Predicted spatio-temporal dynamics of radiocesium deposited on forests following the Fukushima Dai-ichi nuclear power plant accident

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Radiocesium (134Cs and 137Cs) released from the Fukushima Dai-ichi nuclear power plant to the atmosphere contaminated a large area of Japan's land surface, the majority of which is covered by forest. Here we simulated the dynamics of radiocesium deposited on Japanese forest ecosystems in 2011 using a model that was developed for tracking radionuclides in forest ecosystems after the Chernobyl accident in 1986. The fate of the radiocesium was simulated using the initial conditions observed following the Fukushima accident. In addition, the simulation results were incorporated with a spatial distribution map of deposited radionuclides that was based on an air-borne survey. The simulation demonstrated that in the first two years after initial deposition radiocesium is retained primarily in the soil surface organic layer. Over a period of five to ten years radiocesium is predicted to move from the surface organic soil to the deeper mineral soil, which will eventually become the largest reservoir of radiocesium within forest ecosystems. Spatial analysis clearly shows the reduction in the extent of contaminated areas which will occur as a result of natural decay of radiocesium, as well as the spatial distribution of radiocesium in each forest component. Considering the heavier rainfall and warmer conditions in Japan than in the countries contaminated by the Chernobyl accident, migration of radiocesium from organic to mineral soil may be faster than predicted. Although the uncertainty of our simulations should be taken into account, they provide a basis for understanding and anticipating the future dynamics of radiocesium in Japanese forests following the Fukushima accident.