A coupled watershed-biogeochemical model to simulate dissolved and particulate $^{137}$Cs discharge from a forested catchment affected by the Fukushima accident

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Dissolved $^{137}$Cs discharge represents approximately 30% of the total $^{137}$Cs discharge from the forested upstream catchment of the Ohta River in Fukushima, Japan [1]. It is thought that a major source of the dissolved $^{137}$Cs entering the river water may be leaching from forest litter [1]. A watershed simulation based on the distribution coefficient ($K_d$) that modelled water, sediment, and particulate and dissolved $^{137}$Cs transport could not reproduce the seasonal variability of the base flow dissolved $^{137}$Cs concentrations, nor the peaks in concentration that occurred during storms [2].

We developed a combined watershed-biogeochemistry model for simulating dissolved and particulate $^{137}$Cs discharge from forest catchments to describe the two phenomenon as mentioned above. A compartment model for the forest ecosystem was appended to the General-purpose Terrestrial fluid-Flow Simulator (GETFLOWS) watershed code. The compartment model included compartments for undecomposed and decomposed litter, with transfer from the former into the latter depending on temperature. A pathway for dissolved $^{137}$Cs input to forest streams was linked from the decomposed litter compartment.

The results from a simulation with the new simulation model reproduced the seasonal variability of dissolved $^{137}$Cs concentrations and the peaks occurring during storms. Therefore the new modelling results add weight to the theory that leaching from decomposed litter can input dissolved $^{137}$Cs concentrations in river water in Fukushima Prefecture. The developed model is expected to be useful for further explorations into factors affecting dissolved $^{137}$Cs input to river water in forested catchments.
