Limited Area Modelling Activities in Portugal

42nd EWGLAM/27th SRNWP meetings, 28 Sep - 02 Oct 2020

1 Summary

During 2019-2020 a few changes occurred on the local operational NWP systems (see Section 2): ALADIN system v40T1_bf07 has entered into operations for all the geographical domains and the scripting system was upgraded to cope with new workflow aspects; besides, the coupling files availability (including the geographical projection) was tailored to support IPMA-AEMET collaboration. With these upgrades, the hourly high-resolution (2,5km) Optimal Interpolation (OI) analysis of screen-level parameters – CANARI (Taileffeur, 2002) - having as background a short-term forecast from AROME-PT2, initialized by a surface Data Assimilation (DA) cycling (Giard and Bazile, 2000), was kept unchanged in operations. In the meantime, the actual IBM-P7+ machine as been considered obsolete to cope with the installation of new cycles, therefore the development associated to new cycles was moved to ECMWF HPC platforms. The following Portuguese NWP configurations of the ALADIN system v43T2 are now being tested, tuned and validated (PT2 domain, 2.5km, L60): AROME dynamical adaptation; AROME surface (OI_MAIN) Data Assimilation (DA); AROME combined (OI_MAIN+3D-Var) DA. The last two configurations work is being developed under the coordination of the ALADIN core programme "DA basic KIT" (DAsKIT) which was assumed by Portugal since 2018. Due to the natural geographical proximity and in the last couple of years, IPMA keeps a communication channel with AEMET, with Météo-France and also with KNMI (see Section 3). Further local team efforts have been put to support other research projects, internal requests (post-processing) and also ALADIN/SRNWP activities.

2 The Portuguese NWP system versions

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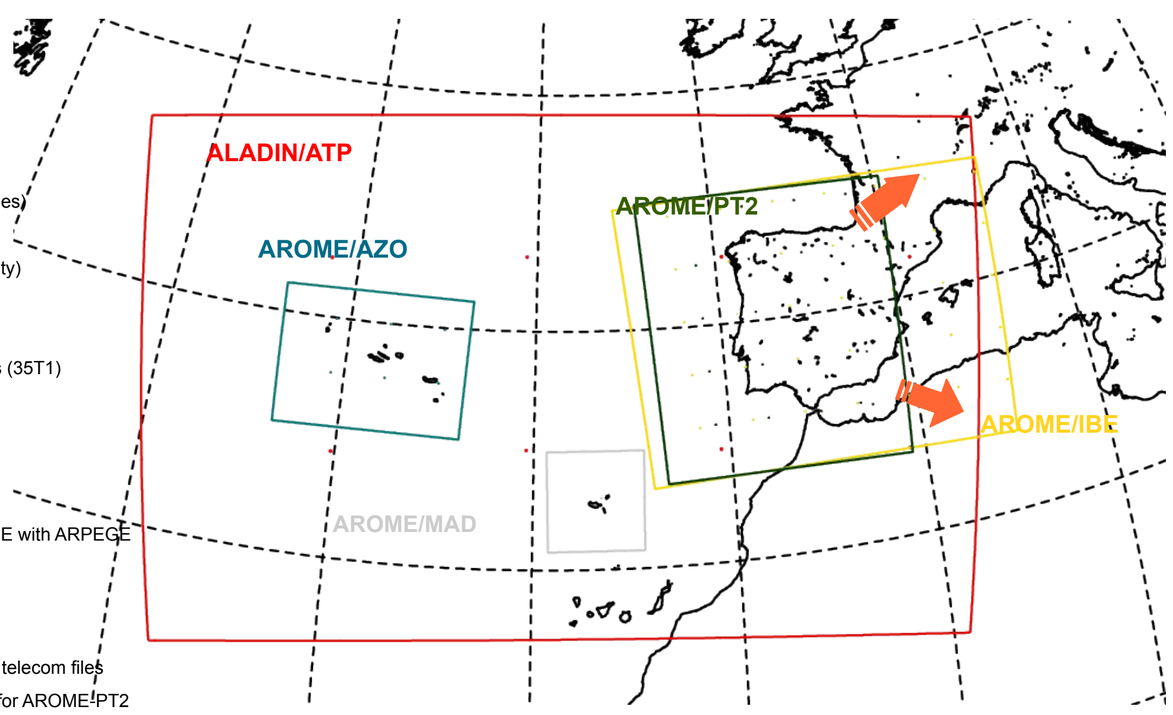
The Portuguese (SR)NWPean including the Portuguese Islands NWP is described according to its application: prognostic products - the integration of the AROME forecasting model, done for three domains Portuguese Mainland (PT2), Madeira (MAD) and Azores (AZO) Archipelagos (takes direct ARPEGE fields for its initialization); diagnostic products: hourly CANARI analysis for PT2 domain, having as first guess a short-term AROME forecast produced by a surface assimilation system.

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
Jul 2017 Increase on the number of levels in all domains
Jul 2017 Increase on the run frequency for PT2 domain
Dec 2017 SURFEX replaced ISBA in ARPEGE (CY42_op02) telecom files
Sep 2018 Hourly screen-level OI analysis from a surface DA for AROME-PT2
Nov 2019 New projection and geographical area of ARPEGE coupling files
Feb 2020 CY40T1_bf07 in all domains



OPER		DEVELOPMENT
IBM Blade + IBM-p7+	Computing platform	IBM Blade + IBM-p7+
AROME (CY40T1 export)	Model physics	AROME (CY43T2_bf10 export)
2,5km	Horizontal resolution	2,5km
60	Vertical levels	60
ARPEGE (10,0km)	Coupling model	ARPEGE (10,0km)
No-DFI, no-DA	Initialisation method	No-DFI
CY38T1 (PT2, MAD), CY35T2 (AZO), CY40 (ARP LBC)	climatologies	CY38T1 (PT2, MAD), CY35T2 (AZO), CY40 (ARP LBC)
3h	Coupling frequency	3h
00UTC, 06UTC, 12UTC, 18UTC	Integration hours	00UTC, 06UTC, 12UTC, 18UTC
48	Forecast range	48
PT2, MAD, AZO	domains	PT2, MAD, AZO
CANARI (CY38T1)	Standalone surface analysis	
AROME (OI_MAIN)	background	
Regional WMO BUFR SYNOP	observations	Regional WMO BUFR SYNOP
	Computing platform	ECMWF cca
	NWP configuration	AROME surface (OI_MAIN) DA (CY43T2)
	NWP configuration	AROME combined DA (OI_MAIN+3D-Var) (CY43T2)

Foreseen operational activities will include: porting and validation of AROME operational configurations to CY43T2_bf10 (export version); validation of new assimilation configuration following the step-by-step approach and plans of DAsKIT framework.

3 Actual development activities

Framework of AROME

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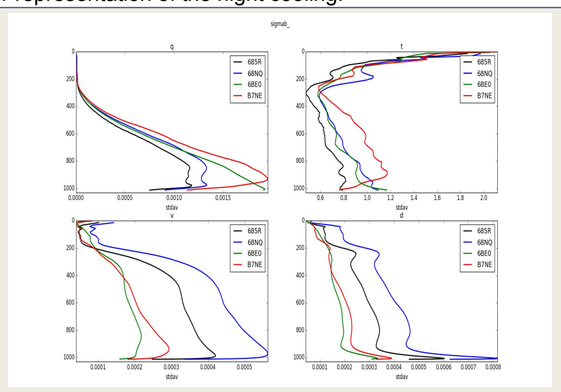
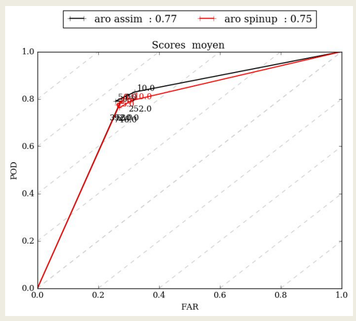
Towards a combined OI_MAIN+3D-Var solution for AROME/PT2 (cy43t2_bf10) at ECMWF computing platforms

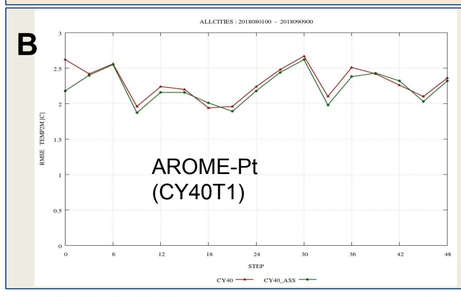
A combined solution of OI_MAIN + 3D-Var DA is being tuned and validated on the ECMWF computing platforms for AROME/PT2. In this section three different aspects of the work are illustrated: **A**. the feasibility study which was conducted at the reference environment of Météo-France, where Portuguese and Spanish OIFS HDF5 radar data was assimilated with conventional observations, showing a slightly positive impact; **B.** the impact studies of the AROME surface DA scheme at CY40T1_bf07, which was locally conducted under the framework of ALADIN DAsKIT programme; and **C.** the initial validation of CY43T2_bf10 (dynamical adaptation configuration), showing a better representation of the night cooling.

A



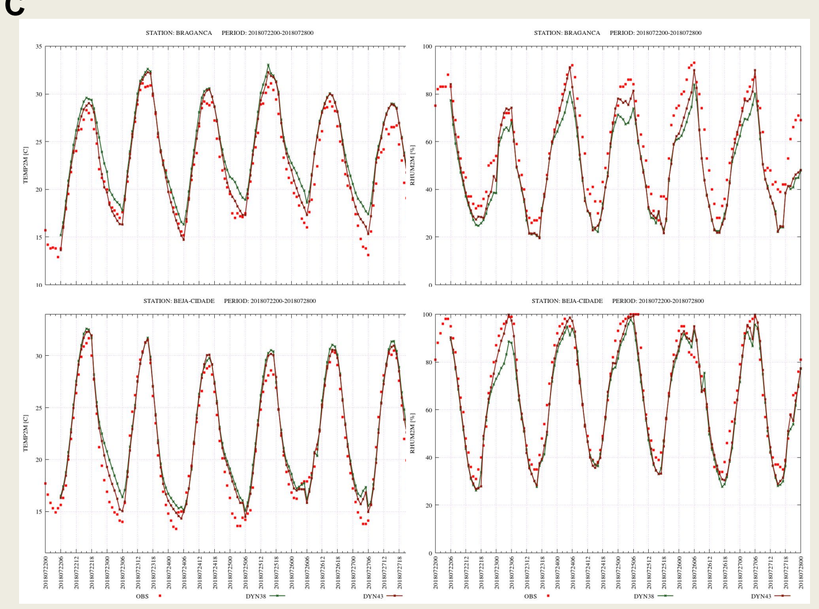


B

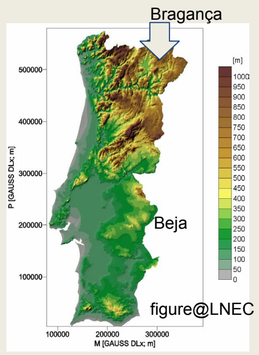


Preliminary validation over AROME/PT2 48-h forecast	SUMMER	WINTER
T2M	positive (specially at H+00)	positive up to H+12; negative afterwards
H2M	positive during day (H+00); negative during night(not shown)	positive (specially at H+00)

C



verification plots by joao.rio@ipma.pt



- - observations
- - oper (CY38)
- - dynAD (CY43)

Giard, ., & 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**; Taillefer, F. (2002),** CANARI (based on ARPEGE cycle CY25T1 for ALADIN),GMAP/CNRM Technical Documentation, MétéoFrance.

Framework of HARMONIE-AROME

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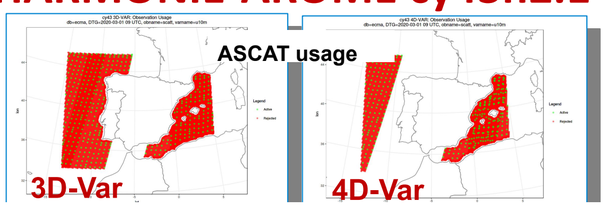
3D-Var/ 4D-Var tests HARMONIE-AROME cy43h2.1

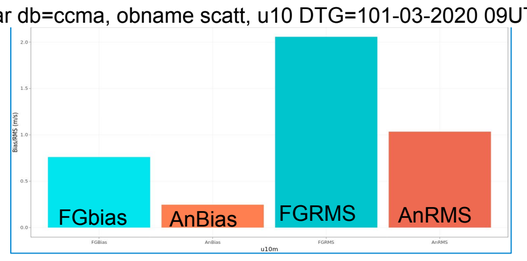
HARMONIE-AROME 43h2.1 implemented in the work environment is . It includes the latest 4D-Var developments.

- 65 vertical levels (model top 10 hPa);
- 2.5 km grid;
- LBC from ECMWF HRES 6 h lag.
- 8 cycles (every 3h)
- 3D-Var: 3h ass. window centred @ anal. time
- 4D-Var: 2loops, 2h ass. window/7sub-windows

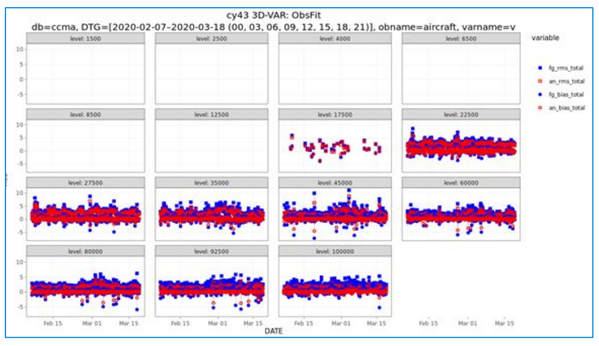
Details on the system implementation and specific documentation on code and tools can be found in https://hirlam.org/trac/wiki/HarmonieSystemDocumentation/43h2.1.

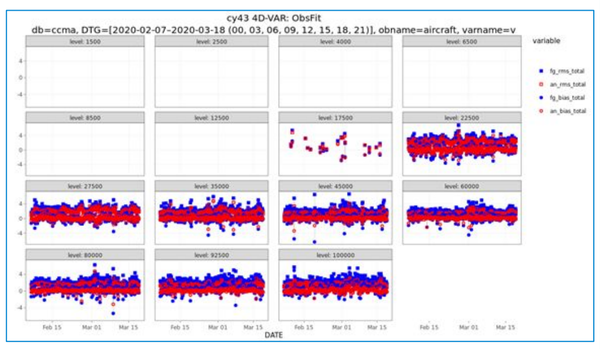


3D-Var db=ccma, obname scatt, u10 DTG=101-03-2020 09UTC



Tests were performed to check the use of observations in 3D-Var and 4D-Var (2 experiments conducted from 7 February to 18 March 2020). To assess if the assimilation system was well calibrated using HARMONIE-AROME post processing (obsmon).





Fit to AIREP and AMDAR observation data: First guess (blue) and analysis(red) root mean square error(squares) and bias (circles) meridional wind component; for 3D-Var configuration, left panel, and 4D-Var configuration, right panel. 20 days experiments from 7 February to 18 March 2020. Each individual plot refers to a pressure a level in Pa

MESOSCALE IMPROVED DATA ASSIMILATION OF SCATTEROMETER WINDS (MIDAS)

Main objectives:

- Assess the impact of scatterometer data assimilation in mesoscale NWP.
- Investigate strategies to take optimal benefit from denser space-time scatterometer wind observations in mesoscale data assimilation.
- Learn about the optimal spatial-temporal coverage of scatterometers data assimilation in mesoscale NWP.

More information about the project can be found at:
https://www.eumetsat.int/website/home/Data/ScienceActivities/ScienceStudies/MesoscaleImprovedDataAssimilationsofScatterometerwindsMIDAS/index.html?lang=EN

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