► SPECTRAL ANALYSIS AROUND 1-6 HZ REVEALS VALUABLE SUBSURFACE INFORMATION

Low frequency passive seismic

The current economic uncertainty, low oil prices and frozen capital markets, together with the growing complexity of reservoirs being explored, are having a significant effect on oil and gas companies, with a renewed focus on reducing risk and managing costs.

There is a genuine need for new and innovative exploration technologies that can increase the probability of success in discovering and delineating reservoirs, reduce exploration costs, and shorten project execution time.

Spectraseis says that its commercialisation of low frequency (LF) passive seismic, and the spectral analysis of the passive seismic wavefield of the Earth around 1-6 Hz, is helping to achieve this. The last 12 months have seen a number of technical developments in LF passive seismic by Spectraseis in collaboration with the Swiss Federal Institute of Technology (ETH Zurich). A growing number of their technical papers have been accepted at events around the world, including the EAGE.

Spectraseis believes that a coherent explanation of the more complete properties of the reservoir system - specifically at previously uncommon measurement frequencies - will explain the field observations that have been collected around the world over the last decade linking reservoirs to passive seismic energy anomalies in the frequency domain. To this end, Spectraseis is devising and testing new imaging algorithms aimed at locating subsurface sources of low frequency anomalies that may be related to hydrocarbon deposits, in order to locate subsurface sources of low frequency energy both in space and depth.

One example is Time Reverse Modelling (TRM), which takes synchronous recordings from multiple receivers in a selected area and performs reverse time modelling on these signals to determine the source location of the LF anomaly, which we assume is the reservoir. The goal of TRM is to effectively create a depth image of the potential hydrocarbon reservoir. New research at Spectraseis is also focusing on statistical analysis of the data and probabilistic estimates. By building a database of surveys in many different geographical and geological environments, probabilistic estimates can continue to be refined.

Work is also going into the acquisition, processing and analysis of LF passive seismic data. For example, Spectraseis has developed hand-held devices and accompanying software for use in the field, designed specifically to minimize human input and potential errors. Built-in GPS receivers record the location of sensor placement; a built-in camera collects photographs of the environment; and a built-in barcode reader identifies the specific acquisition instruments being used. After the field measurements are collected, all the data, including photographs and metadata, are QC'd in the field then sent to Spectraseis' office in Zurich for processing and analysis.

LF technology comes with a series of unique data processing challenges. These include the need to take account of naturally occurring and human induced noise, very long trace lengths (compared to conventional seismic surveys) and the generally low signal to noise (S/N) ratio. To meet these challenges, Spectraseis is developing new software and processing techniques that ensure the quality of the technical information, support scientific research, and deliver tangible results that are easily adapted into operators' business processes. For example, these processing and analysis tools characterize the data according to time stability, noise, and other factors such as weather influences. Software is used to mark unwanted time windows in the data and allows the analyst to view the raw signal both in the time domain and in a spectrogram, where the frequency components of the signal can be viewed in relation to time.

A data analyst can then use this tool to plot a Syncrogram - multiple spectrograms that represent data recorded during the same time window - and identify specific measurement windows to analyze over a geographic area. This makes it possible to do further analysis on these synchronous measurements and create 2D attribute profiles or grid maps of LF attributes. Multiple sets of synchronous measurements and various time windows also allow the geophysicist many alternative TRM runs, for example to deliver reliable estimations that can be stacked to improve S/N.

Spectraseis recently carried out a LF passive seismic survey over an oilfield in and around a German city, which forms the subject matter of a technical paper to be presented at Amsterdam 2009. Spectraseis cites this survey as an example of how the company can acquire exploration data accurately in populated areas with little impact on local residents, and how human noise can be mitigated by specialized tools and workflows. In this case, careful data analysis was required to identify and separate various types of anthropogenic noise from the records in order to isolate the uncontaminated seismic background wavefield. Spikes from machinery were removed, along with remaining transient noise, using automated and statistically-based software. The result was that Spectraseis observed a statistically significant increase in the spectral ratio between vertically and horizontally polarized seismic energy above the reservoir.

From frontier exploration to field extensions, prospect de-risking and reservoir property mapping, LF passive seismic remains an evolving and fast moving technology. Spectraseis says that the result is commercially valuable subsurface information for exploration and field development decisions. To learn more, go to www.spectraseis.com or visit Spectraseis at booth 1520. ■

SMT partners with JewelSuite

Seismic Micro-Technology (SMT), a provider of Windows-based geoscientific interpretation software, has announced a partnership with JewelSuite. This partnership will allow SMT to incorporate the patent-pending JewelSuite gridding technology as a part of the new KINGDOM Geomodeling solution. SMT says that, with KINGDOM Geomodeling, organizations can now conduct 3D geomodeling within the same application as their initial interpretation. This capability helps upstream exploration and production companies reduce cycle times and improve drilling decisions through more accurate volumetric calculations.

Commenting on the announcement, Arshad Matin, President and CEO of SMT, said, "Today, Interpretation and Modeling exist as separate silos within organizations, managed by separate teams. This dysfunctional process is akin to a sculptor having to write his design on paper and require someone else to build it. With KINGDOM Geomodeling, SMT puts the tools back in the hands of the artist. And because it is so cost effective and easy to use, now everyone can be an artist."

Commenting on the announcement, Gerard de Jager, President of JOA, said: "This is an important step for our industry. Next to the engineering domain, where the orthogonal Jewel gridding has proven superior, the partnership with SMT will integrate Seismic Interpretation. Due to the true vertical gridding method, seamless workflow integration will be achieved, leading to faster and better asset team decision making".

According to SMT, KINGDOM Geomodeling allows companies to create sealed structural models, build 3D geocellular grids, distribute properties across the grid, and arrive at more accurate volumetric calculations. Companies no longer have to export or import their interpretation data to their modeling solution, because both are integrated in one solution. The new gridding capability provides more flexible mapping of complex structures compared to legacy Pillar gridding technologies. As a result of the partnership, SMT and JewelSuite will share technology and co-market the new solution. KINGDOM Geomodeling, a part of the new KINGDOM Advanced product line, will be in limited availability in Q4, 2009. For more information, visit SMT at booth 326.