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The time series analysis of the radionuclide emissions from Fukushima Daiichi nuclear power plant by online global chemistry transport model and inverse model

Takashi Maki, Taichu Tanaka, Mizuo Kajino, Tsuyoshi Sekiyama, Yasuhito Igarashi, and Masao Mikami
Meteorological Research Institute, Japan (tmaki@mri-jma.go.jp)

The accident of the Fukushima Daiichi nuclear power plant that occurred in March 2011 emitted a large amount of radionuclide. The important feature of this accident was that the source position was evidently clear, however, time and vertical emission variations were unknown (in this case, it was known that the height of emission was not so high in altitude). In such a case, the technique of inverse model was a powerful tool to gain answers to questions; high resolution and more precise analysis by using prior emission information with relatively low computational cost are expected to be obtainable. Tagged simulation results by global aerosol model named MASINGAR (Tanaka et al., 2005) were used; the horizontal resolution was TL319 (about 60 km). Tagged tracers (Cs137) from lowest model layer (surface to 100m) were released every three hours with 1Tg/hr which accumulated daily mean. 50 sites' daily observation data in the world (CTBTO, Ro5, Berkeley, Hoffmann and Taiwan) were collected. The analysis period was 40 days, from 11 March to 19 April. We tested two prior emission information. The first information was JAEA posterior emission (Chino et al., 2011) and the second was NILU prior emission (not posterior) (Stohl et al.,2011) as our observation data were almost similar to their study. Due to consideration for observation error and space representation error, the observation error was set as 20%. Several sensitivity tests were examined by changing prior emission flux uncertainties. As a result, Cs137 estimated the total emission amount from 11 March to 19 April as 18.5PBq with the uncertainty of 3.6PBq. Moreover, the maximum radio nuclei emission occurred during 15 March, which was larger than prior information. The precision of the analysis was highly dependent on observation data (quantity and quality) and precision of transport model. Possibility to obtain robust result by using multi-model ensemble results with inverse model was also considered. The results of this study are available for modification of many processes of aerosol transport models. In the future, the combination of regional chemistry transport model and higher time resolution observation data in order to obtain robust emission time series of radionuclide is being planned.