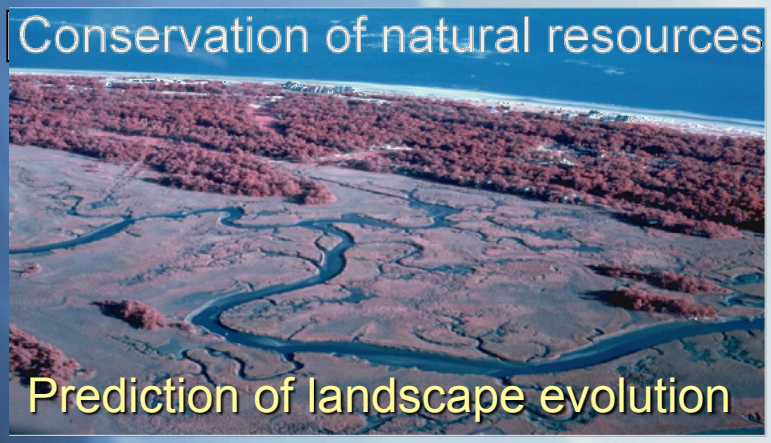
CSDMS

COMMUNITY SURFACE DYNAMICS MODELING SYSTEM



CSDMS Goals:

Develop, integrate, disseminate & archive software that define the earth's surface dynamics by simulating the movement of fluids, and the flux of sediment and solutes (production, erosion, transport, & deposition), through landscapes, seascapes, and their sedimentary basins.

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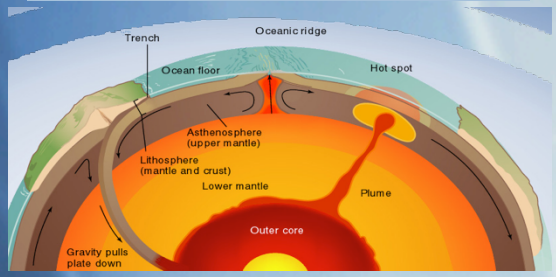
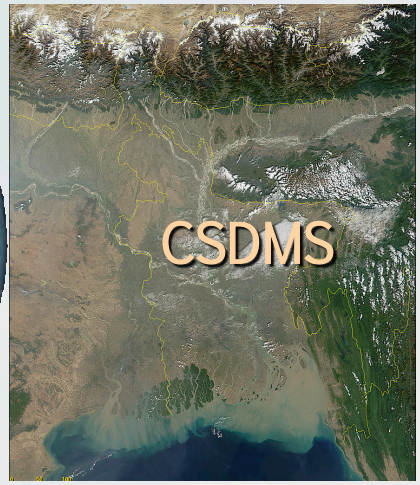
Modeling Planet Earth (CIG, CSDMS, CCSM)





CSDMS Governance Structure

- Executive Committee
- Industrial Consortium
- Interagency Committee
- Steering Committee
- Integration Facility
- Working Groups
- Focus Research Groups
- Partners

The CSDMS Integration Facility

- Repositories: 1) Data; 2) Models; 3) Education
- Operations, governance, logistics: 1) Business Meetings; 2) Working Groups; 3) Workshops, 4) Short Courses; 5) Web Wiki
- *Tool/Model* protocol testing & evaluation on varied platforms
- Hardware & software configurations with CSDMS products
- Cyber-infrastructure (e.g. frameworks; licenses; protocols)
- Software modeling guidance
- Community coordination, public relations, product penetration
- Cooperation between field and modeling communities.

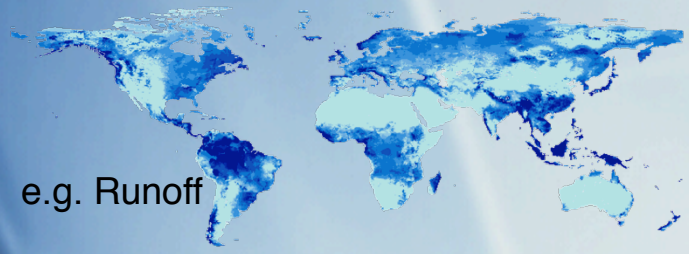
The Integration Facility *helps the surface-dynamics community move to High Performance Computing* — via a dedicated supercomputer with 512 x 3.0GHz cores for 6 Tflops with 1.2 TB memory, 72TB storage.

The CSDMS HPC linked to

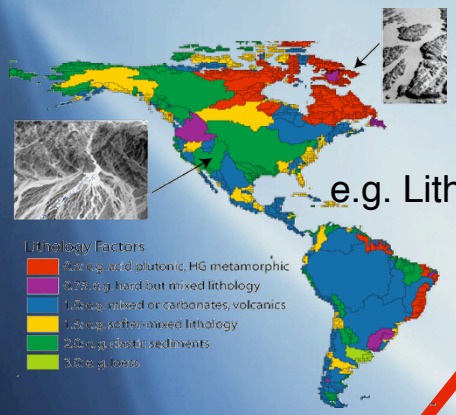
1) A Front Range HPC, >7000 core, >100 Tflops,
2) The US TerraGrid,
3) A proposed NCAR/UCAR Petascale HPC dedicated to the Geosciences (100,000 core)

The CSDMS Data Repository

Climatology: T°C, PPT, Wind, Waves



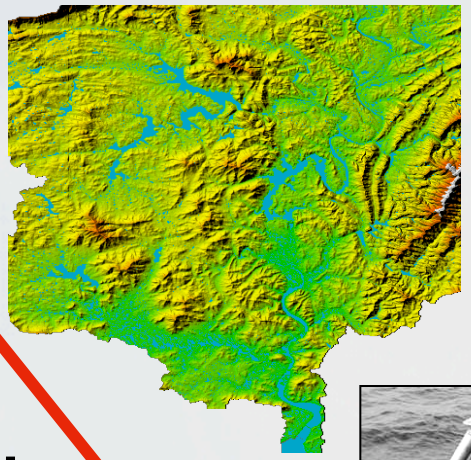
e.g. Runoff

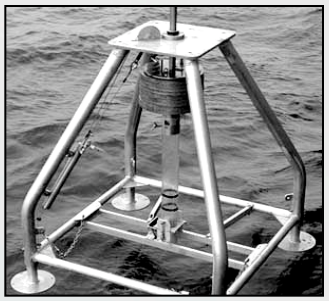


e.g. Lithology

Gridded Boundary Conditions

Topography/Bathymetry/Sea Level



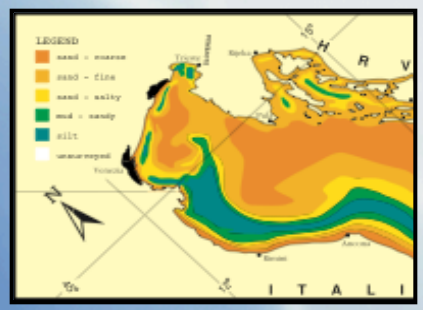


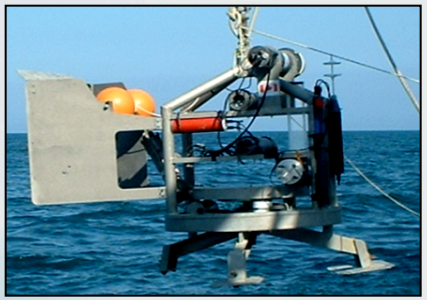
Data Integration in Modeling

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

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

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The CSDMS Data Repository

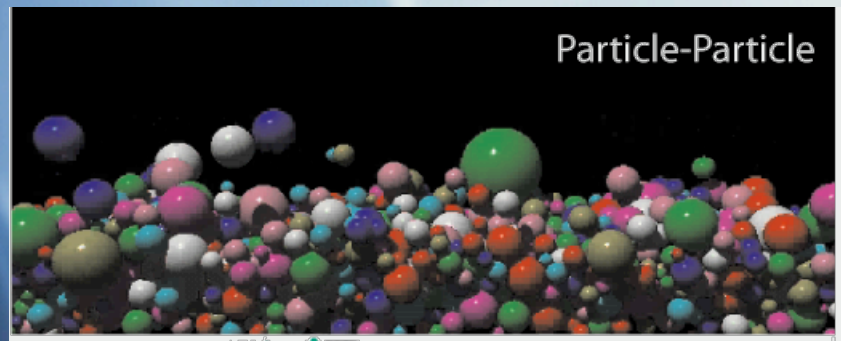
Archiving & distribution of data useful for model initializations & boundary conditions, for benchmarking of individual models, and for CSDMS framework-integrated validation experiments.

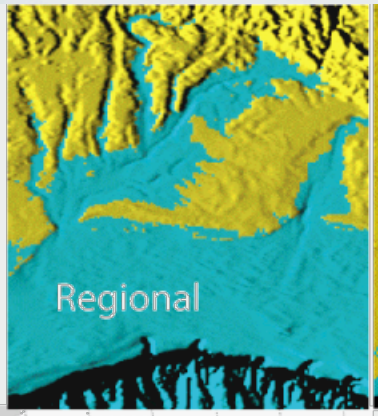
CSDMS presently offers the following gridded & geo-referenced data:

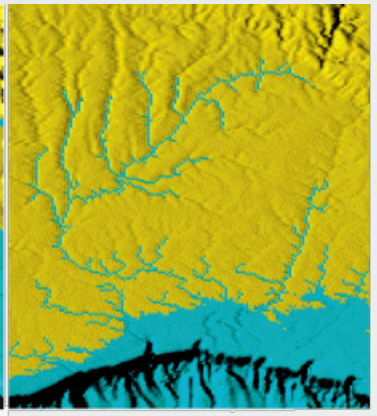
- **Bathymetry:** 1) GEBCO; 2) Smith & Sandwell (1-min); 3) IBCAO
- **Climate:** 1) GCRP; 2) GHCN (NOAA Global Historical Climate Network); 3) GOBALSOD (NOAA Daily Global Summary of Day); 4) PSD (Climate & Weather); 5) TRMM (Tropical Rainfall Measuring Mission); and 6) Unisys historical hurricane global data
- **Topography:** 1) LiDAR/ALSM (Airborne Laser Swath Mapping); 2) TOPO2 (Global 2-min); 3) ETOPO5 (Global 5-min); 4) GLOBE (Global 1-km); 5) GTOPO30 (Global 30 Arc-Sec); 6) NED (National Elevation Dataset); 7) SLA-02 (Shuttle Laser Altimeter); and 8) SRTM (Shuttle Radar Topography Mission)
- **Discharge:** 1) USGS (US daily, monthly), 2) HYDAT (Canada daily, monthly WSC), and 3) R-Arctic Net (Arctic-wide monthly)
- NISDIS World Glacier Inventory

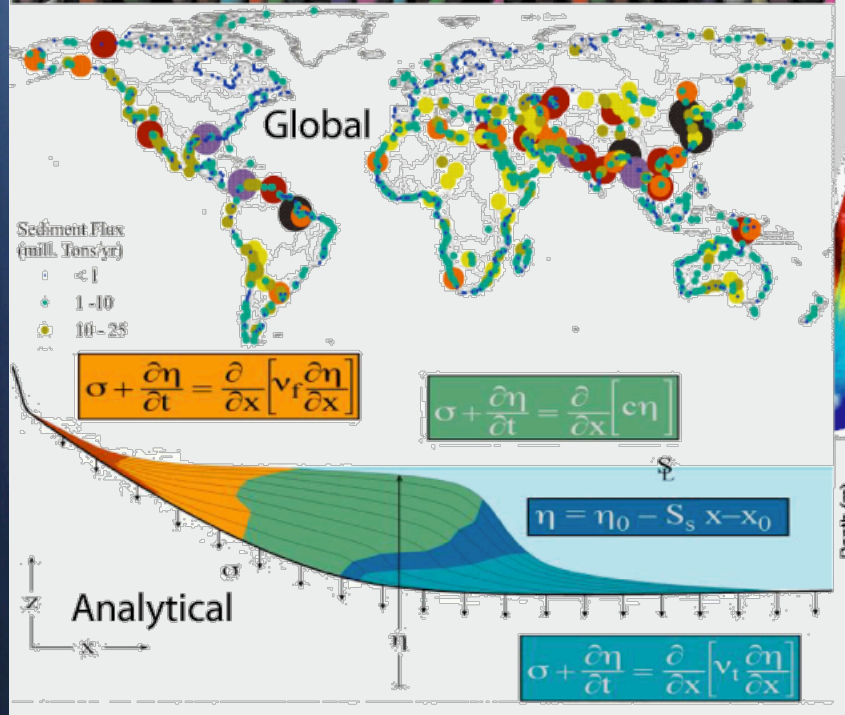
The CSDMS Models/Tools Repository

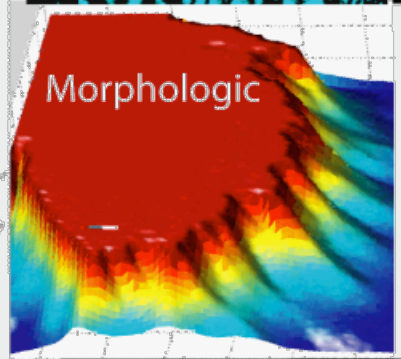
CSDMS hosts relevant surface dynamics models & tools, including novel computational strategies

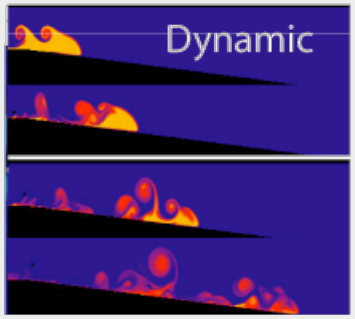


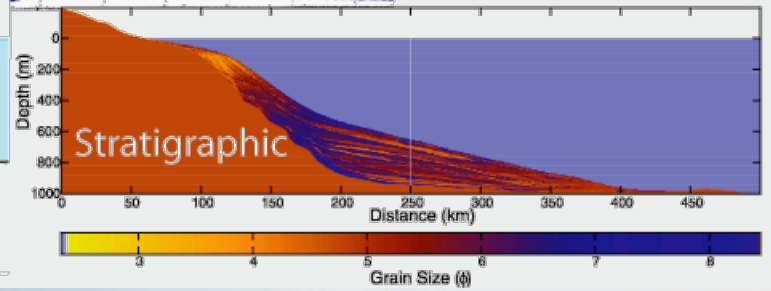












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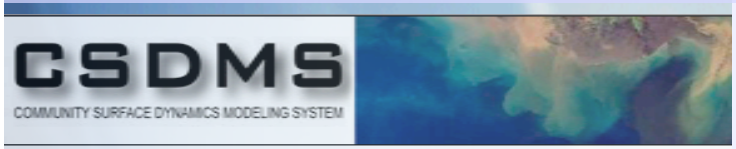
CSDMS offers >150,000 lines of code

Domain	Models+	Metadata	Source code
Terrestrial	47	33	20
Coastal	68	29	12
Marine	27	14	9



About | Organization | Meetings | Models

Intro | Model description | Tools | Data | Link to products

Model domains:
Terrestrial
Coastal
Marine

Model statistics:
SLOC

Model licenses:
License

Page edit toolkit
Page
Discussion
View source
History

Toolbox
Print as PDF
Wiki Help

Terrestrial model descriptions

To submit your model to the list, please complete this
you want to update the information about a model tha

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

Models with a link to their model information, have a
a questionnaire are encouraged to do so as soon as p

Program	Description
AquaTellUs	Model: Fluvial-dominated delta sediment
Avulsion	Model: Stream avulsion model
BEDLOAD	Subroutine: Bedload transport model
Caesar	Model: Cellular landscape evolution mod
Cascade	Model: Large scale SPM based on irregu
CHILD	Model: Landscape Evolution Model
DECAL	Model: Aeolian dune landscape model
Delft3D	Model: 3D hydrodynamic and sediment t
Dionisos	Model: 3D basin-scale stratigraphic mod
DRAINAL	Model: Surface process model
DR3M	Model: Distributed Routing Rainfall-Runo
ENTRAIN	Subroutine: Simulates critical shear stre
ENTRAINH	Subroutine: Simulates critical shields th
Erode	Model: Fluvial landscape evolution mode
FLDTA	Subroutine: Simulates flow characteristi varied flow equation
gc2d	Model: Glacier / ice sheet evolution

Model descriptions:
Terrestrial
Coastal
Marine

CAESAR:
Home
Information
Issues
Help
Download
Source

Page edit toolkit
Article
Discussion
View source
History

Technical background information on CAESAR

Contact information

Model:	CAESAR
Contact person:	Tom Coulthard
Institute:	University of Hull
City:	Hull
Country:	United Kingdom
Email:	T.Coulthard@hull.ac.uk

Model description

Model type:	Modular model for the terrestrial domain.
Description:	CAESAR is a cellular landscape evolution model, with an emphasis on fluvial processes, including flow routing, multi grainsize sediment transport. It models morphological change in river catchments.

Technical information

Supported platforms:	Linux, Windows
Programming language:	C, C#
Model development started at:	1996 and is still going on
To what degree will the model become available:	Source code will be available, and model can be used as well as a teaching tool and executable will be available.
Current license type:	GNU
Memory requirements:	>512MB
Typical run time:	5 min to 50 days

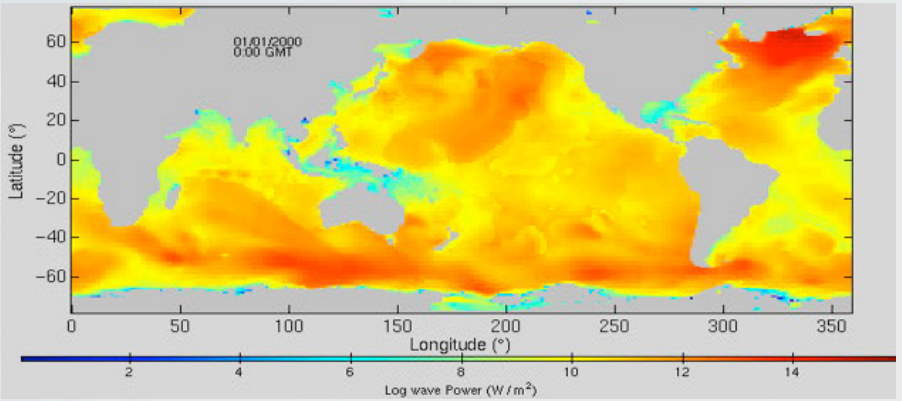
Input / Output description

Input parameters:	DEM as ascii grid (output from arcGIS), Rainfall data as a space separated ascii file (straightforward list), Inputs of water/sediment in an ascii file. Other single value parameter inputs for grainsize, flow parameters, slope processes etc..
Input format:	ASCII
Output parameters:	ascii grids (readable into arcGIS) and google earth images of: DEM, flow depth, surface grainsize, shear stress, vegetation cover, velocity. Also time series of water discharge and sediment discharge (across 9 grainsizes) at user chosen interval. Also visual output to AVI [illegible]
Output format:	ASCII

The CSDMS Education Repository

CSDMS distributes:

1) Model Simulations,
2) Educational PPTs,
3) Reports, Publication links,
4) Short Course Materials,
5) Images,
6) Workshop Presentations.



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Home Search Contact Us

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

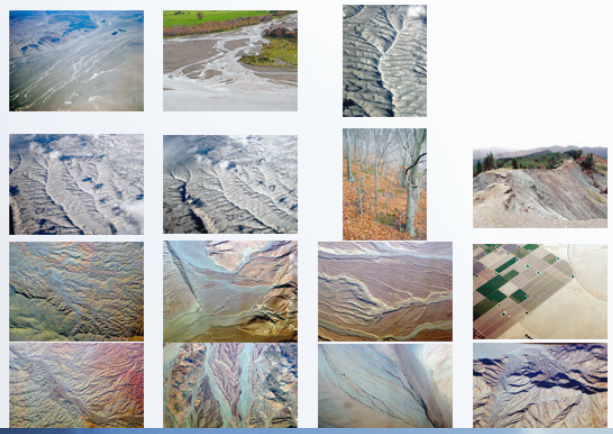
Products | Publications | Gallery | Models | Data

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.



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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	

CSDMS Working Groups & Focus Research Groups

Terrestrial

Tucker/CIRES
65 members
45 institutions
7 countries

Coastal

Murray/Duke
55 members
43 institutions
11 countries

Marine

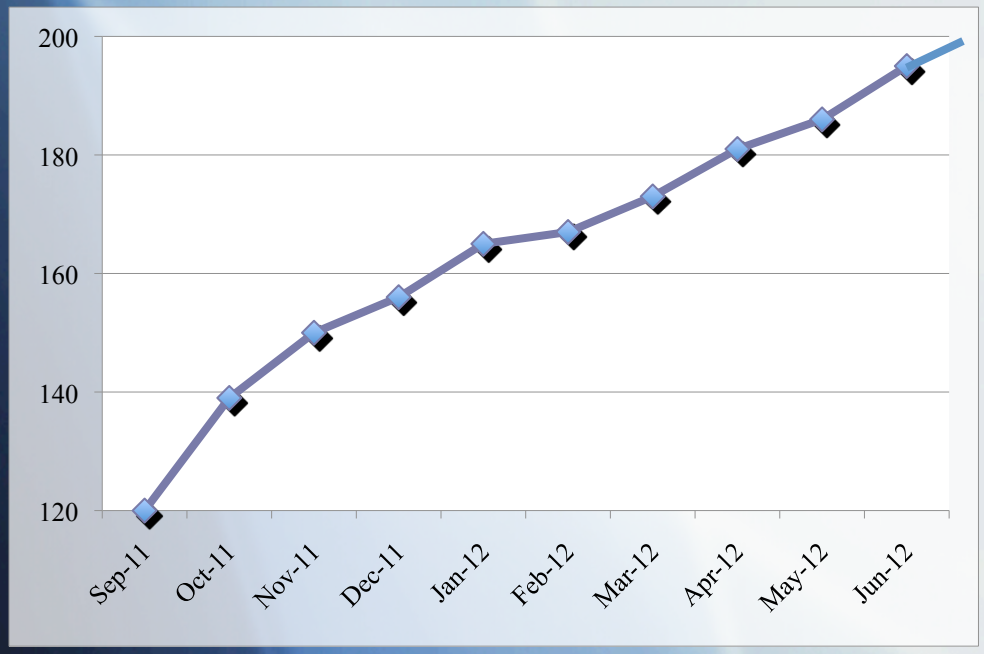
Wiberg/VIMS
47 members
40 institutions
8 countries

Cyber/Numerics

Tao Sun/ExxonMobil
30 members
20 institutions
3 countries

EKT

TBD
12 members
8 institutions
USA



Carbonate

Burgess/London
22 members
18 institutions
5 countries

Hydrology

Famiglietti/UCSB
?? members
?? institutions
?? countries

Chesapeake

Voinov/CCMP
?? members
?? institutions
USA

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CSDMS Cyber & Numerics Working Group

Evaluates numerical codes according to interoperability, protocol compliance, technical documentation, adequacy of supporting boundary conditions and boundary initializations.

Compliant code functions within a CSDMS framework

Operating systems: *fedora, ubuntu, OSX10.5, and Solaris 8*

Parallel computation: *MPI*

Language interoperability: *Babel*

Model Architecture: *CCA*

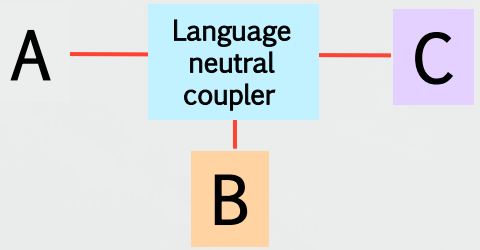
Model Interface Standard: *OpenMI*

Software Distribution: *RPM, Debian, PackageMaker, Contractor*

Platform-independent GUI: *wxPython*

Version control: *Subversion*

Open source software license: *CSDMS architecture: MITX11*
Components: GPL2 compatible OSI approved.



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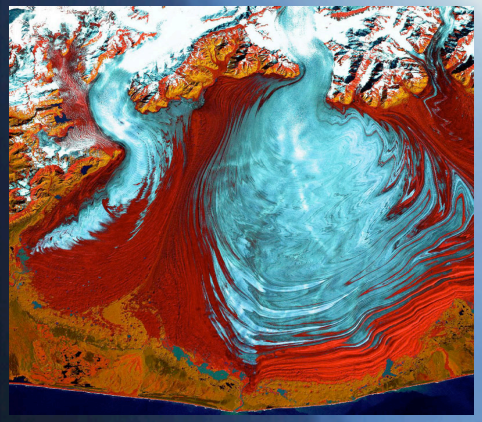
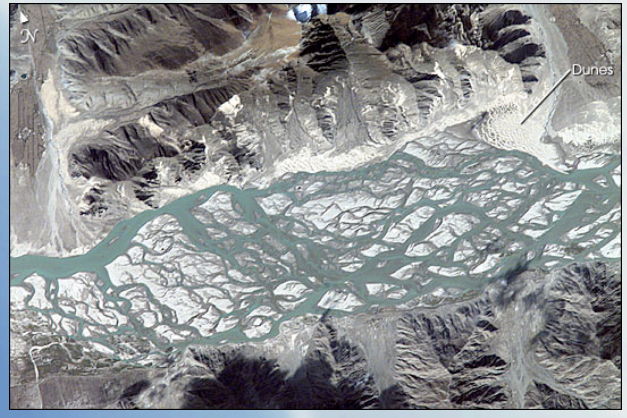
Environmental WGs & FRGs advance short & long term goals; modeling priorities; quality control









CSDMS Terrestrial WG Scope

EKT Workshop, Boulder, Oct. 2008

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Hydrology Focus Research Group
Cosponsored with CUAHSI

Community Hydrologic Modeling Platform (CHyMP) Goals

· link to atmospheric & ocean GCMs & Earth system models;
· link to biogeochemical, ecological, surface dynamics, & environmental engineering models
· forward & inverse modeling, optimization, stochastic analyses;
· interface with CUAHSI Hydrologic Information System;
· support environmental decision making, management & policy;
· serve as an educational tool.

Environmental WGs & FRGs provide community input: models, boundary conditions, validation datasets; documentation.

CSDMS Coastal WG Scope

EKT Workshop, Boulder, Oct. 2008

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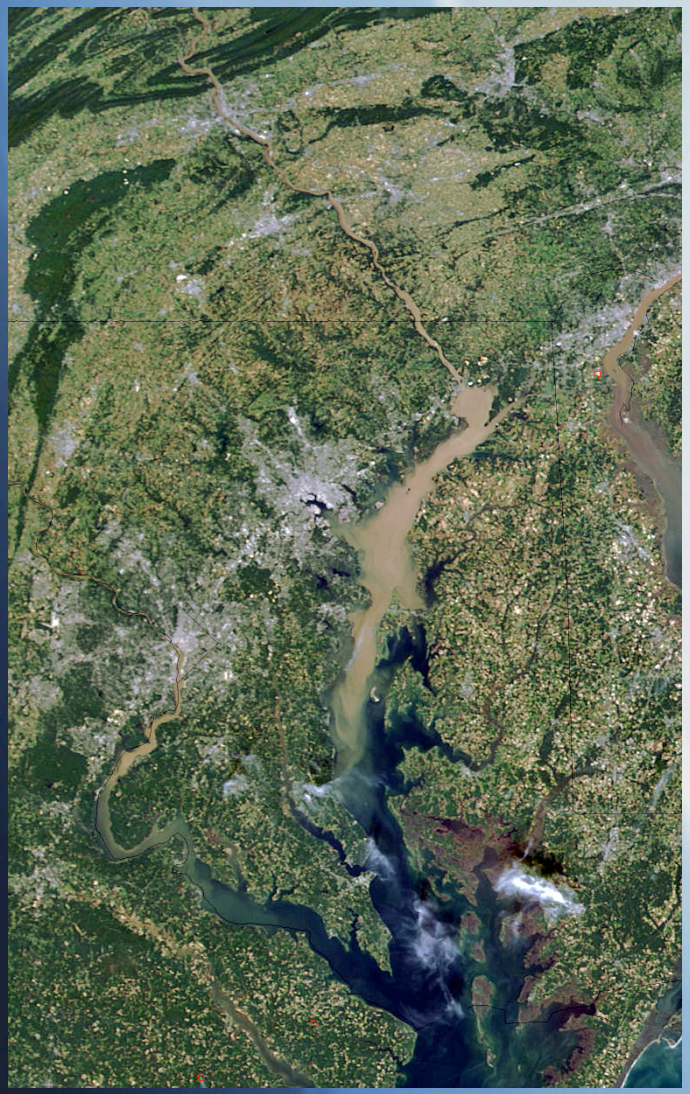
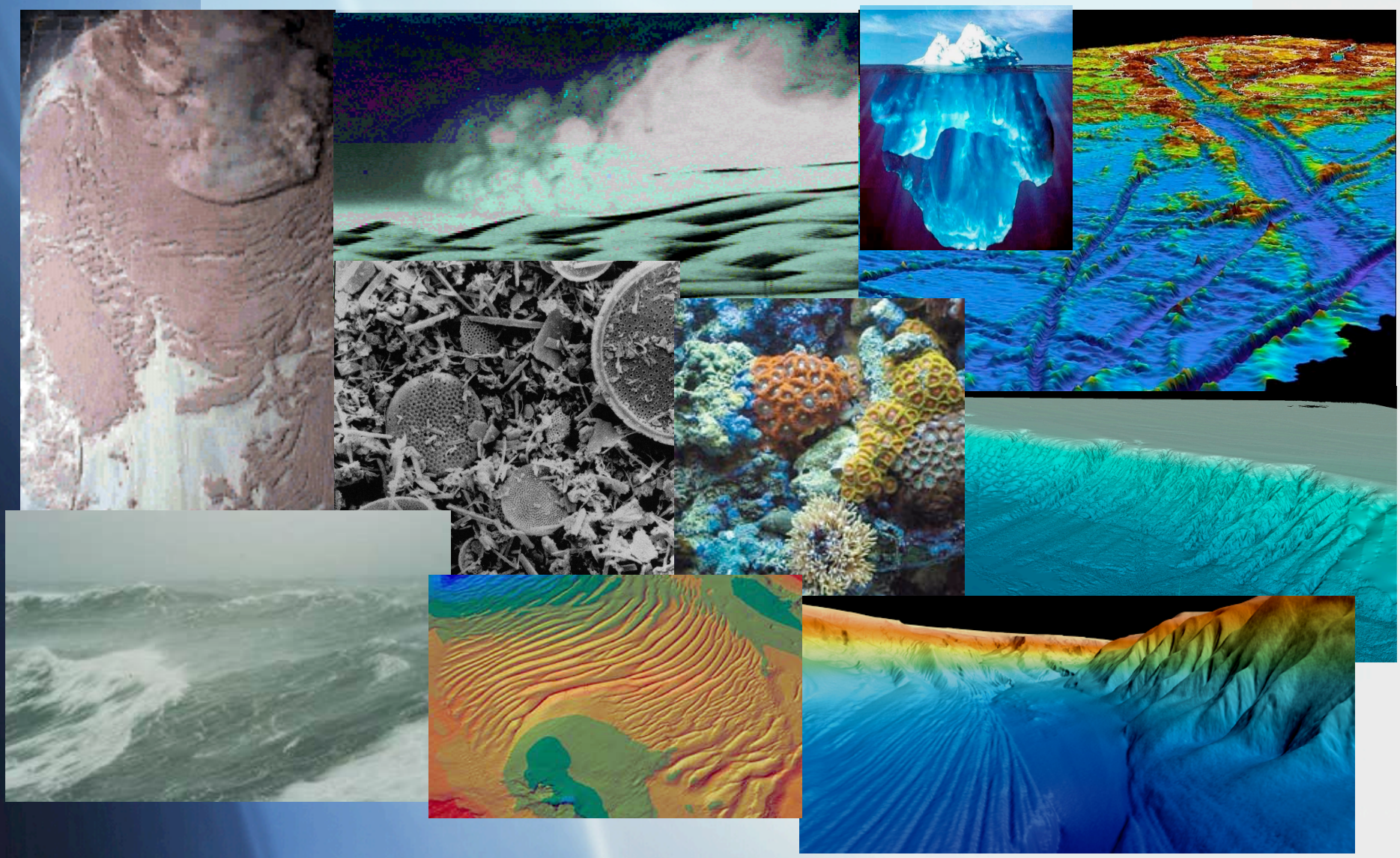
Chesapeake Focus Research Group
Cosponsored with CCMP



Chesapeake Community Modeling Program (CCMP)

- Supported by the Chesapeake Bay research community
- An open source system of watershed and estuary models specific to the Chesapeake Bay region.
- A watershed-estuary modeling framework consisting of interchangeable individual modules defining hydrodynamics, ecosystem dynamics, trophic exchanges, and watershed interactions.

Environmental WGs & FRGs are responsible for proof-of-concept challenges;



CSDMS Marine WG Scope

EKT Workshop, Boulder, Oct. 2008

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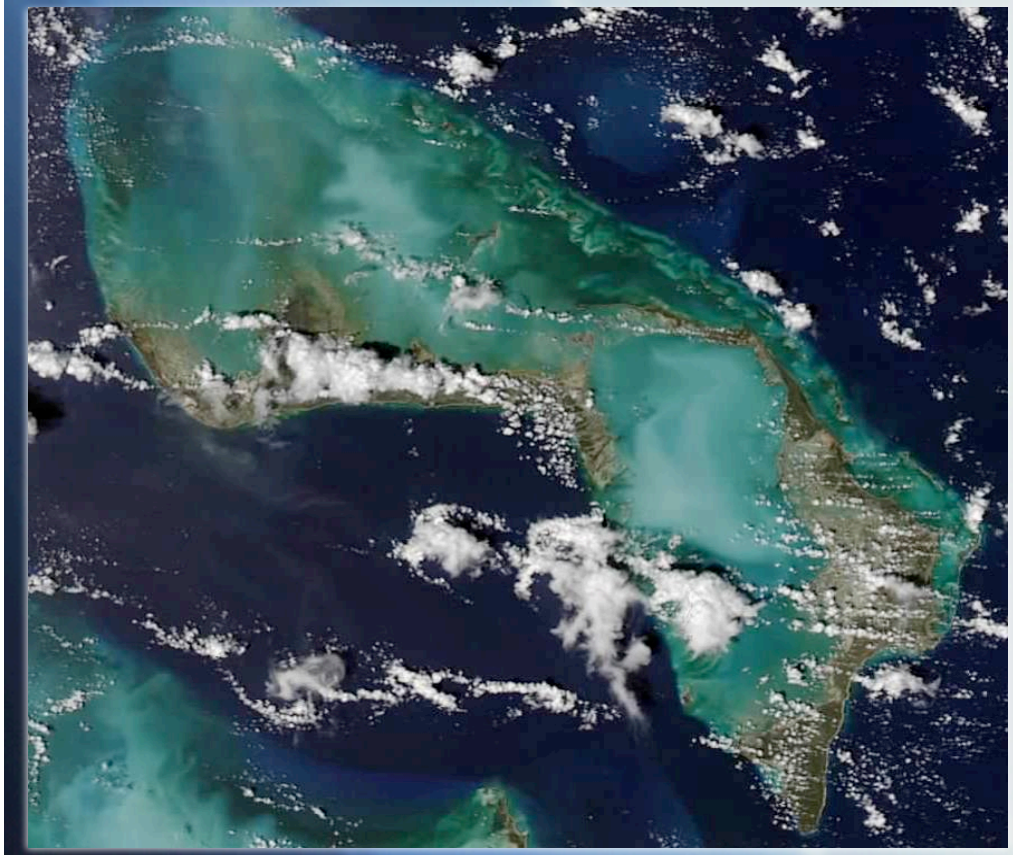
Carbonate Focus Research Group



Community Carbonate Model (CCM) Goal

Develop a numerical work-bench for carbonates that:

1) includes process modules (i.e., deposition, diagenesis, deformation/fracturing);
2) is linked to other models (e.g., ocean, climate, etc.);
3) accepts observations from different sources & databases;
4) has inversion/verification schemes & sensitivity/response surfaces; and
5) offers multiple time & space scales.

CSDMS Proof of Concept Model Challenges

1. Tracking the production, transport & fate of water, sediments, carbon & nutrients.
2. Dynamic models that include the *Human Dimension*
3. Integration of models that track surface dynamics across moving boundaries (e.g. sea level, climate)

CSDMS Education & Knowledge Transfer WG

- Education audiences: university students, professionals, secondary and college teachers, and the general public.
- Knowledge Transfer audiences: Industry and Federal Agencies
- Professional training in the use of CSDMS and its components.
- Undergraduate education: develop and formally assess instructional modules centered on interactive, animated simulations of earth-surface processes; engage students in real problems.
- Build on the teacher-training program via NCED: 1) ESTREAMS teachers in research program, 2) summer Teacher Institutes
- Contribute to the public understanding of Earth-surface dynamics by working with the Science Museum of Minnesota; develop a 3D movie to convey the excitement of earth-surface science, while emphasizing space-time complexity (Funding from NCED).
- Engaging the CU SMART program that nationally targets historically underserved undergraduates in science and engineering through ten-week research internships each summer.

CSDMS Education & Knowledge Transfer WG

- Tests hypotheses to support data interpretation
- Utilize pre- & post-processing visualization tools
- Tests modules as part of field campaigns

- Run scenarios
- Relate spatial output to environmental factors
- Quantify uncertainties in decision making

Uncertainty, Variability, Error, Precision, Accuracy, Confidence

- Illustrates surface processes using pre-packaged models
- Builds intuition with "what-if" model runs
- Develops case studies that integrate field data and model simulations.

CSDMS
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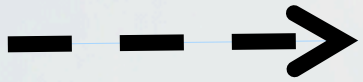
NSF year 2	NSF year 3
$420K IF Staff	$660K IF Staff
0.40 Ex. Director	0.50 Ex. Director
0.75 Senior S Eng	0.75 Senior S Eng
1.00 Software Eng	1.00 Software Eng
0.40 Software PDF	1.00 Software PDF
1.00 Ex. Assistant	1.00 Ex. Assistant
0.50 Web Master	1.00 Web Master
0.20 Sys. Admin	0.28 Sys. Admin
0.25 Accountant	0.36 Accountant
	1.00 EKT specialist
$80K Workshops	$80K Workshops
$40K Travel (all)	$40K Travel (all)
$26K Operations	$38K Operations

CSDMS is underwritten by NSF and importantly an assortment of research funds from NASA, ONR, USGS, ConocoPhilips, ExxonMobil, plus ....



Yr 2: CSDMS NSF-supported staff = 4.5 FTE
CSDMS non NSF-supported staff ≈ 4.5 FTE

Yr 3: CSDMS NSF-supported staff = 7 FTE
CSDMS non NSF-supported staff ≈ 6 FTE

CSDMS
COMMUNITY SURFACE DYNAMICS MODELING SYSTEM

Principal Year 2 Goals

Goal 1) Establish interface standards that define how components can be connected with OpenMI within CCA

Goal 2) Link refactored code contributions from the community as CSDMS components within the CSDMS framework

Goal 3) Implement a glacier erosion model (e.g. *GC2D*) with a distributed hydrologic model (e.g. *TopoFlow*) as an application built from CCA-compliant components

Goal 4) Implement a landscape evolution model (e.g. *CHILD*) and a coastal evolution (e.g. *COAST*) built as CCA compliant components

Goal 5) Explore the coupling of a 3D hydrodynamic ocean model within CSDMS/CCA (e.g. *ROMS* or *Delft3D-Flow*)

Goal 6) Begin to assemble a set of standard components that transcend model components and facilitate their linkage of components into working applications

Goal 7) Create two educational modules, conduct a training workshop and assist the CSDMS community in preparing code and model contributions that comply with the CSDMS standards and interfaces

Principal Year 2 Goals (cont.)

Goal 8) Develop further, the three CSDMS repositories (Data, Model, & Education), through community contributions.

Goal 9) Purchase and setup the CSDMS Experimental Supercomputer, test compilers with *SedFlux*, and once operational, open up system to the CSDMS community for computational activities.

Goal 10) Further develop the CSDMS Wiki website in aid of community integration and participation

Goal 11) Organize &/or sponsor &/or host 4 workshops (Clinoform, Sedibud, CUAHSI Biennial Colloquium, IAHS/S2S workshop), 7 working group meetings, 4 management meetings, 1 Open Town-hall meeting and 1 short course.

Goal 12) Host the Industry Consortium first meeting; host a U.S. interagency partners meeting; represent CSDMS within the US and abroad (e.g. teach a CSDMS S2S modeling workshop in New Zealand)

The Promise of CSDMS

Better understanding of the evolution of Earth's environments,
Better quantification of our knowledge uncertainties.
Contribute new numerical models to address the complexities, feedbacks & linkages in earth-surface science.
Proffer new numerical approaches for the benefit of society.

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