Subject offered for a contract starting in October 2013

SUBJECT TITLE: ***Prediction of multiples for variable-depth streamer using curvelets.***

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Host lab/ Team : **GPX, Centre de Géosciences, MINES ParisTech, Fontainebleau**

Financing: University of Campinas/Ecole de Mines

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Considerable efforts have been recently made by the seismic industry to increase the bandwidth of marine seismic data. Very low-frequency signals are extremely important for the imaging of deep subsalt structures. Whereas, high frequencies allow getting a better resolution of the migrated images. The bandwidth limits of marine seismic data are imposed by the presence of receiver ghosts. To overcome this problem, Soubaras (2010) proposed to use a variable-depth streamer acquisition. Starting from the first channel, the receiver depth increases with offset, introducing diversity in the receiver ghosts. This diversity enables the receiver ghost to be fully removed (Soubaras, 2010), resulting in a wider signal bandwidth. However, some of the seismic processing techniques need to be adjusted for properly working with the variable-depth streamer data (Lin et al., 2011).

Several issues appear when trying to predict multiples from variable-depth streamer data using SRME (Surface-Related Multiple Elimination), because variable receiver depth creates visible differences in the signal wavelet, from near to far offsets. The goal of this PhD is to investigate an innovative method that exploits the decomposition of the seismic data in the curvelet domain within a SRME-based approach.

The curvelet transform is a sparse transform particularly well-suited for seismic data decomposition, since only few curvelet coefficients can efficiently represent most of any seismic sections. Curvelets have been already successfully used by the GPX team (esp. Mines Paristech) for multiple prediction (Donno et al., 2010), but for the case of a conventional marine acquisition. The main advantage of using curvelets for the prediction of multiples is that the stationary zone of the multiple contribution gather is automatically selected, thus reducing possible artifacts in the predicted multiples. The aim of the PhD project is to exploit this good property of curvelets, and the fact that in the curvelet domain we can easily decompose the data into frequency-dip sub-bands, for reducing the noise in the predicted multiples related to the presence of wavelet differences with offset. Moreover, the depth difference between source and receiver can also be adjusted within the curvelet transform framework.

The candidate must have a research master degree in physics, geophysics or applied mathematics, and be interested in seismic signal processing, seismic modelling and seismic imaging. The candidate should also have experience in programming. Good knowledge of English is essential.

References:

Donno, D., H. Chauris, M. Noble, 2010, Curvelet-based multiple prediction. *Geophysics*, vol. 75, pp. WB255-WB263.

Lin, D., R. Sablon, Y. Gao, D. Russier, D. Hardouin, B. Gratacos, R. Soubaras, P. Whiting, 2011, Optimizing the processing flow for variable-depth streamer data. *First Break*, vol. 29, pp. 89-95.

Soubaras, R., 2010, Deghosting by joint deconvolution of a migration and a mirror migration. *80th SEG Annual Meeting*, pp. 3406-3410.