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The ensemble atmospheric dispersion modeling of Fukushima Dai-ichi nuclear accident

Li Sheng
China Meteorological Administration, National Meteorological Center, China (shengli@cma.gov.cn)

Ensemble prediction, originally developed for weather prediction, is lately being extended to atmospheric dispersion applications, which is a new, effective methodology for improving the atmospheric dispersion numerical modeling. In March 2011, due to the massive 9.0 earthquakes and ensuing tsunami that struck off the northern coast of the island of Honshu, the Fukushima Nuclear Plant I had the substantial leak of radioactive materials into surrounding environment and atmosphere. To aim at the global dispersion modeling of atmospheric radionuclides from Fukushima Nuclear Accident, two approaches of atmospheric dispersion forecasting: ensemble dispersion modeling (EDM) and deterministic dispersion modeling (DDM) are developed for the globally dispersion modeling cases for Fukushima nuclear accident. EDM includes two different perturbation methods: meteorological perturbation method and ensemble dispersion physical parameterization forecasting method. The simulation results show that the trajectories from EDM have a better performance, which is in better agreement with the atmospheric circulation and observation data; the spread from DDM is slower and not as far as EDM. Additionally, the results from EDM display a better performance in the global atmospheric transport modeling of Fukushima accident. Therefore, this study can serve as a reference to atmospheric dispersion and environmental emergency response.