

# **EarthCube RCN Sediment Experimentalist Network (SEN)**

## **Report of the 2016 SEN Clinic at the CSDMS-SEN Annual Meeting SEN Clinic: Take only Measurements, Leave only Data**

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Network, “Building a Sediment Experimentalist Network”**

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## **Summary**

SEN held its 3rd community workshop concurrently with the Community Surface Dynamics Modeling System (CSDMS) meeting in Boulder, CO on May 17-19, 2016. Fifty-seven participants gathered to attend a clinic that focused on experiment-model integration and using SEN-developed tools and resources. As was the case for previous SEN activities, there was a focus on inviting early-career participants.

The clinic had three stations - (1) Live experiments on delta morphology, (2) Primer on documenting experimental data through the SEN Knowledge Base, (3) Primer on data and numerical model integration through use of CSDMS standard names. Following the stations,

breakouts were held to spend time in generating and using SEN Knowledge base content. Poster presentations were held jointly with the larger CSDMS meeting. SEN PIs also had time to connect with CSDMS working group leadership, and discussed about the potential new focus group of experimentalists in CSDMS.

Before the meeting, SEN held a travel grant contest by soliciting data-utilization cases for data in the SEN Knowledge base. Two students were funded, Hui Tang of Virginia Tech and Mitchell Donovan of Utah State University.

SEN clinic participants completed surveys and feedback forms before, during, and after the clinic, specifying current practices and perceptions of model-experiment integration, and strengths and weaknesses of SEN-produced resources.

Recommendations from the workshop include to continue to build and populate the SEN Knowledge Base, improve search capabilities of the Knowledge Base, and to continue to engage with the CSDMS community in order to address challenges in model-data integration.

# 1. Goal and Motivation

The Sediment Experimentalist Network (SEN) held its 2016 workshop "Take only measurements. Leave only data." at University of Colorado, Boulder East Campus concurrently with [the Community Surface Dynamics Modeling System \(CSDMS\) Annual Meeting from May 17-19, 2016](#).

The joint event with CSDMS strengthened the connection between experimental data producers from SEN and numerical modeler data consumers from CSDMS. Fifty-seven participants took part in SEN clinic on May 18, primarily SEN-supported from the United States, but also including CSDMS community members that are not affiliated with SEN.

The group was approximately 65% early career, defined as graduate students and postdocs. The annual meetings are an important opportunity to share methods, techniques, and tools that will accelerate scientific research in the SEN community.

Previous workshops focused on gathering researcher needs, but the current workshop focused on putting SEN tools to the test. The SEN Knowledge Base (SEN-KB) has been under continuous development by the University of Minnesota, with feedback from the SEN-KB PI team, but during this community event, we sought usability comments from a large group that was new to the tool.

SEN is an EarthCube Research Coordination Network (RCN) formed in August 2013 to integrate efforts of sediment experimentalists and to build tools for sharing data and methods. SEN seeks to harness the collective efforts of sediment laboratories worldwide to address three grand challenge issues: (1) relating experiments to natural systems, (2) ensuring reproducibility of experiments, and (3) distinguishing internal and external controls on landscape and stratigraphic variability. To address these grand challenges, SEN project goals include: formation of a **Knowledge Base (SEN-KB)** for data, workflows, methods, equipment, and other aspects of the experimental process; coordination of **Experimental Collaboratories (SEN-EC)**, an international network of cooperating experimental facilities; and implementation of **Education and Data Standards (SEN-ED)** alongside development of technology and sharing tools.

The CSDMS-SEN joint meeting is the third in a series of three international workshops (Previously August 2013 at Nagasaki University, Japan and November 2014 at University of Utrecht). Activities at the SEN-CSDMS workshop included:

- **Keynote talk** by Wonsuck Kim on "Overcoming Grand Challenges by Collaboration between Experimentalists and Modelers"
- **Clinic activity 1:** Community Experiment, a table top rigid lid delta experiment
- **Clinic activity 2:** Primer on the SEN Knowledge Base

- **Clinic activity 3:** Primer on use of CSDMS Standard names
- **Posters** from the participants about their work, held jointly with the CSDMS larger poster session, and on display for the duration of the CSDMS-meeting.
- **Discussion groups** on creating and using SEN-Knowledge Base entries
- **Networking with the CSDMS community** to document model-data integration practices and challenges

Integral to the CSDMS-SEN workshop was the SEN clinic, which included 3 activities demonstrating and testing the role of SEN Knowledge Base for methods documentation and sharing associated with a real experiment on delta formation. In the clinic, groups rotated among 3 activities: (1) Community experiment on delta formation, (2) Primer on SEN Knowledge Base, and (3) Primer on use of CSDMS Standard Names. Then, six subgroups participated in two activities requiring them first to contribute entries to the SEN Knowledge Base and then to attempt to use these entries to achieve science goals. Associated with the clinic, all participants completed pre- and post-clinic surveys, and a few of the clinic participants competed in a “data utilization contest” to simulate the process of using SEN Knowledge Base entries to achieve science goals.

## 2. The SEN and CSDMS Connection

The [Community Surface Dynamics Modeling System \(CSDMS\)](#) is an NSF-funded, international effort to develop a suite of modular numerical models able to simulate the evolution of landscapes and sedimentary basins. Since the proposal of SEN, the SEN team has planned to coordinate with CSDMS because of the opportunities for collaborations between experimental data producers and numerical modeler data consumers, which are not mutually exclusive groups.

A SEN-CSDMS connection provides insight into general processes for integrating numerical models and experimental data. SEN members can learn about CSDMS tools and resources like the Basic Modeling Interface, CSDMS Standard Names, and LandLab. Our intention is that networking between the two communities will lead to specific collaborations.

## 3. SEN Clinic

### 3.1 Community Experiment

In the spirit of the sediment experimentalists, we (Brandon McElroy and Wonsuck Kim) ran a short experiment to demonstrate the capabilities and explore the needs of the current SEN Knowledge Base. The experiments were conducted to demonstrate river mouth processes under backwater conditions using a flume with a rigid lid. Data was generated using

photographic techniques as well as basic mass balances of water and sediment. In addition the experiment was broadcast on Youtube and archive video is perennially available. Participants in the SEN clinic of the CSDMS annual meeting then constructed a SEN-KB entry using the array of data types, methods, and equipment. Overall, the experiment successfully captured SEN's goals of knowledge transfer, education about data management, and executing an experimental collaboratory.



### 3.2 SEN Knowledge Base

In this part of the clinic, led by Raleigh Martin and Charles Nguyen, clinic participants were introduced to the SEN Knowledge Base (SEN-KB). In particular, participants were walked through how to contribute entries to this community resource, the different types of possible entries (e.g., lab facility, experimental set-up, method, equipment), and the potential for using the SEAD (Sustainable Environment Actionable Data) data services to store datasets associated with SEN-KB entries. Following the three clinic activities, participants were broken into 6 subgroups each tasked with generating a different type of SEN-KB entry. Then, these groups briefly sketched out strategies for addressing science questions through information found in the SEN-KB resource. Throughout this process, groups collected ideas and recommendations for improving SEN-KB and fixing bugs based on their experiences. Following the workshop, we collected these ideas (as well as survey responses) to make improvements to the SEN Knowledge Base (see section 6 below for some outcomes from this).



### 3.3 SEN Vocabularies

In this part of the clinic, led by Leslie Hsu and Kimberly Miller, clinic participants were introduced to the concept of standard names as a common language that is used to describe variables to allow automated linkages between data and models. Participants were introduced to several current standard name vocabularies, including the CSDMS standard names, Observations Data Model Vocabulary, and CF standard names. The participants learned of the importance of standard names and how projects, like the [EarthCube Geosemantic Framework project](#), are working towards integrating standard names with data. The participants were shown in detail how to construct a standard name for variables using the CSDMS standard name method. The participants then engaged in an activity where they were asked to make a list of their most used variables for their research, as they would be written in a journal publication, and then try mapping these terms to a CSDMS standard name. We held a drawing from the submitted variables and gave out a SEN t-shirt. After the clinic, Hsu and Miller compiled the terms and will use them to both add new terms to the current list of CSDMS standard names as well as create name mappings for the Geosemantic Framework project.

## 5. Survey and in-person feedback outcomes

Two surveys were conducted, a pre-clinic survey and a post-clinic survey. In addition, we captured usability comments on paper slips during the break-out and discussion sections.

**The pre-clinic survey focused on how participants would like to link experimental data and numerical models, and their perceptions on how hard it would be.** Clinic participants were a mix of experimentalists and numerical modelers.

1. 19 out of 33 respondents (58%) generate experimental data
2. 26 out of 33 respondents (79%) would want to use others' experimental data
3. 50% of respondents had heard of CSDMS standard names and 50% had not.
4. Of those that had heard of CSDMS standard names, on a scale of 1-10, they rated the difficulty (1 not difficult, 10 most difficult) of mapping their variable names with standard names as 4.6 with a standard deviation of 2.1. (Average difficulty.)
5. Perceived difficulties in achieving ideal model-data pairings included
  - a. Not knowing what experimental data are available
  - b. Scaling
  - c. Not knowing what numerical model would be rapidly adaptable for pairing
  - d. Not being certain enough of the boundary conditions that can be specified for such a model to match the experiment
  - e. Lacking the essential length and time scales required to understand how to pair data and models
  - f. Lack of familiarity of model capabilities for non modelers
  - g. Errors in both modeled and measured quantities
  - h. Spatial scale of measurements vs. model grid
  - i. Modeling at boundaries (bed and water surface)
  - j. Lack of a model that works well for sediment transport because of lack of datasets that have equilibrium conditions when modeling nonuniform material
  - k. Finding a way to collect data so that it can inform the construction of the numerical model and make model predictions that can be directly tested by data.
  - l. The numerical model does not exist
  - m. Phenomena that are difficult to simulate by experiment, like tsunamis
  - n. Models have not reached the point where they can model realistic sediment particles

**The post-clinic survey focused on the effectiveness of the SEN Knowledge Base and what would be the most useful next steps to help members answer science questions.**

1. The perceived benefits of SEN KB is its role in increasing awareness of facilities, data, methods, equipment, in the SEN community, and the potential to capture lots of information ("institutional knowledge") that is currently lost when students, post-docs, and researchers move to different jobs. The focus of SEN-KB on experiments only is helpful.
2. SEN-KB needs and shortcomings:
  - a. The desire for more types of content - tips and tricks, vendors, negative results.
  - b. Desire for more advanced search of SEN resources: Desire for better keyword searches (develop a comprehensive vocabulary to cover SEN offerings)
  - c. The need for more content.
3. New technical tools desired are:

- a. Accessibility to good field data
- b. More measurement and processing information than is currently published
- c. More access to grey literature
- d. Access to scripts
- e. Something like Google Earth Engine for experiments
- f. Access to legacy data

In-person feedback was focused on small items and bugs related to the SEN Knowledge Base, which we have systematically worked to address since the meeting. Larger items and more fundamental changes to the SEN Knowledge Base have been documented and will be addressed as the time and resources become available.

## 6. Recommendations

Based on the activities, discussions, and survey results of the SEN Workshop, we make the following recommendations for SEN moving forward. While strongly informed by the participants in the workshop, these recommendations are based on the views of the SEN coordinating team.

1. Continue populating and improving the SEN Knowledge Base, which is reaching its goal as a centralized place for sediment experiment knowledge.
2. Improve the search capabilities of the SEN resources, emphasizing implementation of a keyword vocabulary.
3. Continue activities to inform experimentalists about CSDMS resources such as the CSDMS Standard Names. Maintain mapping of SEN variables to CSDMS standard names.
4. Obtain a no-cost extension to the SEN RCN grant.
5. Ensure that SEN-developed resources remain sustainable past the completion of the grant.
6. Poll the community to determine how best to carry forward SEN activities into the future.

### **Acknowledgments**

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## Appendices

### Meeting materials

- [Link to CSDMS official meeting materials](#)

# Participants

SEN-funded participants to the annual CSDMS Meeting (32).

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