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Sensitivity of depositions to the size and hygroscopicity of Cs-bearing aerosols released from the Fukushima nuclear accident

Mizuo Kajino, Kouji Adachi, Tsuyoshi Sekiyama, Yuji Zaizen, and Yasuhito Igarashi
Meteorological Research Institute, Tsukuba, Japan (kajino@mri-jma.go.jp)

We recently revealed that the microphysical properties of aerosols carrying the radioactive Cs released from the Fukushima Daiichi Nuclear Power Plant (FDNPP) at an early stage (March 14-15, 2011) of the accident could be very different from what we assumed previously: super-micron and non-hygroscopic at the early stage, whereas sub-micron and hygroscopic afterwards (at least later than March 20-22). In the study, two sensitivity simulations with the two different aerosol microphysical properties were conducted using a regional scale meteorology-chemical transport model (NHM-Chem). The impact of the difference was quite significant. 17% (0.001%) of the radioactive Cs fell onto the ground by dry (wet) deposition processes, and the rest was deposited into the ocean or was transported out of the model domain, which is central and northern part of the main land of Japan, under the assumption that Cs-bearing aerosols are non-hygroscopic and super-micron. On the other hand, 5.7% (11.3%) fell onto the ground by dry (wet) deposition, for the cases under the assumption that the Cs-bearing aerosols are hygroscopic and sub-micron. For the accurate simulation of the deposition of radionuclides, knowledge of the aerosol microphysical properties is essential as well as the accuracy of the simulated wind fields and precipitation patterns.