Ensemble experiments of local heavy rainfall that occurred in Osaka, Japan, 5 September 2008

HIROMU SEKO[1], MASARU KUNII[2], TAKUYA KAWABATA[1]
and TAKEMASA MIYOSHI[2]

[1]*Meteorological Research Institute of Japan Meteorological Agency*
[2]*University of Maryland*

2

1. Introduction

Because local heavy rainfalls that occur in the urban area affect urban functions, accurate forecasts of generation and development of the convections are desired. Because of their small spatial scale and short duration, forecasts of local heavy rainfalls are more difficult than those of mesoscale heavy rainfalls. To reproduce local heavy rainfalls, techniques for producing accurate initial conditions, such as assimilation of radial wind of Doppler radar, have been developed. However, in most of these experiments, the horizontal convergences that were determined by boundary conditions were roughly reproduced, and then they were shifted to the observed positions by the assimilation of the observation data. Even if convergences surrounding local heavy rainfalls are not reproduced by deterministic forecasts, some members of ensemble forecasts can produce the convergence. In this study, the usefulness of ensemble forecast for reproduction of the mesoscale convergence is shown.

2. Osaka intense rainfall

Figure 1 shows rainfall distribution on 5 September 2008. Rainfall of which 1-hour rainfall amount exceeded 93 mm was observed in the southern part of Osaka (Fig. 1). When ensemble forecast with 20 members was performed with the NHM-LETKF (Miyoshi and Aranami, 2006), the spread was so large that the convergence positions were scattered, because of the insufficient observation data. However, one member, #005 roughly reproduced the position of convergence. Next, all members' outputs of this ensemble forecast were used as the first guess, and then radial wind of Doppler radars was assimilated. The heavy rainfall was reproduced when output of #005 was used as the first guess (Fig. 2). However, the heavy rainfall was not reproduced when other members' outputs were used. This result indicates that accurate boundary condition that determines the convergence position is needed to reproduce local heavy rainfall, and that NHM-LETKF is useful to reproduce the mesoscale convergence where local heavy rainfall is generated.

Besides the convective scale horizontal wind provided by Doppler radar, the convective scale water vapor and the loading of precipitation were introduced in the initial condition by following Seko et al. (2007). When initial condition was modified, the reproduced local heavy rainfall became closer to the observed one (not shown).

3. Summary

Ensemble forecast is useful to reproduce the mesoscale convergence where local heavy rainfall is generated.

References

Miyoshi, T. and K. Aranami 2006: Applying a Four-dimensional Local Ensemble Transform Kalman Filter (4D-LETKF) to the JMA Nonhydrostatic Model (NHM). *SOLA*, **2**, 128-131.

H. Seko, Y. Shoji and F. Fujibe, Evolution and Air flow Structure of a Kanto Thunderstorm on 21 July 1999 (the Nerima Heavy Rainfall Event). 2007, *JMSJ*, **85**, 455-477. .

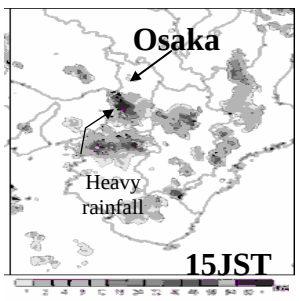

Fig. 1 Rainfall distribution observed by the conventional radars of JMA.

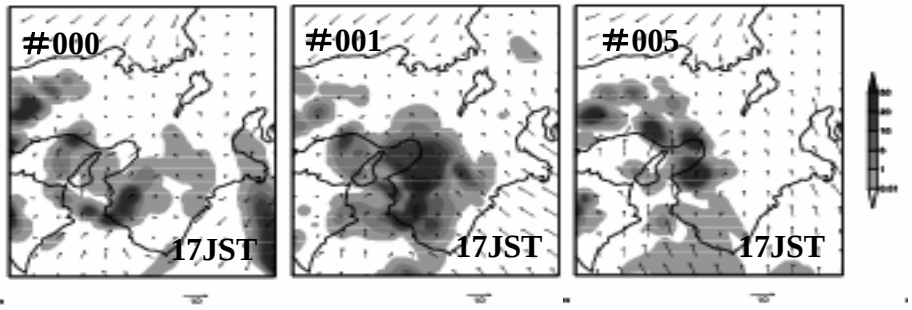

Fig. 2. Rainfall and horizontal wind distributions predicted from the assimilated fields of radial wind of Doppler radar. First guess of assimilation were the ensemble forecasts obtained by LETKF.