GEOSCIENCE IN FOUR DIMENSIONS

MONDAY, NOVEMBER 13, 2017

NATIONAL ACADEMY OF SCIENCES BUILDING
LECTURE
2101 CONSTITUTION AVE NW
WASHINGTON, DC

TUESDAY, NOVEMBER 14, 2017

KECK CENTER
ROOM 100
500 5TH STREET NW
WASHINGTON, DC

SEAFLOOR MINING

Monday
November 13, 2017
([Zoom Web Connection Link](#))

Geosciences are critical for the economic growth of the United States, and also provide a vital contribution to national security. Geological, geophysical and geospatial data have fundamentally enhanced the nation's growth and security through the identification, development, and stewardship of mineral, energy, and water resources; identification of potential hazards; location and development of new infrastructure; and transformation of geospatial intelligence. When combined with elevation and deformation data more recently available from lidar and InSAR technologies, geological and geophysical data are essential for decisions and planning from local to national levels. Additionally, the advent of new sensors and technologies for collecting and storing information about rock properties and fluid flow from the deep Earth to the shallow subsurface have greatly expanded our capacity to address geotechnical engineering and design problems, location and extent of mineral and energy resources, well and mine construction, water infrastructure issues, flow and quantity of groundwater, and hazardous waste monitoring and cleanup. The potential to combine, analyze, visualize, and interpret both surface and subsurface data *through space and time* offers the potential for new insights and information that can support economic growth and societal and security needs.

PURPOSE: This session will examine the opportunities and needs to expand the availability, integration, and innovative application of geological, geophysical and geospatial data.

OBJECTIVE: Understanding how integration of geological, geophysical, and geospatial data can serve the needs of local, state, and national decision-making.

Overarching questions for each presenter:

1. How does integration of geoscience data enable new science frontiers?
2. What are the major scientific and technological challenges for pursuing this integration at scale?

Tuesday Afternoon
November 14, 2017
([Zoom Web Connection Link](#))

Deep-sea mining represents one of the frontiers for exploring commercially important mineral resources on Earth. Manganese nodules, ferromanganese crusts, massive sulfides, and metal-rich muds have the potential to provide economically important metals such as cobalt and copper, as well as rare earth elements that are critical for many technological applications. The challenges faced in identifying, characterizing, and extracting these resources can be great, yet companies are responding by creating new technologies that can efficiently map and mine the bottom. This session will provide a status update on progress related to deep-sea mining, including exploration of the global resource, discussion of technologies being used for extraction, and the environmental impacts that may occur as areas are opened up for mining. How do we evaluate and weigh the trade-offs?

National Academy of Sciences Building

Keck Center

GEOSCIENCE
IN FOUR DIMENSIONS

Integration of geological, geophysical, and geospatial data
to advance U.S. economic growth and security

OPEN AGENDA

8:00 - 9:00 AM **CLOSED SESSION** *BESR & CER Members and Staff Only*	

Zoom Web Connection Link

Time	Item	Speaker
09:00	Registration and Meet/Greet	
09:30	Welcome and introductions	**Gene Whitney**, *BESR Chair &* **Jim Slutz**, *CER Chair*
09:45	KEYNOTE: Current trends in geoscience mapping	**Harvey Thorleifson**, *State Geologist and Director, Minnesota Geological Survey*
10:15	BREAK	

Data collection, synthesis, and visualization

Time	Item	Speaker
10:30-10:45	Data science – capture and analysis	**Shaowen Wang**, *University of Illinois at Urbana-Champaign/BESR member*
10:45-11:00	Data synthesis – analysis and visualization	**Eva Zanzerkia**, *National Science Foundation*
11:00-11:15	Q&A	

Mineral Resources

Time	Item	Speaker
11:15-11:30	Multi-dimensional geological maps and the national mineral endowment	**Larry Meinert**, *U.S. Geological Survey*
11:30-11:45	Multi-dimensional geodata: Geomechanical framework models for developing deep, safe hard-rock mines	**Matthew Pierce**, *Pierce Engineering*
11:45-12:00	Q&A	
12:00 – 13:00	LUNCH	

13:00	**Water Resources**	
13:00-13:15	Data, mapping, and models to understand water flow, use, and management	**David Hyndman,** *Michigan State University*
13:15-13:30	The Columbia River system and legacy issues: Hanford, groundwater, energy, and the environment	**Thomas Tebb,** *Department of Ecology State of Washington*
13:30-13:45	Q&A	
13:45	**Maps to Models**	
13:45-14:00	Vision for energy data systems and communities: toward predictive modeling	**Kelly Rose,** *National Energy Technology Laboratory*
14:00-14:15	Integrated interpretation and modeling of the subsurface, artificial intelligence, and machine learning	**Peter Tilke,** *Schlumberger Research*
14:15-14:30	Q&A	**Gene Whitney,** *BESR Chair &* **Jim Slutz,** *CER Chair*
14:30 – 16:00	Plenary discussion	
	Meeting adjourns	

16:00 - 20:00
CLOSED SESSION
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14:00	*Welcome*	***Larry Mayer** & **Gene Whitney***

14:10
- What is the current state of deep sea mining—people, policy, and practice (?) (e.g., who has current leases, who is moving toward operations, who is most advanced?)

- Where is deep-sea mining expected to move into development in the next 5-10 years?

Michael Lodge
International Seabed Authority

15:00 *Panel Discussion*

1. **Resource Assessment**

   o What are current estimates of the resource potential on the sea-floor, where are the resources located, and how do they compare to active or potential deposits on land (quantity, economics of exploration and development, etc.)?
   o How are these resources being identified, mapped, and characterized?
   o What minerals are likely targets for extraction?
   o What is the genesis of these minerals?

   Mark Hannington
   Helmholtz Center for Ocean Research
   (GEOMAR)

2. **Mining Technology**

   o What technologies are being used for exploration, extraction and separation?
   o What are the challenges of working on the seafloor/in the ocean, and what are the

   Jennifer Warren
   Lockheed-Martin

opportunities?

3. **Environmental Impacts and Governance Issues**

    o   What is the range of environmental impacts
        expected from deep sea mining? Which
        environmental concerns require the most urgent
        consideration?.
    o   What are the information needs for determining
        environmental impacts at a particular site?
    o   What monitoring will be needed to track
        environmental impacts? To assess recover when
        mining operations cease?

Cindy Van Dover
Duke University

Conn Nugent
Director
Seabed Mining Project
Pew Charitable Trusts

16:30 **Adjourn open session**

16:45 – 20:39
CLOSED SESSION
OSB, BESR, & CER Members and Staff Only

End of meeting