



Estimation of total released amount of Cs-137 and Cs-134 derived from TEPCO-FNPP1 accident into the North Pacific Ocean by using optimal interpolation analysis

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The oceanic distribution of Cs-137 and Cs-134 released from the Tokyo Electric Power Company-Fukushima Daiichi Nuclear Power Plant (TEPCO-FNPP1) accident were investigated by using the optimal interpolation (OI) analysis. The two domains (open ocean, $>141.5^{\circ}\text{E}$; coastal region near the TEPCO-FNPP1, $<141.5^{\circ}\text{E}$) were set to the OI analysis.

During the period from end of March to early of April 2011, extremely high activities of Cs-137 and Cs-134 in seawater were concentrated along the coast near the TEPCO-FNPP1. The high activities area spread to the region of 165°E with a latitudinal center of 40°N in the western North Pacific Ocean. Atmospheric deposition is also cause to high activities in the region between 180° and 130° W in the North Pacific Ocean. The total inventory of FNPP1-released Cs-134 in the North Pacific Ocean is estimated to be 15.2 ± 1.8 PBq. In these, about half (8.3 ± 1.8 PBq) of the total released Cs-134 amount existed in the coastal region near the TEPCO-FNPP1. It appeared that the total OICs134 inventory, which is defined as a total Cs-134 inventory in the coastal area near the TEPCO-FNPP1, is controlled by direct release, atmospheric deposition, and coastal current system. Leak of stagnant water induced by heavy rainfall would also cause the increase of the total OICs134 inventory. After the direct discharge of the contaminated water ceased on 6 April, 2011, the total OICs134 inventory exponentially with a half-time of 4.2 ± 0.5 days and became to about 2.0 ± 0.4 PBq at the middle of May 2011. Considering that the Cs-134/Cs-137 activity ratios for the FNPP1 accident were very close to one (0.99 ± 0.03) and extremely uniform during the first month, the total amount of Cs-137 released by the TEPCO-FNPP1 accident reached to 20% of a current North Pacific inventory (60 PBq, Aoyama et al., 2012) of bomb-derived Cs-137 injected in the 1950s and early 1960s.