The Community Surface Dynamics Modeling System: Experiences on Building a Collaborative Modeling Platform

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CSDMS
COMMUNITY SURFACE DYNAMICS MODELING SYSTEM

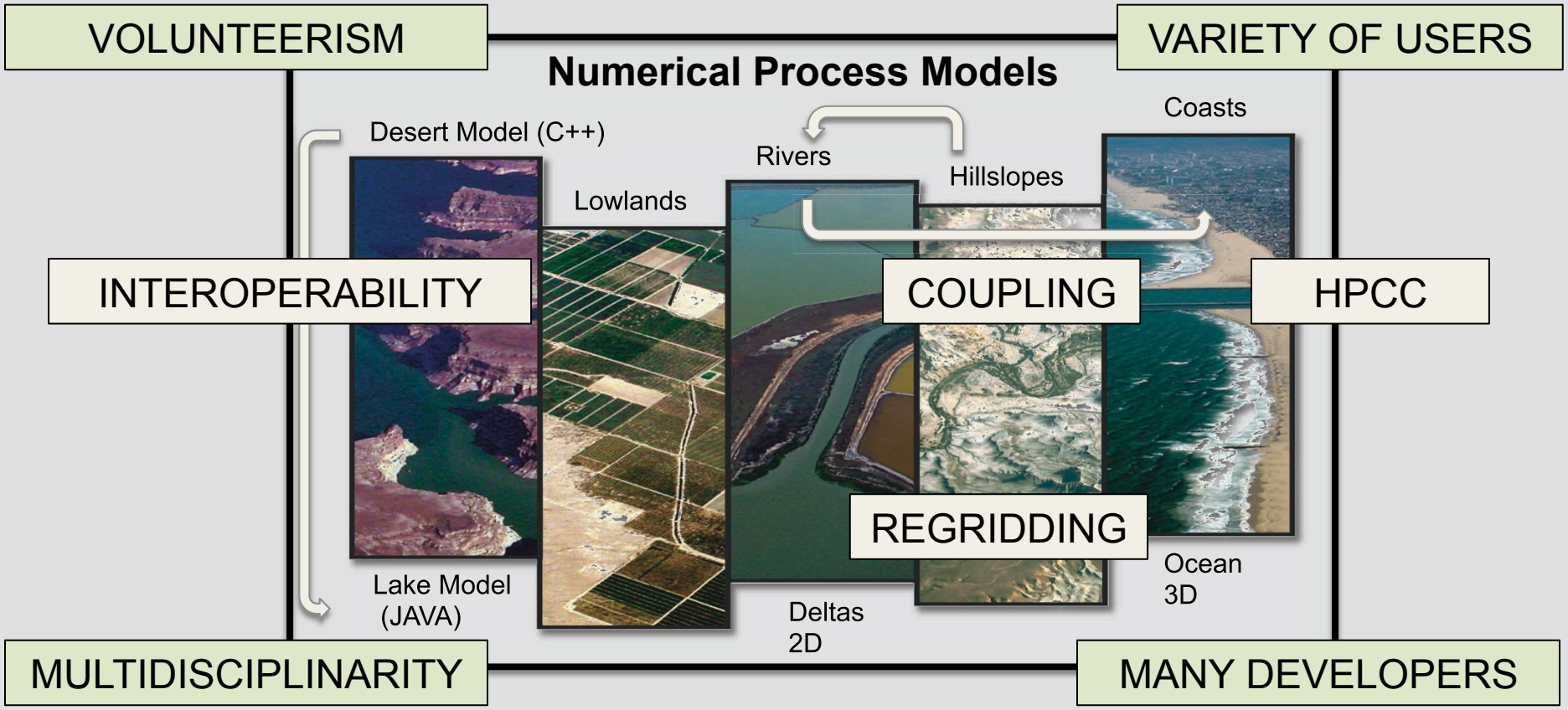
Outline

- What is CSDMS?
- Overview of CSDMS Members and Governance
- Tools for Collaboration
  1) CSDMS Wiki
  2) CSDMS Modeling Tool
- Strategies for Transparent Model Development
- Data Analysis of Community Participation and Contribution
- Data Analysis Novice User Engagement
- Future

What is CSDMS: the Community Surface Dynamics Modeling System

Develops, integrates and disseminates software to define the earth's surface dynamics by simulating the movement of water, sediment and nutrients through landscapes and seascapes.

Grand Challenge: Building a Toolbox of Component Models with guidance and input of a large community of scientists



CSDMS Community

Workshops, symposia & Working Group meetings

12 CSDMS Short Courses (U.S.A., Germany, Korea, New Zealand)

CSDMS meets face-to-face, but is mostly virtual

- Annual All-Hands Member Meeting (1/year)
- Working Group Meetings (1/year)
- Executive Committee Meeting (2/year)
- Steering Committee Meeting (1/year)

Beyond meetings we are a virtual community:
CSDMS Wiki, Reports and Email Lists
http://csdms.colorado.edu

Annual all-hands meeting

CSDMS Community & Governance

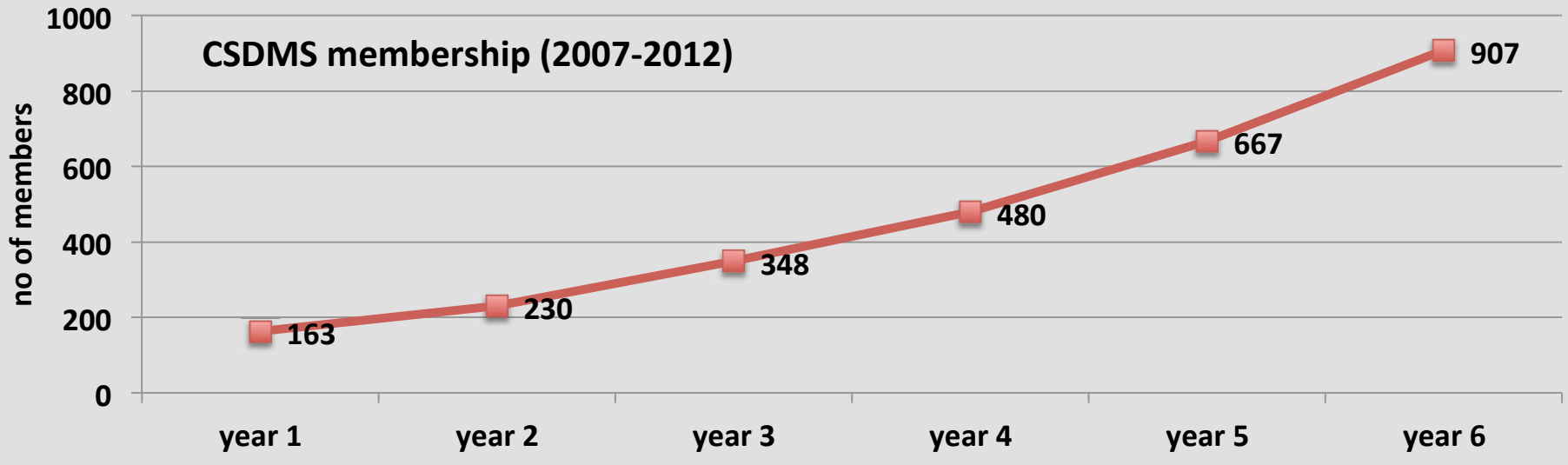
Members

Terrestrial	417
Coastal	330
Hydrology	321
Marine	227
Cyber	142
EKT	135
Carbonate	63
Chesapeake	44

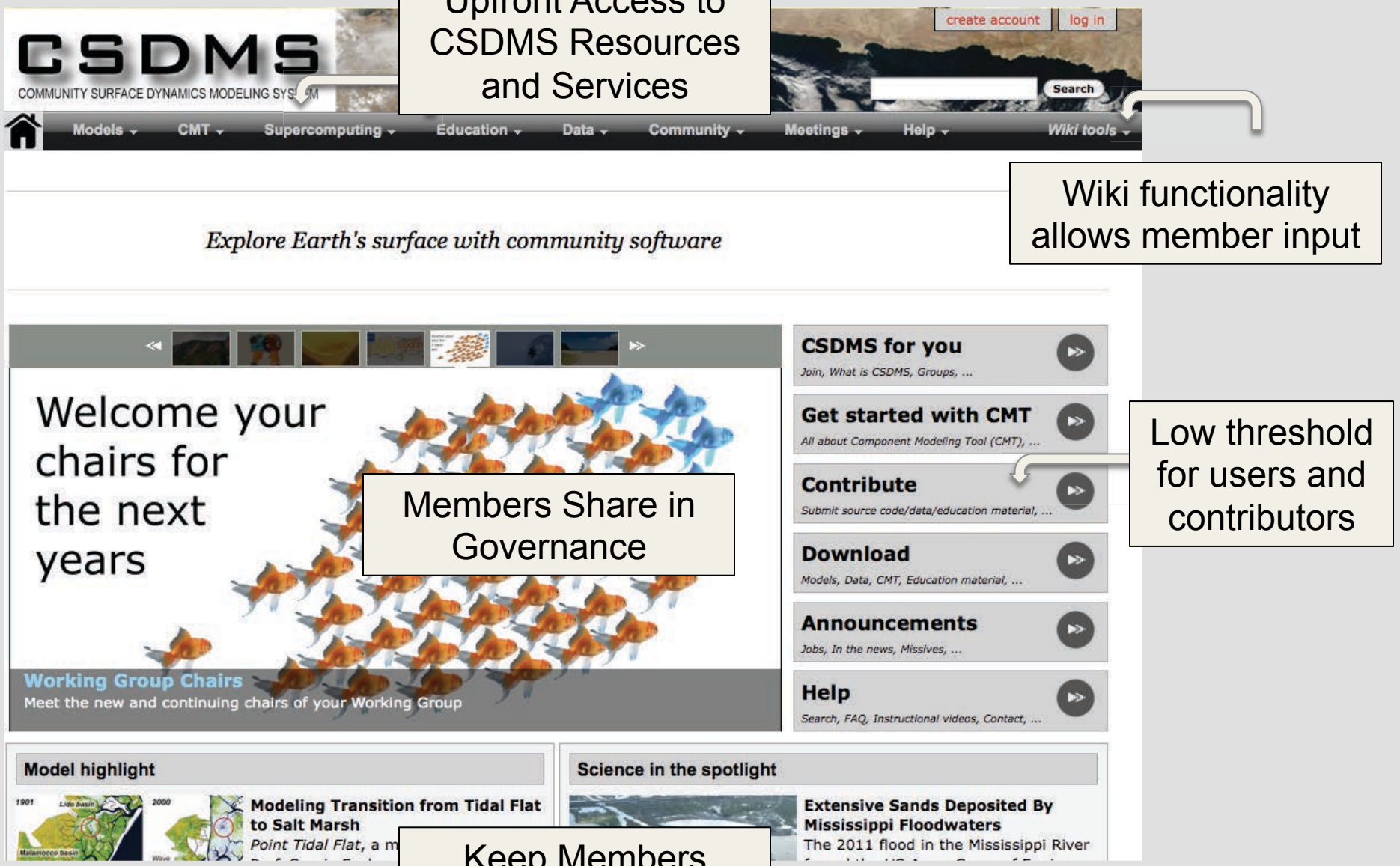
~Now 907 members

Governance

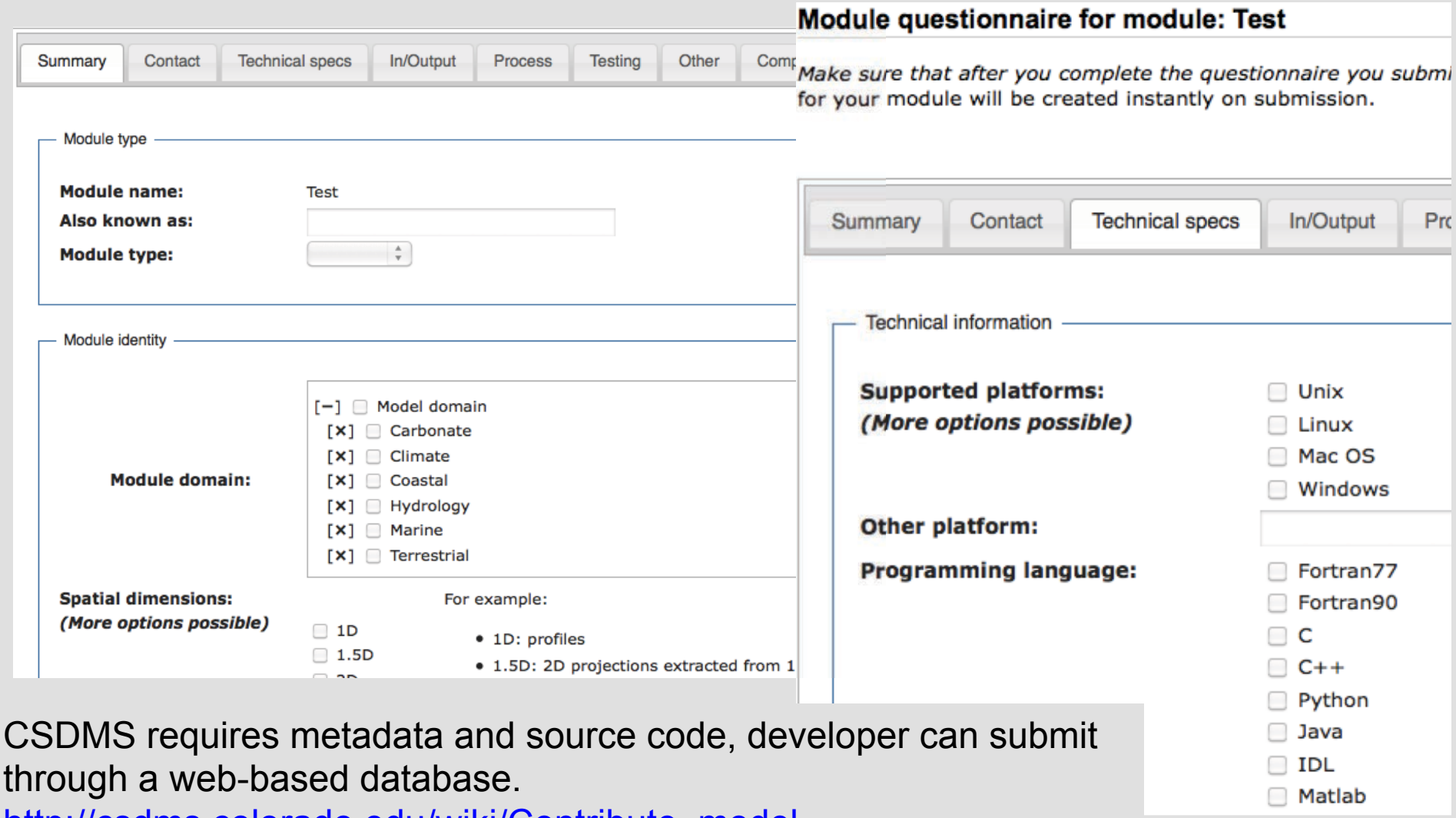
- 8 Elected Working Group Chairs, CSDMS Director, and Senior Software Architect comprise the Executive Committee.
- 10 Steering Committee Members, (NSF Program Officer and CSDMS Director serve as ex-officio).



CSDMS Wiki: a Platform for our Virtual Community

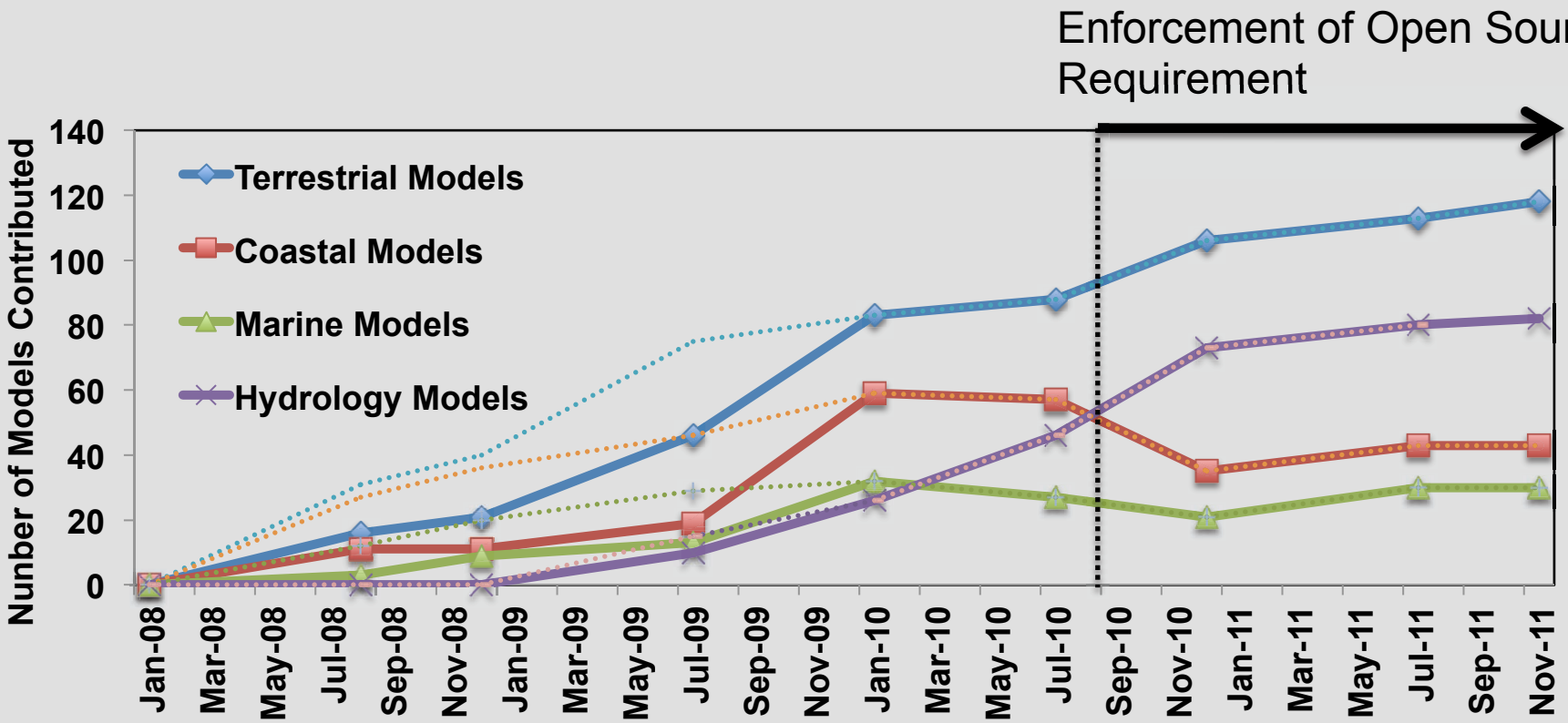


Web-Forms for Model Metadata, Educational Material, Data



CSDMS requires metadata and source code, developer can submit through a web-based database.
http://csdms.colorado.edu/wiki/Contribute_model
CSDMS test whether code compiles. Metadata becomes accessible for everyone, code is archived in Subversion and downloadable.

Open-Source Model Repository



- As of end 2012, 94 model developers (or teams) contributed their source code.
- Total of 165 models are now available (>6.7 million lines of code).
- Often different models for similar processes have been submitted
- Recorded 9788 downloads from 2008 onwards, 20 models have >100 downloads

Governance through CSDMS wiki?

Coastal models (51)

Program	Description	Developer	Voting results
2DFLOWVEL	Tidal & wind-driven coastal circulation routine	**Slingerland**, Rudy	*0*
ADCIRC	Coastal Circulation and Storm Surge Model	**Luettich**, Rick	**0.73** (*1 voter*)
AlluvStrat	Rules-based model to generate a 2-dimensional cross section of alluvial stratigraphy based on fluvial processes	**Wickert**, Andy	
AquaTellUs	Fluvial-dominated delta sedimentation model	**Overeem**, Irina	
Avulsion A.k.a. *Debouche*	Stream avulsion model	**Hutton**, Eric	
CEM	Coastline evolution model	**Murray**, A. Brad	
CMFT	Coupled salt Marsh - tidal Flat Transect model	**Mariotti**, Giulio	**1** (*1 voter*)
DELTA	Simulates circulation and sedimentation in a 2D turbulent plane jet and resulting delta growth	**Slingerland**, Rudy	**1** (*1 voter*)
DROG3D	3-DIMENSIONAL DROGUE TRACKING ALGORITHM FOR A FINITE ELEMENT GRID WITH LINEAR FINITE ELEMENTS	**Blanton**, Brian	*0*
Delft3D	3D hydrodynamic and sediment transport model	**Delft3D**, Support	**3.95** (*5 voters*)

‘Online Voting’ to Prioritize Models finds limited use

Roadmap AquaTellUs component status:

Project owner CSMDS-IF: Irina Overeem
Start date project: 05/22/2011
Estimated release date: **12/31/2012**
Project status: 53%

Milestone: Executable

100%

Status	Task	Task owner	Information	Estimated completion date
✓	Provide metadata	Irina Overeem	More...	02/12/2009

‘Roadmap’ Developers hardly use project timeline tracking on the wiki

CSDMS CMT - component modeling tool

CSDMS CMT Framework & Services:

(1) Platform-independent Modeling Tool *CMT* (Linux, Mac OS X, Windows)

(2) Language interoperability (C, C++, Java, Python, Fortran) with *Babel;*

(3) Component preparation *&* project management using *Bocca;*

(4) Low-level model coupling within a HPC environment using *Ccaffeine;*

(5) Single-processor spatial regridding (OpenMI *Regrid)* or multi-processor spatial regridding (ESMF *Regrid)* – all grid types;

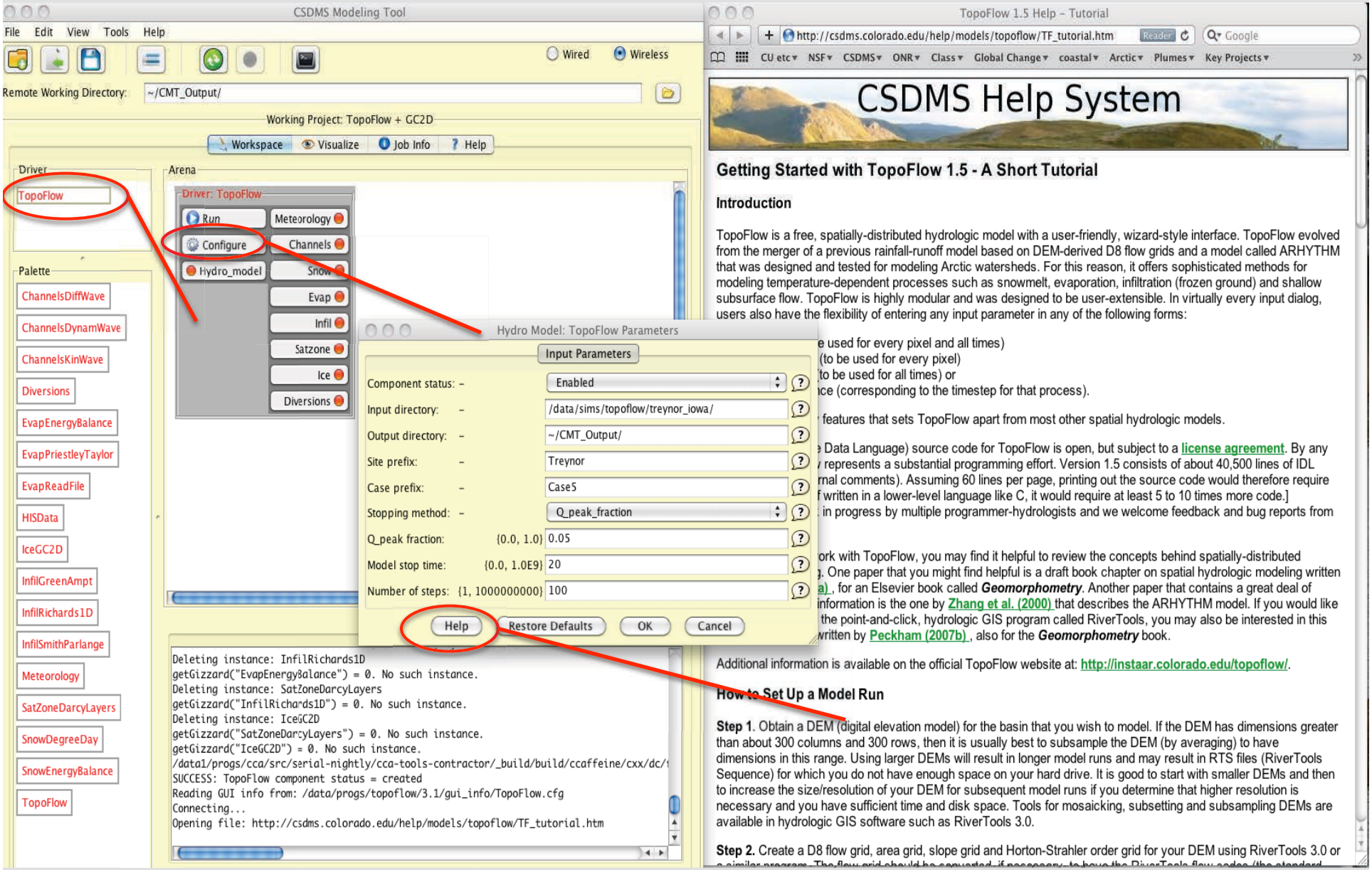
(6) Component interface standards BMI & CMI;

(7) Open-source standards (e.g. CCA, SIDL, OGC, MPI, NetCDF, OpenDAP).

(8) Visualization of large datasets in a multiple processor environment (*VisIt)*

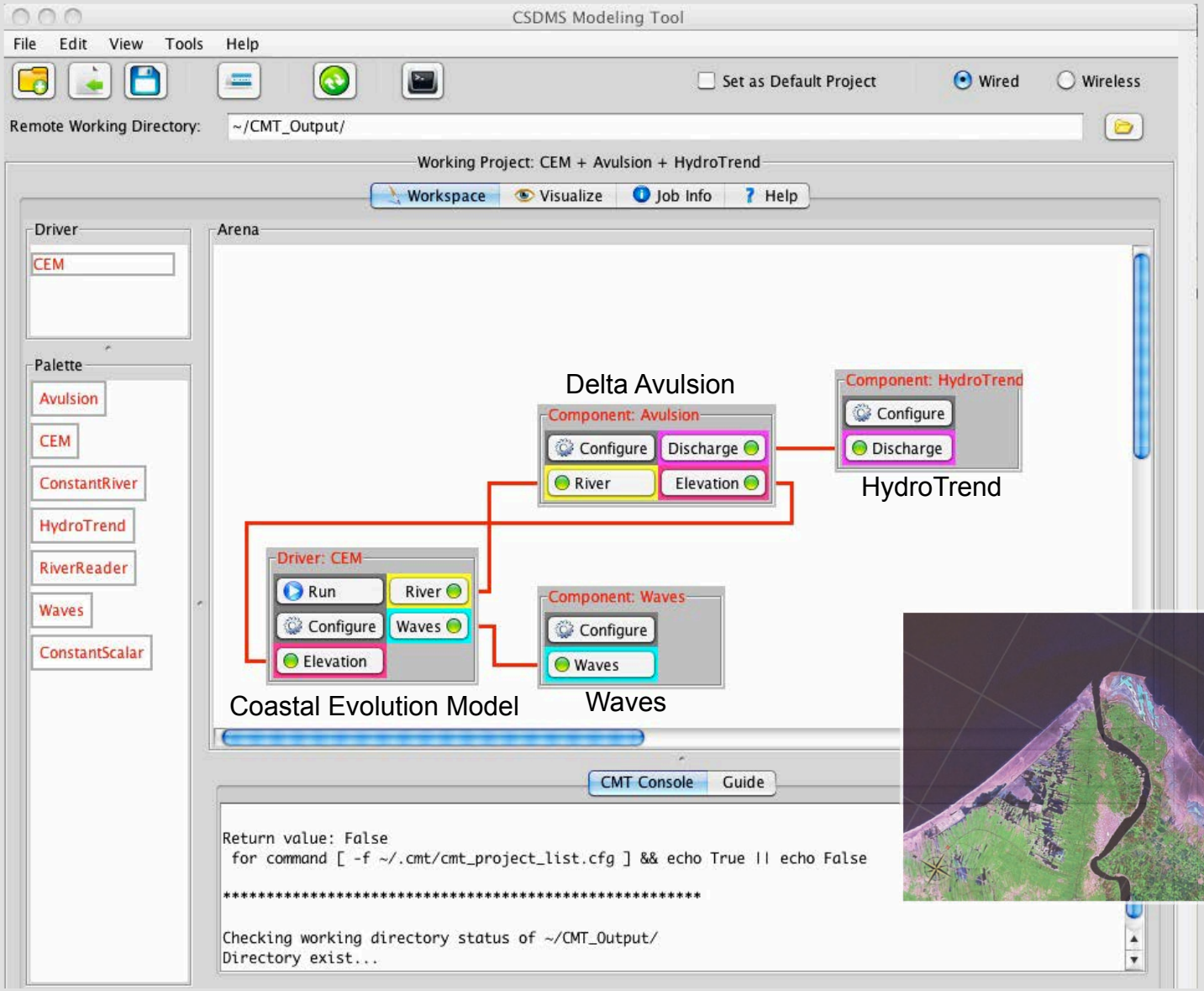
(9) Message passing within the HPC environment using *MPI (MPICH) & OpenMP with PETSc* - Portable Extensible Toolkit for Scientific Computation

Developed Tool for running CSDMS-component models



Online Wiki-Based CMT 'help system' avoids black-box syndrome
Designed to become an interactive user platform, tightly linked to CSDMS wiki.

Model Coupling Example



Running CMT allows a user's computer to become a client that connects remotely to a server on the CSDMS HPC cluster, where the model computation takes place

Coupled code has 3 legacy models and 1 new model of > 7 developers linked.

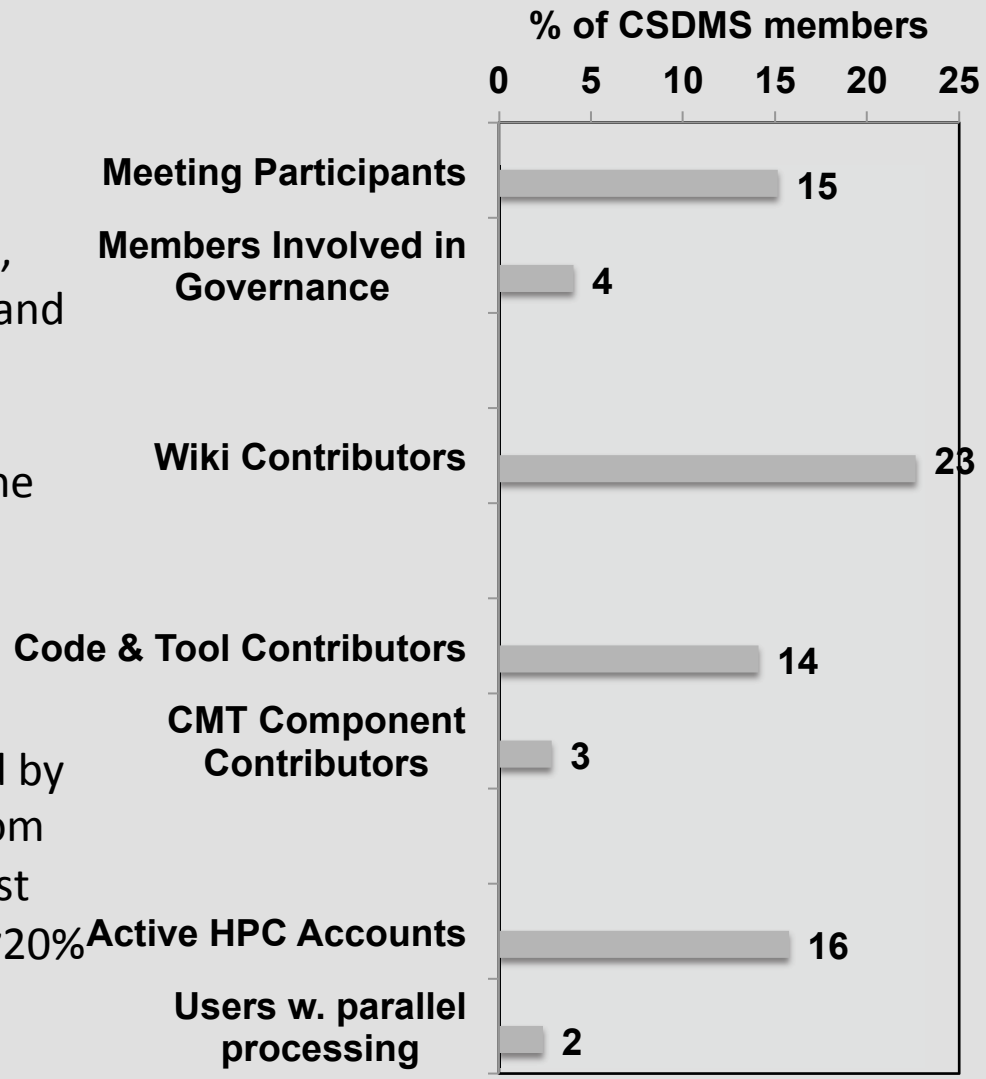
Community Participation

Volunteers vs. Staff

Funded staff has an essential role in web development, coupling software development, education of modelers , development of data and teaching resources.

About 23% of members contributed edits to the wiki, still the greater part of web building and editing is done by the web specialist and staff.

Protocols for the CSDMS infrastructure are entirely designed, developed and documented by CSDMS-funded staff, with critical feedback from volunteers. About 14% of all members are most active code contributors, IF staff contributed ~20% of models and tools.



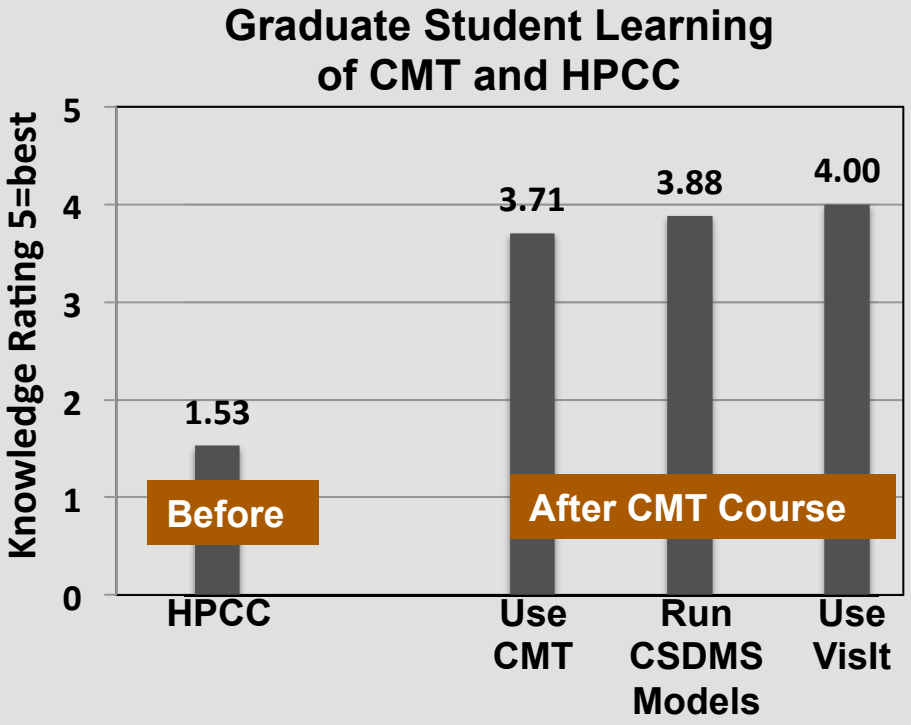
CSDMS Engagement of Novice Users

Instructional videos

Description	Link
How to connect to the supercomputer An instructional video that shows how to connect to the CSDMS High Performance Computer Cluster (HPCC; beach) and the CSDMS Modeling Tool (CMT; model coupling GUI).	
How to contribute to the CSDMS repositories A step by step video of how to contribute a model to the CSDMS model repository and show how to edit your entries.	
How to use the model repository A brief video of how to use the model repository	
How to become a member A short description of how to become a member and what are the benefits of a CSDMS member.	

CSDMS instructional videos offer step by step instruction on how to use the various tools and facilities of CSDMS.

Courses engage students in modeling and HPC-simulations (2 credit graduate course, 2 day summer institute / every year)



Future CSDMS

- Discussion is ongoing to expand governance of increasing working groups, to include co-chairs or core-teams.
- CSDMS wiki can be a platform for discussion and user interaction.
- Increase ease-of-use of CMT:

1) A web-based Component Modeling Tool will allows users to run coupled models directly through a web browser
2) Pre-built executables of models and tools able to run on a wide range of platforms, should facilitate use.
3) Automate ‘wrapping’ processes to allow legacy code in the repository to become CSDMS components faster