



Community Earth System Model

A Framework for Collaborative Research

Marika Holland
CESM Chief Scientist

CESM Management Structure



CESM is primarily sponsored by
the National Science Foundation
and the Department of Energy

CESM Management Structure

CESM Advisory Board

Membership from university faculty,
gov't labs

CESM Scientific Steering Committee

Provide overall scientific leadership
Membership from NCAR, universities, Gov't Labs



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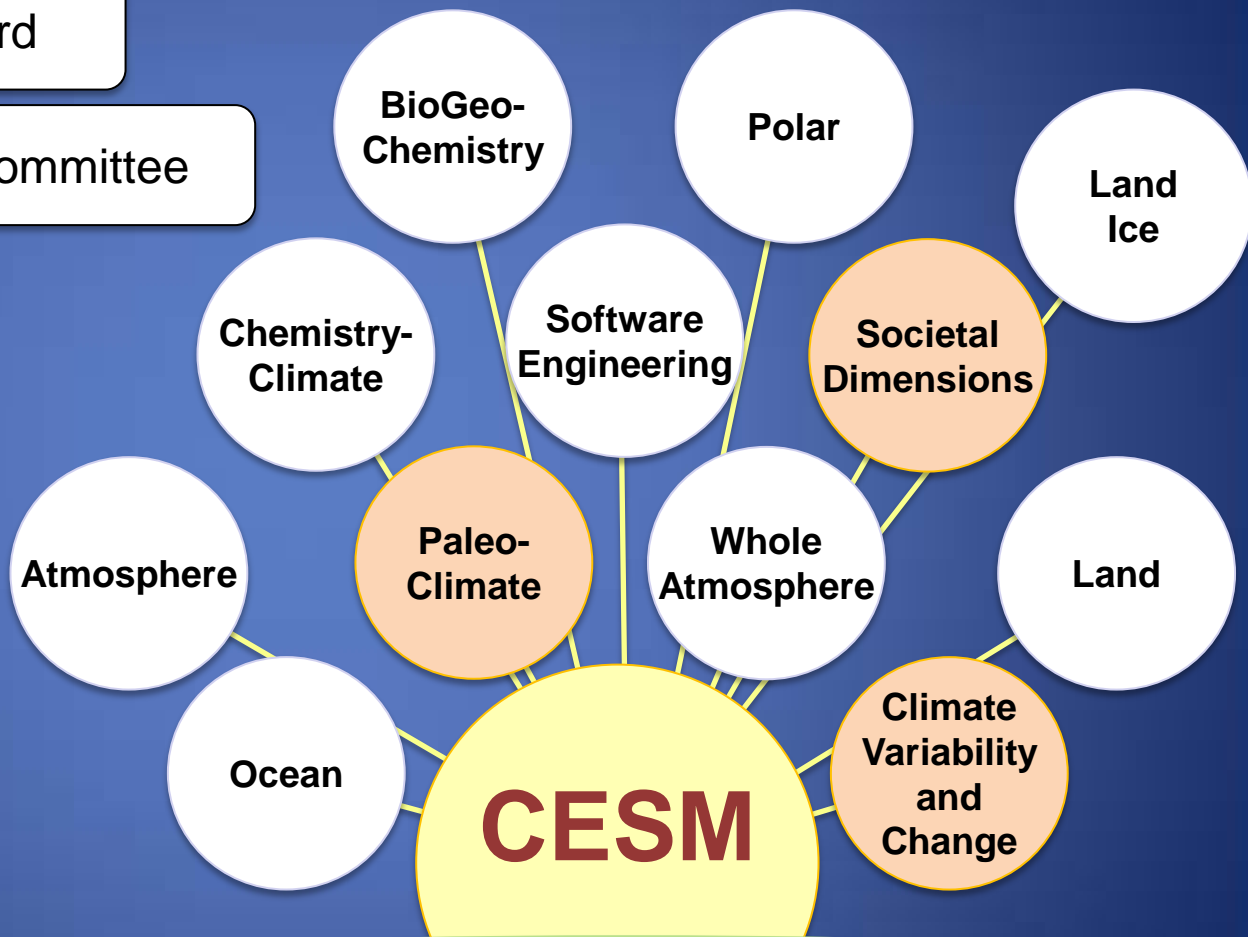
12 working groups – encompass both model development and applications

CESM Advisory Board

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<http://www.cesm.ucar.edu/management>



CESM Project Updates/Announcements

CESM Tutorial

- Third Annual CESM Tutorial planned for 30 July – 3 August, 2012
- Announcement is out and applications are being accepted
- We are again targeting about 80 participants
- Thanks to Dave Bailey for chairing the organizing committee

<http://www.cesm.ucar.edu/events/tutorials/073012/announcement.html>



CESM Project Updates/Announcements

Experiments

Information from <http://www.cesm.ucar.edu/experiments/cesm1.0/index.html>

Community Earth System Model

CESM 1.0 EXPERIMENTS, DATA AND DIAGNOSTICS

Stand-Alone Diagnostics

- CAM4.0
- CAM5.0
- CLM4.0
- CICE4.0
- POP2

J. Climate Special Issue Collection

- CCSM4
- CESM1 (restricted)

Note that although CESM1.0 supersedes CCSM4.0, users can run equivalent CCSM4.0 experiments from the CESM1.0 code base. Also note that the CCSM4.0 experiments below are equivalent to running CESM1.0 (CAM4). All current CESM release codebases (e.g. cesm1_0, cesm1_0_1, etc.) can also reproduce the climates shown below.

If you still have questions after reviewing the details of the model runs below, it is recommended that you contact the relevant [CESM Working Group Liaison](#).

Note about CCR diagnostics: Sudden large spikes in CCR diagnostic fields most likely indicate a CCR software diagnostics failure, and have absolutely nothing to do with the fidelity of the simulation. Use CCR diagnostics with caution.

Jump To: Control Simulations | 20th Century Single-Forcings Simulations | 20th Century All-Forcings Simulations | RCP Simulations | AMIP Simulations | CO₂ Simulations | Paleoclimate Simulations

CONTROL SIMULATIONS

Brief Description	Case Details	Diagnostics				Length of Run Diagnostics		
		Atm	Ice	Land	Ocean			
CCSM4 1* Pre-Industrial Control Case Name: b40.1850.track1.1deg.006 Data Location: ESG	Details	863-892 w/observations	Atm	Ice	Land	Ocean	CCR	Ocean Timeseries
		863-882 - CCSM3 T85 Pre-Industrial Control	Atm	Ice	Land	Ocean		
CCSM4 1* Pre-Industrial Control (MOAR) Case Name: b40.1850.track1.1deg.006a Data Location: ESG	Details	1050-1079 w/observations	Atm	Ice	Land	Ocean	---	Ocean Timeseries
CCSM4 2* Pre-Industrial Control Case Name: b40.1850.track1.2deg.003 Data Location: ESG	Details	501-530 w/observations	Atm	Ice	Land	Ocean	CCR	Ocean Timeseries
		501-520 - CCSM3 T42 Pre-Industrial Control	Atm	Ice	Land	Ocean		

PI Controls

- CCSM4: 1°, 2°, T31,
- CESM1: BGC, FASTCHEM, WACCM

20C runs

- All forcings-6 members
- single forcings

RCPs 2.6, 4.5, 6.0, 8.5

- 6 ensemble members

Paleoclimate Runs:

- Last Millenium, LGM, Mid-Holocene

Additional CESM1.0(CAM5) runs including 1° and 2° 1850, 20C and RCPs



CESM Project Updates/Announcements

Experiment Data Release

Information from <http://www.cesm.ucar.edu/experiments/cesm1.0/index.html>

CESM Earth System Grid Collection

CCSM4 and CESM1 long-term runs and post-processed single-field output, includes;

- CESM1 PI controls with BGC, FASTCHEM, WACCM
- Paleoclimate simulations
- CCSM4 20C and RCPs
- CCSM4 20C Single Forcing Simulations



CESM Project Updates/Announcements

Experiment Data Release CMIP5 Archive

- CCSM4 atm/ocn/ice/land output:
 - Preindustrial control, historical (20C) runs, RCP runs
- Atmospheric output from CCSM4 paleoclimate runs:
 - Mid-Holocene
 - Last Glacial Maximum
 - Last Millennium (some land data also)
- Atmospheric output from 1%CO₂ run available
- Atmospheric output from historical single forcing runs
- CESM1(BGC) and Decadal prediction runs coming soon
- Other runs (CESM-CAM5, etc) to follow



CCSM4/CESM J. Climate Special Collections

- 27 Papers available via AMS early-online release
- Numerous other papers in various stages of review
- Many CESM papers still in preparation
- Document major model components and numerous aspects of simulated variability and change



The screenshot shows the AMS Journals Online website. At the top, there are logos for the American Meteorological Society and AMS Journals Online. Below the logos, there are navigation links for Journals, Subscribe, For Authors, Information, and Online Help. A search bar is visible on the right side. The main content area is titled "CCSM4 Special Collection" and "CESM1 Special Collection". Under each title, there is a "Theme Description" section. The CCSM4 description mentions that the collection consists of papers analyzing results from the recently completed and released Community Climate System Model, version 4. The CESM1 description mentions that the second part of the collection has papers analyzing results from the recently completed and released Community Earth System Model, version 1. Below the descriptions, there is a section titled "The CCSM4/CESM1 Special Collection organizers are:" followed by the names and affiliations of Peter Gutz and Jim Harrell. At the bottom of the page, there is a list of abstracts for AMS articles, including titles like "Tropical Atlantic Bias in CCSM4" and "Climate system response to external forcings and climate change projections in CCSM4".

<http://journals.ametsoc.org/page/CCSM4/CESM1>

CESM Project Updates/Announcements

Model releases:

Recent Release (last week)

CESM 1.0.4

- Capability for Interannual Forcing for data atmosphere model
- WACCMX capability (vertical extension of WACCM through thermosphere/ionosphere ~500km)
- Released on 21 Feb, 2012
- More information:
http://www.cesm.ucar.edu/models/cesm1.0/tags/index.html#CESM1_0_4



CESM Project Updates/Announcements

Model releases:

Near Future Releases –

Spring (early June) Release CESM1.1.0

- Spectral Element (SE) Dynamical Core (HOMME) in CAM
- Control Runs (~1-degree) to include:
 - Short (~200 yr) control,
 - 1XCO2 run, 2XCO2 SOM runs
- Possible functionality additions: high resolution land datasets, chemistry in CAM5, orography generating tools, others



Proposal for Climate Simulation Laboratory (CSL) Computational Resources

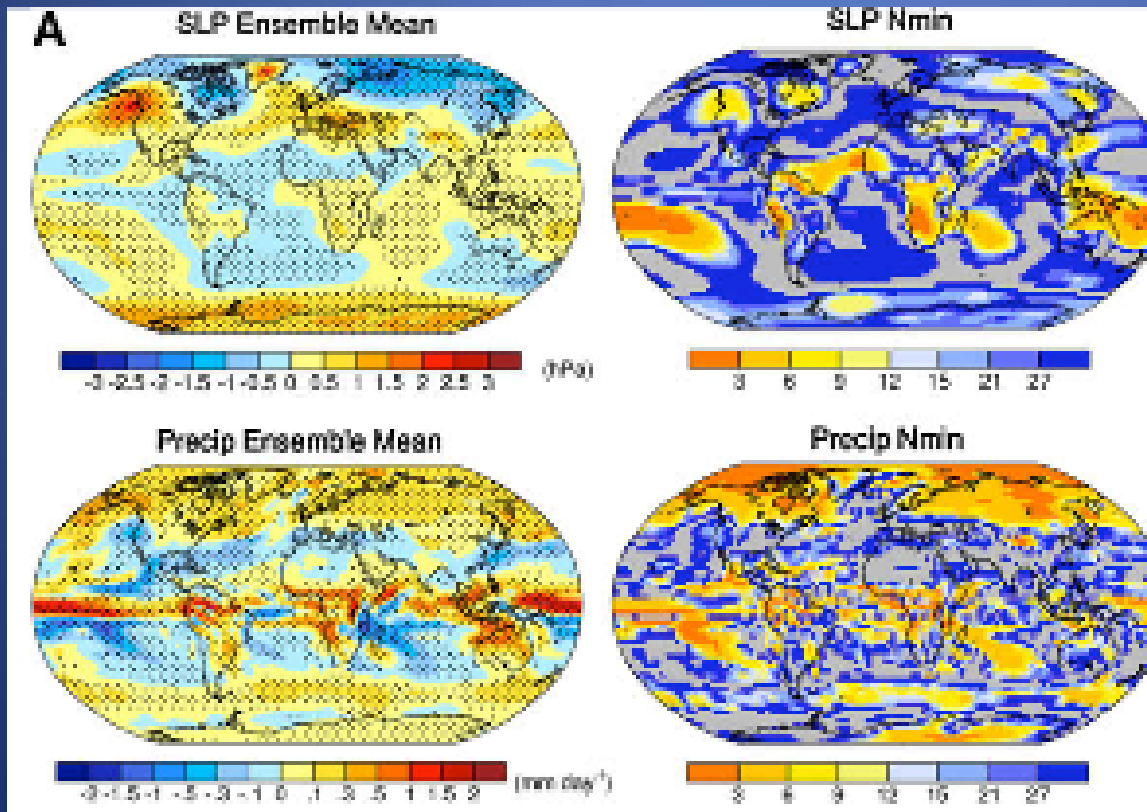
- Submitted 17 Feb, 2012
- Dedicated climate model computing facility that is supported by the USGCRP
- Yellowstone resources available at the NWSC Center – CSL proposal for August, 2012-January, 2014
- Working Groups requesting resources for Development and Production simulations
- Additional “Community Projects” are proposed
 - Broad cross-working group simulations with numerous scientific applications



Proposed Community Projects

Large Ensemble Project. 1950-2099 (RCP 8.5):

- 40 members, CESM-CAM5 with BGC
- 10 members, CESM-CAM5 with atmospheric chemistry
- 10 members, CESM-WACCM (2°)
- 10 members, CESM1.5



CCSM3 40-member ensemble mean epoch Differences for DJF (2051–2060 minus 2005–2014)

(Right) minimum number of members needed to detect a significant epoch difference response

From Deser et al., 2010

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Last Millennium Ensemble Project. 850-2005

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- 4 members, single forcings (GHG, Volcanic, Solar Variability)
- 1 member, land-use, orbital changes
- 2 members with WACCM5



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High Resolution Control Integration

- Spectral Element Dynamical Core,
- 0.25° Atm, 1° Ocean/Ice
- 300-year integration



Where we are heading

- Capability for Higher Spatial Resolutions
- New Earth System Component Capabilities
- Improved Model Processes



Increasing Model Capabilities

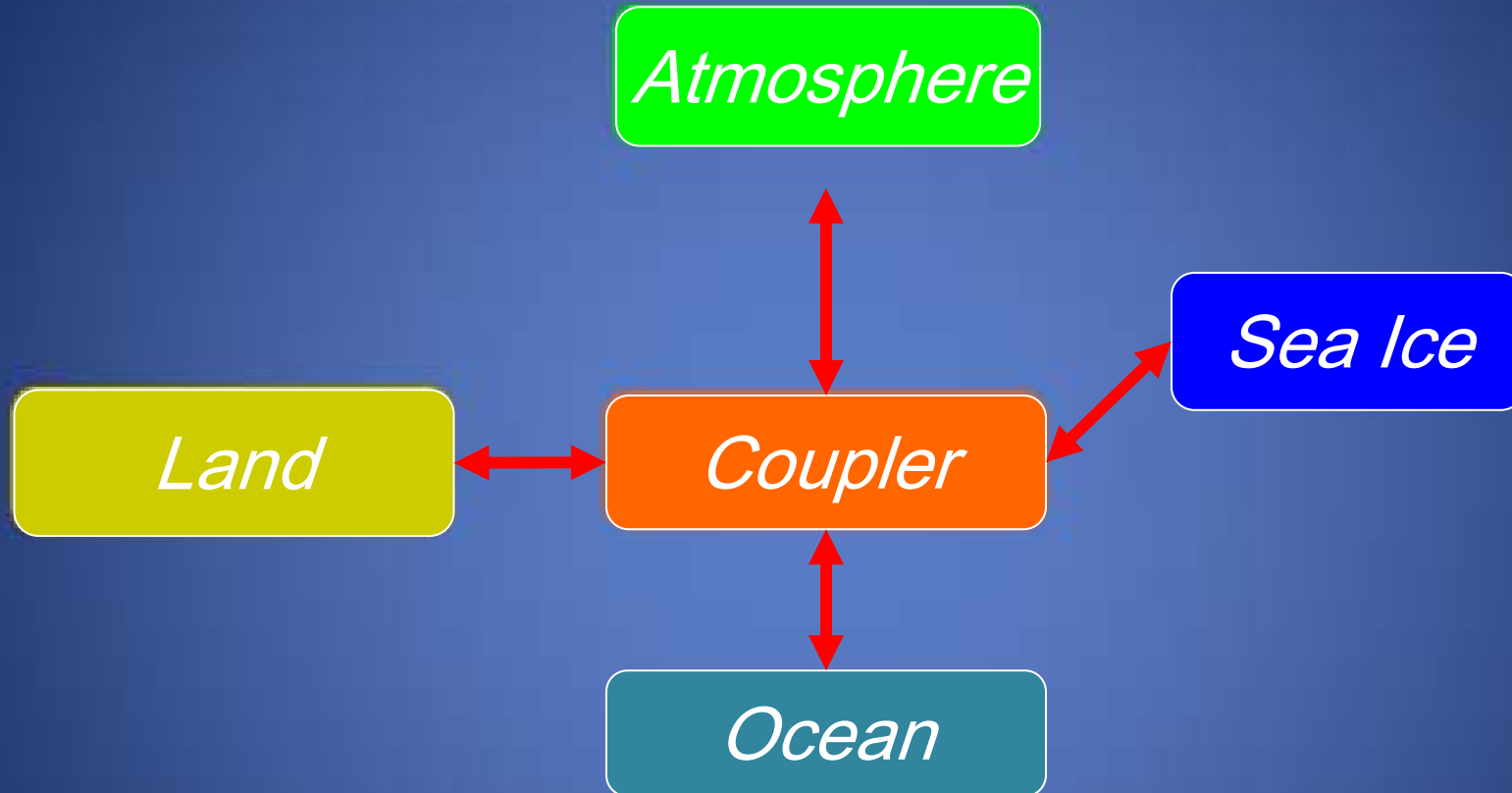
A subset of developments underway/being considered:

- Coupling to (Data Assimilation Research Testbed) DART, multi-instance capability
- Super-parameterization
- Ocean wave model (WaveWatch)
- Refined and regional grids
- Water and Carbon Isotopes
- New atmosphere dynamical cores
- New Land Ice dynamical cores
- And More...



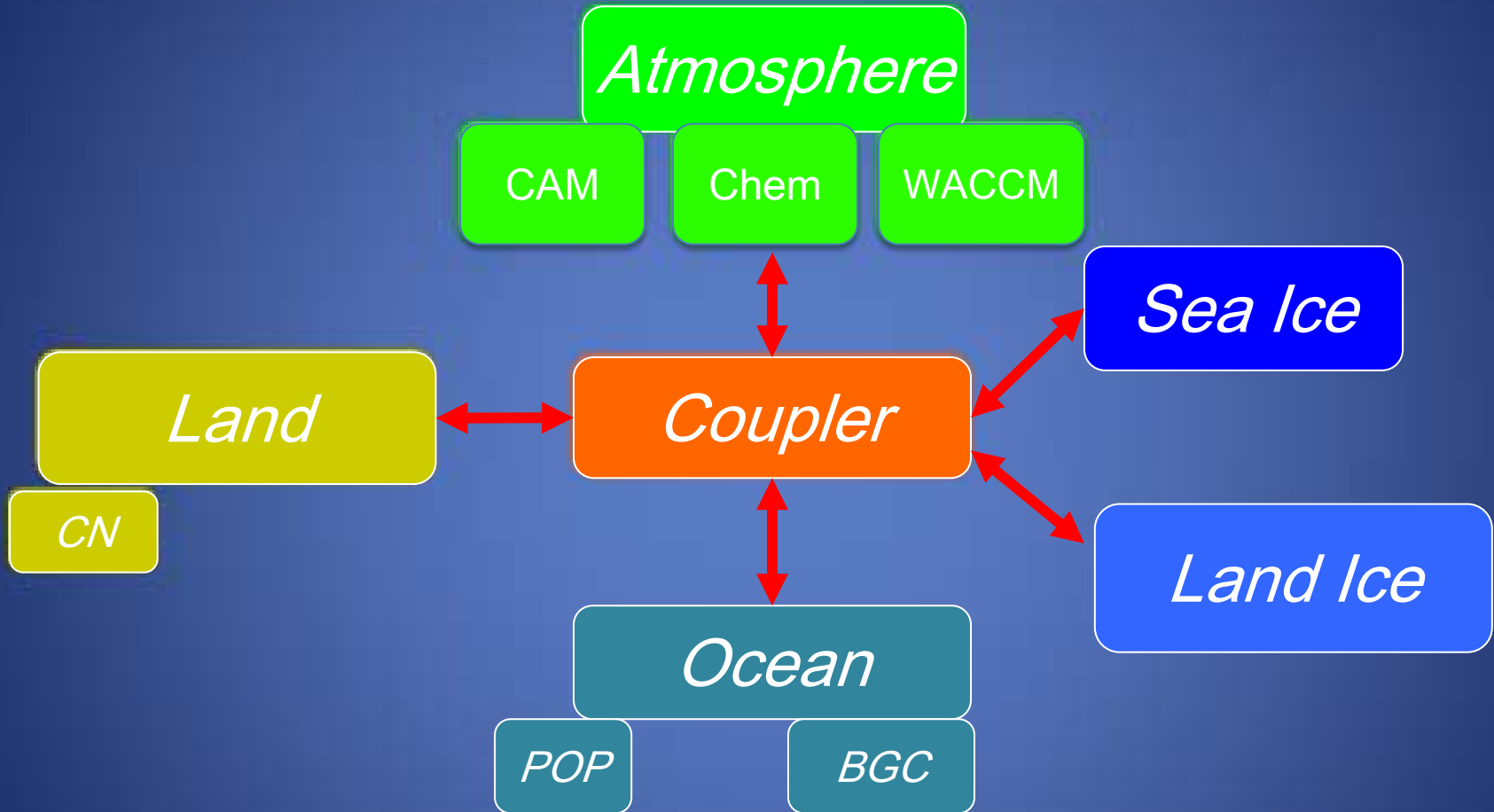
Increasing Components/Capabilities

Community Climate System Model

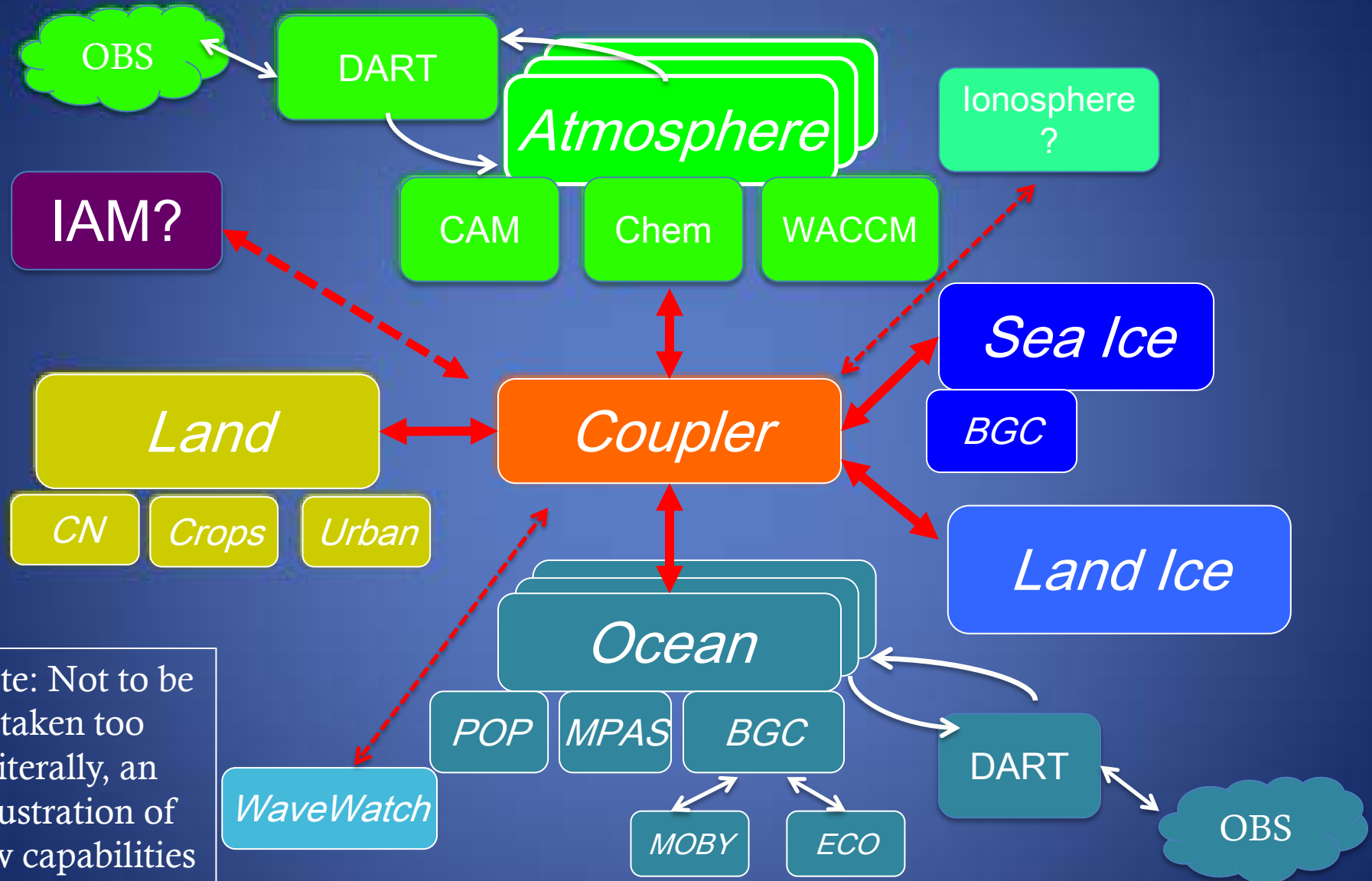


Increasing Components/Capabilities

Community Earth System Model



Increasing Components/Capabilities



Capability for Higher Resolution/Refined Grids

SE Progress on unstructured grids

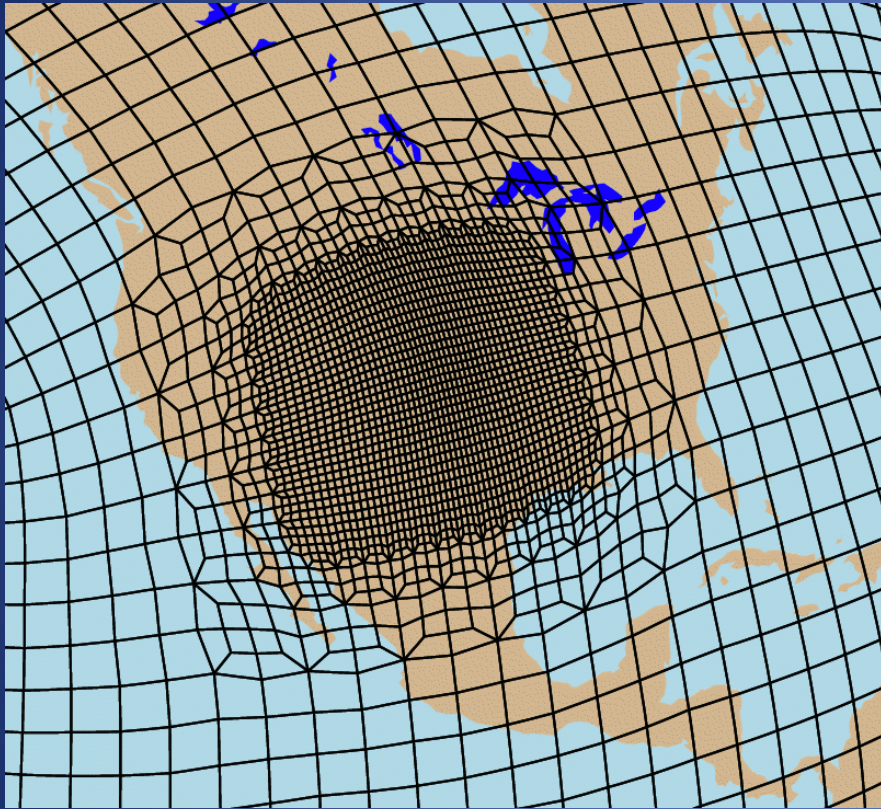
Land can run on same grid

User sets up customized input files
as pre-build step

(new tool chain capability)

Model challenges remain –

- Need for scale-aware parameterizations
- How to appropriately couple
- Considerable development work targeted at this



Regional refinement
(1° to $1/8^\circ$ over USA)

New Developments Enable New Science

For Example:

- Assess the importance of new feedbacks and interactions
- Examine regional variability/change
- Assess predictability on interannual-decadal timescales
- Apply new tools to studies of climate variability and change



Questions?



Extra Slides



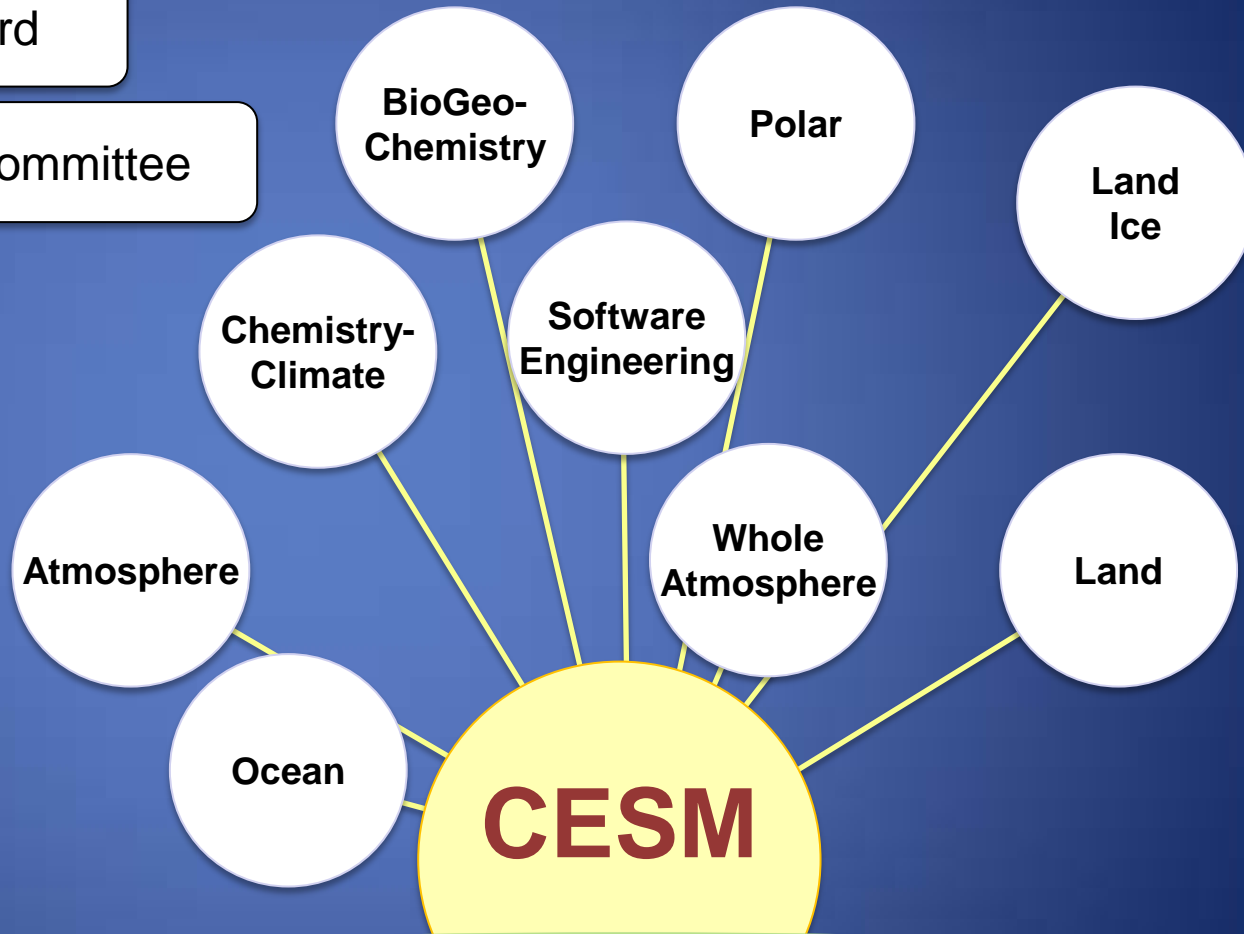
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