

## Hydromechanical coupling generating tilt signals

### Context and objectives

Hydromechanical coupling plays an important role in the Earth's crust, as it generates various effects, including subtle variations in subsurface tilt. These small deformations are often difficult to detect, yet they provide valuable information about ongoing processes underground. Specialized instruments have been developed to measure these fine tilt variations with high precision. However, this type of monitoring remains underused. In particular, it could be effectively deployed to monitor fluid injection in the subsurface, such as in CO<sub>2</sub> storage or simulation operation for geothermal projects. The objective of this work is to review the different processes that generate tilt variations, to develop or adopt methods to quantify them, and to interpret tilt data using these approaches.

### Methodology

The first step will be to review the existing literature in order to identify the different processes and situations in which tilt has been measured, as well as the methods available to simulate tilt signals.

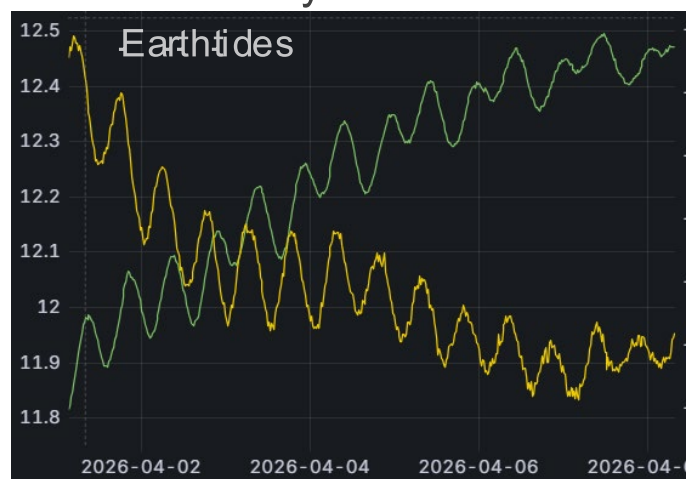
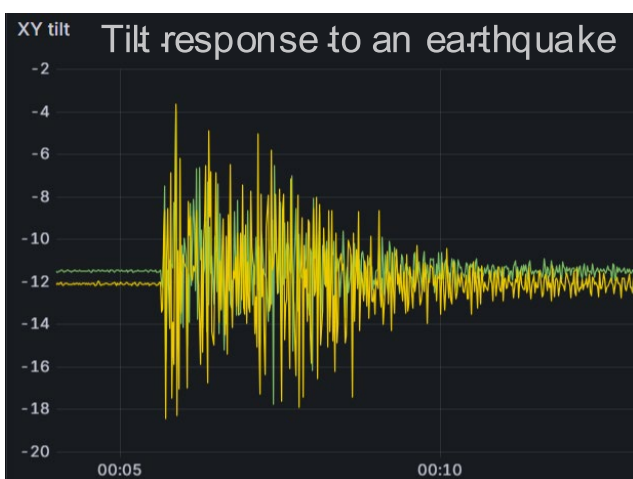
Based on this review, the response at several sites will be simulated. These will include the Bedretto Underground Laboratory, where measurements are currently ongoing, and the Mont Terri Underground Rock Laboratory, where injection experiments are planned. Larger-scale sites will also be considered, such as Trüllikon for CO<sub>2</sub> storage and Haute-Sorne for deep geothermal energy. These simulations will help anticipate expected responses and design an efficient monitoring network. Finally, real data from the Bedretto site will be analyzed in relation to ongoing processes, whether natural, such as Earth tides, or induced, such as fluid injections.

### Supervision and collaboration

The project will be supervised by Prof. Dr. B. Valley (CHYN, UniNE).

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## Tiltmeter data recorded at the Bedretto Laboratory



Example of tilt data available for this project