Data assimilation for KMA local model with extended domain

Eunjoo Lee, Hyun-Cheol Shin, Eunhee Lee, Jung-Rim Lee, Hoyong Lee, Sangwon Joo
National Institute of Meteorological Sciences, Korea Meteorological Administration

Korea Meteorological Administration

1 Introduction

< Korea Meteorological Administration(KMA) operational systems >

◆ KMA operational NWP models are based on UM model of UK Metoffice.
◆ Upgraded version of KMA NWP systems(Global, Regional, Local(XLDAPS), EPS)
   got operational on 29th June 2016.
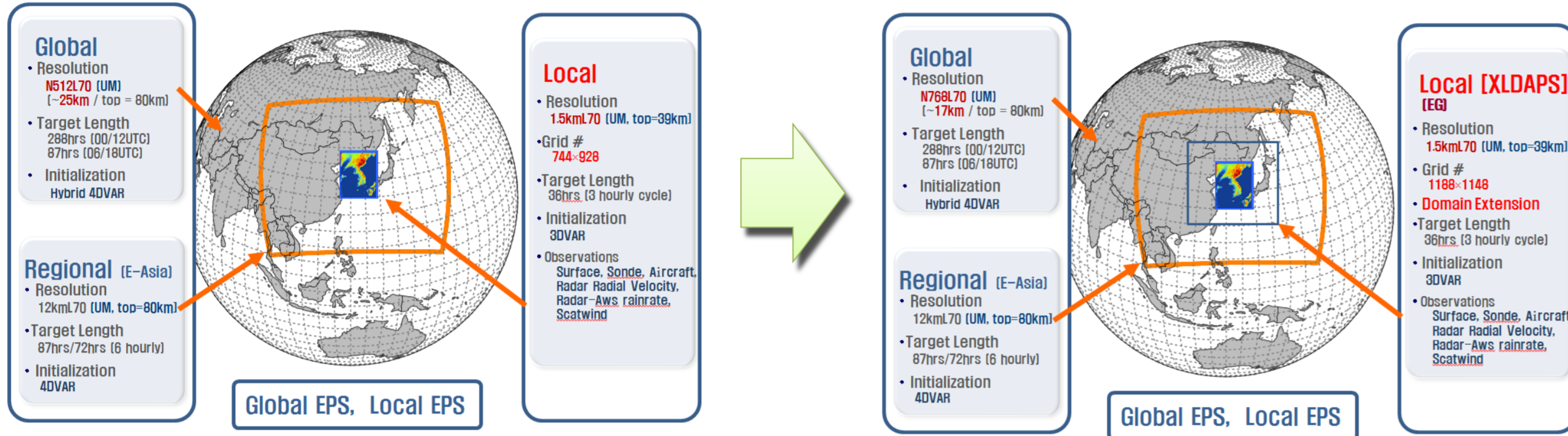
< Previous systems (~ 2016. 6. 28) >   < Current(new) systems (2016. 6. 29 ~) >

< KMA local model with extended domain, XLDAPS >

◆ XLDAPS : eXtended Local Data Assimilation and Prediction System
         : Current(new) KMA local model
◆ The previous KMA local model(LDAPS) was affected by the error from lateral boundary.
   - Delayed/inconsistent synoptic features.
◆ To reduce the affection of the error from lateral boundary, LDAPS domain is extended.

< Development for high resolution satellite data assimilation >

◆ Scatwind data is the only one satellite observation which is used in KMA local model.
◆ To improve convective scale forecast performance of XLDAPS, high temporal/spatial
   resolution satellite data assimilation is in development.
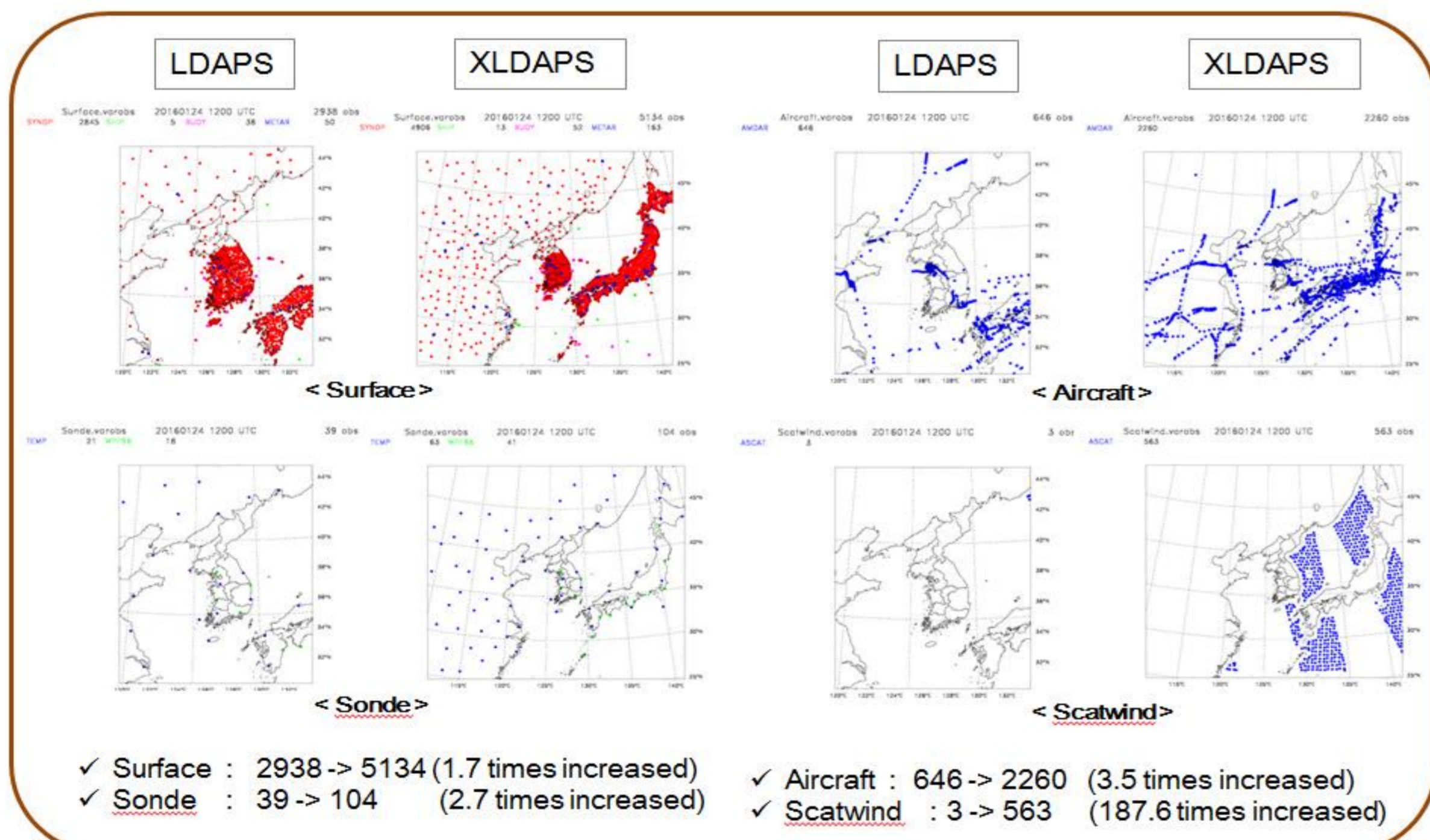
2 XLDAPS domain and DA setups

< XLDAPS domain >

◆ KMA local model has variable-grid zones, and fixed-grid zone for forecast field production.
◆ XLDAPS : Only the outmost zone of LDAPS is extended, not to be affected directly by the
   error from lateral boundary.

<LDAPS domain>   <XLDAPS domain>   <XLDAPS vs. LDAPS>
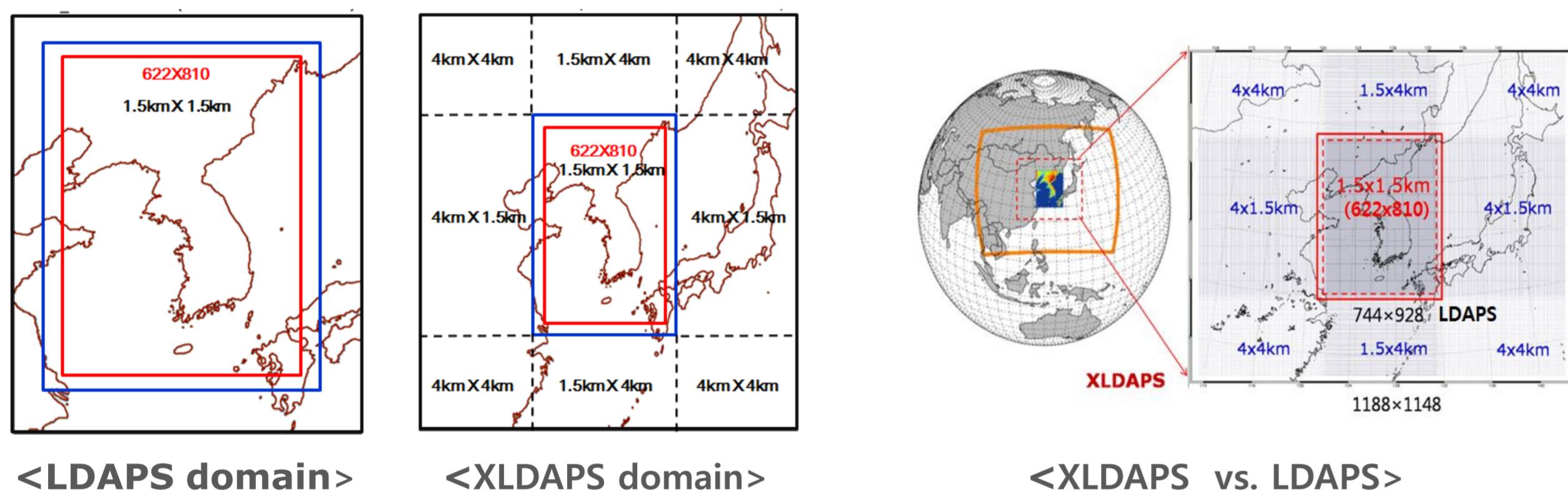
< DA setups >

◆ Used observations : Surface, Sonde, Aircraft, Scatwind, Radial velocity, Radar-AWS rainrate
◆ Resolution/Grid# for DA domain : ~3km, 450X540(LDAPS) → ~3km, 960X768(XLDAPS)

✓ Surface : 2938 -> 5134 (1.7 times increased)   ✓ Aircraft : 646 -> 2260 (3.5 times increased)
✓ Sonde   : 39 -> 104   (2.7 times increased)   ✓ Scatwind : 3 -> 563   (187.6 times increased)

◆ XLDAPS shows better synoptic feature than LDAPS.
   - The affection of lateral boundary error to XLDAPS forecast area is reduced.
   - The use of more observations on the western part of XLDAPS domain where synoptic flow
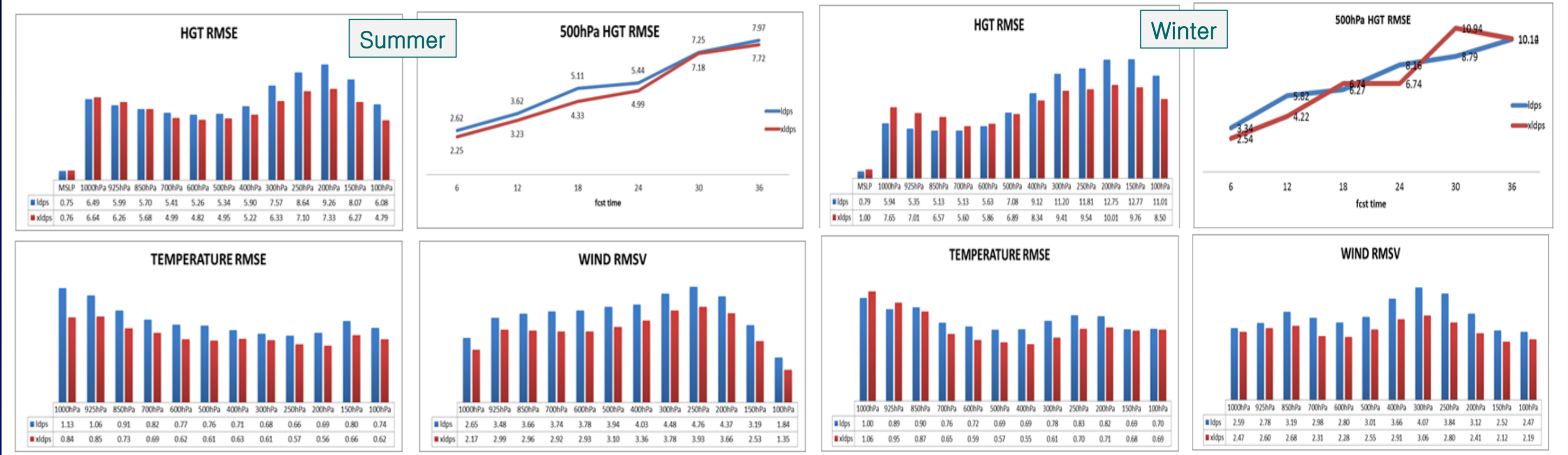   approaches to Korean peninsula seems to contribute on better capture of synoptic pattern.
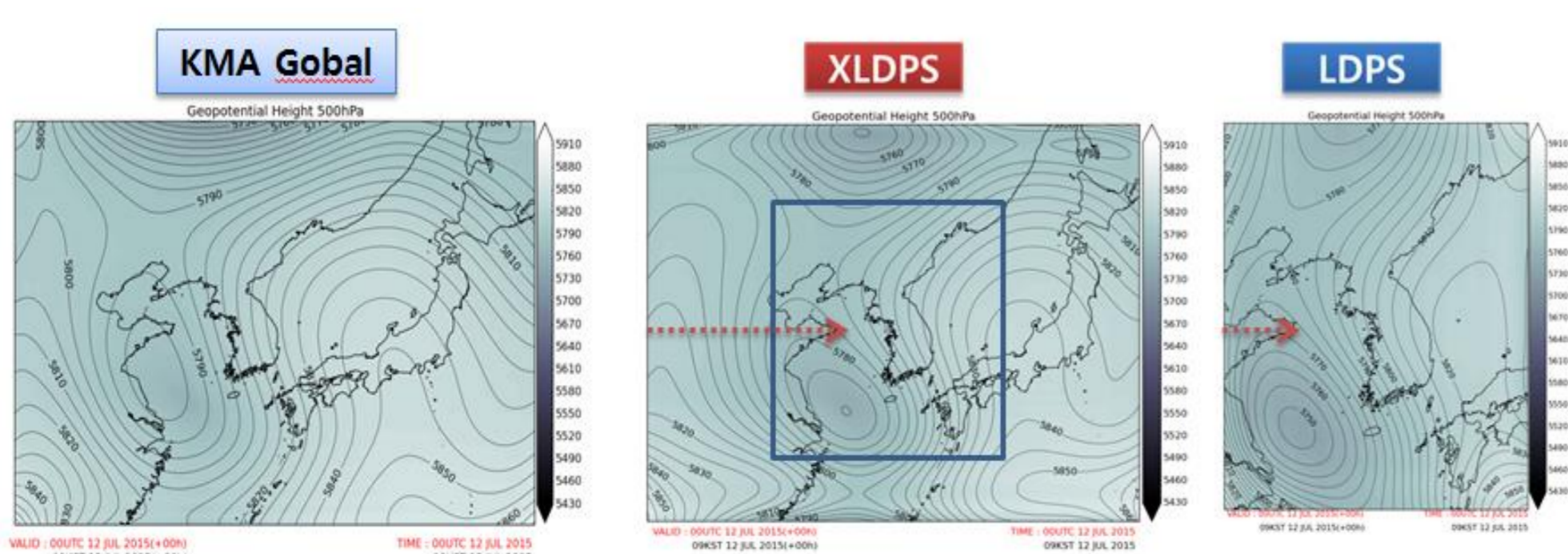
3 Results

< Experiment>

◆ Experiment period : 2015.7(summer), 2016.1(winter)
◆ Additional model physics tunning

< Verification against Analysis >

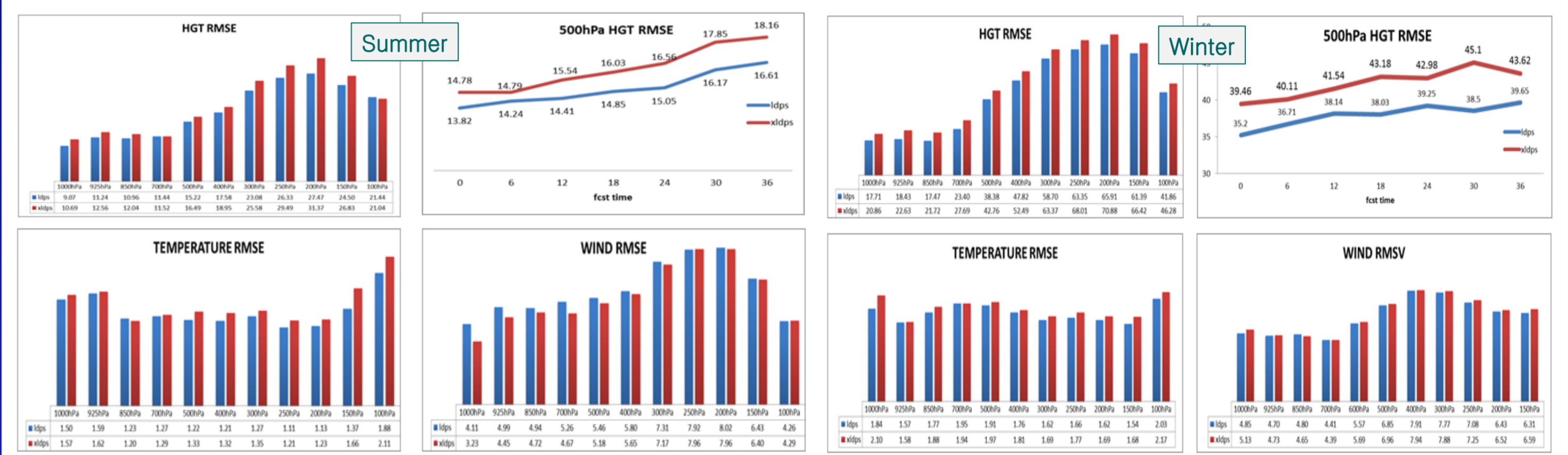All variables improved   Most variables improved

< Verification against Observation (Sonde) >

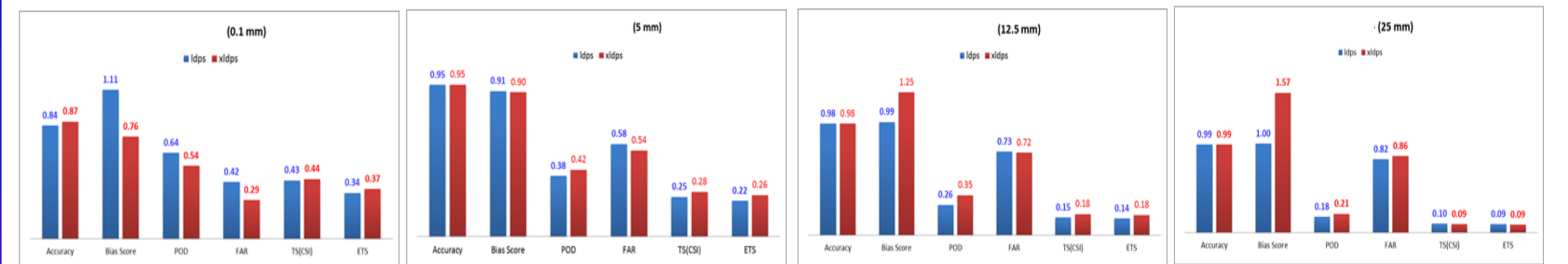Mostly worse. Looking into verification method for XLDAPS.
(* General verification tool for synoptic scale was used.)

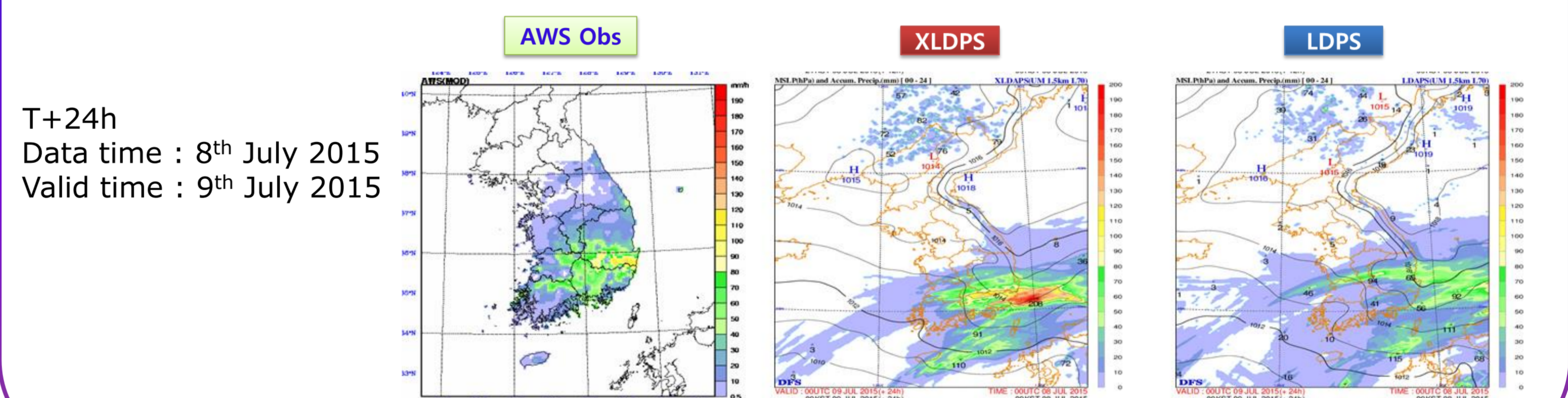### < 3hr accumulated precipitation verification (Summer) >

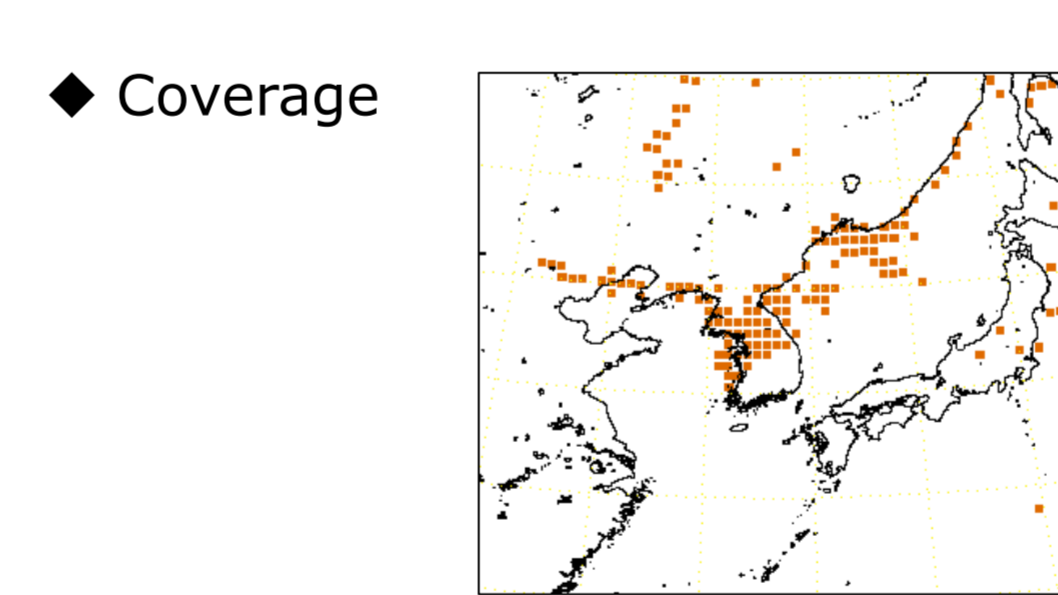* Small case number of winter precipitation, so did not show here.

Mostly improved. XLDAPS shows low performance in weak precipitation(<0.1mm) forecast.

< Case study (24hr accumulated precipitation) >
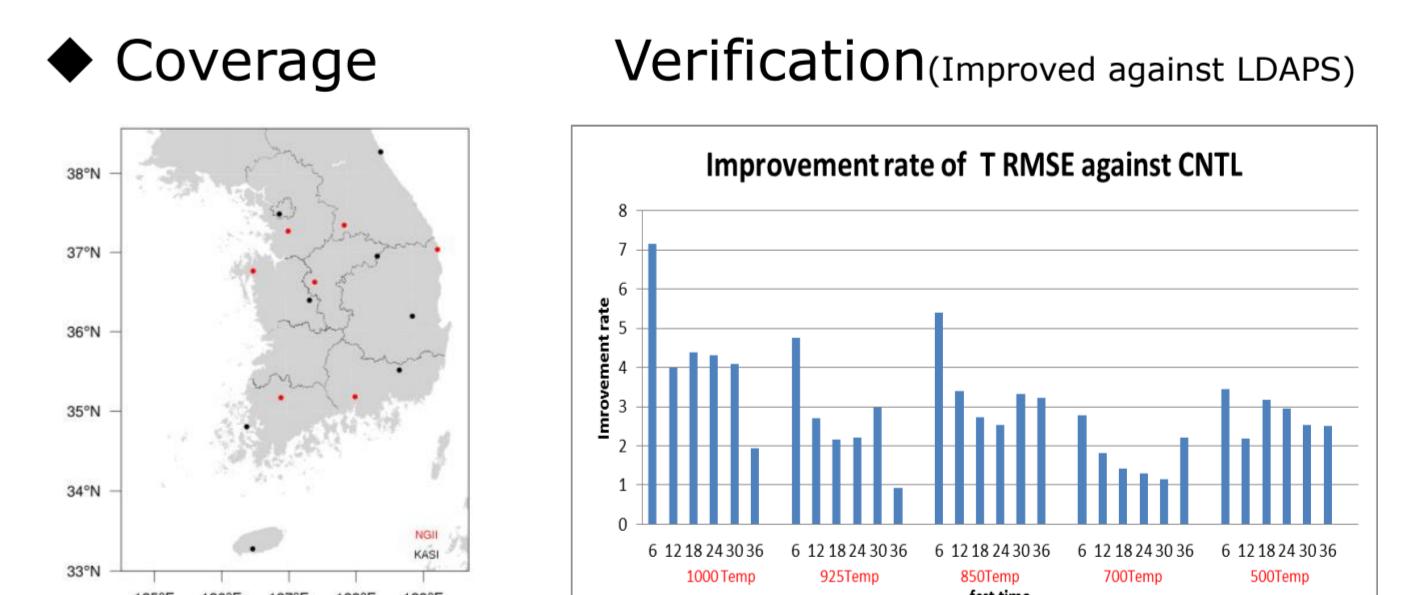

T+24h
Data time : 8th July 2015
Valid time : 9th July 2015

4 High resolution satellite data assimilation (in development)

< COMS satellite data : CSR, AMV >

◆ Coverage

< Ground GNSS >

◆ Coverage   Verification(Improved against LDAPS)

< High resolution AMSUB >
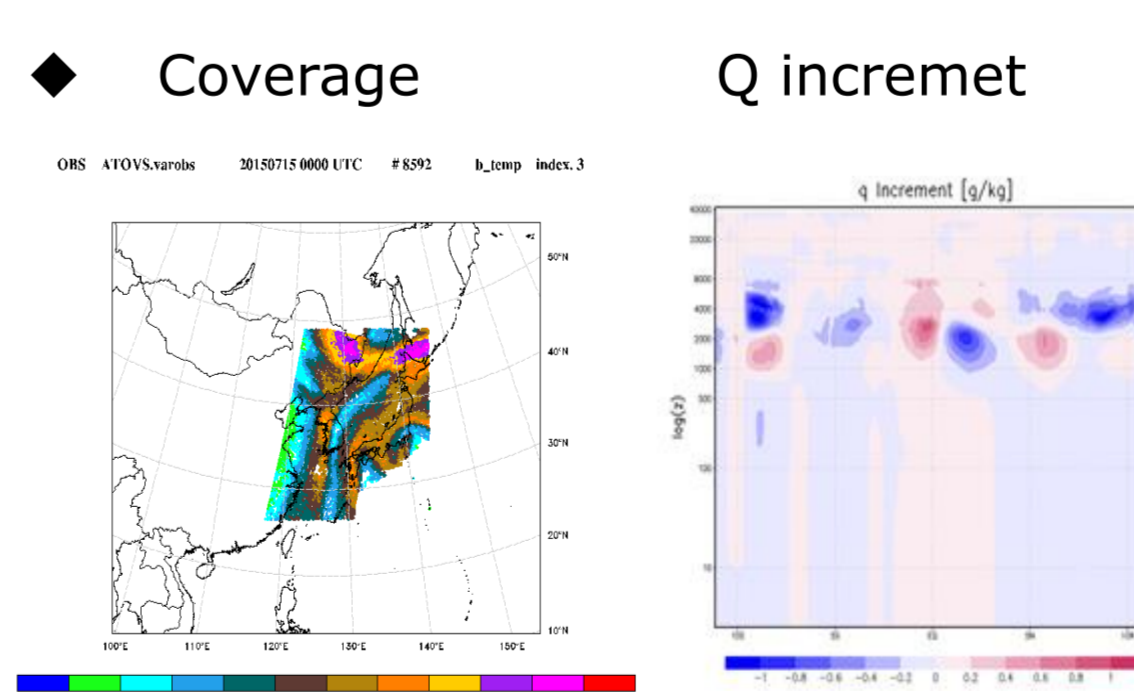
◆ Coverage   Q increment   Verification(RH improved against LDAPS)

< Direct-readout IASI>

◆ channel selection
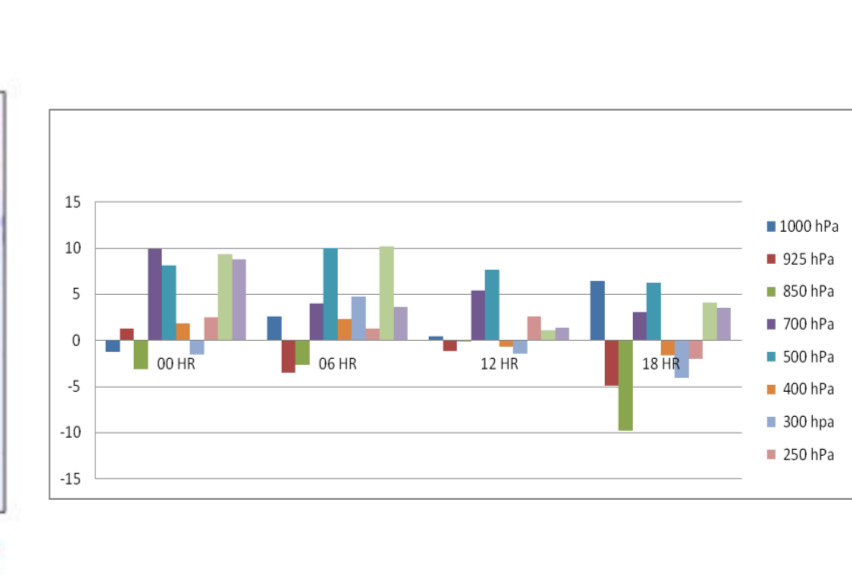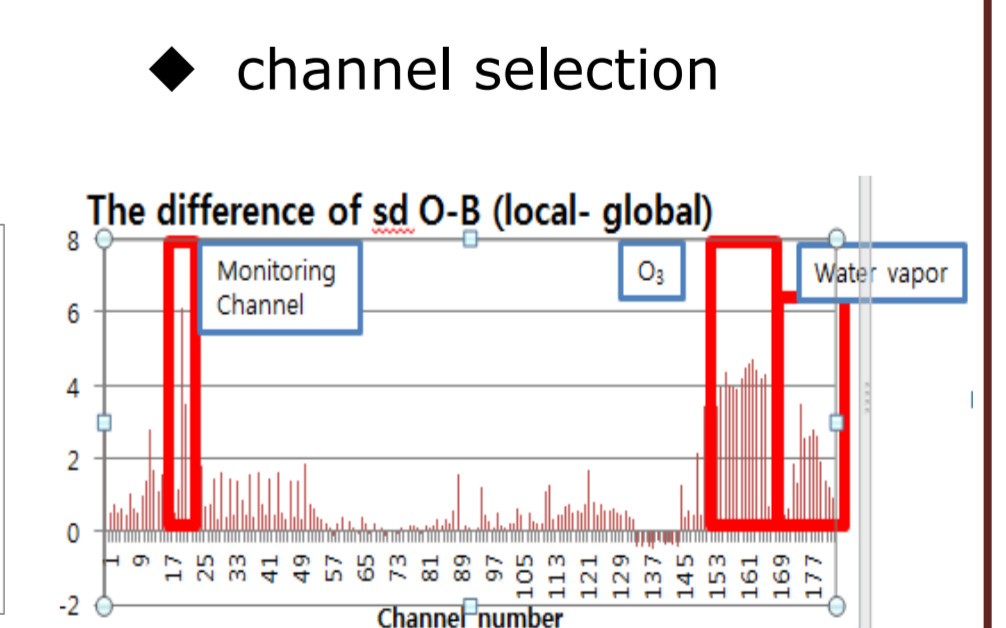

5 Conclusion

◆ To simulate better synoptic flow, KMA local model(XLDAPS) extended its variable-grid zone
   and assimilated more observations.
◆ Additional model physics tunning has performed.
◆ XLDAPS simulates better synoptic feature than LDAPS, and its forecast performance improved.

◆ To improve XLDAPS convective-scale forecast, high resolution satellite data are quality-controlled
   and under development for assimilation.
◆ Satellite data assimilation for XLDAPS are going to go for operation by the end of 2016.