

MIT EARTH RESOURCES LABORATORY
ANNUAL FOUNDING MEMBERS MEETING 2018



Student and Postdoc Introductions

Chen Gu

Current Students and Postdocs

STUDENTS

Al Nasser, Saleh
Al-Dajani, Omar
Aladwani, Mohammad
Alali, Ammar
Alghannam, Maryam Ali A
Alves da Silva, Josimar
Arzuaga García, Ignacio
Beaucé, Eric
Bolotskaya, Ekaterina
Chui, Jane
Clancy, Julien
de Saussure, Arabelle
Dwivedi, Aarti
Ely, Gregory
Florez Torres, Manuel
Golos, Eva
Jung, Na-Hyun (Ella)

STUDENTS

Kang, Hao
Li, Matthew T.C.
Li, Qiuyi Bing
Li, Wei
Mao, Shujuan
Matchette-Downes, Harry
Mighani, Saied
Montgomery, Justin B.
Pahlavan, Amir
Primkulov, Bauyrzhan
Ranganathan, Meghana
Raymond, Samuel
Rodríguez-Buño, Mariana
Salo, Lluís
Sun, Hongyu
Tyukhova, Alina
Yoon, Seonkyoo

POSTDOCS

Bharadwaj, Pawan
Fang, Hongjian
Fu, Xiaojing
Gu, Chen
Haghighat, Ehsan
Mordret, Aurélien
Mukuhira, Yusuke
Rongier, Guillaume
Rude, Cody
Taus, Matthias
Trojer, Mathias
Villamor Lora, Rafael
Wang, Hua
Yang, Zhibing

Current Students and Postdocs

Uncertainty &
Inversion

Imaging

Multi-phase
flow

Rock Physics
& Chemistry

Geomechanics



Recent Alumni

Lubna Barghouty

Attending Harvard Education School

Kevin Chao

Data Science Scholar at Northwestern University

William Frank

Assistant Professor at the University of Southern California

Bruno Goncalves da Silva

Assistant Professor at New Jersey Institute of Technology

Niels Grobbe

Assistant Researcher at the University of Hawaii at Manoa

Elita Li

Assistant Professor at the National University of Singapore

Chunfang Meng

Research Scientist at MIT-ERL

Omid Moradian

Senior Research Associate and Lecturer at ETH Zurich

Stephen Morgan

ExxonMobil

Anna Rogers

Geophysicist at Shell

Farrokh Sheibani

Research Scientist at MIT-ERL

Yuval Tal

Postdoc at CalTech

Bram Willemsen

ExxonMobil

Elezhan Zhakiya

Working for a startup

Recent Alumni on Google Map

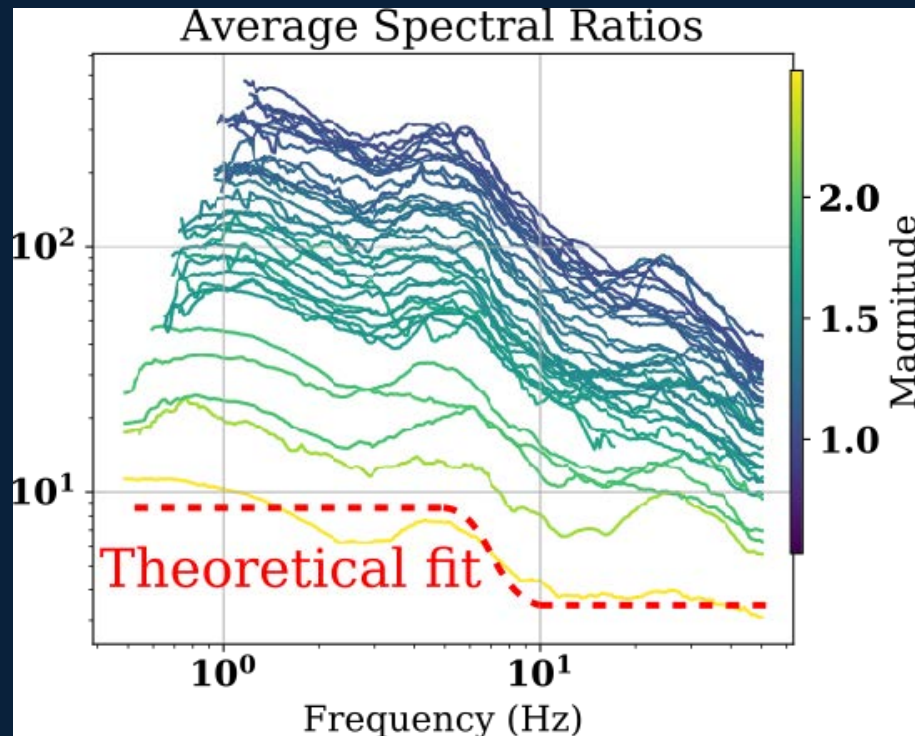


Eric Beaucé

Graduate student working with Prof. Van der Hilst and Prof. Campillo
MSc in Physics, ENS Lyon, 2016

CURRENT RESEARCH INTERESTS

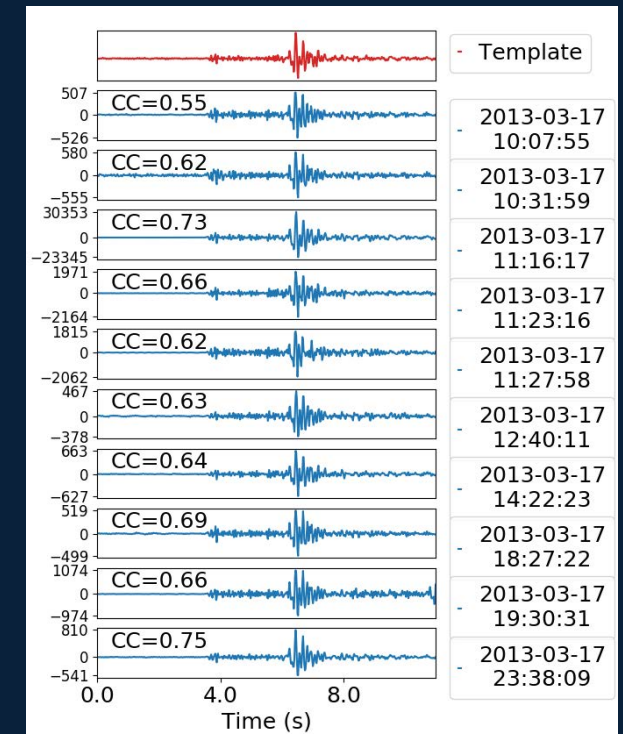
SYSTEMATIC SOURCE CHARACTERIZATION



PAST RESEARCH INTERESTS

AUTOMATIC EARTHQUAKE DETECTION

- Array processing
- Machine learning
- Template Matched-filtering

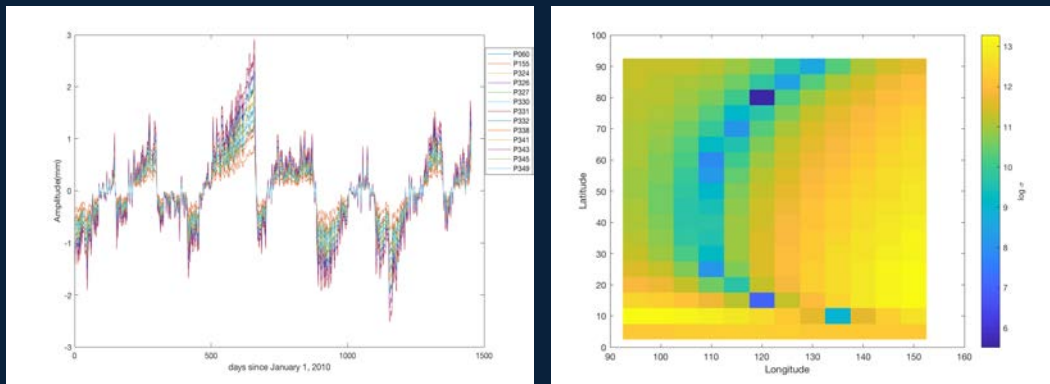


Aarti K. Dwivedi

Grad Student working with Prof. Herring & Prof. Binzel
Integrated M.Tech Geophysics, IIT Roorkee, 2016

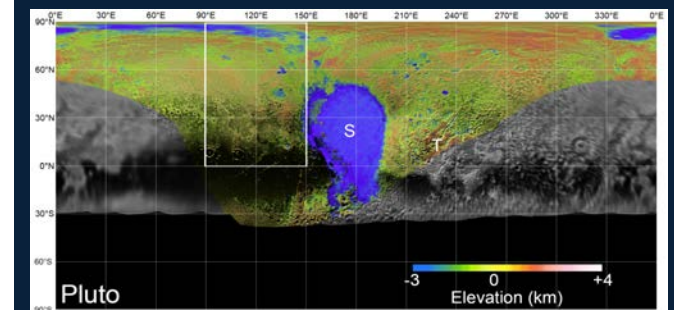
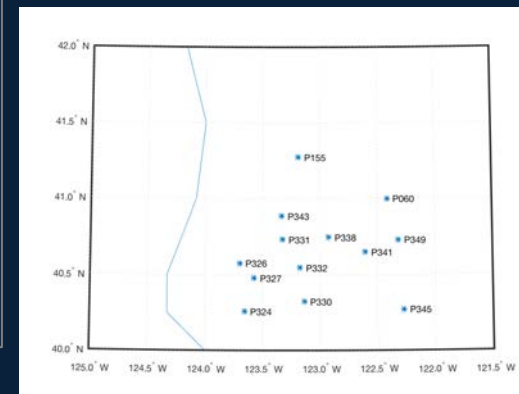
CURRENT RESEARCH INTERESTS

1. SLOW-SLIP EVENTS IN NORTHERN CALIFORNIA
2. CRATER DISTRIBUTION ON PLUTO



PAST RESEARCH INTERESTS

1. CHARACTERIZATION OF TSUNAMIGENIC SOURCES USING REAL TIME WATER LEVEL INVERSION.
2. INVERSION OF EM DATA USING IMMERSSED INTERFACE METHOD
3. CRUSTAL DEFORMATION OF ANTARCTICA

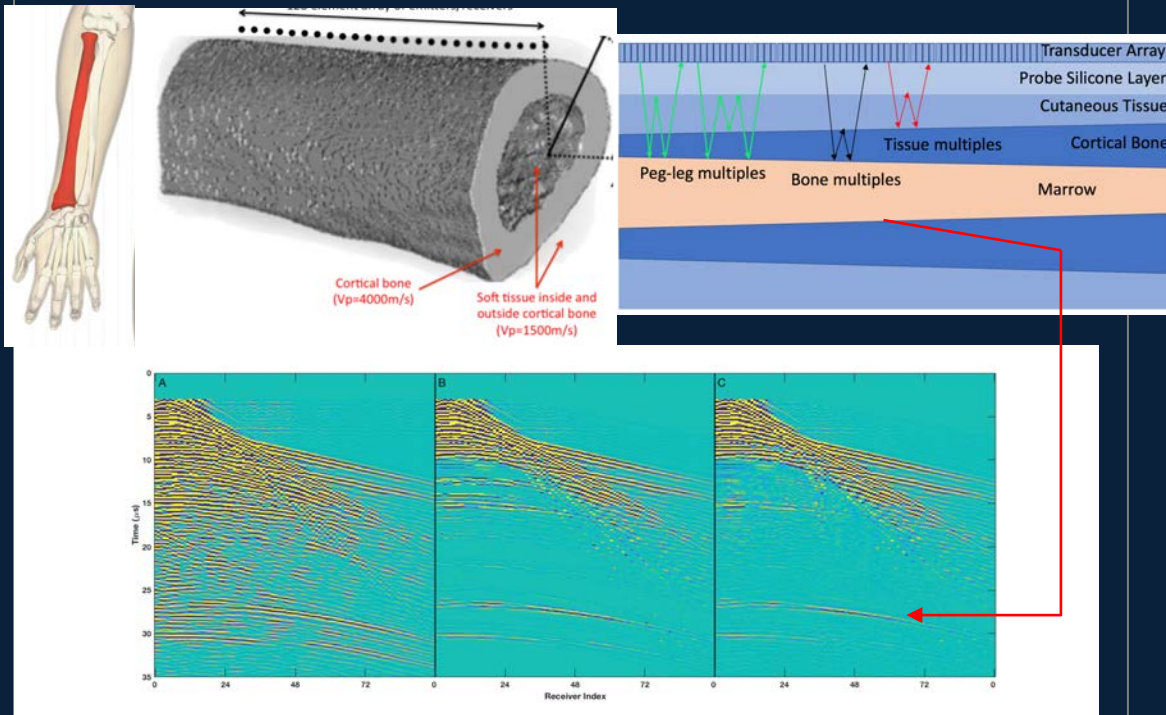


Gregory Ely

PhD candidate working with Prof. Alison Malcolm
 MS Electrical Engineering, Tufts University, 2013
 BA Physics, Carleton College, 2008

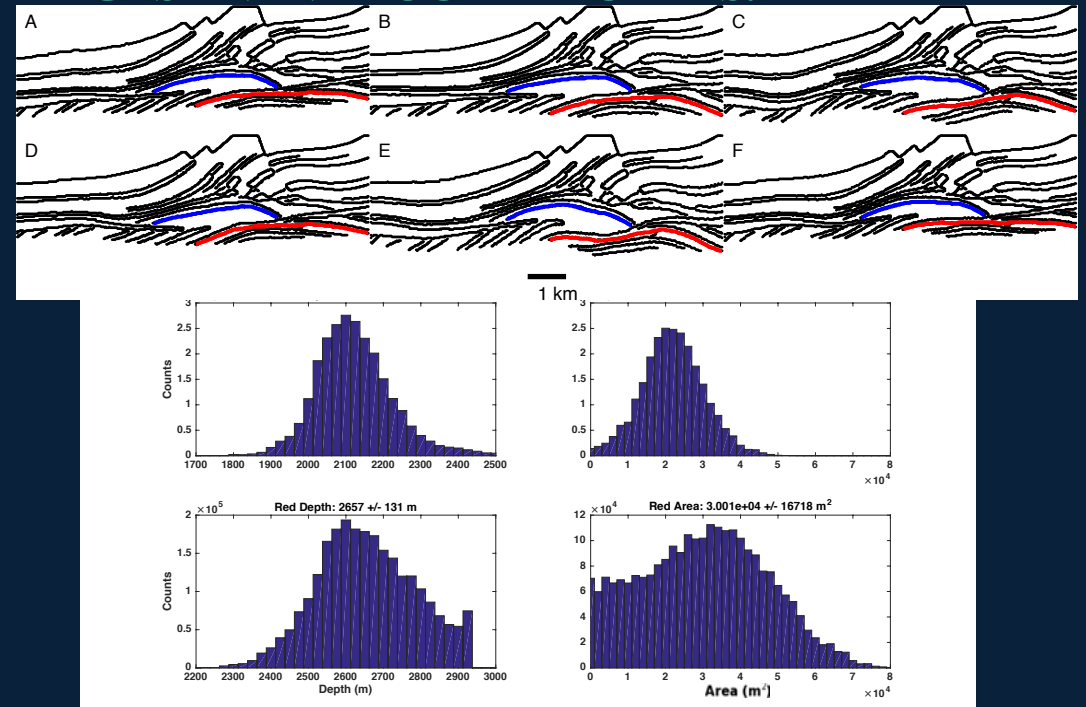
CURRENT RESEARCH INTERESTS

APPLICATIONS OF EXPLORATION SEISMOLOGY TO MEDICAL ULTRASOUND.



PAST RESEARCH INTERESTS

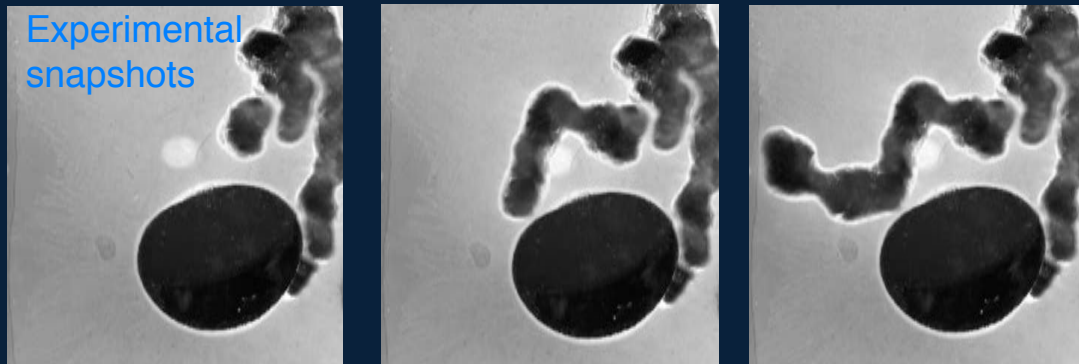
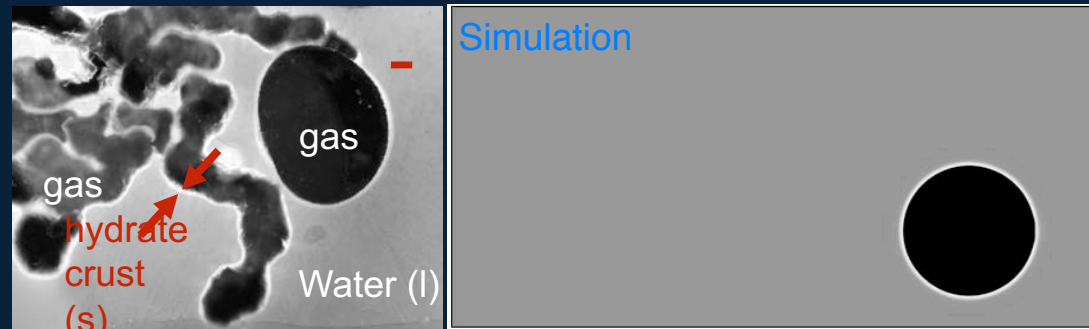
UNCERTAINTY QUANTIFICATION OF SEISMIC IMAGES AND VELOCITY MODELS.



Xiaojing (Ruby) Fu

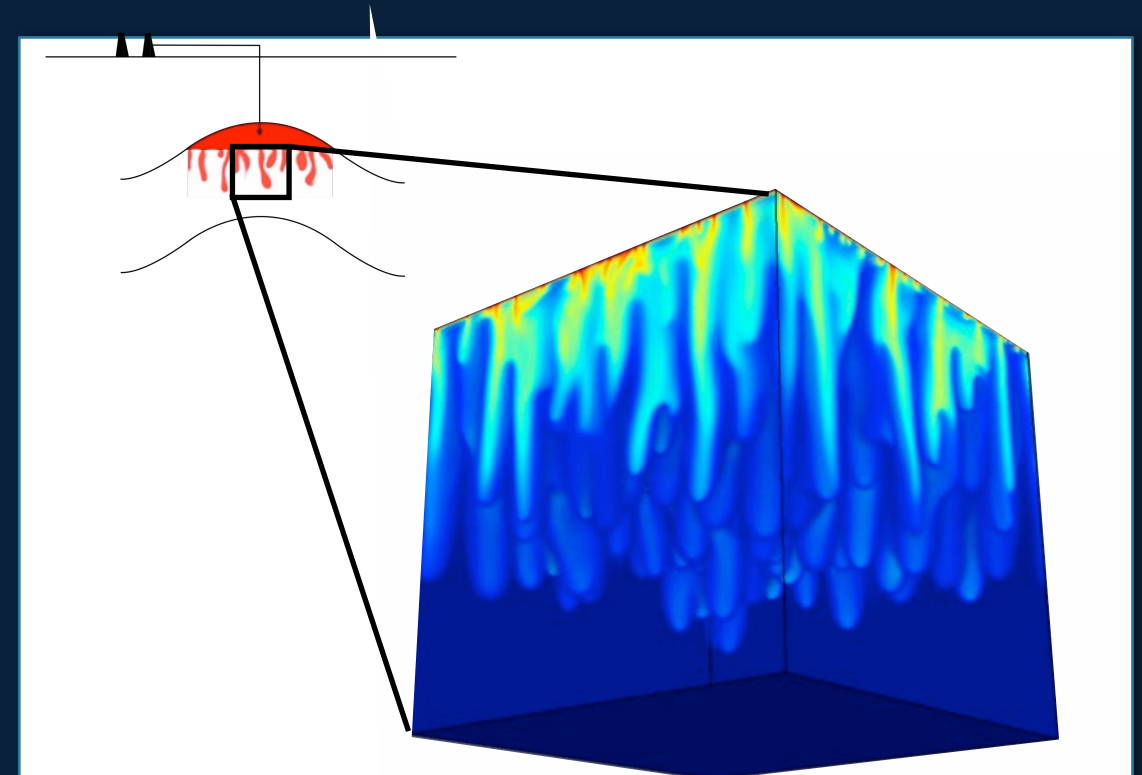
Postdoc working with Prof. Ruben Juanes
PhD, MIT, 2017
B.S., Clarkson University, 2011

PHASE-FIELD MODELING OF GAS HYDRATE SYSTEMS



Fu, Cueto-Felgueroso and Juanes., *Phys. Rev. E* (2016)
Fu, Cueto-Felgueroso and Juanes., *Phys. Rev. Fluids* (2017)
Fu, Cueto-Felgueroso and Juanes., *Phys. Rev. Lett.* (2018)
Fu, et al., *in prep*

CO2 SEQUESTRATION



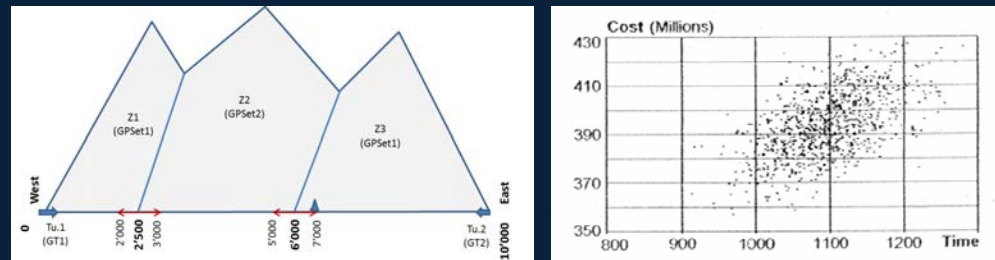
Fu, Cueto-Felgueroso and Juanes., *Phil. Trans. R. Soc.* (2013)
Fu, Cueto-Felgueroso, Bolster and Juanes, *J. Fluid Mech.* (2015)

Ray Harran

M.Sc. Thesis exchange with Prof. H. H. Einstein
 M.Sc., Ecole Polytechnique Fédérale de Lausanne, 2018
 B.E., American University of Beirut, 2016

1. Decision Aids for Tunneling

Considers uncertainties in geology and construction
 Scattergrams based on Monte Carlo simulations



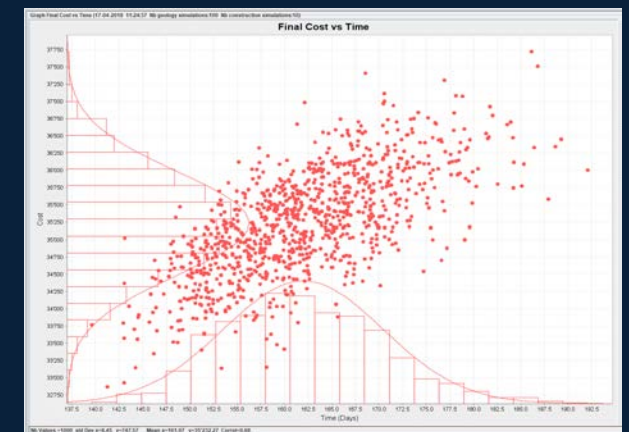
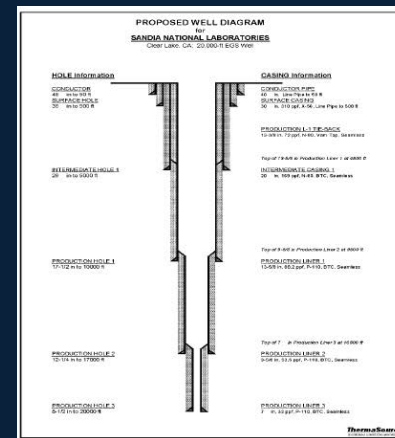
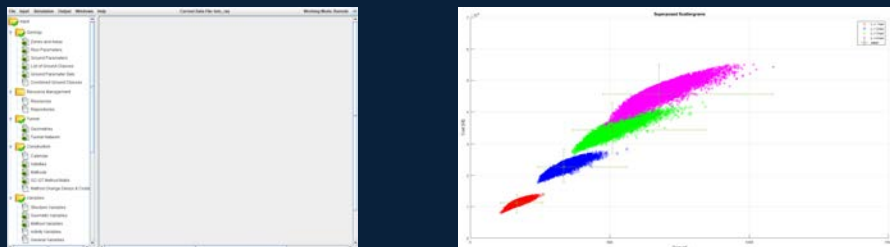
2. DAT Applications

- Finding the best alternative
- Finding the best construction method
- Updating and forecasting
- Resource management
- Extensions to other applications: optimization, risk analysis, roads, deep geothermal wells etc.

3. Current developments

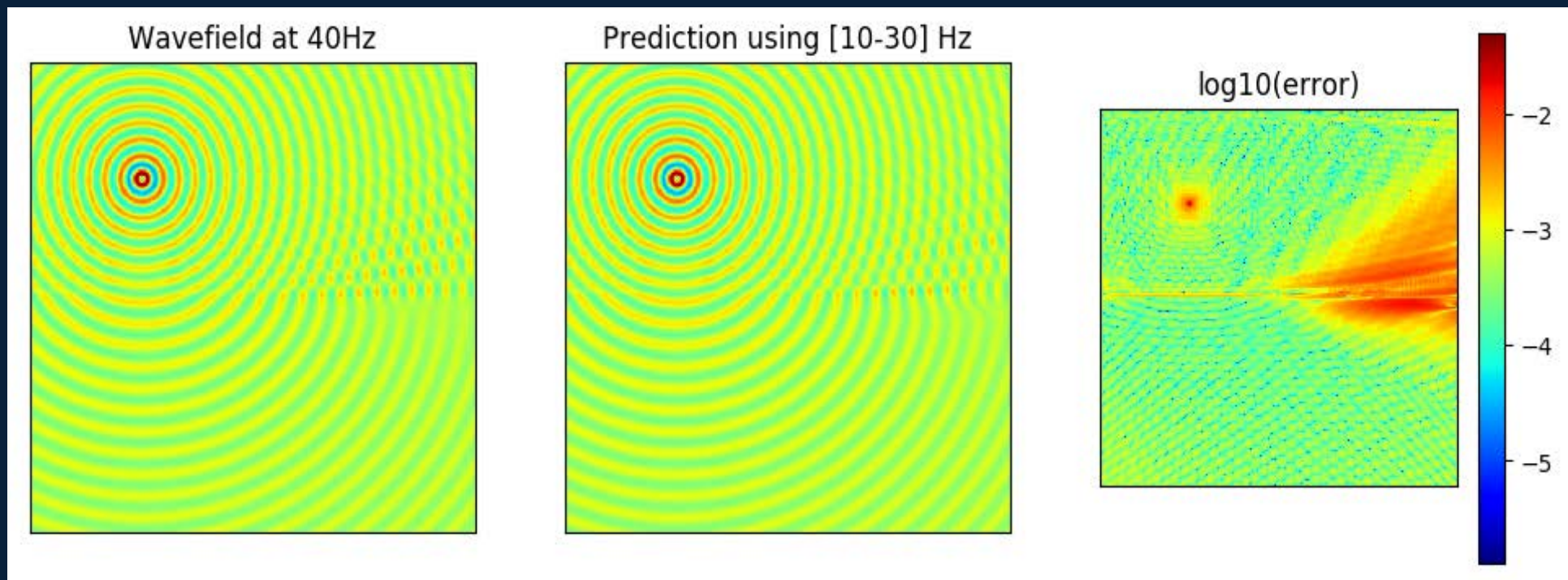
Optimizing the DAT for small tunnels

- Simplified version
- Catalogue for direct consultation



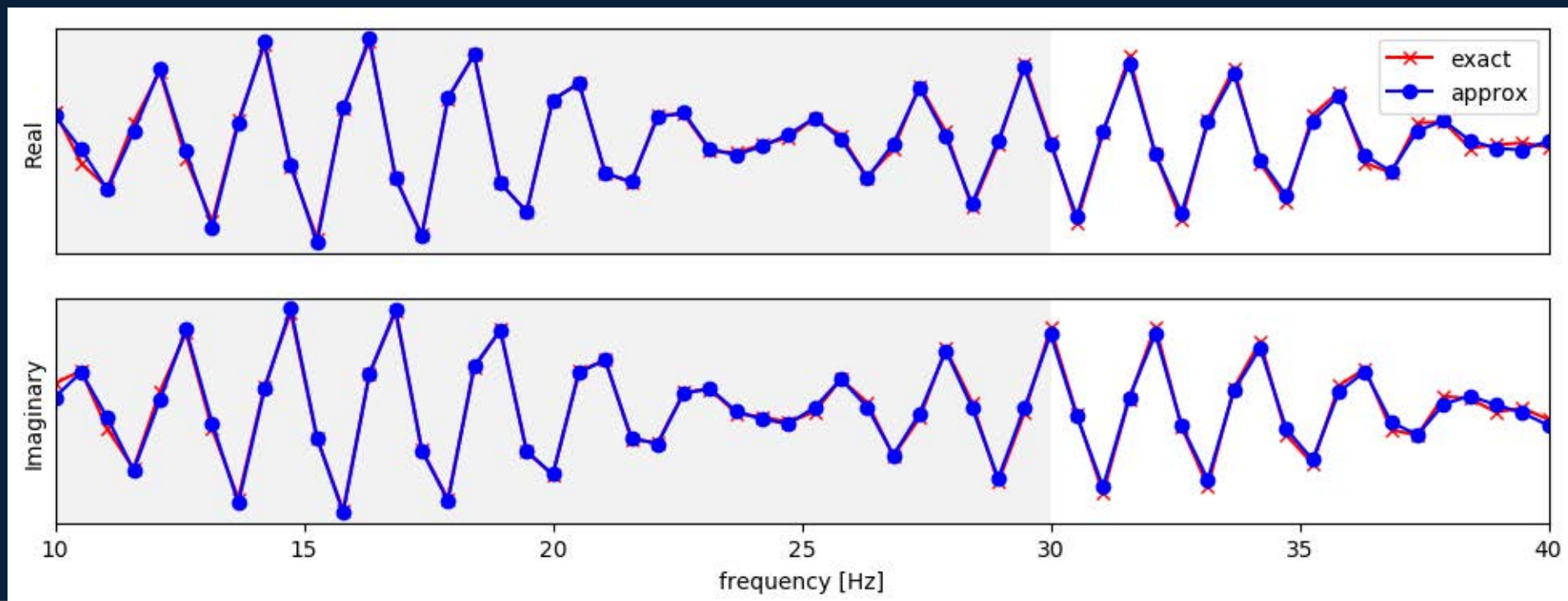
SIGNAL PROCESSING FOR THE HELMHOLTZ EQUATION

- WE SOLVE FOR LOW-FREQUENCY WAVEFIELDS ANYWAYS ... WHY CAN'T WE USE THIS DATA TO PREDICT THE HIGHER FREQUENCY WAVEFIELDS?



SIGNAL PROCESSING FOR THE HELMHOLTZ EQUATION

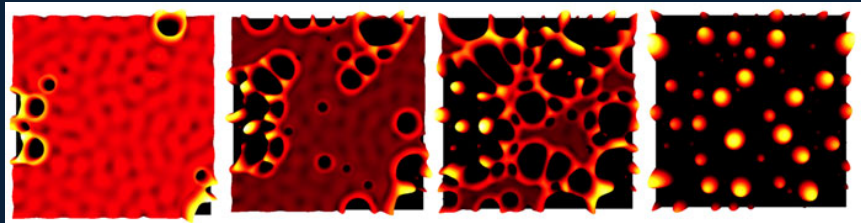
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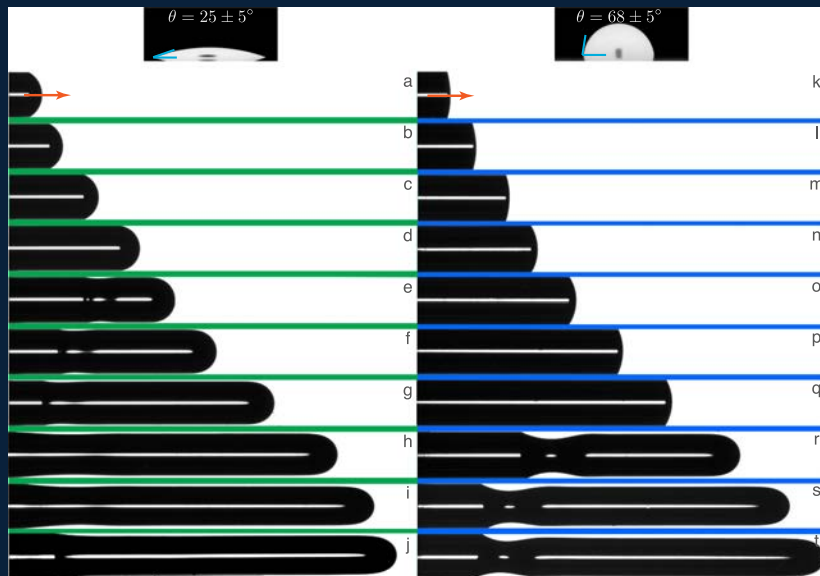
Amir Pahlavan

IMMISCIBLE FLUID FLOW IN POROUS MEDIA

Spreading and dewetting of drops/thin films on solid substrates



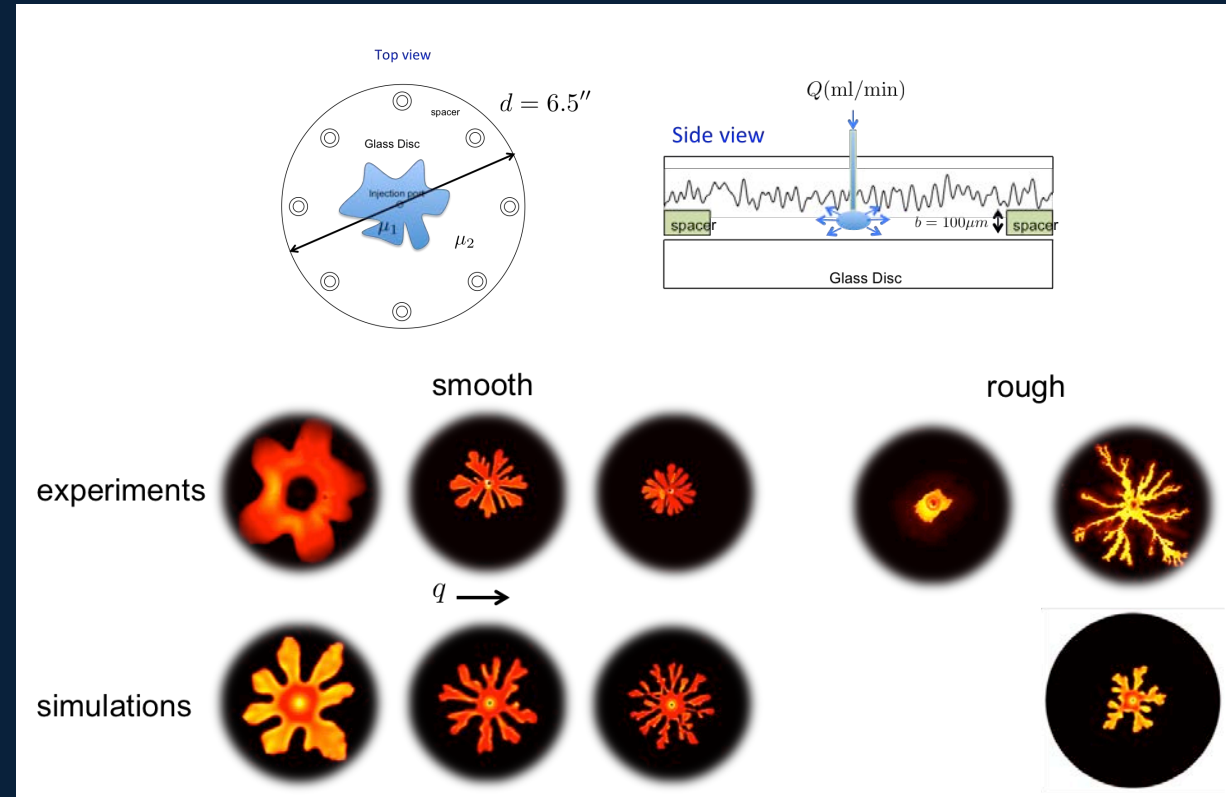
Immiscible displacement in a capillary tube Pahlavan et al., PRL, 2015, JFM, 2018.



Zhao*, Pahlavan* et al., PRL, 2018.
* Equally contributed.

PhD student working with Prof. Ruben Juanes
M.S., University of Illinois, 2010.
B.S., University of Tehran, 2008.

Influence of disorder on immiscible fluid flow



Pahlavan et al., in preparation.

Meghana Ranganathan

PhD Student working with Dr. Sai Ravela
B.A. in Mathematics, Swarthmore College, 2017

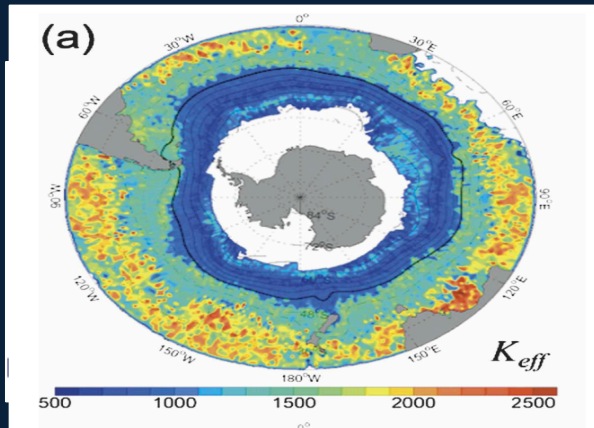
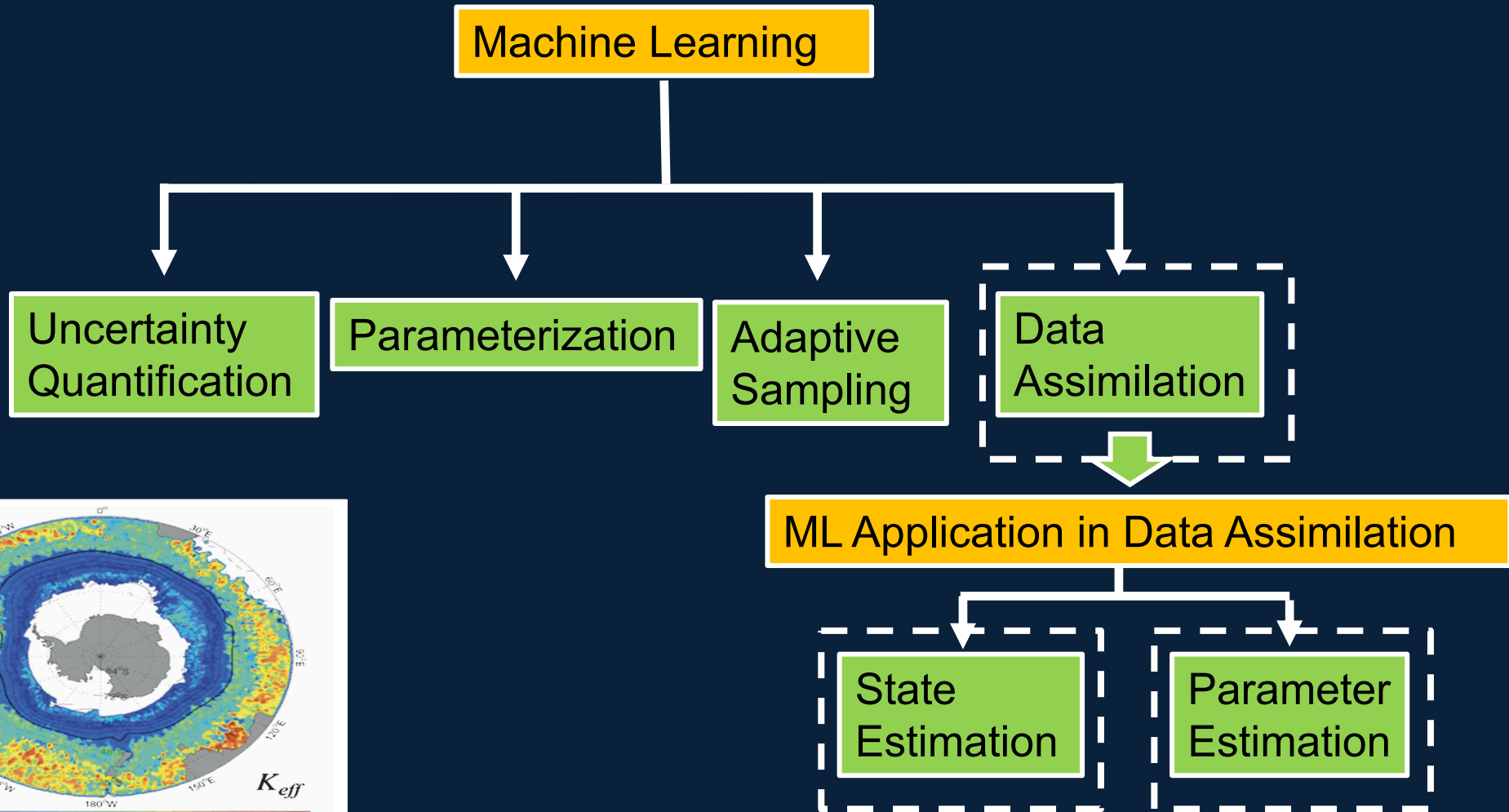


Image: Marshall et al. 2006

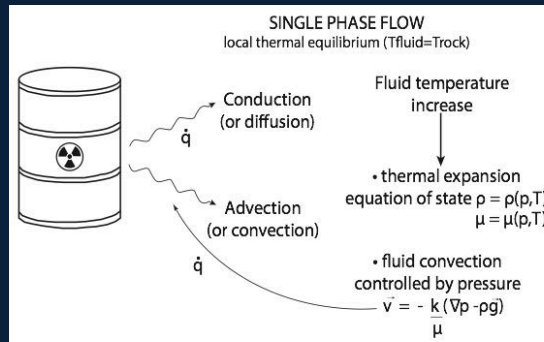
Image: WHOI OAFlux Project

Mariana Rodríguez-Buño

PhD Candidate working with Prof. Einstein
 MSc., MIT, 2014
 Civil Engineering Diploma

CURRENT RESEARCH INTERESTS

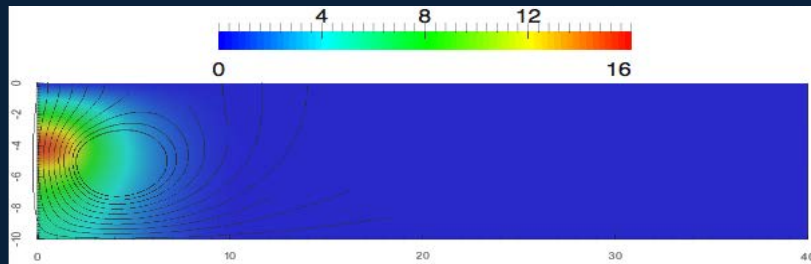
THERMAL-HYDRAULIC-MECHANICAL RESPONSE OF HIGH LEVEL NUCLEAR WASTE DISPOSAL IN DEEP-BOREHOLE IN GRANITE



Numerical Implementation

- MOOSE Framework
- Modeling multi-physics
- Parallelized computations

At 230,000 years

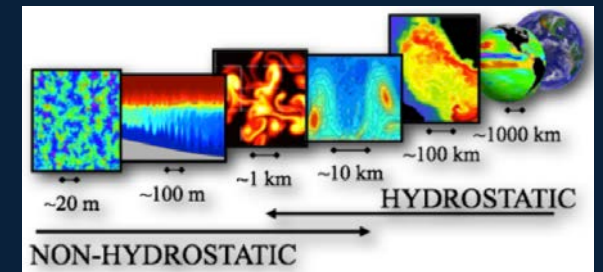
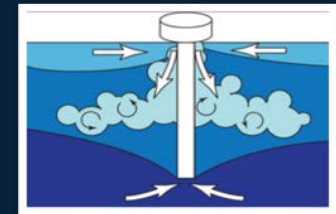


Temperature change (°C) due to nuclear waste and fluid streamlines

PAST RESEARCH INTERESTS

MODELING THE EXTERNAL FLUID MECHANICS OF OCEAN THERMAL ENERGY (OTEC) POWER PLANTS

OTEC plants produce renewable energy from the natural thermal gradient of the ocean

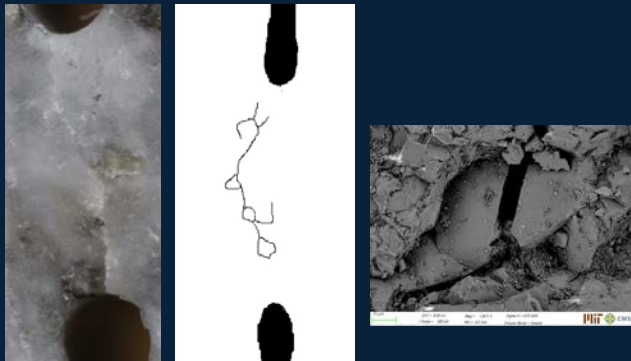


Arabelle de Saussure

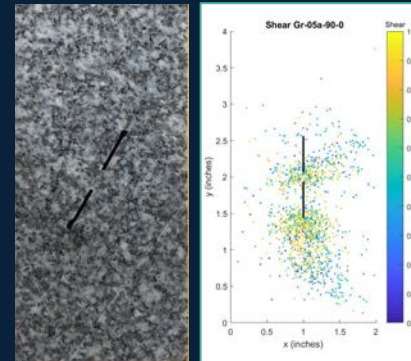
Visiting graduate student working with Prof. H.H. Einstein
M.Sc. in Geotechnical Engineering, EPFL, Sept. 2018
B.Sc. in Civil Engineering, EPFL, 2015

CURRENT RESEARCH INTERESTS

EXPERIMENTATION ON HYDRAULIC FRACTURING OF GRANITE FOR ENHANCED GEOTHERMAL SYSTEMS (EGS)



FRACTURE MECHANISMS AND PATTERNS

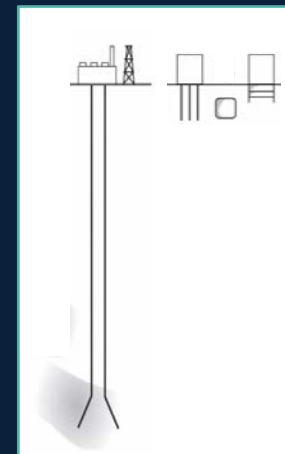


HYDROSHEARING AND INDUCED SEISMICITY

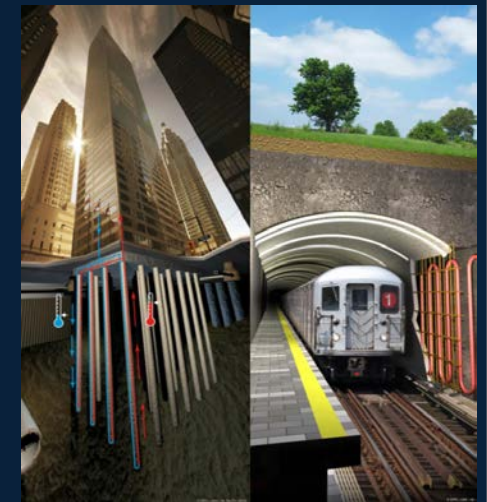
PAST RESEARCH INTERESTS

ENERGY GEOSTRUCTURES

- Prof. L. Laloui, EPFL, Switzerland
- Integrated heat exchangers in foundations: piles, walls and tunnel supports



EGS: 4000-6000 m
ENERGY GEOSTRUCTURES: 10-50 m

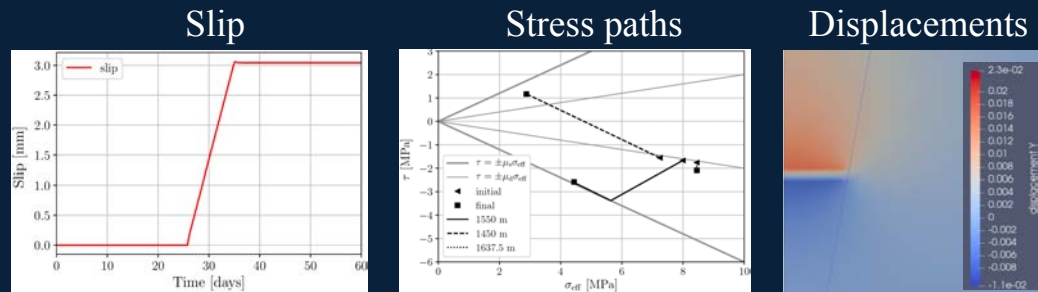


Lluís Saló

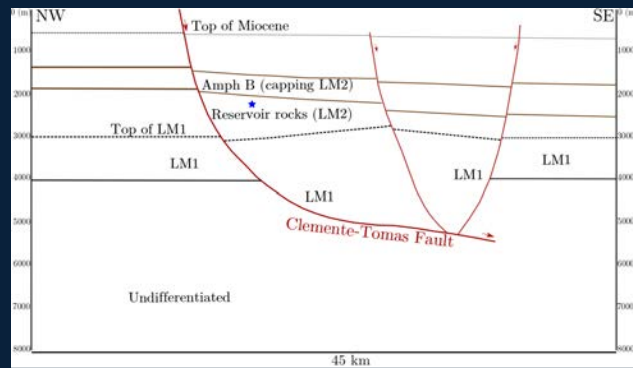
Graduate student working with Prof. R. Juanes
 MS, Technical University of Catalonia, 2016
 BS, University of Barcelona, 2014

CURRENT RESEARCH INTERESTS

COUPLED FLOW-GEOMECHANICS MODELING FOR ASSESSING INDUCED SEISMICITY AND FAULT LEAKAGE

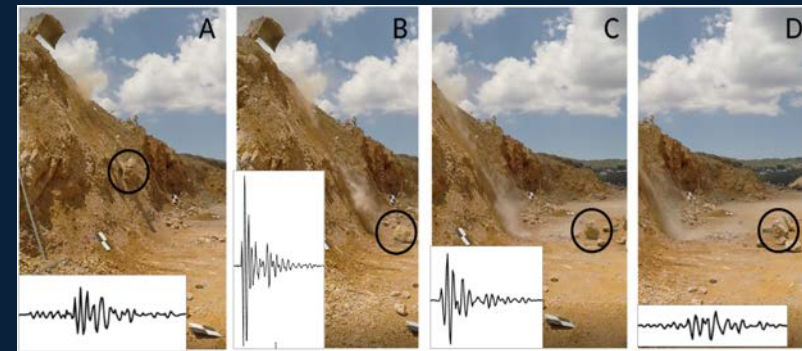


GEOLOGICALLY-REALISTIC MODELS OF CO₂ STORAGE IN SEDIMENTARY BASINS



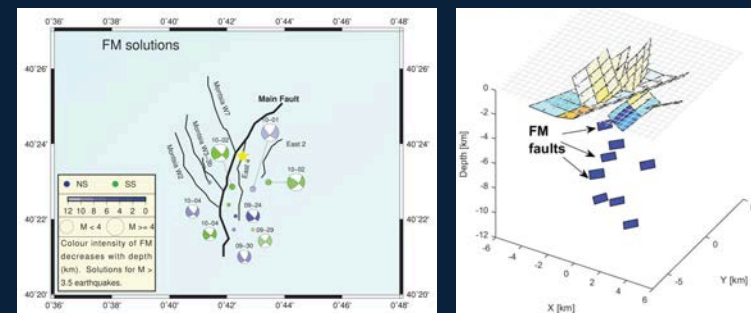
PAST RESEARCH INTERESTS

ROCKFALL SEISMIC SIGNAL ANALYSIS



Saló et al.,
JGR-ES, 2018

INDUCED SEISMICITY CASE STUDIES



Saló et al.,
Solid Earth, 2017

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| **Thank you!**