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Transportation of radiocesium through rivers in Fukushima

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Due to Fukushima Daiichi Nuclear Power Plant accident, radioactive materials including Cs-134 and Cs-137 were widely distributed in surrounded area. The radiocesiums have been transported in river networks. This study showed the monitoring results of radiocesium concentration in river waters and suspended sediments in Abukuma river basin and smaller coastal river catchments.

The monitoring started at 6 sites from June 2011. Subsequently, additional 24 monitoring sites were installed between October 2012 and January 2013. Flow and turbidity (for calculation of suspended sediment concentration) were measured at each site, while suspended sediments and river water were collected every one or half month to measure Cs-134 and Cs-137 activity concentrations by gamma spectrometry.

Activity concentrations of Cs-134 and Cs- 137 on suspended sediments were generally decreasing at all sites. The decreasing rate changed lower at about one year later from the accident. Activity concentration in river waters also showed the same tendency although there are only few data within 1 year from the accident.

Activity concentrations measured at the same day are proportional to the mean catchment inventory. Therefore, the activity concentration can be normalized by the mean catchment inventory. The normalized activity can be fitted to following double exponential function:

[At] = 1.551 exp (-5.265 t) + 0.069 exp (-0.266 t), where t is the time from the accident [year].

Radioceasium flux at a monitoring site was measured from the flow and turbidity data and the radioceasium concentration. Suspended sediment concentration (SSC) could be estimated from the turbidity data. Suspended sediment flux was calculated by multiplying the SSC by flow rate. Then, multiplying the suspended sediment flux by radioceasium concentration gave the radioceasium flux. The highest radioceasium flux occurred in Sep. 2011 due to the typhoon roke. Then, the radioceasium flux declined, however the flux increased in the summer and autumn of 2013 due to typhoon events.

There is no time evolution of Kd between suspended sediments and river water. Instead, Kd was varied spatially. Although the reason of the spatial variation is not clear for now, geology of the catchment (i.e. mineral composition of suspended particles) seems to relate the variation.

Keywords: Radioceasium concentration, suspended sediment