5.027 Ensemble dispersion simulation of tropospheric aerosol plumes using a perturbed meteorological reanalysis.

Presenting Author:
Tsuyoshi Thomas SEKIYAMA, Meteorological Research Institute, Japan Meteorological Agency, Tsukuba, Japan, tsekiyam@mri-jma.go.jp

Co-Authors:
Mizuo KAJINO, Meteorological Research Institute, Japan Meteorological Agency, Tsukuba, Japan

Abstract:

We conducted a single-model ensemble simulation for the dispersion and deposition of point-source aerosol particles emitted from the Fukushima Daiichi nuclear power plant (FDNPP) in March 2011 using a perturbed meteorological reanalysis field. The 60-member meteorological ensemble reanalysis was prepared using 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, a local ensemble transform Kalman filter (LETKF), and the JMA operational observation datasets. The ground-surface wind velocity and aerosol concentration were validated with in-situ measurements of the JMA AMeDAS network (at approximately 70 observatories) and the radioactive Cs-137 concentration retrievals (at approximately 100 observation stations) in eastern Japan. The Brier skill score (BSS) of the radioactive aerosol plume arrivals at each Cs-137 observation station was significantly improved from the deterministic simulation (by a single run) to the probabilistic simulation (by ensemble runs). In this radioactive aerosol concentration experiment, the ensemble spread was almost comparable with the root mean square error (RMSE), which means that the ensemble simulation properly yielded the information on the model simulation error. An ensemble simulation can provide more accurate estimation than a single simulation and additionally multiple possible scenarios for atmospheric species dispersion. The probabilistic information derived from an ensemble simulation exhibits great potential for the analysis and prediction of atmospheric species.