



**Barcelona
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Centro Nacional de Supercomputación



From Autosubmit to Cylc

A community standard for the EC-Earth consortium?

Domingo Manubens



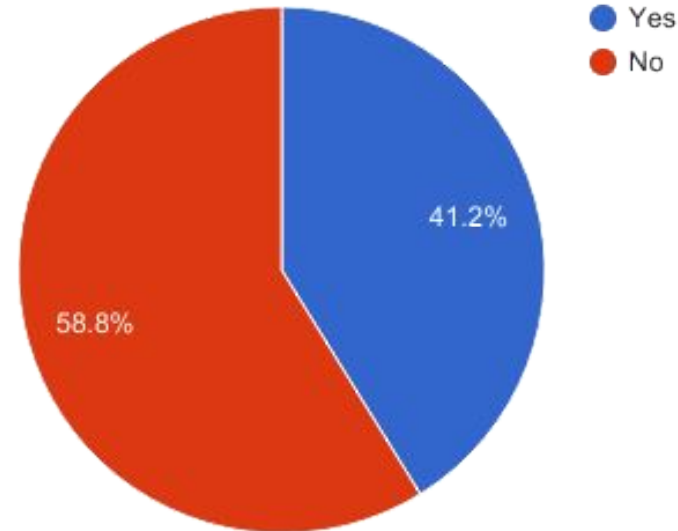
EC-Earth use cases

We conducted a survey among the EC-Earth community to know about their use cases and asking about their needs and expectations from a workflow management system.

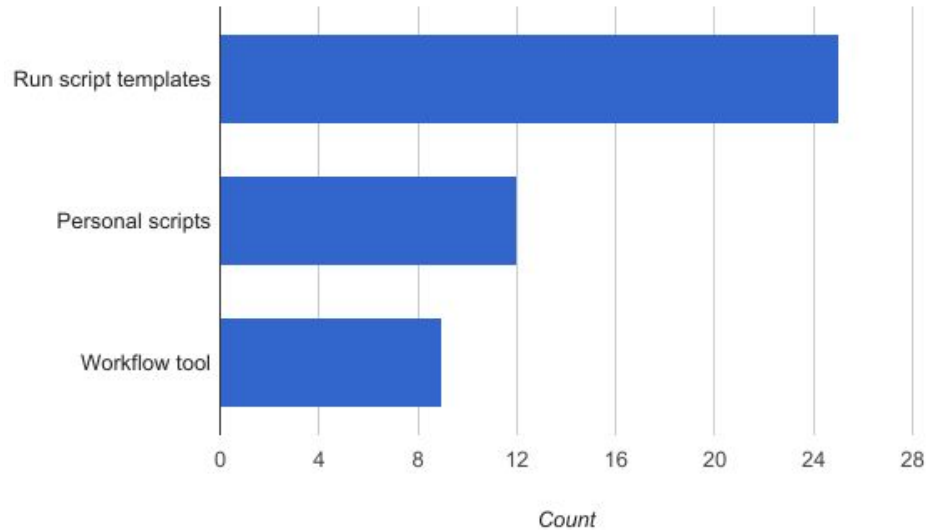
- Participants: 34
(12 countries / 18 institutions)

Country	Institution	# participants
Sweden	Lund (3), SU (2), SMHI (2)	7
Spain	BSC	6
Netherlands	KNMI (3), NSC (1), IMAU(1)	5
Finland	FMI (3), CSC (1)	4
Belgium	UCL	3
Germany	AWI (1), KIT (1)	2
Denmark	DMI	2
Italy	ENEA	1
Norway	UiB	1
Portugal	UL	1
United Kingdom	University of Oxford	1
Ireland	ICHEC	1

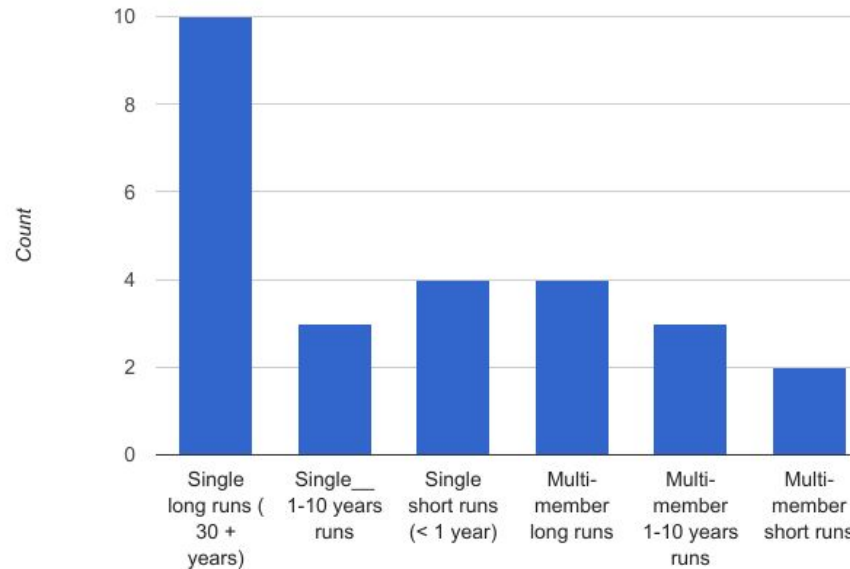
- Have you used a workflow management system?



- How do you run EC-Earth?

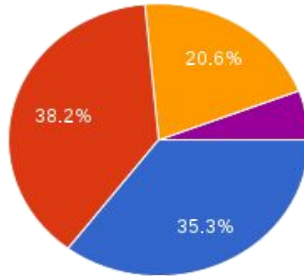


- Model simulation production

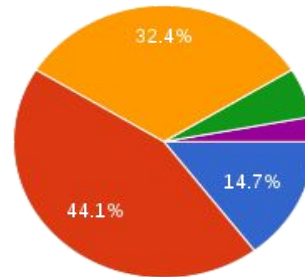


- Fundamental
- Important
- Could be useful
- Not useful
- I don't know

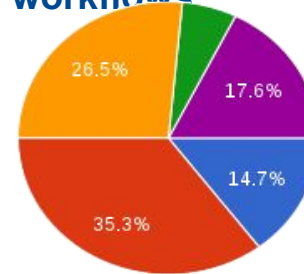
Database



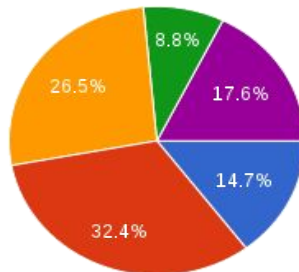
E-mail notifications



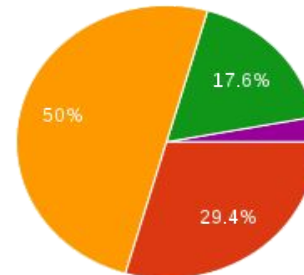
Complex workflows



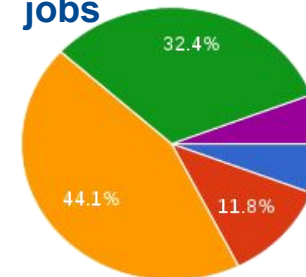
Jobs wrapper



GUI

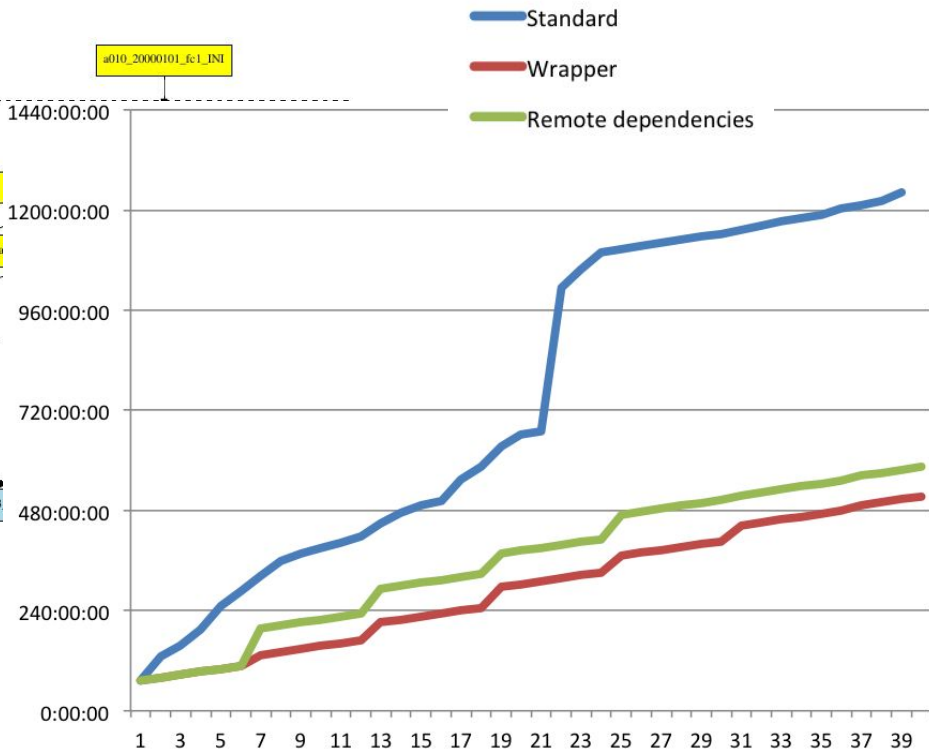
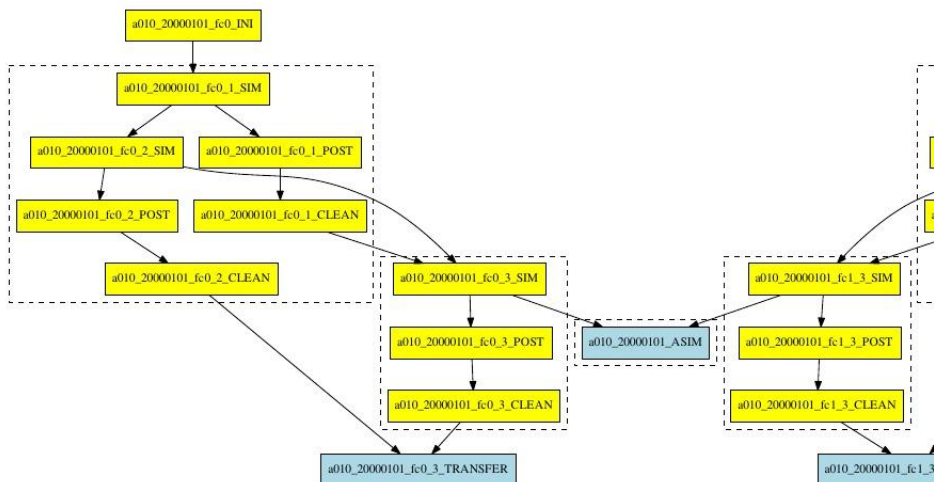


Clock triggered jobs



Autosubmit wrappers (job clustering)

Motivation: to **improve** the throughput by **reducing** queueing time by wrapping different jobs together.

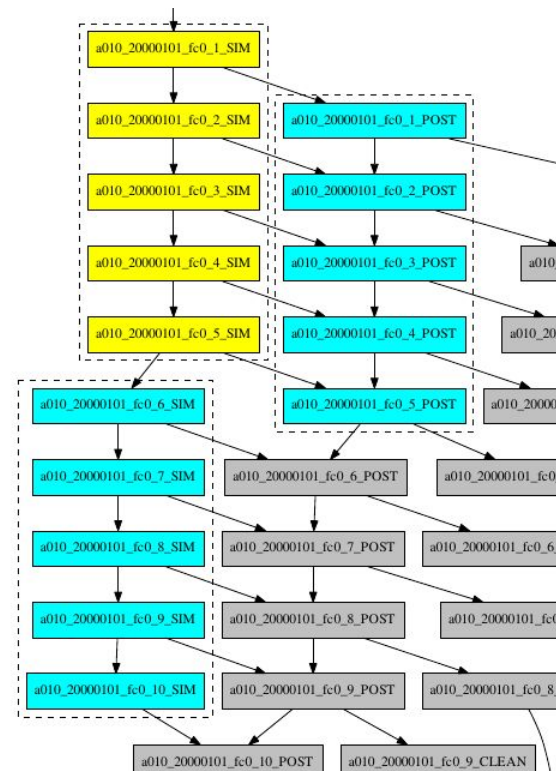


- The status of each job is checked and updated
- Failures are detected, also when a job is running for longer than its wallclock
- In this case, the whole wrapper job is cancelled, and, if there are retries, resubmitted from the point of failure

```
[wrapper]
```

```
TYPE = vertical
```

```
JOBS_IN_WRAPPER = SIM POST
```

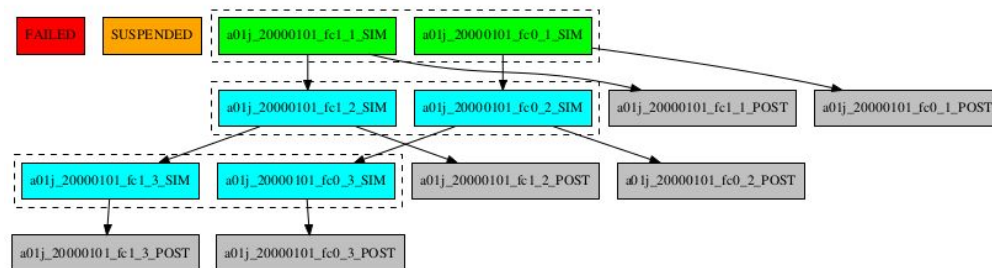


- Usage of machinefiles in mpirun identified by the job name

```
[wrapper]
```

```
TYPE = horizontal
```

```
JOBS_IN_WRAPPER = SIM POST
```

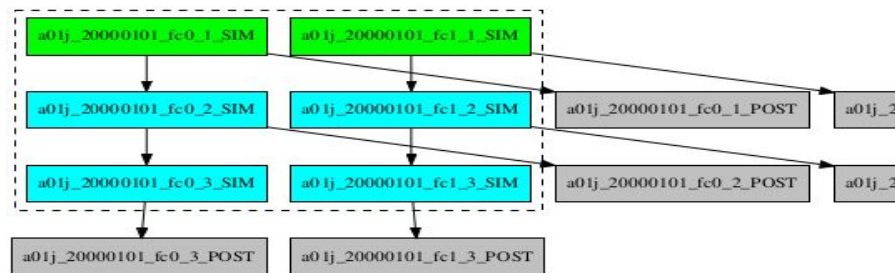


- Mix of vertical and horizontal wrappers
- Runs in parallel independent members, each one having a sequence of jobs that depend on one another

```
[wrapper]
```

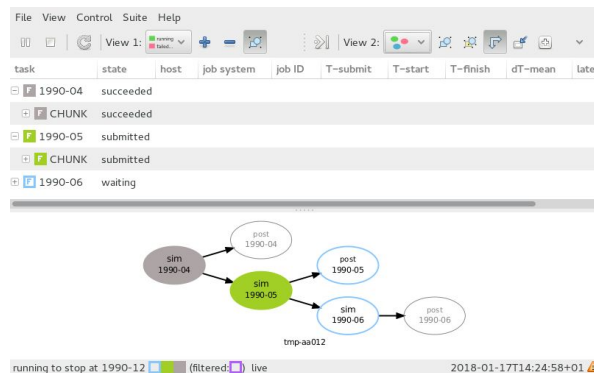
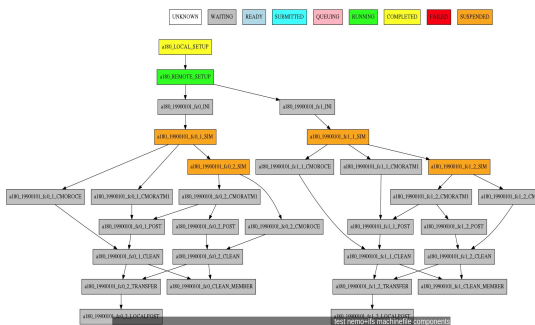
```
TYPE = hybrid
```

```
JOBS_IN_WRAPPER = SIM
```

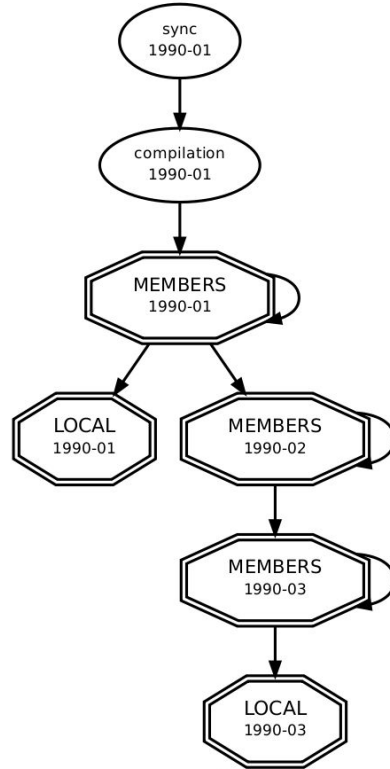


From Autosubmit to Cylc

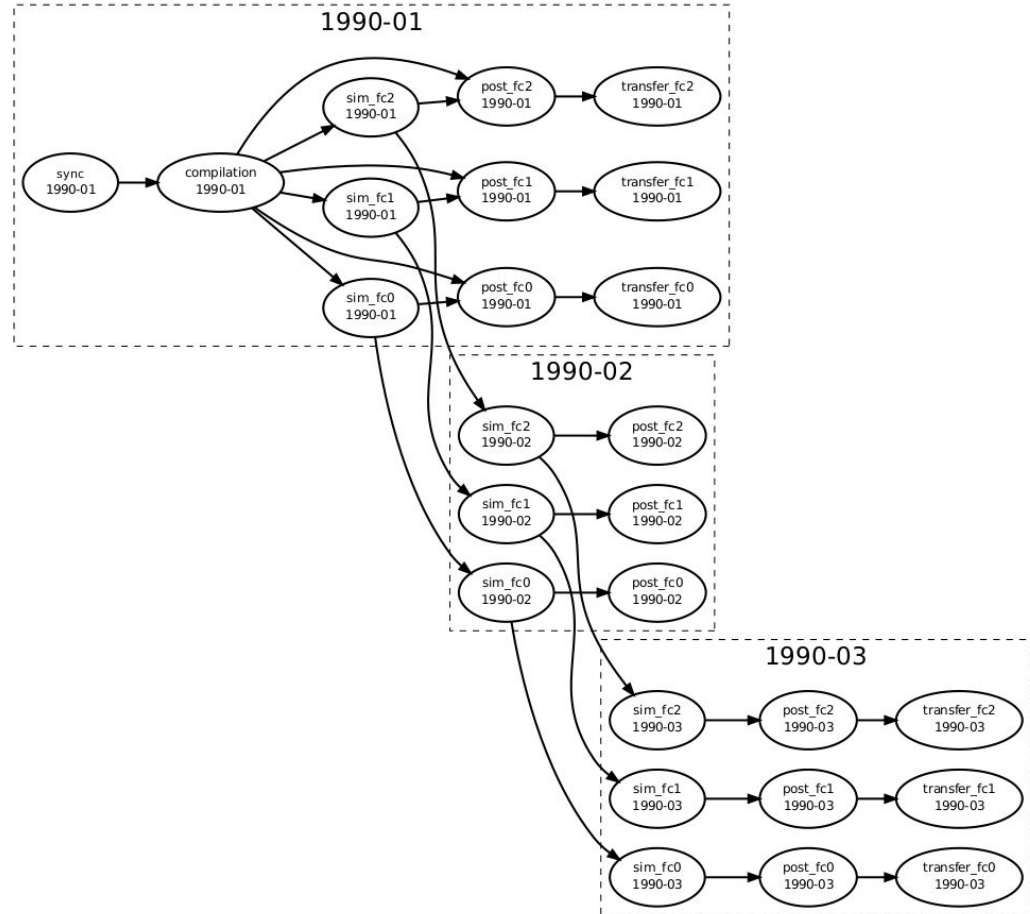
- Some people are interested in a workflow management system common for EC-Earth
- Option Autosubmit is available and will be maintained
- Option Cylc will be implemented in the next 1-2 years



Cylc - workflow engine



tmp-aa016



tmp-aa016

Rose - configuration management, GUI



Goal: to facilitate suite development, management and collaboration

The screenshot displays the Rose GUI interface. On the left is a sidebar with a tree view containing categories like 'suite info', 'suite conf', 'copy-runtime', 'post', 'sim', and 'transfer', with 'env' selected. The main area shows the 'Environment variable configuration' for 'env', listing variables: HPCARCH (marenostrum4), HPCHOST (mn1.bsc.es), HPCROOTDIR (/gpfs/scratch/bsc32/bsc32704/tmp-aa012), and HPCUSER (bsc32704). A floating window titled 'Rose Bush @ bscearth200' shows navigation options like 'cycles list', 'task jobs list', and 'broadcasts list'. Below this is a 'Display Options' button. A status message indicates 'Suite ■ is stopped, last activity 6 minutes ago'. At the bottom, a table shows the history of cycle points.

cycle point	last active time	▶ tasks	⊞ jobs	✓ tasks	⊞ jobs	✗ tasks	⊞ jobs	⊞ log/job-CYC
1990-04	6 minutes ago	0	0	✓ 1	⊞ 1	0	0	
1990-03	11 minutes ago	0	0	✓ 2	⊞ 2	0	0	
1990-02	17 minutes ago	0	0	✓ 2	⊞ 2	0	0	
1990-01	22 minutes ago	0	0	✓ 4	⊞ 4	0	0	

Rosie - experiment database



Goal: version controlling suites and suite discovery and management

tmp: Rosie Suites Discovery @ bscearth200

search

query

Search term ...

all revisions

search

detail ▲	idx	branch	revision	owner	project	title	author	date	from_idx	status
☰	tmp-aa000	trunk	2	dmanuben	specs	test	eadmin	2017-10-18T08:29:22Z	None	A
☰	tmp-aa001	trunk	3	dmanuben	tmp	tmp1	eadmin	2017-11-27T12:25:58Z	None	A
☰	tmp-aa002	trunk	4	dmanuben	tmp	tmp	eadmin	2017-11-27T17:35:48Z	None	A
☰	tmp-aa003	trunk	5	dmanuben	tmp	tmp	eadmin	2017-11-27T17:52:51Z	None	A
☰	tmp-aa004	trunk	6	dmanuben	primavera	spinup	eadmin	2017-11-27T17:59:00Z	None	A
☰	tmp-aa005	trunk	7	dmanuben	specs2	test	eadmin	2017-11-27T18:14:03Z	tmp-aa000	A
☰	tmp-aa006	trunk	8	dmanuben	primavera2	spinup	eadmin	2017-11-28T09:39:04Z	tmp-aa004	A
☰	tmp-aa007	trunk	9	dmanuben	primavera3	spinup	eadmin	2017-11-28T09:39:39Z	tmp-aa006	A
☰	tmp-aa008	trunk	10	dmanuben	primavera4	spinup	eadmin	2017-11-28T09:39:57Z	tmp-aa007	A
☰	tmp-aa009	trunk	11	dmanuben	primavera5	spinup	eadmin	2017-11-28T09:41:09Z	tmp-aa008	A
☰	tmp-aa010	trunk	12	dmanuben	primavera6	spinup	eadmin	2017-11-28T09:41:41Z	tmp-aa009	A
☰	tmp-aa011	trunk	15	user1	blahblah	blah	user1	2017-11-29T10:15:03Z	None	M
☰	tmp-aa012	trunk	16	user1	EC-Earth	Test EC-Earth nemo only	user1	2017-11-29T14:35:54Z	tmp-aa011	A






EC-Earth runtime

Basic set of portable runscript templates

- Classic
 - Simulation template for 4 use cases (ESM, GCM, IFS only, NEMO only)
single runs, multiple platforms supported
 - Variable definitions on templates can be overwritten with specific parameters from config-run.xml at runtime
- Autosubmit
 - The same but support for taking parameters from Autosubmit config files

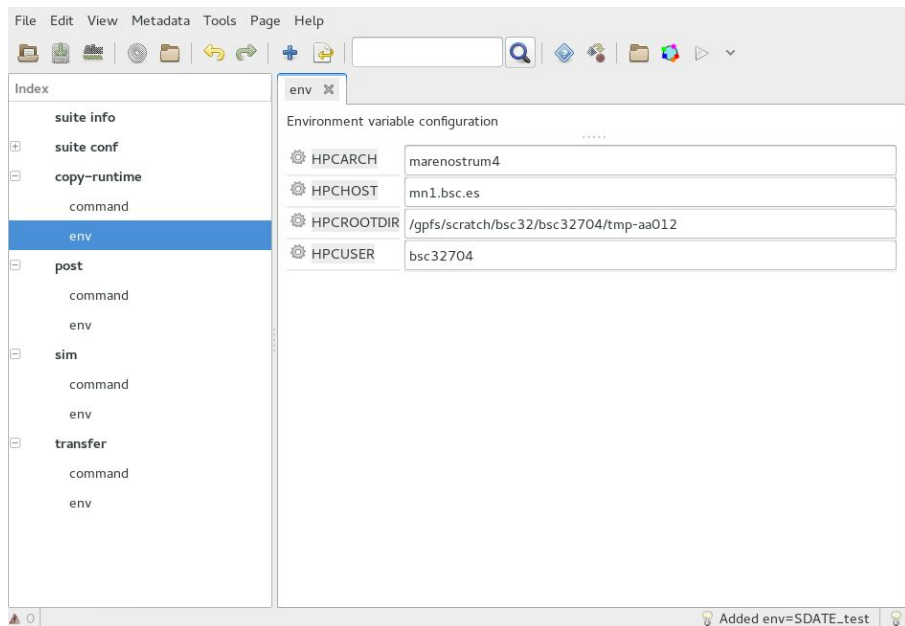
EC-Earth 3

subversion / ecearth3 / trunk

	Name	Size	Revision
+ 	doc		5483
- 	runtime		5800
+ 	autosubmit		5800
- 	classic		5799
+ 	ctrl		5747
+ 	platform		5788
	config-run.xml	9.03 KB	5312
	ece-esm.sh.tmpl	50.2 KB	5799
	ece-ifs+nemo.sh.tmpl	32.5 KB	5799
	ece-ifs.sh.tmpl	22 KB	5799
	ece-lsm.sh.tmpl	20.1 KB	5583
	ece-nemo.sh.tmpl	22 KB	5490
	librunscript.sh	7.47 KB	3977
	libsave_ic.sh	19 KB	5483
+ 	datacheck		5747
+ 	sources		5788

EC-Earth Cylc runtime

- Same idea as for Autosubmit runtime
 - Config-run.xml parameters can be taken from a rose-app.conf

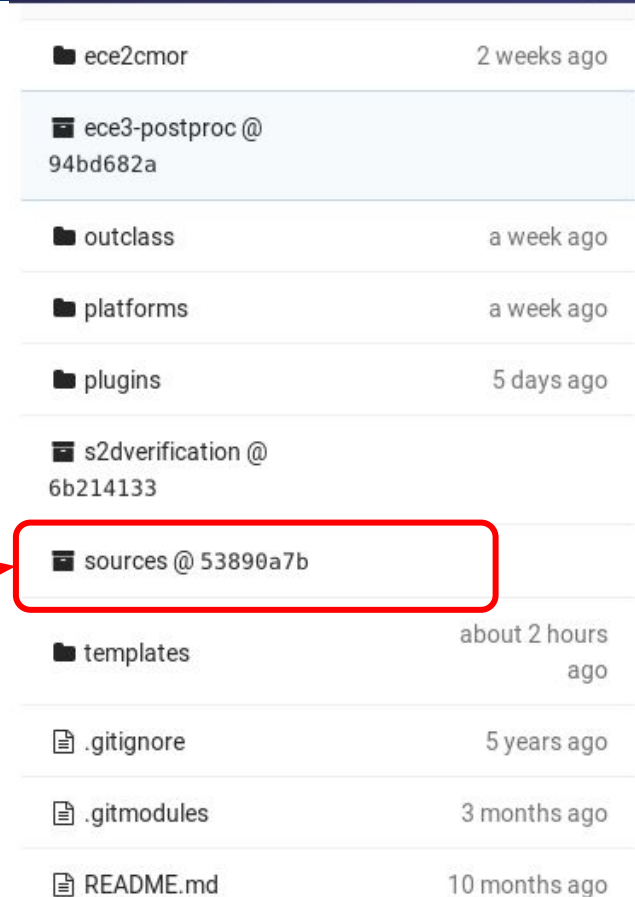


EC-Earth 3

subversion / ecearth3 / branches / development / 2018 / r4871-
cylc-runtime

Name	Size	Revision
+ doc		5328
- runtime		5449
+ autosubmit		5449
+ classic		5449
- cylc		5449
compilation.sh	7 KB	5449
config-run.xml	9.35 KB	5449
ece-esm.sh.tmpl	48.7 KB	5449
ece-ifs+nemo.sh.tmpl	31.1 KB	5449
ece-ifs.sh.tmpl	20.8 KB	5449
ece-lsm.sh.tmpl	18.2 KB	5449
ece-nemo.sh.tmpl	20.3 KB	5449
sync.sh	838 Bytes	5449
+ datacheck		5328
+ sources		5328

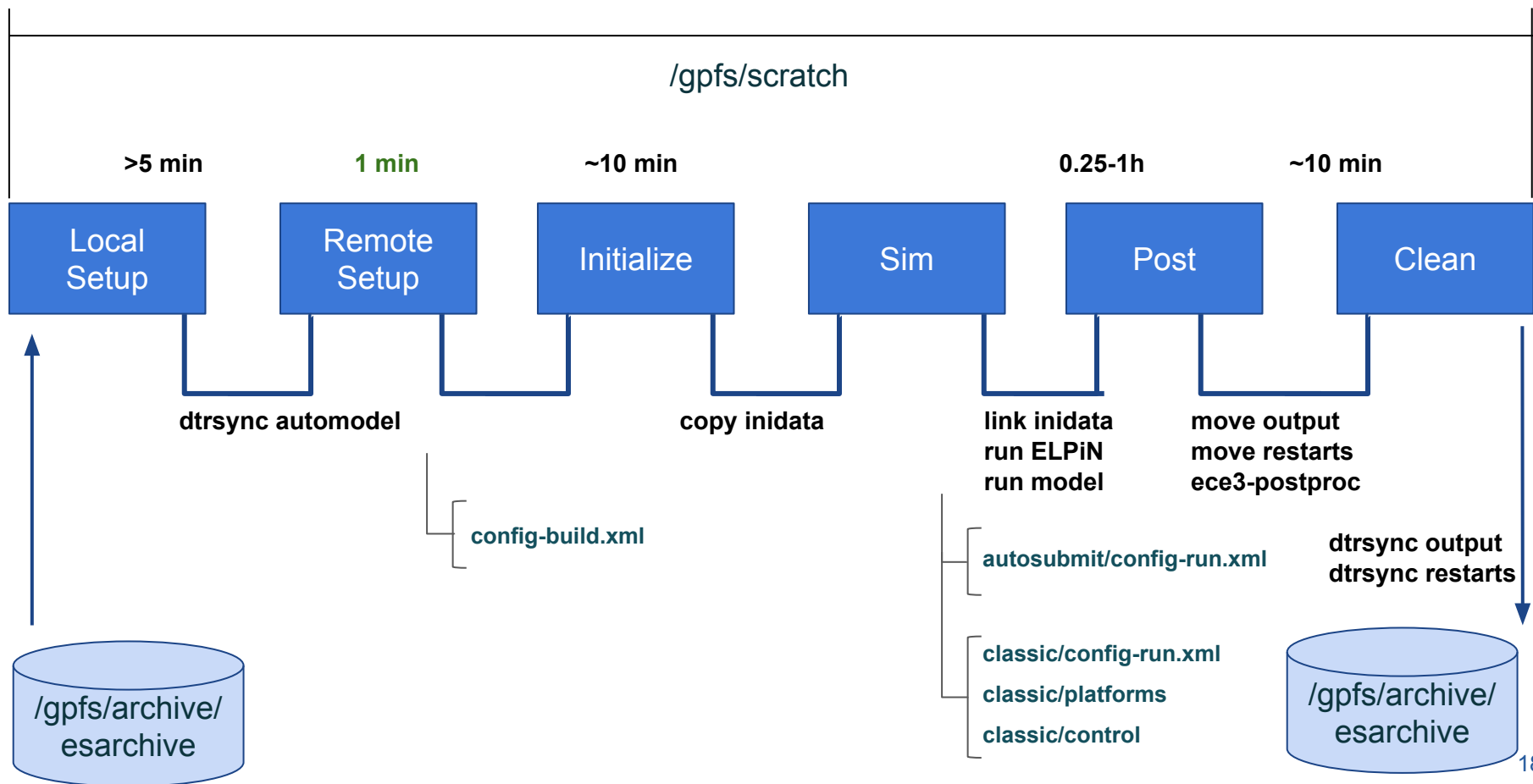
Auto-EC-Earth



📁 ece2cmor	2 weeks ago
📁 ece3-postproc @ 94bd682a	
📁 outclass	a week ago
📁 platforms	a week ago
📁 plugins	5 days ago
📁 s2dverification @ 6b214133	
📁 sources @ 53890a7b	
📁 templates	about 2 hours ago
📄 .gitignore	5 years ago
📄 .gitmodules	3 months ago
📄 README.md	10 months ago

- Framework to run EC-Earth versions with Autosubmit smoothly
 - BSC-ES additional tasks templates (setup, compilation, transfer ...), support for seasonal runs and more complex use cases (data assim, diagnostics, jobs wrapper...) are provided on a different repository (git)
- It includes EC-Earth basic runtime as Git submodule
- All BSC-ES production and development experiments start from an Auto-EC-Earth branch or tag

Auto-EC-Earth, MareNostrum4



Auto-EC-Earth, set of tests

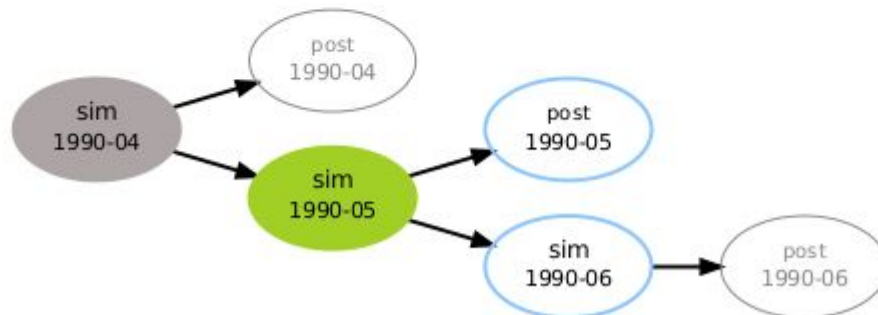


nord3	CCA	MN4	resolution	type	details
t02c	t00u	t00q	T255L91-ORCA1L75-LIM3	coupled	start from restart
		t00v	T255L91-ORCA1L75-LIM3	coupled	ATM nudgin
		t011	T255L91-ORCA1L75-LIM3	coupled	sppt
	t00s	t00o	T255L91-ORCA1L75-LIM3	coupled	cold start
	t01d	t00z	ORCA1L75-LIM3	nemo	cold start
		t01j	ORCA1L75-LIM3	nemo	cold start ocean nudging
	t01e	t00r	T511L91-ORCA025L75-LIM3	coupled	start from restart
		t01o	ORCA025L75-LIM3	nemo	cold start
	t01b	t00y	T511L91	ifs	cold start
	t00t	t00p	T511L91-ORCA025L75-LIM3	coupled	cold start

- Climate prediction
 - EC-Earth / NEMO / OpenIFS
 - ✓ • Historical runs
 - Seasonal / decadal runs
 - Model development (stem?)
- Air quality
 - MONARCH
 - Operational runs
- Computational group
 - Automated tests on multiple platforms
 - Scalability analysis
 - Load balance analysis
 - Precision analysis
 - Data provisioning

Portable experiments including

- ✓ • Compilation
- Initialization
- ✓ • Simulation
 - Post processing
 - Automated transfers
 - Data assimilation



- Portable suites for collaborative model development
 - EC-Earth Cylc runtime simplification
 - Rose metadata compliance
 - Rose stem, is it useful in the testing/development phase?
 - Rosie web services under EC-Earth Development portal
- Capture more use cases @ BSC
 - Suite for ensemble climate prediction
 - Suite for ensemble MONARCH (operational air quality model)
 - System wide installation of Cylc and Rose
- Cylc @ MN4
 - Communication back from tasks to suite host will be possible

- Cylc @ ECMWF
 - Rose suite running at ECMWF, including tasks to archive data at BSC and compute diagnostics on Power9 cluster
 - Will Cylc web-based GUIs be available from ECMWF servers?
 - Could ECMWF HPC be used as remote resource, using the ecaccess web toolkit?
- (later) Single batch job for multiple tasks #2754

- A strategy for adopting Cylc and Rose as the EC-Earth common workflow management system is being build
 - Needs of the community have been taken into account
- A demonstrator has been created at BSC
 - Cylc, Rose and Rosie have been installed on a private virtual machine at BSC
 - Rose suites have been created for running EC-Earth historical and multi-member ensemble climate simulations
 - MareNostrum 4 (Slurm) and data-transfer nodes (background) are being used as remote resources, using polling

- EC-Earth consortium collaboration
 - Develop more EC-Earth use cases
- Close collaboration with the MetOffice
 - ESiWACE 2
 - IS-ENES 3
- Training activities
 - Cylc + Rose from scratch, suite design, at BSC
 - Tutorials at EC-Earth meeting and PATC course





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OCHOA



Thank you!

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For further information please contact
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