Understanding dissolved radiocesium discharge from a forested catchment in Fukushima Prefecture

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The Fukushima Daiichi Nuclear Power Plant accident released cesium-137 into the environment in Fukushima Prefecture. Cesium-137 is discharged from the Prefecture’s river catchments in either the dissolved or particulate form. Field monitoring surveys have shown that the majority of ^{137}Cs export from catchments in Fukushima Prefecture occurs in the particulate form. However dissolved ^{137}Cs discharge is not negligible. Tsuji et al. (2016) [1] reported that the dissolved fraction represents approximately 30% of the total ^{137}Cs discharge through rivers. Tsuji et al. (2016) [1] also reported that dissolved ^{137}Cs concentrations in river water increased during typhoon storms compared to base flow conditions, and that there is seasonal variability of the dissolved ^{137}Cs concentrations under base flow conditions. Various simulation studies have been undertaken into dissolved and particulate ^{137}Cs concentrations in rivers affected by Chernobyl and Fukushima accident fallout. Here we applied the General-purpose Terrestrial fluid-Flow Simulator (GETFLOWS) watershed code [2] to calculate water, sediment, and particulate and dissolved ^{137}Cs discharge from the upstream of Ota River catchment in Fukushima Prefecture. The main land use in this catchment is forest. The simulation results were compared with monitoring data for the amount of water discharge, the concentration of suspended solids and the dissolved ^{137}Cs concentration in river water under both base and storm flow conditions [1].
It was possible for the simulations to reproduce the mean dissolved ^{137}Cs concentrations in river water between 2014 and 2015 under base flow conditions. However neither the seasonal variability of the ^{137}Cs concentrations in base flow periods, nor the peaks in concentration that occurred during storms, could be reproduced in the simulations [3]. This may be because leaching from organic matter in forest litter provides an additional input of dissolved ^{137}Cs to rivers.
We are now extending GETFLOWS with a forest compartment model such that forest canopies, internal transport inside trees, fresh litter fall, and litter decomposition can be simulated, in order to assess the effect of these processes on ^{137}Cs concentrations in river water.

[1] Tsuji *et al.* (2016) *J. Geophys. Res. Biogeosci.* **121**, 2588-2599.
[2] Mori *et al.* (2015) *Environ. Model. Softw.* **72**, 126-146.
[3] Sakuma *et al.* (2018) *J. Environ. Radioact.* **184-185**, 53-62.

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