Development of the JMA Local Analysis

Junya Fukuda, Tadashi Fujita, Yasutaka Ikuta,
Yoshihiro Ishikawa, and Koichi Yoshimoto
Numerical Prediction Division, JMA

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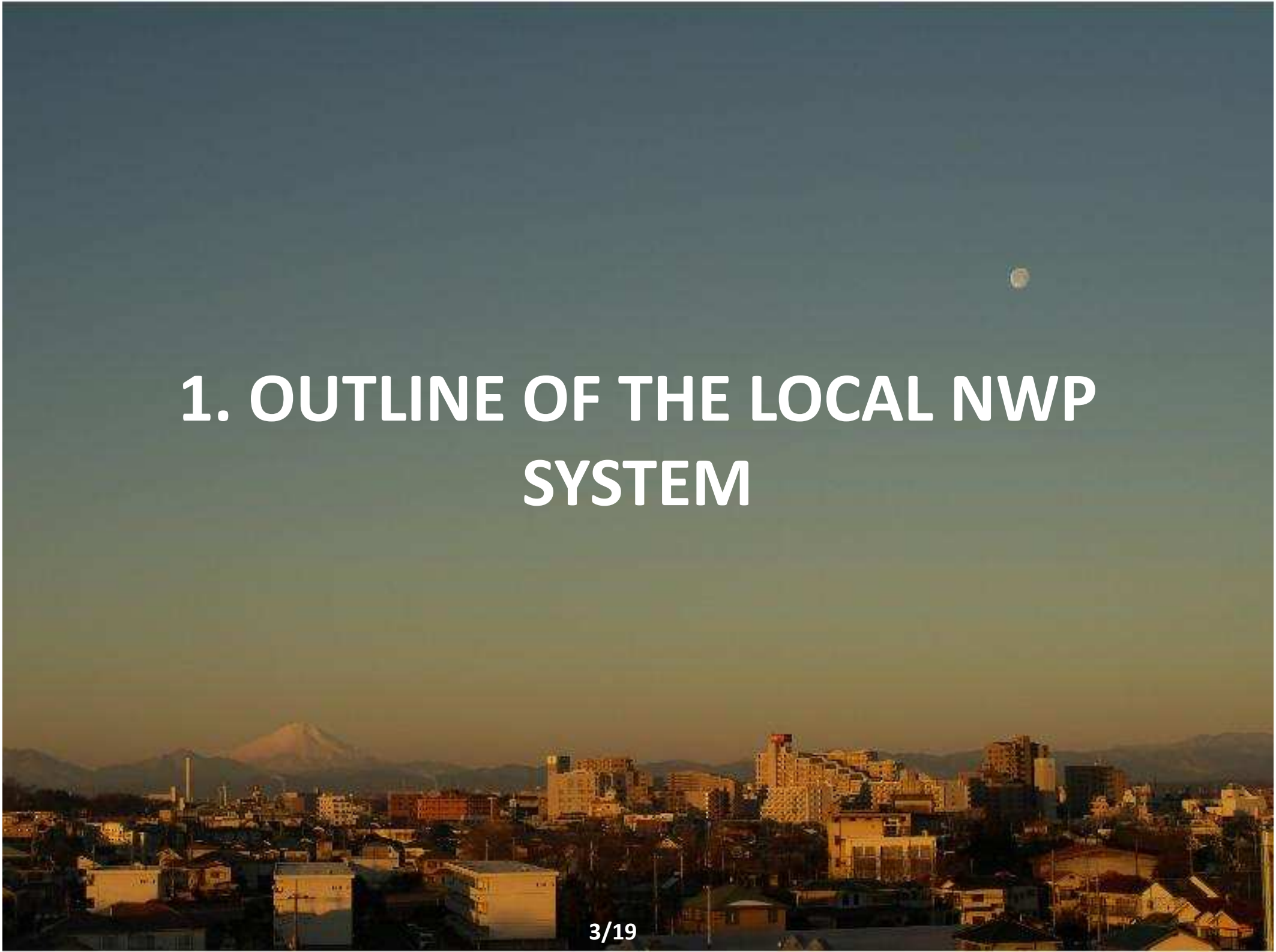


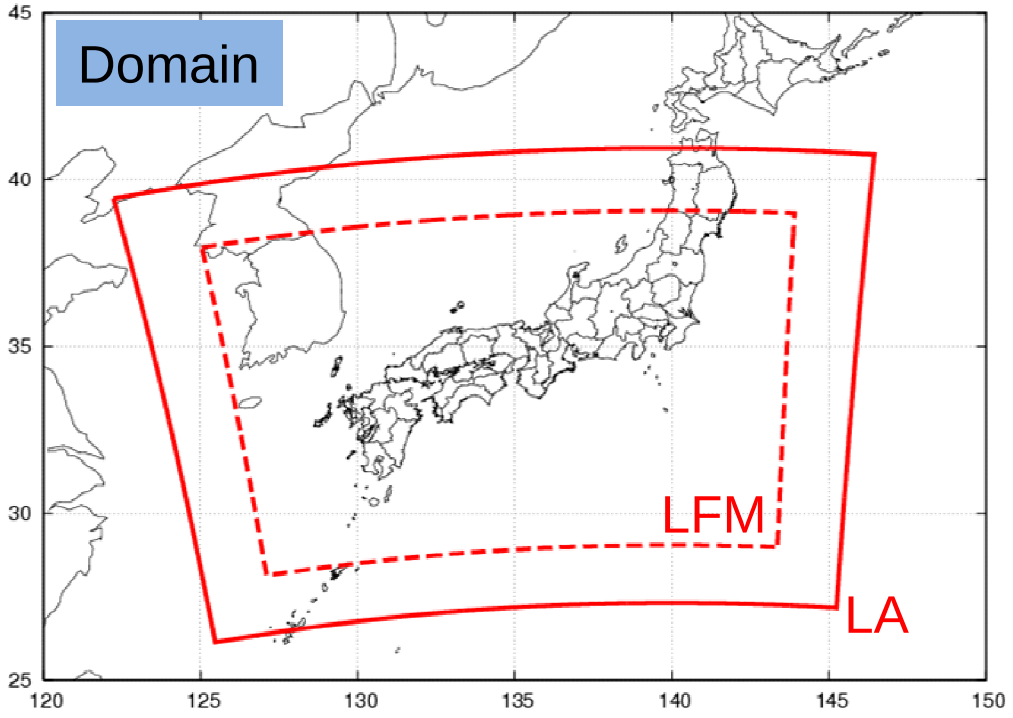
1. OUTLINE OF THE LOCAL NWP SYSTEM

Local NWP system

Forecast Model: Local Forecast Model (LFM)
Analysis: Local Analysis (LA)

Provides products from 2km high resolution NWP.

Objectives: Aviation forecast / Disaster prevention
Status: Trial operation Since Nov. 2010
Schedule: Planning to start operation in 2012



Local Forecast Model (LFM)

- The LFM is based on the JMA non-hydrostatic model (JMA-NHM), same as the operational Meso-Scale Model (MSM).

	LFM (trial operation)	MSM (operation)
Number of grid points	800 × 550 × 60	721 × 577 × 50
Horizontal resolution	2km	5km
Model top	About 21km	About 22km
Integration time step	8 sec.	24 sec.
Forecast length	9hours, 8times/day	15/33hour, 8times/day
Lateral boundary	MSM	GSM
Moist physics	3 ice bulk microphysics (snow, ice, graupel) No forecast of ice number concentration	3 ice bulk microphysics (snow, ice, graupel) Forecast of ice number concentration
Cumulus Parameterization	Not used	Kain-Fritsch scheme

2. DESIGN OF THE LOCAL ANALYSIS

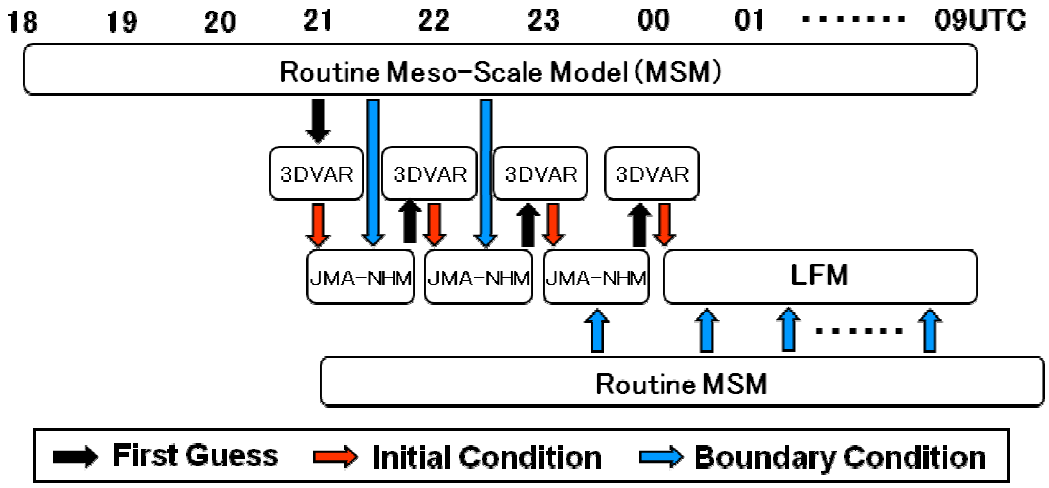
Local Analysis

The LA is constructed using the JNoVA-3DVar, a 3-dimensional variational data assimilation system based on JMA-NHM.

In order to frequently update analysis reflecting information from new observation data within short time, a rapid update cycle method is employed.

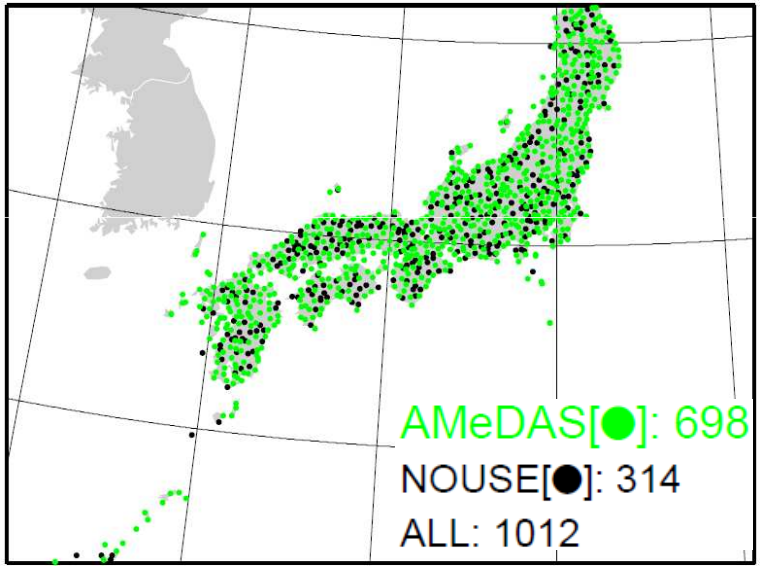
Specification of LA (trial operation)	
Number of grid points	400 × 300 × 50
Horizontal resolution	5km
Observation data cut-off time	30 minutes
Analysis time	8times/day

Design of the LA rapid update cycle

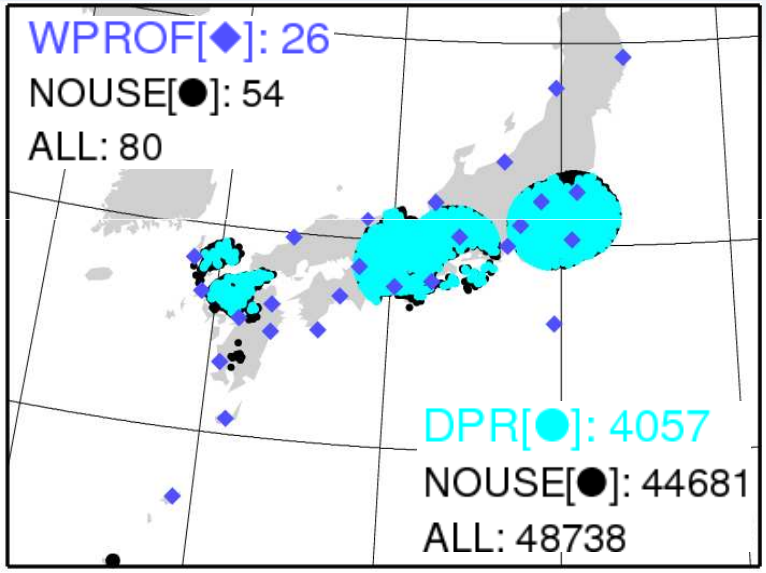


Assimilated Observation Data

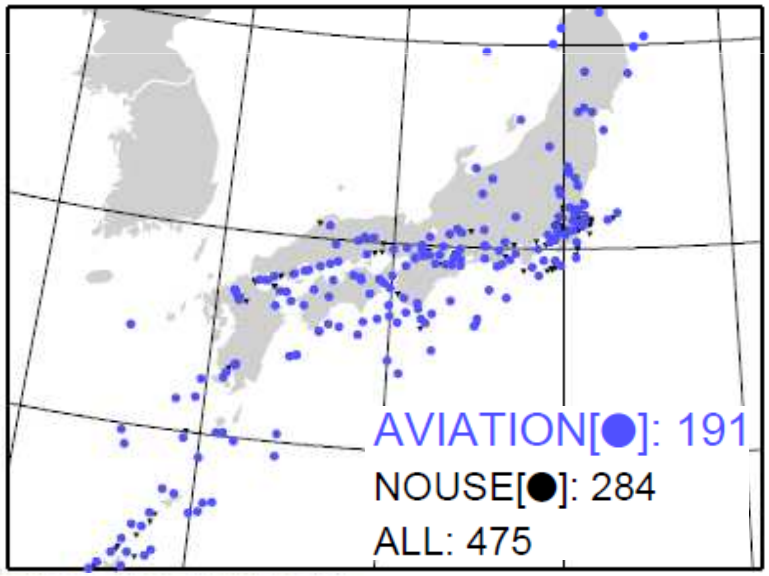
Surface stations (temperature and wind)



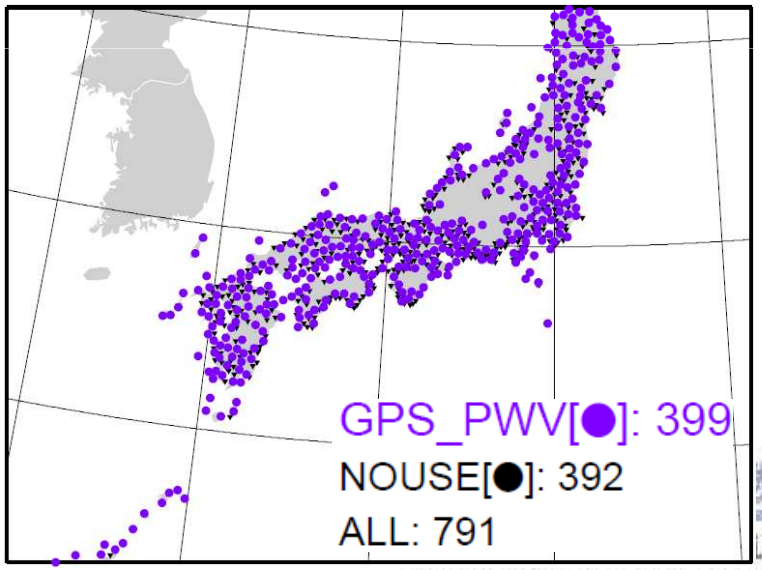
Wind Profiler (horizontal wind) Doppler radar (radial velocity)



Aviation (temperature and horizontal wind)



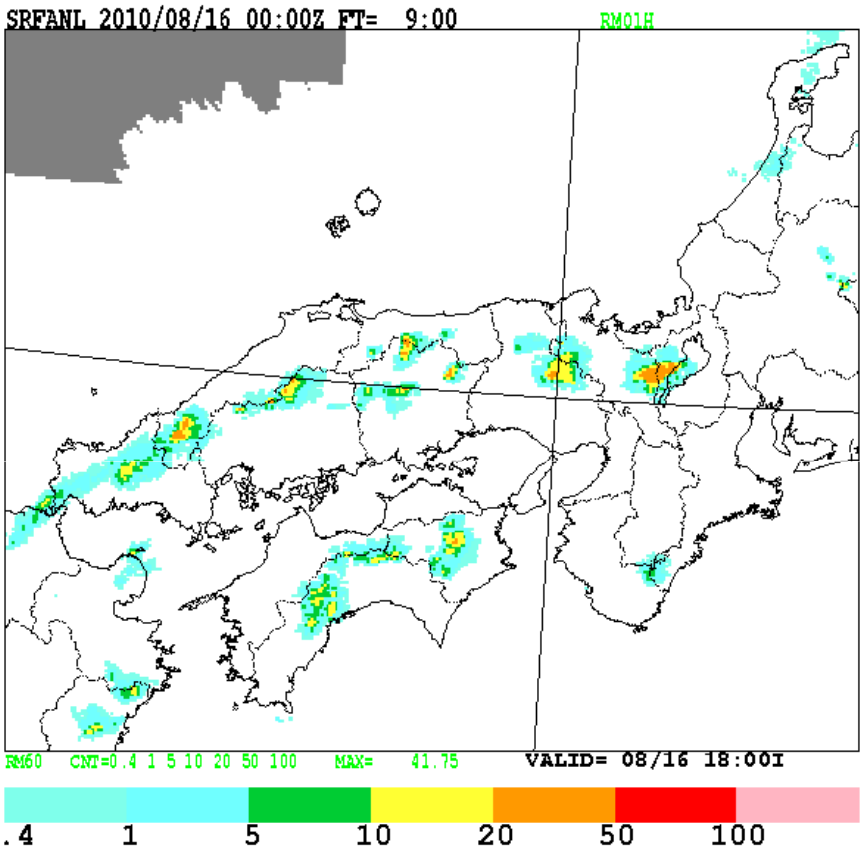
Ground-based GPS (total column water vapor)



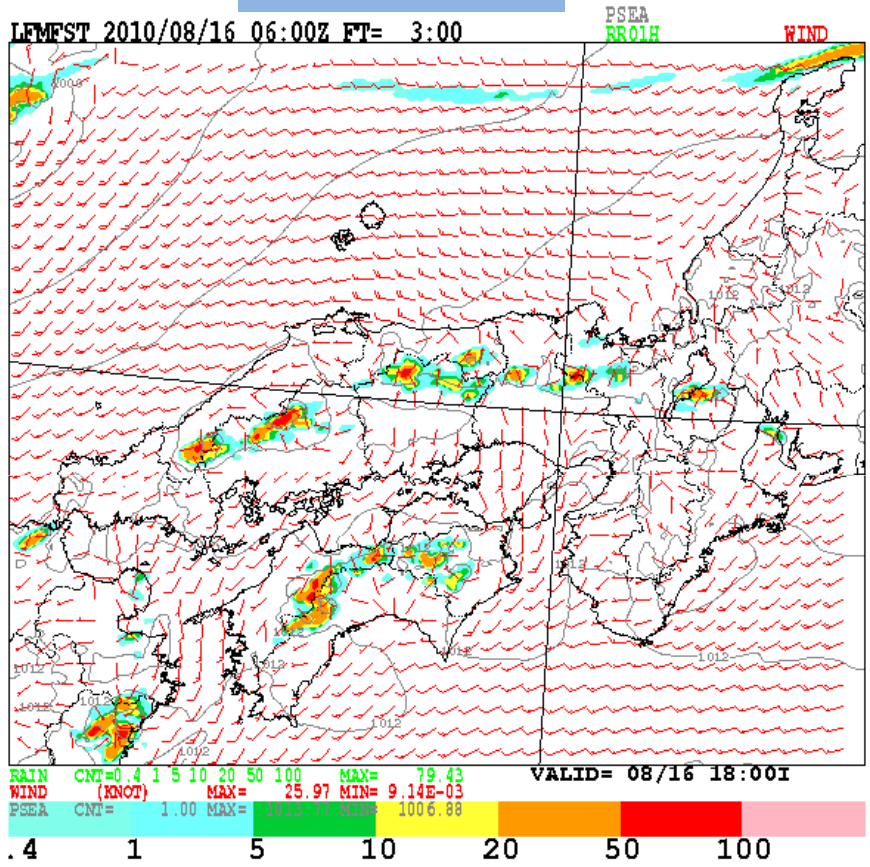
LFM precipitation forecast

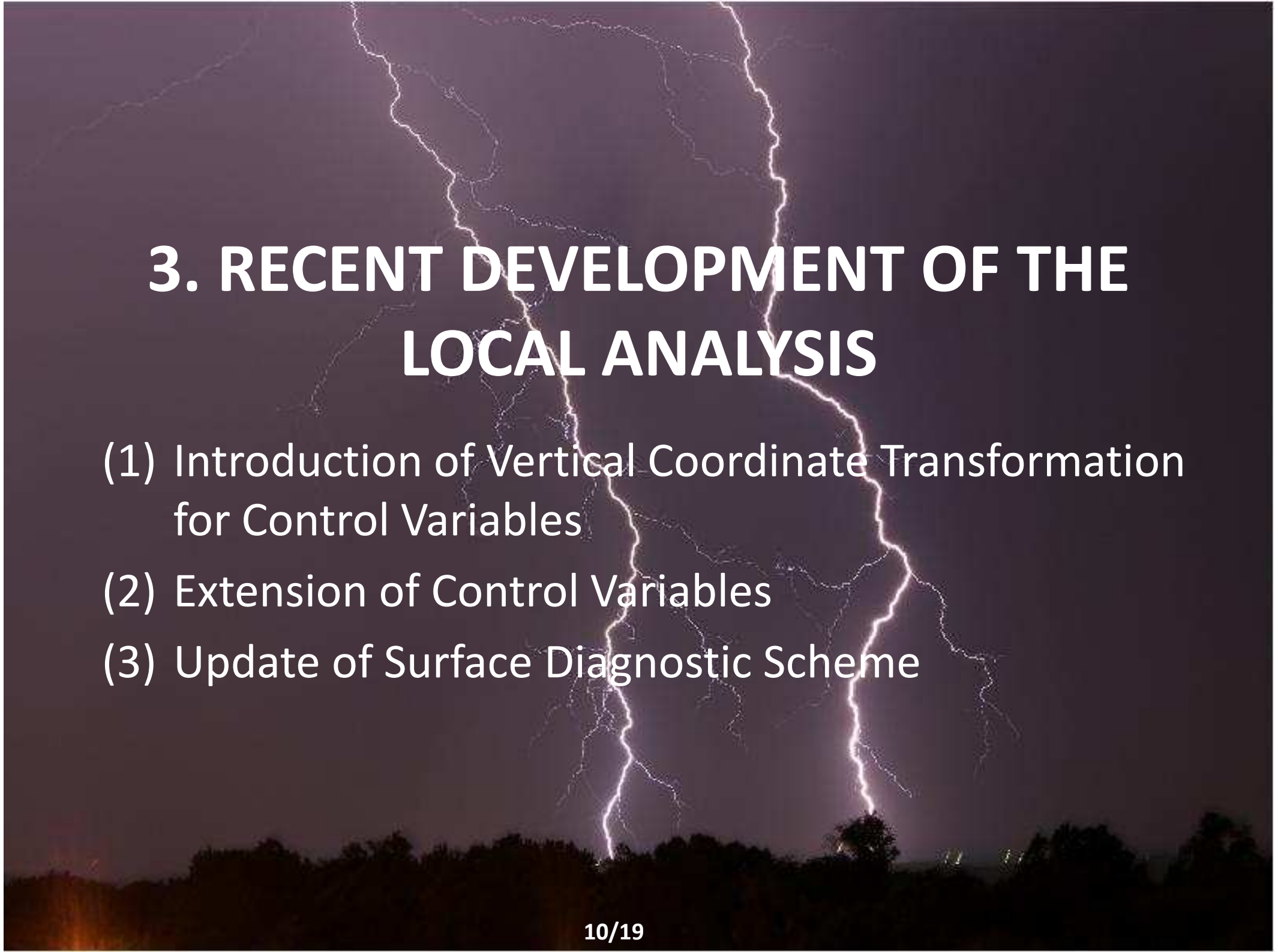
- Forecasting precipitation related to heated land in the afternoon (2010 Aug. 16 06UTC 1hourly precipitation)

Observation



LFM (FT=3)





3. RECENT DEVELOPMENT OF THE LOCAL ANALYSIS

(1) Introduction of Vertical Coordinate Transformation for Control Variables

(2) Extension of Control Variables

(3) Update of Surface Diagnostic Scheme

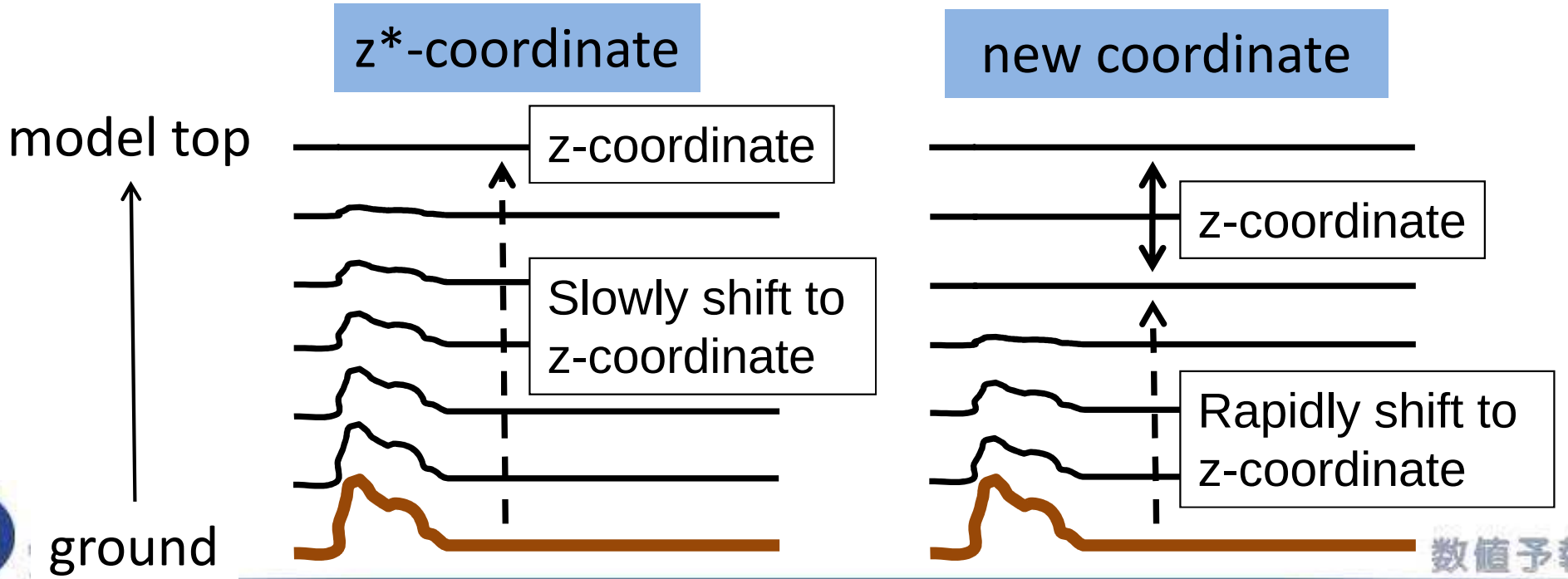
(1) Introduction of Vertical Coordinate Transformation for Control Variables

- Control(=Trial Operation) : z*-coordinate

⇒Influence of topography on analysis increment remains strong up to high altitudes

- Test : New coordinate based on the hybrid coordinate

⇒designed to follow terrain near the surface and rapidly shift to z-coordinate aloft

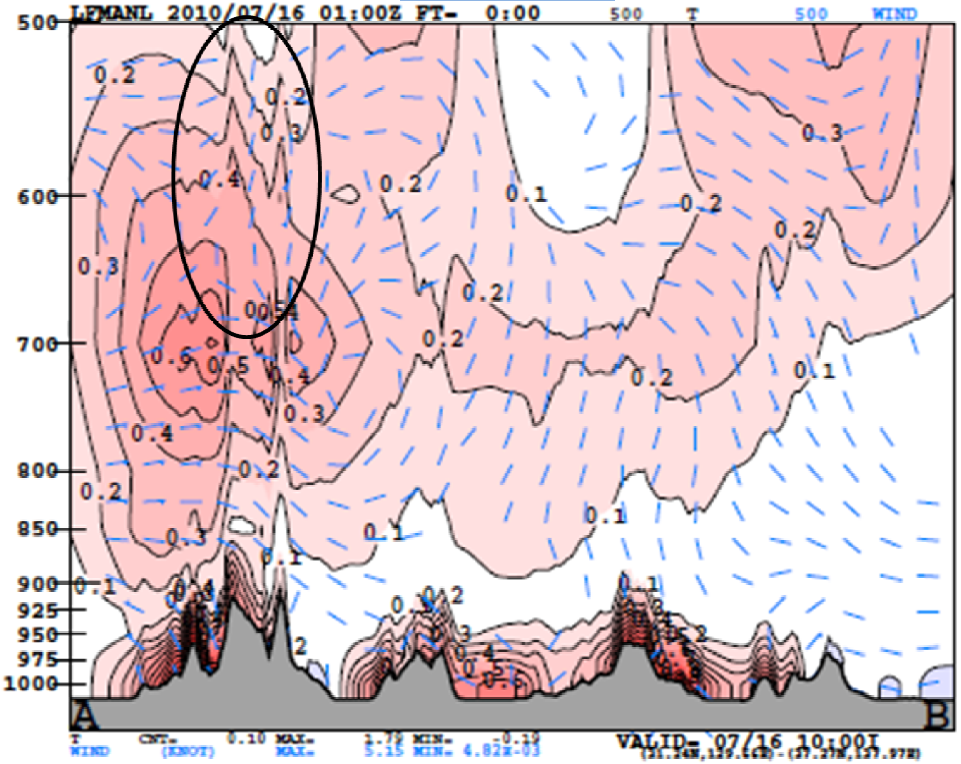


(1) Introduction of Vertical Coordinate Transformation for Control Variables

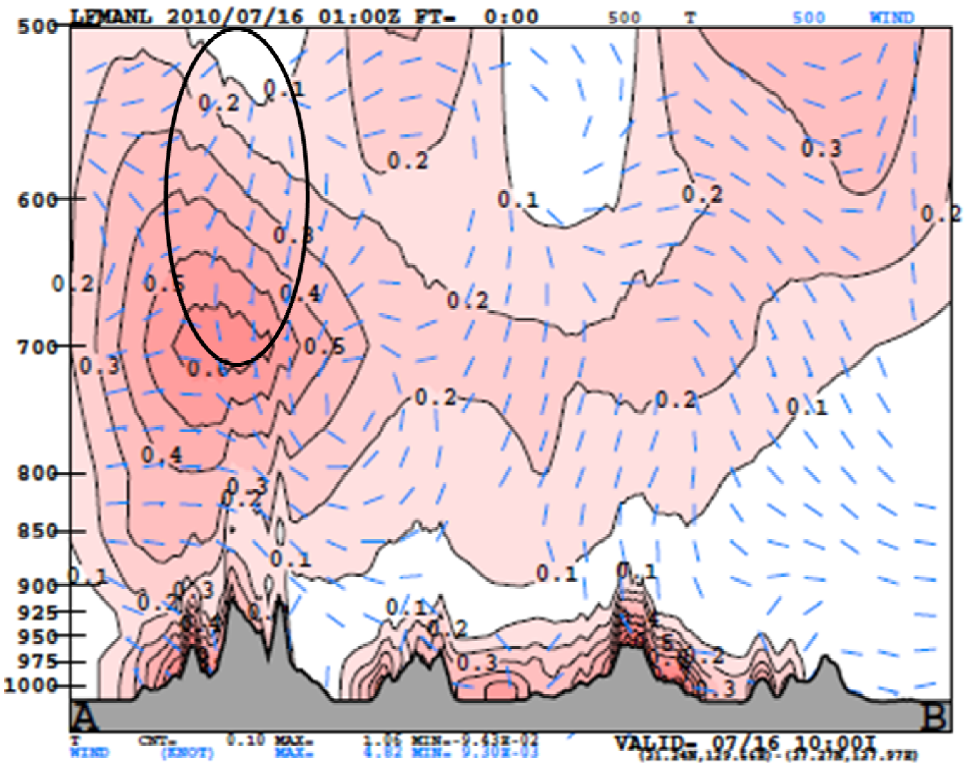
The new coordinate reasonably limits the influence of topography on the analysis increment within the lower troposphere.

Vertical cross section of temperature analysis increment

Control



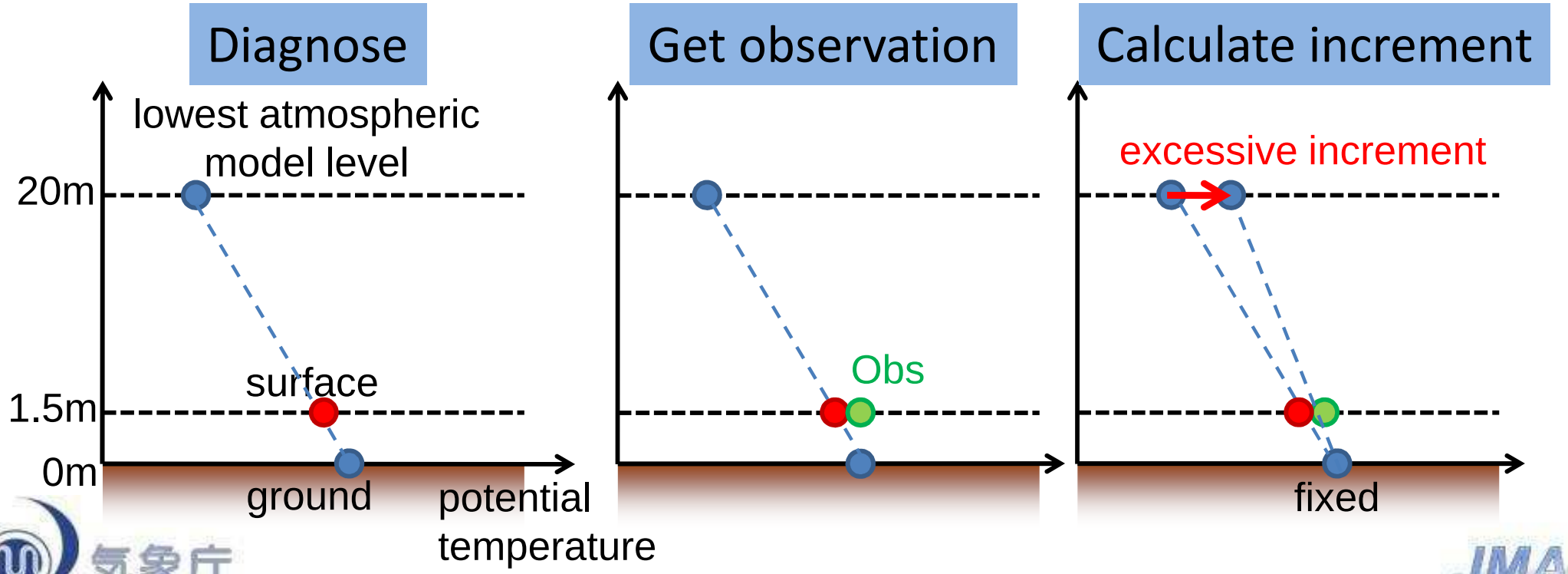
Test



(2) Extension of Control Variables

- Control: potential temperature at the ground is not included in control variable

⇒excessive temperature increment is found in the lower troposphere



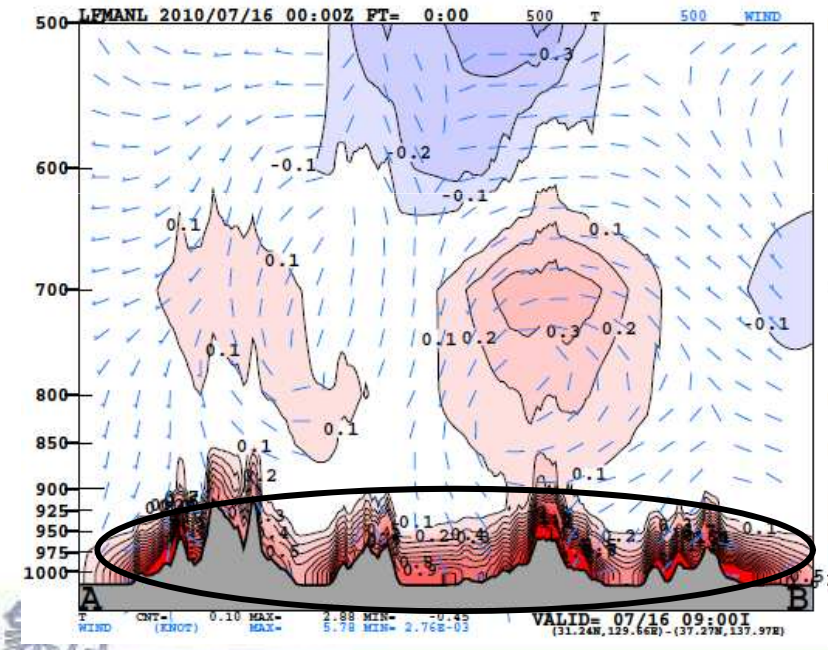
(2) Extension of Control Variables

- Test: extend the control variable to include potential temperature at the ground

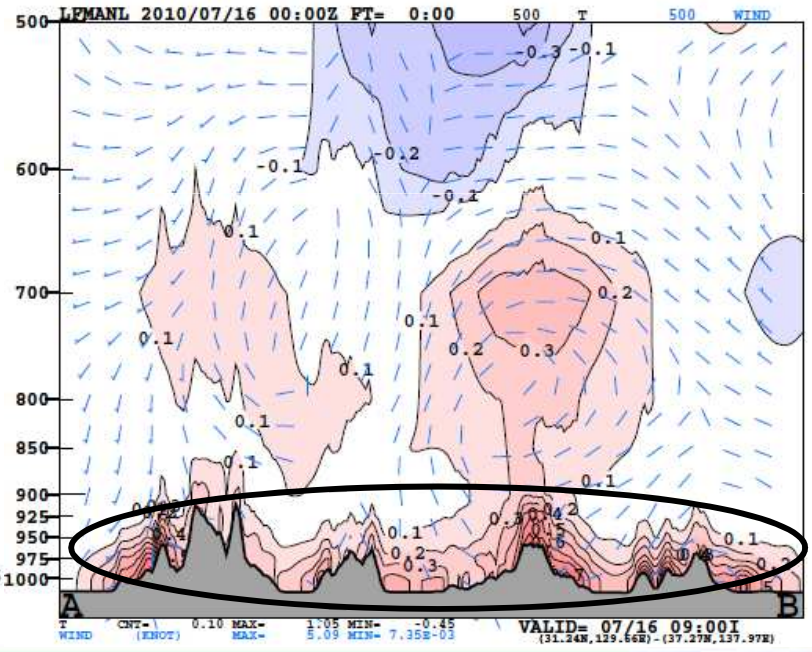
⇒Mitigate excessive temperature increment in the lower troposphere

Vertical cross section of temperature analysis increment

Control

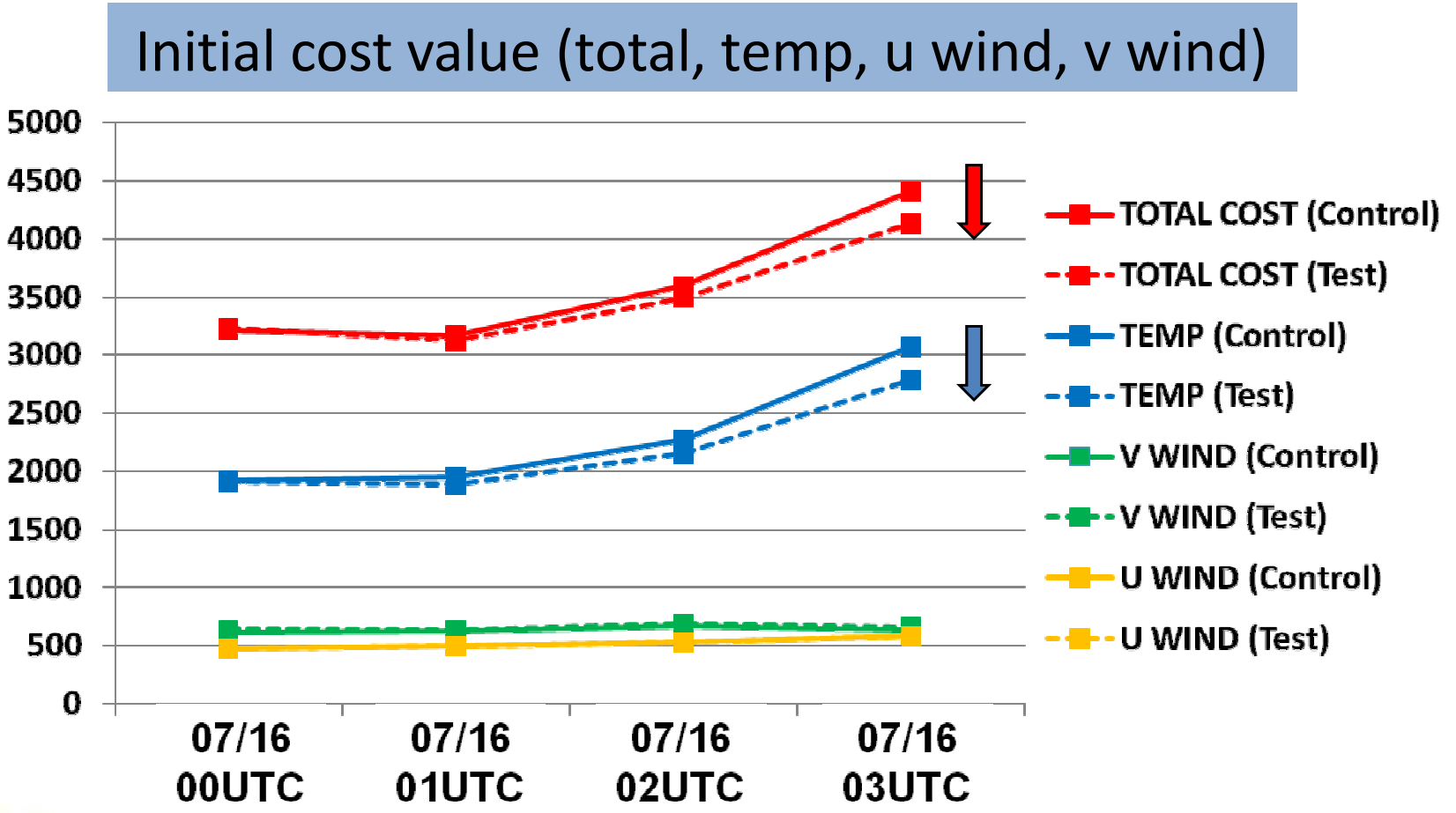


Test



(3) Update of Surface Diagnostic Scheme

- Test: Update surface diagnostic scheme of observation operator to make it consistent to forecast model



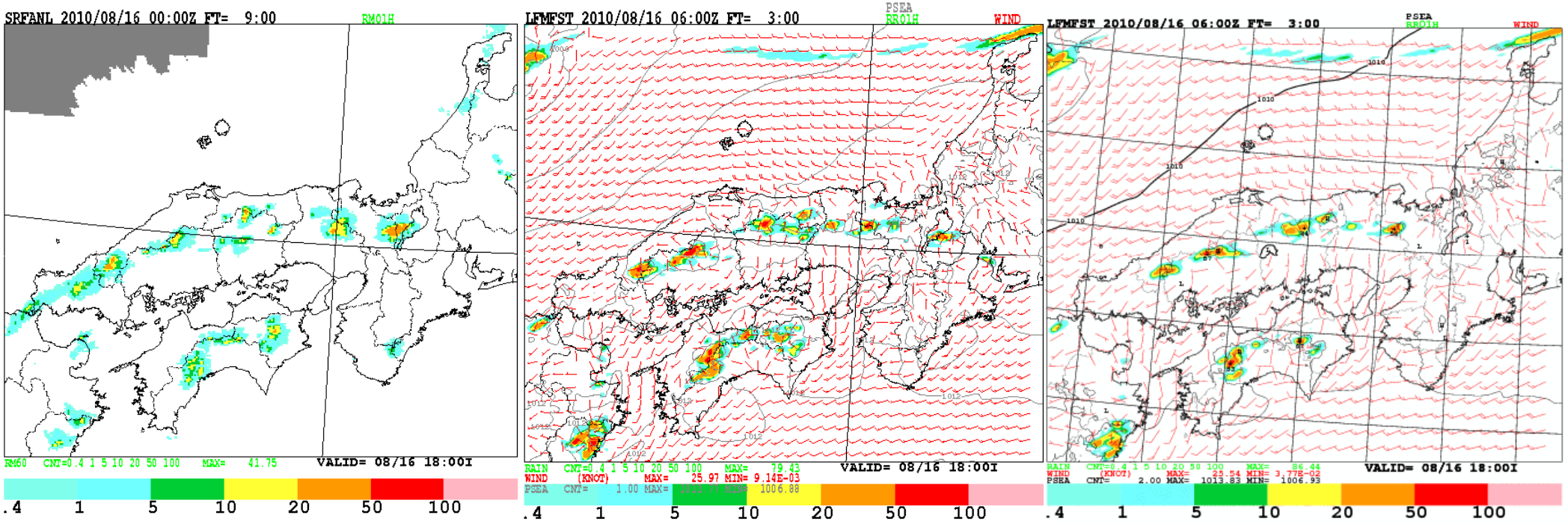
LFM precipitation forecast after the revisions

- Forecasting precipitation related to heated land in the afternoon (2010 Aug. 16 06UTC 1hourly precipitation)

Observation

LFM (FT=3) Control

LFM (FT=3) Test



4. SUMMARY

Summary

- Various efforts are being made to improve the LA towards the operational use of the system planned to start in 2012.
  - A new vertical coordinate is tested to control the terrain effect on analysis increments.
  - Revision of surface observation operator and extension of control variables are being made to obtain more reasonable analysis in the lower troposphere.


THANK YOU FOR YOUR ATTENTION!