The Community Surface Dynamics Modeling System: Infrastructure Updates and EKT

Irina Overeem, Erik Hutton, Albert Kettner, Mark Piper, James Syvitski, Scott Peckham

CSDMS Integration Facility, University of Colorado, Boulder, CO, USA

CSDMS
COMMUNITY SURFACE DYNAMICS MODELING SYSTEM

Outline

- What is CSDMS?

- Tools for Collaboration
  1) CSDMS Wiki
  2) CSDMS Modeling Tool

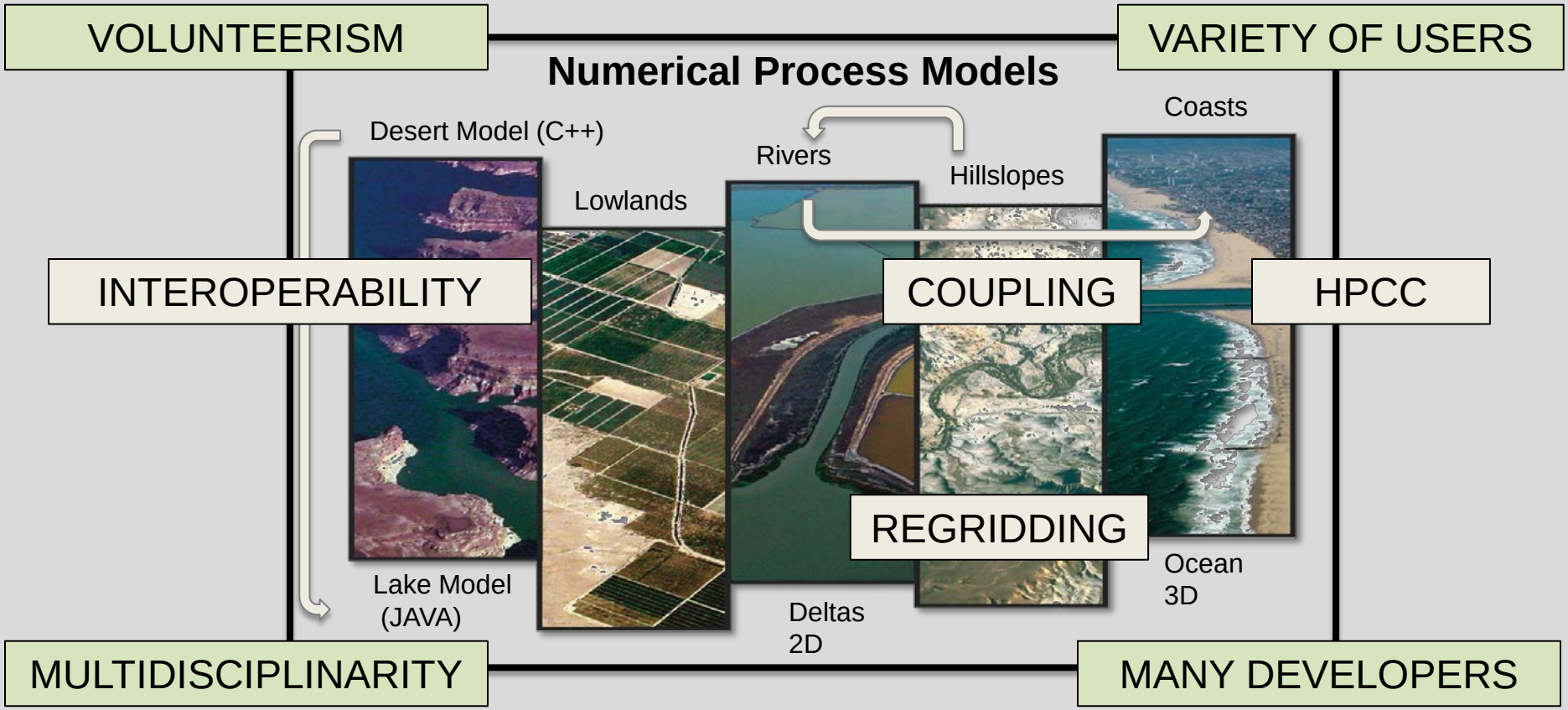
- Education with Models
- Data Analysis Novice User Engagement

- Call for contributions and volunteers with geodynamics expertise!

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

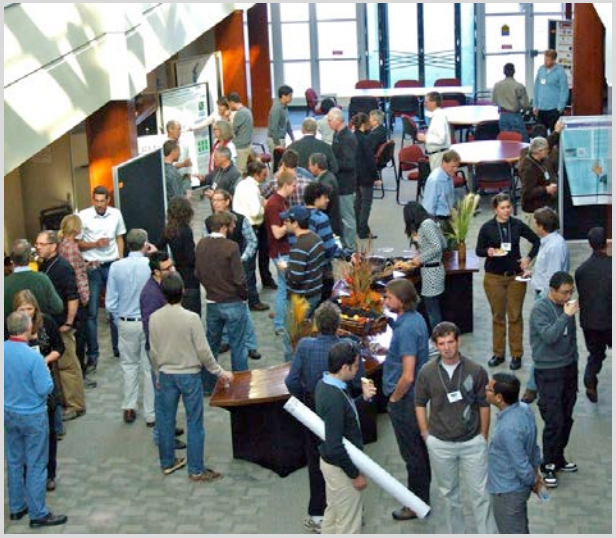
CSDMS Short Courses

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

• Annual All-Hands Member Meeting

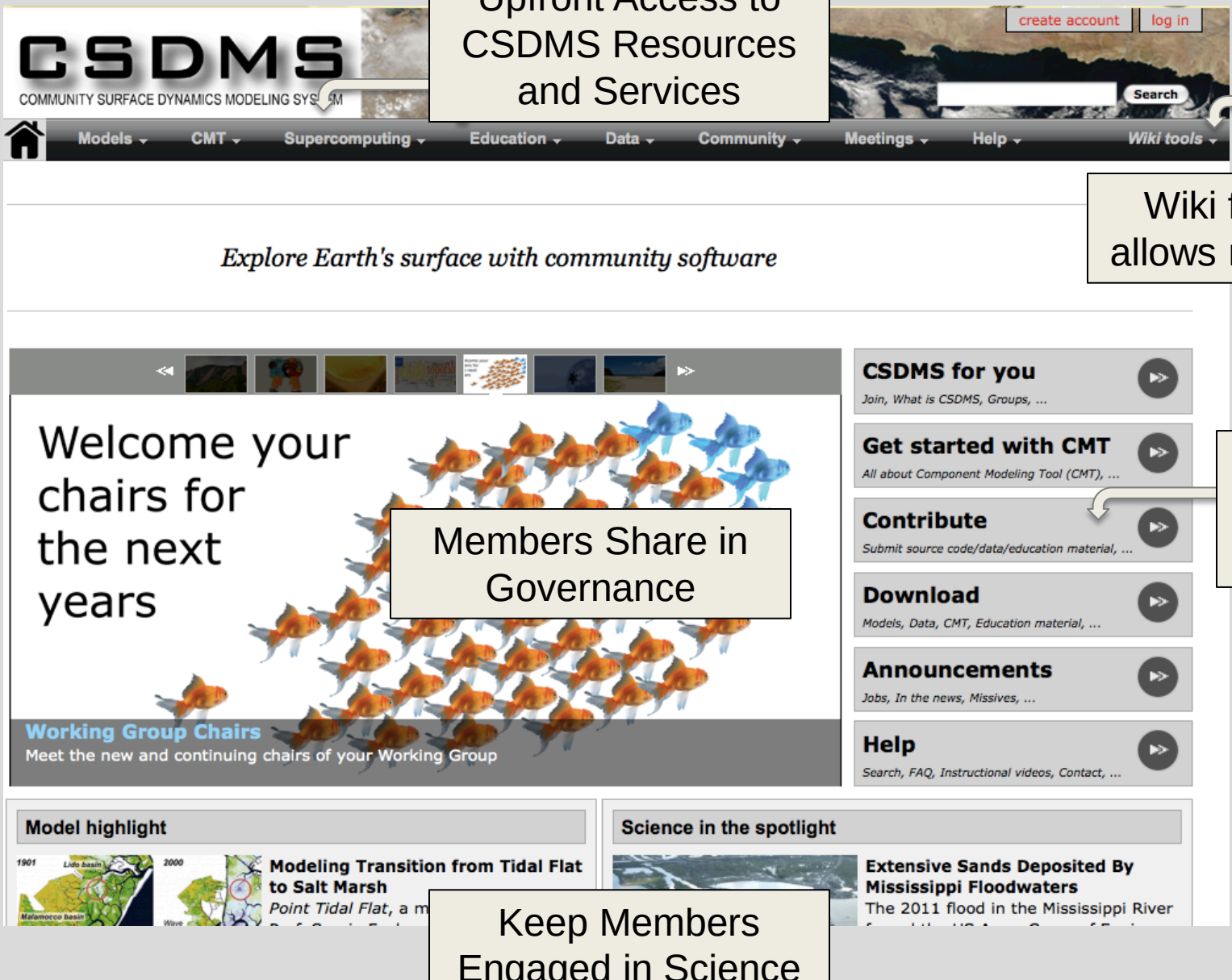
Beyond meetings we are a virtual community:
CSDMS Wiki, Reports and Email Lists
http://csdms.colorado.edu

Sign up to be a Member!

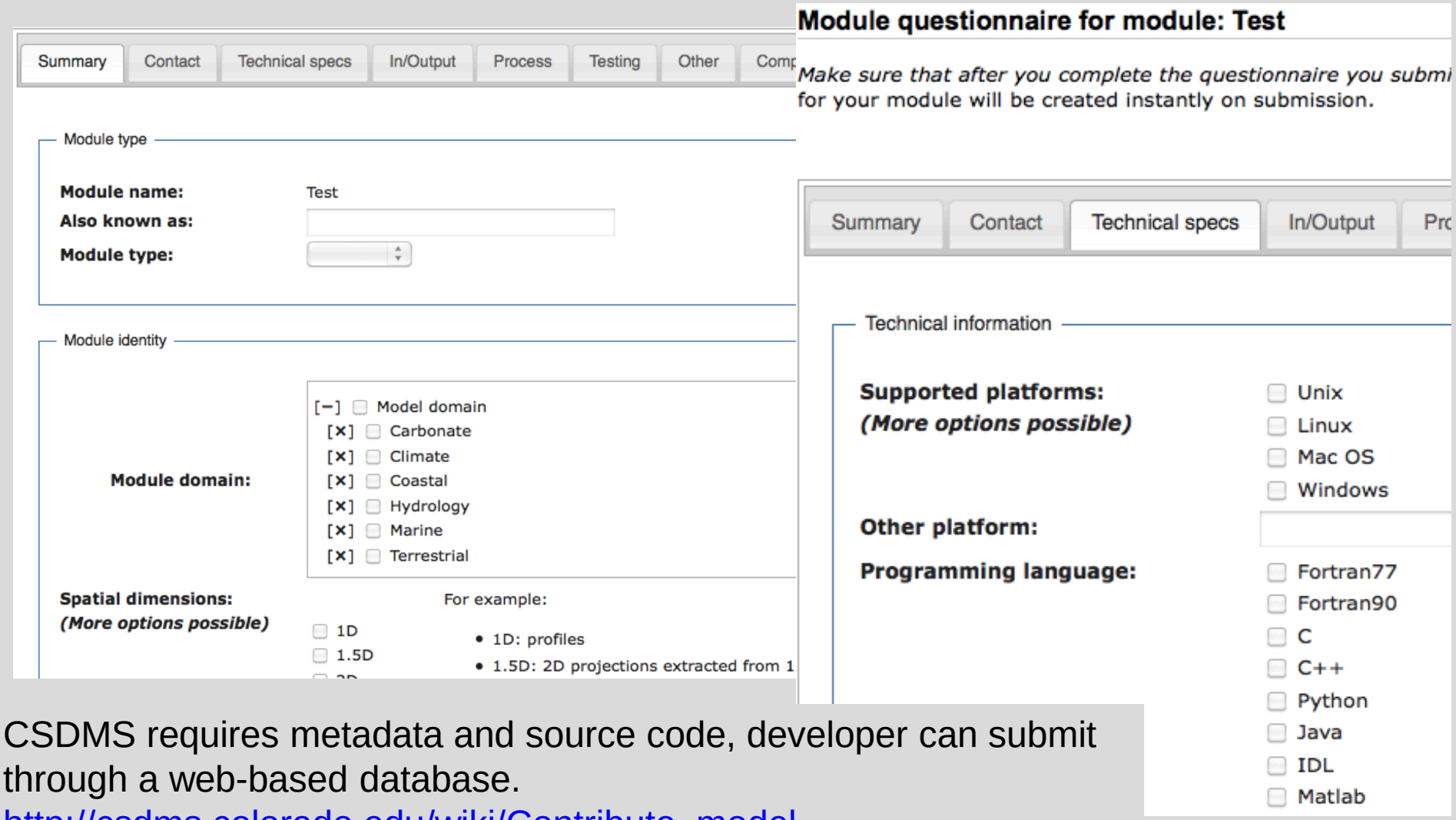


Annual all-hands meeting In Boulder CO

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.

CSDMS CMT - component modeling tool

CSDMS CMT Framework & Services:

(1) Platform-independent Modeling Tool (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;

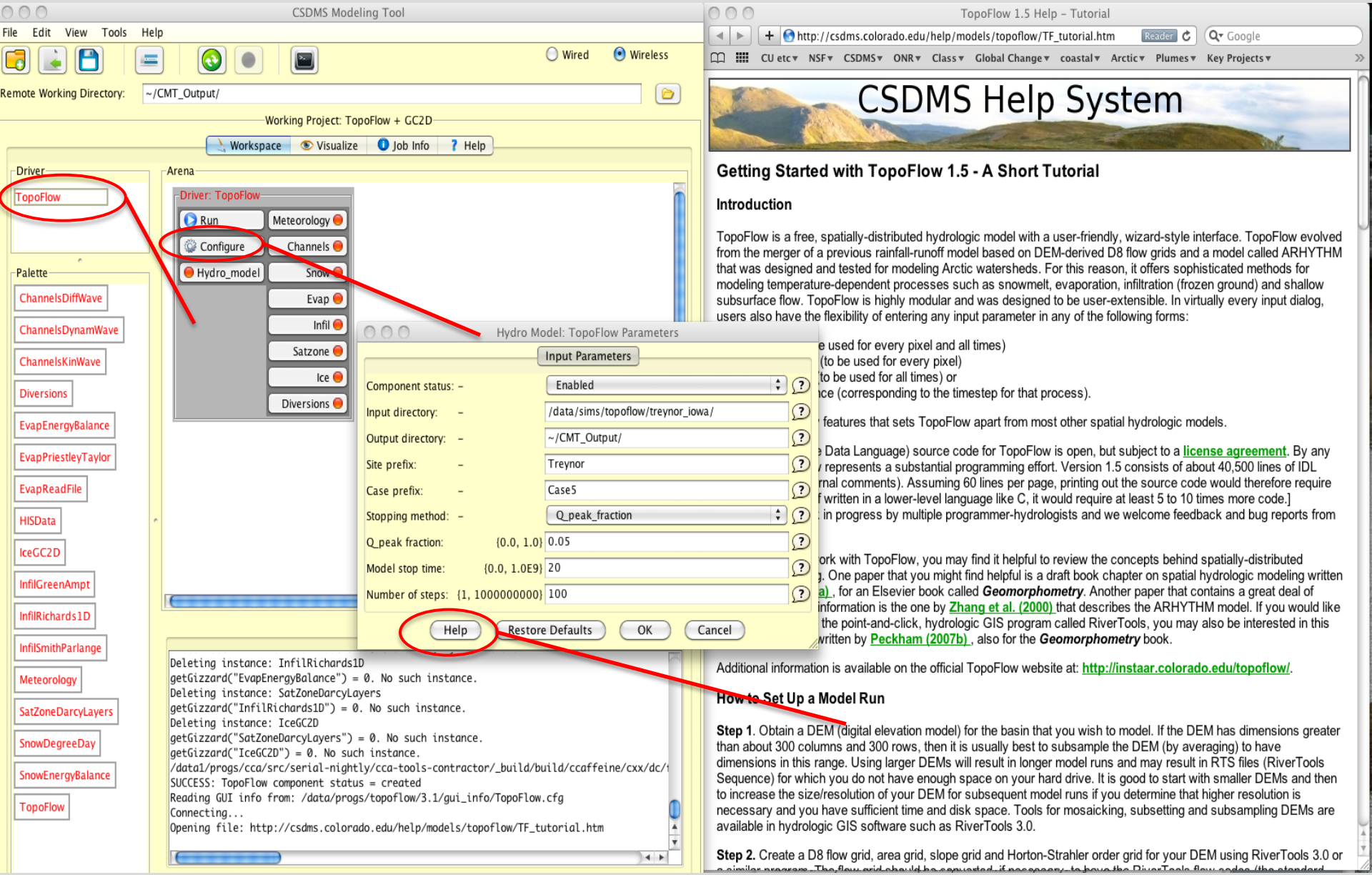
(6) Component interface standards BMI & CMI;

(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

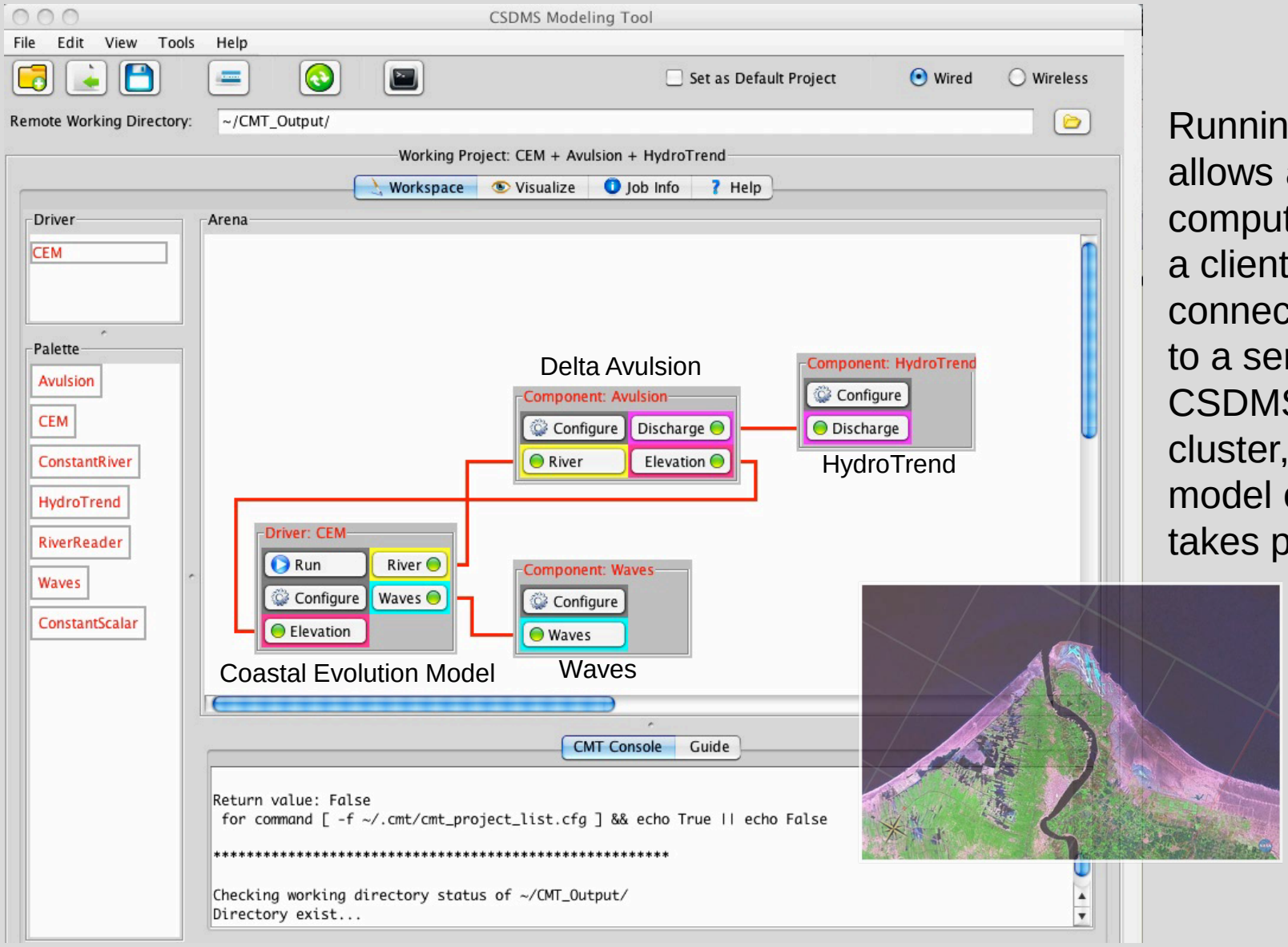
Developed Tool for running CSDMS-component models



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.

Teaching with CSDMS tools

CU graduate student course
2010 and 2013

NCED SIESD summer institute
2011-onwards

Plans for 2014, ‘Early Adopters’ Faculty:

-Louisiana State University with Coastal processes focus

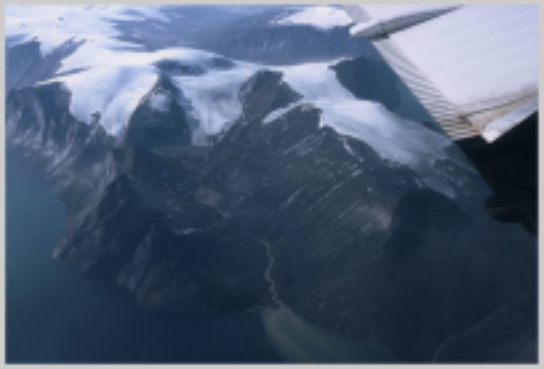
-University of Utah, Logan, with river processes focus

-George Mason University with Marine focus

- VIMS Virginia, with coastal-marine focus

HydroTrend Example
Educational Material in CSDMS wiki

http://csdms.colorado.edu/wiki/Labs_portal

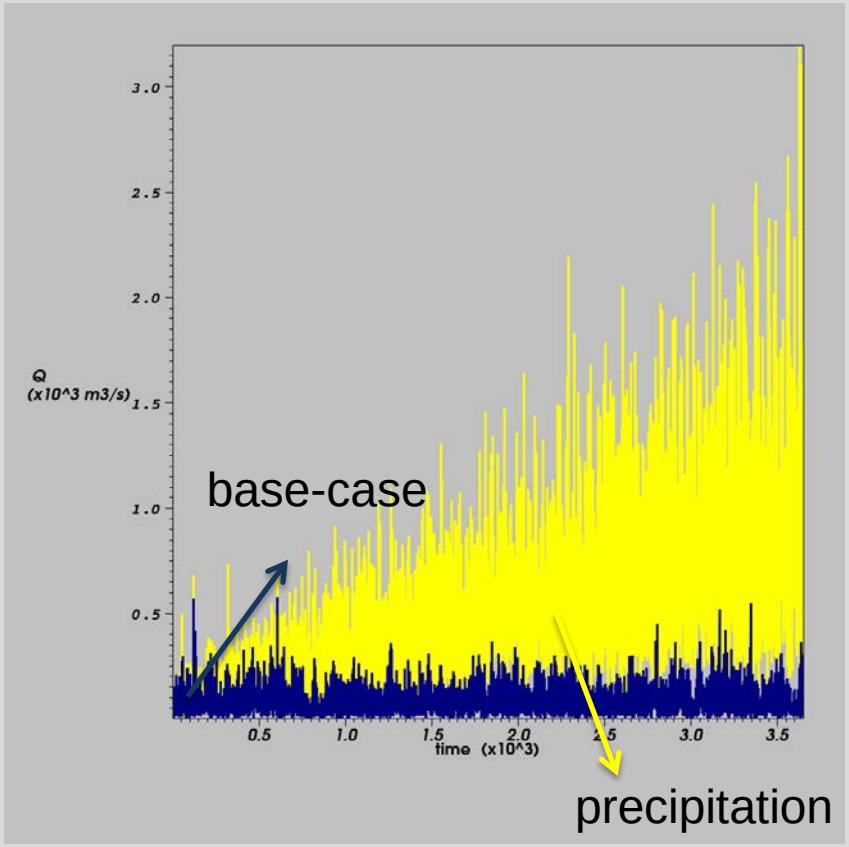


Sediment Supply to the Global Ocean

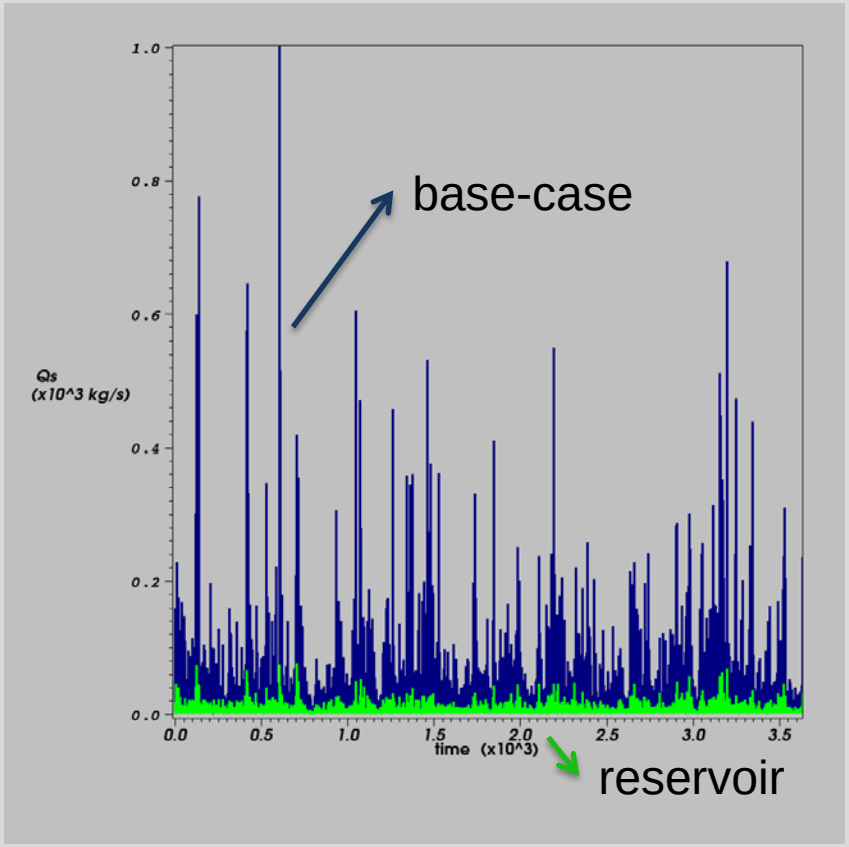
Investigate river sediment supply to the ocean by 1) a spreadsheet lab or 2) an advanced modeling lab using the HydroTrend Model to explore effects of climate changes on river fluxes. We also look at the effect of humans on rivers: the building of a reservoir. Spreadsheet Lab or the River Sediment Supply Modeling with CMT

Output

VisIT: Daily Water Discharge Output

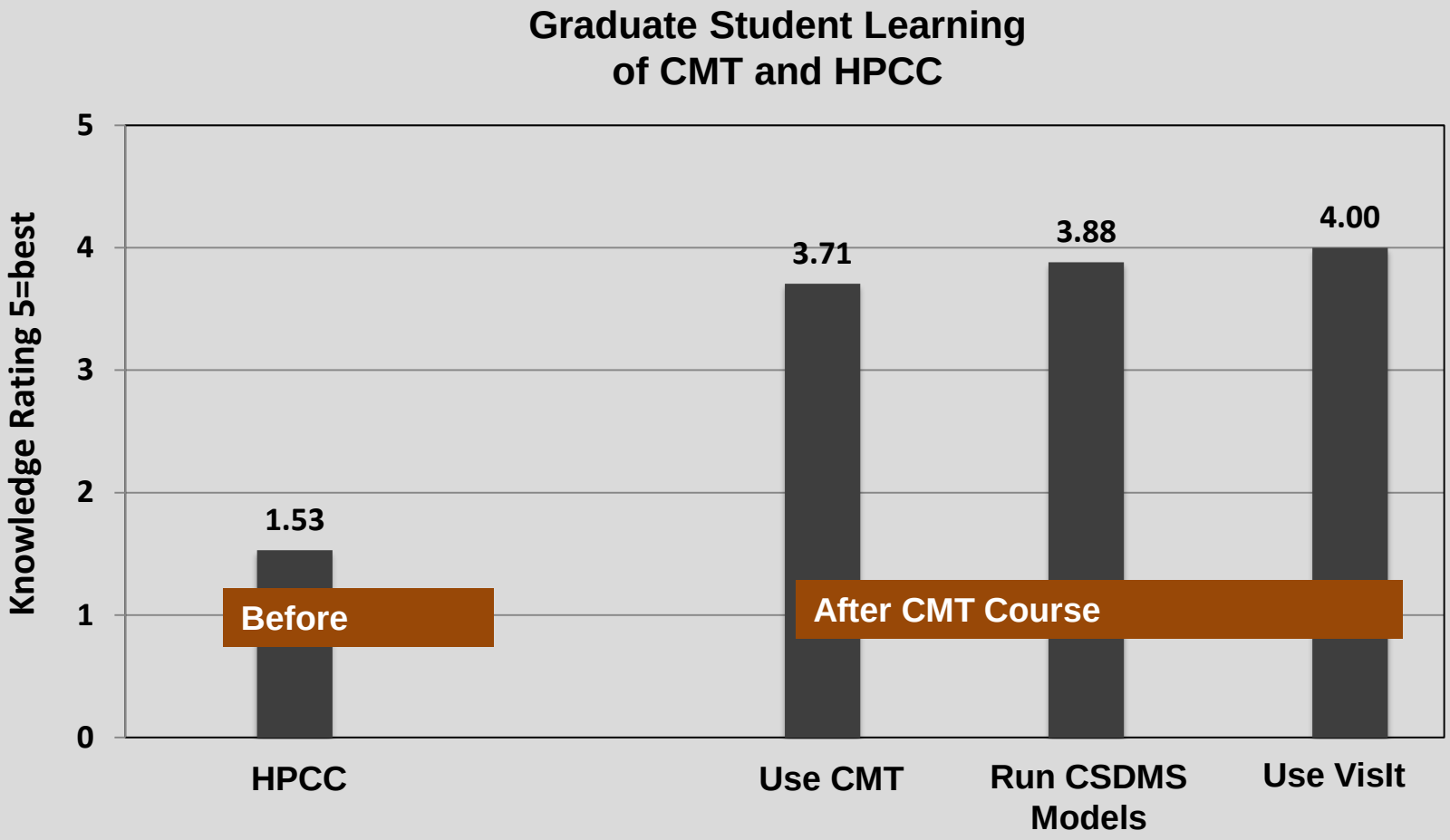


VisIT: Daily Sediment Load Output



Drastic changes in water flux result from increased precipitation regime,
Severe reduction in sediment flux results from damming.

Increasing Student Efficacy with models and HPCC



Summary

- Teaching with models is an way of hands-on engagement of students in problem-solving and creating process understanding
- We need to teach with models, because models are an essential component of Earth Science now.

- CSDMS welcomes geodynamics modeling, task-team is an option?
- Modeling Teaching Resources are made available through CSDMS
- Feel free to contribute to these resources

- Questions/Contributions: irina.overeem@colorado.edu