dGB ++ 09'06

Hot news

Fred president-elect

We congratulate Fred Aminzadeh -the CEO and president of dGB USA- on becoming president-elect of the SEG.

Conferences

SEG New Orleans 2006

1-6 October
Booth #1434

PETOEX 2006

21-23 November
Booth #M12

In this issue

OpendTect SSIS visualization

In recent months many clients made use of dGB's offer to perform proprietary pilot studies with the new OpendTect SSIS (Sequence Stratigraphic Interpretation System) software. Most studies dealt with fluvial-deltaic settings but SSIS was also successfully applied to unravel a carbonate build-up complex in a 3D seismic data set. The carbonate study was an MSc thesis performed by Kirstin McBeath of Leeds University at dGB's office in The Netherlands. All studies to date revealed new insights in the depositional systems. At the same time these studies enabled us to fine-tune the software.

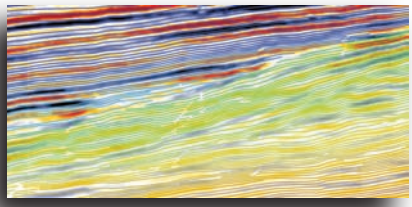


Figure 1: Chronostratigraphy

SSIS was released in OpendTect v2.4. This version offers unique functionality for analyzing and visualizing seismic data. Some basic, yet unique, capabilities are released in OpendTect Base, the open source part of the system. For example annotating seismic sections with arrows, text labels and images is part of the base system (Fig. 3).

Within SSIS chrono-stratigraphic horizons, spaced roughly one seismic sample apart, are auto-tracked within the target interval (Fig. 1). Each 3D chrono-stratigraphic horizon represents a relative geologic time line that can be displayed and used for further analysis. Displaying chrono-stratigraphy as overlays on seismic sections is a powerful tool for Q.C.ing mapped horizons and for identifying unconformities. Chrono-stratigraphy is also used for Wheeler transforming (flattening) seismic data and/or derived attributes. Fig. 2 shows a neural network predicted porosity section in both the structural domain and the Wheeler transformed domain. A text-book quality prograding porosity trend is observed in the Wheeler domain. This trend is much more difficult to recognize in the structural domain.

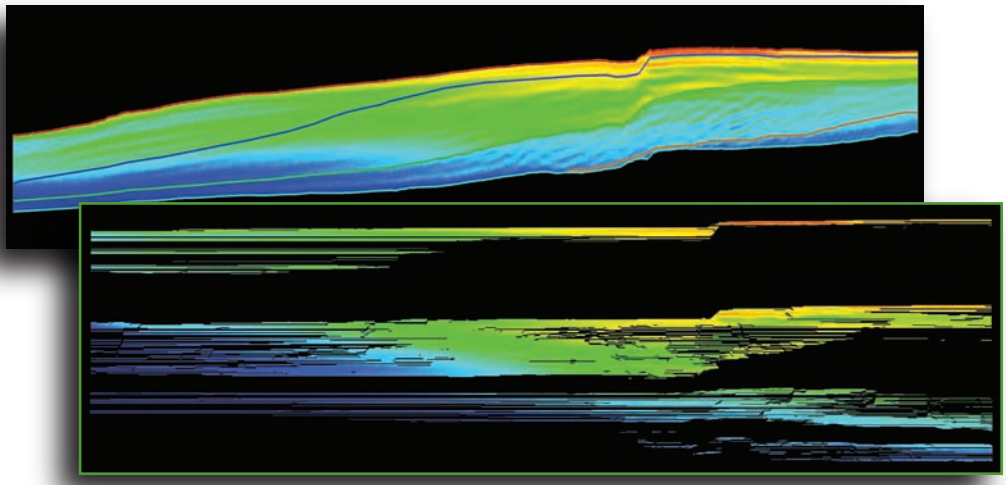


Figure 2: Porosity in both structural and Wheeler transformed domain

"You never fully appreciate the implications of a sequence-stratigraphic interpretation until you've transformed it into a Wheeler diagram"

Peter Vail

Sequence Stratigraphic Interpretation System

OpendTect SSIS visualization
Continued

One of the key benefits of the Wheeler transformed domain is that time-slices represent stratigraphic events that are not distorted by

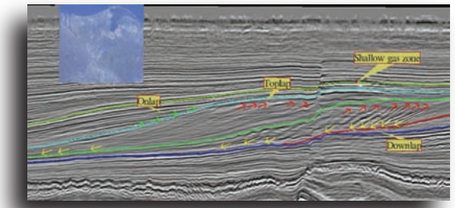


Figure 3: Sequence stratigraphic annotations

structural deformations. Fig. 4 shows an example of a stratigraphic feature that is visible on a time-slice in the Wheeler domain.

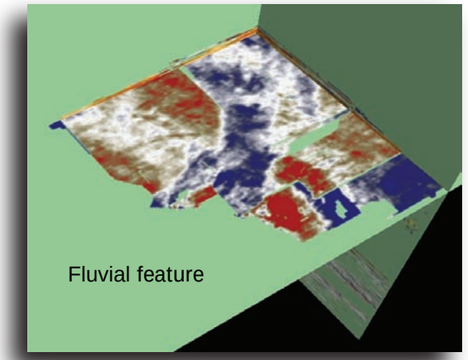


Figure 4: Time-slicing in the Wheeler domain = horizon slicing in the structural domain!

Systems tracts interpretation is another SSIS application that utilizes chrono-stratigraphy. Analyzing patterns in both domains enables us to assign systems tracts per chrono-stratigraphic range. Visualizing the results as in Fig. 5 further improves our understanding of the depositional environment and allows us to predict favorable conditions for stratigraphic traps.

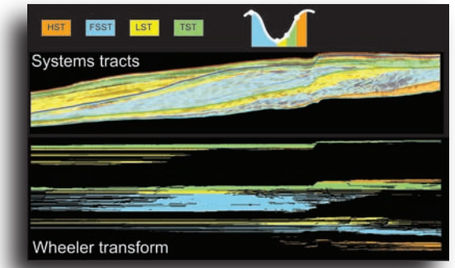


Figure 5: Systems tracts interpretation

OpendTect Fault Enhancement Filter

OpendTect has excellent filtering capabilities for general data enhancement or highlighting specific features in the data. The attribute engine contains many pre-defined filters for example the Laplace Filter and Ridge Enhancement Filter (present as a default attribute set). In addition to this the user can develop many custom filters by combining attributes such as the Position attribute, Volume Statistics attribute, Reference Shift attribute and Mathematics attribute. In the following we will describe and show some results of such a custom made filter that alters the seismic volume to enhance fault visibility.

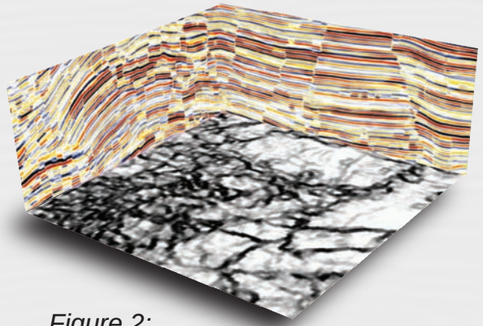


Figure 2: After fault enhancement filtering

The main attribute for showing faults and other lateral discontinuities in seismic data is the Similarity attribute. The average performance of this attribute is very good. However when the seismic is low S/N ratio, has a chaotic or hummocky character, or the faults are zones rather than sharp edges applying Similarity to the raw seismic will give a less than optimal result. To maximize the information we can extract from our seismic volumes we designed a filter that increases the quality of the Similarity attribute.

Designing the filter we are confronted with two contradicting requirements. We want to sharpen and magnify the Similarity where there is lateral discontinuity due to faults, while we want to suppress Similarity anomalies where there are lateral discontinuities due to random noise, acquisition footprint, etc. Assuming that in the raw seismic the strongest similarity values will be associated with faults we split the seismic based on the local similarity value in three zones: there where we want to sharpen and magnify the faults, there where we want to laterally smooth the seismic to suppress noise in the Similarity and a transition zone in between, see figure 1. This is easily done using "if .. then .. else" type statements in the OpendTect 's Mathematics attribute. The smoothing is than done using a structurally oriented Median Filter, or Averaging Filter – implemented using the Volume Statistics attribute. Enhancing the faults is done using a Diffusion Type Filter. In essence information (seismic amplitudes) is moved from areas with high similarity values to areas of low similarity values. By this process the fuzzy zones that are often present at either side of a fault are filled by extending the seismic reflectors at either side of the fault. This is done such that in the center of the fault the extended reflectors will meet in a sharp discontinuity. This kind of filter is easily implemented using the Position Attribute. Figure 2 gives an impression of the results. A presentation with more details on the exact implementation can be found on our website.

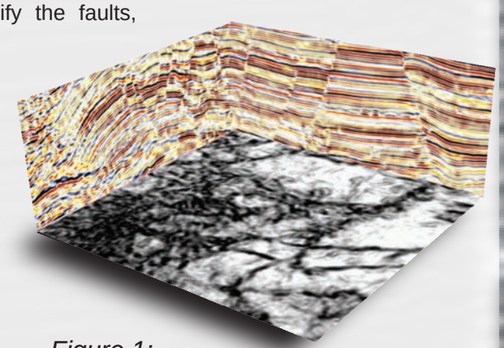


Figure 1: Before fault enhancement filtering

Vacancies

We are looking for **geoscientific software developers** to expand our OpendTect development teams in Enschede, The Netherlands and in Houston, USA. A successful candidate is a dynamic, self-motivating person with Bsc. or MSc. degree in geophysics, or related subject. Strong affinity with programming and software development , as well as excellent communication skills in English are pre-requisites. Knowledge of seismic interpretation, object oriented software development (especially C++) and OpendTect are preferred. Applications and questions can be addressed to the head of R&D: Bert.Bril@dgb-group.com

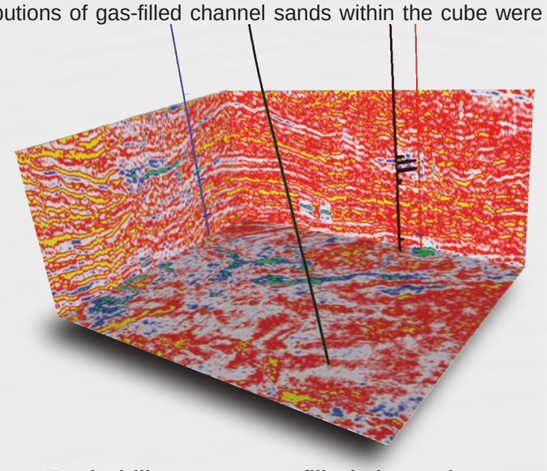
Hit Cube success

Gboyega Ayeni, a student of Leeds University recently completed his MSc thesis at dGB on the application of a novel stochastic inversion approach. The Hit Cube assigns spatial positions to stochastically generated pseudo wells with the aim of predicting rock and fluid properties from seismic data. The method is designed for predicting properties in a volume, optionally from multiple input cubes, but it can equally well be used for characterizing a particular reservoir unit (horizon-based mode).

With GDI's pseudo well simulator two well groups are generated: the Hit targets (e.g. gas-filled reservoirs) and the False Hits (e.g. brine-filled reservoir). The Hit Cube algorithm then matches the synthetic traces with real seismic traces at every sample position throughout the seismic volume. If the match (similarity or correlation-coefficient) between the two traces is above a specified threshold, rock properties defined by both are considered the same and a 'Hit' exists. Outputs from the algorithm include cubes of Hits (time-thickness of Hit target), Scores (sum of similarities/correlation-coefficients) and Winner wells (wells with highest similarities/correlation-coefficient) at each sample position. 'Probability' cubes are obtained by dividing the Hit and Score Cubes of the Hit targets by those of the False Hits.

Using this workflow and algorithm, reservoir presence and distribution within a 3D seismic dataset from a deltaic setting was investigated. By using stochastically simulated pseudo wells, the distributions of gas-filled channel sands within the cube were predicted. The predicted distributions define distributary channels systems known to be present in the area while water saturation logs in the real wells confirmed accurate predictions of hydrocarbon presence.

The Hit cube is offered as a service to the industry. For more information, please contact Paul de Groot (paul.degroot @dgb-group.com)



'Probability score' gas filled channels

Publications

The following is a selection of recent publications and forthcoming talks by dGB staff.

Articles:

P. de Groot, G. de Bruin and K. McBeath, 2006, OpendTect SSIS: Sequence Stratigraphic Interpretation System. Drilling & Exploration World, Sep. 2006.

Presentations:

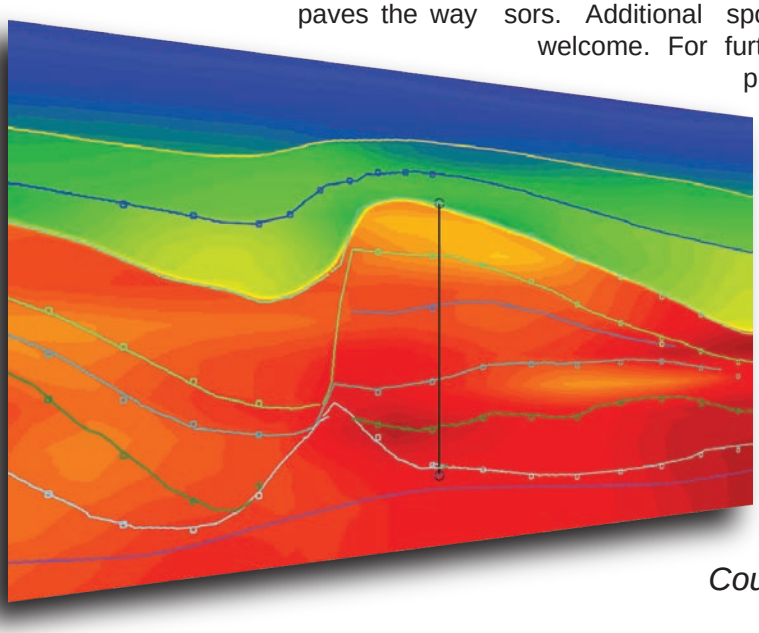
G. de Bruin, H. Ligtenberg, N. Hemstra and K. Tingdahl, 2006, Synchronized sequence stratigraphic interpretation in the structural and chrono-stratigraphic (Wheeler transformed) domain. EAGE Research Workshop 2006, Grenoble, France, 25-27 September 2006.

P. de Groot, G. de Bruin and N. Hemstra, 2006, How to create and use 3D Wheeler transformed seismic volumes. SEG International Exposition and 76th Annual Meeting, New Orleans, 1-6 October 2006.

PSDM-VMB project flies!

The Pre-Stack Depth Migration and Velocity Model Building (PSDM VMB) project is a collaborative effort between dGB and GDC, the Houston-based PSDM specialists. The primary aim is to supply the user community with an extendable PSDM system that shortens cycle times by improving model building and updating. This will allow more possible iterations per study. Coupled with GDC's state-of-the-art algorithms this will lead to superior results. In the project dGB will extend OpendTect base (the open source part of the system) to support pre-stack applications. This extension not only benefits PSDM applications but also paves the way for AVO analysis and other pre-stack processes. Within the scope of the one-year project, three commercial plugins will be developed that together support an efficient and complete PSDM workflow. VMB plugin will be developed, owned and maintained by dGB. Tomography and Kirchhoff migration plugins will be developed, owned and maintained by GDC. Further plugins such as wave-equation based algorithms are anticipated in follow-up projects.

OpendTect PSDM-VMB project started on 1 Sep. 2006 with two industry sponsors. Additional sponsors are still welcome. For further information, please contact Paul de Groot and/or Fred Aminzadeh.



Courtesy GDC

Addax multiple removal plugin

Addax Petroleum Services sponsors the development of a multiple removal capability through prediction error filtering. The new filter will become part of the open source system (OpendTect Base) and is planned for Q306. The type of multiple removal algorithm chosen for this application is the well known least squares prediction error filter, also known as "Gap decon". This filter aims to flatten a user-defined part of an auto-correlation function. The underlying idea is that multiples in the data are repetitions of the primary reflections that show up in the auto-correlation function at a time that corresponds with the extra travel time. The functionality will be implemented in OpendTect's attribute engine. The filter can be applied interactively to a selected visualization element, or in batch-mode to produce a filtered output cube.

Hot news

OpendTect Version 2.4

The latest OpendTect version features several new functionalities:

* Fully reworked horizon tracker. Horizon tracking now has many new options (like line tracking), and it is much more stable and easier to use.

* Annotation objects
Annotations can be added as text or images, with arrows and boxes.

* The 'fingerprint' attribute
Compares multiple attributes to a fingerprint collected at a user-picked fingerprint location(s).

* Multi-attribute display
Most display elements can now hold multiple attribute displays

Commercial plugins:
* New SSIS plugin (dGB)
Includes chrono-stratigraphic horizon tracking, systems tracts interpretations and Wheeler transforms (3D flattening).

* Updated Workstation access plugin (ArkCls). Now supports Both SeisWorks and GeoFrame on Linux too.

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