

COMSES@CSDMS: A DYNAMIC DUO

Michael Barton, Director, Network for Computational Modeling in Social and Ecological Sciences

COMSES NET

- Parallel • organization to **CSDMS**
- Focus on social and • ecological sciences



Bonjour & Google & Apple Stuff & ASU Stuff & classes & GRASS & NSF&NIH & Cloud & Clippers & programming & NETGEAR Gateway

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COMMUNITY CYBERINFRASTRUCTURE TO PRESERVE COMPUTATIONAL MODELS & THEIR DIGITAL CONTEXT + EDUCATIONAL MATERIALS, TUTORIALS AND FAQ'S ON AGENT BASED MODELING

COMSES Net is an international network of researchers, educators and professionals with the common goal of improving the way we develop, share, and use agent based modeling in the social and life sciences. Lea

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Resources for Modelers



in a reproducible containerized environment.

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CoMSES Ne

Preserve the complete digital pipeline used to Comprehensive lists and tutorials on agent

derive a publishable finding. Other researchers based modeling platforms, documentation will be able to discover, cite, and run your code standards, educational materials (curricula, lesson plans, examples of formative or summative assessment), guides to good practice for reuse and reproducibility



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Upcoming Events

ill test.comses.net

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CoMSES Net | The Network for Computational Modeling in Social and Ecological Sciences



Featured Content

The Hohokam Trade Networks Model focuses on key features of the Hohokam economy to explore how differences in trade network topologies may show up in the archaeological record. he model is set in the Phoenix Basin of central Arizona, AD 200-1450.

Our Community

http://www.comses.net

INTERNATIONAL SCIENTIFIC NETWORK



Sessions by Continent







1817 Affiliate Members & 307 Full Members

COMPUTATIONAL MODEL LIBRARY

- 412
 published
 models
- Other resources for modeling science



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COMSES CORE CENTER

- 'Spoke' in NSF national big data network
- Technology and best practices for open science
- Transparency, reproducibility, and reuse in scientific computation
- Topic of Allen Lee's clinic



MODELING EARTH & HUMAN SYSTEMS



- Welcome to this interdisciplinary meeting of modeling scientists
- We need the dynamic duo of Earth and human systems modeling today

WHY WE NEED THIS DYNAMIC DUO

- A few centuries ago, most people lived in small communities
- An individual could observe social and natural phenomena and extrapolate the consequences of their actions on fellow humans and the natural world



• This is no longer the case

A UNIQUE SOCIAL WORLD

- In a few short millennia, humankind has transformed from a normal terrestrial animal to a unique global phenomenon.
- 7.5+ billion humans
- Over half live in urban hives of millions of individuals



A UNIQUE SOCIAL WORLD



- Digital media and rapid transportation now connect humanity economically, socially, and culturally in a planetary network of multiple, crosscutting ties.
- A highly complex socialnatural system
- Unprecedented for any organism in earth's history.

A UNIQUE SOCIAL WORLD



- The multi-dimensional, multi-scale causality and non-linear dynamics of this global complex system
 exceed our innate
 abilities to anticipate the consequences of decisionmaking
- It is also now a major driver of Earth's biophysical environment

A COUPLED NATURAL & HUMAN PLANET





- > 50% of land in crops or pasture
- > 50% of forests cleared; more reforested



A COUPLED NATURAL & HUMAN PLANET

- Coastlines engineered
- > 50% of fresh water used and 6x more water stored
- More N cycled
- More sediment transported



MODELING EARTH SYSTEM TODAY



 But our ability to model the processes that drive Earth systems does not yet represent this reality

MODELING EARTH SYSTEM TODAY

ice & snow

oceans

atmosphere

terrestrial biogeochemistry





Human System Models

THE REAL EARTH SYSTEM (A SMALL PART)

CH₄



CH₄

Pedogenesis

water control

 CO_2

sediment

flux

Sec.

NEXT GENERATION MODELING FOR PLANETARY MANAGERS





- Modeling Earth systems without people, and people without Earth systems is getting the science wrong
- The stakes for getting it right are high and growing

NEXT GENERATION MODELING FOR PLANETARY MANAGERS



- In an Earth dominated by rapidly changing, telecoupled human and biophysical processes...
- we can no longer depend on human intuition and simple statistics to plan our future.
- Need next generation data-driven science and modeling to enable us to sustainably manage dynamics of a planetary socio-ecologicaltechnological system



COMSES/CSDMS COLLABORATION

- Six years ago, Jai and I began discussions about need for integrative modeling of human and earth systems.
- Led to series of collaborations between CSDMS and CoMSES
 - Human Dimensions FRG, co-chaired by CSDMS/Future Earth and CoMSES Net members
 - Participation and clinics by CoMSES Net members in CSDMS annual meetings
 - Workshop on integrative modeling organized by HDFRG, May 2016
 - Collaboration with Future Earth on other initiatives for integrative modeling
 - CoMSES Net invited to co-sponsor this year's CSDMS annual meeting



NEXTGEN MODELING INITIATIVE

- Especially important activity has been planning for a next generation modeling environment that can support integrative simulation of human and Earth system dynamics
- Meetings of modeling scientists in Boulder, Kyoto, Potsdam in 2016 & 2017
- Also discussed at NSF ABM symposium in San Diego (March 2017) and topic of this CSDMS annual meeting
- We need to move beyond discussion and begin to create environments for integrative modeling of natural and human systems



LOOKING AHEAD

- You are on the front line of new directions in modeling science
- Creating the information tools we need to understand our planet and manage it sustainably
- Need to combine our expertise in simulating biogeochemical and social processes and their important feedbacks at multiple scales



LOOKING AHEAD

- Breakout groups today: modeling coupled Earth & human systems
- Other keynotes, clinics, and breakouts deal with these topics
- How can CSDMS, CoMSES Net, and other modeling scientists pool technologies and intellectual capacity to begin to create the NextGen modeling systems we need?
- Need you to discuss issues & ideas, propose goals & solutions
- What are the next steps?

