

Summary of main activities

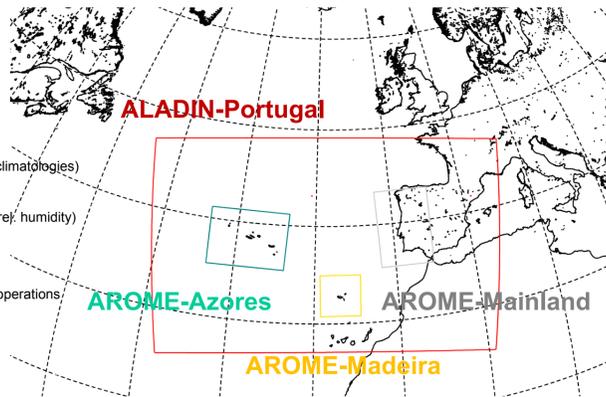
During the last year no changes have taken place on the Portuguese NWP operational system which is described below. However, since December 2013 a backup system has been running at ECMWF as a Time Critical Application for the domains: ALADIN/Portugal (Option 2) and AROME-Mainland. A new HPC machine, an IBM p7, and its front-end platform (this poster, top right) has been acquired. In this way, the actual NWP system will be upgraded to CY38 and is now under test. At the same time, the migration of the post-processing procedures are taking place. There is now a 3D-var HARMONIE setup running on ECMWF's platforms where AROME-Mainland is executed with the assimilation of Portuguese radar data (this poster, bottom right). Besides, several other tasks have taken place in order to support downstream services of the regional NWP system at 2,5 km: the estimation of upper air gust forecasts from the wind output on extreme weather events; the post-processing of screen level parameters from the initial conditions for forest fire risk index calculations; a SST sensitivity test performed under foggy conditions in support of aviation activity; improvements in statistical adaptation of hourly forecasts (this poster, centre right).

ALADIN and AROME operational versions

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.

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. & ref. 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

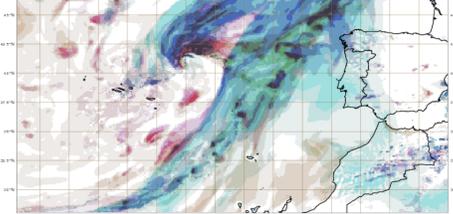
In the short term (end of 2014), the upgrade of the actual system to CY38 and the increase of daily networks, from 00 and 12UTC to 00, 06, 12 and 18UTC; in the long term, the increase of the number of levels from 46 to 60 and the enlargement of the geographical domain.

Models characteristics

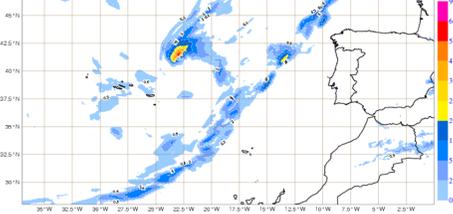
ALADIN-Portugal

- 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

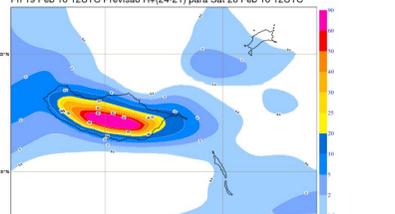
ALADIN: Nuvens Baixas B+M Medias M+A Altas A+B A+M+B
29-09-11 00 UTC Previsão H+42 para 30-09-11 18 UTC



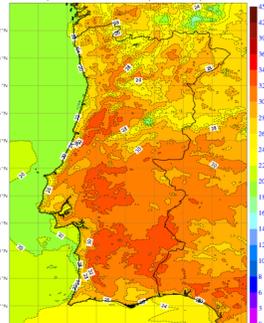
ALADIN: Precipitação total (mm) acumulada em 3 horas
Thu 29 Sep 11 00UTC Previsão H+(42-39) para Fri 30 Sep 11 18UTC



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



AROME: Temperatura a 2m (°C)
Thu 29 Sep 11 00UTC Previsão H+39 para Fri 30 Sep 11 15UTC



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

The new HPC platform

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A new HPC platform has been acquired and is being installed - the IBM Pure Flex system. It is composed by 8+1 IBM Power 7+ nodes with 24 cores each of 3.4 GHz, 128 GB (model p260). Moreover, a 1 IBM Total Storage DCS3700 with 50 discs SAS of 300GB (15TB) at 15 Krpm is available. AIX (7.1) will be used as OS. As a surplus, it includes 3 Intel (x240) X86 nodes.



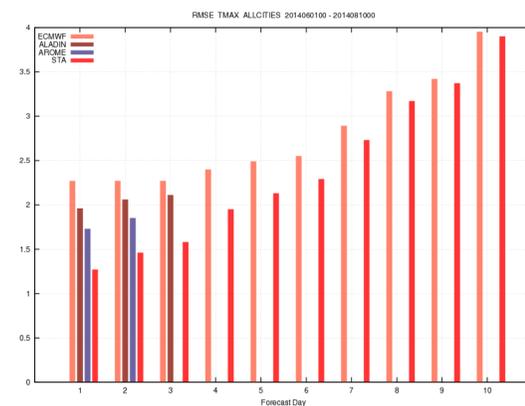
As a front-end to the HPC machine, an high-availability virtualization system will be used, the IBM Blade Center. Each node is a Xeon X5650 with 6 cores at 2,67 GHz; 36 GB of RAM is also available. Linux (Ubuntu) and Windows will be used as OS. The system is also suitable for visualization, pre- and post-processing.



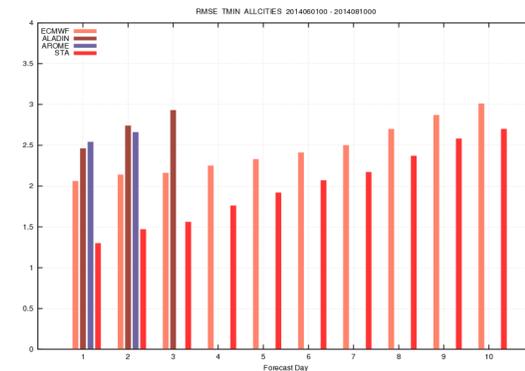
Statistical adaptation of hourly forecasts

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Up to now a statistical adaptation of forecasts from AROME, ALADIN and ECMWF models was available to improve daily minimum and maximum temperatures forecasts in selected locations up to 5 days. The application computed MOS and KALMAN adjusted temperatures for each NWP model (AROME,ALADIN and ECMWF) and the final forecast was then computed as the average of all available post-processed forecasts. In the current year this framework has been extended to the 2 m temperature and relative humidity, as well as the 10 m wind speed, all available with an hourly frequency, up to 3 days. The daily minimum and maximum temperatures forecasts have also been extended to 10 days.



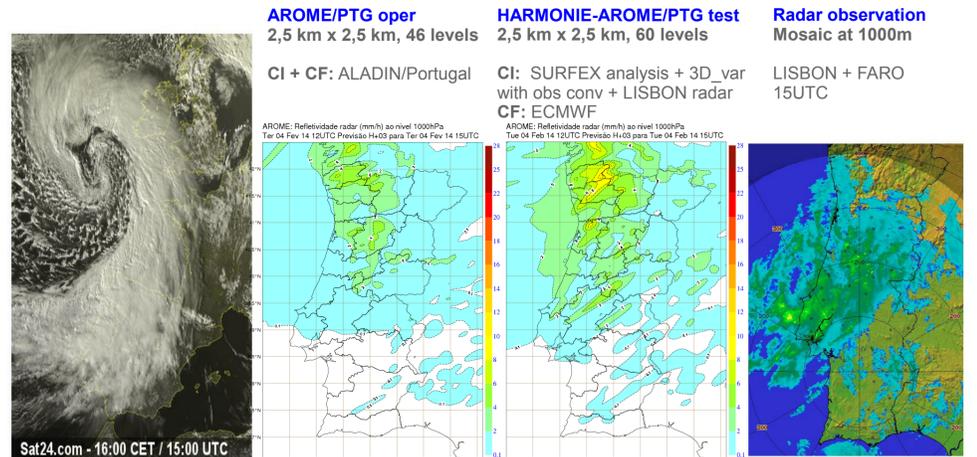
The graphics show the RMSE of maximum (top) and minimum (bottom) temperatures, for the summer of 2014 (1st of June until 10th of August). The scores are valid for the 00 UTC run and computed at 105 weather stations. The plots allow the comparison of the statistical post-processing (STA) and the direct model output (DMO) of ECMWF, ALADIN and AROME forecasts. When assessing Direct Model Output forecasts, the lowest RMSE of 2 m maximum temperature is found for AROME and of 2 m minimum temperature for ECMWF. The statistical post-processing has the lowest values of RMSE, regardless of the variable and forecast length. These products are available through IPMA's website and a mobile app (below).



Radar data assimilation activities

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AROME-Mainland (locally, AROME/PTG) at ECMWF is being run under the HARMONIE system in order to evaluate the impact of the assimilation of Portuguese radar observation. A new pre-processing interface to CONRAD - the CONRAD_RC developed by the LACE sub-consorcium - is being used to convert local IRIS raw data into M-F BUFR format. The Portuguese radar data has been successfully ingested when a reverted version of the BATOR application (cy37t1_bf.04, according to M-F standards) was used. In the illustration below, a successful minimization is achieved when 20% of Lisbon's 3D radar data at 12UTC remains active after screening. Experiments in order to track the added value of each new design component (initial and lateral conditions, surface and upper air assimilation) from the actual operational system is taking place.



Acknowledgements are due to Tomislav Kovacic, Antonio Stanesic, Ulf Andrea, Eric Wattrelot, Roger Randriamampianina, Neva Pristov, Carlos Geijo, Mangnus Lindskog,