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 415.385 s

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

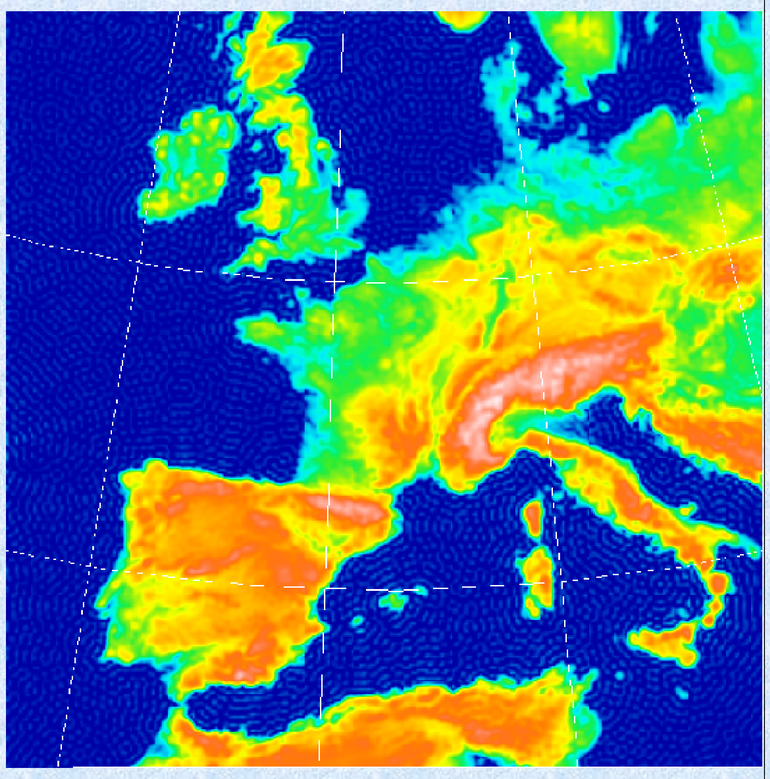


Fig.1. The ALADIN-France domain, with the orography.

The most likely next E-suite

What would be in the E-suite ?

The most remarkable items :

The cycle for the suite will be CY33T0

➢ **ARPEGE**

✓Assimilation : Start on a routine basis an ensemble of 6 assimilation cycles of 6h-window 3D-VAR FGAT in TL358C1.0L60 under OLIVE (March 2008 confirmed).

✓Physics new tuning of horizontal diffusion (to be confirmed), new GWD, revised surface turbulent exchange coefficients, modified snow melting on ground modified timestep for Aladin-FR (450 s) to have an even number of iterations for 1h, modified post-processing for isolated lakes.

➢ **ARPEGE and ALADIN-France**

✓Assimilation of :

- New AQUA/AIRS channels (~54 channels),
- Metop/IASI channels (~60 channels),
- Metop/HIRS, GRAS radio-occultation,
- MSG/SEVIRI Clear Sky Radiances (the 2 so-called "water vapor channel"),
- Clear-sky microwave radiances over land,
- DMSP F14 SSM/I, microwave radiances (AMSUA/B, MHS from NOAA and Metop) over land, in clear-sky, using improved surface emissivity maps.

✓Variances derived from the ensemble assimilation

➢ **ALADIN-France**

New observations like in Arpège, removal of RH2/T2 observations in night time runs (spurious surface/PBL forcing via B matrix, the flag will be on real solar time), VarBC (Variational Bias Correction) for SEVIRI, monitoring of some radar radial winds from the French ARAMIS network (to be confirmed).

This E-suite is expected for testing over March-April 2008. Note that the presence of VarBC in Arpège induces a change in the strategy for starting an E-suite containing new observation types. Since VarBC is a bias correction scheme where all observations are inter-dependent (plus the analysis) inside VarBC, one needs to proceed to a warm-up of the E-suite prior to the actual start. This warm-up consists in introducing progressively the new observations, over about 2-4 weeks. For Aladin-France, the Arpège VarBC file can be read in and the coefficients merged with those adaptively computed for SEVIRI by the Aladin/VarBC.

Latest developments

Implementation of an incremental digital filtering within the ALADIN-FRANCE 3D-VAR

In order to avoid the excessive correction due to digital filtering of the analysis, incremental digital filter (IDFI) are now used operationally in ALADIN. From the finding that inertia-gravity waves can appear either from mismatches in the LBC data or from the imbalances in the analysis increments, we try to assess the benefit of an incremental (i.e only applied to analysis increments), rather than "simple", application of digital filters:

• "simple": start forecast with F(a)

• incremental: start forecast with g+F(a)-F(g)

Spatially consistent LBC are used within IDFI. A modified tuning of the cut-off period is also performed. Series of surface pressure indicate IGW with about 1-1.5h of period (to be compared with Tc=3h presently in the ALADIN-FR DFI).

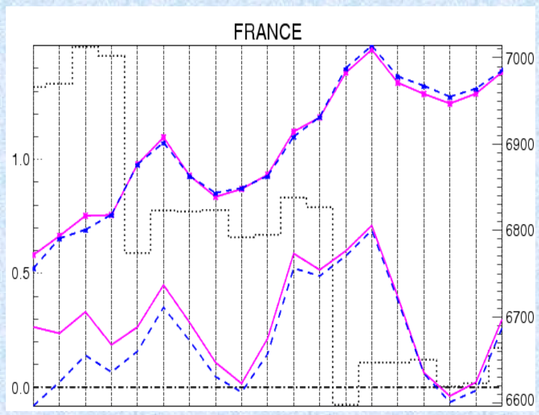
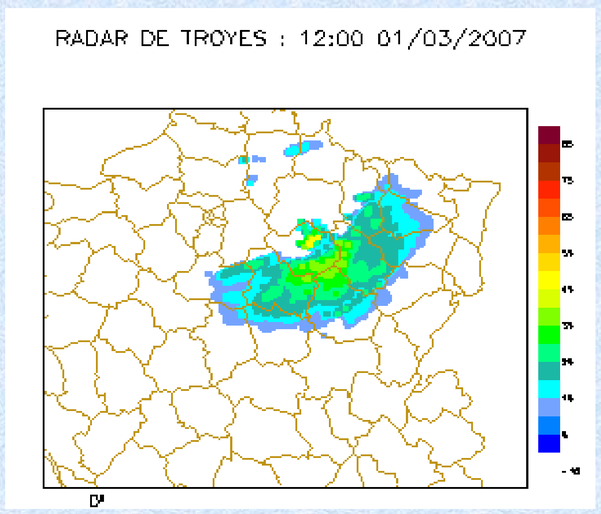


Fig. 2. Bias (bottom) and RMSE (top curves) with respect to French mesonet stations, for MSLP. Magenta for the control run (using DFI) and blue for the test run (using IDFI). Abscissa is forecast range every 3 hours.

Radar reflectivity simulator

The radar reflectivity simulator can be called within both the ALADIN and the AROME models. Most of the work within the ODB is completed; the quality control has been improved (do not reject spatially coherent reflectivity profiles even if they depart quite significantly from the background). Future work will focus on long time series of monitoring for computation of biases and standard deviations and inclusion of a beam blockage model within the simulator (orography). These developments remain closely coordinated with ALADIN (M. Jurasek) and HIRLAM (G. Haase).



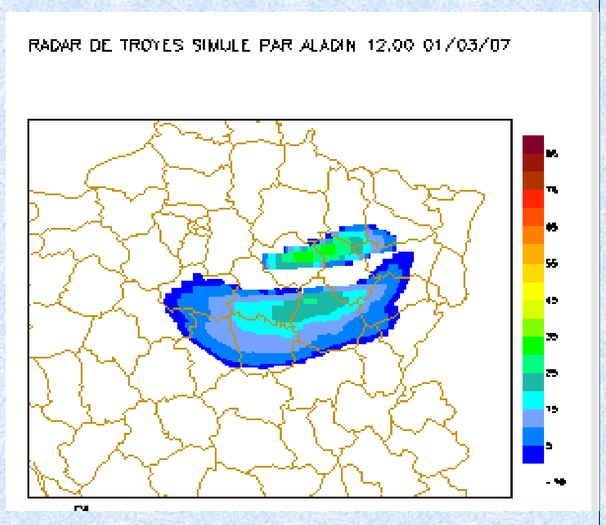


Fig. 3. Comparison of observed (left) and simulated (right) reflectivities

AROME pre-operational settings

Forecast model: envisaged French domain and cost issues

AROME planned operational domain for October 2008 is 600x512 points, with 2.5km horizontal gridmesh. Time step of the model is 60s. On 64 processors of the NEC SX8R, 24 h forecasts can be produced in 20' elapse. The figures show 24h cumulative rainfall on August 23rd 2007 with a good agreement between model and radar picture.

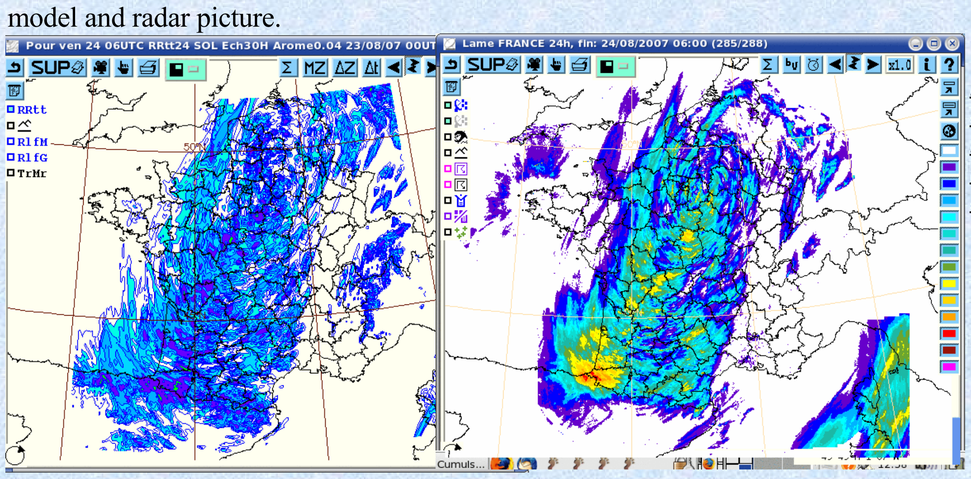


Fig. 5: 24h cumulated rainfalls, Arome (left) and radar composite (right)

Rapid Update Cycle

The first operational AROME version should run on 4 daily production runs, for a 30 h range. Its assimilation should be 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, ETS precipitation scores (equal respectively to 0 and 1 for random and perfect forecast) point out a better Arome's forecast of small rains (<3mm/day) and a slight degradation for larger rains compared to Aladin and Arpege..

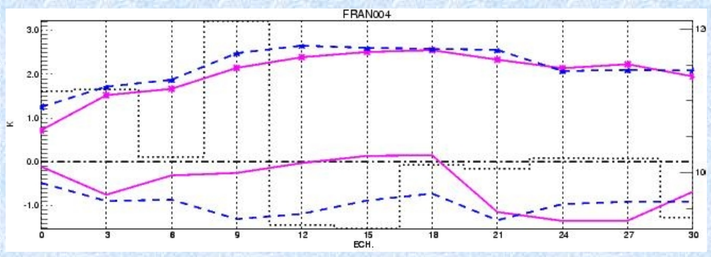


Fig. 7. Bias (bottom) and RMSE (top curves) of Arome (magenta) and Aladin (blue) forecasts in regards to SYNOP measurements for temperature. Abscissa is forecast range (hours).

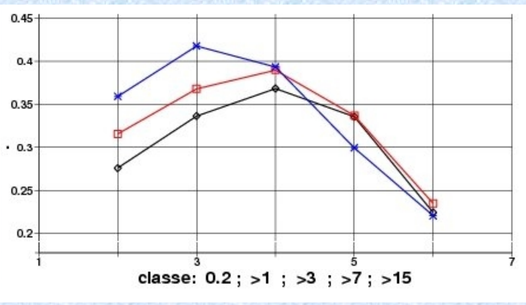


Fig. 8. Equitability Treat Score (ETS) for Arome (blue), Aladin (red) and Arpege (black) as a function of daily precipitation rate (mm/day)