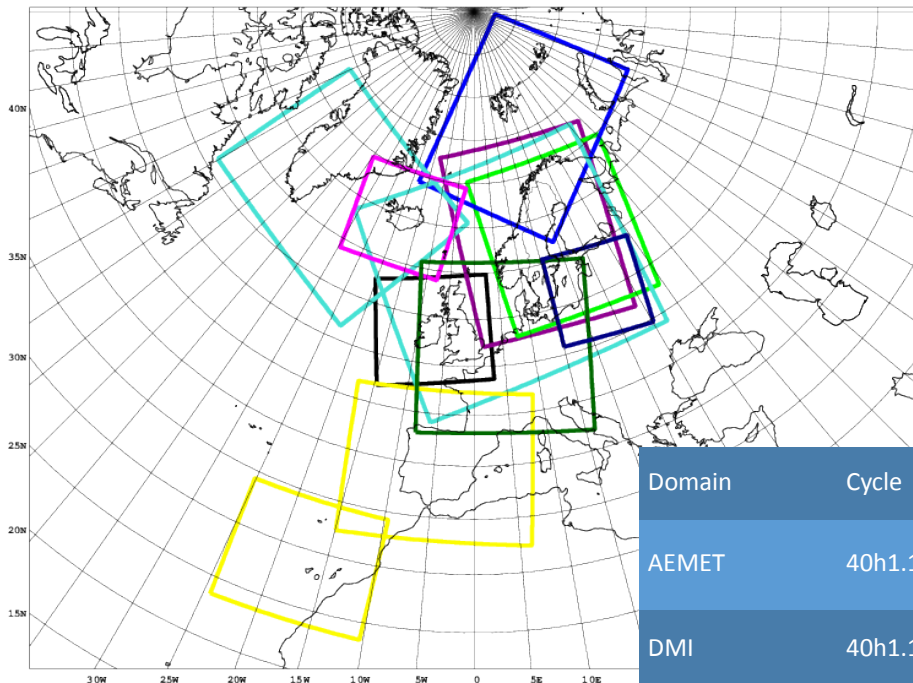# HARMONIE-AROME system
Status and future

ALADIN / HIRLAM

Joint 27th Workshop &All-Staff Meeting 2017

FMI, Helsinki, 3-7 April, 2017

Daniel Santos (AEMET)

Harmonie-Arome operational domains

Domain	Cycle	Grid	DA	forecast length/cycle
AEMET	40h1.1	2.5 km 65 lev	3DVar + surf ana	48h/4times
DMI	40h1.1	2.5 km 65 lev	3DVar + surf ana	60h/8 times
FMI	38h1.2	2.5 km 65 lev	3DVAR + Surf ana	54h/8times
KNMI	36h1.4.bf1	2.5 km 60 lev	3DVAR + Surf ana	48h/8 times
LHMS	37h1.2	2.5 km 60 lev	blending + Surf ana	54h/4 times
MetEireann	37h1.1	2.5 km 65 lev	blending + Surf ana	54h/4 times
MetCoOp HarmonEPS	40h1.1	2.5 km 65 lev	3DVAR + Surf ana	66h at 00,06,12,18, 3h at 03,09,15,21
VI-Iceland	38h1.2	2.5 km 65 lev	blending + Surf ana	48h/4 times

Harmonie-Arome cycles

2016/09/23

Harmonie-40h1.1

2017/04/04

Harmonie-40h1.2.tg1

Harmonie-40h1.2.tg2
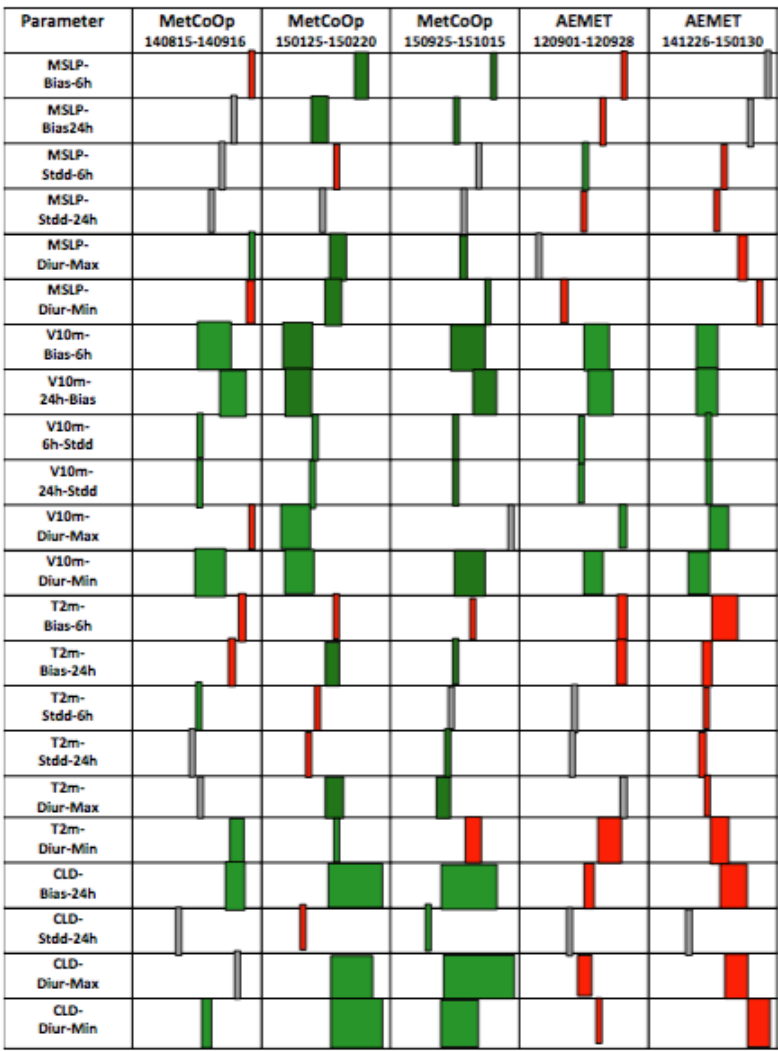
Meteorological verification and validation
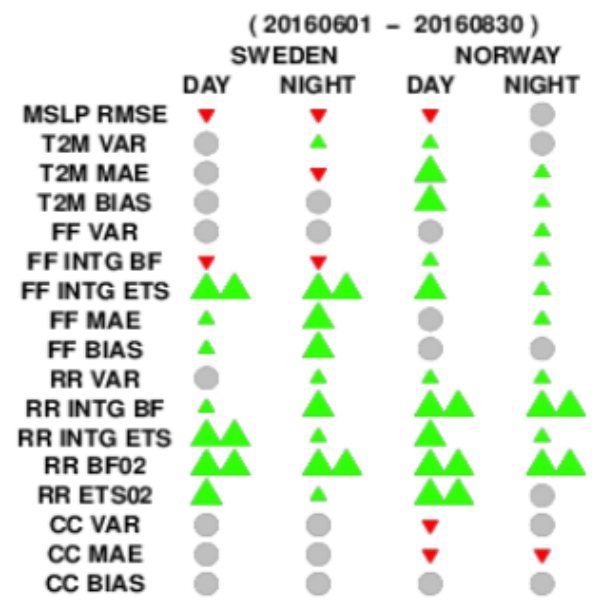
2017/04-05 ...

Harmonie-40h1.2.rc1

2017/06/15

Harmonie-40h1.2

Harmonie-Arome cycles 38h1.2 vs 40h1.1

Parameter	MetCoOp 140815-140916	MetCoOp 150125-150220	MetCoOp 150925-151015	AEMET 120901-120928	AEMET 141226-150130
MSLP-Bias-6h					
MSLP-Bias24h					
MSLP-Stdd-6h					
MSLP-Stdd-24h					
MSLP-Diur-Max					
MSLP-Diur-Min					
V10m-Bias-6h					
V10m-24h-Bias					
V10m-6h-Stdd					
V10m-24h-Stdd					
V10m-Diur-Max					
V10m-Diur-Min					
T2m-Bias-6h					
T2m-Bias-24h					
T2m-Stdd-6h					
T2m-Stdd-24h					
T2m-Diur-Max					
T2m-Diur-Min					
CLD-Bias-24h					
CLD-Stdd-24h					
CLD-Diur-Max					
CLD-Diur-Min					

SCORECARD AROME CY40h1.1 vs ECMWF
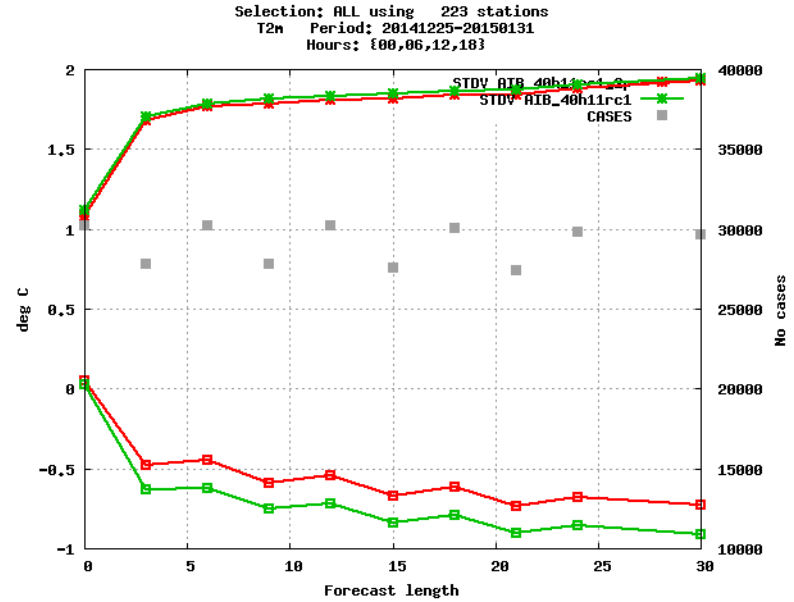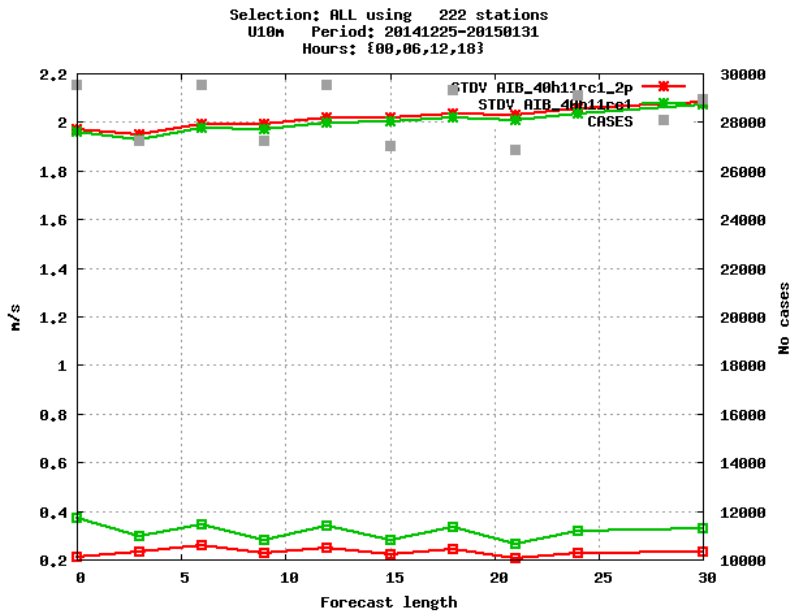
(20160601 – 20160830)

MEPS (40h1.1)

Harmonie-Arome towards new cycle 40h1.2

1. Test individual contributions (i.e. 2 patches in red)

https://hirlam.org/trac/wiki/Harmonie_40h1/validation_for_tagging_40h1.2

Harmonie-Arome towards new cycle 40h1.2

2. Potential updates for tagginng new cycle

Upper air physics and dynamics

Intended for next cycle

Development name	Default/ optional	Developers	System group representative	Status	Documentation scientific	Documentation trunk	Tests
PL responsible to add		PL responsible to	Daniel adds	Daniel and PL	Main developer	On request from Daniel	Bent coordinates
		add at least one		responsible			
Freezing rain update	Default	Karl-Ivar Ivarsson		Submitted to trunk	see comments		
Bug fixes stratospheric warming	Default	Karl-Ivar Ivarsson		Submitted to trunk	see comments		
Accretion changes	Default	Karl-Ivar Ivarsson		Submitted to trunk	see comments		
COMAD	Default	Sylvie Malardel		activated COMAD=TRUE in trunk	see comments		
conversion of graupel to snow	Optional	Karl-Ivar Ivarsson		Submitted to trunk, with original namelist flag LGRSN removed, instead controled by namelist parameters similar to that of the freezing rain updates upon discussion with Meto-France. . Default not activated.	see comments		
Improved microphysics in EDMF	Optional	Lisa Bengtsson		Submitted to trunk LTOTPREC = FALSE	see comments		

Comments

- COMAD: See documentation ⇨ http://onlinelibrary.wiley.com/doi/10.1002/qj.2509/abstract It is an improvement of the interpolations weights in the semi-Lagrangian scheme. The impact is small, but it improves so called "grid-point storms" seen in the model with excessive build up of graupel in individual grid-boxes.
- LGRSN flag: (conversion of graupel to snow, when mixing ratio of graupel is very small.). Included as optional
- Freezing rain update: Higher thresholds for graupel,snow and ice nucleus concentration for permitting conversion of supercooled rain into snow or graupel. Thus, this conversion goes slower, and more supercooled rain remains.
- Bug fixes for stratospheric warming: In the stratosphere, saturation pressure over.e.g. ice may become higher than the atmospheric pressure. In those cases, saturation mixing ratio may be infinite and cause division by zero. Since condensation is not possible when saturation pressure exceeds atmospheric pressure, the bug fix is just to turn of the calculations in those cases.
- Accretion changes: In cy38 the accretion of cloud water into rain was made dependent on cloud droplet size in order to make it more physically realistic. Unfortunately, this was not completely integrated into cy40. This is fixed for cy40h1.2.
- Improved microphysics in EDMF: Flag to activate, LTOTPREC: With LTOTPREC=TRUE precipitation tendencies that are computed in the shallow convection scheme are added to the source terms of precipitation entering the cloud microphysics, such that they are advected before the next time-step. This is in order to enhance convective preciptation advecting in over the coast when generated at sea. If LTOTPREC=FALSE there is no impact of the modification in the model.

https://hirlam.org/trac/wiki/Harmonie_40h1/potential_updates_for_tagging_40h1.2

HARMONIE grid column

Bug fixes on stratospheric warming

Shallow precipitating clouds
Aim at
correct timing
correct type of hydrometeors
e.g.
- freezing rain
- Accretion changes

Suppress unrealistic
precipitation "bombs":
COMAD dynamics
option

noSBL

PGD interpolation bug
Remove smoothing of orography

Two patches in Tyle Nature

Improved treatment
of sea ice SEAICE

patch2   patch1

Sea   Urban   Lake   Nature

Harmonie-Arome towards new cycle 40h1.2

2. Potential updates for tagginng new cycle

- Contribution form

Trunk contribution form

```
=============================================================
GENERAL DESCRIPTION:

SURFEX modifications, produce the same meteorological results with and
without the modifications.

Date and name of Contributor:

19/10/2015
Daniel Santos, AEMET, Spain.

Model or configuration affected by the modset:

LAM: Harmonie-Aromo

Context and cycle:

Dev
40h1.1

Type of file/resource to be modified:

Binary, namelist

Description of the set of modifications:

-With LLCRIT=TRUE the critical condensation threshold in the Sundquist
parameterization for precipitation generation is described as a
function of temperature at the lifting condensation level.

Details about the provided files:

"CY40h11_AEMET_contrib_part1.tar"
"~sp2b/hm_home/CY40h11_AEMET_contrib_part1"

Modified:
    arpifs/module/yomparar.F90
    arpifs/namelist/namparar.nam.h
    arpifs/phys_dmn/vdfparcelh1.F90
    arpifs/phys_dmn/suparar.F90
```

NEAR FUTURE

- Possible code pair-review cross check
- Run the testbed successfully before sending each contribution
- Contribution updated to the trunk level will be a requirement

https://hirlam.org/trac/wiki/Harmonie_40h1/potential_updates_for_tagging_40h1.2

Harmonie-Arome testbed

https://hirlam.org/trac/wiki/HarmonieSystemDocumentation/Evaluation/HarmonieTestbed

The HARMONIE test environment used to test typical configurations on a small domain

- Automatically runs each time our trunk is updated.
- Makes an automatic comparison report with a REFEXP
- Run the testbed successfully for each contribution
- INCLUDE ECOCLIMAP in the tests

TESTBED_LIST:

AROME_3DVAR AROME_1D AROME
AROME_MUSC
AROME_3DVAR_2P
AROME_BD_ARO_2P
ALARO_3DVAR ALARO_1D ALARO
ALARO_MUSC
AROME_BD_ARO AROME_BD_ALA
        AROME_EKF
ALARO_3DVAR_OLD
ALARO_OLD_MUSC
ALARO1_3DVAR_OLD
HarmonEPS
AROME_EPS_COMP

Harmonie-Arome cycles

3. Validation for tagging

Target 1 (tg1)

Following ⇨ Potential updates for tagging HARMONIE-40h1.2 the target 1 will include the "Development name" options:

- Freezing rain update
- Bug fixes stratospheric warming
- Accretion changes
- COMAD
- SICE
- PGD interpolation bug
- noSBL
- Smoothing of orography

Experiment name	Domain	Start of Episode	End of Episode	tester =	cluster	Observation Verification
xxxx	DMI	10 December 2015	31 Jan 2016	Shiyu,Mats	CRAY-XC	
xxxx	DMI	1 May 2016	30 June 2016	Shiyu,Mats	CRAY-XC	
xxxx	KNMI	15 January 2017	28 February 2017	Jan		
xxxx	KNMI	15 July 2016	31 August 2016	Jan		

Target 2 (tg2)

Following ⇨ Potential updates for tagging HARMONIE-40h1.2 the target 2 will include Target 1 + the "Development name" options:

- 2 patches

Experiment name	Domain	Start of Episode	End of Episode	tester	cluster	Observation Verification
xxxx	IBERIAxxm	1 January 2015	31 Janyary 2015	Javier		
xxxx	IBERIAxxm	15 April 2016	15 May 2016	Javier		
~snh/hm_home/40h11_mcp_spring [1]	MetCOOP25B	1 March 2016	10 April 2016	Ulf Andrae	cca	
~fnr/hm_home/40h11_mcp_summer [2]	MetCOOP25B	1 July 2016	10 August 2016	Dag Björge	cca	
~fad/hm_home40h11_mcp_fall [3]	MetCOOP25B	1 October 2016	10 November 2016	Laura Rontu	cca	
~smx/hm_home40h11_mcp_winter [4]	MetCOOP25B	15 December 2016	1 February 2017	Magnus Lindskog	cca	
40h12_tg2_mcp_spring [5]	MetCOOP25B	1 March 2016	10 April 2016	NN	cca	
40h12_tg2_mcp_summer [6]	MetCOOP25B	1 July 2016	10 August 2016	NN	cca	
40h12_tg2_mcp_fall [7]	MetCOOP25B	1 October 2016	10 November 2016	NN	cca	
40h12_tg2_mcp_winter [8]	MetCOOP25B	15 December 2016	1 February 2017	NN	cca	

https://hirlam.org/trac/wiki/Harmonie_40h1/validation_for_tagging_40h1.2

Harmonie-Arome new cycle cy43h1?

- cy43T2 compiles and runs in ECMWF
- Integration aborts to orography mismatch between model and surfex in the very beginning.
- The real space and the spectral space orography fields are completely different.

Françoise Taillefer discovered 2 weeks ago this is due to the routine FAIENO at the end of EINCLI1.F90 (to write the spectral orography in the e923 output file)

- FAIENO reorders the spectral arrays, and as it is already done in 923 it leads to a desordering
- Replacing FAIENO by FAIENC it works well.

Harmonie scripting system sequence mSMS

Harmonie
(top level script, perl)

Main
(old top level script, s

Action
s/Acti

Start
(reads config_exp.h
Harmonie_domains.pm
harmone_namelists.pm
surfex_namelists.pm
surfex_selected_output.pm)

1. Prepare **harmonie.def**
(and harmonie.html)

mSMS.pl
(input: harmonie.tdf;
template definition file)

2. Play **harmonie.def**

mXCdp.pl
(if $mSMS_WEBPORT == 1)

mini-SMS task execution

- **%SMSTRYNO%** is the attempt number of the task. %SMSTRYNO% runs from 1 to **%SMSTRIES%** (default 1) for automatically submitted tasks, but %SMSTRIES% is ignored for tasks that are rerun through the GUI.

- **"task".job%SMSTRYNO%-q**. Headers (for the queueing system) and footers might have been added.

"task".sms   **"task".job%SMSTRYNO%**
(container script)(sh script)

Submit.pl   **submission.db**
(Universal Job Submission Filter)(**Env_submit** reader and header and foorter adder)

"task".job%SMSTRYNO%-q
(sh script)

ecFLOW

ecFLOW	*mSMS*
Server/Client	batch Script
Dynamical suite def	Static suite def
Python/CDP	CDP
Scripts *.ecf	Scripts *.sms
More control and options	Few options

HARMONIE-AROME SCRIPTING SYSTEM UPGRADE STRATEGY

- Reduce the number of languages: Shell Script, Perl, Python …

- Improve the use of env Variables

- Use ECMWF scheduler like glameps in stead of job1, job1-q strategy?

- Set up control variables at scheduler level not inside the script.

- Improve the control over the task making them more modular

- Convergence to a Aladin-Hirlam common code

Communication:

Forum:

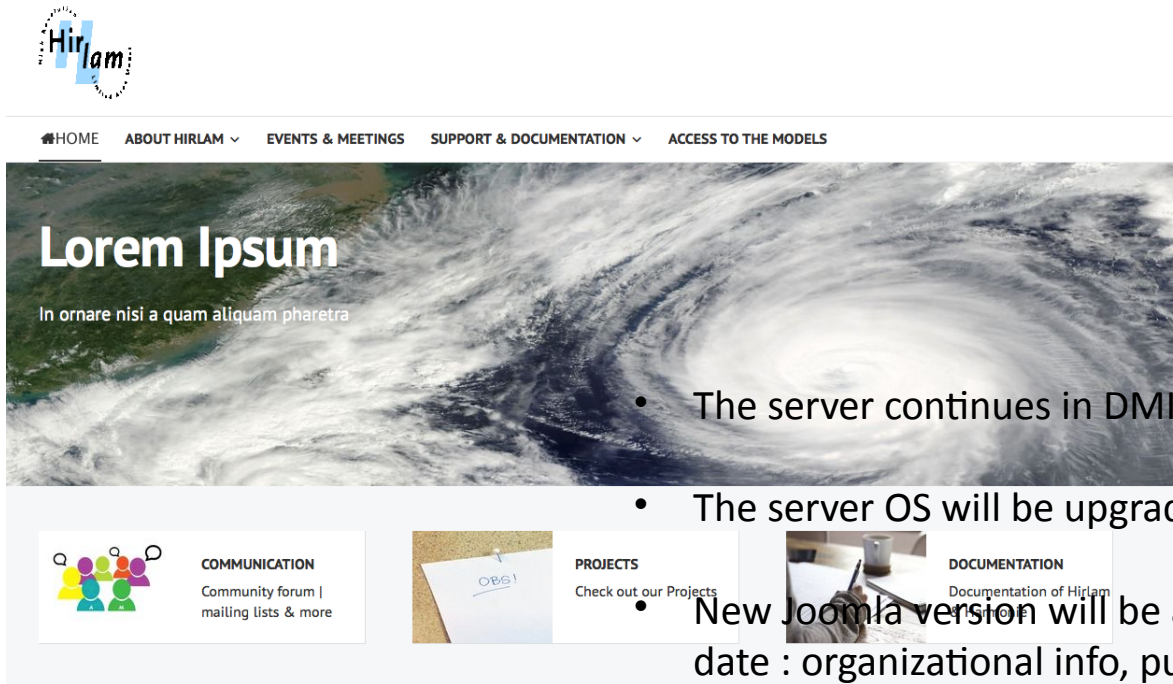- Facilitate de information exchange inside and outside the community.

Mailing lists:

- Every HIRLAM user has been included in Announce mailing list
- Several mailing lists are not active => pruning

List	Description
4dvar	Hirlam 4DVAR developers forum
Announce	Community-wide information with restricted posting privilege
Chemical	Hirlam forum on chemical branch
Climate	Information about climate modelling with HARMONIE
Commits	Commits to the Subversion repository
Da	HIRLAM data assimilation community forum
Dev	Discussions of HIRLAM development in particular in commection with releases
Eps	Hirlam-ALADIN eps project
Exp	experimenter's forum
Glameps	GLAMEPS developer forum
Harmonie	Hirlam-Aladin Harmonie System
harp	HIRLAM-ALADIN HARP developer
Helpdesk	HIRLAM-B Help Desk
Hirald	Hirlam ALADIN forecast and da system user 's forum
Mailman	[no description available]
Monitor	GLAMEPS monitoring
Notification	[no description available]
Obsimpact	Coherent observation impact studies
Operational	Operational matters of the HIRLAM system
Operator	GLAMEPS operators mailing list
Physics	Hirlam-physics project forum
QA	HIRLAM-C discussion on quality assurance
Radar_wg	[no description available]
Support	Hirlam Q & A for internal and external users
Surface	HARMONIE surface development
Surfex	HIRLAM surfex list
Sysopr	system management for operational Hirlam
System	The HIRLAM system managers
System-core	[no description available]

Hirlam.org

- The server continues in DMI facilities.

- The server OS will be upgrade to a new version.

- New Joomla version will be available and content must be up-to-date : organizational info, publications, steering documents and work plans, meetings, news, …

- Wiki: Ensure that index of wiki pages is more logically structured and promote that readers use the index facility rather than search. Re-organize index of wiki content.

- HARMONIE-AROME tutorial
  - Text (pdf)
  - Video tutorial about HARMONIE-AROME use will be available

Very hires Harmonie-Arome

- Working group on very high resolution modeling

    - Towards increased operational resolution (1km, 90L?), first in deterministic mode and then as EPS (1km) Hectometric scales, on the longer term.

    - Scientific (dynamics (stability, level definition, ...), parametrizations, DA, surface, EPS) including urban aspects and the use of VHR local network observations

    - Computational efficiency aspects.
    - 2 different laboratories:
            "maritime" Canary Islands
            "continental "Denmark

Teide HPC's infrastructure

This infrastructure constitutes a key piece of the ALiX project, allowing the introduction of infrastructures orientated towards the creation of an industrial network linked to the Information and the Communication Technologies (ICTs) in Tenerife.
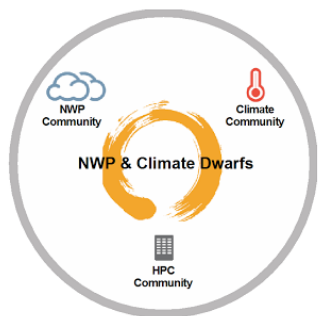
The supercomputer TEIDE-HPC (High Performance Computing)

The second most powerful in Spain, offer researchers, companies of the Technological and Scientific Park of Tenerife and the University of La Laguna a high-process capacity to improve and extend both the national and international scope of their researches.
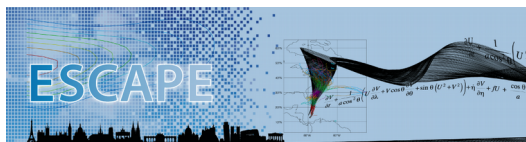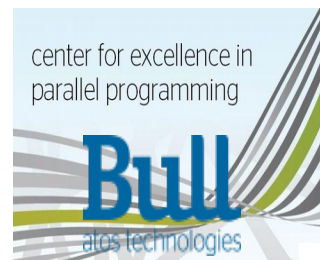
Harmonie-Arome scalability

https:// hirlam.org/trac/wiki/HarmonieSystemDocumentation/Scalability_and_Refactoring
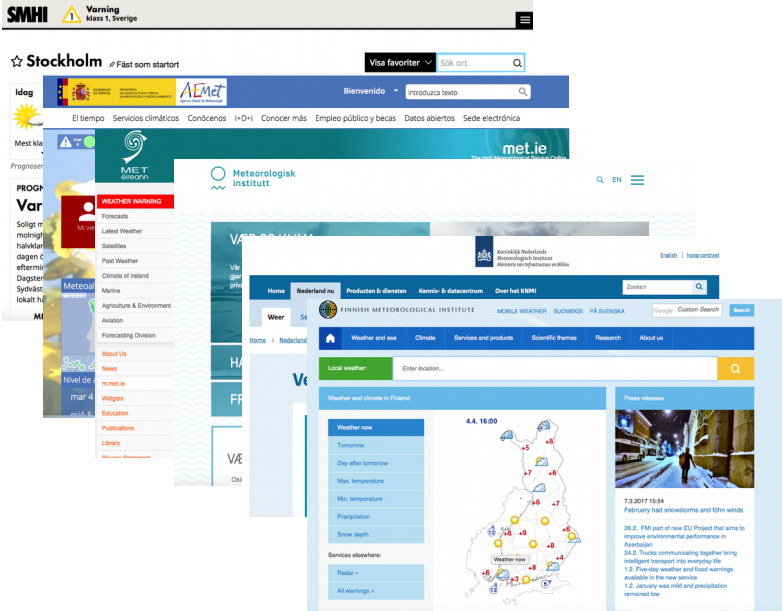

ECMWF

17th Workshop on High Performance Computing in Meteorology

Attempt to collect benchmarks reports from local HPC tender procedures
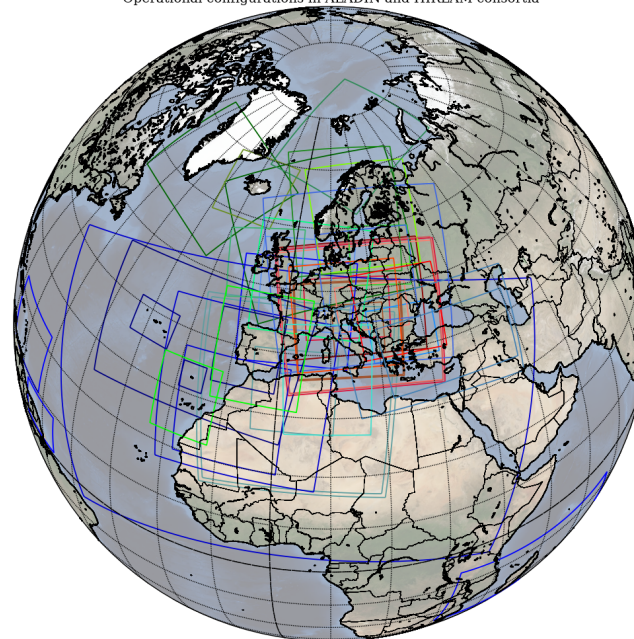
Final users feedback

- 10 member states using the same models

- IFS
- Hirlam
- Harmonie-Arome

- It seems logical to share tools or points of view and best practice about model use

- Good feedback of model use from final users
  - Forecasters
  - NHMS web pages
  - External users.

Aladin-Hirlam common environment

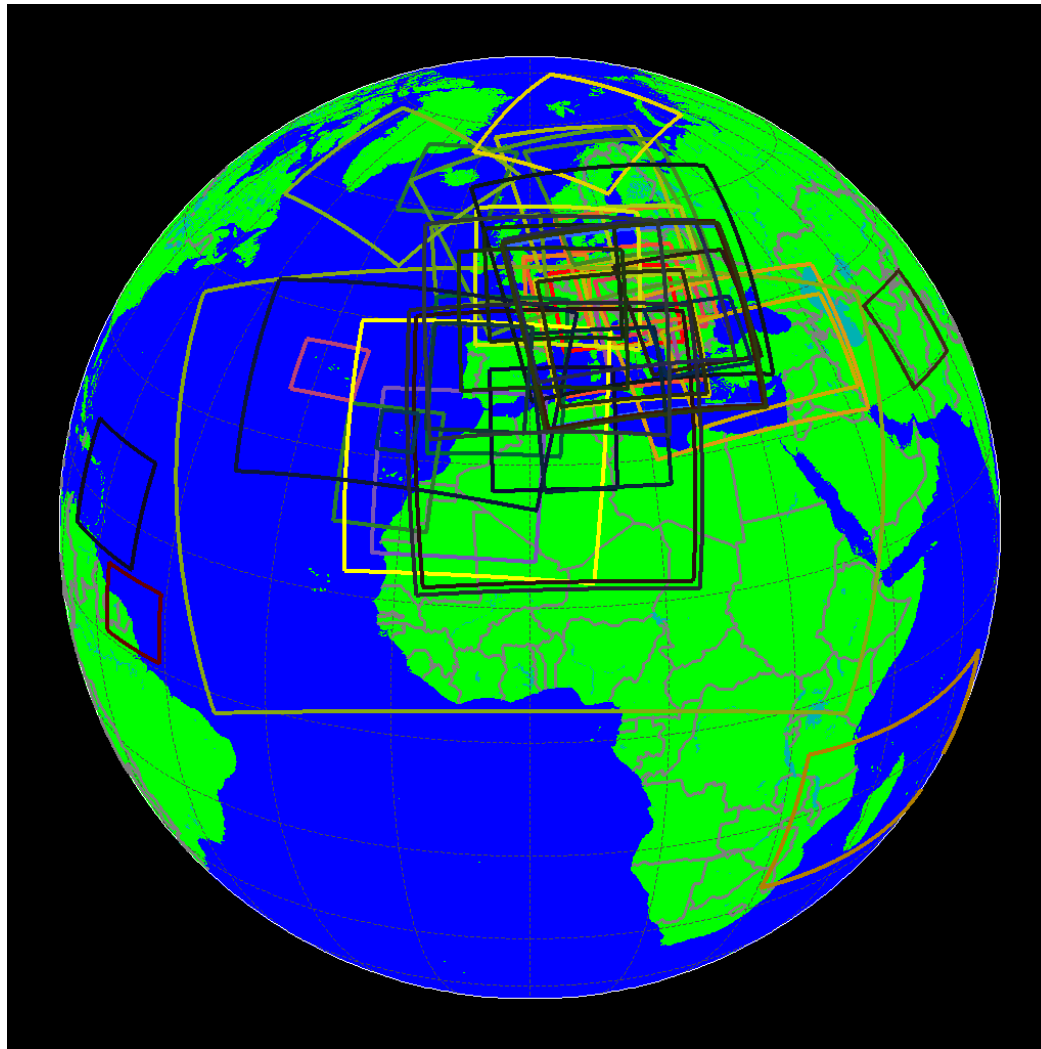Operational configurations in ALADIN and HIRLAM consortia

1. Algeria: ALGE (aladin)
2. Algeria: ALADIN_DUST
3. Algeria: AROME-NORD-ALGE
4. Austria: ALARO5-AUSTRIA
5. Austria: AROME-AUSTRIA
6. Belgium: Belgium-Alaro-7km
7. Belgium: Belgium-alaro-4km
8. Bulgaria: aladin-Bulgaria
9. Croatia: HR-alaro-88
10. Croatia: HR-alaro-44
11. Croatia: HR-alaro-22
12. Czech Rep: CZ-alaro
13. Denmark: AROME-NEA (Denmark)
14. Denmark: AROME-IMO (Ic+S.Gre)
15. France: AROME-FRA
16. France: Arome-France
17. France: AROME-Indian
18. France: AROME-Polynesia
19. France: AROME-Caledonia
20. France: AROME-Guyana
21. France: AROME-Antilles
22. Hungary: ALARO-HU determinis
23. Hungary: Arome-HU
24. Iceland: AROME-IMO
25. Ireland: AROME-IRELAND25
26. Lithuania: AROME-LHMS
27. Morocco: aladin-Mo1
28. Morocco: aladin-Mo2
29. Morocco: AROME Maroc
30. Netherlands: AROME-KNMI
31. Norway: AROME-Arctic
32. Fi&No&Se: AROME-MetCoOp
33. Poland: E040-alaro
34. Poland: P020-arome
35. Portugal: ALADIN-Portugal(ATP)
36. Portugal: AROME-Portugal(PT2)
37. Portugal: AROME-Madeira(MAD)
38. Portugal: AROME-Azores(AZO)
39. Romania: ALARO-RO
40. Slovakia: Slovakia-alaro
41. Slovenia: sis4-alaro
42. Spain: IBERIA
43. Spain: CANARIAS
44. Tunisia: Tunisia-aladin
45. Turkey: Turkey-alaro
46. Turkey: Turkey-Arome

Sinergetic points between Aladin and HIRLAM comunnities

- System maintenance in common (AH common codes) or local support
- Develop common tools or local tools
- Common scripting or local scriptimg
- Local obs preprocesing or common obs preprocessing
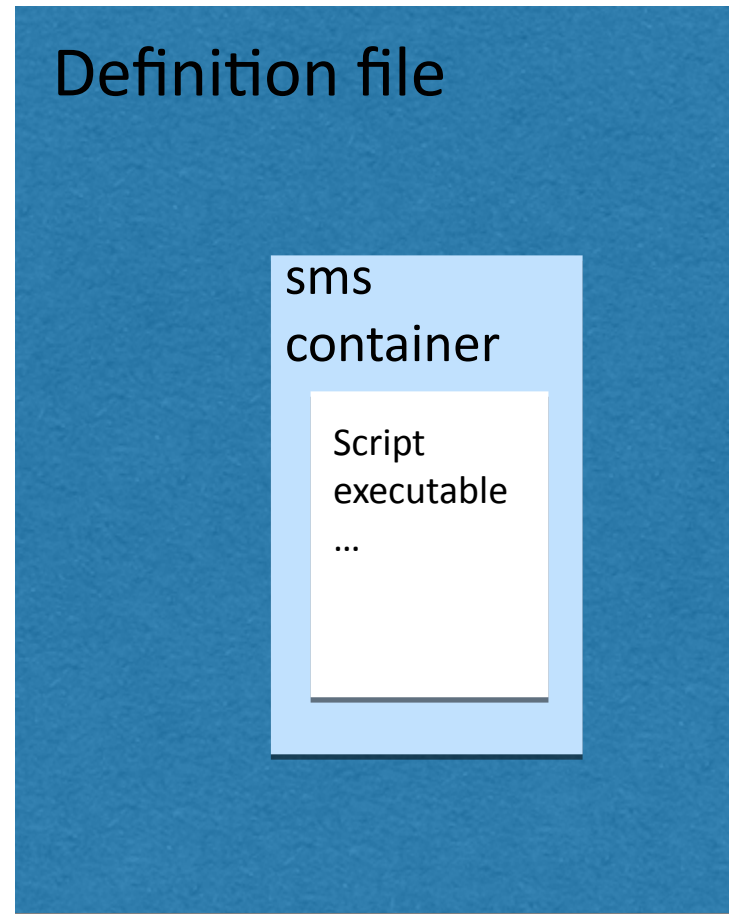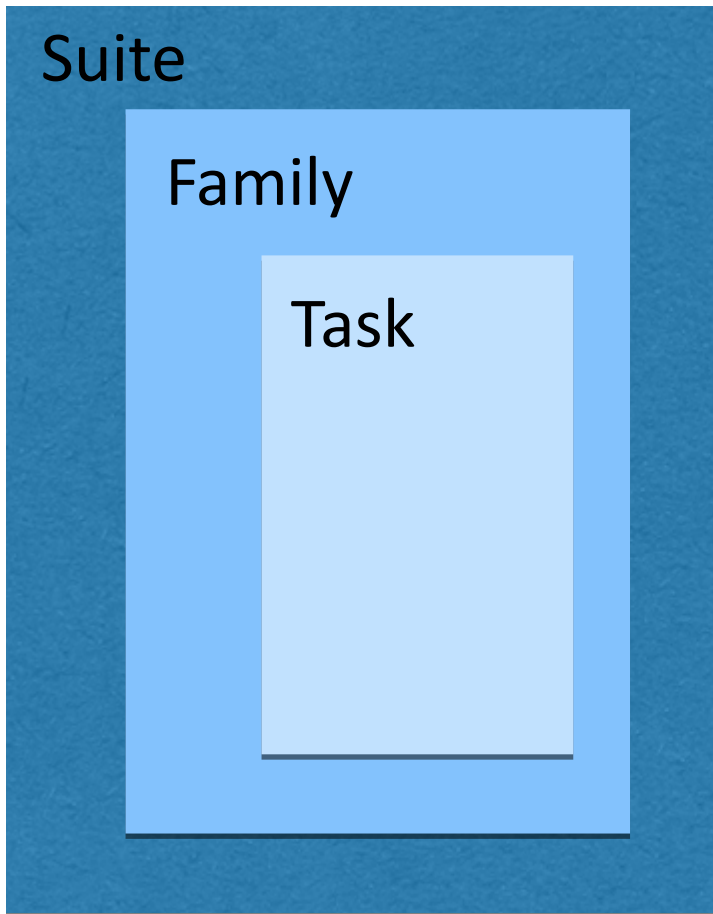
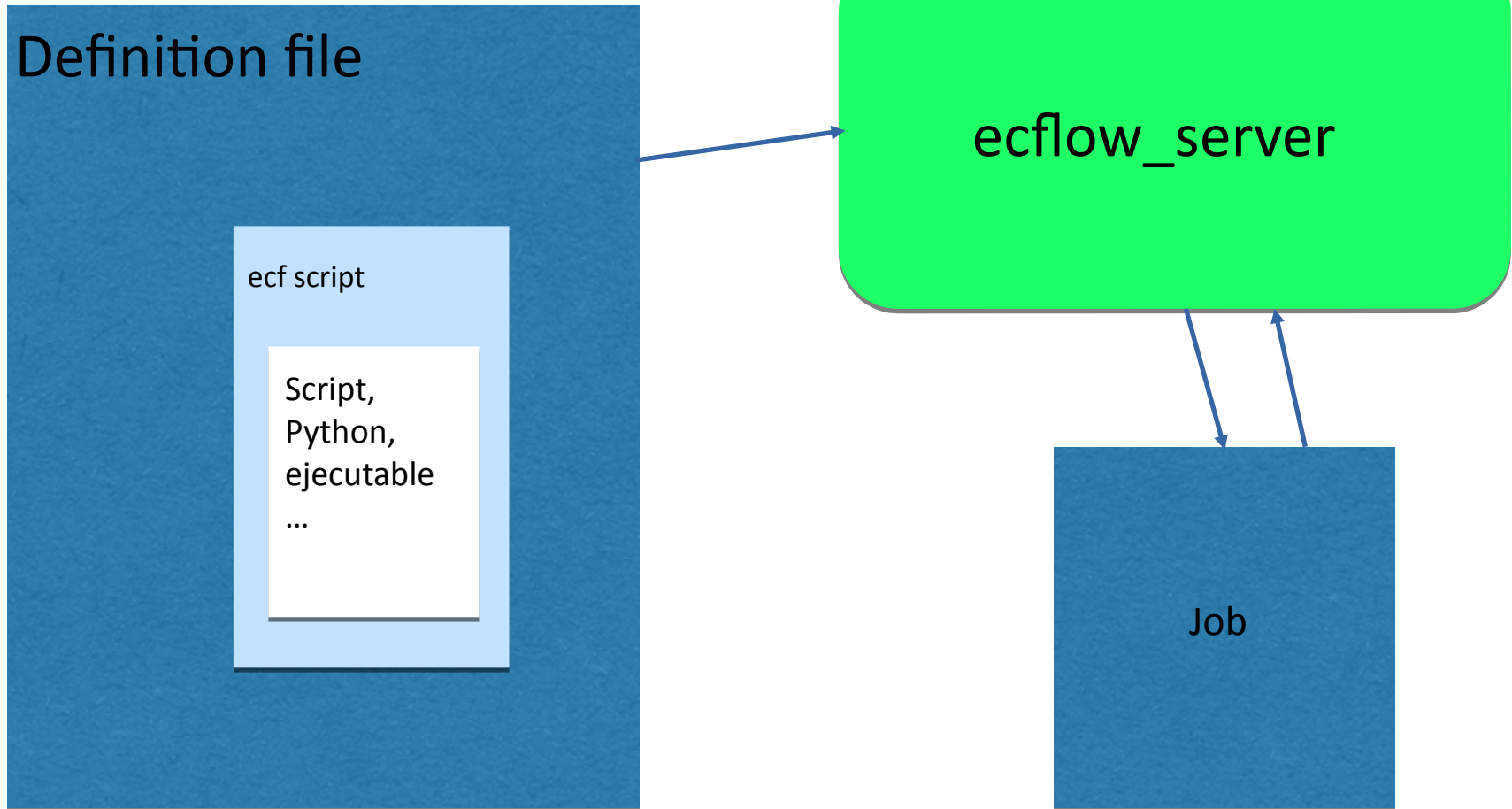Thank you for your attention

QUESTIONS ?

ecFLOW

- **ecFLOW** is the new ECMWF's workflow manager

- Development of SMS has now stopped. (Not supported on new platforms)

- ecFlow is a complete rewrite using **object oriented methodology**. The rewrite will help improve maintainability, allow easier modification and introduce object orientated features.

- Proprietary script languages, such as CDP, have been replaced by **Python**.

- **Multiple suites can monitored at the same time**

- **Server/Client structure with backup server and log server capabilities**.

- **Dynamical suite definition in python**. Not template parsing needed.

- **Text based** **suite definition** allow backwards compatibility. More control options of each family, tasks, variables and more powerful GUI than mSMS.

mini-SMS

Suite

Family

Task

Definition file

sms container

Script executable ...

ecFLOW

Definition file

ecf script

Script,
Python,
ejecutable
…

ecflow_server

Job

ecFLOW

- **ecflow_server** The schedule a daemon runs continuously(nohup &)

- **ecflow_client**   Command line interface with ecFlow Child commands updtate the task state in ecflow_server

- **Python API**

- **ecflowview**   or **ecflow_UI** ecFlow GUI

- **Several experiments and servers can be monitored with the same viewer**

- More than one experiment is not allowed with the same name monitored in the same server.