

Simulating Earthquakes in the Laboratory: Understanding the Behavior of Active Strike-Slip Faults Across Time Scales

project subtitle

Department: Earth Sciences

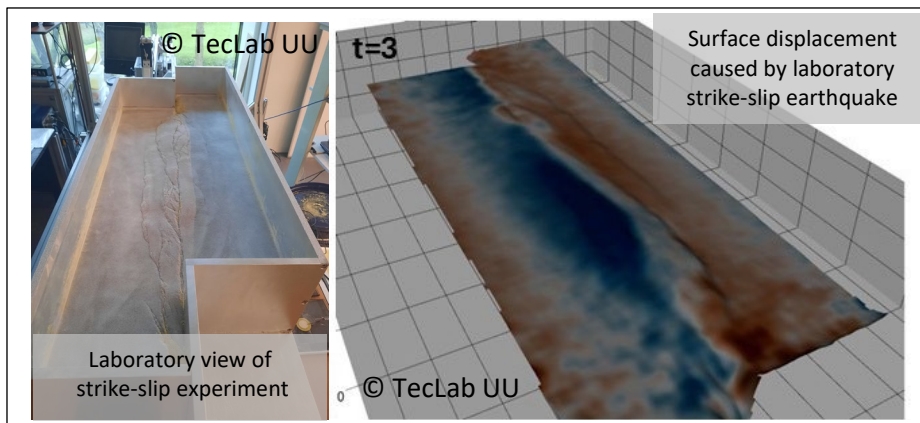
Research group: Tectonics

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Project description

We simulate earthquakes in the laboratory to understand how active strike-slip faults behave and how their motion affects the ground surface over time. Faults can move in different ways depending on how friction changes during sliding. In some cases, friction decreases as slip accelerates, allowing energy to be released suddenly as large earthquakes (e.g., the 2025 Myanmar earthquake and the 2023 Türkiye–Syria earthquakes, which resulted in tens of thousands of casualties). In other cases, friction increases with sliding speed, promoting stable motion rather than an earthquake. By reproducing these different behaviors in laboratory experiments, we can observe how faults slip and how this influences surface deformation above the fault. The experiments allow us to study fault behavior across different time scales. Individual earthquakes are short-term processes that occur over seconds to minutes. Repeating many earthquakes simulates fault activity over years to decades, and long sequences of earthquake cycles help us explore how faults gradually shape surface structures over hundreds to thousands of years.



The project will provide hands-on experience in experimental design and data analysis related to earthquake fault mechanics. The student will conduct laboratory experiments and collect measurements from force sensors, acoustic emission sensors, laser scanners, and high-speed cameras. The student will interpret laboratory observations within the frame of the earthquake cycle and compare them to observations from nature.

Job requirements

- Highly motivated to perform laboratory work. Manual tasks such as sieving material into the setup and working with laboratory equipment will be part of the work.
- Good programming skills in Python for visualization and data analysis.