

CESM Tutorial

Intro to Lab: Basics of CESM

NSF NCAR CGD Laboratory

Kate Thayer-Calder
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
- Goal 2: Checkout CESM and Explore Derecho
 - 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

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
- This will set up your account to “charge” time on the supercomputer and the special queue we set up for the week.

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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

Prerequisites

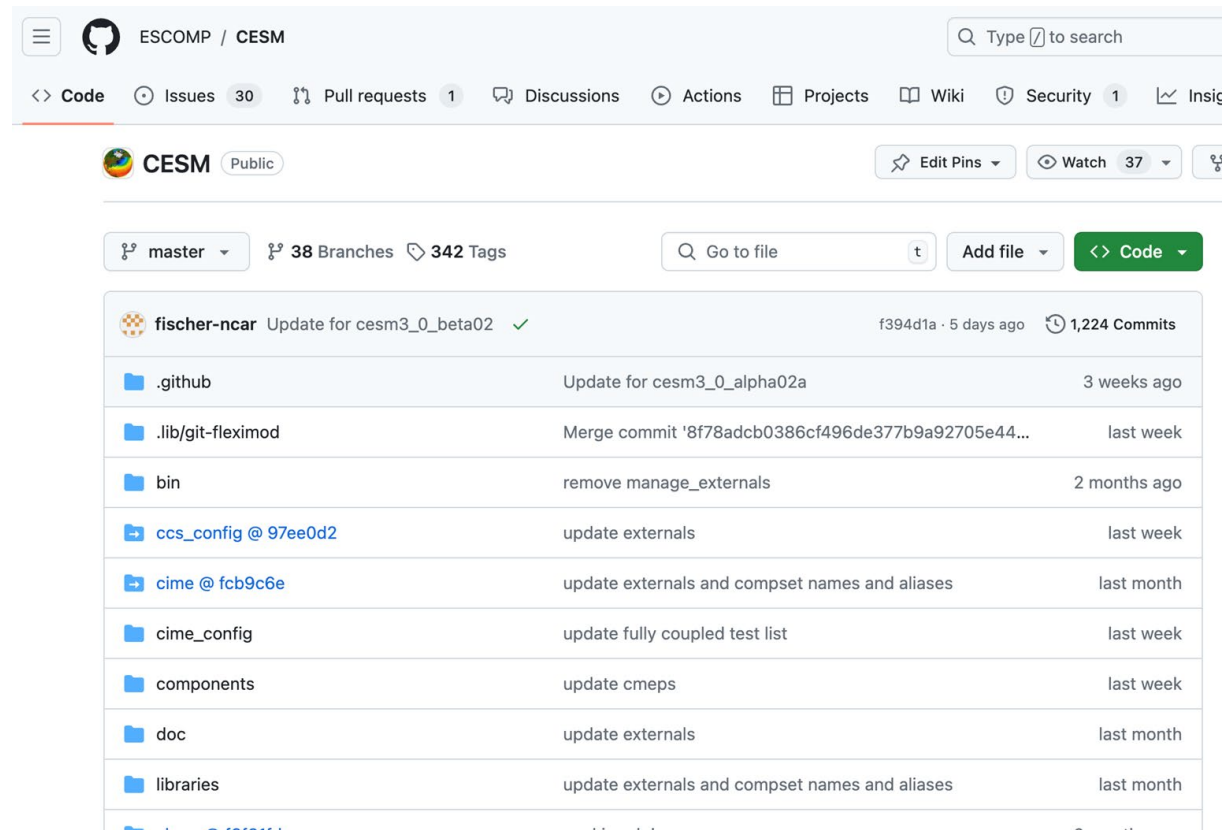
- Find or Download and Install a Unix terminal shell for your laptop
 - <https://ncar.github.io/CESM-Tutorial/notebooks/resources/terminals.html>
 - Mac: Use Terminal but will likely need XQuartz
 - PC: Terminal from Start Menu or Fast X
 - Talk to helpers if you have any questions or technical issues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

Download CESM

- 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
 - Once you download it, you will use “manage_externals” to pull in code from many other repositories
 - Note: CESM~3 uses a different tool (git-fleximod) instead of manage_externals, but it does very similar things.

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

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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

CESM Tutorial Exercise Layout

https://ncar.github.io/CESM-Tutorial/notebooks/basics/exercises/first_B1850.html



Q Search

⌕ + K

Welcome to the CESM Tutorial

Introduction

Prerequisites for Success

Basics

Workspaces

CESM code

CESM Workflow

Exercise Overview

Your first CESM run

Extending your run

Examine History Files

Explore Further

Review Questions

Simple XML Modifications

Namelist Modifications

Troubleshooting runtime errors



Your first CESM run

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

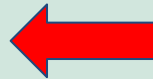
Create a case called **b1850.basics** using the compset **B1850** at **f19_g17** resolution.

Check the status of the run after submitting.

► [Click here for hints](#)



► [Click here for the solution](#)



Test your understanding

- Did your run complete successfully?
- What sorts of files did you get as output?
- How long is the simulation?

Create an Experiment

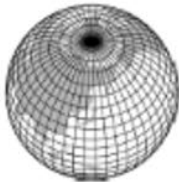
- CESM experiments are organized into “cases” and each case contains all of the parameters needed to describe a specific run.
- Use “create_newcase” in “my_cesm_code/cime/scripts” to define a new case or experiment

create_newcase requires 3 arguments

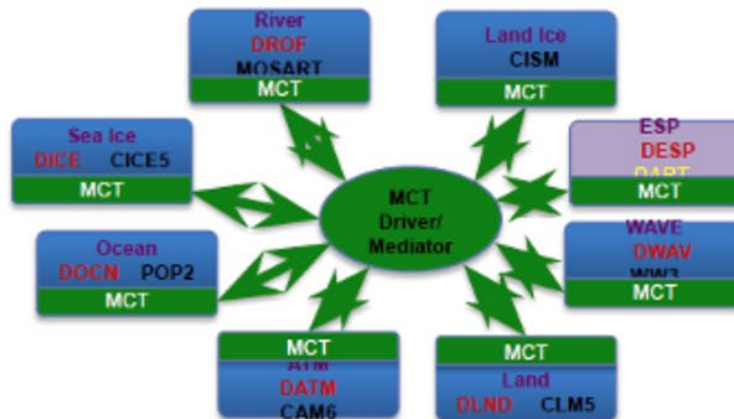
What is the
casename ?



Which
resolution?



Which model configuration ?
Which set of components ?



Which machine
are you running on?



Sometimes Optional

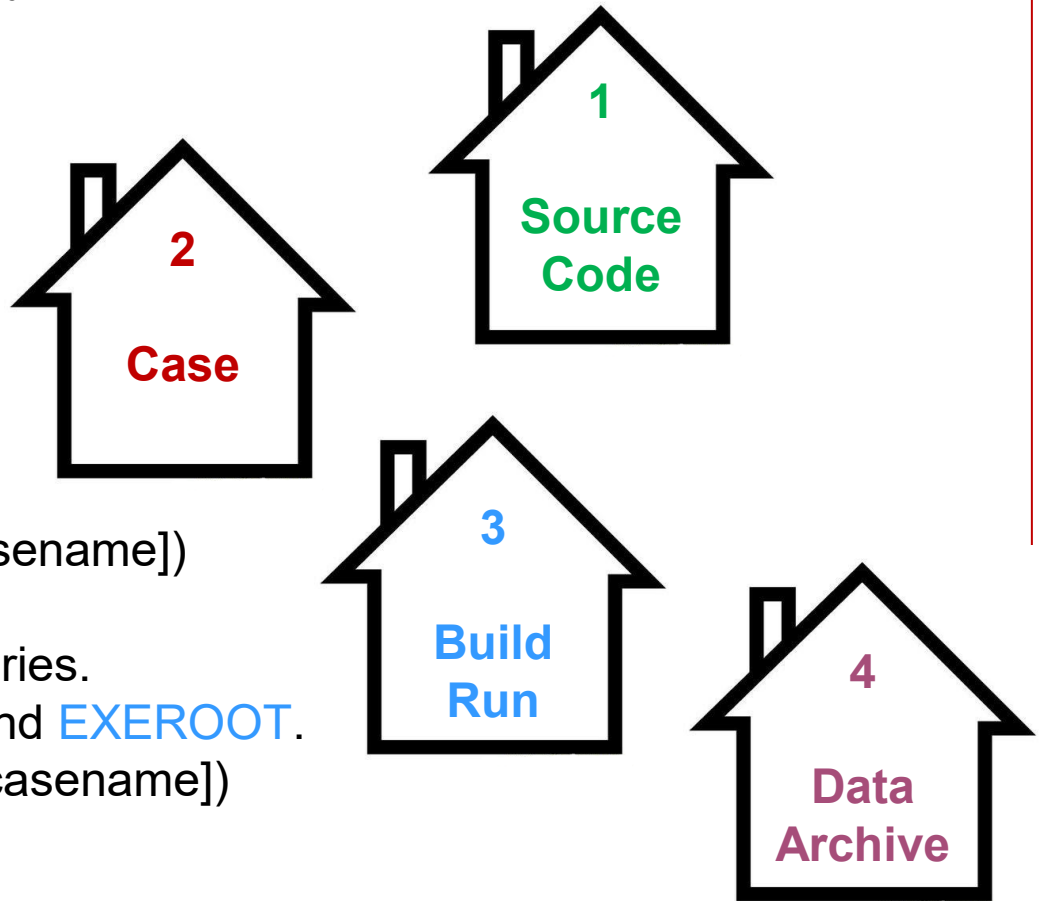
Create an Experiment

- Your first CESM experiment (or “Case”) will be a **B1850** case with a **2 degree finite volume global grid** (f19_g17). 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])



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	29	61	Invitation to participate in CESM integrated data search survey by aliceb June 15, 2015 - 6:14pm
	Bug reporting Community Bug Reporting	194	625	CCSM3 run error by janezhang8587@... July 21, 2015 - 3:03am
	Climate Variability Diagnostics Package inquiries	2	20	Sign of PDO by asphilli June 9, 2014 - 10:40am
	General Discussion Includes requests for new features and configuration inquiries	434	1479	CLM4 Irrigation Modification by mdfowler@... July 29, 2015 - 9:11am
	Git Issues This forum is for the discussion of git issues in the CIME repository	3	16	svn external for a given git tag by andre May 6, 2015 - 4:04pm
	Input Data inquiries	207	555	map_fv0.9x1.25_to_T85_aave_110411.nc by aliceb July 30, 2015 - 11:43am
	Known Issues Posted and Moderated by CSEG only 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 CESM MIP simulations, including CMIP5	14	47	Notice to the Community: ESGF Nodes Going Offline by strandwg June 21, 2015 - 10:36am
	New Feature Requests	1	2	user_nl feature request by jedwards 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



☰ Contents

Goals of This Tutorial

Yearly In-Person Tutorials

CESM Project Funding

Acknowledgements

Welcome to the CESM Tutorial

In 1983 NCAR created the *Community Climate Model* (CCM) as a freely available global atmosphere model for use by the climate research community. The scope of CCM development continued to expand and in 1994 NCAR scientists released the *Climate System Model* (CSM), a global model that included component models for the atmosphere, land surface, ocean, and sea-ice, communicating through a central coupler component. To recognize the broad community of users and sponsors contributing to this effort, the CSM was renamed the *Community Climate System Model* (CCSM). The CCSM model evolved to include ice sheet and biogeochemical modeling and was renamed the *Community Earth System Model* (CESM) in 2013.

This repository includes materials designed to be an introduction to running the CESM. The materials were developed to support the CESM tutorial and serve as reference documentation for all CESM users.

Goals of This Tutorial

Through this online tutorial you will learn how to run the CESM model, modify the model experiments, and use the model output. These tutorial materials are designed for the CESM version 2 (CESM2)

Yearly In-Person Tutorials

The CESM tutorial was started in 2010 and is typically offered as an in-person summer workshop. If you are interested in attending the tutorial, please see the [CESM webpage](#) for the most up to date information about when the tutorial will next be offered in Boulder, Colorado and the timeline for applying.

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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