ALADIN – Portuguese Technical and Scientific Activities

27th ALADIN Workshop & HIRLAM All Staff Meeting 2017, 3-7 April 2017, Helsinki, Finland

1 Summary

During 2016 no changes occurred on the local operational NWP system. A pre-operational system has been set taking advantage of an update on the ARPEGE dissemination, allowing the increase on the number of model levels (from 46 to 60) and on the frequency of daily runs (see Section 2). Efforts are being dedicated to improve the surface representation of the AROME model with the introduction and validation of the Alqueva Lake physiography (see Section 3). Local progress has been noticeable in Data Assimilation: a surface cycling by the OI_MAIN formalism [1] has been set and is now under validation and a 3D-Var testbed has been implemented on the HPC platform of IPMA, the IBM p7+(9 nodes) (see Section 4, left panel). To support this work a collaboration has been established with CHMI on observations processing and a collaboration was established also with AEMET by sharing real-time regional surface data over the Iberian Peninsula. In parallel and under the framework of a cooperation with NWP SAF, IPMA's satellites group also started data assimilation activities with ASCAT information over the Iberian Peninsula by using the HARMONIE-AROME platform [2] at ECMWF (see section 4, right panel). Further local team efforts have been put to support other research projects, internal requests and also ALADIN/SRNWP activities: the organization of the 26th ALADIN Workshop & HIRLAM All Staff Meeting 2016 and, more recently, the organization of the "ALADIN Data Assimilation basic kit Working Days", in Lisbon.

2 The Portuguese NWP system versions

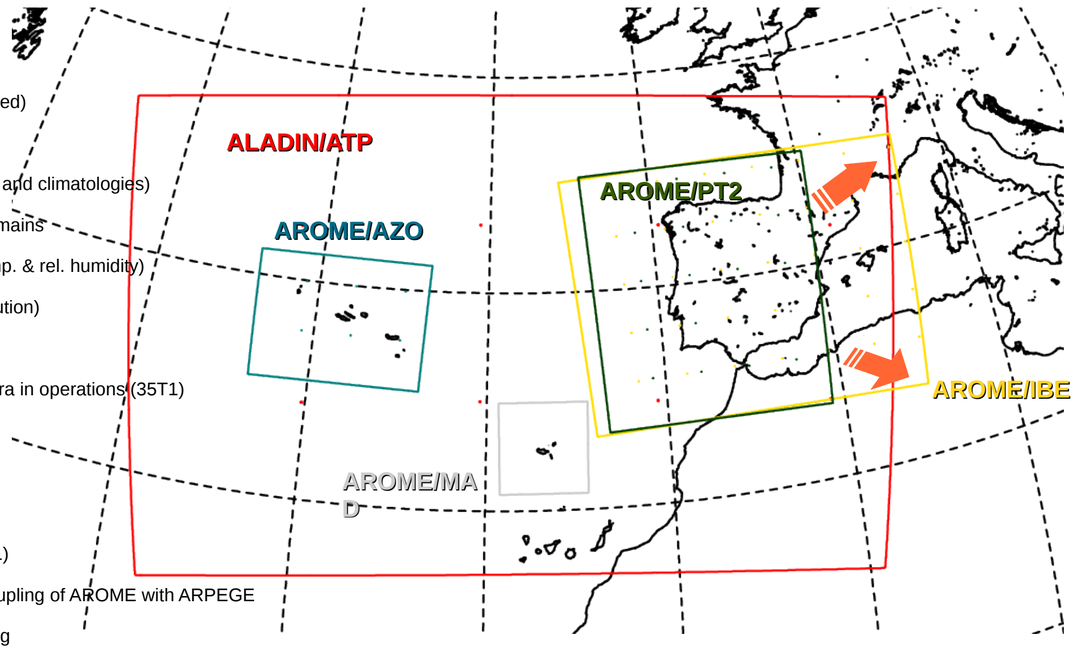
(vanda.costa@ipma.pt, manuel.lopes@ipma.pt, maria.monteiro@ipma.pt)

The Portuguese (SR)NWP system is based on a set of SMS/XCdp scripts submitted from a front-end cluster to an HPC IBM platform (see Table). 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 (ATP). The integration of the AROME forecasting model is done for three domains: Portuguese Mainland (PT2), Madeira (MAD) and Azores (AZO) Archipelagos. The latest model takes direct ARPEGE fields for its initialization.

OPER		PRE-OPER
IBM blade + IBM p7+	computing platform	IBM blade + IBM p7+
ALADIN (CY38T1 export)	model physics	
9,0km	horizontal resolution	
46	vertical levels	
ARPEGE	coupling model	
DFI	initialisation method	
CY38T1	climatologies	
3h	coupling frequency	
1h	output frequency	
00UTC, 12UTC	integration hours	
72,72	forecast range	
ATP	domains	
AROME (CY38T1 export)	model physics	AROME (CY38T1 export)
2,5km	horizontal resolution	2,5km
46	vertical levels	60
ARPEGE (10,0km)	coupling model	ARPEGE (10,0km)
No-DFI, no-DA	initialisation method	No-DFI, no-DA
CY38T1 (PT2, MAD), CY35T2 (AZO), CY40 (ARP LBC)	climatologies	CY38T1 (PT2, MAD), CY35T2 (AZO), CY40 (ARP LBC)
3h	coupling frequency	3h
1h	output frequency	1h (up to 48 hours)
00UTC, 12UTC	integration hours	00UTC, 06UTC, 12UTC, 18UTC
48, 48	forecast range	48, 30, 48, 30
PT2, MAD, AZO	domains	PT2, MAD, AZO
CANARI (CY38T1)	standalone surface analysis	OI_MAIN (CY38T1)
ALADIN-ATP	background	AROME-PT2
SYNOP	observations	SYNOP
	cycling	06 h

Time Line

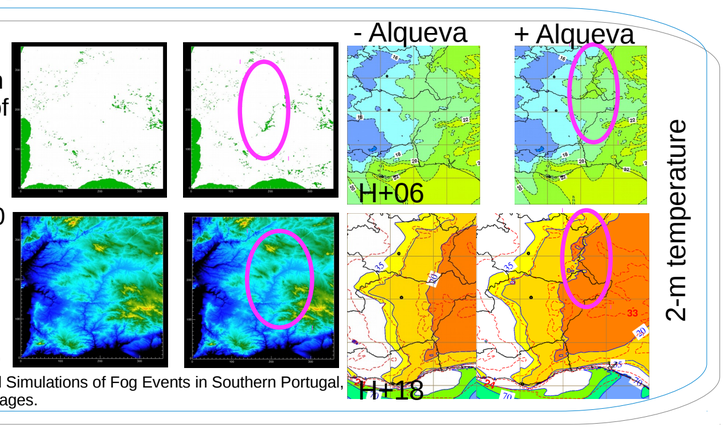
Apr 2000 Cycle 09
Jun 2000 Cycle 11T2 (CYCORA included)
Jul 2001 Cycle 12_bf02 (CYCORA_bis included)
Apr 2002 Time step change (540s to 600s)
Jun 2006 Cycle 28T3 (new geographical area and climatologies)
Jun 2007 Wind dynamical adaptation for 3 domains
Apr 2008 CANARI surface analysis fields (temp. & 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)
Apr 2015 Cycle 38T1 in all domains; direct coupling of AROME with ARPEGE
Jun 2015 10km resolution in ARPEGE coupling



3 Alqueva Lake physiography validation

(Sonia.assuncao@ipma.pt, maria.monteiro@ipma.pt, rsal@uevora.pt)

Alqueva is the biggest artificial lake in Europe, located in Southern Portugal. The representation of this lake can have an impact on the forecast of localized phenomena, has shown recently [3]. Alqueva physiography (top, central panels) has been introduced on ECOCLIMAP_II_v2.3 and the corresponding orography in GMTED2010_30 (botton, central panels). These changes are being validated by checking its impact on AROME-PT2 forecasts. Physical consistent impacts on screen level parameters during a Summer observations field campain were found.



[3] Policarpo, C., Salgado, R. and Costa, M.J. (2017): Numerical Simulations of Fog Events in Southern Portugal, Advances in Meteorology, Volume 2017, Article ID 1276784, 16 pages.

Foreseen activities

During 2017 the pre-operational suite should become operational. New ARPEGE dissemination facilities on the extension of the couplings range at 06 and 18 UTC should occur. Furthermore, the OI_MAIN cycling should be changed to 3 hours with an upgrade of BATOR to account with the newst WMO BUFR AMDAR templates and a new assimilation cycle with the 3D-Var scripting system should start, after the computation of a first B-matrix. New AROME post-processing fields should enter into operations to give support to other research projects, like New European Wind Atlas (NEWA). At the same time, the physiography of Alqueva Lake should enter in to operations. In parallel, the collaboration with AEMET should progress, on data assimilation and ensemble systems.

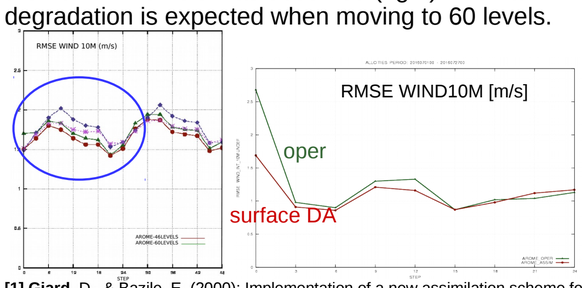
4 Data Assimilation activities

On the local Data Assimilation systems the CY38T1 has been used. Moreover, the new systems have been built as extensions of the actual operational SMS/Xcdp scripting environment. Collaboration with CHMI, OMSZ and AEMET was a key issue in these achievements. Further developments and validation is on-going.

Towards a DA system for AROME-PT2 (maria.monteiro@ipma.pt)

6-hour surface Data Assimilation system by OI_MAIN [1]

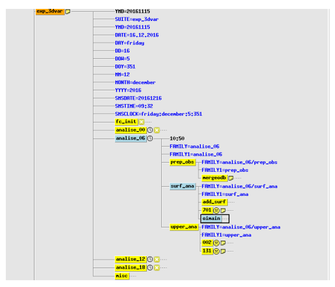
Impact of screen level parameters up to 24-hour forecast using oper as control was checked. An improvement on the 10-m wind field was observed (right) when a degradation is expected when moving to 60 levels.



[1] Giard, D., & Bazile, E. (2000): Implementation of a new assimilation scheme for soil and surface variables in a global NWP model. Monthly Weather Review, 128, 997-1015.

Local implementation of the LACE 3D-Var testbed

Minimization takes roughly the resources of a 6-hour forecast (1 proc); a 3-hour cycling should start during 2017.

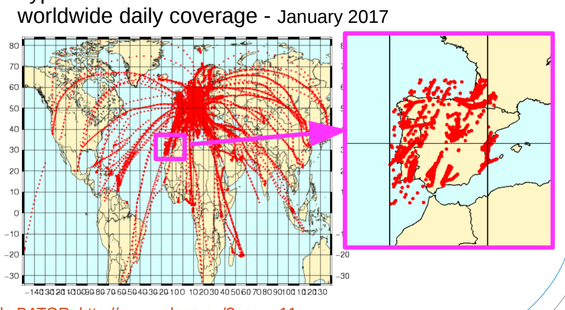


Iberian WMO BUFR conventional observation processing with BATOR

For the on-going local capacities building on processing WMO BUFR templates of SYNOP, TEMP and E-AMDAR observations, working methodologies by backphasing [5] BATOR or creating new subroutines (amdarWMO) [6] have been found in collaboration with OPLACE (CHMI).

336 (3-hour) Iberian SYNOP observations
2016.07.19 12UTC

Typical 311010 WMO BUFR formatted E-AMDAR worldwide daily coverage - January 2017



[5] **Monteiro**, M. (2016): Validation of a back-phased version of source code BATOR ,http://www.rclace.eu/?page=11
[6] **Monteiro**, M. (2017): Upgrade of the source code BATOR to WMO AMDAR template 311010v7,http://www.rclace.eu/?page=11

Scatterometer Assimilation with HARMONIE-AROME over south-western Europe (isabel.monteiro@ipma.pt)

Can scatterometer winds be used in DA for an improved estimate of the model initial state (for a domain over Iberia)? Many meteorological conditions over Portugal are generated in the Atlantic where observations are scarce. Observed winds are expected to contribute to a better model initial state. Scatterometers [2] provide a regular large spatial density of wind observations near the ocean surface. **This project was developed in the framework of IPMA/KNMI cooperation in scatterometry.**

"Stephanie storm": 6-day period 06-02-2014 to 11-02-2014

HARMONIE-AROME [4]: CY40H1.1
Domain: IBERIAxxm_2.5,
2.5 km grid size, 65 vertical levels
3D-Var: 8 times per day, 24-hour forecast
IFS/ECMWF boundaries

Experiment	Data Assimilated
Iberia_EXP0	Conventional (used as control)
Iberia_EXP1	No observations
Iberia_EXP2	Conventional+ ASCAT-coastal (MetOp-A and MetOp-B) with data thinning (default setting in HARMONIE)

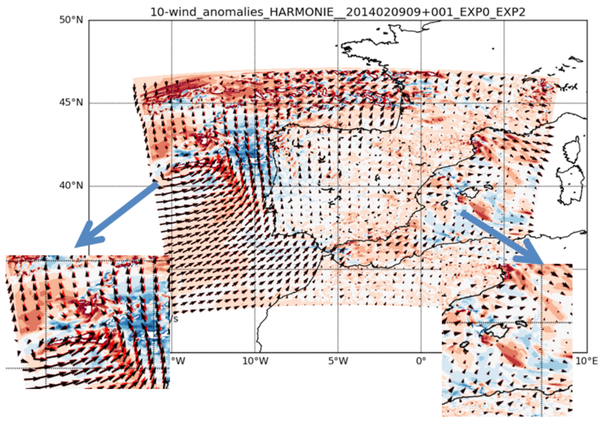


Figure 1. 10-m wind speed difference between Iberia_EXP0 and Iberia_Exp2 experiments in forecasts +1 h for 9 February 2014. Red (black) arrows wind vector Iberia_EXP0 (Iberia_EXP2).

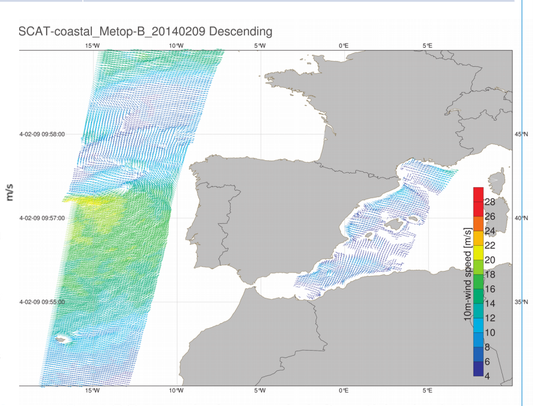


Figure 2. ASCAT winds used (after thinning) in Iberia_Exp2 experiment (analysis time of Fig.2).

bias and std dev for (o-a) smaller than for (o-b) as expected, this is true for all observing systems => the DA system works, no deterioration

[2] Bengtsson, L., U. Andrae, T. Aspelien, Y. Batrak, J. Calvo, W. de Rooy, E.Gleeson, B. Hansen-Sass, M. Homleid, M. Hortal, K. Ivarsson, G. Lenderink, S.Niemelä, K. Pagh Nielsen, J. Onvlee, L. Rontu, P. Samuelsson, D. Santos Muñoz, A. Subias, S. Tijm, V. Toll, X. Yang, and M. Ødegaard Køltzow (2017): The HARMONIE-AROME model configuration in the ALADIN-HIRLAM NWP system.Mon. Wea. Rev. doi:10.1175/MWR-D-16-0417.1, in press.
[4] Marseille Gert-Jan and Ad Stoffelen (2017): Toward Scatterometer Winds Assimilation in the Mesoscale HARMONIE Model. IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing PP(99):1-11 · January 2017

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