NorESM e-resources
Part I : git-repository structure

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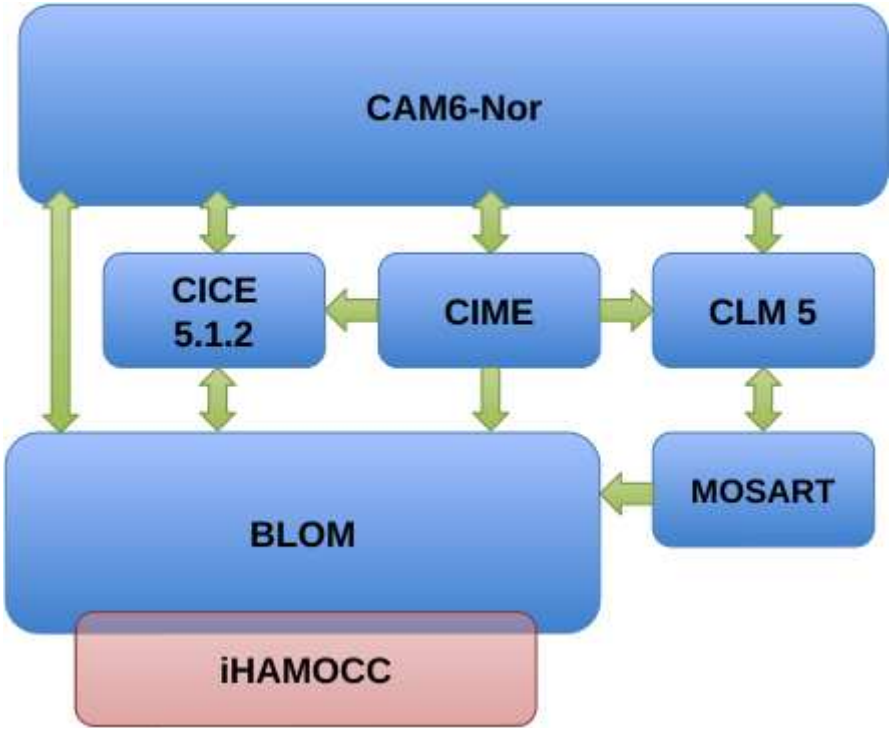
Overview

- The components of NorESM2
- The repository structure of NorESM2
- The tags/branches/releases
- Obtaining a version of NorESM2
- (Contributing to NorESM2)
- Résumé

1. The components of NorESM2

NorESM2 – an Earth System Model

The model structure of NorESM2 :

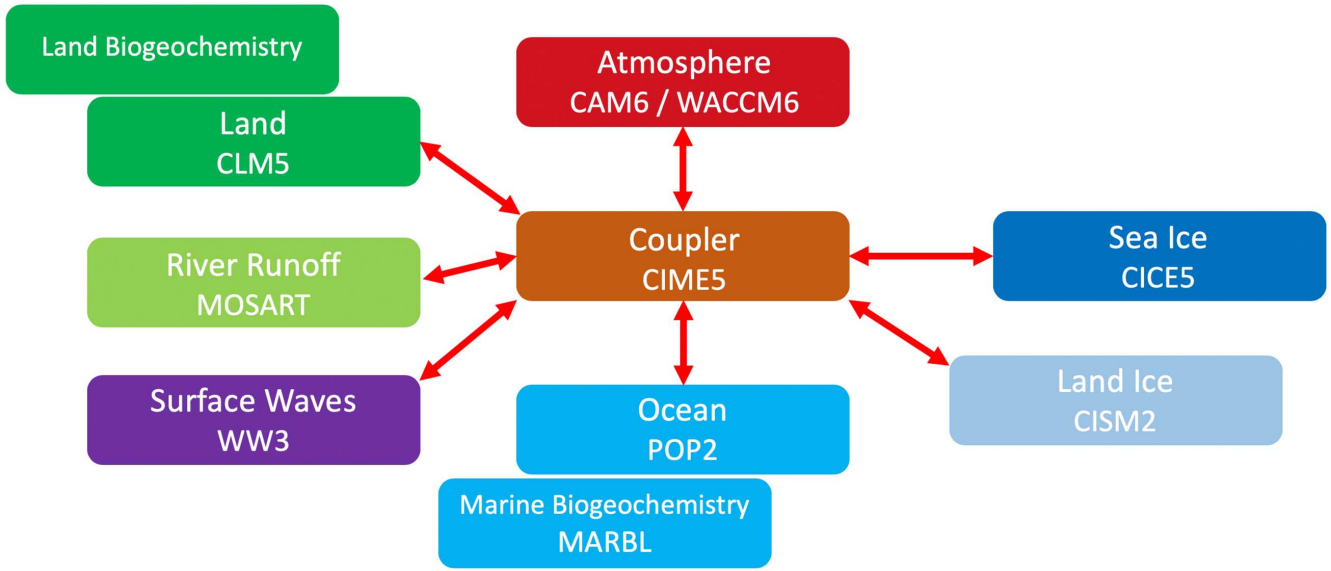


Seland et al. [2020, GMDD]

NorESM2 – based on CESM2

NorESM2 is based on CESM2 ! (Community Earth System Model version 2)

The model structure of CESM2 :



Danabasoglue et al. [2020, JAMES]

Additional components in CESM2 (w.r.t. NorESM2) : waves, land-ice.

2. The repository structure of NorESM2

Overview of the repositories

Code version system : git

Where can one find the model code for NorESM2? **https://github.com/NorESMhub/** [Norwegian Earth System Modelling hub]

Separarte repository for each component [7 in total]

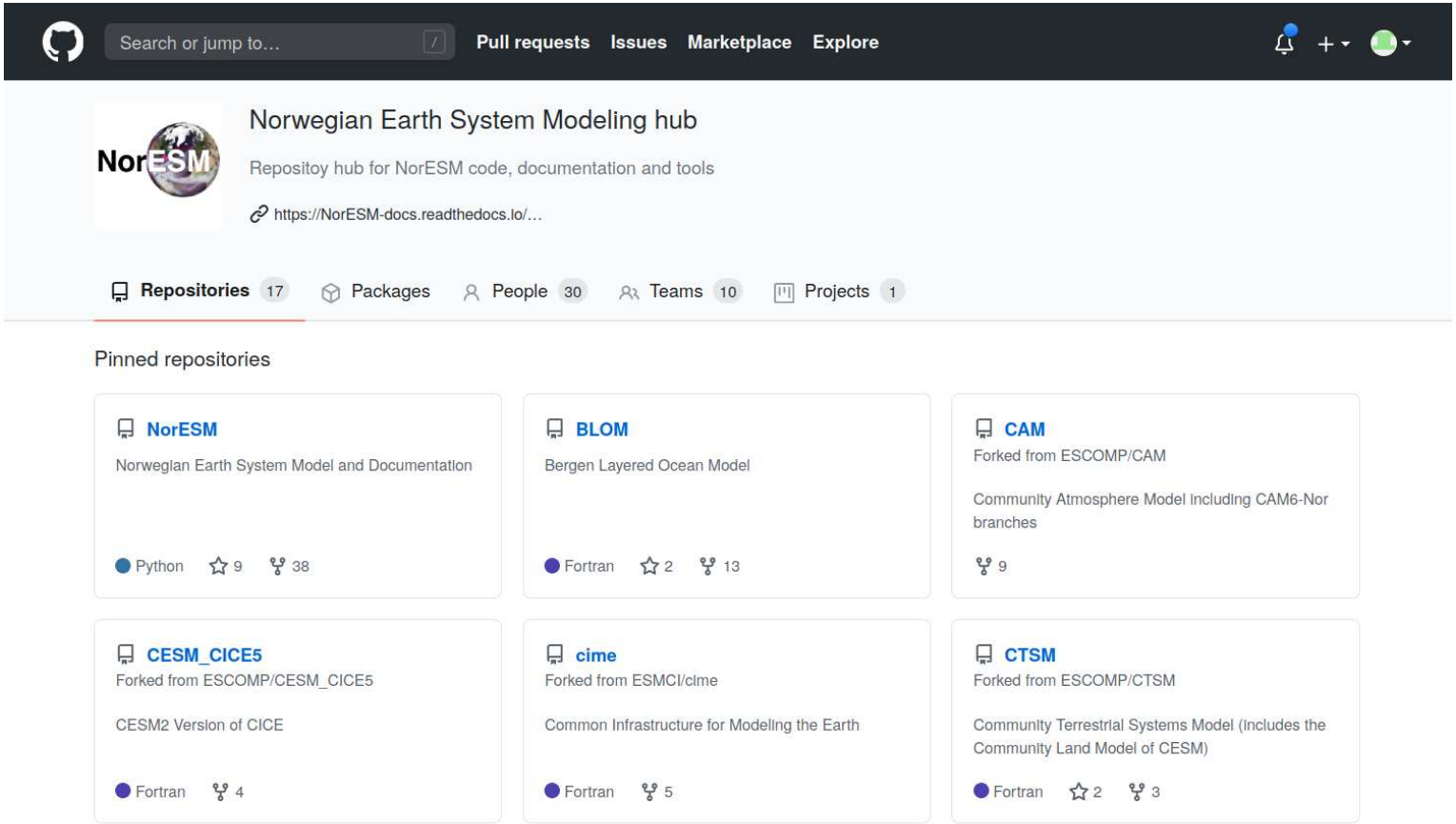
- NorESM : Norwegian Earth System Model and Documentation [Mainly an umbrella]
- BLOM : Bergen Layered Ocean Model
- CAM : Community Atmosphere Model including CAM6-Nor branches
- CESM_CICE5 : CESM2 Version of CICE
- cime : Common Infrastructure for Modelling the Earth
- CTSM : Community Terrestrial Systems Model [includes the Community Land Model of CESM]
- MOSART : Model for Scale Adaptive River Transport, Mosart, part of the Community Earth System Model

CESM has some additional repositories

- CISM : The Community Ice Sheet Model
- POP : Parallel Ocean Program
- RTM : The River Transport Model [older version of new MOSART]
- WW3 : Wave Watch III Model

NorESMhub

https://github.com/NorESMhub



NorESM git-structure

Original or derived derived Some of the repositories in github.com/NorESMhub are independent, some have been derived from github.com/ESCOMPE (or github.com/ESMCI)

Overview of the repositories for NorESM2

github.com/ESCOMPE github.com/ESMCI		**github.com/NorESMhub**
		NorESMhub/**NorESM**
		NorESMhub/**BLOM**
ESCOMPE/CAM	→	NorESMhub/**CAM**
ESCOMPE/CESM_CICE5	→	NorESMhub/**CESM_CICE5**
ESMCI/cime	→	NorESMhub/**cime**
ESCOMPE/CTSM	→	NorESMhub/**CTSM**
ESCOMPE/MOSART	→	NorESMhub/**MOSART**

Differences between github.com/ESCOMPE and github.com/NorESMhub
Some differences are very small (e.g., CTSM and MOSART)
Other differences are substantial due to specific NorESM2-developments (e.g., CAM)

3. The commits/tags/branches

Branches/tags

Repository can contain different versions of the model in the form of branches/commits/tags

branch There are different lines of development : **branch** to distinguish these ...
[Continuous evolution → Obtaining the latest version might differ from week to week]

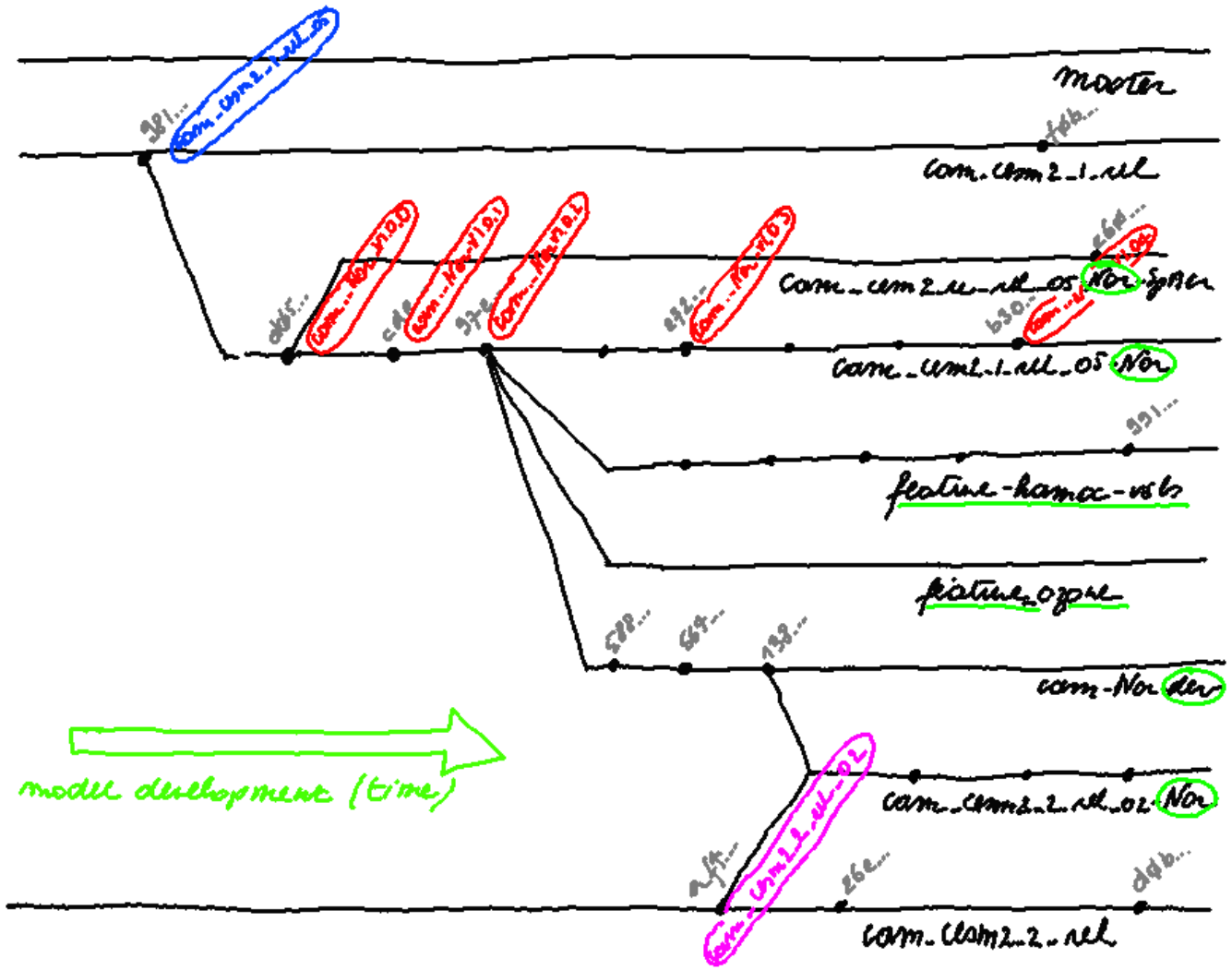
commit There are different points (in time) marked on the branches : name is a 40-digit (hexadecimal) string [There can be many of these]

tag Some of the commits can be marked with a meaningful name : **tags** to distinguish these ...
[Fixed model versions→ always the same code]

Obtaining a model version to run a simulation

- To run the model : you need at least NorESM + 6 components
- From all the components one specific version/branch/tag/commit/...

Branches and tags in CAM [NorESMhub]



Branches and tags in CAM [NorESMhub]

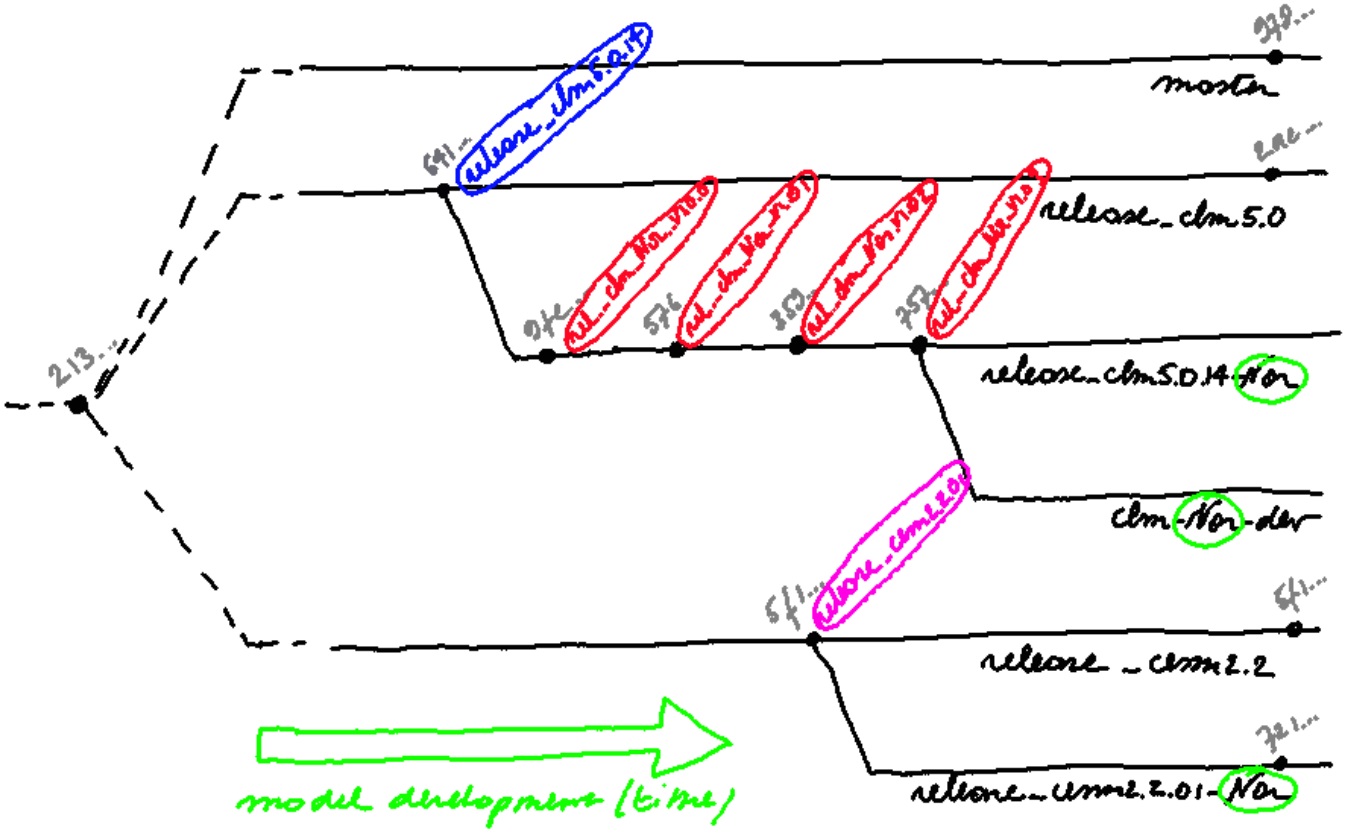
Branches [evolving]

- master (almost empty)
- cam_cesm2_1_rel (from CESM)
- **cam_cesm2_1_rel_05-Nor**
- cam_cesm2_1_rel_05-Nor-SpAer
- feature-hamocc-vsls
- feature-ozone
- cam-Nor-dev
- cam_cesm2_2_rel (from CESM)
- cam_cesm2_2_rel_02-Nor
- ...

Tags [fixed]

- **cam_cesm2_1_rel_05-Nor_v1.0.5** [on branch cam_cesm2_1_rel_05-Nor]
- ...
- cam_cesm2_1_rel_05-Nor_v1.0.1 [on branch cam_cesm2_1_rel_05-Nor]
- cam_cesm2_1_rel_05-Nor_v1.0.0 [on branch cam_cesm2_1_rel_05-Nor]
- ...
- cam_cesm2_1_rel_05 [on branch cam_cesm2_1_rel]
- cam_cesm2_2_rel_02 [on branch cam_cesm2_2_rel]

Branches and tags in CTSM/CLM [NorESMhub]



Branches and tags in CTSM/CLM [NorESMhub]

Branches [evolving]

- master
- release-cesm2.0
- release-clm5.0
- **release-clm5.0.14-Nor**
- clm-Nor-dev
- release-cesm2.2
- release-cesm2.2.01-Nor
- ...

Tags [fixed]

- **release-clm5.0.14-Nor_v1.0.3** [on branch release-clm5.0.14-Nor]
- ...
- release-clm5.0.14-Nor_v1.0.0 [on branch release-clm5.0.14-Nor]
- ...
- release-clm5.0.14 [on branch release-clm5.0]
- release-cesm.2.2.01 [on branch release-cesm2.2]

Branches and tags in BLOM [NorESMhub]

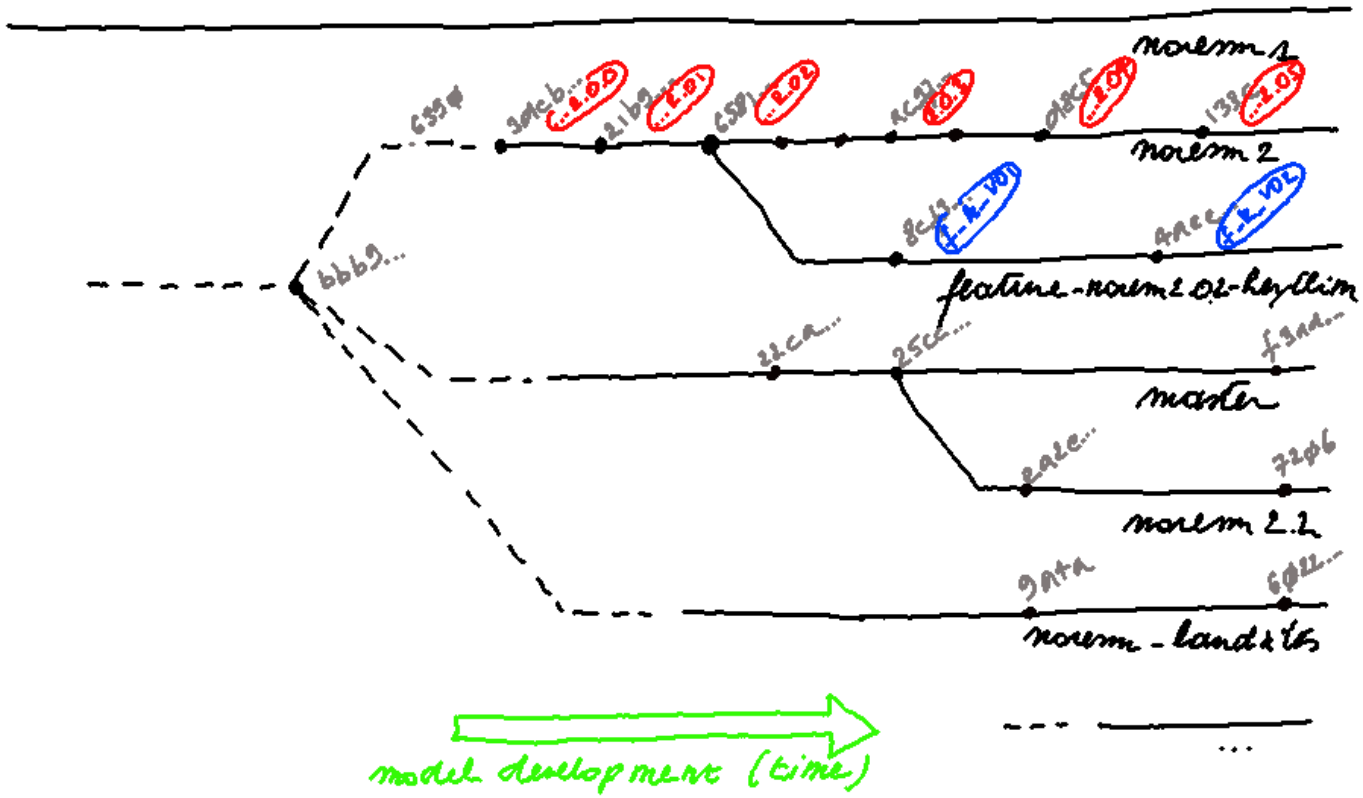
Branches [evolving]

- master
- release-1.0
- release-1.1
- release-1.2
- feature-hybrid_coord2
- feature-hybrid_coord
- feature-hamocc-vsls
- feature-hamocc_sediment_burst-coupling
- feature-hybrid_coord
- feature-hybrid_coord2
- feature_GPU_channel2
- feature_GPU_channel2_hackathon

Tags [fixed]

- **v1.1.0**
- v1.0.0
- pre-v1.0.0
- blomb0_0_001
- blom0_0_000

Branches and tags in NorESM [NorESMhub]



Branches and tags in NorESM [NorESMhub]

Branches

- master_cesm
- noresm1 (only documentation)
- master
- **noresm2** [evolving, but no answer changing modifications anymore]
- feature-noresm2.0.2_keyClim
- noresm2.2
- noresm_landsites

Tags

- release-noresm2.0.0, release-noresm2.0.1, release-noresm2.0.2, release-noresm2.0.3, release-noresm2.0.4, **release-noresm2.0.5** [May 28, 2021] [on branch noresm2]
- feature-noresm2.0.2_keyClim_v01, feature-noresm2.0.2_keyClim_v02 [November 1, 2021] [on branch feature-noresm2.0.2_keyClim]
- 1.0.0

NorESM repository

Contains some machine settings, some experiment set-ups, some user-mods, . . .

NorESM repository

Contains one important file **Externals.cfg**

4. Obtaining a version of NorESM2

The file Externals.cfg

Role of Externals.cfg

- Determines which tag/branch for the different components should be used
- Is used in the automatic download of the different components
- Allows to prescribe coherent component combinations

Content of Externals.cfg

```
[cam]
tag = cam_cesm2_1_rel_05-Nor_v1.0.4
protocol = git
repo_url = https://github.com/NorESMhub/CAM
local_path = components/cam
required = True
[cice]
tag = cice5_20181109-Nor_v1.0.3
protocol = git
repo_url = https://github.com/NorESMHub/CESM_CICE5
local_path = components/cice
required = True
[cime]
tag = cime5.6.10_cesm2_1_rel_06-Nor_v1.0.5
protocol = git
repo_url = https://github.com/NorESMhub/cime
local_path = cime
required = True
...
```

Obtaining NorESM2

What determines the model version? The actual model version is determined by tag/branch of NorESM2, which determines (via Externals.cfg) the component version.

To obtain a working model version

1. Download (clone) the (small) NorESM git-repository
2. Choose your tag/branch of NorESM2 → Externals.cfg
3. Based on Externals.cfg, download automatically all the other components (their specific branch/tag) [./manage_externals/checkout_externals]

Convention

Released tags of NorESM2 : should refer only to tags of the components. Makes the model completely reproducible.
Branch of NorESM2 : can refer to branches of the components.

You can modify Externals.cfg [before step 3]

- to use another tag/branch than the one prescribed
- to use *your/someone else* personal repository (e.g., repo_url = https://github.com/<gituser>/CAM)

Subcomponent of component

The components can contain their own subcomponents (e.g., via External_CAM.cfg, External_CLM.cfg, . . .)
Checking out sub-components : goes automatically . . .

Dowloaded version of NorESM2

Results of the download

- Code directory ready to build an experiment and compile the model
- The code is downloaded with correct links to the git repositories (e.g., *git remote -vv*)

Code structure of downloaded model

cime_config
Externals.cfg
manage_externals/checkout_externals
cime
components/blom
components/cam
components/clm
components/cice
components/mosart

Remark

1. All components are individual clones of the corresponding git-repositories → allows to use standard git-commands (e.g, change branch)
2. One can change Externals.cfg and rerun ./manage_externals/checkout_externals to change branch

5. Contributing to NorESM2

Your personal git-repositories for the NorESM components

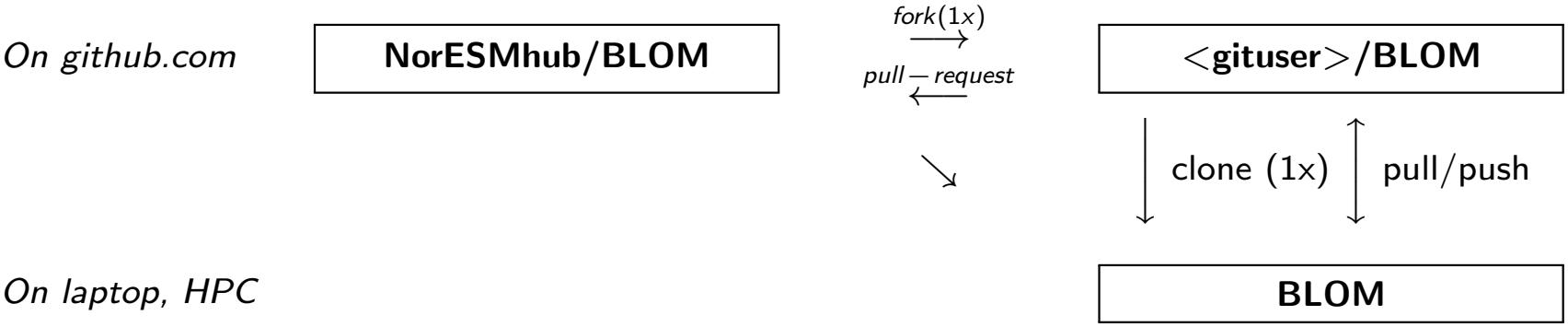
Overview of the repositories for NorESM2

github.com/ESCOMPE **github.com/ESMCI**		**github.com/NorESMhub**		**github.com/<gituser>**
		NorESMhub/**NorESM**	→	<gituser>/NorESM
		NorESMhub/**BLOM**		
ESCOMPE/CAM	→	NorESMhub/**CAM**	→	<gituser>/CAM
ESCOMPE/CESM_CICE5	→	NorESMhub/**CESM_CICE5**		
ESMCI/cime	→	NorESMhub/**cime**	→	<gituser>/cime
ESCOMPE/CTSM	→	NorESMhub/**CTSM**	→	<gituser>/CTSM
ESCOMPE/MOSART	→	NorESMhub/**MOSART**	→	<gituser>/MOSART

Fork

What is fork? A personal copy on github of *someone else* project on github.com

Schematic of fork on github.com



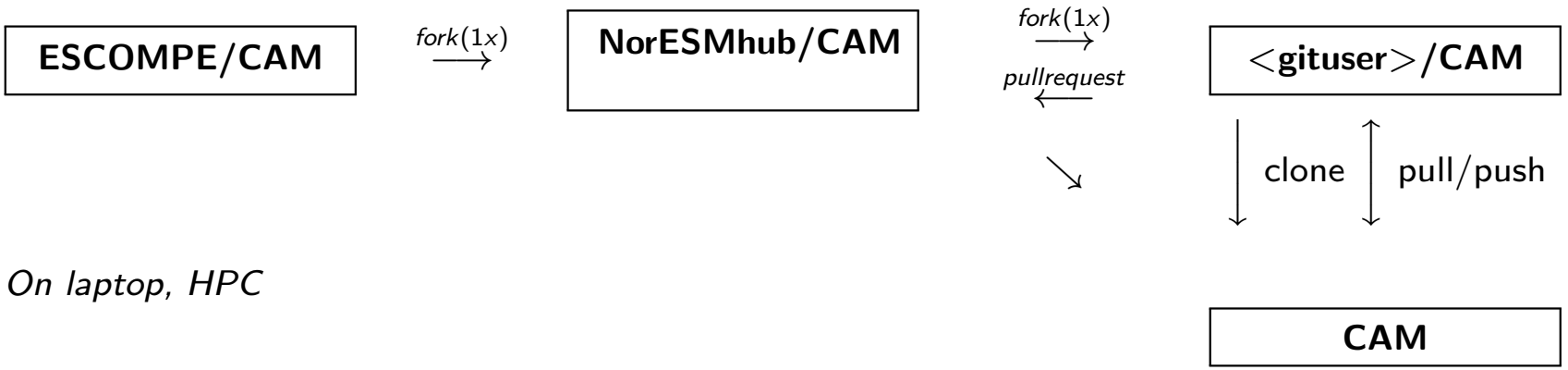
Make a fork? [Action on github.com] [only once]

Make a pull-request [Action on github.com]

Fork of a fork . . .

Schematic of fork of fork on github.com

On github.com



On laptop, HPC

6. Résumé

Résumé

github.com/NorESMhub NorESM2 consists out of 7 repositories

Branches/tags

Externals.cfg File which determines the branch/tag for individual components (to be used in your NorESM2-setup)

Different usage of repositories Clone one component *versus* obtaining a full model-version to run a simulation

Fork/pull-request Repositories can be forked to contain personal developments.
NorESMhub-version can be upgraded via pull-requests.

NorESM evolution

NorESM versions

NorESM1 (used for CMIP5) **NorESM1-happi**	CAM4-Oslo	**CCSM4.0** (April 2010)	https://github.com/metno/noresm https://github.com/metno/noresm	(2007–. . .) (2016–. . .)
NorESM_c1.2	CAM5.3-Oslo	**CESM1.2** (June 2013)	https://github.com/metno/noresm	(2013–. . .)
NorESM2 (used for CMIP6)	CAM6-Oslo	**CESM2.1** (Dec 2018)	https://github.com/metno/noresm-dev	(2016–. . .)
NorESM2	CAM6-Nor	**CESM2.1** (Dec 2018)	https://github.com/NorESMhub	(2020–. . .)
NorESM2.2 (in development)	..	**CESM2.2** (2020)	https://github.com/NorESMhub	(2021–. . .)

Acknowledgements

NCAR

Then end

Questions?