

## Measurement of radiocesium in spare seawater samples collected in marine monitoring for the Fukushima accident in 2011

KUMAMOTO, Yuichiro<sup>1\*</sup> ; YAMADA, Masatoshi<sup>2</sup> ; AOYAMA, Michio<sup>3</sup> ; HAMAJIMA, Yasunori<sup>4</sup> ; MURATA, Akihiko<sup>1</sup> ; KAWANO, Takeshi<sup>1</sup>

<sup>1</sup>JAMSTEC, <sup>2</sup>Hirosaki University, <sup>3</sup>Fukushima University, <sup>4</sup>Kanazawa University

In March 2011 radionuclides, including radiocesium, were released from damaged Fukushima Dai-ichi Nuclear Power Plants (FNPP1) to the environment. It has been suggested that a large portion of radiocesium was transported into the North Pacific Ocean. However, its transportation process and total amount in the open are still unclear. Just after the accident, from 23th March 2011, Ministry of Education, Culture, Sports, Science and Technology (MEXT) started marine monitoring in a coastal area between 30 and 50 km approximately away from the FNPP1. Results of radionuclides (radiocesium, radiostrontium, and radioiodine) measurements had been published by MEXT (after April 2013 those are available on a web page of Nuclear Regulation Authority). Number of these observational data, however, is not enough to discuss transportation process of the Fukushima-derived radionuclides in the ocean mainly because of urgent and quick measurements during the marine monitoring. For example, radiocesium in the seawaters had been measured using a simple method by July 2011. As a result, about three months from May to July 2011 was a data-blank period in the open ocean within approximately 200 km from the FNPP1 because most of the measurement results were under detection limit. During the marine monitoring in 2011, spare seawater samples were also collected in some cruises conducted by research ships of the Japan Agency for Marine-Earth Science and Technology (JAMSTEC). We obtained these spare samples from JAMSTEC and measured radiocesium in them using a high-sensitivity method and present here spreading process of the Fukushima-derived radiocesium from May to July 2011 in the open ocean. The spare seawater samples (10 or 20 liters each) were collected during seven cruises using Niskin samplers. Radiocesium in the spare samples from four cruises (YK11-E02, NT11-E01, MR11-E02, and KR11-E04) was concentrated by evaporation or addition of ammonium phosphomolybdate and measured with low-background Ge-detectors at the Low Level Radioactivity Laboratory, Kanazawa University or Mutsu Institute for Oceanography, JAMSTEC. Uncertainty of the measurements, which was derived from sample preparation and analysis, was about 8%. In the early May 2011, high activity concentration (more than 500 Bq/m<sup>3</sup>) of <sup>134</sup>Cs, which was released from the FNPP1 to the North Pacific though direct discharge of contaminated water in April 2011, was observed within about 50 km from the shore in off of Fukushima and Miyagi Pref. This north/southward spreading could be explained by prevailing north/southward coastal current in off of Fukushima Pref. On the other hand, a high activity concentration observed at a station located in 37.5N/142E about 100 km away from the FNPP1 implies eastward spreading of the Fukushima-derived <sup>134</sup>Cs due to a mesoscale eddy. In the early June 2011, the activity concentration decreased in off of Fukushima Pref. within about 50 km from the FNPP1 while the high activity concentration water had been spread to the Sendai Bay (Miyagi Pref.) and Kashima-Nada (Ibaraki Pref.). In addition, the high activity concentration water was transported eastward to about 200 km offshore (around 142.5E) along the Kuroshio Extension Current between 36.5 and 37N approximately. The southward and eastward wide-spreading in June could be derived from erosion of a warm mesoscale eddy off Ibaraki Pref. by the end of May 2011. In the early July, the high activity concentration of <sup>134</sup>Cs was observed only in the Sendai Bay and Kashima-Nada, except at stations nearby the FNPP1, suggesting that a main body of the <sup>134</sup>Cs contaminated water due to the direct discharge had been transported to outside of about 200 km from the FNPP1. Water-column inventory of the Fukushima-derived <sup>134</sup>Cs will be also presented in our presentation. This work was partially supported by Japan Society for the Promotion of Science (JSPS) KAKENHI Grant Number 24110005.

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