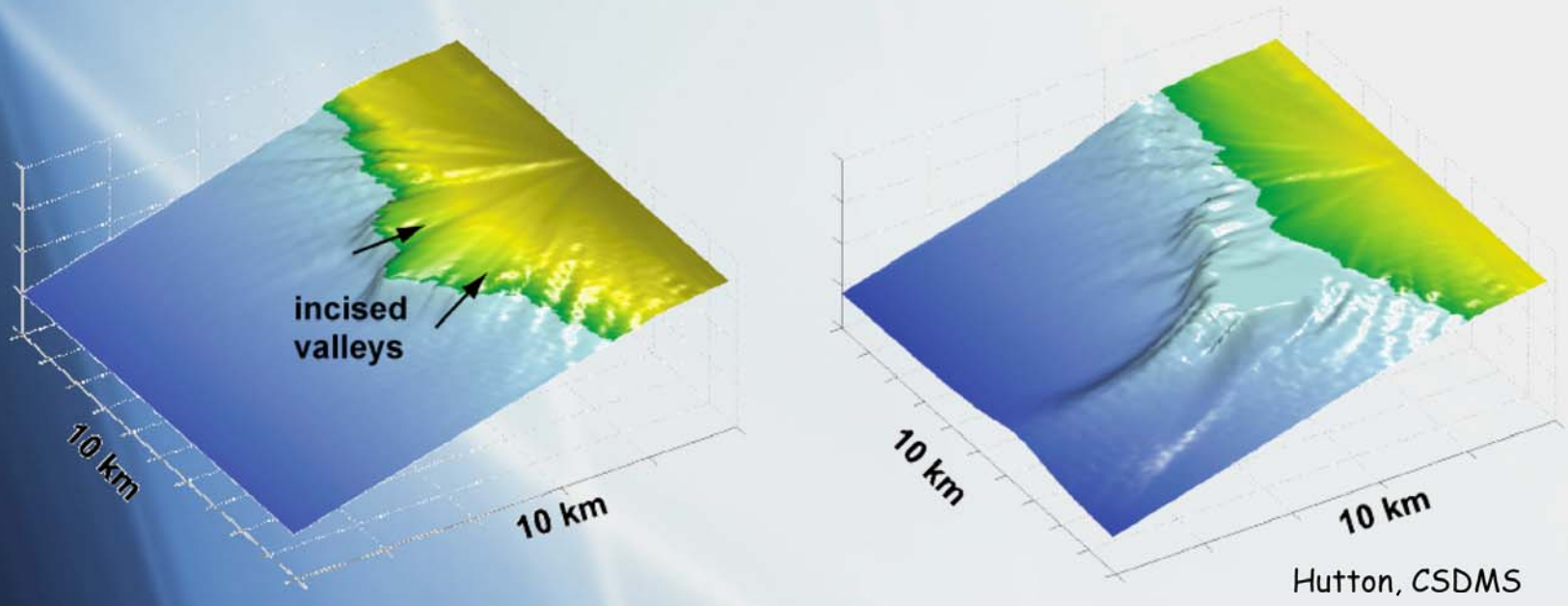
Community Surface Dynamics Modeling System
CSDMS Working Group Charge

James P.M. Syvitski
CSDMS Integration Facility
U.Colorado—Boulder



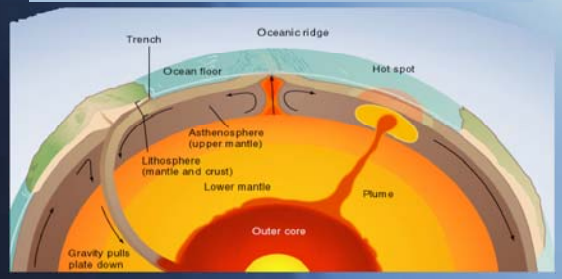
Hutton, CSDMS

COMMUNITY SURFACE DYNAMICS
CSDMS
MODELING SYSTEM

What is CSDMS?

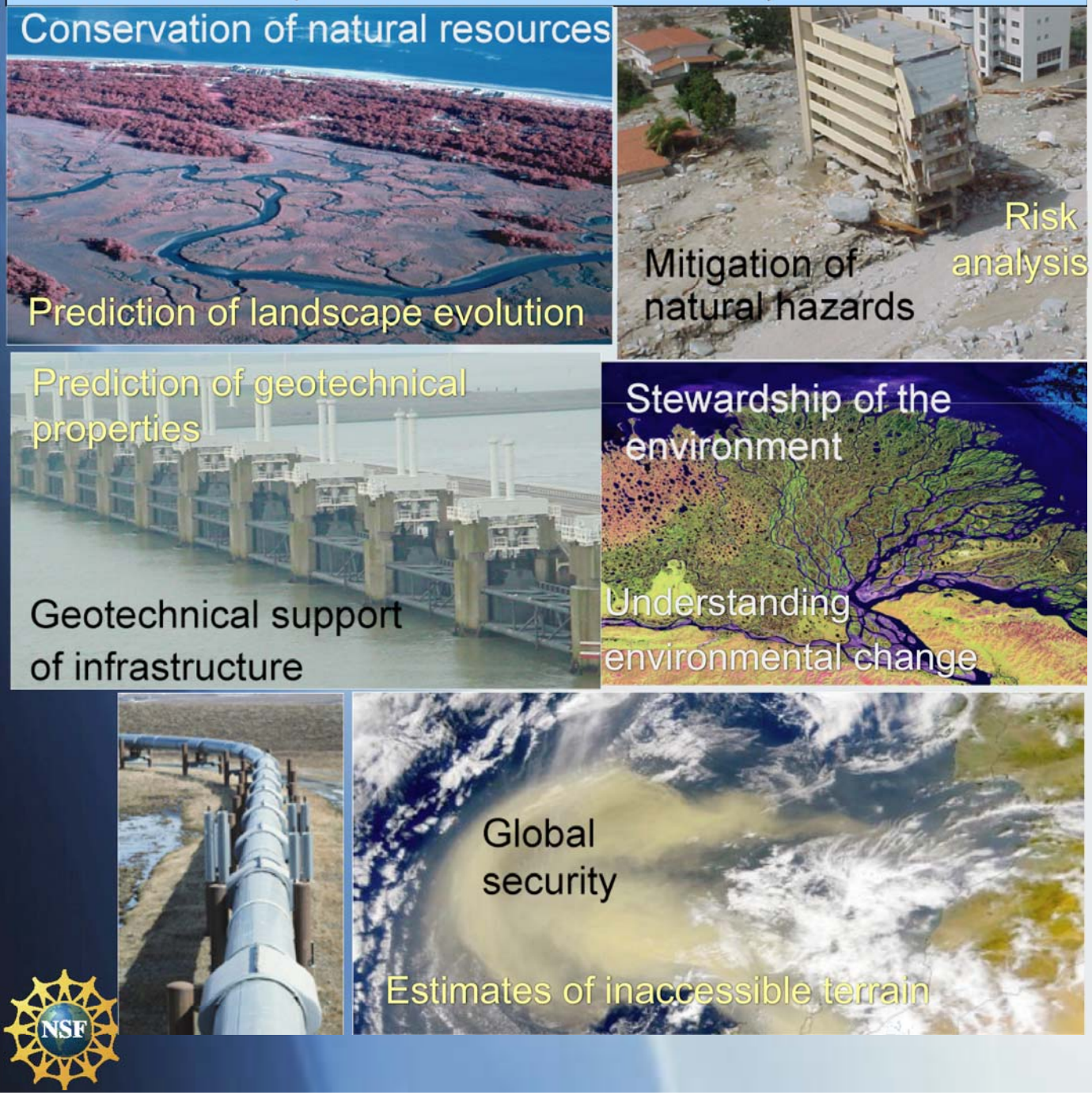
- An integrated community of experts to promote the modeling of earth-surface processes.
- Protocols for the library of community-generated, continuously evolving, open software.
- Cyber-infrastructure to distribute software tools & models in aid of applied and education uses.
- Partnerships with related scientific programs, providing strong linkage between predictions and observations.

Modeling Planet Earth
(CIG, CSDMS, CCSM)



CSDMS

NRC National Imperatives will be addressed by the CSDMS Effort



CSDMS Goal:

Develop and disseminate software modules that predict the erosion, transport, and deposition of sediment & solutes in landscapes and their sedimentary basins.

CSDMS


USGS
science for a changing world
OFFICE OF NAVAL RESEARCH
GEON PORTAL
neon
NATIONAL ECOLOGICAL OBSERVATORY NETWORK
NATIONAL SCIENCE FOUNDATION
US Army Corps of Engineers ®
NASA
CZO
CZEN
NCED
Earth · Water · Life
MARGINS
to understand the complex interplay of processes that govern the evolution of continental margins
RDECOM
TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.
U.S. Army Research, Development and Engineering Command
U.S. Army Research Laboratory
CUAHSI
universities allied for water research
NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
UNITED STATES DEPARTMENT OF COMMERCE
The National Center for Atmospheric Research
sponsored by NSF
NCAR
managed by UCAR to serve the community
GWSP
Global Water System Project
LOICZ
IAHS AISH
NOPP
National Oceanographic Partnership Program
Promoting Partnerships for the Future of Oceanography
GLOBAL CHANGE
IGBP
International Geosphere-Biosphere Programme
International Council for Science
Scientific Committee on Oceanic Research
IASC
International Arctic Science Committee
NSF
Building the GeoInformatics System
CSDMS

CSDMS is developing industrial consortiums: (Environment & Engineering; and Geological)

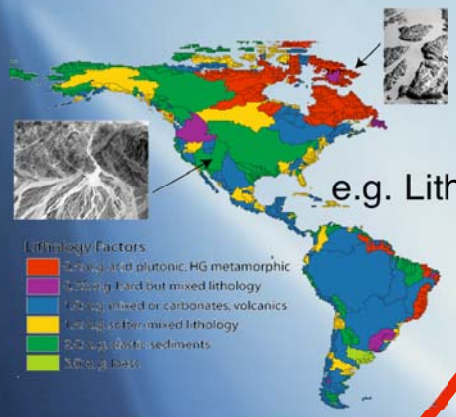
The following have provided members to CSDMS working groups.

CSDMS

The CSDMS Data Repository

Climatology: T°C, PPT, Wind, Waves

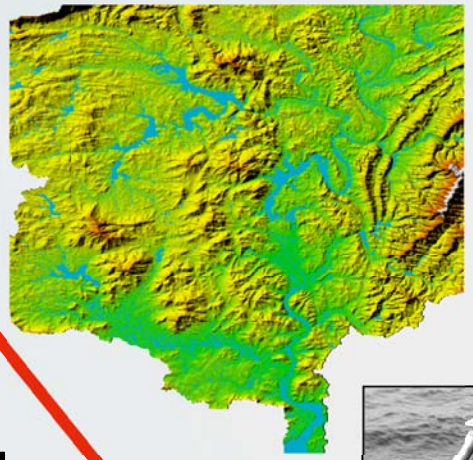
e.g. Runoff

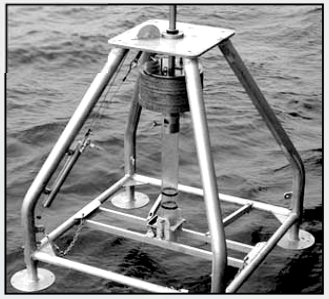


e.g. Lithology

Gridded Boundary Conditions

Topography/Bathymetry/Sea Level



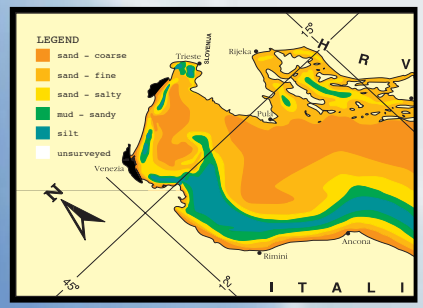


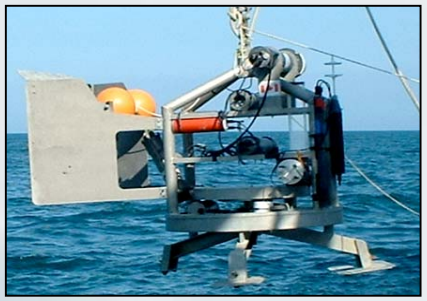
Data Integration in Modeling

$$Q^{x}_{s,s} = \int_{z=\delta wbl}^{h} c_s U dz$$

Gridded Initializations

Ice Sheet Cover
Soil Type/Thickness
Grain Size
Lakes/Reservoirs
Human Factors: GNP, Pop.
Vegetation
Lithology





Domain Parameterization

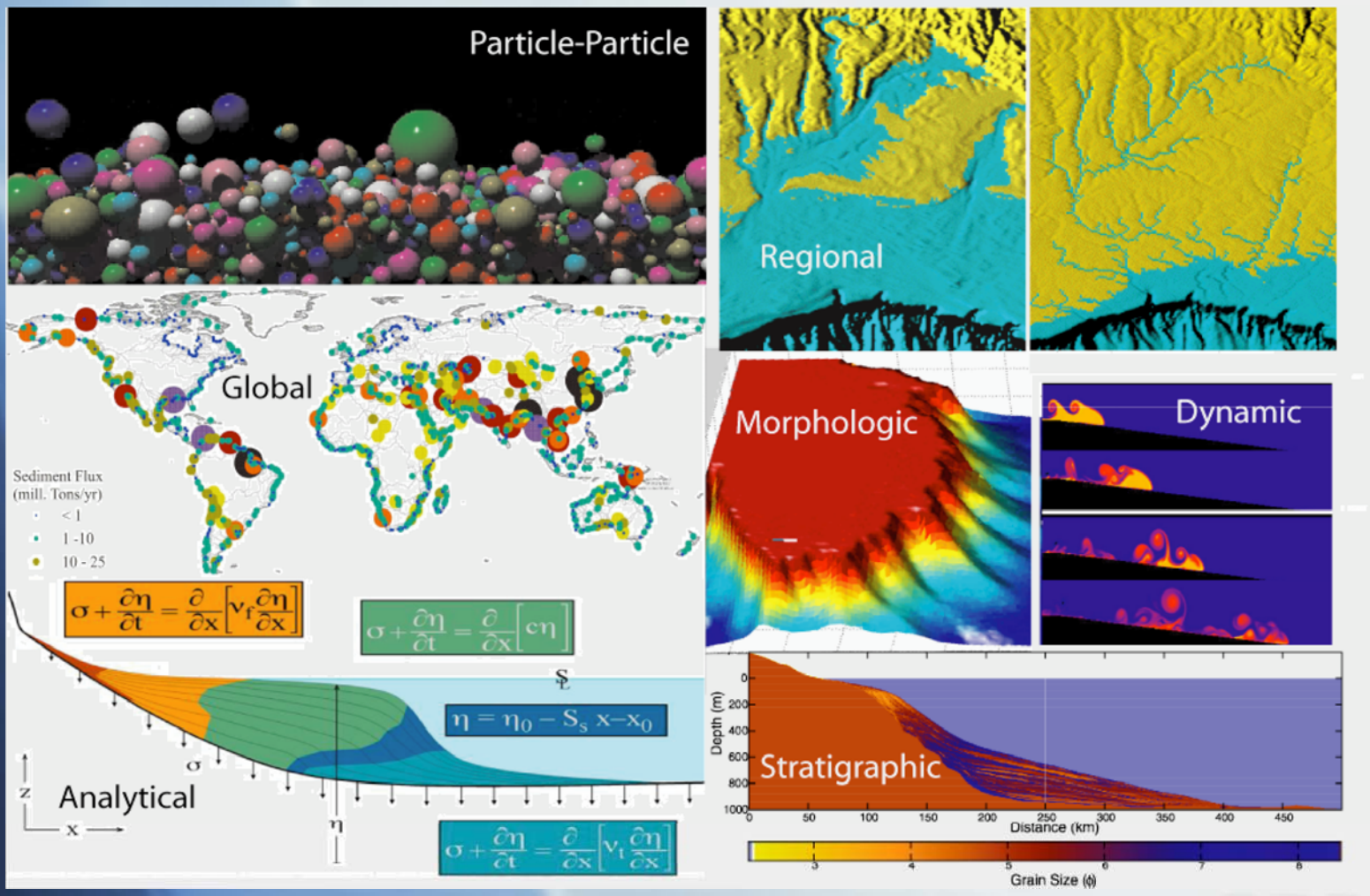
Flocculation
Critical Shear Stress
Bioturbation
Weathering grade
Productivity
Authigenesis

http://csdms.colorado.edu/models/data.html

CSDMS

The CSDMS Model/Tools Repository

CSDMS welcomes stand-alone models/languages & tools relevant to surface dynamics, including novel computational strategies, moving boundary methods, distributed source terms, & nested modules

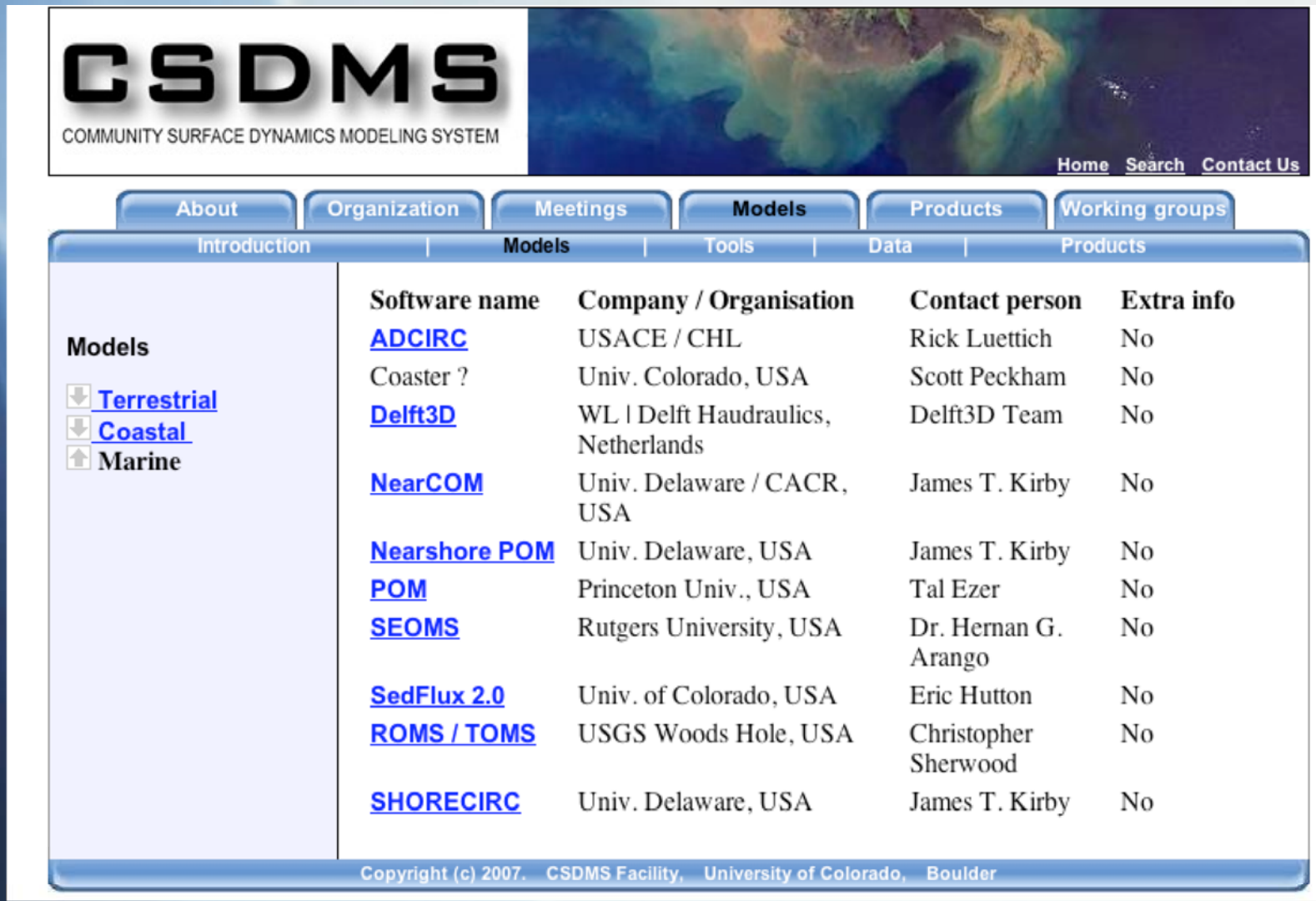


http://csdms.colorado.edu/models/introduction.html

CSDMS

The CSDMS Model/Tools Repository

CSDMS will point to, or distribute, legacy models/code



http://csdms.colorado.edu/models/models.html

CSDMS

The CSDMS Model/Tools Repository

CSDMS will distribute contributed CSDMS models/code

IDENTITY

- Model name (and version):
- Model type; 1) Tool, 2) Single model, 3) Modular model:
- Mark one or more of the following categories that describes the domain where model simulates processes: 1) Terrestrial, 2) Coastal or 3) Marine.
- Modeler's name and affiliation:
- Model code developer(s) name and affiliation:
- Brief model description:

TECHNICAL INFORMATION

- Coding language:
- Computer platforms supported:
- How long has the model been developed/used:
- To what degree and how will the model become available to other researchers. license type:
- Typical run time and memory requirements on designated platforms:

INPUT DESCRIPTION

- Input parameters:
- Input format:

PROCESS DESCRIPTIONS

- Processes represented by the model:
- Key physical parameters & equations:
- Length scale and resolution constraints:
- Time scale and resolution constraints:

OUTPUT DESCRIPTION

- Output parameters:
- Output format:
- Specific software needed for output processing and visualization:

TESTING

- Available calibration & test data sets:
- Ideal real-world data for testing your model (Laboratory and/or Field):

USER GROUP

- Are you currently, or do you presently have plans for, collaborating with other researchers? :

DOCUMENTATION

- Key papers on model:
- Manual available:
- Model website:

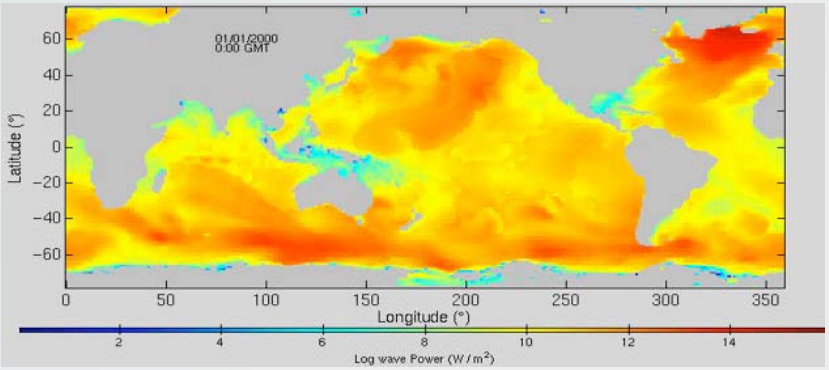
ADDITIONAL COMMENTS:

http://csdms.colorado.edu/models/models.html

CSDMS

The CSDMS Education Repository

CSDMS will also distribute: 1) model simulations, 2) Educational PPTs, 3) Reports, Publications*, 4) Short Course Materials, 5) Images, 6) Meeting presentations.



CSDMS
COMMUNITY SURFACE DYNAMICS MODELING SYSTEM
Home Search Contact Us

About | Organization | Meetings | Models | Products | Working groups

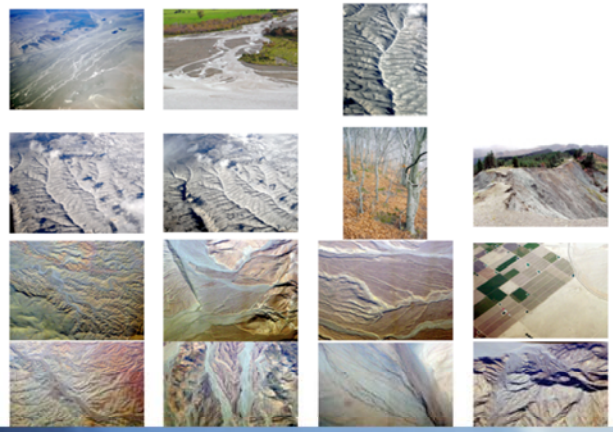
Products | Publications | Gallery | Models | Data

CSDMS Image Gallery

Galleries

- Terrestrial
- Coastal
- Marine
- Other

The images on this page illustrate aspects of environments that the CSDMS Project tries to capture by a suite of models. The freely downloadable images are generously contributed by various people. Please make sure to credit the contributors when you are using these images.
Email us your images if you are willing to share your best Surface Dynamics images.



CSDMS
COMMUNITY SURFACE DYNAMICS MODELING SYSTEM
Home Search Contact Us

About | Organization | Meetings | Models | Products | Working groups

Upcoming Meetings | Past Meetings | General Info

Mechanisms of Sediment Retention in Estuaries

Title: Mechanisms of Sediment Retention in Estuaries

Date: September 23 to 25, 2007

Location: Boulder, Colorado, USA

Agenda: Agenda as Pdf

Talks:	Presented by	Title	pdf
	James Syvitski	CSDMS introduction	
	James Syvitski	Geology, Geography, and Humans Battle for Dominance over the Delivery of Fluvial Sediment to the Coastal Ocean	
	John Milliman	Introduction to group discussion	
	Maria Snoussi	Discussion notes Sunday morning session	
	Yoshi Saito	Morphodynamics and evolution of estuaries in response to climate and anthropogenic forcing	

http://csdms.colorado.edu/models/models.html

CSDMS

The CSDMS Compliant Repository

Contributed compliant code to function within the CSDMS integrated modeling framework

Specs for the CSDMS Framework	
Supports multiple operating systems: *Linux, Mac-OSX & Windows*	•CCA, ESMF
Supports parallel computation *(via MPI standard)*	•CCA, ESMF
Language interoperability: *C, Fortran & object-oriented languages (e.g. Java, C++, Python)*	•CCA
Supports both legacy (non-protocol) code and structured code (procedural and object-oriented)	•CCA
Interoperable with other coupling frameworks	•CCA, ESMF
Supports both structured and unstructured grids	•CCA
Supports platform-independent GUI *(e.g. via wxPython)*	•CCA
Large offering of open-source tools	•CCA
Open source software license, industry-friendly, protection for authors, tracks modifications, GPL2 compatible OSI approved.	•BSD/MIT X11

CSDMS

High Performance Computing in the Geosciences Workshop

September 25-27, 2006

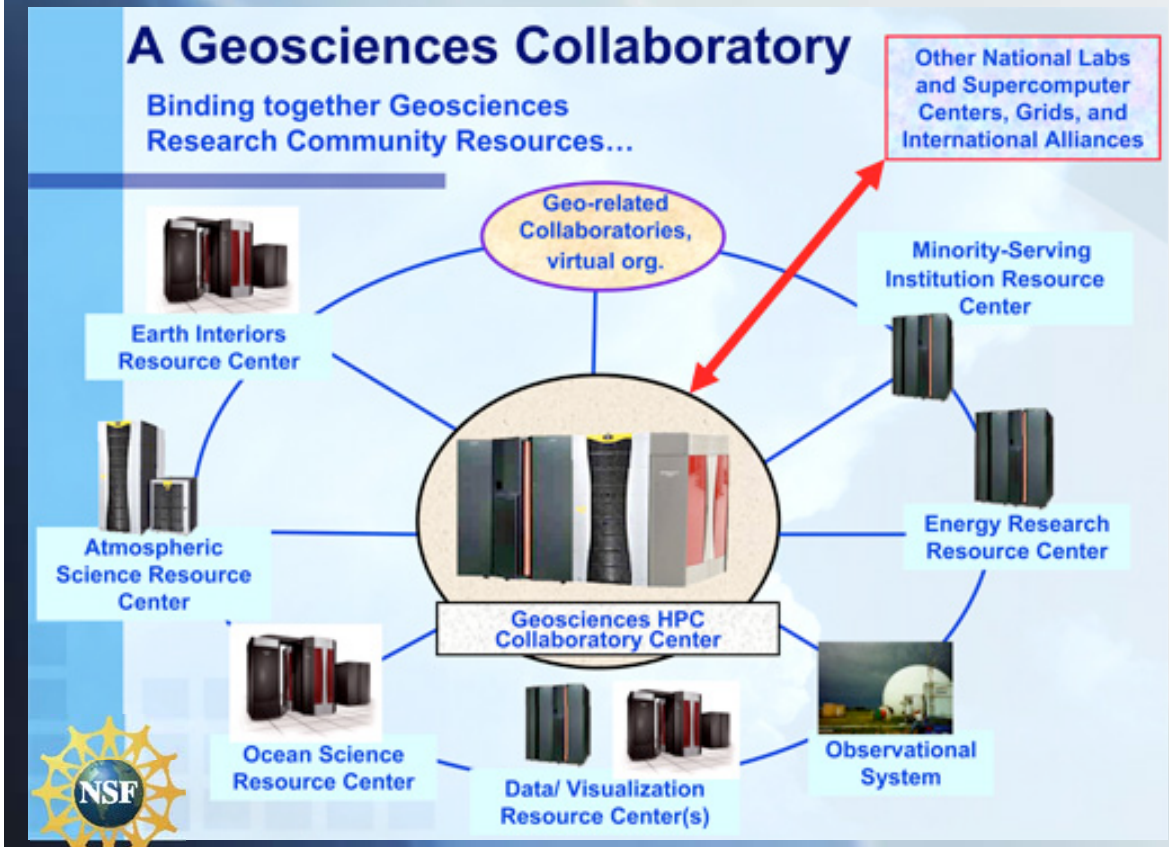
National Center for Atmospheric Research, Boulder, Colorado

NCAR

"CSDMS accepts the NSF directive to aid the surface-dynamics community moving towards modern High Performance Computers."

-- Syvitski, 2006, NCAR

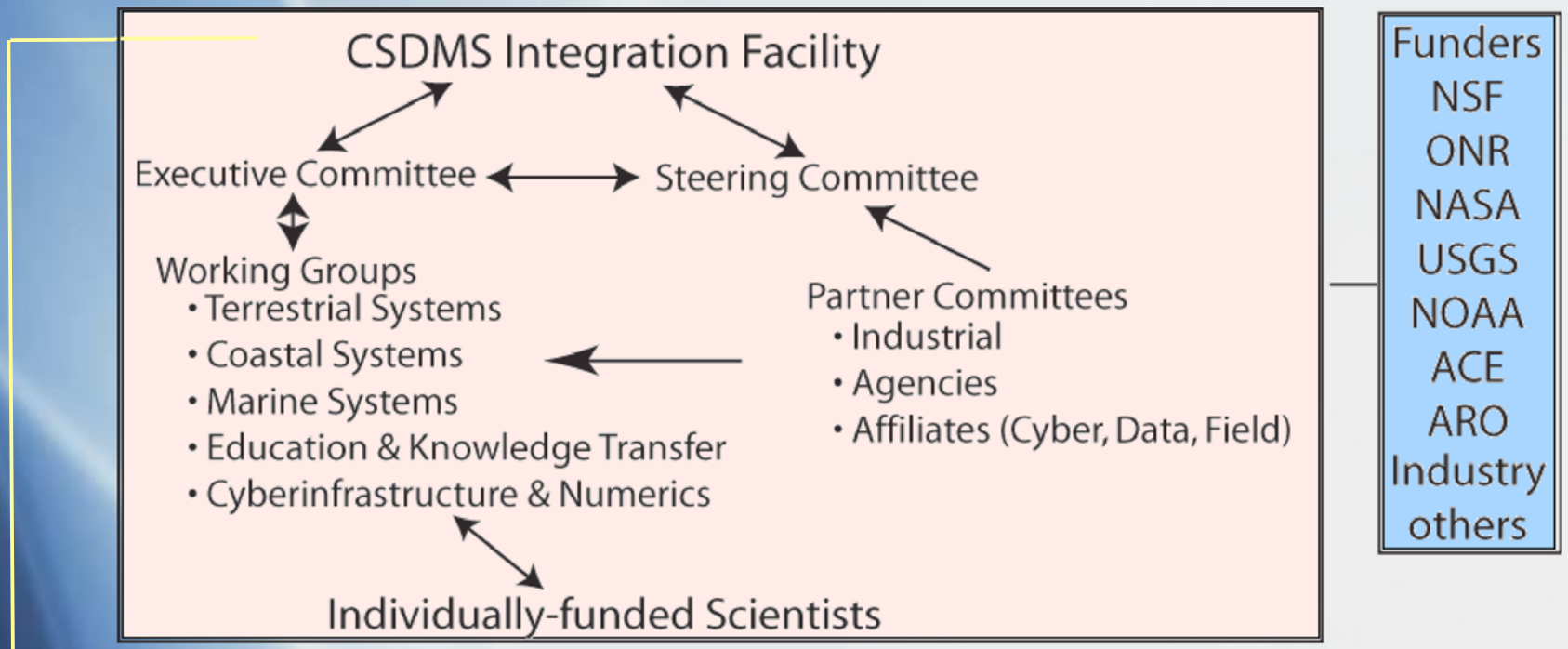
The CSDMS IF is hoping to soon acquire a CSDMS-operated Experimental Supercomputer (ES) offering >256 cores for >3 teraflops of computing power, and configured with two HPC approaches — 1) massive shared memory among fewer processors, and 2) the more typical parallel configuration — running Linux with Fortran, C and C++ compilers.



It is hoped that the CSDMS ES will be linked to the proposed Front Range HPC with 7000 core, >100 teraflops, and in turn linked to the US TerraGrid and the proposed Cheyenne NCAR/UCAR Petascale HPC dedicated to the NSF Geoscience Collaboratory.

CSDMS

The CSDMS Org Chart



Yr 1: NSF CSDMS: 0.25 ED; 0.75 EA; 1.5 S.E.; 0.5 web; 0.15 SysAdm; 0.2 Acct Tech = 3.4 FTE
NOPP + CP + NASA + ONR + NSF + CU = 3.5 FTE = 3.5 FTE
= 6.9 FTE

Yr 2: NSF CSDMS: 0.5 ED; 1 EA; 2.2 S.E.; 0.5 web; 0.2 SysAdm; 0.25 Acct Tech = 4.6 FTE
NOPP + CP + NASA + ONR + NSF + CU ≈ 4.0 FTE ≈ 4.0 FTE
= 8.6 FTE

Yr 3: NSF CSDMS: 0.5 ED; 1 EA; 2.75 S.E.; 1 web; 0.3 SysAdm; 0.35 Acct Tech; 1 EKT = 6.9 FTE
NOPP + CP + NASA + ONR + NSF + CU ≈ 3.6 FTE ≈ 3.6 FTE
= 10.5 FTE

CSDMS

The CSDMS Team

Terrestrial	Coastal	Marine	Cyber/Numerics	EKT
Tucker/CIRES	Murray/Duke	Wiberg/VIMS	Sun/ExxonMobil	*Pratson/Duke*
51 members	49 members	39 members	17 members	9 members
35 institutions	41 institutions	36 institutions	15 institutions	7 institutions
5 countries	11 countries	8 countries	2 countries	USA

CSDMS ExCom: the primary decision-making body. Ensures that the NSF Cooperative Agreement is met. Develops By-Laws & Operational Procedures. Approves the annual science plan, semi-annual reports, management plan, budget, partner memberships, and other issues that arise in the running of the CSDMS. Consists of the **ExDir as ExCom Chair, + 5 W.G. Chairs + S.C. Chair + S.S.E.**

CSDMS Steering Committee: Assesses the competing objectives and needs of the CSDMS; progress of CSDMS in terms of science, management, outreach, and education; and advises on revisions to the 5-year strategic plan. Approves the By-Laws.

Chair R. Slingerland (Penn State); T. Drake (ONR), B. Jagers (Delft Hydraulics), R. Sarg (Mines), G. Parker (U. Ill. Urbana Champaign), D. Tetzlaff (Schlumberger-Doll), D. Furbish (Vanderbilt), T. Dunne (UC-Santa Barbara) + ex officio members J. Syvitski (CSDMS ExDir) & M. Ellis (NSF).

CSDMS

The CSDMS Integration Facility

- Maintains the CSDMS Repositories: 1) Data Repository; 2) Model/Tools Repository; 3) Education Repository; 4) Compliant Repository; 5) Membership Repository; 6) CSDMS Communication Repository & 7) CSDMS Governance
- Facilitates CSDMS Communication: 1) Business Meetings (SC, ExCom, Partners, Directorate); 2) Working Group Meetings; 3) Workshops, 4) Short Courses; 5) Web Pages, 6) Teleconference, 7) Videoconferences, and 8) Email Communication
- Facilitates Community coordination & public relations
- Facilitates Product Penetration
- Conducts Tool/Model Protocol testing & evaluation on varied platforms
- Evaluates hardware & software configurations with CSDMS products
- Develops the CSDMS cyber-infrastructure (e.g. coupling frameworks; licenses; protocols)
- Provides CSDMS software modeling guidance (expertise)
- Maintains the CSDMS Vision & Cooperation between disparate communities, & between field and modeling communities.

CSDMS Environmental Working Group Activities

Identify: processes that should be in their **disciplinary toolkit**, **gaps in knowledge**, and areas for **numerical tool development**.

Develop a list of short & long term goals

Set: scientific **modeling priorities** for their discipline.

Recommend: **resource prioritization** to ExCom & the Integration Facility.

Create / manage: the environmental process modules related to their discipline. **Ensure: quality control** for the algorithms and modules for their area of expertise (benchmark validation datassets).

Coordinate: the **evaluation of numerical codes** according to interoperability, scientific contribution, protocol compliance, and technical documentation. Ensure adequacy of supporting boundary conditions and boundary initializations.

Address: a CSDMS proof-of-concept challenge. Provide community continuity to meet long-term CSDMS objectives.

Stimulate proposals and input from the community.

Report progress annually.

CSDMS

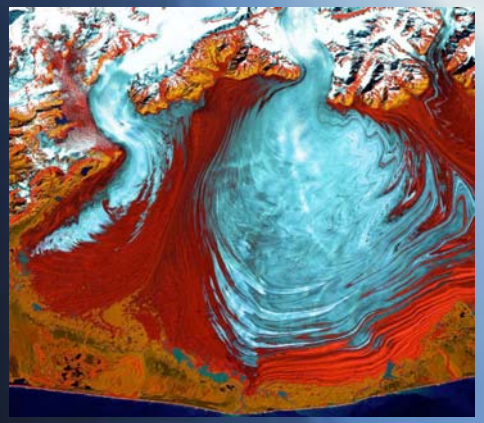
CSDMS Terrestrial Working Group Scope







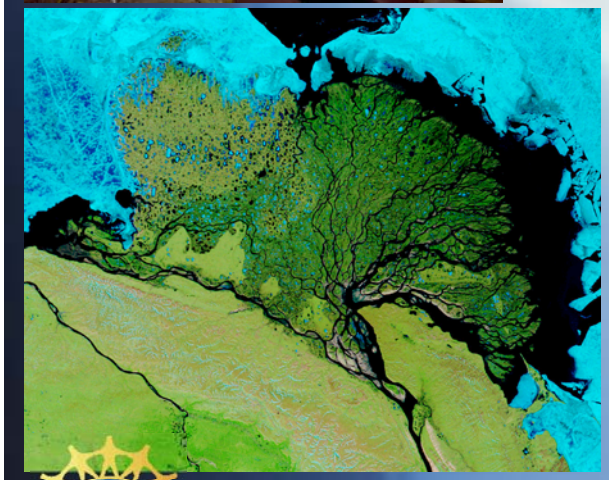


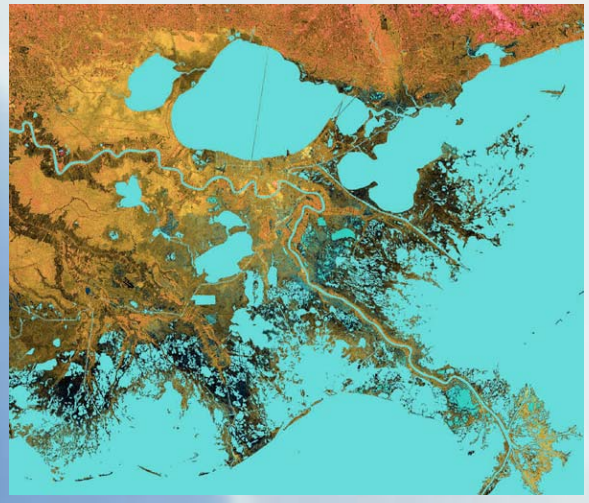



CSDMS

CSDMS Coastal Working Group Scope



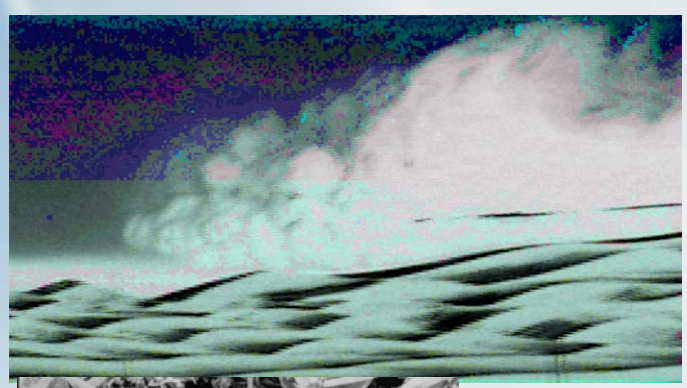
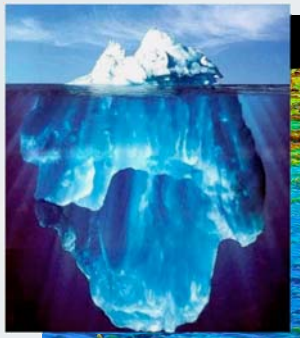


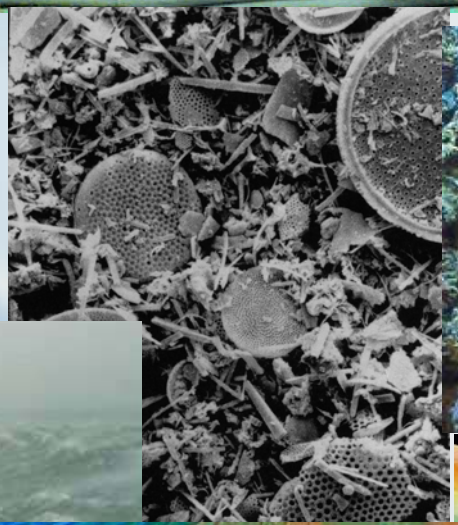


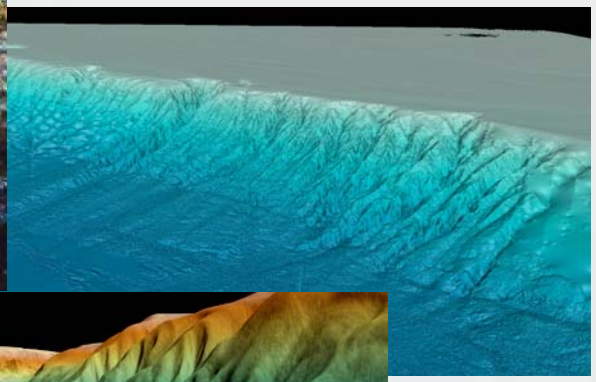
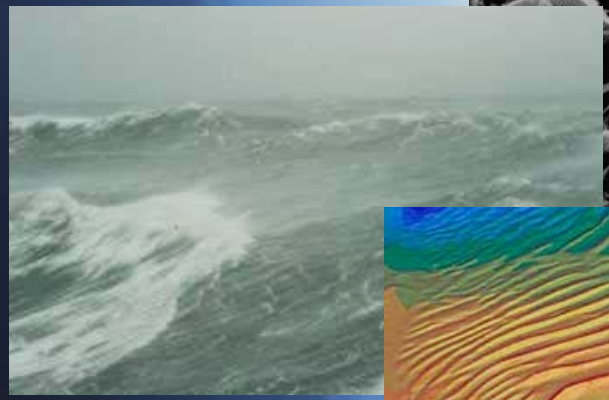
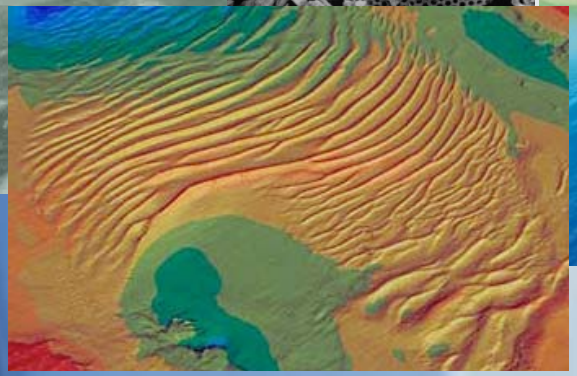
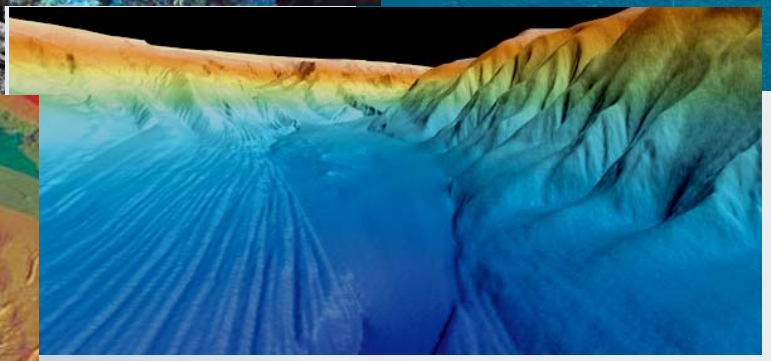



CSDMS

CSDMS Marine Working Group Scope



CSDMS

CSDMS Cyber & Numerics Working Group Activities

Develop and prioritize the CSDMS 5-year Cyber-Infrastructure Eg.

- Protocols for linking modules.
- Common data structures and interfaces to link transport processes.
- Incorporation of "legacy code" from the modeling community.
- Toolkits for pre- and post-processing, and model visualization.
- Standards for benchmarking and testing modules with the setup of standardized data sets.
- Standard computational tools, including low-level routines (I/O error handling and data exchange); as well as grid generators and PDE/flux solvers.
- Infrastructure to facilitate the proof-of-concept challenges undertaken by WG
- Graphical user interface (GUI).

Metrics for success: 1) Ability to track the material flux and its characteristics, with conservation of mass and momentum, from the mountains to deep ocean, 2) Ability to link modules with dynamic feedback of state variables/arrays between modules, and 3) Ability to flip modules in an out.

Report progress annually.

CSDMS

CSDMS SC Recommendations

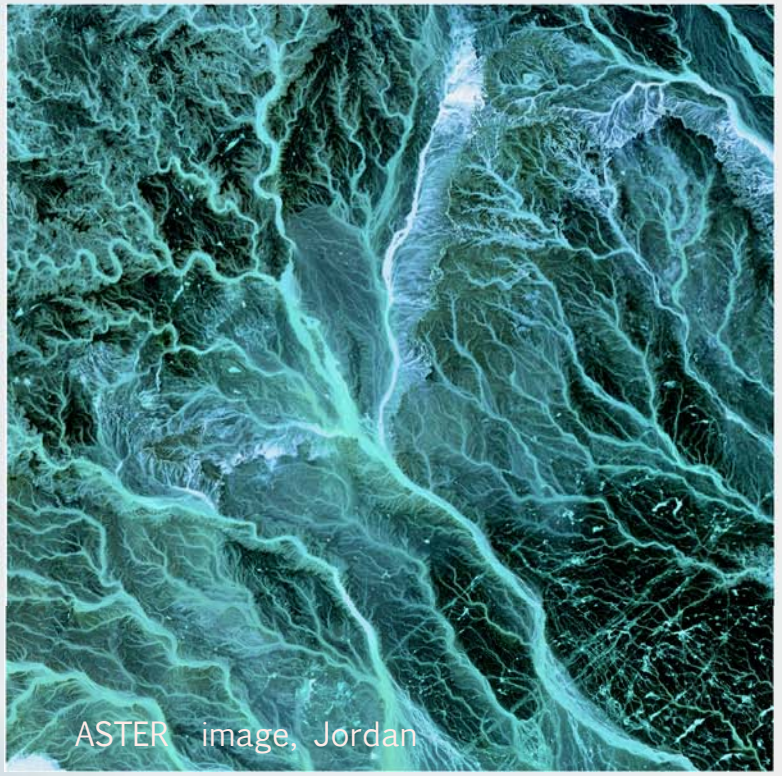
The Steering Committee recommends that CSDMS adopt the MIT XII open source software license. In addition, the CSDMS Facility should consider publishing ethical guidelines for appropriate collegial use of CSDMS code that protects for example, a student working on a Ph.D.

The SC recommends that a key metric of success should be a showcase example that integrates components from each of the Working Groups. A critical part is the "handing off" of processes/data/results from one model to the next. The most important "handoffs" should be prioritized among and within the Working Groups with a focus on the highest priorities. One possibility is that all Working Groups nominate liaisons to work together. CSDMS will be successful if the Working Groups are able to take pieces of models – small component pieces addressing specific processes – and put them together to form a new modularized model that addresses a specific issue. Towards this end, the Steering Committee recommends that a decision on the coupling module/system be made soon.

CSDMS

CSDMS Working Group Model Challenges

1. Models that track the transport and fate of water, sediments, carbon & nutrients.
2. Surface dynamic models that include the *Human Dimension*
3. Models that track surface dynamics thru Pleistocene glacial cycles
4. Models in aid of natural disasters mitigation



ASTER image, Jordan

CSDMS

Membership has its privileges

- Part of a family of experts — advantages in staying current within a community taking the Earth Sciences to the next level
- Competitive funding opportunities — better integrated proposals
- Better knowledge on available models — for education and application
- Recognized service in an interesting & new field of interdisciplinary science
- Better/faster penetration of one's numerical advances, data and simulation products
- Closer interaction with a wide variety of industrial & NGO partners and federal agencies, with possible spin-off funding opportunities
- Better academic & public recognition for code development
- Increased outreach and knowledge-transfer opportunities

CSDMS

The Promise of CSDMS

- Better understand the evolution of Earth's surface environments, while understanding the uncertainties in the predictions.
- Provide tools/models in support of surface-dynamic research.
- Address the complexities of feedbacks and linkages known in surface science, employing a wide variety of experts.
- Develop useful products for the benefit of broader society.

CSDMS