ALADIN – Portuguese Technical and Scientific Activities

28th ALADIN Workshop & HIRLAM All Staff Meeting 2018, 16-20 April 2018, Toulouse, France

IPMA
Instituto Português
do Mar e da Atmosfera

1 Summary

During 2017 a few changes occurred on the local operational NWP system: in July, the number of levels was increased in all domains and the frequency of daily runs was increased just for the Iberian domain AROME-PT2; in December, SURFEX replaced ISBA as the surface scheme in the coupling model ARPEGE (CY42T_op02) with impact on the local forecasts (see Section 2). More recently CY40T1_bf07 has been installed on the local IBM p7+ and a preliminary validation has taken place (see Section 3). Progress in the surface Data Assimilation with the OI_MAIN formalism [1] has brought a positive impact on the screen-level fields forecasts and a new hourly analysis of screen-level fields using CANARI is now available (see Section 4). In parallel, under the framework of a cooperation with NWP SAF, IPMA's satellites group has locally implemented HARMONIE-AROME on a new IBM p8 platform (see Workshop Presentation). Further local team efforts have been put to support other research projects, internal requests and also ALADIN/SRNWP activities.
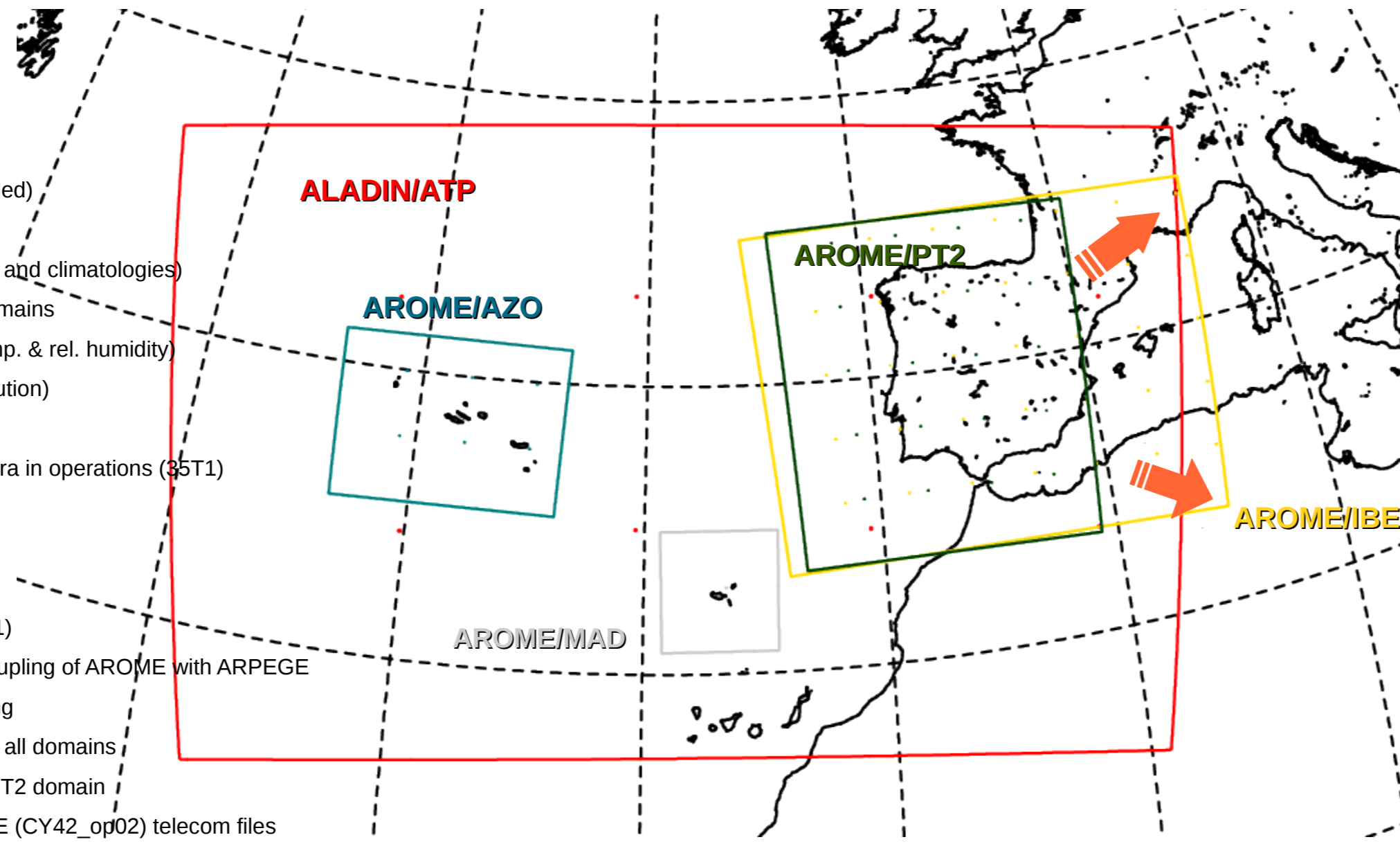
2 The Portuguese NWP system versions (vanda.costa@ipma.pt, manuel.lopes@ipma.pt, maria.monteiro@ipma.pt)

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.
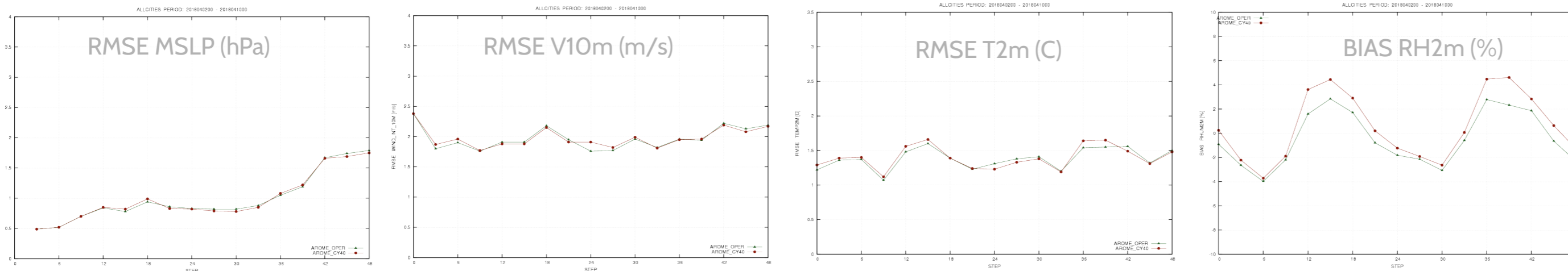
Time Line

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

	OPER		DEVELOPMENT
	IBM blade + IBM p7*	computing platform	**IBM blade + IBM p7***
	ALADIN-ATP domain (CY38T1 export)	model physics	**To be locally discontinued**
	9.0km, 46 levels, DFI, ARPEGE 3-hour coupling, 00/12UTC runs up to 72 hours	local version aspects	
	AROME (CY38T1 export)	model physics	**AROME (CY40T1_bf07 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, DA (3-hour OI_MAIN)
	CY38T1 (PT2, MAD), CY35T2 (AZO), CY40 (ARP LBC)	climatologies	**CY38T1 (PT2, with Alqueva lake physiography), CY40 (ARP LBC)**
	3h	coupling frequency	3h
	00UTC, 06UTC, 12UTC, 18UTC	integration hours	12UTC
	48, 30/48, 48, 30/48	forecast range	48
	PT2, MAD, AZO	domains	PT2
	CANARI (CY38T1)	standalone surface analysis	**CANARI (CY38T1)**
	ALADIN-ATP	background	AROME-PT2 (OI_MAIN)
	Regional WMO BUFR SYNOP	observations	Regional WMO BUFR SYNOP

3 AROME Model activities (maria.monteiro@ipma.pt, joao.rio@ipma.pt)

Validation of CY40T1_bf07

RMSE MSLP (hPa)   RMSE V10m (m/s)   RMSE T2m (C)   BIAS RH2m (%)

A preliminary 9-days validation of CY40T1_bf07 for AROME-PT2 version during the Spring period of 2-10 April this year has just taken place. Panels on the left side show the main scores against ~110 surface stations for the surface parameters: 2-metre temperature (T2m) and relative humidity (R2m), 10-metre wind (W10m) and mean-sea level pressure (MSLP). Overall, the impact of the new cycle seems to be neutral; a detailed analysis shows that R2M/T2M error bias follows more closely the diurnal cycle than with CY38T1 over this domain.

4 Data Assimilation activities

The new local DA system was implemented in AROME-PT2 and has been built as extensions of the actual local operational SMS/Xcdp scripting environment. On the local Data Assimilation system the CY38T1 has been used. Collaboration with RC-LACE [1] countries and AEMET was a key issue in these achievements. Further developments and validation is on-going. Foreesen steps will include the implementation of a full CANARI/OI_MAIN + 3D-Var assimilation scheme, taking advantage of recent develpments on upper-air pre-processing achievements [2,3] and on the ALADIN Core Programme for the establishement of a Data Assimilation basic KIT.

Towards a DA system for AROME-PT2: tailor-made surface DA and surface hourly analysis (maria.monteiro@ipma.pt)

OI_MAIN Surface DA (Giard & Bazile, 2000) + OI hourly analysis (Taillefeur, 2000)

Along 2017, the local surface DA cycling suffered two important upgrades giving rise to a positive impact on the screen level parameters forecasts (see right side top panel): decrease of the cycling period, from 6- to 3-hour; 6-hour change of SST. The added value of OI_MAIN join with the cheap computational coast made its forecasts ideal as background to a standalone CANARI (OI) hourly analysis of screen level parameters which was validated with added value over the locally available products (see right side bottom panel)i. Therefore, the new analyses are being used for agricultural as well as fire prevenction purposes (see full scheme on the panel below).

> AROME-PT2 (CY38T1, 46Lev.)

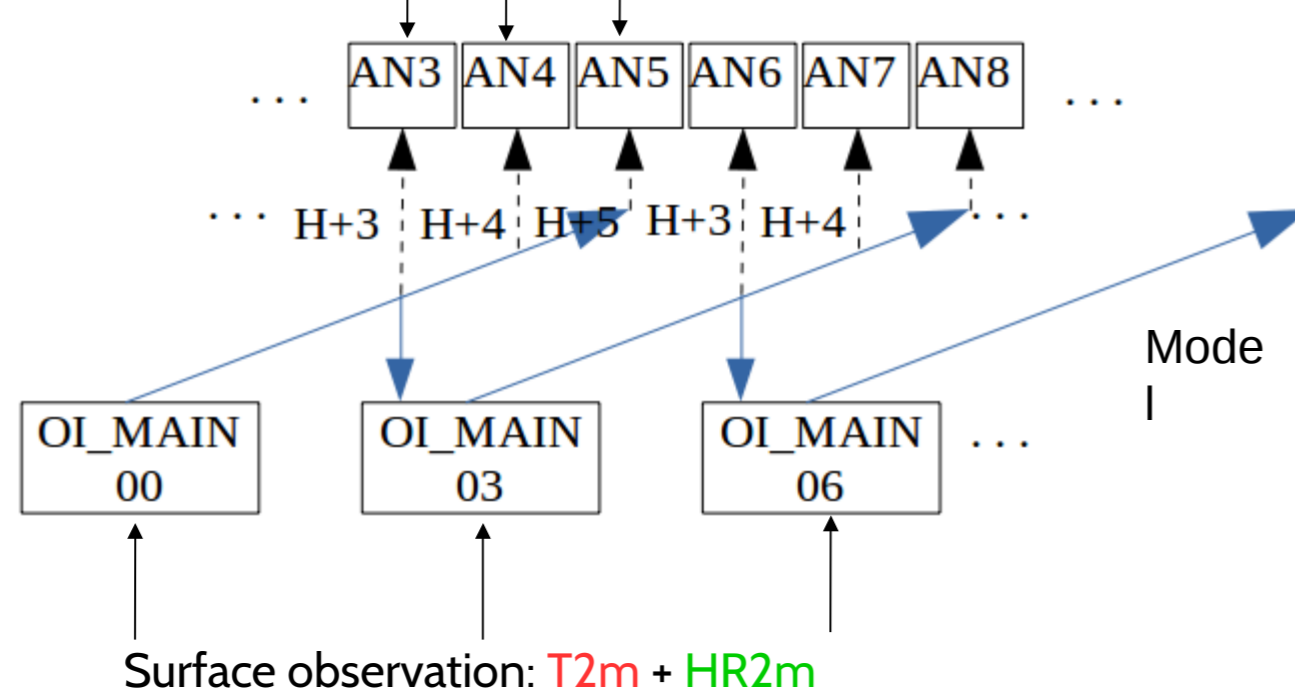> 1-hour regional sharing WMO BUFR SYNOP

> home-made pre-processing (emoslib, ECMWF):
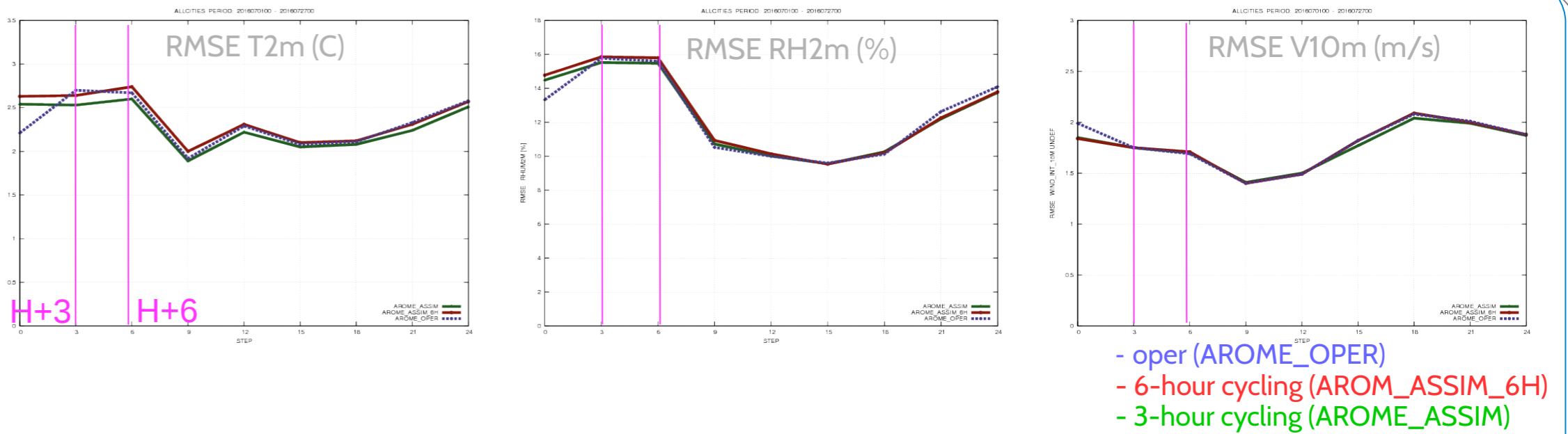. retards & ammends,
. duplicates,
. choose WMO IDs overlaps between Portugal and Spain (922, 912, 927, 960 at least)
. Rem. obs records with ambiguos metadata.

> SST update each 6-hour

Surface observation: T2m + HR2m + V10m

AN3 AN4 AN5 AN6 AN7 AN8

H+3 H+4 H+5 H+3 H+4

OI_MAIN 00   OI_MAIN 03   OI_MAIN 06 ...   Model

Surface observation: T2m + HR2m

24-hour forecast OI_MAIN validation for a Summer period: 20160701 – 20160727 (00UTC network)

RMSE T2m (C)   RMSE RH2m (%)   RMSE V10m (m/s)

H+3   H+6

- oper (AROME_OPER)
- 6-hour cycling (AROM_ASSIM_6H)
- 3-hour cycling (AROME_ASSIM)

Hourly CANARI-AROME validation (00UTC network): Summer (20170801 – 20170815) Winter (20170110 – 20170207)

Table - RMSE and BIAS of screen level parameters analysis over Mainland for Portugal CAN-ARO and CAN-ALA vs. ARO-OP initial fields

| | T2M | | H2M | | V10M | |
EXP	RMSE (C)	BIAS (C)	RMSE (%)	BIAS (%)	RMSE (m/s)	BIAS (m/s)
CAN-ARO(Summer)	1.52	0.18	8.86	-0.70	1.37	0.18
CAN-ARO(Winter)	1.63	-0.01	8.58	-1.36	1.35	0.03
CAN-ALA(Summer)	1.78	0.43	10.95	-0.76	2.18	0.92
CAN-ALA(Winter)	1.85	-0.09	10.66	-0.72	2.25	0.82
ARO-OP (Summer)	2.07	0.90	11.79	-4.69	2.50	1.63
ARO-OP (Winter)	2.06	0.27	12.69	-5.26	2.16	1.24

Conclusions: CAN-ARO is closer to observations than any other local product at 00UTC and 12UTC;
daily analysis monitoring shows the results are consistent at any hour of the day.

[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; [2] Taillefer, F. (2002), CANARI (based on ARPEGE cycle CY25T1 for ALADIN),GMAP/CNRM Technical Documentation, MétéoFrance, Toulouse, France; [3]Assunção, S., Monteiro, M., Salgado, R. (2017), Impact of the Introduction of Alqueva Dam in the AROME Forecasting Model. Proceedings 10th Simpósio de Meteorologia e Geofísica Proceedings 10°. Simpósio de Meteorologia e Geofísica.
[4] Monteiro, M. (2016): Validation of a back-phased version of source code BATOR ,http://www.rclace.eu/?page=11
[5] Monteiro, M. (2017): Upgrade of the source code BATOR to WMO AMDAR template 311010v7,http://www.rclace.eu/?page=11
[6] Monteiro, M. (2018): CPDA1.3 - implementation and validation of BATOR: SHIP&BUOY