Limited Area Modelling Activities in Portugal

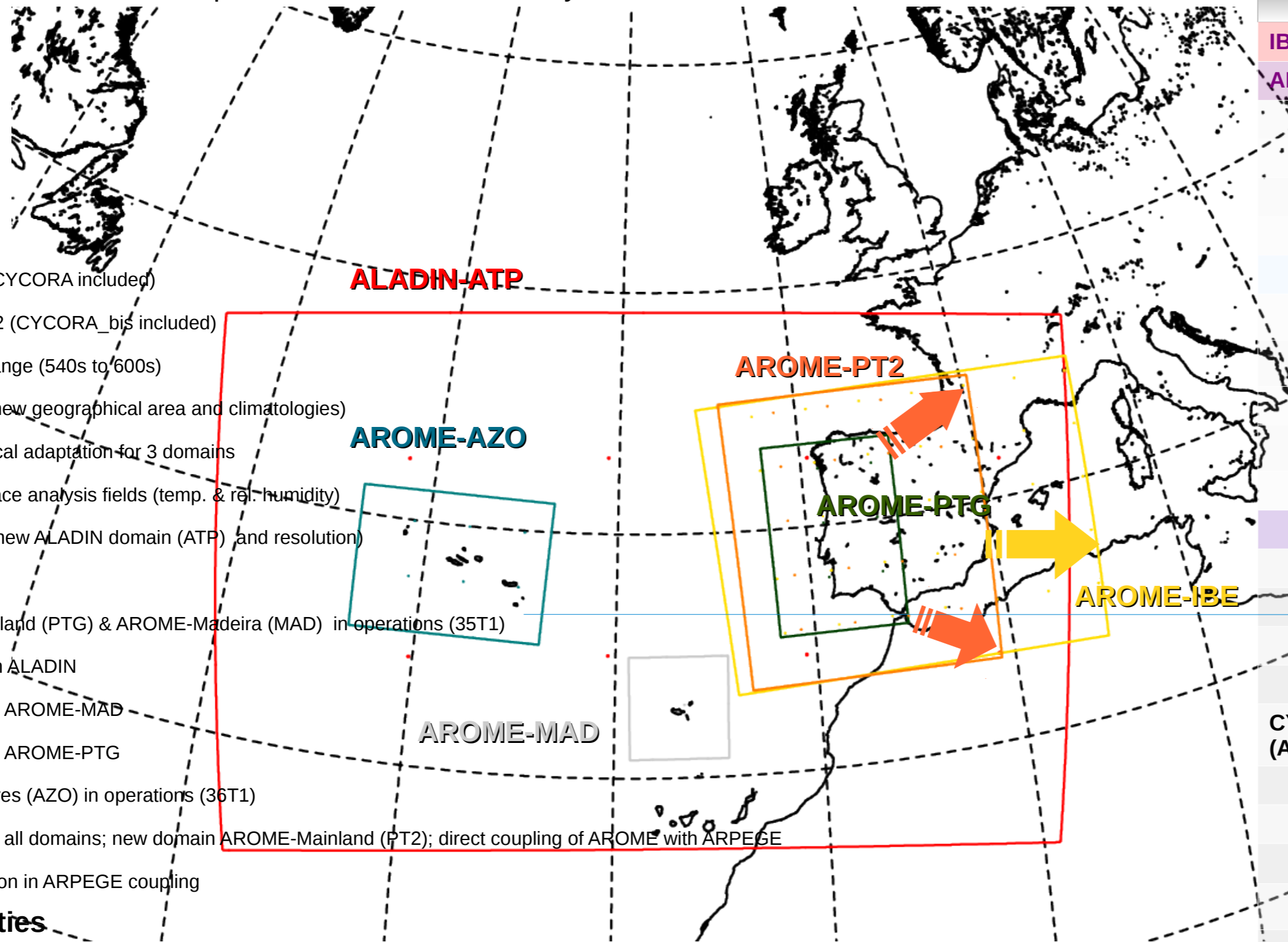### 38th EWGLAM/23nd SRNWP meetings, 03-06/10/2016, Rome, Italy

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Summary

During 2016 there were no changes on the local operational NWP system (see section 2). Main developments occurred as a follow up of new 2015 resources: the availability of a new HPC system (the IBM p7+ with 9 nodes) and of new requirements for the ARPEGE dissemination (the increase of the model number of levels, enlargement of the geographical area and the increase on the frequency daily runs). The update of the ARPEGE dissemination has given rise to the implementation of a new suite where the local version of AROME (CY38T1) is running 4 times a day with 60 levels; this suite is now in pre-operational mode and some scores are shown here (see section 3). Following the implementation of an off-line version of the OI_MAIN methodology for the geographical domain of AROME-PT2, a 6-hour surface data assimilation system is now running over an historical period (see section 4). The analysis of the former were validated on a winter period by checking the impact on the computation of a local version of the Canadian Fire Weather Index (FWI); the later is being used to validate of the surface data assimilation cycling through the analysis of the 24-hour forecast. In both systems a back-phased version of BATOR code, compliant with WMO BUFR template is in use. Meanwhile, new procedures are taking place in order to upgrade the HPC machine. At the same time, and as a consequence of the recent organization of the 2016 ALADIN workshop and HIRLAM All Staff Meeting in Lisbon, new research groups have shown interest to participate on the local NWP activities.

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The Portuguese NWP system versions (vanda.costa@ipma.pt, manuel.lopes@ipma.pt, maria.monteiro@ipma.pt)

The Portuguese 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 (ALADIN-ATP) runs over a domain which covers the Portuguese mainland and the adjacent Atlantic Ocean including the Portuguese Islands, at 9km of horizontal resolution. The integration of the AROME forecasting model is done for three domains of Portuguese Mainland (AROME-PT2), Madeira (AROME-MAD) and Azores (AROME-AZO) Archipelagos. On the new system the ALADIN model does not provides initial and boundary conditions to model AROME.

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 ALADIN domain (ATP) and resolution)
- Out 2009 Cycle 35T1
- Jan 2010 AROME-Mainland (PTG) & AROME-Madeira (MAD) in operations (35T1)
- Dec 2010 Cycle 36T1 in ALADIN
- Jun 2011 Cycle 36T1 in AROME-MAD
- Out 2011 Cycle 36T1 in AROME-PTG
- Dez 2011 AROME-Azores (AZO) in operations (36T1)
- Abr 2015 Cycle 38T1 in all domains; new domain AROME-Mainland (PT2); direct coupling of AROME with ARPEGE
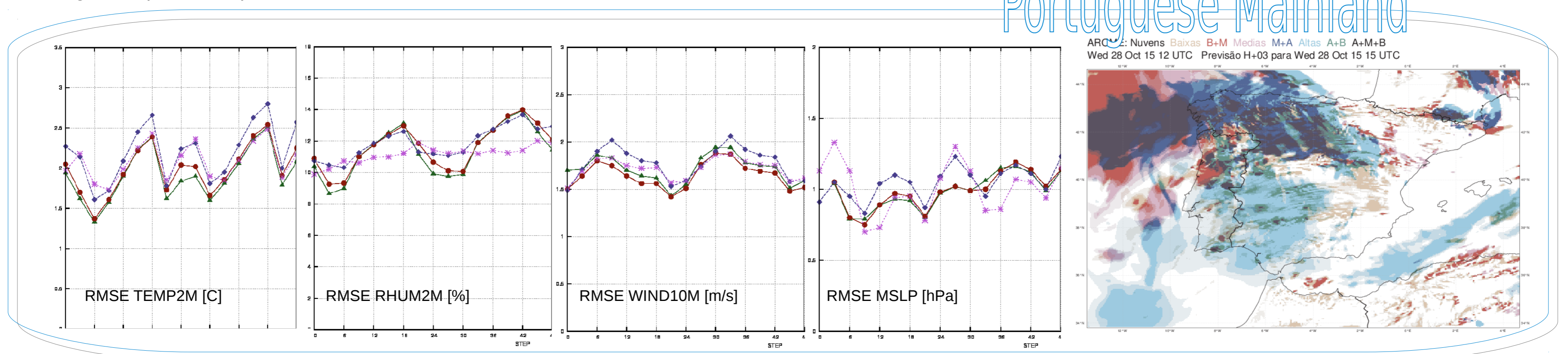- Jun 2015 10km resolution in ARPEGE coupling

Foreseen activities

During 2016, the actual pre-operational model version should enter into operations. Already during 2017, a new version of the code should be implemented locally following the expected upgrade of the HPC structure. On the assimilation side, the local implementation of a 3D-Var system should take place as well as a full validation of the actual surface data assimilation system. At the same time, a new HARMONIE/AROME-PT2 experiment at ECMWF using the 3 Portuguese radars under OPERA (with the "BALTRAD" pre-processing) should be validated. Finally, the impact of the physiography of Alqueva Lake in AROME-PT2 forecasts should be assessed and the information on this lake should enter into ecoclimap to be used in operations.

OPER		computing platform	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		

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Validation of a new operational model system design (joao.rio@ipma.pt, vanda.costa@ipma.pt)

To validate the impact of increasing the number of levels from 46 to 60 on the local version of AROME, a statistical study has been performed over the 48-hour forecasts of the 12UTC runs during a 3-month summer-fall period (20150807-20151004). Screen level as well as accumulated precipitation fields were examined using 110 Portuguese synoptic stations. The 60-level model version has been run over the Iberian Peninsula, the domain AROME-IBE. The 46-level version was integrated over the smaller operational domain, the AROME-PT2. The panels illustrate the RMSE for AROME-IBE (60 levels, in green) and AROME-PT2 (46 levels, in red); other forecasts were used as reference. Although the slight degradation on the wind, a general positive impact has been found for the 60-level model version.

RMSE TEMP2M [C] — RMSE RHUM2M [%] — RMSE WIND10M [m/s] — RMSE MSLP [hPa]

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Local developments (maria.monteiro@ipma.pt, lourdes.bugalho@ipma.pt)

A new off-line 6-hour cycling OI_MAIN system is running on a daily basis since Feb 2016 using AROME-PT2 model as background (with screen level parameters assimilation) to provide the analysis used to compute the local FWI. This analysis has been validated for a winter-spring period showing an adjustment of the screen level fields at the observation points (see left panels, in blue). Further progress was directed to the implementation of a surface data assimilation system which is running for an historical Summer period. The 24-hour forecast performance is being assessed to validate the 00UTC (and 12UTC, not shown) analysis; the model version corresponds to the actual operational AROME-PT2 at 46 levels; CY38T1 is used. In order to take advantage of the operational surface observations network over the Iberian Peninsula, a neighboord exchange of real-time SYNOP data under WMO BUFR template is being experienced with AEMET (see middle panel) and a back-phased version of BATOR was implemented. In the preliminary scores illustration (see right panels, in red), the operational dynamical adaptation model version is used as reference (in green). It shows that the new system has (still) configuration problems. As a side effect, however, we see a positive impact on the 10-meter wind, resulting from the introduction of small scales information during the initialization process.

Iberian SYNOP observations (under WMO BUFR) 20160719 12 UTC

RMSE TEMP2M [C] — RMSE RHUM2M [%] — RMSE WIND10M [m/s]