

# CESM Societal Dimensions Working Group

June 21, 2012  
CESM Workshop



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



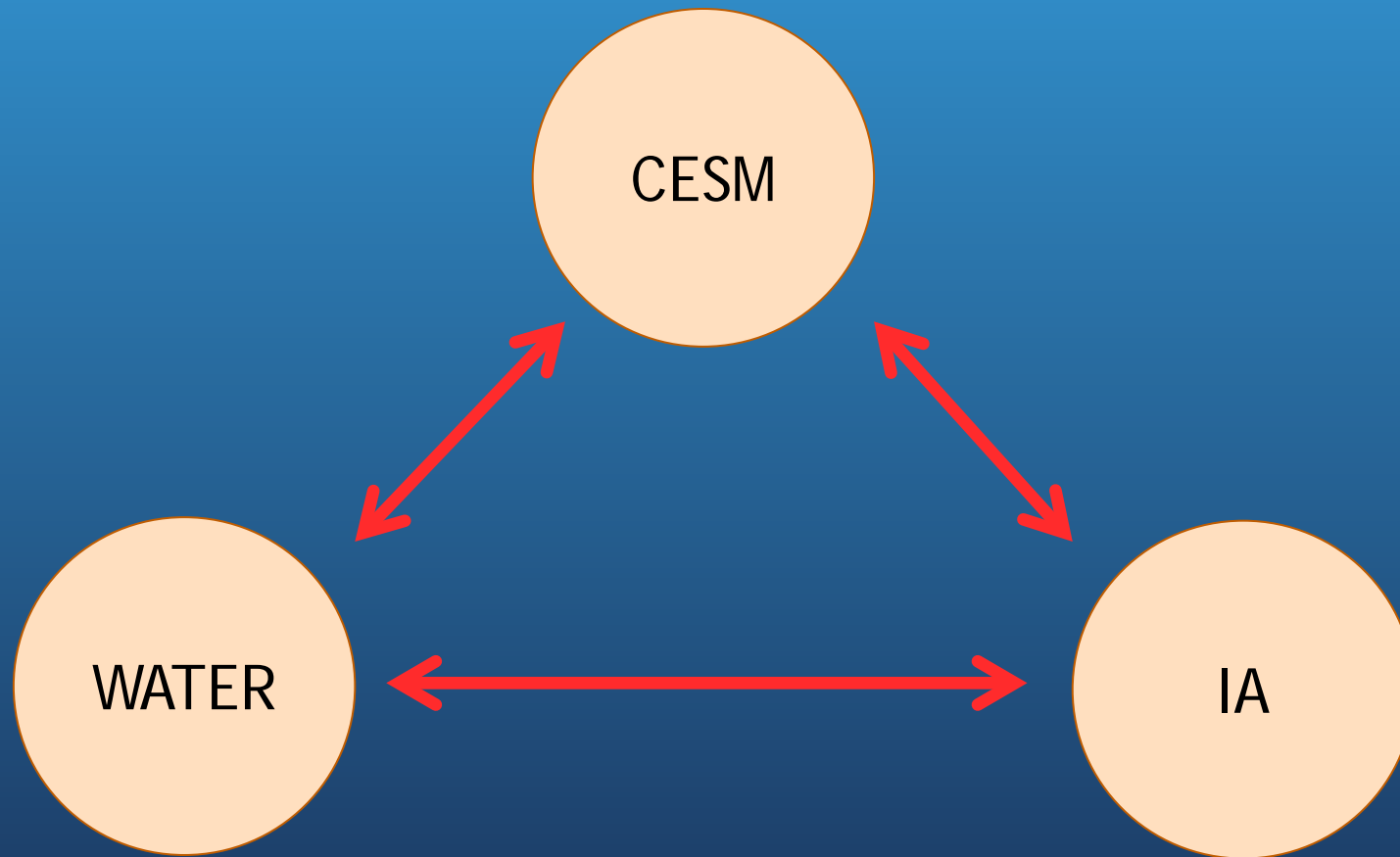
# SDWG Background

- Growing interest within CCSM/CESM to better connect the modeling activity to climate-related societal issues
  - Initial meeting at the 2010 CCSM Workshop
  - May 2011 scoping workshop
  - White paper produced: Focus on Water and IAM
  - Working Group approved by CCSM SSC, July 2011
  - First SDWG meeting Feb 2012
- Co-chairs: Bill Gutowski (ISU), Brian O'Neill (NCAR),  
Bill Collins (LBNL), Lawrence Buja (NCAR)
- Next working group meeting: Late Feb 2013



# CESM and Societal Dimensions

Develop collaborations between the CESM community & those working on issues relating societal dimensions and climate change



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



## Community Earth System Model

Google Custom Search Search advanced

## CESM SOCIETAL DIMENSIONS WORKING GROUP

***Our Mission***

The overall goal of the Societal Dimensions Working Group is to enhance CESM and its application in order to improve understanding of the interactions between human and earth systems. The group was started in 2011 with a focus on interactions between CESM and two research and user communities: integrated assessment modeling and water management. More broadly, the group's mission is to foster and sustain dialogue between the CESM community and other communities of researchers and practitioners studying interaction of society and climate change and variability and implementing measures to adapt to or mitigate climate climate.

***White Paper on Societal Dimensions of Earth System Modeling***

July 5, 2011 [[white paper](#)]  
November 9, 2011 [[presentation](#)]

***Upcoming Meetings***

Societal Dimensions sessions, 27 - 28 February 2012. [[Agenda](#)] [[Water Utility Briefing Paper](#)] [[CSL Proposal](#)] [[SDWG summary](#)]

***17th Annual CESM Workshop***

The 17th Annual CESM Workshop will held at [The Village at Breckenridge](#), Breckenridge, CO, 18 - 21 June 2012. [[event details](#)] [[agenda](#)] [[webcasts](#)] [[questions](#)]

Review [archives](#) of past meeting agendas, reports, and presentations.

***Co-Chair Contact Information:***

## 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).

## RELATED

- [CESM Working Group Co-chairs](#)
- [CESM Working Group Co-Chairs Terms of Reference](#)

## CONTACT INFORMATION

- [Email: CESM Working Group Co-Chairs](#)
- [Email: CESM Contact](#)
- [Email: SDWG members](#)
- [Subscribe to CESM SD List](#)

## Where we are today:

### Feb 2012 Initial WG Meeting:

- Top down with lots of discussion to get started

### This and future SDWG meetings:

- Mixed Bottom-up & top-down
  - Bottom up: communicate work on any relevant topics with a societal dimension
  - Top down: focus on highest priority areas, as identified by community
- Usually time for more discussion at Feb meeting



# EaSM Proposal: Advanced Climate and Regional Model Validation for Societal Applications

L. Buja (NCAR), W. Gutowski (ISU),  
L. Kaatz (Denver Water), B. Brown (NCAR)



# Metrics for Assessing Global/Regional Climate Models

- What is the added value provided by higher resolution in general and by RCM simulation in particular?
- Where and when do the metrics indicate poor or superior performance by a climate model?
- What physical processes occur during episodes of either poor or superior performance?

→ What is the “actionable” information?

→ Can we inform future CESM development?





# CORDEX/North America

Convergence of interests might motivate support for CORDEX/North America:

- water utilities, which want to know how climate change may affect the demand for, management of, and financing for water resources in the future,
- the agricultural research community, which is exploring how to model agricultural futures in the face of climate change,
- the climate science community, which studies the modeling of climate at regional scales and assesses the value and methods of climate downscaling.
- other impacts community members such as those investigating impacts on urban areas, health & energy





# Opportunities

- ✧ Possible pilot projects? Use existing CESM output to explore issues of scale, uncertainty, processes.
  - A scale analysis of threshold exceedances for variables of interest to water management decisions
  - Power spectra of relevant variables of interest
  - Description of CESM simulations in language understandable by, e.g., water managers
- ✧ Sea-level rise from CESM: Impacts on coastal infrastructure, water resources, etc.
- ✧ Other proposal opportunities (e.g., USAID)

Can we justify an NCAR liaison?  
... or are there volunteers?



## SDWG Proposed Water Runs:

Improving CESM Hydrology by reducing model uncertainty and bias  
(Community Runs 2A1, 2A2)

Providing relevant Hydroclimate variables for downscaling & decision making  
(Community Runs 2A4, 2B1)

Simulating the impacts of climate change on important precipitation systems, focusing on short timescales, extremes & means,  
4AB American monsoon and Droughts in the American southwest  
**proposal to retask these to WRF downscaled runs**

Experiment	Model Configuration	# runs	# of years	Core hour / year	Total core-hours	Total data volume in TB	Priority
2A1 Ensembles	B, CESM-CAM5 1°	5	150	910	825000	23	ABC
2A2 Obs/Paleo	B, CESM-CAM5 2°	2	1155	280	646800	43	B
2A3 TropPac							
2A4 Decadal	B, CESM-CAM4 1°	60	10	500	300000	19	C
2B1 Regional	CESM .25°	1	500	56000	840000	46	A
<del>4A Monsoon</del>	<del>B, CESM 1°</del>	<del>5</del>	<del>250</del>	<del>910</del>	<del>1137500</del>	<del>33</del>	<del>BC</del>
4B Drought	B, CESM 1°	5	250	910	1137500	33	A

# IAM topics of interest

- Land use
- Urban areas and energy use
- Water in IAMs
- Forestry management
- Assessing renewable energy potentials
- Air quality, climate, and impacts



# Land Use: Overarching Questions

- How sensitive is regional climate to differences in land use and land cover change?
- How sensitive are land use decisions to differences in regional climate change?



# Possible Near-Term Activities

- Test sensitivity of climate outcomes in the Representative Concentration Pathways (RCPs) to land use assumptions
- Examine the climate implications of IAM scenarios that make alternative assumptions about agricultural productivity
- Test the implications of full IAM-CESM coupling vs one-way coupling



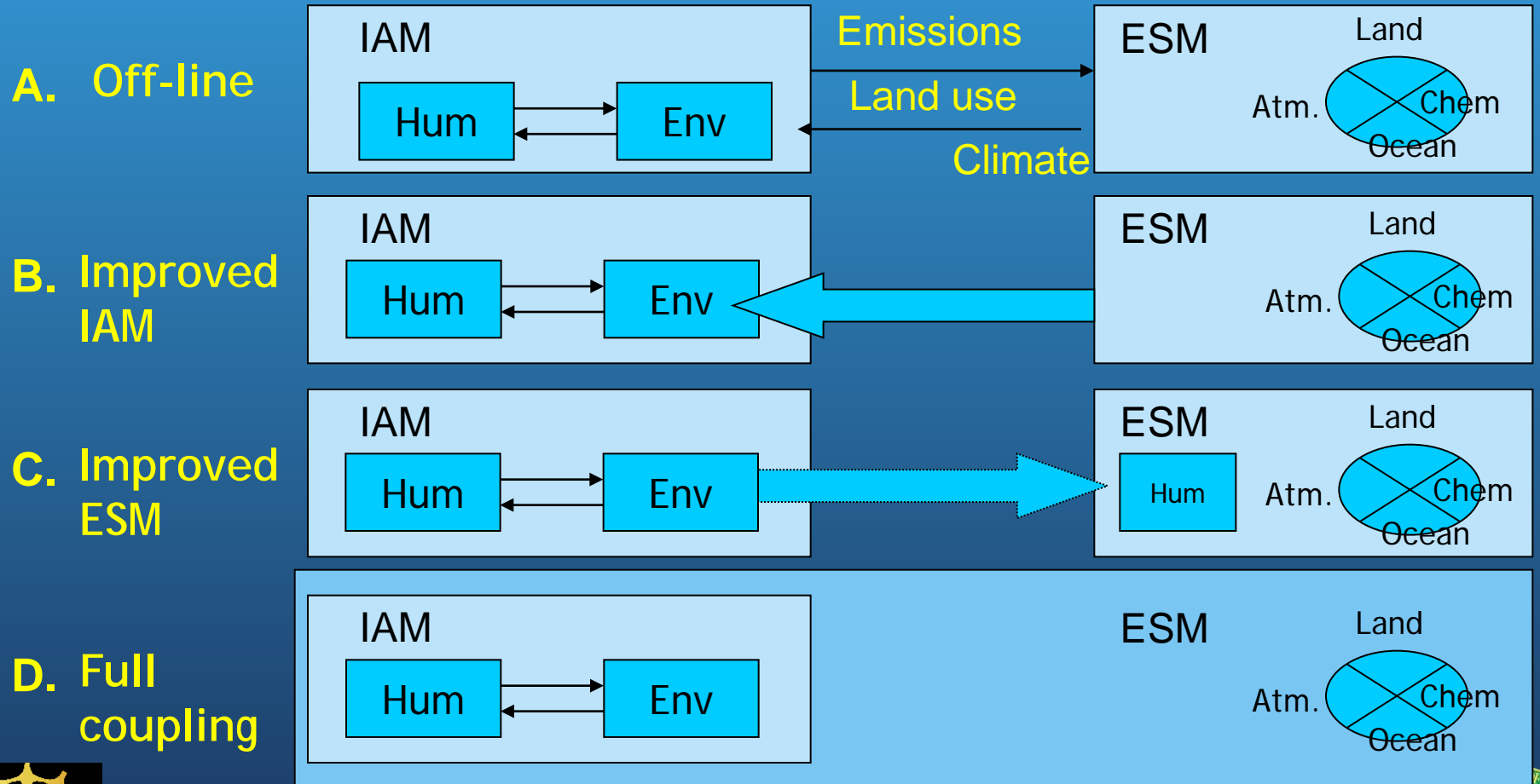
## SDWG IAM Runs:

- IAM: Linking new CLM Agricultural, Forest Systems & Ecosystem Dynamics and Integrated Assessment Modeling (1A, 1B)
- 3A. interpreting IA model land use scenarios in CESM,
  - 3B. assessing the importance of regional climate feedbacks,
  - 3C. assessing the importance of model coupling, and
  - 3D. evaluating possible future activities in the area of air quality.

Experiment	Model Configuration	# runs	# of years	Core hour / year	Total core-hours	Total data volume in TB	Priority
1A Land use and land cover change representation	B_1850_CN (0.9x1.25_gx1v6)	36	100	300	1080000	72	A
1B	ICN (0.47x0.63)	36	100	60	216000	15	A
3A GLM vs. Direct IAM land use	B_1850_CN (0.9x1.25_gx1v6)	20	100	295	590320	39	BC
3B regional land use feedback	B_1850_CN (0.9x1.25_gx1v6)	20	100	295	590320	39	A
3C iESM simulations	B_1850_CAM5 (0.9x1.25_gx1v6)	12	100	910	1092000	32	A
3D air quality-atmospheric chemistry	B_1degree_CAM5 _STRATTROP	4	100	2000	800000	20	BC



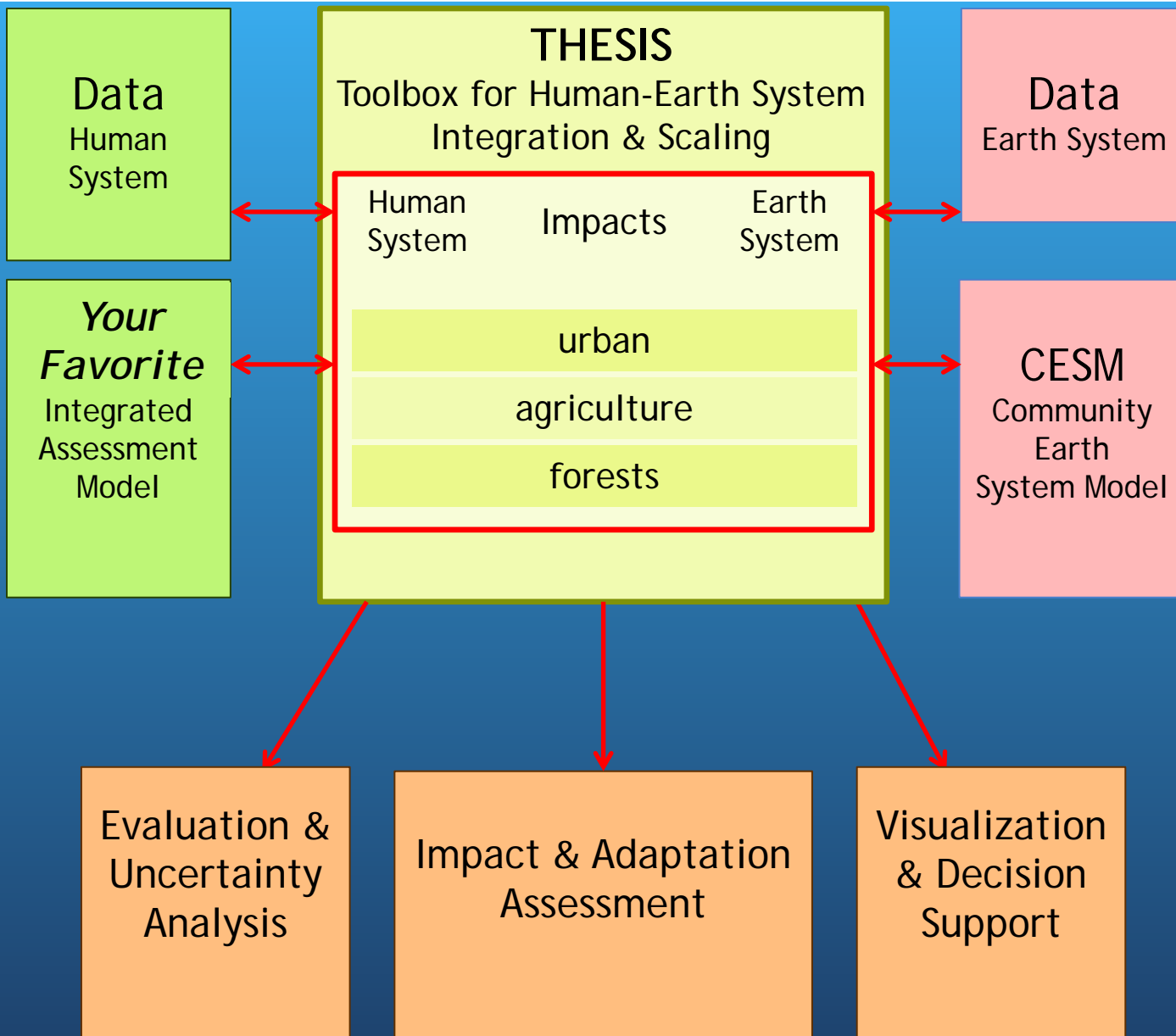
# Types of IAM-ESM interactions



Based on van Vuuren et al., 2012, ERL.

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





EaSM2 Proposal. PI: O'Neill (NCAR); Co-PIs: Lawrence, Levis, Oleson (NCAR), Feddema (U. Kansas), Jain (U. Illinois), Barton (ASU)

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



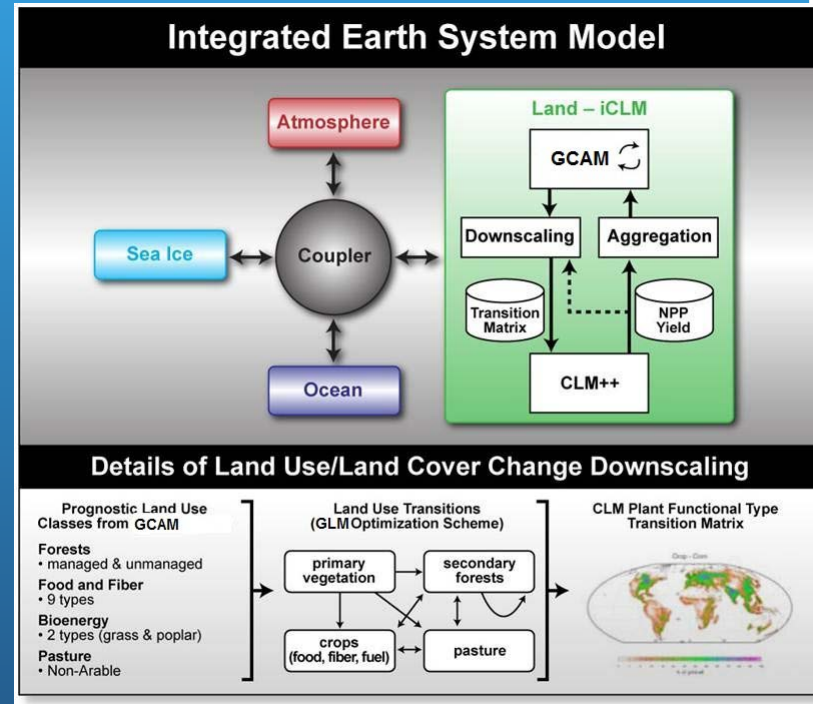
# Three Major Goals of iESM

- Create a first generation integrated Earth System Model (iESM) with both the human components of an IAM and a physical ESM.
- Further develop components and linkages within the iESM and apply the model to improve our understanding of the coupled physical, ecological, and human system.
- Foster a community of users and applications of iESM.

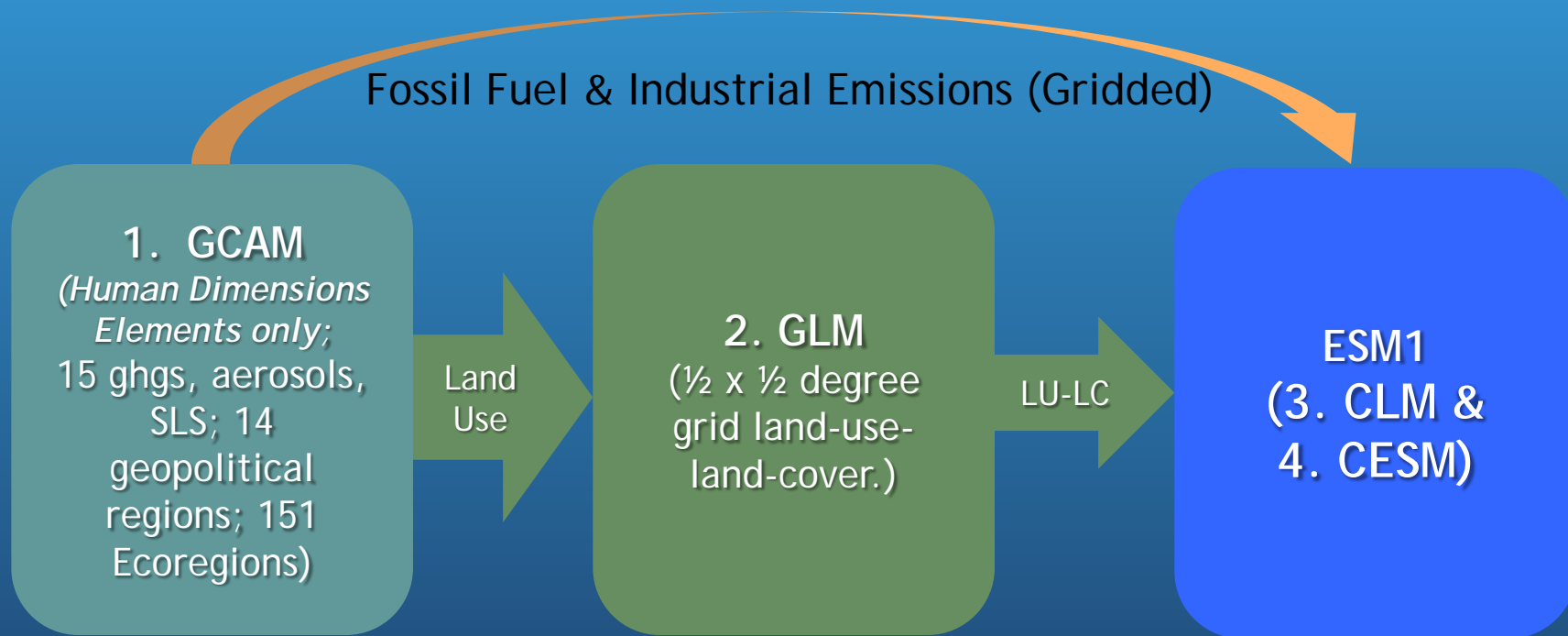


# What core capabilities does this provide?

- Ability to factor climate change effects into analyses of mitigation strategies.
- Quantification of resource demands required to address climate change.
- Determination of how coupling affects the climate-energy-land system:  
*Comparison to uncoupled approaches*
- The development of an iESM means that fully consistent analysis of potential future climate change, emissions mitigation options, and impacts and adaptation options will be possible.



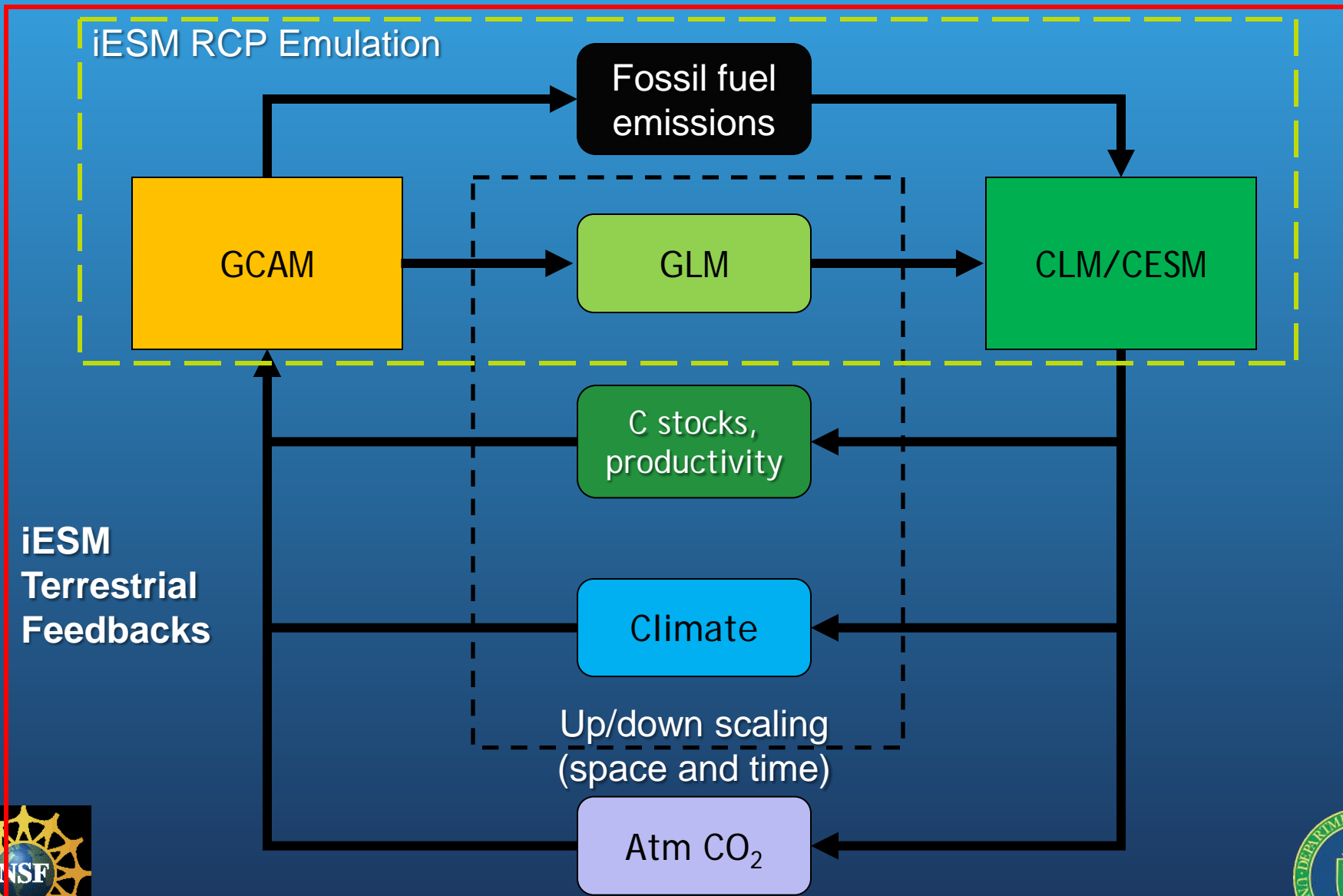
# iESM = 4 Models: GCAM, GLM, CLM, & CESM



This provides the same capability as the RCP+CMIP process.



# Exploratory simulations with iESM





The End



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

