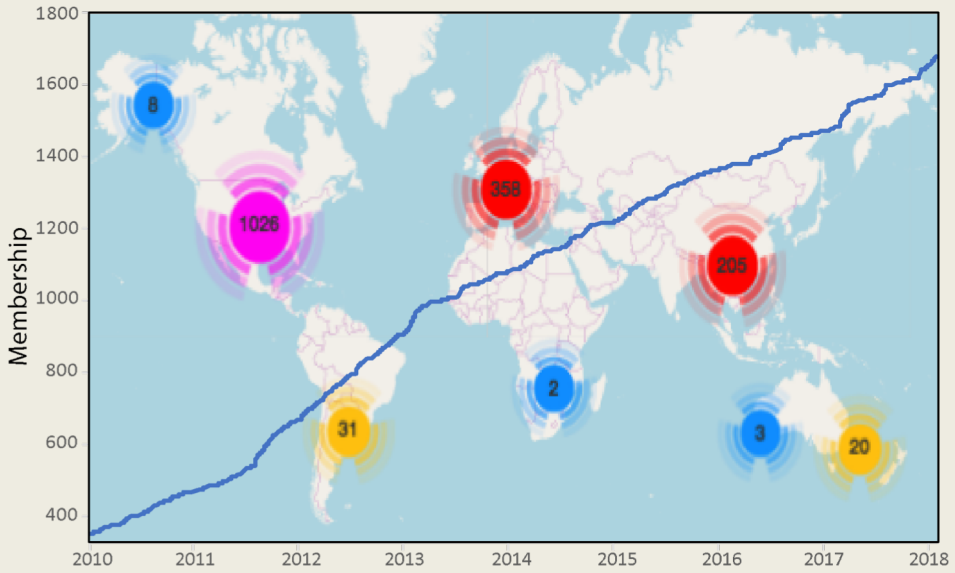
CSDMS

COMMUNITY SURFACE DYNAMICS MODELING SYSTEM

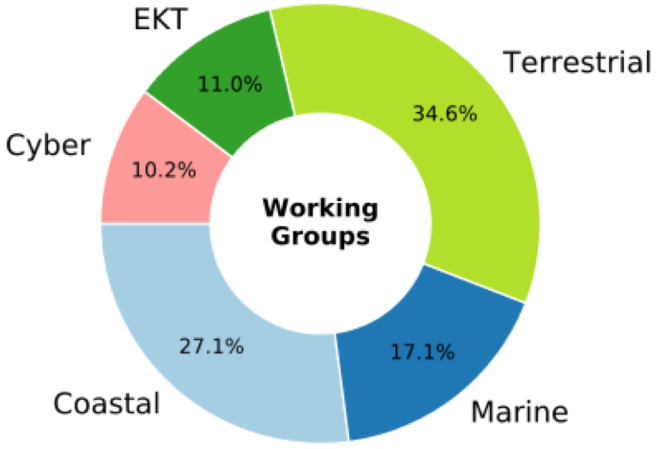
CSDMS Tools for Flood Modeling

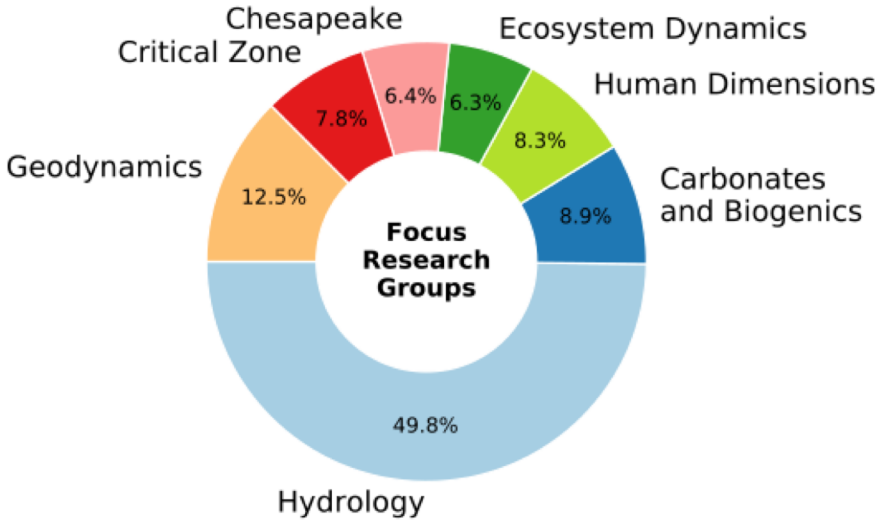
Greg Tucker, CSDMS Executive Director
CIRES and Department of Geological Sciences
University of Colorado, Boulder

CSDMS community



~1,740 members





CSDMS supports computational modeling in earth-surface science by engaging ***community***, developing ***computing*** resources, and promoting ***education***

share resources, collaborate

COMMUNITY
SUPPORT

create, run, test, analyze, and apply models

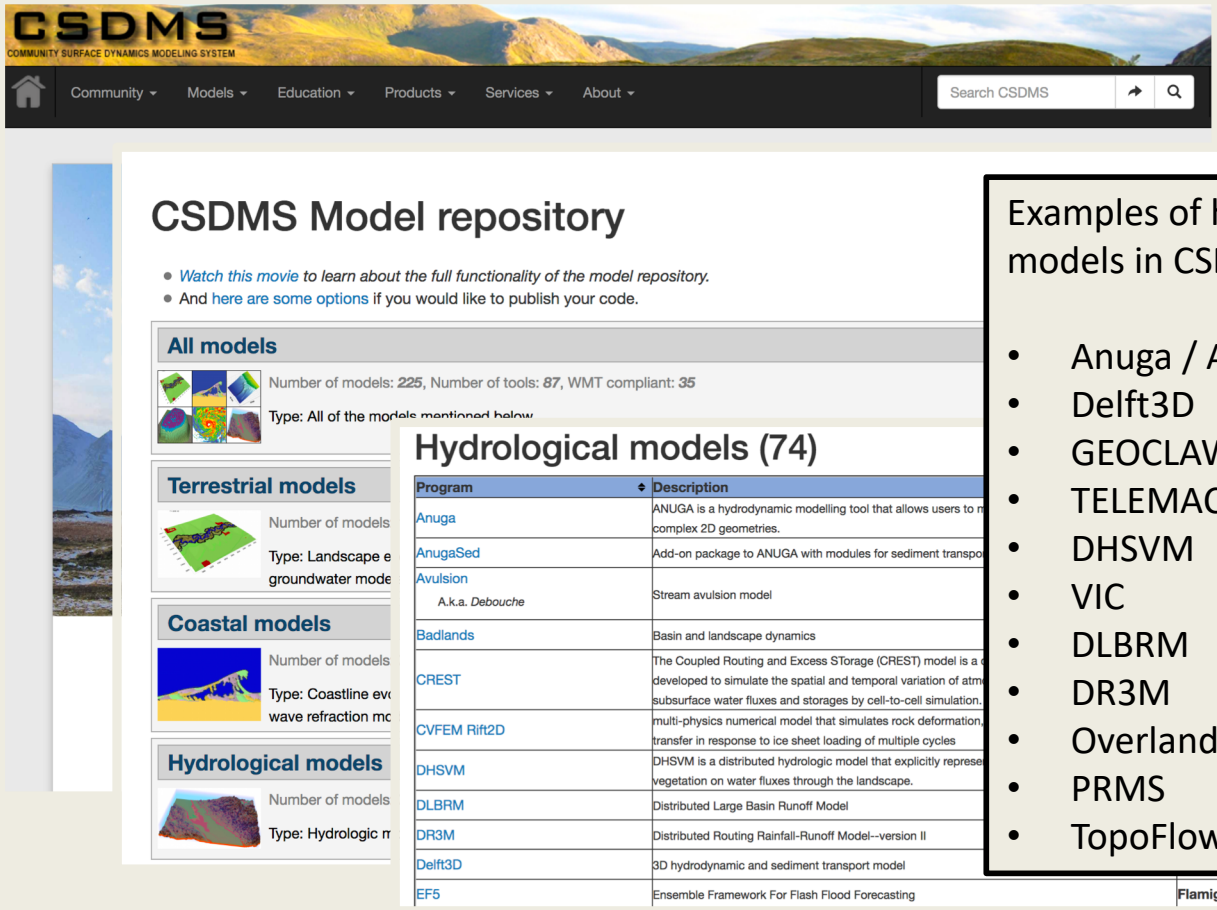
COMPUTING
RESOURCES

learn and teach

EDUCATION
OPPORTUNITIES

WEB PORTAL AND MODEL REPOSITORY

COMMUNITY
SUPPORT



Examples of hydrodynamic models in CSDMS repository:

- Anuga / AnugaSed
- Delft3D
- GEOCLAW
- TELEMAC
- DHSVM
- VIC
- DLBRM
- DR3M
- OverlandFlow
- PRMS
- TopoFlow

MEETINGS AND WORKSHOPS

Geoprocesses, geohazards - CSDMS 2018

May 22-24th 2018 in Boulder Colorado, USA

EDUCATION
OPPORTUNITIES

RESOURCES FOR EDUCATORS

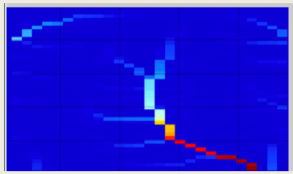
CSDMS
COMMUNITY SURFACE DYNAMICS MODELING SYSTEM

Community | Models | Education | Products

- Webinars
- Movies
- Labs
- Lectures
- Textbooks
- Science on a Sphere
- Images
- Contribute

7	8	9
4	SOURCE CELL	6
1	2	3

Hydrology and Flow Routing
Learn about flow routing over a landscape and basic algorithms for numerical modeling of combined hillslope and river sediment transport processes. WMT Modeling Exercise on flow routing



Stream Response to Rain
Introduction to hydrological process modeling. Learn about stream responses to different rainfall events. Explore hydrographs. Modeling Stream Response to Rainfall

RESOURCES FOR LEARNING

Get Started with Python
These lessons cover the basics of using Python 2.7 for numerical modeling. Some previous experience in s helpful but not necessary. Python Tutorial

Post-conference hackathon

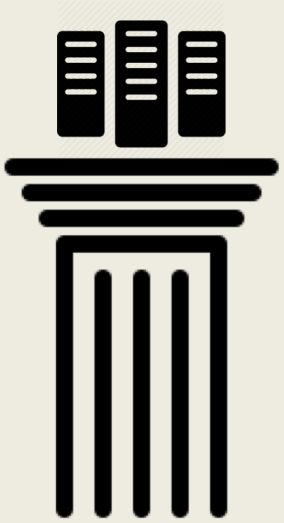
CSDMS will host a one-day post-conference hackathon on Friday May 26th, 2017, organized by Eric Hutton and Mark Piper.

Upcoming webinars

Date	Time	Presenter	Title	
2018/10/09	10:00 am MDT	**Overeem**, Irina	Using CSDMS in the Classroom	Register
2018/11/12	10:00 am MST	**Piper**, Mark	CSDMS Basic Model Interface (BMI)	Register

Watch past webinars

Date	Presenter	Title
2018/09/14	**Tucker**, Greg	Landlab Toolkit overview



COMPUTING RESOURCES

HIGH-PERFORMANCE COMPUTING FACILITY

Hardware

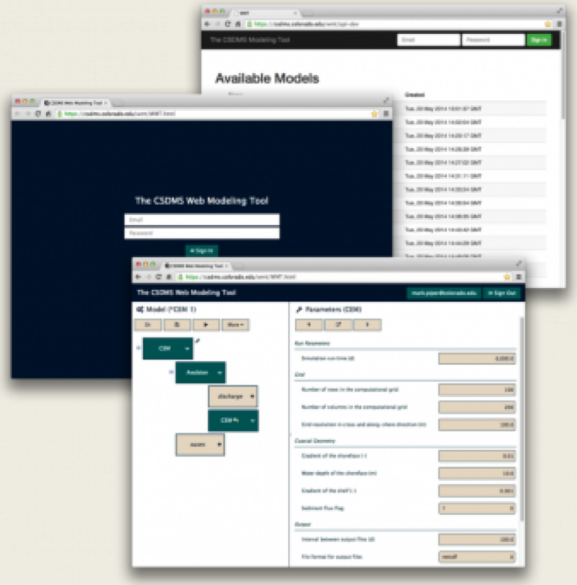
CSDMS has purchased compute nodes that operate as part of the ***Blanca*** cluster. The specifications for the CSDMS nodes are:

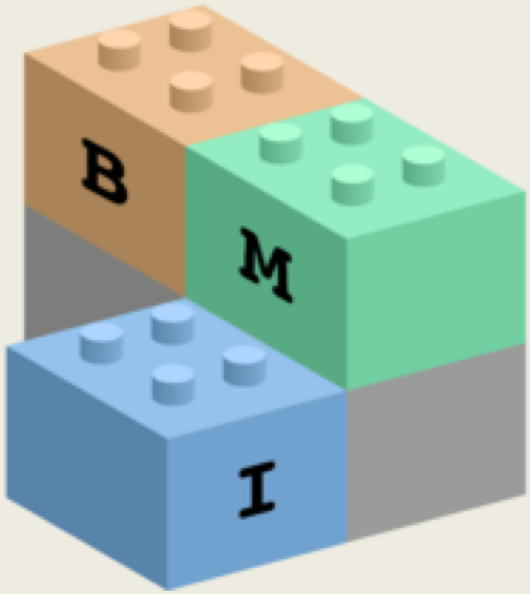
- 2x 14-core 2.4 GHz Intel “Broadwell” processors
- 128 GB RAM at 2400 MHz
- 1x 1 TB 7200 RPM hard drive
- 10 gigabit/s Ethernet

As of 10/02/2018, CSDMS owns 2 compute nodes and has the intention to expand this by at least 2 nodes for the 2018 academic year. In addition to these nodes, CSDMS members also have access to the larger cluster based on current usage.

MIDDLEWARE FOR RUNNING AND COUPLING MODELS:

PLUG-AND-PLAY



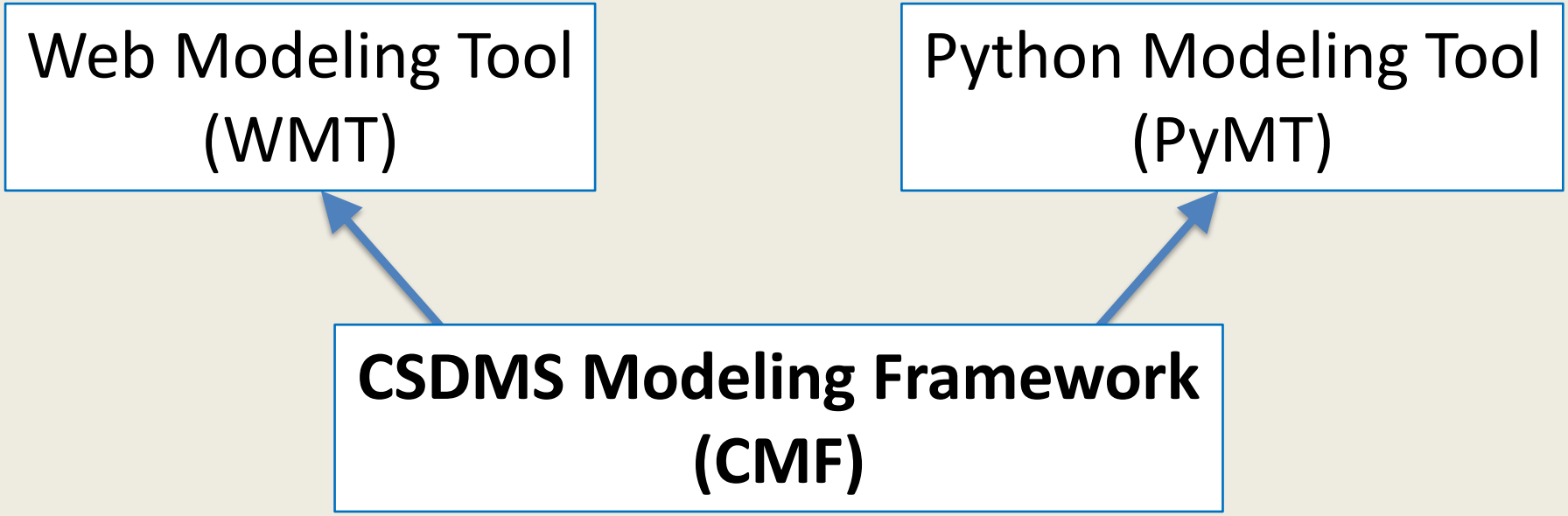


PyMT

python powered

LANDLAB

CSDMS component-based modeling tools



Model codes become **components**:

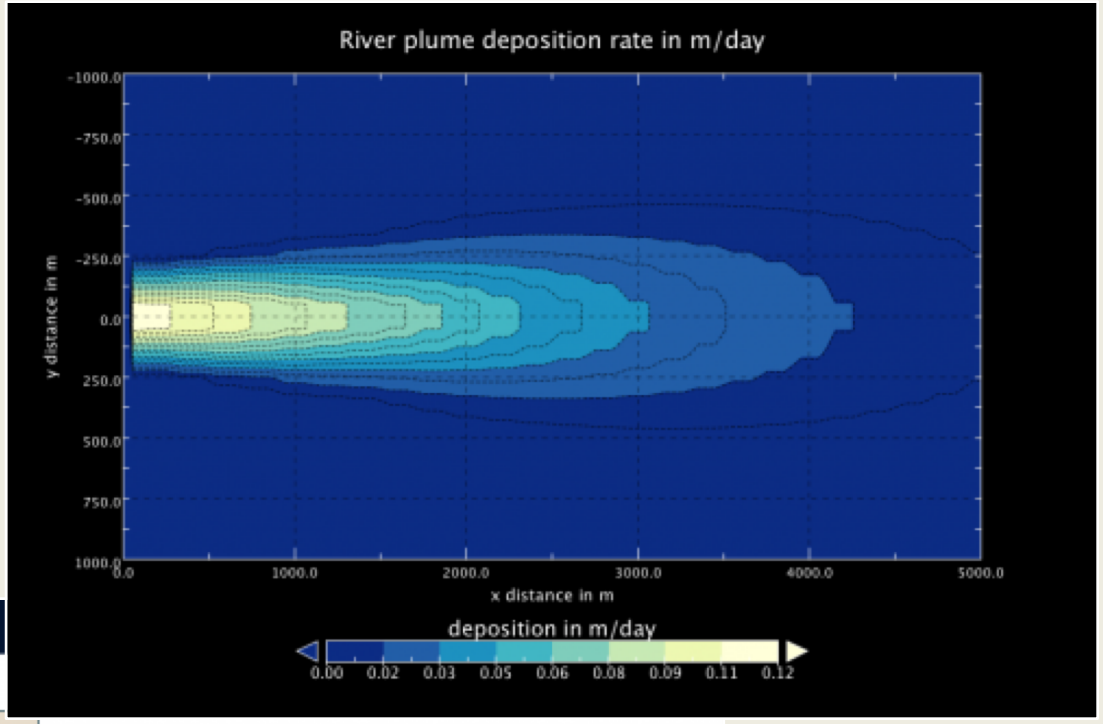
- Can be run stand-alone or coupled to other components
- Framework provides *service components*, e.g., for re-gridding

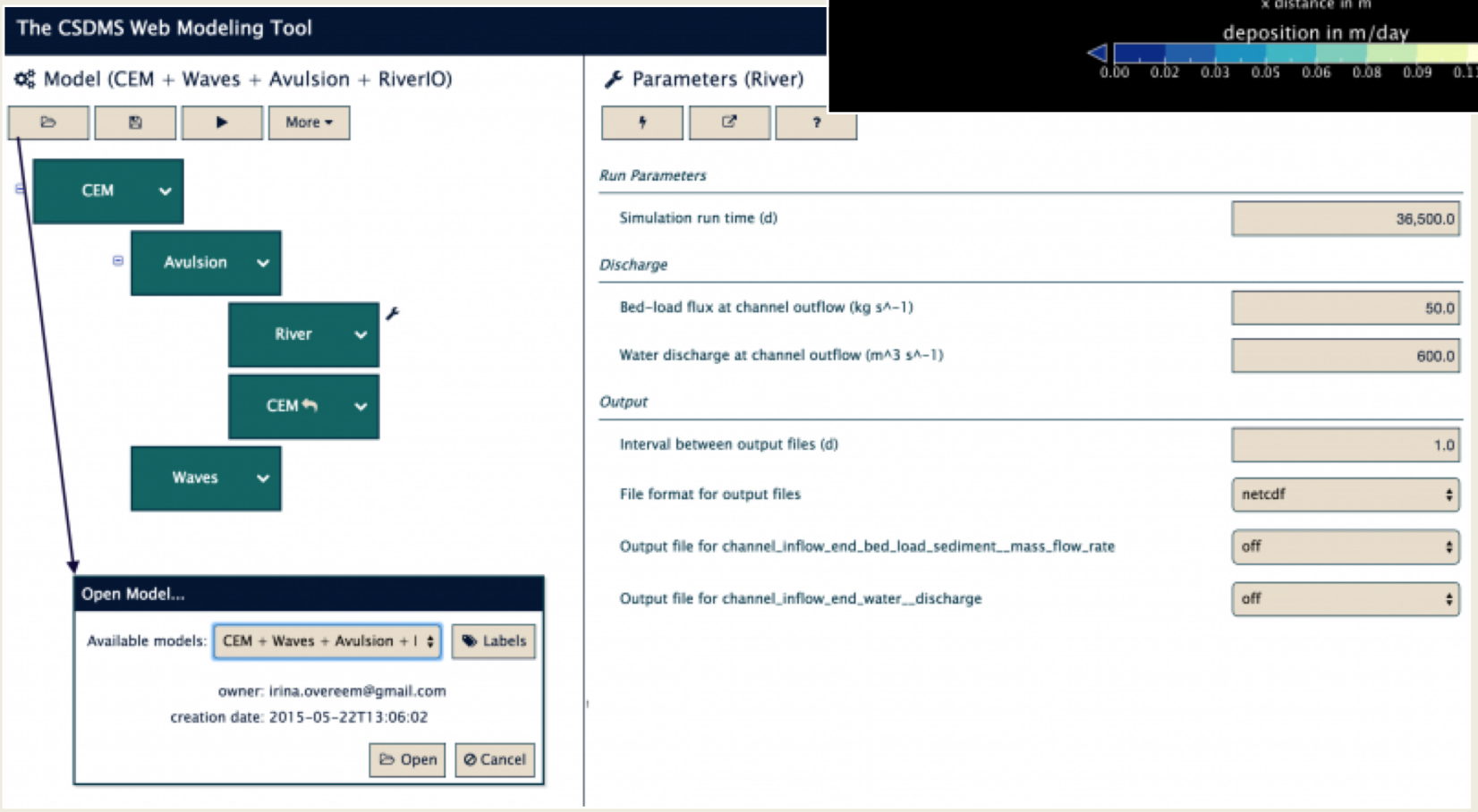
Supported languages:

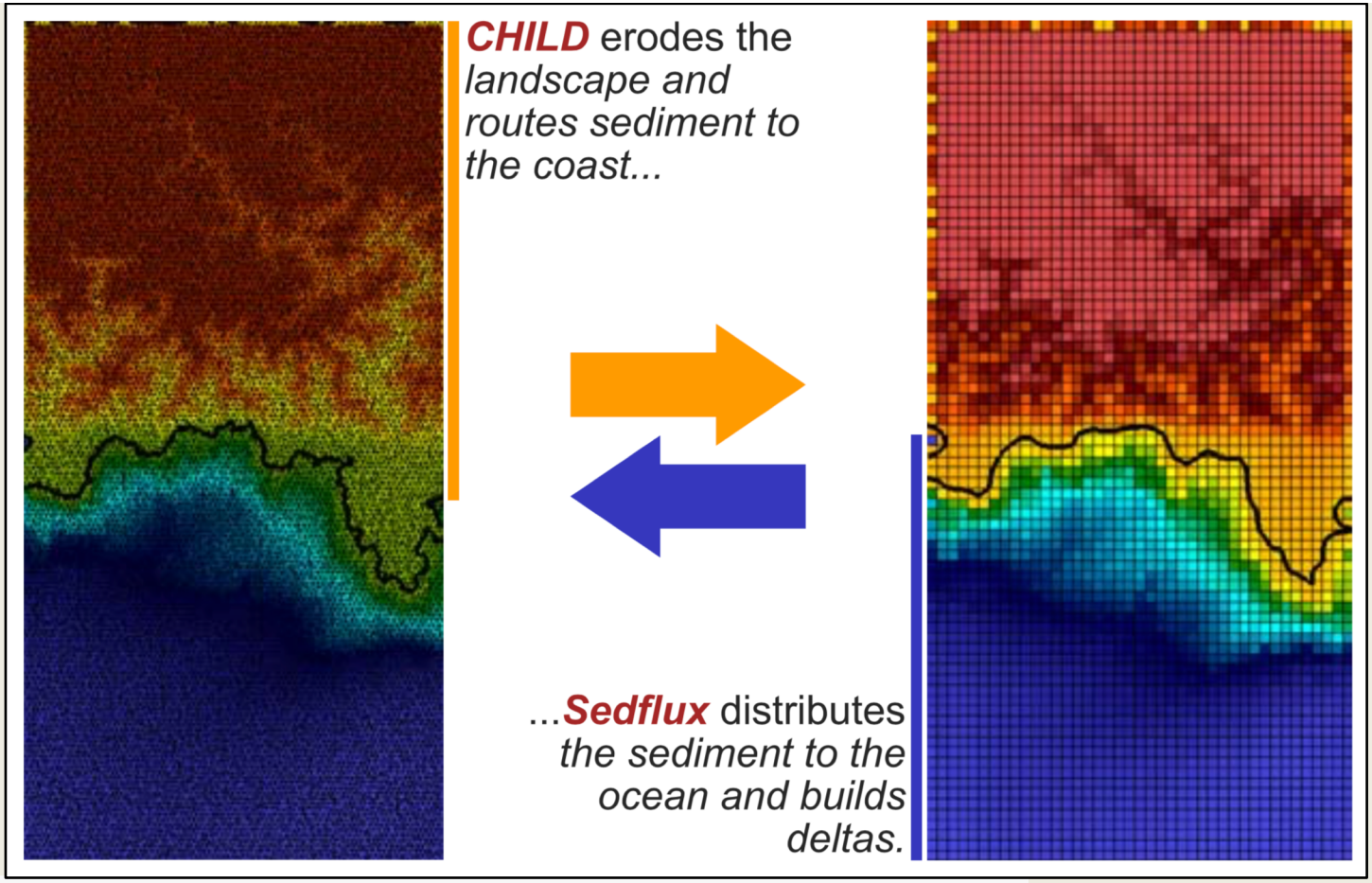
- C / C++
- Fortran
- Python
- Java

Web Modeling Tool

https://csdms.colorado.edu/wmt/





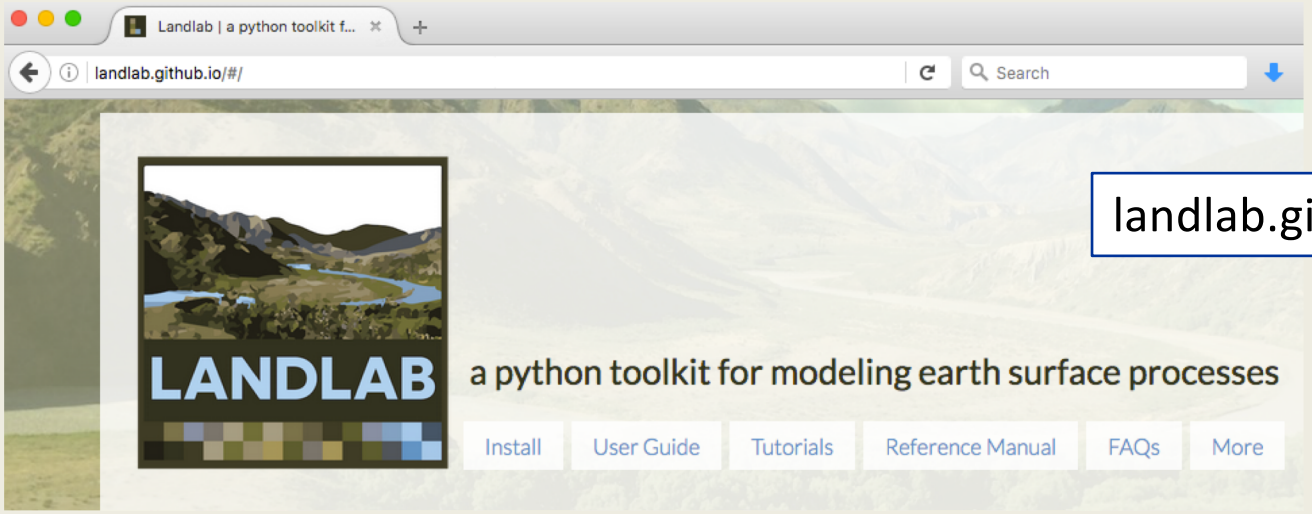



```
from pymt.components import Sedflux3D, Child

child = Child()
sedflux = Sedflux3D()

child_in, child_dir = child.setup('_child',
                                  grid_node_spacing=500.,
                                  grid_x_size=40000.,
                                  grid_y_size=20000.,
                                  run_duration=1e6)
sedflux_in, sedflux_dir = sedflux.setup('_sedflux',
                                        river_bed_load_flux=0.,
                                        river_suspended_load_concentration_0=.001,
                                        river_suspended_load_concentration_1=.001,
                                        run_duration=1e6 * 365.)

child.initialize(child_in, dir=child_dir)
sedflux.initialize(sedflux_in, dir=sedflux_dir)
```

PyMT: the Python Modeling Tool

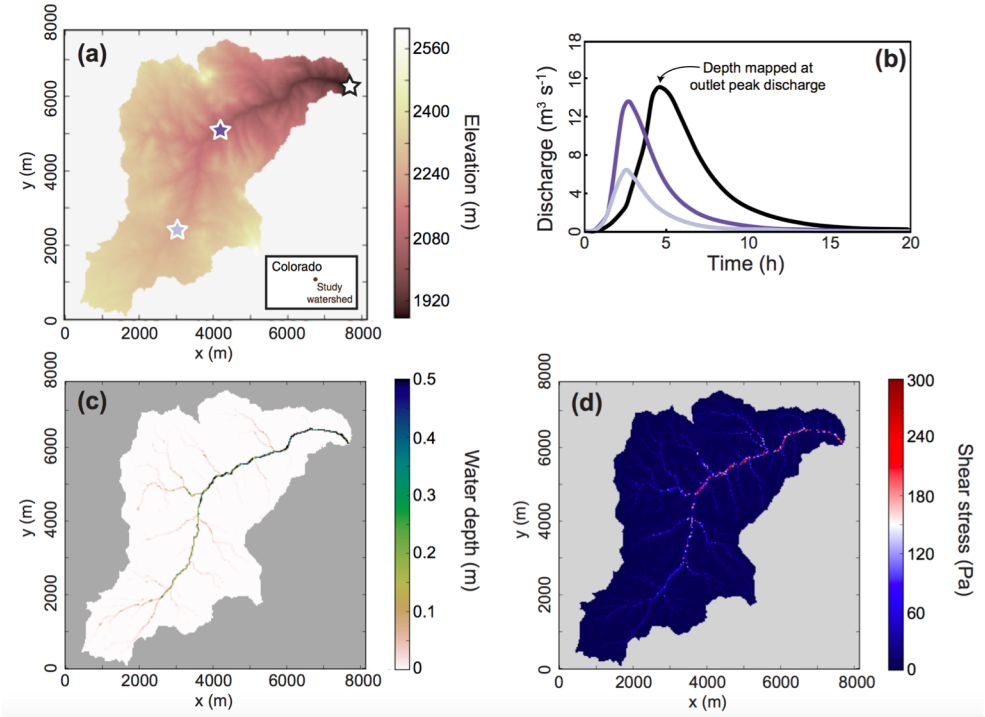
LANDLAB

- Python-language programming library
- Efficient creation of 2D numerical models
- Geared toward (but not limited to) hydrology & geomorphology
- **Gridding:** 2D structured or unstructured grids
- **Plug and play:** reusable components
  - Examples: *OverlandFlow, SoilInfiltrationGreenAmpt*

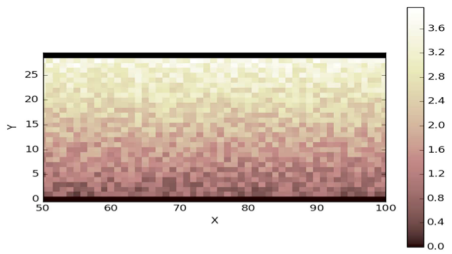


landlab.github.io

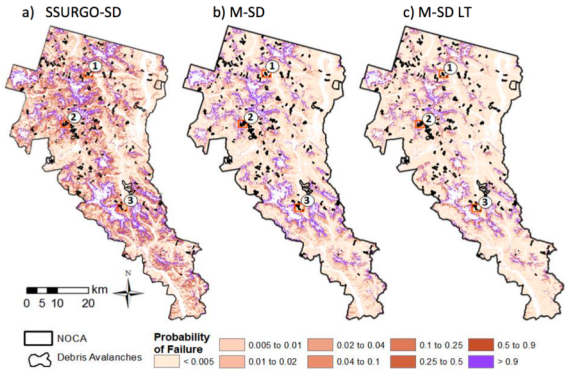
Examples of Landlab-built models



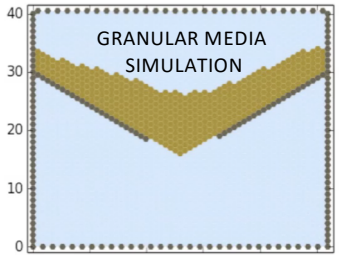
Rainfall-runoff
(Adams et al., 2017)



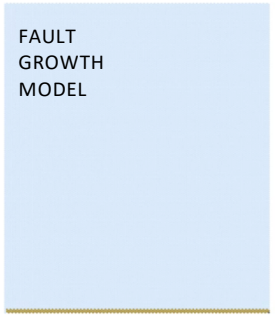
Tectonic geomorphology
(Gray et al., 2017)



Landslide probability (Strauch et al., 2018)



Cellular automata
(Tucker et al., 2016)



Where to learn more?

- CSDMS web portal: http://csdms.colorado.edu

- Webinars: https://csdms.colorado.edu/wiki/Webinars
- Landlab: http://landlab.github.io
- PyMT: https://github.com/csdms/pymt

https://github.com/mcflugen/pymt_hydrotrend/blob/master/notebooks/Hydrotrend_lesson_1.ipynb

Summary

CSDMS Model Repository provides easy access to >200 community model codes

CSDMS Education Repository includes material for teachers and learners

Computing tools like PyMT and Landlab make it easier to build, explore, and couple numerical models