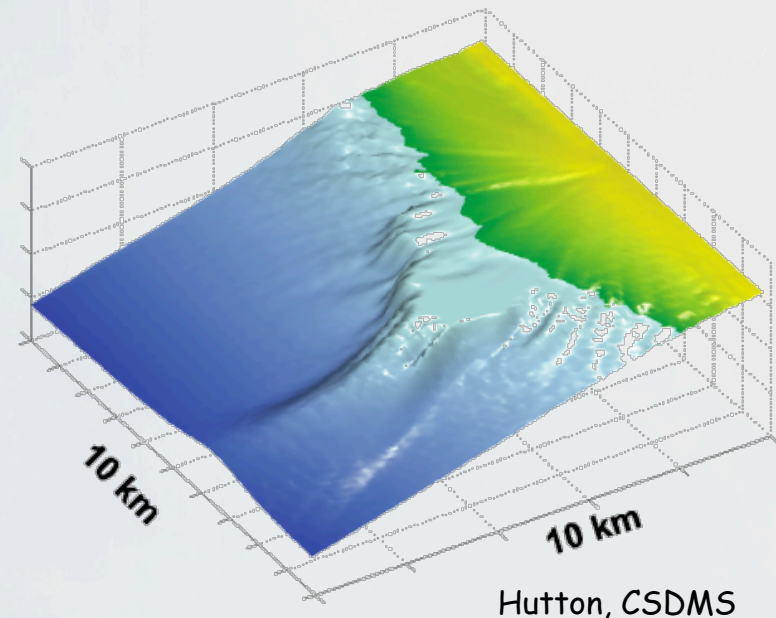
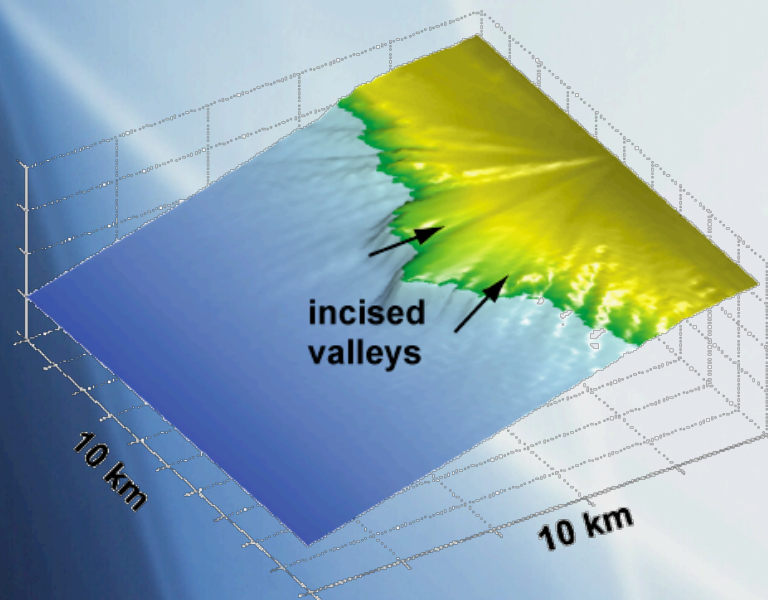


A Brief Overview of CSDMS, the Community Surface Dynamics Modeling System

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CSDMS Integration Facility
University of Colorado, Boulder*



**Chesapeake Focus Research Group Meeting
Annapolis, MD
April 3, 2009**



COMMUNITY SURFACE DYNAMICS
CSDMS
MODELING SYSTEM

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



CSDMS Domain: The Earth surface — the dynamic interface between lithosphere, atmosphere, cryosphere, and hydrosphere, including the oceans and their seafloor.

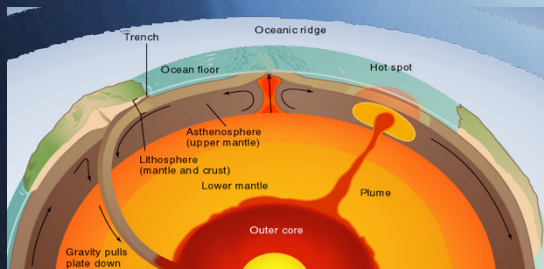


CSDMS

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)

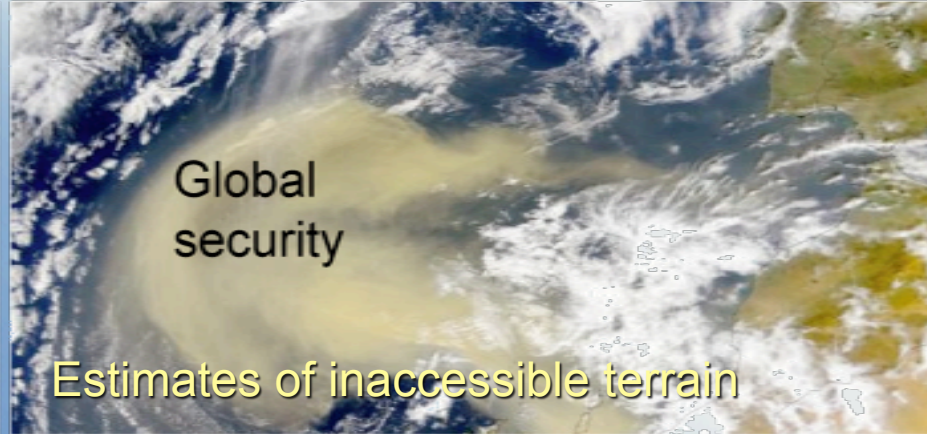


NRC National Imperatives will be addressed by the CSDMS Effort

Conservation of natural resources

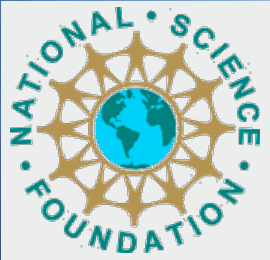


Prediction of geotechnical properties





GEON PORTAL



U.S. Army Research Laboratory



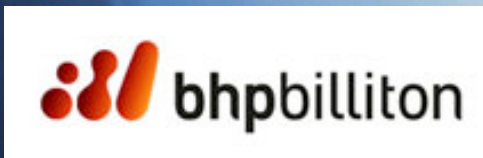
Building the GeoInformatics System



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



JAMSTEC
JAPAN AGENCY FOR MARINE-EARTH SCIENCE AND TECHNOLOGY

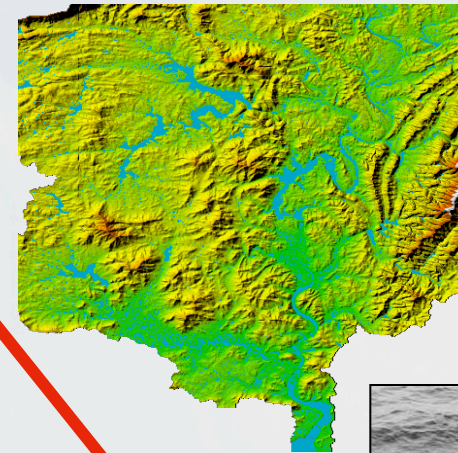


CSDMS

The CSDMS Data Repository

Climatology: T°C, PPT, Wind, Waves

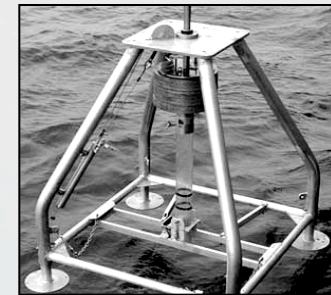
Topography/Bathymetry/Sea Level



**Gridded
Boundary
Conditions**

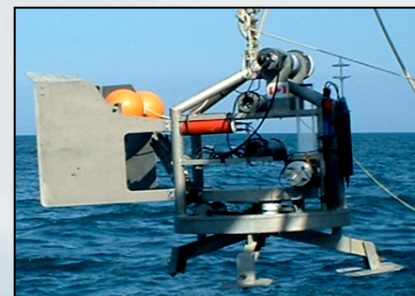
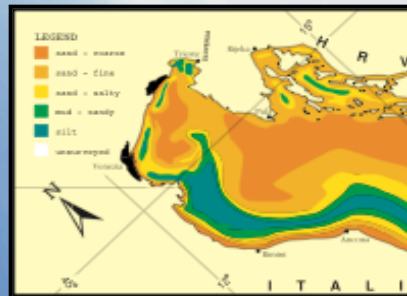
**Data Integration
in Modeling**

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



**Gridded
Initializations**

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



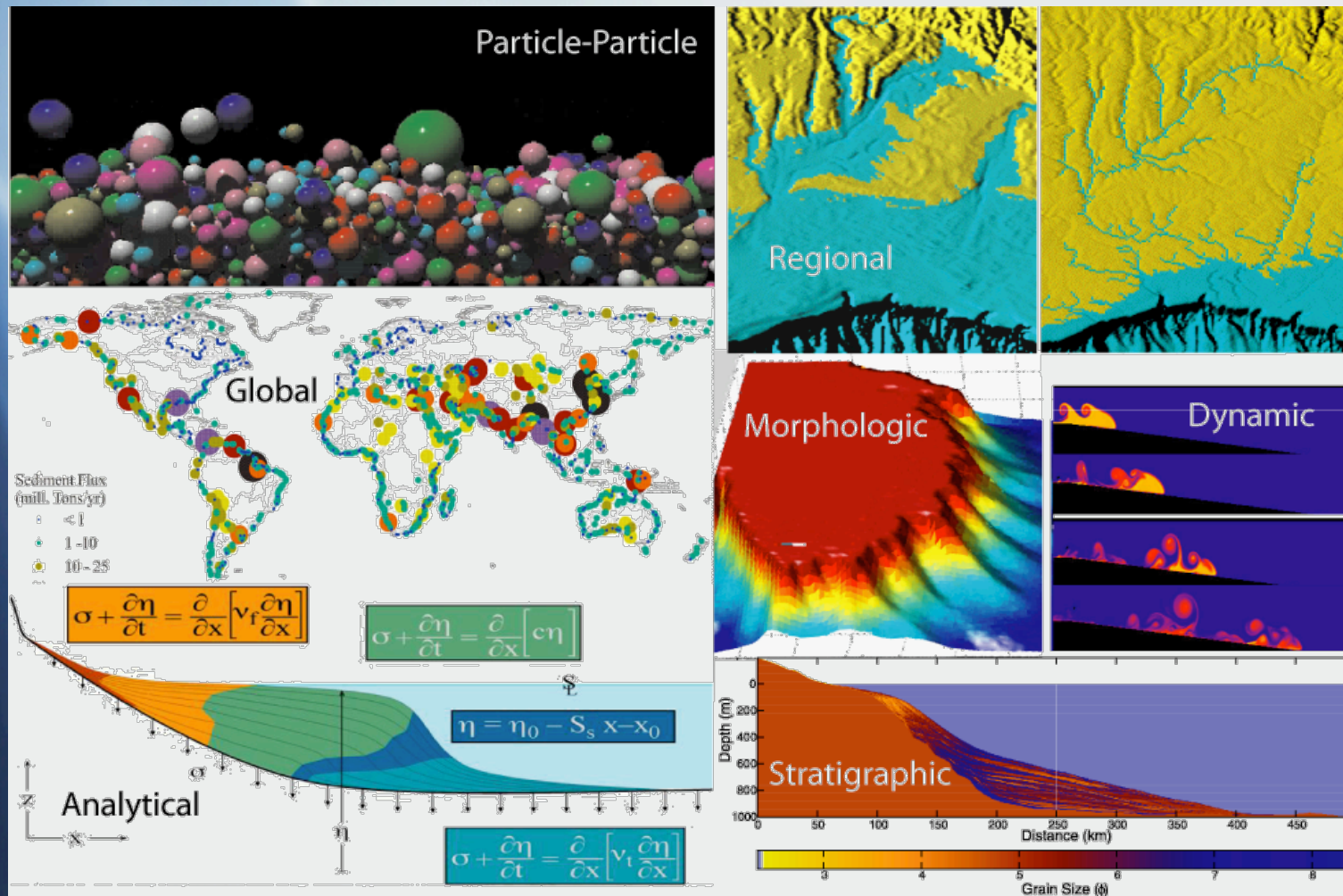
**Domain
Parameterization**

- Flocculation
- Critical Shear Stress
- Bioturbation
- Weathering grade
- Productivity
- Authigenesis



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



The CSDMS Model/Tools Repository

The screenshot shows a web browser window titled "Main Page - Community Surface Dynamics Modeling System 'CSDMS'". The address bar contains the URL http://csdms.colorado.edu/wiki/index.php/Main_Page. The browser's search bar has "Google" entered. Below the browser window, the website header features the "CSDMS" logo and the text "COMMUNITY SURFACE DYNAMICS MODELING SYSTEM". A search bar is located on the right side of the header. A navigation menu includes links for "About", "Organization", "Meetings", "Data", "Models", "Education", "Group area", and "Help". Below this, a secondary menu lists "Home", "Introduction", "Contact us", "CSDMS docs", "Logos", "Links", "News", and "Jobs". The main content area is titled "Page Trail: Main Page" and "New on the CSDMS site:". A news item states: "The Chesapeake Focus Research Group Meeting will be held on April 3, 2009 at the Chesapeake Bay Program Office, Conference Room 305A. Directions: <http://www.chesapeakebay.net/directions.aspx?menuitem=14908>". Below this, there are two columns: "About" and "Upcoming Meetings". The "About" column lists: "CSDMS is the Community Surface Dynamics Modeling System.", "CSDMS is about community. Become part of it by [signing up](#) today!", "Read the [latest update](#) from the director.", and "Contact CSDMS or send us an email: CSDMS@Colorado.edu". The "Upcoming Meetings" column lists: "April 3, [Chesapeake Focus Research Group Meeting](#), Baltimore, Maryland", "June 1-3, [Modeling of turbidity currents and related gravity currents](#), Santa Barbara, CA", and "More...". At the bottom of the main content area is the CSDMS logo and the text "COMMUNITY SURFACE DYNAMICS MODELING SYSTEM". On the left side of the page, there is a "Page edit toolkit" with links for "Page", "Discussion", "View source", and "History". Below that is a "Toolbox" with links for "Print as PDF" and "Wiki Help".



The CSDMS Model/Tools Repository

Marine Mo - Community Surface Dynamics Modeling System 'CSDMS'

http://csdms.colorado.edu/wiki/index.php/Marine_Mo

Navigation: About | Organization | Meetings | Data | Models | Education | Group area | Help

Introduction | Terrestrial | Coastal | Marine | Hydrology | Carbonate | Model tools

Page Trail: Marine Mo

Model statistics:
SLOC

Model licenses:
License

Page edit toolkit
Page
Discussion
View source
History

Toolbox
Print as PDF
Wiki Help

Marine model descriptions

This is an automatically generated table. To submit your model to this table, please complete this [questionnaire](#) first. Feel free to [contact us](#) or use the wiki and follow one of the model links if you want to update the information about a model that is already listed.

Table legend

- Source code not yet available
- Source code available through owner
- Source code available through CSDMS repository

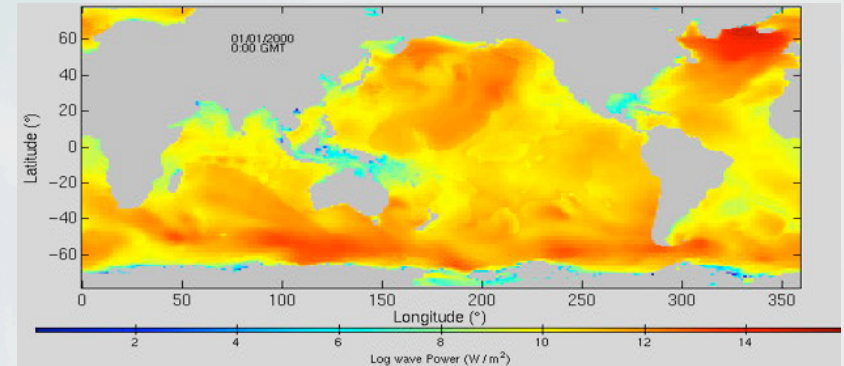
There are **26 marine model** descriptions available in the table below:

Program	Type	Description	Developer	Source code
BarSim	Model	Simulates cross shore coastal respons at millenium scale	Storms, Joep	Source code not yet available
Bing	Model	Submarine debris flows	Hutton, Eric	Source code available through CSDMS repository
Bio	Model	Biogenic mixing of marine sediments	Hutton, Eric	Source code available through CSDMS repository
CSt ASMITA	Model	Aggregate scale morphodynamic model of integrated coastal systems	Niedoroda, Alan	Source code not yet available
Carbonate GPM	Model	Carbonate deposition module for GPM	Hill, Jon	Source code not yet available
Compact	Model	Sediment compaction	Hutton, Eric	Source code available through CSDMS repository
Delft3D	Model	3D hydrodynamic and sediment transport model	Delft3D support	Source code not yet available



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.



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	

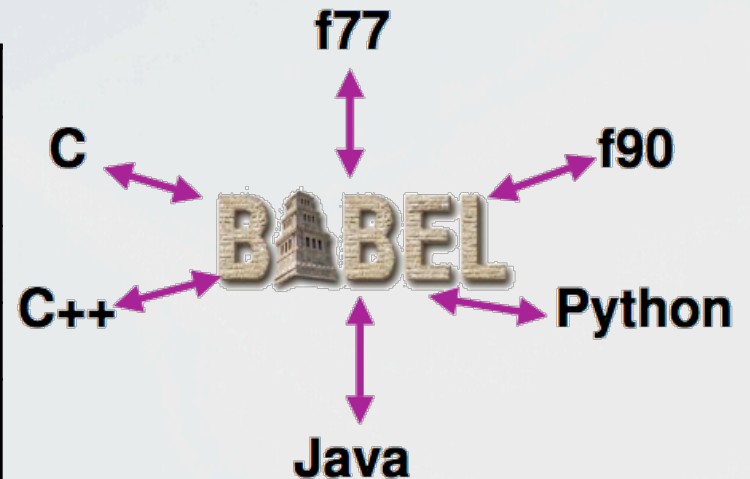


<http://csdms.colorado.edu/models/models.html>

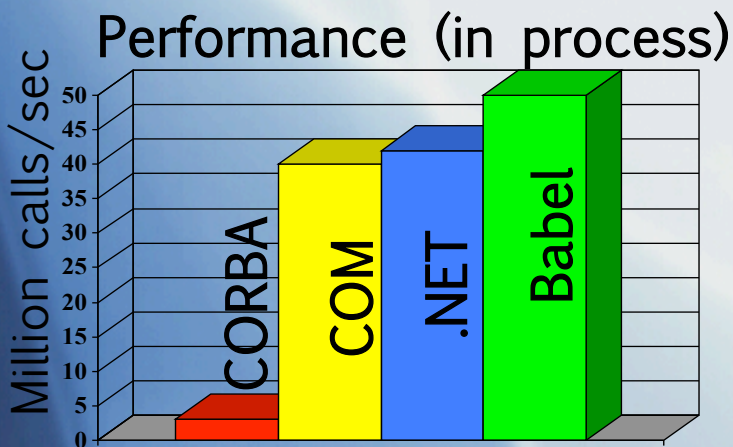
CSDMS

The CSDMS Compliant Repository

	CORBA	COM	.NET	Babel
BlueGene, Cray, Linux, AIX, & OSX	No	No	No	Yes*
Fortran	No	Limited	Limited	Yes
Multi-Dim Arrays	No	No	No	Yes
Complex Numbers	No	No	No	Yes
Licensing	Vendor Specific	Closed Source	Closed Source	Open Source

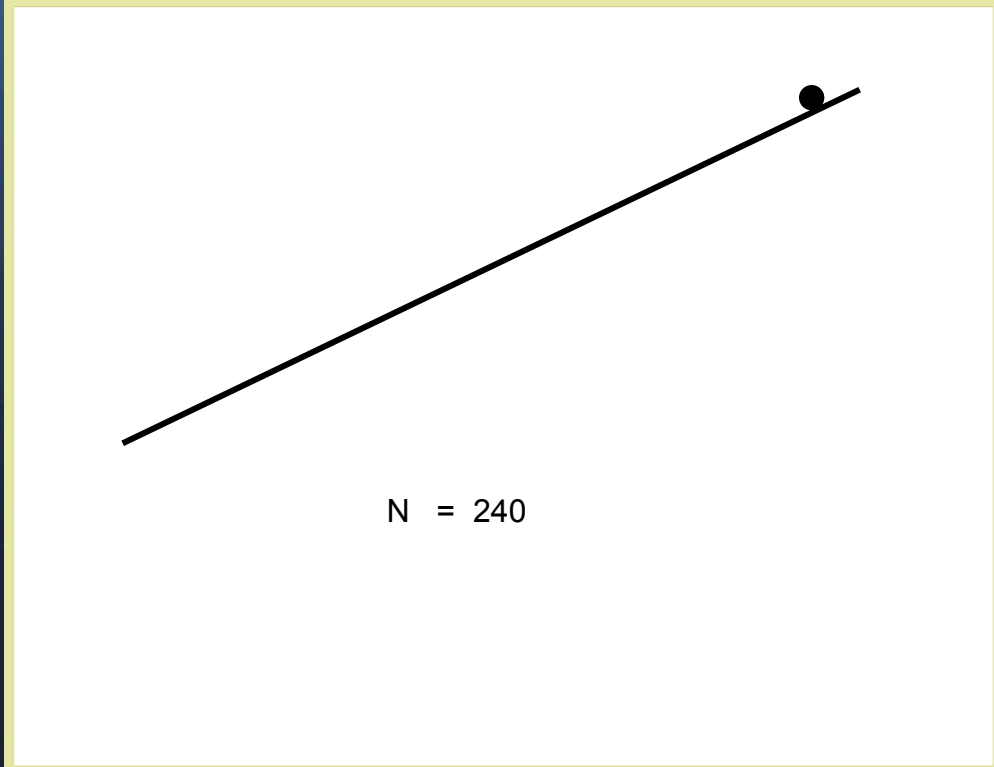


Language interoperability:
Components written in different languages can be rapidly linked with little performance cost, allowing for open-source solutions (e.g. libraries), and access to both procedural and object-oriented strategies (legacy and modern code), with graphics & within GUIs.



CSDMS Working Groups & Focus Research Groups

Terrestrial	Coastal	Marine	Cyber/Numerics	EKT
<u>Tucker/CIRES</u> 109 members 70 institutions 11 countries	<u>Murray/Duke</u> 74 members 55 institutions 13 countries	<u>Wiberg/VIMS</u> 61 members 50 institutions 8 countries	<u>Tao Sun/ExxonMobil</u> 43 members 31 institutions 6 countries	<u>Campbell/NCED</u> 21 members 18 institutions 3 countries



Carbonate	Chesapeake
<u>Burgess/U. London</u> 15 members 10 institutions 3 countries	<u>Voinov/CCMP</u> 8 members 5 institutions USA

Hydrology
<u>Famiglietti/UCIrvine</u> 33 members 25 institutions 5 countries



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 & Energy & Cooperation between disparate communities, & between field and modeling communities.



CSDMS Integration Staff



James Syvitski
Executive Director



Scott Peckham
Senior Software Architect
WGs: Cyber, Hydrology, Chesapeake



Eric Hutton
Software Engineer
WGs: Cyber, Marine, Coastal



Irina Overeem
EKT Scientist
WGs: Industry, EKT



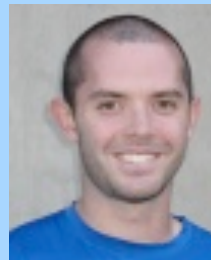
Albert Kettner
Cyber Scientist
WGs: Terrestrial, Carbonate



Beichuan Yan
Software Engineer



Mark Hannon
Ph.D. Student



Scott Bachmann
Ph.D. Student



Yun-zhen (Jane) Chen
Visiting Ph.D. Student



Mary Fentress
Accounting Tech



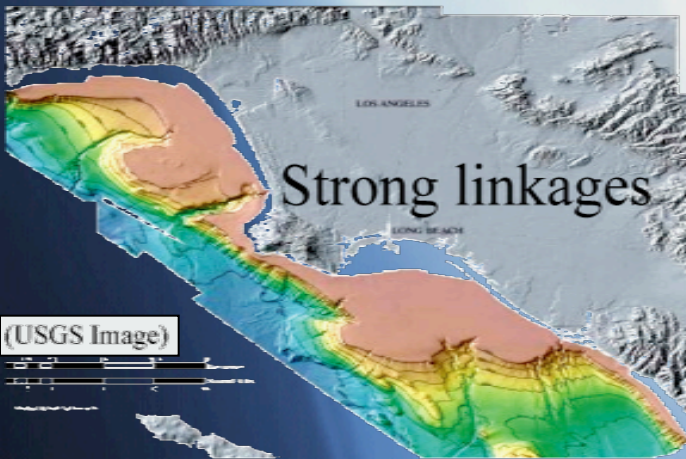
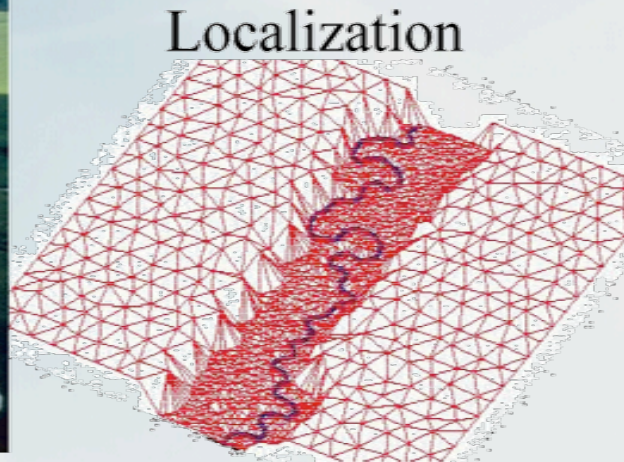
Marlene Lofton
Executive Assistant



Chad Stoffel
System Administrator



CSDMS Working Group Model Challenges



Key properties of surface systems



CSDMS Working Group Activities

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

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 (benchmarking and model testing).

Coordinate: the evaluation of numerical codes according to interoperability, scientific contribution, 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.



Membership has its privileges

- Advantages in staying current for education and application
- Opportunities for integrated & collaborative proposals
- Recognized service opportunities; academic & public recognition for code development
- Penetration of one's models, data & simulation products; Increased outreach and knowledge-transfer opportunities
- Interaction with industry, NGO partners & government agencies
- Mechanism to fulfill Federal requirement that states that code developed on Federal \$ is to be both open-source & made public
- Access to the CSDMS-dedicated HPC Cluster (>6 Tflops) with links to Tier 3 (150 Tflops) & Petascale (Tier 2) high performance computers



The Promise of CSDMS

- Better predict the evolution of Earth's varied 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.

