

# CSDMS 2018: Geoprocesses, Geohazards



**Greg Tucker, CSDMS Director**



**PREEVENTS**

Prediction of, and Resilience against,  
Extreme Events



**Polar RCN**

Polar Research Coordination Network



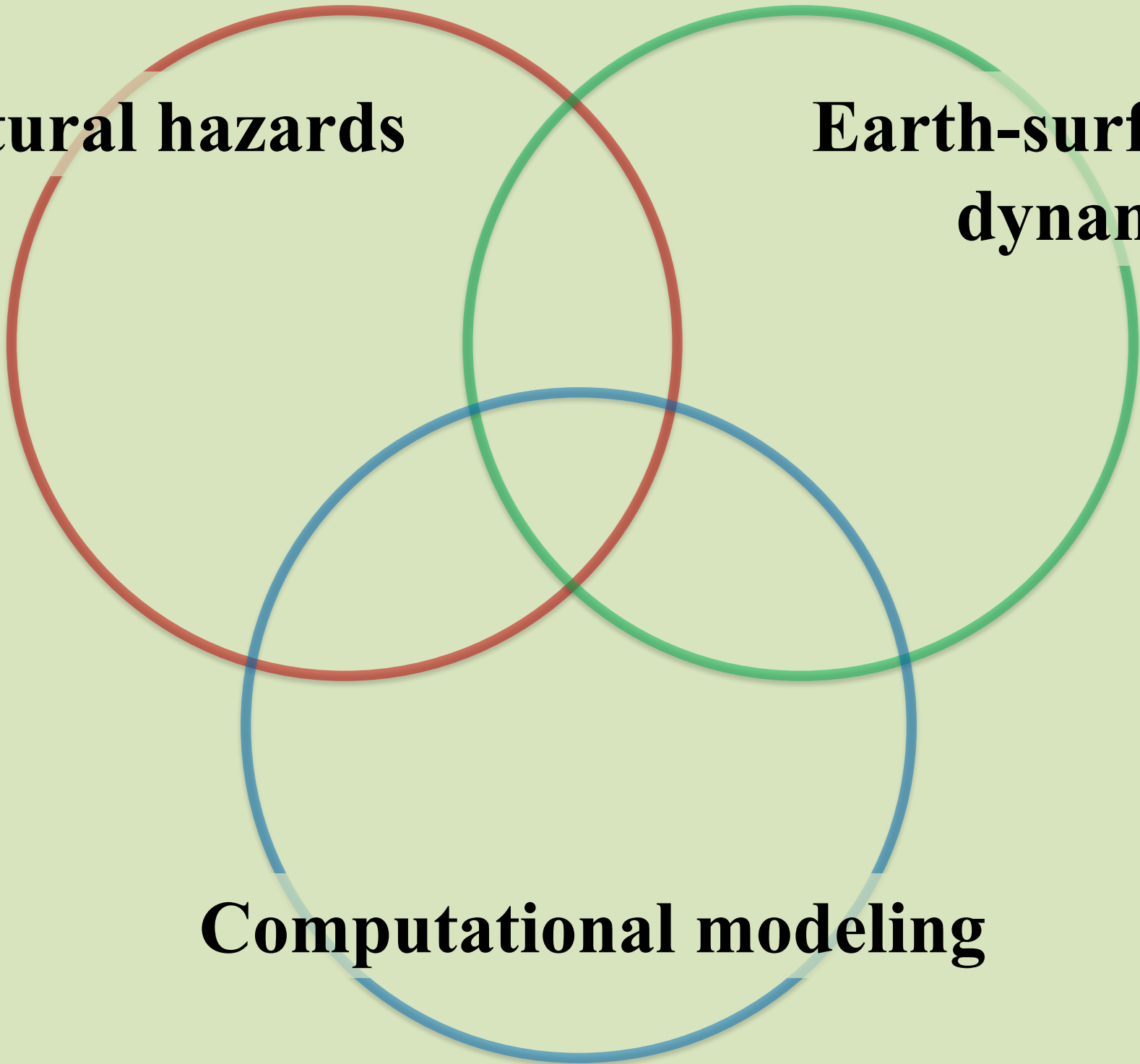
**CSDMS**

COMMUNITY SURFACE DYNAMICS MODELING SYSTEM

**Natural hazards**

**Earth-surface  
dynamics**

**Computational modeling**



# **Natural hazards**



- **Vulnerability**
- **Resilience**
- **Risk assessment**
- **Mitigation**
- **Sustainability**
- **Safety**
- **Planning**
- **Recovery**
- **Extreme events**
- **Emergency response**

- **Topography**
- **Bathymetry**
- **Stratigraphy**
- **Erosion**
- **Sedimentation**
- **Landslides**
- **Rivers**
- **Coastlines**
- **Deltas**
- **Volcanism**
- **Marine processes**



**Earth-surface  
dynamics**

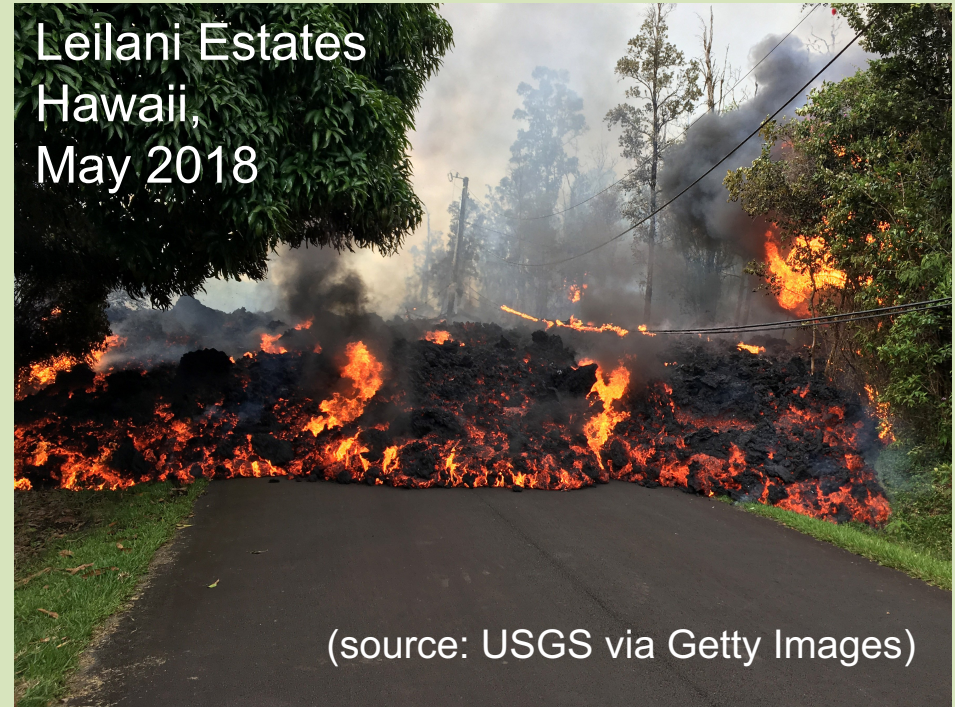
# Some geomorphic processes ARE the primary hazard

2014 Oso landslide, WA state



(source: AP)

Leilani Estates  
Hawaii,  
May 2018



(source: USGS via Getty Images)

Hemsby, UK, March 2018



(credit: Mike Page)

Monterey Park, CA  
Winter 1980



(D. Morton, USGS)

# Sometimes geomorphic processes accompany and compound the primary hazard

Kaikoura (NZ)  
earthquake



S St. Vrain, CO  
2013



Earthquake-triggered landslide  
Taiwan, 1999



Colorado, 2013



# Some hazards increase the risk of subsequent geomorphic events



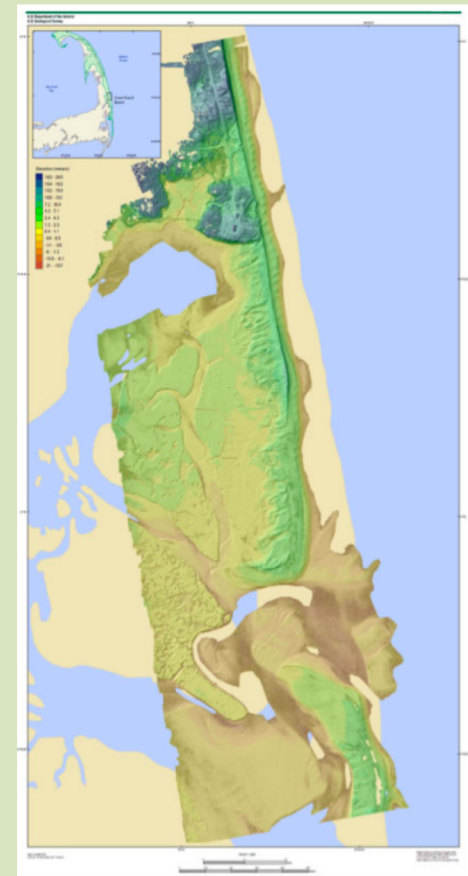
- **Exploring ideas**
- **Testing hypotheses**
- **Enhancing insight**
- **Visualizing dynamics**

- **Explaining observations**
- **Studying “what ifs”**
- **Planning for scenarios**
- **Making forecasts**



(Perignon et al., 2013)

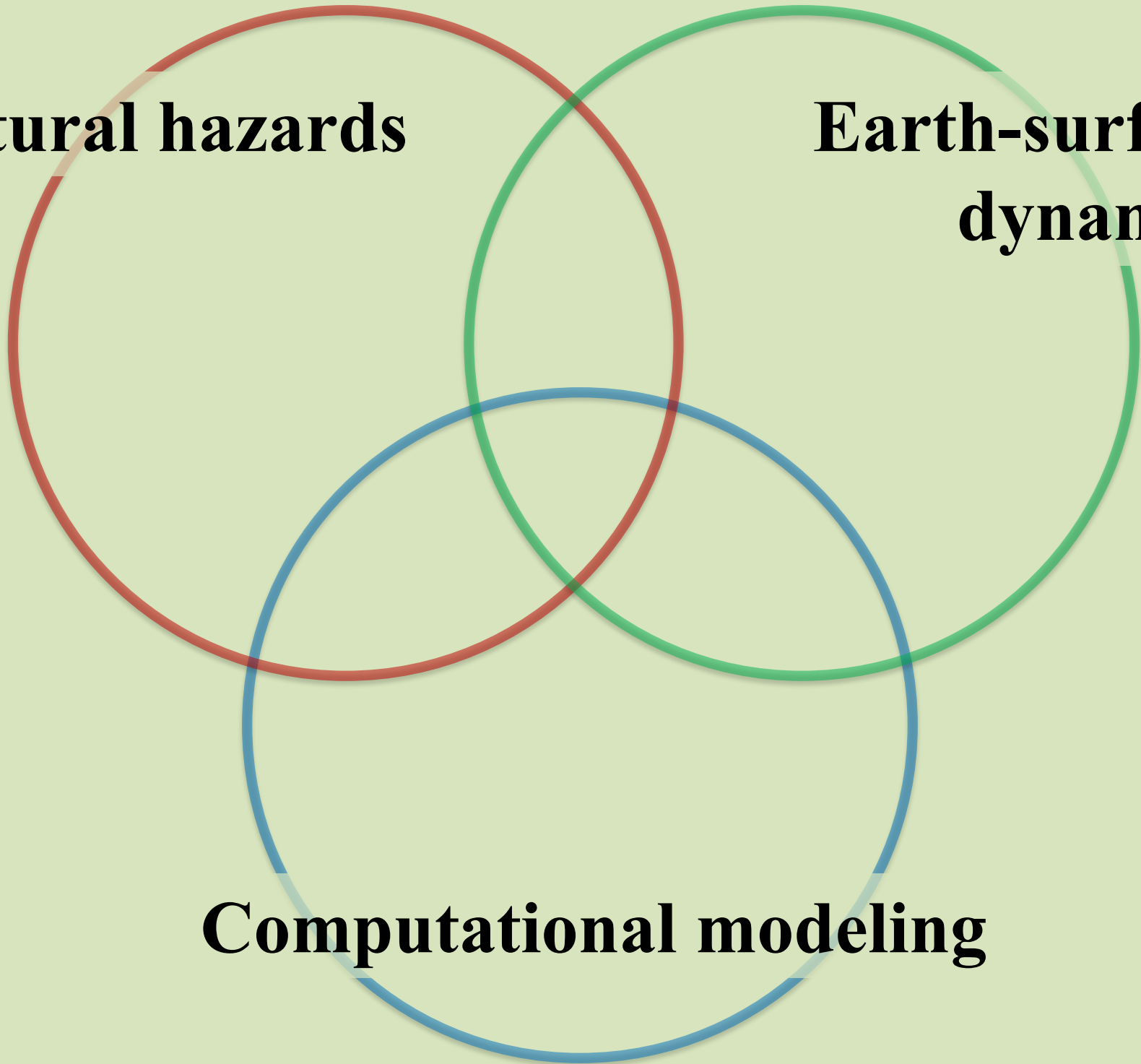
## Computational modeling



**Natural hazards**

**Earth-surface  
dynamics**

**Computational modeling**



# Format and aims of this meeting

**Tuesday, May 22, 2018**

<b>Time</b>	<b>Location</b>	<b>What</b>	<b>Presenter</b>	<b>Topic</b>
8:00AM		Busses depart hotel		
8:15AM	Lobby	<b>Registration &amp; Breakfast</b>		
9:00AM	C120	Welcome	Brad Murray, Duke U	Welcome
9:05 AM	C120	CSDMS	Greg Tucker, CSDMS	Introduction to the Natural Hazards Modeling WS
9:30 AM	C120	<b>Plenary</b> Keynote	Susan Cutter, U South Carolina	<i>Social Vulnerability and Community Resilience to Natural Hazards: Models, Tools and Practice</i>
10:00AM	C120	<b>Plenary</b> Keynote	David George, USGS	<i>Modeling earth-surface flow hazards with D-Claw</i>
10:30AM	C120	<b>Plenary</b> Keynote	Paul Bates, U Bristol, UK	<i>Modeling flood risk in the continental US</i>
11:00AM	Lobby	<b>Break</b>		
11:15AM	C120	Breakout 1.1	Eli Lazarus, U Southampton	<i>Challenges and gaps in natural hazards modeling</i>
	S225	Breakout 1.2	David Mohrig, U Texas, Austin	
	S372A	Breakout 1.3	Kristy Tiampo, U Colorado	
	N149	Breakout 1.4	Kimberly Rogers, U Colorado	
	N136	Breakout 1.5	Wonsuck Kim, U Texas, Austin	
12:30PM	<b>Lunch</b>			
1:30PM	S225	Clinic 1.1	Guy Schumann, Remote Sensing Solutions, CA	<i>LISFLOOD-FP Clinic: Introduction to Flood Hazard Modeling</i>
	N126	Clinic 1.2	Mark Piper, CSDMS IF	<i>BMI, Live!</i>
	N129	Clinic 1.3	Sediment Experimentalist Network	<i>Sediment Experimentalist Network (SEN) – Wrangling your research data</i>
	N128	Clinic 1.4	Doug Edmonds, Indiana University	<i>An Introduction to Using Google Earth Engine</i>
3:30PM	Lobby	<b>Break</b>		
3:45PM	C120	<b>Plenary</b> Student Talk 1	Julio Hoffman-Mendez, Stanford U	<i>ImageQuilting.jl: A code for generating 3D stratigraphy from data collected in flume experiments</i>
4:00PM	C120	<b>Plenary</b> Student Talk 2	Rachel Glade, CU Boulder	<i>Modeling blocky hillslope evolution in layered landscapes</i>
4:15PM	C120	<b>Poster</b> Session 1		
6:30PM		Busses depart to hotel		

# Workshop white paper

## To address

- ***Pinpoint new frontiers*** in fundamental process understanding in earth surface and natural hazards modeling.
- ***Identify needs and develop strategies*** for model testing, model validation and model benchmarking against natural disasters.
- ***Identify critical missing components*** in our ability to provide better assessment of earth surface change in the face of natural hazards.

Builds upon notes of the breakout groups and uses presentation examples for illustration ... ***Thank you discussion leaders and rapporteurs!***

## Timeline

- June – August 2018: Writing draft by small team
- September: Get feedback from larger group (those that are interested)
- November: Distribute final version & scope potential publication avenues

## Want to be contribute?

- Be an active participant, contribute your presentation examples
- Volunteer for writing assignments
- Come and see Albert during the meeting, or email [csdms@colorado.edu](mailto:csdms@colorado.edu)

# Journal special issue

Topic: ***The role of models in better understanding natural hazards and improving risk assessment: current state and gaps***

Proposed journal: **NHESS**, Natural Hazards and Earth System Sciences

- I. Interactive open-access journal of EGU (I.F. ~2.5)
- II. Broad journal scope: natural hazards, monitoring and ***modelling***, vulnerability and risk assessment, and the design and implementation of mitigation and adaptation strategies, including economical, societal, and educational aspects

Timeline:

- I. **August, 15<sup>th</sup> 2018**: Due date for expression of interest (submit: working title, max 1 page abstract, authors)
- II. We need 15+ topics for a proposal for special issue to NHESS
- III. If approved: submissions accepted through ~summer 2019

To contribute: email [csdms@Colorado.edu](mailto:csdms@Colorado.edu) by Aug 15, subject: Special Issue



# CSDMS

COMMUNITY SURFACE DYNAMICS MODELING SYSTEM

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

*share resources,  
collaborate*



**COMMUNITY  
SUPPORT**

*create, run, test,  
analyze, and apply  
models*



**COMPUTING  
RESOURCES**

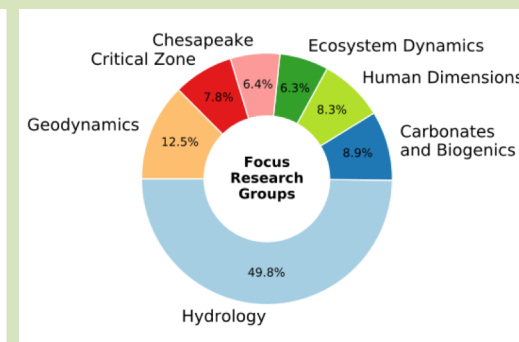
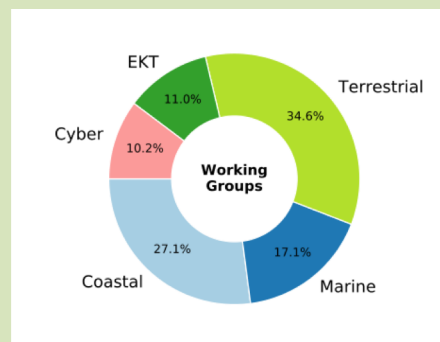
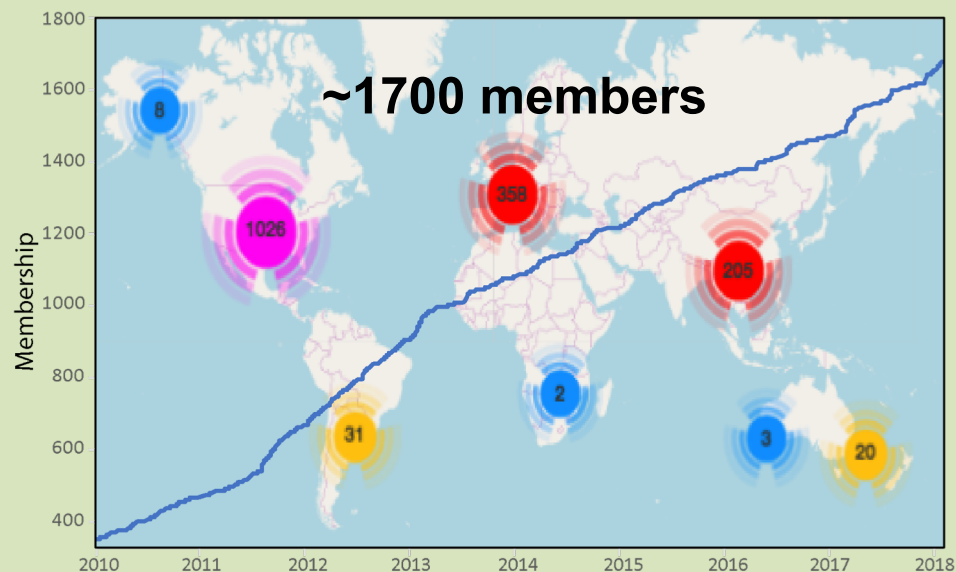
*learn and teach*



**EDUCATION  
OPPORTUNITIES**



# CSDMS community: 2017-18 highlights



## Model repository:

- 219 models
- 86 tools
- Metadata
- DOIs
- H-index for models

## Model info

Authors [\[Expand\]](#)  
 Source code [\[Collapse\]](#)  
 • [Go to external source code site](#)  
 DOI [\[Collapse\]](#)  
 • Download CHILDR version:  
 2010.07.06  
 Doi: 10.1594/IEDA/100102  
 Model citations [\[Collapse\]](#)  
 Citation indices [CHILD](#)  
 Citations: 4171  
 h-index: 28  
 QR-code [\[Collapse\]](#)  
  
 Link to this page  
 Other models by this author [\[Expand\]](#)

## CTSP: Coupling of Tectonic and Surface Processes

April 25 -27<sup>th</sup> 2018, Boulder Colorado, USA



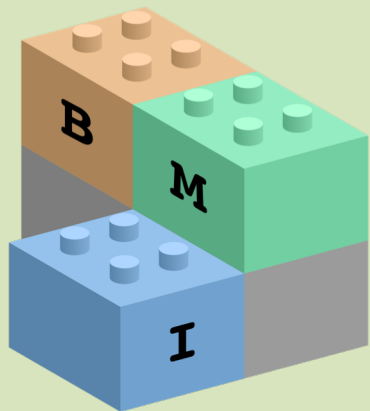
# Computing highlights

Web Modeling Tool  
(WMT)

Python Modeling Tool  
(PyMT)

*NEW: efficient pathway from C/C++*

**CSDMS Modeling Framework  
(CMF)**



**Basic  
Model  
Interface**

CSDMS  
High-Performance  
Computing facility:

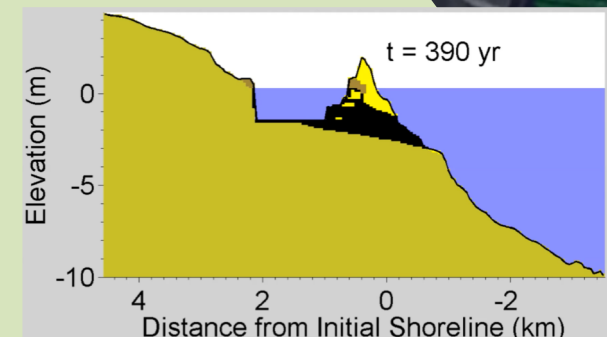
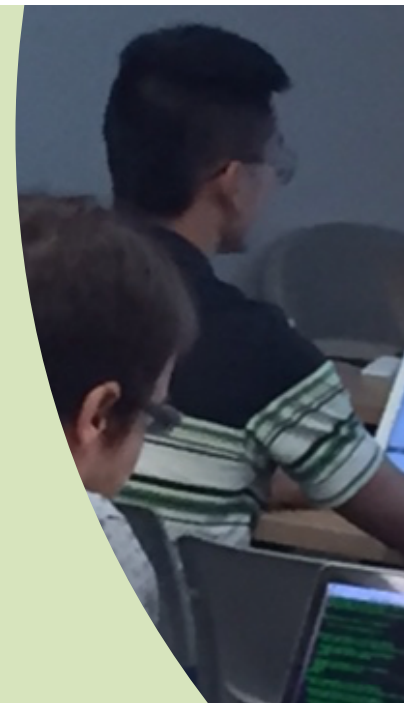
*beach → blanca*





# Education highlights

- Bootcamps on basic programming and HPC (> 100 participants) at CSDMS & NCED
- Jupyter Notebooks now can be served and accessed from CSDMS server Siwenna
- New teaching notebooks: Landlab modeling (Gasparini et al.); cold-region models (Overeem et al.)
- Barrier model and marsh evolution model simulations with teaching material (May 2018, Lauzon & Murray).
- Pre/post-lab survey material for WMT + ROMS (Harris, Moriarty, and Overeem).



```
In [ ]: ## Code Block 2

basin_flag = 'Square' # 'Square' or 'Long'
storm_flag = 'Base' # 'Base' or 'HigherIntensity' or 'Longer'

### If the basin flag matches one of the two select basins,
### below will set the filename which to read the DEM from
### the outlet link and upstream link to sample discharge v
### from for plotting.

if basin_flag == 'Square':
    watershed_dem = 'Square_TestBasin.asc'
    outlet_link_to_sample = 299
    outlet_node_to_sample = 300
    upstream_link_to_sample = 59340
    upstream_node_to_sample = 29889
    midstream_link_to_sample = 25439
    midstream_node_to_sample = 12903
else:
    watershed_dem = 'Long_TestBasin.asc'
    outlet_link_to_sample = 149
    outlet_node_to_sample = 150
    upstream_link_to_sample = 71800
    upstream_node_to_sample = 36161
    midstream_link_to_sample = 50688
    midstream_node_to_sample = 25543
```



# CSDMS

COMMUNITY SURFACE DYNAMICS MODELING SYSTEM

## ON THE SURFACE

CSDMS QUARTERLY NEWSLETTER

May 2018



**BLANCA** - [Blanca](#) is the new CSDMS high-performance computing cluster, replacing beach, which was retired in March 2018. Blanca is a "condo" cluster managed by the Univ. of Colorado. CSDMS has purchased several nodes available for community member use. This cluster allows for easy expansion of compute capabilities. As with beach, CSDMS members get free access to blanca without an allocation. Blanca is administered by CU's [Research Computing](#) group, which also provides [documentation](#) on its use. Contact CSDMS to [get an account](#) on blanca.

**GRASS** - A new set of [GRASS binaries for Mac](#) - a free Geographic Information System - has been released by Michael Barton, with help from Eric Hutton of the CSDMS IF. The binaries are built with an embedded Anaconda Python distribution with all dependencies bundled inside the app. This eliminates many hard-to-fix installation issues with previous versions. The new GRASS binaries are also available as [Anaconda packages](#) that can easily be installed from the csdms-stack channel on [Anaconda Cloud](#).

# Thanks to supporting organizations



## **PREEVENTS**

Prediction of, and Resilience against,  
Extreme Events

## Sediment Experimentalist Network



## Polar Research Coordination Network

### **Polar RCN**

Polar Research Coordination Network

About

People

Events

Research



The Polar Research Coordination Network aims to connect the Polar Science, Data and High-Performance and Distributed Computing (HPDC) communities to enable deeper penetration of computing methods and cyberinfrastructure into the polar sciences.

## 2018 Syvitski Student Modeler Award

### Julio Hoffmann

- *Stochastic simulation by image quilting of process-based geological models*
- Ph.D. candidate at Department of Energy Resources, Stanford University
- Author of GeoStats.jl and ImageQuilting.jl



**2018 Best  
Poster Award**



# 2018 CSDMS Integration Facility Staff & Associates



**Greg Tucker**  
Director



**Lynn McCready**  
Executive Assistant



**Eric Hutton**  
Senior Software  
Engineer



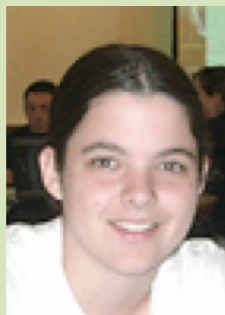
**Irina Overeem**  
Deputy Director



**Albert Kettner**  
Cyber Com & Data



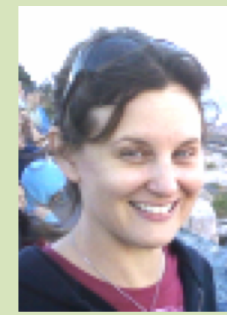
**Mark Piper**  
Software Engineer



**Mariela Perignon**  
Software Carpenter



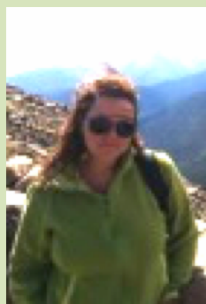
**Chris Jenkins**  
Marine Data



**Kimberly Rogers**  
Human Dimensions



**Bob Brakenridge**  
Dir, Flood Observatory



**Chrystal Pochay**  
Accountant



**Chad Stoffel**  
IT



**Jaia Syvitski**  
Director Emeritus



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