Topics Fukushima 26 July 2013 No.25

Autonomous unmanned helicopter flying over Fukushima University

Creating a 3D topographical map using an autonomous unmanned helicopter

Combination with radiation dose map enables the analysis of the topography effects

The Japan Atomic Energy Agency (JAEA) conducted remote measurement of radiation dose using an autonomous unmanned helicopter over the campus of Fukushima University on May 3, 2013. This measurement was in accordance with a research cooperation agreement between the JAEA and Fukushima University concluded in July 2011. Fukushima University will take into consideration of the results to formulate a decontamination plan for the school grounds.

Twenty-two people including members of radiation measurement group of the JAEA gathered at Fukushima University on the day. The takeoff and landing point was set at a plot by the training camp building, and the ground base which controls the helicopter autonomously and monitors the flight and measurement status was installed on the rooftop of the Symbiotic Systems Science Research Center building.

The autonomous unmanned helicopter took off at 9:00 am with manual operation (**Photo 1**). The helicopter was operated by Katsuya Nishihara who got a license of unmanned helicopters for high altitude flight in a single year. It is said that getting the license requires experiences in crop dusting more than 10 years.

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When the autonomous unmanned helicopter reached the altitude of 80 meters, Yoshiharu Sato at the ground base switched the control from manual to autonomy then the helicopter began to fly along the pre-programmed route over the campus of Fukushima University. The position coordinate of the helicopter and air dose rates and video taken by the helicopter were sent to a computer at the ground base and shown on the display in real time (**Photo 2**).

The measurements were completed in one hour. Based on the measurement results, radiation measurement group of the JAEA prepared a radiation dose map on the campus grounds.

In addition to measuring radiation dose, the group also took aerial photographs data to create an ortho-image of 3D topographical map. "Ortho-images" are images obtained by compensating distortion of aerial photograph. The effect of topography on measured radiation dose can be examined by combining ortho-images with radiation dose data.

Radiation measurement group of the JAEA has been working on research and development of remote monitoring systems that utilize unmanned helicopters and airplanes. The group has been conducting research and development of an underwater measurement system for rivers and lakes as well as airborne monitoring.

Monitoring method

・Radiation dose measurements obtained with the detector (LaBr3 scintillator) mounted on the autonomous unmanned helicopter are converted to air dose rates at the height of one meter above the ground using parameters established in advance.

・Dose rates emitted from natural radionuclides are subtracted from the air dose rates, then amounts of both Cs-137 and Cs-134 deposition are evaluated with the dose rate-deposition conversion coefficient given in the manual put out by the Ministry of Education, Culture, Sports, Science & Technology (MEXT).

・The air dose rates and the deposition of cesium are mapped by interpolation method (kriging) using a commercially available GIS software.

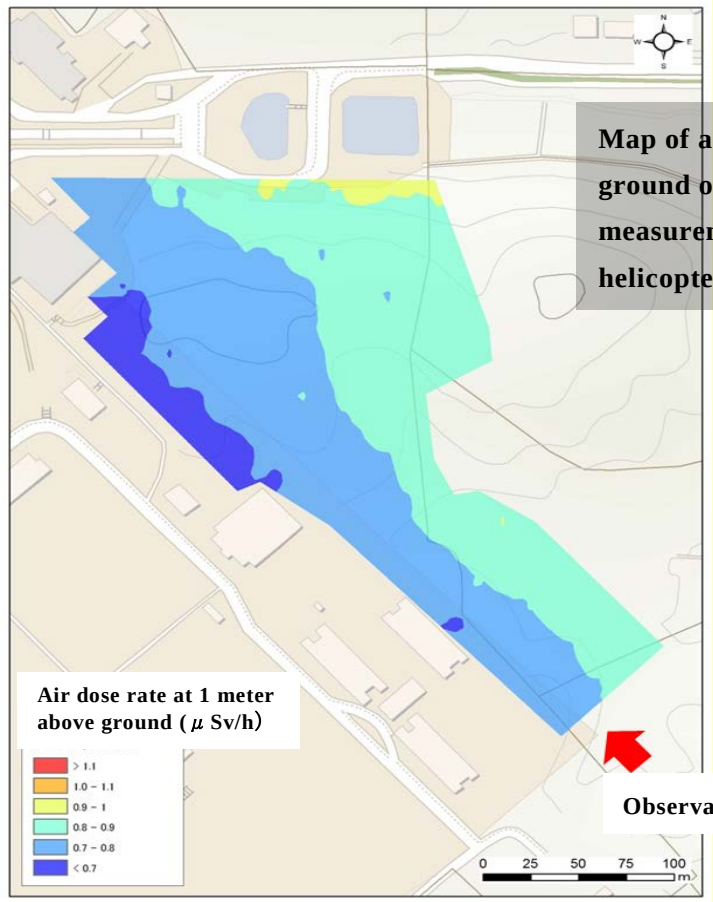
・The flight altitude above the ground of the autonomous unmanned helicopter was 80 to 100 meters (when measuring radiation) and the flight speed was 5 m/s (18 km/h).

Results

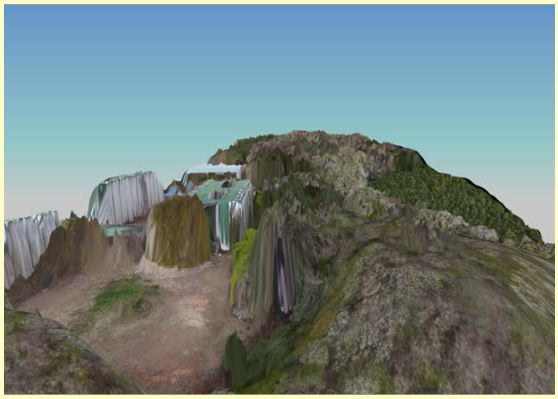
・There was not a significant gradient in the map of radiation dose.

・The maximum dose rate was 0.93μSv/h, amount of Cs-137 deposition was 1.93E+5Bq/m2, and amount of Cs-134 deposition was 1.03E+5Bq/m2.

The result of radiation dose rate measurement and the 3D topographical map



Map of air dose rates at 1 meter above ground obtained by radiation measurement using the unmanned helicopter



←3D topographical map developed by ortho-images

Position and altitude data are also saved as digital numerical data. The data can be used for analysis of the effects by topography or vegetation on dose rates.