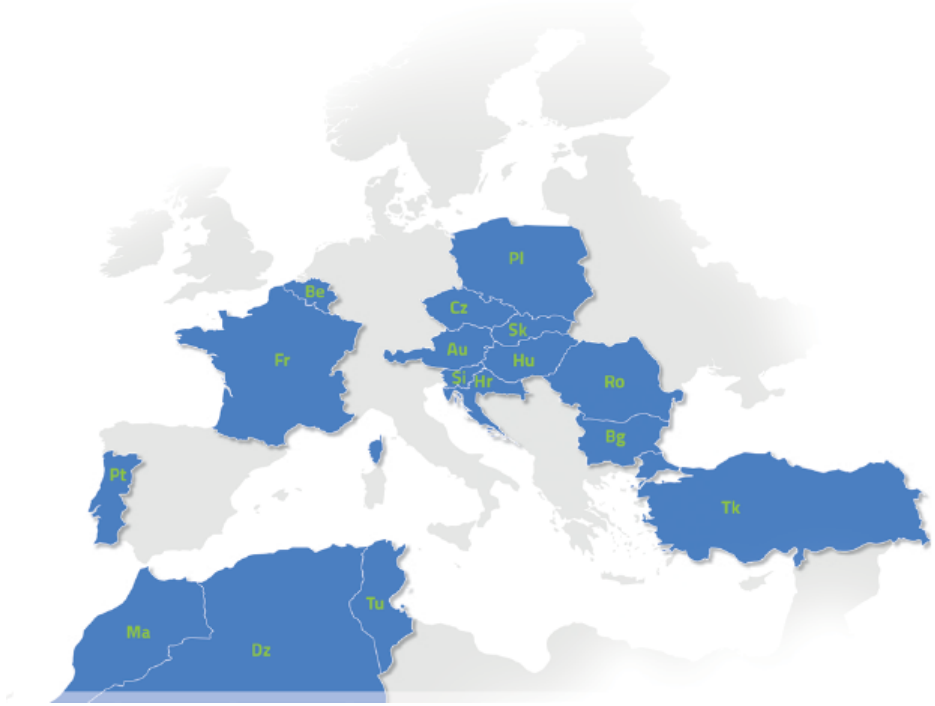
ALADIN status review

http://www.cnrm.meteo.fr/aladin/

EWGLAM meeting, 2017, 2-5 October 22017, ECMWF

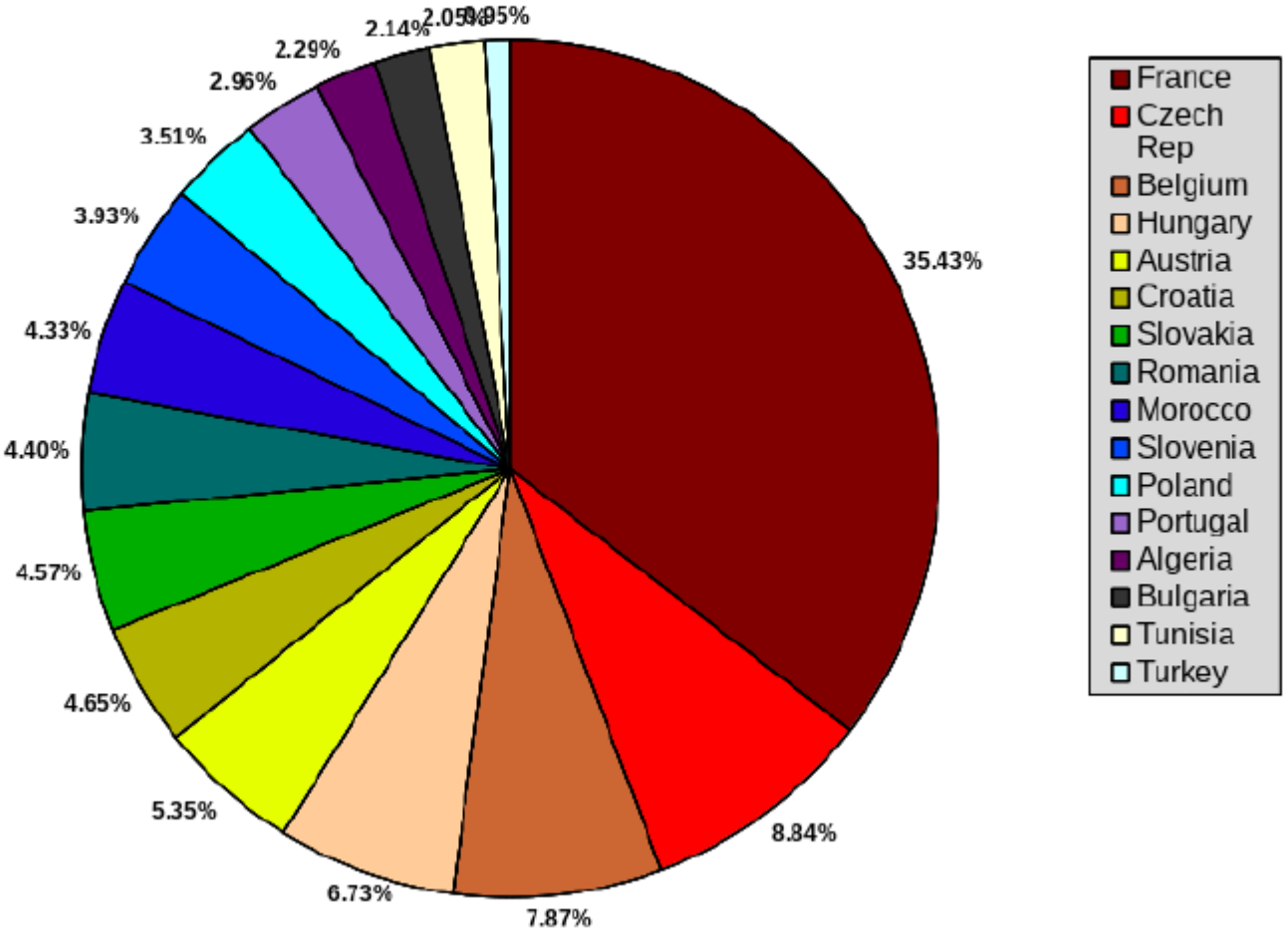
The ALADIN Partners



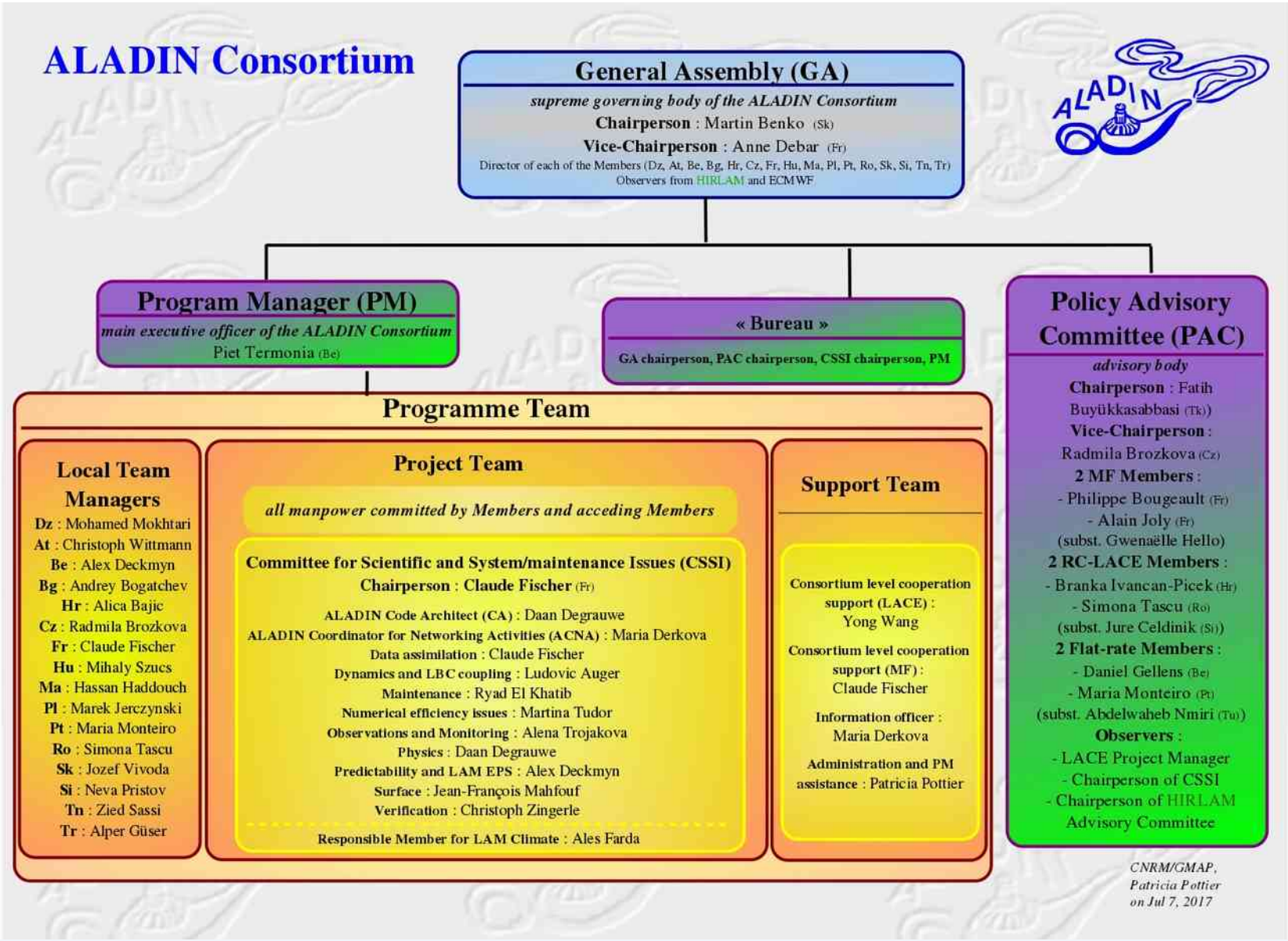
- 16 Partners
- ~ 90 FTE/year
- Shared code: ECMWF, HIRLAM

Participation in the ALADIN project since 1991

Breakdown of the person.months by country



Current ALADIN governance



The operational configurations of the ALADIN System

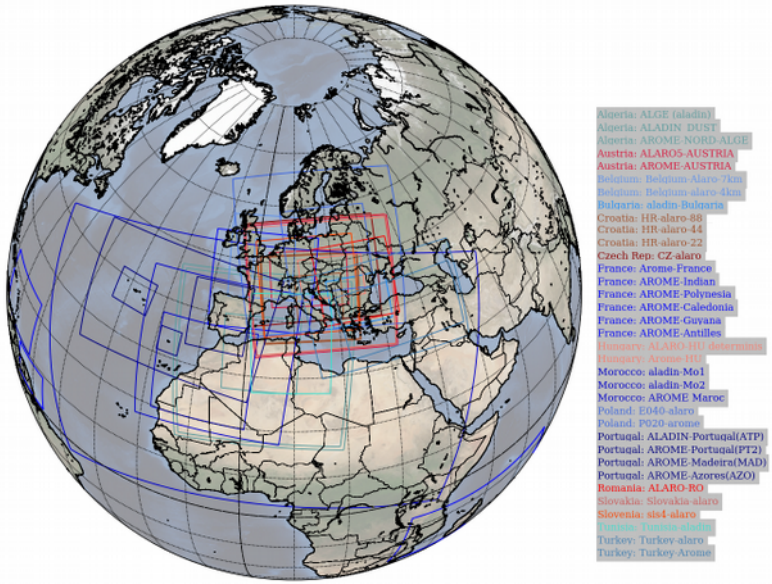
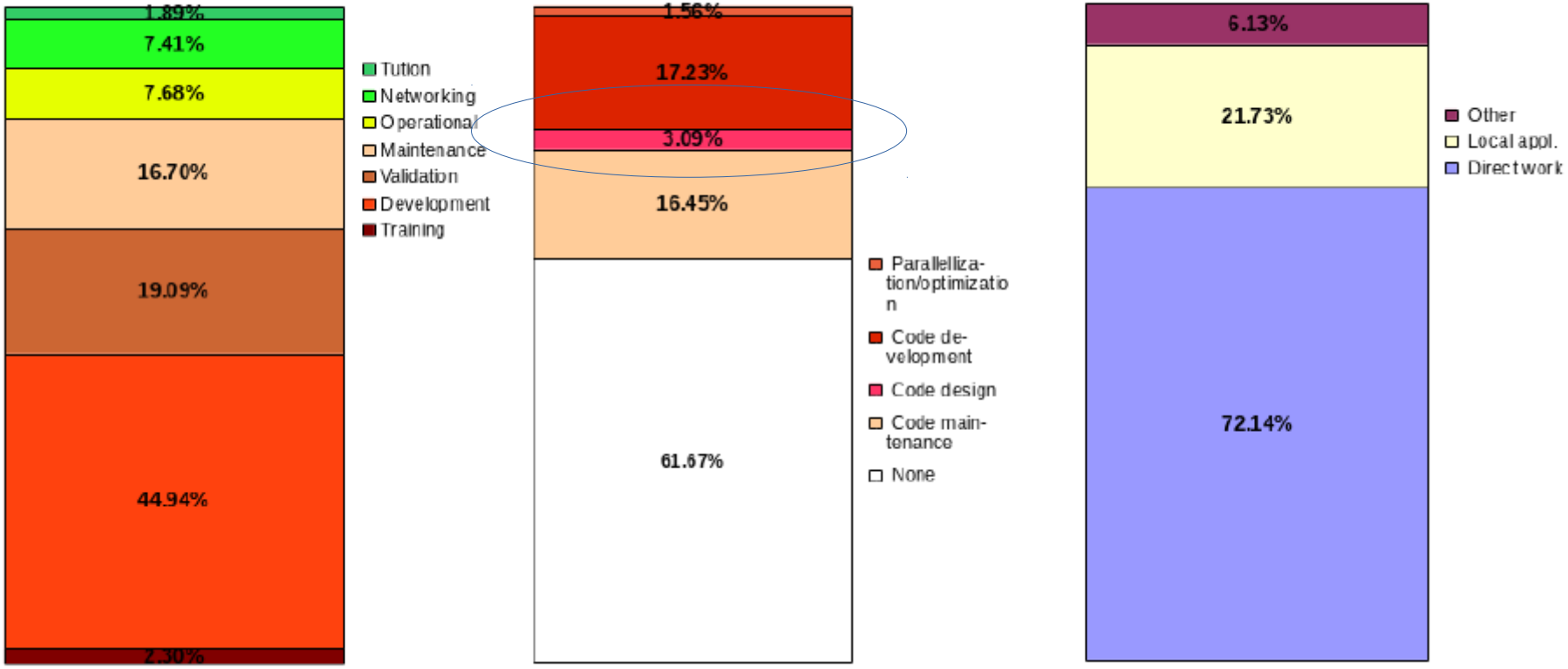


Table 4. The current configurations of the ALADIN System running in the ALADIN partner countries, with their nationally-used name, horizontal resolution (HRES), domain size, number of vertical levels (NLEV), Version of the ALADIN System, coupling model and the used configuration (ALADIN, ALARO, AROME).

Partner	Oper. Model	HRES	Domain size	NLEV	Model version	Coupled with	Configuration
Algeria	ALADIN-ALGE	8.00	450x450	70	CY40T1	ARPEGE	ALADIN
Algeria	ALADIN-DUST	14.00	250x250	70	CY38T1	ARPEGE	ALADIN
Algeria	AROME-NORD-ALGE	3.00	500x500	41	CY40T1	ALADIN-ALGE	AROME
Austria	ALARO5-AUSTRIA	4.82	540x600	60	CY36T1	IFS	ALARO
Austria	AROME-AUSTRIA	2.50	432x600	90	CY40T1	IFS	AROME
Belgium	Belgium-Alaro-7km	6.97	240x240	46	CY38T1	ARPEGE	ALARO
Belgium	Belgium-alaro-4km	4.01	181x181	46	CY38T1	ARPEGE	ALARO
Bulgaria	aladin-Bulgaria	7.00	144x180	70	CY38T1	ARPEGE	ALADIN
Croatia	HR-alaro-88	8.00	216x240	37	CY38T1	IFS	ALARO
Croatia	HR-alaro-44	4.00	432x480	73	CY38T1	IFS	ALARO
Croatia	HR-alaro-22	2.00	450x450	37	CY36T1	HR-alaro-88	ALARO
Croatia	HR-alaro-HRDA	2.00	450x450	15	CY38T1	HR-alaro-88	ALARO
Czech Rep	CZ-alaro	4.71	432x540	87	CY38T1	ARPEGE	ALARO
France	Arome-France	1.30	1440x1536	90	CY41T1	ARPEGE	AROME
France	AROME-Indean Ocean	2.50	900x1600	90	CY41T1	IFS	AROME
France	AROME-Polynesia	2.50	600x600	90	CY41T1	IFS	AROME
France	AROME-Caledonia	2.50	600x600	90	CY41T1	IFS	AROME
France	AROME-Guyana	2.50	384x500	90	CY41T1	IFS	AROME
France	AROME-Caribbean	2.50	576x720	90	CY41T1	IFS	AROME
Hungary	ALARO-HU determinis	7.96	320x360	49	CY38T1	IFS	ALARO
Hungary	Arome-HU	2.50	320x500	60	CY38T1	IFS	AROME
Morocco	Aladin-NORAF	18.00	324x540	70	CY41T1	ARPEGE	ALADIN
Morocco	ALADIN Maroc	7.50	400x400	70	CY41T1	ARPEGE	ALADIN
Morocco	ALADIN Ma 3DVar	10.00	320X320	60	CY36T1	ARPEGE	AROME
Morocco	AROME Maroc	2.50	800x800	60	CY41T1	ALADIN Ma 3DVar	AROME
Poland	E040-alaro	4.00	800x800	60	CY40T1	ARPEGE	ALARO
Poland	P020-arome	2.04	810x810	60	CY40T1	E040-alaro	AROME
Portugal	ALADIN-Portugal(ATP)	9.00	288x450	46	CY38T1	ARPEGE	ALADIN
Portugal	AROME-Portugal(PT2)	2.50	540x480	46	CY38T1	ARPEGE	AROME
Portugal	AROME-Madeira(MAD)	2.50	200x192	46	CY38T1	ARPEGE	AROME
Portugal	AROME-Azores(AZO)	2.50	270x360	46	CY38T1	ARPEGE	AROME
Romania	ALARO-RO	6.50	240x240	60	CY40T1	ARPEGE	ALARO
Slovakia	Slovakia-alaro	4.50	576x625	63	CY36T1	ARPEGE	ALARO
Slovenia	sis4-alaro	4.40	432x432	87	CY38T1	IFS	ALARO
Tunisia	Tunisia-ALADIN	7.50	216x270	70	CY38T1	ARPEGE	ALADIN
Turkey	Turkey-alaro	4.50	450x720	60	CY38T1	ARPEGE	ALARO
Turkey	Turkey-Arome	2.50	512x1000	60	CY38T1	ARPEGE	AROME

Breakdown of the ALADIN effort Jan. 2012 – Dec. 2016



The ALADIN System and its "Canonical" Model Configurations

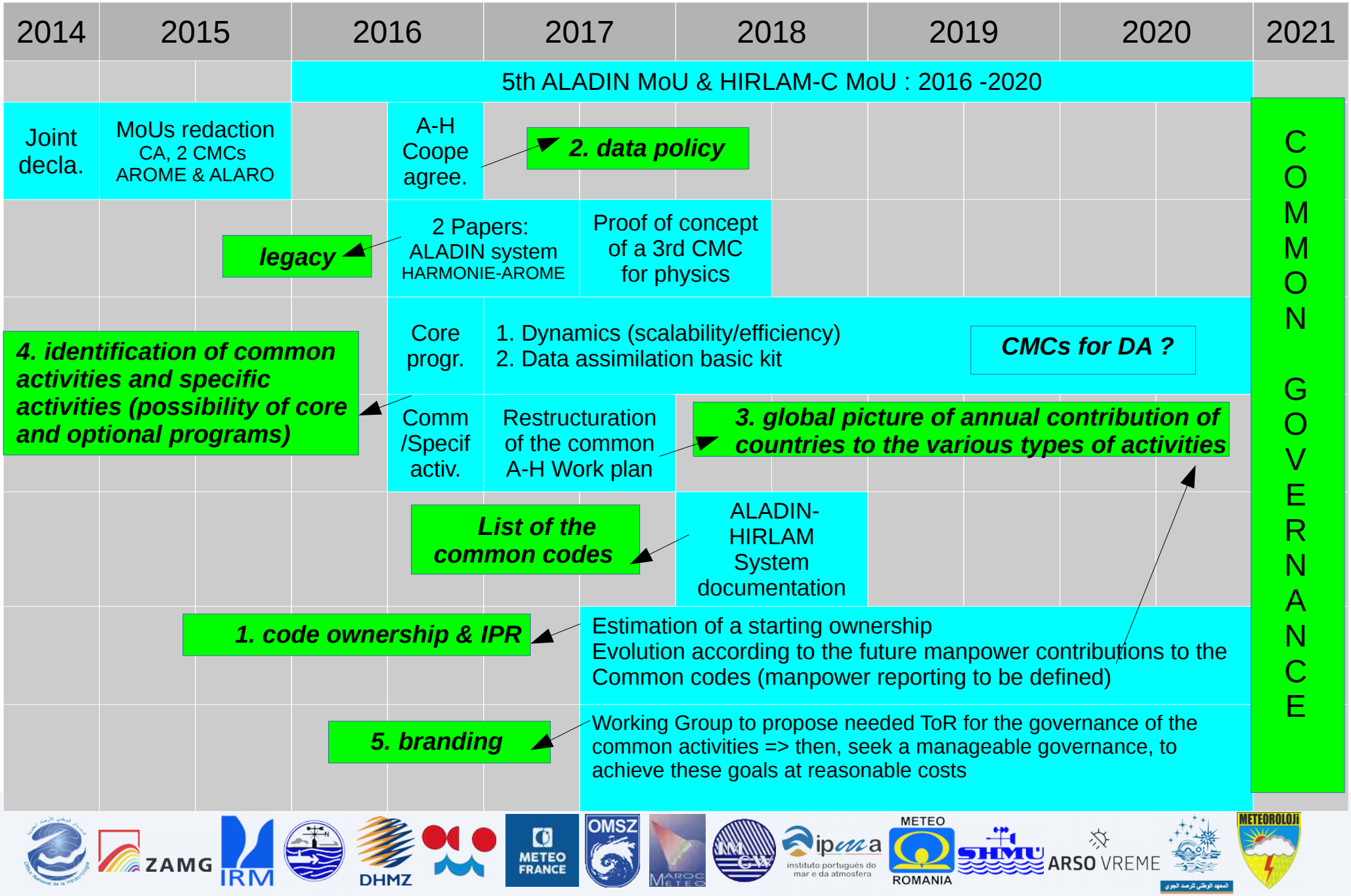
- No major problem with porting of CY40t1bf05_ export today. Status on 04/04/2017:
- 2 Partners have no no plans for CY40t1
- 7 Partners are running operationally

countries		Oct2015	Apr2016	Oct2016	Mar2016
Algeria	ALADIN	no	ported	ported	operational
Austria	ALARO	ported	e-suite	operational	operational
	AROME				
Belgium	ALARO	ported	ported	e-suite	e-suite
Bulgaria	ALADIN	ported	ported	e-suite CY41	e-suite CY41
Croatia	ALARO	no (but CY41)			
Czech R.	ALARO	not planned (HPC upgrade 2017)			
France	AROME	operational	operational	operational	operational
Hungary	ALARO	no	ported	ported	e-suite
	AROME				
Morocco	ALADIN	ported	ported	ported	
	AROME				
Poland	ALARO	operational	operational	operational	operational
	AROME				
Portugal	ALADIN	not planned (HPC upgrade 2017)			
	AROME				
Romania	ALARO	ported	operational	operational	operational
Slovakia	ALARO	ported	ported	operational	operational
Slovenia	ALARO	no	no	ported	e-suite
Tunisia	ALADIN	no	ported	ported	ported
Turkey	ALARO	ported	ported	operational	operational
	AROME	not planned (HPC upgrade 2017)			
ported/operational		**10/2**	**13/3**	**14/6(2)**	**14/7(5)**

New ALADIN-HIRLAM agreement signed in December 2017

- The shared ALADIN-HIRLAM system
- Built around the notion of Canonical Model Configurations (CMCs)
- A Canonical Model Configuration is a configuration of the shared ALADIN-HIRLAM System for which resources are provided by the ALADIN or HIRLAM Members in order to perform regular code updates. This includes the required scientific and technical validation according to the state of the art of the latest research and development results/practices.
- ALADIN-baseline, AROME, ALARO , HARMONIE-AROME

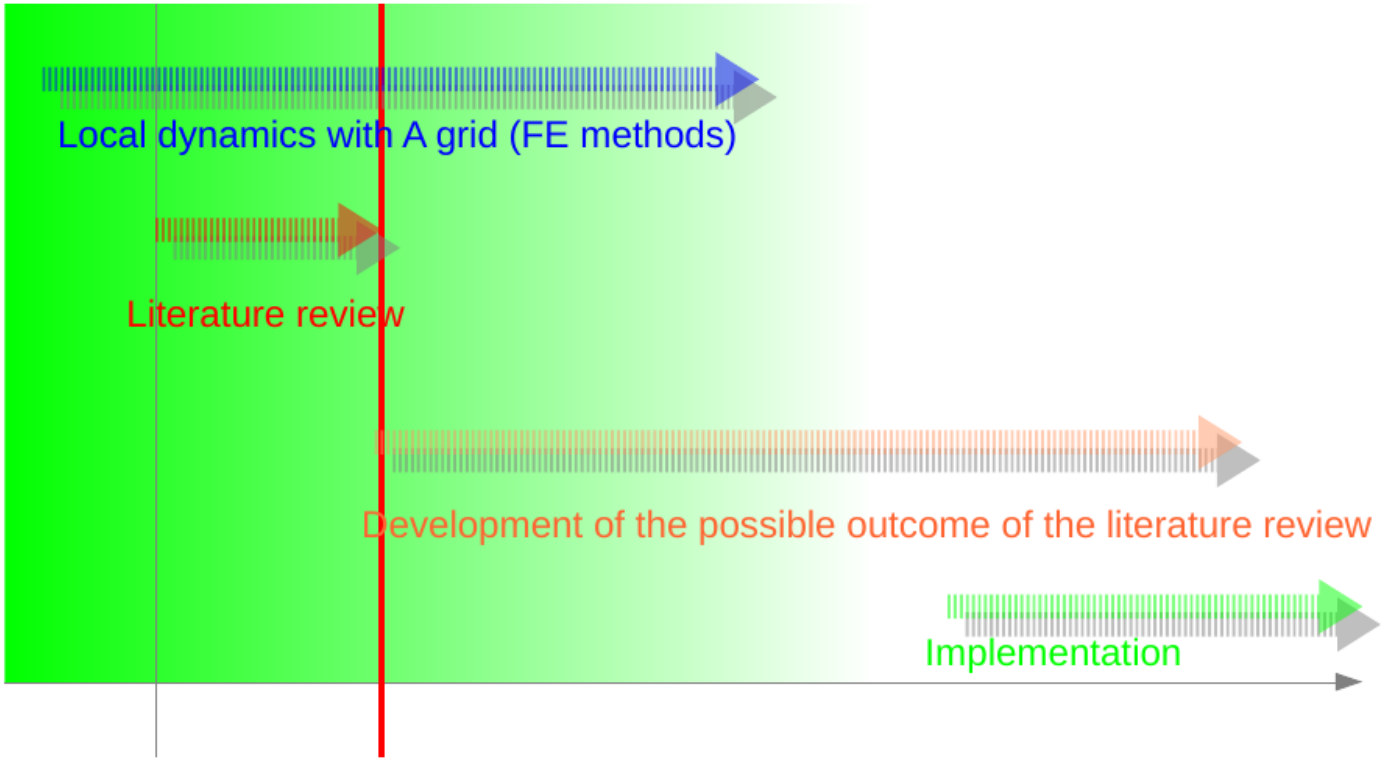
Convergence roadmap



Dynamics

Reminder: dynamics road map

Eliminating the A grid means we have to overhaul the whole system.
We stay with the current system at least for the term of the current strategy plan (green area).



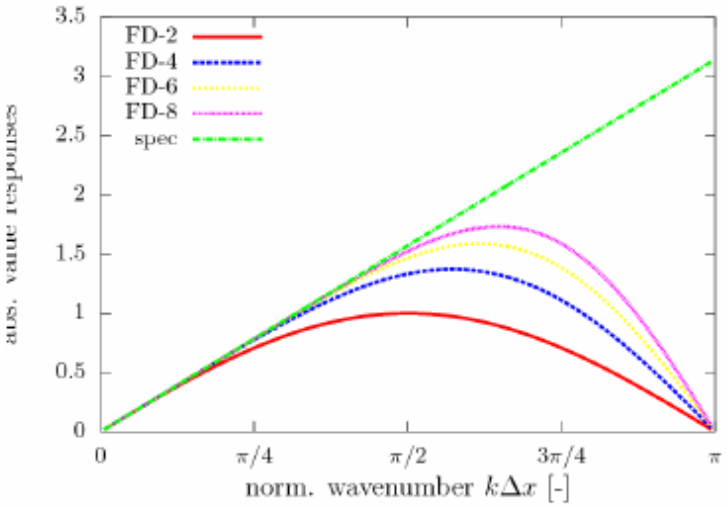
We can mimic a FD spatial discretization in the spectral ALADIN model by changing the responses.

The scientific impact of local schemes can be tested by replacing the spectral responses by finite differences responses.

	detail of ALADIN timestep organization	
9	solve for updated fields	$\mathbf{U}_A^+ = (\mathcal{I} - \frac{\Delta t}{2}\mathcal{L}^*)^{-1}\mathbf{R}_{tot}$

operator	second-order FD	spectral	linear FE
$\mathcal{P}f$	f_x	f_x	$\frac{1}{6}\left[f_{x+\Delta x} + 4f_x + f_{x-\Delta x}\right]$
$\mathcal{P}_x f$	$\frac{1}{2\Delta x}\left[f_{x+\Delta x} - f_{x-\Delta x}\right]$	$\left(\frac{df}{dx}\right)_x$	$\frac{1}{2\Delta x}\left[f_{x+\Delta x} - f_{x-\Delta x}\right]$
$\mathcal{P}_{xx} f$	$\frac{1}{\Delta x^2}\left[f_{x+\Delta x} - 2f_x + f_{x-\Delta x}\right]$	$\left(\frac{d^2f}{dx^2}\right)_x$	$\frac{1}{\Delta x^2}\left[f_{x+\Delta x} - 2f_x + f_{x-\Delta x}\right]$

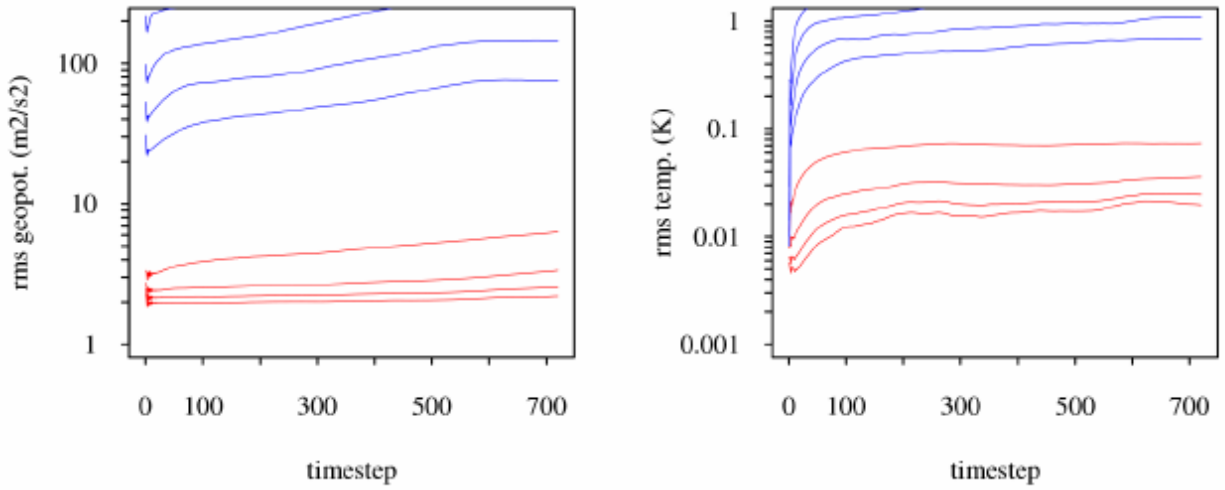
response	second-order FD	spectral	linear FE
p	1	1	$\frac{1}{3}\left[2 + \cos(k\Delta x)\right]$
p_x	$\frac{1}{\Delta x} ik \sin(k\Delta x)$	ik	$\frac{1}{\Delta x} ik \sin(k\Delta x)$
p_{xx}	$\frac{2}{\Delta x^2}\left[\cos(k\Delta x) - 1\right]$	$-k^2$	$\frac{2}{\Delta x^2}\left[\cos(k\Delta x) - 1\right]$



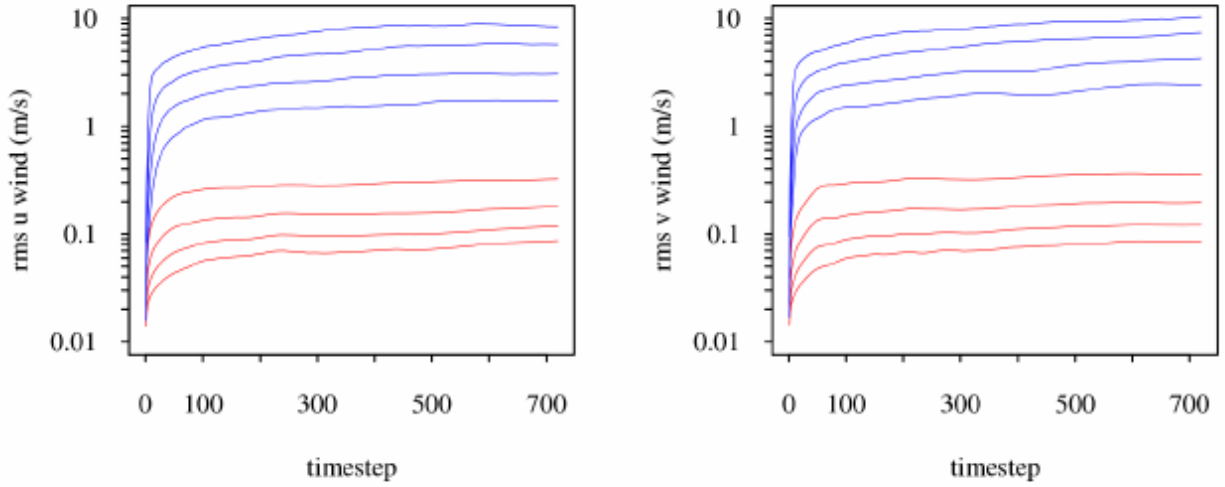
Different response functions for 1st order derivative

→ Implementation is trivial but the approach is very powerful and 'scientifically clean'. ALADIN provides a unique testbed!

A grid simulation (red): convergence to the spectral solution



BE40l summer F



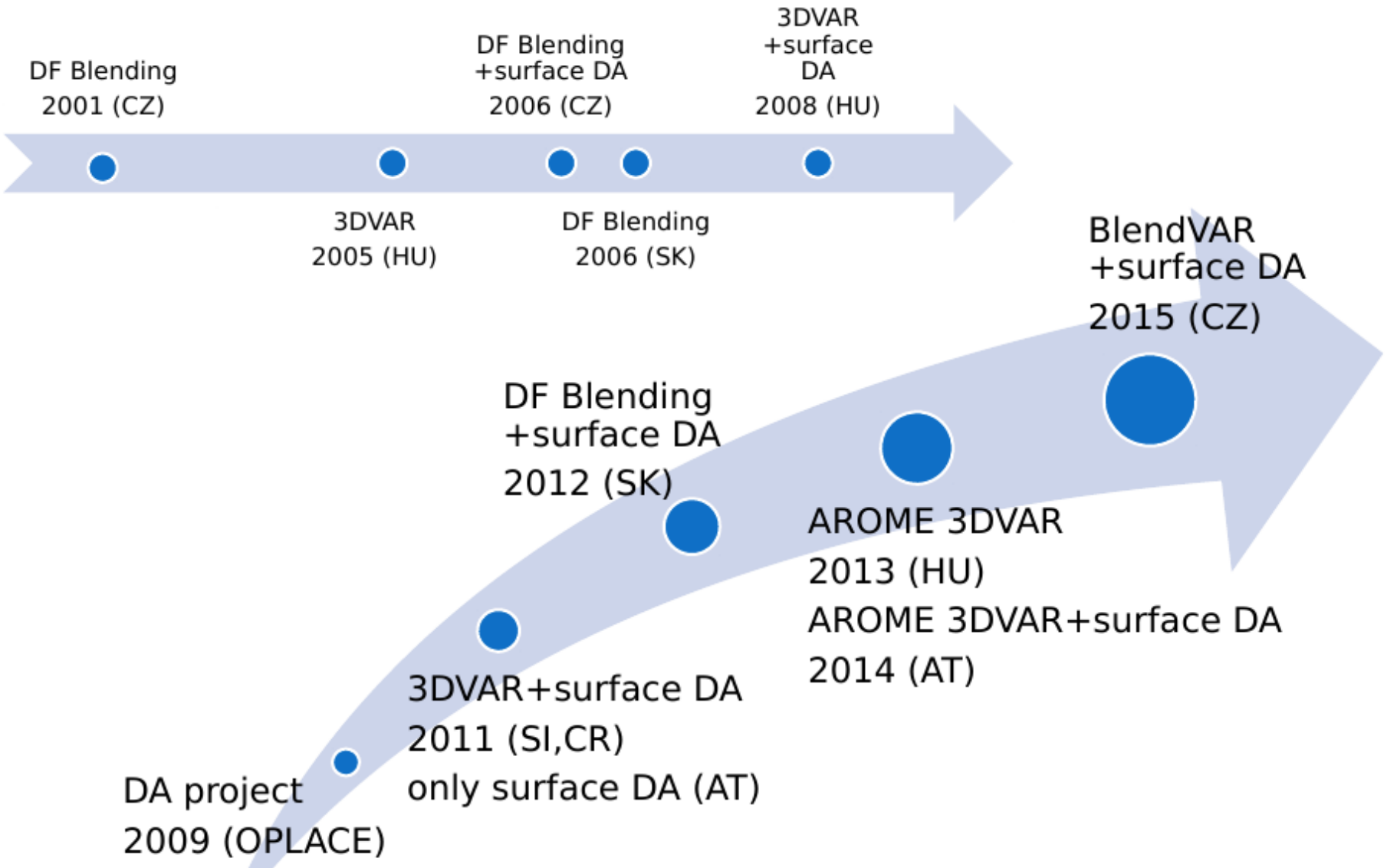
Plot of the rms difference with respect to the spectral run of the geopotential height, temperature and wind components at 500 hPa, averaged over the entire considered summer period (20/6/1016 to 26/6/2016) and all grid points. The grid is the 12 km grid with linear truncation and no DFI ('F' notation meaning 'False'). The blue (resp. red) lines represent the Z (resp. A) grid and per color the lines with smaller rms errors represent higher order finite difference runs.

Extra efforts on data assimilation, following the example of LACE

Regional Cooperation for Limited Area Modeling in Central Europe

LACE nwp central europe

LACE DA history



Thank you for your attention!