CLM4.5 Tutorial: Basic Modifications

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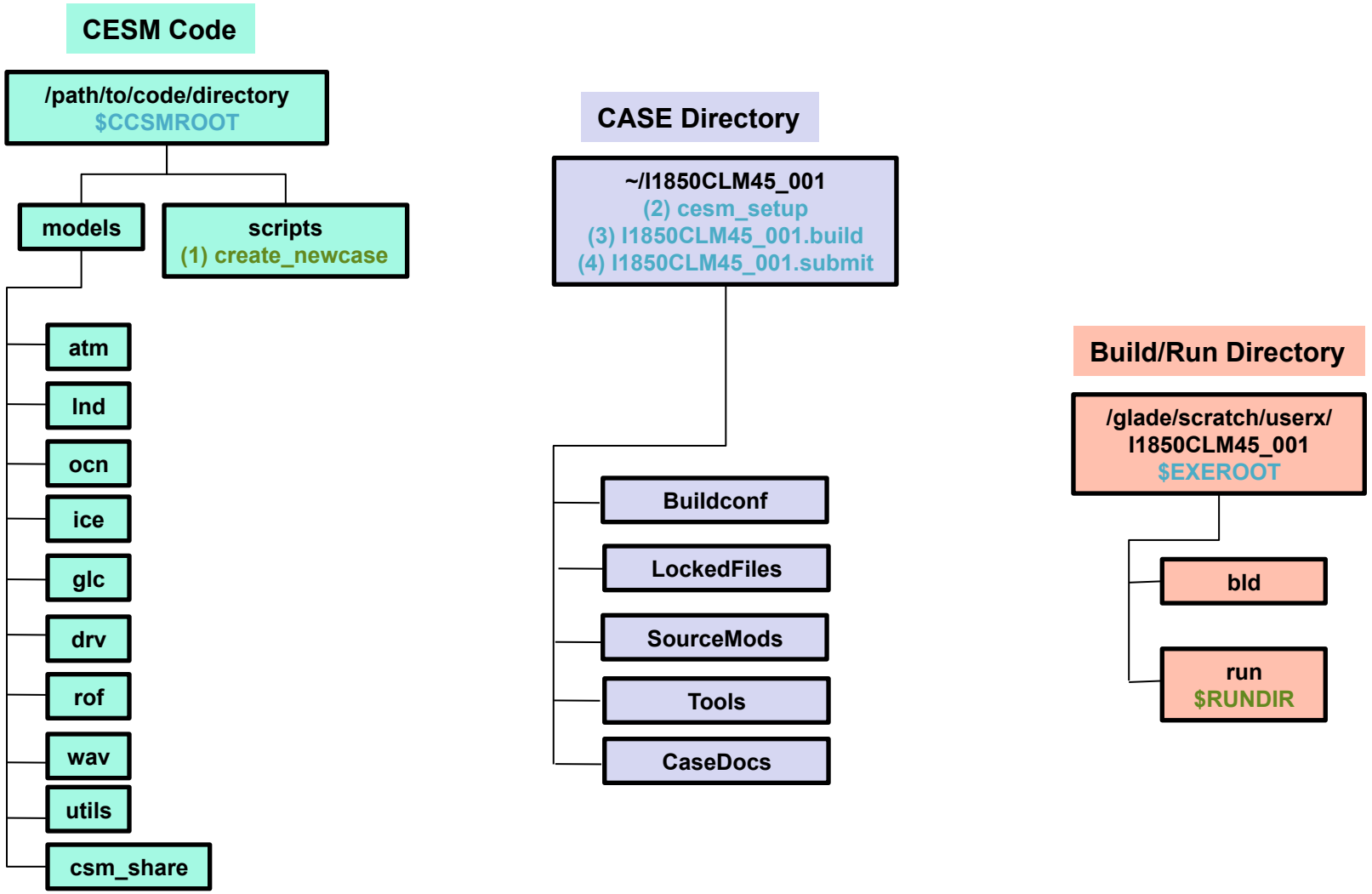
Review: The 4 commands to run CLM

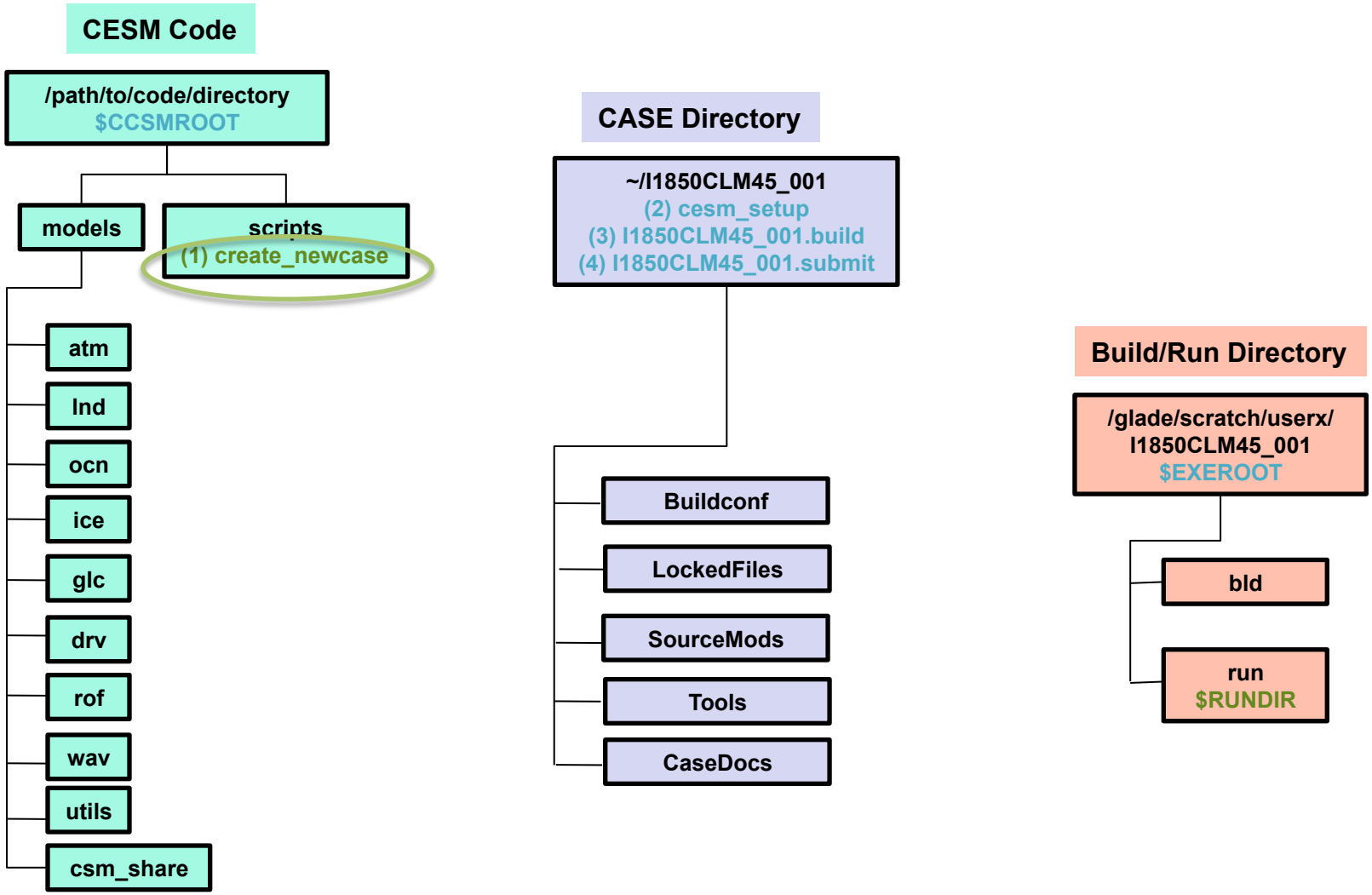
Set of commands to build and run the model on a supported machine: ”yellowstone”

```
# go into scripts directory into the source code download
cd /glade/p/cesm/lmwg/CLM2014_tutorial_n03_clm4_5_62/scripts

# (1) create a new case in the directory “cases” in your home directory
./create_newcase -case ~/I1850CLM45_001 -res f19_g16 -compset I1850CLM45 -mach yellowstone

# go into the case you just created in the last step
cd ~/I1850CLM45_001

# (2) invoke cesm_setup
./cesm_setup

# (3) build the executable
./I1850CLM45_001.build

# (4) submit your run to the batch queue
./I1850CLM45_001.submit
```

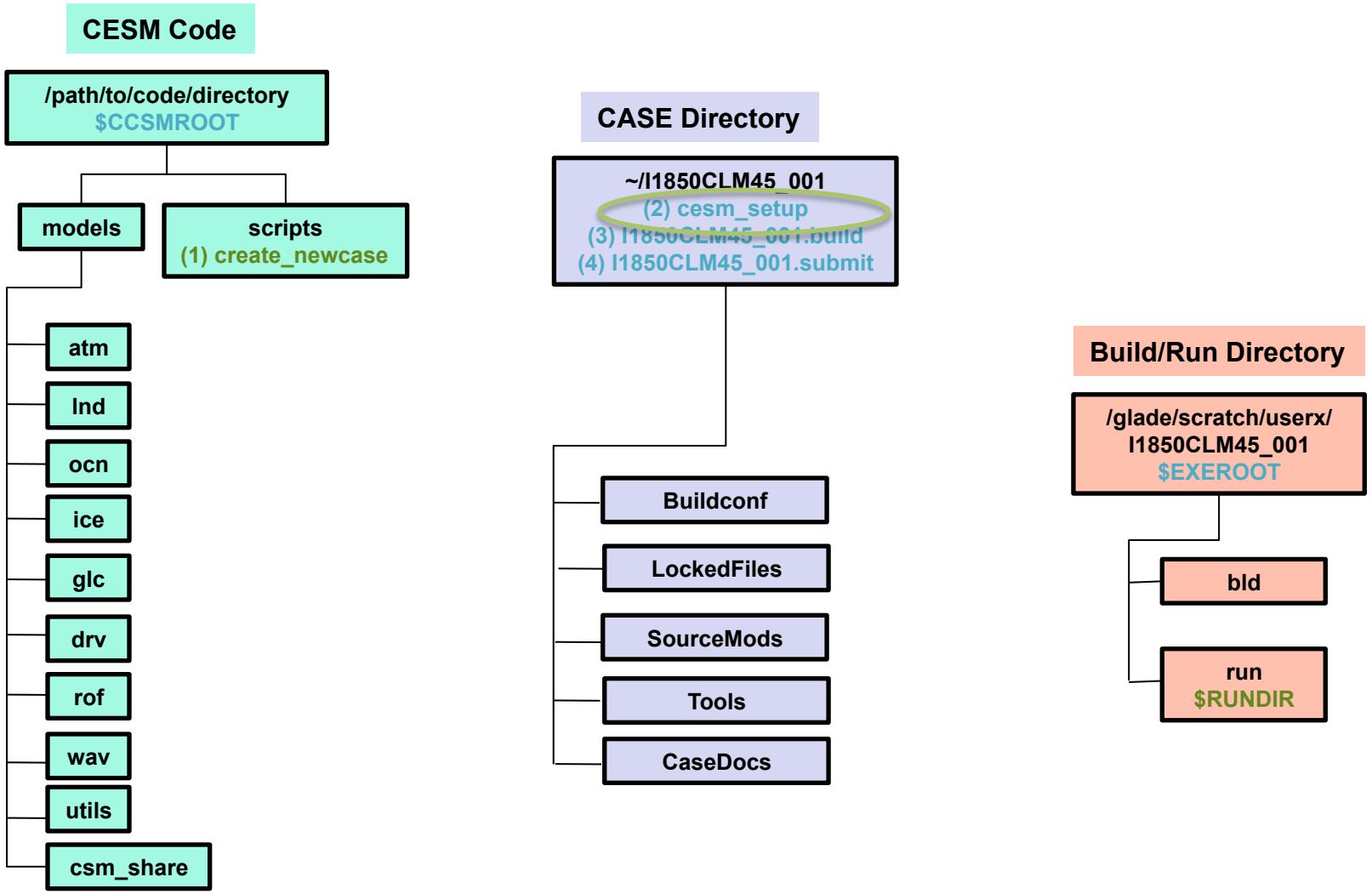
CLM directories & commands



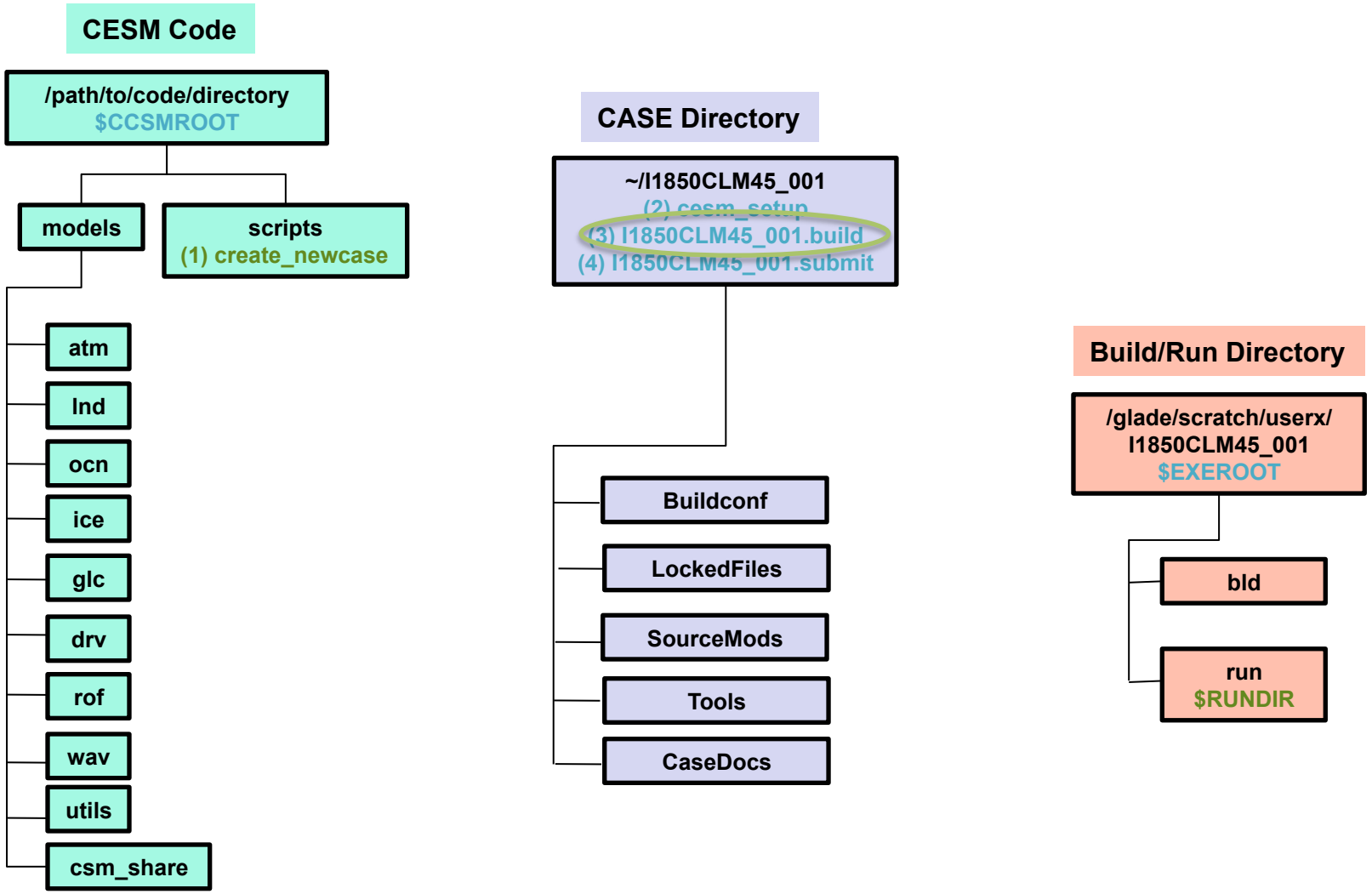
CLM directories & commands



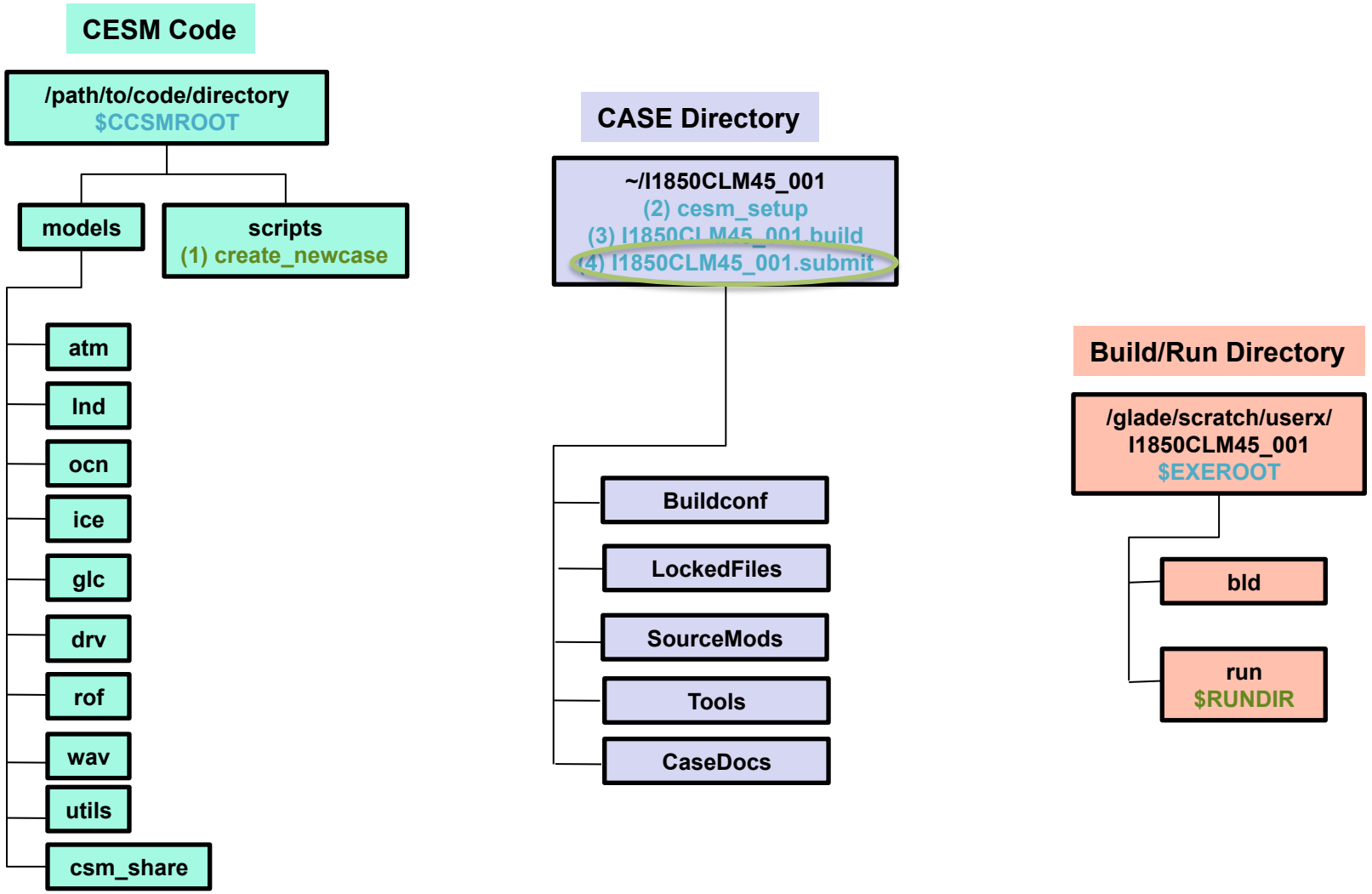
CLM directories & commands



CLM directories & commands



CLM directories & commands



Review: Queues and Jobs

Yellowstone

Checking jobs:

a. Type *bjobs* or
b. Type *bjobs -u all* to see everyone's jobs, or

Killing jobs:

a. Find your JOBID after typing *bjobs*
b. Type *bkill <JOBID>*

Finding model output

Directory:

Change this to your user name

/glade/scratch/{userXX}/archive/I850CLM45_001/lnd/hist

Finding model output

Directory:

Change this to your user name

/glade/scratch/{userXX}/archive/I850CLM45_001/lnd/hist

Files (use "*ls*" to list them):

I1850CLM45_001.h0.0001-12.nc

Case Name

Output Type
(history)

Time

File Type
(netCDF)

3 Types of Basic Modifications

1. Component Sets
2. ENV files (env_[command])
3. Namelist files (user_nl_[model])

3 Types of Basic Modifications

1. Component Sets

   Set up a simulation for 2000

2. ENV files (env_[command])

3. Namelist files (user_nl_[model])

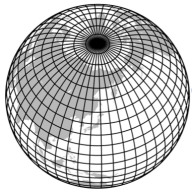
Creating a new case

create_newcase requires 4 arguments

What is the casename ?

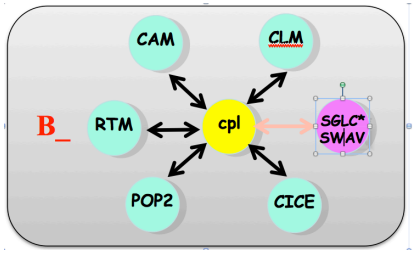
YourCaseName

Which resolution?



f19_g16
(2-degree)

Which model configuration ? Which set of components ?



I1850CLM45
(I = CLM only, 1850)

Which machine are you running on?

yellowstone

./create_newcase –case ~/I1850CLM45_001 –res f19_g16 –compset I1850CLM45 -mach yellowstone

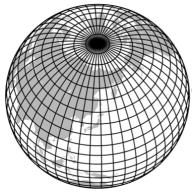
Creating a new case

create_newcase requires 4 arguments

What is the casename ?

YourCaseName

Which resolution?



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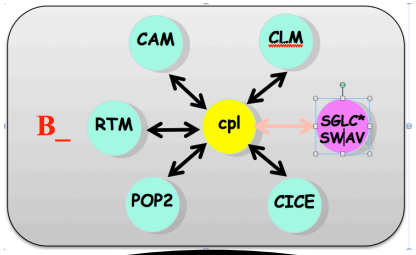

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(I = CLM only, 1850)

Which machine are you running on?

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./create_newcase –case ~/I1850CLM45_001 –res f19_g16 –compset I1850CLM45 -mach yellowstone

Changing Simulation Components

Compset, or component set:

predefined options for running the model

Use compset to change the type of simulation

Changing compsets lets you run different experiments

Component options:

- Year (1850, 2000, transient, etc.)
- Data atmosphere (Qian, CRUNCEP, CPLHIST3HrWx)
- Model options (SP [satellite phenology], BGC [biogeochemistry])
- RCP scenarios

Changing compsets lets you run different experiments

Component options:

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- RCP scenarios

Examples of simulations using different compsets:

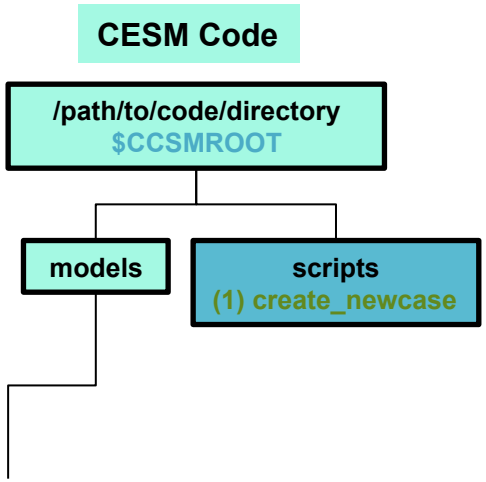
- Stabilize ("spin up") a biogeochemsitry (includes N & C cycles) simulation for 1850
- Run a transient historical simulation from 1850-2000 based on the 1850 spin up
- Run a transient future simulation from 2000 through 2100 using RCP8.5
- Run a "time slice" simulation for 2000

Where to find a list of compsets:

http://www.cesm.ucar.edu/models/cesm1.2/clm/scripts/ccsm_utils/Case.template/config_compsets.xml

- Website lists ALL compsets for CESM. CLM only = "I" compsets

In CESM scripts directory, can run:
./create_newcase –list compsets



Tip: Add " | more" at the end of the command line, then use the spacebar to scroll through the options

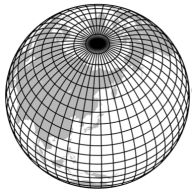
Exercise 1: Create & build simulation for 2000

create_newcase requires 4 arguments

What is the casename ?

YourCaseName

Which resolution?



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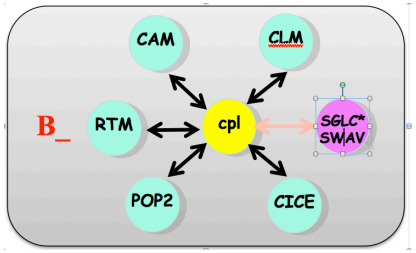
Which model configuration ? Which set of components ?



ICLM45
(I = CLM only, 2000)

Which machine are you running on?

yellowstone

./create_newcase –case ~/I2000CLM45_001 –res f19_g16 –compset ICLM45 -mach yellowstone

Exercise 1: Create & build simulation for 2000

 # go into scripts directory into the source code download
cd /glade/p/cesm/lmwg/CLM2014_tutorial_n03_clm4_5_62/scripts

 # (1) create a new case in the directory "cases" in your home directory
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 # go into the case you just created in the last step
cd ~/I2000CLM45_001

 # (2) invoke cesm_setup
./cesm_setup

 # (3) build the executable
./I2000CLM45_001.build

Stop Here

 # (4) submit your run to the batch queue
./I2000CLM45_001.submit

3 Types of Basic Modifications

1. Component Sets

2. ENV files (env_[command].xml)

   Changing the length of the run

3. Namelist files (user_nl_[model])

Review: The 4 commands to run CLM

Set of commands to build and run the model on a supported machine: ”yellowstone”

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# go into the case you just created in the last step
cd ~/I2000CLM45_001

# (2) invoke cesm_setup
./cesm_setup

# (3) build the executable
./I2000CLM45_001.build

# (4) submit your run to the batch queue
./I2000CLM45_001.submit
```

Change the run length BEFORE submitting

ENV files

Example 2. Simulations for a different length of time

Two steps to change run length:

1) Modify env_run.xml to set desired simulated length
2) Modify I2000CLM45_001.run to tell computer how much computer time is needed to complete the simulation (Wall Clock Time)

When modifying files, use an editor of your choice

Examples:

emacs
nedit
vi

"xmlchange" command

Use when modifying "xml" files (e.g. env_run.xml)

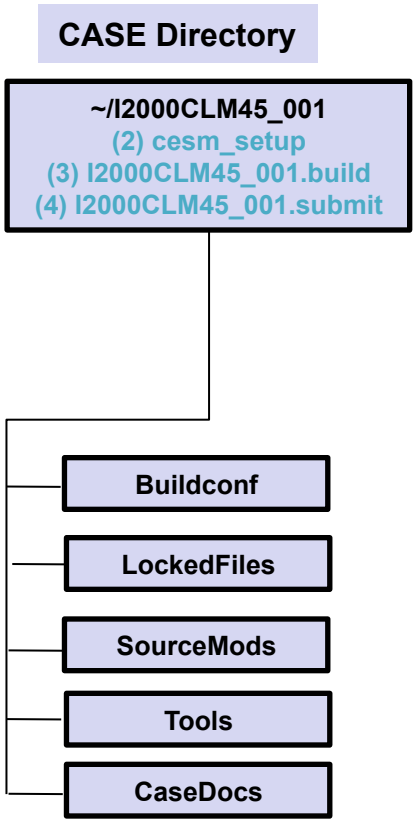
1. Benefit: Won't let you mess up the syntax!
2. For help, type *./xmlchange –help*
3. Use "*./xmlquery list*" to list all variables and their values in all the .xml files

Example: editing env_run.xml via the xmlchange tool

./xmlchange {variable to be changed}={value to change to}

* We won't use xml commands right now, but you will during the next section.

1) Modify env_run.xml to set desired simulated length



In a text editor*, open env_run.xml

* If you don't have a preferred editor, emacs is more user friendly.
Type "emacs env_run.xml" (or "emacs anyfilename")

```
<!-- ========================================================================= -->
<!--                                                                           -->
<!--       These variables MAY BE CHANGED ANYTIME during a run.                -->
<!--       Additional machine speific variables that can be changed            -->
<!--       during a run are contained in the env_mach_specific file            -->
<!--                                                                           -->
<!--       Note1: users SHOULD NOT modify BUILD_COMPETE in env_build.xml       -->
<!--              this is done automatically by the scripts                    -->
<!--                                                                           -->
<!-- ========================================================================= -->



<!--"case run directory (by default will be set to $EXEROOT/../run) (char) " -->
<entry id="RUNDIR"   value="/glade/scratch/$CCSMUSER/$CASE/run"  />

<!--"CCSM tag (char) " -->
<entry id="CCSM_REPOTAG"   value=""  />

<!--"case description (char) " -->
<entry id="CASESTR"   value="UNSET"  />

<!-- ================================== -->

<!--"Run initialization type, valid values: startup,hybrid,branch (char) " -->
<entry id="RUN_TYPE"   value="startup"  />

<!--"Run start date (yyyy-mm-dd). Only used for startup or hybrid runs (char) " -->
<entry id="RUN_STARTDATE"   value="0001-01-01"  />

<!--"start time-of-day (integer) " -->
<entry id="START_TOD"   value="0"  />

<!--"Reference case for hybrid or branch runs (char*256) " -->
<entry id="RUN_REFCASE"   value="case.std"  />

<!--"Reference date for hybrid or branch runs (yyyy-mm-dd) (char*10) " -->
<entry id="RUN_REFDATE"   value="0001-01-01"  />

<!--"Reference time of day (seconds) for hybrid or branch runs (sssss) (char) " -->
<entry id="RUN_REFTOD"   value="00000"  />

<!--"allow same branch casename as reference casename, valid values: TRUE,FALSE (logical) " -->
<entry id="BRNCH_RETAIN_CASENAME"   value="FALSE"  />

<!--"flag for automatically prestaging the refcase restart dataset, valid values: TRUE,FALSE (logical) " -->
<entry id="GET_REFCASE"   value="FALSE"  />

<!-- ================================== -->

<!--"sets the run length with STOP_N and STOP_DATE (must be nyear(s) for _GLC compsets for restarts to work properly), valid values: none,never,nsteps,nstep,
nseconds,nsecond,nminutes,nminute,nhours,nhour,ndays,nday,nmonths,nmonth,nyears,nyear,date,ifdays0,end (char) " -->
<entry id="STOP_OPTION"   value="nyears"  />

<!--"sets the run length with STOP_OPTION and STOP_DATE (integer) " -->
<entry id="STOP_N"   value="20"  />

<!--"date in yyyymmdd format, sets the run length with STOP_OPTION and STOP_N (integer) " -->
<entry id="STOP_DATE"   value="-999"  />
```

env_run.xml

Runtime variables can be changed in env_run.xml *at any point* during the run and control the mechanics of the run (length, resubmits, and archiving).

Common variables to change include

1. **STOP_OPTION** → sets the run time interval type, i.e. nmonths, ndays, nyears

2. **STOP_N** → sets the number of intervals to run the model during the specified wallclock* time.

   * Wallclock time is set in your YourCaseName.run file and is a measure of the actual time.

3. **RESUBMIT** → sets the number of times to resubmit the run

env_run.xml

Exercise 2: Run simulation for 5 years (Part 1)

1. **STOP_OPTION** → change to “nyears”

2. **STOP_N** → change to “5”

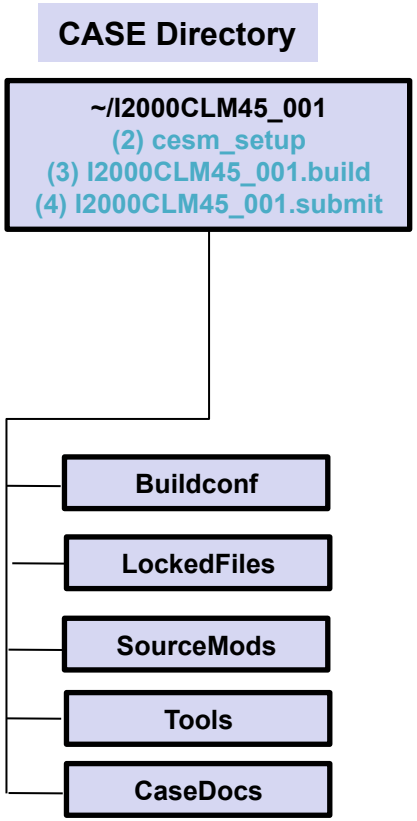
3. **RESUBMIT** → sets the number of times to resubmit the run

   To use resubmit, can set “STOP_N” to 1, then set RESUBMIT to “4”.

   ** This will run 5 different simulations for 1 year each **

Run Scripts: Wall clock time

2) Modify I2000CLM45_001.run to tell computer how much computer time is needed to complete the simulation (Wall Clock Time)



Using a text editor,

open I2000CLM45_001.run

Run Scripts: Wall clock time

Review run script: ***I2000CLM45_001.run***

Common BSUB command to change:

#BSUB –q regular	queue type (also: economy, premium, etc.)
#BSUB -o cesm.stdout.%J	machine standard out
#BSUB -e cesm.stderr.%J	machine standard error
#BSUB -J ICLM200045_001	job name
#BSUB -W **2:00**	wallclock time requested*
#BSUB -P UCGD0001	project number

Files written to case directory

*Note: Maximum allowable wall clock time on Yellowstone is 12 hours.
Submissions requesting under an hour typically have shorter wait times in the queue.

Exercise 2: Run for different length of time

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 # go into the case you just created in the last step
cd ~/I2000CLM45_001

 # (2) invoke cesm_setup
./cesm_setup

 # (3) build the executable
./I2000CLM45_001.build

After modifying env_run.xml and I2000CLM45_001.run,
START HERE

 # (4) submit your run to the batch queue
./I2000CLM45_001.submit

3 Types of Basic Modifications

1. Component Sets

2. ENV files (env_[command])

3. Namelist files (user_nl_[model])

   * Going back to I1850CLM45_001 case, changing data record frequency

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```
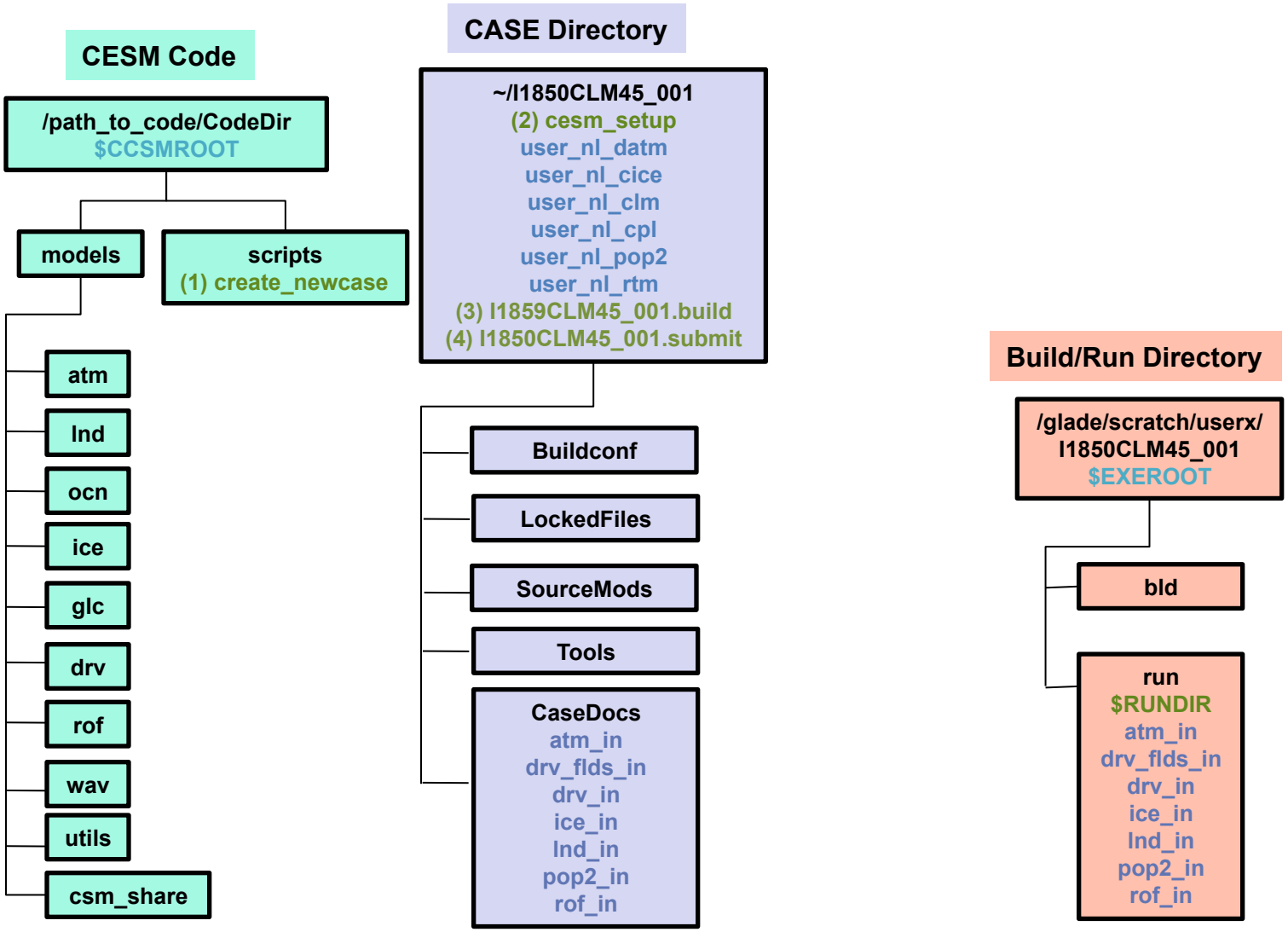

This is when you modify the namelists (and Source Code – Friday practicum)

CLM directories & commands



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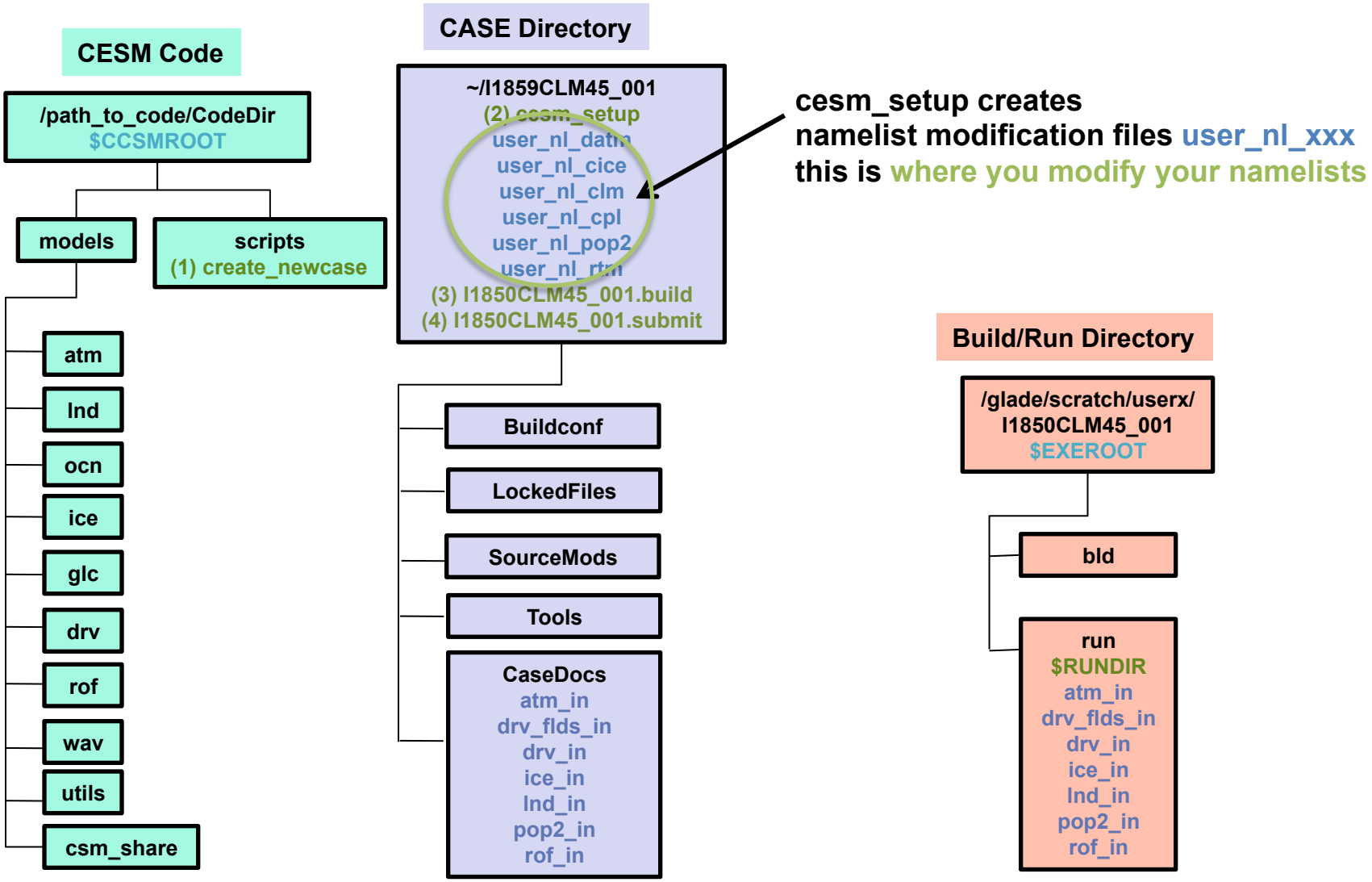

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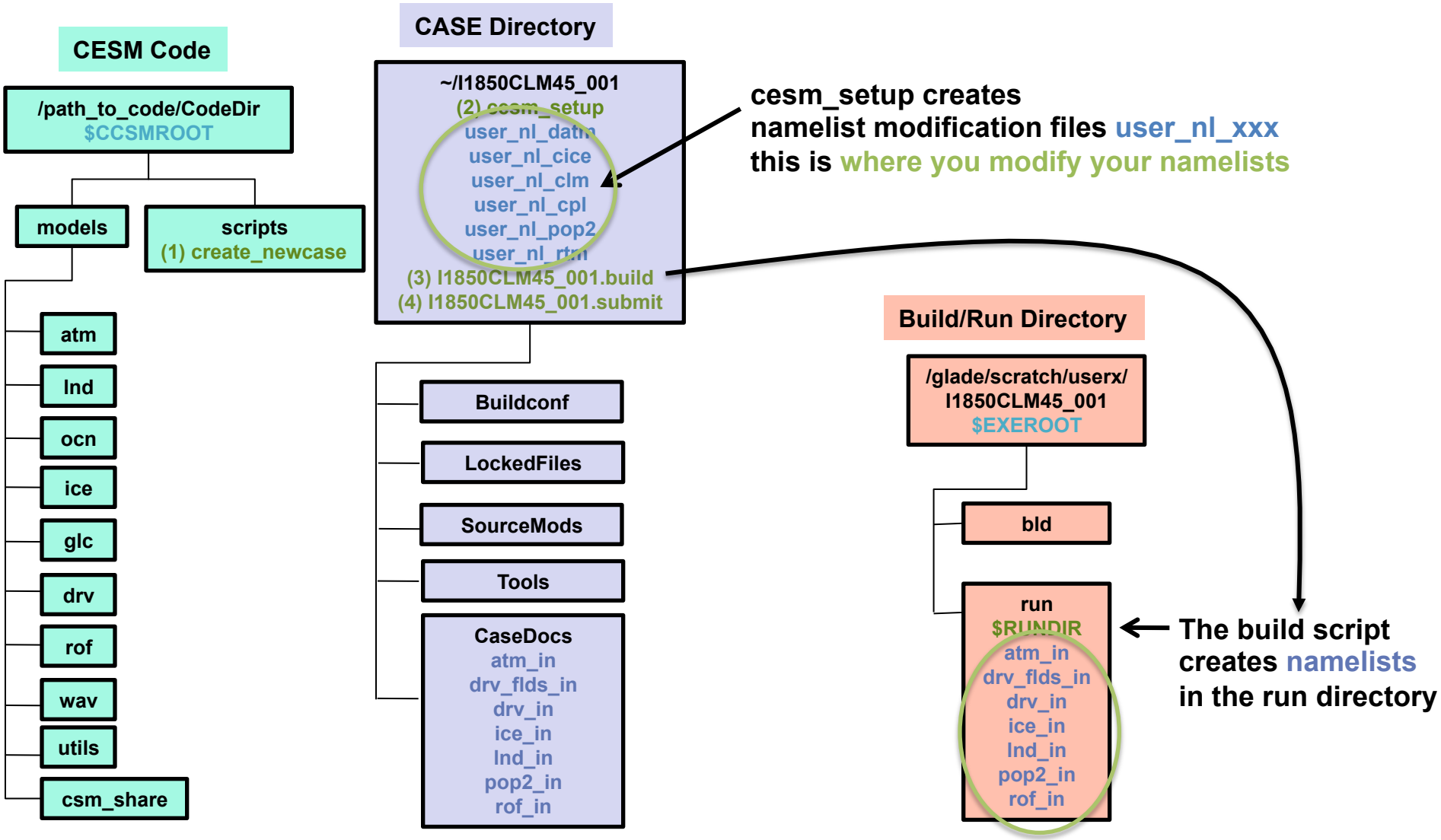

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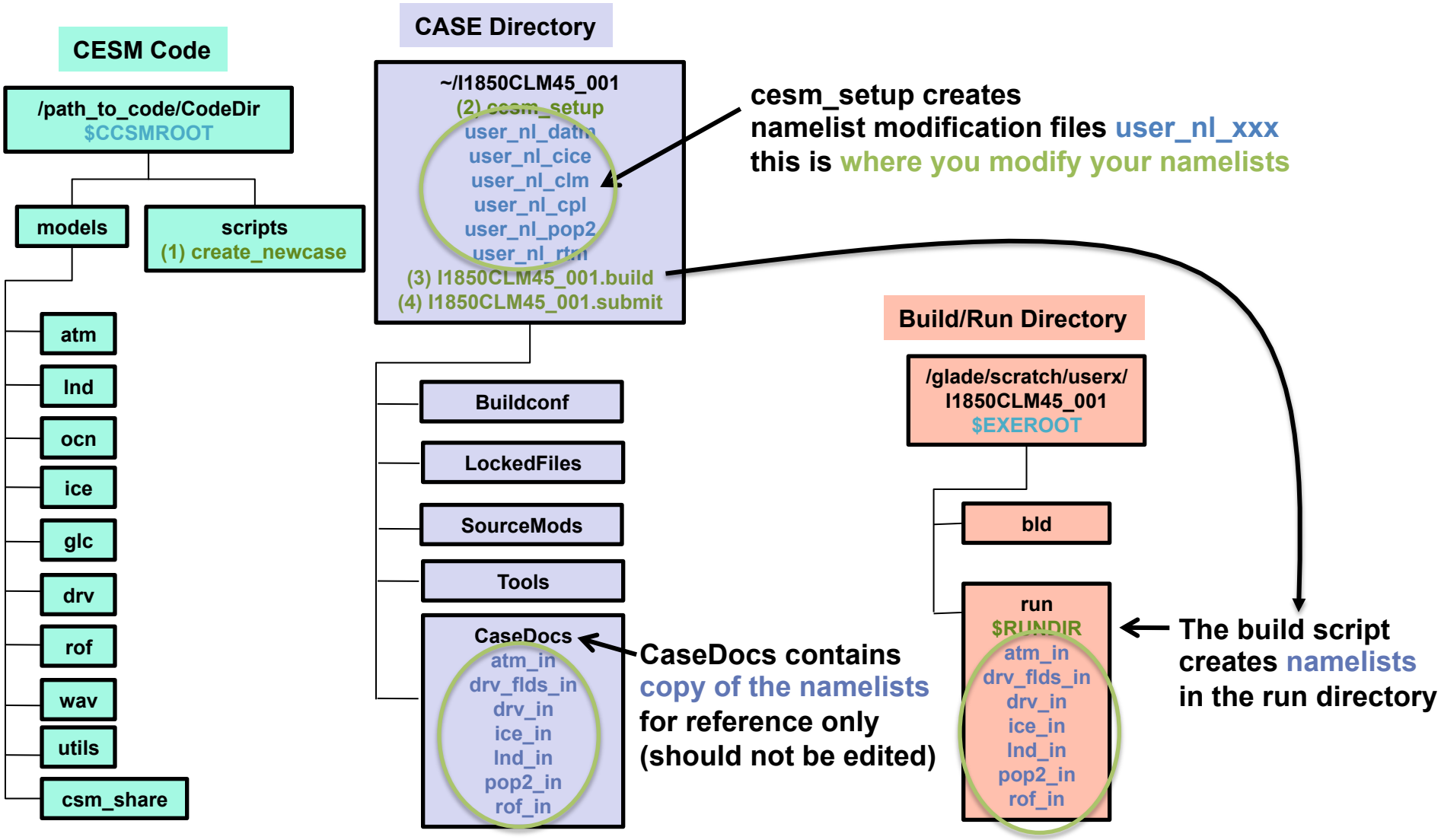

CESM1 Tutorial: Basic Modifications: Namelist variables/tool: user_nl_<model>

- Not all changes can be made in env_run.xml.
- **user_nl_<model>** files appear in the case directory after ./cesm_setup is invoked:

user_nl_datm	⟷	atmosphere (atm_in)
user_nl_clm	⟷	land (lnd_in)
user_nl_cice	⟷	ice (ice_in)
user_nl_pop2	⟷	ocean (pop2_in)
user_nl_cpl	⟷	coupler (driver; drv_in)
user_nl_rtm	⟷	river transport (rof_in)

Modifying Namelists

- Compsets set up namelists
- user_nl_clm modifies lnd_in namelist file

  Important: Don't modify the namelist file directly. Use user_nl_clm.

Modifying Namelists

- Compsets set up namelists
- user_nl_clm modifies lnd_in namelist file

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- Website for CLM namelist variables:

http://www.cesm.ucar.edu/models/cesm1.1/cesm/doc/modelnl/nl_clm.html

** Some namelist variables can also be changed in env_run.xml file

Looking at Namelist Files

Option 1

- cd into your case directory, then CaseDocs
  - (~/I1850CLM45_001/CaseDocs)
- Open lnd_in with text editor

Option 2

- cd into your run directory
  - (glade/scratch/I1850CLM45_001/run)
- Open lnd_in with text editor

```
&clm_inparm
 albice = 0.60,0.40
 co2_ppmv = 367.0
 co2_type = 'constant'
 create_crop_landunit = .false.
 dtime = 1800
 fatmlndfrc = '/glade/p/cesmdata/cseg/inputdata/share/domains/domain.lnd.fv1.9x2.5_gx1v6.090206.nc'
 finidat = ' '
 fsnowaging = '/glade/p/cesmdata/cseg/inputdata/lnd/clm2/snicardata/snicar_drdt_bst_fit_60_c070416.nc'
 fsnowoptics = '/glade/p/cesmdata/cseg/inputdata/lnd/clm2/snicardata/snicar_optics_5bnd_c090915.nc'
 fsurdat = '/glade/p/cesmdata/cseg/inputdata/lnd/clm2/surfdata_map/surfdata_1.9x2.5_simyr2000_c130927.nc'
 maxpatch_glcmec = 0
 maxpatch_pft = 17
 more_vertlayers = .false.
 nsegspc = 20
 paramfile = '/glade/p/cesmdata/cseg/inputdata/lnd/clm2/paramdata/clm_params.c130821.nc'
 urban_hac = 'ON'
 urban_traffic = .false.
 use_century_decomp = .false.
 use_cn = .false.
 use_crop = .false.
 use_lch4 = .false.
 use_nitrif_denitrif = .false.
 use_vertsoilc = .false.
/
&ndepdyn_nml
/
&popd_streams
/
&light_streams
/
&clm_hydrology1_inparm
/
&clm_soilhydrology_inparm
/
#!-------------------------------------------------------------------------------------------------------------------
#! lnd_in:: Comment:
#! This namelist was created using the following command-line:
#!     /glade/p/cesm/lmwg/CLM2014_tutorial_n02_clm4_5_57/models/lnd/clm/bld/CLM build-namelist -infile /glade/p/work/dll/testcases/CL
M2014Tutorial_20yr2000SP_n02_clm4_5_57/Buildconf/clmconf/cesm_namelist -csmdata /glade/p/cesmdata/cseg/inputdata -inputdata /glade/p/
work/dll/testcases/CLM2014Tutorial_20yr2000SP_n02_clm4_5_57/Buildconf/clm.input_data_list -ignore_ic_year -namelist &clm_inparm start
_ymd = 00010101  / -use_case 2000_control -res 1.9x2.5 -clm_start_type default -l_ncpl 48 -lnd_frac /glade/p/cesmdata/cseg/inputdata/
share/domains/domain.lnd.fv1.9x2.5_gx1v6.090206.nc -glc_nec 0 -co2_ppmv 367.0 -co2_type constant -config /glade/p/work/dll/testcases/
CLM2014Tutorial_20yr2000SP_n02_clm4_5_57/Buildconf/clmconf/config_cache.xml -bgc sp
#! For help on options use: /glade/p/cesm/lmwg/CLM2014_tutorial_n02_clm4_5_57/models/lnd/clm/bld/CLM build-namelist -help
#!-------------------------------------------------------------------------------------------------------------------
~
~
                                                                                                          1,1           All
```

dll29 — dll@yslogin3:CaseDocs — ssh — 133×49

```
&clm_inparm
 albice = 0.60,0.40
 co2_ppmv = 367.0
 co2_type = 'constant'
 create_crop_landunit = .false.
 dtime = 1800
 fatmlndfrc = '/glade/p/cesmdata/cseg/inputdata/share/domains/domain.lnd.fv1.9x2.5_gx1v6.090206.nc'
 finidat = ' '
 fsnowaging = '/glade/p/cesmdata/cseg/inputdata/lnd/clm2/snicardata/snicar_drdt_bst_fit_60_c070416.nc'
 fsnowoptics = '/glade/p/cesmdata/cseg/inputdata/lnd/clm2/snicardata/snicar_optics_5bnd_c090915.nc'
 fsurdat = '/glade/p/cesmdata/cseg/inputdata/lnd/clm2/surfdata_map/surfdata_1.9x2.5_simyr2000_c130927.nc'
 maxpatch_glcmec = 0
 maxpatch_pft = 17
 more_vertlayers = .false.
 nsegspc = 20
 paramfile = '/glade/p/cesmdata/cseg/inputdata/lnd/clm2/paramdata/clm_params.c130821.nc'
 urban_hac = 'ON'
 urban_traffic = .false.
 use_century_decomp = .false.
 use_cn = .false.
 use_crop = .false.
 use_lch4 = .false.
 use_nitrif_denitrif = .false.
 use_vertsoilc = .false.
/
&ndepdyn_nml
/
&popd_streams
/
&light_streams
/
&clm_hydrology1_inparm
/
&clm_soilhydrology_inparm
/
#!-------------------------------------------------------------------------------------------------------------------
#! lnd_in:: Comment:
#! This namelist was created using the following command-line:
#!     /glade/p/cesm/lmwg/CLM2014_tutorial_n02_clm4_5_57/models/lnd/clm/bld/CLM build-namelist -infile /glade/p/work/dll/testcases/CL
M2014Tutorial_20yr2000SP_n02_clm4_5_57/Buildconf/clmconf/cesm_namelist -csmdata /glade/p/cesmdata/cseg/inputdata -inputdata /glade/p/
work/dll/testcases/CLM2014Tutorial_20yr2000SP_n02_clm4_5_57/Buildconf/clm.input_data_list -ignore_ic_year -namelist &clm_inparm start
_ymd = 00010101  / -use_case 2000_control -res 1.9x2.5 -clm_start_type default -l_ncpl 48 -lnd_frac /glade/p/cesmdata/cseg/inputdata/
share/domains/domain.lnd.fv1.9x2.5_gx1v6.090206.nc -glc_nec 0 -co2_ppmv 367.0 -co2_type constant -config /glade/p/work/dll/testcases/
CLM2014Tutorial_20yr2000SP_n02_clm4_5_57/Buildconf/clmconf/config_cache.xml -bgc sp
#! For help on options use: /glade/p/cesm/lmwg/CLM2014_tutorial_n02_clm4_5_57/models/lnd/clm/bld/CLM build-namelist -help
#!-------------------------------------------------------------------------------------------------------------------
~
~
                                                                                                          1,1           All
```

Different compsets will change the status of some of these things.

Example Modification: user_nl_clm

Changing the frequency of model output

hist_mfilt: Number of samples within a file

- Default is 1
- Setting value to 12 would put 12 records into a single file

* Both hist_mfilt & hist_nhtfrq must be integers

Example Modification: user_nl_clm

Changing the frequency of model output

hist_mfilt: Number of samples within a file

Default is 1

Setting value to 12 would put 12 records into a single file

hist_nhtfrq: Frequency that data are recorded and written to a file

Default: 0 means that output is recorded every month (monthly averages)

Positive Values: Number of model timesteps (half-hourly) for output record

ex: 48 means output is recorded every day (daily averages)

Negative Values: Absolute value in hours for output record

ex: -1 means output is recorded hourly; -24 means output is recorded daily

* Both hist_mfilt & hist_nhtfrq must be integers

Example Modification: user_nl_clm

Changing the frequency of model output

Daily output with a years worth of daily records in a file:

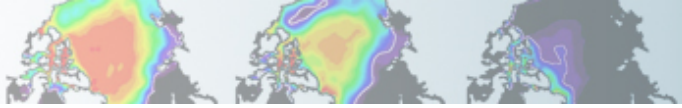
hist_mfilt = 365

hist_nhtfrq = -24

Monthly output with each month written to a separate file (default, as in I2000CLM45_001 case):

hist_mfilt = 1

hist_nhtfrq = 0



For this tutorial, we changed the default data record setting to daily in the I1850CLM45 compset.

Example 3: Modify user_nl_clm to get monthly output, 1 file per month in I1850CLM45_001

Run I1850CLM45_001 for 5 years

1. Change user_nl_clm to record monthly output
   - Rebuild the case: I1850CLM45_001.build
2. Change variables in env_run.xml
3. Change wall clock time in I1850CLM45_001.run
4. Rerun the simulation
   - I1850CLM45_001.submit

Review: The 4 commands to run CLM

Set of commands to build and run the model on a supported machine: ”yellowstone”

```
# go into scripts directory into the source code download
cd /glade/p/cesm/lmwg/CLM2014_tutorial_n03_clm4_5_62/scripts

# (1) create a new case in the directory “cases” in your home directory
./create_newcase -case ~/I1850CLM45_001 -res f19_g16 -compset I1850CLM45 -mach yellowstone

# go into the case you just created in the last step
cd ~/I1850CLM45_001

# (2) invoke cesm_setup
./cesm_setup

After modifying namelists,
START HERE

# (3) build the executable
./I1850CLM45_001.build

# (4) submit your run to the batch queue
./I1850CLM45_001.submit
```

Now YOU know how to run the model!

Use these 3 basic modifications to run a variety of simulations.

1. Component Sets
2. ENV files (env_[command])
3. Namelist files (user_nl_[model])

Documenting Your Changes: README files

In your case directory, you will find automatically generated documentation files.

1. **README.science_support**: refers you to the on-line documentation.
2. **README.case file**: detailed information on your compset and resolution, including whether your configuration has science support.

SCIENCE_SUPPORT: NO

***README.case*, we highly recommend YOU document any changes you make to the default scripts. It is YOUR paper trail and opportunity to list modifications.**

For additional information on running & configuring CLM, see CLM User's Guide:

http://www.cesm.ucar.edu/models/cesm1.2/clm/models/lnd/clm/doc/UsersGuide/book1.html