ÉCOLE DOCTORALE SCIENCES DE LA TERRE

Subject offered for a contract starting in October 2015

SUBJECT TITLE: ***Deep Seismic imaging using ultra-low frequencies***

Advisor: GPX Team
Second Advisor/ Supervisor: Satish Singh (IPGP) and Massimiliano Vassallo, Yusuf Amin (SLB)
Host lab/ Team : **Marine Geoscience**

Financing: GPX/IPGP

For more information go to http://ed109.ipgp.fr, section: Offres de these (PhD offer), You must apply on the Doctoral School website

For deep seismic imaging and full waveform, one would require frequencies down 0.5 Hz. However, the most of current recording system low cut filter at 3 Hz, with usual frequencies above 5 Hz. Recently, Schlumberger has developed new streamer, IsoMetrix, where pressure sensors record frequencies below 0.5 Hz. However, the raw data are pre-processed with low cut of 1.5 Hz 18 dB, which means the energy below 1.5 Hz is filtered.

In March-April 2015, about 2800 km of long ultra-deep seismic reflection data with the idea to image down to 70-80 km depth on board WesternGeco vessel Western Trident. A 12 km long multi-component IsoMetrix streamer was deployed at 30 m water depth, which recorded both total pressure and particle acceleration vectors using densely sampled micro-electrical mechanical system (MEMS) accelerometers at every 3.125 m, the most advanced technology available in seismic industry. The energy source was a 10,170 cubic inch air-gun array comprised of 6 sub-arrays with 8 guns each, deployed at 15 m depth, targeting very low frequency output. The shot interval varied from 50 m to 75 m, and consequently the record length from 20 s to 30 s, depending upon the target depth along the profile.

WesternGeco, in principle, has kindly agreed to provide un-processed raw data (IIM) that contain frequencies down to 0.5 Hz. In this project, we propose to use these raw data, filter all the noise while preserving weak signal from deep earth and develop a technique to process these data image deep structures. Although the decrease in frequency would be only 1 Hz (from 1.5 to 0.5), its effect on deep imaging could be very significant. Such a low frequency data would also be extremely useful for full waveform inversion.

Students with background mathematics and signal processing, with interest in development of new algorithms are encouraged to apply. The student will be a member of the Paris Exploration Geophysics Group (GPX) and will benefit from its wide-ranging projects and interaction with industry partners. The student will have opportunity to work with our industry partners and may spend some time at their premises.

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