# ALADIN - Portuguese technical and scientific activities

23th ALADIN Workshop & HIRLAM All Staff Meeting 2013, 15-19/04/2013, Reyjavik, Iceland

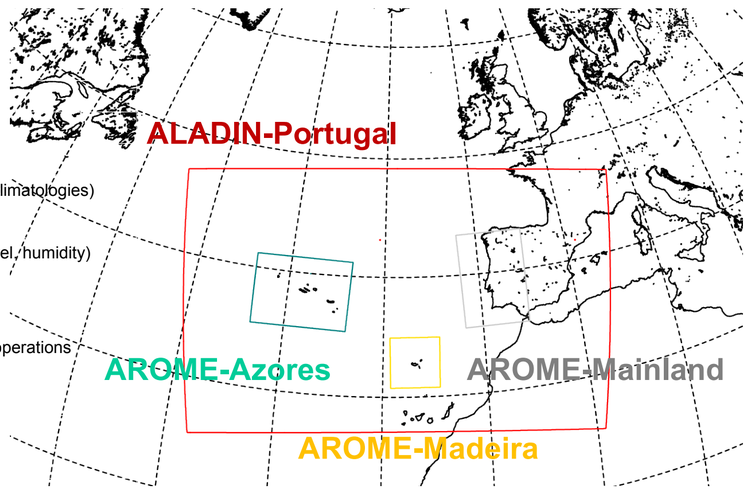
## Summary of main activities

The Portuguese NWP operational system is based on a set of SMS/XCdp scripts which are submitted from a front-end DELL cluster to an IBM p575 platform. ALADIN-Portugal runs over a domain which covers the Portuguese mainland and the adjacent Atlantic Ocean including the Portuguese Islands, at 9km of horizontal resolution and 46 vertical levels. The ALADIN model provides initial and boundary conditions to the highest resolution model AROME. Operational runs with AROME model at 2.5 km resolution started in 2009, 2010 and 2011 respectively for three domains of Portuguese mainland, Madeira archipelago and Azores archipelago. Cycle 36T1 is being used in operations since December 2010. Meanwhile, tests have been done to run ALADIN and AROME models at ECMWF (c2a), in backup mode of IPMA's operational system. Moreover, future scenarios of computing requirement have been drawn to prepare the acquisition of a new HPC infrastructure. At the same time, case-studies have been conducted in order to assess the models performance in severe weather conditions. The effort onto the acquisition of new capacities for the creation of a local data assimilation cycle is still on going: a climatological B matrix has been calculated (during a stay in Météo-France, using OLIVE) for an ALADIN/Portugal 3D-Var testing cycle and in addition, technical work for the ingestion of Portuguese radar data into an AROME/Portugal 3D-Var cycle has been started (during a stay in OMSZ, using HARMONIE).

## 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

- Diagnosis of a climatological B matrix for the 3D-Var ALADIN/Portugal testing cycle
- Ingestion of Portuguese radar data into an AROME 3D-Var data assimilation cycle
- Full upgrade of the actual operational ALADIN/AROME system: new computing platform and new NWP system configuration, including: 4x/day production runs, increase of the forecast range, horizontal and vertical resolutions of the coupling files and increase of geographical domain for the AROME model.

### Models characteristics

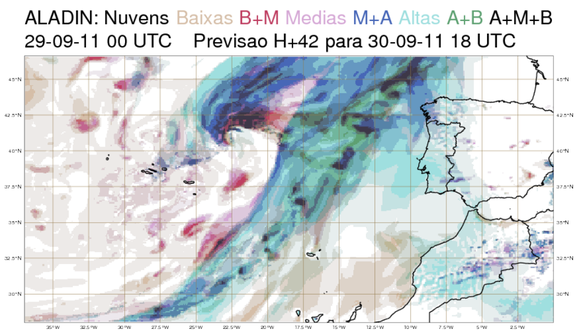
ALADIN-Portugal

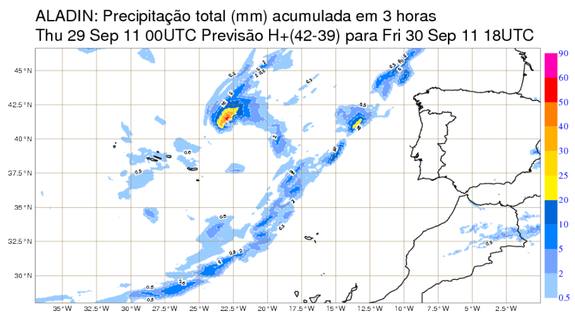
- Spectral hydrostatic model
- Hybrid vertical coordinates
- Digital filter initialisation
- Semi-lagrangian advection scheme
- Two-time-level semi-implicit time scheme
- ISBA surface parameterisation scheme
- Initial and LBC from ARPEGE
- 3 hour coupling frequency
- Geometry:
  - Size (lon x lat): 439 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

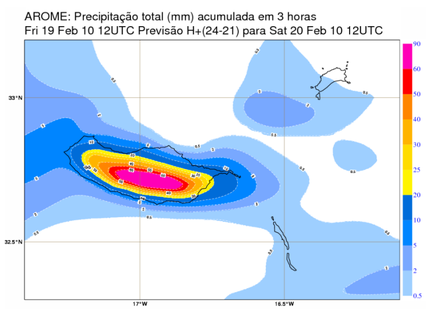
AROME

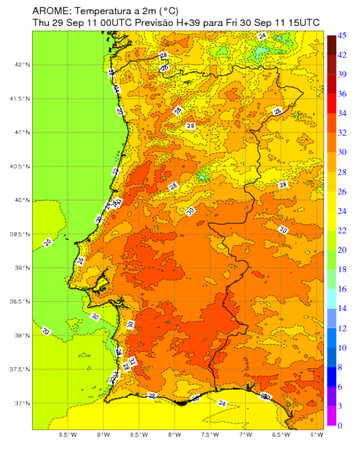
- Spectral non-hydrostatic model
- Initial and LBC from ALADIN-Portugal
- 3 hour coupling frequency
- Geometry:

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



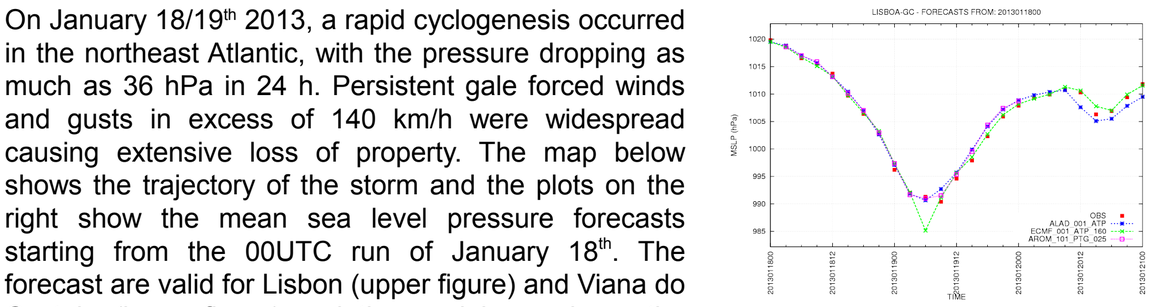



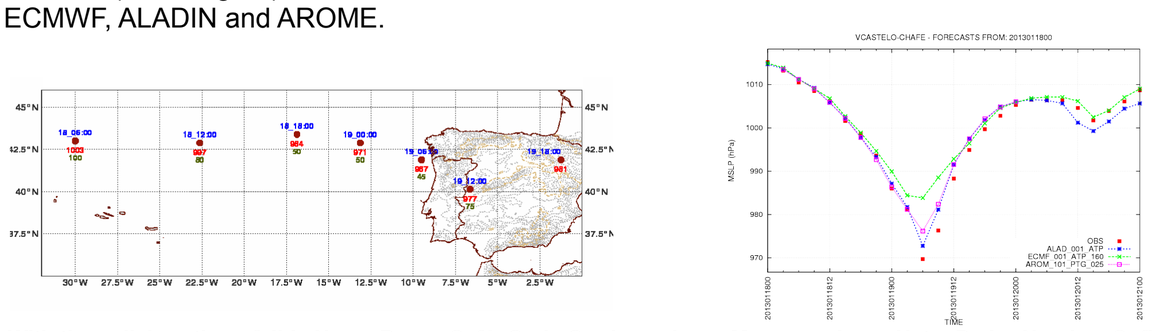




## Case study of Rapid Cyclogenesis

**(joao.rio@ipma.pt)**

On January 18/19th 2013, a rapid cyclogenesis occurred in the northeast Atlantic, with the pressure dropping as much as 36 hPa in 24 h. Persistent gale forced winds and gusts in excess of 140 km/h were widespread causing extensive loss of property. The map below shows the trajectory of the storm and the plots on the right show the mean sea level pressure forecasts starting from the 00UTC run of January 18th. The forecast are valid for Lisbon (upper figure) and Viana do Castelo (lower figure) and the models used are the ECMWF, ALADIN and AROME.







**With the collaboration of Ilda Novo, Bruno Café, Carla Cardoso, Jorge Marques, Jorge Neto, Pedro Narciso, Sofia Cunho.**

## Snow events in Portugal-Mainland

**(manuel.lopes@ipma.pt)**

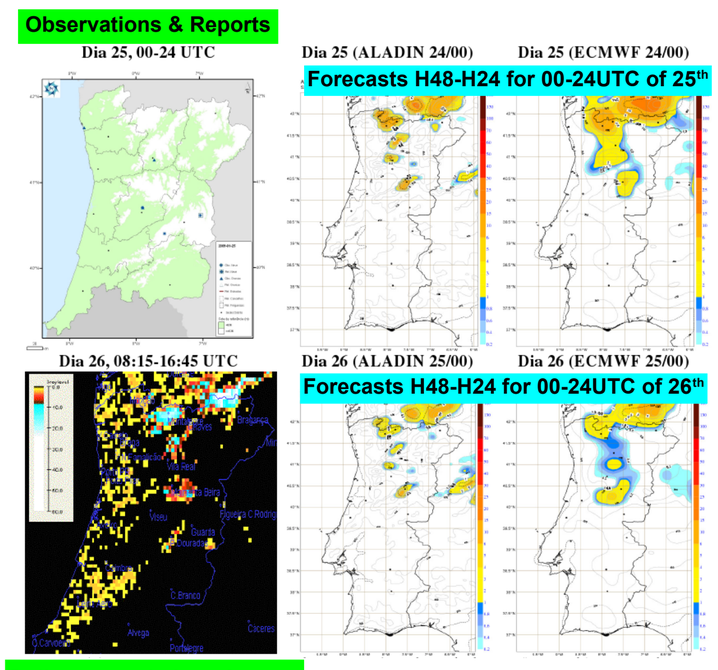
Several snow events occurred between 27/11/2008 and 16/02/2009 in Portugal-Mainland. Forecasts of snowfall and snow depth from ALADIN and ECMWF model were assessed. The results can be summarized as:

- Forecasts up to 36 hours provided reasonable results in both models, despite some temporal errors.
- ALADIN has in general a better performance than ECMWF: areas of snowfall in ALADIN are usually smaller than in ECMWF, due to its more detailed orography (see the illustration below for the event 25-26/01/2009).
- However, ECMWF had a better performance for snowfall at unexpected low altitudes .
- Snow depth's usefulness seems to be rather limited in our operational area.

**Maximum values of snowfall match highest mountain tops**

**Smaller areas in ALADIN than in ECMWF**

**=> ALADIN more consistent with observations & reports**



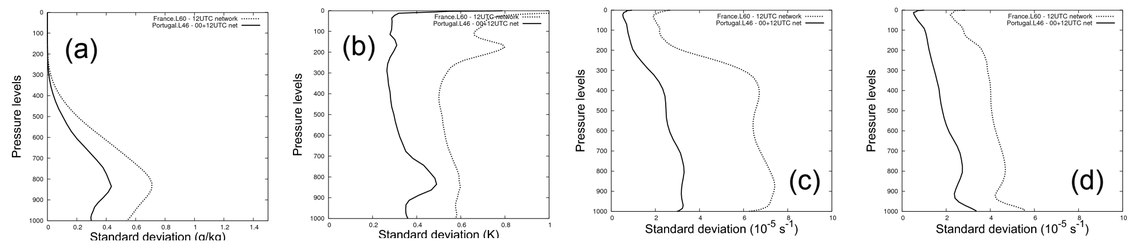

**With the collaboration of Nuno Moreira, Álvaro Silva, Ilda Novo, Luís Pessanha, Luísa Mendes, Jorge Neto, Manuel Mendes, Margarida Belo, Paula Peixe, Tânia Viegas, Vanda Cabrinha.**

## Local Data Assimilation Activities

**(maria.monteiro@ipma.pt)**

The acquisition of local data assimilation capacities has been an issue during the last year:

**1.** ALADIN-Portugal 6h forecast error statistics used to compute a first climatological B matrix to be included in the 3D-Var minimization algorithm are being diagnosed. The errors have been performed using an ensemble technique ensemble in dynamical adaptation mode with the OLIVE system during a stay in Météo-France (M-F). The panels in the illustration show the vertical profiles of horizontally averaged standard deviations of the 6h forecast errors, estimated for ALADIN-Portugal (solid line) and for ALADIN/France (dashed line) at two different periods, 20120401-20120430 and 20080213-20080313, respectively, for: (a) specific humidity, (b) temperature, (c ) vorticity and (d) divergence.




**2.** AROME-PTG at ECMWF is being used under the HARMONIE system to prepare an experiment (ptg37h12) in order to evaluate the impact of Portuguese radar observation on its forecasts in a couple of case-studies. The application **aromebufr** from the Hungarian radar team has been adapted to convert Portuguese reflectivities in cartesian representation - PPIs, into M-F BUFR format. The Portuguese radar data has been sucessfully ingested when a reverted version of the BATOR application and according to M-F standards (cy37t1_bf.04) is used; it fails for the actual HARMONIE version.

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Ministério da Agricultura, do Mar, do Ambiente e do Ordenamento do Território
**Instituto Português do Mar e da Atmosfera, I. P.** Rua C – Aeroporto de Lisboa 1749-077 Lisboa – Portugal Tel.: (351) 21 844 7000 Fax: (351) 21 840 2370
e-mail: informacoes@meteo.pt URL: http://www.meteo.pt