Geophysical Research Abstracts
Vol. 20, EGU2018-5866, 2018
EGU General Assembly 2018

Rapid transportation of FNPP1 derived radiocaesium suggesting new pathway of subtropical mode water from the western North Pacific to the Sea of Japan

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Fukushima Dai-ichi Nuclear Power Plant (FNPP1) accident occurred in March 2011 released radiocaesium (137Cs (T1/2 30.07 yr) and 134 Cs (T1/2 2.06 yr)) by atmospheric deposition and direct discharge of liquid contaminated water, mostly in the western North Pacific Ocean. After several years, it was found that radiocaesium activity concentrations in seawater in the Sea of Japan tend to increase due to the transportation of FNPP1 derived 137Cs (Aoyama et al., 2017). The inflow of FNPP1derived 137Cs in the Sea of Japan had started in 2012 and activity concentration of FNPP1 derived radiocaesium in surface water reached to the maximum in 2015/2016. Transport route and or its mechanism were considered as follows; FNPP1 derived 137Cs had injected into the western North Pacific Ocean at south of Kuroshio, then subducted into ocean interior just after the accident due to formation of Sub Tropical Mode Water (STMW), then transported southward/southwestward. A part of FNPP1derived 137Cs in STMW may reached the western boundary at lower latitudes, and obduct to the surface seawater across the Kuroshio, and is northward transported to the west of Kyushu by Tsushima Warm Current bifurcated from the Kuroshio. This pathway might be new finding of transport process from the western North Pacific Ocean to the Sea of Japan. Almost same value of the decay corrected 134Cs/137Cs activity ratio at the time of the accident around the Japanese islands (East China Sea, Sea of Japan, and the northwestern Pacific Ocean in the south of the Japanese islands) also support this circulation route. The integrated amount of FNPP1 derived 137Cs entered in the SOJ until 2016 was estimated to be 0.20±0.03 PBq, which corresponds to 5.1 (3.4-8.0) % of 4.2±1.1 PBq, the total amount of FNPP1derived 137Cs in the STMW which was estimated by Kaeriyaka et al., (2016). The integrated amount of FNPP1derived137Cs back to the North Pacific Ocean through the Tsugaru Straight in the surface layer was 0.1±0.02 Bq, which corresponds to 0.6 (0.4-1.0) % of the total amount of FNPP1derived 137Cs in the STMW.

(Reference)

Aoyama et al. (2017) Recirculation of FNPP1-derived radiocaesium observed in winter 2015/2016 in coastal regions of Japan, Applied Radi. Isotopes., 126, 83-87.

Kaeriyama et al. (2014) Intrusion of Fukushima-derived radiocaesium into subsurface water due to formation of mode waters in the North Pacific, Sci. Rep., 6, 22010, DOI: 10.1038/srep22010.