THE REGIONAL NWP SYSTEMS AT METEO-FRANCE
with contributions from the CNRM/GMAP staff
Météo-France

ALADIN-FRANCE : some general features

About ALADIN-FRANCE

The French domain can be seen in Figure 1. The centre of the domain is located at 46.47°N; 2.58°E. Computations are performed in spectral bi-Fourier space with elliptic truncation at wave number 199. The equivalent grid has 7.5 Km gridmesh (400x400 points). The vertical dimension is discretized in 70 levels

During a forecast, ALADIN-FRANCE is coupled with ARPEGE every 3 hours. The timestep is 450 s to have an even number of iterations for 1h

4 runs are performed operationally each day at 00, 06, 12 ant 18 UTC. Forecast terms are 54H for the 00 UTC forecast, 48H for 06 UTC, 42H for 12 UTC and 36H for 18 UTC.
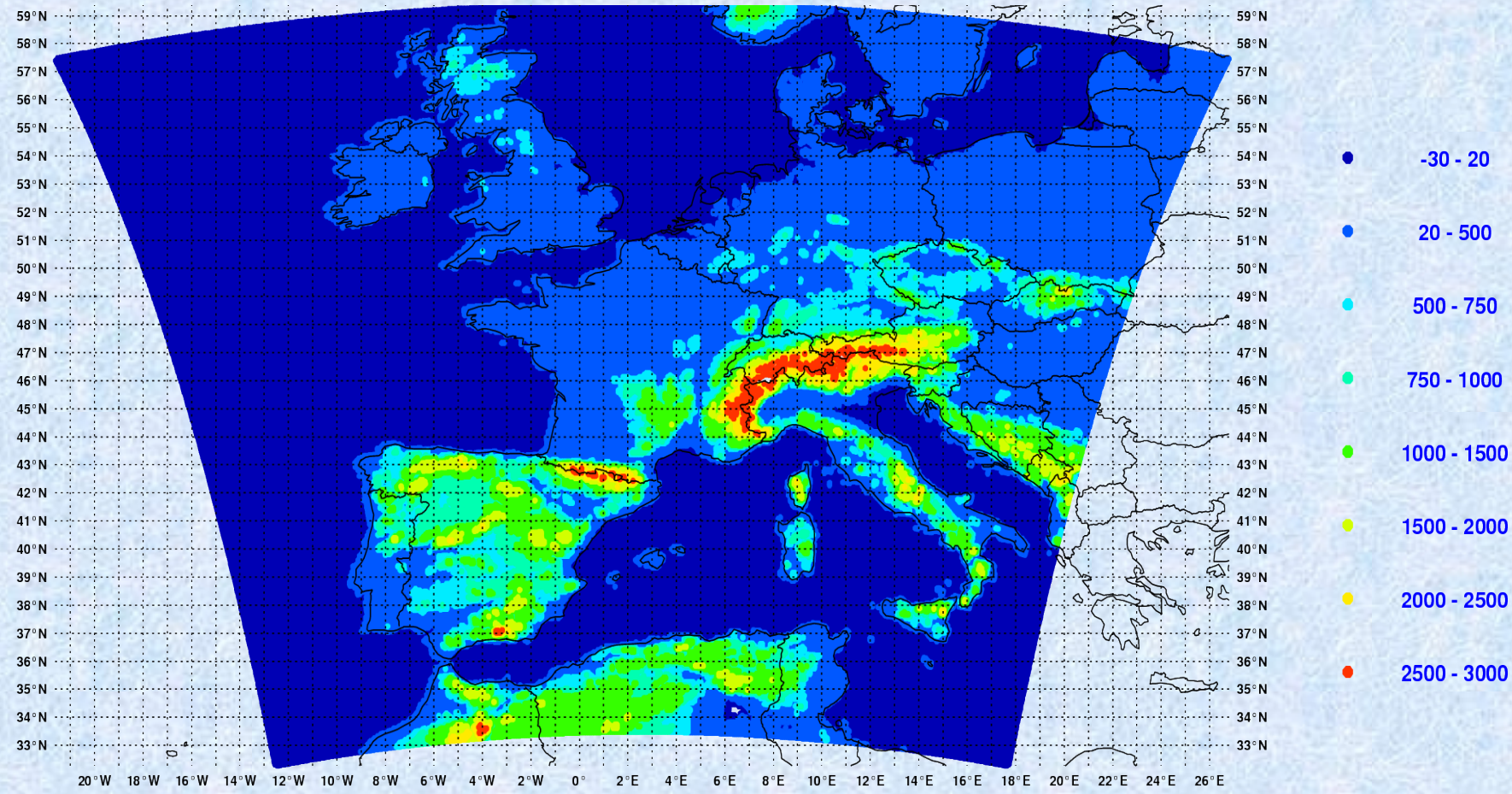

Fig.1. The ALADIN-France operational domain.

The operational Data assimilation

The assimilation scheme is 3D-Var with a 6H window. A continuous "long cut-off" cycle provides the guess for a "short cut-off" production which provides the operationally used analysis. Coefficients for variational bias correction (applied to satellite observations) are computed by Arpege.

Assimilated observations are :
- Surface pressure and SHIP winds
- T2m and RH2m, 10m winds
- Aircraft data
- Drifting buoys surface pressure
- Soundings (TEMP, PILOT)
- European wind profilers
- Winds from AMV (SATOB) and scaterometers
- GPS (ZTD and radio occultation)

- Satellite radiances: AMSU-A, AMSU-B, HIRS (NOAA and METOP), Meteosat-9 SEVIRI (5 channels), clear-sky microwaves over land, cloudy AIRS, IASI (sea/land/sea-ice), AQUA/AIRS channels (~54)

Changes in the operational suite ARPEGE-ALADIN

The cycle for the operational suite is CY35T2, this suite contains important changes in the horizontal resolutions of ARPEGE and ALADIN. It has been running since April 2010.

- **ARPEGE and ALADIN-France:**
  - Change of resolution of ARPEGE: T798C2.4L70, (with 2 outer loops in 4D-VAR T107/T323)
  - Doubling of the density of about all radiances types (change the scale of data use from one spot every 250 km to one every 125 km)

- **ALADIN-France**
  - Increase of horiz. resolution for ALADIN-France L70 to 7.5 km. Slight increase of the domain's size.

Fig. 2. Horizontal resolution of operational ARPEGE suite

ARP-ALD current E-suite (June-Sept 2010)

- CY36T1
- Assimilation of SSMI/S, GRAS/METOP GPS, low-peaking AMSU over sea-ice,
- Assimilation synop RH2m in daytime (ARPEGE)
- RS bias correction.
- Modif. algorithm for handling METOP/ASCAT ambiguous wind direction
- Use ensemble assimilation σb's in screening, and for qv in Jb (in addition to vor, div and T in oper)
- Relaxation towards OSTIA SST
- Microphysics : different fall velocities for qc/qr, corrections to prevent qc when T<0 in all the column
- Modifications of z0 over orography.

Fig. 3. AMSU-B assimilated data

Fig. 4. Impact of AMSU-B assimilation over sea-ice (+30% data) Wind scores on January 2009 compared with Radiosoundings, Blue indicates an improvement of the quality of the forecast.

Changes in the Arpege Ensemble Prediction system

PEARP2 (operational version) :
- Running at 06UTC with a 72h range and 18UTC with a 108h range
- A control run and 34 operational members
- Initial perturbations :
  - dry singular vectors on 4 different areas >
  - using the 6 analyses computed by AEARP (Assimilation Ensemble ARpege)
  - scaled to an amplitude size using error variances background of the day consistent with 4D-Var assimilation cycle
- Model perturbations : multi-physics (7 physics +ARPEGE operational physical package)
- Resolution PEARP2 T358L55 C2.4 (~23km over France)

	OTI (h)	resolution
EURAT	12	Tl95
HNC and HS	24	Tl44
TROP	12	Tl44

PEARP3 (next E-suite planned for winter 2010-2011) :
- 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 computed by AEARP (Assimilation Ensemble ARpege)
  - scaled to an amplitude size using error variances background of the day consistent with 4D-Var assimilation cycle
- Model perturbations : multi-physics (9 physics +ARPEGE operational physical package)
- Resolution PEARP3 T538L65C2.4 (~15km over France)

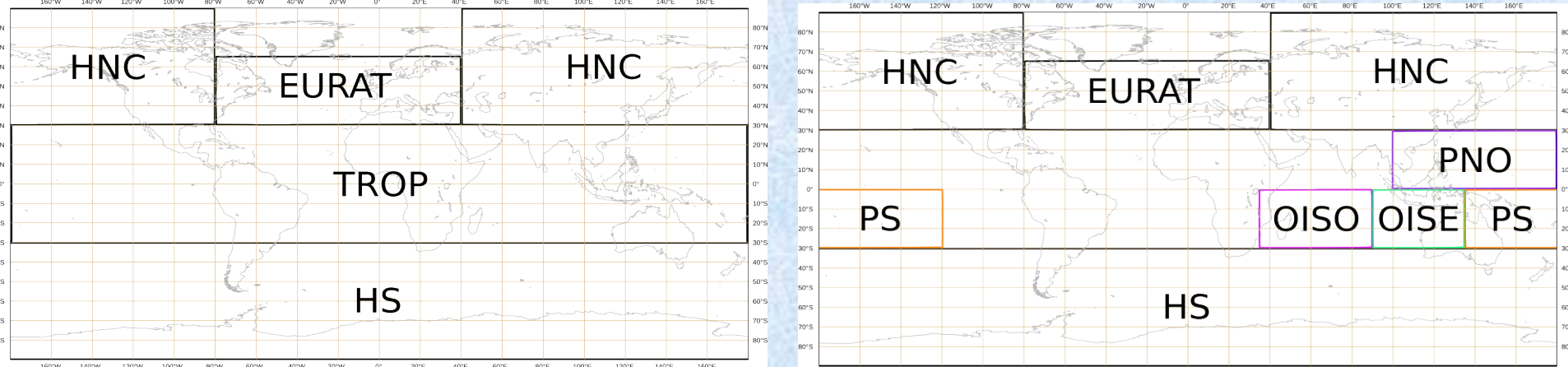|	OTI	Res.	Norm
EURAT	18	Tl95	TE
HNC and HS	24	Tl95	TE
TROP	18	Tl95	KE

Fig. 5. Areas for dry singular vectors computations (left :PEARP2, right: PEARP3 for southern hemisphere)

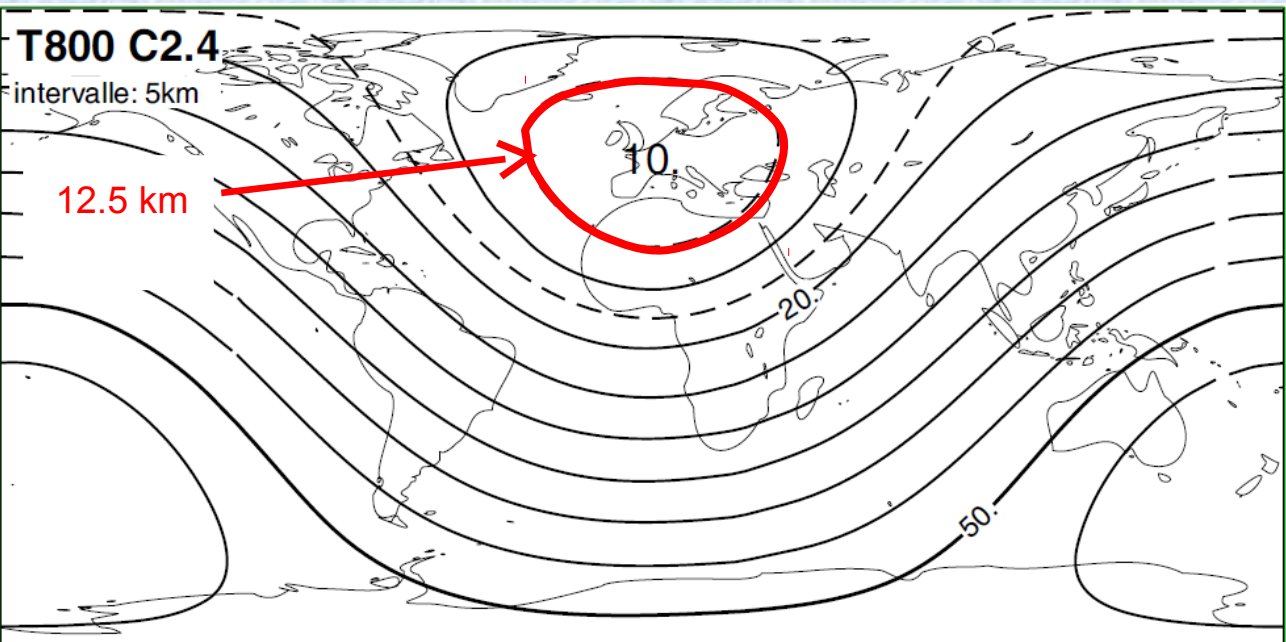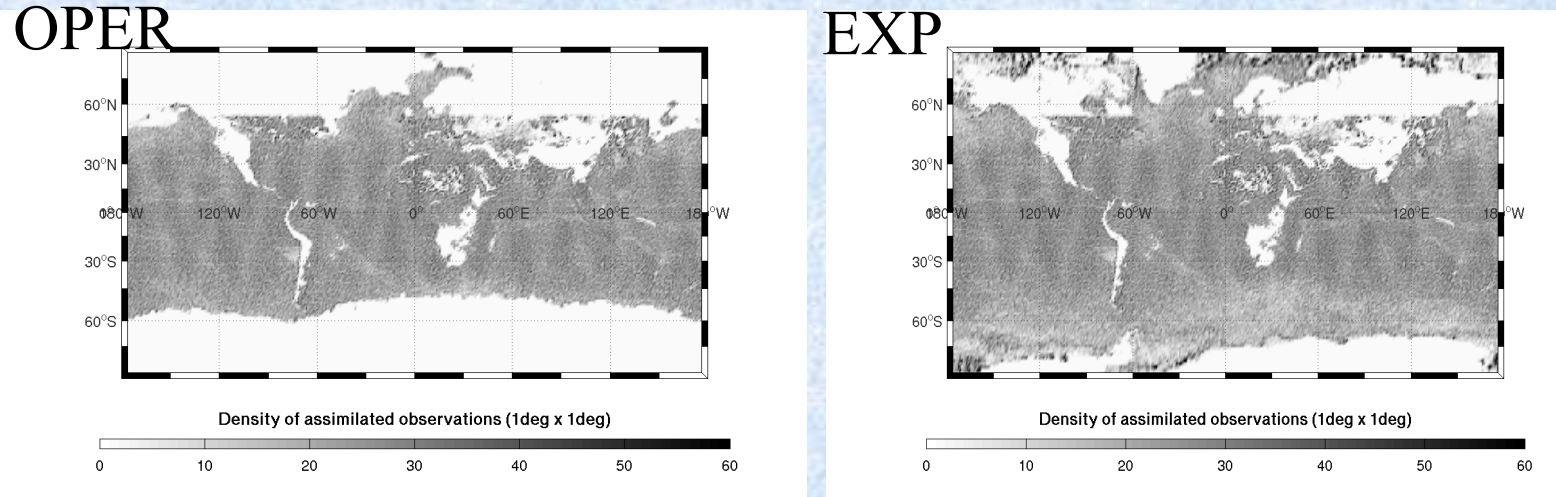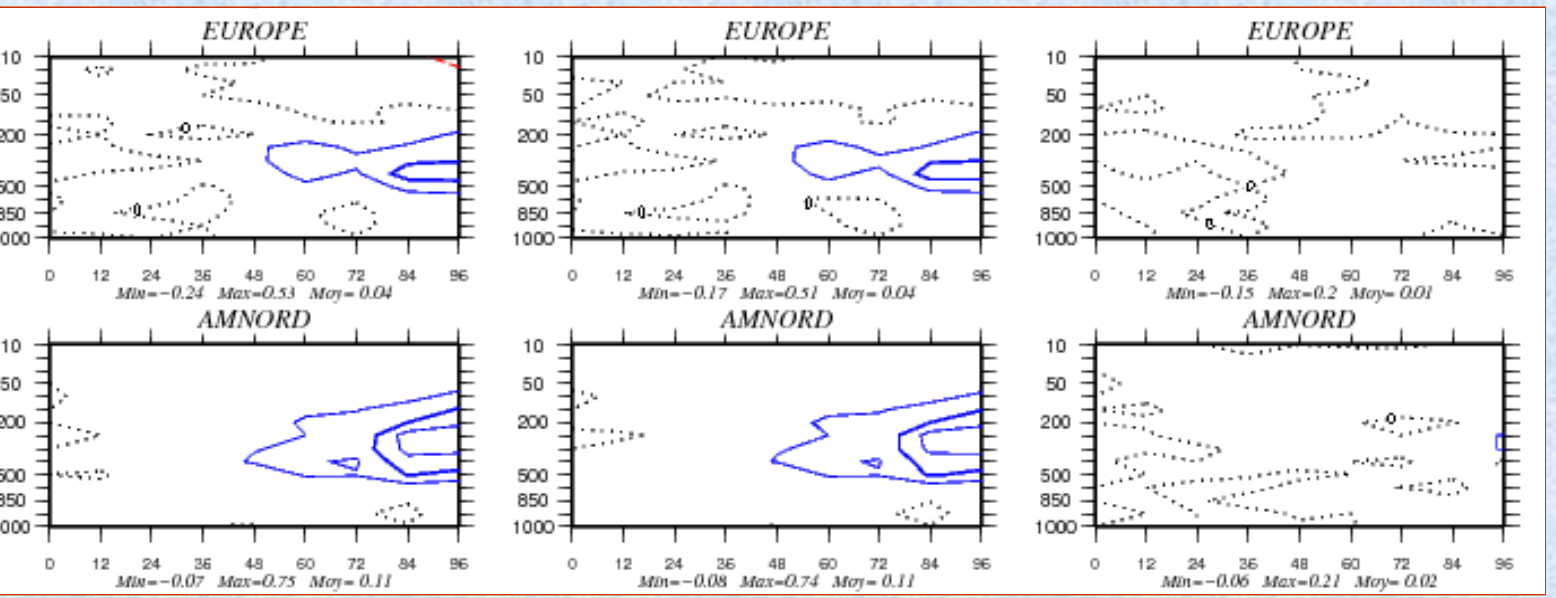*Fig. 6. Probability map for 30h rainfall > 100 mm on 15 June 2010*

Changes in the operational suite AROME

Forecast model: French domain and cost issues

- AROME operational domain is 600x512 points, with 2.5km horizontal gridmesh. Time step of the model is 60s. On 32 processors of the NEC SX9, 30 h forecasts can be produced in 2000s elapse.
- CY35T2
- AROME version is running on 4 daily production runs, for a 30 h range. Its assimilation is with 3 hourly RUC including radar data (reflectivity and doppler winds)
- Switch to 60 vertical levels
- New version of EDKF (improved entrainment/detrainment in dry PBL)
- Activation of fog sedimentation
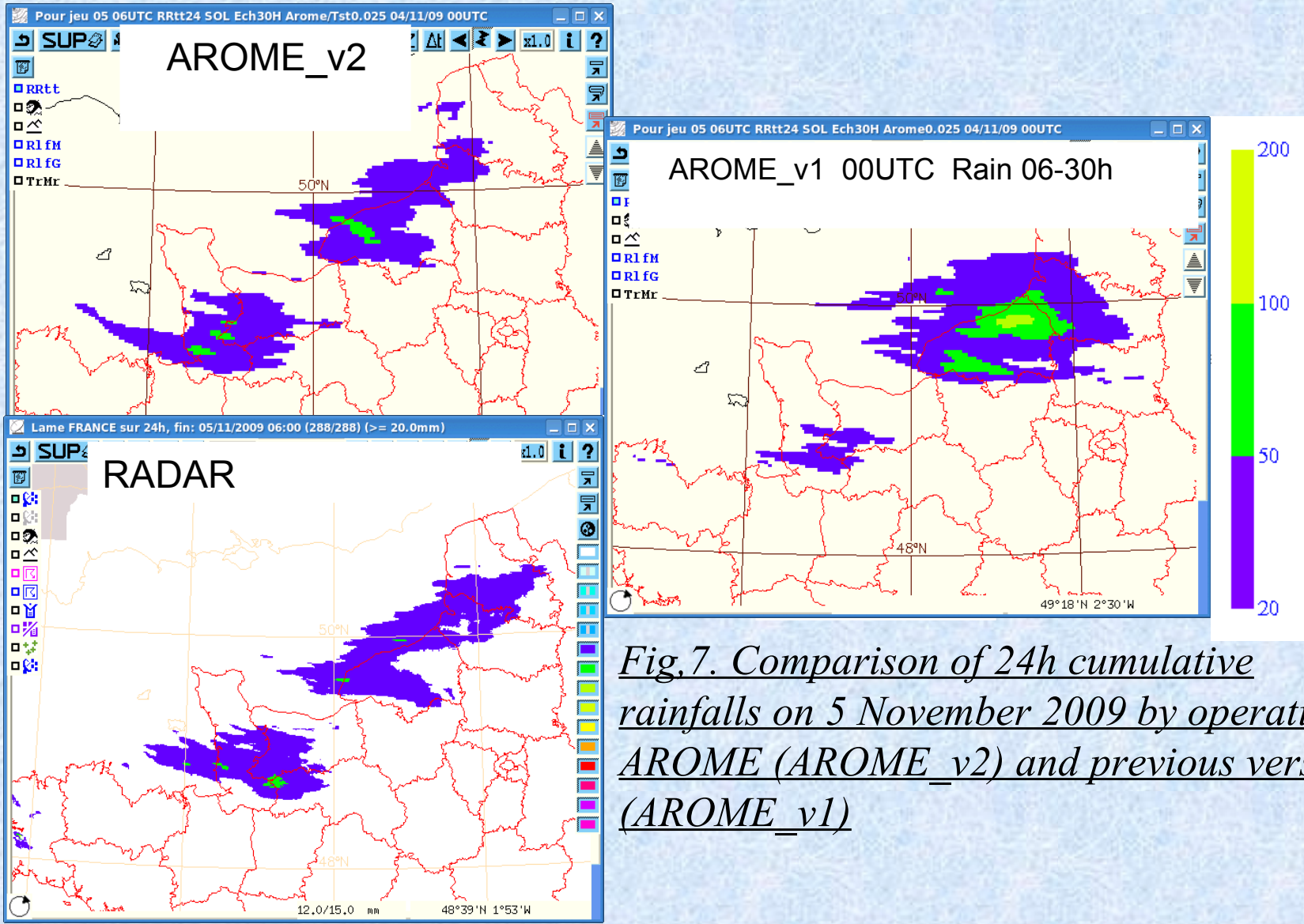- Direct coupling with high resolution stretched Arpège T798C2.4

Fig.7. Comparison of 24h cumulative rainfalls on 5 November 2009 by operational AROME (AROME_v2) and previous version (AROME_v1)
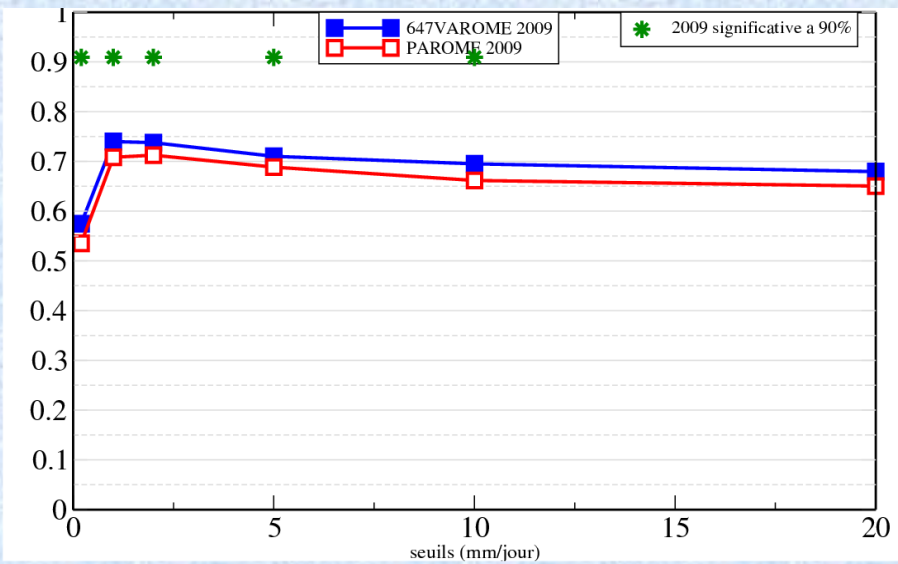

Fig.8. 24h cumulative rainfalls Brier skill score (15 Sept 2009 - 3 March 2010) (AROME_v1 and AROME_v2)

Current E-Suite: Arome V3 (Spring 2010)

- 80 km thinning for IASI, 25km for AIREP
- Assimilation of doppler winds from more radars
- tunings for reflectivity retrievals
- Surfex surface analysis
- 76% extension of the horizontal size of the domain (750x720)
- Use AROME analyses as 0h coupling file
- Code optimisation (EDKF, I/O)
- Modifications of z0
- Diagnostics (PBL height, surface radiation fluxes, modelled satellite imagery)
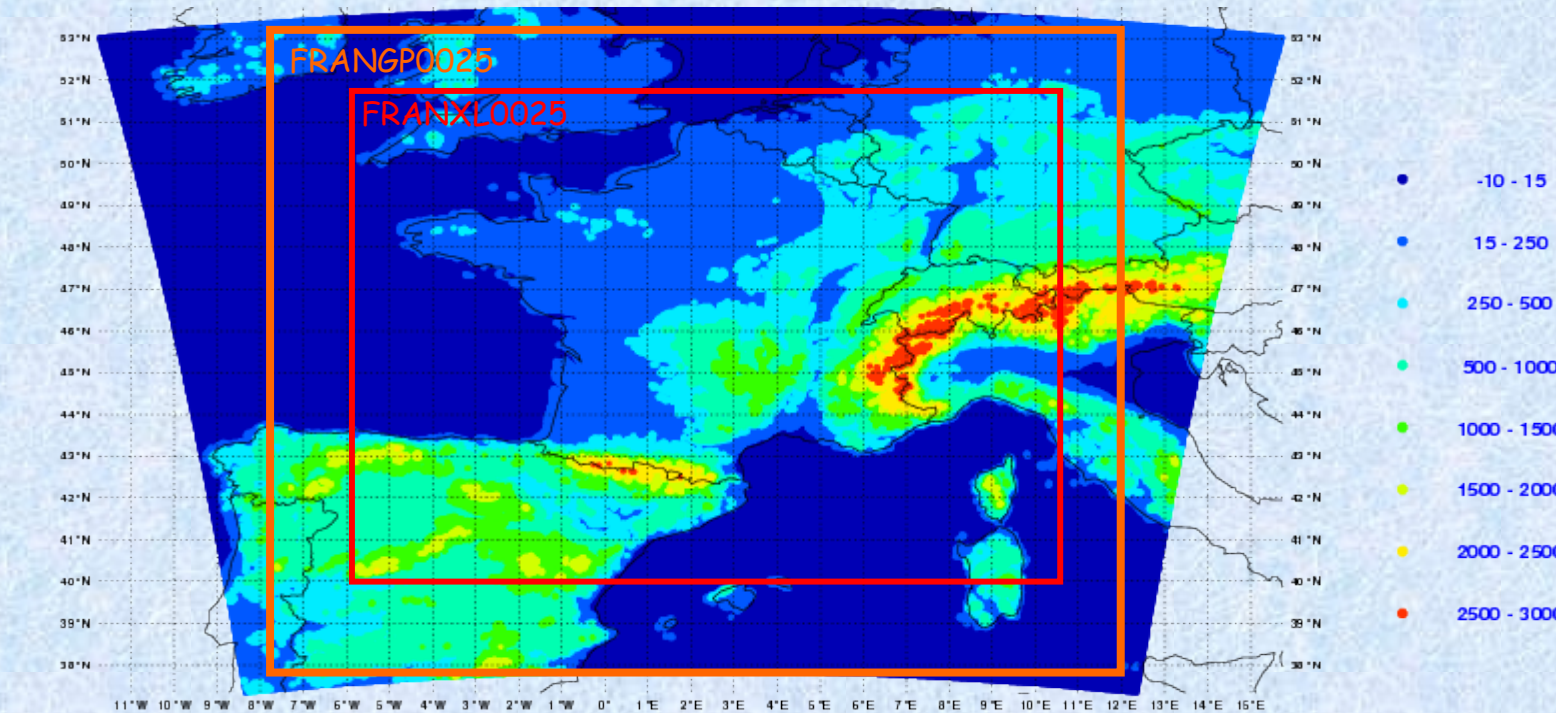

Fig. 9 AROME new domain orography and post processing domains (new , old).