23rd ALADIN Wk & HIRLAM ASM 2013
Reykjavik, 15-18 April, 2013

THE NWP SYSTEMS AT METEO-FRANCE

with contributions from the CNRM/GMAP staff
Météo-France

New HPC at MF

Porting computer
November 2012

Centre National de Calcul
Météopole, Toulouse

522 TFlops peak performance
56 racks **bullx DLC**
1008 nodes
Fat Tree InfiniBand FDR
Lustre **2 Po, 69 GB/s**
Disks storage 209 TB

Computer C1 (03/2013)

2,85 PFlops peak performance
56+45 racks **bullx DLC**
1800 nodes
Fat Tree InfiniBand FDR
Lustre **3,57 Po, 138 GB/s**
Disks storage 400 TB

Computer C3 (08/2015)

Research

2013 2014 **2015** 2016

Operational

522 TFlops peak performance
56 racks **bullx DLC**
1008 nodes
Fat Tree InfiniBand FDR
Lustre **1,53 Po, 46 GB/s**
Disks storage 135 TB

Computer C2 (11/2013)

Espace Clément Ader
Montaudran

2,85 PFlops peak performance
56+45 racks **bullx DLC**
1800 nodes
Fat Tree InfiniBand FDR
Lustre **2,55 Po, 92 GB/s**
Disks storage 135 TB

Computer C4 (04/2016)

ARPEGE-ALADIN operational suites

Planned changes to the operational suite ARPEGE/ALADIN
Cycle of the current experimental suite CY38T1_op1 (to become operational mid 2013)

Observations
- *satellite data from new instruments* : Suomi-NPP/ATMS + CriS radiances, Oceansat-2/OSCAT winds, CSR from GOES-13 and GOES-14, METOP-B instruments (IASI, AMSU-A, MHS, GRAS, ASCAT)
- *Additional observations from current instruments* : METOP-A/GRAS, METOP-A/IASI WV channels, Aqua/AIRS, SSMI/S sounding channels, METOP-A/MHS
- Specific observations for the AROME 3D-Var : additional AMSU-A radiances, MSG-3/SEVIRI radiances over land, Doppler winds from one X-band radar (Mt Maurel)

4D-Var ARPEGE assimilation system : wavelet approach for the B matrix
ARPEGE and ALADIN models : changes to the deep convection scheme, improved description of surface properties over ice caps (thermal inertia, albedo, roughness length)

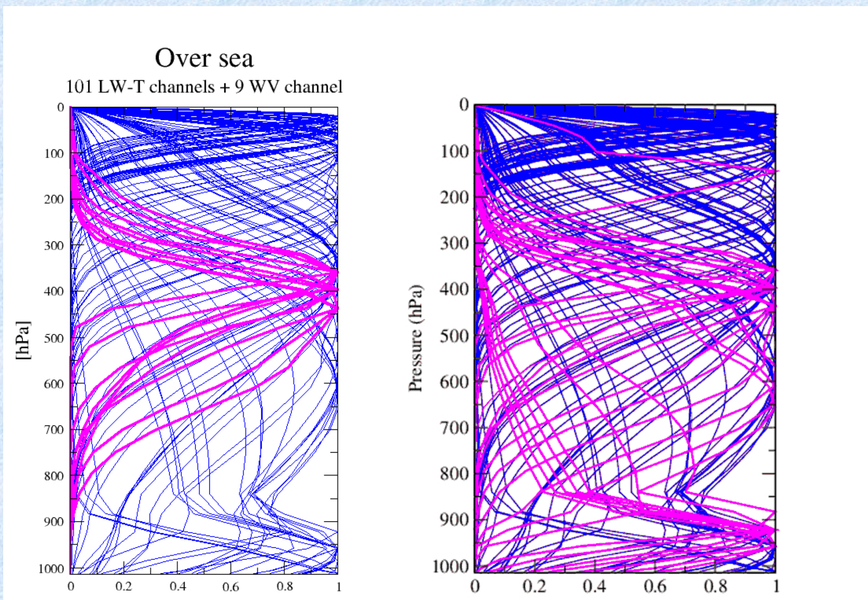

Figure 1 : Assimilated IASI channels (blue : temperature, pink : water vapour) in ARPÈGE. Left panel : current operational configuration. Right panel : experimental suite

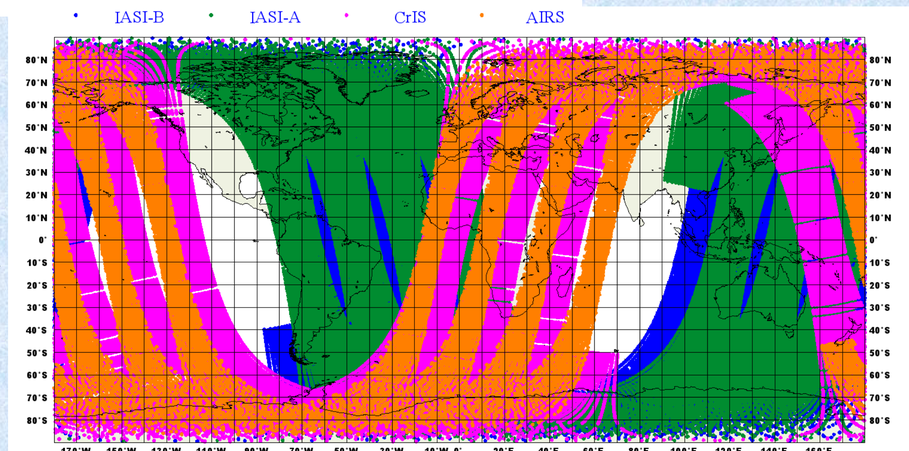

Figure 2 : Spatial coverage over a 6 hour window (11/03/2013 00 UTC) of infra-red hyperspectral instruments (current : METOP-A/IASI and Aqua/IASI + future : Suomi-NPP/CriS and METOP-B/IASI)

ARPEGE Ensemble Prediction system

PEARP3 (operational version since September 2011) :

- Running at 06 UTC with a 72h range - 18UTC with a 108h range
- A control run and 34 operational members
- Initial perturbations :
  . dry singular vectors on 7 different areas
  . using the 6 analyses and the mean computed by AEARP (Assimilation Ensemble ARPege)
  . scaled to an amplitude size using background error variances of the day consistent with the 4D-Var assimilation cycle

- Model perturbations : multi-physics (9 physics +ARPEGE operational physical package)
- Resolution PEARP3 T538L65C2.4 (~15km over France)

	OTI	Res.	Norm
EURAT	18	Tl95	TE
HNC and HS	24	Tl95	TE
TROP	18	Tl95	KE

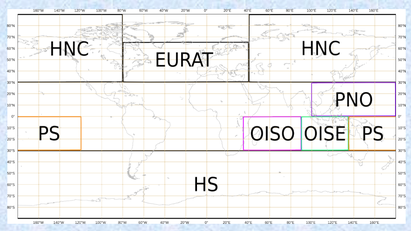

Fig. 4. singular vectors characteristics (left) and areas for dry singular vectors computations during Northern Hemisphere winter (right)

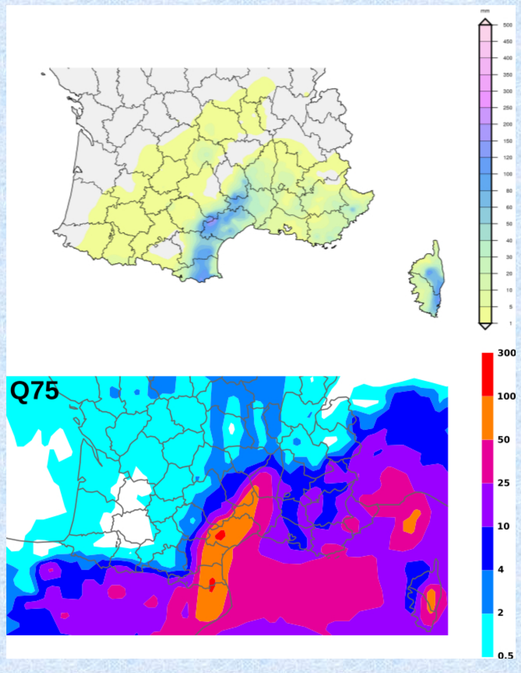

Fig. 5.

Upper panel :

24h-accumulated rainfall observations on March 5, 2013 over Southeastern France. 120 to 200 mm were observed over Pyrénées-Orientales district and 150 to 200 mm over Hérault and Haute-Corse districts.

Bottom panel :

108h range forecast for the third quantile of ARPEGE ensemble prediction system (PEARP) and for 24h accumulated rainfall on March 5, 2013.

In other words, 25% of PEARP members forecasts that the 24h accumulated rainfall will reach at least the value drawn in the picture.

AROME operational suite

CY37T1-op1, oper since end of September 2012 :

- 750x720 points per 60 vertical levels, with 2.5km horizontal gridmesh. The model time step is 60s. On 48 processors of the NEC SX9, 30h forecasts can be produced in 2400s elapse. AROME is hourly coupled with ARPEGE and is running on 5 daily production runs (0,3,6,12,18), for a 30 h range (except r12 +36h). Its assimilation is based on a 3 hourly RUC including radar data (reflectivity and doppler winds)

Compared with previous CY36T1_op2 suite :
- Modifications in shallow convection and cloud schemes
- surfex v6+ (optimisations)
- new clim files (clay,sand and orography).
- coupling of hydrometeors (to fix problems in coupling zone)

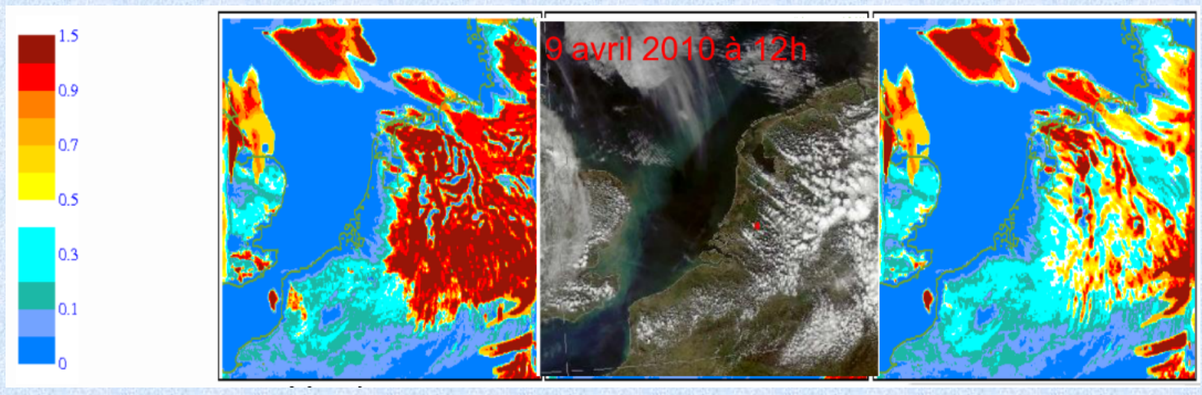

Fig.6. Comparison of total cloudiness for 9 April 2010 +12 TU, right :AROME-36t1-op2, left AROME-37t1-op

Starting work for future 2014 AROME-France-1.3km :

- Tests of various vertical discretisations around 90 levels (lowest model level at 5m)
- Stability tests with dt=45s, and Predictor Corrector iterative scheme (NSITER=1) OK
- Daliy experimental runs and first scores on 48 convective events :

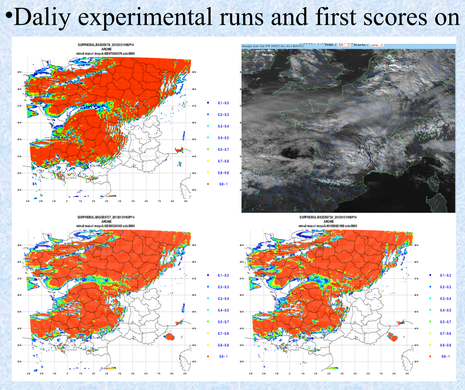

Fig.8 : 31st January 2013 14 TU low level cloudiness (orographic waves well captured by AROME 1,3km)
top left : AROME1,3kmL90, top right : Satellite observation,
bottom left : AROME2,5kmL90, bottom right : AROME2,5kmL60

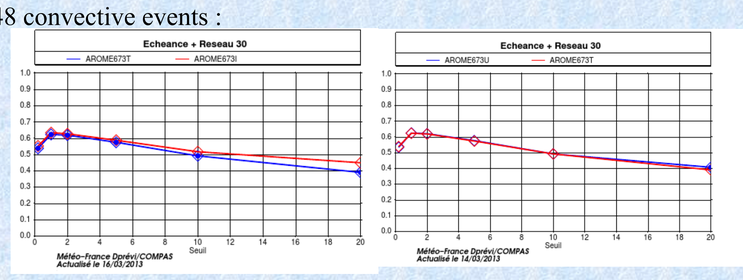

Fig.7. 24H cumulated rainfall BSS (P30-P6) on 48 days (selected for their high lightning activity during summer au autumn 2013). 673T=AROME2,5 L90 673U=AROME2,5 L60, 673I=AROME1,3L90