Recent progress of GRAPES_GFS in China and the relevant parallel experiment system

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outline

- About GRAPES
- Recent progress of GRAPES_GFS
- Parallel experiment system of GRAPES_GFS
- Future plan

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About GRAPES

Why and When called GRAPES?

GRAPES (Global/Regional Assimilation PrEdiction System), project launched since 2001.

What GRAPES' characteristics are?

A Unified NWP system

a common dynamic core with different configurations of physics for different applications

Four main components

- ✓*Variational DAS*
- ✓*Unified dynamic core*
- ✓*Physical parameterization scheme*
- ✓*Parallel computing*

Milestone of GRAPES

2001:
Project Launched

2001

2001—2005:
Regional 3DVar
Unified dynamic frame
Regional physics package

2006
MESO V2.0
Operational system(35km)

2006—2009:
Improve precip. scheme

2009
MESO V3.0
Operational system(15km)

2009—2013:
Solve issues about topo. and overestimated precip.

2013
MESO V3.3
operational system(15km)

2006—2007:
Global 3DVar
Conv. obs.
Dynamic frame

2007
GFS V1.0

2007—2009:
Sat. data
Global physics

2009
Quasi-operational system of GFS(1°)

2009—2013:
More sat. data
Improve precip. and cloud scheme

2013
GFS V1.4
Upgrade parallel experiment system(0.5°)

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Recent progress of GRAPES_GFS

from last December :

- ✓Released a new version(June, 2013)
- ✓Updated parallel experiment system(July, 2013)
- ✓Improved GFS to adapt to new HPC IBM_Flex(July, 2013)
- ✓Migrated parallel experiment system to IBM_Flex(August, 2013)
- ✓ Developed evaluation tools

new version(GRAPES_GFS_1-4-2-2)

Data assimilation

- Horizontal resolution from 1° to 0.5°
- Re-calculate background error covariance
- Height assignment for FY-2E AMVs
- QC for surface obs.
- NOAA 19
- AIRS

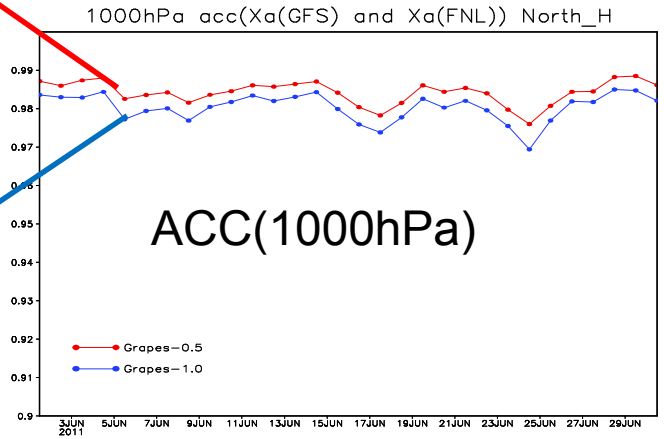
Model

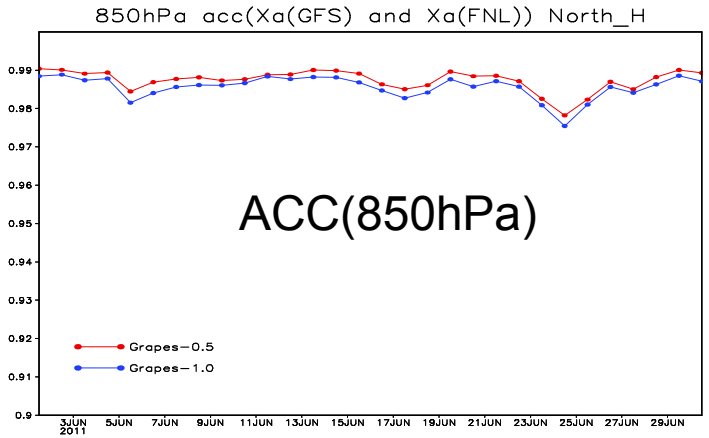
- 4th order diffusion
- PRM for scalar advection
- SPLINE for dyn-phy interpolation
- Update PBL and SAS

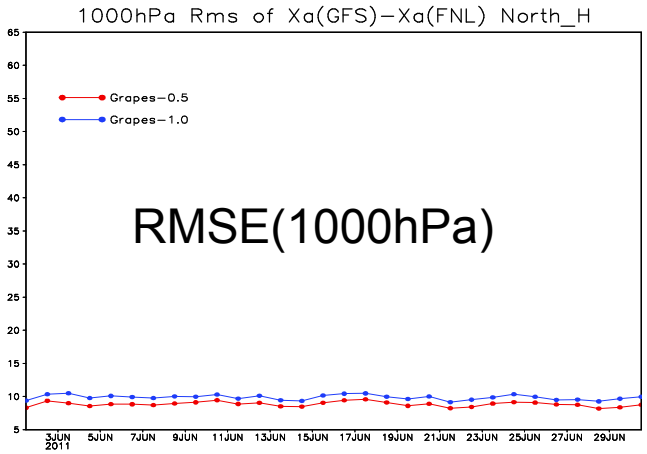
DA's horizontal resolution from 1° to 0.5°

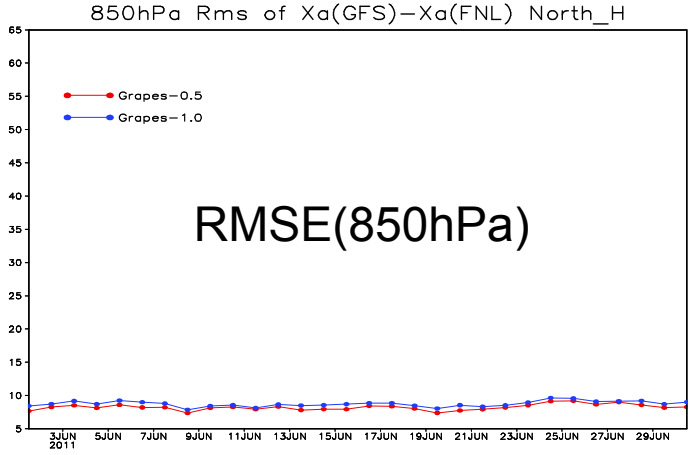
0.5

1.0









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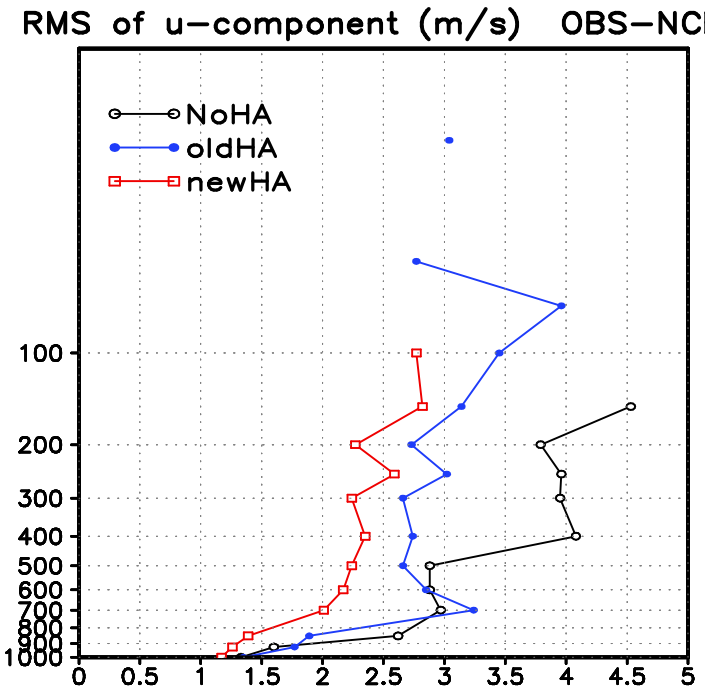
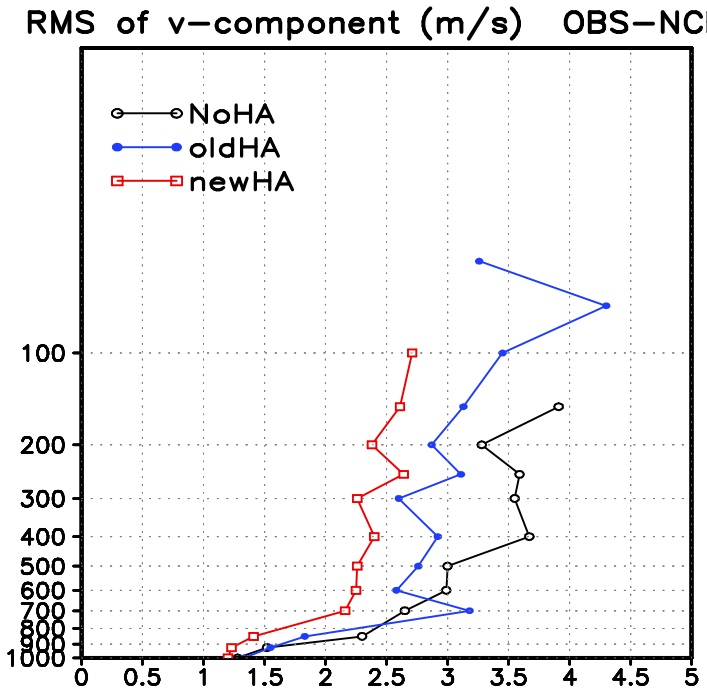
Height assignment for FY-2E AMVs

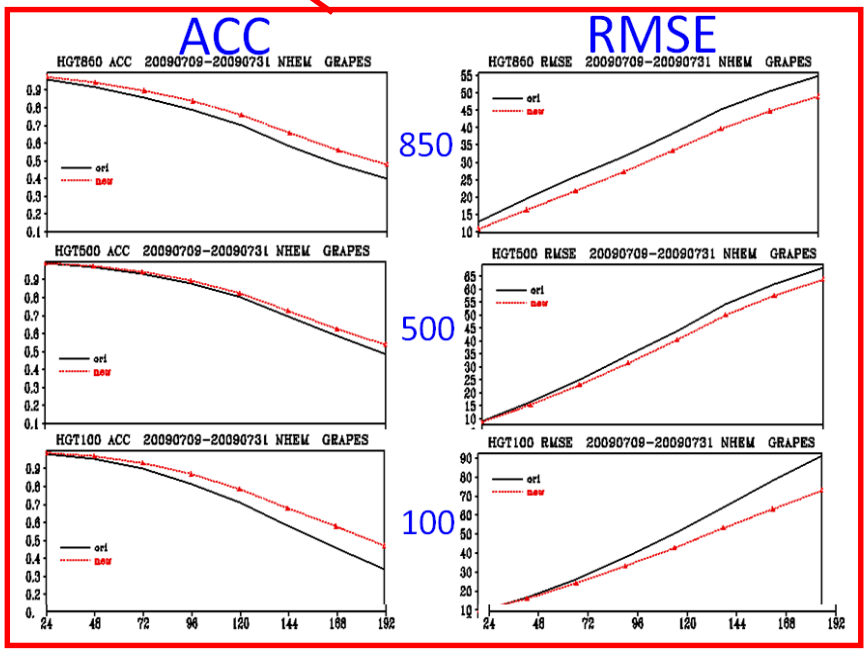


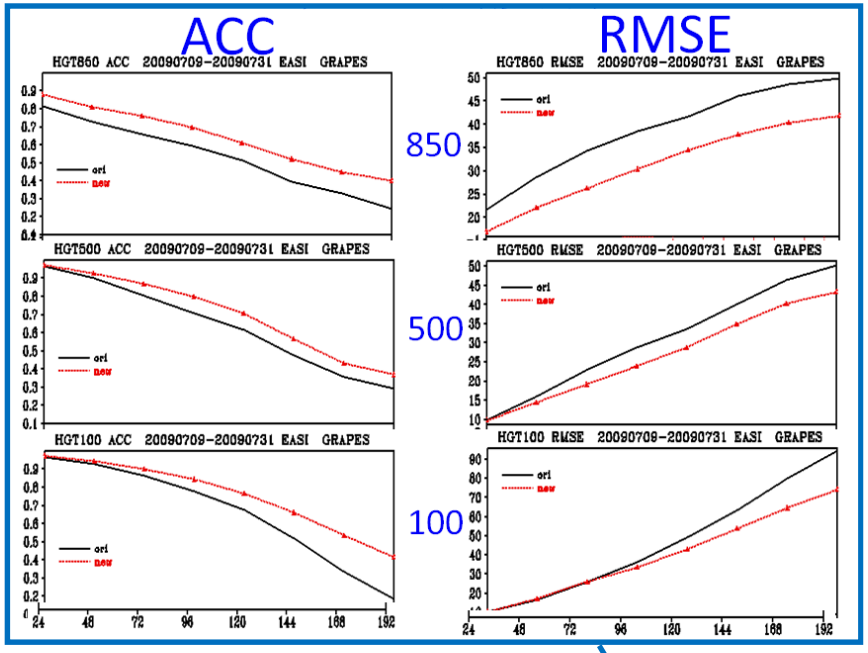


RMSE of u/v against NCEP analysis are reduced

PRM and SPLINE

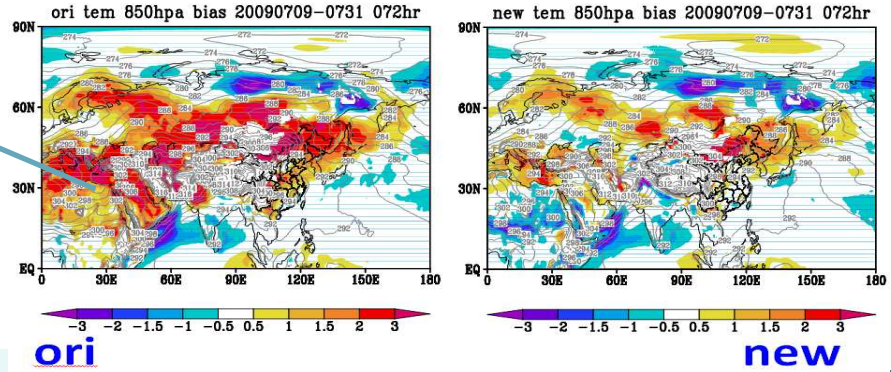
N.H





E.A

Temperature bias



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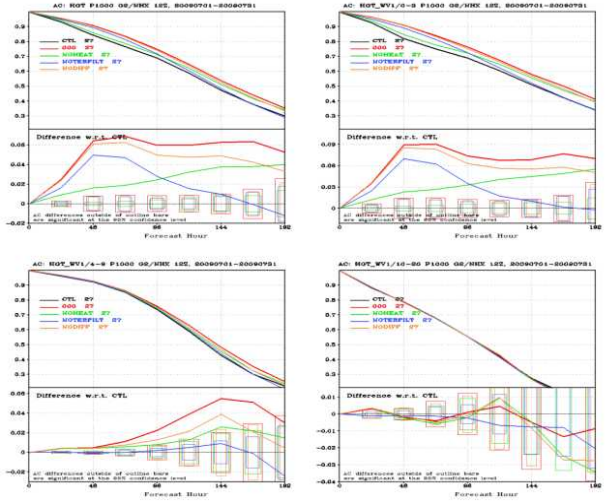
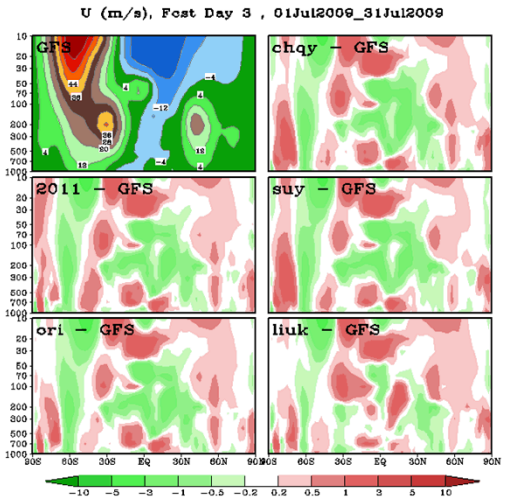
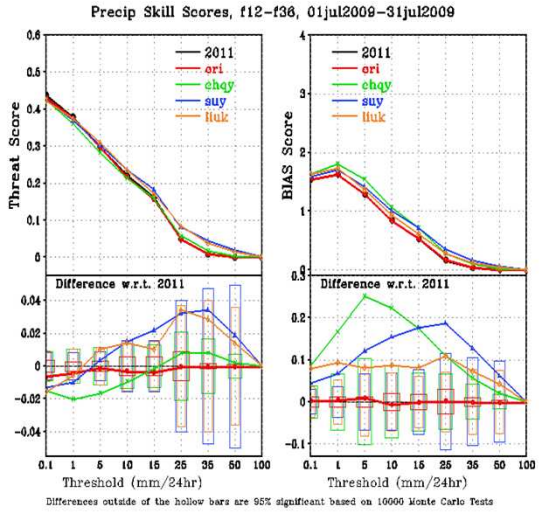
Grapes Evaluate Tool（GET）



Statistical verification

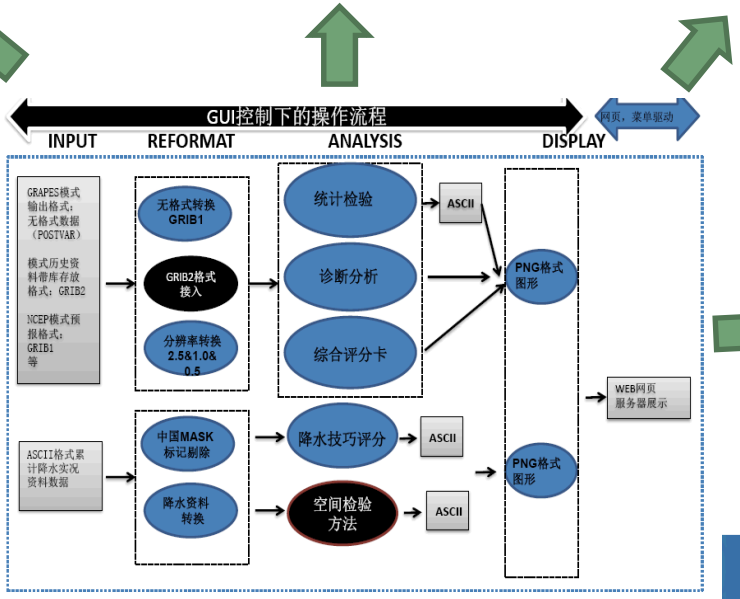


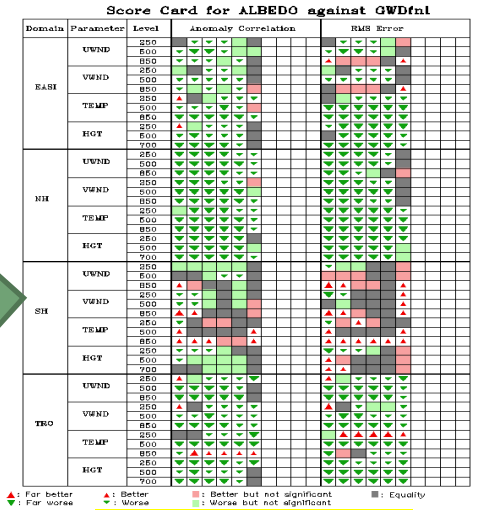
Diagnosis



Precipitaion verification

Web Page





Skill card

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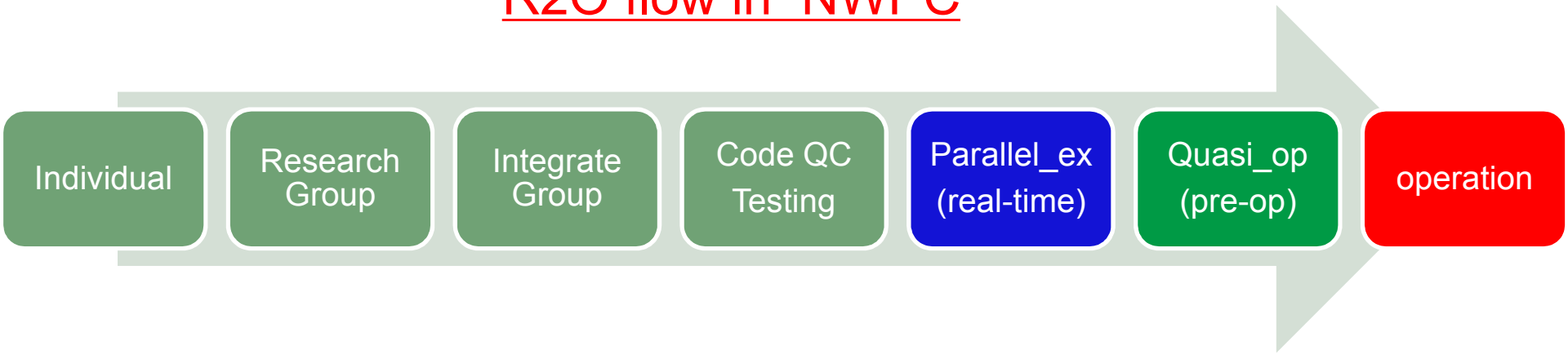
Parallel experiment system of GRAPES_GFS

R2O flow in NWPC

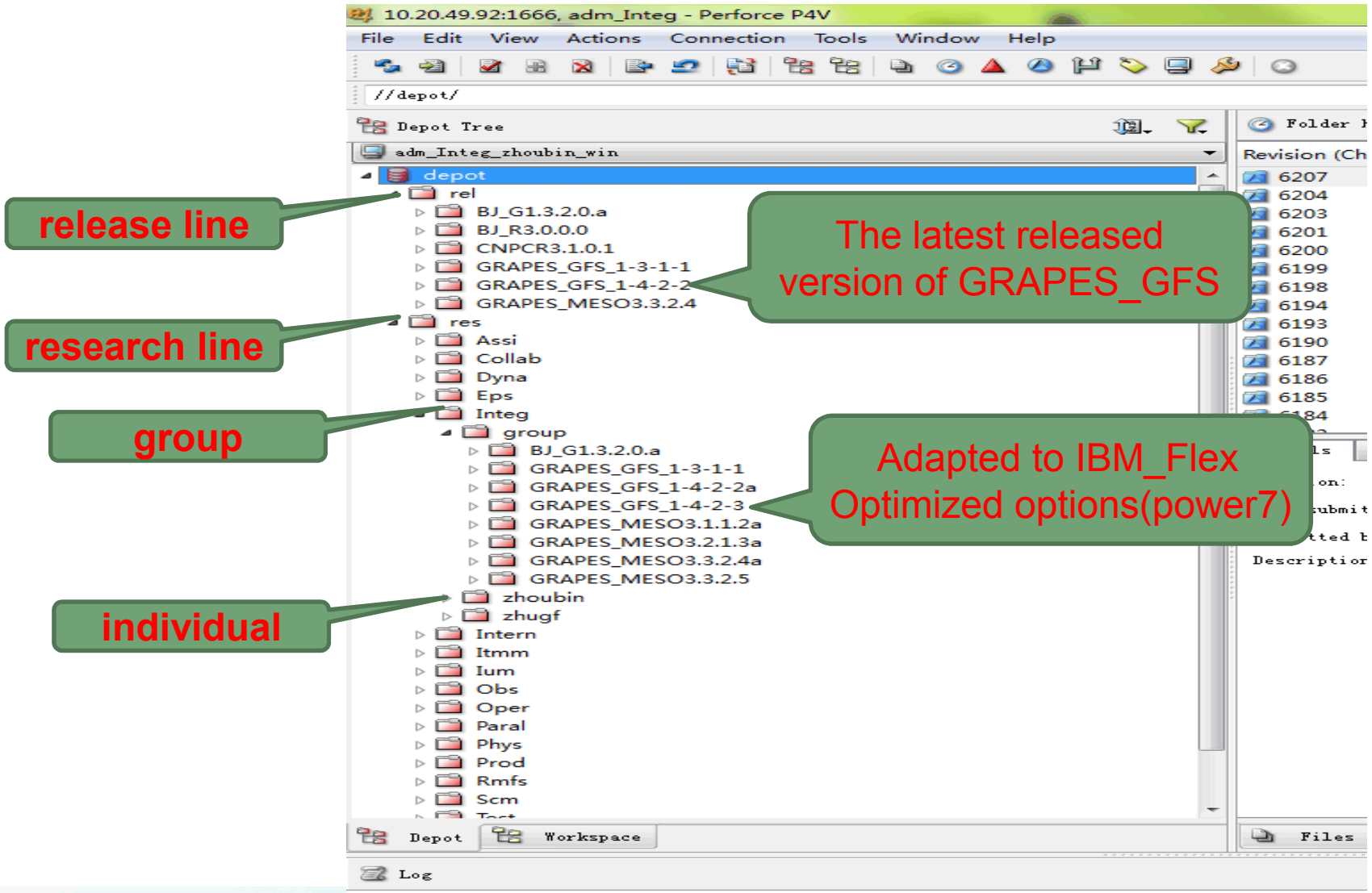


Now, this system is based on **GRAPES_GFS_1-4-2-3** (this version is adapted to our new high performance computer IBM_Flex) .

Used techniques:

- Perforce(from ECMWF)
- Supervisor Monitor Scheduler (from ECMWF)
- MARS (from ECMWF)
- GET(based on NCAR evaluate tools)

Perforce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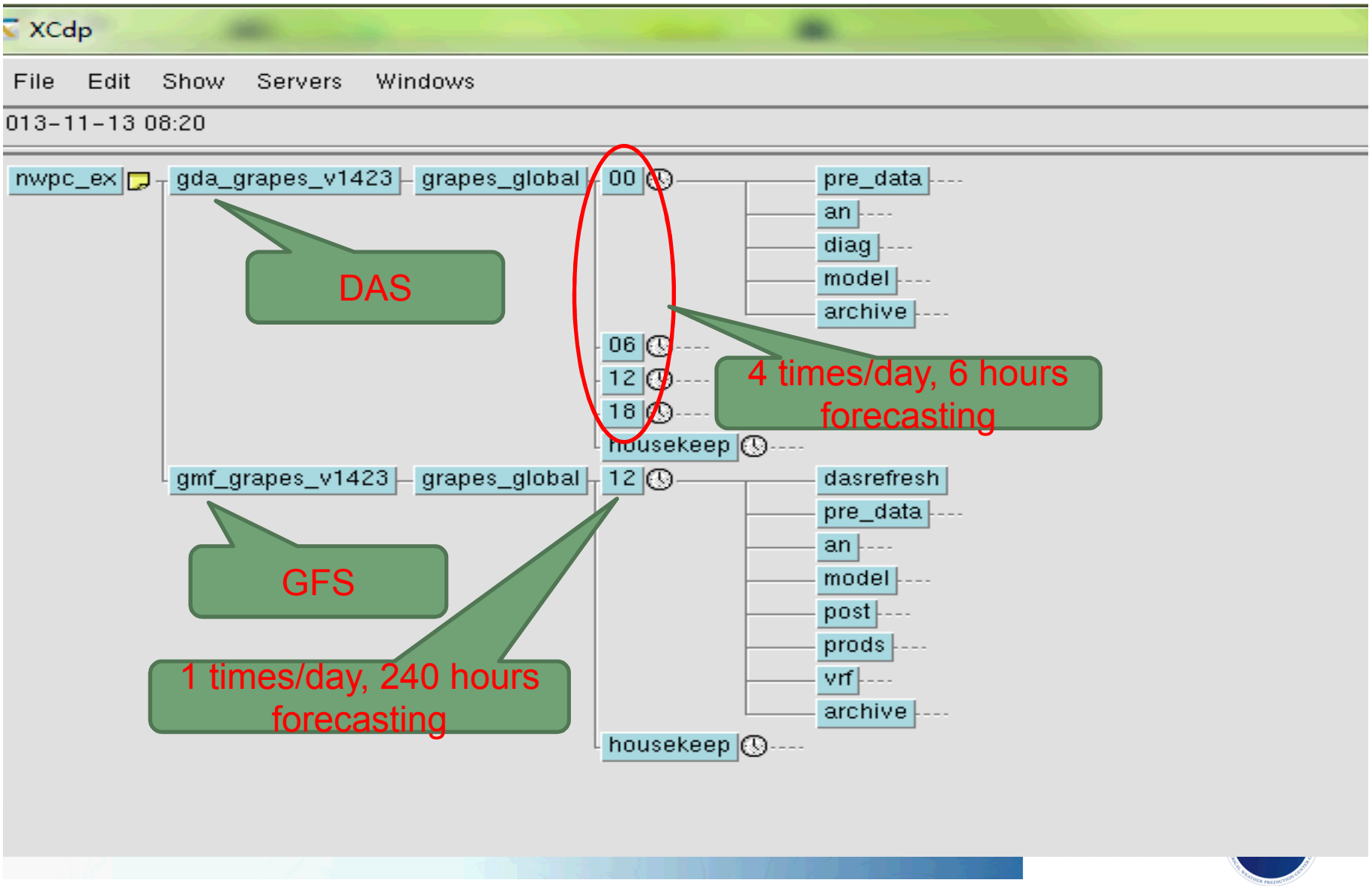
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vrf
archive
housekeep
GFS
1 times/day, 240 hours forecasting

GRAPES_GFS parallel experiment system(config)

- Leading time: 240 hour forecast (12UTC)
- Resolution: model:0.5° /L36 with model top at 1 hPa
- Model physics:
  - Radiation: RRTMG LW(V4.71)/SW(V3.61)
  - Cumulus: Simplified Arakawa Schubert with modified entrainment and detrainment rates
  - Grid-scale precipitation: WSM-6
  - Cloud: Xu & Randall diagnostic cloud
  - Land surface: CoLM
  - PBL: Modified Hong & Pan nonlocal PBL
  - Gravity wave drag: Baines & Palmer (1990)
- DAS:
  - Incremental analysis,
  - Digital filterbackground error covariance – NMC method
  - 0.5°X0.5° resolution, 17 standard pressure levels

  - Recalculated pressure levels
  - Bias correction scheme of satellite radiances based on simple linear regression (Harris and Kelly,2001): (1) 1000-300 hPa thickness, (2)200-50 hPa thickness.

Observations assimilated

Observations assimilated

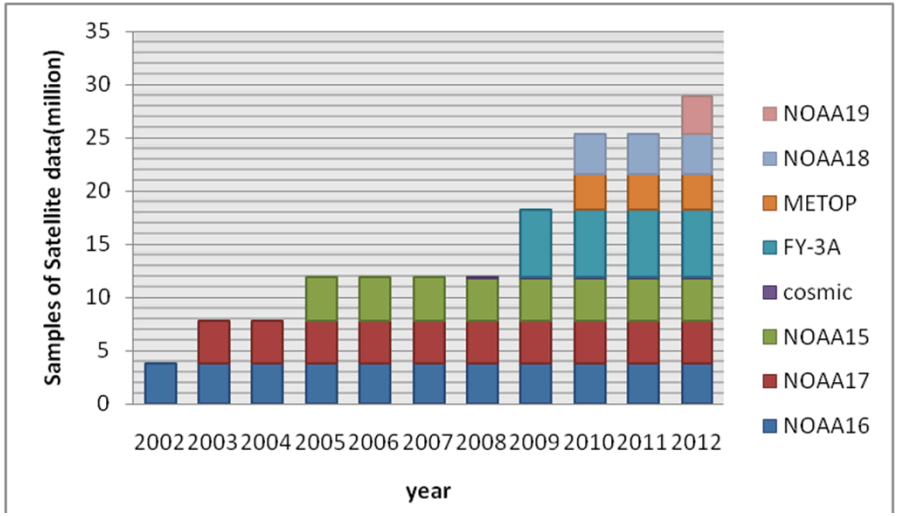
- **Conventional obs. (TEMP, SYNOP,SHIPS,SATOB,AIRCRAFT)**

- **Unconventional obs.**

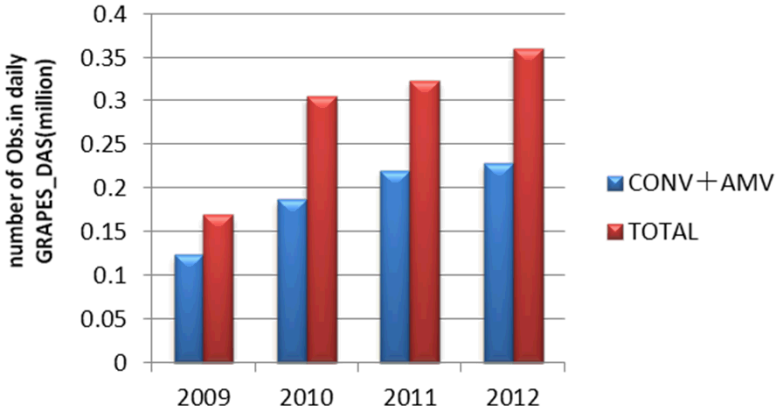
•TOVS(NOAA15/16/17/18/19/METOP)
• GPS/RO(COSMIC)
• RADAR(wind and refractivity)
• GPS/PW
• TC Bogus
• FY
•AIRS

Will be assimilated:
•IASI
•ASCAT

Daily sat. Obs. Received in CMA



Daily Obs. Used in GRAPES_DAS



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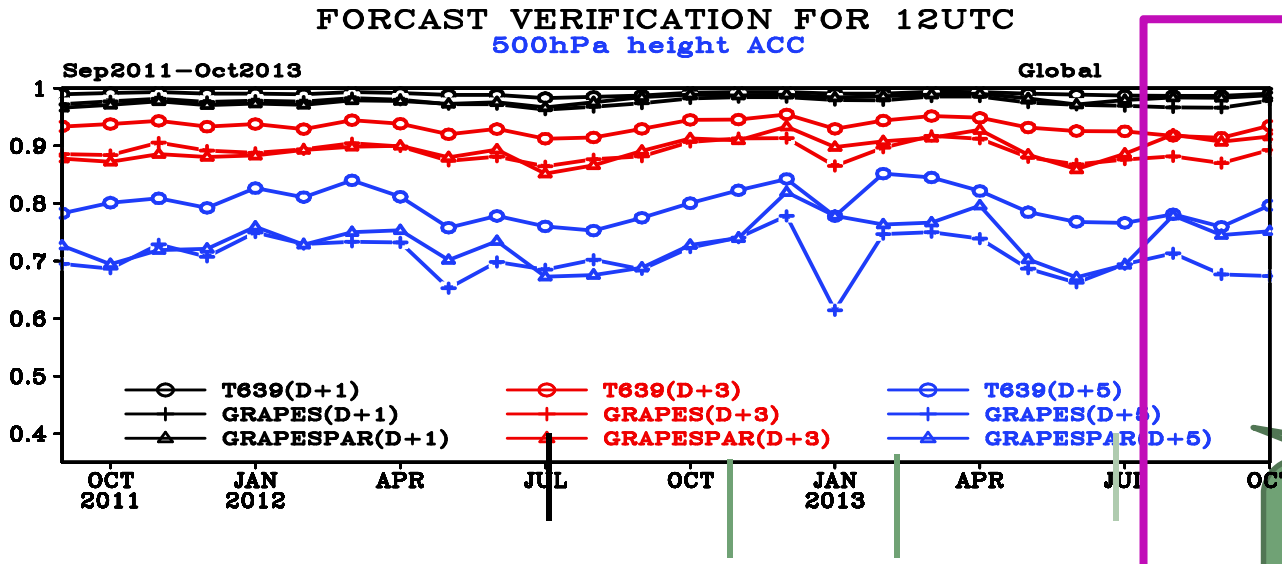
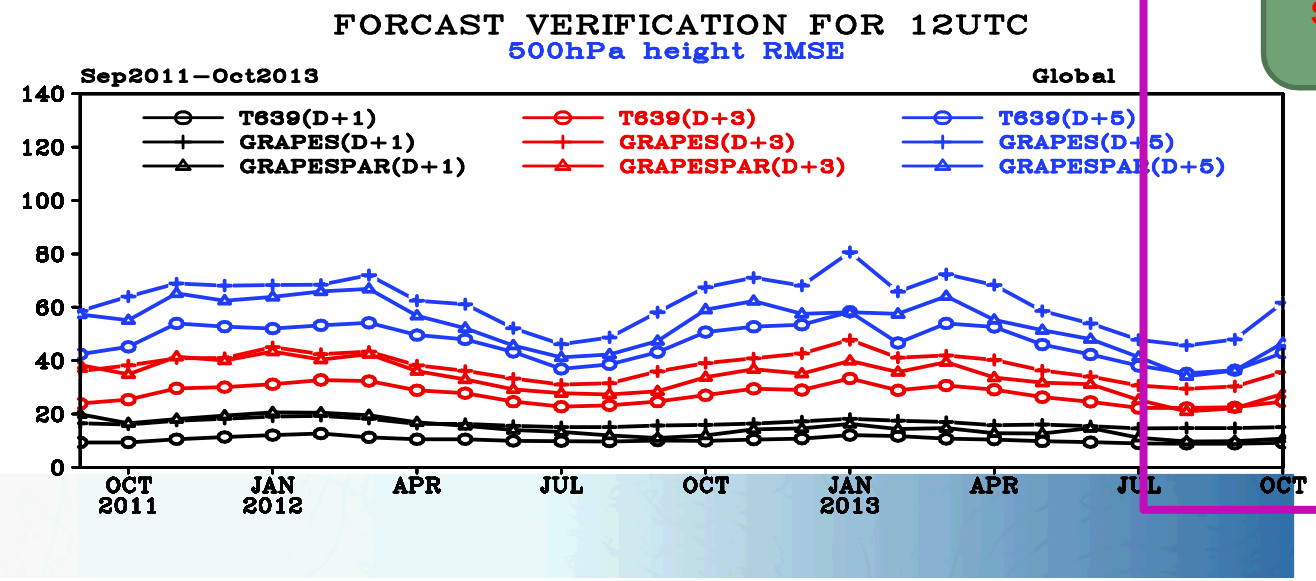
Verification





In this period, the parallel experiment system used new GRAPES_GFS

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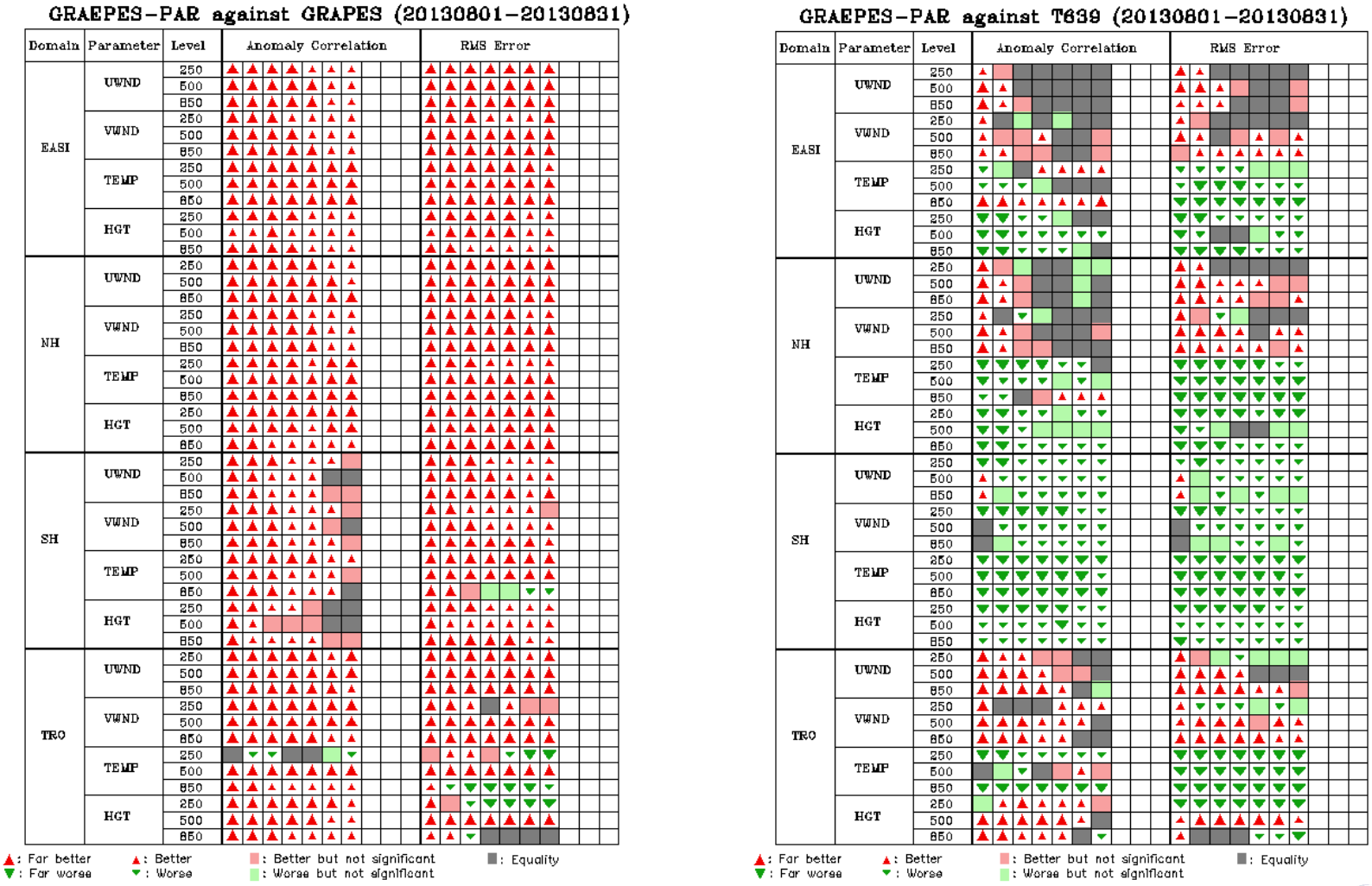
Skill card



red: better, green: worse

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Focus of future work

Reseach:

- **Improve the ability in assimilating satellite data**
- **Dynamic**
  - **Yin-Yang grid**
  - **Vertical coordinate**
- **Physics**
  - **topography-related process**
    - Tibet Plateau Field Experiment
  - **Macro-physics**

Plan before 2015

Operation aims:

- Perform 3DVAR on model level
- Horizontal resolution: 0. 5^{o} -> 0.25^{o}
- Vertical resolution: 36 -> 60 levels
- Top layer: 1hPa -> 0.1hPa
- Use GRAPES_GFS to replace T639

Plan before 2015

Support system:
Develop a testbed of GRAPES

Prototype based on ECMWF PrepIFS

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THANKS FOR YOUR ATTENTION!