Internship available – Master (Lyon & Paris)

Subsidence and induced seismicity in the Patos-Marinze oil field (Albania)
Subsidence et sismicité induite dans le champ pétrolier de Patos-Marinze (Albanie)

Context :
In the Patos-Marinze oil field (40.71°N,19.61°E), the largest onshore field in Europe, more than 7 millions oil barrels a year are extracted from the sandy formations of the Dures basin at ~2km depth. The intense extraction of buried oil and sandy material goes together with re-injection of waste water under pressure in other buried sedimentary layers. In autumn 2016, an anomalous seismic swarm developed in the vicinity of the main injection wells, damaging houses and triggering the opening of a public inquiry. Insar displacement maps calculated before the swarm event show a continuous subsidence of the entire oil field at impressive rates of 2 cm/yr since 2014 together with uplift around the injection wells. All together these observations raise the issue of man-induced seismicity and crustal deformation associated to the extraction of buried material, in particular fluids. Space geodesy recently highlighted the relation-ship between fracking and the occurrence of a large (Mw 5.7) earthquake on a previously unmapped fault buried in the basement in Oklahoma [Grandin et al. 2017]. Earthquake hazard in Albania is poorly constrained but certainly one of the highest in Europe with several Mw 6 shallow earthquakes that stroke the country during the 20th century. Better understanding the physical processes at play in the Patos-Marinze oil field, and the possible relation-ship between anthropic activities and crustal deformation is therefore a pressing issue. Space geodesy offers a unique tool to achieve this goal.

Aims :
During this internship, we aim at quantifying, analyzing and modeling the deformation pattern of the Patos-Marinze oil field in order to assess whether the increase in seismicity in the area could be man-related.

Tools :
The intern will use the NSBAS processing tool to calculate interferograms from Sentinel images and displacement time-series together with Raphaël Grandin (IPGP Paris) and Cécile Lasserre (LGLTPE) in order to gain a refined view of the oil-field straining.
The observed velocity-field will then be modeled using the Tdefnode code in order to quantify the extracted and injected fluid needed to get such a deformation pattern. The results will be discussed with Albanian researchers from the Polytechnic University of Tirana, R.Koçi and E.Dushi, who will provide us with seismic records and informations coming from the national oil company.

Scientific team :
Marianne Métois (LGLTPE, Lyon), Raphaël Grandin (IPGP, Paris), Cécile Lasserre (LGLTPE, Lyon)

Pay: 554€/month