Fukushima Dai-ichi and the Ocean: 10 years of study and insight Abstract Submission Form : Entry # 46

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Session

What happened

Abstract Title (English, limited to 300 characters)

Characterization of cesium isotopic composition in offshore seawater in May 2011 after Fukushima nuclear accident

Abstract (English)

Since the Fukushima Daiichi nuclear power plant (FDNPP) accident in 2011, intensive studies on the distribution of released fission products, in particular 134Cs and 137Cs, in the environment have been conducted, and the activity ratio of 134Cs/137Cs has been widely used as a tracer for contamination source identification, for tracing the migration of released 137Cs in the North Pacific and study on the mode water evolution. However, due to the short half-life of 134Cs (2.06 y), this tracer will become unavailable in the future.
Cs isotopes are FPs with high yields up to 6.535 % and 6.236 % for 135Cs and 137Cs, respectively, from the thermal neutron fission of 235U. In addition, 135Cs has a half-life of 2x106 y, therefore, the 135Cs/137Cs isotopic ratio can be considered as a new powerful tracer for long-term source identification and environmental behavior studies. It has been estimated that ca. 7.01x10-5 PBq (1.64 kg) 135Cs has been released into ocean since the FDNPP accident.
To use Fukushima accident released 135Cs as new tracer for traceing the transport of released radionuclides in the Pacific Ocean and other potential oceanography studies, the isotopic fingerprint must be elicidated. We recently analyzed activities of 137Cs and 135Cs, and Cs isotopic reatios (135Cs/137Cs, 135Cs/133Cs) in Fukushima offshore seawaters collected in May 2011 in YK11-E02 cruise using a newly developed ICP-MS/MS analytical method with 2 L seawater. The 137Cs activity ranged from 0.97 to 13.7 Bq/L in the 16 analyzed seawater samples. The highest 137Cs activity measured in these offshore water was more than 4 orders of magnitude increase over prior activities. The 135Cs concentration ragned from 0.13 to 1.4 pg/L in the analyzed offshore waters. The

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135Cs/137Cs atom ratios ranged from 0.28 to 0.34, with a mean of 0.32+/-0.02. A linear corelation between 137Cs activity and 135Cs/133Cs atom ratio was observed. These results indicated that similar to the 137Cs atmospheric deposition in terrestrial environment, the main release sources for Fukushima accident derived radiocesium in the North Pacific were the units 2 and unit 3 reactors. The characterization of radiocesium isotopic composition in the source-term seawater will be of benefit to verify simulation models for better understanding the dispersion/migration of the accident-released radionuclides in the Pacific Ocean