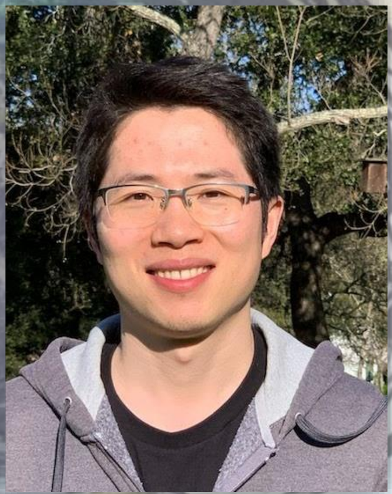
Earthquake Monitoring and Modeling with Deep Learning and Numerical Simulation



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The development in massive observational data, high-performance computing, and emerging analysis technologies has the potential to greatly advance the monitoring and modeling of complex earthquake sequences. Thus, designing algorithms and simulations to extract useful information and gain new insights from large datasets and physical models is a challenging, but potentially rewarding, task. I will present two research works with (1) a data-driven approach to improve earthquake monitoring using deep learning and (2) a model-driven approach to understand the fault-valving mechanism using numerical simulation. First, we build high-resolution spatial-temporal earthquake activity maps from massive seismic datasets to reveal detailed earthquake processes, such as earthquake swarms and induced seismicity. Specifically, we have developed deep learning models for phase picking, phase association, and denoising to greatly improve earthquake monitoring workflows. Second, we build physical models and perform numerical simulations to explain physical mechanisms behind complex earthquake behaviors, such as earthquake swarms and aseismic slip considering pore pressure dynamics and fault-zone fluid flow. Specifically, we have developed a fully coupled earthquake simulation that includes fluid diffusion, permeability evolution, and rate-and-state friction to quantitatively analyze the fault-valving behavior. Results from both data-driven and model-driven approaches can help uncover the connections between seismic observations and physical mechanisms behind earthquake sequences.

3 August 2021

9:00 a.m.

Zoom Link: **Here**
Meeting ID: 992 4969 9833
Passcode: 983837

EARTH SYSTEM SCIENCE PROGRAMME

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