

## Numerical simulations of seismic wave propagation in poroelastic media

### Contact persons

Beatriz Quintal ([beatriz.quintal@unil.ch](mailto:beatriz.quintal@unil.ch)), Yuri Podladchikov ([yury.podladchikov@unil.ch](mailto:yury.podladchikov@unil.ch))

### Context

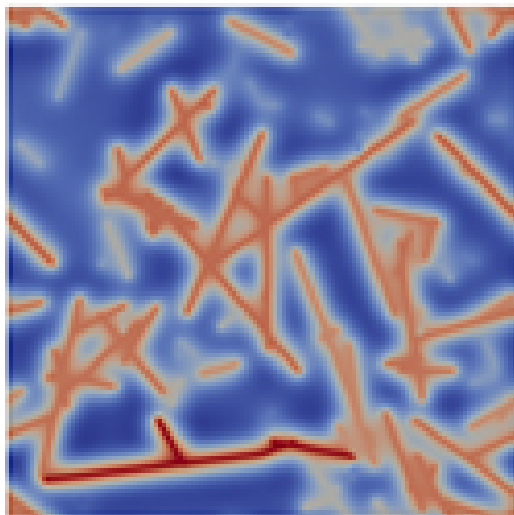
Subsurface rocks are saturated with one or more fluids and can be described as poroelastic media. Biot (1962) derived equations for wave propagation in poroelastic media. Solving these equations we can understand how the propagation of seismic waves is affected by different characteristics of subsurface rocks, such as fluid saturation and the presence of fractures, for example. This understanding is of great importance for seismic exploration and monitoring of deep hydrocarbon or geothermal reservoirs, as well as for using seismic methods in near surface scenarios.

### Objectives and Methods

In this project the student will use a simple 2D finite-difference code that solves Biot's (1962) equations to simulate wave propagation in poroelastic media. The equations are discretized on a regular staggered grid and solved in parallel on GPUs (Graphic Processing Units). She/he will mainly focus on two physical mechanisms for energy loss (attenuation) in those media: (1) Biot's mechanism, also known as global flow, and (2) mesoscopic flow, which is associated with the presence of heterogeneities (e.g., Quintal et al., 2011). For that, she/he will first compare the numerical results with analytical ones considering idealized scenarios, and then study a few applications considering more realistic media.

### Literature

- Biot, M. A., 1962, *Mechanics of deformation and acoustic propagation in porous media: Journal of Applied Physics*, 33, 1482-1498.
- Quintal, B., H. Steeb, M. Frehner, and S. M. Schmalholz, 2011, *Quasi-static finite-element modeling of seismic attenuation and dispersion due to wave-induced fluid flow in poroelastic media: Journal of Geophysical Research*, 116, B01201.



### WEB sites

### Choice of orientation

- 1) Sedimentary, Environmental and Reservoir Geology