1–17 Prediction of the Amount of Radiocesium Discharge during Typhoons and Heavy-Rainfall Events

— Simulation of the Amount of Radiocesium Discharge between Several River Basins —

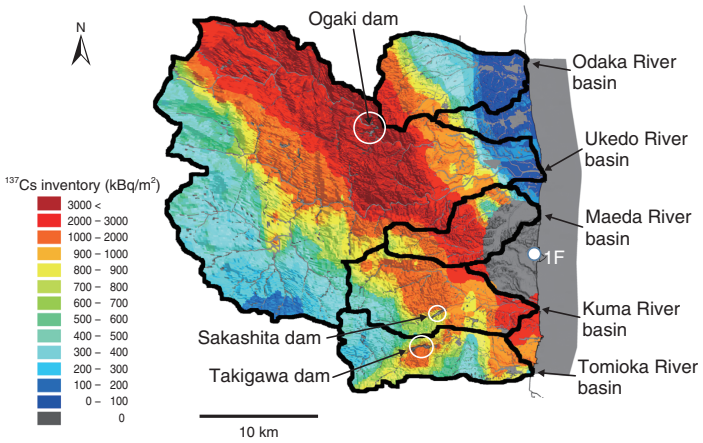

Fig.1-35 A spatial distribution of the ^{137}Cs inventory between five river basins (Odaka River, Ukedo River, Maeda River, Kuma River, and Tomioka River) near the 1F (data from the Second Airborne Monitoring Survey, May 2011)
Radiocesium inventories differ between basins. Some river basins have a dam reservoir that decreases sediment-sorbed radiocesium discharge (Odaka River basin: Without; Ukedo River basin: With; Maeda River basin: Without; Kuma River basin: With; Tomioka River basin: With). Bold black lines indicate borders between basins.

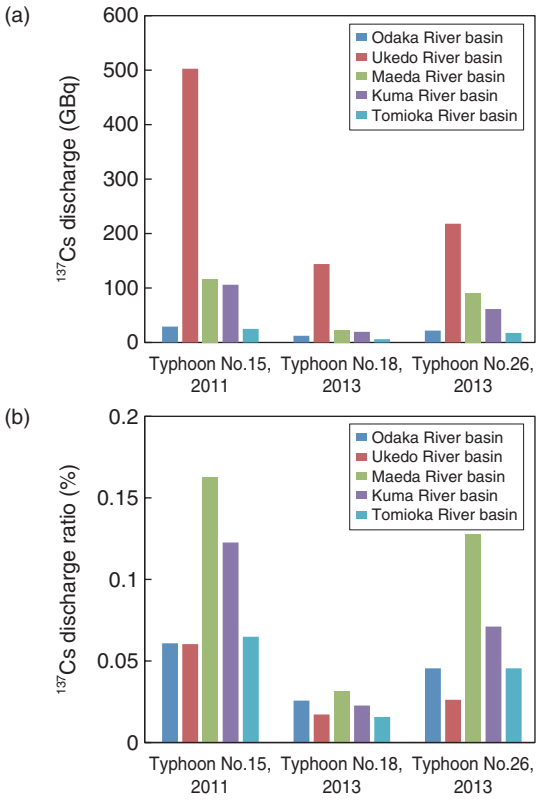

Fig.1-36 Amount of ^{137}Cs discharge (a) and discharge ratio (b) from five river basins under heavy-rainfall events such as typhoons
The amount of radiocesium discharge and the discharge ratio differ according to precipitation, initial inventory, presence of a dam reservoir, and land use.

A large amount of radiocesium derived from the TEPCO's Fukushima Daiichi NPS (1F) accident remains in the top surface-soil layer due to strong absorption to soil particles including clay minerals. Therefore, some radiocesium is discharged into rivers and oceans through rainfall events such as typhoons due to water flow and sediment transport. By understanding the characteristics of radiocesium discharge, it is possible to predict the amount of this discharge in the future.

In this study, we extended an existing watershed model of water flow and sediment transport to calculate the migration of cesium-137 (^{137}Cs) into the environment. We simulated water, sediment, and ^{137}Cs discharge during heavy-rainfall events such as typhoons in five contaminated river basins near to 1F (Fig.1-35).

In the simulation, the amount of ^{137}Cs discharge and the ^{137}Cs-discharge ratio (fraction of the amount of discharge against the initial fallout) are calculated in each river basin. The quantities for each basin are considered to differ due to the amount of sediment supplied to the river by precipitation, the initial ^{137}Cs inventory, the presence of a dam reservoir, and the land use.

Our results appear in Fig.1-36. The Ukedo River basin has a large amount of ^{137}Cs discharge due to a high initial ^{137}Cs inventory; however, its discharge ratio was low. The dam reservoir, which served to trap sediment discharge from the upper part of the river, may reduce discharge of radiocesium attached to the suspended sediment downstream. In addition, forested areas can reduce the amount of sediment discharge because surface-water flow does not occur much. Therefore, the Ukedo River basin had low ^{137}Cs discharge because the area upstream of the dam reservoir was forested. The Maeda River basin have no dam reservoir and a highly ^{137}Cs-contaminated paddy-field area, which supplied significant quantities of sediment discharge, thus resulting in a high ^{137}Cs-discharge ratio.

Verification and improvement of this study can be used to predict the amounts of sediment and ^{137}Cs discharge from basins in future.

Reference

Sakuma, K. et al., Characteristics of Radio-Cesium Transport and Discharge between Different Basins near to the Fukushima Dai-Ichi Nuclear Power Plant after Heavy Rainfall Events, Journal of Environmental Radioactivity, vols.169-170, 2017, p.137-150.