Mid-long term change of particulate/dissolved $^{137}$Cs concentration in river water and the impact of Typhoon Hagibis in 2019

Hideki Tsuji, Hirokazu Ozaki, and Seiji Hayashi
National Institute for Environmental Studies, Fukushima Branch, Miharu, Tamura, Fukushima, Japan
(tsuji.hideki@nies.go.jp)

In Fukushima Prefecture, radiocesium as the particulate and dissolved form has been discharging from the mountains and forests since the Fukushima Dai-ichi nuclear power plant (FDNPP) accident in 2011. In particular, in October 2019, the watershed around the FDNPP was subjected to extensive flooding due to Typhoon Hagibis, resulting in significant changes in the hydrological environment. In this study, we investigated the characteristics of changes in particulate/dissolved $^{137}$Cs concentrations in the main 3 rivers in the north region of FDNPP 3–9 years after the nuclear accident and the impact of the typhoon on $^{137}$Cs dynamics in river water.

Monthly observations of river waters in baseflow conditions showed a decrease in dissolved $^{137}$Cs concentration with an environmental half-life of 2–10 years, and seasonal fluctuation such as increasing in summer and decreasing in winter. The annual amplitude of the dissolved $^{137}$Cs concentration in water released from dams was smaller and the peak of the concentration was observed later than that in river sites where the influence of dams is small. The $^{137}$Cs concentrations in the suspended solids did not show any significant seasonal variation, and the environmental half-life of 1–8 years was relatively faster than the dissolved forms observed at the same site. Immediately after Typhoon Hagibis in 2019, the dissolved $^{137}$Cs concentration decreased significantly compared to the previous years, especially at two dam lake discharge sites. At the two sites, the dissolved $^{137}$Cs concentration did not recover to the level predicted by the pre-typhoon data even one year after the typhoon event, but no significant decrease in $^{137}$Cs concentration in suspended solids was observed. These differences in the environmental behavior of $^{137}$Cs in different forms suggest that there are limitations in predicting particulate and dissolved $^{137}$Cs concentrations with a fixed parameter such as partition coefficient.