Short Course

Characterizing the Near Surface with Seismic Refraction Attributes

An Introduction to the GRM and RCS

The next five years will see major advances in near surface refraction seismology, through the greater use of refraction attributes and full waveform methods. Model and field case studies demonstrate that refraction tomograms are usually very similar to the starting models and that automatic tomography with low resolution starting models is an overly simplistic approach which reduces the resolution and therefore the usefulness of near surface refraction seismology. As a result, the application of the GRM and RCS to generate refraction attributes will increase, both to provide more comprehensive geotechnical characterization of the near surface and to provide realistic starting models for model-based inversion. Also, more effective integration of geoscientific and engineering data in geotechnical site characterization can be achieved with the application of multivariate geostatistics to refraction attributes. Innovative methods of refraction data processing, such as the common receiver stack, can result in significant improvements in signal-to-noise ratios, and can even eliminate the need to pick first break traveltimes. This course provides an introduction to the generation of more detailed and comprehensive models of the near surface with refraction attributes, using traveltimes, head wave amplitudes and full waveforms, in order to achieve more effective implementation of traveltime tomography and full waveform inversion.

Course Content: Individual courses can be customized to suit any level of expertise, from introductory undergraduate to advanced practitioner.

Presenter: Derecke Palmer

Duration: 1 to 5 days, as required.

Cost: POA

Requirements: Notebook computer and spreadsheet. Full waveform classes will require the installation of Seismic Unix or equivalent.

References:

Palmer, D., 2008. Is it time to re-engineer geotechnical seismic refraction methods? *First Break* **26(8)**, 69-77

Palmer, D., 2010, Are refraction attributes more useful than refraction tomography?: *First Break* **28(7)**, 43–52.

Palmer, D., 2010, Characterizing the near surface with detailed refraction attributes. *in* R. D Miller, J. H. Bradford and K. Hollinger, eds., Advances in near-surface seismology and ground-penetrating radar: SEG Geophysical Development Series No. 15, Chapter 14, 233-250.

Derecke Palmer

Derecke Palmer graduated from The University of Sydney in 1967 with a B.Sc. (Hons 1). From 1967 to 1992, he was employed as a geophysicist by the Geological Survey of New South Wales. From 1992 to 2005, he was a Senior Lecturer in Geophysics in the School of Biological, Earth and Environmental Sciences at The University of New South Wales. He is currently a senior visiting fellow at the University of New South Wales.

He is widely known for his work on shallow seismic refraction methods and in 1976, he was awarded an M.Sc from The University of Sydney for a thesis on the generalized reciprocal method (GRM). In 2001 he was awarded a Ph D from The University of New South Wales for a thesis on the refraction convolution section (RCS).

In 1992, he was presented with the Grahame Sands Award for Innovation in Applied Geoscience by the Australian Society of Exploration Geophysicists for his work on the GRM. In 1995, he was presented with the Reginald Fessenden Award by the Society of Exploration Geophysicists for "the generalized reciprocal method, one of the most significant advances in refraction seismology in more than fifty years."

In 2005, the GRM and the RCS were recognized in the 75th anniversary celebrations of the SEG in the "Exploration Geophysics – Petroleum Industry Timeline."

In 2005, he was part of the Distinguished Lecturer Programme of the European Association of Geoscientists and Engineers. In 2009, he was a Distinguished Foreign Scientist at the National Geophysical Research Institute in Hyderabad in India.

His current research interests are largely focused on the processing of full waveform seismic refraction data with Seismic Unix, in order to generate detailed compressional and shear wave models of the near surface. These methods can be applied to statics corrections for seismic reflection data, especially where the weathering and sub-weathering are complex and where low signal-to-noise ratios occur, such as sand dunes, windy environments or near infrastructure. Other applications include the extraction of detailed traveltime and amplitude attributes, in order to facilitate more comprehensive characterization of the near-surface for geotechnical, exploration and natural resource management, and to generate detailed starting models for traveltime and full waveform inversion.