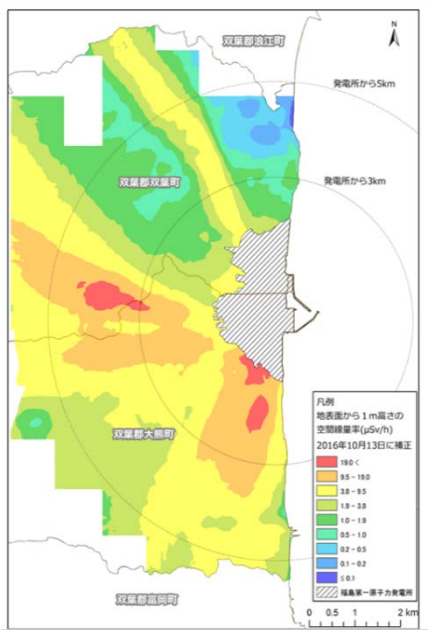
Measure the ground from the sky

Research and development of radiation measurement technology by unmanned helicopter



Example of radiation contamination map produced by the measurements using unmanned helicopter.

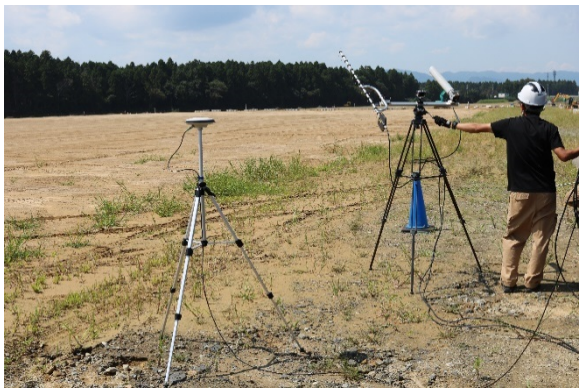
Before the accident of the Fukushima Daiichi Nuclear Power Station (1F), Tokyo Electric Power Company Holdings Inc., radiation had been generally measured only in highly contaminated areas (hot spots) using simple radiation detectors such as survey meters. However, it became necessary to develop technology to know the situation of radioactivity contamination in wide area after the 1F accident. Japan Atomic Energy Agency (JAEA) has been developing a technology to measure radiation from the sky using manned helicopter and remote-controlled unmanned helicopter.

In order to measure the radiation accurately and present the obtained data in the visible form like “radiation contamination map (air dose rate map)”, we have developed the analytical technology based on the

regional needs. The developed technology is now being used in supporting the preparation of restoration bases in the difficult-to-return zones and radiation monitoring by the Nuclear Regulatory Agency. Furthermore, the technology is used in supporting the residents to return their home.

How radiation is measured by unmanned helicopter?

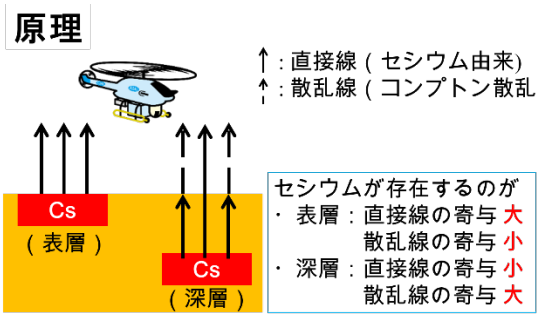
The unmanned helicopter (FAZER-R, Yamaha Motor Co. Ltd.) owned by the Fukushima Environmental Safety Center (Minamisoma City) can continuously fly for about 2 hours with a maximum load weight of about 25 kg. It can load the radiation detector for measuring radiation and the camera for surveying topography. The unmanned helicopter can fly either by manual control or by remote-control with program. Since the programmed flight has the advantage of being able to fly in the same place in the same way, it is suitable to measure the changes in radiation over the years. At the time of flight, the base stations are installed. The aircraft information is obtained and data are exchanged through the base stations. In addition to the measurement from the sky, we are also measuring radiation on the ground. Comparing and evaluating the amount of radiation obtained by the respective measurements, we are upgrading the radiation measurement system using unmanned helicopter.



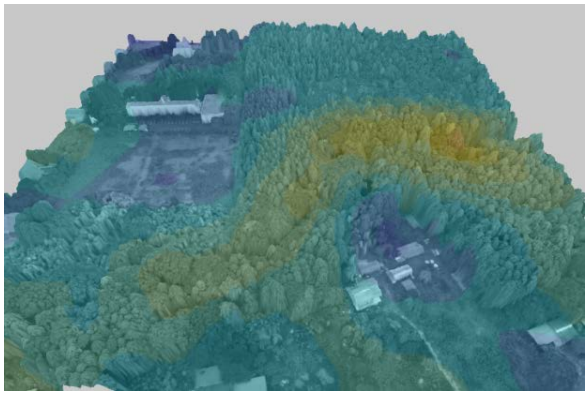
Setting up a base station.

Let's aim for upgrading the radiation measurement from the sky!

The radiation measurements from the sky by unmanned helicopter has an advantage of being able to quickly



The transmission of radiation changes depending on the depth. Using this property, the depth distribution of radioactive materials is estimated.

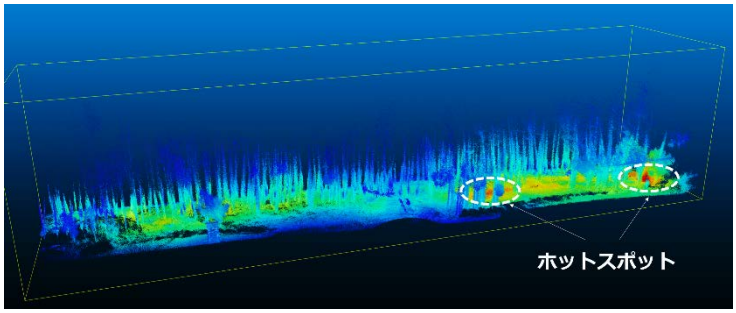


Three-dimensional map obtained by the conversion method using the information on land topography. It is seen that the radiation in forests is high.

measure wide region. However, compared with the radiation measurements on the ground, the measurements from the sky has a disadvantage because the distance between the measured ground and the detector is long. For this reason, it is difficult to measure the radiation distribution in localized region like hot spot (region where the concentration of radiation is high). To overcome this disadvantage, JAEA is developing a method to estimate the radiation at 1 m height on the ground based on the data measured from the sky. In the previous method, the radiation at 1 m height had been obtained based on only the flight altitude. In the newly developed method, we also use the information on the surrounding land topography in addition to the flight altitude. This made it possible to create a radiation map which is closer to that based on the ground measurements.

JAEA is also developing a technology to measure the depth distribution of radioactive cesium in soil from the sky. In the previous method, soil samples were collected, and then the depth profile of the radiation in soil was obtained by measuring the radioactivity after the pre-treatments of the sample. The new technology developed by JAEA enabled us to clarify the approximate depth distribution of radioactive materials in soil with simple measurements form the sky.

Further, JAEA has developed a new detector combining three-dimensional (3D) laser survey and radiation measurement in order to measure 3D radiation distribution in collaboration with the Lawrence Berkeley National Laboratory, USA. In future, we plan to develop a radiation measurement system that can obtain 3D radiation distribution not only by the measurement from the sky but also by the remote measurement.



Result of radiation distribution in a bamboo forest obtained by combining laser survey and radiation measurement. The position of the hot spot can be visually observed.

From a researcher

Miyuki Sasaki, a researcher of the Fukushima Remote Monitoring Group, Fukushima Environmental Safety Center, who is in charge of the development of technology on conversion of radiation measurement, said, “In the past three years of development, it was an unknown field because we did not know how we can convert the values measured from the sky to the ground values. Therefore, we started the work with making the computer program to convert the measured values by ourselves. We developed an optimal program in trial and error. After the hard work, we succeeded in presenting where the radiation is high in

3D space using the measured values and information on land topography. When promoting research and development, I always think that the radiation measurement technology will contribute to the residents' return as much as possible. I also hope it will be useful for the residents in Fukushima prefecture."

TOPICS Fukushima No.86
Fukushima Administrative Department
Sector of Fukushima Research and Development
Japan Atomic Energy Agency (JAEA)
Address: 8F Taira Central Building, 7-1 Aza-Omachi, Taira, Iwaki-shi, Fukushima 970-8026, Japan
Phone: +81-246-35-7650 Fax: +81-246-24-4031
Website: https://fukushima.jaea.go.jp/en/