

# CESM Tutorial

## Intro to Lab: Basics of CESM

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**CESM Software Engineering Group**

NCAR is sponsored by the National Science Foundation



# Lab 1 Goals

- Goal 1: Finish Prerequisites
  - [https://ncar.github.io/CESM-Tutorial/notebooks/prereqs/prereqs\\_overview.html](https://ncar.github.io/CESM-Tutorial/notebooks/prereqs/prereqs_overview.html)
- Goal 2: Checkout CESM and Explore Derecho
  - [https://ncar.github.io/CESM-Tutorial/notebooks/basics/basics\\_overview.html](https://ncar.github.io/CESM-Tutorial/notebooks/basics/basics_overview.html)
- Goal 3: Create and Run an experiment
  - [https://ncar.github.io/CESM-Tutorial/notebooks/basics/exercises\\_overview.html](https://ncar.github.io/CESM-Tutorial/notebooks/basics/exercises_overview.html)

# Goal 1: Prerequisites

- **Wireless access**

- Use the **UCAR Visitor** wireless. It is an open, unencrypted network (require registration for access).
- Use the **Eduroam** wireless only if you have it already installed on your computer

- **Project account & Reservation Queues**

- Make sure you follow the instructions in the “One time setup” area of the materials:  
[https://ncar.github.io/CESM-Tutorial/notebooks/resources/tutorial\\_one\\_time\\_setup.html](https://ncar.github.io/CESM-Tutorial/notebooks/resources/tutorial_one_time_setup.html)
- This will set up your account to “charge” time on the supercomputer and the special queue we set up for the week.

NCAR | NATIONAL CENTER FOR  
UCAR | ATMOSPHERIC RESEARCH

Select connect to agree to the [terms of use](#) and gain access to the UCAR Visitor Network.

UCAR employees can use Eduroam or GlobalProtect now for encrypted access to all UCAR networks.



Questions about UCAR Visitor? Visit our FAQ page [here](#).

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Resources ^

NCAR Supercomputer ^

Modules on NCAR HPC

Tutorial one time setup

Tutorial queue and  
account

# Goal 1: Prerequisites

- Find or Download and Install a Unix terminal shell for your laptop
  - <https://ncar.github.io/CESM-Tutorial/notebooks/resources/terminals.html>
  - Mac: Use Terminal but will likely need XQuartz
  - PC: Terminal from Start Menu or Fast X
  - Talk to helpers if you have any questions or technical issues
- Log into the Derecho supercomputer
  - “ssh -Y [username@derecho.hpc.ucar.edu](https://derecho.hpc.ucar.edu)”
  - Explore the machine areas Rory talked about!



## Goal 2: Download CESM3



- The first Tutorial with CESM3
- THIS MODEL IS **NOT OFFICIALLY RELEASED YET**
- You are **Early Adopters!**
- Be prepared for possible glitches
  - Tutorial resources have been updated but there could be mistakes/missed pieces
  - Code has been tested but you are testing it more!
- The resolution we are using is brand new
- It is **NOT SCIENTIFICALLY SUPPORTED**
- Documentation for this version is limited
- **Do not use this tag in your research!!**
  - Wait for the official release tag

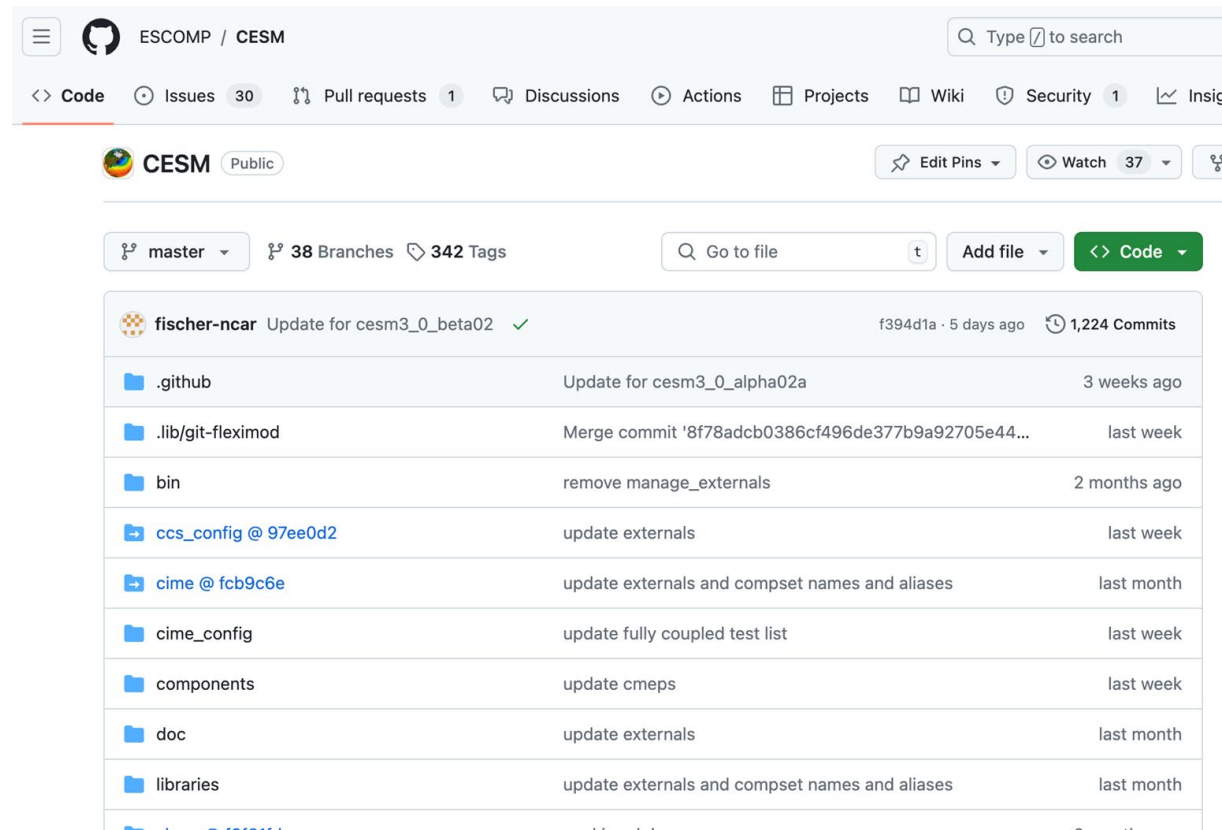


## Goal 2: Download CESM3

- Use git to download and set up your CESM code
  - CESM code is publically available
  - Instructions for downloading and checking out the correct tag are in the exercise:
    - [https://ncar.github.io/CESM-Tutorial/notebooks/basics/code/git\\_download\\_cesm.html](https://ncar.github.io/CESM-Tutorial/notebooks/basics/code/git_download_cesm.html)
  - New to CESM3: Once you download it, you will use “git-fleximod” to pull in code from many other repositories

# Goal 2: Download CESM

- A good idea to explore the CESM Github pages
- <https://github.com/ESCOMP/CESM>
- Issues, discussions, and the place to start code modifications.



ESCOMP / CESM

Code Issues 30 Pull requests 1 Discussions Actions Projects Wiki Security 1 Insights

CESM Public

master 38 Branches 342 Tags

Go to file t Add file <> Code

|                                                                                                          |                                                    |                      |                 |
|----------------------------------------------------------------------------------------------------------|----------------------------------------------------|----------------------|-----------------|
|  fischer-ncar           | Update for cesm3_0_beta02 ✓                        | f394d1a · 5 days ago | 🕒 1,224 Commits |
|  .github                | Update for cesm3_0_alpha02a                        |                      | 3 weeks ago     |
|  .lib/git-fleximod     | Merge commit '8f78adcb0386cf496de377b9a92705e44... |                      | last week       |
|  bin                  | remove manageExternals                             |                      | 2 months ago    |
|  ccs_config @ 97ee0d2 | update externals                                   |                      | last week       |
|  cime @ fcb9c6e       | update externals and compset names and aliases     |                      | last month      |
|  cime_config          | update fully coupled test list                     |                      | last week       |
|  components           | update cmeps                                       |                      | last week       |
|  doc                  | update externals                                   |                      | last month      |
|  libraries            | update externals and compset names and aliases     |                      | last month      |

# Goal 3: CESM Tutorial Exercise Layout

[https://ncar.github.io/CESM-Tutorial/notebooks/basics/exercises/first\\_B1850.html](https://ncar.github.io/CESM-Tutorial/notebooks/basics/exercises/first_B1850.html)



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% + K

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Download CESM

Explore CESM Code

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## Your first CESM run

**Exercise: Run a basic, out-of-the-box (that is, no user changes are implemented) CESM experiment**

Create a case called **b1850.basics** using the compset `B1850C_LTso` at `ne16pg3_t201` resolution. Note: You will need to use the “–run-unsupported” flag this year as we are using a very new version of CESM.

Check the status of the run after submitting.

*Please ensure that you have completed the [Tutorial One-Time Setup step](#) before starting this exercise!*

► [Click here for hints](#)



► [Click here for the solution](#)



## Test your understanding

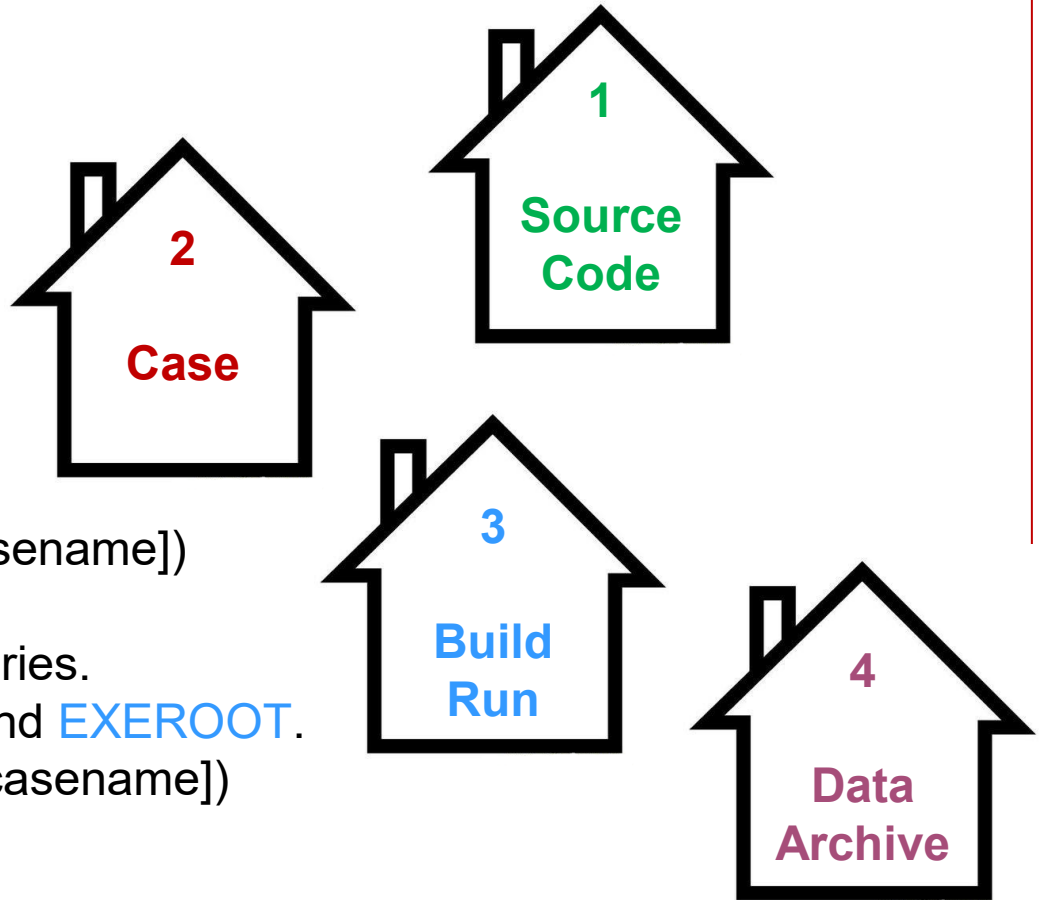
## Goal 3: Create an Experiment

- Your first CESM experiment (or “Case”) will be a **B1850C\_LTso** case with a **2-ish degree spectral element global grid** (ne16pg3\_t201). This is an “**All Active**” experiment, so you will have active atmosphere, ocean, land, sea ice, river and wave components.
- The default configuration runs all of these models together, coupled, for **5 days with preindustrial (year 1850) conditions**.
- You will change the details of the run (start-up options, run length, restart options, namelist configuration changes, etc) using the XML files in your new case directory.
- The model will build and run in scratch space, and your output will be archived to your archive directory.

# CESM Case, Build and Run directories

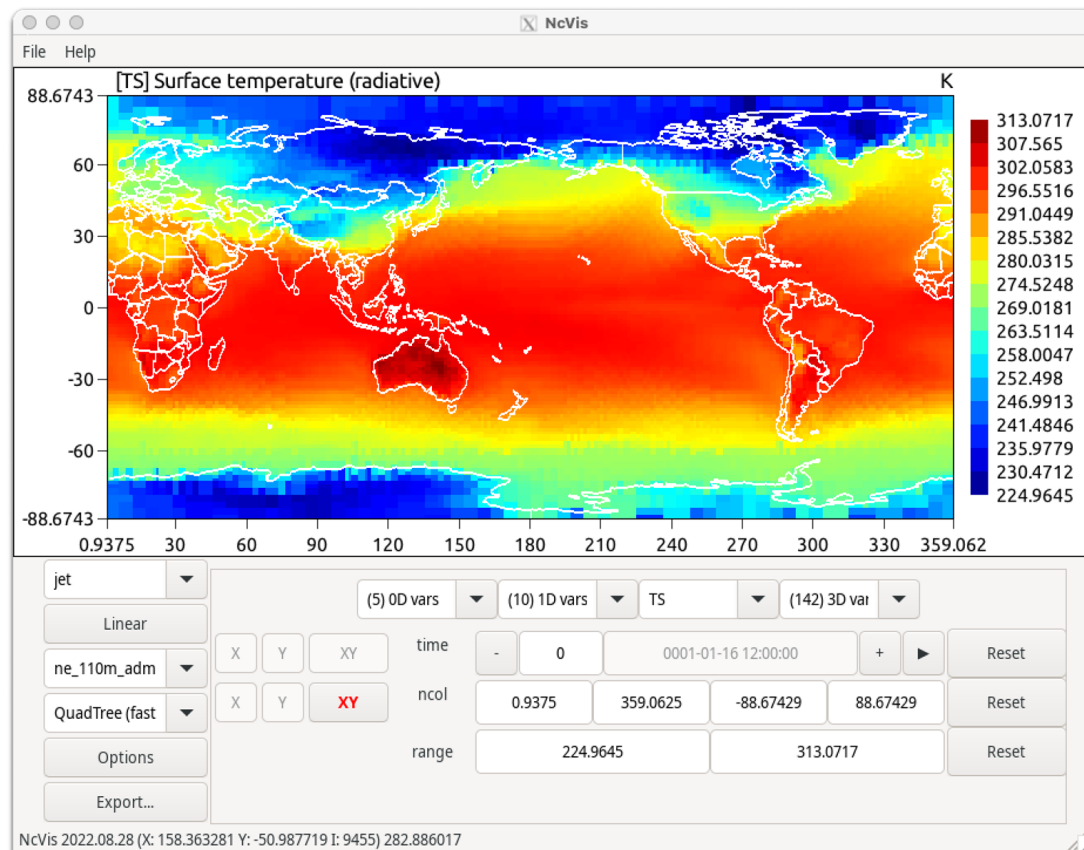
You will need to be aware of 4 paths in your project,  
These are stored in your case directory in XML  
variables

- Path to your CESM code.  
This is referred to as **SRCROOT**  
and contains **CIMEROOT**.  
(/glade/u/home/[username]/code)
- Path to your case directories.  
This is your **CASEROOT**.  
(/glade/u/home/[username]/cases/[casename])
- Path to your build and run directories.  
Referred to later as **OBJROOT** and **EXEROOT**.  
(/glade/derecho/scratch/[username]/[casename])
- Path to your Archived data.  
Saved as your **DOUT\_S\_ROOT**.  
(/glade/derecho/scratch/[username]/archive/[casename])



# Looking at the Results

- After your first experiments run, we will look at the output using the **ncvis** tool for a quick glimpse.
- You will need to have X-11 forwarding working with your terminal for this.



# Looking at the Results

- Near the end of the day, we will also **test logging into the NCAR JupyterHub tool**. This will run the python notebooks that we use for the Diagnostics day.
- This year we will use a NEW login method, so we need to test it before using it at scale on Thursday.
- Wait for us to say when to log in (we will go all together)
- Instructions available here:

[https://ncar.github.io/CESM-Tutorial/notebooks/resources/ncar\\_hpc.html#using-jupyterhub](https://ncar.github.io/CESM-Tutorial/notebooks/resources/ncar_hpc.html#using-jupyterhub)

Home / My Interactive Sessions / Jupyter

**Interactive Apps**

- Desktops
  - ☐ Casper Login VNC Desktop
  - ☐ Casper VNC Desktop
- Tools
  - ☒ MATLAB
  - ☐ Code Server
  - ☒ Jupyter

**Jupyter**

Launch a Jupyter server with Python on the Casper cluster. Check the [Changelog](#) for the recent updates.

**Cluster**  
Casper

**Resource Selection**  
Casper PBS batch

**Queue or Reservation (-q)**  
casper

**Project Account (-A)**  
NCDD0039

Select the account to charge for this job.

**Specify N Nodes (-i select=N)**  
1

**Specify N CPUs per Node (-i ncpus=N)**  
2

**Specify Threads per Process (-i ompthreads=N)**  
1

**Specify MPI processes per Node (-i mpirproc=N)**  
1

**Specify Memory per Node in GB (-i mem=N)**  
10

**Specify X Number of GPUs / Node (-i ngpus=X)**  
0

**Select GPU Type, X (-i gpu\_type=X)**  
NVIDIA Compute Capability 7.0

**Wall Time in hours (24-hour max)**  
2

**Jupyter Environment**  
[Dropdown menu]

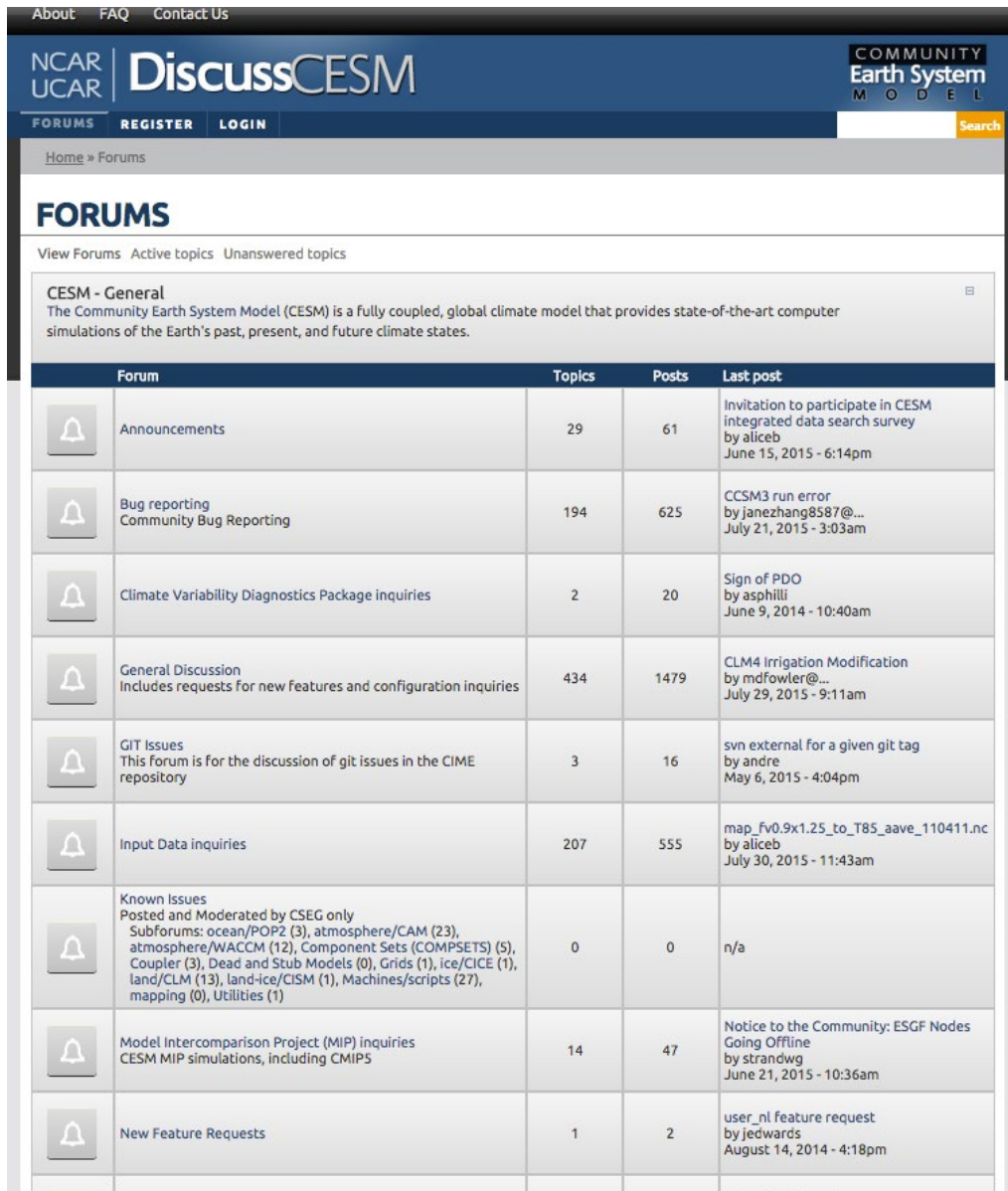
☐ I would like to receive an email when the session starts

**Launch**

\* The Jupyter session data for this session can be accessed under the `data` root directory.

# More Information/Getting Help

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



NCAR UCAR DiscussCESM COMMUNITY Earth System MODEL

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## FORUMS

View Forums Active topics Unanswered topics

**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                                                                                                                                                                                                                                                                                                    | 29     | 61    | Invitation to participate in CESM integrated data search survey by aliceb<br>June 15, 2015 - 6:14pm |
|  Bug reporting<br>Community Bug Reporting                                                                                                                                                                                                                                                                         | 194    | 625   | CCSM3 run error by janezhang8587@...<br>July 21, 2015 - 3:03am                                      |
|  Climate Variability Diagnostics Package inquiries                                                                                                                                                                                                                                                                | 2      | 20    | Sign of PDO by asphilli<br>June 9, 2014 - 10:40am                                                   |
|  General Discussion<br>Includes requests for new features and configuration inquiries                                                                                                                                                                                                                             | 434    | 1479  | CLM4 Irrigation Modification by mdfowler@...<br>July 29, 2015 - 9:11am                              |
|  GIT Issues<br>This forum is for the discussion of git issues in the CIME repository                                                                                                                                                                                                                              | 3      | 16    | svn external for a given git tag by andre<br>May 6, 2015 - 4:04pm                                   |
|  Input Data inquiries                                                                                                                                                                                                                                                                                           | 207    | 555   | map_fv0.9x1.25_to_T85_aave_110411.nc by aliceb<br>July 30, 2015 - 11:43am                           |
|  Known Issues<br>Posted and Moderated by CSEG only<br>Subforums: ocean/POP2 (3), atmosphere/CAM (23), atmosphere/WACCM (12), Component Sets (COMPSETS) (5), Coupler (3), Dead and Stub Models (0), Grids (1), ice/CICE (1), land/CLM (13), land-ice/CISM (1), Machines/scripts (27), mapping (0), Utilities (1) | 0      | 0     | n/a                                                                                                 |
|  Model Intercomparison Project (MIP) inquiries<br>CESM MIP simulations, including CMIP5                                                                                                                                                                                                                         | 14     | 47    | Notice to the Community: ESGF Nodes Going Offline by strandwg<br>June 21, 2015 - 10:36am            |
|  New Feature Requests                                                                                                                                                                                                                                                                                           | 1      | 2     | user_nl feature request by jedwards<br>August 14, 2014 - 4:18pm                                     |

- **Register** as a forums user by entering your valid information in the registration form
- **Subscribe** to forums of interest - especially the “Announcements” and “Known Problems” – this is one way that we communicate updates to you!
- **Join** the CESM participants email list at:  
<http://mailman.cgd.ucar.edu/mailman/listinfo/ccsm-participants>
- **Create** a github account and opt-in to “watch” CESM related repositories

# More Information/Getting Help

**CESM tutorial:** [https://ncar.github.io/CESM-Tutorial/notebooks/basics/basics\\_overview.html](https://ncar.github.io/CESM-Tutorial/notebooks/basics/basics_overview.html)



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Advanced Knowledge

## Introduction

Welcome to the world of the **Community Earth System Model (CESM)**. This introduction will discuss the structure of the CESM model, provide information about how to become more involved in the CESM community, and how to get help if required.

## Visualizing this documentation

Depending on your computer settings, you may see this documentation with a **white** or **black background**. To toggle between these settings click the sun or moon in the upper right of the page (see red arrow below).

We have developed the documentation with the **white background** and recommend you use these settings. If you choose to use the dark background it is possible some of the visualizations will be more difficult to read.



Welcome to the **CESM Tutorial**

# Thank You!

The UCAR 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.

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