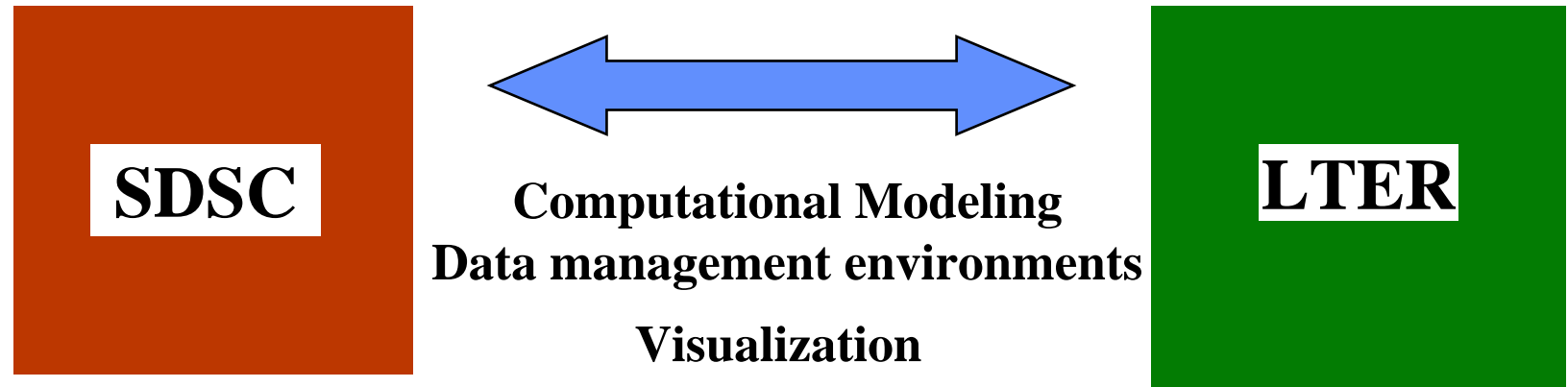


***Strategic Partnership:
San Diego Supercomputer Center (SDSC),
National Partnership for Advanced
Computational Infrastructure (NPACI),
Long Term Ecological Research (LTER)
Network***

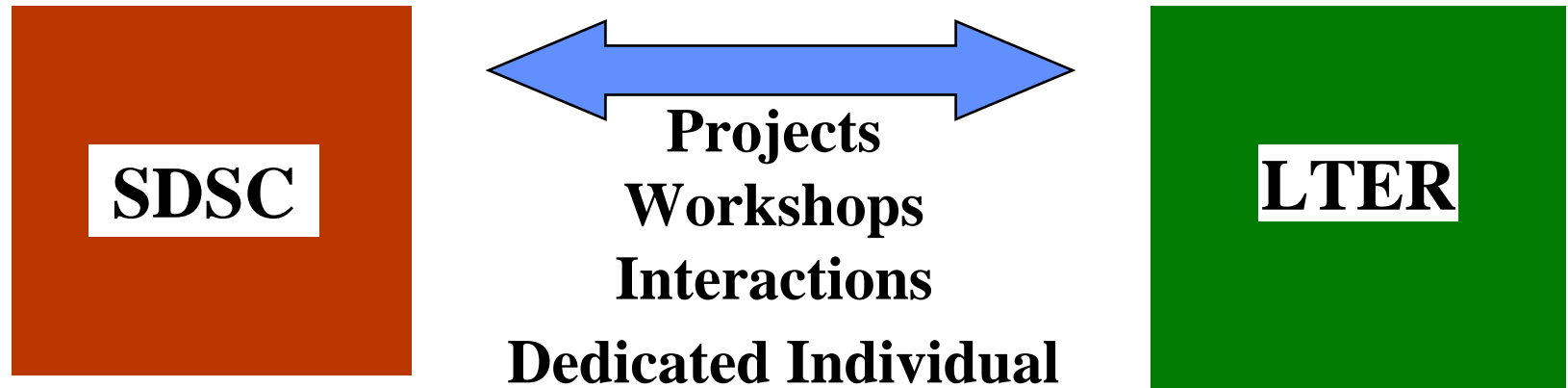
**Peter Arzberger
Deputy Director, SDSC
Executive Director, NPACI
<http://www.npaci.edu>**

SDSC and LTER Network Office: Partnership Goal



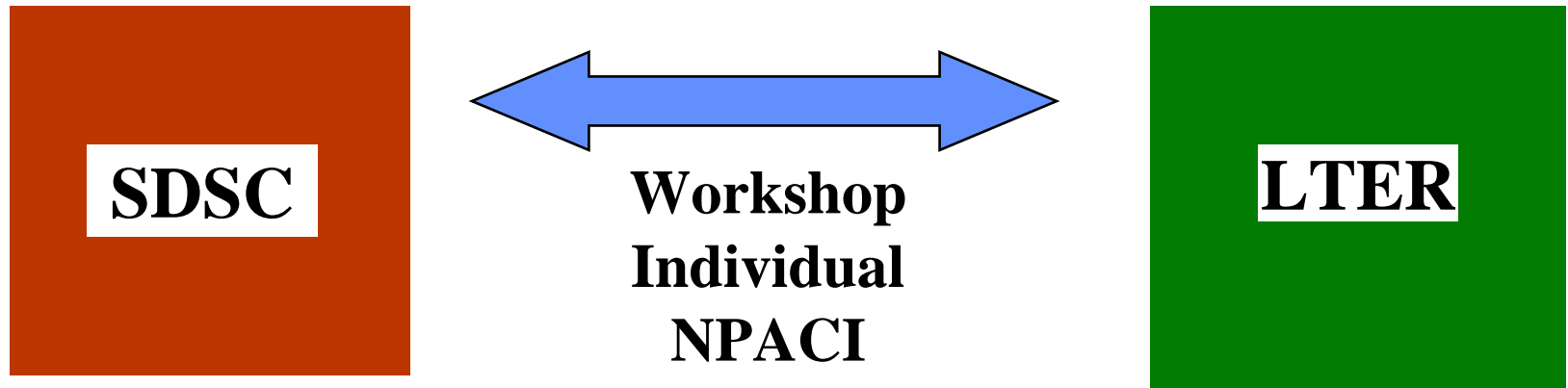
*Conduct and catalyze long-term ecological research by
promoting and disseminating new technologies
to the LTER community*

SDSC and LTER Network Office: Partnership Strategy



Conduct and catalyze long-term ecological research by promoting and disseminating new technologies to the LTER community

SDSC and LTER Network Office: Partnership Activities



*Conduct and catalyze long-term ecological research by
promoting and disseminating new technologies
to the LTER community*

Biological Scale Process Modeling Workshop on Modeling of Ecosystem Processes at Regional Scales

- **Dec 15 - 17, 1998, San Diego**
- **Co-Sponsored**
 - LTER Network Office
 - NPACI Earth Systems Science Thrust
 - National Center for Ecological Analysis and Synthesis
- **Organizers**
 - John Helly
 - Stuart Gage
 - Bob Waide

Biological Scale Process Modeling Workshop on Modeling of Ecosystem Processes at Regional Scales (Cont.)

- **Desired results:**
 - establish set of regionalized models of ecosystem processes to be used in predictive experiments of testable hypotheses
 - determine and establish computational infrastructure to support these experiments and their analysis.
 - Identify and pursue opportunities for collaboration between the biodiversity and modeling communities
- **Projects**

Biological Scale Process Modeling

Workshop on Modeling of Ecosystem Processes at Regional Scales: Participants

- **Jianguo Wu: Central Arizona - Phoenix Urban**
- **Joseph Vallino: Plum Island Sound; Artic Tundra**
- **Debra Coffin: Sevilleta-Jornada**
- **Scott Martens: Sevilleta**
- **Paul Bolstad, Coweeta Hydrologic Laboratory**
- **Mark Harmon: Andrews Forest**
- **John Yarie: U Alaska**
- **Jonathan Foley, Northern Temperate Lakes**
- **Tamera Minnick, Cedar Creek**
- **Guofan Shao: Virginia Coastal Reserve**
- **Roelof Boumans: Baltimore Ecosystem Studies**
- **John Thomlinson, Luquillo**
- **Patrick Bourgeron, Niwot Ridget**
- **William Parton, CPR-Shortgrass Steppe**
- **James Brunt: LTER Network Office**

Biological Scale Process Modeling Workshop on Modeling of Ecosystem Processes at Regional Scales: Participants

- **Leonard Krishtalka, Natural History Museum and Biodiversity Research Center, U Kansas**
- **Dave Viegles, U Kansas**
- **Terry Yates, U NM**
- **Allen Allison, Bishop Museum**
- **Scott Miller, Biodiversity and Conservation Program (ICIPE)**
- **Joe Eastman, Colorado State**
- **David Stockwell, SDSC**

Partnership of Partnerships

SDSC

**National
Partnership for
Advanced
Computational
Infrastructure**

LTER

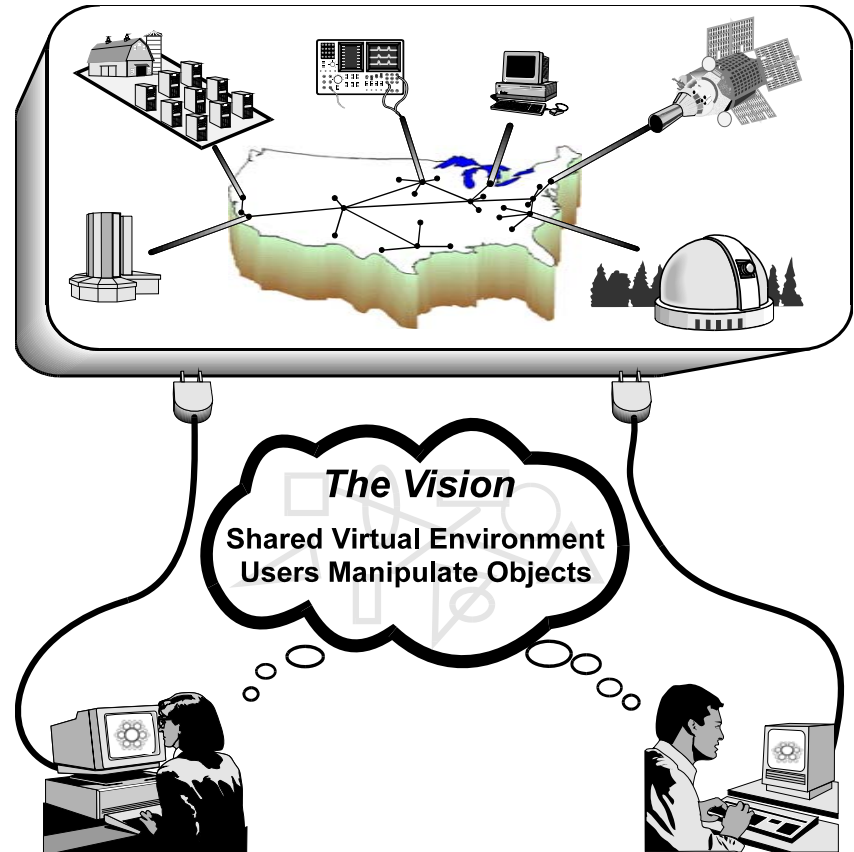
*Develop and provide advanced computational infrastructure
for the nation*



NPACI Is Building a National Infrastructure to Benefit the Entire Academic Research Community

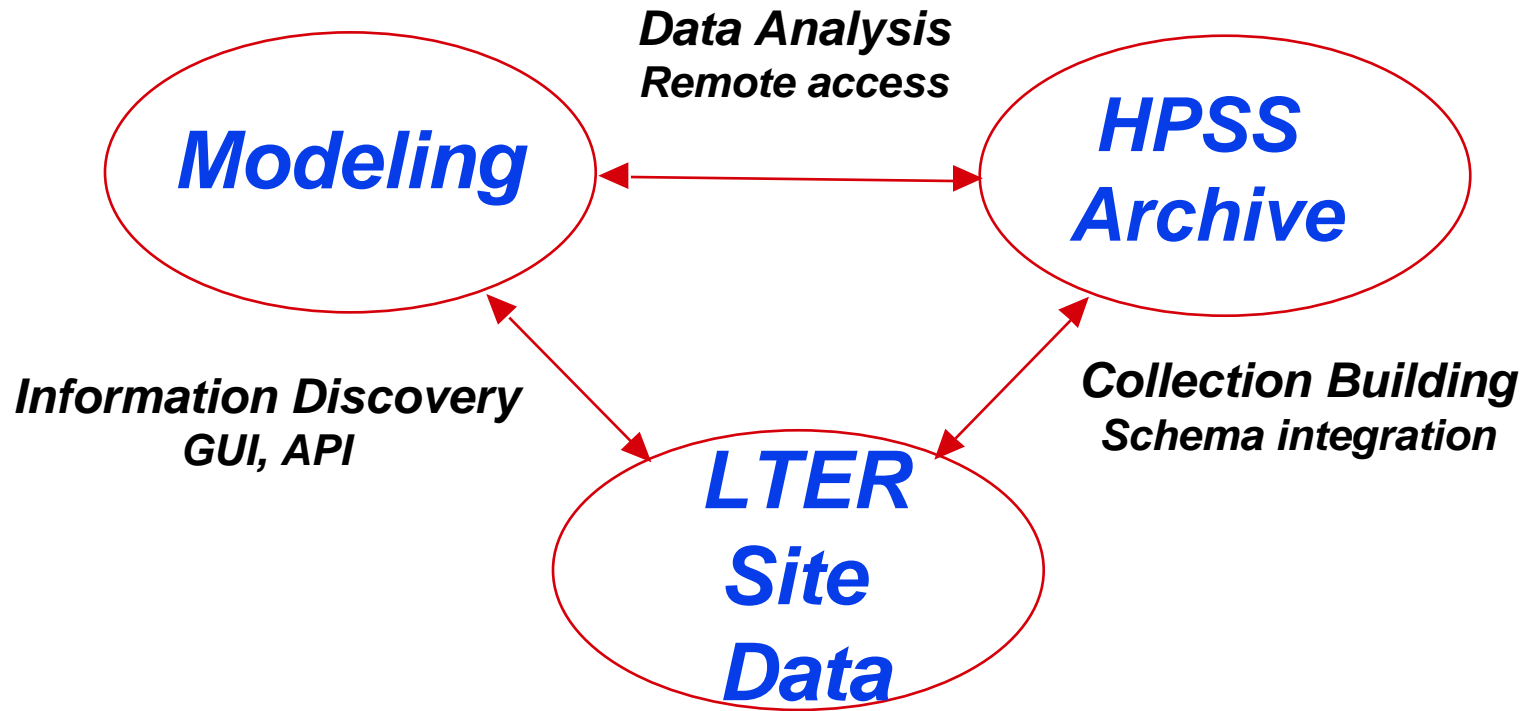
- **Creating a ubiquitous, continuous, pervasive HPC infrastructure**
- **Looking ahead to multi-tera-scale compute platforms**
- **Accelerating data-intensive computing**
- **Broadening impact of computational science and engineering**
- **Promote multidisciplinary interactions**

Our vision: One transparent system

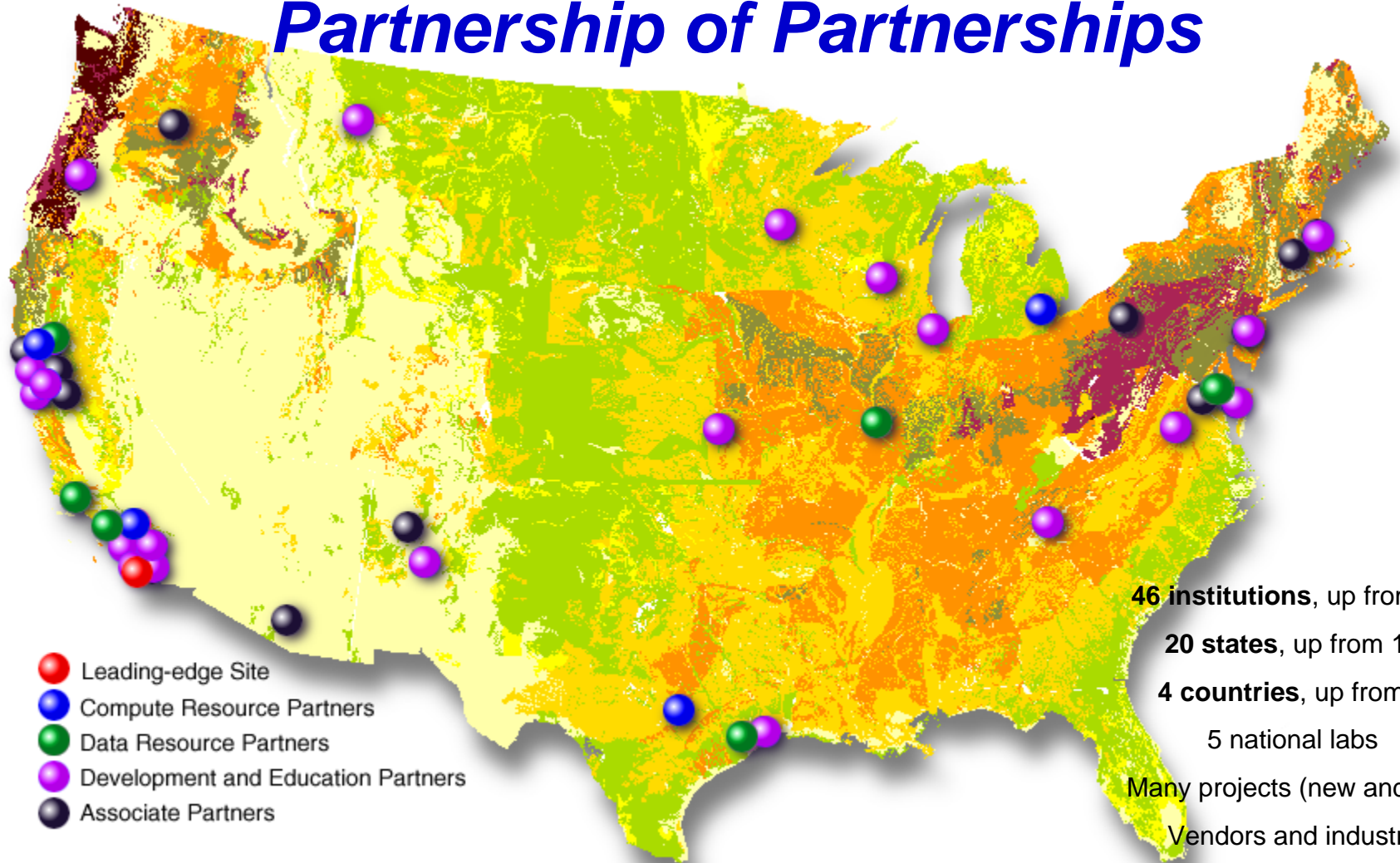


- ◆ High-performance
- ◆ Distributed
- ◆ Secure
- ◆ Fault-tolerant
- ◆ Transparent

Information Based Computing



NPACI Is Highly Leveraged National Partnership of Partnerships

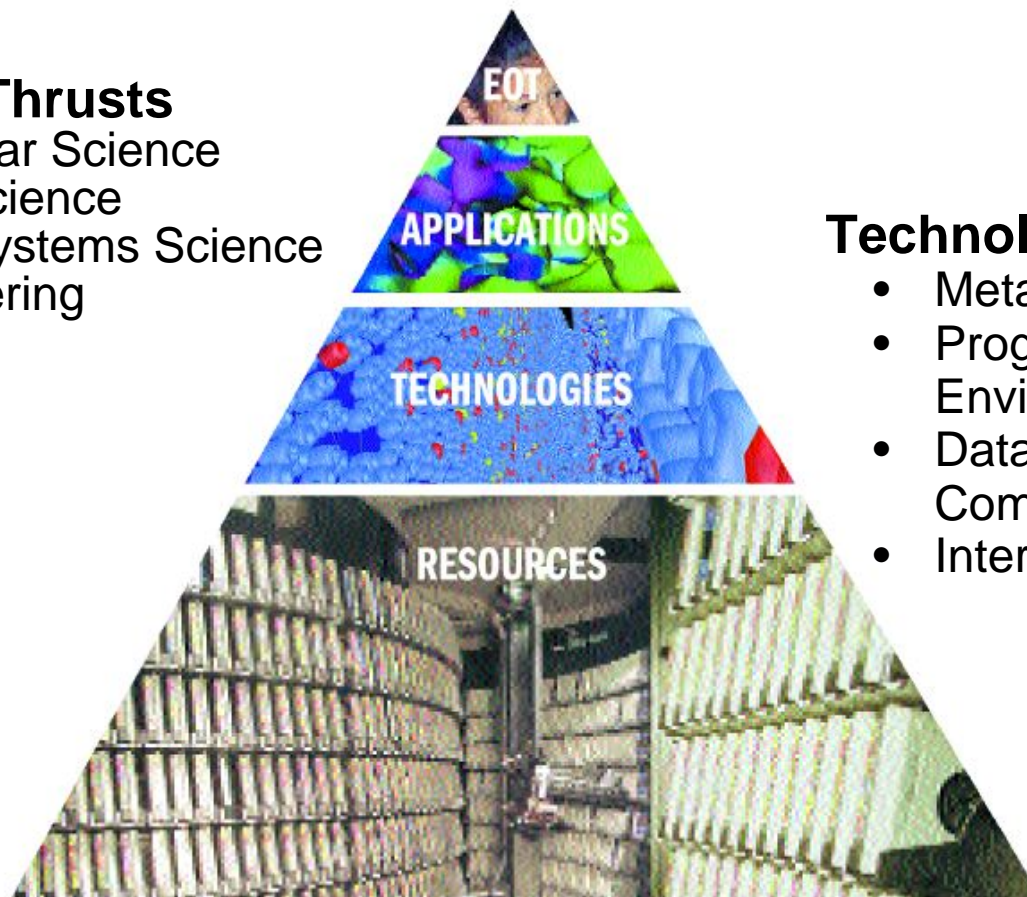


- Leading-edge Site
- Compute Resource Partners
- Data Resource Partners
- Development and Education Partners
- Associate Partners

Partnership Organizing Principle: “Multidisciplinary Thrusts”

Application Thrusts

- Molecular Science
- Neuroscience
- Earth Systems Science
- Engineering

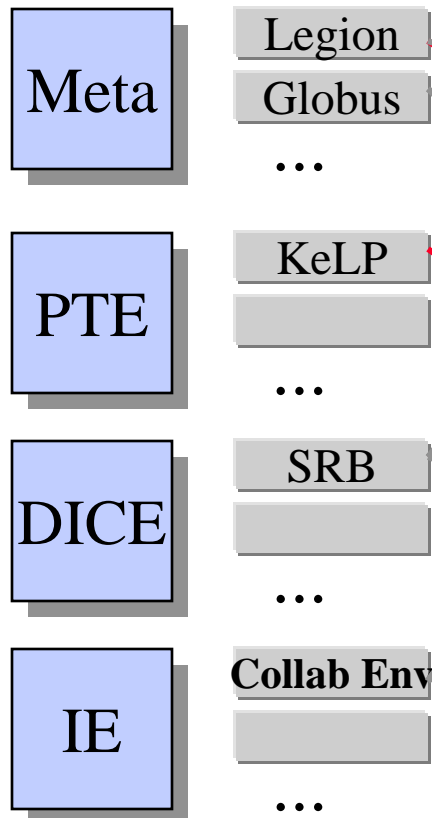


Technology Thrusts

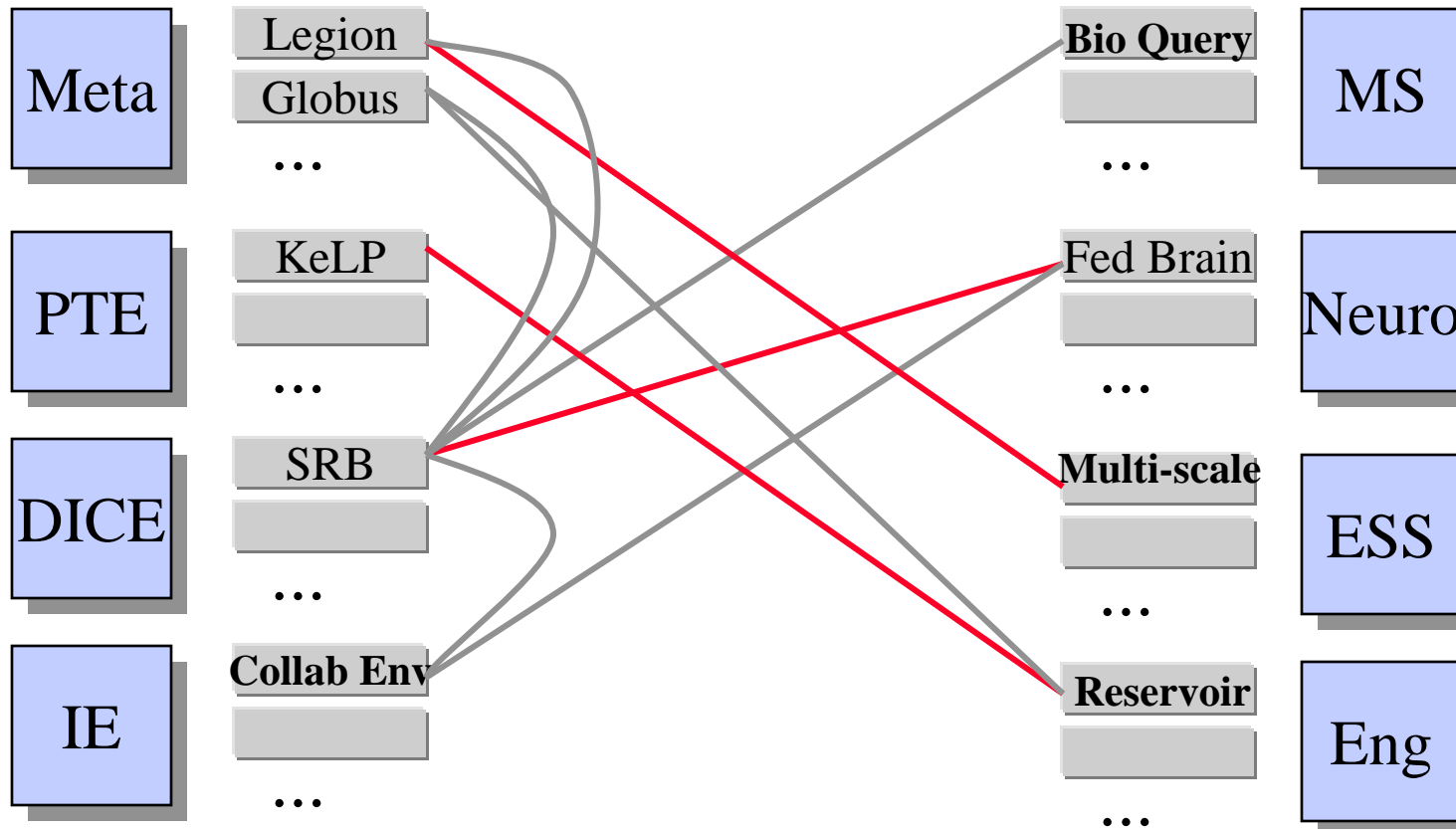
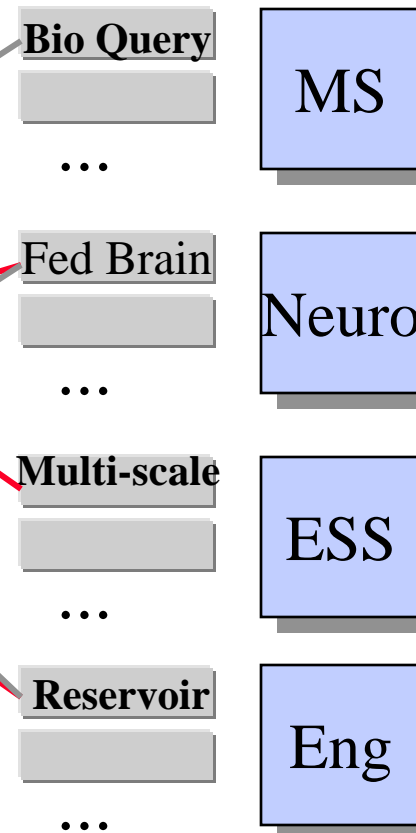
- Metasystems
- Programming Tools & Environments
- Data-intensive Computing
- Interactive Environments

Examples of Projects

Enabling Technologies

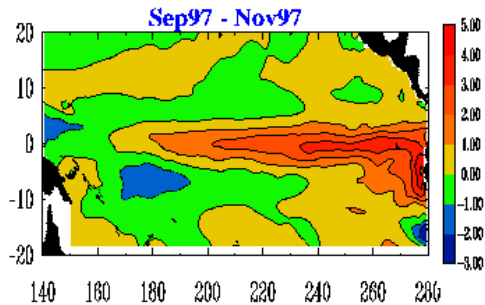


Applications



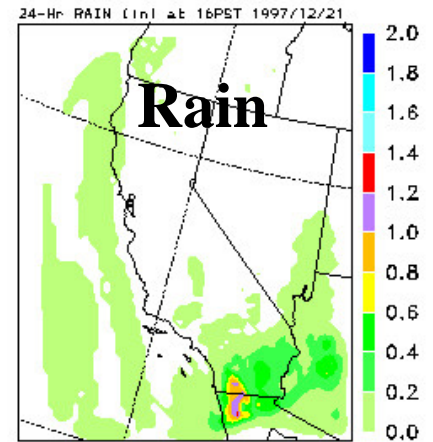
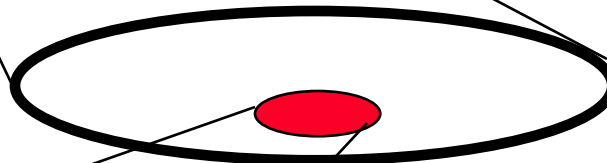
Integration across scales

Experimental Long-Range Prediction

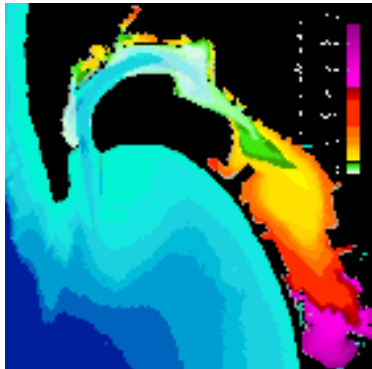


GLOBAL
Coupled ocean/atmosphere

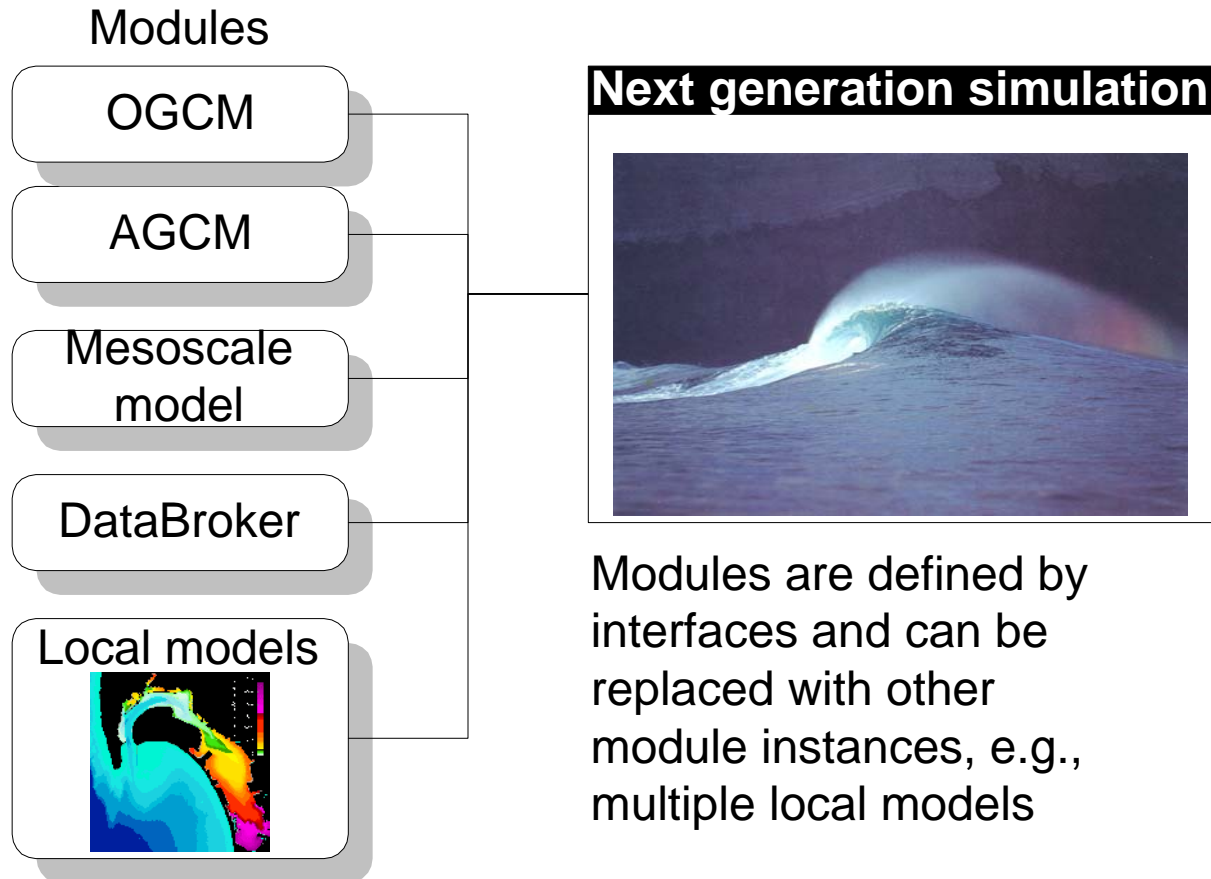
REGIONAL
weather model



LOCAL model - e.g., bay, basin or estuary

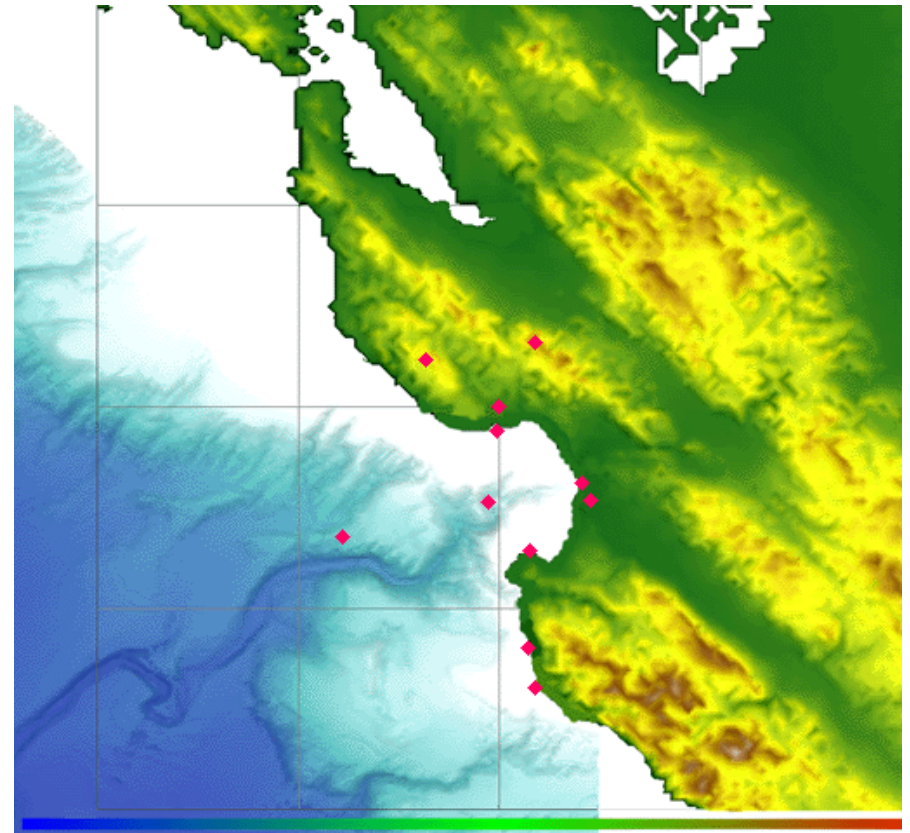


Modeling vision



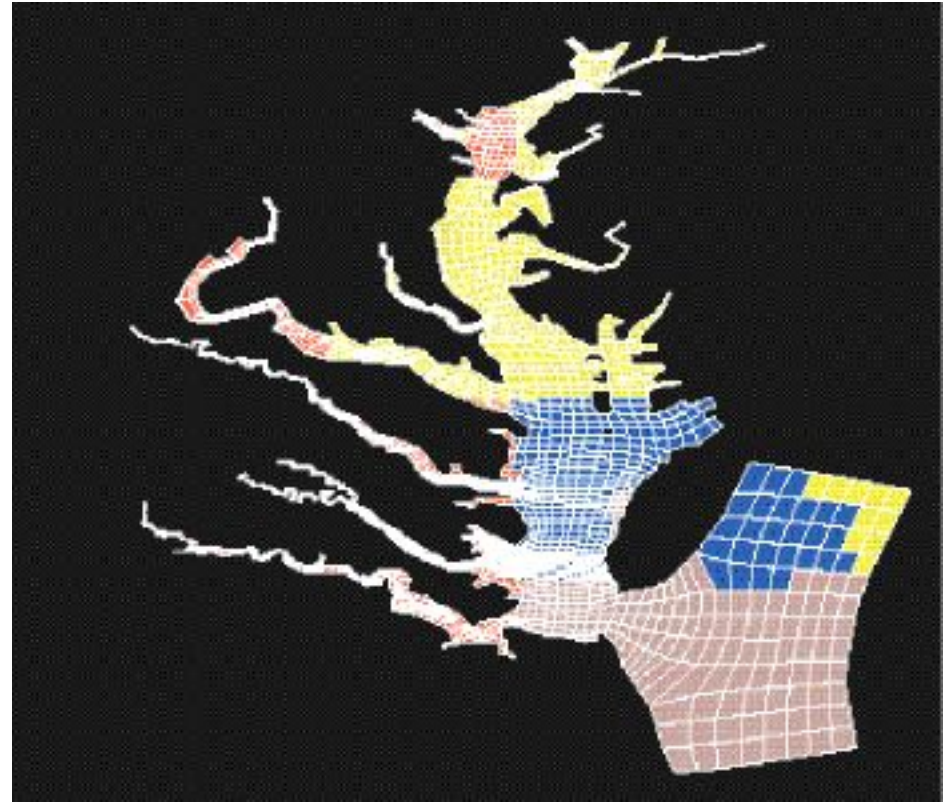
Internet-based Data Acquisition

- **Real-time Environmental Information Network and Analysis System (REINAS)**
 - *real-time data from dispersed sensors distributed measurement-gathering environment*
 - *supports all scales of earth science*
 - *stored in logically integrated but physically distributed database via the Internet*
- **Network Membership**
 - *Monterey Bay network nodes depicted here*
 - *San Diego (SIO and SDSC) are being added*
 - *international nodes in planning*

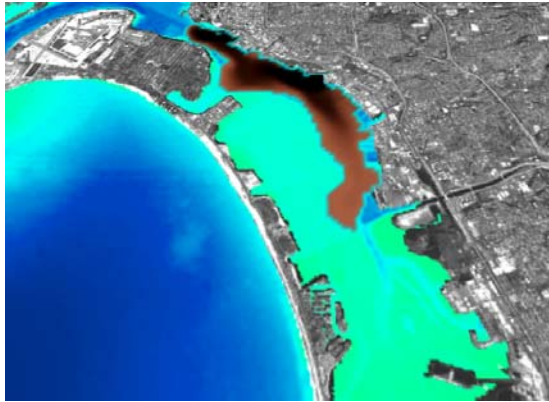


Bay and Estuary Simulation

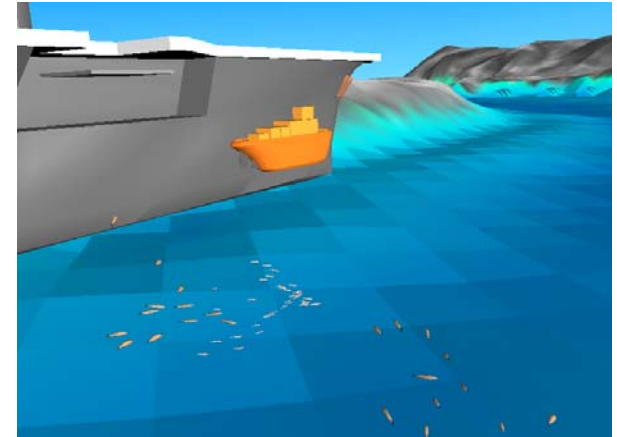
- **Simulation of Chesapeake Bay by the U Texas Bays and Estuaries Simulator (UTBEST),**
 - PI: Mary Wheeler, UTexas
- **Two-part simulation first models shallow water along coastlines, and then chemicals reacting and moving in water.**
- **Simulations linked by exchanging simulation snapshots via Active Data Repository (U Maryland).**



Interactive Visualization

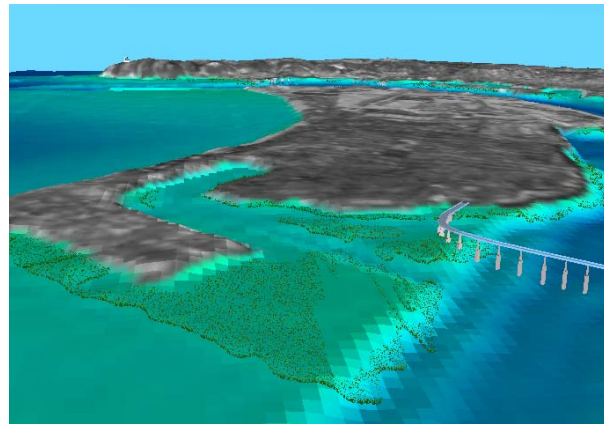


Multi-source Data
Integration



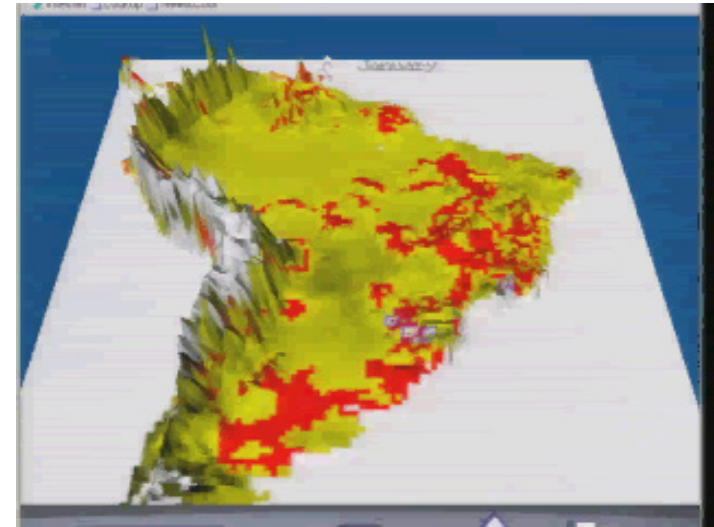
Shared-use
Evaluation

Coupled Watershed
& Hydrodynamic
Models



Biological-Scale Process Modeling

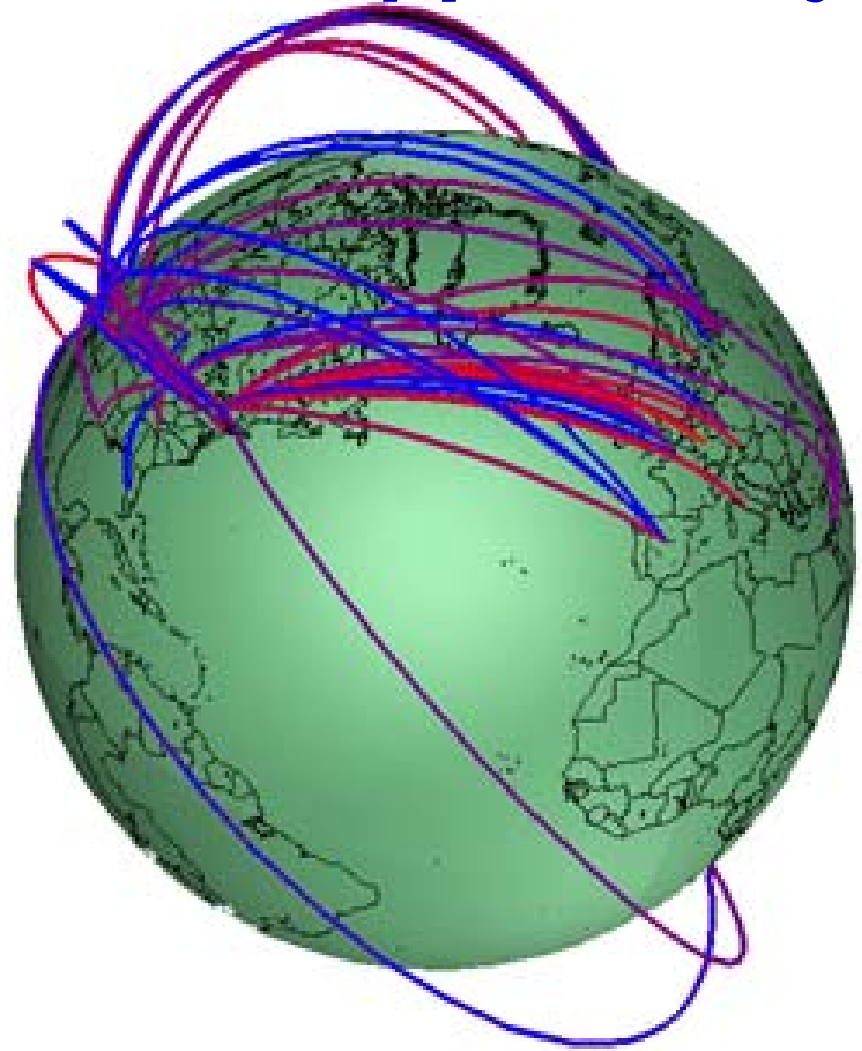
- Leonard Krishtalka, Robert Waide, David Stockwell, David Vieglais
- **Develop infrastructure to integrate**
 - collection-based biodiversity data, abiotic data, predictive species modeling with
 - ecological and ecosystem parameters, such as primary productivity and factors affecting soil biodiversity



- **Interactions with Digital Library Interoperability project**
- **Knowledge Networking of Biodiversity Information**

This Is a Time of Great Opportunity

- **Digital information explodes**
- **HPC Technologies advance**
- **Bandwidth increases**
- **Collaborative multidisciplinary activities increase**



All-Hands Meeting

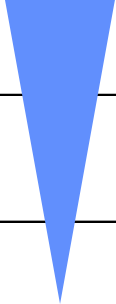
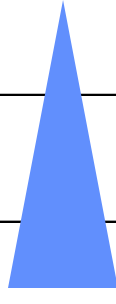
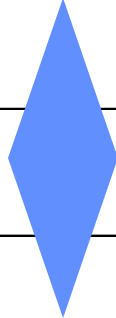

- **January 28, 29, 1999**
- **San Diego, CA**
- **Theme: NPACI in 2003**
- **Opportunity to involve new communities and partners**
- **<http://www.npaci.edu>**

Additional Slides

1998-99 ESS Projects

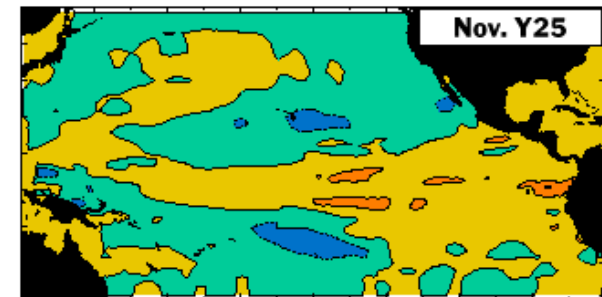
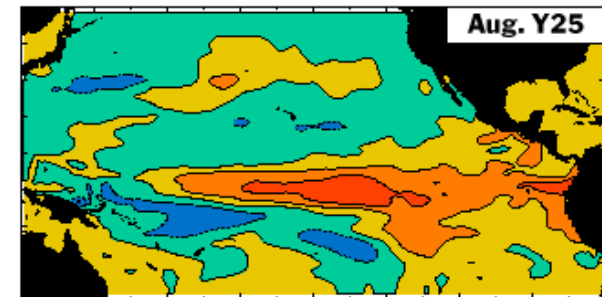
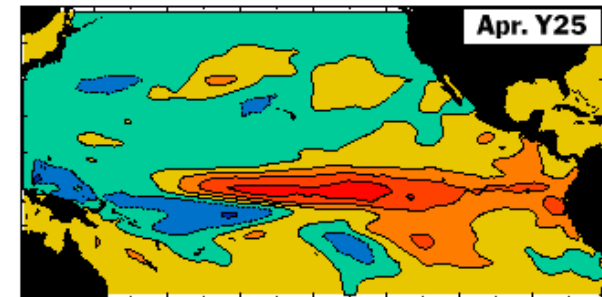
| | |
|----------------------------------------------------|------------------------------------------------------------------------------------|
| Earth Systems Modeling (ESM) | Multi-Scale Multi-Resolution Modeling (Mechose, UCLA; Grimshaw U VA) |
| | Surface Water Transport and Flow (Wheeler, U TX; Kesselman, ISI, Saltz UMD) |
| | Ocean Circulation and Climate Modeling (Munsch, MIT) |
| | Real-Time Coastal Data Acquisition (Mantey, UCSC; Moore, UCSD) |
| Ecological and Environmental Modeling (EEM) | Biological Scale Process Modeling (Krishtalka, U Kansas; Moore, UCSD; Waide, LTER) |
| | Atmospheric Chemistry (Dabdub, UCI; Grimshaw, UVA) |
| | Quantitative Geography for Ground Truth (JaJa, UMD; Rajasekar, UCSD) |
| Earth Systems Digital Library (ESDL) | Ecological Data Archives |
| | NASA GCMD (in discussion) |
| | Electronic Journals |
| | SAR/GPS |

Earth Systems Science/technology couplings

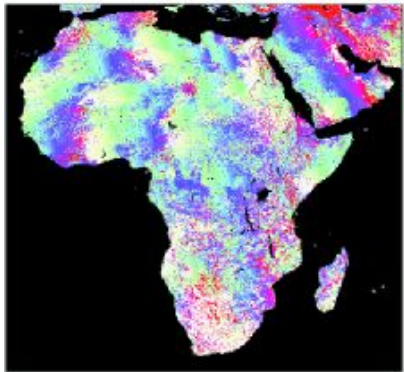
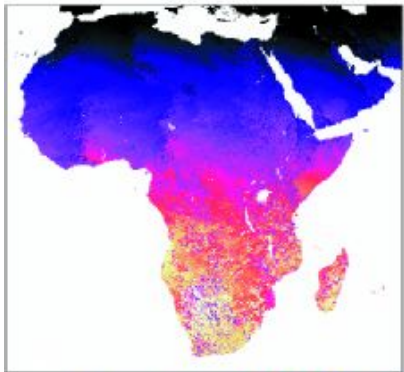
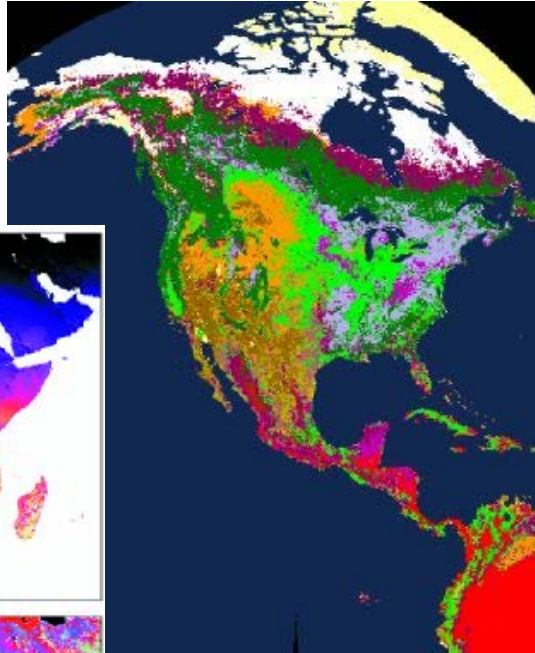
| | Meta Computing | Data Intensive Computing | Interaction Environments | Programming Tools |
|-------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| ESM |  |  |  |  |
| EEM | | | | |
| ESDL | | | | |

Ocean/Air Global Circulation Models

- **El Niño, La Niña affect areas far from the tropical Pacific**
 - Costly consequences: storms, floods, mud slides, drought, and forest fires
- **Multi-scale, Multi-resolution modeling project**
 - PI: C. Roberto Mechoso, UCLA
 - Link ocean/air global circulation models in single simulation
- **Collaboration with Metasystems**
 - Legion, U Virginia



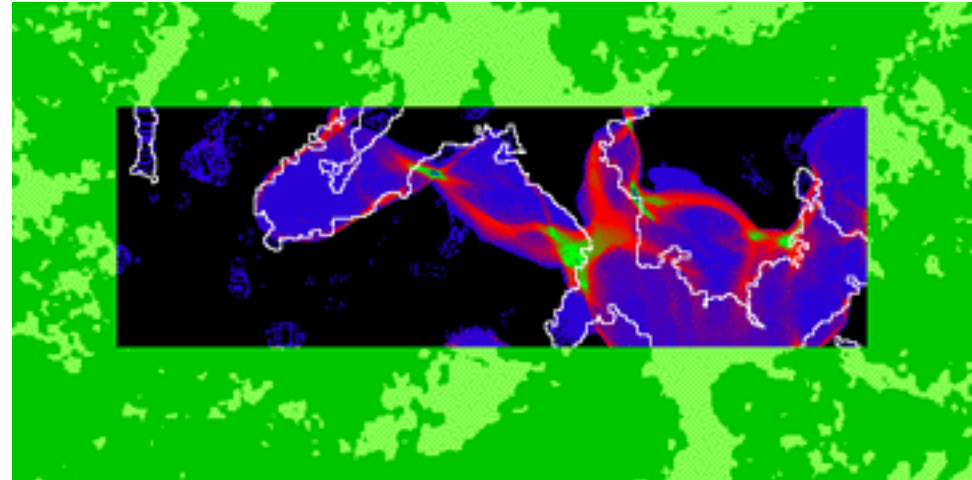
Land Cover Dynamics



- **Quantitative Geography for Ground Truth**
 - PI: Joseph Já Já and John Townshend, U Maryland
 - Collaboration with Data-intensive Computing and Programming Tools and Environments.
- **Processing remote-sensing data sets for regional and global studies**
 - Loss of tropical rain forests
 - Spread of deserts.

Finding Transitions in Ecosystems

- Identifying landscapes at risk from climate change is a manual process and an imprecise science.
- Computer methods to located the critical edges between forests and grasslands
 - Bruce Milne at U New Mexico
 - From aerial photographs of piñon and juniper forests.



Trees (dark green) and grasslands (light green) are distinct vegetation phases. Superimposed is the "hull edge" (white) of large tree clusters. Bruce Milne and colleagues at U New Mexico found that the hull occurs most often at the environmental thresholds that enable trees to survive. Colors (blue to red to green) indicate where the critical probability was observed at different scales.

Gypsy Moth Patterns

- **Analysis of 10 years of gypsy moth population data to deduce infestation patterns**
 - Stuart Gage, Michigan State U, SDSC visiting scientist
- **Long-term goal calls for developing a predictive model based on patterns in the data.**

In 1985, Michigan had only one gypsy moth "hot spot" with populations that could defoliate trees. 1995 data show population hot spots nearing Grand Rapids and Detroit. The upper peninsula has stayed relatively moth-free because of the water barrier and its colder winters.

