Atmospheric plume dispersion induced by the Fukushima nuclear accident: Probabilistic information and multiple case scenarios

*T. T. SEKIYAMA, M. KAJINO, AND M. KUNII

Meteorological Research Institute, Tsukuba, Japan
(*correspondence: tsekiyam@mri-jma.go.jp)

Single-model initial-perturbed ensemble simulations for the dispersion of radioactive (Cs-137) aerosols emitted by the Fukushima Daiichi nuclear power plant (FDNPP) accident were performed in this study. The ensembles of the meteorological field were prepared by an ensemble-based data assimilation system that consisted of the Japan Meteorological Agency's non-hydrostatic weather-forecast model (JMA-NHM; with a 3 km horizontal resolution) and a four-dimensional local ensemble transform Kalman filter (4D-LETKF). Both the weather and aerosol simulations were validated with in-situ measurements of wind speed and Cs-137 concentration in Fukushima Prefecture and Ibaraki Prefecture. The advantage of ensemble simulations is the ability to provide probabilistic information and multiple case scenarios. In this study, some of the ensemble members successfully reproduced the arrival time and intensity of the radioactive aerosol plumes even when the deterministic simulation failed to reproduce them (Figure 1). The ensemble spread of wind speed and Cs-137 concentration indicates the reliability of the meteorological field prepared by the data assimilation sysytem. The probabilistic information derived from the ensemble simulations exhibits great potential for the analysis and prediction of aerosols.

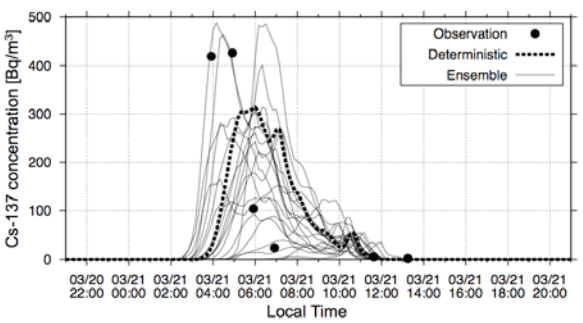

Figure 1. Cesium-137 concentrations at Tokai Village measured by the Japan Atomic Energy Agency (JAEA) and simulated by the 20 ensemble runs and the deterministic run from 21:00 March 20 to 21:00 March 21, 2011 local time.