

Centre Activities in High-Res NWP



Presenter: Gary Dietachmayer, on behalf of the members of WGNE

WGNE-29
Melbourne, 10-13 March 2014



Australian Government
Bureau of Meteorology

The Centre for Australian Weather and Climate Research
A partnership between CSIRO and the Bureau of Meteorology



Approach

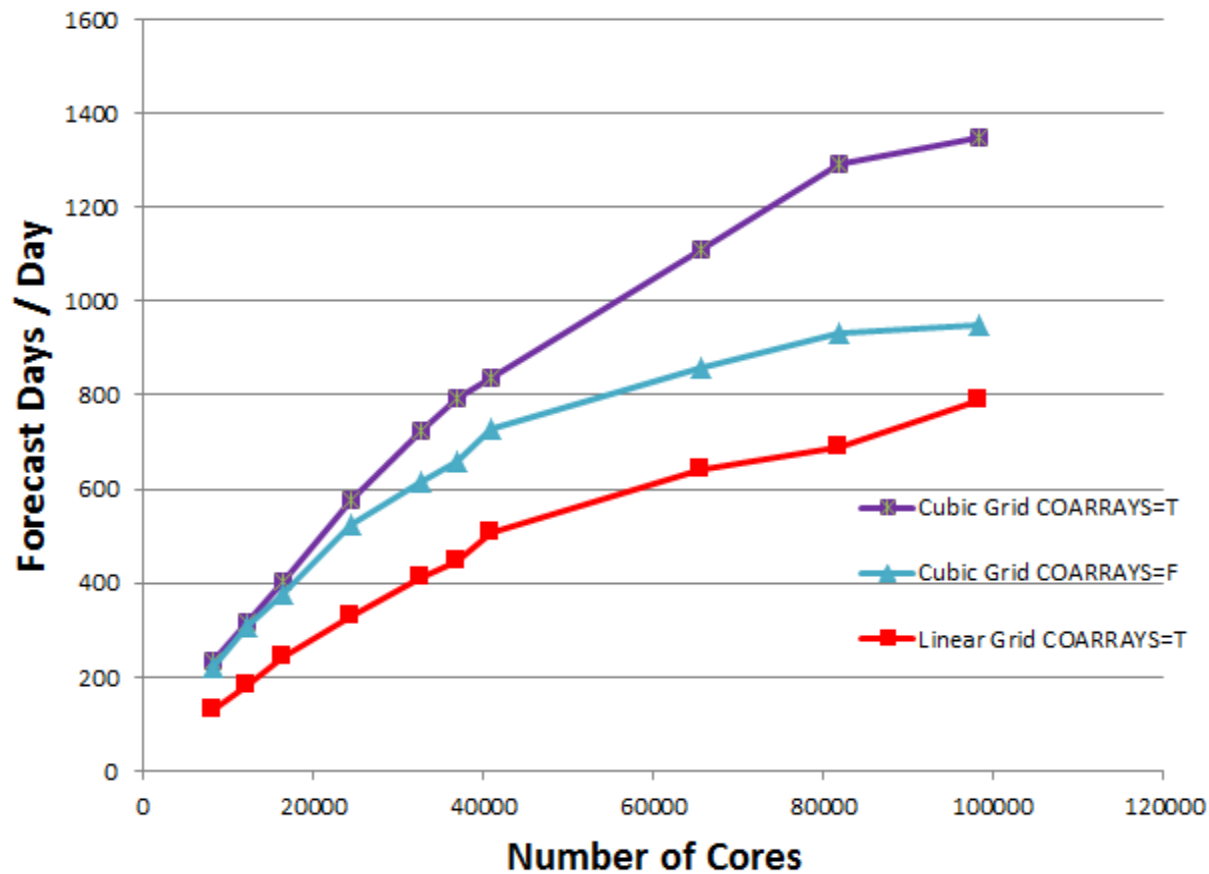


- Not repeat material (eg., from centre reports)
- "Part Two" (largely) following on from Jeanette
- Try to tease out common elements
 - Create them where they don't exist 😊
 - Sort by theme rather than centre

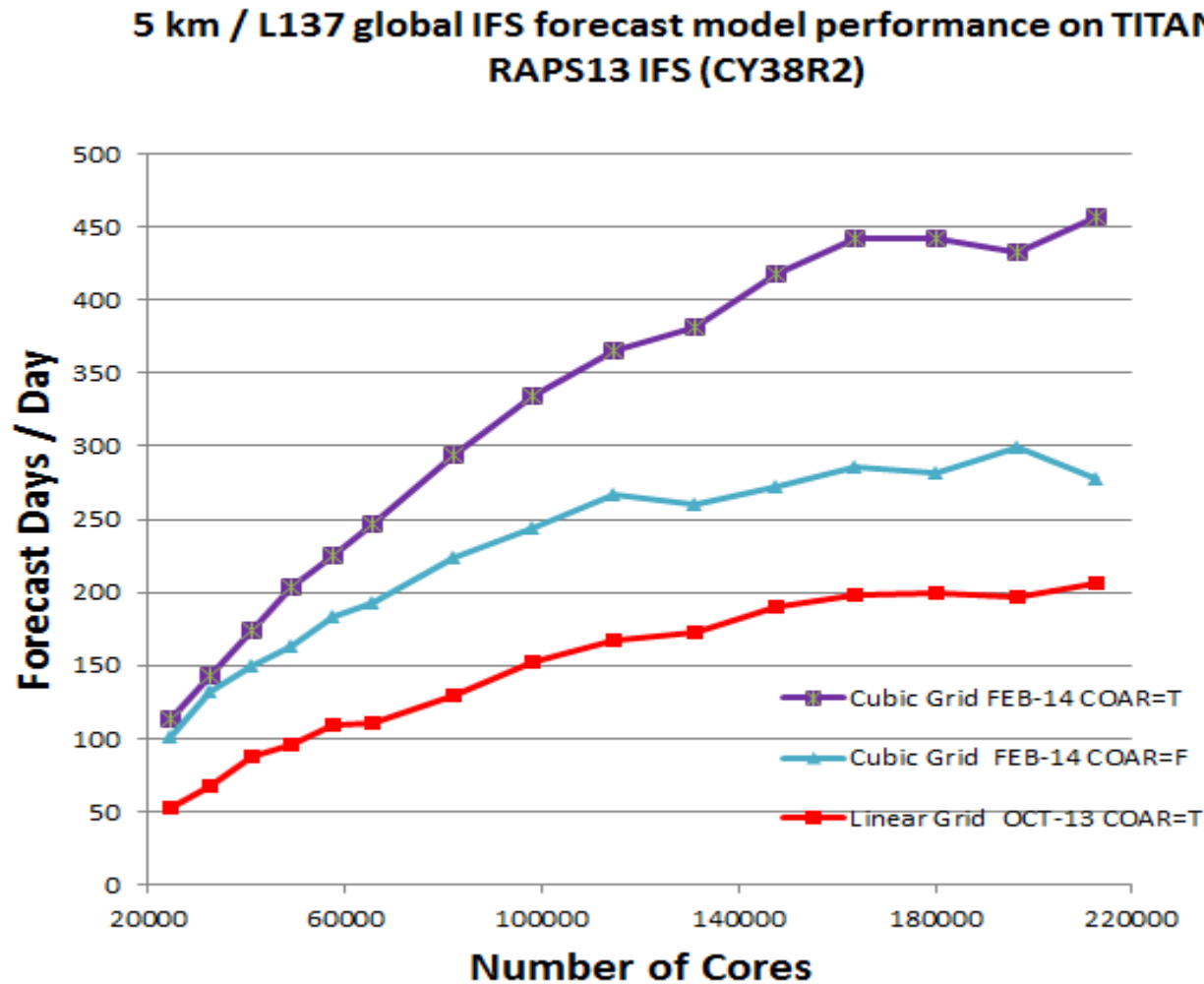
High-resolution as a driver of scalability and DCs

10 km IFS model scaling on TITAN (CRESTA project)

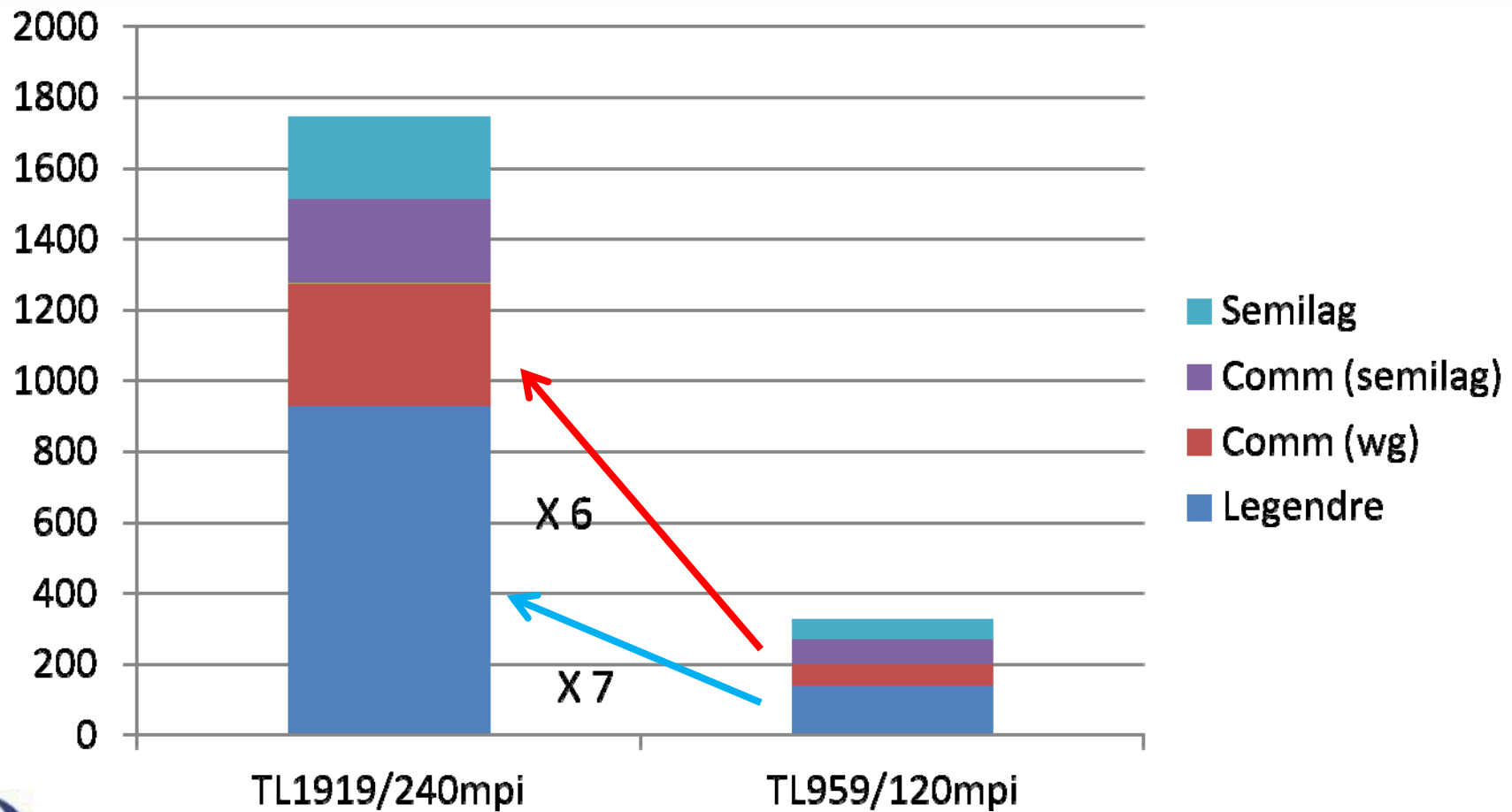
10 km / L137 global IFS forecast model performance on TITAN



5 km IFS model scaling on TITAN (CRESTA project)



Computational cost TL1919 vs TL959



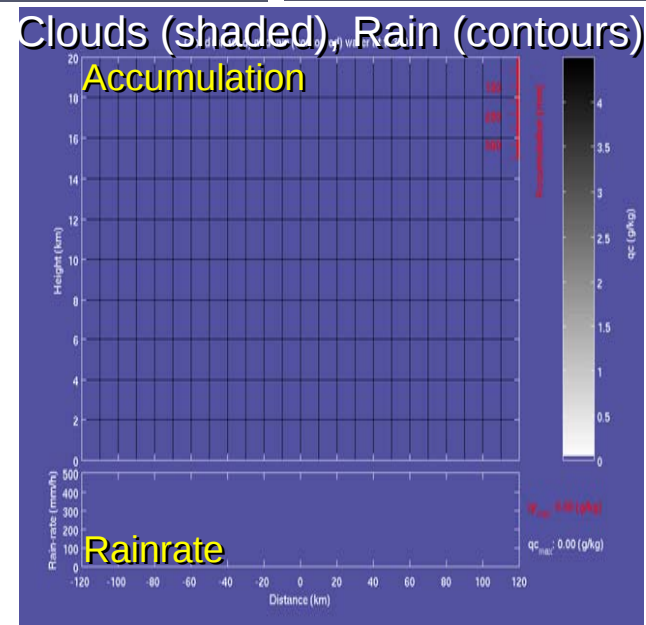
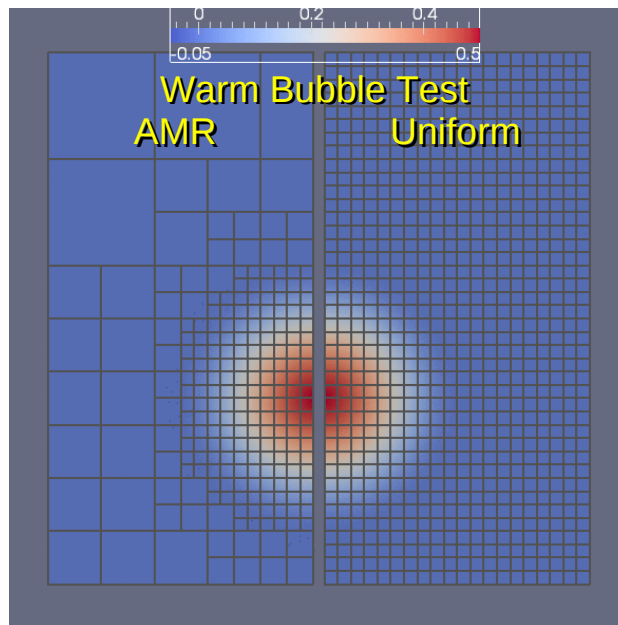
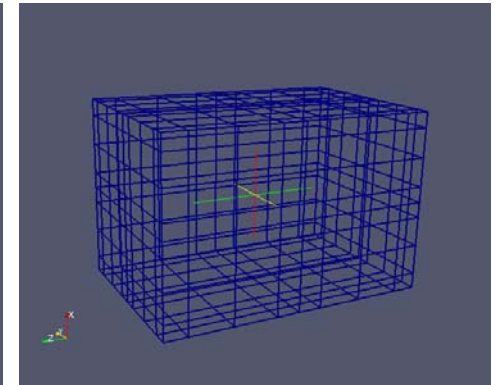
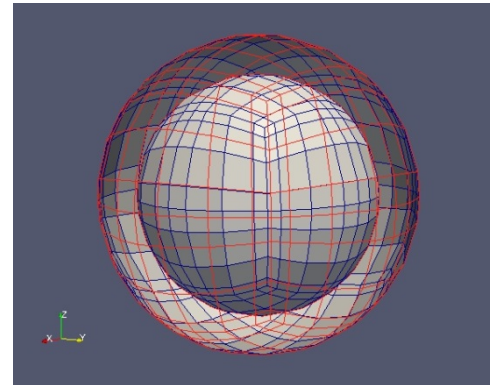


Next Generation Global-Regional System

Navy Environ. Pred. SysTem Utilizing the NUMA CorE (NEPTUNE)

3-D Spectral Element Model

- High order accuracy core (NUMA)
- Extremely scalable
- Mesoscale, global options (w/ MPI)
- Adaptive mesh refinement (AMR)
- Incorporation of physics underway



NEPTUNE is being developed as a possible next-generation unified global-regional prediction system using the NUMA spectral element core.

F. Giraldo (NPS), S. Gabersek, A. Reinecke, K. Viner, E. Hendricks, J. Doyle (NRL)

NRL High Resolution Applications using COAMPS and COAMPS-TC

High-resolution global model experimentation

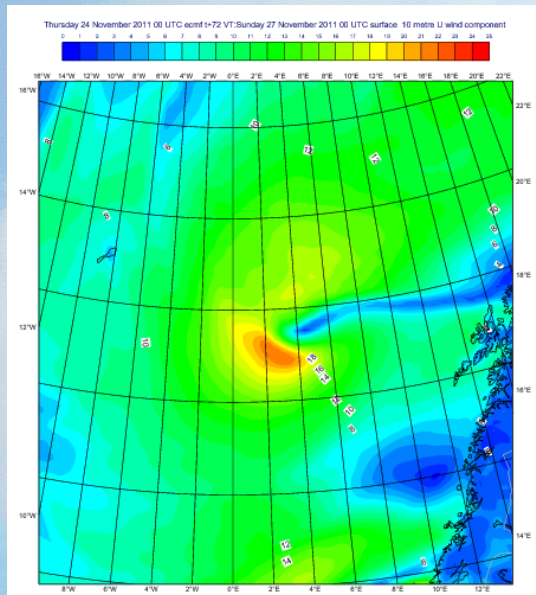
Simulations on a 5 km reduced Gaussian grid with the IFS

- **Global simulations at T3999 /5 km resolution on a “linear” reduced Gaussian**
 - **hydrostatic/non-hydrostatic?**
 - **parametrised or explicit deep convection?**
- **Comparison with simulations on the same grid but T1999 (no aliasing on a “cubic” grid)**
 - ✓ **Several case studies on the Cray XC-30 with the hydrostatic and the non-hydrostatic version of the IFS and different configurations of the current IFS physics package**

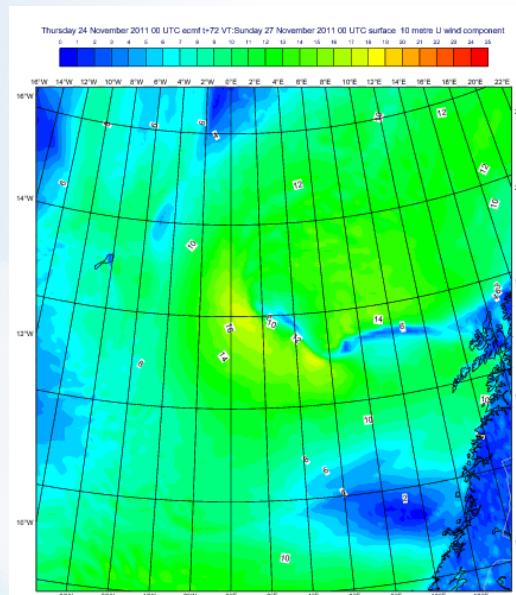
T3999 with and without deep convection scheme

Polar Low 27 nov 2011, 00UTC

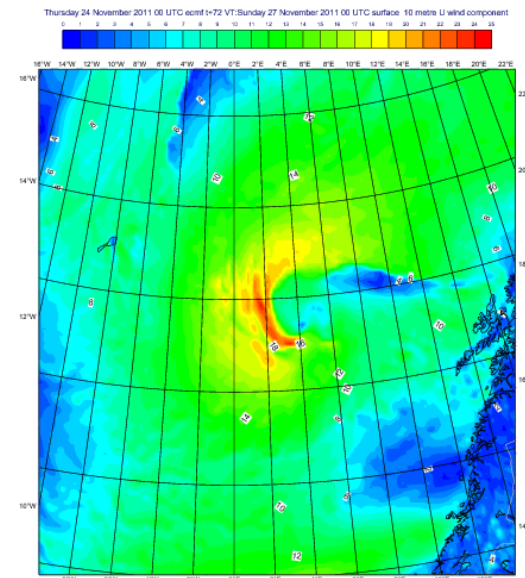
10 m wind force



**Operational
T1279**



**Hydrostatic
T3999
With deep
conv. scheme**

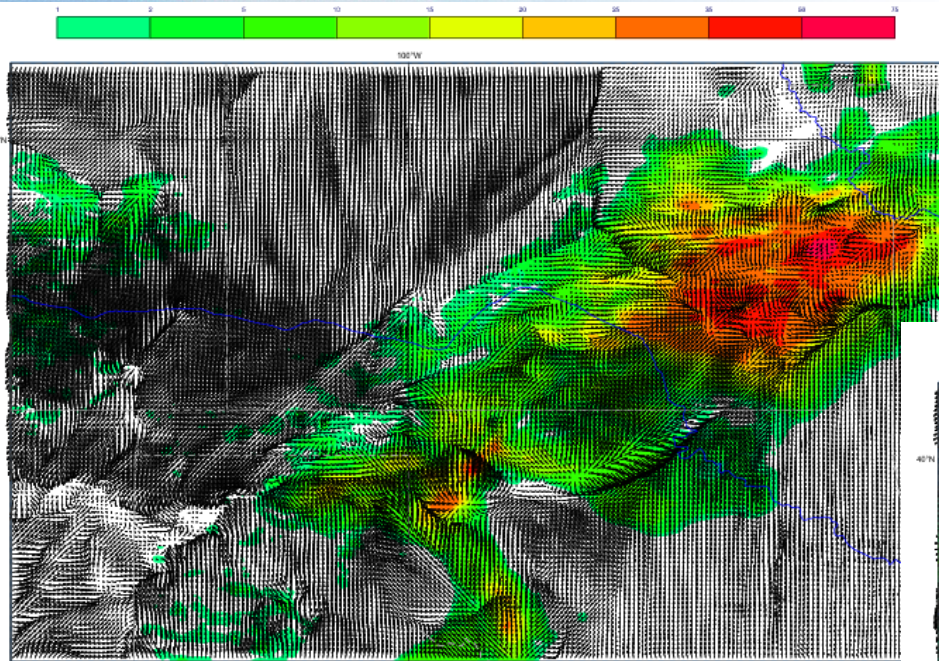


**Hydrostatic
T3999
Explicit convection**

T3999 with and without deep convection scheme

Squall line during Vortex 2, 16 May 2009 00UTC

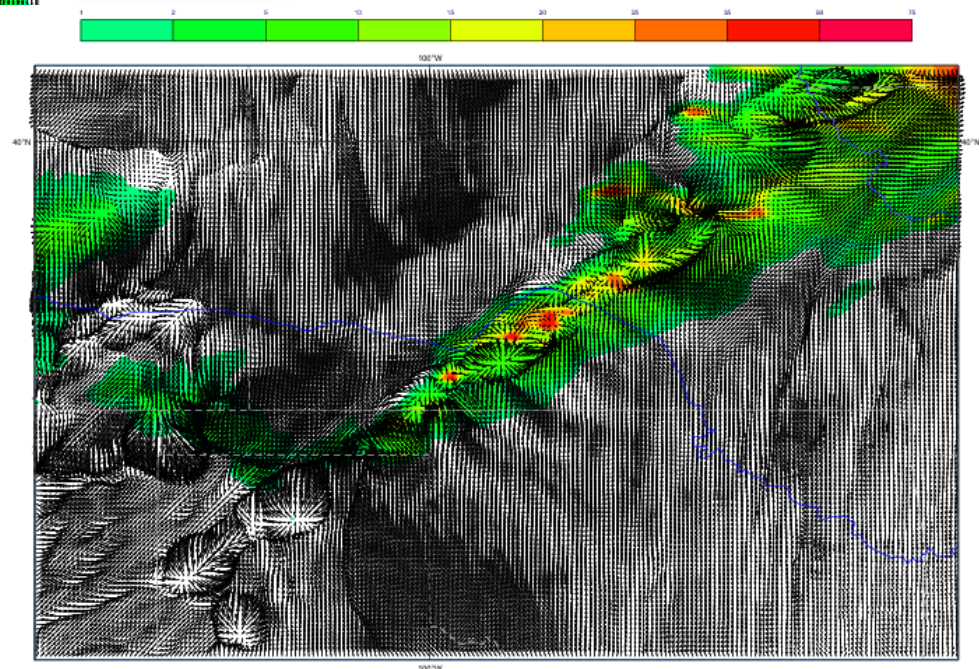
10m wind and 6h accumulated precipitation



Hydrostatic
T3999
With deep
conv. scheme

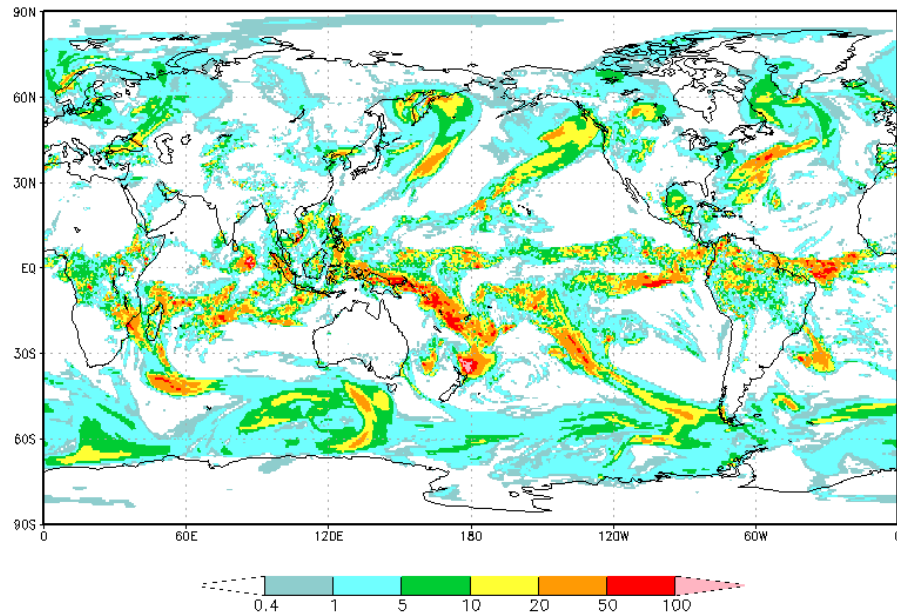


Hydrostatic
T3999
Explicit convection

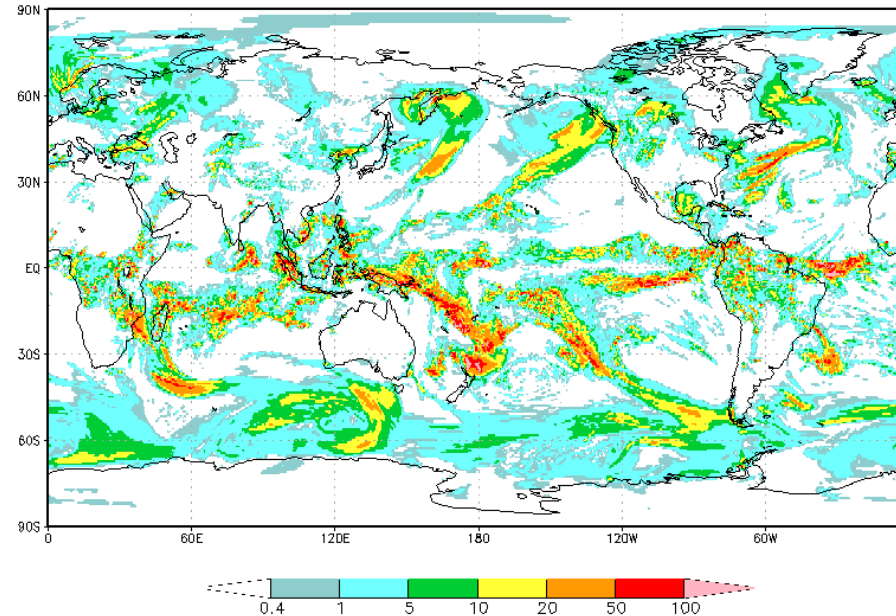


TL959 vs TL1919 rainfall distribution

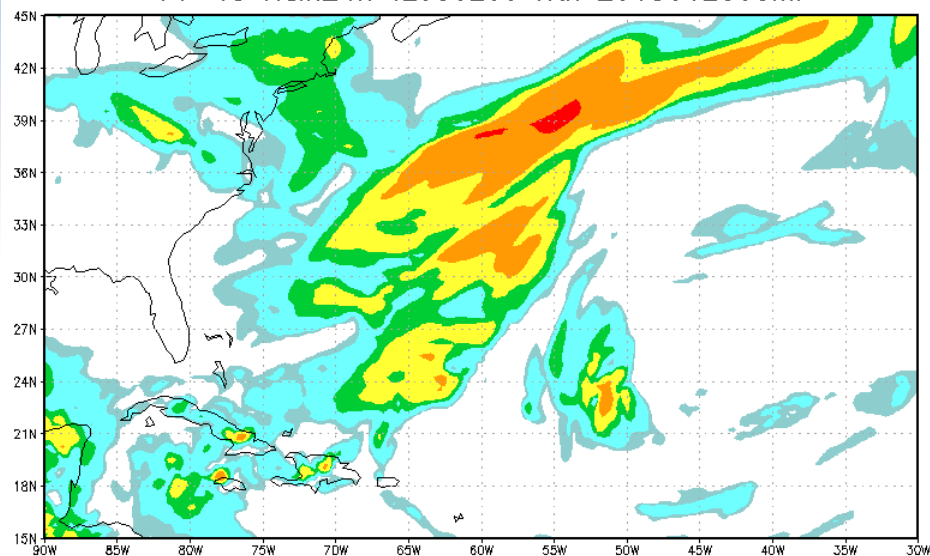
FT=48 Rain24h TL959L60 Rtn 2013012000ini



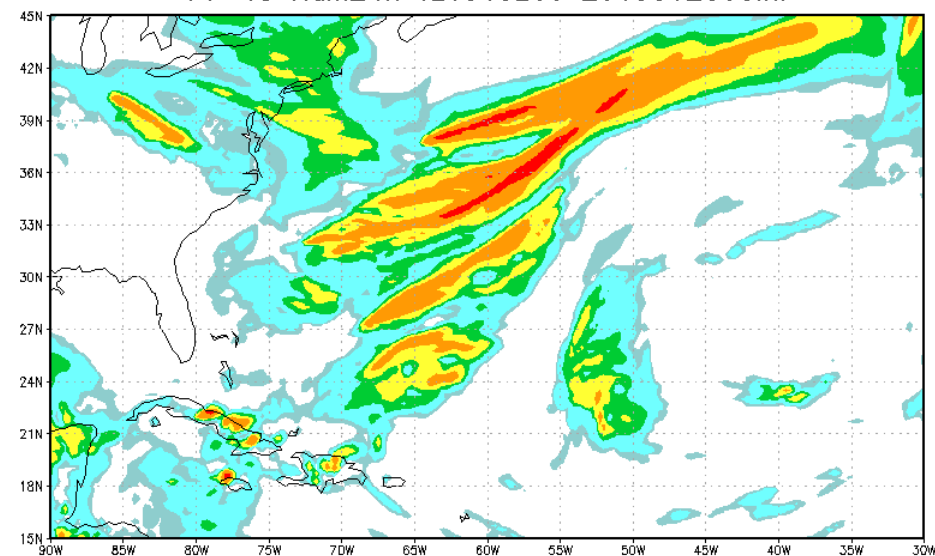
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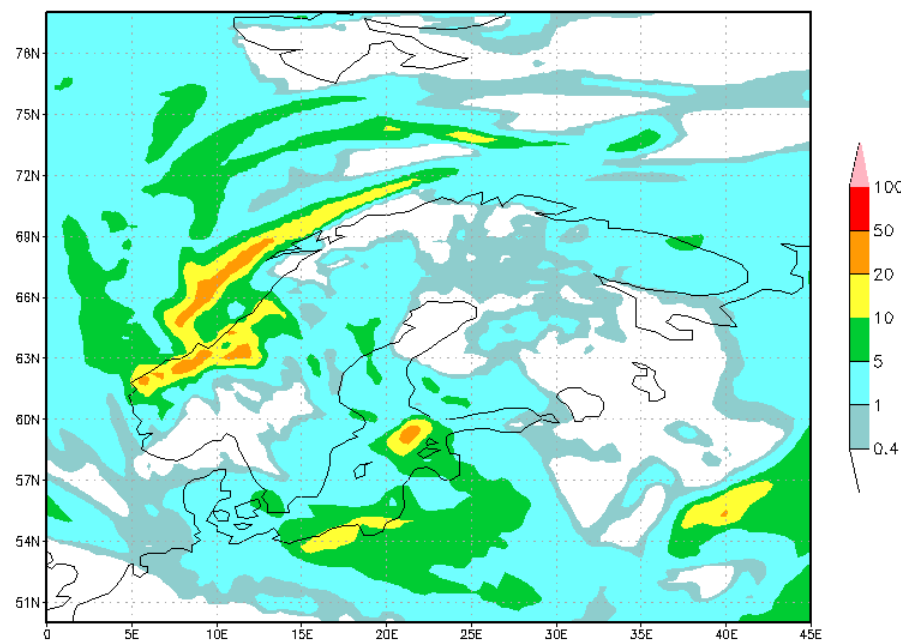
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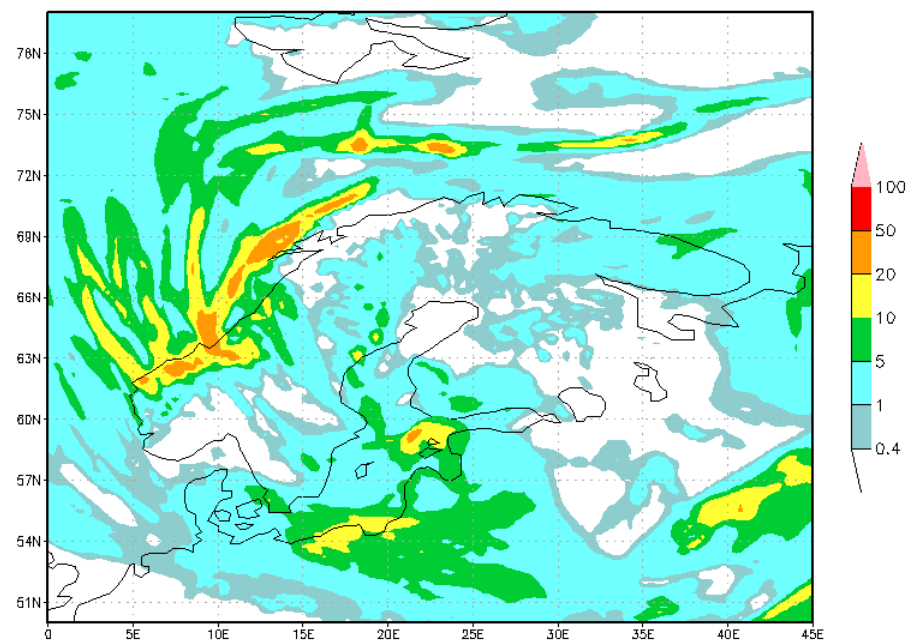
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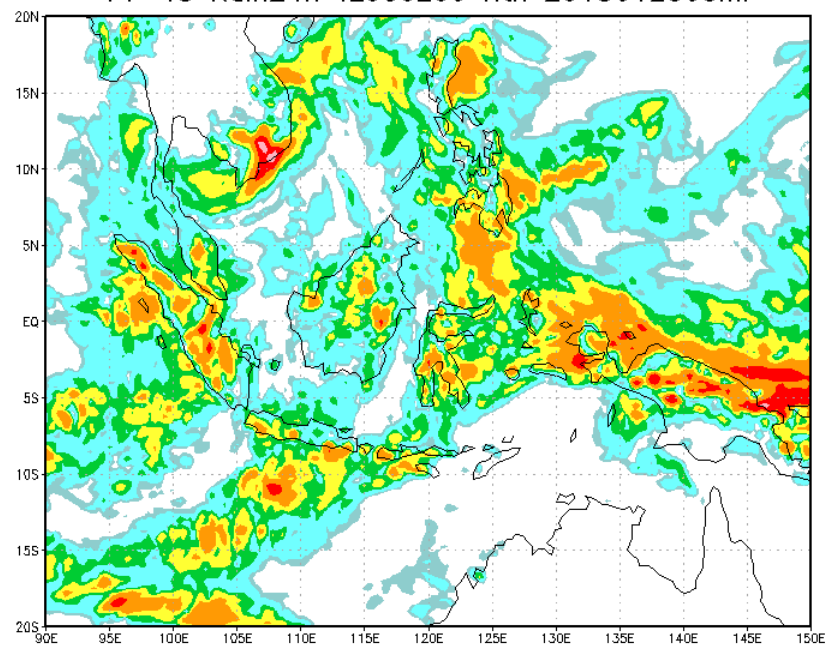
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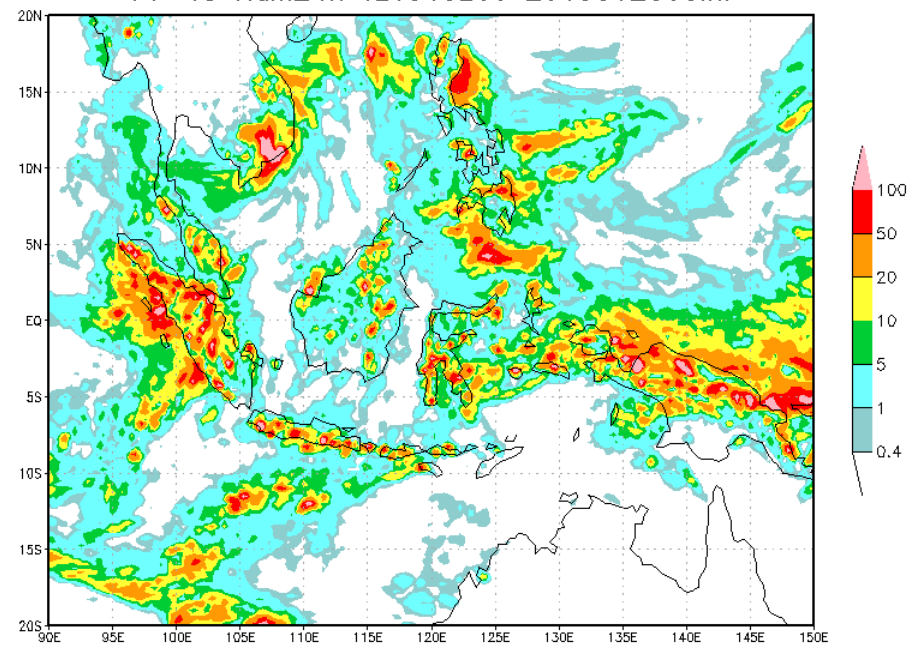
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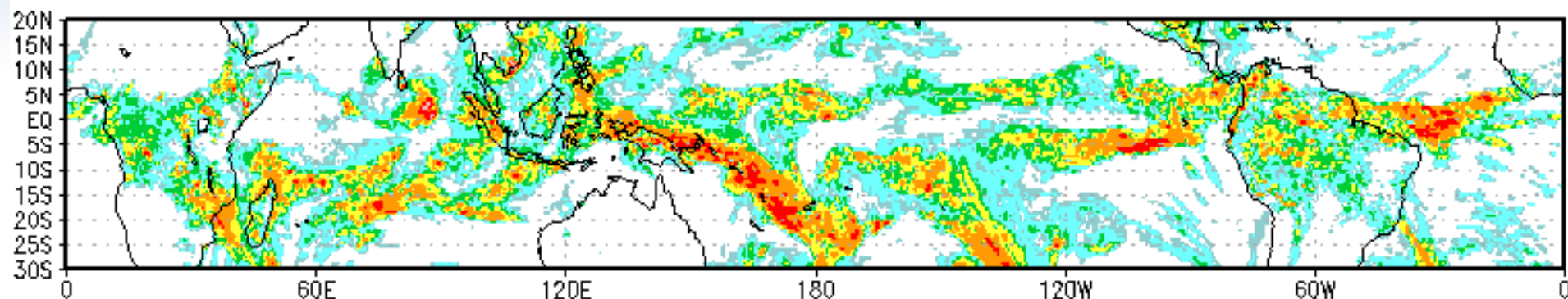
FT=48 Rain24h TL959L60 Rtn 2013012000ini



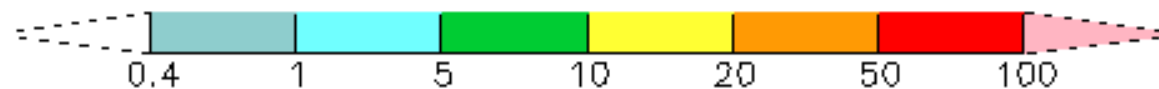
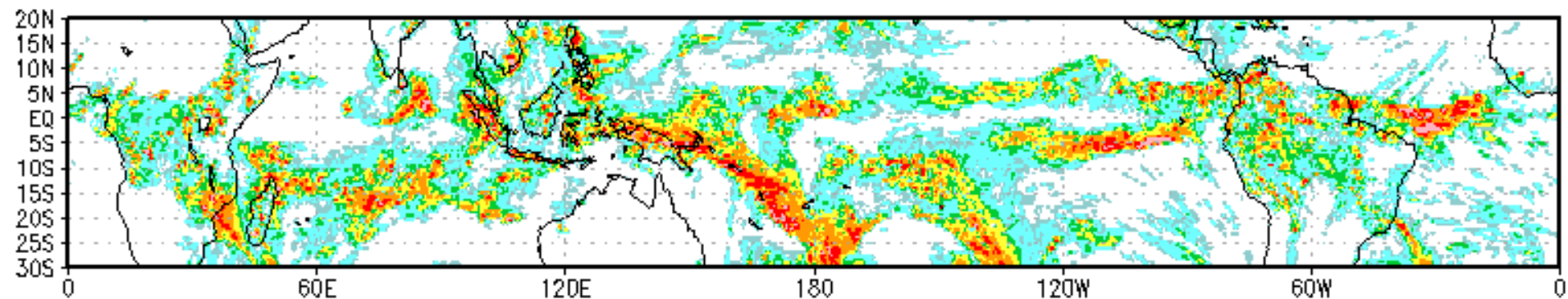
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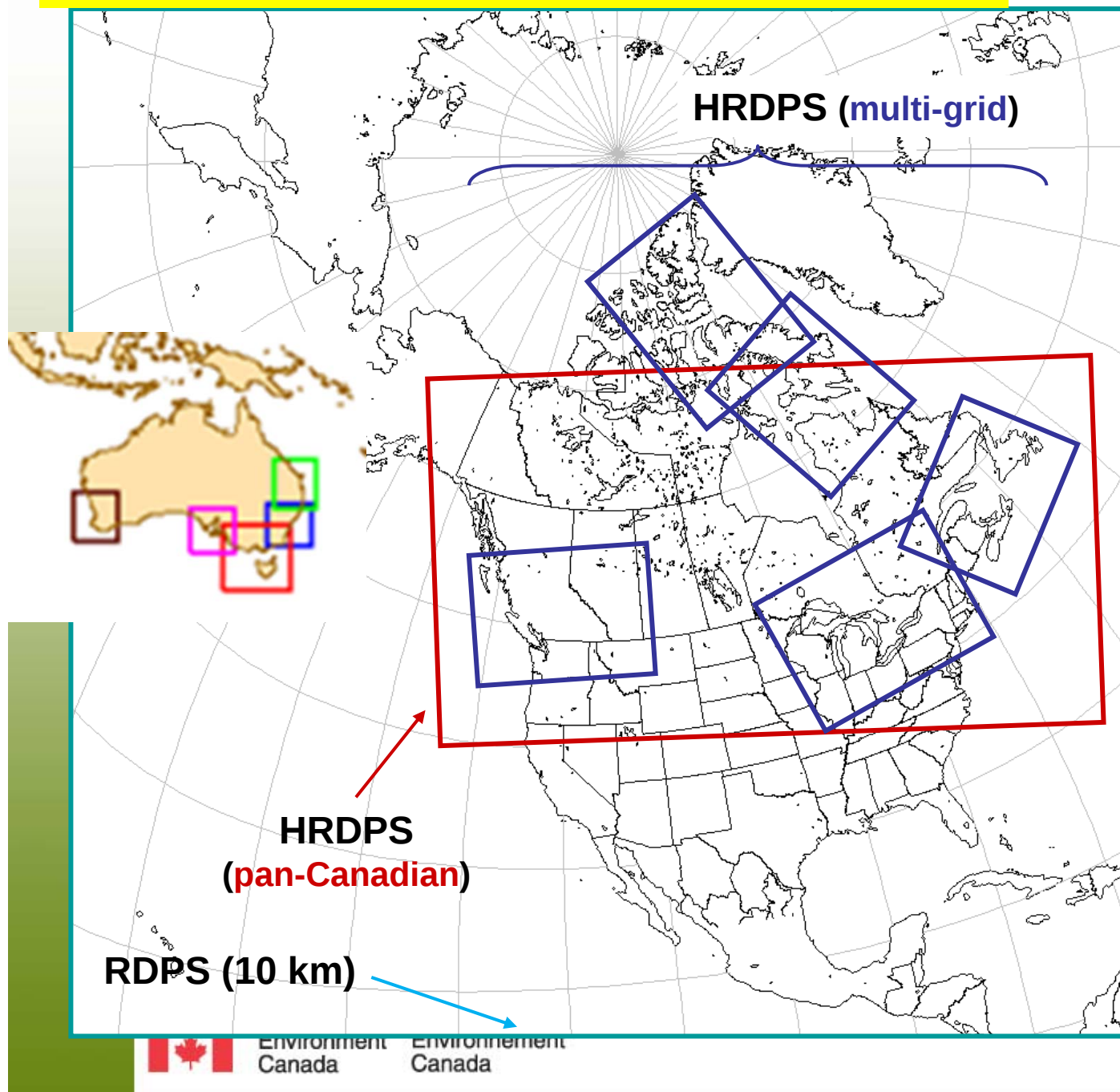
FT=48 Rain24h TL1919L60 2013012000ini





High-resolution: domains, “adaptivity”, rationalisation, and “the big (global) squeeze”

REPRISE – domains: split or rationalise?



RDPS = current
Regional
Deterministic
Prediction
System

HRDPS = High
Resolution
(2.5km)
Deterministic
Prediction
System : multi-
grid approach is
being replaced
by a single grid
(initially a pan-
Canadian
domain, to be
extended later)

High resolution NWP in CMA

© Upgrades

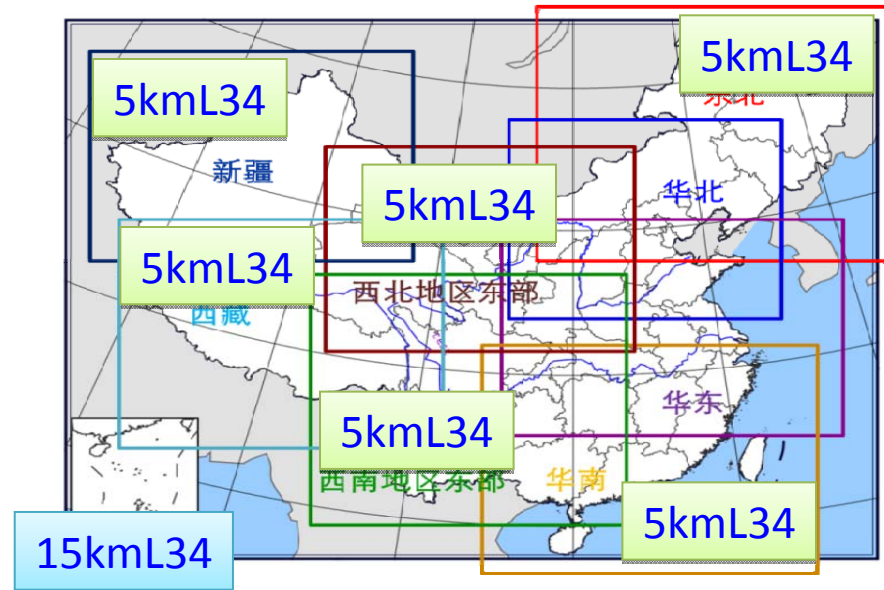
Model GRAPEPS_Meso

- Bug fix in land surface scheme: better surface energy balance
- Improved accuracy of dynamics-physics feedback

Regional GRAPES_3DVAR

- GPS/PW QC and assimilation
 - Data sources: CMA (303 stations) & CEA (243 stations)
 - Key issue: QC (Homogenization)
- New height adjustment algorithm of FY-2D/2E AMV
- New bias correction method of sounding RH
- Cloud analysis, DFI + cloud water nudging
- Implementation of Var-QC

© Start to provide 5km NWP products

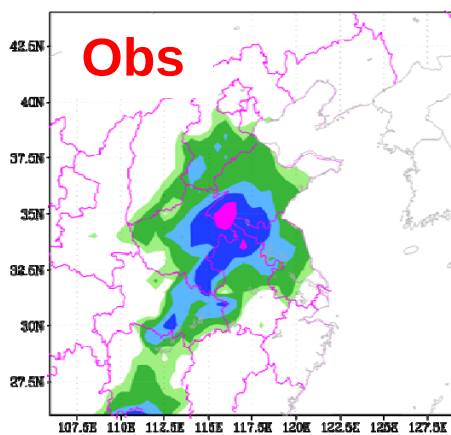


- For rainy season (May to Sep.)
- Over 7 regions whenever severe weather occurring

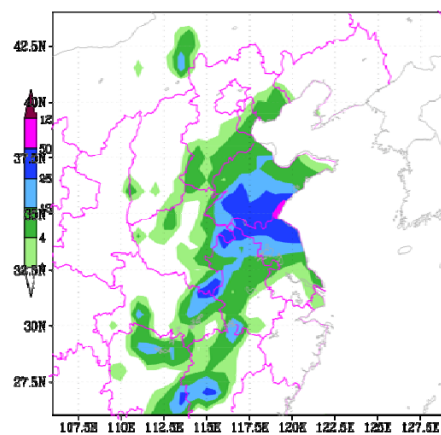


Case: successful heavy rainfall forecast

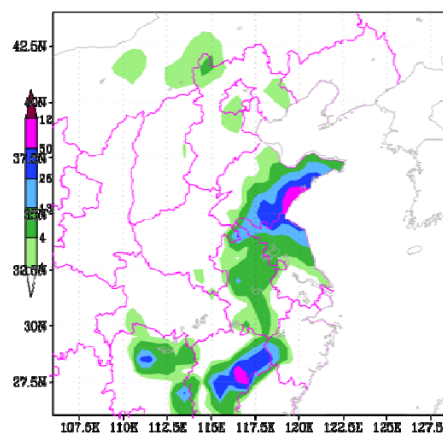
Observed-Precipitation
period:2013052600-2013052606UTC



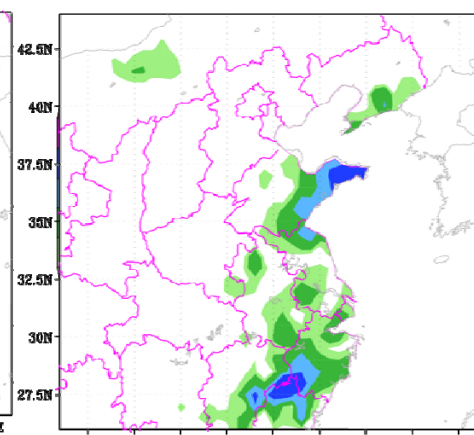
Observed-Precipitation
period:2013052606-2013052612UTC



Observed-Precipitation
period:2013052612-2013052618UTC

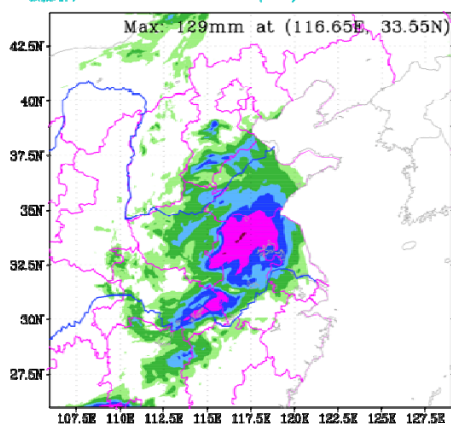


Observed-Precipitation
period:2013052618-2013052700UTC



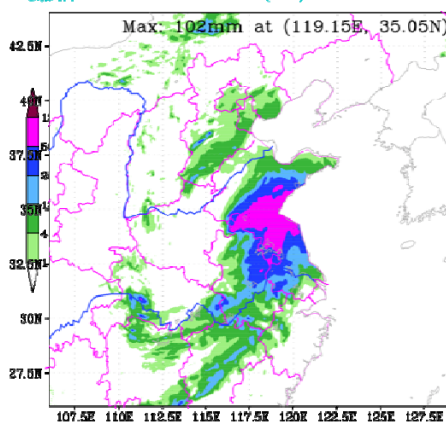
CMA_GRAPES_5km降水预报(24-30小时)

模式起始时间:2013-5-25-0(UTC)
预报时间:2013-5-26-0-2013-5-26-6(UTC)



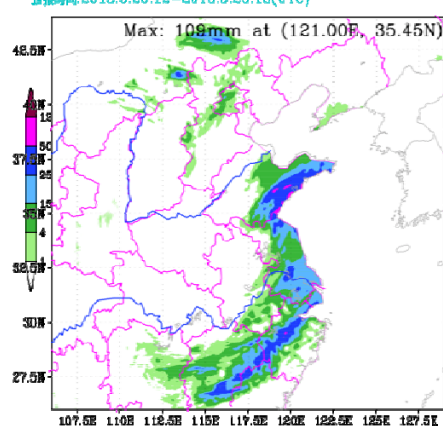
CMA_GRAPES_5km降水预报(30-36小时)

模式起始时间:2013-5-25-0(UTC)
预报时间:2013-5-26-6-2013-5-26-12(UTC)



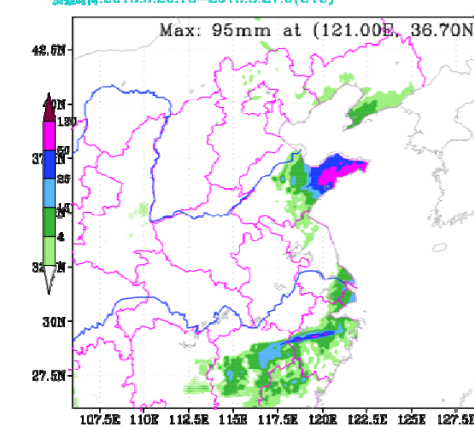
CMA_GRAPES_5km降水预报(36-42小时)

模式起始时间:2013-5-25-0(UTC)
预报时间:2013-5-26-12-2013-5-26-18(UTC)



CMA_GRAPES_5km降水预报(42-48小时)

模式起始时间:2013-5-25-0(UTC)
预报时间:2013-5-26-18-2013-5-27-0(UTC)



Fcst.24-30hr

Fcst.30-36hr

Fcst.36-42hr

Fcst.42-48hr

