

Behavior and migration of radiocesium in brackish water: A case study of the Matsukawa-ura lagoon, Fukushima, Japan

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Radionuclides were released into the environment associated with the Fukushima Daiichi Nuclear Power Plant (FDNPP) disaster. Radiocesium (Cs), released from FDNPP and deposited on the land, will migrate to the ocean through the surface runoff. In this study, we intended to determine the geochemical transport of Cs in the system of river - estuary - ocean in Matsukawa-ura Lagoon, northern Fukushima, Japan as a model area. Samples were collected in the study area from September 2013 till now. Sinking particle sampling was involved in the installation of sediment traps from November 26 to December 19, 2013. Surface sediment Cs-137 in the Matsukawa-ura showed apparent spatial and temporal variations, therefore, time series of the weighted average sediment Cs-137 was used in the following discussion. It was speculated that some natural purifying processes affected the sediment Cs in the Matsukawa-ura because the observed effective half-life of Cs-137 in the sediment was shorter than the theoretically physical half-life. Sinking particles were re-suspended in the Matsukawa-ura and transported to the ocean by tidal pumping because total sinking particle flux and particulate Cs-137 export flux in the mouth were larger than those in the inner lagoon. It is suggested that re-suspension in the lagoon and transport to the ocean of particles were important natural purifying processes for Cs in Matsukawa-ura. In water samples, particulate Cs-137 was significant relative to dissolved Cs-137 in the river; in contrast, dissolved Cs-137 was dominant in brackish water. So, it is found that the outflow of the dissolved phase is important in the material cycle of Cs because the dissolved abundance ratio increases in brackish water. The enrichment behavior of dissolved Cs-137 in the brackish water could be attributable to particle desorption. It is suggested seawater exchange with lagoon water desorbed Cs and outside seawater contribute a natural purifying effect in the Matsukawa-ura.

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