

MIT Earth Resources Laboratory Annual Founding Members Meeting 2020
Perspectives for geophysics in industry: Deep nets for inverse problems and questions in carbon injection
Subject to change - last updated 05/19/20

Day	Start	End	Session	Speaker	Title	Summary
Wednesday, May 20	10:00	10:15	Welcome	Laurent Demanet		
	10:15	10:45	Plenary Session I	John Williams	A Data 1st Case Study – Learning from Production Data	
	10:45	11:00	Break			
	11:00	11:20	Uncertainty Quantification & Geothermal	Stephen Brown	Machine learning for natural resource assessment: an application to the blind geothermal systems of Nevada	Regional scale maps of geological and geophysical parameters are being used in machine learning algorithms to estimate the geothermal energy potential of the Great Basin of the western United States.
	11:20	11:40		Chen Gu	Bayesian model selection and the application to geothermal development	I developed a bayesian model selection method to compare multiple geothermal predictive models on the same scale, and select the best model to do robust geothermal prediction with uncertainty quantification.
	11:40	12:00		Andrea Scarinci	Assessing inference quality under model misspecification: an application to seismic inversion	We proposed a new misfit measure for robust inference under model misspecification. How can we quantitatively verify the improvement? And in what terms?
	12:00	12:15	Break			
	12:15	12:30	Student and Postdoc Introductions	Samiya Alkhairy, Hilary Chang, Aarti Dwivedi, Sarah Greer, Jing Jian, Magreth Kakoko, Brindha Kanniah, Paris Smalls, Anuar Togaibekov, Mohamad Zaarour, Chenguang Zhang		ERL students and postdoctoral researchers introduce their work.
	12:30	13:45	Break			
	13:45	14:05	CO2 Storage & Induced Seismicity	Maryam Alghannam	Understanding rate effects in induced seismicity	We developed a new spring-slider model of earthquake nucleation that reflects pressurization rate effects on induced earthquakes.
	14:05	14:25		Josimar Alves da Silva	Modeling CO2 Storage in a Gulf of Mexico Reservoir Using Coupled Flow and Geomechanics	We investigate the impact of large scale CO2 storage on the stability of faults in the Gulf of Mexico using a coupled flow and geomechanics model. Our model is grounded on a realistic geological model typical of the Gulf of Mexico area. We show that large-scale CO2 injection can be performed safely but care must be taken regarding the well locations and the injection schedule.
	14:25	14:45		Tiange Xing	Time-dependent Deformation in Basalt	We constrained the effect of water on time-dependent brittle creep deformation in basaltic rocks from the CarbFix site in Iceland. These experiments form a base line for future carbonation experiments on the basalts. Our study will fill the current gaps in understanding of long-term deformation behavior and transport properties of basaltic rocks at reservoir conditions and provide guidance to future applications of geological CO2
	14:45	15:00	Break			
	15:00	15:20	Deep Learning & Seismic Inversion	Hongyu Sun	Elastic full waveform inversion with extrapolated low frequency data	By leveraging deep learning technologies, we extend our work on extrapolated FWI (EFWI) by proposing to synthesize the low frequencies of multi-component elastic seismic records, and use those "artificial" low frequencies to seed the frequency sweep of elastic FWI.
	15:20	15:40		Pawan Bharadwaj	SymAE: an autoencoder with embedded physical symmetries for passive time-lapse monitoring	SymAE is a network trained to accurately monitor the subsurface changes irrespective of the variability in the passive sources.
	15:40	16:00		Matthew T.C. Li	Wide-band Butterfly Network: An architecture for multifrequency sub-wavelength imaging	We incorporate the physics of wave propagation into our neural network architecture in order to super-resolve scatterers with length scales below the diffraction limit.
	16:00	16:15	Break			
	16:15	16:35	Next-Generation Computational Methods	Adrien Scheuer	The method of polarized traces for the 3D Helmholtz equation	We have developed a fast, accurate and scalable solver for the high-frequency 3D Helmholtz equation in heterogeneous acoustic media. The solver is based on the method of polarized traces and is coupled with distributed linear algebra libraries and pipelining of the many sources to achieve a sublinear online runtime with respect to the total number of unknowns.

	16:35	16:55		Zhilong Fang	Lift and Relax for waveform inversion	We developed a Lift and Relax method for full waveform inversion to mitigate the local minima issue.
	16:55	17:15		Matteo Couplet	Porous media reconstruction using Deep Texture Synthesis	Using deep learning, we have successfully reconstructed 3D porous media models from 2D images while preserving the macroscopic physical properties.
Wed. 05/20 Informal Discussion Rooms	12:00	14:00	1. Uncertainty Quantification & Geothermal	Hosted by Andrea Scarinci		
	14:00	15:00	4. Next-Generation Computational Methods	Hosted by Matthew T.C. Li		
	14:45	16:00	2. CO2 Storage & Induced Seismicity	Hosted by Josimar Alves da Silva		
	14:45	17:45	5. Fractures	Hosted by Hao Kang		
	16:00	17:00	3. Deep Learning & Seismic Inversion	Hosted by Nori Nakata		
	17:15	18:15	4. Next-Generation Computational Methods	Hosted by Adrien Scheuer		
	18:15	19:15		Hosted by Zhilong Fang		
Thursday, May 21	10:00	10:15	Welcome	Laurent Demanet		
	10:15	10:45	Plenary Session II	Shuhei Ono	Generation temperature of methane estimated from doubly substituted isotopologue (13CH3D)	
	10:45	11:00	Break			
	11:00	11:20	Fractures	Ekaterina Bolotskaya	Earthquake Rupture Modeling: Fracturing vs. Friction	We qualitatively and quantitatively compared the fault parameters for different rupture propagation approaches (rate-and-state friction, slip weakening friction, exponential cohesive zone fracturing model) by means of FEM simulations. Results produced by different approaches are virtually indistinguishable (apart from very near-field stress profile observations) given the fracture energy is set the same in all cases.
	11:20	11:40		Yue Olivia Meng	Jamming transition and emergence of fracturing in wet granular media	We developed a hydromechanical model to study the impact of wettability on hydraulic fracturing patterns, and the proposed jamming phase diagram provides insights on the interplay between solid and fluid mechanics, which has wide applications in enhanced oil
	11:40	12:00		Ignacio Arzuaga García	Interaction of hydraulically induced fractures with natural fractures in shale	We introduce a combined AE-Imaging(Visual)-DIC data analysis process through which we generated Qualitative and Quantitative correlations between governing parameters of interaction between natural and hydraulic fractures in shale, particularly focused on addressing Vaca Muerta's formation strike-slip stress regime effect on wells productivity.
	12:00	12:20		Rafael Villamor Lora & Hao Kang	Fracture deformation and its effects on flow - experiments and simulations	We have developed a novel experimental setup to investigate the interplay between flow and fracture stiffness in stressed fractures. In addition, we have successfully used ABAQUS to simulate micro-indentation and the mechanical compression of multiple fracture surface asperities.
	12:20	12:40		Ammar Alali	Hybrid Data Driven Drilling and Rate of Penetration Optimization	We have built a data-driven scheme to optimize the drilling rate of penetration by utilizing historical and real-time data, which can work in any development field."
	12:40	14:00	Break			
	14:00	15:00	Business Meeting		For representatives of ERL Founding Member companies and ERL faculty.	
Thu. 05/21 Informal Discussion Rooms	12:00	14:00	2. CO2 Storage & Induced Seismicity	Hosted by Saleh Al-Nasser		
	12:00	14:00	3. Deep Learning & Seismic Inversion	Hosted by Hongyu Sun		
	12:40	13:40	1. Uncertainty Quantification	Hosted by F. Dale Morgan		