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 149. The equivalent grid has 9.51 Km gridmesh. The vertical dimension is discretized in 60 levels (+ a surface)

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.

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
- –2m temperature and RH, 10m winds
- –Aircraft data
- –SATOB motion winds (AMV)
- –Drifting buoys surface pressure
- –Soundings (TEMP, PILOT)
- –European wind profilers
- –Satellite radiances: AMSU-A, AMSU-B, HIRS (NOAA and METOP), Meteosat-9 SEVIRI (5 channels)
- –QuikSCAT winds
- –Ground-based GPS zenithal delays
- –New AQUA/AIRS channels (~54)
- –MSG/SEVIRI Clear Sky Radiances (the 2 so-called "water vapor channel")
- –Clear-sky microwave radiances over land

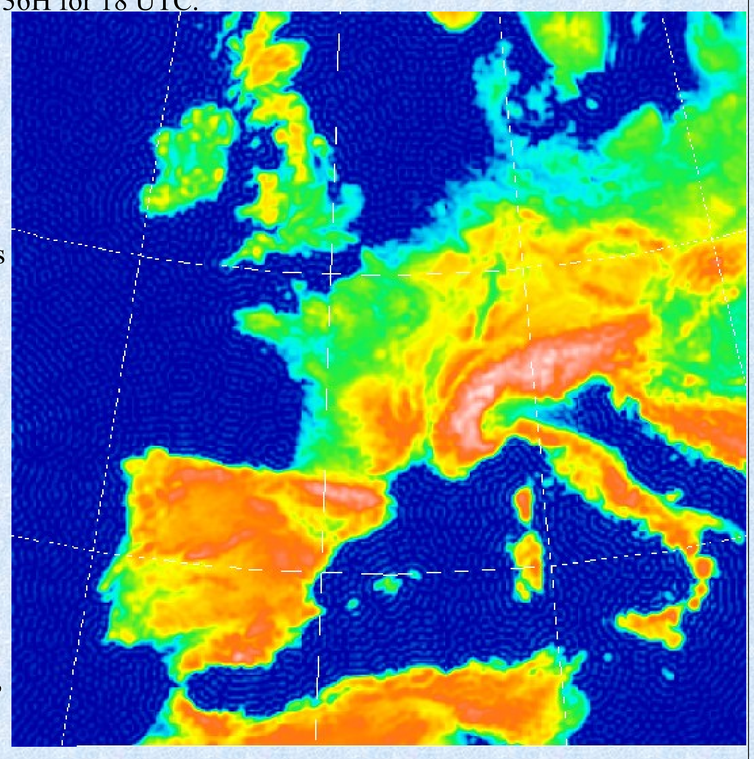


Fig.1. The ALADIN-France domain, with the orography.

-Cloudy AIRS
-IASI (sea/land/seaice)

The operational suite

The cycle for the operational suite is CY33T1, this suite contains important changes in the physical parametrizations used in Arpege and Aladin. It has been running since februar 2009.

➢ **ARPEGE and ALADIN-France:**

✓ Physics:

- identical horizontal diffusion of vorticity, divergence and temperature
- vertical turbulent diffusion scheme with prognostic tubulent kinetic energy (CBR)
- shalllow convection scheme form Bechthold et al. (2001)
- use of sea surface turbulent fluxes scheme ECUME (Weil et al. 2003)
- improved entrainment at the top of boundary layer

➢ **ALADIN-France**

- Same changes than in Arpège plus introduction of surface assimilation scheme CANARI adapted from Arpège.

ARPEGE and ALADIN next E-suite (Spring 2010)

- 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)
- Increase of resolution for ALADIN-France L70 to 7.5 km. Slight increase of the domain's size.
- Cy35t2

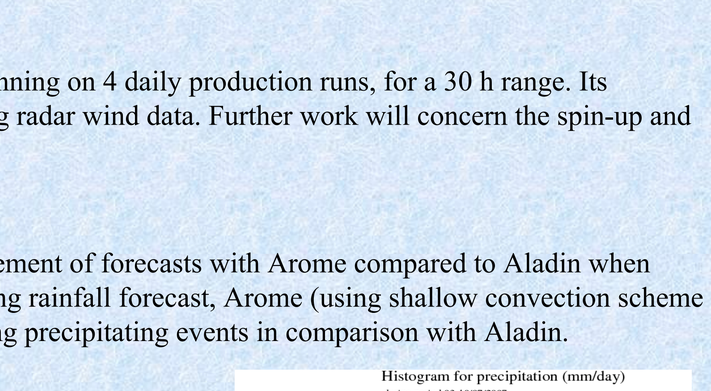
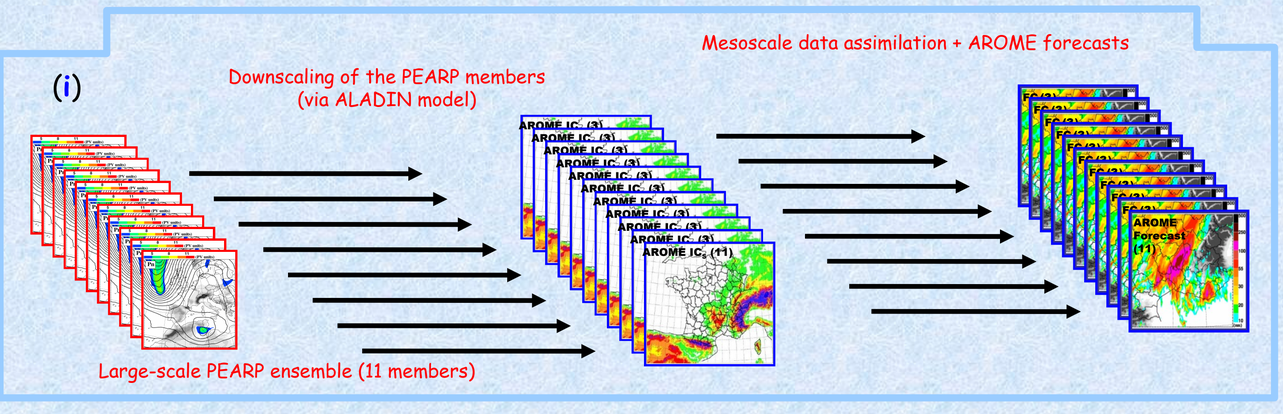


Fig. 3. Differences of RMSE (in comparison with TEMP measurements) between 48h forecasts with the actual operational suite and the old operational suite for moisture (left) and temperature (right). Blue (red) contours means better (worse) agreement with observations.

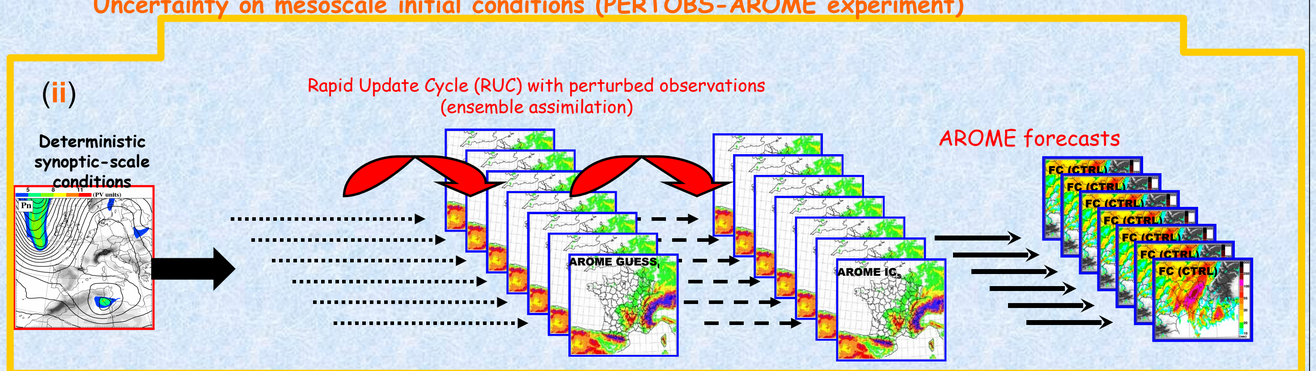
Convective-scale predictability studies with AROME

(Mediteranean Heavy Precipitation Events)

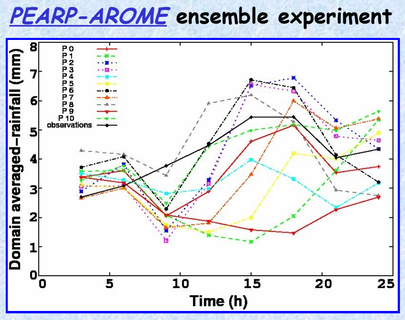
Uncertainty on synoptic-scale initial conditions and lateral boundary conditions (PEARP-AROME experiment)



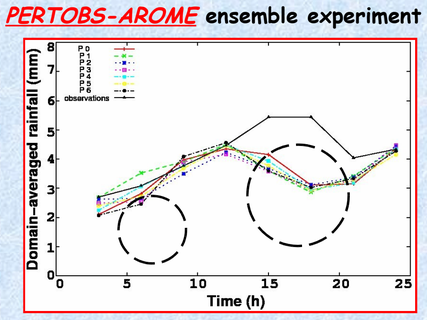
Uncertainty on mesoscale initial conditions (PERTOBS-AROME experiment)



PEARP-AROME **ensemble experiment**



PERTOBS-AROME **ensemble experiment**



The maximum rainfall peak is better captured in ***PEARP-AROME*** ensemble despite relative poor performance over the first half of forecast period

Over the first half of forecast period the uncertainty is fairly reduced and better distributed around observations in ***PERTOBS-AROME*** ensemble but it fails to reproduce the precipitation peak

Further issues:

- Testing of combinaison of both methods
- Improvement of observation perturbation method
- Evaluation of ensembles on longer periods

AROME now operational at Météo-France

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.

Rapid Update Cycle

The first operational AROME version is running on 4 daily production runs, for a 30 h range. Its assimilation is with 3 hourly RUC including radar wind data. Further work will concern the spin-up and the initialization of forecasts.

Scores

Temperature scores (Fig 7) display improvement of forecasts with Arome compared to Aladin when forecast range is smaller than 24h. Regarding rainfall forecast, Arome (using shallow convection scheme EDKF) improves forecasts of low and strong precipitating events in comparison with Aladin.

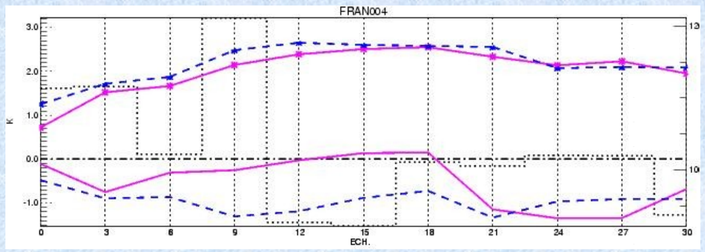


Fig. 5. Bias (bottom) and RMSE (top curves) of Arome (magenta) and Aladin (blue) forecasts in regards to SYNOP measurements for temperature. Abscissa is forecast range (hours).

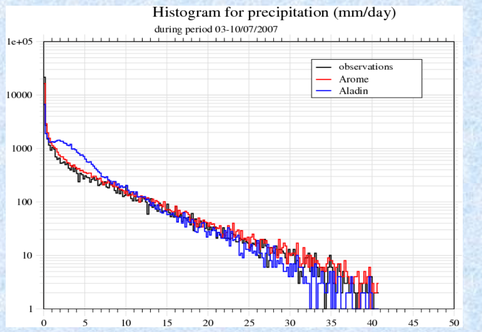


Fig. 6. Histogram for precipitation (mm/day) for Arome with EDKF (red), Aladin (blue), and observations (black). Frequency of low and strong precipitation are improved in respect with observations.

Next E-Suite: Arome V2 (Spring 2010)

- 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 to be evaluated
- Assimilation of radar reflectivities

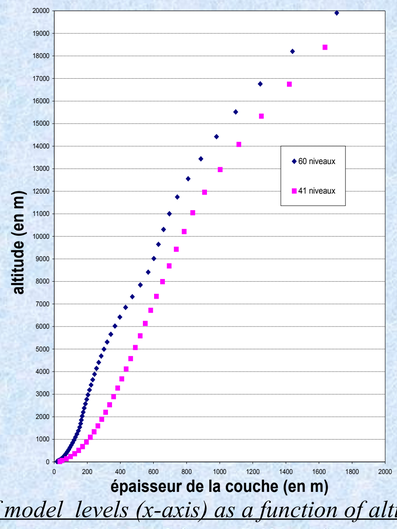


Fig7. Width of model levels (x-axis) as a function of altitude (y-axis) for operational L41 and future L60 configurations