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

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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, forecast of local heavy rainfalls is more difficult than that 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 convergence that is determined by the boundary condition was roughly reproduced, and then they were shifted to the observed ones by the assimilation of the observation data. Even if the convergence surrounding the local heavy rainfalls are not reproduced by the deterministic forecast, some members can produce the convergence in ensemble forecasts. In this study, the usefulness of ensemble forecast for reproduction of the mesoscale convergence was shown.

Figure 1 shows rainfall of 5th September 2008. Intense rainfall of which 1 hour rainfall amount exceeded 93 mm was generated in the southern part of Osaka (Fig. 1). When ensemble forecast with 20 members was performed with the LETKF (Miyoshi and Aranami, 2007), the spread was so large that the convergence positions were so scattered because of the insufficient observation data. However, one member, #005 roughly reproduced the position of convergence. Then, the output of this ensemble forecast was 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). This result indicates that LETKF is useful to reproduce the mesoscale convergence where local heavy rainfall is generated. When the loading of precipitation and the convective scale water vapor distribution were introduced in the initial condition, the reproduced local heavy rainfall became closer to the observed one (not shown).

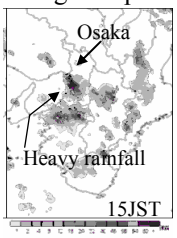

Fig. 1 Rainfall distribution observed by conventional radars of JMA.

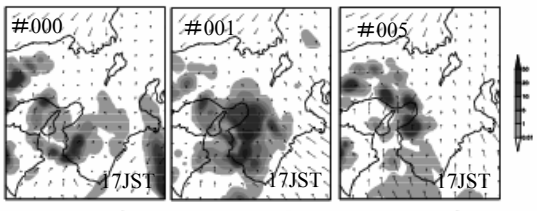

Fig. 2 . Rainfall and horizontal wind distributions predicted from the assimilated fields of radial wind of Doppler radar. First guess of assimilation were the ensemble forecasts obtained by LETKF.