Vertical profiles of 134Cs and 137Cs in 1980, 2002, 2011, 2012 and 2015 along 165 deg. E in the North Pacific Ocean

*Michio Aoyama[1], Daisuke Tsumune[2], Takaki Tsubono[2], Yasunori Hamajima[3], Yuichiro Kumamoto[4], Toshiya Nakano[5]

1.Institute of Environmnetal Radioactivity, Fukushima University, 2.Central Research Institute of Electric Power Industry, 3.Low Level Radioactivity Laboratory, Kanazawa University, 4.Japan Agency for Marine-Earth Science and Technology, 5.Japan Meteorological Agency

134Cs and 137Cs, hereafter radiocaesium, were released to the North Pacific Ocean by two major likely pathways, direct discharge from the TEPCO Fukushima Dai-ichi Nuclear Power Plant (FNPP1) accident site and atmospheric deposition off Honshu Islands of Japan, east and northeast of the site. Activities of radiocaesium released by the FNPP1 accident were measured along 165 deg. E in 2011, 2012 and 2015. In this presentation, we present long term behavior of FNPP1 released radiocaesium in the ocean interior of the North Pacific Ocean based on the observations and model simulations through 2015. We also discuss about 137Cs profiles observed in 1980 and 2002 in the same region which derived from atmospheric nuclear weapons tests conducted in late 1950s and early 1960s.

In 2002, the 137Cs profile along 165°E in the North Pacific Ocean is characterized by several subsurface cores with high 137Cs, including two 137Cs concentration maxima at 20°N, 165°E, one at 250 m and one at 400–500 m depths. The shallower maximum is in the density range of subtropical mode water (STMW) and the deeper one is in the density range of central mode water (CMW). The main 137Cs cores, therefore, were formed by movements of STMW and CMW in the interior ocean during the past four decades in 2002. The 137Cs has been transported from subarctic region to subtropics and tropics as a result of subduction.

In October 2011, 134Cs activity derived from FNPP1 accident showed a maximum of 24.4 ±1.77 Bq m−3 at 26 meters depth at 40°N, 165°E and 80 % of 134Cs inventory existed shallower than 200 meters depth while 134Cs activity showed a maximum of 9.18 ±0.71 Bq m−3 at 301 meters depth at 39°N, 165°E and only 20 % of 134Cs inventory existed shallower than 200 meters depth in June 2012.

In June 2012, 134Cs activity also showed a maximum at subsurface at 29°N, 165°E. This subsurface maximum, which was also observed along 149°E, might reflect the southward transport of FNPP1-derived radiocaesium in association with the formation and subduction of STMW. In June 2012 at 34°N–39°N along 165°E, 134Cs activity showed a maximum at around potential density= 26.3 kg m−3, which corresponds to CMW. 134Cs activity was higher in CMW than in any of the surrounding waters, including STMW. These observations indicate that the most effective pathway by which FNPP1-derived radiocaesium is introduced into the ocean interior on a 1-year time scale is CMW formation and subduction. In June-July 2015 at 36°N–44°N along 165°E, there are only very week signal of subduction of FNPP1-derived radiocaesium which means subducted radiocaesium might move eastward from this region.

Keywords: radiocaesium, North Pacific Ocean, subduction, Fukushima Dai-ichi Nuclear Power Plant (FNPP1) accident

