# Experimental operation of a high-resolution local forecast model at JMA (3)

Takahisa Ishimizu and Masashi Ujiie

*Numerical Prediction Division, Japan Meteorological Agency,*
*1-3-4 Otemachi, Chiyoda-ku, Tokyo 100-8122, Japan*
*E-mail: ishimizu@naps.kishou.go.jp*

## 1. Introduction

The Numerical Prediction Division of the Japan Meteorological Agency is developing a model called the LFM (Local Forecast Model).The purposes of the LFM are to contribute to aviation forecasting and more detailed information for disaster prevention.

The LFM is based on JMA-NHM (Saito et al., 2006) with a horizontal grid spacing of 2km. The LFM has been applied to improvement of the operational 5km-mesh meso-scale model, the MSM (Hara et al., 2007). As a part of the development, the NPD/JMA has experimentally operated the LFM since July 2007 (Nakayama et al., 2007), and verification around Tokyo international airport has been examined.

## 2. Enhancements in 2009

(1) Treatment of cumulus scheme

To suppress excessive rainfalls such as a grid point storm, a modified version of the Kain-Fritsch scheme was temporarily used for the LFM (Takenouchi et al., 2008). The LFM is not currently being run with the Kain-Fritsch scheme to seek more adequate schemes.

(2) Enlargement of computational domain

To reduce the effects of the lateral boundary condition, we enlarged the domain to the west to cover the western part of Japan in August 2009 (shown in Figure 1). Since then, unrealistic convergence lines (Ujiie et al., 2009) have not appeared so far. But it is necessary to monitor the situation to watch for their possible appearance.

(3) A new high performance computer

Three nodes of the SX-9 were installed in March 2009. Since the system transition, we have run the experimental LFM on a new high performance computer.

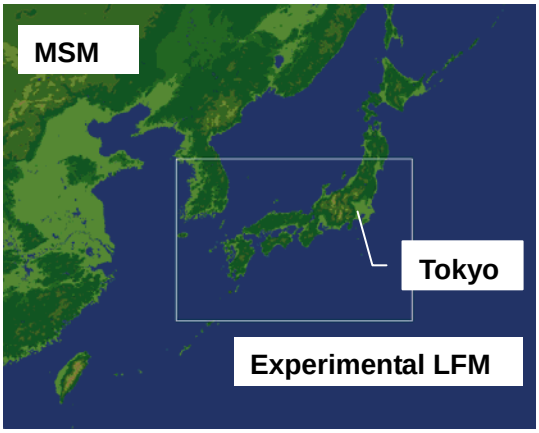


Figure 1: Experimental LFM and MSM domain

## 3. Specifications of experimental LFM

Table 1: Specifications of the experimental LFM

| | LFM (August 2009) |
|---|---|
| Horizontal mesh | 800 x 550 |
| Resolution | 2km |
| Vertical layers | 60 (top level 20km) |
| Time interval | 8 seconds |
| Forecast period | 12 hours |
| Run frequency | 4 times a day |
| Initial conditions | JNoVA-3DVar* |
| Lateral boundary | MSM |
| Boundary layer | Improved Mellor-Yamada Level3 |
| Moist physics | 3 ice bulk microphysics (snow, ice, graupel) |
| Cumulus Parameterization | Not used |

*JNoVA is the JMA Nonhydrostatic Model-based Variational Data Assimilation System. The LFM initial condition is prepared using a rapid update cycle with the 3D-Var version of JNoVA, which assimilates surface observations (wind and temperature) and vertical wind fields (wind profilers, doppler radars and ACARS).

## 4. Case Study

Figure 2 shows a case with synoptic scale disturbances accompanying a cold front that passed over Japan. The experimental LFM represented rainfall better than the MSM on southern slopes of terrain. This is because of the differences in horizontal resolutions and the treatment of cumulus schemes between the LFM and the MSM.

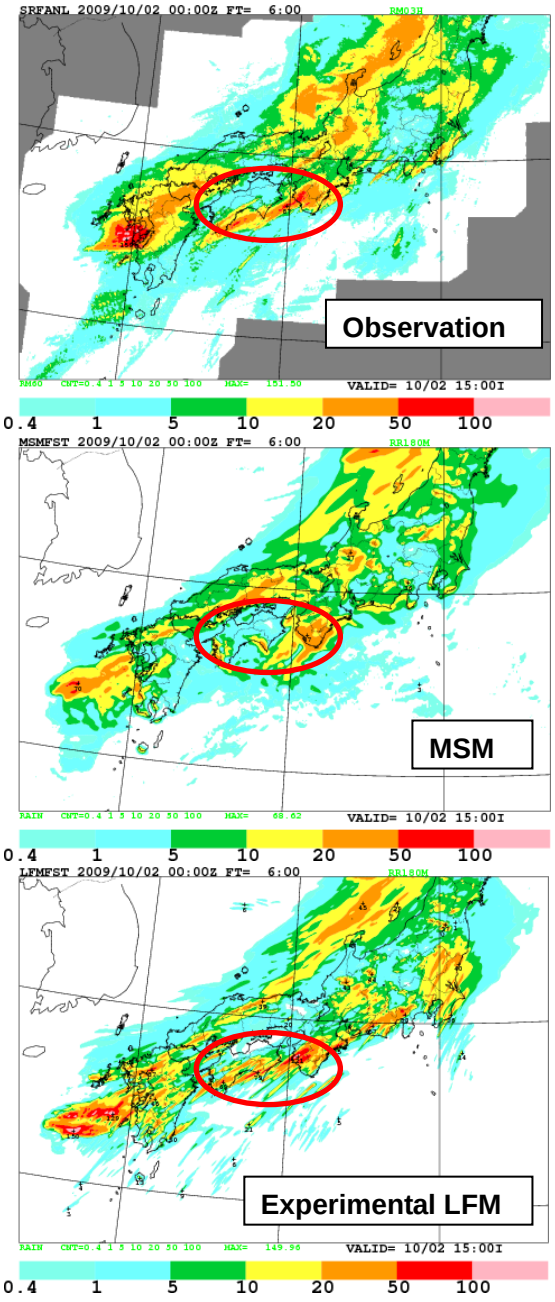


Figure2: Precipitation [mm/3hours] is shown with coloured shading. Top: precipitation analyzed by surface observation and radar, Middle: MSM (JMA operational 5km-mesh meso-scale model), Bottom: experimental LFM (INIT2009/10/02 00 UTC, FT=6).

## 5. Future plans and issues

The JMA is planning to operate a 2km-mesh meso-scale model over all Japan from 2013. However, case studies have revealed a few issues, delay of rainfall beginnings, overly intense convection to make local circulation worse (Ujiie et al., 2009) affecting vertical profiles of the atmosphere. To represent more accurate precipitation and vertical profiles, we should improve the related physical processes and verify the initiation timing of convection.

## References


Nakayama, H., Y. Ishikawa, T. Fujita and K. Takenouchi, 2007 : Experimental operation of a high-resolution local forecast model at JMA. *CAS/JSC WGNE Res. Activ. Atmos. Oceanic Modell.*, **37**, 0519-0520.

Kensuke Takenouchi, Haruka Kurahashi, Tadashi Fujita and Kohei Aranami, 2008 : Experimental operation of a high-resolution local forecast model at JMA(2). *CAS/JSC WGNE Res. Activ. Atmos. Oceanic Modell.*, **38**, 0523-0524.

Saito, K., T. Fujita, Y. Yamada, J. Ishida, Y. Kumagai, K. Aranami, S. Ohmori, R. Nagasawa, S.Kumagai, C. Muroi, T. Kato, H. Eito and Y. Yamazaki 2006: The operational JMA Non-hydrostatic Mesoscale Model. *Mon. Wea. Rev.*, **134**, 1266-1298.

Hara, T., K. Aranami, R. Nagasawa, M. Narita, T. Segawa, D. Miura, Y. Honda, H. Nakayama, and K. Takenouchi, 2007: Upgrade of the operational JMA non-hydrostatic mesoscale model. *CAS/JSC WGNE Res. Activ. Atmos. Oceanic Modell.*, **37**, 0511-0512.

Ujiie, M., H. Kurahashi and K. Aranami, 2009: Performance of a high resolution local forecast model of the JMA on torrential rains forecast: *8th International SRNWP-Workshop on Non-Hydrostatic Modelling*.