



Analysis of 60-yr record of surface ^{137}Cs concentrations in the global 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. 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. Based on the 0.5-y average value of ^{137}Cs concentrations in the surface water in each box, we classified the temporal variations into four types. In the North Pacific Ocean 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. Latitudinal differences in ^{137}Cs concentrations in the North Pacific Ocean became small with time. After March 2011, extremely high concentrations ($3.26 \times 10^7 \text{ Bq/m}^3$) were observed in the western North Pacific Ocean based on the direct release and atmospheric deposition of FNPP1-derived ^{137}Cs . In the equatorial Pacific and Indian Oceans, the ^{137}Cs concentrations varied within a constant range in the 1970s and 1980s, due to the advection of ^{137}Cs from areas of high global fallout in the mid-latitudes of the North Pacific Ocean. In the eastern South Pacific and Atlantic Oceans (south of 40°S), the concentrations decreased exponentially over the six decades. In the Arctic and North Atlantic Oceans, including marginal seas, ^{137}Cs concentrations were strongly controlled by discharge from nuclear reprocessing plants after the late 1970s. The ^{137}Cs concentrations were rapidly decreased after the early 1980s, and advected into the Arctic Ocean.

The averaged ^{137}Cs concentrations in each box in the year of 1970 were $1\text{--}716 \text{ Bq/m}^3$, and those were decreased to $0.2\text{--}28 \text{ Bq/m}^3$ in the year of 2010. The apparent half-residence times of ^{137}Cs in the surface waters of the global ocean from 1970 to 2010 ranged from 4.2 to 48.1 years for each box.

(Reference)

Inomata et al. (2009) Analysis of 50-y record of surface ^{137}Cs concentrations in the global ocean using the HAM-global database. *Journal of Environmental Monitoring*, DOI: 10.1039/b811421h.

