Re-circulation of ^{137}Cs concentrations in surface seawater in the western North Pacific Ocean

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We investigated spatial and temporal variations in ^{137}Cs concentrations in the surface waters of the global ocean for the period from 1957 to 2018 by using HAM database global 2019 version. In order to study the distribution of ^{137}Cs concentrations in surface seawater, we divided the global ocean into 37 latitudinal boxes on the basis of known ocean current systems, latitudinal and longitudinal distributions of ^{137}Cs concentrations, the distribution of global fallout, locations of nuclear reprocessing plants, fallout from the Chernobyl accident, and release from Fukushima Nuclear Power Plant accident. The 0.5-y average value of ^{137}Cs concentrations in the surface water in each box were estimated.

In this study, we focus on temporal variation of ^{137}Cs concentrations in the western North Pacific Ocean (NPO) and its marginal sea. In the NPO where there was high fallout from atmospheric nuclear weapons tests, the rates of decrease in the ^{137}Cs concentrations changed over the five decades: the rate of decrease from the 1950s to the 1970s was much faster than that after the 1970s, and the ^{137}Cs concentrations were almost constant after the 1990s. The ^{137}Cs released into the western North Pacific Ocean by global fallout were transported eastward with the Kuroshio and North Pacific Currents and accumulated in the eastern NPO. Following then, global fallout-^{137}Cs were southward transport in the NPO and subducted into the subsurface layer (1). It was found that global fallout-^{137}Cs were westward transported into subtropical mode water and Central Mode Water in the NPO, suggesting the re-circulation of global fallout-^{137}Cs (2). The apparent half residence time (Tap) of ^{137}Cs in the surface sea water in the western NPO, Sea of Japan (SOJ), East China Sea (ECS) between 2000 and 2010 were 17.3yr, 23.5yr, and 18.0 yr, respectively. The longer Tap in SOJ and ECS suggests that ^{137}Cs derived from global fallout may be recirculated into the SOJ through ECS from wNPO. The recirculation of ^{137}Cs is also found by the intrusion of Fukushima Daiichi Nuclear Plant derived ^{137}Cs (FNPP1-^{137}Cs) after 2012 (3,4). Considering that the increase of FNPP1-^{137}Cs occurred within several years after the FNPP1 accident, the seawater transport route into the SOJ from the NPO with shorter time scale would be existed.

(Reference)
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