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Fukushima-derived radiocesium flux observed by time-series sediment traps in the western North Pacific

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On 11 March 2011, the 2011 Tohoku-Oki Earthquake occurred. This earthquake and the tsunami it generated seriously damaged the Fukushima Daiichi Nuclear Power Plant (FNPP1). Large quantities of artificial radionuclides were emitted from FNPP1 by hydrogen explosions, venting, and intentional and accidental discharge of radiologically contaminated water. At two stations in the western North Pacific, K2 in the subarctic gyre and S1 in the subtropical gyre, time-series sediment traps were collecting sinking particles when the FNPP1 accident occurred. Radiocesium (134Cs and 137Cs) derived from FNPP1 accident was detected in sinking particles collected at 500 m by late March 2011 and at 4810 m by early April 2011 at both stations. The sinking velocity of 134Cs and 137Cs was estimated to be 8 to 36 m day–1 between the surface and 500 m and >180 m day–1 between 500 m and 4810 m. 137Cs specific activity varied from 0.14 to 0.25 Bq g–1 dry weight. These values are higher than those of surface seawater, suspended particles, and zooplankton collected in April 2011. Although the radiocesium may have been adsorbed onto or incorporated into clay minerals, correlations between 134Cs and lithogenic material were not always significant; therefore, the form of the cesium associated with the sinking particles is still an open question. The total 137Cs flux by late June at K2 and by late July at S1 was 0.5 to 1.7 Bq m–2 at both depths. Compared with 137Cs input to both stations by April 2011, estimated from the surface 137Cs activity and mixed layer depth and by assuming that the observed 137Cs flux was constant throughout the year, the estimated removal rate of 137Cs from the upper layer (residence time in the upper layer) was 0.3 to 1.5% (68 to 312 years). The estimated removal rates and residence times are comparable to previously reported values. Based on preliminary results of measurement of flux and concentration of 134Cs flux at 4810 m of K2 obtained by February 2012, the maximum of flux and concentration was observed in May and Jun 2011 and decreased gradually thereafter. However 134Cs was still detected and the ratio of 134Cs to 137Cs was close to one in sinking particle collected in February 2012. Total 134Cs flux at 4810 m of K2 by February 2012, at about one year after FNPP1 accident, was estimated to be higher than 2.5 Bq m-2. Assuming that the 134Cs inventory (atmospheric 134Cs input) at K2 was 450 Bq m-2, removal rate of 134Cs from the upper layer (residence time in the upper layer) was > 0.6% (< 180 years). In June-July 2012, seafloor sediments at K2 and S1 were collected. Analysis of radiocesium in the seafloor sediment and sinking particle collected by sediment trap is still ongoing. During EGU 2013 meeting, Fukushima derived radiocesium flux in sinking particle and inventory of radiocesium in the seafloor sediment will be discussed.