

Estimate of possible sources of high Cs-137 in atmospheric aerosols measured in south Miyagi during 2 years (2012-2013)

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A volunteer team organized by the Japan Geoscience Union has started an intensive field study to monitor radioactive materials in the atmosphere, which were released by the Fukushima Daiichi Nuclear Power Plant (FD1NPP) accident, and by re-suspension of radioactive materials from soils and forests in a regional scale in and surrounding Fukushima area since April 2011. At present, the continuous measurement has been made at Marumori town in Miyagi prefecture, Fukushima city and Koriyama city in Fukushima prefecture, and Hitachi city in Ibaraki prefecture. In this paper, a case study on high concentrations of atmospheric radiocesium frequently measured at Marumori will be reported. At the Marumori town office in south Miyagi, atmospheric aerosols have been collected since December 2011, on a quartz fiber filter every several days by using a high volume air sampler, and radioactive materials in the aerosols were measured with a Ge detector. Forward trajectory analysis by a Lagrangian model was made to trace air masses started from the FD1NPP for 48 hours. The atmospheric concentration of Cs-137 at Marumori was in a level of 10^{-4} Bq m⁻³ until April 2012, and then gradually decreased to the level of 10^{-5} Bq m⁻³ in the latter half of 2013. High concentrations of Cs-137 more than 10^{-4} Bq m⁻³ were measured in the winter and early spring of 2012 and 2013 when the wind speed was high and relative humidity was low. It strongly suggests that the possible source of high Cs-137 could be re-suspension of radioactive materials from soils. In September and November 2012 and from May to August 2013, however, high concentrations more than 10^{-4} Bq m⁻³ were also frequently measured, and the highest concentration of 4.6×10^{-3} Bq m⁻³ was measured in a sampling period of 16-20 August 2013. On 19 August, unusual high Cs-137 concentration of 7.1×10^{-1} - 8.7×10^{-1} Bq m⁻³ and 5.8×10^2 Bq m⁻³ was measured at a monitoring post of Koriyama in Futabamachi 2.8 km north of the FD1NPP, and in front of a building inside the FD1NPP, respectively. According to the forward trajectory analysis, the air masses started from the FD1NPP at 09:00 and 12:00 on August 19 2013 arrived at Marumori on the afternoon of 15:00 and 18:00, respectively. It indicates that radioactive materials released from the FD1NPP were directly transported to Marumori about six hours later. The transport pathways similar to those on August 19 were also shown by the forward trajectory analysis in the other periods when the high Cs-137 concentrations were measured except for winter and early spring. These results clearly demonstrate that radioactive materials were still released into the atmosphere from the FD1NPP. We acknowledge the staff members of the Marumori town office for continuous sampling of atmospheric aerosols for these two years.

Keywords: atmospheric aerosols, radiocesium, source estimate, forward trajectory analysis