

$^{129}\text{I}/^{127}\text{I}$ ratios in precipitation from Fukushima over 2010-2017

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The precipitation samples were monthly collected over a period between November 2010 and December 2017 from the Fukushima University campus (37°41'00"N, 140°27'16"E), located about 60 km northwest of the Fukushima Dai-ichi Nuclear Power Plant (FDNPP). The ^{127}I and ^{129}I concentrations have been determined in order to examine the temporal variations of atmospheric level and behaviour of stable and radioactive iodine before and after the FDNPP accident occurred on 11th March 2011. The ^{127}I and ^{129}I concentrations in 2010-2017 varied from 0.5 to 10 µg/L and from 3×10^7 to 8×10^{11} atoms/L, respectively, resulting in $^{129}\text{I}/^{127}\text{I}$ atomic ratio ranges from 4×10^{-9} to 7×10^{-5} .

Before the FDNPP accident, the deposited ^{129}I in Fukushima was generally attributed to originate from the global ^{129}I source mainly from the European reprocessing plants. The ^{129}I concentration of 10^8 atoms/L in 2010 before the accident dramatically increased about four orders of magnitude to 7.6×10^{11} atoms/L in March 2011 immediately after the accident with a $^{129}\text{I}/^{127}\text{I}$ ratio up to 7×10^{-5} . Soon after the accident, the ^{129}I concentrations in precipitation decreased exponentially with several fluctuations, which can be attributed to initial Fukushima-derived ^{129}I dispersion, local resuspension of the Fukushima-derived radionuclide bearing soil particles deposited on land surfaces, and re-emission through vegetation taking up ^{129}I from contaminated soil and water.

After 2013, the ^{129}I deposition fluxes decreased gradually to approach the pre-accident level. During this period, although the Fukushima-derived ^{129}I was still considered as the major source of local atmospheric ^{129}I by resuspension and re-emission during spring-summer, the long-term variations of ^{129}I in precipitation might be partly attributed to temporal changes in on-going discharges of ^{129}I from west European reprocessing plants in conjunction with the trajectories of airstreams prevailing over Japan at the time of sampling.