sensor, and the distance between an EM sensor and ground surface. As a result, the acquired data clearly show the difference between the paddy field and farm. This result must promise the further possibility of droneborne resistivity mapping.

Keywords: drone, electromagnetics, resistivity

Improvement test and field application applicability of airborne electromagnetic survey using drone

*Youichi Yuuki[1], Akira Jomori[2], Atsuyoshi Jomori[2], Takashi Kondoh[2]

1. Oyo corporation, 2. NEOSCIENCE

Drone aerial electromagnetic survey method installs a transmission source on the ground and measures the induced magnetic field with a drone. The depth that can be investigated was up to 200 m in measurements so far. Drone airborne electromagnetic survey method can be applied to wide area survey in the future due to drone performance improvement. As a result, we carried out an improvement test of the exploration device and a field application test.
The device uses an induction coil as receiver, but the specification of the coil cannot measure the low frequency from the deep underground due to the restriction on the drone's operation. Therefore, we conducted experiments in Kusatsu-machi, Gumma Prefecture, using Magneto-Impedance (MI) sensors that can measure low frequencies. Experiment result confirmed that the MI sensor can measure the induced magnetic field from the drone.
Also, in order to know the limit of measurement using the induction coil, data was taken at a point about 900 m away from the transmission source. As a result, although it was measured on the ground, the induced magnetic field could be measured at a point of 900 m from the transmission source, and the depth of survey was 600 m.
It was confirmed that the drone airborne electromagnetic survey method could possibly be applied to deep survey in wide areas without using helicopters in the future. It is expected that the cost of the survey cost can be reduced, so that airborne electromagnetic survey can be utilized easily at more sites.

Keywords: airbonne electromagnetics, drone airborne electromagnetic survey, drone, MI sensor

Special Techniques for Airborne Laser Scanning Using Unmanned Helicopters

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1. Introduction

In case of using the unmanned helicopters, we can scan elevation point data high frequency from 50-150m height. This practical method is developed a small unmanned helicopter owned by the Hokkaido Regional Development Bureau, through industry-university-government collaboration. Through these studies, we were able to verify the feasibility of all of these methodologies. In this paper, we discuss the special techniques that we employed with regards to airborne survey technologies, namely, installing antennas using a lift type vehicle, laser scanning from the air as well as discuss the equipment used and specific methods for performing these tasks.

2. Small unmanned helicopter specifications and survey location:

In this study, an autonomous unmanned helicopter (Yamaha RMAX-G1) owned by the Hokkaido Regional Development Bureau was used. During flight, the helicopter's remote controls were connected to the base station by radio, the flight route can be changed, the camera on the helicopter can be operated and the winch used to hang the sensor can be moved up and down when necessary. The helicopter's maximum flight time is roughly 90 minutes with a range of up to a 5 km radius from the base station. Its payload capacity is 10 kg at an elevation of 0 meters at 20ºC. It has actual track records of performing studies at an elevation of roughly 1,300 m carrying observation equipment of roughly 5 kg in weight.

In this study, the survey location was the Tottabetsu river, and set up a takeoff/landing 6 priod(2018.6) and 20 period(2018.10).

3. Installing antennas using a lift type vehicle:

Wireless transmission between the base station and the small unmanned helicopter consists of a 2.4 GHz data communication band for operations, and an analog 1.2 GHz band for camera images. Both bands require good visibility. In particular, when waves for the control system are blocked, the automatic return function will be activated and the survey will be discontinued. Trees may often not have a blocking effect, but we used a lift type vehicle to install both antennas higher than the tree. The lift type vehicle is the so-called "super deck" with a platform of approximately 2.5 ×1.5 m. It allows two people. With the use of this, we were able to assign both the antenna operator and visual helicopter watchperson at the high platform, and the antennas could be attached to the handrails.

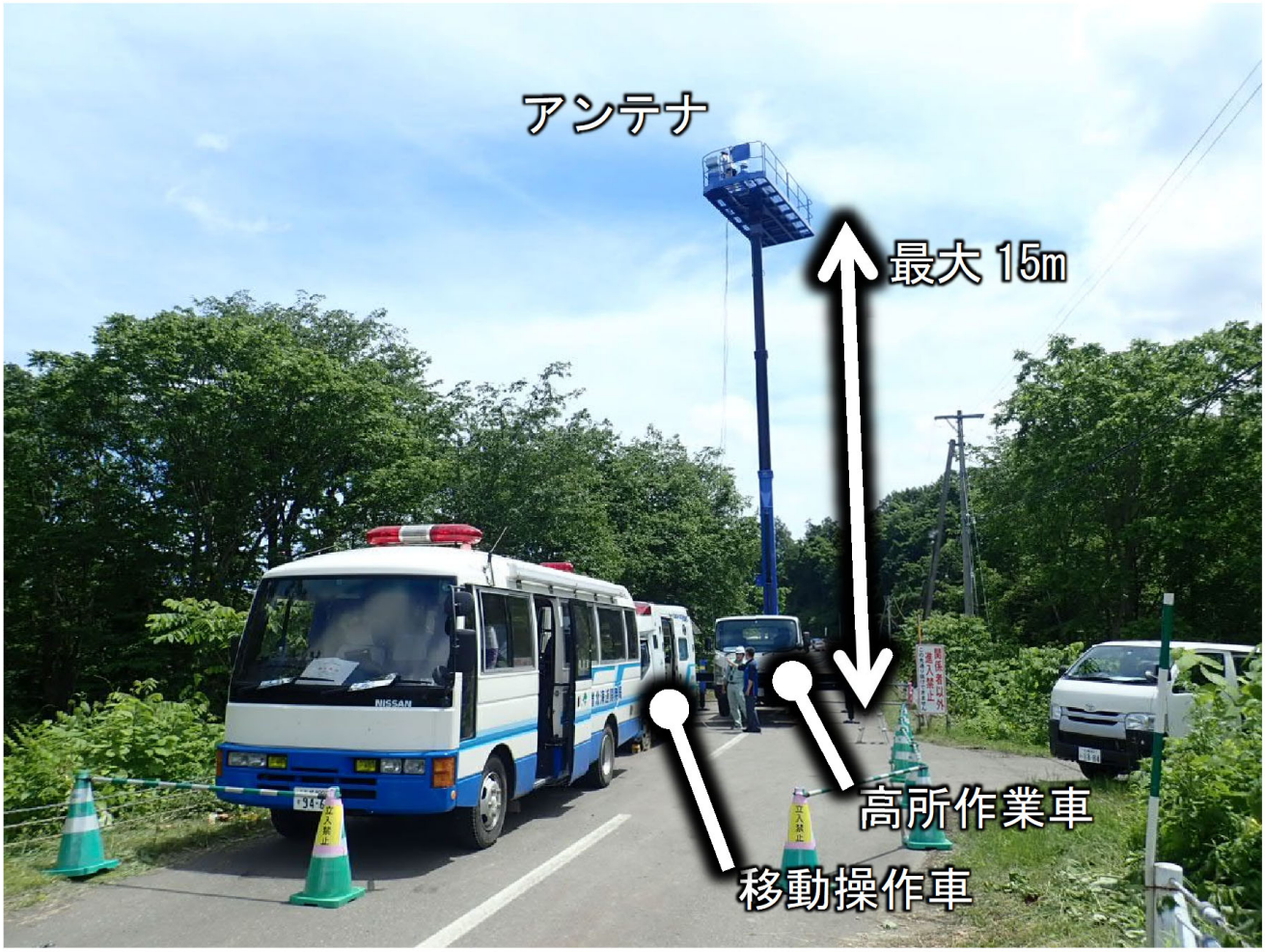
4. Laser scanning from the air:

We scan elevation point data using SkEyesBox owned by Yamaha Motorcycle co., ltd, while flying 50-70m height, 3-5m/s. We corrected position of the elevation point data using the method by the static data from Geographical Survey Instiude.

5. In closing:

In order to implement studies using unmanned helicopters, we will need to have command of these special techniques as part of our know-how and it will be important to implement regular training for staff involved in these studies.

Keywords: Unmanned Helicopters, Airborne Laser Scanning



[J] Poster | M (Multidisciplinary and Interdisciplinary)：M-AG Applied Geosciences

Sun. May 26, 2019 5:15 PM - 6:30 PM JST | Sun. May 26, 2019 8:15 AM - 9:30 AM UTC | Poster Hall International Exhibition Hall8, Makuhari Messe_46

[M-AG41] Dynamics of radionuclides emitted from Fukuchima Dai-ichi Nuclear Power Plant in the environment

convener:Yoshio Takahashi(Department of Earth and Planetary Science, Graduate School of Science, The University of Tokyo), Kazuyuki Kita(Faculty of Science, Ibaraki University), Yuichi Onda(Center for Research on Isotopes and Environmental Dynamics, University of Tsukuba), Daisuke Tsumune(Central Research Institute of Electric Power Industry)

The Great East Japan Earthquake caused the severe accident in TEPCO Fukushima dai-ichi nuclear power plant (FDNPP), leading to emission of huge amount of radionuclides to the environment. They have been transported and diffused by atmospheric motion, depositing them to soil and vegetation. Deposited radionuclides are dynamically shifted in the earth environment; atmosphere, soil, inland water, ocean, and ecosystem. To understand this dynamic shift in the environment and for the long-term prediction of the disaster by the radionuclides, investigation and discussion based on not only the earth sciences including ecology but also on the radiochemistry and other related sciences. In this session, various efforts to understand the dynamic behavior of radionuclides emitted from FDNPP accident in the earth system as well as to predict their influences on the environment. It is expected that this session will offer a good opportunity to discuss radionuclides in the earth environment from wide aspect and to exchange information in various research fields.

[MAG41-P01] Discovering U particle with Zr from CsMP emitted from Unit 1 of FDNPP using synchrotron radiation X-ray analyses

*Hikaru Miura[1], Yuichi Kurihara[2], Masayoshi Yamamoto[3], Aya Sakaguchi[4], Kazuya Tanaka[2], Shogo Higaki[5], Yoshio Takahashi[5] (1.Central Research Institute of Electric Power Industry, 2.JAEA, 3.University of Kanazawa, 4.University of Tsukuba, 5.The University of Tokyo)

[MAG41-P02] Atmospheric re-emission of radio-cesium with bioaerosols and trial for estimateing their emission flux

★Invited Papers

*Kazuyuki Kita[1], Naho Hayashi[1], Koutaro Minami[1], Mao Kimura[1], Yasuhito Igarashi[1,7], Kouji Adachi[2], Teruya Maki[3], Atsuyuki Sorimachi[4], Ishizuka Masahide[5], Jun Furukawa[6], Kazuhiko Ninomiya[8], Atsushi Shinohara[8], Olivier Masson[9] (1.Graduate School of Science and Engineering, Ibaraki University, 2.Meteorological Research Laboratory, 3.Kanazakwa University, 4.Fukushima Medical Univeristy, 5.Kagawa University, 6.Tsukuba University, 7.Kyoto University, 8.Osaka University, 9.IRSN)

[MAG41-P03] The effect of canopy interception processes on radiocesium and dissolved matter concentrations in throughfall

*Tomoki Shinozuka[1], Hiroaki Kato[2], Satoru Akaiwa[1], Yuichi Onda[2] (1.College of Geoscience, School of Life and Environmental Sciences, University of Tsukuba, 2.Center for Research in Isotopes and Environmental Dynamics, University of Tsukuba)

[MAG41-P04] Effects of RCs concentration and dissolved organic matter on RCs migration in soil under flowing condition

*Takahiro Tatsuno[1], Shoichiro Hamamoto[1], Naoto Nihei[1], Taku Nishimura[1] (1.Deptartment of Biological and Environmental Engineering, Graduate School of Agricultural and Life Sciences, University of Tokyo)

[MAG41-P05] Behavior of dissolved radiocesium in the decay degree of organic matter of deciduous broad-leaved trees

*Yoshito Sasaki[1], Tadafumi Niizato[1], Katsuaki Mitachi[2], Satomi Ito[1], Takayoshi Watanabe[1] (1.Japan Atomic Energy Agency , 2.ATOM TRANSPORT SERVICE CO., LTD)

[MAG41-P06] **Effect of Coarse Organic Matter on the Dissolved Radioactive Cesium Concentration in Stream Water from headwater catchment**

*Satoru Akaiwa[1], Hiroaki Kato[2], Tomoki Shinozuka[1], Yuichi Onda[2] (1.College of Geoscience, School of Life and Environmental Sciences, University of Tsukuba, 2.Center for Research on Isotopes and Environmental Dynamics, University of Tsukuba)

[MAG41-P07] **Eight-year monitoring study of radiocesium transfer in forest environments after the FDNPP accident**

*Hiroaki Kato[1], Yuichi Onda[1], Zul Hilmi Saidin[1], Momo Kurihara[1], Tomoki Shinozuka[2], Satoru Akaiwa[2] (1.Center for Research in Isotopes and Environmental Dynamics, University of Tsukuba, 2.College of Geoscience, School of Life and Environmental Sciences, University of Tsukuba)

[MAG41-P08] Seasonal change of radiocaesium and its factor in the forest catchment contaminated by the Fukushima Dai-ichi Nuclear Power Station Accident

★Invited Papers

*Shota Kambayashi[1], Tatsuo Aono[1], Hiroki Hamajima[1], Hiroyuki Takahashi[1], Mitsuru Yamamura[2], Yutaka Yamada[1] (1.National Institute of Radiological Sciences, National Institutes for Quantum and Radiological Science and Technology, 2.Japan Conservation Engineers & Co.,LTD Inc.)

[MAG41-P09] Research of discharge radioactive Cs-bearing microparticles from a small forested catchment

*Satoshi Hadano[1], Shoichiro Hamamoto[1], Naoto Nihei[1], Taiga Okumura[1], Toshihiro Kogure[1], Taku Nishimura[1] (1.The University of Tokyo)

[MAG41-P10] Estimating impacts of direct release and riverine discharge on oceanic ^{137}Cs derived from the Fukushima Dai-ichi Nuclear Power Plant accident by an regional ocean model

★Invited Papers

*Daisuke Tsumune[1], Tsubono Takaki[1], Kazuhiro Misumi[1], Yutaka Tateda[1], Yuichi Onda[2], Michio Aoyama[3] (1.Central Research Institute of Electric Power Industry, 2.Center for Research in Isotopes and Environmental Dynamics, University of Tsukuba, 3.Institute of Environmental Radioactivity, Fukushima University)

[MAG41-P11] FNPP1 accident derived radiocaesium and tritium in Fukushima coast through the end of 2018

*Michio Aoyama[1], Yasunori Hamajima[2], Yayoi Inomata[2], Yuichiro Kumamoto[3], Tsubono Takaki[4], Daisuke Tsumune[4] (1.Institute of Environmnetal Radioactivity, Fukushima University, 2.Institute of Nature and Environmental Technology, Kanazawa university, 3.Japan Agency for Marine-Earth Science and Technology, 4.Environmental Science Research Laboratory, Central Research Institute of Electric Power Industry)

[MAG41-P12] Radiocesium in the swash zones off the coast of the Japan Sea

*Hyoe Takata[1], Mutsuo Inoue[2], Natsumi Kudo[1], Yuhei Shirotani[1] (1.Marine Ecoloy Research Institute, 2.Kanazawa Univ.)

[MAG41-P13] Numerical simulation of Cs-137 activity in the North Pacific using two atmospheric deposition fluxes estimated by atmospheric chemical transport models

*Tsubono Takaki[1], Kazuhiro Misumi[1], Daisuke Tsumune[1], Michio Aoyama[2], Katsumi Hirose[3] (1.Central Research Institute of Electric Power Industry, 2.Fukushima University, 3.Sophia University)

[MAG41-P14] Seasonal deposition of radiocesium in wooden houses from summer to winter seven years after the Fukushima nuclear accident

*Ryo Takakura[1], Katsumi Shozugawa[1], Mayumi Hori[1], Motoyuki Matsuo[1] (1.Graduate school of arts and sciences, the university of Tokyo)

Discovering U particle with Zr from CsMP emitted from Unit 1 of FDNPP using synchrotron radiation X-ray analyses

*Hikaru Miura[1], Yuichi Kurihara[2], Masayoshi Yamamoto[3], Aya Sakaguchi[4], Kazuya Tanaka[2], Shogo Higaki[5], Yoshio Takahashi[5]

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Introduction: A large amount of radiocesium (Cs) was emitted into environment by the Fukushima Nuclear Power Plant (FDNPP) accident in March, 2011. Adachi et al. (2013) reported glassy water-insoluble microparticles including radiocesium, called as radiocesium-bearing microparticles (Type-A particles). Based on the $^{134}Cs/^{137}Cs$ ratio calculated by Nishihara et al. (2012), Type-A particle is thought to be emitted from Unit 2 or 3 of FDNPP (Higaki et al., 2017; Miura et al., 2018). Abe et al. (2014) detected uranium (U) in Type-A particle by synchrotron radiation measurement. In addition, Ochiai et al. (2018) reported that Type-A particle has UO_2 with zirconium (Zr). In contrast, Ono et al. (2017) reported new particles called as Type-B particles emitted from Unit 1. Type-B particle is different from Type-A particle in size, shape, Cs concentration and so on. We measured some Type-A and Type-B particles to clarify chemical condition of U by synchrotron radiation measurement. Difference in chemical condition of U in each particle may represent the difference of generating process or condition of each reactor unit at the accident.

Method: In this study, we collected Type-A and B particles from road dusts and non-woven fabric cloths from Fukushima by a wet separation method. After measurement of radioactivity with a high-purity germanium semiconductor detector, scanning electron microscope and energy dispersive X-ray spectroscopy analyses were performed to confirm that separated particles were Type-A or Type-B particles. X-ray fluorescence (XRF) mapping and X-ray adsorption near edge structure (XANES) measurement were performed at BL37XU (SPring-8, Hyogo). Bent Crystal Laue Analyzer (BCLA) was used to detect U peaks, because energy of U Lα emission is close to energies of rubidium Kα and strontium Kα emissions.

Results: We could detect U in Type-A and B particles using BCLA which decreased background contribution about one tenth. U-enriched area in the Type-B particle was about several microns, which is much bigger than U nano-particle in Type-A particle reported by Ochiai et al. (2018). This difference in size possibly suggested that U particle in Type-B particle was derived from melt in contrast to that in Type-A particle possibly produced from vapor. XANES measurement showed the presence of U(IV) in Type-B particle but also U(VI) in Type-A and B particles, which suggested $U(VI)O_2$ fuel was oxidized possibly due to its exposure to air at the surface of the particles. In the spots of detecting U, we also detected Zr which is used for fuel cladding tube. It is needed to identify chemical-states of Zr and U as a future study.

Keywords: FDNPP accident, Cesium-bearing microparticle, Synchrotron radiation X-ray analysis

Atmospheric re-emission of radio-cesium with bioaerosols and trial for estimateing their emission flux

*Kazuyuki Kita[1], Naho Hayashi[1], Koutaro Minami[1], Mao Kimura[1], Yasuhito Igarashi[1,7], Kouji Adachi[2], Teruya Maki[3], Atsuyuki Sorimachi[4], Ishizuka Masahide[5], Jun Furukawa[6], Kazuhiko Ninomiya[8], Atsushi Shinohara[8], Olivier Masson[9]

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Radionuclides emitted in the Fukushima dai-ichi nuclear power plant (FNDPP) accident in March 2011 have been deposited on the soil, ocean and vegetation. Re-suspension of radioactive cesium from the soil and vegetation to the atmosphere may be one of significant path in the diffusion of radionuclides after the accident.

We have measured the concentration of atmospheric Cs-134/137 radioactivity at Namie, Fukushima, where deposition amount of Cs-134/137 is relatively high. Atmospheric suspended particles have been collected on a sheet of quartz fiber filter with high-volume air samplers mounted at a playground site and forest site, and gamma-ray emission from them were measured with Ge detector to obtain the atmospheric activity concentration of Cs-134/137. A small part of each filter was used to measure chemical composition and microscope particle observation. To estimate emission flux, altitude difference of Cs activity concentration and bioaerosol concentration were measued using 6m height tower. By equiping ultrasonic anemometer, REA flux measurement of bioaerosols has been also tried.

The atmospheric Cs radioactivity concentration increased from late May to September, summer and autumn. It was higher in the forest than that at the playground in these season. The measured concentration of atmospheric Cs-134/137 was positively correlated with amount of carbonatious particles in these seasons. Bioaerosol sampling and analyses showed that major coarse particles in these seasons were spores of fungi and stain. We counted the spores collected on the sample filters to evaluate their number density, and found the number density was positively correlated with the atmospheric Cs radioactivity concentration. We collected fungi at Namie to sample its spores. About half of Cs-137 in the spores was removed by pure water, being consistent with similar experiment for the atmospheric particle samples. These results indicated that spore emission from fungi significantly contributes to the resuspension of radioactive Cs to the atmosphere in summer and autumn. Results of flux measurement will be shown.

Keywords: Radiocesium, atmospheric reemission, bioaerosol

The effect of canopy interception processes on radiocesium and dissolved matter concentrations in throughfall

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This study examined the effects of canopy interception processes on the formation of throughfall and dissolved matter concentrations under the canopy. The concentrations of radiocesium and dissolved matter in throughfall were measured in the cedar forest stand located in Namie Town, Fukushima Prefecture. Furthermore, we investigated the influence of canopy structure on the generation of spatial heterogeneity in rainwater amount and dissolved matter concentrations in throughfall. The study period was about 4 months from June 25 to November 5, 2018. The results of this study indicated that the amount of thgoughfall increased with canopy openness. The Cs-137 concentration tended to decrease as the amount of throughfall increased, and consequently the transfer flux of Cs-137 from the canopy to the forest floor by the throughfall did not increase even if the throughfall increase. The particulate form of Cs-137 contained in the throughfall tended to decrease as the amount of throughfall increased. However, during large rainfall event such as typhoon, the proportion of the particulate Cs-137 increased regardless of throughfall amount. On the other hand, the dissolved Cs-137 and Mg^{2+}, Ca^{2+}, and K^{+} concentrations in throughfall decreased with the increase of canopy openness. These results suggested that rain properties and canopy structure affect the leaching flux of radiocesium from the canopy to rainwater. The periodical transfer flux of Cs-137 from the canopy to forest floor via throughfall was 0.25% of the initial atmospheric deposition (June 25 –September 13, 2018).

Keywords: radiocesium, canopy interception process, throughfall, monitoring

Effects of RCs concentration and dissolved organic matter on RCs migration in soil under flowing condition

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INTRODUCTION

To understand migration of radiocesium (RCs) in soils is an important issue after the accident of Fukushima Dai-ichi nuclear power plant, Japan. In general, RCs strongly adsorb to soils, especially clay minerals in the soil. Frayed Edge Site (FES), siloxane ditrigonal cavity (SDC), and clay plane are known as RCs adsorption sites of clay minerals. The clay planes have much more adsorption sites than FES and SDC, while RCs adsorbed on the clay plane is relatively easy exchanged with other cations. On the other hand, RCs fixed on high affinity site such as SDC and FES cannot be readily exchanged with other cations. RCs concentration of the applied solution may affect effective sites for RCs adsorption. The lower RCs concentration in the soil solution, the greater the contribution of high affinity sites such as SDC and FES is expected.

Dissolved organic matters (DOMs) alter sorption and transport of RCs in soils. There are three possible processes in regard to DOM-induced RCs transport. First, DOMs in soil solution can complex with RCs and the RCs-DOM complexes enhance RCs transport to deeper layer or prevent it due to their adsorption to the soil. Second, DOMs in the soil solution may remove RCs adsorbed on the soils and promote RCs migration. Third, DOMs adsorbed on the soil can prevent RCs to access to high affinity sites (i e., FES and SDC).

There are many previous studies on the effects of RCs concentration and soil organic matters on RCs adsorption based on batch experiments with high DOM concentration. However, these studies are not enough for fully understanding RCs migration in a real soil system where water flow should occur and DOM concentration is low. In this study, we investigated the effect of DOM on the migration of RCs using two different concentrations of RCs solution by laboratory column experiments.

MATERIALS and METHODS

Soil sample was a weathered granite called as Masa-soil in local dialect. It was collected at an abandoned forest in Iitate, Fukushima, Japan. DOM solution was extracted from a litter which was collected from forest floor of university forest of the University of Tokyo in Chichibu city, Saitama prefecture, Japan in 2008. Dissolved organic carbon (DOC) in the DOM solution was adjusted to 20mg-C/L.

The Cs solutions with two different concentrations, 1.5×10^{-4} mol/L prepared by using stable CsCl (^{133}Cs) as the high one and 4.5×10^{-17} mol/L made by diluting the ^{137} Cs solution as low concentration solution. The Cs-DOM mixture was also used as a percolation solution.

An acrylic plastic column was used for the transport experiments. The soil column was prepared by packing air dried soil sample. Then, different solutions were applied with a constant ponding depth. Four different sequences of flowing solution were as follows ; (i) NaCl solution (pH6, ionic strength of 1mM) followed by Cs solution, (ii) NaCl solution followed by Cs-DOM mixed solution, (iii) DOM solution followed by Cs solution, and (iv) NaCl solution followed by Cs solution in soil which was adsorbed DOM in advance. Cs concentration of the effluent was measured. Some effluent solution was divided into water-soluble Cs and Cs-DOM complexes by ultrafiltration.

RESULTS and DISCUSSION

During the experiment using the high concentration Cs solution, there was no significant difference in the effluent Cs concentration among all conditions ((i) - (iv)). On the other hand, when using the low Cs concentration solution, effluent Cs concentrations of the column (ii) and (iv) were higher than that of (i). The ultrafiltration for some selected effluent samples of the column experiment with Cs-DOM mixture as supplied solution, and effluents of (ii) and (iv) showed all the Cs in the effluents were water-soluble form. These findings suggest DOM did not work as a carrier for Cs, but rather promoted Cs migration by inhibiting Cs adsorption to high selective sites.

ACKNNOWLEDGEMENT
This work was supported by JSPS grant Number 15H02467.

Keywords: Fukushima, cesium, dissolved organic matter

Behavior of dissolved radiocesium in the decay degree of organic matter of deciduous broad-leaved trees

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Approximately 70% of radiocesium released by the Fukushima Daiichi Nuclear Power Station of Tokyo Electric Power Company Holdings accident was deposited in the forest and would remain in the forest. Dissolved radiocesium would be easy to be incorporated into organisms. There are many unknown parts regarding the elution mechanism of the elution of dissolved radiocesium from organic matter such as litter, which would be a potential source of dissolved radiocesium. Here we report the results of the study on the difference in transfer behavior of dissolved radiocesium at the different degree of decomposition of organic matter of deciduous broad-leaved tree leaves. After making organic matter with different degree of decomposition (litter, leaf mold, humus) using litter collected in deciduous broad - leaved forest in Fukushima prefecture, dissolution rates of dissolved radiocesium eluted from these organic matters were compared. The highest dissolution rate was litter in organic matters with different degrees of decomposition. The dissolution rate of leaf mold and humus was about 1/10 of that of litter. These results suggested that dissolved radiocesium elution from organic matter on the forest floor differs at the decomposition stage of organic matter

Keywords: Fukushima Dai-ichi Nuclear Power Plant accident, radiocesium, deciduous broad-leaved tree, litter layer

Effect of Coarse Organic Matter on the Dissolved Radioactive Cesium Concentration in Stream Water from headwater catchment

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This study examined the mechanisms of radiocesium discharge via stream water in a headwater forest catchment. We measured the stream water runoff, the dissolved and particulate Cs-137 concentrations in spring water, stream water, soil water, suspended sediment and coarse organic matter in the forest catchment located in Namie Town of Fukushima Prefecture. We conducted sample collection for 6 times during the monitoring period from June 25 to September 13, 2018. Stream water was sampled at four locations, namely the spring water and the stream water in the experimental watershed, and the middle and the large scale catchments where the experimental watershed stream joins. The soil water was collected by using two types of zero tension lysimeter which consists of only litter layer, and the combination of litter and surface soil (0-10 cm) layers. Coarse organic matter was collected by a screen mesh installed in the downstream channel of the experimental watershed. The dissolved Cs-137 concentrations in stream water and soil water showed similar temporal changes with the increasing trend in July. In addition, the dissolved Cs-137concentration in stream water was higher than that of spring water, suggesting that the dissolved Cs-137 concentration in stream water increased during the stream water flowing down along the stream channel. In addition to the monitoring study in the experimental watershed, the sampling of stream water was conducted in total of 25 catchments located in Kawamata Town and Nihonmatsu City in Fukushima prefecture, on August 1, 2018. The dissolved Cs-137 concentration in each stream water sample was analyzed. The dissolved Cs-137 concentration in stream water increased with the proportion of forest area to the total catchment area, suggesting that the discharges of dissolved Cs-137 in stream water from forest area maintain the measured high Cs-137 concentrations in stream water.

Keywords: Fukushima Dai-ichi Nuclear Power Plant, dissolved cesium 137, stream water

Eight-year monitoring study of radiocesium transfer in forest environments after the FDNPP accident

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This study investigated temporal changes in ^{137}Cs concentrations in environmental samples collected from various forests over 8 years following the accident, in Yamakiya district of Kawamata town. Cesium-137 was detected in all forest environmental samples; however, the concentration in most samples decreased exponentially with time. The decreasing trend of ^{137}Cs concentrations varied between needles/leaves and the outer bark of Japanese cedar and konara oak trees, suggesting that self-decontamination processes and internal recycling of ^{137}Cs varied among tree species and different tree parts. We selected a cedar stand in the highly contaminated area of Namie Town, the mechanisms of radiocesium leaching from forest canopy to rainwater and those influences to temporal trend of self-decontamination processes were examined by measuring particulate and dissolved radiocesium concentrations in throughfall.

Keywords: Fukushima Dai-ichi Nuclear Power Plant accident, Forest, Radiocesium

Seasonal change of radiocaesium and its factor in the forest catchment contaminated by the Fukushima Dai-ichi Nuclear Power Station Accident

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A huge amount of radionuclides such as radiocaesium were dispersed and deposited on the territorial area of Fukushima Prefecture, Japan, after the accident at the TEPCO Fukushima Daiichi Nuclear Power Station (FDNPS) on March 2011. Since Fukushima prefecture is covered by about 70% of forest area, it is important to investigate the distribution, behavior and runoff process of radiocaesium in this area. In this study, we collected stream water from forest catchment and river water in mainstream within evacuation zone in vicinity of the FDNPS from December 2017 to February 2019 in order to assess the distribution, biogeochemical behavior and fluxes of dissolved radiocaesium in these areas. Regarding the analysis results and discussion, we reached the following findings.
1) Activity concentrations of dissolved ^{137}Cs collected in Takase River and Saruta River ranged from 10.3 to 37.2 mBq L^{-1}, 44.3 to 322.9 mBq L^{-1}, respectively. These results indicate that the activity concentration of dissolved radiocaesium (DRCs) is depended on the air does rate around catchment area in the river. Also, the DRCs collected in Takase River and upstream of Saruta River related to water temperature. This result suggests that the influential source of DRCs for these two rivers are due to desorption from litter.
2) Calculation results of dissolved ^{137}Cs (DCs-137) flux in Saruta River show that radiocaesium input form tributary streams have a great influence on DCs-137 flux of main stream. Moreover, DRCs activity concentration in pore water collected in reservoir was much higher than in overlying water, suggesting that a significant amount of radiocaesium in sediment desorb into pore water. The ^{137}Cs flux between the sediment and overlying water was comparable to fluxes from tributary streams. DCs-137 flux of Saruta River contribute to that of Takase River was also estimated to be about ten percent. This result indicates that dissolved radiocaesium input from forest catchment have a small influence on main river.

This work was supported by Research and Development to Radiological Sciences in Fukushima Prefecture.

Keywords: Radiocaesium, Behavior, Stream water, Forest catchment

Research of discharge radioactive Cs-bearing microparticles from a small forested catchment

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INTRODUCTION

Vast amount of radioactive cesium (RCs) deposited by the accident of Fukushima Dai-Ichi Nuclear Power Plant (FDNPP). Fate of the RCs in the environments is important since RCs has long half-life. Previous studies estimated annual RCs runoff as about 0.1% or less of the total RCs deposition in the forest. Many previous studies reported concentration of suspended solids and RCs concentrations in water samples had linear correlation. However, there were still some extremely high RCs concentration was observed among water samples. Few studies analyzed such high RCs concentration water samples. Radioactive Cs-microparticles (CsMPs) are one of particulate RCs released from FDNPP. They are about 1-10 μm in size. The matrix is SiO2 glass which contains Cs and other elements such as iron, zinc and tin. One of the remarkable features of CsMPs is high radioactivity per volume compared with soil particles that absorb RCs. There is a possibility that a water sample showing high radioactivity may contain CsMPS. But few studies focused on CsMPs in suspended solids in river water from forested catchment. The aim of this study is to consider whether there is an outflow of CsMPs from forested catchment focusing CsPMs in suspended matter.

METHODS

Study site is a small forested catchment in Iitate village, Fukushima prefecture. Catchment area is around 56 ha. Estimated RCs deposition was 1 MBq m-2. Water level gauge, a turbidity meter, and automatic water sampler was installed for stream water monitoring and sampling. Water samples were brought to the laboratory and filtered to separate suspended matter and supernatant. RCs radioactivity of suspended matter, and Imaging Plate (IP) images were taken for suspended matter whose radioactivity was higher than the average. When expected microparticles which seemed to be CsMPs was detected on the IP image it was fractionated and isolated from suspended matter. Isolated particles were observed using a scanning transmission electron microscope (SEM, Hitachi S-4500) with an energy-dispersive X-ray detector (EDS, Kevex, SIGMA).

RESULTS

We isolated two CsMPs from all samples from stream water samples during summer of 2018. SEM image and gamma counter suggested small particles with a diameter of 2.4 μm emitted relatively high radioactivity. As a result of examining chemical composition of each CsMPs by EDS, such elements as silicon, zinc, and iron which were confirmed in previous research were confirmed. Also, they were isolated from the same sample, and RCs radioactivity of each CsMPs is 2.33 and 2.22 Bq which was about 12%

against total RCs radioactivity of the water sample. On the other hand, approximately, the mass of the two CsMPs were 50 pg which was about 5.7×10^{-9} % against the total mass of the suspended matter in the water sample. It suggests that the contribution of CsMPs to RCs radioactivity of the water sample. From the view of suspended matter concentrations in the stream water sample, the sample from which we isolated CsMPs was collected at relatively frequent intensity rainfall and the out flow of CsMPs can be considered in the future.

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Keywords: Fukushima, radioactive Cs-bearing microparticles, stream water monitoring and sampling

Estimating impacts of direct release and riverine discharge on oceanic ^{137}Cs derived from the Fukushima Dai-ichi Nuclear Power Plant accident by an regional ocean model

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A series of accidents at the Fukushima Dai-ichi Nuclear Power Plant (1F NPP) following the Great East Japan Earthquake and tsunami of 11 March 2011 resulted in the release of radioactive materials to the ocean. Measured ^{137}Cs activities in the coastal zone adjacent to the 1F NPP are still higher than the one before the accident because sources to the ocean are still existing. The Regional Ocean Model System (ROMS) was employed for regional-scale simulation of ^{137}Cs activity in the ocean offshore of Fukushima, the sources of radioactivity being direct release, atmospheric deposition, the inflow of ^{137}Cs deposited into the ocean by atmospheric deposition outside the domain of the model, and river discharges. Direct release of ^{137}Cs was estimated for 7 years after the accident by comparing simulated results and measured activities adjacent to the accident site. In addition, riverine discharge rates ^{137}Cs were also estimated by multiplication between river flow simulation rate and measured ^{137}Cs activities. Simulated atmospheric deposition to the ocean was employed by atmospheric transport model. Inflow of ^{137}Cs from boundary sections was set by the results of the North Pacific scale ocean model. Sensitivity experiments were carried out to investigate the contributions of each source to measured ^{137}Cs activities in the ocean. We focused on the term from 2013 to 2016 because there were few data in the river before 2012, and also focused on dissolved ^{137}Cs because most of ^{137}Cs is dissolved form in the ocean.

Simulated ^{137}Cs activity attributable to direct release were in good agreement with measured data in the coast zone adjacent to the 1F NPP, because the effect of direct release was dominant from 2013 to 2016. On the other hands, simulated results attributable to inflow from boundary sections were slightly underestimated to the measured data offshore area. This suggests that recirculation of subducted ^{137}Cs to the surface layer was underestimated in the North Pacific model. Apparent half-life of direct released and river discharged ^{137}Cs activity were estimated to be about 1 year and 2 years, respectively. And apparent half-life of inflow of ^{137}Cs activity was much longer due to time scale of dilution process in the North Pacific. Apparent half-life of each source should be similar to the measured one attributable to each source. Apparent half-life of measured ^{137}Cs activity adjacent to the 1F NPP was about 1 year, on the other hand, the ones increased with increasing distance from the 1F NPP. Apparent half-life of measured data was about 2 years in front of the Uda river mouth where is far from the 1F NPP. Although ^{137}Cs activity in this area was mainly affected by the river input, simulated ^{137}Cs activities with river input were one fifth of observations. There is a brackish lagoon, Matsukawa-ura in front of Uda river mouth. The observed ^{137}Cs activities in the Matsukawa-ura were 3-5 times larger than the one in the Uda river. This suggests the removal process from particle ^{137}Cs to dissolved form in the brackish lagoon may be important.

Keywords: Fukushima Dai-ichi Nuclear Power Plant accident, Cs-137, Regional Ocean Model, Direct release, River input

FNPP1 accident derived radiocaesium and tritium in Fukushima coast through the end of 2018

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The temporal variation of 137Cs activity concentration are similar and 137Cs activity concentration was low in winter (January - February) and high in summer-fall (July - October) both at the inside the port and 56N canal of Fukushima Dai-ichi nuclear power plant (FNPP1). 137Cs at both stations might be originated from the same source. The concentration in the port drops about one order of magnitude lower when the installation of the sea side barrier wall in 2015, while 137Cs activity concentration at 56 N canal did not follow a trend in the port, so the leakage route to the port and 56N canal may be different. After 2016, 137Cs activity concentration at 56N canal did not change very much and annual average of 137Cs activity concentration was 100-140 Bq m-3 in 2016, 2017 and 2018. At Tomioka (10 km to the south from FNPP1), 137Cs activity concentration was about 1/10 of the 137Cs activity concentration at 56N canal and showed the same tendency. At Soma (48 km to the north from FNPP1), 137Cs activity concentration was about half of those at Tomioka in general. 137Cs activity concentration was 34 Bq m-3 at Tomioka River in June 2018 while 137Cs activity concentration in seawater was 11 Bq m-3 in June 2018.
3H activity concentration in Tomioka River decreased from ca. 1000 Bq m-3 in 2013 to ca. 400 Bq m-3 in 2018. 3H activity concentration in seawater collected at Tomioka did not change and ranged from 90 to 160 Bq m-3 during the period from 2014 to 2018. Good linear relationship between 137Cs and 3H in 2014 indicates that the source of both radionuclides should be liquid form and originated from same place.

Keywords: radiocaesium, tritium, Fukuhsima accident, fukushima coast

Radiocesium in the swash zones off the coast of the Japan Sea

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Radiocesium concentrations were measured in seawater and sediment samples collected in the swash zones in Ishikawa and Niigata prefectures, off the coast of Japan Sea opposite to the side where TEPCO Fukushima daiichi Nuclear Power Plant (FDNPP) is located in September 2016 and August 2017, five to six years after the accident. Cs-134 in the seawater samples was detected, suggesting the intrusion of FDNPP-derived radiocesium in both swash zones. FDNPP-derived radiocesium was appeared to be transported by the Tsushima Warm Current. In the surface sediments only ^{137}Cs was detected during the sampling period. We could not find out the presence of the FDNPP-derived radiocesium in the corresponding sediment on the swash zones; however, detected radiocesium in those sediments was assumed to be influenced by ^{137}Cs of FDNPP-derived radiocesium little for Ishikawa area and some for Niigata area.

Keywords: Japan Sea, Cs-134

Numerical simulation of Cs-137 activity in the North Pacific using two atmospheric deposition fluxes estimated by atmospheric chemical transport models

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We investigated the difference in the ^{137}Cs activity in the North Pacific Ocean (NPO) water after the Fukushima Dai-ichi Nuclear Power Plant (1F NPP) accident using two atmospheric deposition fluxes estimated by atmospheric chemical transport models; Model of Aerosol Species IN the Global Atmosphere (: MASINGAR MK-II) (Aoyama et al, 2015) and Meteorological Research Institute Passive-tracers Model for radionuclides (MRI-PM/r) (Kajino et al, 2012). The difference between both models is the total deposition amount into the NPO water in March and April 2011; 6.4 PBq for MASINGAR, 5.0 PBq for MPI-PM/r. In addition, The MASINGAR estimated larger (smaller) total deposition in north (south) of Kuroshio Extension than MPI-PM/r.
We conducted two five-ensemble simulations of ^{137}Cs activity in the North Pacific Ocean (NPO) from 2011 to 2020 due to the direct discharge (Tsumune et al., 2013) from the power plant and the atmospheric deposition flux by using the Regional Ocean Model System (ROMS) with variable mesh of 1/12º-1/4º in horizontal.
Since the calculated ^{134}Cs using the original atmospheric deposition fluxes showed smaller than the observations in the surface water in almost whole NPO from 2011 to 2014, we calculated the magnifications for the fluxes by the regression analysis between the observed and calculated ^{134}Cs. The magnifications provided the increase in the total amounts of ^{134}Cs and ^{137}Cs activity in NPO water after the accident, which is 16±1.5 PBq for MASINGAR, 21±2 PBq for MPI-PM/r. The Comparison between the observations and the ^{137}Cs calculated with the magnified fluxes represented that the correlation coefficient and the root mean square error are 0.86 and 5.7 Bq/ m^{-3} for MASINGAR, 0.75 and 7.3 Bq/ m^{-3} for MPI-PM/r.
The vertical distributions of the ^{137}Cs for the model with MPI-PM/r flux represented relatively larger in the Subtropical Mode Water in 165 ºE in 2012 than that for the model with MASINGAR flux. The model with MPI-PM/r flux consequentially represented that the^{137}Cs activity was able to be detected west of Okinawa Islands until 2014, while MASINGAR until 2012.

Keywords: Cs-137, North Pacific ocean, atmospheric deposition fluxes

Seasonal deposition of radiocesium in wooden houses from summer to winter seven years after the Fukushima nuclear accident

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As the evacuation zone covering around the Fukushima nuclear plant will be re-opened, some of residents would return to their houses. Nevertheless reports on the contamination in their houses are limited [1], especially the information of short-time scale contamination is completely insufficient. Due to the diversity of residents' lifestyles, to provide information of deposition interior the house is very important from the perspective of radiation protection prior to cancellation of the evacuation order.

In this study, seasonal deposition of radiocesium contamination interior the wooden houses in the evacuation zone, Fukushima, Japan, has been investigated from Sep. 2018 to Feb. 2019.

Because electric power has been interrupted since the Fukushima accident in 2011, dust sampler could not use for sampling over research period. Thus, a method of collecting radiocesium using cloths was applied. Although this method is capable of long-term sampling, it is not as efficient as the method using basin. Therefore, the results of this research may be underestimated than the actual deposition.

Two representative results are shown below:

[A case in Okuma town] The house to be surveyed is located about 5 km from the Fukushima nuclear plant and was a wooden house built in 2007. In this house, deposition has been confirmed to range from 3.2e-4 to 4.1e-5 $Bq \cdot cm^{-2} \cdot day^{-1}$ from summer to winter season, 2018 and it was found that this range was one order of magnitude less than the outside deposition of the same period. During the survey period, there was a positive correlation between the number of days with no precipitation and the amount of deposition.

[A case in Namie town] One of the houses in Namie Town is located about 11 km away from the Fukushima nuclear plant and was a typical Japanese-style house. From the end of August to the beginning of September, deposition was higher than that in other seasons, which was 4.0e-4 $Bq \cdot cm^{-2} \cdot day^{-1}$. This may be caused by frequent entry of residents for the care of the house.

[1] N. Shinohara and H. Yoshida-Ohuchi, Radiocesium contamination in house dust within evacuation areas close to the Fukushima Daiichi nuclear power plant, Environment international, 114, 107-114, 2018.

Keywords: Fukushima nuclear accident, house dust, radiocesium, lifestyle

