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Application of Numerical Simulation to Predict the Environmental Transport of Radioactive Materials Discharged from Fukushima Daiichi Nuclear Power Plant due to Accident

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SUMMARY

The Fukushima Daiichi nuclear power plant accident in Japan triggered by a magnitude 9.0 earthquake and resulting tsunami on March 11, 2011 caused the month-long discharge of radioactive materials into the atmosphere. It is urgent to assess the radiological dose to the public resulting from this release. In order to do this task, the spatial and temporal distribution of radioactive materials in the environment needs to be determined although it is hardly to be obtained considering the condition of existing measured data. Computer simulations based on dispersion modeling are very useful and effective to provide the spatially and temporally 4-dimensional distribution of radioactive materials in the environment by connecting fragmentary measured data in space and time.

Japan Atomic Energy Agency (JAEA) has been developing numerical simulation system to predict the environmental transport of radioactive materials. Starting from System for Prediction of Environmental Emergency Dose Information (SPEEDI), which is currently operational as a nuclear emergency response system of Ministry of Education, Culture, Sports, Science and Technology, and Worldwide version of SPEEDI (WSPEEDI-II), we are constructing new numerical simulation system for material transport in the atmospheric, terrestrial, and oceanic environments, SPEEDI-MP (SPEEDI Multi-model Package). These numerical simulation systems have been and are planning to be applied to predict the environmental transport of radioactive materials discharged due to the Fukushima Daiichi nuclear power plant accident.

As the first step, the source term of radioactive materials discharged into the atmosphere has been estimated by coupling environmental monitoring data with atmospheric dispersion simulations under the assumption of unit release rate (1 Bq/h). The atmospheric dispersion models used for this task are SPEEDI and WSPEEDI-II. Here, the outputs of SPEEDI are provided from the Nuclear Safety Commission of Japan. As the next step, detailed analysis on the local dispersion around the plant is carried out by using WSPEEDI-II. In this analysis, the mechanism for the formation of high radiation dose zone around north-west direction from the plant. Then, we are planning to apply SPEEDI-MP to provide more information on the distribution of radioactive materials in the whole environment.