

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

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Session

What happened

Abstract Title (English, limited to 300 characters)

Retrieval of hourly atmospheric radiocesium in the early period of the TEPCO Fukushima Daiichi Nuclear Power Plant accident by analyzing used filter-tapes of operational air pollution monitoring stations

Abstract (English)

The data of atmospheric radionuclides were limited in the early period after the TEPCO Fukushima Daiichi Nuclear Power Plant (FD1NPP) accident on March 11, 2011, compared to the data of deposition densities of radionuclides on the ground. To reduce the uncertainties of source term, atmospheric transport models, and internal exposure related to the accident, which the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR, 2013) already pointed out, we have started to retrieve the hourly atmospheric radiocesium (^{134}Cs and ^{137}Cs) concentrations in the early period after the accident in the eastern part of Japan since 2012. The radiocesium in suspended particulate matter (SPM<10 μm in diameter) have been measured by Ge semiconductor detectors, which were automatically collected every hour on filter-tapes in SPM monitors to measure SPM concentrations ($\mu\text{g m}^{-3}$) in the air pollution network of Japan, after the used filter-tapes at more than 500 stations were offered by many local governments through the Ministry of the Environment, Japan. The hourly atmospheric radiocesium concentrations during March 12-23, 2011 at 101 stations including two stations closely located near the FD1NPP were already reported (Tsuruta et al., 2014, 2018; Oura et al. 2015), excluding the dates when the radioactive plumes were assumed not to be transported to the SPM stations.

Major findings are as follows by analyzing those data. The spatio-temporal distributions of atmospheric ^{137}Cs concentrations were retrieved in the eastern part of Fukushima prefecture and the Kantou area where the Tokyo Metropolitan Area is included. 19 radioactive plumes/polluted air masses with high ^{137}Cs concentrations ($>15 \text{ Bq m}^{-3}$) were identified, and most of them were transported to the eastern part of the Fukushima prefecture, and 4 plumes among them were transported at first to the southeastern part of the Fukushima prefecture, and then to the Kantou area. The highest ^{137}Cs concentration of $13,600 \text{ Bq m}^{-3}$ was measured at the SPM station located 3.2 km northwest of the FD1NPP at 15:00 (JST) on March 12, 2011 after the vent operation at Unit 1, just before the hydrogen explosion of Unit 1 at 15:36 (JST). The activity ratios of $^{134}\text{Cs}/^{137}\text{Cs}$ (0.92-0.94) at around peak concentrations in the plumes observed during March 12-13 indicate that the plumes

were released from Unit 1, corresponding to the ratio of 0.94 in the inventory data (Nishihara et al. 2012), while the sources of the other plumes observed after March 15 with the ratio of 1.01-1.05 were Unit 2 and/or Unit 3. The hotspot area of the high ^{137}Cs deposition densities in the Kantou area measured by the airborne monitoring (MEXT, 2012) was consistent with the area of the SPM stations with the high time-integrated ^{137}Cs concentrations on the morning of March 21 when the precipitation was observed uniformly in the Kantou area. It strongly indicates that the spatio-temporal distribution of atmospheric ^{137}Cs was the major factor controlling the deposition map of ^{137}Cs .