Fukushima Dai-ichi and the Ocean: 10 years of study and insight Abstract Submission Form : Entry # 27

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Consequences for the ocean

Abstract Title (English, limited to 300 characters)

Spreading of the Fukushima-derived radiocesium in the North Pacific Ocean and its adjacent seas in the past decade

Abstract (English)

In March/April 2011, a large amount of radiocesium (134Cs and 137Cs) was released into the atmosphere from the damaged Fukushima Dai-ichi Nuclear Power Plants (FNPP1). The released radiocesium was deposited mainly on the land of Japan, North Pacific Ocean, Japan Sea, and Okhotsk Sea. Another main source is contaminated water discharged to the North Pacific from the FNPP1. The oceanic radiocesium was dissolved in seawater immediately because of its solubility and then transported along with seawater circulations in the surface layer. There are two large surface circulations in the North Pacific Ocean; the southern clockwise (subtropical) and northern anti-clockwise (subarctic) circulations. Around 35–45ºN between the two circulations, there is a strong eastward current. Because the FNPP1 locates at 37.4°N/141.0°E, 134Cs directly-discharged and atmospheric-deposited on the coastal area of the FNPP1 was transported along with the eastward surface current in the mid-latitude from Japan to the North American Continent. The core of a high-134Cs-concentration water plume in the surface layer shallower than about 200 m depth was observed at around 180° in summer 2012, 150°W in 2014, and the coastal area of the North American Continent in 2016. Subsequently, the main body of the water plume turned northward and then westward along with the anti-clockwise subarctic circulation in the Gulf of Alaska in 2017 and probably arrived at the Bering Sea in 2018/2019. Furthermore, low concentrations of the FNPP1-derived 134Cs were observed in the Arctic Ocean (the Chukchi Sea) in 2017. The 134Cs deposited just south of the eastward current around 35ºN was penetrated to a few hundred-meter depth due to the formation of the subtropical mode water (STMW). Consequently, it has been transported southward through 200–400 m subsurface depth along with a clockwise circulation of STMW and spread over the western subtropical area, East China Sea, and then Japan Sea. Another subsurface mode water, the central mode water (CMW) denser than STMW also has conveyed the FNPP1-derived 134Cs southward. The decay-corrected inventory of the FNPP1-derived 134Cs in the subarctic area was estimated to be 9–16 PBq. In the subtropical area, the estimated inventory in STMW was 4–6 PBq while the inventory in CMW is unknown due to the lack of the data.