

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

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^{134}Cs and ^{137}Cs , 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 ^{137}Cs 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 ^{137}Cs profile along 165°E in the North Pacific Ocean is characterized by several subsurface cores with high ^{137}Cs , including two ^{137}Cs 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 ^{137}Cs cores, therefore, were formed by movements of STMW and CMW in the interior ocean during the past four decades in 2002. The ^{137}Cs has been transported from subarctic region to subtropics and tropics as a result of subduction.

In October 2011, ^{134}Cs 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 ^{134}Cs inventory existed shallower than 200 meters depth while ^{134}Cs 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 ^{134}Cs inventory existed shallower than 200 meters depth in June 2012.

In June 2012, ^{134}Cs 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, ^{134}Cs activity showed a maximum at around potential density= 26.3 kg m⁻³, which corresponds to CMW. ^{134}Cs 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 weak 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