Formula for the tutorial

Short presentation followed by a panel discussion

Our panel of CESM experts

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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/

MODEL DOCUMENTATION

- CESM1.2
  - User's Guide
  - Machines, Resolutions, Component sets
  - Model Component Names
  - SCARDROOT files

- Atmosphere Models
- Land Models
- Sea Ice Models
- Coupler

- Ocean Models
- Land Ice Models
- River Models

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 input data 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 Timing Table.

DATA MANAGEMENT AND DISTRIBUTION

A short registration is required to access the repository. After registering, you will receive an email containing a user name and password that is necessary to gain access to the repository.

Accoultion of the code is more fully described in the most recent version of the CESM 1.2 User's Guide.

REPORTING A PROBLEM
If you have any problems, please first read the User's Guide including the sections on FAQs and User Guides. Please also refer to the CESM Bulletin Board, which is in place to facilitate communication within the CESM community. Finally, please also refer to the Release Notes entries that are provided with every release and release update. If questions or problems still exist, then please send an email to cesm-help@mps.ucar.edu. Support questions will be answered as resources are available.

CESM SUPPORT POLICY
CESM Support Policy - November 2012

CESM DATA MANAGEMENT & DISTRIBUTION PLAN
The Community Earth System Model (CESM) Data Management and Distribution Plan documents the procedures for the storage and distribution of data associated with the CESM project.

Data management and distribution

Model
Input data
Timing
and load balance
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
  - **bluewaters** – 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)
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
(A) Registration

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

- 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
  (4) Run the Model and Output Data Flow
(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/
The CESM root consists of 2 directories: models and scripts

Code for all the components, coupler, etc…
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
Overview of Directories (+ inputdata directory)

**INPUTDATA Directory**

```
/glade/p/cesm/cseg/inputdata
$DIN_LOC_ROOT
```

### CESM Download

```
~/cesm1_2_0
$CCSMROOT
```

- **models**
  - **atm**
  - **Ind**
  - **ocn**
  - **ice**
  - **glc**
  - **drv**
  - **rof**
  - **wav**
  - **utils**
  - **csm_share**

- **scripts**
  - **create_newcase**

**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

• 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
  (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
(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
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) 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

g# 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

It is that easy! 🧐👍🏼
```
Basic Work Flow
(or how to set up and run an experiment)

• One-Time Setup Steps
  (A) Registration
  (B) Download the CESM code
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  (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
Overview of Directories (+ before create_newcase)

This is the script you need to create a new case

CESM Download

~/cesm1_2_0
$CCSMROOT

models
scripts
create_newcase

atm
Ind
ocn
ice
glc
drv
rof
wav
utils
csm_share

INPUTDATA Directory

/glade/p/csm/cseg/inputdata
$DIN_LOC_ROOT

share
cpl
atm
Ind
ocn
ice
glc
wav
rof
Set of commands to build and run the model on a supported machine: ”yellowstone”

```bash
# 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/lnd_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
(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

Diagram showing plug and play of components with different component models.
(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]

List of valid values is also available from the CESM website
http://www.cesm.ucar.edu/models/cesm1.2/
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).

...
Overview of Directories (after create_newcase)

**CASE Directory**

- ~/cases/case01
- $CASEROOT
- cesm_setup
- env_*xml
- xmlchange

**CASE Directory** contains:
- CESM Download
  - ~/cesm1_2_0
  - $CCSMROOT
- scripts
  - create_newcase
- SourceMods
- LockedFiles
- Tools
- Buildconf

**INPUTDATA Directory**

- /glade/p/cesm/cseg/inputdata
  - $DIN_LOC_ROOT
  - share
  - cpl
  - atm
  - Ind
  - ocn
  - ice
  - glc
  - wav
  - rof

**cesm_setup** script used in the next step

**INPUTDATA Directory** contains:
- subdirectory for case specific code modifications
- files with xml variables used by CESM

**create_newcase** creates case directory that contains:
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

```xml
<entry id="STOP_OPTION" value="ndays" />

<entry id="STOP_N" value="5" />
```

“id” - variable name
“value” – variable value

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
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Work Flow: Super Quick Start

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

```bash
# 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 Download

~/cesm1_2_0
$CCSMROOT

models

scripts
create_newcase

atm
Ind
ocn
ice
glc
drv
rof
wav
util

csm_share

CASE Directory

~/cases/case01
cesm_setup
case01.build
case01.submit
user_nl_xxx*

namelist modification files user_nl_xxx*
this is where you modify your namelists

cesm_setup creates:
case scripts (to build, run and archive)

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
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Work Flow: Super Quick Start

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

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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)

**CESM Download**
- ~/cesm1_2_0
- $CCSMROOT
  - models
  - scripts
    - create_newcase
  - atm
  - Ind
  - ocn
  - ice
  - glc
  - drv
  - rof
  - wav
  - utils
  - csm_share

**CASE Directory**
- case01
  - cesm_setup
  - case01.build
  - case01.submit
  - user_nl_xxx
  - Buildconf
  - CaseDocs
  - LockedFiles
  - SourceMods
  - Tools

**Build/Run Directory**
- /glade/scratch/use
  - rx/ case01
    - $SEXEROOT
  - bld
    - run
      - $SRUNDIR
      - atm
      - Ind
      - ocn
      - ice
      - glc
      - cpl
      - rof
      - wav
      - mct
      - lib

**INPUTDATA Directory**
- /glade/p/cesm/cseg/inputdata
  - $DIN_LOC_ROOT
  - atm
  - lnd
  - ocn
  - ice
  - glc
  - wav

The build script

1. **checks input data**
   - If any input data 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

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

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

Use **"bjobs"** to check if job is running

```bash
~/cases/case01>bjobs

<table>
<thead>
<tr>
<th>JOBID</th>
<th>USER</th>
<th>STAT</th>
<th>QUEUE</th>
<th>FROM_HOST</th>
<th>EXEC_HOST</th>
<th>JOB_NAME</th>
<th>SUBMIT_TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>960463</td>
<td>userx</td>
<td>PEND</td>
<td>regular</td>
<td>yslogin3-ib</td>
<td></td>
<td>case01</td>
<td>Jun 17 08:34</td>
</tr>
</tbody>
</table>

Your job is waiting in the queue

```bash
~/cases/case01>bjobs

<table>
<thead>
<tr>
<th>JOBID</th>
<th>USER</th>
<th>STAT</th>
<th>QUEUE</th>
<th>FROM_HOST</th>
<th>EXEC_HOST</th>
<th>JOB_NAME</th>
<th>SUBMIT_TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>960463</td>
<td>userx</td>
<td>RUN</td>
<td>regular</td>
<td>yslogin3-ib</td>
<td>15*ys0702-i</td>
<td>case01</td>
<td>Jun 17 08:34</td>
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<td></td>
<td></td>
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<td>15*ys1872-ib</td>
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<td>15*ys1908-ib</td>
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<td>15*ys2130-ib</td>
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<td>15*ys2216-ib</td>
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<td></td>
<td></td>
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<td>15*ys2218-ib</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

Your 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)

(1) Move timing and log files into case directory
(2) Leave in $rundir what is needed to continue the run
(3) Move history and log files to short-term archive
(4) Move data to permanent long-term storage
Set DOUT_S to TRUE in env_run.xml
More Information/Getting Help

Model User Guides: [http://www.cesm.ucar.edu/models/cesm1.2/](http://www.cesm.ucar.edu/models/cesm1.2/)
# More Information/Getting Help

**CESM Bulletin Board:** [http://bb.cgd.ucar.edu/](http://bb.cgd.ucar.edu/)

<table>
<thead>
<tr>
<th>Forum</th>
<th>Topics</th>
<th>Posts</th>
<th>Last post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Announcements</td>
<td>16</td>
<td>41</td>
<td>CESM1.2.0 Release Announcement by alieberi</td>
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<td>June 12, 2013 - 11:52am</td>
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<td>Bug reporting</td>
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<td>306</td>
<td>output date error - monthly history files shifted 1 month by eisbrenn 11 hours 50 mins ago</td>
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<td>Input Data inquiries</td>
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<td>CICE input data for B20T1R? by marve11@... 11 hours 3 mins ago</td>
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<td>start time by hannay May 22, 2013 - 2:02pm</td>
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<td>runoff_to_och by cdeo@... May 23, 2013 - 8:22am</td>
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More Information/Getting Help

CESM tutorial: http://www.cesm.ucar.edu/events/tutorials/
Thank You!

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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.

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