
norESM documentation Documentation

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The purpose of the norESM documentation is to provide a common place for NorESM users and developers to share information. How is the code organised? What tools are you using? Which version should I run for what purpose? etc.

This documentation is being re-organized and a Github project has been created to follow the progress at <https://github.com/NorESMhub/NorESM-docs/projects>.

If you have any questions or interested in actively participate in the reorganization, create a new issue on github at <https://github.com/NorESMhub/norESM-docs/issues>

Information on how to contribute to this documentation can be found at <https://github.com/NorESMhub/NorESM/blob/master/doc/README.md>.

1.1 Introduction

NorESM1 is the Norwegian Earth System model used for CMIP5. The model is based on the CCSM framework (http://en.wikipedia.org/wiki/Community_Climate_System_Model). However, NorESM has special features developed by Norwegian researchers, including (but not limited to)

- Atmosphere module : CAM-Oslo replaces standard CAM
- Ocean module : Based on the isopycnic coordinate model MICOM

Main references are:

GMD - Special issue The Norwegian Earth System Model: NorESM; basic development, validation, scientific analyses, and climate scenarios

http://www.geosci-model-dev.net/special_issue20.html [1] [2] [3] [4]

The next version of the model NorESM2 is built on a update version of the CCSM framework, CESM2. (<http://www.cesm.ucar.edu/models/cesm2/>); (https://en.wikipedia.org/wiki/Community_Earth_System_Model). Its aerosol module is based on OsloAero5.3 of NorESM1.2 / CAM5.3-Oslo [5].

This website contains information shared between NorESM developers and users

1.1.1 Obtaining a version of the model

- The development version has been moved to git: Obtain a copy through `git clone https://<githubUserName>@github.com/metno/noresm-dev.git`. You first need to be registered as a noresm user on github (see detailed info in *Obtain a copy of the model (using git)*).

If you are on a normal ubuntu PC and want the source code, you might see that “svn checkout” complains about “gnome keyring”. If you see this problem, the solution is here: <http://askubuntu.com/questions/206604/svn-and-gnome-keyring>

- **Need access to other versions: Special access document**:** https://docs.google.com/a/met.no/document/d/1G1ezxtBhzDyNWwrKJYWmp8gn402bOWThe_6gN00PDMQ/edit?usp=sharing

1.1.2 Running / Configuring the model

- *Newbies guide to running NorESM*
- *Advanced configuration of NorESM1*
- *Advanced configuration of NorESM2*
- *Fluxes crossing boundaries*
- *CMIP6 volcanic forcing*
- *CMIP6 emissions of short-lived components*
- *cmip6greenhouseGasConcentrations*
- *Atmospheric output for some commonly used configurations of NorESM2 (Oct 30'th 2018)*

1.1.3 Develop the model

Setting up at different machines

Most developers compile and run NorESM on hexagon (hexagon.bccs.uib.no). That machine uses the portland group fortran compiler. Most developers develop the code on that machine using “develop/compile/run/analyze print statements” on that machine.

Some experiments have also been done with compiling running CAM on a normal Linux PC in order to use interactive debuggers. (see below)

Setting up CAM on your own linux PC

Issue tracker

Any development should ideally be agreed with the NorESM development team and be properly described in the issue tracker, see the link below

Using the issue tracker

If you have changed the model and want to merge your changes to the trunk, your model has to pass some tests:

Testing

Test list for NorESM

Version control best practices

- **NEW**:** After switching to git (13th november 2015) the svn-repository is read-only. Some advice on how to use the new git-repository are available here: *Obtain a copy of the model (using git)*

Some guidelines for modifying NorESM's subversion repository: *SVN - Best Practice/FAQ*

How-to for setting up svn repositories on NorStore: *Subversion how-to for NorStore*

NorESM2 branches in active development

- <https://github.com/metno/noresm/>: master (this is the trunk/master version)
- <https://github.com/metno/noresm/>: featureCAM5-OsloDevelopment_trunk2.0-6 (Main development branch for CAM-Oslo aerosol features)
- <https://github.com/metno/noresm/>: feature-classnuc-ice_featureCAM5-OsloDevelopment-2 (ice nucleation feature branch)
- <https://github.com/metno/noresm/>: featureNitrate_featureCAM5-OsloDevelopment-2/ (aerosol nitrate feature branch)

NorESM1 branches in active development

- <https://github.com/metno/noresm/noresm-ver1-cmip5/> (Original NorESM1-M CMIP5 version. Only technical updates)
- https://github.com/metno/noresm/noresm-ver1_r112-r169/ (Further development from the CMIP5 version. Include EU-ACCESS project improvements)

You obtain the model code through checking it out. The command would be

```
git clone https://<githubUserName>@github.com/metno/noresm-dev.git
git checkout -b aBranchName origin/aBranchName
```

This gives the code in your directory.

Uncertain parameters in the aerosol model

Developing the model also involves setting some uncertain numbers into the model. Not all of these are available from namelists. Go to the link below to understand where main uncertainties are.

Uncertain parameters (which can be discussed) in the aerosol model

1.1.4 Analyze model results

Model Diagnostic Tools

Several tools are shared among NorESM users

- noresm2nc4mpi
- noresm2nc4norstore
- *Model Diagnostic Tools*
- esmvaltool

1.1.5 Archive model results

Long-term archiving is normally done on NorStore's disk resources (e.g, in /projects/NS2345K/noresm/cases).

To avoid loss of data, another copy should be placed on tape. For instructions, see [Norstore Tape](#)

Data that builds the basis of publications should be migrated to NorStore's Research Data Archive in order to guarantee preservation and also to offload the project area. For specific NorESM instructions, see *NorStore Research Data Archive: Guidelines for ingestion of NorESM output*

1.1.6 CMIP5 archive of NorESM results

NorStore Research Data Archive: Guidelines for ingestion of NorESM output

1.1.7 Share model results

Model output and derived data products can be shared via the Norwegian Earth System Grid data portal <http://noresg.norstore.no> (see [norstoreesg](#) for instructions).

Some aerosol and cloud-relevant output for the development version of NorESM2 is available for those with MET Norway affiliation through VpN at /vol/fou/emep/People/alfk/CAM-Oslo-diagnostics/

1.1.8 Past and ongoing work

Several simulations have been performed with NorESM. A list of available simulations and runs can be found here, [listofruns](#). The page also contains an overview of planned simulations. A fairly extensive description of the model and to some extent also the CMIP5 runs can be found at <http://pcmdi9.llnl.gov/esgf-web-fe/>

Choose one of the links. Search for NorESM1-M CMIP5 in the search fields. Choose the link model documentation

NorESM is also used in several projects: *Existing projects*

1.1.9 Resources

* TaiESM CCLiCS workshop in Taipei 2016 - Ingo Bethke

1.2 Newbies guide to running NorESM

The purpose of this page is to be able to set up and run the model within 15 minutes. For more advanced configuration, please consult http://www.cesm.ucar.edu/models/ccsm4.0/ccsm_doc/ug.pdf

This guide assumes that you have properly checked out the model to some directory which will call \$NORESM. This directory will contain subdirectories "models" and "scripts".

1.2.1 Go to scripts directory

The following guidelines assumes that execution is done from the scripts folder

```
cd $NORESM/scripts
```

1.2.2 Create the case

```
./create_newcase -case ../cases///casename/// -mach //machinename// -res
f19_g16 -compset //compsetname//
```

(where //casename//, //machinename// and //compsetname// are user input. Res is imodel resolution. The user can //not// give any resolution since input data are not prepared for any resolution in NorESM.)

To see a list of available compsets type

```
./create_newcase -list
```

The simplest case which runs production tagged aerosols and data ocean in a VERY coarse resolution is

```
./create_newcase -case /path/to/where/I/store/the/case -compset NFPTAERO
-mach hexagon -res f10_f10
```

1.2.3 Configure the case

```
cd $NORESM/cases///casename//
```

edit any configuration files (understand env_conf.xml and env_run.xml)

```
./configure -case (in NorESM1 / CAM4)
```

or

```
./cesm_setup (in NorESM2 / CAM5)
```

After these two commands, the case is configured

1.2.4 Build the case

```
../casename//../machinename//.build (NorESM1 / CAM4)
../casename//.build (NorESM2 / CAM5)
```

1.2.5 Run the case

```
qsub //casename//../machinename//.run
```

1.2.6 Example

=

There are already several pre-defined compsets. They all have long and short names. As an example we can use the compset N_2000_AEROSLO_CN (with short name N2000AERCN). Thus a valid command on the machine //hexagon// is:

```
./create_newcase -case /path/to/my/case/directory/ -mach hexagon -res
f19_g16 -compset N2000AERCN
```

(will run a “year 2000” CAM4/NorESM1 case with the Oslo-aerosols)

```
./create_newcase -case /path/to/my/case/directory/ -mach hexagon -res  
f19_g16 -compset FAMIPCS
```

(will configure the “default” atmosphere-only simulation of CAM5)

1.2.7 Important files

The most important files to understand in your case-directory are:

* env_run.xml (model run type, how long time to run etc) * env_conf.xml (model configuration)

1.2.8 More information

Go to *Advanced configuration of NorESM1* for more information

1.3 Advanced configuration of NorESM1

1.3.1 Understanding compsets

A compset is a collection of configuration parameters which describe a specific case. NorESM has several pre-defined compsets. The CCSM users guide provides information on configuring your own compsets. The compsets define things like //how many processors will be used in this case //, //which options go to cam_oslo in this case //

For existing compsets, search for the file config_compsets.xml in your \$NORESM folder. They can also all be printed by going to \$NORESM/scripts and type the command

```
./create_newcase -list
```

1.3.2 AMIP type simulations

For AMIP type simulations, using the data ocean model with prescribed (observed) SST, use one of the pre-defined compsets with long names starting with “**NF_**”. One, used in the AMIP run for CMIP5, is “NF_1979-2005_AER_AMIP_OBS”, with the short name “NF2005AERAMIPO”. To create a Case with the chosen name AMIPtest for this compset, as an example, write

```
./create_newcase -case ../cases/AMIPtest/ -mach hexagon -res f19_f19 -  
→compset NF2005AERAMIPO
```

1.3.3 Running with offline aerosol interaction

In order to limit the number of compsets there are (at present) no compsets available for automatically setting up the model in offline mode (i.e., the meteorology is forced by aerosol optics and CDNC from CAM4 instead of CAM4-Oslo) or for taking out extra AeroCom diagnostics, which requires numerous additional subroutine calls and therefore is quite expensive to run, both with respect to CPU time and memory. To set up the model in offline mode (before compiling), simply find all subroutines which contain the logical variable AEROFFL (e.g.: grep AEROFFL *.F90), and replace all instances of

```
#. undef AEROFFL
```

and

```
!#define AEROFFL
```

with

```
#. define AEROFFL
```

This is useful for short simulations where we want to look at direct and/or indirect radiative forcing by aerosols, since the meteorology does not change with changing aerosol emissions (e.g. for year 1850 and 2000). Similarly, to set up the model to take out additional aerosol output for use in AeroCom or other studies where there is a need for extensive aerosol diagnostics, find all subroutines which contain the logical variable AEROCOM (e.g.: `grep AEROCOM *.F90`), and then replace all

```
!#define AEROCOM
```

with

```
#. define AEROCOM
```

The model may be run with any combination of these options: with AEROFFL only, with AEROCOM only, or with AEROFFL and AEROCOM activated at the same time.

See also presentation from NorESM workshop November 28'th 2013.

1.3.4 Use of look-up tables for aerosol optics and activation to cloud droplets

See presentation from NorESM workshop November 28'th 2013:

The look-up table code, AeroTab, is now available through subversion under `cam/tools/AeroTab` on `norEsmTrunk`. To obtain a local copy (`myAeroTab`) of the newest version without checking out the whole NorESM model, run

```
svn checkout
https://svn.met.no/NorESM/noresm/trunk/noresm/models/atm/cam/tools/AeroTab
myAeroTab
```

Or, if you are interested in the CMIP5 version (with some updates), run instead

```
svn checkout -r 199
https://svn.met.no/NorESM/noresm/trunk/noresm/models/atm/cam/tools/AeroTab
myAeroTab
```

1.3.5 Use of chemistry

See presentation from NorESM workshop November 28'th 2013:

1.4 Advanced configuration of NorESM2

- **NOTE THAT THE COMPSETS MENTIONED IN THIS EXAMPLE ARE NO LONGER MAINTAINED! THE GENERAL EXPLANATION AND IDEAS ARE STILL VALID!**

1.4.1 Creating a new compset

The essential file to edit is `~/noresm/scripts/ccsm_utils/Case.template/config_compsets.xml`

This examples shows how to simply add a to the “F_AMIP_CAM5” compset:

Under ” “, add

```
AMIP_CAM5%OSLO_CLM40%SP_CICE%PRES_DOCN%DOM_RTM_SGLC_SWAV
```

The “CAM5%OSLO” options have to be defined, so a line like this is needed:

```
-phys cam5 -cam_oslo aerlife
```

The compset needs a description, we also need the line `cam 5 physcs` and `oslo aerosols`

We could also define a specific use-case (namelist) for our compset. This would need a line like:

```
my_namelist
```

This would only work if the file `my_namelist.xml` exists as

```
noresm/models/atm/cam/bld/namelist_files/use_cases/my_namelist.xml
```

1.4.2 Setting up a case with the new compset and building the model

It should now be possible to create a new case directory, which we here name `FAMIPOSLOtst` and configure with 1 degree horizontal atmospheric resolution;

```
./create_newcase -case ../cases/FAMIPOSLOtst -compset FAMIPOSLO -mach
hexagon -res f09_f09
```

and finally set up and compile the model: `cd ../cases/FAMIPOSLOtst`

```
./cesm_setup
./FAMIPOSLOtst.build
```

1.4.3 Why does it work to change `config_compsets.xml` ?

In NorESM there are 3 new config-options for CAM:

“ * `-cam-oslo aerlife` (turns on transport of oslo tracers)“

“ * `-cam-oslo dirind` (also turns on interaction with radiation)“

“ * `-cam-oslo warmclouds` (also turns on interaction with warm clouds)“

They change number of tracers and turn on different preprocessor flags in in a perl script called “configure”, see: `models/atm/cam/bld/configure`

To understand the implementation do: `svn diff -r 202 models/atm/cam/bld/configure`

The new oslo-options also need to be defined, see `models/atm/cam/bld/config_files/definition.xml`

To see how these new options were added, do: `svn diff -r 202 models/atm/cam/bld/config_files/definition.xml`

1.4.4 Configure nudging

Create the met-data

First run the model to produce 6 hourly data. The following namelists are needed:

```
user_nl_cam &camexp mfilt = 1, 4, nhtfrq = 0, -6, avgflag_pertape
= 'A','I', fincl2 = 'PS','U','V','TAUX','TAUY','FSDS','TS','T','Q','PHIS','QFLX','SHFLX'
user_nl_clm &clmexp hist_mfilt = 1,4 hist_nhtfrq = 0,-6
hist_avgflag_pertape = 'A','I' hist_fincl2 = 'SNOWDP','H2OSNO','H2OSOI'
```

Use the met-data in another run

First create a compset which has the configure-option “-offline_dyn”. Check in config_compsets.xml which compsets have this configure-option added. See for example the compset NFAMIPNUDGEPTAERO in https://svn.met.no/NorESM/noesm/branches/featureCAM5-OsloDevelopment_trunk2.0-1/noesm/scripts/ccsm_utils/Case.template/config_compsets.xml

Then use this compset to create a case. You need the following user-input (for example in your user_nl_cam)

```
&metdata_nl
met_data_file = '/work/shared/noesm/inputForNudging/FAMIPC5NudgeOut/atm/hist/
↳FAMIPC5NudgeOut.cam.h1.1979-01-01-00000.nc'
met_filenames_list =
'/work/shared/noesm/inputForNudging/FAMIPC5NudgeOut/atm/hist/fileList.txt'
```

This info can be added directly in a use_case which you associate with the compset created (see e.g. 2000_cam5_oslonudge.xml)

where met_data_file is the first met-data file to read, and met_filenames_list is a list of the following met-data. The first lines of the file should look something like this (guess what the rest of the file should look like? 8-o:)

```
/work/shared/noesm/inputForNudging/FAMIPC5NudgeOut/atm/hist/FAMIPC5NudgeOut.cam.h1.
↳1979-01-01-00000.nc
/work/shared/noesm/inputForNudging/FAMIPC5NudgeOut/atm/hist/FAMIPC5NudgeOut.cam.h1.
↳1979-01-02-00000.nc
/work/shared/noesm/inputForNudging/FAMIPC5NudgeOut/atm/hist/FAMIPC5NudgeOut.cam.h1.
↳1979-01-03-00000.nc
```

This file can be created at the place where you put the metadata with this command:

```
alfgr@hexagon-4: /work/shared/noesm/inputForNudging/FAMIPC5NudgeOut/atm/hist>
ls -d -1 $PWD/*.h1.*.nc > fileList.txt
```

Namelist options

When looking at aerosol indirect effects, it’s recommended to nudge only U, V and PS: &metdata_nl

```
met_nudge_only_uvps = .true.
```

Choose relaxation time (hours). Use the same time as dt in met_data_file: &metdata_nl

```
met_rlx_time = 6
```

Nudge to ERA-interim reanalysis

Link to ERA-interim metdata instead of model produced metdata. Remember to choose the files corresponding to your resolution (examples below are for f09_f09 and 32 levels in the vertical): `&metdata_nl`

```
met_data_file = '/work/shared/noresm/inputdata/noresm-only/inputForNudging/ERA_f09f09_
↳30L_days/2001-01-01.nc'
met_filenames_list = '/work/shared/noresm/inputdata/noresm-only/inputForNudging/ERA_
↳f09f09_30L_days/fileList2001-2015.txt'
```

Add also the ERA-topography (no matter which fields you are nudging):

```
&cam_inparm

bnd_topo = '/work/shared/noresm/inputdata/noresm-only/inputForNudging/ERA_f09f09_30L_
↳days/ERA_bnd_topo.nc'
```

1.5 Fluxes crossing boundaries

NorESM can simulate several biogeochemical cycles. Here is a list of the fluxes which cross boundaries in the models and how to enable/disable interactions

^ Component ^ Source ^ Receiver ^Unit ^ How to enable ^ | Dust | CLM | CAM |kg/m2/s |Always calculated by CLM. Picked up and used by atmosphere. Used differently in different aerosol-packages (bulk-aero, MAM, OSLO_AERO) || Dust | CAM | HAMMOC |kg/m2/s |Leaves CAM as `cam_out%dstwet{n},cam_out%dstdry{n}` (n=1-4), picked up by HAMMOC in coupler || DMS | HAMMOC | CAM |kg/m2/s |HAMMOC writes DMS to the coupler if one sets “CCSM_BGC=CO2_DMSA” in `env_run.xml`. Picked up and used by CAM-Oslo if `namelist-variable dms_source==’ocean_flux’`. Only compsets with MICOM%ECO run HAMMOC | CO2 | CLM | CAM | ?? || CO2 | HAMMOC | CAM | ?? || CH4 | CLM | CAM | ?? || isoprenes/monoterpenes| CLM | CAM | kg/m2/s| Calculated by MEGAN in CLM by setting “‘isoprene = isoprene’,monoterp = myrcene + sabinene + limonene + carene_3 + ocimene_t_b + pinene_b + pinene_a” Note that any additional emission-file for monoterpenes will be ADDED to the MEGAN emissions || NO (?) | CLM | CAM || | NH3 (?) | HAMMOC | CAM || | NHx (?) | CAM | CLM + HAMMOC || | NOx (?) | CAM | CLM + HAMMOC || |

1.6 CMIP6 volcanic forcing

1.6.1 Code and installation

The CMIP6 volcanic forcing implementation has been committed to the noresm (CESM1.2) repository and the noresm-dev (CESM2_beta) repository. The changes can be viewed here: \ <https://github.com/metno/noresm/commit/59d2b4c4714c0df41141a10d79fd329b27b8aed6> \ <https://github.com/metno/noresm-dev/commit/bbec72fa49ed57ab70d5052b8b4c0162eeb6ab88>

SourceMods are available on FRAM/NIRD: \

```
/nird/projects/fram/nn2345k/ingo/CMIP6/Forcing/Volc/SourceMods_noresm_cesm1.2

/nird/projects/fram/nn2345k/ingo/CMIP6/Forcing/Volc/SourceMods_noresm_cesm2beta6
```

The folder


```
SourceMods_noresm_cesm2beta6
```

also contains a modified version of CAM's

```
build-namelist
```

script that needs to be installed in

```
components/cam/bld/
```

1.6.2 Configuration of user namelists

For some compsets the below specifications are applied automatically. Still, you can specify the same settings in your

```
user_nl_cam
```

in your case directory.

CESM1.2 - climatological background forcing

Specify following in your

```
user_nl_cam
```

to activate the use of CMIP6 compliant volcanic background forcing: ! Users should add all user specific namelist changes below in the form of ! namelist_var = new_namelist_value

```
prescribed_volcaero_datapath      = '/cluster/shared/noresm/inputdata/atm/cam/
↪volc'
prescribed_volcaero_file          = 'CMIP_CAM6_radiation_average_v3_reformatted.
↪nc'
prescribed_volcaero_cycle_yr      = 1850
prescribed_volcaero_type          = 'CYCLICAL'
rad_climate                       = 'A:Q:H2O', 'N:O2:O2', 'N:CO2:CO2', 'N:ozone:O3', 'N:N2O:N2O',
↪ 'N:CH4:CH4', 'N:CFC11:CFC11', 'N:CFC12:CFC12'
fincll = 'AODVVOLC', 'ABSVVOLC'
```

Note that

```
rad_climate
```

is specified here because CAM's

```
build-namelist
```

script will otherwise add an extra entry that was needed by the CMIP5 volcanic forcing implementation.

CESM1.2 - transient forcing

Specify following in your

```
user_nl_cam
```

to activate the use of CMIP6 compliant transient (1850-2014) volcanic forcing: ! Users should add all user specific namelist changes below in the form of ! namelist_var = new_namelist_value

```
prescribed_volcaero_datapath      = '/cluster/shared/noresm/inputdata/atm/cam/
↳volc'
prescribed_volcaero_file          = 'CMIP_CAM6_radiation_v3_reformatted.nc'
rad_climate                       = 'A:Q:H2O', 'N:O2:O2', 'N:CO2:CO2', 'N:ozone:O3', 'N:N2O:N2O',
↳ 'N:CH4:CH4', 'N:CFC11:CFC11', 'N:CFC12:CFC12'
fincl1 = 'AODVVOLC', 'ABSVVOLC'
```

CESM2_beta - climatological background & transient

The

```
user_nl_cam
```

namelist settings are the same as for CESM1.2, except that following extra line needs to be added:

```
prescribed_strataero_file        = ' '
```

This will deactivate the use of NCAR's alternative CMIP6 volcanic forcing.

CAM's original

```
build-namelist
```

script does not properly recognise the deactivation and will issue an error that both

```
prescribed_strataero_file
```

and

```
prescribed_volcaero_file
```

are set.

As a workaround, replace

```
components/cam/bld/build-namelist
```

in your model tree with the modified version

```
:: /nird/projects/fram/nn2345k/ingo/CMIP6/Forcing/Volc/SourceMods_noresm_cesm2beta6/build-namelist
```

Writing the volcanic forcing to the history output for verification

The complete set of optical parameters of the volcanic forcing can be written to CAM-OSLO's monthly history output by adding following in the case's

```
user_nl_cam
```

```
fincl1 = 'ext_sun1','ext_sun2','ext_sun3','ext_sun4','ext_sun5','ext_sun6','ext_sun7',
↳'ext_sun8','ext_sun9','ext_sun10','ext_sun11','ext_sun12','ext_sun13','ext_sun14',
↳'omega_sun1','omega_sun2','omega_sun3','omega_sun4','omega_sun5','omega_sun6',
↳'omega_sun7','omega_sun8','omega_sun9','omega_sun10','omega_sun11','omega_sun12',
↳'omega_sun13','omega_sun14','g_sun1','g_sun2','g_sun3','g_sun4','g_sun5','g_sun6',
↳'g_sun7','g_sun8','g_sun9','g_sun10','g_sun11','g_sun12','g_sun13','g_sun14','ext
↳earth1','ext_earth2','ext_earth3','ext_earth4','ext_earth5','ext_earth6','ext_earth7
↳','ext_earth8','ext_earth9','ext_earth10','ext_earth11','ext_earth12','ext_earth13',
14'ext_earth14','ext_earth15','ext_earth16','omega_earth1','omega_earth2','omega_earth3',
↳'omega_earth4','omega_earth5','omega_earth6','omega_earth7','omega_earth8',
↳'omega_earth9','omega_earth10','omega_earth11','omega_earth12','omega_earth13',
↳'omega_earth14','omega_earth15','omega_earth16','g_earth1','g_earth2','g_earth3','g_
↳earth4','g_earth5','g_earth6','g_earth7','g_earth8','g_earth9','g_earth10','g_
```

(continues on next page)

(continued from previous page)

Note that each variable corresponds to a single band, that values are masked below the model's tropopause and that all values are interpolated online from altitude to pressure. The output can be compared to the original input data which is stored in

```
CMIP_CAM6_radiation_average_v3.nc
```

and

```
CMIP_CAM6_radiation_v3.nc
```

in

```
/cluster/shared/noresm/inputdata/atm/cam/volc
```

on FRAM.

1.7 CMIP6 emissions of short-lived components

.

1.8 Atmospheric output for some commonly used configurations of NorESM2

In preparation for CMIP6 and the required model output for the various MIPs, NorESM2 has been set up with different configurations, all run as AMIP using the compset NF2000climo (on 2 degrees) in noresm-dev (2.0: commit 7757f2d8258d5f84e960db12f840afebc69d7856 from October 30'th 2018; (2.1: COMMIT 35b90aab78c2ccee636539894c9ff9015355f2f from March 25'th 2019) The given estimates in CPU-time increase are based on 1 month simulations, including model initialization, and are therefore low end estimates.

With standard set-up of the model, the monthly output variables (1, 2 and 3 D) are:

```
standard_output
```

Adding `history_aerosol = .true.` to `user_nl_cam` gives the following additional 577 variables (+ ca. 13 % CPU-time)

```
history_aerosol_extra_output
```

Furthermore including `#define AEROFFL` to `preprocessorDefinitions.h` gives 8 additionally variables (+ ca. 5% CPU-time)

```
aeroffl_extra_output
```

and when also `#define AEROCOM` is activated there, we additionally get the following 149 variables (+ ca. 13% CPU-time)

```
aerocom_extra_output
```

Finally, also taking out COSP data (`./xmlchange --append CAM_CONFIG_OPTS='-cosp'`), the following 57 output variables (of which 7 are 4 D) are added to the output (+ ca. 10% CPU-time):

```
cosp_extra_output
```

1.9 Update of NorESM2 with CESM2.1.0

This document describes the upgrade of NorESM with CESM2.1.0. The previous update of NorESM-dev dated from June 2018, and was based on a predecessor of CESM2.0.

A new branch has been created : featureCESM2.1.0-OsloDevelopment [notice the 2.1.0]. This is to prevent too much trouble for people currently working with featureCESM2-OsloDevelopment.

Please feel free to edit and improve this document. On several locations, there are comments in colour and with question marks.

The main topics treated in this document are :

A description of the CESM2.1.0 version used for the update.

A description of some of the structural differences between NorESM2 and CESM2.

Update of NorESM2.

1.9.1 General comments and remarks

This section contains some general comments about extra modification suggestions to the code. Most of them are not urgent.

Checking code

Directories to possible remove

Skip in the code structure : directory CESM12_deprecated.

Skip in the code structure : directory models

Skip in the code structure : cime_config/usermods_dirs/n1850r227

Skip in the code structure : cime_config/usermods_dirs/nhistr227

CISM

Current NorESM is setup to not used CISM2. We should be careful that we are consistent. E.g., NorESM compsets use GLACE, whereas CESM compsets use CISM2%NOEVOLVE.

Also for initial conditions/REFCASE one should be careful : see cime_config/config_compsets.xml

Carbon cycle

There are now CO2 emissions at surface and from aircraft in CESM. They exist both on 0.9x1.25 and 1.9x2.5 resolution.

History_dust

history_dust : has been added on some places, but not everywhere. CAM-Oslo is currently not using it.

Supported grids

Should we use support_grid (as for CESM)?

CLM

UiO (Kjetil) is willing to implement an extra correction for the land model

Running pure CESM code based on the NorESM repository

It is/would be a nice feature if one can still run pure CESM based on the NorESM repository. However, one should be careful about :

cam/bld/configure : how to switch off the NorESM directories for pure CESM?

landmodel : there is a single modification which is hard-coded

one should avoid that CAM-Oslo namelist options end up in namelist (dms_source, volc_fraction, ...)

Clean-up of old compsets

There are still a lot of reference to emission files from CMIP5 used by CAM-Oslo5.3 and NorESM_c1.2. These are however not used and maybe can be removed.

CLM and netcdf3/netcdf4

There are two bomb-emissions files (for C13 and C14) for the landmodel, which are used when “CMIP6” is activated in the land model. These files are however NetCDF3 format. This requires to convert the files to NetCDF4, or to use “netcdf” instead of “pnetcdf” for CLM.

1.9x2.5 grid in CESM

Only the CO2 emissions (surface and aircraft) used in BHIST have separate resolutions.

Initial files for 1.9x2.5 are often old files (e.g. dating 2015).

Decisions to be made for NorESM

CROP

When will we have CROP active? The F2000climo compset (CESM) has CROP not anymore active, so I switched it also off for NF2000climo.

GHG concentration

Which GHG concentrations to be used in the spinup? The GHG concentrations in the pre-industrial control B1850 of CESM, are not identical to the values in Meinshausen et al. [2017]. I will check this again.

Naming conventions for NorESM compsets

The current NorESM preindustrial compset, is named N1850OCBDRDDMS (compared to B1850 in CESM). This motivated me to call the historical NorESM compset NHISTOCBDRDDMS (compared to BHIST in CESM).

Updates in CESM2.1.0 for CMIP6

Forcings have been updated for quite some COMPSETS (for NF2000climo they have not changed)

Diagnostics have been extended

New compsets have appeared : 4xCO2 and 1pctCO2

More for 2x2 has become available

CLM5 has now the CLM50%BGC-CROP-CMIP6DECK configuration (`cime_config/config_compsets.xml`).

CICE has CICE%CMIP6

(should be extended)

1.9.2 CESM2.1.0 version

CESM2.1.0 standard version

This section describes how the implemented CESM2.1.0 version has been obtained.

CESM2.1.0 version made by THT

The code is based on CESM2.1.0 : obtained from

`git clone -b release-cesm2.1.0 https://github.com/ESCOMP/cesm.git`

For CAM, some additional recent updates have been used (from `cam6_1_010`) :

`https://svn-ccsm-models.cgd.ucar.edu/cam1/trunk_tags/cam6_1_010`. By using `cam6-1_010` tag, 7 files were affected :

1. `components/cam/cime_config/config_compsets.xml`
2. `components/cam/src/chemistry/mozart/mo_fstrat.F90`
3. `components/cam/src/chemistry/mozart/mo_photo.F90`
4. `components/cam/src/control/ncdio_atm.F90`
5. `components/cam/src/physics/cam/physics_types.F90`
6. `components/cam/src/physics/cam/physpkg.F90`
7. `components/cam/src/utils/cam_grid_support.F90`

In addition, the code has been modified such that it contains the changes from Thomas Thoniazzi (THT), and such that it can run on vilje and fram. This concerns files in several components, and is related to energy conservation, flux parameterizations, ... However, all these modification can be deactivated using correct settings in the namelist.

This version made by THT, and called `cam_cesm2_1_rel_05`, did not contain POP, and had used on older version of WW3, than the one prescribed in CESM2.1.0.

In the table below is shown wat tags were used for the different components.

	CESM2.1.0	cam_cesm2_1_rel_05				
	Externals.cfg	Ext.cfg.all	mini	orig	pop	Ext.cfg.rest
cam	cam_cesm2_1_rel_05	–	–	–	–	–
cice	cice5_20181109	(id.)	(id.)	cice5_cesm2_0_rel_01–	–	–
cime	cime5.6.10_cesm2_1_rel_06	(id.)	(id.)	cime_cesm2_0_rel_06–	–	–
cism	release-cesm2.0.04	(id.)	–	release-cesm2.0.01	–	(id.)
clm	release-clm5.0.14	(id.)	(id.)	release-clm5.0.01	–	–
mosart	release-cesm2.0.03	(id.)	–	release-cesm2.0.00	–	(id.)
pop	pop2_cesm2_1_rel_n01	(id.)	–	–	(id.)	–
rtm	release-cesm2.0.02	(id.)	–	release-cesm2.0.00	–	(id.)
ww3	ww3_cesm2_1_rel_01	ww3_cesm2_0_rel_01–	–	ww3_cesm2_0_rel_01–	–	ww3_cesm2_0_rel_01

The external files used were probably : Ext.cf.mini + Ext.cfg.rest

Overview of the modifications by THT

The tables below shows which files in CESM2.1.0 made by THT differ from a standard downloaded CESM2.1.0.

CIME

1	config_grids.xml	
2	config_batch.xml	
3	config_compilers.xml	
4	config_machines.xml	
5	case_submit.py	
6	env_batch.py	
7	case.build	
8	check_case	
9	docn_comp_mod.F90	THT
10	namelist_definition_drv.xml	THT
11	cime_comp_mod.F90	
12	seq_flux_mct.F90	
13	seq_infodata_mod.F90	
14	shr_flux_mod.F9	
15	shr_orb_mod.F90	

CAM

1	namelist_defaults_cam.xml		THT
2	namelist_definition.xml		THT
3	config_compsets.xml	CAM_6_1_010	
4	mo_fstrat.F90	CAM_6_1_010	
5	mo_gas_phase_ch emdr.F90		THT
6	mo_photo.F90	CAM_6_1_010	
7	mo_wacm_hrates.F90		THT
8	cam_history.F90		
9	ncdio_atm.F90	CAM_6_1_010	
10	cd_core.F90		
11	ctem.F90		THT
12	tp_core.F90		
13	cam_diagnostics.F90		THT
14	phys_control.F90		THT
15	physics_types.F90	CAM_6_1_010	THT
16	physpkg.F90	CAM_6_1_010	THT
17	radiation.F90		THT
18	radiation.F90		THT
19	cam_grid_support.F90	CAM_6_1_010	
20	orbit.F90		THT

CICE

1	ice_orbital.F90		THT
---	-----------------	--	-----

CLM

1	SurfaceAlbedoMod.F90		THT
2	SurfaceAlbedoMod.F90		THT

WW3

1	Changelog		
2	buildnml		

Details of the modifications

This section describes in slightly more detail the differences between the CESM2.1.0 made by THT and a standard CESM2.1.0 version.

Under “REMARK”, some of the differences are shortly described. “FILE” refers to the full path to the location of the file.

Difference can be found in CIME, CAM, CICE, CLM and WW3.

CIME

- 1) config_grids.xml

REMARK

- a) extra grids (e.g., tn ...) : contained NorESM grids

b) extra grid : f09_f09 [WHY?]

FILE

cime/config/cesm/config_grids.xml

2) config_batch.xml

REMARK

vilje and fram extra

FILE

cime/config/cesm/machines/config_batch.xml

3) config_compilers.xml [OK]

REMARK : vilje and fram extra

FILE : cime/config/cesm/machines/config_compilers.xml

4) config_machines.xml [OK]

REMARK : vilje and fram extra

FILE : cime/config/cesm/machines/config_machines.xml

5) case_submit.py

REMARK :

a) extra for fram : limit0, limit1

b) extra import sys [IS THIS NEEDED?]

c) extra caseroot [IS THIS NEEDED?]

FILE : cime/scripts/lib/CIME/case/case_submit.py

6) env_batch.py

REMARK :

a) extra for vilje

b) extra for fram : to define queue for archiving job

FILE : cime/scripts/lib/CIME/XML/env_batch.py

7) case.build

REMARK : return of function : fixed argument 0 instead of “not args.skip_provenance_check”

FILE : cime/scripts/Tools/case.build

8) check_case

REMARK : case.check_lockedfiles(skip=”env_batch”) : instead of no argument

FILE : cime/scripts/Tools/check_case

9) docn_comp_mod.F90

REMARK

a) extra kifra

b) tfreeze = ... (modified)

c) factor order of multiplication changed

d) sst_flattification

FILE : cime/src/components/data_comps/docn/docn_comp_mod.F90

10) namelist_definition_drv.xml [THT modification]

REMARK : extra flux_scheme and alb_cosz_avg

FILE : cime/src/drivers/mct/cime_config/namelist_definition_drv.xml

11) cime_comp_mod.F90 [THT modification]

REMARK :

a) shr_orb_doalbavg, shr_flux_docoare

b) call seq_flux_ocnalb_mct(..., dtime) : extra argument [4 times]

c) misses : write_hist_alarm = t24hr_alarm .or. stop_alarm

FILE : cime/src/drivers/mct/main/cime_comp_mod.F90

12) seq_flux_mct.F90 [THT modification]

REMARK :

a) subroutine seq_flux_ocnalb_mct(.., dtime) : extra argument

b) uses function shr_orb_cosz(..., dtavg) : extra argument

FILE :

cime/src/drivers/mct/main/seq_flux_mct.F90

13) seq_infodata_mod.F90 [THT modification]

REMARK : related to flux_scheme and alb_cosz_avg

FILE : cime/src/drivers/mct/shr/seq_infodata_mod.F90

14) shr_flux_mod.F90 [THT modification]

REMARK : related to flux_scheme, considerably different

FILE : cime/src/share/util/shr_flux_mod.F90

15) shr_orb_mod.F90 [THT modification]

REMARK : about alb_cosz

a) definition function shr_orb_cosz(..., rad_call) : extra argument

b) extra subroutine shr_orb_doalbavg(iflag)

FILE :

cime/src/share/util/shr_orb_mod.F90

CAM

1) namelist_defaults_cam.xml [THINGS SHOULD BE ACTIVATED AGAIN] [THT modification]

REMARK

a) contains <dme_energy_adjust>.true.</dme_energy_adjust>

b) contains all cmip5 cam-oslo emission filenames from noesm-only directory [MAYBE CAN BE SKIPPED]

c) contains (BUT COMMENTED OUT) : vol_fraction-coarse, aerotab_table_dir, dms_source, dms_source_type, dms_cycle_year, opom_source, opom_cycle_year, ocean_filename, ocean_filepath

FILE :

components/cam/bld/namelist_files/namelist_defaults_cam.xml

2) namelist_definition.xml [THINGS SHOULD BE ACTIVATED AGAIN] [THT modification]

REMARK

a) met_nudge_only_uvps

b) cam_chempkg; but trop_mam_oslo COMMENTED OUT

c) dme_energy_adjust

d) flds_co2_dmsb : but COMMENTED OUT

e) vol_fraction-coarse, aerotab_table_dir, dms_source, dms_source_type, dms_cycle_year, opom_source, opom_cycle_year, ocean_filename, ocean_filepath; but COMMENTED OUT

FILE :

components/cam/bld/namelist_files/namelist_definition.xml

3) config_compsets.xml [CAM_6_1_010]

REMARK :

1) FKESLER : no science_support grid

2) FW1850 : disappeared

3) FWsc2010climo, FWsc2000climo, FWsc1850, FWscHIST, FW1850 : extra science_support grid

4) FW4madHIST, FW4madSD, FX2000, FXHIST, FXmadHIST, FXSD, FXmadSD : CLM50 instead of CLM40

FILE :

components/cam/cime_config/config_compsets.xml

4) mo_fstrat.F90 [CAM_6_1_010]

REMARK :

lat variable disappeared (only within #ifdef DEBUG)

FILE :

components/cam/src/chemistry/mozart/mo_fstrat.F90

5) mo_gas_phase_chemdr.F90 [THT modification]

REMARK :

call zenith(..., delt) : extra argument

FILE :

components/cam/src/chemistry/mozart/mo_gas_phase_chemdr.F90

6) mo_photo.F90 [CAM_6_1_010]

REMARK :

added "if (masterproc) then" (only within #ifdef DEBUG)

FILE

components/cam/src/chemistry/mozart/mo_photo.F90

7) mo_waccm_hrates.F90 [THT modification]

REMARK

call zenith(..., dtavg) : extra argument

FILE

components/cam/src/chemistry/mozart/mo_waccm_hrates.F90

8) cam_history.F90

REMARK

1) i_am_a_nazi_arse=.false.

2) fincl shift

3) fexcl shift

FILE

components/cam/src/control/cam_history.F90

9) ncdio_atm.F90 [CAM_6_1_010 modification]

REMARK : ndims = ndims -1

FILE : components/cam/src/control/ncdio_atm.F90

10) cd_core.F90 [ALL EQUAL] : why was it present?

FILE : components/cam/src/dynamics/fv/cd_core.F90

11) ctem.F90 [THT modification]

REMARK : on winds

FILE : components/cam/src/dynamics/fv/ctem.F90

12) tp_core.F90

REMARK :

cos_van, cos_ppm = 0.1_r8 !roughly at 84 deg instead of

cos_van, cos_ppm = D0_25 !roughly at 75 deg

FILE :

components/cam/src/dynamics/fv/tp_core.F90

13) cam_diagnostics.F90 [THT modification]

REMARK

a) extra THT diagnostics : EBREAK, PTTEND_DME, IETEND_DME, EFLX

b) subroutine diag_phys_tend_writeout_dry(..., tmp_t, eflx, dsema) : 3 extra arguments

c) call check_energy_get_integrals(..., tedif_glob_out=tedif_glob) : 1 extra argument

d) subroutine diag_phys_tend_writeout(..., tmp_t, ..., eflx, dsema) : 3 extra arguments

e) call diag_phys_tend_writeout_dry(..., stmp_t, eflx, dsema) : 3 extra arguments

FILE :

components/cam/src/physics/cam/cam_diagnostics.F90

14) phys_control.F90 [THT modification]

REMARK

a) `dme_energy_adjust = .false.` : extra

b) subroutine `phys_getopts(...,dme_energy_adjust_out)` : extra argument

FILE

`components/cam/src/physics/cam/phys_control.F90`

15) `physics_types.F90` [THT modification + CAM_6_1_010 modification]

REMARK : `unupdate <- orig` (shows impact of THT)

a) `logical, parameter :: adjust_te` : commented out

b) subroutine `physics_dme_adjust(..., eflx, ent_tnd, ohf_adjust, ocnfrac, sst, ts)` : 6 extra arguments

c) subroutine `physics_dme_adjust_BAB` : completely extra

d) subroutine `physics_dme_adjust_THT` : completely extra

REMARK : `final <- unupdated` (shows impact of `cam_6_1_010` instead of `cam_6_1_...`)

a) `cpairv_loc(:,:), rairv_loc(:,:)` instead of `cpairv_loc(:,,:), rairv_loc(:,,:)`

b) some related changes

FILE

`components/cam/src/physics/cam/physics_types.F90`

16) `physpkg.F90` [THT modification + CAM_6_1_010 modification]

REMARK : `unupdate <- orig` (shows impact of THT)

a) extra variables : `tmp_t, eflx, dsema, ohf_adjust,`

b) call `physics_dme_adjust(..., eflx, dsema, ohf_adjust, cam_in%ocnfrac, cam_in%sst, cam_in%ts)` : 6 extra arguments

c) call `diag_phys_tend_writeout(..., tmp_t, ..., eflx, dsema)` : 3 extra arguments

REMARK : `final <- unupdated` (shows impact of `cam_6_1_010` instead of `cam_6_1_...`)

a) call `endrun(...)` : change in message

FILE :

`components/cam/src/physics/cam/physpkg.F90`

17) `radiation.F90` [THT modification]

REMARK :

a) `cosz_rad_call=.true.`

b) call `zenith(..., cosz_rad_call)` : extra argument

FILE :

`components/cam/src/physics/camrt/radiation.F90`

18) `radiation.F90` [THT modification]

REMARK :

a) `cosz_rad_call=.true.`

b) function `shr_orb_cosz(..., cosz_rad_call)` : extra argument

FILE :

components/cam/src/physics/rrtmg/radiation.F90

19) cam_grid_support.F90 [CAM_6_1_010 update]

REMARK : call pio_write_darray(..., ierr) instead of call pio_write_darray(..., ierr, fillval=grid_fill_value)

FILE : components/cam/src/utils/cam_grid_support.F90

20) orbit.F90 [THT modification]

REMARK

a) subroutine zenith(..., rad_call) : extra argument

b) call to function shr_orb_cosz(..., rad_call) : extra argument

FILE

components/cam/src/utils/orbit.F90

CICE

1) ice_orbital.F90 [THT modifications]

REMARK

1) use shr_orb_mod, only: shr_orb_cosz : extra

2) uses #ifdef CESMCOUPLED changes together with THT changes. It is equal to old NorESM, so probably ok. [IS THIS OK?]

FILE

components/cice/src/source/ice_orbital.F90

CLM

1) SurfaceAlbedoMod.F90 [OK : THT modifications]

REMARK : use of function shr_orb_cosz (... ,dtavg) : extra argument

FILE : components/clm/src/biogeophys/SurfaceAlbedoMod.F90

2) SurfaceAlbedoMod.F90 [OK : THT modifications]

REMARK : use of function shr_orb_cosz (... ,dtavg) : extra argument

FILE : components/clm/src_clm40/biogeophys/SurfaceAlbedoMod.F90

WW3 : (because older tag used by THOMAS)

1) ChangeLog

REMARK : extra comment 01 Oct 2018

FILE : components/ww3/ChangeLog

2) buildnml

REMARK : quite some changes

FILE : components/ww3/cime_config/buildnml

CESM2.1.0 brought into noresm-dev repository

The version of CESM2.1.0 brought into the branch featureCESMNCARBeta_trunk2.0-7 of the repository noresm-dev is :

- based on CESM2.1.0 standard (downloaded from <https://github.com/ESCOMP/cesm.git>)
- including the modifications from THT(cam_cesm2_1_rel05)
- includes POP
- includes for WW3 the standard CESM2.1.0. tag (and not the older tag used in cam_cesm2_1_rel05)

1.9.3 NorESM code structure

How are the NorESM code changes introduced?

Some of the changes are modifications to existing files (scripts, xml-files, F90-files, ...), some code by copying original files in a different directory and modifying them, and really new code.

In some of the F90 file, some of the changes are activated by #CAMOSLO

Below some of the differences are described

The main differences in the code :

CAM-Oslo aerosol scheme

Different aerosol scheme in CAM. The code for this scheme can be mainly be found in the following directories :

components/cam/src/chemistry/pp_trop_mam_oslo [contains code generated by a preprocessor]

components/cam/src/chemistry/oslo_aero [contains a lot of code which originally resides in other cam-directories]

components/cam/src/physics/cam_oslo

components/cam/NorESM/

components/cam/NorESM/fv

CAM

Some modifications in CAM (which are not related to the CAM-Oslo aerosol scheme) are implemented in the original code, but with namelist choices such that the modifications can be activated/deactivated:

flux parameterisation for ocean-atmosphere exchange

averaging over (changing) zenith angle during one model time step

energy conservation

previously angular momentum conservation

MICOM/HAMOCC

The ocean model micom and the ocean biogeochemistry model HAMOCC. The source code can be found in : components/micom.

As the ocean grid for micon is different from POP grid (standard CESM ocean model), specific definitions have to be added.

CICE

Modifications in CICE are implemented in the original code. These modifications can be deactivated by specific namelist settings.

CLM

Modifications in CLM, implemented in the original code. These modifications are always active.

1.9.4 Compsets in CESM and NorESM

NorESM compsets will start with “N”, but follow in general the CESM naming convention.

fully-coupled compsets

CESM

The table below shows for some compsets (left column) which configuration of a component (top row) is used. This table is based on information in the file : cime_config/config_compsets.xml

	CAM6	CLM5	CICE	POP2	CISM2	BGC
B1850		%BGC-CROP		%ECO%ABIO-DIC	%NOE-VOLVE	%BDRD
B1850cmip6		%BGC-CROP-CMIP6DECK	%CMIP6	%ECO%ABIO-DIC	%NOE-VOLVE	%BDRD
BCO2x4cmip6	%4xCO2	%BGC-CROP-CMIP6DECK	%CMIP6	%ECO%ABIO-DIC	%NOE-VOLVE	%BDRD
B1PCTcmip6	%1PCT	%BGC-CROP-CMIP6DECK	%CMIP6	%ECO%ABIO-DIC	%NOE-VOLVE	%BDRD
BHIST		%BGC-CROP		POP2%ECO%A BIO	%NOE-VOLVE	%BDRD
BHISTcmip6		%BGC-CROP-CMIP6DECK	%CMIP6	%ECO%ABIO-DIC	%NOE-VOLVE	%BDRD
B1850G		%BGC-CROP		%ECO	%EVOLVE	%BDRD

NorESM

	CAM6	CLM50	MICOM	SGLC	BGC
N1850	%PTAERO	%BGC-CROP			-
N1850OC	%PTAERO	%BGC	%ECO		-
N1850OCBPRP	%PTAERO	%BGC	%ECO		%BPRP
N1850OCBPRP DMS	%PTAERO	%BGC	%ECO		%BPRPDMS
N1850OCBDRD DMS	%PTAERO	%BGC-CROP	%ECO		%BDRDDMS
N1850OCDMS	%PTAERO	%BGC	%ECO		%DMS
NHIST	%PTAERO	%BGC-CROP			-
NHISTOCBDRD DMS	%PTAERO	%BGC-CROP	%ECO		%BDRDDMS

Remark 1 : the NHIST should maybe be changed into NHISTOCBDRDDMS.

Remark 2 : the CLM50 attributes are probably not correct (some with BGC, some with BGC-CROP)

Remark 3 : new NHISTOCBDRDDMS

Fixed-SST compsets

CESM

The following table is based on the file : featureCESM2.1.0-OsloDevelopment.

	CAM6	CLM50	CICE	DOCN	CISM2	BGC
F1850		%SP	%PRES	%DOM	%NOEVOLVE	–
F1850_BDR D		%BGC	%PRES	%DOM	%NOEVOLVE	%BDRD
FHIST		%SP	%PRES	%DOM	%NOEVOLVE	–
FHIST_BGC		%BGC-CROP	%PRES	%DOM	%NOEVOLVE	–
FHIST_BDR D		%BGC-CROP	%PRES	%DOM	%NOEVOLVE	%BDRD
F2000climo		%SP	%PRES	%DOM	%NOEVOLVE	–
F2010climo		%SP	%PRES	%DOM	%NOEVOLVE	–

Remark 1 : – means that the components is NOT active.

Remark 2 : not mentioning anything : component is ACTIVE but without any specific configuration

Remark 3 : why F1850_BDRD with only BGC (and not BGC-CROP) in CLM50?

NorESM

	CAM60	CLM50	CICE	DOCN	GLACE
NF1850	%PTAERO	%SP	%PRES	%DOM%DOM	
NFHIST	%PTAERO	%SP	%PRES	%DOM%DOM	
NF2000climo	%PTAERO	%SP	%PRES	%DOM%DOM	

Remark 1) currently only NF2000climo exists

Remark 2) added NF1850 and NFHIST

Remark 3) do we need a NF2010climo?

1.9.5 Forcings and initial conditions

CESM

Currently, the setup of BCO2x4cmip6 differs from B1850 only in its initial file (ncdata) and co2vmr. Therefore BCO2x4cmip6 will not be mentioned explicitly for most of the forcings.

CAM

Aersol emissions

The same files (on 1x1) are used for 1x1 and 2x2 simulations.

Dust emissions

Scaling factor : always 0.7 (both for 1x1 and 2x2 resolution).

Erod file : always dst_source2x2tunedcam6-2x2-04062017.nc

Topography

	bnd_topo
1x1	fv_0.9x1.25_nc3000_Nsw042_Nrs008_Co060_Fi001_ZR_sgh30_24km_GRN L_c170103.nc
2x2	fv_1.9x2.5_nc3000_Nsw084_Nrs016_Co120_Fi001_ZR_061116.nc

Solar forcing

		solar_irrad_data_file	solar_data_ymd
B1850,F1850	1x1, 2x2	SolarForcingCMIP6piControl_c160921.nc	18500101
BHIST/FHIST	1x1, 2x2	SolarForcingCMIP6_18491230-22991231_c171031.nc	
F2000climo	1x1, 2x2	SolarForcing1995-2005avg_c160929.nc	20000101
F2010climo	1x1, 2x2	SolarForcing1995-2005avg_c160929.nc	20100101

Remark 1) SolarForcing1995-2005avg_c160929.nc contains 2 dates : 00000101 and 99991231.

Remark 2) SolarForcingCMIP6_18491230-22991231_c171031.nc contains daily dates : from 18491230 until 22991231.

Ozone forcing

		prescribed_ozone_file	
B1850,F1850	1x1, 2x2	ozone_strataero_cyclical_WACCM6_L70_CMIP6-piControl.001_y21-50avg_zm_5day_c180802.nc	1850
BHIST/FHIST	1x1, 2x2	ozone_strataero_WACCM_L70_zm5day_18500101-20150103_CMIP6ensAvg_c180923.nc	
F2000climo	1x1, 2x2	ozone_strataero_CAM6chem_2000climo_zm_5day_c171004.nc	2000
F2010climo	1x1, 2x2	ozone_strataero_CAM6chem_2010climo_zm_5day_c171004.nc	2010

Oxidants

		tracer_cnst_file	
B1850, F1850	1x1, 2x2	tracer_cnst_WACCM6_halons_3DmonthlyL70_1850climoCMIP6piControl001_y21-50avg_c180802.nc	1850
BHIST, FHIST	1x1, 2x2	tracer_cnst_halons_3D_L70_1849-2015_CMIP6ensAvg_c180927.nc	
F2000climo	1x1, 2x2	tracer_cnst_CAM6chem_2000climo_3D_monthly_c171004.nc	2000
F2010climo	1x1, 2x2	tracer_cnst_CAM6chem_2010climo_3D_monthly_c171004.nc	2010

H2O emissions

		ext_frc_specifier	
B1850, F1850	1x1, 2x2	H2O_emission_CH4_oxidationx2_ele v_3DmonthlyL70_1850climoCMIP6piControl001_y21-50avg_c180802.nc	1850
BHIST, FHIST	1x1, 2x2	H2OemissionCH4oxidationx2_3D_L70_1849-2015_CMIP6ensAvg_c180927.nc	
F2000climo	1x1, 2x2	H2O_emission_CH4_oxidationx2_ele v_3Dmonthly_L70_2000climo_c180511.nc	2000
F2010climo	1x1, 2x2	H2O_emission_CH4_oxidationx2_ele v_3Dmonthly_L70_2010climo_c180511.nc	2010

GHG forcing

B1850, F1850	1x1, 2x2	ch4vmr = 791.6e-9 co2vmr = 284.7e-6 f11vmr = 12.48e-12 f12vmr = 0.0 flbc_list = 'n2ovmr = 275.68e-9'	
BCO2x4cmip6	1x1, 2x2	ch4vmr = 791.6e-9 co2vmr = 1138.8e-6 f11vmr = 12.48e-12 f12vmr = 0.0 flbc_list = 'n2ovmr = 275.68e-9'	
B1PCTcmip6	1x1, 2x2	LBC_CMIP6_1pctCO2_y1-165_GlobAnnAvg_0p5degLat_c180929.nc flbc_list = 'CO2','CH4','N2O', 'CFC11eq','CFC12' flbc_type = 'SERIAL' scenario_ghg = 'CHEM_LBC_FILE'	
BHIST, FHIST	1x1, 2x2	LBC_1750-2015_CMIP6_GlobAnnAvg_c180926.nc flbc_list = 'CO2','CH4','N2O', 'CFC11eq','CFC12' flbc_type = 'SERIAL' scenario_ghg = 'CHEM_LBC_FILE'	
F2000climo	1x1, 2x2	flbc_cycle_yr = 2000 flbc_file = LBC_2000climo_CMIP6_0p5degLat_c180227.nc flbc_list = 'CO2','CH4','N2O', 'CFC11eq','CFC12' flbc_type = 'CYCLICAL' scenario_ghg = 'CHEM_LBC_FILE'	2000
F2010climo	1x1, 2x2	flbc_cycle_yr = 2010 flbc_file = LBC_2010climo_CMIP6_0p5degLat_c180227.nc flbc_list = 'CO2','CH4','N2O', 'CFC11eq','CFC12' flbc_type = 'CYCLICAL' scenario_ghg = 'CHEM_LBC_FILE'	2010

Volcanic forcing (same files as ozone forcing)

		prescribed_strat_ero_file	
B1850, F1850	1x1, 2x2	ozone_strataero_cyclical_WACCM6_L70_CMIP6-piControl.001_y21-50avg_zm_5day_c180802.nc	1850
BHIST, FHIST	1x1, 2x2	ozone_strataero_WACCM_L70_zm5day_18500101-20150103_CMIP6ensAvg_c180923.nc	
F2000climo	1x1, 2x2	ozone_strataero_CAM6chem_2000climo_zm_5day_c171004.nc	2000
F2010climo	1x1, 2x2	ozone_strataero_CAM6chem_2010climo_zm_5day_c171004.nc	2010

Sea surface temperatures (SSTs)

F1850	1x1 2x2	sst_HadOIBI_bc_0.9x1.25_clim_pi_c101028.nc sst_HadOIBI_bc_1.9x2.5_clim_pi_c101028.nc	
FHIST	1x1 2x2	sst_HadOIBI_bc_0.9x1.25_1850_2017_c180507.nc sst_HadOIBI_bc_1.9x2.5_1850_2017_c180507.nc	
F2000climo	1x1 2x2	sst_HadOIBI_bc_0.9x1.25_2000climo_c180511.nc sst_HadOIBI_bc_1.9x2.5_2000climo_c180511.nc	2000
F2010climo	1x1 2x2	sst_HadOIBI_bc_0.9x1.25_2010climo_c180511.nc sst_HadOIBI_bc_1.9x2.5_2010climo_c180511.nc	2010

CAM Initial files

		ncdata
B1850	1x1 2x2	b.e20.B1850.f09_g17.pi_control.all.299_merg_e_v2.cam.i.0134-01-01-00000.nc cami-mam3_0000-01-01_1.9x2.5_L32_c150407.nc
F1850	1x1 2x2	cami-mam3_0000-01-01_0.9x1.25_L32_c141031.nc cami-mam3_0000-01-01_1.9x2.5_L32_c150407.nc
BCO2x4cmip6	1x1 2x2	b.e21.B1850.f09_g17.CMIP6-piControl.001.cam.i.0501-01-01-00000.nc
B1PCTcmip6	1x1 2x2	b.e21.B1850.f09_g17.CMIP6-piControl.001.cam.i.0501-01-01-00000.nc cami-mam3_0000-01-01_1.9x2.5_L32_c150407.nc
BHIST	1x1 2x2	b.e21.B1850.f09_g17.CMIP6-piControl.001.cam.i.0501-01-01-00000.nc cami-mam3_0000-01-01_1.9x2.5_L32_c150407.nc
FHIST	1x1 2x2	cami-mam3_0000-01-01_0.9x1.25_L32_c141031.nc cami-mam3_0000-01-01_1.9x2.5_L32_c150407.nc
FHIST_BGC	1x1 2x2	b.e20.BHIST.f09_g17.20thC.297_01_v2.cam.i.1979-01-01-00000.nc cami-mam3_0000-01-01_1.9x2.5_L32_c150407.nc
F2000climo	1x1 2x2	cami-mam3_0000-01-01_0.9x1.25_L32_c141031.nc cami-mam3_0000-01-01_1.9x2.5_L32_c150407.nc
F2010climo	1x1 2x2	cami-mam3_0000-01-01_0.9x1.25_L32_c141031.nc cami-mam3_0000-01-01_1.9x2.5_L32_c150407.nc

CO2 cycle

		co2_flag	co2_readflux_fuel	co2_readflux_aircraft
B1850	1x1, 2x2	true		
F1850	1x1, 2x2	-		
BHIST	1x1, 2x2	true	true	true
FHIST	1x1, 2x2			
F2000climo	1x1, 2x2			
F2010climo	1x1, 2x2			

CO2 - aircraft

		aircraft_specifier
BHIST	1x1 2x2	ac_CO2_filelist_175001-201512_fv_0.9x1.25_c20181011.txt ac_CO2_filelist_175001-201512_fv_1.9x2.5_c20181011.txt

These txt files contain the following information :

BHIST	1x1 2x2	emissions-cmip6_CO2_a nthro_ac_175001-201512_fv_0.9x1.25_c20181011.nc emissions-cmip6_CO2_a nthro_ac_175001-201512_fv_1.9x2.5_c20181011.nc
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CO2 - surface

		co2flux_fuel_file
BHIST	1x1 2x2	emissions-cmip6_CO2_a nthro_surface_175001-201512_fv_0.9x1.25_c20181011.nc emissions-cmip6_CO2_a nthro_surface_175001-201512_fv_1.9x2.5_c20181011.nc

CLM

Landfraction

	fatmLndfrc
1x1	domain.lnd.fv0.9x1.25_gx1v7.151020.nc
2x2	domain.lnd.fv1.9x2.5_gx1v7.170518.nc

CLM initial files

		finidat
B1850	1x1 2x2	b.e20.B1850.f09_g17.pi_control.all.299_merge_v2.clm2.r.0134-01-01-00000.nc clmi.B1850.1171-01-01.0.9x1.25_gx1v7_simyr1850_c181029.nc
BCO2x4cmip6	1x1 2x2	b.e21.B1850.f09_g17.CMIP6-piControl.001.clm2.r.0501-01-01-00000.nc clmi.B1850.1171-01-01.0.9x1.25_gx1v7_simyr1850_c181029.nc
F1850	1x1 2x2	clmi.B1850.1171-01-01.0.9x1.25_gx1v7_simyr1850_c181029.nc clmi.B1850.1171-01-01.0.9x1.25_gx1v7_simyr1850_c181029.nc
BHIST	1x1 2x2	b.e21.B1850.f09_g17.CMIP6-piControl.001.clm2.r.0501-01-01-00000.nc clmi.B1850.1171-01-01.0.9x1.25_gx1v7_simyr1850_c181029.nc
FHIST	1x1 2x2	clmi.BHIST.2000-01-01.0.9x1.25_gx1v7_simyr2000_c181015.nc clmi.BHIST.2000-01-01.0.9x1.25_gx1v7_simyr2000_c181015.nc
FHIST_BGC	1x1 2x2	b.e20.BHIST.f09_g17.20thC.297_01_v2.clm2.r.1979-01-01-00000.nc clmi.BHIST.2000-01-01.0.9x1.25_gx1v7_simyr2000_c181015.nc
F2000climo	1x1 2x2	clmi.BHIST.2000-01-01.0.9x1.25_gx1v7_simyr2000_c181015.nc clmi.BHIST.2000-01-01.0.9x1.25_gx1v7_simyr2000_c181015.nc
F2010climo	1x1 2x2	clmi.BHIST.2000-01-01.0.9x1.25_gx1v7_simyr2000_c181015.nc clmi.BHIST.2000-01-01.0.9x1.25_gx1v7_simyr2000_c181015.nc

CLM interpolation initial file

		init_interp_method	use_init_interp
B1850	1x1	use_finidat_areas	true
	2x2	general	true
B1850cmip6	1x1	general	true
	2x2	general	true
F1850	1x1	general	true
	2x2	general	true
BHIST	1x1	general	true
	2x2	general	true
FHIST	1x1	general	true
	2x2	general	true
FHIST_BGC	1x1	-	-
	2x2	general	true
F2000climo	1x1	general	true
	2x2	general	true
F2010climo	1x1	general	true
	2x2	general	true

CLM surface types

		fsurdat
B1850	1x1 2x2	surfdata_0.9x1.25_78p_fts_CMIP6_simyr1850_c170824.nc surfdata_1.9x2.5_78pf_ts_CMIP6_simyr1850_c170824.nc
F1850	1x1 2x2	surfdata_0.9x1.25_16p_fts_Irrig_CMIP6_simyr1850_c170824.nc surfdata_1.9x2.5_16pf_ts_Irrig_CMIP6_simyr1850_c170824.nc
BHIST	1x1 2x2	surfdata_0.9x1.25_78p_fts_CMIP6_simyr1850_c170824.nc surfdata_1.9x2.5_78pf_ts_CMIP6_simyr1850_c170824.nc
FHIST	1x1 2x2	surfdata_0.9x1.25_16p_fts_Irrig_CMIP6_simyr1850_c170824.nc surfdata_1.9x2.5_16pf_ts_Irrig_CMIP6_simyr1850_c170824.nc
FHIST_BGC	1x1 2x2	surfdata_0.9x1.25_78p_fts_CMIP6_simyr1850_c170824.nc surfdata_1.9x2.5_78pf_ts_CMIP6_simyr1850_c170824.nc
F2000climo	1x1 2x2	surfdata_0.9x1.25_16p_fts_Irrig_CMIP6_simyr2000_c170824.nc surfdata_1.9x2.5_16pf_ts_Irrig_CMIP6_simyr2000_c170824.nc
F2010climo	1x1 2x2	surfdata_0.9x1.25_16p_fts_Irrig_CMIP6_simyr2000_c170824.nc surfdata_1.9x2.5_16pf_ts_Irrig_CMIP6_simyr2000_c170824.nc

Remark) F2000climo and F2010climo use the same fsurdat files.

NorESM

CAM

Aerosol emissions

Separate files are used for 1x1 and 2x2.

Dust emission factor

Always 0.7

Always soil_erosion_file = dst_source2x2tunedcam6-2x2-04062017.nc

Ozone forcing

Modified : components/cam/bld/namelist_files/use_cases/1850_cam6_oslo.xml

		prescribed_ozone_file	
N1850, NF1850	1x1, 2x2	ozone_strataero_WACCM6_L70_zm5day_1850climo_295_c180426.nc ozone_strataero_cyclical_WACCM6_L70_CMIP6-piContr_ol.001_y21-50avg_zm_5day_c180802.nc	1850
BHIST/FHIST	1x1, 2x2	ozone_strataero_CAM6chem_1849-2014_zm_5day_c170924.nc ozone_strataero_WACCM6_L70_zm5day_18500101-20150103_CMIP6ensAvg_c180923.nc	
NF2000climo	1x1, 2x2	ozone_strataero_CAM6chem_2000climo_zm_5day_c171004.nc	2000

Oxidants

Modified : components/cam/bld/namelist_files/use_cases/1850_cam6_oslo.xml

		tracer_cnst_file	
N1850, NF1850	1x1, 2x2	tracer_cnst_WACC M6_halons_3DmonthlyL70_1850climo295_c180426.nc tracer_cnst_WACC M6_halons_3DmonthlyL70_1850climoCMIP6piControl001_y21-50avg_c180802.nc	1850
BHIST, NFHIST	1x1, 2x2	tracer_cnst_CAM6_chem_1849-2014_3D_monthly_c170925.nc tracer_cnst_halons_3D_L70_1849-2015_CMIP6ensAvg_c180927.nc	
NF2000climo	1x1, 2x2		2000

H2O emissions

Modified : components/cam/bld/namelist_files/use_cases/1850_cam6_oslo.xml

		ext_frc_specifier	
N1850, NF1850	1x1, 2x2	H2O_emission_CH4_oxidationx2_element_3DmonthlyL70_1850climo295_c180426.nc H2O_emission_CH4_oxidationx2_element_3DmonthlyL70_1850climoCMIP6piControl001_y21-50avg_c180802.nc	1850
BHIST, FHIST	1x1, 2x2	H2O_emission_CH4_oxidationx2_element_1850-2100_CCMI_RCP6_0_c160219.nc H2OemissionCH4oxidationx2_3D_L70_1849-2015_CMIP6ensAvg_c180927.nc	
NF2000climo	1x1, 2x2		2000

GHG forcing

N1850, NF1850	1x1, 2x2	ch4vmr = 808.25e-9 co2vmr = 284.32e-6 f11vmr = 32.11e-12 f12vmr = 0.0 fbc_list = '' n2ovmr = 273.02e-9	
NHIST, NFHIST	1x1, 2x2	LBC_17500116-2015_0116_CMIP6_0p5degLat_c180227.nc LBC_1750-2015_CMIP6_GlobAnnAvg_c180926.nc	
NF2000climo	1x1, 2x2	(as F2000climo)	2000

Remark : so no latitudinal dependence anymore in HIST.

Volcanic forcing

		prescribed_volcano_file	
N1850, NF1850	1x1, 2x2	CMIP_CAM6_radiation_average_v3_reformatted.nc	1850
NHIST, NFHIST	1x1, 2x2	CMIP_CAM6_radiation_v3_reformatted.nc	
NF2000climo	1x1, 2x2	CMIP_CAM6_radiation_v3_reformatted_1995-2005_climo.nc	2000

Sea surface temperatures (SSTs)

NF1850	1x1, 2x2	sst_HadOIBI_bc_0.9x1.25_clim_pi_c101028.nc sst_HadOIBI_bc_1.9x2.5_clim_pi_c101028.nc	
NFHIST	1x1, 2x2	sst_HadOIBI_bc_0.9x1.25_1850_2017_c180507.nc sst_HadOIBI_bc_1.9x2.5_1850_2017_c180507.nc	
NF2000climo	1x1, 2x2	sst_HadOIBI_bc_0.9x1.25_2000climo_c180511.nc sst_HadOIBI_bc_1.9x2.5_2000climo_c180511.nc	

Initial conditions CAM

		ncdata
N1850OCBDRDDMS	1x1 2x2	cam3-mam3_0000-01-01_0.9x1.25_L32_c141031.nc cam3-mam3_0000-01-01_1.9x2.5_L32_c150407.nc
NF1850	1x1 2x2	cam3-mam3_0000-01-01_0.9x1.25_L32_c141031.nc cam3-mam3_0000-01-01_1.9x2.5_L32_c150407.nc
NHISTOCB-DRDDMS	1x1 2x2	cam3-mam3_0000-01-01_0.9x1.25_L32_c141031.nc cam3-mam3_0000-01-01_1.9x2.5_L32_c150407.nc
NFHIST	1x1 2x2	cam3-mam3_0000-01-01_0.9x1.25_L32_c141031.nc cam3-mam3_0000-01-01_1.9x2.5_L32_c150407.nc
NF2000climo	1x1 2x2	cam3-mam3_0000-01-01_0.9x1.25_L32_c141031.nc cam3-mam3_0000-01-01_1.9x2.5_L32_c150407.nc

CO2 cycle

		co2_flag	dms_source	
N1850OCBDRDDMS	1x1, 2x2	true	ocean_flux	
NF1850	1x1, 2x2	-	lana	
NHISTOCBDRDDMS	1x1, 2x2	true	ocean_flux	
NFHIST	1x1, 2x2	-	lana	
NF2000climo	1x1, 2x2	-	lana	

CLM

Land fraction

(still to be added)

Initial conditions CLM

		finidat
N1850OCBDRDDMS	1x1 2x2	clmi.B1850.1171-01-01.0.9x1.25_gx1v7_simyr18_50_c181029.nc clmi.B1850.1171-01-01.0.9x1.25_gx1v7_simyr18_50_c181029.nc
NF1850	1x1 2x2	clmi.B1850.1171-01-01.0.9x1.25_gx1v7_simyr18_50_c181029.nc clmi.B1850.1171-01-01.0.9x1.25_gx1v7_simyr18_50_c181029.nc
NHISTOCB-DRDDMS	1x1 2x2	clmi.B1850.1171-01-01.0.9x1.25_gx1v7_simyr18_50_c181029.nc clmi.B1850.1171-01-01.0.9x1.25_gx1v7_simyr18_50_c181029.nc
NFHIST	1x1 2x2	clmi.BHIST.2000-01-01.0.9x1.25_gx1v7_simyr20_00_c181015.nc clmi.BHIST.2000-01-01.0.9x1.25_gx1v7_simyr20_00_c181015.nc
NF2000climo	1x1 2x2	clmi.BHIST.2000-01-01.0.9x1.25_gx1v7_simyr20_00_c181015.nc clmi.BHIST.2000-01-01.0.9x1.25_gx1v7_simyr20_00_c181015.nc

Remark : some initial files differ from CESM.

CLM interpolation initial file

		init_interp_method	use_init_interp
N1850OCBDRDDMS	1x1	general	true
	2x2	general	true
NF1850	1x1	general	true
	2x2	general	true
NHISTOCBDRDDMS	1x1	general	true
	2x2	general	true
FHIST	1x1	general	true
	2x2	general	true
NF2000climo	1x1	general	true
	2x2	general	true

CLM surface types

		fsurdat
N1850OCBDRDDMS	1x1	surfdata_0.9x1.25_78pfts_CMIP6_simyr1850_c170824.nc
	2x2	surfdata_1.9x2.5_78pfts_CMIP6_simyr1850_c170824.nc
NF1850	1x1	surfdata_0.9x1.25_16pfts_Irrig_CMIP6_simyr1850_c170824.nc
	2x2	surfdata_1.9x2.5_16pfts_Irrig_CMIP6_simyr1850_c170824.nc
NHISTOCBDRDDMS	1x1	surfdata_0.9x1.25_78pfts_CMIP6_simyr1850_c170824.nc
	2x2	surfdata_1.9x2.5_78pfts_CMIP6_simyr1850_c170824.nc
NFHIST	1x1	surfdata_0.9x1.25_16pfts_Irrig_CMIP6_simyr1850_c170824.nc
	2x2	surfdata_1.9x2.5_16pfts_Irrig_CMIP6_simyr1850_c170824.nc
NF2000climo	1x1	surfdata_0.9x1.25_16pfts_Irrig_CMIP6_simyr2000_c170824.nc
	2x2	surfdata_1.9x2.5_16pfts_Irrig_CMIP6_simyr2000_c170824.nc

1.9.6 Different namelist settings between CESM and NorESM

Namelist for CAM : atm_in

	NorESM	CESM
	Angular momentum	
fv_am_correction	true	–
fv_am_diag	true	–
fv_am_fix_lbl	true	–
fv_am_fixer	true	–
	Energy conservation correction	
dme_energy_adjust	true	–
	Deep convection	
zmconv_c0_lnd	0.03	0.0075
zmconv_c0_ocn	0.03	0.03
zmconv_ke	8e-6	5e-6
zmconv_ke_lnd	8e-6	1e-5
	Circulation diagnostics	
do_circulation_diags	true	–
	Some general settings	
mode_defs	–	
aer_drydep_list	–	[list of aerosols]
aer_wetdep_list	–	[list of aerosols]

Continued on next page

Table 1 – continued from previous page

modal_accum_coarse-exch	–	true
seasalt_emis_scale	–	1
clim_modal_aero_top_press	–	1e-4
water_refindex_file	–	water_refindex_rrtmg_c080910.nc
	oslo_ctl_nl	
aerotab_table_dir	‘/cluster/shared/noresm/...’	–
dms_cycle_year	2000	–
dms_source	‘lana’	–
dms_source_type	‘CYCLICAL’	–
ocean_filename	‘Lana_ocean_1849_2006.nc’	–
ocean_filepath	‘/cluster/shared/noresm/...’	–
opom_cycle_year	2000	–
opom_source	‘odowd’	–
opom_source_type	‘CYCLICAL’	–
volc_fraction_coarse	0.0	–
	prescribed_volcaero_nl	
prescribed_volcaero_cycle_yr	e.g., 2000	–
prescribed_volcaero_datapath		–
prescribed_volcaero_file		–
prescribed_volcaero_type	e.g., ‘CYCLICAL’	–
	prescribed_strataero_nl	
prescribed_strataero_cycle_yr	–	e.g., 2000
prescribed_strataero_datapath	–	
prescribed_strataero_file	–	
prescribed_strataero_type	–	e.g.,
prescribed_strataero_use_chemtrop	–	.false.

Remark 1) The oslo_ctl_nl variables currently also appear in the CESM namelist, but they should not.

Namelist for CLM : lnd_in

	NorESM	CESM
glc_do_dynglacier	.false.	.true.
fatmlndfrc		
finidat		
init_interp_method		

drv_in

	NorESM	CESM
flds_co2_dmsb	.true.	.false.
flds_co2	.false.	.true.
seq_flds_i2o_per_cat	.false.	.true.
alb_cosz_avg	.true.	.false.
bfbflag	.true.	.false.
flux_scheme	1	0
glc_gnam	null	gland4
ice_gnam	tnx1v4	gx1v7
ocn_gnam	tnx1v4	gx1v7
wav_gnam	null	ww3a
glc_cpl_dt	1800	86400

8.3drv_flds_in

	NorESM	CESM
megan_factors_file		-
megan_specifier		-

1.9.7 Merging CESM2.1.0 into NorESM

The branch featureCESMNCARBeta_trunk2.0-7 (which contains the update CESM2.1.0) has been merged into the branch featureCESM2-OsloDevelopment.

This is done by :

```
git config merge.renameLimit 999999
```

```
git merge origin/featureCESMNCARBeta_trunk2.0-7 -X rename-threshold=20 [to have only 20% resemblance needed]
```

```
git mergetool [to resolve conflicts]
```

This however does not update the files which live in specific NorESM directories (pp_trop_mam_oslo, oslo_aero, or NorESM). Those have to be updated by comparing them with the updates in the original CESM directories.

Below are listed most of the changes.

Even after the merge, some files (belonging to CESM) had not appeared in the NorESM structure [lacking]. They have been added too, and maybe should not be listed here as these were not modified.

CESM12_deprecated

Only in noresm-dev-oslo: CESM12_deprecated [MAYBE CAN BE REMOVED?]

cesm2NorESM.log

Only in noresm-dev-oslo: cesm2NorESM.log [MAYBE SHOULD BE UPDATED?]

ChangeLog

[MAYBE SHOULD BE UPDATED?]

CIME :

1. config_archive.xml

REMARK : something on MICOM

MERGE-REMARK : something on rtm and mosart removed

FILE : cime/config/cesm/config_archive.xml

2. config_files.xml

REMARK

- 1) micom
- 2) mpas-o [QUESTION : DO WE NEED THIS?]

FILE : cime/config/cesm/config_files.xml

3. config_grids.xml [MAYBE SHOULD BE CHECKED]

REMARK : extra

- a) T62_tn21
- b) tn2v1
- c) ...

REMARK-AUTOMERGE : extra

- a) f05_f05_mg17
- b) 0.47x0.63 : extra gx1v7
- c) T42 : update gx1v7 dates
- d) T62/tnx1v1 tnx1v3 tnx1v4 tnx0.25v1 tnx0.25v3 tnx0.25v4
- e) r05/tnx1v1 tnx1v4 tnx1v3 tnx0.25v1 tnx0.25v3 tnx0.25v4
- f) 0.47x0.63

FILE : noresm-dev-oslo/cime/config/cesm/config_grids.xml

4. config_batch.xml

REMARK : 0:59:00 instead of 0:20:00

REMARK-MERGE : quite some changes

FILE : cime/config/cesm/machines/config_batch.xml

5. config_compilers.xml

REMARK : identical (vilje before defined twice - removed one)

REMARK-MERGE : quite some different machines

FILE : cime/config/cesm/machines/config_compilers.xml

6. cime_dir.rst : lacking file

cime/doc/source/users_guide/cime-dir.rst [CIME-COPIED]

7. case.py

REMARK

- 1) noresm2netcdf4.sh extra
- 2) things about “ABOUT YOUR GIT VERSION CONTROL SYSTEM”

FILE

cime/scripts/lib/CIME/case/case.py

8. case_st-archive.py

REMARK

- 1) things on fram
- 2) things on compressing files
- 3) “import sys” [MAYBE NOT NEEDED?]

FILE

cime/scripts/lib/CIME/case/case_st_archive.py

9. env_batch.py

REMARK

difference is commented out block. [CAN THIS BE REMOVED?]

FILE

cime/scripts/lib/CIME/XML/env_batch.py

10. archive_metadata : lacking

FILE : cime/scripts/Tools/archive_metadata [CIME-COPIED]

11. case.build

REMARK : return of function has hardcoded 0 (instead of not args.skip_provenance_check)

FILE : cime/scripts/Tools/case.build

12. Makefile

REMARK : something on MICOM (FFLAGS += -DPNETCDF)

FILE : cime/scripts/Tools/Makefile

13. noresm2netcdf4.sh [only in NorESM]

cime/scripts/Tools/noresm2netcdf4.sh

14. docn_comp_mod.F90

FILE : noresm-dcime/src/components/data_comps/docn/docn_comp_mod.F90

REMARK : docn_comp_mod.F90 exists and is equal in both CESM and NorESM

15. buildnml

REMARK : COSZ_AVG, OCN_FLUX_SCHEME

FILE ; cime/src/drivers/mct/cime_config/buildnml

16. config_component_cesm.xml [MAYBE TO BE CHECKED]

REMARK

- 1) COMPRESS_ARCHIVE_FILES
- 2) _MICOM
- 3) CO2_DMSA,CO2_DMSB : links BGC%BPRPDMS to CO2_DMSA, BGC%BDRDDMS to CO2_DMSB, and BGC%DMS to CO2_DMSB
- 4) COSZ_AVG : true for _CAM5%PTAEROUPD1 _CAM60%PTAERO, _CAM54%PTAERO,_CAM5%NUDGEPTAEROUPD1,_CAM60%NUDGEPTAERO,_MICO5) OCN_FLUX_SCHEME : 1 for ...

FILE :

cime/src/drivers/mct/cime_config/config_component_cesm.xml

17. config_component.xml

REMARK : for tn2v1, EPS_OGRIS = 0.1 instead of 0.01

FILE : cime/src/drivers/mct/cime_config/config_component.xml

18. namelist_definition_drv.xml

REMARK

- 1) flds_co2_dmsb / CO2_DMSB
- 2) \$OCN_FLUX_SCHEME (instead of 0) [QUESTION : IS THIS OK?]
- 3) \$COSZ_AVG (instead of 1) [QUESTION : IS THIS OK?]

FILE

cime/src/drivers/mct/cime_config/namelist_definition_drv.xml

19. seq_flds_mod.F90

REMARK : flds_co2_dmsb

FILE : cime/src/drivers/mct/shr/seq_flds_mod.F90

20. cmake_config.h.in [copied in]

cime/src/externals/pio2/cmake_config.h.in [CIME-COPIED]

21. maps

cime/tools/mapping/gen_mapping_files/runoff_to_ocn/maps [EMPTY ANYWAY - NOT YET COPIED OVER]

22.-26. lacking files [copied over]

cime/tools/statistical_ensemble_test/pyCECT/EET.py [CIME-COPIED]

cime/tools/statistical_ensemble_test/pyCECT/ens_sub.pbs [CIME-COPIED]

cime/tools/statistical_ensemble_test/pyCECT/exclude_empty.json [CIME-COPIED]

cime/tools/statistical_ensemble_test/pyCECT/included_varlist.json [CIME-COPIED]

cime/tools/statistical_ensemble_test/pyCECT/test_pyEnsSumPop.sh [CIME-COPIED]

CIME_CONFIG

1. config_compsets

REMARK

- 1) our still contains CAM54

2) N1850 NHIST N1850OC N1850OCBPRP N1850OCBPRPDMS N1850OCBDRDDMS N1850OCDMS N1850P
N1850CwWs N1850C5L45BGCR

REMARK-MERGE :

- 1) B1850 B1850cmip6 BCO2x4cmip6 B1PCTcmip6 BW1850cmip6 ...
- 2) support grid : should we also do that
- 3) RUN_REFDATE, RUN_TYPE, ... CLM_NAMELIST_OPTS (like use_init_interp=.true.)

FILES

cime_config/config_compsets.xml

2. config_pes.xml

REMARK : a lot of vilje/fram things (some commented out) / djlo [SHOULD BE CHECKED]

FILE : cime_config/config_pes.xml

3. n1850r227 [only in NorESM]

FILE : cime_config/usermods_dirs/n1850r227 [CAN BE REMOVED LATER]

4. nhistr227

FILE :cime_config/usermods_dirs/nhistr227 [CAN BE REMOVED LATER]

CAM :

1. build-namelist

REMARK

- 1) flds_co2_dmsb
- 2) _oslo, _mam_oslo
- 3) avoiding standard cam6 volcanoes when using cam_oslo
- 4) old part on dms_oslo_emis_file, ... [CAN MAYBE REMOVED]
- 5) list of cam_oslo variables : volc_fraction_ coarse, aerotab_table_dir, dms_source, dms_source_type
dms_cycle_year ocean_filename, ocean_filepath, opom_source , opom_source_type opom_cycle_year
- 6) use_hetfrz_classnuc (phys_ctl_n1) set .true. when cam_oslo [IS THIS NEEDED]

FILE

components/cam/bld/build-namelist

2. definition.xml

REMARK

- 1) "chem" contains possibility of "trop_mam_oslo"
- 2) "ocn" contains possibility of "micom"

FILE

components/cam/bld/config_files/definition.xml

3. configure

REMARK

- 1) "chem" contains possibility of "trop_mam_oslo"

2) _oslo then -DOSLO_AERO -DDIRIND

3) camsrcdir/cam/src/NorESM and camsrcdir/cam/src/NorESM/\$dyn [THIS SHOULD NOT BE ACTIVE WHEN PURE CESM]

4) camsrcdir/cam/src/chemistry/oslo_aero and \$camsrcdir/cam/src/physics/cam_oslo (instead of modal_aero and bull_aero)

FILE

components/cam/bld/configure

4. namelist_defaults_cam.xml

REMARK

1) prescribed_aero_datapath/file/model/ ... in case of “aer_model = oslo” [but probably not used]

2) aerodep_flx_datapath/file/type/cycle_yr in case of “aer_model = oslo” [but probably not used]

3) something on micro_do_sb_physics : but commented out [can probably be removed]

4) something on dust_emis_fact in case of trop_mam_oslo, but commented out : can probably be removed. However, still used for cam6, so maybe to keep here instead of in other namelist; can be resolution dependent

5) THT had commented out volc_fraction, aerotab_table_dir, ... : still active in norESM version [so activated again] [HOW TO ACTIVATE/DEACTIVATE?]

FILE

components/cam/bld/namelist_files/namelist_defaults_cam.xml

5. namelist_definition.xml

REMARK

1) cam_chempkg : trop_mam_oslo extra

2) dme_energy_adjust extra

3) flds_co2_dmsb : active (while commented out in ncar)

4) volc_fraction_coarse, aerotab_table_dir, ... : active (but commented out in ncar)

FILE

components/cam/bld/namelist_files/namelist_definition.xml

Files in NorESM

components/cam/bld/namelist_files/use_cases/1850_cam54_ptaero.xml

components/cam/bld/namelist_files/use_cases/1850_cam5_ptaero.xml

components/cam/bld/namelist_files/use_cases/1850_cam6_oslo.xml

components/cam/bld/namelist_files/use_cases/2000_cam6_noclb_oslonudge.xml

components/cam/bld/namelist_files/use_cases/2000_cam6_noclb_oslo.xml

components/cam/bld/namelist_files/use_cases/2000_cam6_noclb.xml

components/cam/bld/namelist_files/use_cases/2000_cam6_oslonudge.xml

components/cam/bld/namelist_files/use_cases/2000_cam6_oslo.xml

components/cam/bld/namelist_files/use_cases/cam54_ptaero_up1.xml

components/cam/bld/namelist_files/use_cases/cam5_nudge_ptaero_up1.xml

components/cam/bld/namelist_files/use_cases/cam5_ptaero_up1.xml

Lacking file [copied over]

components/cam/bld/namelist_files/use_cases/dctest_tj2016.xml [CAM-COPIED]

Only in NorESM

components/cam/bld/namelist_files/use_cases/hist_cam6_oslo.xml

Lacking file [copied over]

components/cam/bld/namelist_files/use_cases/hist_trop_strat_vbsext_cam6.xml [CAM-COPIED]

components/cam/bld/namelist_files/use_cases/hist_trop_strat_vbsfire_cam6.xml [CAM-COPIED]

components/cam/bld/namelist_files/use_cases/sd_cam6.xml [CAM-COPIED]

components/cam/bld/namelist_files/use_cases/sd_waccm_ma_cam4.xml [CAM-COPIED]

components/cam/bld/namelist_files/use_cases/waccm_ma_hist_cam4.xml [CAM-COPIED]

components/cam/bld/namelist_files/use_cases/waccm_sc_1850_cam6.xml [CAM-COPIED]

components/cam/bld/namelist_files/use_cases/waccm_sc_2000_cam6.xml [CAM-COPIED]

components/cam/bld/namelist_files/use_cases/waccm_sc_2010_cam6.xml [CAM-COPIED]

components/cam/bld/namelist_files/use_cases/waccm_tsmlt_2010_cam6.xml [CAM-COPIED]

components/cam/bld/scripts/remapfv2eul.ncl [CAM-COPIED]

components/cam/chem_proc/bin [CAM-COPIED]

components/cam/chem_proc/output [CAM-COPIED]

components/cam/chem_proc/src/OBJ [CAM-COPIED]

components/cam/chem_proc/tmp [CAM-COPIED]

6. buildnml

REMARK : DMS_MODE = case.get_value("CCSM_BGC")

FILE :components/cam/cime_config/buildnml

7. config_component.xml

REMARK

- 1) ...PTAERO... / ...NUDGEPTAERO... things [DO WE KEEP ALL THOSE?]
- 2) CAM54
- 3) _BGC%BDRD, _BGC%BPRPDMS (extra), _BGC%BDRDDMS (extra), _BGC%DMS (extra) (CESM only has _BGC%BDRD)

FILE

components/cam/cime_config/config_component.xml

8. config_compsets.xml

REMARK

- 1) NF2000climo [CROP ...]
- 2) extra combinations with g%null... SGLC instead of g%gland4 ... CISM2%NOEVOLVE (3 times: RUN_TYPE, RUN_REFCASE, RUN_REFDATE, RUN_REFDIR)

FILE

components/cam/cime_config/config_compsets.xml

9. config_pes.xml

REMARK : only extra is viljelhexagon on 1.9x2.5

FILE : components/cam/cime_config/config_pes.xml

Lacking files [copied over]

components/cam/cime_config/testdefs/testmods_dirs/cam/nudging [CAM-COPIED]

components/cam/cime_config/testdefs/testmods_dirs/cam/outfrq1d_amie [CAM-COPIED]

components/cam/cime_config/testdefs/testmods_dirs/cam/outfrq9s_amie [CAM-COPIED]

components/cam/cime_config/testdefs/testmods_dirs/cam/outfrq9s_sd [CAM-COPIED]

components/cam/cime_config/testdefs/testmods_dirs/cam/wacmx_weimer [CAM-COPIED]

components/cam/cime_config/usermods_dirs/CMIP6_B1850 [CAM-COPIED]

components/cam/cime_config/usermods_dirs/CMIP6_B1850_WACCM [CAM-COPIED]

components/cam/cime_config/usermods_dirs/CMIP6_BHIST

components/cam/cime_config/usermods_dirs/CMIP6_BHIST_WACCM [CAM-COPIED]

components/cam/cime_config/usermods_dirs/CMIP6_GENERIC [CAM-COPIED]

10. chemistry.F90

REMARK : CT_H2O_GHG instead of CT_H2O (only affects diagnostics)

FILES : components/cam/src/chemistry/mozart/chemistry.F90

Oslo_aero : components/cam/src/chemistry/oslo_aero

This directory contains files which are only used by CAM-Oslo, or CESM files which have been modified to be used in CAM-Oslo.

When files have a CESM analogue, the location of that analogue is mentioned. If that analogue is updated, one should also update the CAM-Oslo version

1. aero_model.F90

REMARK

1) contains #include <preprocessorDefinitions.h>

2) has_sox boolean is not used [NOT A DRAMA]

3) contains empty versions of subroutines (which are used in CAM)

subroutine aero_model_readnl

subroutine aero_model_register

subroutine aero_model_init

subroutine aero_model_drydep : contains call calcaersize_sub and call oslo_aero_dry_intr

subroutine aero_model_wetdep : contains call oslo_aero_wet_intr

subroutine aero_model_surfarea : not empty

subroutine aero_model_strat_surfarea : shorter

subroutine aero_model_gasaerexch

subroutine aero_model_emissions
subroutine surf_area_dens
subroutine modal_aero_bescavcoef_init
subroutine modal_aero_depvel_part
subroutine modal_aero_bescavcoef_get
subroutine calc_1_impact_rate [NOT in oslo_aero]
subroutine qqcw2vmr
subroutine vmr2qqcw

FILES

cam/src/chemistry/oslo_aero/aero_model.F90 [SHOULD WE UPDATE THE DUST?]

cam/src/chemistry/bulk_aero/aero_model.F90 [NEW : history_dust]

cam/src/chemistry/modal_aero/aero_model.F90 [NEW : history_dust]

2. aeronucl.F90

cam/src/chemistry/oslo_aero/aeronucl.F90

3. aerosoldef.F90

cam/src/chemistry/oslo_aero/aerosoldef.F90

4. appformrate.F90

cam/src/chemistry/oslo_aero/appformrate.F90

5. calcaersize.F90

cam/src/chemistry/oslo_aero/calcaersize.F90

6. commondefinitions.F90

cam/src/chemistry/oslo_aero/commondefinitions.F90

cam/tools/AeroTab/commondefinitions.F90 [NOT RELEVANT]

7. condvend.F90

cam/src/chemistry/oslo_aero/condvend.F90

8. constants.F90

cam/src/chemistry/oslo_aero/constants.F90

9. const.F90

cam/src/chemistry/oslo_aero/const.F90

10. dust_model.F90

cam/src/chemistry/oslo_aero/dust_model.F90

cam/src/chemistry/bulk_aero/dust_model.F90 [NO CHANGE]

cam/src/chemistry/modal_aero/dust_model.F90 [NO CHANGE]

11. dust_sediment_mod.F90

cam/src/chemistry/oslo_aero/dust_sediment_mod.F90

cam/src/chemistry/aerosol/dust_sediment_mod.F90 [NO CHANGE]

12. hetfrz_classnuc_oslo.F90

REMARK : very different [SHOULD THIS BE CHECKED/UPDATED AT SOME POINT]

cam_oslo CONTAINS :

subroutine hetfrz_classnuc_oslo_readnl
subroutine hetfrz_classnuc_oslo_register
subroutine hetfrz_classnuc_oslo_init
subroutine hetfrz_classnuc_oslo_calc
subroutine hetfrz_classnuc_oslo_save_cbaero
subroutine get_aer_num

standards cam CONTAINS :

subroutine hetfrz_classnuc_init
subroutine hetfrz_classnuc_calc
subroutine collkernel
subroutine hetfrz_classnuc_init_pdftheta

FILES :

cam/src/chemistry/oslo_aero/hetfrz_classnuc_oslo.F90
cam/src/physics/cam/hetfrz_classnuc.F90 [NO CHANGE]

13. initlogn.F90

cam/src/chemistry/oslo_aero/initlogn.F90

14. intlog1to3.F90

cam/src/chemistry/oslo_aero/intlog1to3.F90

15. intlog4.F90

cam/src/chemistry/oslo_aero/intlog4.F90

16. intlog5to10.F90

cam/src/chemistry/oslo_aero/intlog5to10.F90

17. koagsub.F90

cam/src/chemistry/oslo_aero/koagsub.F90

18. microp_aero.F90

cam/src/chemistry/oslo_aero/microp_aero.F90

19. mo_chm_diags.F90

REMARK :

1. does not have history_dust [SHOULD WE ADD IT?]
2. has WD_A (aerosol deposition) [MAYBE NOT NEEDED ANYMORE] [SHOULD BE CHECKED]
3. has a lot of extra output : SRF, mmr_AEROSOLTYPE, cb_AEROSOLTYPE, cloud-tracers
4. subroutine chm_diags(...,pbuf) : extra argument

FILES :

cam/src/chemistry/oslo_aero/mo_chm_diags.F90 : [SKIPPED : do_neu_wetdep]

cam/src/chemistry/mozart/mo_chm_diags.F90 [NEW : history_dust]

20. modal_aero_data.F90

REMARK : very different

FILES :

cam/src/chemistry/oslo_aero/modal_aero_data.F90

cam/src/chemistry/modal_aero/modal_aero_data.F90 [NO CHANGE]

21. modal_aero_deposition.F90

REMARK

1) considerably different

2) assignment to cam_out%ocphidry, ... happens here

FILES

cam/src/chemistry/oslo_aero/modal_aero_deposition.F90

cam/src/chemistry/utills/modal_aero_deposition.F90 [NO CHANGE]

22. modalapp2d.F90

./cam/src/chemistry/oslo_aero/modalapp2d.F90

23. mo_drydep.F90

REMARK : Only difference : prog_modal_aero = .TRUE. (#ifdef OSLO_AERO)

FILES

cam/src/chemistry/oslo_aero/mo_drydep.F90

cam/src/chemistry/mozart/mo_drydep.F90 [NO CHANGE]

24. mo_extfrfc.F90

REMARK : Only difference is a typo

FILES

cam/src/chemistry/oslo_aero/mo_extfrfc.F90

cam/src/chemistry/mozart/mo_extfrfc.F90 [NO CHANGE]

25. mo_gas_phase_chemdr.F90

REMARK

1. treatment of oxidant climatologies : IHK

2. call chm_diags(...,pbuf) : has extra argument

3. most of differences by #ifdef OSLO_AERO, but not all (so little bit inconsistent)

FILES

cam/src/chemistry/oslo_aero/mo_gas_phase_chemdr.F90 [I removed "is_first_timestep"]

cam/src/chemistry/mozart/mo_gas_phase_chemdr.F90 [is_first_timestep : DISAPPEARED]

26. mo_neu_wetdep.F90

REMARK : oslo_aero has this output in case of NEU : WD_A [THIS CAN PROBABLY BE REMOVED]

FILES

cam/src/chemistry/oslo_aero/mo_neu_wetdep.F90 [do_neu_wetdep was not in agreement : corrected this]

cam/src/chemistry/mozart/mo_neu_wetdep.F90 [NO CHANGE]

27. mo_setsox.F90

REMARK

1) only difference : cloud_borne = .TRUE. , modal_aerosols = .TRUE.

2) all well with OSLO_AERO

FILES

cam/src/chemistry/oslo_aero/mo_setsox.F90

cam/src/chemistry/aerosol/mo_setsox.F90 [NO CHANGE]

28. mo_srf_emissions.F90

REMARK

1) only difference related to DMS

2) not completely consistent with #OSLO_AERO

FILES

cam/src/chemistry/oslo_aero/mo_srf_emissions.F90

cam/src/chemistry/mozart/mo_srf_emissions.F90 [NO CHANGE]

29. mo_usrxrt.F90

REMARK

1) only difference : nmodes / nmodes_oslo / ntot_amode

2) consistent with #OSLO_AERO

FILES

cam/src/chemistry/oslo_aero/mo_usrxrt.F90

cam/src/chemistry/mozart/mo_usrxrt.F90 [NO CHANGE]

30. ndrop.F90

REMARK : complicated [WORTH CHECKING]

FILES

cam/src/chemistry/oslo_aero/ndrop.F90

cam/src/physics/cam/ndrop.F90 [NO CHANGE]

31a. nucleate_ice_oslo.F90

REMARK

1) considerably different

2) subroutines have “_oslo” instead of “_cam”

FILES :

cam/src/chemistry/oslo_aero/nucleate_ice_oslo.F90

cam/src/physics/cam/nucleate_ice_cam.F90 [NO CHANGE]

31b. nucleate_ice.F90

cam/src/physics/cam/nucleate_ice.F90 [NO CHANGE] [probably used by both ...]

32. oslo_aerosols_intr.F90

REMARK :

1) complicated comparison

2) contains

subroutine oslo_aero_initialize (based on aerol_model_init)

subroutine oslo_aero_dry_intr (based on aero_model_drydep, but more arguments)

subroutine oslo_aero_wet_intr (based on aero_model_wetdep, same arguments)

subroutine modal_aero_depvel_part (as modal_aero_depvel_part)

3) contains implicit solving method for tracers with short lifetime

FILE

cam/src/chemistry/oslo_aero/oslo_aerosols_intr.F90 [SHOULD WE TAKE THIS OVER]

cam/src/chemistry/modal_aero/aero_model.F90 [NEW : history_dust]

33. oslo_ocean_intr.F90

cam/src/chemistry/oslo_aero/oslo_ocean_intr.F90

34. oslo_utils.F90

cam/src/chemistry/oslo_aero/oslo_utils.F90

35. oxi_diurnal_var.F90

REMARK

because CAM-Oslo has diurnal variation

FILE

cam/src/chemistry/oslo_aero/oxi_diurnal_var.F90

36. parmix_progncdnc.F90

FILE

cam/src/chemistry/oslo_aero/parmix_progncdnc.F90

37. seasalt_model.F90

REMARK

considerably different

FILES

cam/src/chemistry/oslo_aero/seasalt_model.F90

cam/src/chemistry/bulk_aero/seasalt_model.F90 [NO CHANGE]

cam/src/chemistry/modal_aero/seasalt_model.F90 [NO CHANGE]

38. sox_cldaero_mod.F90

REMARK :

1) considerably different

2) shouldn't $aqh2so4(:,n)=aqh2so4(:,n) + \dots$ be $aqh2so4(i,n)=aqh2so4(i,n)+ \dots$ [I THINK IT IS WRONG] It is probably a column-integrated diagnostic, so it will not affect the simulation.

FILES

cam/src/chemistry/oslo_aero/sox_cldaero_mod.F90

cam/src/chemistry/bulk_aero/sox_cldaero_mod.F90 [NO CHANGE]

cam/src/chemistry/modal_aero/sox_cldaero_mod.F90 [NO CHANGE]

39. vertical_diffusion.F90

REMARK

1) prog_modal_aero = .TRUE. (#ifdef OSLO_AERO)

2) some extra output (AL)

3) Oslo aero adds emissions together with dry deposition : process not done here but somewhere else

FILES

cam/src/chemistry/oslo_aero/vertical_diffusion.F90

cam/src/physics/cam/vertical_diffusion.F90 [NO CHANGE]

40. zm_microphysics.F90

REMARK :

only difference : call activate_modal(...) commented out

FILES

cam/src/chemistry/oslo_aero/zm_microphysics.F90

cam/src/physics/cam/zm_microphysics.F90 [NO CHANGE]

Only in noresm-dev-oslo/components/cam/src/chemistry/pp_trop_mam_oslo [WHOLE DIRECTORY]

pp_trop_mam4 [NO CHANGE]

pp_trop_mam7 [NO CHANGE]

Only in noresm-dev-ncar/components/cam/src/chemistry/pp_trop_strat_mam4_vbsext [CAM-COPIED]

Only in noresm-dev-ncar/components/cam/src/chemistry/pp_waccm_mad [CAM-COPIED]

CONTINUATION STANDARD CAM DIRECTORY :

41. prescribed_volcaero.F90

REMARK

1) is in directory which is normally not touched for CAM-Oslo developments

2) prescribed_volcaero.F90 has been further developed for CAM-Oslo

3) new has_prescribed_volcaero_cmip6,solar_bands,terrestrial_bands, has_prescribed_volcaero_cmip6

FILE

components/cam/src/chemistry/utills/prescribed_volcaero.F90

42. runtime_opts.F90

REMARK

1) is in directory which is normally not touched for CAM-Oslo developments

2) call oslo_ctl_readnl(nlfilename) #if (defined OSLO_AERO)

3) nicely used #if (defined OSLO_AERO)

FILE

components/cam/src/control/runtime_opts.F90

NORESM : components/cam/src/NorESM

This directory contains files which have a CESM version but are modified to run NorESM.

We mention therefore here the file as it can be found in the NorESM-directory, but also the location of the original CESM file it is based on.

When the original CESM is updated, the corresponding NorESM file should also be updated.

1. cam_diagnostics.F90

REMARK

1) contains #include <preprocessorDefinitions.h>

2) ixcldice, ixclqliq, ixcldni, ixcldnc : defined in diag_init_dry (but not used [COULD BE REMOVED])

3) contains AL changes

4) contains a lot of AeroCom output

5) call outfld for m=1.pcnst

FILE :

components/cam/src/NorESM/cam_diagnostics.F90 [UPDATED with most of the cam changes]

components/cam/src/physics/cam/cam_diagnostics.F90 [CHANGE : quite some changes]

1) energy and angular momentum diagnostics : shifted from subroutine diag_init_moist to subroutine diag_init_dry [IS THIS OK]

2) pbuf for some of the arguments

3) PSL added in buffer

4) extra iftest if (ixclqliq > 0) then

5) subroutine diag_phys_writeout_dry and diag_phys_writeout_moist : arguments changed]

2. macrop_driver.F90

REMARK

1) contains AL (Anna Lewinschal) extra output

2) why not in oslo_aero directory?

FILE

cam/src/NorESM/macrop_driver.F90

cam/src/physics/cam/macrop_driver.F90

3. micro_mg1_0.F90

REMARK : contains AL extra output

FILE

cam/src/NorESM/micro_mg1_0.F90

cam/src/physics/cam/micro_mg1_0.F90

4. micro_mg2_0.F90

REMARK : contains AL changes

FILE

cam/src/NorESM/micro_mg2_0.F90

cam/src/physics/cam/micro_mg2_0.F90 [Andrew Gettleman comment disappeared - NO OTHER

5. micro_mg_cam.F90

REMARK :

- 1) contains AL changes
- 2) contains IHK (Bennartz) changes
- 3) contains AKC6 changes

FILE

cam/src/NorESM/micro_mg_cam.F90

cam/src/physics/cam/micro_mg_cam.F90 [NO CHANGE]

6. phys_control.F90

REMARK

- 1) only remaining difference pro_modal_aer = .FALSE.
- 2) nicely uses #ifdef OSLO_AERO

FILE

cam/src/NorESM/phys_control.F90 : ADDED history_dust [SO MAYBE ALSO EVERYWHERE ELSE?]

cam/src/physics/cam/phys_control.F90 [NEW : history_dust]

7. physpkg.F90 : should be checked !!!

REMARK

- 1) contains include <preprocessorDefinitions.h> : is that still needed?
- 2) contains AL variables, DIRIND, AEROCOM
- 3) contains call oslo_ocean_intr with #ifdef CAM_OSLO
- 4) maybe an m-index is not used

TO BE CHECKED !!!!! :

CHECK DYCORE IFs !!!!!

CHECK call calc_te_and_aam_budgets !!! (looks fine)

FILES :

cam/src/NorESM/physpkg.F90 : REMOVED infnan (was used to initialise some arrays (probably for testing)),
changed diag_phys_writeout

cam/src/physics/cam/physpkg.F90 [CHANGE : quite some changes; infnan removed, nudging, co2_cycle, THT changes are different, dycore, diag_phys_writeout]

cam/src/physics/cam/physpkg.F90.beta07

cam/src/physics/simple/physpkg.F90 [CHANGE : quite some, e.g. tj2016]

8. zm_conv.F90

REMARK : contains THT modifications

FILES

cam/src/NorESM/zm_conv.F90

cam/src/physics/cam/zm_conv.F90 [NO CHANGE]

9. zm_conv_intr.F90

REMARK : contains THT modifications

FILES

cam/src/NorESM/zm_conv_intr.F90

cam/src/physics/cam/zm_conv_intr.F90 [NO CHANGE]

10. fv/dp_coupling.F90

REMARK :

1) extra test : (iam .lt. grid%npes_xy)

2) contains THT changes related to ixcldice and ixclldiq [IS THIS OK]

FILES

cam/src/NorESM/fv/dp_coupling.F90

cam/src/dynamics/fv/dp_coupling.F90 [NO CHANGE]

cam/src/dynamics/se/dp_coupling.F90

cam/src/dynamics/eul/dp_coupling.F90

11. fv/metdata.F90

REMARK

contains IHK uvps : does not nudge

1) stress and heat fluxes

2) TS and SNOWH

3) T and Q

FILES

cam/src/NorESM/fv/metdata.F90 [HAVE taken over all changes, and tried to keep IH changes]

cam/src/dynamics/fv/metdata.F90 [QUITE SOME CHANGES]

OUTSIDE STANDARD :

noesm-dev-oslo/components/cam/src/physics/cam/check_energy.F90

noesm-dev-ncar/components/cam/src/physics/cam/check_energy.F90 [only a different comment]

File remnants from earlier updates

Only in noresm-dev-oslo/components/cam/src/physics/cam/check_energy.F90.orig

Only in noresm-dev-oslo/components/cam/src/physics/cam/clubb_intr.F90.beta07

Only in noresm-dev-oslo/components/cam/src/physics/cam/micro_mg2_0.F90.orig

Only in noresm-dev-ncar/components/cam/src/physics/cam/physics_types.F90.unupdated

Only in noresm-dev-oslo/components/cam/src/physics/cam/phypkg.F90.beta07

Only in noresm-dev-ncar/components/cam/src/physics/cam/phypkg.F90.unupdated

Only in noresm-dev-oslo/components/cam/src/physics/cam/vertical_diffusion.F90.beta07

CAM_OSLO : components/cam/src/physics/cam_oslo

This directory contains subroutines for the CAM-Oslo aerosol scheme. They are specific to that scheme and have for most of them no corresponding CESM version.

Files only in NorESM

1. aerocopt2.h
2. aerocopt.h
3. aerodry.h
4. aero_to_srf.F90
5. checkTableHeader.F90
6. colst4intcons.F90
7. initaeropt.F90
8. initdryp.F90
9. inputForInterpol.F90
10. intaeropt0.F90
11. intaeropt1.F90
13. intaeropt2to3.F90
14. intaeropt4.F90
15. intaeropt5to10.F90
16. indrypar0.F90
17. indrypar1.F90
18. indrypar2to3.F90
19. indrypar4.F90
20. indrypar5to10.F90
21. intfrh.F90
22. lininterpol3dim.F90
23. lininterpol4dim.F90
24. lininterpol5dim.F90
25. opticsAtConstRh.F90

- 26. optinterpol.F90
- 27. opttab.F90
- 28. opttab_lw.F90
- 29. oslo_control.F90
- 30. pmxsub.F90
- 31. preprocessorDefinitions.h

REMARK contains

#undef AEROCOM

#undef AEROFFL

#undef COLTST4INTCONS

#undef AEROCOM_INSITU

- 32. ptaero_table.F90

- 33. radiation.F90 [probably OK]

REMARK

- 1) based on rrtmg-version
- 2) contains #include <preprocessorDefinitions.h>
- 3) contains #DIRIND AEROCOM AEROFFL
- 4) uses volc_fraction_coarse [IS THIS WELL SET]

FILE :

components/cam/src/physics/cam_oslo/radiation.F90 [updated based on rrtmg version]

components/cam/src/physics/camrt/radiation.F90 [contains 2 modified THT lines]

components/cam/src/physics/simple/radiation.F90

components/cam/src/physics/rrtmg/radiation.F90 [updated with

1) FLNTCLR, FREQCLR

- 2) 0 -> 0._r8

3) subroutine radiation_output_lw(..., freqclr, flntclr) : two extra arguments

4) call radiation_output_lw(..., freqclr, flntclr) : two extra arguments]

Lacking files

components/cam/src/physics/waccmx/trsolv_mod.F90 [CAM-COPIED]

components/cam/test/system/config_files/f0.9c6aqccdm [CAM-COPIED]

components/cam/test/system/config_files/f10c6aqtsvbsxdm [CAM-COPIED]

components/cam/test/system/config_files/f1.9c6aqtsvbsxdh [CAM-COPIED]

components/cam/test/system/tests_waccmx_mpi [CAM-COPIED]

Files only in NorESM

components/cam/tools/aerocom

components/cam/tools/aerocom3-PNSD_scripts-and-code

components/cam/tools/AeroTab
components/cam/tools/diagnostics
components/cam/tools/emis

CICE

1. check_decomp.csh

REMARK : extra resolutions : tnx1v1 tnx0.25v1 tnx1v3 tnx1v4

FILE : components/cice/bld/check_decomp.csh

2. buildnml

REMARK

- 1) ocn_model
- 2) snowphys_nml

FILE

components/cice/cime_config/buildnml

3. config_component.xml

REMARK : missed CICE_NAMELIST_OPTS / _CAM4 [SHOULD THIS BE PRESENT?]

FILE : components/cice/cime_config/config_component.xml

4. namelist_definition_cice.xml

REMARK

- 1) extra grids :tnx2v1 tnx1v1 tnx1v3 tnx1v4 tnx0.25v1 tnx0.25v3 tnx0.25v4
- 2) extra snowphys_nml : blowingsnow, rhos, ksno
- 3) update_ocn_f (commented out in NCAR)
- 4) f_sn2oc, f_snfonice (instead of f_dsnow)

FILE

components/cice/cime_config/namelist_definition_cice.xml

5. ice_constants.F90

REMARK

- 1) extra rhos and ksno (in module)
- 2) rhos = 330.0_dbl_kind and ksno = 0.30_dbl_kind : commented out

FILE

components/cice/src/drivers/cesm/ice_constants.F90

6. ice_prescribed_mod.F90

REMARK : several parameters commented out

FILE : components/cice/src/drivers/cesm/ice_prescribed_mod.F90

7. ice_flux.F90

REMARK : snow2ocn, snowfonice, ... extra

FILE : components/cice/src/source/ice_flux.F90

8. ice_history.F90

REMARK : f_sn2oc, f_snfonice : extra

FILE : components/cice/src/source/ice_history.F90

9. ice_history_shared.F90

REMARK : f_sn2oc, _snfonice : extra

FILE : components/cice/src/source/ice_history_shared.F90

10. ice_init.F90

REMARK : rhos, ksno, blowingsnow : extra

FILE : components/cice/src/source/ice_init.F90

11. ice_itd.F90

REMARK : max_error = puny*Lfresh*rhos : described later

FILE : components/cice/src/source/ice_itd.F90

12. ice_snowphys_mod.F90

REMARK : This file only exists for NorESM

FILE : components/cice/src/source/ice_snowphys_mod.F90

13. ice_step_mod.F90

REMARK : blowingsnow, snowphys_snowfonice, snowfonicen, snow2ocnn, snowfonice, snow2ocn : extra

FILE : components/cice/src/source/ice_step_mod.F90

14. ice_therm_mushy.F90

REMARK A = $c1 / (rhos * cp_{ice})$: variable instead of parameter [DOES IT MATTER?]

FILE : components/cice/src/source/ice_therm_mushy.F90

CISM

Lacking file :

Only in noesm-dev-ncar/components/cism/doc [CISM-COPIED]

Lacking file [not copied over]

components/cism/manage_externals/test/repos/container.git

components/cism/manage_externals/test/repos/mixed-cont-ext.git

components/cism/manage_externals/test/repos/simple-ext-fork.git

components/cism/manage_externals/test/repos/simple-ext.git

CLM

Lacking file :

components/clm/bld/namelist_files/createMkSrfEntry.py [CLM-COPIED]

1) namelist_definition_clm4_5.xml

REMARK : extra grids : tnx1v1,tnx0.25v1,tnx0.25v3,tnx0.25v4,tnx1v4,tnx1v3

FILE : components/clm/bld/namelist_files/namelist_definition_clm4_5.xml

Lacking file :

components/clm/bld/namelist_files/use_cases/2010_control.xml [CLM-COPIED]

2) buildnml

REMARK :

1) ocn_grid = case.get_value("OCN_GRID")

2) extra if test : tnx1v1, tnx0.25v1, tnx1v3, tnx1v4, tnx0.25v3, tnx0.25v4

FILE:

noresm-dev-oslo/components/clm/cime_config/buildnml

Lacking files

components/clm/cime_config/testdefs/testmods_dirs/clm/basic [CLM-COPIED]

components/clm/cime_config/testdefs/testmods_dirs/clm/clm50cam6LndTuningMode [CLM-COPIED]

components/clm/cime_config/testdefs/testmods_dirs/clm/cmip6_deck [CLM-COPIED]

components/clm/cime_config/testdefs/testmods_dirs/clm/DA_multidrv [CLM-COPIED]

components/clm/cime_config/testdefs/testmods_dirs/clm/output_bgc_highfreq [CLM-COPIED]

components/clm/cime_config/testdefs/testmods_dirs/clm/output_crop_highfreq [CLM-COPIED]

components/clm/cime_config/testdefs/testmods_dirs/clm/output_sp_highfreq [CLM-COPIED]

components/clm/cime_config/testdefs/testmods_dirs/clm/waccmx_offline [CLM-COPIED]

components/clm/cime_config/usermods_dirs/cmip6_deck [CLM-COPIED]

components/clm/cime_config/usermods_dirs/cmip6_waccm_deck [CLM-COPIED]

components/clm/cime_config/usermods_dirs/_includes [CLM-COPIED]

components/clm/cime_config/usermods_dirs/output_bgc [CLM-COPIED]

components/clm/cime_config/usermods_dirs/output_bgc_highfreq [CLM-COPIED]

components/clm/cime_config/usermods_dirs/output_crop [CLM-COPIED]

components/clm/cime_config/usermods_dirs/output_crop_highfreq [CLM-COPIED]

components/clm/cime_config/usermods_dirs/output_sp [CLM-COPIED]

components/clm/cime_config/usermods_dirs/output_sp_highfreq [CLM-COPIED]

components/clm/CONTRIBUTING.md [CLM-COPIED]

components/clm/CTSMMasterChecklist [CLM-COPIED]

components/clm/doc/clm5_0_ChangeLog [CLM-COPIED]

components/clm/doc/design [CLM-COPIED]

Lacking files (not taken over)

components/clm/manage_externals/test/repos/container.git

components/clm/manage_externals/test/repos/mixed-cont-ext.git

components/clm/manage_externals/test/repos/simple-ext-fork.git

components/clm/manage_externals/test/repos/simple-ext.git

3. SoilHydrologyMod.F90

REMARK : t_h2osfc [PROBABLY KJETIL CORRECTION]

FILE : components/clm/src/biogeophys/SoilHydrologyMod.F90

Lacking files :

Only in noresm-dev-ncar/components/clm/src/biogeophys/test/Balance_test [CLM-COPIED]

4. histFileMod.F90

REMARK :

1) iftest hist_ndens(t) == 1 : switched off

2) always ncd_double

FILE :

components/clm/src/main/histFileMod.F90

Lacking files :

components/clm/test/tools/nl_files/mksrfdt_1x1_numaIA_crp_SSP5-8.5_1850-2100 [CLM-COPIED]

components/clm/test/tools/tests_posttag_dav_mpi [CLM-COPIED]

components/clm/tools/mkmapdata/regridgeyser.sh [CLM-COPIED]

MICOM

Only in noresm-dev-oslo/components/micom

POP

General remark : a lot files are missing. I copied over everything except 4 *.git files

Lacking files [copied over]

components/pop/cime_config/testdefs/testmods_dirs/pop/default_spacecurve [POP-COPIED]

components/pop/cime_config/testdefs/testmods_dirs/pop/ecosys_cesm2_0_settings [POP-COPIED]

components/pop/cime_config/testdefs/testmods_dirs/pop/ecosys_ocn_transient_1850_2000 [POP-COPIED]

components/pop/cime_config/testdefs/testmods_dirs/pop/no_cvmix [POP-COPIED]

components/pop/doc [POP-COPIED]

components/pop/externals/CVMix/bin [POP-COPIED]

components/pop/externals/CVMix/bld/obj [POP-COPIED]

components/pop/externals/CVMix/include [POP-COPIED]

components/pop/externals/CVMix/inputdata [POP-COPIED]

components/pop/externals/CVMix/lib [POP-COPIED]

Lacking files [not copied over]

components/pop/externals/manage_externals/test/repos/container.git

components/pop/externals/manage_externals/test/repos/mixed-cont-ext.git

components/pop/externals/manage_externals/test/repos/simple-ext-fork.git

components/pop/externals/manage_externals/test/repos/simple-ext.git

components/pop/externals/manage_externals/test/test_sys_repository_git.py

Lacking files [copied over]

components/pop/externals/MARBL/defaults [POP-COPIED]

components/pop/externals/MARBL/docs [POP-COPIED]

components/pop/externals/MARBL/include [POP-COPIED]

components/pop/externals/MARBL/INSTALL [POP-COPIED]

components/pop/externals/MARBL/lib [POP-COPIED]

components/pop/externals/MARBL/LICENSE.txt [POP-COPIED]

components/pop/externals/MARBL/MARBL_tools/code_consistency.py [POP-COPIED]

components/pop/externals/MARBL/MARBL_tools/pylintrc [POP-COPIED]

components/pop/externals/MARBL/MARBL_tools/run_test_suite.sh [POP-COPIED]

components/pop/externals/MARBL/src/marbl_ciso_diagnostics_mod.F90 [POP-COPIED]

components/pop/externals/MARBL/src/marbl_ciso_init_mod.F90 [POP-COPIED]

components/pop/externals/MARBL/src/marbl_ciso_interior_tendency_mod.F90 [POP-COPIED]

components/pop/externals/MARBL/src/marbl_ciso_surface_flux_mod.F90 [POP-COPIED]

components/pop/externals/MARBL/src/marbl_diagnostics_share_mod.F90 [POP-COPIED]

components/pop/externals/MARBL/src/marbl_glo_avg_mod.F90 [POP-COPIED]

components/pop/externals/MARBL/src/marbl_interior_tendency_mod.F90 [POP-COPIED]

components/pop/externals/MARBL/src/marbl_interior_tendency_share_mod.F90 [POP-COPIED]

components/pop/externals/MARBL/src/marbl_surface_flux_mod.F90 [POP-COPIED]

components/pop/externals/MARBL/src/marbl_surface_flux_share_mod.F90 [POP-COPIED]

components/pop/externals/MARBL/tests/driver_exe [POP-COPIED]

components/pop/externals/MARBL/tests/obj [POP-COPIED]

components/pop/externals/MARBL/.travis.yml [POP-COPIED]

components/pop/input_templates/gm_bolus_terms_tavg_contents [POP-COPIED]

components/pop/input_templates/gm_bolus_terms_tavg_contents_high_freq [POP-COPIED]

components/pop/input_templates/submeso_terms_tavg_contents [POP-COPIED]

components/pop/input_templates/submeso_terms_tavg_contents_high_freq [POP-COPIED]

components/pop/source/hmix_gm_share.F90 [POP-COPIED]

components/pop/test/system [POP-COPIED]

WW3

Lacking files [copied over]

components/ww3/src/cpl_esmf [WW3-COPIED]

MODELS

Only in noresm-dev-oslo: models

1.9.8 Overview of test experiments

These experiments can be found on fram in the directory :

/cluster/projects/nn2345k/olivie/cases-cesm2.1.0

CESM

	1x1	2x2
B1850	E13	E21
B1850cmip6	E15	
BHIST	E16	E31
BHISTcmip6	E18	E22/E23
F1850	E40	E41
FHIST	E28	E29
FHIST_BGC	E38	E39
F2000climo	E24	E25
F2010climo	E26	E27BCO2x4cmip6

NorESM

	1x1	2x2
N1850OCBDRDDMS	E34	E35
NHISTOCBDRDDMS	E46	E47
NF1850	E42	E43
NFHIST	E44	E45
NF2000climo	E36	E37

1.10 Setting up CAM on your own linux PC

CAM is the atmospheric component of NoRESM. It is possible to compile and run CAM on your own Linux PC. This makes it easier to debug simple tests using programs like ddd or gdb. CAM 5.3 compiles with gfortran.

1.10.1 Obtain CAM 5.3 source code

```
svn checkout
https://svn-ccsm-release.cgd.ucar.edu/model_versions/cesm1_2_0
```

You will be asked for a user name and password. You can easily get that from NCAR through http://www.cesm.ucar.edu/models/cesm1.0/register/register_cesm1.0.cgi

(the first time it will use your unix user name.. Just type the wrong password, and then it will prompt you for another user name, then use the one provided by NCAR).

- **To use the development version of CAM5-Oslo, check out NorESM (not CESM) from the noresm repository****

```
svn checkout
https://svn.met.no/NorESM/noresm/branches/featureCAM5-OsloDevelopment_trunk2.0-4
myCamOsloDev
```

1.10.2 Compile the netcdf libraries using gfortran

1) INSTALL NETCDF (4.2): Follow instructions on <http://www.unidata.ucar.edu/software/netcdf/docs/netcdf-install/Quick-Instructions.html#Quick-Instructions>

I created library directories on /home/alfg/LIBS/.

For example /home/alfg/LIBS/netcdf-4.2.gfortran. These directories are use as “prefix=” in the installation guide..

When installing:

- Use instructions on how to build with hdf5
- Use the instructions about shared libraries. (There are also instructions about static libraries)
- Remember to set the LD_LIBRARY_PATH variable as described. Otherwise it does not work.

==> Some exceptions

(Build order is wrong) http://mail.lists.hdfgroup.org/pipermail/hdf-forum_lists.hdfgroup.org/2013-May/006818.html

(Have to do separately)

```
make
make check
make install
```

Add the following to your .bashrc file:

```
export FC=gfortran
export CC=gcc
export CFLAGS=-O0
export CXX=g++
export CXXFLAGS=-O0
```

The netcdf c-library complains about a non-successful compilation because it can not find Doxyfile. This is not important. The compilation needs also the following env-variables: CPPFLAGS=-I\${dir}/include, LDFLAGS=-L\${dir}/lib, where “dir” is directory you use for the “configure” scripts

3) Get the netcdf source code (including the c-headers) from <http://www.unidata.ucar.edu/software/netcdf/docs/getting.html> a) make b) make check c) make install

4) Get fortran netcdf api (<http://www.unidata.ucar.edu/downloads/netcdf/index.jsp>) and follow <http://www.unidata.ucar.edu/software/netcdf/docs/netcdf-fortran-install.html>

1.10.3 Compile CAM on your Linux PC

When you have successfully obtained netCDF libraries, you need to set some environment variables in order to tell CAM where to find these libraries, add the following to your `.bashrc` file (but change the path to the correct path). Make sure you have the netcdf.mod-file in “MOD_NETCF”. These environment variables are used by the CAM “configure” script!

```
export INC_NETCDF=/home/alfg/LIBS/netcdf-4.2.gfortran/include export
LIB_NETCDF=/home/alfg/LIBS/netcdf-4.2.gfortran/lib export
MOD_NETCDF=/home/alfg/LIBS/netcdf-4.2.gfortran/include export
LD_LIBRARY_PATH=$LD_LIBRARY_PATH:$LIB_NETCDF
```

The steps for building and installing CAM are well described at http://www.cesm.ucar.edu/models/cesm1.0/cam/docs/ug5_1/ug.html

You need the following settings in your `.bashrc` file:

```
export camcfg=/path/to/CESM_1_2_0/cesm1_2_0/models/atm/cam/bld
export CSMDATA=/path/to/cam/input/data
```

This command configures CAM (not including any CAM-Oslo code) on my machine. It creates a Makefile used later for compilation.

```
$camcfg/configure -dyn fv -debug -hgrid 10x15 -fc gfortran -nospmd
-nosmp -test -fc_type gnu
```

- As long as `$camcfg` is defined, you can execute this from any directory.**

Then you need the following commands **executed from the same directory as you executed “configure”**
`$camcfg/build-namelist -test -config config_cache.xml`

```
make
```

The input data have been collected and put at norstore:

```
/projects/NS2345K/noresm/CAM5.3_PCLinux/CAM5.3Input10x15/csm/inputdata
```

You should copy these files to somewhere on your computer. The CSMDATA environment variable should point to the “input-data” directory after the copying. For example I copied it to `/disk1/alfg/csm/`, so my `$CSMDATA` is `alfg@pc4400:$ echo $CSMDATA /disk1/alfg/csm/inputdata`

Finally run the model simply executing the command `./cam`

NOTE: In CAM5.5 (upcoming versions) this same procedure is supposed to work with the following command (NOT VERIFIED):

```
$camcfg/configure -fc
gfortran -fc_type gnu -debug -nospmd -nosmp -dyn fv -res 10x15 -ice sice
-phys cam5
```

1.10.4 Including cam-oslo code

This assumes you checked out NorESM (and CESM) with subversion

Works with latest version of oslo aerosol development branch

```
$camcfg/configure -dyn fv -debug -hgrid 10x15 -fc gfortran -nospmd -nosmp -test -fc_  
↪type gnu -chem trop_mam_oslo ``
```

There are additional input needed for the CAM-Oslo code. They are available in the same input-directory as the normal CESM-input files. As long as the whole input directory is copied and the CSMDATA-environmen-variable is set, you don't have to do anything. The input-directory at norstore is:

```
/projects/NS2345K/noresm/CAM5.3_PCLinux/CAM5.3Input10x15/csm/inputdata
```

1.10.5 Debug the model using ddd or gdb

Some first test show that the following information is useful:

gdb hangs forever on backtrace commmand sometimes. Adding `//set print frame-arguments none//` to your `~/gdbinit` file solves that problem on the expense of less information on “bt” command.

ddd sometimes hangs forever on startup. If that happens you need to remove the `~/ddd/init` file

gdb has problems with printing info about allocatable arrays. Allocatable arrays have to be displayed as `“(real_8 *)my_array + N)@M”` where N is number of elements beyond first element and M is number of elements to show. (See bottom of this page (and links therein) <http://stackoverflow.com/questions/11786958/how-to-print-fortran-arrays-in-gdb>)

It is sometimes useful to let the compiler tell you about additional errors. Assuming you use gfortran on your PC: See <https://gcc.gnu.org/onlinedocs/gfortran/Code-Gen-Options.html> for additional options. For example if you want to check just about everything, add `“-fcheck=all”` to the “FC_FLAGS” in the gfortran section. (Note: Running configure again re-generates the Makefile)

1.10.6 View results

ncview has trouble visualizing results which are of this coarse resolution (10x15 degrees). Panoply is a better option. Download from http://www.giss.nasa.gov/tools/panoply/download_gen.html

“ - Unpack the files“

“ - Add the folder where you find panoply.sh to your path (in your .bashrc file, add: export PATH=\$PATH:/path/to/panoply/dot/sh)“

“ - launch program with “panoply.sh netcdfFileName” from any folder“

1.10.7 Configure your case

If you want an other configuration than the standard configuration, you must add a use-case. The use case is an xml-file which is added to the `/cesm1_2_0/models/atm/cam/bld/namelist_files/use_cases/` directory.

Below is an example of a use-case which writes some more frequent output (every hour) to history files.

The file says that we have 5 different history files. The first one is the monthly output with max one time step. The other files are output every hour (-1) with max number of samples 30 in each file.

For each of the different files (1-5) we have specified the fields we want to output. For example in the second, we output QREFHT, TREFHTMN etc..

Fields which end in “:I” are instantaneous values as opposed to time averages.

Save the xml-file to the use_cases directory as “my_case.xml” and run the command

```
$camcfg/build-namelist -test -config config_cache.xml -use_case my_case

<?xml version="1.0"?>

1,30,30,30,30

0,-1,-1,-1,-1

'QREFHT','TREFHTMN','TREFHTMX','TREFHT','PRECT','PRECC','PRECSC','PRECSL','PSL','T',
↪ 'Z3','U','V','PS','TS','SST','PHIS','CLDTOT'
'U850:I','V850:I','T850:I','Q850:I','OMEGA850:I','U:I','V:I','T:I','PS:I','PSL:I',
↪ 'Q:I','PHIS:I'
'PRECT','LHFLX','SHFLX','FLDS','FLNS','FSNS','PRECC','PRECSC','PRECSL'
'TREFHT:I','QREFHT:I','TS:I','SST:I','PS:I'
```

1.11 Model Diagnostic Tools

This page links to tools used for the NorESM model evaluation.

1.11.1 NorESM Diagnostic Packages

Output from the latest NCAR diagnostic pages can be found on nird here:

via the web: http://ns2345k.web.sigma2.no/noresm_diagnostics/

via the filesystem on nird here: /projects/NS2345K/www/noresm_diagnostics/

The diagnostics packages are currently available on NIRD. Each package can be run/configured from the command line using the program `diag_run`:

Program: `/projects/NS2345K/noresm_diagnostics/bin/diag_run` Version: 5.1

Short description: A wrapper script for NorESM diagnostic packages.

Basic usage: `diag_run -m [model] -c [test case name] -s [test case start yr] -e [test case end yr] # Run model-obs diagnostics`
`diag_run -m [model] -c [test case name] -s [test case start yr] -e [test case end yr] -c2 [cntl case name] -s2 [cntl case start yr] -e2 [cntl case end yr] # Run model1-model2 diagnostics`
`nohup /projects/NS2345K/noresm_diagnostics/bin/diag_run -m [model] -c [test case name] -s [test case start yr] -e [test case end yr] &> out & # Run model-obs diagnostics in the background with nohup`

Command-line options: `-m, --model=MODEL` Specify the diagnostics package (REQUIRED).

```
“ Valid arguments:“
“ cam : atmospheric package (AMWG)“
“ clm : land package (LMWG)“
“ cice : sea-ice package“
“ micom : ocean package“
“ hamocc : biogeochemistry package“
“ all : configure all available packages.“
```

-c, -c1, -case=CASE1, -case1=CASE1 Test case simulation (OPTIONAL).

-s, -s1, -start_yr=SYR1, -start_yr1=SYR1 Start year of test case climatology (OPTIONAL). -e, -e1, -end_yr=EYR1, -end_yr1=EYR1 End year of test case climatology (OPTIONAL). -c2, -case2=CASE2 Control case simulation (OPTIONAL). -s2, -start_yr2=SYR2 Start year of control case climatology (OPTIONAL). -e2, -end_yr2=EYR2 End year of control case climatology (OPTIONAL). -i, -i1, -input-dir=DIR, -input-dir1=DIR Specify the directory where the test case history files are located (OPTIONAL).

“ Default is -input-dir=/projects/NS2345K/noresm/cases“

-i2, -input-dir2=DIR Specify the directory where the control case history files are located (OPTIONAL).

“ Default is -input-dir=/projects/NS2345K/noresm/cases“

-o, -output-dir=DIR Specify the directory where the package(s) the climatology and time-series files should be stored (OPTIONAL).

“ Default is -output-dir=/projects/NS2345K/noresm_diagnostics/out/\$USER“

-p, -passive-mode Run the script in passive mode: the diagnostic script will be configured but not executed (OPTIONAL). -t, -type=TYPE Specify climatology or time series diagnostics (OPTIONAL): valid options are -type=climo and -type=time_series.

“ Default is to run both. Note that the time series are computed over the entire simulation.“

-w, -web-dir=DIR Specify the directory where the html should be published (OPTIONAL).

“ Default is -web-dir=/projects/NS2345K/www/noresm_diagnostics“

-no-atm Run CLM diagnostics without CAM data. Must be used for offline CLM simulations.

Examples: `diag_run -m all -c N1850_f19_tn11_exp1 -s 21 -e 50 # model-obs diagnostics of case=N1850_f19_tn11_exp1 (climatology between yrs 21 and 50) for all model components.` `diag_run -m cam -c N1850_f19_tn11_exp1 -s 21 -e 50 -w /path/to/my/html # model-obs diagnostics in CAM, publish the html in /path/to/my/html.` `diag_run -m micom -c N1850_f19_tn11_exp1 -t time_series # model-obs time-series diagnostics in MICOM for all years represented in the model output directory (/projects/NS2345K/noresm/cases/N1850_f19_tn11_exp1/ocn/hist/).` `diag_run -m cice -c N1850_f19_tn11_exp1 -s 21 -e 50 -p # configure (but do not run) model-obs diagnostics for CICE.` `diag_run -m clm -c N1850_f19_tn11_exp1 -s 21 -e 50 -i /input/directory1 -c2 N1850_f19_tn11_exp2 -s2 21 -e2 50 -i2 /input/directory2 # model1-model2 diagnostics for CLM with user-specified history file directories` `diag_run -m micom -c N1850_f19_tn11_exp1 -s 21 -e 50 -t climo # model-obs climatology diagnostics (no time series) for MICOM:` `diag_run -m cam -o /my/dir # install CAM diagnostics in /my/dir with minimal configuration.` `diag_run -m micom,hamocc -c N1850OC_f19_tn11_exp1 -s 21 -e 50 # model-obs diagnostics for MICOM and HAMOCC.` `diag_run -m clm -c N1850_f19_tn11_clmexp1 -s 71 -e 100 -no-atm # model-obs time-series diagnostics for an offline (uncoupled) CLM simulation.` `diag_run -m hamocc -c N1850OC_f19_tn11_exp1 -s 31 -e 100 -t time_series # model-obs time-series diagnostics in HAMOCC between yrs 31 and 100.` A comprehensive technical summary of `diag_run` (pdf): `{ { :noresm:diag_run_documentation.pdf | }`

Report any problems, comments or suggestions to Yanchun He: yanchun.he@nersc.no

1.11.2 Recent updates

“ * 29.08.10. Update to v5.1: update NCO/NCL versions to support efficient process of compressed netcdf-4 files.“

“ * 29.06.18. Update to v5.0: new fields to HAMOCC and MICOM diagnostics; minor fixes to other issues.“

“ * 20.04.18. Update to v4.3: added new fields to HAMOCC diagnostics.“

“ * 19.04.18. Update to v4.2: included ability to do time-series diagnostics between two user-specified years.“

“ * 18.04.18. Update to v4.1: improved climatology and time-series calculations in CLM, and introduction of the -no-atm option to enable diagnostics for offline CLM simulations.“

“ * 09.04.18. Update to v4.0: included the HAMOCC diagnostics package.“

“ * 23.02.18. Update to v3.1: added monthly MLD, seasonal SST/SSS and annual meridional heat/salinity fluxes to the MICOM diagnostics.”

“ * 17.01.18. Update to v3.0: the first version of MICOM diagnostics has been included.”

“ * 28.11.17. Update to v2.0: included a set of time series plots in CAM diagnostics, along with an html interface, which can be accessed from the index page (sets.htm). “

1.11.3 Using diag_run with cron

If you want to use diag_run with crontab, you first need to load \$HOME/.bash_profile, i.e.:

1.

#. Min Hour Day Month Weekday Command(s) #.

```
50 09 23 11 * . $HOME/.bash_profile; /projects/NS2345K/noresm_diagnostics/bin/diag_run -m cam,cice -c
N18_f19_tn11_080617 -s 21 -e 50 -o /scratch/$USER/noresm_diagnostics2 -w \ /projects/NS2345K/www/test -t
time_series >& /scratch/$USER/cron_out
```

1.11.4 Other tips

It is useful to add diag_run as an alias in \$HOME/.bashrc, so that you do not need to write out the whole path every time you run it: alias diag_run='/projects/NS2345K/noresm_diagnostics/bin/diag_run'

1.11.5 NorESM diagnostics on GitHub

The NorESM diagnostics packages and diag_run are included in the Git version control repository: <https://github.com/johiak/NoresmDiagnostics>

Aerosol and Chemistry, Clouds and Forcing Diagnostics

In both the default CAM5-aerosol packages (MAM3,MAM7) and the Oslo-aerosol packages, the budget terms can be taken out using a variable in the namelist :

1.11.6 Configuring a run with more aerosol diagnostics in (NorESM2)

```
&phys_ctl_n1 history_aerosol = .true. /
```

Two more diagnostics are useful:

“ * Enable estimates multiple calls to radiation which are necessary for effective radiative forcing estimates“

“ * Enable diagnostics for AEROCOM“

To enable this, take the file cam/src/physics/cam_oslo\$ vim preprocessorDefinitions.h and copy it to your Source-Mods/src.cam folder

Change both preprocessor definitions to true

1. define AEROCOM
2. define AEROFFL

The AEROCOM-token turns on diagnostics needed for AEROCOM The AEROFFL-token tells the model to do additional radiation-diagnostics for aerosol indirect effect

Tracer Budget terms

1.11.7 Fields produced in monthly average files when running with budgets activated

Running with budgets activated will produce the following terms in the monthly output files:

^ Output variable name ^ Meaning ^ Comment ^ | SF{Tracer} | Emissions from surface | | | GS_{Tracer} | gas phase chemistry | 3D-emissions and gas phase washout included in this term | | AQ_{Tracer} | aqueous chemistry | | | {Tracer}_Mixnuc1 | Activation in clouds and evaporation of cloud droplets | | | {Tracer}_DDF | Dry deposition flux (aerosol tracers) | | | {Tracer}_SFWET | Wet deposition flux (aerosol tracers) | | | {Tracer}_condtend | loss/production in condensation/nuclation | (CAM-Oslo only) | | {Tracer}_coagTend | loss/production in coagulation | (CAM-Oslo only) | | DF_{Tracer} | dry deposition flux (gas tracers) | output with history_aerosol with CAM-Oslo only | | WD_A_{Tracer} | wet depositon flux (gas tracers) | output with history_aerosol with CAM-Oslo only | | {Tracer}_CLXF | 3D-emissions (“external forcing”) | output with history_aerosol with CAM-Oslo only | | {Tracer}_clcoagTend | loss of tracer due to coagulation with cloud droplets | output with history_aerosol with CAM-Oslo only |

Note: Since 3D-emissions and and gas washout rates are included in the term GS_{Tracer} in the moztart chemistry solver, the individual terms can be found like this (example for SO2): ncap2 -O -s GS_ONLY_SO2=GS_SO2-WD_A_SO2-SO2_CLXF infile.nc outfile.nc

More info on SO2 budgets (see /models/atm/cam/tools/diagnostics/ncl/ModIvsModII/ for scripts with info on all tracers):

GS_SO2 contains the SO2 budget terms for all that goes on in the chemistry-routine, which is \ 1) Gas phase chemistry, 2) Wet deposition, and 3) 3D-emissions.\ Gas phase chemistry is both production from DMS (GS_DMS) and loss through OH (GL_OH) \ For calculations of net loss, e.g. used to calculate SO2 life-times, we’re interested in the \ loss through OH from the chemistry-term (GL_OH).\ $GS_SO2 = GL_OH + SO2_CLXF - WD_A_SO2 - GS_DMS * 64 / 62$ \ or \ $GL_OH = GS_SO2 - SO2_CLXF + WD_A_SO2 + GS_DMS * 64 / 62$ \

Estimating chemical loss w.r.t. S (instead of SO2 or DMS), for comparison with CAM4-Oslo numbers:\ net chemical loss gas phase = $(GS_SO2 / 1.998 - SO2_CLXF + WD_A_SO2) / 1.998 + GS_DMS / 1.938$ \ net chemical loss = net chemical loss gas phase + $AQ_SO2 / 1.998$ \

Finally, total net loss (used to calculate life-time = -load/(net loss), where load = $cb_SO2 / 1.998$):\ net loss = \ - $WD_A_SO2 / 1.998$;wet deposition in kg/m2/sec (positive in output file) \ - $DF_SO2 / 1.998$;dry deposition in kg/m2/sec (positive in output file) \ + $AQ_SO2 / 1.998$;wet phase production of SO4 in kg/m2/sec (negative in output file) \ + $(GS_SO2 - SO2_CLXF + WD_A_SO2) / 1.998 + GS_DMS / 1.938$; net chemical loss gas phase \

1.11.8 Looking at the aerosol budgets (CAM-Oslo only)

“ * Go to the directory models/atm/cam/tools/diagnostics/ncl/budgets“

“ * Change the filename to use in the file budgets.ncl (“myFileName” around line 18). Should be for example yearly average of month-avg file in a run with budgets“

“ * Run the script budgets.sh to create a pdf-file (output.pdf)“

NCL Model Version Comparison package (Alf K)

=

1.11.9 Making ncl plots of often used aerosol and cloud fields, including ERFs, for two model versions (CAM-Oslo only)

```

“ * Make a local copy (on Linux) of the directory models/atm/cam/tools/diagnostics/ncl/ModIvsModII“
“ * Assuming that you have produced output data from 4 simulations: two different model ver-
sions, each with PD and PI emissions, and all run with #define AEROCOM & AEROFFL: “
“ * In ModIvsModII.csh (note: read the header info):“
“ * - edit model info for the first model (shown to the left in the plots): modelI = CAM4-Oslo or modelII = CAM5-
Oslo ?“
“ * - provide paths and partial file names of the model data (PD and PI) for Model I (CAM4-Oslo or CAM5-
Oslo) and Model II (must be CAM5-Oslo)“
“ * - choose desired plot format (plotf=ps, eps, pdf or png)“
“ * Run the script: ./ModIvsModII.csh“
“ * Furthermore, to display the plots in an organized form by use of a web browser (only possible if the cho-
sen plot format is png): “
“ * - download htm template files from \ `` ftp://ftp.met.no/projects/noresmatm/upload/
NorESM2Diagnostics/ModIvsModII/htm-templates/
<ftp://ftp.met.no/projects/noresmatm/upload/NorESM2Diagnostics/ModIvsModII/htm-templates/>‘__
“ * - edit general model info (only) in ModIvsModII.htm, and manually cut and paste the mass budget num-
bers from the script output into this file “
“ * - copy all png (plots) and htm files to the desired output (common) directory“
“ * - open ModIvsModII.htm in your browser: hyper-links to all other htm files, including plots, are found here“
“ * Example: \
`` ftp://ftp.met.no/projects/noresmatm/upload/NorESM2Diagnostics/ModIvsModII/
revision610inclSOA-Nudged_1984-12to1985-11_vs_CAM4-Oslo/ModIvsModII.htm
<ftp://ftp.met.no/projects/noresmatm/upload/NorESM2Diagnostics/ModIvsModII/revision610inclSOA-Nudged_
1984-12to1985-11_vs_CAM4-Oslo/ModIvsModII.htm>‘__

```

Cloud water mass and number analysis (budgets)

=

1.11.10 Configuring a run with more cloud diagnostics in NorESM2

To switch on extra output for cloud diagnostics (mass and number tendencies for liquid water and mass) change the following namelist variable:

```
&phys_ctl_n1 history_budget = .true. /
```

A python script for plotting the mass and number budgets for the cloud microphysics can be found under:

models/atm/cam/tools/diagnostics/ncl/cloudBudgets

in the same branch. Copy the script to your local computer or lustre and edit the script to read the correct input file(s) (instructions inside the script). Run the script by typing:

```
python scriptname.py
```

in your terminal.

Automatic AEROCOM analysis

To prepare output so that it is processed automatically by the aerocom tools, use the script located at `**models/atm/cam/tools/aerocom/**` in the svn repository. The script prepares files such that the idl aerocom tools prepare plots for the aerocom webinterface: [URL link to NorESM on AeroCom webinterface](#)

The script requires `_` and `as` as input.

`:` for a climatological average and run choose 9999, for nudged simulations choose the year of the meteorology

`_`: is the dataset identifier under which the plots appear on the AeroCom webinterface \ in the required format

- `NorESM-CAM5_svn{RevisionNumber}_YYMMDD{initials}_Freetext**.` \

Example: `“NorESM-CAM5_svn1094_151201AG_CMIP6endelig”` \ Initials AG: Alf Grini, AK: Alf Kirkevåg, DO: Dirk Olivie...

Where the date YYMMDD corresponds to the time when the AeroCom data preparation script has been executed.

The script creates files named like

`“aerocom3____.nc”`

eg `NorESM-CAM53 \ svn{RevisionNumber}_YYMMDD{initials}_Freetext`

\ aerocom variable names \ `“Surface”, “Column”, “ModelLevel”, “SurfaceAtStations”, “ModelLevelAtStations”` \ eg `“2008”, “2010”, “9999”` \ `“timeinvariant”, “hourly”, “daily”, “monthly”, “sat1000”, “sat1330”, “sat2200”, “sat0130”` \

Note that `VerticalCoordinateType` is dependent on the variable!! It is not a question about “vertical coordinate type used in model simulations”!

The script copies files on norstore into

- `/projects/NS2345K/CAM-Oslo/DO_AEROCOM/_/renamed/**`

ESMval CIS JASMIN platform and tools

ESMVALtool <http://www.geosci-model-dev-discuss.net/8/7541/2015/gmdd-8-7541-2015-discussion.html>

cis tools <http://www.cistools.net>

JASMIN <http://www.jasmin.ac.uk/services/jasmin-analysis-platform/>

Post analysis and workup of CAM diagnostics output tables

A tool for post analysis of (multiple) CAM diagnostics ASCII tables can be found in the following repository:

GitHub https://github.com/jgliss/noesm_diag_postproc

To get started, please follow the instructions in repository README (displayed in repository). Currently, the main analysis tool is a jupyter IPython notebook called

`//analysis_tool.ipynb//` (https://github.com/jgliss/noesm_diag_postproc/blob/master/analysis_tool.ipynb)

which includes more detailed instructions about setup and options.

Use the notebook

https://github.com/jgliss/noesm_diag_postproc/blob/master/download_tables.ipynb

to download local copies of result tables using a list of URL's.

- Short summary:`**`

The notebook reads multiple diagnostics files (runs) into one long table and creates heatmap plots of `//Bias, RMSE and RMSE relative error//` for a subset of variables (rows -> y-axis of heatmap) vs. the individual runs (columns -> xaxis).

- **NOTE:** In the current version, you need to download all tables** that you are interested in as csv or ascii into one directory, that is specified in the header of the notebook.

Variable groups can be defined in this config file:

```
https://github.com/jgliss/noresm_diag_postproc/blob/master/config/var_groups.ini
```

- **NOTE:** If you add groups to this file in your local copy of the** repository, please consider sending the updated to jonasg@met.no or to submit a pull request, so that the remote repository remains up to date.

- Troubleshooting**

If you run into problems, please raise an issue in the repository or contact jonasg@met.no

1.12 Using the issue tracker

[Quick Link to NORESM scrum](#)

1.12.1 Why do we need an issue tracker

- Oslo and Bergen can easily see what the others are working on
- Better traceability of code changes (an issue can contain a reference to a code change)
- Better work planning
- Better communication between developers
- Help us work as a team, not just a collection of individuals.

1.12.2 Log in and check what is there

- In github: Go to the “issues” tab. Sort by milestones or labels to see the ones you are interested in

1.12.3 Create issues

- Go to “create issue”. Note that in NorESM, the issues are different **components**. Make sure you select the right component for your issue.
- Also add other information to the issue as label (can be e.g. be a project-name). Adding Multiple labels is OK.

1.12.4 Priority definition for NorESM

- Blocker: We need to solve this immediately. Some project can not be delivered because of this problem. Problem blocks other people from working.
- Critical: Should be solved as quickly as possible. Major problem with product functionality.
- Major: This is the default priority
- Minor: Nice to do this, but not really necessary
- Trivial: Fix this when you have the time
- Not prioritized: We don’t need to do this

1.12.5 Which issues should we add to different milestones

- Find out together with your team which issues are most important
- Add the issue to the appropriate milestone

1.12.6 Working

- When you want to start working on something you should always do something which is **included in a milestone**. Those are the tasks that the team has defined as most important.
- Go to the task and choose “assign” and “assign to me”.

1.12.7 Connection to version control system

- Mention the task when you commit the fix. For example `git commit -m “metno/noresm#346: I did something clever”` will link the changeset to the right issue in github.

1.13 Test list for NorESM

This page contains a list of tests which need to pass before any changes can be ported to the trunk. By definition, the trunk always passes these tests. Any person who finds that the trunk does not pass these tests should immediately send an email to [noresm-ncc\(at\)met.no](mailto:noresm-ncc(at)met.no)

Any development version which does ****not**** pass the tests ****can only exist on branches****.

1.13.1 Restart test

- Start a 2 month branch run, create monthly average output
- Start the same model run, but define it as two single months with restart in between.
- Verify that the last monthly average is equal in both runs.

1.13.2 Bit-identical meteorology for “technical only” code changes

This test is applicable for code which is not supposed to change the model physics (e.g. writing out extra diagnostics, cleaning up code without changing the functionality..)

- Run the code without the new changes
- Run the code with the new changes
- Verify that temperature is equal in both runs (ncdiff file1.nc file2.nc file3.nc) should give zero values in file3.nc

1.13.3 Physical tests (early development)

These tests are applicable for early development of the model. At later stages, closer to important deliveries, other (and stricter) tests may apply.

Compare your new result with a result from the previous version of the trunk code.

If any of the global average of the following variables change with more than a limit X, then you must first pass through a discussion with the other developers. Send an e-mail to noresm-ncc(at)met.no before merging your changes to trunk:

- Aerosol optical depth (AOD_VIS, X=10%)
- Cloud droplet number concentration (CDNC, X=10%)
- Temperature (X = 2K)
- Liquid water path (LWP, X=10%)
- Total aerosol number concentration (N_AER, X=10%)
- Total precipitation (PRECT, X=10%)

1.14 Coding guidelines for HAMOCC

These guidelines are based in part on the NEMO coding guidelines, the «Fortran Coding Standards and Style» by The Fortran Company and the current HAMOCC (and MICOM) code. These recommendations are *guidelines* to ease the life of the user, developer and computer, on short to long term. This set of recommendations is not a proposal to rewrite MICOM/HAMOCC. It is rather meant to be considered when modifying or extending the code. A discussion about applying similar guidelines to MICOM and NorESM would be useful.

Modal verbs are used roughly as in RFC 2119.

1.14.1 Coding guidelines

- The code is to be written in Fortran 95, which is—rather than a completely new version—mostly a *clarification* of Fortran 90. When useful, features from newer Fortran versions may be used but never features from beyond Fortran 2008. Moreover, compiler-specific features that are not part of any Fortran standard must not be used.
- Prefer readable/maintainable code over efficient code.
- All subroutines and functions must include an IMPLICIT NONE statement.
- All dummy arguments (in subroutines and functions) must have their intent declared.
- All functions should be pure such that they have no side effects. For instance, `pure function square(x)` will only return the square of `x` and does not change `x` or any other variable. In addition, all dummy arguments of a pure function must be declared `intent(in)`.
- Local arguments should be declared separate from the list of dummy arguments (e.g. by putting a blank line after the dummy argument declaration and/or indicating this with a comment).
- Modules should be used instead of obsolescent common blocks (typically in header files).
- Indentation should be 3 spaces. We don't use tab characters—rather set your editor that hitting Tab corresponds to 3-space indentation. However, embedded `do i =`, `do j =`, ... loops are allowed without relative indentation (historical coding style).
- Each `use` statement is recommended to have an `only` clause to identify the source of the used variables and to limit the number of side effects.
- For floating point (real) types, Fortran 95 kind types should be used, namely `real(kind=wp)`. See `mo_kind.F90` for the kinds that we use (and update if needed).
- Use logical variables for flags, not integers (and certainly not reals).
- The variable and data type should be separated with two colons (`::`).

- The variable that is declared should have all attributes in the declaration line.
- A variable declaration should be followed by a comment explaining what the variable is, for instance `real, dimension(:, :), allocatable :: myvar !: This is a description of myvar.`
- All variables should be in lower case and self-explanatory; use underscores (`_`) if this improves readability.
- All keywords should be in lower case as well. However, some things like C pre-processor keys and namelist variables may be capitalised. Even though Fortran is not case-sensitive, you must not use different case for different instances of the same variable, subroutine or function name.
- Free-form source is used. Lines must never be longer than 90 characters. You may impose a shorter limit on yourself if you want to. Continuation is done with ampersands (&) at both the end of the line and start of the continued line (after a standard 3-character indentation). The ampersands will be aligned.
- The more modern `==` should be used instead of `.eq.` etc.
- Routine argument lists should contain a maximum of 5 variables per line, whilst continuation lines can be used. This applies both to the calling routine and the dummy argument list in the routine being called. The argument sublist per continuation line must be consistent between the calling routine and the dummy argument list.
- `#ifdefs` and `#if defined()` directives should be avoided.
- When using an embedded construct with such directives, indent with one space but leave the `#` at the start of the line, thus `# ifdef, # ifdef` etc.
- Use comments where useful. However, code should be readable without the comments.
- When in doubt, ask a colleague what they does or would do.
- It is often a good idea to ask a colleague to audit (a part of) your code.

There are more things that could be specified (like having spaces around `=` or whether to write `end do` or `enddo`), but many of those I left out because it can be left to the programmer in question who also wants to conform as much as possible to the existing code they is modifying.

1.15 Obtain a copy of the model (using git)

- **Create a github user:** You can create the github user yourself. Go to <https://github.com/join> and create a user (Make user-name which is easy to understand, for example `FirstnameLastname`. You can attach several email-addresses to the same user.)
- Visit this page: <https://git-scm.com/book/en/v2/Getting-Started-First-Time-Git-Setup>
- Send email to oyvind.seland@met.no to get the right permissions for the new github user (The email must contain who you are and the github username).
- When you have the right permissions, you can obtain the code.
- `git clone https://github.com/metno/noresm.git`

The last point will create a new directory called “noresm” in the place you checked out the model. Go to that directory before executing any git-commands.

If you get error messages, verify that you can open the page <https://github.com/metno/noresm> in a web-browser. If you can not, you are probably not a github-user or not member of the noresm group on github.

- Also do the following on all machines where you use git:

* **Make sure you have a version of git \geq 2.0** (add the line “module load git” to your .bashrc files on hexagon, vilje) * **git config - -global push.default simple** (Will edit your ~/.gitconfig file to a safer way to share your modifications, see <http://stackoverflow.com/questions/13148066/warning-push-default-is-unset-its-implicit-value-is-changing-in-git-2-0>)

Note that with git, the main branch is no longer called “trunk”, it is called “master”!

1.16 Verify that you have the correct checkout

When you have cloned the model, check that you have gotten what you wanted!

Check that your favourite branch is available using the command `git branch -all` (You should see the branch “master” on top with a star next to it. This is the branch you get by default. The other branches are listed below with `remotes/origin/branchName`, but you can not work on them until you check them out, see below)

To check out (locally) your favourite branch and to start working on it, write `git checkout -b myBranchName origin/myBranchName` (Note that `myBranchName` must be one of the branches listed by the above command)

If you don’t use the “-b” option, you will get something which is not correct. Make sure you are tracking a remote branch. You can write `git branch -vv` to see which remote branch you are tracking. The output will be something like:
* `myCheckedOutBranchName 1a08184 [origin/myCheckedOutBranchname] LatestCommitMessageOnBranch`

Note that once a branch has been checked out using the -b option, you can switch between any of your checked out branches using the command `git checkout aCheckedOutBranchName`

Note that in git, switching to a new branch change the files in your working directory. Git will warn you if you have any modified files before switching to a new branch. This is different from how svn works.

1.17 Modify files

Modify the code (for example a file named `myChangedFile.F90`) and send back to your local repository through `git add myChangedFile.F90 git commit -m “aMessage”`

The message should link to the issue on github, so if you fix issue number 100 by this code change, you would probably write something like `git commit -am “Did part of the work to resolve metno/noresm#100”`

Verify, using the tool “gitk” that the changes make sense.

1.18 Get modifications from github

```
git pull
```

To be absolutely sure about branch names etc, you can do

`git pull remoteName remoteBranchName:myLocalBranchName` which if your are picking up changes the master-branch would translate to `git pull origin master:master`

1.19 Send modifications to github

This command assumes that your changes go to the remote branch named like your branch (which is most of the times the case) `git push`

You can also do (to be completely sure): `git push remoteName myLocalBranchName:remoteBranchName` which if your are changing the master-branch would translate to `git push origin master:master` (The above command means push my changes to the remote named “origin” from my local branch named master to the remote branch named master. If you are changing another branch than master, you must obviously not write “master”).

1.20 If you don't understand and want to get back to svn

<http://www.git-tower.com/blog/git-for-subversion-users-cheat-sheet/>

1.21 SVN - Best Practice/FAQ

We encourage developers to use branches when developing the model. Do you find version control, branching and merging a bit difficult, try the NorESM svn branch/merge tutorial to understand branching and merging. In 30 minutes you can become an svn wizard

Follow this link to find the tutorial: [NORESM:SvnTutorial](#)

- **Note: As of November 13th 2015, NorESM uses git as version control** system. The rules and guidelines for merging/branching, tags and branch names are still valid in the new system**

1.22 Branches

1.22.1 What is a branch?

A branch is your own version of the repository. Sometimes it is nice to work on a feature “in private” without having to relate to other developers’ codes. And sometimes you want to work on something which takes some time before it is finished.

In these cases you can create a `//branch//`. You can work on it on your own or in a team of colleagues. When you are happy with the the content of the branch, you can merge it back to the `//trunk//`.

The `//trunk//` is considered a safe repository. **The code in the trunk should always have passed a set of tests to make sure it is stable.(<https://wiki.met.no/noesm/testlist>)**

Branches let you take advantage of the svn features, but without having to worry every day that your code passes the tests.

Create a branch with (<http://svnbook.red-bean.com/en/1.7/svn.branchmerge.using.html>)

```
svn copy http://svn.example.com/repos/calc/trunk
http://svn.example.com/repos/calc/branches/my-calc-branch -m
↪ "Creating a private branch of /calc/trunk."

or specifically for the NorESM repository with
```

```
“ svn copy \ `` https://svn.met.no/NorESM/noesm/tags/trunk2.0-1
<https://svn.met.no/NorESM/noesm/tags/trunk2.0-1>‘__“ “
“ \
`` https://svn.met.no/NorESM/noesm/branches/privateMYPORJECT_trunk2.0-1
<https://svn.met.no/NorESM/noesm/branches/privateMYPORJECT_trunk2.0-1>‘__“ “
```

“ -m “Creating a project branch of tags/trunk2.0-1.” “

Then check out the branch using `svn checkout $BRANCHURL nameOfBranchOnMyPC`

In git: First create your new branch locally and then make the remote aware of the new branch like so: `git checkout -b my_branch_name git push -u origin my_branch_name`

..and make sure your `.gitconfig`-file is configured for doing a merge (for example):

```
[merge]
```

```
tool = vimdiff
```

```
[diff]
```

```
tool = vimdiff
```

1.22.2 When should I work on a branch?

In most cases the answer is “always”. However look at it this way:

If you work directly on the trunk you have to check that your code passes the tests every time you change the code. This is cumbersome and takes a lot of time. However if you are on a branch, you can work peacefully together with your small team taking full advantage of the version control system. In the end, when you and your teammates are happy with the changes, you perform the tests and merge back to trunk.

You should obviously test your code also before you commit to a branch, but for a branch the test does not include running and analyzing long simulations.

1.22.3 How should I name the branch?

The NorESM branches have the following **naming convention** : `{PurposeOfLife}_{ParentTagName}`. This means that a branch name should state **why** it is created and **where** it is created from.

PurposeOfLife is a text string (allowed characters are a-z, A-Z, 0-9 and “.”) that must start with `//feature//`, `//release//`, `//project//` or `//private//`, where

“ * a `//feature//` branch is a temporary branch created to work on a complex change without interfering with the stability of `/trunk` (or another parent branch). Feature branches are always reintegrated. See also \

`` <http://svnbook.red-bean.com/en/1.7/svn.branchmerge.commonpatterns.html>

<<http://svnbook.red-bean.com/en/1.7/svn.branchmerge.commonpatterns.html>>‘__

“ * a `//release//` branch is created if a version with frozen functionality is desired. The development on the release branch itself is limited to bug fixes, addition of forcing scenarios and other minor changes. Releases branches are not reintegrated. “

“ * a `//project //` branch is similar to a release branch. For some projects a specific version with small changes might be required to do specific model runs. It is important that all members of the project use the same code. If the project involves major development tasks, the project team should consider creating a `//feature//` branch instead. A `//project//` branch is likely not reintegrated.“

“ * a `//private//` branch can be created if a project requires a strongly tailored version of the model, that typically is maintained by only one person. Commits to a private branch should be agreed on with the branch creator. Private branches are not necessarily reintegrated. “

ParentTagName is the name of an existing noresm tag.

Examples of valid branch names are:

```
“* \ *` `featureIceActivation_trunk2.0-1` `*\`
` ` (development of ice activation feature, created from tag ` ` \
*` `trunk2.0-1` `*\` ` `)
“* “““release2.0.0_trunk2.0-19“““ (release branch created from tag “““trunk2.0-19“““) “
“* “““release2.0.1_release2.0.0-15“““ (release branch created from tag “““release2.0.0-15“““) “
“* \ *` `privateHiatusStudy_release2.0.1-3` `*\`
` ` (private branch for Ingo's hiatus study, created from tag ` ` \
*` `release2.0.1-3` `*\` ` `)
“* \ *` `projectEXPECT_cmip5-r143-1` `*\`
` ` (branch created for use in project named EXPECT, created from tag ` ` \
*` `cmip5-r143-1` `*\` ` `)
```

Note that in this scheme a new branch is never branched off directly from trunk or another branch. ****A tag MUST be created before creating a branch**** (see section on tags below).

Note that purposeOfLife of release-branches contains version numbers. “release2.0.0” and “release2.0.1” are “purposeOfLife”. When creating release-branches, please agree on numbering with <Mats.Bentsen@uni.no>. ****The version numbers in release-branches’ “purposeOfLife” should not be confused with “increasingVersionNumber” used to make tag-names unique.****

1.22.4 A note on branch / tag naming

Naming of feature branches and associated tags

Consider the following example: A small group decides to have a branch of their own. The group defines their branch’s purpose of life as “featureLandSurfaceModeling”.

They can now branch off from trunk and create the branch *featureLandSurfaceModeling_trunk2.0-1*. They will work happily on their branch until one day they have completed their feature. In the mean time they have tagged their branch a couple of times as *featureLandSurfaceModeling-1*, *featureLandSurfaceModeling-2*.

After the feature is completed, the branch is merged back to trunk, and following svn recommendations, the branch should now be considered dead.

The team still want their branch on which they cooperate well. They should now re-generate their branch from trunk, for example *featureLandSurfaceModeling_trunk2.0-40*. This is OK. The repository should now have two branches, but by inspection of branch names it is easy to see that *featureLandSurfaceModeling_trunk2.0-40* is the recent one and the other is a dead end.

While developing on *featureLandSurfaceModeling_trunk2.0-40*, the team decides to tag their model twice, creating the tags *featureLandSurfaceModeling-3* and *featureLandSurfaceModeling-4*.

The repository now has four tags: *featureLandSurfaceModeling-1*, *featureLandSurfaceModeling-2*, *featureLandSurfaceModeling-3* and *featureLandSurfaceModeling-4*. They originate from two different branches. However this is OK in the NorESM naming convention scheme!

Naming of release branches and associated tags

The PurposeOfLife string of a release branch should begin with “release” followed by .. (e.g., *release2.0.1*).

The numbers are inherited from the tag from which the branch is created. The number is set to 0 in the special case that the parent is a trunk tag (e.g., *release2.0.0_trunk2.0-19*) and augmented if the release branch is created from an existing release branch tag (e.g., *release2.0.1_release2.0.0-5*).

For more information on and see section “How should I name the tag”.

1.22.5 How and when should I merge from trunk to my branch?

You can decide this for yourself. The main hypothesis is that the trunk is always stable and working, so you will not harm your branch by merging from trunk. If you are working on something which you will finally merge back to the trunk, you can merge often. Then the final merge will be easier.

Just use `svn merge ^/noresm/trunk` (The “^” means “the URL of the repository’s root directory” in newer versions of svn. In older versions you need to give full URL)

1.22.6 How can I merge my branch back into the trunk?

You can merge to trunk after your changed code has passed a list of tests. The tests are available here: <https://wiki.met.no/noresm/testlist>

If your code does not pass the tests, you can **not** merge your code back to the trunk

Note that in svn, **you can only merge ONE time from your branch to the trunk**, or you risk making a mess of the system! (See <http://svnbook.red-bean.com/en/1.7/svn.branchmerge.basicmerging.html> ==> “Reintegrating a branch”, note the statement **“Once a –reintegrate merge is done from branch to trunk, the branch is no longer usable for further work”**). N.B. There is a workaround to this, described in <http://svnbook.red-bean.com/en/1.7/svn.branchmerge.advanced.html#svn.branchmerge.advanced.reintegratetwice>

The merge command (from trunk) will be something like (<http://svnbook.red-bean.com/en/1.7/svn.branchmerge.basicmerging.html>) `svn merge –reintegrate $BRANCHURL`

Using git, just use `git merge branchNameIWantToMergeWith`

1.22.7 What is a tag?

A tag is a version of the model which should be considered “frozen”. It makes sense to make a new “tag” for a production system, for example a specific version which should be used for many runs.

In svn notation, there is no difference between a branch and a tag. It is just a question of naming convention. Recommended convention is that tags are branches saved under the “tags” subdirectory and a branch is saved under the “branches” directory.

- – In NorESM tags are considered frozen, and people are not allowed to do development on tagged versions.

Create the tag with a command like (<http://svnbook.red-bean.com/en/1.6/svn.branchmerge.tags.html>)

```
“ svn copy \ `` `http://svn.example.com/repos/calc/trunk
<http://svn.example.com/repos/calc/trunk>‘_‘ ‘ ‘
“ \ `` `http://svn.example.com/repos/calc/tags/release-1.0
<http://svn.example.com/repos/calc/tags/release-1.0>‘_‘ ‘ ‘
“ -m “Tagging the 1.0 release of the ‘calc’ project.”“
```

or specifically for the NorESM repository with

```
“ svn copy \ `` `https://svn.met.no/NorESM/noesm/trunk
<https://svn.met.no/NorESM/noesm/trunk>’_“ “
“ \ `` `https://svn.met.no/NorESM/noesm/tags/trunk2.0-2
<https://svn.met.no/NorESM/noesm/tags/trunk2.0-2>’_“ “
“ -m “Creating new tag of trunk.” “
```

1.22.8 When should I create a tag?

You should create a tag in the following cases:

- “ * When you want to create a branch! **Always tag the model first and then create the branch from the tag.** (If a tag has already been made at the point where you want to branch off, you don’t need to create a new tag!)“
- “ * A “released” version, a version which has been properly tested and which we recommend other users to run“
- “ * A version which has been used for some specific paper (maybe you want to do more runs after referee comments)“

1.22.9 What tags exist?

All tags are in <https://svn.met.no/viewvc/noesm/noesm/tags/>. Have a look there to find out which tags exist before you create a new tag. In order not to break the naming convention scheme, you need to know which tags exist already!

1.22.10 How should I name the tag?

Tags created from trunk have the naming convention:

```
“ trunk{MainModelVersion}.{MinorModelVersion}-{IncreasingVersionNumber}“
```

Tags created from branches have the naming convention:

```
“ {BranchPurposeOfLife}-{IncreasingVersionNumber}“
```

Every time a release branch is created from trunk, then MinorModelVersion is increased and IncreasingVersionNumber reset to 1. If no new release branch is created, then MinorModelVersion stays the same and IncreasingVersionNumber is increased.

- – Important: ** If a user wants to create a tag from a freshly created branch, then IncreasingVersionNumber should be set to 0 (e.g., *featureMicomDevelopment-0). Be aware, however, that creating a tag from a freshly created branch results in tag duplication, e.g., if the branch is featureMicomDevelopment_trunk2.0-19 then featureMicomDevelopment-0 will be identical to trunk2.0-19.*

MainModelVersion and MinorModelVersion are global counters while IncreasingVersionNumber is local to the trunk or a specific branch.

Examples are:

```
“ * ““trunk2.0-1“
“ * ““trunk2.0-2“
“ * ““featureIceActivation-1“
“ * ““release2.0.0-1“
“ * ““release2.0.0-2“
```

```

“* \ *`release2.0.1-1`*\
` (associated branch created from tag release2.0.0-2)
“* \ *`privateHiatusStudy-1`*\ ` (owned by Ingo)
“* \ *`privateKatlaStudy-1`*\ ` (owned by Øyvind)

```

Note how this is consistent with the branch naming scheme. ****You actually need to create a tag in order to give your branch a proper name!****

1.22.11 Tagging noesm0 and noesm1 branches?

NorESM0 and NorESM1 had a quite random naming convention for branches where branch names involved “noesm” and “revision numbers”. For example a NorESM1 branch name is “noesm-ver1_cmip5-r112/”. When tagging these, we need to know what is “purposeOfLife” of this branch. People tend to talk about these branches as the “112-version” or the branch “noesm-ver1_cmip5-r143/” as the “143 version”.

Therefore, even though it is confusing it is proposed here to use “cmip5-r112” or “cmip5-r143” as purposeOfLife for these branches. So tags created from these branches would be called “cmip5-r112-1”, “cmip5-r112-2”, “cmip5-r143-1”, “cmip5-r143-2” etc.

- – purposeOfLife of NorESM1 branches is therefore whatever follows after “noesm-verX-” in the branch name**

1.22.12 Case 1

//A user has performed a control simulation using a tagged NorESM version. He/she wants to use this control simulation as baseline for several new implementations. How should the user create/update working branches without having to worry about changes in trunk that can affect the result?//

This is straight forward. The user creates several branches based on the original tag. Following the naming convention scheme, they all have a different “PurposeOfLife” but they have the same ParentTagName. The combination is a unique branch name for all the new implementations.

Importantly, “merge from trunk” - which is required to be able to reintegrate the branch into trunk - has to be postponed until after evaluation experiments for the new implementations have been performed.

1.22.13 Case 2

//A user group wants to develop one model component without constantly having to worry about changes in other model components.//

A solution is to bundle new implementations for a specific component by creating a super branch (e.g., *featureMicomDevelopment_trunk2.0-19*).

The super branch can then be used to create ordinary feature branches for the individual implementations (e.g., *featureNewMixingScheme_featureMicomDevelopment-0*).

Reintegration into trunk is done in two steps: First, feature branches from the individual implementations are reintegrated into the super branch. Last, the super branch is reintegrated into trunk.

1.22.14 Case 3

// A tagged NorESM version has been used for the production of a certain simulation. Part of the simulations has to be rerun with extended diagnostic capability (e.g., with U10 output). How can I commit the extended diagnostic capability to svn?//

One can imagine that something like this happened:

```
“ * The originally tagged version was made from a branched called “release2.0.0_trunk2.0-45”“  
“ * The experiment was run with “release2.0.0-3”“
```

When the update is needed there are two possibilities:

This is the normal (and simplest) case:

Update the “release2.0.0_trunk2.0-45” branch with the changes needed. After the development is done on “release2.0.0_trunk2.0-45” brand, tag this as “release2.0.0-4” and do the experiments.

In the mean time, someone has done a lot of bugfixing in “release2.0.0_trunk2.0-45”, so the latest version of “release2.0.0_trunk2.0-45” is significantly different from “release2.0.0-3” and you are afraid including the bugfixes will change the original results. You can not include all the bugfixes before doing the extra simulations so using the latest version of “release2.0.0_trunk2.0-45” is not an option.

In this case, create a new branch: “release2.0.1_release2.0.0-3”, update it and tag it “release2.0.1-1”. **Note that in this case, you have created a new branch with a different “purposeOfLife”: “release2.0.1” is different from “release2.0.0”.**

==== SVN messages ====

1.22.15 What should be stated in the commit message?

- – Always state the JIRA issue associated with the work**! This makes the code changes pop up in JIRA!: For example “svn commit -m “NE-100: These are the fixes needed to solve this issue”” (see <https://wiki.met.no/noresm/usingtheissuetracker>)

The commit message should include a concise description of the committed changes.

Furthermore, it should indicate whether the changes preserve bit-reproducibility. If this information is omitted, then one should assume that bit-identity is broken.

Examples 1:

```
“ Added new compset COMPSETNAME, bit identical compared to revision r “
```

Examples 2:

```
“ Added new diagnostics in cloud.F90, bit identical compared to revision r“
```

1.22.16 What should be stated in the copy message of a branch?

A more elaborated “purpose of life” than indicated by the branch name can be provide as svn message when creating the branch. If a corresponding jira issue exists, then the text provided to the issue track can be reused here.

1.22.17 What should be stated in the copy message of a tag?

Ideally, the commit message of a tag should provide a complete change history relative to the last tag. This information can be easily extracted from the svn viewer.

Example 1: Change history: trunk-2.0 -> trunk-2.1 (r190 -> r198)

Revision 198

changes made in r198...

Revision 193

changes made in r193...

Revision 190

changes made in r190...

Example 2: Change history: trunk-2.3 -> featureMicomDevelopment-1 (r200 -> r205)

Revision 205

changes made in r205 to branch featureMicomDevelopment...

Revision 202

“ changes made in r202 to branch featureMicomDevelopment... “

Revision 200

“ changes made in r200 to branch featureMicomDevelopment... “

1.23 Subversion how-to for NorStore

1.23.1 How it works

NorStore uses the `svnserv` server solution to take local svn repositories online.

On the NorStore node `noreg.norstore.no`, a `svnmerge` demon is running as a background process. The demon serves repositories that are stored in NorStore's project work space in `/projects/NS2345K/svn`. The svn repositories each receive an URL of form `svn://noreg.norstore.no/<repository name>`

1.23.2 Prerequisites

To create and manage a repository, you need a user account at NorStore which is member of the ns2345k project.

The creator of a repository has the full flexibility to grant remote read/write access to external users. Once the repository is create, the use of the repository does not require a NorStore account. The repository creator can define svn users (consisting of a user-name with corresponding password) which in general have no relation to NorStore user accounts.

To start and stop the svn server, your NorStore user must in addition have access to `noreg.norstore.no`. Currently, this group contains following people: Alf Grini, Ingo Bethke, Thierry Toutain and Martin King.

1.23.3 Start/stop server

Log on to *noresg.norstore.no* via ssh.

To take all svn repositories online, do

```
“ svnserve -d -r /projects/NS2345K/svn --log-file /projects/NS2345K/svn/svnserve.log --pid-file /projects/NS2345K/svn/svnserve.pid“
```

An svnserve demon has now been started as a background process on *noresg.norstore.no*. The process id is logged in */projects/NS2345K/svn/svnserve.pid*.

To take all repositories offline again, do

```
:literal:‘ kill cat /projects/NS2345K/svn/svnserve.pid‘
```

1.23.4 Creating a new repository

Log on to *norstore.uio.no* via ssh.

Change directory to */projects/NS2345K/svn*.

Create a new svn repository with

```
“ svnadmin create testrepo“
```

where *testrepo* is to be replaced with the repository name.

The new repository is now set up in */projects/NS2345K/svn/testrepo*

1.23.5 Customizing access rights

Edit *testrepo/conf/svnserve.conf* for general customisation of access rights. Important: Make sure to remove all leading blanks when activating an option.

The default is read/write access for authenticated users and no access for anonymous.

To limited access to read for authenticated users, change

```
“ # auth-access = write“
```

to

```
“ auth-access = read “
```

To grant anonymous read, change

```
“ # anon-access = none “
```

to

```
“ anon-access = read“
```

```
“ “
```

The users of the repository are defined in *testrepo/conf/passwd* with user name and password, e.g.

```
“ [users]“
```

```
“ harry = harryssecret“
```

```
“ sally = sallysecret “
“ guestuser = friendly “
```

The user customisation is activated in *svnserve.conf* by uncommenting

```
“ # password-db = passwd “
```

to

```
“ password-db = passwd “
```

Further fine tuning of access rights can be done in *testrepo/conf/authz*. E.g.,

```
“ [/] “
“ harry = rw “
“ guestuser = r “
```

gives *harry* read/write access but limits the access of *guestuser* to read-only. The *authz* customisation is activated in *svnserve.conf* by uncommenting

```
“ # authz-db = authz “
```

to

```
“ authz-db = authz “
“ “
```

1.23.6 Remote access

After taking the repository online, the URL of the repository *testrepo* is `svn://noresg.norstore.no/testrepo`

To checkout the repository, do

```
“ svn co \ ` ` ` svn://noresg.norstore.no/testrepo <svn://noresg.norstore.no/testrepo> ‘__
“ “
```

Change directory to *testrepo*

```
“ cd testrepo “
“ “
```

Create a dummy file and mark it for adding

```
“ echo test > README “
“ svn add README “
```

Commit the repository

```
“ svn commit -m “my commit message” “
“ “
```

1.24 Uncertain parameters (which can be discussed) in the aerosol model

^ Parameter ^ Meaning ^ Where in code ^ | sticking coefficients | How easy is it for H2SO4 to condense on aerosol modes | condend.F90 (and AeroTab for the look-up tables) | | size distribution/total dust emission | Tune on fraction of dust going to different modes (back to aerocom estimates??): how much is emitted in DST_A2 relative to the DST_A3 tracer | oslo_dust_intr.F90 | | om_to_oc | How much more “OM” do we get when “OC” is emitted | mo_srf_emission.F90, mo_extfrc.F90 | | below cloud scavengin coeffs | Below cloud scavenging coefficients | aerosoldef.F90 | | size of “life-cycle species” | what is the effective size of “condensate”, “coagulate” | aerosoldef.F90 |

1.25 NorStore Tape Storage

1.25.1 Basic use

Instructions for basic use of the tape resources are found on NorStore’s [homepage](#).

1.25.2 Advanced use

A collection of high-level tape tools is available in `**/projects/NS2345K/tools**`.

noresm2tape

noresm2tape copies the output of a NorESM case from NorStore’s disk area to NorStore’s tape resource. The output folder should be organised in the standard CCSM way (e.g., atmospheric output is expected in ‘atm/hist’). If that is not the case, please use the command disk2tape instead.

- – IMPORTANT:** It is highly recommended to run the script in background using the nohup command, e.g.,

```
“ “nohup ““““““/projects/NS2345K/tools/noresm2tape ““““““““““& “““”.” Make sure not to forget the “&” at the end of the line. After submitting the script with nohup, it is safe to log out. You will receive a notification email when the transfer to tape is completed. “ “
```

Run `/projects/NS2345K/tools/noresm2tape -h` to print detailed instructions:

Usage: noresm2tape

Example: `noresm2tape /scratch/ingo/mycase /tape/NS2345K/cases/mycase auto replica`

Purpose: Copies NorESM case output from disk to tape.

Description: and must be full path names (see example).

```
“ “ “ “ must be one of: auto, all, 1, 10, 100, or 1000 (numbers “ “
```

```

“ indicate simulation years per chunk)“
“
“ \ \ `` must be either 'replica' - resulting in two tape copies -
“ or 'noreplica'. “
“
“ The output folder ““ will be created - with parent “
“ directories if necessary - and must not exist before running this “
“ script. “

“ The input data is staged in form of tar-chuncks in “
“ /scratch/ingo/noresm2tape. The tar-chunks are removed from “
“ scratch after successfull transfer to tape. “

“ Checksums for all input files are computed and stored in a separate “
“ checksum file. The checksums are used to verify the tar-chunks. “

```

disk2tape

disk2tape copies a folder from NorStore’s disk area to NorStore’s tape resource. In contrast to noesm2tape, the data folder can have any structure and content.

- – **IMPORTANT:**** It is highly recommended to run the script in background using the nohup command, e.g.,

```

"“nohup““““/projects/NS2345K/tools/disk2tape““““““““““&“““”. Make sure not to for-
get the “&” at the end of the line. After submitting the script with nohup, it is safe to log out. You will re-
ceive a notification email when the transfer to tape is completed. “

```

Run `/projects/NS2345K/tools/disk2tape -h` to print detailed instructions: Usage: disk2tape [none|gzip|bzip2] [replicate]

Example: `disk2tape /projects/NS2345K/hirlam /tape/NS2345K/hirlam`

Purpose: Copies a folder from disk to tape.

Description: must be the absolute path to the input folder.

```

“ ““ will be created - with parent directories if “
“ necessary - and must not exist before running this script. “
“
“ gzip or bzip2 compression will be performed if the third argument is “
“ set to “gzip” or “bzip2”, respectively. The default is no compression.“
“
“ If the forth argument is set to “replicate” then a second copy of “
“ the data will be stored on another physical tape medium. “
“ The path of the additional copy differs from the path of the first “
“ copy by that /tape is replaced with /replica. “

“ The input data is staged in form of tar-chuncks in “
:literal: /scratch/$USER/basename $0. The tar-chunks are removed from ‘

```

“ scratch after success transfer to tape. “

“ The size of a single tar-chunk is about 15Gb if no compression is “
“ applied. If compression is applied, the size of the tar-chunks can “
“ be up to 60Gb as a compression factor 4 is assumed. “

“ Checksums for all input files are computed and stored in a separate “
“ checksum file. The checksums are used to verify the tar-chunks. “

tape2disk

tape2disk copies a folder that had been put on tape with either noresm2tape or disk2tape. All tar-archives found in the top-level folder are unpacked while tar-files stored within tar-files are not inflated.

Run `/projects/NS2345K/tools/tape2disk -h` to print detailed instructions:

Usage: `/projects/NS2345K/tools/tape2disk`

Example: `/projects/NS2345K/tools/tape2disk /tape/NS2345K/hirlam /scratch/ingo/hirlam`

Purpose: Retrieves a folder from tape and unpacks all tar-archives contained in it.

Description: will be created if it does not exist.

listontape

listontape lists all files that are archived in a tape folder.

Run `/projects/NS2345K/tools/listontape -h` to print detailed instructions:

Usage: `/projects/NS2345K/tools/listontape`

“ or “

“ `/projects/NS2345K/tools/listontape` “

Example: `/projects/NS2345K/tools/listontape /tape/NS2345K/hirham_nobackup/BCM`

“ or “

“ `/projects/NS2345K/tools/listontape /tape/NS2345K/hirham_nobackup/BCM/BCM.md5.tar` “

“ “

Purpose: Lists the names of files that are archived in a given directory on tape.

Description: The script relies on the existence of a checksum file, with extension

“ `md5.tar`, that is stored in the archive directory. “

“ If exactly one checksum file exists then directory path is sufficient “

“ as input argument. However, if two or more checksum file exist then “

“ the absolute path to the checksum file has to be provided. “

1.26 NorStore Research Data Archive: Guidelines for ingestion of NorESM output

The recommendations presented on this page are based on discussion between Alok, Mats and Ingo. Please feel free to comment and modify them.

The access point to NorStore’s Research Data Archive is <http://archive.norstore.no>

For testing purposes, the alternative site <http://archive-test.norstore.uio.no> should be used.

1.26.1 Metadata recommendations

BibliographicCitation

Specify “<http://cmip-pcmdi.llnl.gov/cmip5/terms.html>” as value.

Coverage

Please follow DCMI recommendations when specifying coverage.

Box (<http://dublincore.org/documents/dcmi-box>)

If coverage is global, use:

```
“ * northlimit=90“
“ * southlimit=-90 “
“ * westlimit=-180“
“ * eastlimit=180“
“ * units=signed decimal degrees “
```

(leave rest unspecified)

Period (<http://dublincore.org/documents/dcmi-period> <http://www.w3.org/TR/NOTE-datetime>)

Specification of start- and end-year required (optionally, month and day):

```
“ * start=YYYY[-MM-DD]“
“ * end=YYYY[-MM-DD]“
“ * scheme=W3C-DTF“
```

The value of //scheme// should be always set to W3C-DTF. The value of //name// can be left blank.

Description

Recommended content in description:

“ * long version of title, e.g. “Norwegian Earth System Model version 1 (medium resolution) output prepared for the CMIP5 pre-industrial control experiment.” “
 “ * citation information (see below)“
 “ * reference to CMIP5 experimental design (http://cmip-pcmdi.llnl.gov/cmip5/docs/Taylor_CMIP5_design.pdf) “
 “ * forcing agents (link to \ \ \ `http://search.es-doc.org
 <<http://search.es-doc.org>>‘_‘“) (INGO: skip?) “
 “ * initialisation (parent experiment, branch time) (INGO: skip?) “

NorESM1-M citation:

- – Bentsen, M., Bethke, I., Debernard, J. B., Iversen, T., Kirkevåg, A., Seland, Ø., Drange, H., Roelandt, C., Seierstad, I. A., Hoose, C., and Kristjánsson, J. E.: The Norwegian Earth System Model, NorESM1-M – Part 1: Description and basic evaluation of the physical climate, *Geosci. Model Dev.*, 6, 687-720, doi:10.5194/gmd-6-687-2013, 2013.**

NorESM1-ME citation:

- – Tjiputra, J. F., Roelandt, C., Bentsen, M., Lawrence, D. M., Lorentzen, T., Schwinger, J., Seland, Ø., and Heinze, C.: Evaluation of the carbon cycle components in the Norwegian Earth System Model (NorESM), *Geosci. Model Dev.*, 6, 301-325, doi:10.5194/gmd-6-301-2013, 2013.**

Mapping of CMIP experiment long/short names

10- or 30-year run initialized in year XXXX decadalXXXX volcano-free

hindcast initialized in year XXXX noVolcXXXX prediction with 2010 volcano volcIn2010 pre-industrial control pi-Control historical historical historical extension historicalExt other historical forcing historicalMisc mid-Holocene midHolocene last glacial maximum lgm last millennium past1000 RCP4.5 rcp45 RCP8.5 rcp85 RCP2.6 rcp26 RCP6 rcp60 ESM pre-industrial control esmControl ESM historical esmHistorical ESM RCP8.5 esmrcp85 ESM fixed climate 1 esmFixClim1 ESM fixed climate 2 esmFixClim2 ESM feedback 1 esmFdbk1 ESM feedback 2 esmFdbk2 1 percent per year CO2 1pctCO2 abrupt 4XCO2 abrupt4xCO2 natural-only historicalNat GHG-only historicalGHG AMIP amip 2030 time-slice sst2030 control SST climatology sstClim CO2 forcing sstClim4xCO2 all aerosol forcing sstClimAerosol sulfate aerosol forcing sstClimSulfate 4xCO2 AMIP amip4xCO2 AMIP plus patterned anomaly amipFuture aqua planet control aquaControl 4xCO2 aqua planet aqua4xCO2 aqua planet plus 4K anomaly aqua4K AMIP plus 4K anomaly amip4K

Boundary conditions

piControl: -Prescribed atmospheric concentrations of pre-industrial well mixed gas: Carbon Dioxide -Unperturbed Pre-Industrial Land Use -Prescribed concentrations or emissions of pre-industrial natural aerosols -Prescribed concentrations or emissions of pre-industrial natural aerosol precursors -Prescribed atmospheric concentration of pre-industrial short lived (reactive) gas species -Prescribed concentrations or emissions of pre-industrial short lived (reactive) aerosol species -Prescribed atmospheric concentrations of pre-industrial well mixed gases: excluding CO2

Label

If the dataset matches a NorESM case then specify the case name as label, e.g., //NAER1850CNOC_f19_g16_06//.


```
historicalExt  r3 NRCP85AERCN_f19_g16_03 GHG+AER
historicalGHG  r1 N20TRAERCNGHG_f19_g16_01 (1850-2005),
NRCP85AERCNGHG_f19_g16_01 (2006-2012) (7.2) GHG
historicalMisc r1 N20TRAERCNAER_f19_g16_01 (1850-2005),
NRCP85AERCNAER_f19_g16_01 (2006-2012) (7.3) AER
historicalNat  r1 N20TRAERCNNAT_f19_g16_01 (1850-2005),
NRCP85AERCNNAT_f19_g16_01 (2006-2012) (7.1) NONE
“rcp26      r1 NRCP26AERCN_f19_g16_01 (4.3) GHG+AER “
rcp45          r1 NRCP45AERCN_f19_g16_01 (2006-2100),
NRCP45XTAERCN_f19_g16_01 (2101-2300) (4.1-L) GHG+AER
rcp6           r1 NRCP60AERCN_f19_g16_01 (4.4) GHG+AER
rcp85          r1 NRCP85AERCN_f19_g16_01 (4.2) GHG+AER
sst2030        r1 NFRCP45_2026-2035_f19_f19 (2.1) GHG+AER
sstClim        r1 NF1850AERCNAMIPC_f19_f19_01 (6.2a) none
sstClim4xCO2   r1 NF18504XAERCNAMIPC_f19_f19_01 (6.2b) GHG
sstClimAerosol r1 NF1850AER20CNAMIPC_f19_f19_01 (6.4a) AER
```

Mapping between CMIP5 experiment acronyms and NorESM1-ME cases names:

```
“ piControl  r1 N1850AERCNOC_f19_g16_CTRL_02 “
“ 1pctCO2    r1 N1850RMAERCNOC_f19_g16_02 “
“ historical  r1 N20TRAERCNOC_01 “
“ esmControl r1 N1850AERBPRP_f19_g16_02 “
“ esmHistorical r1 N20TRAERCNOCBPRP_f19_g16_01 “
“ esmrcp85   r1 NRCP85AERBPRP_f19_g16_03 “
“ esmFdbk1   r1 N1850RMAERCNOC_f19_g16_RAD_02 “
“ esmFixClim1 r1 N1850RMAERCNOC_f19_g16_BGC_02 “
“ rcp26      r1 NRCP26AERCNOC_f19_g16_01 (2006-2060), NRCP26AERCNOC_f19_g16_02 (2061-2101) “
“ rcp45      r1 NRCP45AERCNOC_f19_g16_02 “
“ rcp6       r1 NRCP60AERCNOC_f19_g16_01 (2006-2050), NRCP60AERCNOC_f19_g16_02 (2051-2101) “
“ rcp85      r1 NRCP85AERCNOC_f19_g16_01 (2006-2044), NRCP85AERCNOC_f19_g16_02 (2045-2100) “
```

Project

For CMIP5 output, specify `//Integrated Earth System Approach to Explore Natural Variability and Climate Sensitivity (EarthClim)//`

Conforms to

If in doubt, specify `//Climate and Forecast (CF) metadata conventions//`

Provenance

In case the output has been compressed, specify `//gzip compression of restart files and conversion of history output to compressed NetCDF-4 format//` and state the time stamp of the last compressed restart file.

Please add additional provenance entries in case further manipulations have been performed on the output.

1.26.2 Metadata example

Link to [this section](#). ^ Parameter ^ Value ^ Comment ^ | **Title** | NorESM1-M CMIP5 historicalExt (3.2) r2 raw output | **Created on** | 29/Oct/2011 | **Ingo:** *time stamp of the last restart folder (i.e, time experiment was completed)* | **Category** | Simulation | **State** | Raw | **Domain** | Natural Sciences | **Field** | Earth Sciences | **Creator** | Norwegian Climate Center (NCC) | **Contributor** | Alok Kumar Gupta (Alok.Gupta@uni.no) | **Ingo:** *NorStore defines the contributor as the person who puts in the metadata | **Data Manager** | Alok Kumar Gupta (Alok.Gupta@uni.no) | **Rights Holder** | Norwegian Climate Center (NCC) (Ingo.Bethke@uni.no) | **Ingo:** *need to find better solution for the email address* | **Access Rights** | Public | **Ingo:** *our processed CMIP5 is public, so we might as well make the raw data public* | **Label** | NRCP85AERCN_f19_g16_02 | **Ingo:** *decided to use the experiment "case name" as label* | **BibliographicCitation** | <http://www.geosci-model-dev.net/6/687/2013/gmd-6-687-2013.html> | **Ingo:** *the **BibliographicCitation** value has to be an URL. We decided to add additional citation information to **Description*** | **Project** | Integrated Earth System Approach to Explore Natural Variability and Climate Sensitivity (EarthClim) | **Conforms to** | Climate and Forecast (CF) metadata conventions | **Provenance** | gzip compression of restart files and conversion of history output to compressed NetCDF-4 format | **Ingo:** *specify time stamp of last compressed restart file* | **Coverage** | Box: Southlimit=-90, Northlimit=90, Westlimit=-180, Eastlimit=180, Uplimit=20000, Downlimit=-9000, Units=signed decimal degrees, Zunits=m; Period: start=2006-01-01, end=2012-12-31, scheme=W3C-DTF | **Ingo:** *use of DCMI standard makes it easy for external servers to interpret the coverage information* |*

- - Description

Norwegian Earth System Model version 1 (medium resolution) output prepared for the CMIP5 historical extension experiment with forcing scenario RCP8.5.

Citation: Bentsen, M., Bethke, I., Debernard, J. B., Iversen, T., Kirkevåg, A., Seland, Ø., Drange, H., Roelandt, C., Seierstad, I. A., Hoose, C., and Kristjánsson, J. E.: The Norwegian Earth System Model, NorESM1-M – Part 1: Description and basic evaluation of the physical climate, *Geosci. Model Dev.*, 6, 687-720, doi:10.5194/gmd-6-687-2013, 2013.

Technical details: Production machine: Cray XT3 in Bergen (hexagon) Model source: https://svn.met.no/viewvc/noesm/noesm/branches/noesm-ver1_cmip5-r112 Model revision number: 112 Model components: atmosphere=CAM4; ocean=MICOM; land=CLM; sea ice=CICE Horizontal resolution: atmosphere/land=1.9x2.5 degree; ocean/sea ice=~1 degree Output frequency: monthly + daily + 6-hourly + 3-hourly as requested by CMIP5 Experiment type: fully coupled Initialisation: branched from CMIP5 historical simulation r2 (N20TRAERCN_f19_g16_02) at 2006-01-01 Changing forcing agents: prescribed GHG concentration changes; aerosol emissions for SO4, POM and BC (see Kirkevåg et al. 2013) Tuning parameters changed relative to the host model CAM4: rhmin=0.90 (0.91 in CAM4) reduced RH threshold for formation of low stratiform clouds; critrp=5.0 mm/day (0.5 mm/day in CAM4) maximum precipitation rate for suppression of autoconversion of cloud water; r3lc=14 um (10 um in CAM4) critical mean droplet volume radius for onset of autoconversion Other comments: -

External references: http://cmip-pcmdi.llnl.gov/cmip5/docs/Taylor_CMIP5_design.pdf (experimental design) <http://search.es-doc.org> (model system, boundary conditions, experiments, etc) <http://noesg.norstore.no> (Norwegian ESGF portal with post-processed CMIP5 data) http://www.geosci-model-dev.net/special_issue20.html (NorESM special issue) <http://www.cristin.no/as/WebObjects/cristin.woa/wo/18.Profil.29.25.2.3.3.7> (link to national publication database)

1.27 Existing projects

NORESMP:Projects:Expect

1.28 References

CHAPTER 2

Search

- search

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