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

Kazuyuki Sakuma[1], Kazuya Yoshimura[2], Hiroshi Kurikami[3], Alex Malins[4], and Hironori Funaki[5]
[1]Japan Atomic Energy Agency, Kashiwa, Japan (sakuma.kazuyuki@jaea.go.jp)
[2]Japan Atomic Energy Agency, Minamisoma, Japan (yoshimura.kazuya@jaea.go.jp)
[3]Japan Atomic Energy Agency, Miharu, Japan (kurikami.hiroshi@jaea.go.jp)
[4]Japan Atomic Energy Agency, Kashiwa, Japan (malins.alex@jaea.go.jp)
[5]Japan Atomic Energy Agency, Minamisoma, Japan (funaki.hironori@jaea.go.jp)

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.

[1]Tsuji et al., 2016. J. Geophys. Res. Biogeosci. 121, 2588-2599.

[2]Sakuma et al., 2018. J. Environ. Radioact. 184-185, 53-62.