

CESM Tutorial

NCAR Earth System Laboratory

**CESM 1.2.x and CESM1.1.x
CESM1.0.x (see earlier tutorials)**

NCAR is sponsored by the National Science Foundation



Formula for the tutorial

Short presentation followed by a panel discussion

Our panel of CESM experts



Cecile Hannay



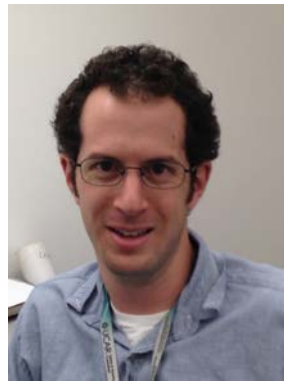
Christine Shields



Adam Phillips



Sean Santos



Mike Levy



Jim Edwards

Outline

- **The CESM webpage**
- **Software & Hardware Requirements**
- **One-Time Setup**
- **Creating & Running a Case**
- **Getting More Help**

CESM 1.2 Web Page

http://www.cesm.ucar.edu/models/cesm1.2/

CESM Models

Home » CESM Models » CESM1.2 Series Public Release

CESM1.2 SERIES PUBLIC RELEASE

ABOUT THIS RELEASE SERIES

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DIAGNOSTIC PACKAGES AND NAMING CONVENTIONS

- Post Processing Utilities
- Model File Naming Conventions
- Experiment Case Naming Conventions

MODEL DOCUMENTATION

CESM1.2

- ▶ User's Guide
- ▶ Machines, Resolutions, Component sets
- ▶ Model Component NameLists
- ▶ \$CASEROOT xml files

Atmosphere Models

- ▶ Community Atmosphere Model (CAM5, CAM-CHM, WACCM)
- ▶ Climatological Data Model (CLM4)

Land Models

- ▶ Community Land Model (CLM4, CLM4.5)
- ▶ Climatological Data Model (CLM4)

Sea Ice Models

- ▶ Community Ice CodE (ICE4)
- ▶ Climatological Ice Model (ICE)

Coupler

- ▶ CESM Coupler (CPL7)

Ocean Models

Land Ice Models

River Models

CESM PROJECT

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MODEL SOURCE CODE

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REPORTING A PROBLEM

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CESM SUPPORT POLICY

CESM Support Policy - November 2012

CESM DATA MANAGEMENT

Release Notes



Scientific validation



Guidance on model versions



Post processing Tools



Model Documentation



Background and Sponsors



How to acquire the code



Reporting problems Getting Help



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- ▶ Climatological Data Model (clm1a)

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- ▶ Community Land Model (CLM4.0, CLM5)
- ▶ Climatological Data Model (clm1a)

Sea Ice Models

- ▶ Community Ice CodE (ICE4)
- ▶ Climatological Ice Model (ICE)

Coupler

- ▶ CESM Coupler (CPL7)

Ocean Models

- ▶ Parallel Ocean Program (POP2, POP2-86G)
- ▶ Climatological/Slab-Ocean Data Model (ocsv)

Land Ice Models

- ▶ Community Ice Sheet Model (Glimmer - CISM)

River Models

- ▶ River Transport Model (RTM)
- ▶ Climatological River Runoff Model (r2cor)

EXTERNAL LIBRARY DOCUMENTATION

- [Parallel I/O Library \(PIO\)](#)
- [Model Coupling Toolkit \(MCT\)](#)
- [Earth System Modeling Framework \(ESMF\)](#)

MODEL INPUT DATA

The input data necessary to run all supported component sets is made available from a public [Subversion input data repository](#). Note that the inputdata repository has much more data in it than you need to run CESM1.2 — **DO NOT attempt to svn checkout the whole input data repository**. The [CESM1.2 User's Guide](#) explains how to obtain the subset of input data required for your needs.

PERFORMANCE AND LOAD BALANCING DATA

The timing table provides performance data that will continue to evolve due to changes in the model, machine hardware and input from the user community. For CESM1.2, please refer to the [CESM1.1.1 Timing Table](#).

Model Input data →

Timing and load balance →

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[CESM Support Policy - November 2012](#)

CESM DATA MANAGEMENT & DISTRIBUTION PLAN

The [Community Earth System Model \(CESM\) Data Management and Data Distribution Plan](#) documents the procedures for the storage and distribution of data associated with the CESM project.

← Data management and distribution

Hardware/Software Requirements

- **Supported platforms**

CESM currently runs “**out of the box**” today on the following machines

- **yellowstone** – NCAR IBM
- **titan** – ORNL Cray XK6
- **hopper** – NERSC Cray XE6
- **edison** – NERSC Cray Cascade
- **bluwaters** – ORNL Cray XE6
- **intrepid** – ANL IBM Bluegene/P
- **mira** – ANL IBM Bluegene/Q
- **janus** – Univ Colorado HPC cluster
- **pleiades** – NASA SGI ICE cluster
- **and a few others**

- **Running CESM on other platforms**

Require porting + software

- Subversion client (version 1.4.2 or greater)
- Fortran and C compilers (recommend pgi, intel, or ibm xlf compilers)
- NetCDF library (recommend netcdf4.1.3 or later)
- MPI (MPI1 is adequate, Open MPI or MPICH seem to work on Linux clusters)



out of the box = works immediately after installation without any modification

Basic Work Flow

(or how to set up and run an experiment)

- **One-Time Setup Steps**



- (A) Registration

- (B) Download the CESM code

- (C) Create an Input Data Root Directory

- (D) Porting

- **Creating & Running a Case**

- (1) Create a New Case

- (2) Invoke `cesm_setup`

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(A) Registration

- Go to CESM1.2 home page: <http://www.cesm.ucar.edu/models/cesm1.2/>

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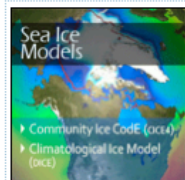
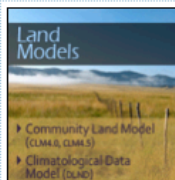
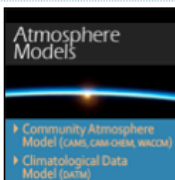
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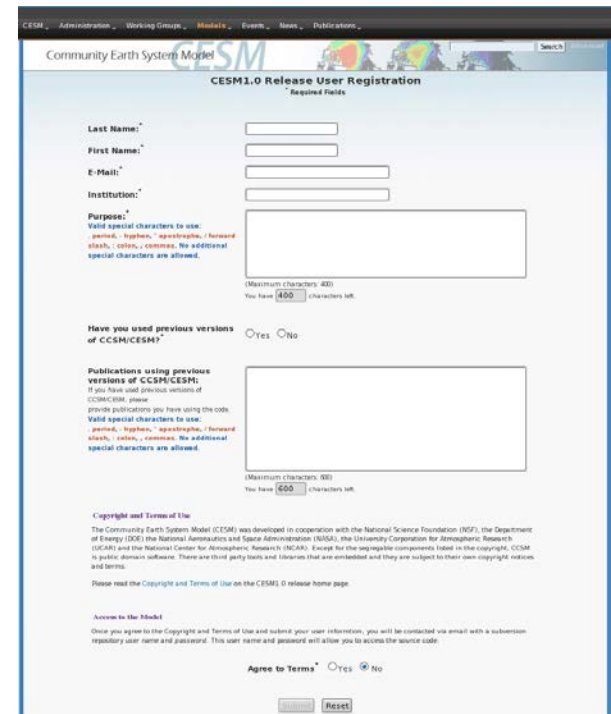
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CESM SUPPORT POLICY

CESM Support Policy - November 2012

- Right hand column has a link to the registration page, click on it



- Register -- you will be emailed a username and password

Basic Work Flow

(or how to set up and run an experiment)

- **One-Time Setup Steps**

- (A) Registration



- (B) Download the CESM code

- (C) Create an Input Data Root Directory

- (D) Porting

- **Creating & Running a Case**

- (1) Create a New Case

- (2) Invoke `cesm_setup`

- (3) Build the Executable

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(B) Download the Source Code

- Code and input datasets are in a subversion repository (*)

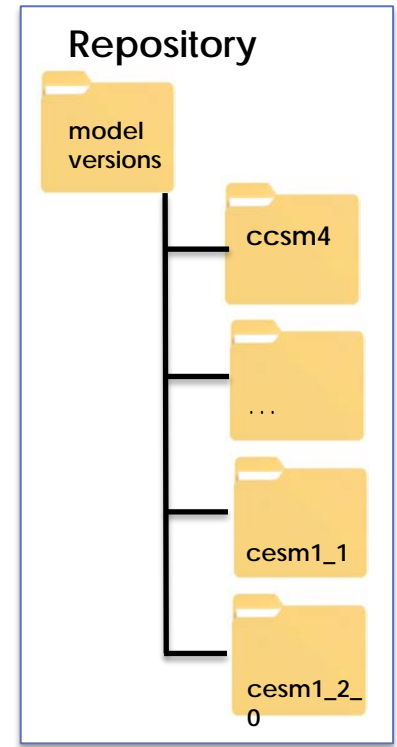
https://svn-ccsm-release.cgd.ucar.edu/model_versions

- List the versions available on the CESM repository

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

- Check out a working copy from the repository (“Download code”)

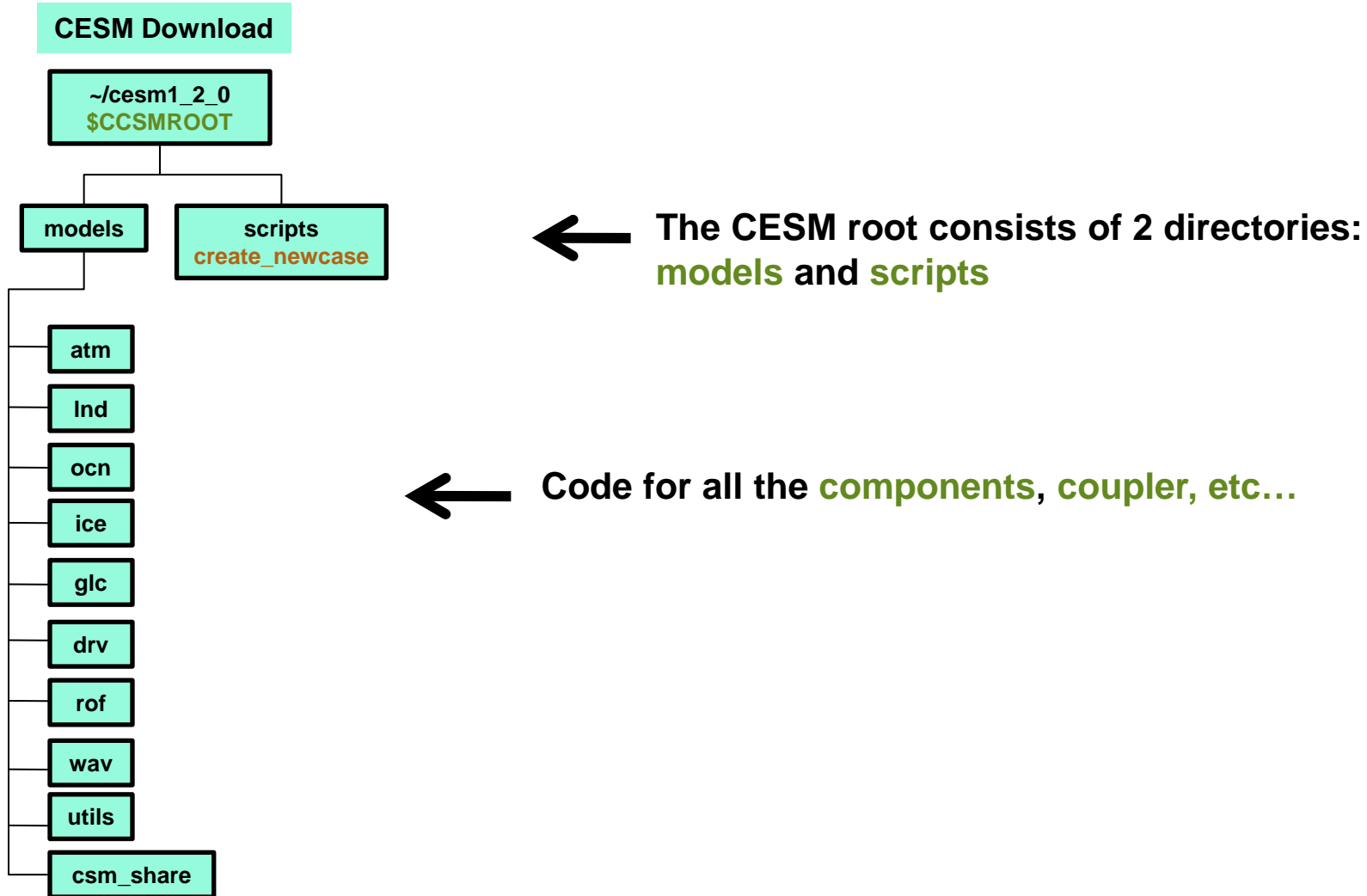
`svn co https://svn-ccsm-release.cgd.ucar.edu/model_versions/cesm1_2_0`



(*) You can get subversion at <http://subversion.apache.org/>



Overview of Directories (after initial model download)



Basic Work Flow

(or how to set up and run an experiment)

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- **Creating & Running a Case**

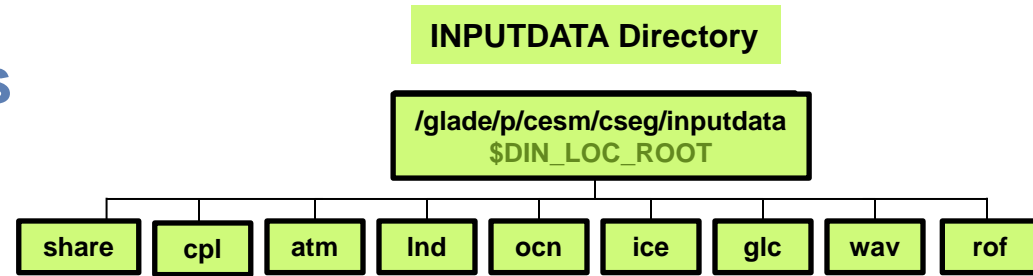
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Overview of Directories (+ inputdata directory)



Inputdata directory `$DIN_LOC_ROOT`

contains all input data required to run the model

- on supported machines - populated inputdata already exists
- on non-supported machines - need to create inputdata directory root

CESM Download

`~/cesm1_2_0`
`$CCSMROOT`

models

scripts

`create_newcase`

atm

ln_d

ocn

ice

glc

drv

rof

wav

utils

csm_share

- Ideally directory is shared by a group of users to save disc space
- To download input data: use the script `check_input_data`
 - downloads only the data needed
 - puts the data in the proper subdirectories
 - **Do NOT download input data manually** (ie. by using `svn co`)

Basic Work Flow

(or how to set up and run an experiment)

- **One-Time Setup Steps**

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- (D) Porting

- **Creating & Running a Case**

- (1) Create a New Case

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(D) Porting

- On supported machines - no porting is necessary
- On new machines – porting needs to be done

Porting details are outside the scope of this tutorial

User's Guide

Porting and Validating CESM on a new platform

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Work Flow: Super Quick Start

CESM can be run with a set of **4 commands**

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

- ```
go into scripts directory into the source code download
cd /path_to_source_code_download/cesm1_2_0/scripts
```
- (1) # (1) create a new case in the directory "cases" in your home directory  
`./create_newcase -case ~/cases/case01 -res f19_g16 -compset B_1850 -mach yellowstone`
- ```
# go into the case you just created in the last step
cd ~/cases/case01/
```
- (2) # (2) invoke cesm_setup
`./cesm_setup`
- (3) # (3) build the executable
`./case01.build`
- (4) # (4) submit your run to the batch queue
`./case01.submit`

It is that easy !



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(or how to set up and run an experiment)

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- **Creating & Running a Case**



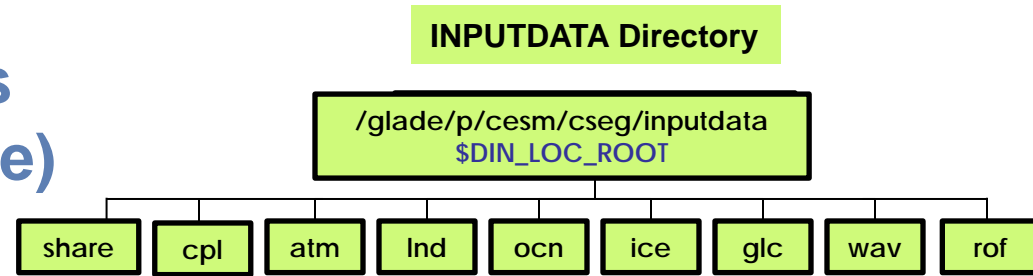
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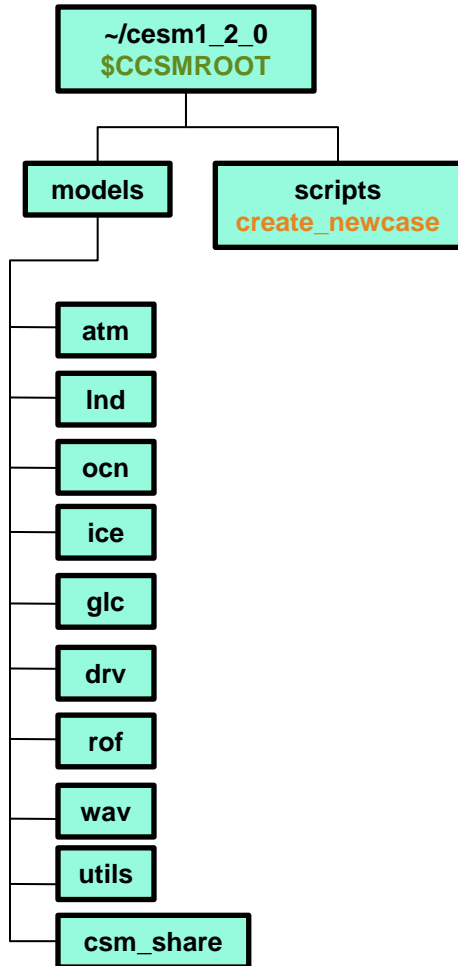
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Overview of Directories (+ before create_newcase)



CESM Download



This is the **script** you need to create a new case

Work Flow: Super Quick Start

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

```
# go into scripts directory into the source code download  
cd /path_to_source_code_download/cesm1_2_0/scripts
```

```
# (1) create a new case in the directory "cases" in your home directory
```

```
./create_newcase -case ~/cases/case01 -res f19_g16 -compset B_1850 -mach yellowstone
```

```
# go into the case you just created in the last step
```

```
cd ~/cases/case01/
```

```
# (2) invoke cesm_setup
```

```
./cesm_setup
```

```
# (3) build the executable
```

```
./case01.build
```

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

```
./case01.submit
```

(1) Create a new case

In the scripts directory, `create_newcase` is the tool that generates a new case.

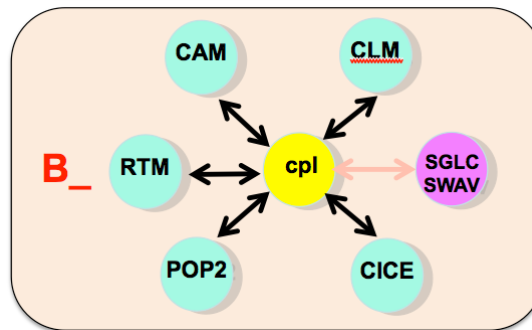
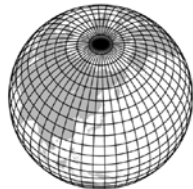
`create_newcase` requires 4 arguments

What is the casename ?

Which resolution?

Which model configuration ?
Which set of components ?

Which machine are you running on?



(1) create_newcase arguments

create_newcase requires 4 arguments

```
create_newcase -case ~/cases/case01 -res f19_g16 -compset B_1850 -mach yellowstone
```

(1) create_newcase arguments

create_newcase requires 4 arguments

```
create_newcase -case ~/cases/case01 -res f19_g16 -compset B_1850 -mach yellowstone
```

What is the
casename ?



case specify the name and location of the case being created
~/cases/case01

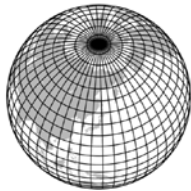


(1) create_newcase arguments

create_newcase requires 4 arguments

```
create_newcase -case ~/cases/case01 -res f19_g16 -compset B_1850 -mach yellowstone
```

Which resolution?



res specifies the **model resolutions** (or grid)

New grid naming convention

Each model resolution can be specified by its alias, short name and long name.

Example of equivalent alias, short name and long name:

- alias: f19_g16 (atm/Ind_ocn/ice)
- short name: 1.9x2.5_gx1v6
- long name = a%1.9x2.5_l%1.9x2.5_oi%gx1v6_r%r05_m%gx1v6_g%null_w%null

↑
atm

↑
Ind

↑
ocn/ice

↑
river

↑
Ind
mask

↑
Ind-ice

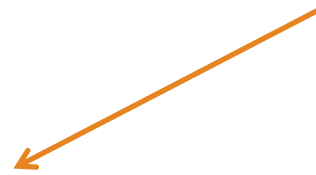
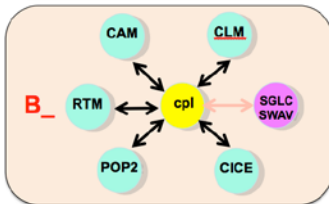
↑
wave

(1) create_newcase arguments

create_newcase requires 4 arguments

```
create_newcase -case ~/cases/case01 -res f19_g16 -compset B_1850 -mach yellowstone
```

Which component set ?



compset specifies the “component set”

Component set specifies component models, forcing scenarios and physics options for those models

New compset naming convention

Each model compset can be specified by its alias, short name and long name.

Example of equivalent alias, short name and long name:

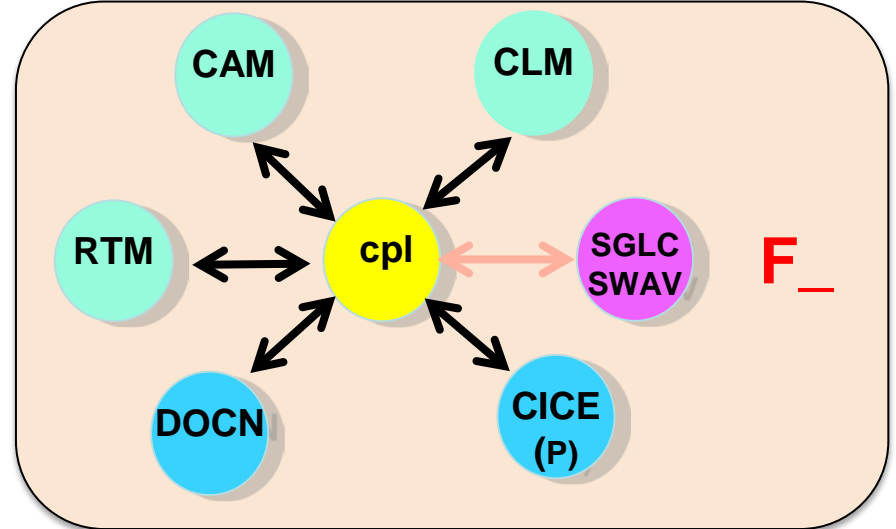
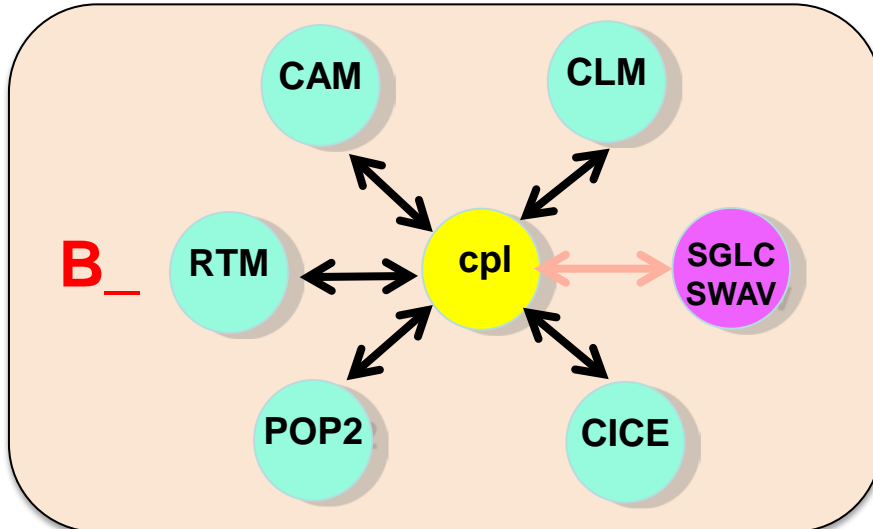
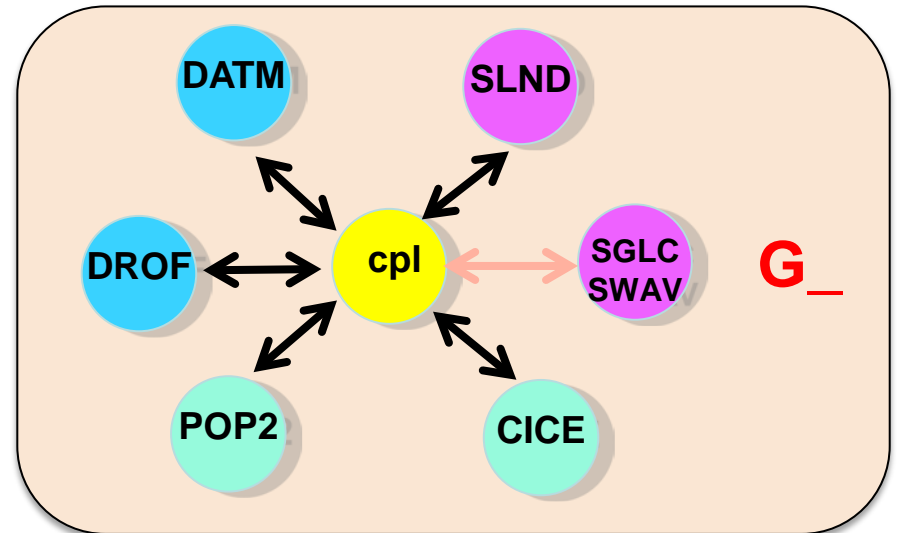
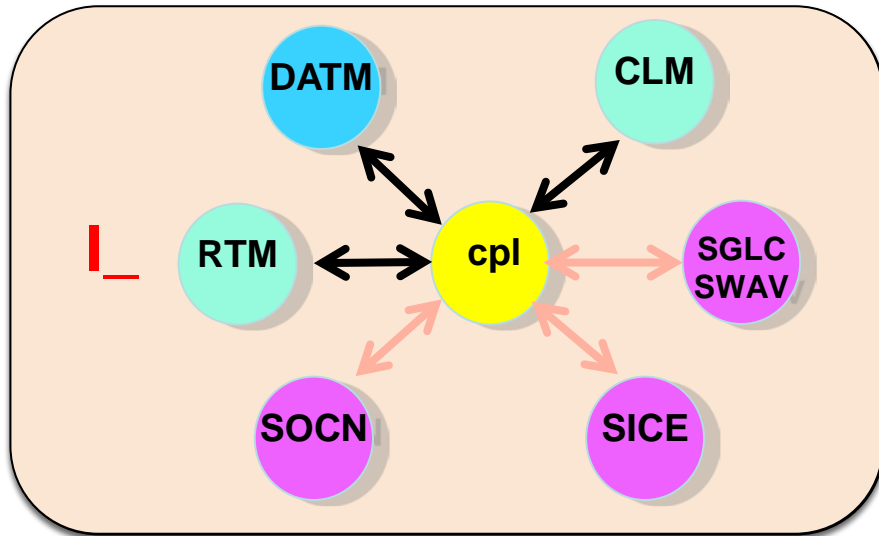
- alias: B1850
- short name: B_1850
- long name = 1850_CAM4_CLM40%SP_CICE_POP2_RTM_SGLC_SWAV

↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑
time atm Ind ice ocn river Ind-ice wave

More on CESM component sets

Plug and play of components with different component models

Color code: active data stub



(1) create_newcase arguments

`create_newcase` requires 4 arguments

```
create_newcase -case ~/cases/case01 -res f19_g16 -compset B_1850 -mach yellowstone
```

Which machine
are you running on?



`mach` specifies the `machine` that will be used.

“supported” machines tested regularly, eg. yellowstone, titan, hopper, intrepid

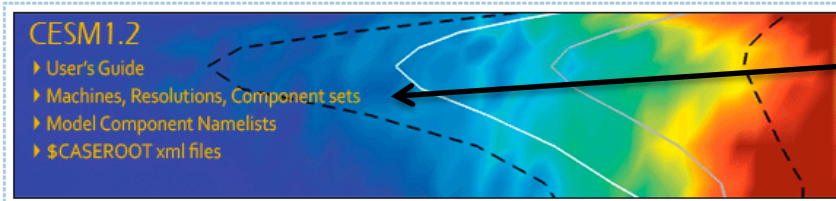
Valid Values for res, compset, and mach

Command line to list all the valid choices for grids, compsets and machines

`./create_newcase -list <type>`

with type can be [compsets, grids, machines]

MODEL DOCUMENTATION

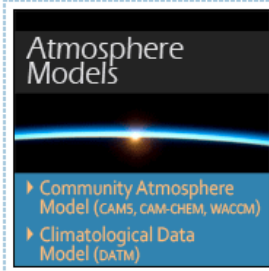


CESM1.2

- ▶ User's Guide
- ▶ Machines, Resolutions, Component sets
- ▶ Model Component Namelists
- ▶ \$CASEROOT xml files

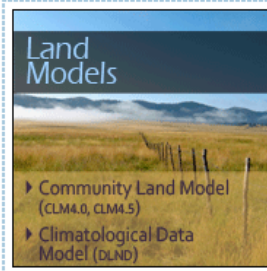
List of valid values is also available from the CESM website

<http://www.cesm.ucar.edu/models/cesm1.2/>



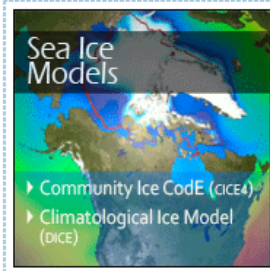
Atmosphere Models

- ▶ Community Atmosphere Model (CAM5, CAM-CHEM, WACCM)
- ▶ Climatological Data Model (DATM)



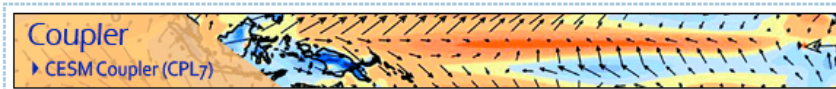
Land Models

- ▶ Community Land Model (CLM4.0, CLM4.5)
- ▶ Climatological Data Model (DLND)



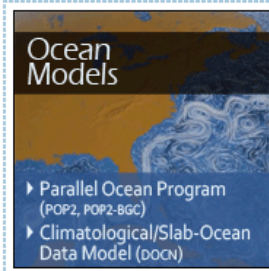
Sea Ice Models

- ▶ Community Ice Code (CICE4)
- ▶ Climatological Ice Model (OICE)



Coupler

- ▶ CESM Coupler (CPL7)



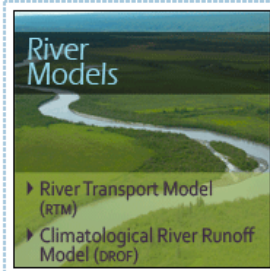
Ocean Models

- ▶ Parallel Ocean Program (POP2, POP2-BGC)
- ▶ Climatological/Slab-Ocean Data Model (DOCN)



Land Ice Models

- ▶ Community Ice Sheet Model (Climmer - CISM)



River Models

- ▶ River Transport Model (RTM)
- ▶ Climatological River Runoff Model (PROF)

About create_newcase

./create_newcase -help lists all the available options

Most often only four options are used: case, compset, res, and mach

```
cd ../cesm1_2_0/scripts/  
./create_newcase -help
```

SYNOPSIS

```
create_newcase [options]
```

OPTIONS

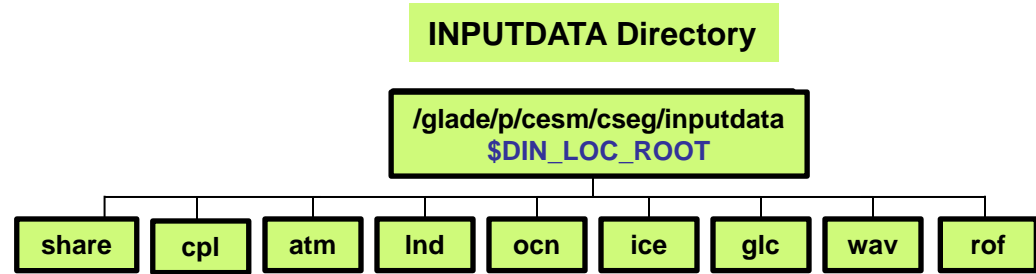
User supplied values are denoted in angle brackets (<>). Any value that contains white-space must be quoted. Long option names may be supplied with either single or double leading dashes. A consequence of this is that single letter options may NOT be bundled.

-case <name>	Specifies the case name (required).
-compset <name>	Specify a CESM compset (required).
-res <name>	Specify a CESM grid resolution (required).
-mach <name>	Specify a CESM machine (required).
-compiler <name>	Specify a compiler for the target machine (optional) default: default compiler for the target machine
-mpilib <name>	Specify a mpi library for the target machine (optional) default: default mpi library for the target machine allowed: openmpi, mpich, ibm, mpi-serial, etc redundant with _M confopts setting
-mach_dir <path>	Specify the locations of the Machines directory (optional). default: /glade/p/cesm/cseg/collections/cesm1_2_0_beta08/scripts/ccsm_utils/Machines
-pecount <name>	Value of S,M,L,X1,X2 (optional). default: M, partially redundant with confopts _P
-pes_file <name>	Full pathname of pes file to use (will overwrite default settings) (optional). See sample_pes_file.xml for an example.
-user_compset	Long name for new user compset file to use (optional) This assumes that all of the compset settings in the long name have been defined.
-grid_file <name>	Full pathname of grid file to use (optional) See sample_grid_file.xml for an example. Note that compset components must support the new grid.
-help [or -h]	Print usage to STDOUT (optional).
-list <type>	Only list valid values, type can be [compsets, grids, machines] (optional).

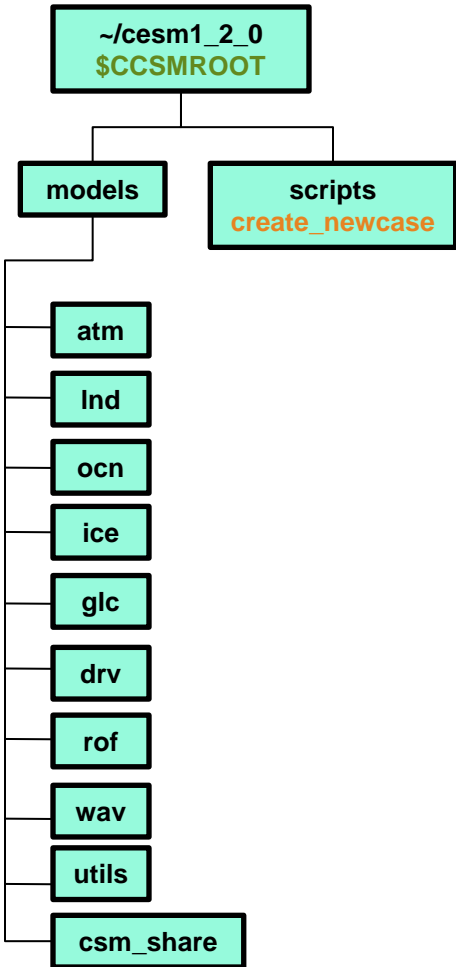
required arguments

...

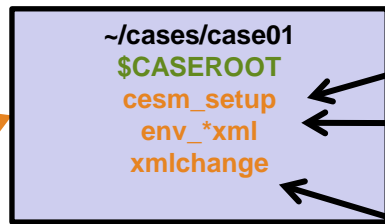
Overview of Directories (after create_newcase)



CESM Download



CASE Directory

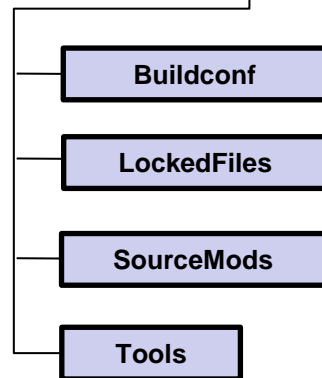


create_newcase creates **case directory** that contains:

cesm_setup: script used in the next step

files with **xml variables** used by CESM scripts

script to **edit env_*.xml** files



subdirectory for **case specific code modifications**

About env_*.xml files

- env_*.xml contains variables used by scripts -- some can be changed by the user
 - env_case.xml: set by create_newcase and cannot be modified
 - env_mach_pes.xml : specifies layout of components
 - env_build.xml: specifies build information
 - env_run.xml : sets run time information (such as length of run, frequency of restarts, ...)
User interacts with this file most frequently

- Here's a snippet of the env_run.xml file

```
<!--"sets the run length in conjunction with STOP_N and STOP_DATE, valid values: none,never,nstep,nstep,nseconds,nsecond,nminutes,nminute,nhours,nhour,ndays,nday,nmonths,nmonth,nyears,nyear,date,ifdays0,end (char) " -->  
<entry id="STOP_OPTION" value="ndays" />  
  
<!--"sets the run length in conjunction with STOP_OPTION and STOP_DATE (integer) " -->  
<entry id="STOP_N" value="5" />
```

“id” - variable name

“value” – variable value

CESM will run for 5 days

- To modify a variable in an xml file – use **xmlchange**
xmlchange STOP_N=20

Basic Work Flow

(or how to set up and run an experiment)

- **One-Time Setup Steps**

- (A) Registration

- (B) Download the CESM code

- (C) Create an Input Data Root Directory

- (D) Porting

- **Creating & Running a Case**

- (1) Create a New Case

- (2) Invoke `cesm_setup`

- (3) Build the Executable

- (4) Run the Model and Output Data Flow



Work Flow: Super Quick Start

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

```
# go into scripts directory into the source code download
cd /path_to_source_code_download/cesm1_2_0/scripts

# (1) create a new case in the directory "cases" in your home directory
./create_newcase -case ~/cases/case01 -res f19_g16 -compset B_1850 -mach yellowstone

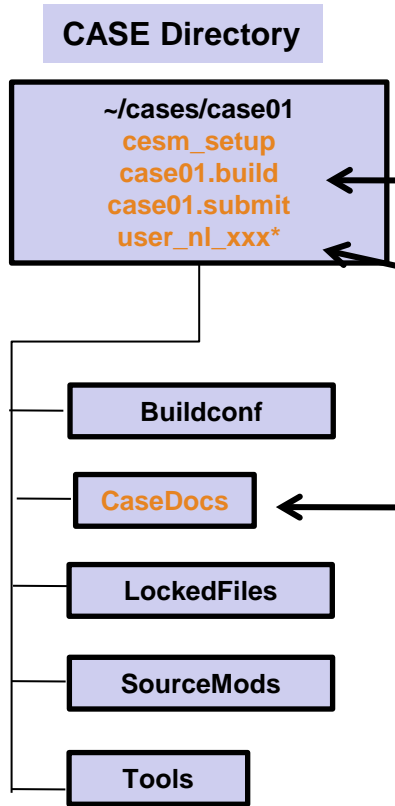
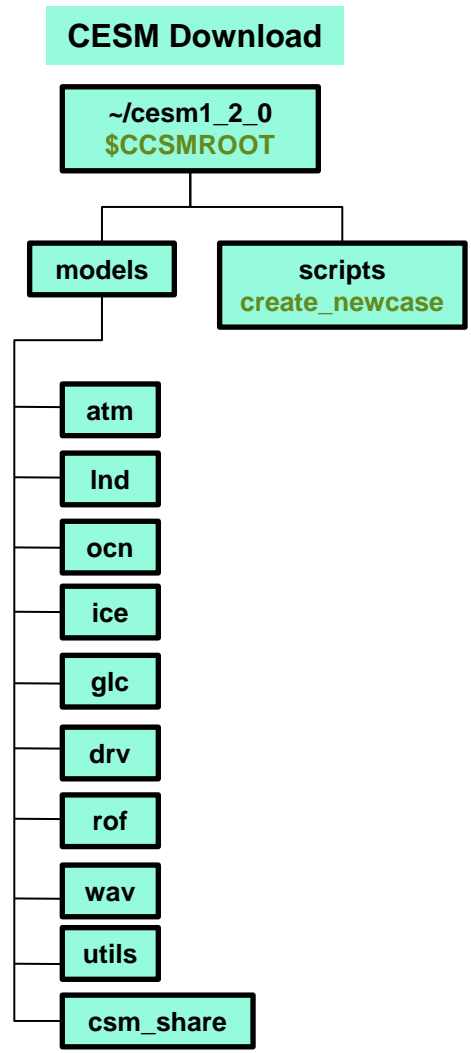
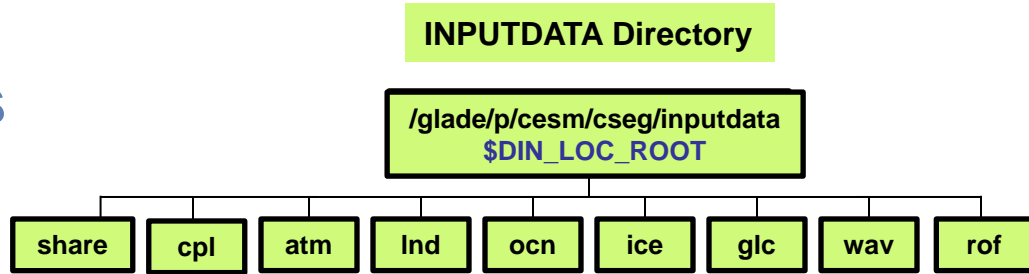
# go into the case you just created in the last step
cd ~/cases/case01/

# (2) invoke cesm_setup
./cesm_setup

# (3) build the executable
./case01.build

# (4) submit your run to the batch queue
./case01.submit
```


Overview of Directories (after cesm_setup)



cesm_setup creates:

- case scripts (to build, run and archive)
- namelist modification files **user_nl_*****
this is where you modify **your namelists**

CaseDocs: contains **copy of the namelists**
This is for reference only and files in this directory **SHOULD NOT BE EDITED.**

Basic Work Flow

(or how to set up and run an experiment)

- **One-Time Setup Steps**

- (A) Registration

- (B) Download the CESM code

- (C) Create an Input Data Root Directory

- (D) Porting

- **Creating & Running a Case**

- (1) Create a New Case

- (2) Invoke `cesm_setup`

- (3) Build the Executable

- (4) Run the Model and Output Data Flow



Work Flow: Super Quick Start

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

```
# go into scripts directory into the source code download
cd /path_to_source_code_download/cesm1_2_0/scripts

# (1) create a new case in the directory "cases" in your home directory
./create_newcase -case ~/cases/case01 -res f19_g16 -compset B_1850 -mach yellowstone

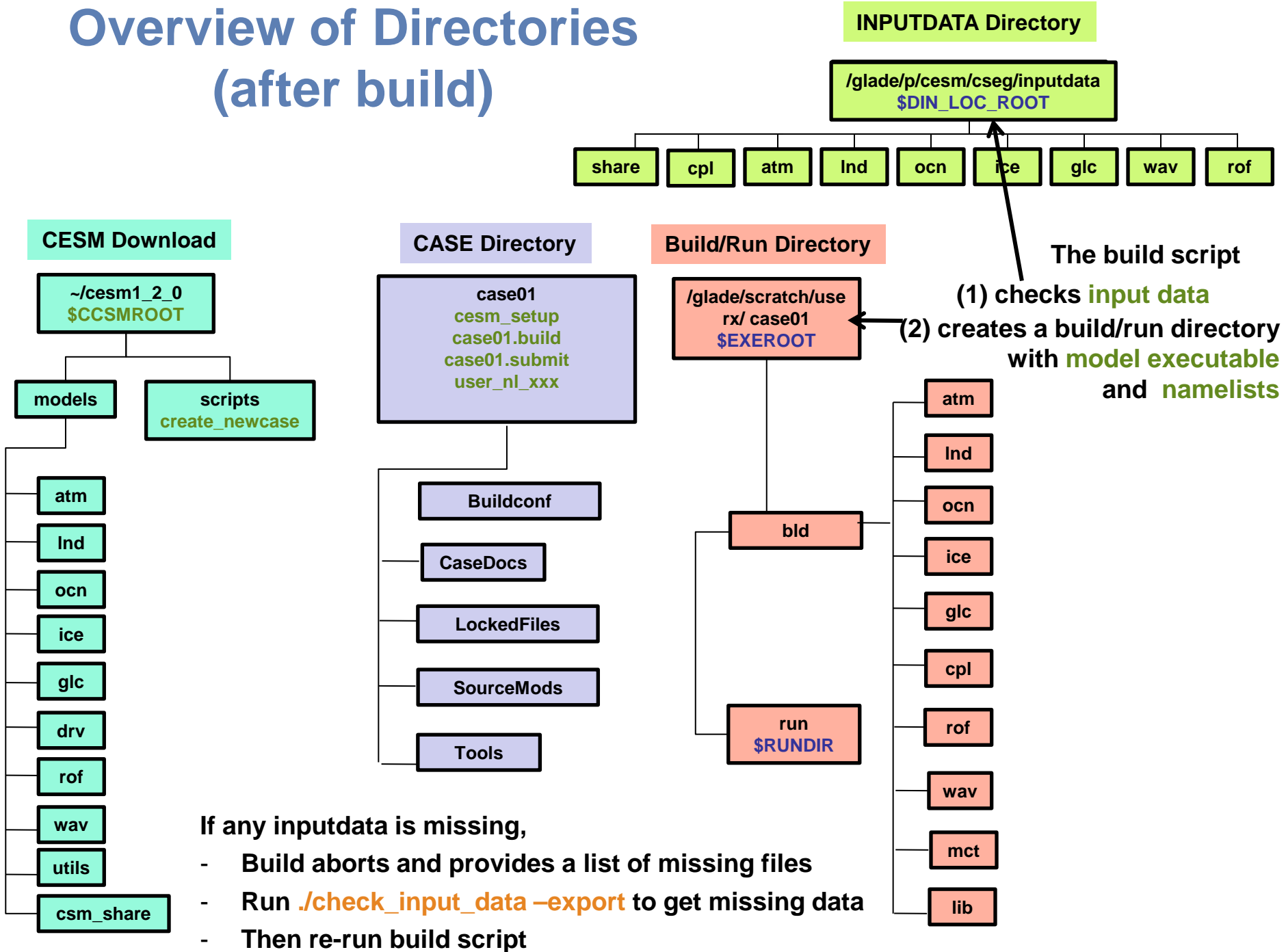
# go into the case you just created in the last step
cd ~/cases/case01/

# (2) invoke cesm_setup
./cesm_setup

# (3) build the executable
./case01.build

# (4) submit your run to the batch queue
./case01.submit
```

Overview of Directories (after build)



If any inputdata is missing,

- Build aborts and provides a list of missing files
- Run `./check_input_data -export` to get missing data
- Then re-run build script

Basic Work Flow

(or how to set up and run an experiment)

- **One-Time Setup Steps**
 - (A) Registration and Download
 - (B) Create an Input Data Root Directory
 - (C) Porting
- **Creating & Running a Case**
 - (1) Create a New Case
 - (2) Invoke `cesm_setup`
 - (3) Build the Executable
 - (4) Run the Model and Output Data Flow



Work Flow: Super Quick Start

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

```
# go into scripts directory into the source code download
cd /path_to_source_code_download/cesm1_2_0/scripts

# (1) create a new case in the directory "cases" in your home directory
./create_newcase -case ~/cases/case01 -res f19_g16 -compset B_1850 -mach yellowstone

# go into the case you just created in the last step
cd ~/cases/case01/

# (2) invoke cesm_setup
./cesm_setup

# (3) build the executable
./case01.build

# (4) submit your run to the batch queue
./case01.submit
```

(4) Running the Model

When you submit your jobs

```
~/cases/case01>case01.submit  
check_case OK  
Job <959733> is submitted to queue <regular>
```

Use “**bjobs**” to check if job is running

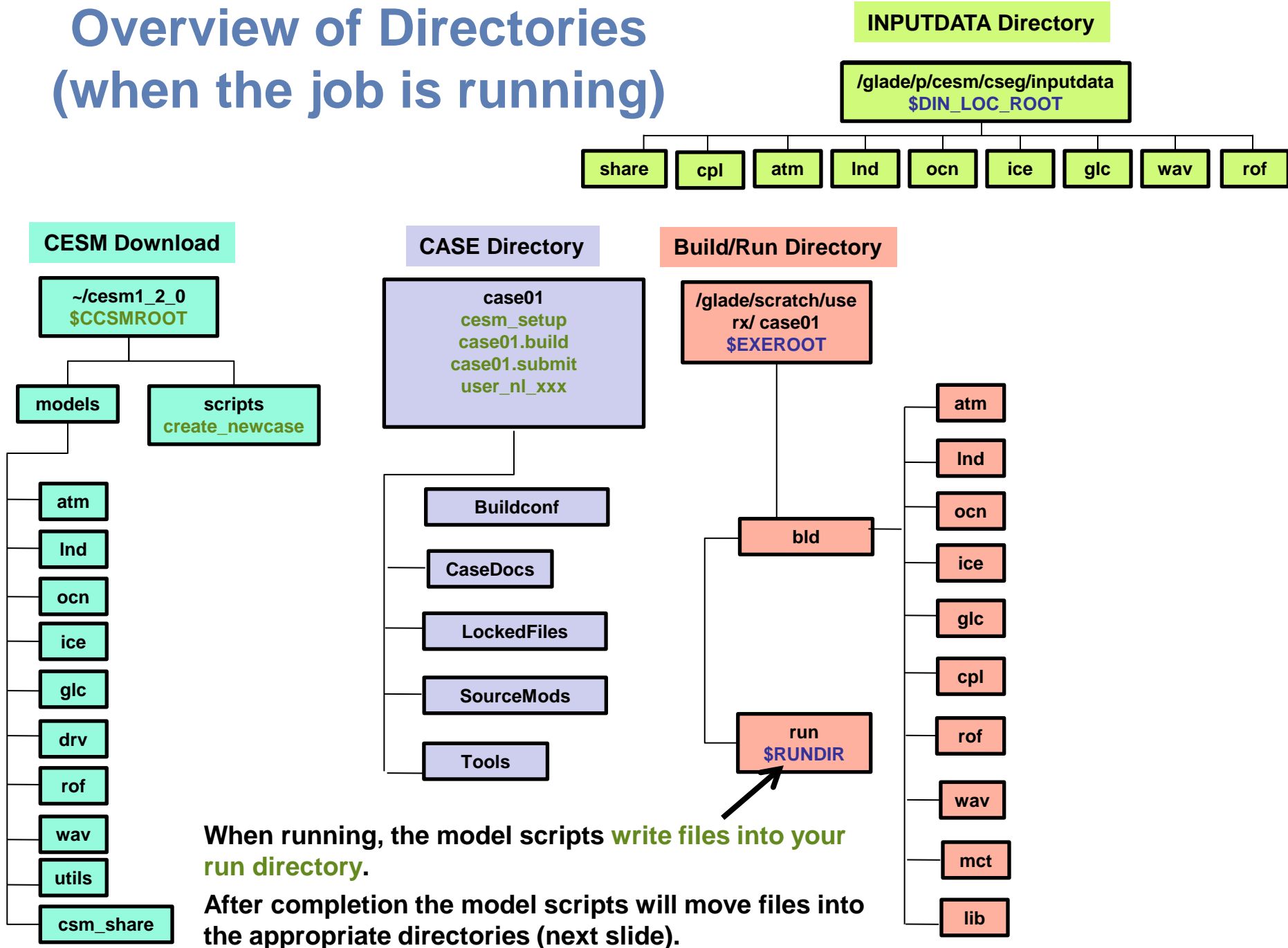
```
~/cases/case01>bjobs  
JOBID  USER  STAT  QUEUE  FROM_HOST  EXEC_HOST  JOB_NAME  SUBMIT_TIME  
960463  userx  PEND  regular  yslogin3-ib  case01  Jun 17 08:34
```

 Your job is waiting in the queue

```
~/cases/case01>bjobs  
JOBID  USER  STAT  QUEUE  FROM_HOST  EXEC_HOST  JOB_NAME  SUBMIT_TIME  
960463  userx  RUN   regular  yslogin3-ib  15*ys0702-i  case01  Jun 17 08:34  
15*ys1872-ib  
15*ys1906-ib  
15*ys1907-ib  
15*ys1908-ib  
15*ys1918-ib  
15*ys2055-ib  
15*ys2057-ib  
15*ys2058-ib  
15*ys2130-ib  
15*ys2131-ib  
15*ys2132-ib  
15*ys2216-ib  
15*ys2218-ib
```

 Your job is running

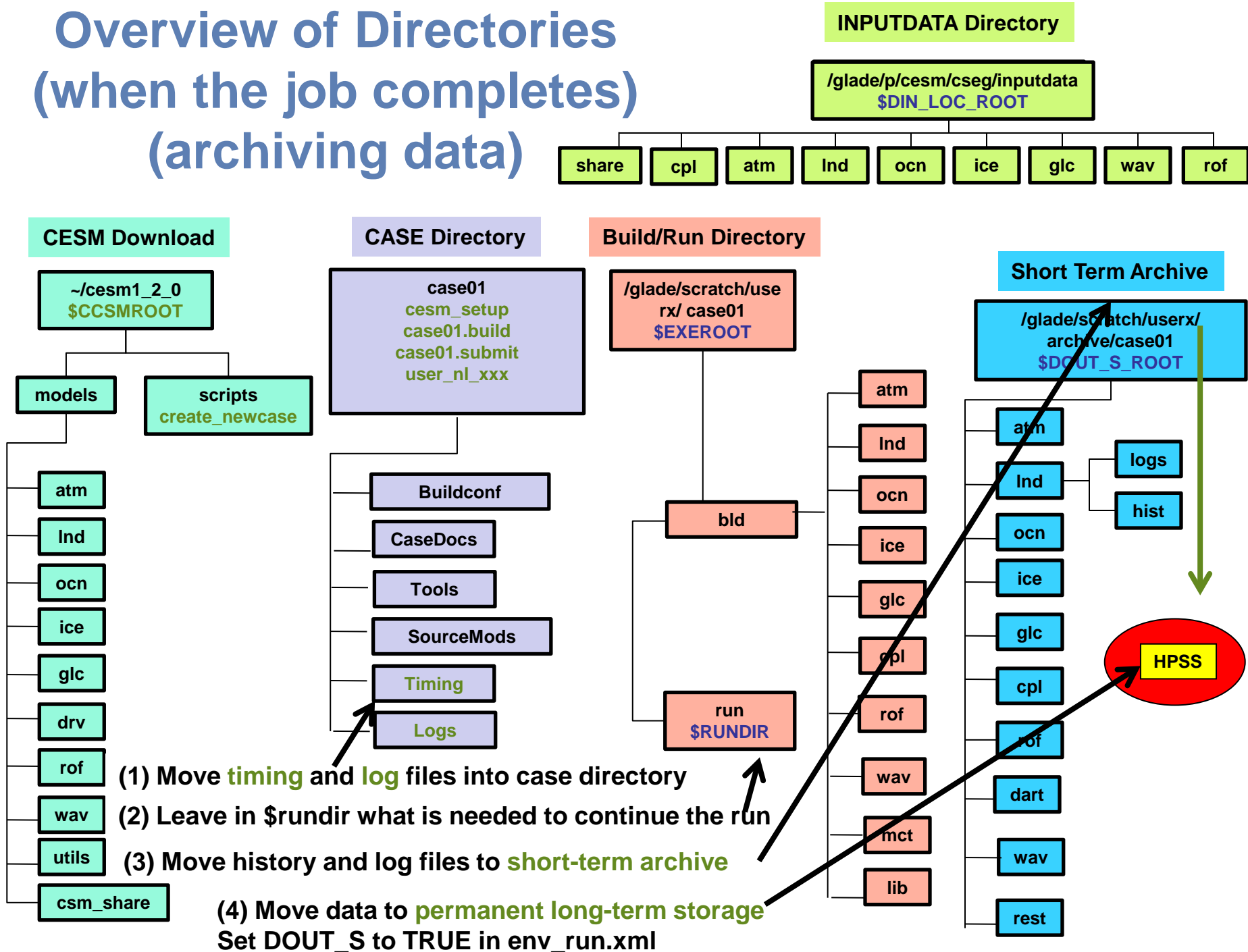
Overview of Directories (when the job is running)



When running, the model scripts **write files into your run directory.**

After completion the model scripts will move files into the appropriate directories (next slide).

Overview of Directories (when the job completes) (archiving data)



More Information/Getting Help

Model User Guides: <http://www.cesm.ucar.edu/models/cesm1.2/>

MODEL DOCUMENTATION

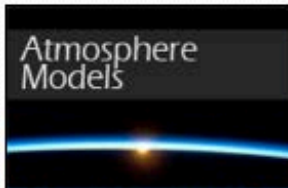
CESM1.2

- ▶ User's Guide
- ▶ Machines, Resolutions, Component sets
- ▶ Model Component Namelists
- ▶ \$CASEROOT xml files



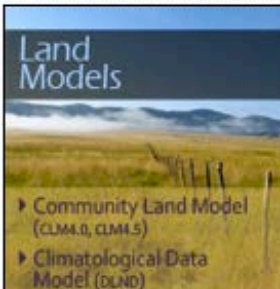
Atmosphere Models

- ▶ Community Atmosphere Model (CAM5, CAM-chem, WACM)
- ▶ Climatological Data Model (DATM)



Land Models

- ▶ Community Land Model (CLM4.0, CLM5)
- ▶ Climatological Data Model (CLND)



Sea Ice Models

- ▶ Community Ice Code (ICE4)
- ▶ Climatological Ice Model (ICE)



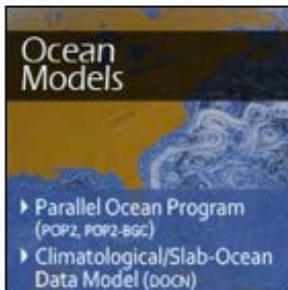
Coupler

- ▶ CESM Coupler (CPL7)




Ocean Models

- ▶ Parallel Ocean Program (POP2, POP2-BGC)
- ▶ Climatological/Slab-Ocean Data Model (COCM)



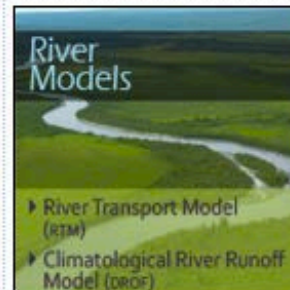
Land Ice Models

- ▶ Community Ice Sheet Model (Glimmer - CISM)



River Models

- ▶ River Transport Model (RTM)
- ▶ Climatological River Runoff Model (CRRF)



More Information/Getting Help

CESM Bulletin Board: <http://bb.cgd.ucar.edu/>

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CESM - General
The Community Earth System Model (CESM) is a fully coupled, global climate model that provides state-of-the-art computer simulations of the Earth's past, present, and future climate states.

Forum	Topics	Posts	Last post
Announcements	16	41	CESM1.2.0 Release Announcement by aliceb June 12, 2013 - 11:52am
Bug reporting	110	306	output date error - monthly history files shifted 1 month by eaton 11 hours 50 min ago
Input Data Inquiries	108	260	CICE input data for B2OTR? by marvel1@... 11 hours 3 min ago
Output Data Inquiries	85	202	start time by hannay May 22, 2013 - 2:02pm
Tools A place for questions about the ESMF mapping tools and the cpnc tool as well as any topics related to grid generation.	3	10	runoff_to_ocn by cyoo@... May 23, 2013 - 8:22am
Software Development Includes issues for building/running on supported machines and porting to unsupported machines	174	515	Error in porting CESM by jedwards June 14, 2013 - 10:00am
General Discussion Includes requests for new features and configuration inquiries	193	458	More general MOC computation in POP by afrigola@... June 10, 2013 - 11:48am
Subversion Issues Forum for issues related to the new version control system	9	20	CCSM4/CESM1_0 download problem by sirajkhan78@... March 4, 2011 - 5:06pm
Tutorials For discussion regarding the web based modeling tutorials	5	13	Basic_B_1850 Compilation by sstrey2@... June 4, 2013 - 9:10am

More Information/Getting Help

CESM tutorial: <http://www.cesm.ucar.edu/events/tutorials/>

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COMMUNITY EARTH SYSTEM MODEL

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CESM Tutorials

UPCOMING CESM TUTORIALS

2014 CLM TUTORIAL

18 - 21 February 2014, National Center for Atmospheric Research, Mesa Lab, Boulder, CO [[tutorial home](#)] [[announcement](#)]

2014 CESM TUTORIAL

11 - 5 August 2014, National Center for Atmospheric Research, Mesa Lab, Boulder, CO [[tutorial home](#)] [[announcement](#)]

PAST CESM TUTORIALS

2013 COMMUNITY EARTH SYSTEM MODELING TUTORIAL

12 - 16 August 2013, National Center for Atmospheric Research, Boulder, CO [[tutorial home](#)] [[announcement](#)] [[tutorial agenda](#)] [[tutorial coursework](#)]

2012 COMMUNITY EARTH SYSTEM MODELING TUTORIAL

30 July - 03 August 2012, National Center for Atmospheric Research, Boulder, CO [[tutorial home](#)] [[announcement](#)]

2011 COMMUNITY EARTH SYSTEM MODELING TUTORIAL

1 - 5 August 2011, National Center for Atmospheric Research, Boulder, CO [[tutorial home](#)] [[agenda](#)] [[participants](#)]

2010 COMMUNITY EARTH SYSTEM MODELING TUTORIAL

12-16 July 2010, National Center for Atmospheric Research, Boulder, CO [[agenda](#)] [[announcement](#)] [[course materials](#)]

CESM PROJECT

The Community Earth System Model (CESM) is a fully-coupled, global climate model that provides state-of-the-art computer simulations of the Earth's past, present, and future climate states.

CESM is sponsored by the National Science Foundation (NSF) and the U.S. Department of Energy (DOE). Administration of the CESM is maintained by the Climate and Global Dynamics Division (CGD) at the National Center for Atmospheric Research (NCAR).

CESM ADMINISTRATION

- SSC
- CAB
- Governance

Thank You!

The NESL Mission is:

To advance understanding of weather, climate, atmospheric composition and processes;
To provide facility support to the wider community; and,
To apply the results to benefit society.

NCAR is sponsored by the National Science Foundation

