



ÉCOLE DOCTORALE SCIENCES DE LA TERRE



Subject offered for a contract starting in October 2014

SUBJECT TITLE: *A priori information for time-lapse imaging*

Advisor: CHAURIS, Hervé, PR, herve.chauris@mines-paristech.fr
Second Advisor/ Supervisor:
Host lab/ Team : **GPX, Centre de Géosciences, MINES ParisTech, Fontainebleau**

Financing: GPX/IPGP/Industry

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Time-lapse or 4D seismic imaging consists of determining the Earth structure and its evolution from a series of data sets acquired at different periods, for example every year. Typically, the subsurface reflectivity is modified around the reservoir when the pressure decreases during exploitation.

Time-lapse effects are subtle effects: only small time shifts are usually expected. Moreover, seismic imaging consists of solving a non-linear inverse problem without a unique solution. For these reasons, it is therefore difficult to retrieve changes in velocity or density properties from time-lapse data sets.

The objective of the project is to properly study how to introduce a priori information. A priori information could for example be the specification of the zone where changes are expected. But this could also be the fact that changes are expected to be localized, without indicating their position. It is also important to study how incorrect a priori information could impact the final result. Dynamic a priori information (with a penalty factor varying during the minimization process) could be introduced for that purpose.

MINES ParisTech has a long experience with seismic imaging and inverse problems. Time-lapse imaging becomes now popular as permanent receivers are emerging.

The candidate must have interest in seismic modelling and seismic imaging. The candidate should also have experience in programming.

References:

[1] Asnaashari, A., R. Brossier, S. Garambois, F. Audebert, P. Thore, and J. Virieux, 2013, Regularized seismic full waveform inversion with prior model information: *Geophysics*, 78(2), R25–R36