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Characteristics of radiocesium runoff between five river basins near to the Fukushima Daiichi Nuclear Power Plant over heavy rainfall events

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Due to the Fukushima Daiichi Nuclear Power Plant accident triggered by the earthquake and subsequent tsunami on 11 March 2011, many radionuclides were released into environments such as forests, rivers, dam reservoirs, and the ocean. 137Cs is one of the most important radio-contaminants. In order to investigate 137Cs transport and discharge from contaminated basins, in this study we developed a three dimensional model of five river basins near to the Fukushima Daiichi Nuclear Power Plant. We applied the General-purpose Terrestrial fluid-Flow Simulator (GETFLOWS) watershed code to the Odaka, Ukedo, Maeda, Kuma, and Tomioka River basins. The main land uses in these areas are forests, rice paddy fields, crop fields and urban. The Ukedo, Kuma and Tomioka Rivers have relatively large dam reservoirs (>106 m3) in the upper basins. The radiocesium distribution was initiated based on the Second Airborne Monitoring Survey. The simulation periods were 2011 Typhoon Roke, nine heavy rainfall events in 2013, Typhoons Man-yi and Wipha, and tropical storm Etau in 2015. Water, sediment, and radiocesium discharge from the basins was calculated for these events. The characteristics of 137Cs runoff between the different basins were evaluated in terms of land use, the effect of dam reservoirs, geology, and the fraction of the initial radiocesium inventory discharged. The absolute 137Cs discharge from the Ukedo River basin was highest, however the 137Cs discharge ratio was lowest due to the Ogaki Dam and the inventory being mainly concentrated in upstream forests. The results for the water, suspended sediment and radiocesium discharge as a function of total precipitation over the various rainfall events can be used to predict discharges for other typhoons.