# ALADIN - Portuguese technical and scientific activities

*à frente do nosso tempo*

22nd ALADIN Workshop & HIRLAM All Staff Meeting 2012, 7-10/05/2012, Marrakech, Morocco

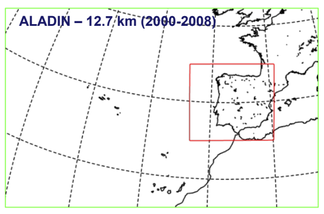
## Summary of main activities (vanda.costa@meteo.pt)

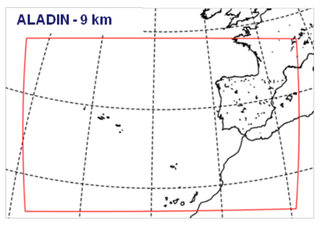
Since the full upgrade of the Portuguese NWP operational system by the end of 2008, to a HPC platform and a DELL cluster, an ALADIN's new geographical domain and resolution, and migration to job's scripts under SMS/XCdp, the main focus has been targeted towards high resolution models. Pre-operational runs with AROME model at 2.5 km resolution for two domains, Portugal mainland and Madeira archipelago, started in 2009 and in 2010 both models became operational. An AROME domain for Azores archipelago is being run operationally with cycle 36T1 since Dezember 2011. ALADIN and the other two operational AROME domains have also been upgraded this year to cycle 36T1. Model output statistics and Kalman filter have been applied to extreme daily temperatures forecasts of ALADIN, AROME and ECMWF models. Regarding NWP model verification system, daily and monthly scores of all models available at IM are being calculated operationally. A testing 3D-Var ALADIN-Portugal data assimilation suite is being built for a geographical domain of 288x288 gridpoints. Operational analysis fields from CANARI system are merged with upper-air 6h ALADIN-Portugal forecasts to build the background.

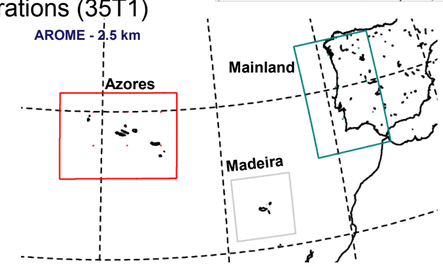
## ALADIN and AROME operational versions

### Timeline of changes

| | | |
|---|---|---|
| Apr | 2000 | Cycle 09 |
| Jun | 2000 | Cycle 11T2 (CYCORA included) |
| Jul | 2001 | Cycle 12_bf02 (CYCORA_bis included) |
| Apr | 2002 | Time step change (540s to 600s) |
| Jun | 2006 | Cycle 28T3 (new geographical area and climatologies) |
| Jun | 2007 | Wind dynamical adaptation for 3 domains |
| Apr | 2008 | CANARI surface analysis fields (temp. & rel. humidity) |
| Dec | 2008 | Cycle 32T3 (new domain and resolution) |
| Out | 2009 | Cycle 35T1 |
| Jan | 2010 | AROME-Mainland & AROME-Madeira in operations (35T1) |
| Dec | 2010 | Cycle 36T1 in ALADIN |
| Jun | 2011 | Cycle 36T1 in AROME-Madeira |
| Out | 2011 | Cycle 36T1 in AROME-Mainland |
| Dez | 2011 | AROME-AZORES in operations (36T1) |



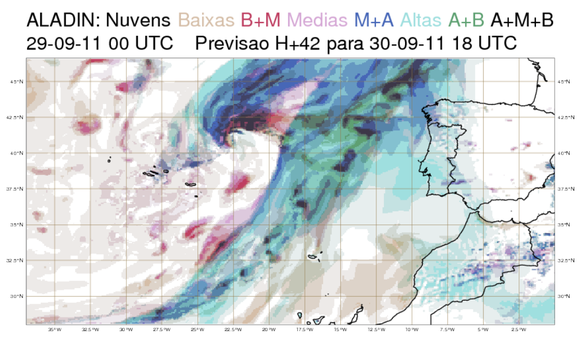

### Foreseen activities

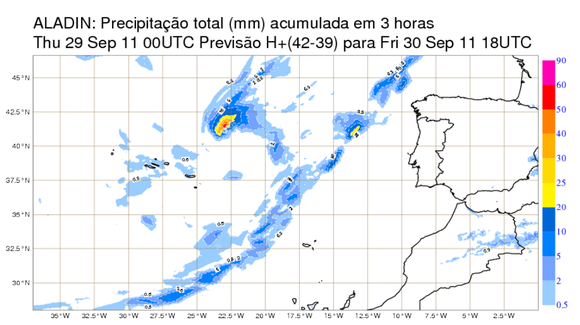
- Calculation of a climatological B matrix by the ensemble method for the 3D-Var ALADIN-Portugal data assimilation system
- Increase of vertical levels in the ALADIN-AROME system
- Increase of AROME-mainland domain

### Models characteristics

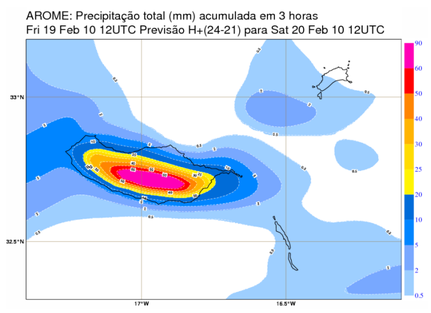
ALADIN-Portugal

- Spectral hydrostatic model
- Hybrid vertical coordinates
- Digital filter initialisation
- Semi-lagrangian advection scheme
- Two-time-level semi-implicit time scheme
- ISBA surface parameterisation scheme
- Initial and LBC from ARPEGE
- 3 hour coupling frequency
- Geometry:
  - Size (lon x lat): 439 x 277 points
  - Horizontal resolution: 9 km
  - Number of vertical levels: 46
  - Time step: 360 s
- Integration frequency: twice a day
- Forecast range: 72 hours
- Output frequency: 1 hour
- Cycle 36T1



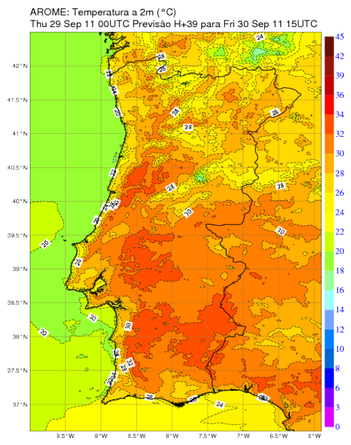

AROME: Precipitação total (mm) acumulada em 3 horas
Fri 19 Feb 10 12UTC Previsão H+(24-21) para Sat 20 Feb 10 12UTC



AROME

- Spectral non-hydrostatic model
- Initial and LBC from ALADIN-Portugal
- 3 hour coupling frequency
- Geometry:

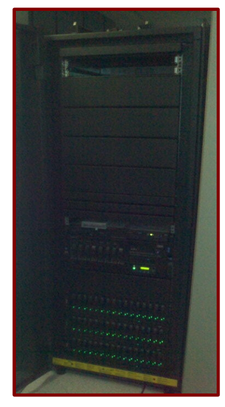
| Domain | Mesh size (lon x lat) | Horizontal Resolution (km) | Vertical levels | Time step |
|---|---|---|---|---|
| Mainland | 360 x 250 | 2.5 | 46 | 60 |
| Madeira | 200 x 192 | | | |
| Azores | 270 x 360 | | | |




## Computing resources

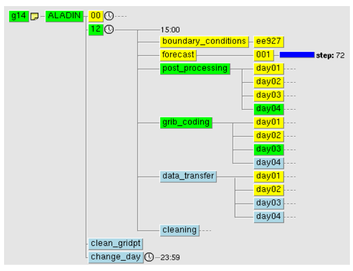
**HPC system IBM p5-575**

10 nodes
Each node with 8 Power 5+ dual-core processors @ 1.9 GHz
32 GB RAM of memory per node
2 TB total disk space
AIX 5.3 operating system
Open Multi-Processing and Simultaneous Multi-Threading
General Parallel File System
LoadLeveler
Fortran (xlf) and C/C++ (xlc) IBM compilers



**DELL PowerEdge 2950**

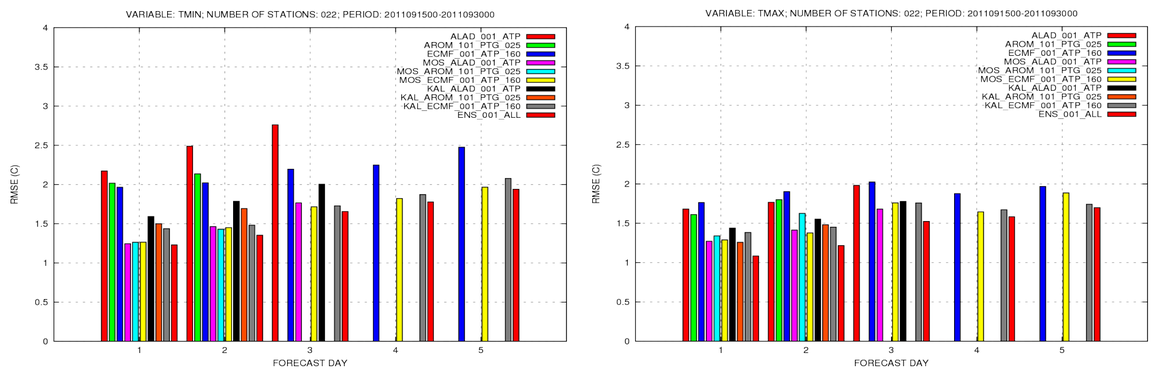
10 nodes
2 Intel Xeon X5355 Quad-core processors @ 2.66 GHz
4 x 2GB RAM
8 TB per node
Linux PAIPIX-IM operating system with:
Fortran and C/C++ compilers
Metview/Magics (ECMWF) graphical software
SMS/Xcdp (ECMWF) job scheduler
Local database (Temporal Instrumental Data Base – TIDB/IM)




DELL system is the front-end device of IBM and SMS software is used for batch job scheduling from a DELL machine to the HPC cluster. DELL machines are used for data processing, visualization and archiving. The NWP operational system is run under SMS suites.

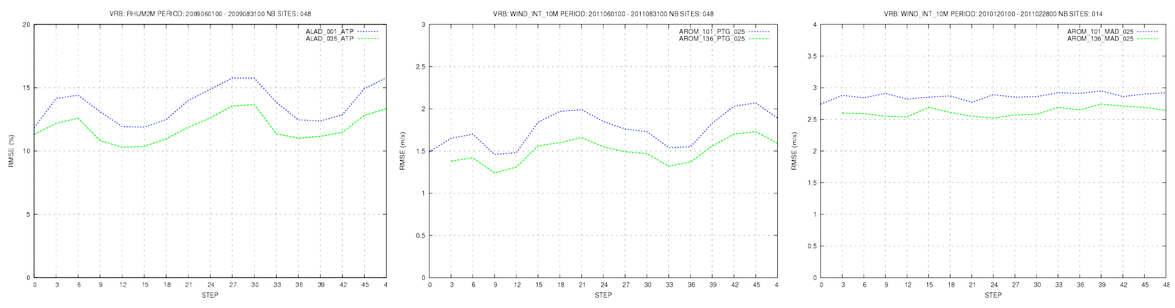
## Models verification (joao.rio@meteo.pt, nuno.lopes@meteo.pt, manuel.lopes@meteo.pt) c

### Statistical models




RMSE of tmin and tmax of direct models output (ALADIN, AROME and ECMWF), MOS and Kalman filter and an "ensemble" (average of the statistical models). Results have shown the advantage of using the "ensemble" product to forecast extreme daily temperatures.

### Cycle 36T1 versus cycle 35T1

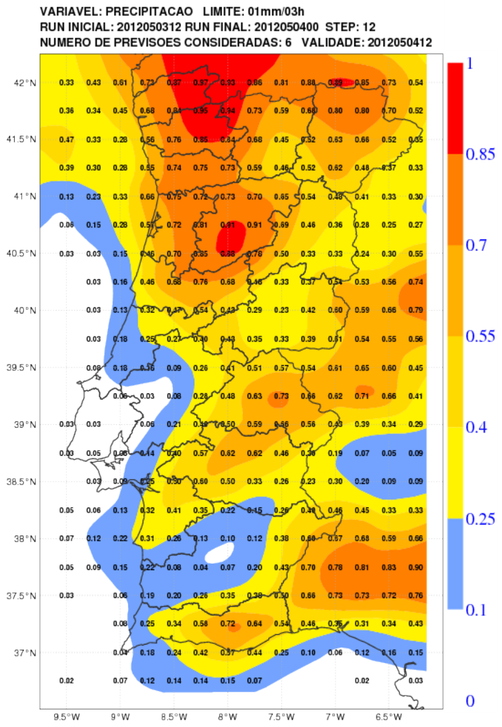



ALADIN and AROME's validations of cycle 36T1 compared to cycle 35T1 have shown a clear improvement in the forecast skill of 2 metres relative humidity for ALADIN (left) and a small improvement in the forecast skill of 10 metres wind speed of AROME- Mainland (middle) and AROME- MAD (right).

## Local post-processing (joao.rio@meteo.pt)

Forecast probability of 3 h total precipitation of at least 1, 10 and 20 mm is built from ECMWF, ALADIN-Portugal and AROME-Portugal products. The figure illustrates the actual 00 UTC operational product, valid for the 04 Mai 2012 at 12 UTC. Totally, 6 forecast products have been used, to give the probability forecast of total precipitation to be at least 1 mm/3h.

A similar product is built for wind gusts and wind speed.

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