Development of real model creation tool for evaluation of air dose rate by PHITS

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Seven years have now past since the Fukushima Daiichi Nuclear Power Plant accident and evacuation orders have been rescinded in many areas. There is a need for simulations of air dose rates in the environment to consider the differences in radiocesium levels between different land types, building surfaces and forest compartments. Moreover simulations should capture the complex shielding effects of buildings, terrain, trees and soil on air dose rates. In this research a tool was developed for making 3D models of the land surface, the land type, and buildings and trees within a target area for subsequent simulation of air dose rates in PHITS. The tool utilizes ortho-photographs of the target area, as well as digital elevation models (DEM) and digital surface models (DSM) of the land, for the creation of PHITS geometry input files. The tool incorporates models for nine common building types, as well as coniferous and broadleaf trees, such that models can be customized specific for the target area. Once the geometry of the model has been created, ^{134}Cs and ^{137}Cs radioactive sources can be set flexibly across the different elements of the model.

In this presentation we report a model of a 200 m by 200 m area within Okuma Town, about 5 km away from the Fukushima Daiichi Nuclear Power Plant. The ^{134}Cs and ^{137}Cs activity distribution within the model was defined based on in-situ gamma spectroscopy measurements of radioactivities within the target area. Simulated air dose rates from PHITS were then compared to the results of a person-borne air dose rate survey across the study area. The effects of the different components of the model were tested by performing more simplistic air dose rate simulations considering flat topography without buildings and trees, as well as average uniform ^{134}Cs and ^{137}Cs activity distributions across the study area.

Keywords: air dose rate, modelling, Fukushima accident, Monte Carlo, PHITS

