1–13 Prediction of Radiocesium Behavior in Upstream Catchment

— Sediment and Radiocesium-Transport Simulation during Approximately Five Years Following the 1F Accident —

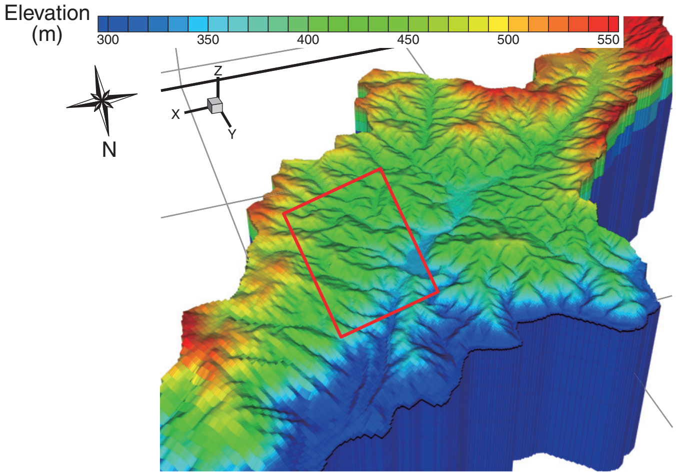

Fig.1-30 3-D-structure model developed for the study area
The red frame shows the boundary of Fig.1-31. In GETFLOWS, parameters such as the hydraulic coefficient and Manning's roughness coefficients are set for each grid described as Fig.1-30 and both surface and subsurface water flow are simulated simultaneously. Sediment and radiocesium transport are simulated based on the water fluxes of whole area and radiocesium behavior is predicted for the environment.

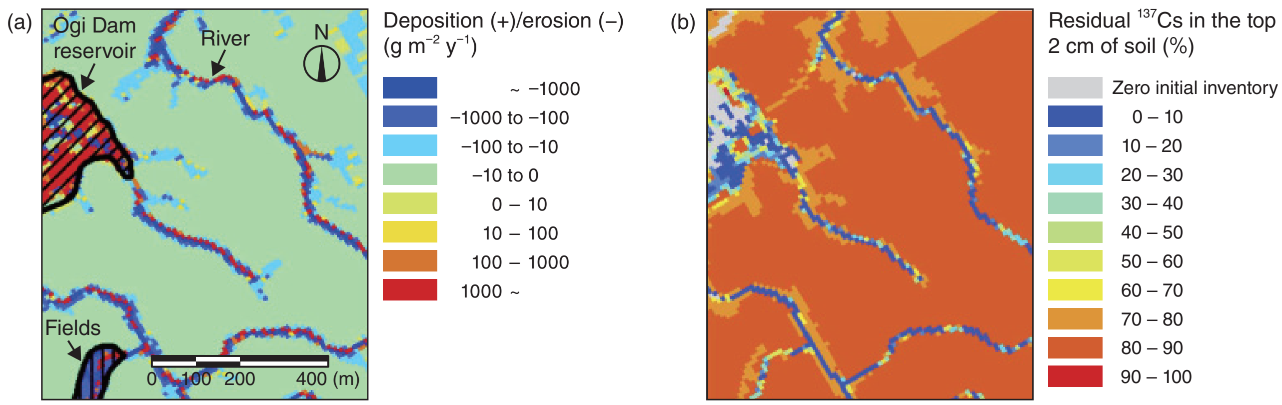

Fig.1-31 The amount of sediment erosion and deposition (a) and the fraction of residual ^{137}Cs (b) from May 2011 to December 2015
These maps show spatial redistribution of the sediment and radiocesium discharge through rivers from forested areas including crop and paddy fields. The area in the vicinity of river channel and forest gullies experience a large amount of sediment erosion, thus resulting in a reduction of residual ^{137}Cs.

Due to the accident at the TEPCO's Fukushima Daiichi NPS, significant amounts of radiocesium (RCs) remain in the top surface soil because RCs have the characteristic of adsorbing strongly to soil particles including clay minerals. Surface-soil erosion by heavy rainfalls such as typhoons is important for predicting RCs behavior in the watershed; however, we need to describe both surface and subsurface water flow to simulate this behavior with and without precipitation periods. In this study, we applied the watershed model GETFLOWS, which can describe sediment and RCs transport to an Oginosawa river catchment (Fig.1-30) in Fukushima.

Fig.1-31 shows the amount of sediment erosion/deposition and the fraction of the residual ^{137}Cs inventory from May 2011 to December 2015. Sediment erosion was found to have occurred significantly and the ^{137}Cs inventory decreased in the vicinity of the river channel and forest gullies. On the other hand, sediment erosion did not occur much in the forested area far from the rivers, with the result that the ^{137}Cs inventory remained. Therefore, the physical decay of ^{137}Cs is the most important factor in forested areas far from rivers. Calculation of ^{137}Cs sources supplied to the river at this catchment showed that contributions from the vicinity of the river channel were an order of magnitude higher than that from the forested area far from rivers. This is because surface-water flow during heavy-rainfall events can cause high sediment-erosion rates. In the future, ^{137}Cs discharge to the river is expected to decrease due to the decreasing ^{137}Cs inventory in the vicinity of the river and the migration of ^{137}Cs from top-surface soil to deeper soil. We need to watch the downstream influence of ^{137}Cs discharge by decontamination or starting cultivation in the future.

Verification and improvement of this study, especially dissolved RCs which is high bioavailability, can be used to understand mechanisms of dissolved RCs behaviors in environment in the future.

Reference
Sakuma, K. et al., Evaluation of Sediment and ^{137}Cs Redistribution in the Oginosawa River Catchment near the Fukushima Dai-Ichi Nuclear Power Plant Using Integrated Watershed Modeling, Journal of Environmental Radioactivity, vol.182, 2018, p.44–51.