Radar reflectivity assimilation in JMA's operational meso-analysis system

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The Japan Meteorological Agency (JMA) operates a meso-scale model (MSM) with a meso-analysis (MA) system to support the provision of additional information on disaster prevention. The MSM produces very short-range weather forecasts, and MA provides high-quality initial atmospheric conditions for it. In order to improve precipitation forecasting with the MSM, MA must be made to describe water vapor distribution in the initial condition more accurately. To this end, JMA started using radar reflectivity data in the operational MA system on June 9, 2011.

To assimilate radar reflectivity data in MA, an indirect assimilation technique called 1D+4DVAR (Ikuta and Honda 2011) is employed. In this method, radar reflectivity data are used to determine relative humidity (RH), and the RH values retrieved are assimilated as conventional observation data using 4DVAR. In this system, only RH retrievals below the melting layer are used because it is known that reflectivity is inappropriately simulated in the ice phase with the operational MSM hydrometeor forecast, and this causes large biases in RH data. In addition, data from around the 2,000 m level are not used because they are adopted to create radar/raingauge-analyzed precipitation data, which are assimilated in MA in another form (surface rainfall).

For operation, reflectivity data from JMA's C-band radar network (20 sites) are used. As shown in Figure 1, the retrieved RH data cover most of the Japanese archipelago.

The positive impact of the 1D+4DVAR approach using radar reflectivity is expected to improve the water vapor profile of initial conditions and to reduce displacement errors in the precipitation system (Ikuta and Honda 2011), and this was supported by the results of an eight-day pre-operational test of the method started on July 19, 2009. Figure 2 illustrates the reduction of displacement errors. The control and test experiments produced prediction results with and without assimilation of radar reflectivity data. The control showed a strong rain band off the coast of Kyushu, while the observation showed the band located along the coast. This displacement error was reduced in the test.

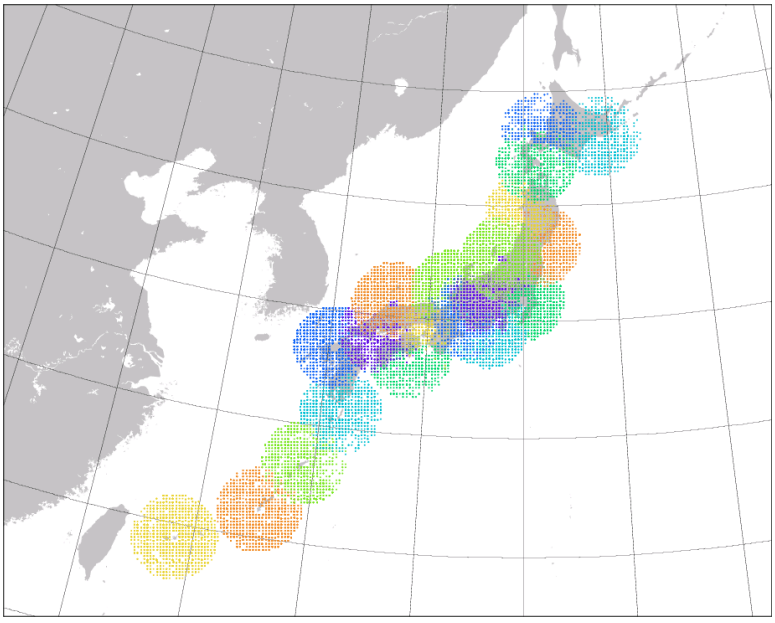

Figure 1. Area covered by retrieved RH data from JMA's C-band radar network

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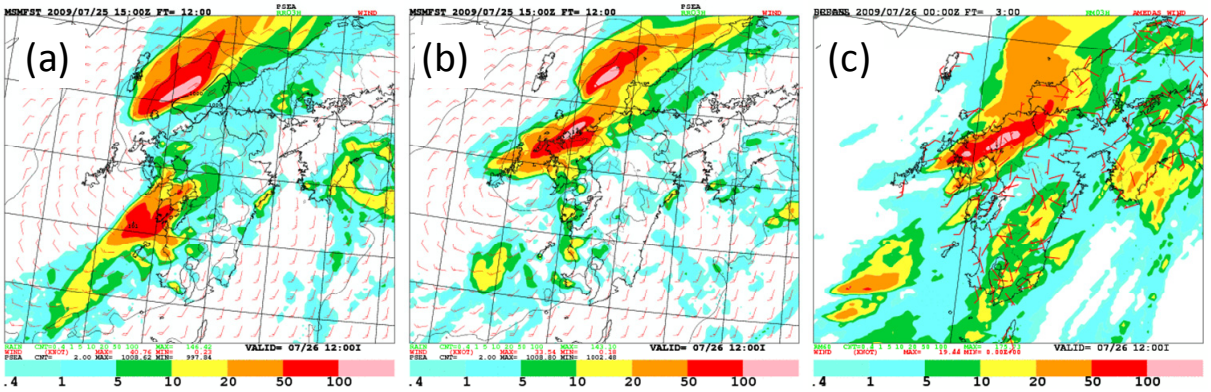

Figure 2. 3-hour cumulative precipitation at a forecast time of 12 hours: (a) control experiment, (b) test experiment, and (c) observation

Reference

Ikuta, Y. and Y. Honda, 2011: Development of 1D+4DVAR data assimilation of radar reflectivity in JNoVA. *CAS/JSC WGNE Res. Activ. Atmos. Oceanic Modell.,* **41**, 01.09 – 01.10.