Probing Sedimentary Basins and Geothermal Systems with body waves

Contact persons: *Matteo Lupi (matteo.lupi@unige.ch), Fabio Villani (INGV), Adriano Mazzini (CEED)*

Context

Sedimentary and geothermal systems are ideal natural laboratories to test innovative prospecting methods thanks to the often sharp contrasts of impedance found at depth. In the framework of a collaborative effort between University of Geneva, the National Institute of Geophysics and Volcanology of Italy (INGV), and the Centre of Earth Evolution and Dynamics (CEED), Oslo, this project will investigate the subsurface structure of sedimentary basins and geothermal systems. In this framework, 200 wireless geophones will be deployed to record ambient noise for about one month. This MSc project will benefit of such a deployment and energise part of the dense nodal network with weigth drops to performe active seismic acqusitions. The nodes will also acquire S-wave data using the minivib. The recorded reflected and refracted body-waves will be inverted to characterise the velocity structure of the upper part of this geothermal setting.
Previous studies have shown that significant subsurface information may be obtained using high impact mass drops from helicopter (Jolly et al., 2012). Unfortunately, Jolly et al., (2012) could benefit of a limited number of stations scattered across a large area. We propose to combine the newly developed technology of the Seismic Nodes (Hand, 2014) with weight drops released from a drone. This wireless technology, combined with an UAV (unmanned aerial vehicle) allows conducting seismic investigations in logistically complex regions where classical active seismic sources do not have access. Assuminig homogeneous and isotropic lithologies, the rule of thumb suggests that 100 J are sufficient to penetrate about 50 m of unconsolidated sediments. The impact of a 3 kg mass from 60 m imposes an energy of about 1760 J on the ground. By varying the altitude of release, it will be possible to increase the energy and therefore the penetration depth. Each impact point should be measured with a differential GPS to define the precise location of the source of energy (i.e. point of release of the p-waves).

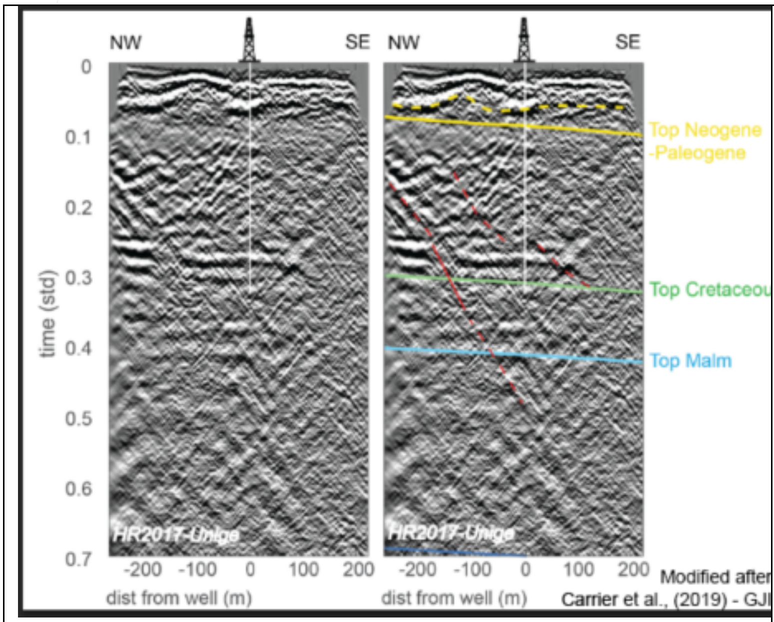
Objectives and Methods

Methods:
- *Reflection and refraction seismic acquired with wireless geophones and dropweight from a drone. Unmanned aerial vehicle*

Objectives:
- *Characterise the subsurface structure of a geothermal system*
- *Design an innovative active seismic method that could be operated in logistically complex conditions where traditional energy sources are not accessible.*
- *Use passive and active seismic datasets to compare complementaly information.*

Literature

Jolly, A. D., Chardot, L. Neuberg, J., Fournier, N., Scott, B. J. Sherburn, S. High impact mass drops from helicopter: A new active seismic source method applied in an active volcanic setting. 2012, Geophysical Research Letters, doi: 10.1029/2012GL051880
Hand, E. A boom in boomless seismology. 2014, Science, 345, 6198



WEB sites

https://www.unige.ch/sciences/terre/en/research/crustal-deformation-and-fluid-flow/
https://www.mn.uio.no/ceed/english/
https://www.ingv.it/

Choice of orientation : (supprimer les orientations qui ne conviendraient pas)

1) Sedimentary, Environmental and Reservoir Geology **3**) Geological Risks