



First retrieval of hourly atmospheric radionuclides just after the Fukushima accident by analyzing filter-tapes of operational air pollution monitoring stations

Haruo Tsuruta (1), Yasuji Oura (2), Mitsuru Ebihara (2), Toshimasa Ohara (3), and Teruyuki Nakajima (1)

(1) The University of Tokyo, Atmosphere and Ocean Research Institute, Kashiwa, Chiba, Japan (haru2004@aori.u-tokyo.ac.jp), (2) Department of Chemistry, Tokyo Metropolitan University, Hachioji, Tokyo, Japan, (3) Fukushima Project Office, National Institute for Environmental Studies, Tsukuba, Japan

The current estimates for the internal radiation doses from inhalation by the Fukushima Daiichi Nuclear Power Station (FD1NPS) accident on March 11, 2011 have large uncertainty, because no observed data has been found of continuous monitoring of radioactive materials in the atmosphere in the Fukushima prefecture (FP) just after the accident, compared with the many observed datasets of deposition densities of radionuclides on the grounds in eastern Japan. To retrieve the atmospheric transport of radioactive materials released from the FD1NPS, we collected the used filter tapes installed in Suspended Particulate Matter (SPM) monitors with beta-ray attenuation method operated in the air pollution monitoring network of eastern Japan. Then, we measured hourly Cs-134 and Cs-137 concentrations in SPM at 40 monitoring sites in the FP and Tokyo Metropolitan Area (TMA) located more than 170 km southwest of the FD1NPS, after more than one year. The period for measurements was during March 12-23, 2011, when atmospheric, aquatic, and terrestrial environments were seriously suffered in most of eastern Japan by a large amount of radioactive materials released from the FD1NPS. In this paper, a comprehensive study will be reported for the first time on a spatio-temporal variation of atmospheric Cs-137 concentrations in the FP and the TMA. Major results are as follows; (1) Nine major plumes with Cs-137 concentrations higher than 10 Bq m⁻³ were found, of which 5 and 4 plumes were transported to the FP and TMA, respectively. The radioactive materials from the FD1NPS was transported four times in the period to the northern part of Hamadori located in the east coast of the FP, and which was little known up to this study. (2) Two plumes transported to the TMA were newly founded, in addition to the well-known two major plumes on March 15 and 21, 2011. (3) The radiation dose rate measured at some monitoring posts in Nakadori located in the central area of the FP, did not increase even when a plume passed by. It was already too high to detect a new plume, due to the ground-shine caused by the deposition of a large amount of radionuclides on the grounds by precipitation. (4) Accordingly, the polluted air masses with high Cs-137 (around 80 Bq m⁻³) were observed in Nakadori for more than half a day from the evening of March 20 to the morning of March 21, and which was not recognized until now. (5) A local area of relatively high Cs-137 deposition density in the TMA by precipitation on the morning of March 21, 2011, was consistent with an area where the time-integrated atmospheric Cs-137 concentrations were also high due to the transport of a plume on the morning of March 21, 2011. In the Fukushima prefecture, however, the correlation was not so clear.