Geophysical Society of Houston

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Poststack Processing for Attribute Analysis and Sequence Stratigraphy

John Kerr, Gary Jones, Murray Roth and Dennis McMullin
Landmark Graphics

Poststack data processing on a geophysical workstation is most often used to prepare seismic data before interpretation through frequency filtering, wavelet correction, amplitude scaling. It has also been used for many years for conventional trace attribute processing such as phase, amplitude envelope, and instantaneous frequency. However, a growing number of geoscientists are beginning to see the potential for manipulating their seismic data during interpretation, for example, by high resolution flattening or continuity processing.

The latest generations of geophysical interpretation workstation software allows the user to convert conventional seismic traces into "continuity data" or "termination data" which reveals and heightens lateral changes in the data.

In such displays, faults and stratigraphic changes will often stand out as prominent disruptions in otherwise homogenous data. Interpretation becomes easier, and, with both conventional and enhanced data at hand, more reliable.

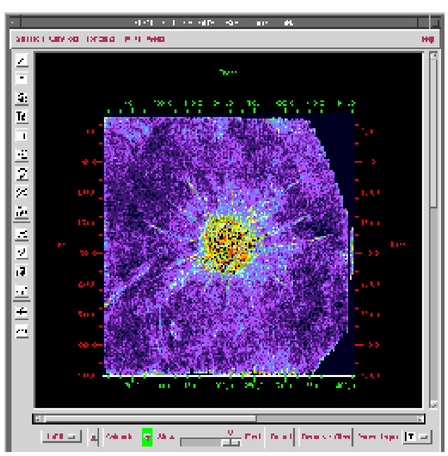
These new processing methods can aid the interpretation by their increased visualization of seismic features, before the interpreter has drawn a single fault or horizon with the cursor.

What is continuity or coherency of seismic data?

Continuity is a measurement of the local lateral similarity of seismic trace data (Figure 1). There are at least two methods of analyzing continuity:

- Correlation - For each trace, data within a sliding time window is cross-correlated with data from 2, 4, or 8 adjacent traces (Figure 2).
- Semblance - Slant, or dip-scan, stacks are generated over a range of dips, and trace similarity is determined by calculating semblance values for the central trace and each of 2, 4, or 8 adjacent traces (Figure 2).

In both correlation and semblance, a single similarity measurement is output for the central trace position at the center of the time analysis window. Generally, the minimum correlation coefficient or minimum semblance value will be output, but additional correlation



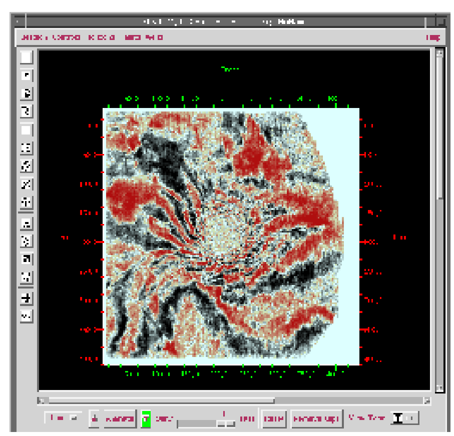


Figure 1. Faults radiating from a salt dome are much more apparent in a continuity timeslice (left) than in the original seismic data (right). Photo courtesy of CAEX Services.

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I N S I D E

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Technical Luncheon November 18

Topic: **Surface Seismic Data Acquisition: Current Technology, Trends and Issues**

Speaker: Dr. Fred J. Barr

Introduction

We currently find ourselves armed with a dazzling array of technologies with which to acquire seismic data. These technologies, as well as their attendant trends and issues, have developed in response to both market and technical forces, powerful forces at work for several decades.

The market forces demand lower costs for finding and producing hydrocarbons. The technical forces, as if to test our collective sense of humor, have led us to realize that high-quality 3-D data represent surface seismic's most effective contribution to that goal. The rub, of course, is that acquiring and processing high-quality 3-D seismic data is, itself, very expensive.

This apparent dichotomy has resulted in pressure to reduce the cost of acquiring and processing 3-D data. Seismic contractors and equipment manufacturers have responded with methods and systems to increase acquisition and processing productivity. In the marine environment, the trend has been toward towing more streamers and sources in an effort to illuminate a larger subsurface area with each pass of the vessel over a prospect. Unfortunately, while providing higher productivity, these wide-tow configurations have also introduced significant amplitude and phase anomalies into the final imaged data, reducing their quality.

In land operations, the quest has led to methods yielding higher production, lighter and more reliable equipment, and shooting geometries that require fewer shots or receiver stations, whichever are more expensive in a particular survey area. For every survey, the chosen recording geometry must be balanced against the terrain and available equipment to yield a smooth time and motion demand.

A second backdrop against which we geophysicists find ourselves laboring is an increasing demand to reduce our seismic crew "footprints" on the environment, as well as a growing demand to acquire data in areas that include transition zones. As luck would have it, many of these transition zones represent some of the world's more ecologically fragile areas. We've developed equipment and methods to satisfy these conflicting demands and continue to refine them.

Finally, and thankfully, some "spit and polish" is being applied to, or at least contemplated for, some existing seismic tools to improve our ability to meet today's market demands. These include reevaluating vibrator data processing to improve its quality, and infusing new technology into the ocean-bottom cable method to improve the resolution of marine data. It also includes a return of serious interest in recording mode-converted shear waves, as well as time lapse 3-D surveys for monitoring reservoir fluid movements.

3-D Geometry Design

The recording geometry with which 3-D data are acquired has been, and remains, among the most contentious issues facing geophysicists. It has a big impact upon the cost of a 3-D survey.

Whereas modern wave-equation imaging algorithms such as DMO and migration have drastically improved the accuracy and resolution of seismic data, the amplitude and phase of their outputs have also proven much more sensitive to the acquisition geometry than are simple NMO and stacking. This sensitivity can be appreciated using Huygen's Principle which leads one to understand that every reflecting horizon, dipping or flat, can be represented as an infinite number of point diffractors. Each of these point diffractors contains dips ranging from -90 to +90 degrees.

We do not record the continuous wave field in time or space. In both dimensions, we sample the wave field at discrete points. The recording geometry must sample the seismic wave field in such a manner that we avoid spatially aliasing data from the point diffractors, as well as any source-generated noise. Any 3-D recording geometry being contemplated for a survey must be analyzed on the basis of not only midpoint fold, offset, and azimuth distributions, but also on the range and uniformity of dips that the wave equation operators contribute to each cell's output trace. Otherwise, the recording geometry may introduce amplitude and phase anomalies that could be misinterpreted as subsurface geologic changes.

Seismic Energy Sources

The air gun remains the dominant energy source in marine seismic acquisition. Until recently, the sleeve air gun demonstrated clear performance advantages over other available designs; recent improvements have narrowed the performance gap. There have been innovative developments with generator-injector gun clusters to produce quite high pulse-to-bubble ratios. And further refinements in methods of computing far-field air gun array signatures from near-field measurements have been targeted at time-lapse 3-D surveys, also referred to as 4-D.

Potential environmental concerns have resulted in some reengineering of the marine vibrator source in an attempt to improve low-frequency output. However, there has also been concern expressed that impulses may disturb marine creatures less than long duration oscillatory signals that are similar to, or could mask, their communication signals.

The vibrator remains the dominant land energy source, in part because of its lower operating expense. Units capable of generating peak forces approaching 65,000 pounds have been developed and have allowed sweep times to be significantly reduced,

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Seismic Data Processing SIG

Date: November 20
Wednesday
Time: 4:00 p.m. - 6:00 p.m.
Location: Exxon Production Research Company, Rm S-202, 3120 Buffalo speedway
Cost: NO CHARGE; please call 917-0218 for reservation.
Topic: Ocean bottom cable acquisition and processing
Speakers: Joel Starr, PGS Tensor
Organizer: Jerry Kapoor, Western Geophysical
Young Kim, Exxon Production Research Company
Parking: The location is on the west side of Buffalo speedway between Richmond and Alabama. There are two parking lots for visitors: one at north and another at south of the building.

OBS Processing
Mr. Joel Starr, PGS Tensor

Ocean Bottom Seismic (OBS) processing combines the geophysical challenges of processing land seismic data with the data volume challenges of processing marine seismic data. OBS acquisition provides stationary receivers, which allows for superior statics, and positioning solutions. However, the independence of the sources and recording system means geometry initialization over a typical 500 square mile surveys can strain traditional methods. In addition, OBS has its own unique processes such as dual sensor technology.
This talk explores the today's challenges for processing Ocean Bottom Seismic surveys.

Potential Fields SIG

Date: November 21
Thursday
Time: 5:30 - Social Hour,
6:30 - Dinner,
7:30 - Talk
Location: Hess Building, 3121 Buffalo Speedway
Cost: $20.00
Topic: Constrained Gravity interpretation in the major sedimentary basins of Venezuela.
Speaker: Victor Graterol
Reservation: Chuck Campbell, ACCEL Services, Inc. campbell@neosoft.com, or 713-993-0671

Abstract:
In the evaluation of sedimentary basins with extensive gravity and magnetic coverage , but with limited seismic data, the integrated interpretation of the three types of geophysical information is strictly necessary to establish not only the possible potential of the basin, but also to define the follow up exploration program.

Constrained Gravity interpretation is the key to establishing basin potential. Control points coming from the limiting existing seismic data and direct information from wells and geological surface maps, can be employed to obtain regional and residual constrained maps that permit a more adequate quantitative gravity modeling method for outlining the main existing geological structures in the basin. The final composite structural interpreted map showing the top of the main density interface , also permit the optimum design for the location of the eventual follow seismic program.

Examples of constrained gravity interpretation for specific areas within the Eastern Venezuelan , Guarumen and Maracaibo basins are presented to illustrate this approach in the interpretation of potential field data.

Biography:
Victor graduated in 1962 as a Mining Engineer at the Universidad Central De Venezuela, he started as a Production Engineer at the Creole Petroleum Corp. (Lagoven S.A.). From 1965 to 1967 he was a member of the Geophysics Department of the Ministry of Energy and Mines of the Republic of Venezuela. Between 1967 and 1969 he was a graduate student at the University of Toronto in Canada where he finished his M.Sc. In Geophysics.

Back in Venezuela he became head of the Geophysics Department at the MEM and started his academic career as Instructor at the Universidad Central de Venezuela. In 1974, as a member of the Physics Department of the Simon Bolivar University, he developed the former Geophysics Section that today is the Earth Science Department, part of Engineering Geophysics at this prestigious institution. Victor has over 30 years experience in Potential Methods concentrated in acquisition, processing and interpretation of gravity-magnetic surveys. He classified and evaluated over a half a million gravity land, marine and airborne stations that form today the USB-Venezuela gravity data base.

At present he is an international consulting potential field geophysicist interpreter doing work for companies such as Carson Services - Aerogravity Division and First Exchange Corp. He is a member of the SOVG and SEG.

GSH AUXILIARY NEWS

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ATTENTION MEMBERS OFFICE MOVE

Effective November 1st, the GSH/HGS office has moved to:

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HGS is Soliciting Focused Bulletin Articles & Publication Opportunities

by Ron Nelson
HGS Research & New Publictions Committee

This year the HGS Research & New Publications Committee is attempting to complete two ongoing projects and initiate several new ones. Work on our carryover projects, Low Resistivity Pays of the World and The Building Stones of Houston, is progressing and will hopefully be brought to closure with publication in 1997. However, it has been some years since we have issued a major new publication form our Society. I believe that a local Professional Society of our size and stature should be a leader in publication of technical and exploration related topics of regional interest. To that end, our Committee is actively soliciting publication opportunities from individuals and other Professional Societies that will be of interest and use to our membership. We will consider sole publication of appropriate material or co-publication with sister Societies. If you know of such opportunities please pass them on to me by phone at (366-2198), by fax at (366-2404), or by e-mail at (ran!elson@hou.amoco.com).

In addition to soliciting new publications, this year our Committee is also attempting to acquire new feature articles for our Bulletin that fill a niche in our profession. In particular, we are seeking short, timely, hard hitting articles on exploration-related technologies or regionally important exploration strategies or trends. These need not be "scholarly works" as is required for many of our scientific journals, but brief papers that expose our readership to important information in as efficient and timely a fashion as possible. We envision that many of these will be early publication of ideas and results to a focused audience that may later be "fleshed-out" in more formal journals of broader circulation. The HGS/GSH can offer these authors a quality Bulletin with a readership of about 5,000 and a short turnaround to publication. Both the HGS Bulletin and GSH Newsletter can serve our professions by filling this niche in the industry. If you have ideas for such articles please contact either the HGS or GSH.

Upcoming GSH Auxilliary Events

Luncheons:

Jan. 27, 1997
Lynn Ashby, Columnist, Author, and former Editorial page Editor of the Houston Post
The Junior League Tearoom

May 13, 1997
Annual Business Luncheon
Margaretta Bolding, Humorous Speaker
Braeburn Country Club

Bridge Luncheons

October 14, 1996 and Feb. 17, 1997
HESS Building

Spring Brunch

March 2, 1997
The First Methodist Church and Music Academy of Sugar Land presenting a potpourri of Musical Comedy hits.
Lakeside Country Club

Spring Bus Tour

April 9, 1997
Day trip to Austin including tour of Governor's Mansion

There is also a Duplicate Bridge Group that meets at 7:30 p.m. on the 2nd Friday of each month at the Bridge Studio, 6640 Harwin.

If you are interested in attending any or all of the auxiliary functions as a guest or would like to join our organization, contact Barbara Thigpen, GSH Liaison, at 497-3299.

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achieving higher productivity.

Recording Instrumentation

The 24-bit sigma-delta analog-to-digital converter has almost completely replaced the instantaneous floating point amplifier in new land, marine and transition zone recording systems. To-date, the primary benefits of this technology have been smaller and lighter instruments, reduced power requirements and improved reliability. These new systems provide increased linearity and instantaneous dynamic resolution, and write higher quality data to tape. However, our ability to capitalize upon these improvements by shrinking spatial arrays, recording more noise and attenuating that noise in data processing has been slower to develop.

The increasing numbers of surveys that include open water, transition zone and land topographies have spawned the development of more flexible recording systems. These systems are being designed to accommodate a receiver spread that contains ocean-bottom cable remote units, as well as land cable and radio linked remote units, all of which are controlled and recorded by a single central unit.

Positioning and Navigation

Both land and marine navigation and positioning have been completely upgraded with Global Positioning Satellite receivers and systems. Although the system's signals that are available for civilian access are less accurate than those used by the military, the inclusion of receivers at known locations provide submeter accuracies in x, y, and z virtually everywhere in the world.

Field Processing

Compact, powerful workstations with full seismic processing software systems are appearing in many land crew base camps. The vast majority of land crew field processing is performed to verify the accuracy of the shooting geometry information associated with each shot record. The ability to leave the field with completely correct geometry information reduces the time required to process land 3-D data by between 20 and 30 percent. However, on some particularly remote prospects, much more extensive processing is being implemented.

On marine vessels, parallel-processing super computers have been installed. In one known case, a processing flow culminating in a final, pre-stack time migrated cube was implemented and was able to keep up with the data acquisition.

The future of powerful onboard computers, or at least that of having the processing geophysicists onboard, has been clouded somewhat by the advent of wavelet-transform based data compression algorithms. A major oil company recently implemented such a data compression algorithm and compared the processing results from a 3-D survey's uncompressed data with those from the same data that had been compressed by a factor of 60, sent to a processing center via a satellite link, and uncompressed using the same algorithm. The data telemetry rate was able to keep up with the acquisition and the processing comparison results were impressive. The satellite link costs were nominal.

Improved Technologies

In 1988, a need was expressed to acquire 3-D data over producing marine reservoirs where production and drilling platforms made towing streamers dangerous or impossible. The ocean-bottom cable method, essentially land data acquisition at sea, represented a promising solution. However, data from the method's ocean-bottom hydrophones suffered from ghost reflections from the water surface that accompanied each legitimate reflection wavelet. In water depths greater than about 10 meters, deconvolution is unable to eliminate these ghost reflections. A method was developed that successfully eliminated these ghost reflections. The solution was to record data from both hydrophones and geophones at each receiver station and then to properly combine them in processing. This enhancement eliminated the receiver ghost spectral notch and, therefore, increased the data's bandwidth. With numerous other advantages inherent in the method including surface consistent geometry and elimination of the need for cell flexing, the method has produced imaged data with greater resolution than those produced with towed streamers. Its use has been extended to waters clear of obstacles.

Experiments with time-lapse 3-D, or 4-D, surveys began more than 10 years ago. Interest in this technology has recently risen dramatically. Mapping fluid front movements, as well as estimating reservoir properties to refine reservoir simulator models, are aimed at increasing the efficiency with which hydrocarbons are produced. Estimating reservoir properties has also led to a recurrent interest in recording and processing mode-converted shear waves. For reservoirs in marine settings, this interest has also expanded the industry's focus on the ocean-bottom cable method with three-component geophones in addition to hydrophones. Shear waves can't propagate through water.

Finally, a recently published technical article eloquently explains why, in some cases, land vibrators output more energy in the form of harmonics and subharmonics of the pilot sweep than in the form of the sweep signal itself. In the latter part of that article, the author presents the result of using a near trace as a measure of what was actually output by the vibrator and of performing signature deconvolution on the other traces in order to collapse constructively the harmonics into each reflection wavelet. The result was encouraging.

Biography

Frederick J. Barr began college at Texas A&M University in 1961, majoring in electrical engineering. Prior to receiving his bachelor's degree in 1966, he worked summers on a Shell bay-cable seismic crew that was conducting a long-term program covering the shallow bay systems along

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the Texas Gulf Coast. During the course of those summers, he performed every difficult and unpleasant task the crew could gleefully assign a college summer hire. From that experience he gained a valuable understanding of seismic data acquisition as well as a deep and abiding appreciation for the concept of higher education.

Fred continued his education in the electrical engineering department of Texas A&M, earning a master's degree in 1968 and a Ph.D. in 1970. He performed his master's thesis and Ph.D. dissertation research in the areas of statistical communication theory and electromagnetic wave propagation, respectively. When Petty Geophysical Engineering Company offered a job to perform research and development, focused on data acquisition, these research backgrounds and the "seismic summers" made the move to geophysics an easy decision.

Fred remained in research as Petty and Ray Geophysical were merged to form Geosource in 1973. He was named director of R&D in 1976. In 1978, the president of Petty-Ray decided Fred would benefit from experience in operations management. From 1978 to 1982, he held positions of general manager and vice-president, general manager in the Electronic Systems Division of Geosource where geophysical recording equipment and minicomputer based processing systems were designed, manufactured and marketed.

In 1982, Fred was promoted to Corporate Director of Technology for Geosource. The company had expanded its product and service lines to include seismic, wireline, pumps and precision metering. However, in late 1983, when the precipitous decline in the energy business started to manifest itself, Geosource divested its non-seismic businesses and Fred returned to the R&D department as manager.

In late 1988, Halliburton purchased Geosource and merged them with GSI

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HOLIDAY PARTY 1996

A New Look For Our Good Times: Coming in December!

[***Dateline HOUSTON***] — The GSH is launching a NEW campaign of holiday cheer this year, and YOU can be part of it! Our annual holiday party will have a brand new face reflecting our members' requests. It will be held from 5 to 9 p.m. on Thursday, December 5, to conserve your scarce weekend time around the holidays. At the quietly elegant DoubleTree Hotel at Post Oak, there will be plenty of room to network, mingle, and rekindle friendships in our spacious party area, with multiple bar stations for your convenience. We want to free your time for celebrating, not waiting in line for tickets or drinks! There will be carving stations and hot & cold buffet finger foods to satisfy while you visit, giving you a smorgasbord _and_ mobility. Casual seating will be available.

Please plan to join our party, and encourage your friends and fellow GSH members to do the same. This will be a perfect opportunity for your group- or company-wide gathering under the GSH umbrella. Treat your special clients to an elegant evening! If you and/or your company would like to make reservations for this special celebration, please call 560-1104. We look forward to hearing from you soon. Hope we see you all there!

The Christmas Party Committee would like to express its appreciation for sponsorship of this event by Landmark Graphics Corporation.

Party tickets are $15 per person for GSH members to purchase for themselves and their guests, $25 for non-members to purchase directly, payable in advance. By 11/30/96, please send this registration with your check to the Geophysical Society of Houston to:

Lorinda Driskill
c/o 3782 Georgetown
Houston, TX 77005-2822.

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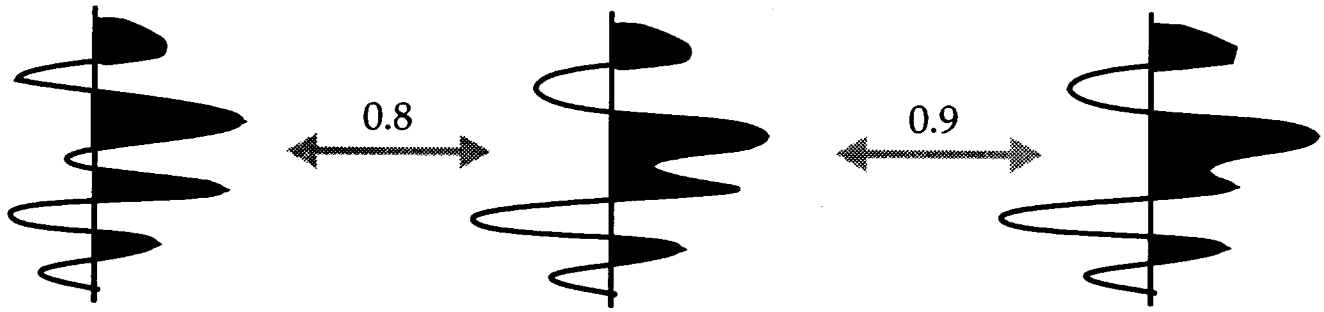

Figure 2. A simple, two-trace comparison pattern that can be used with correlation or semblance analysis. A single similarity measurement is output for the central trace at the center of the time window. Photo courtesy of CAEX Services

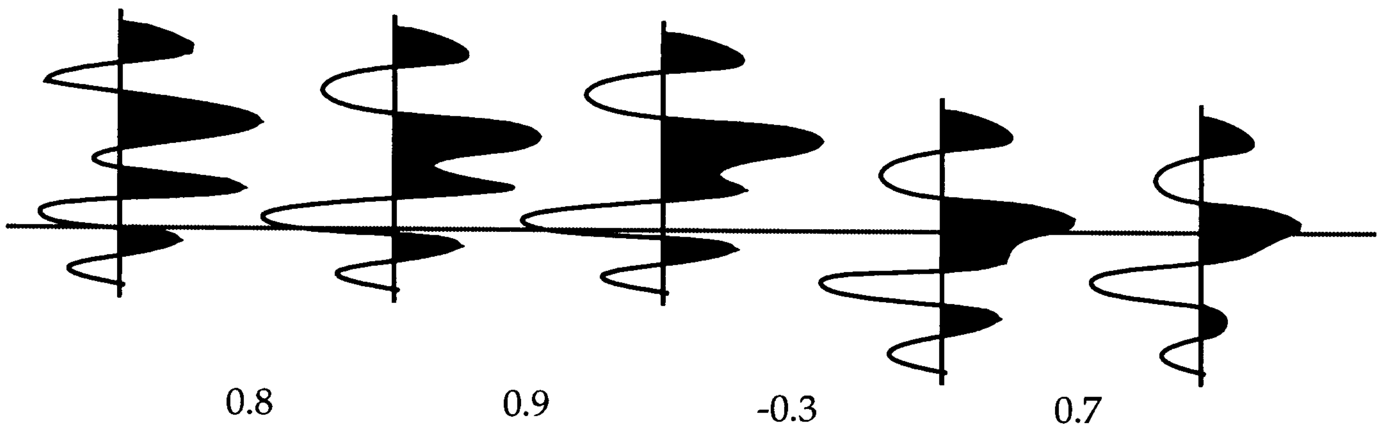

Figure 3. Correlation values reflect discontinuities in this example of relatively flat data. Photo courtesy of CAEX Services

or semblance statistics such as maximum, mean, average, variance, may be found useful in certain circumstances.

What causes low continuity values ?

To interpret continuity data effectively, you must understand what produces low continuity values.

Faulting with detectable vertical throw or wavefield distortion will generally produce clearly identifiable, narrow zones of low continuity. Similarly, abrupt contrasts in seismic character due to stratigraphic or lithologic changes (such as channel sands) will also produce narrow zones of low continuity values. Figure 3 illustrates how continuity correlation values respond to lateral data discontinuities. High values can be associated with bright spots in Gulf of Mexico data.

Gradual stratigraphic contrasts, such as those associated with transgressive sequences, will produce broad regions of moderate continuity values. Highly dipping events, when no dip correction is applied, will result in broad regions of low continuity. Similarly, zones with poor data quality or lack of reflectors (e.g., salt structures) can also produce broad regions of low continuity. Finally, bad traces, migration "smiles," and acquisition "foot print" can also generate localized regions of low continuity.

General tips for using continuity

This type of poststack data processing is numerically intensive. For large 3D volumes, run times of several hours are not uncommon. Some tips for making the most effective use of processing time are included below:

- Test parameters on a swath of vertical sections or narrow time zones.
- Set the maximum input time and use bulk time shifts to make sure you process only the time zone of interest.
- Use smaller comparison patterns (e.g., two traces) for higher resolution and speed.
- Use the dip option only if "dip noise" obscures results.
- Use the amplitude normalization option to take full advantage of the resolution available in your 8-bit or 16-bit output data.
- Use automatic scaling unless you are certain of output amplitudes.

Fault detection tips

For fault detection, maximum results were gained by outputting minimum correlation values for a window of 50 to 100ms and a short two-trace comparison pattern.

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Correlation values will generally be positive, ranging from perhaps 0.3 to 1.0.

Stratigraphic feature detection tips

For detection of channels and similar features, good results have been achieved by running comparison tests. A starting point would be a time window of 100 ms and a two-trace comparison pattern outputting minimum correlation values. Correlation values will tend to be higher for stratigraphic features than for faults. Testing may reveal correlation values of 0.7 to 1.0.

Termination event processing and mapping

Interpretive poststack processing can also allow the mapping of geologic terminations associated with sequence stratigraphy events. Events such as unconformities, downlap, onlap and other sequence boundary related events can be enhanced by this method of specialized poststack processing. The preliminary step is to dip-filter the data with respect to an unconformity viewed in the inline direction three times.

This three step process is to enhance downlap events, onlap events, and subparallel events. With each of the dip-filter pass it is necessary to extract the RMS amplitude profiles, outputting a downlap horizon, onlap horizon, and subparallel horizon. All three horizons are combined in the display found in Figure 4.

When the downlap horizon is mapped significant downlap termination against the unconformity become apparent (Figure 5). This horizon, remember, is composed of RMS amplitudes extracted from dip-filtered data. In contrast, RMS amplitudes extracted from the original data give little indication of where downlap is occurring (Figure 6).

To enhance the downlap events and generate a downlap horizon, each inline is processed in turn as follows:

- Convert the seismic data to cosine of phase to prevent amplitude

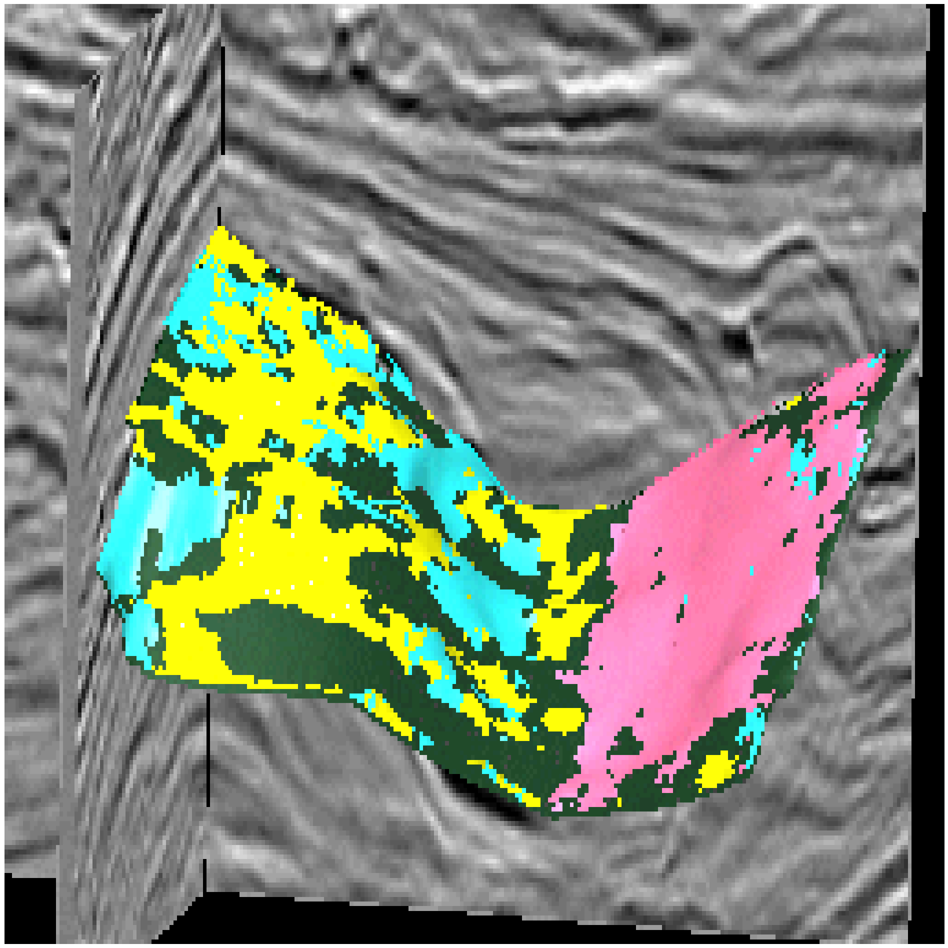

Figure 4. Horizons depicting areas of downlap, onlap, and subparallel terminating events are displayed on the unconformity surface.

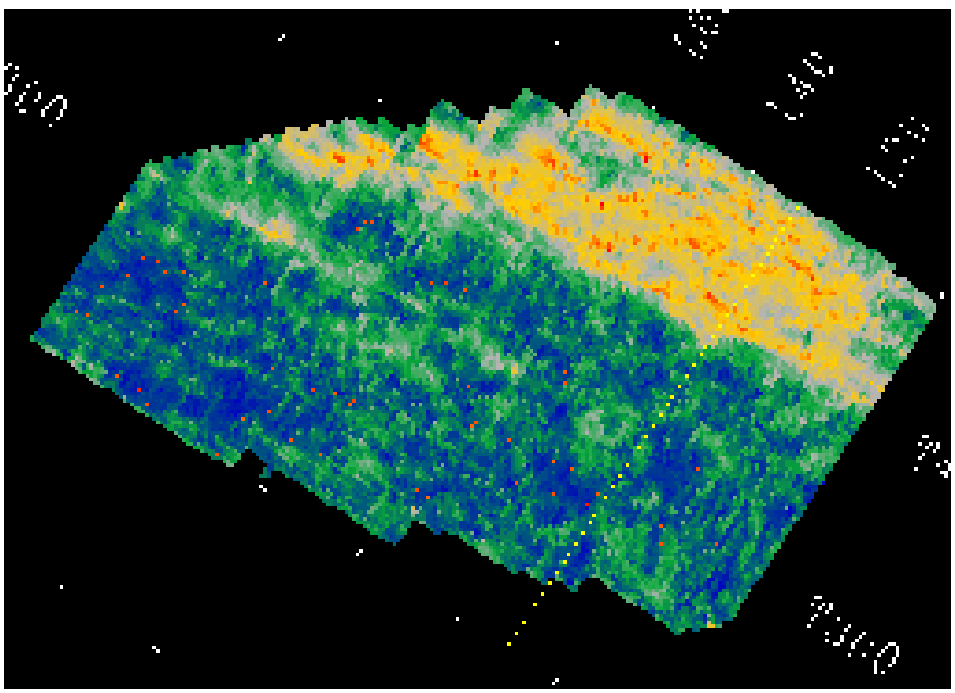

Figure 5. When the downlap horizon is displayed, zones of significant downlap termination against the unconformity (bright areas) are apparent.

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GEOPHYSICAL SOCIETY OF HOUSTON

11th Annual Sporting Clay Event

September 14, 1996

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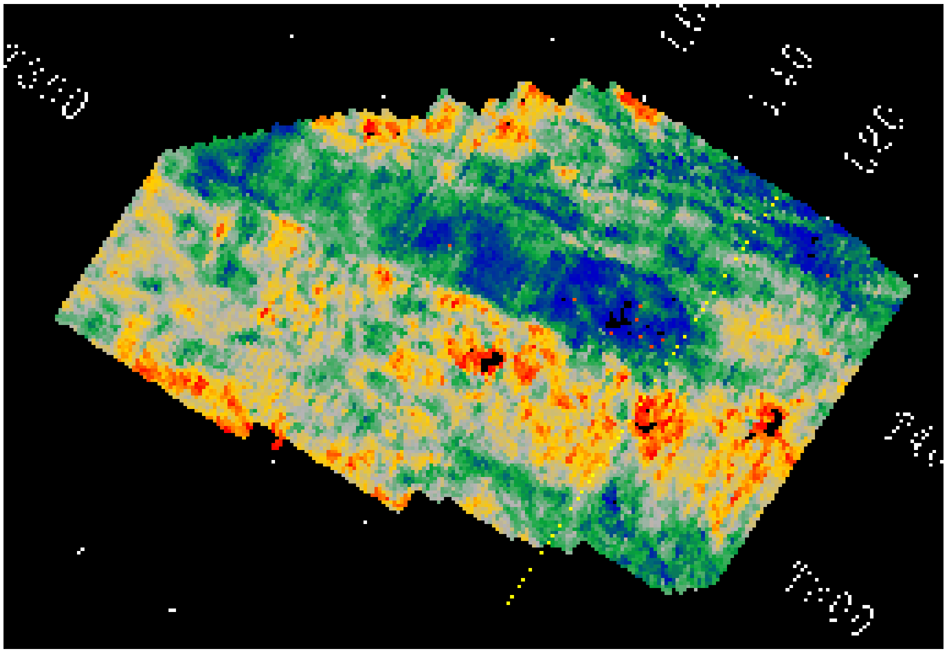

Figure 6. RMS amplitudes extracted from the original data give a much less distinct picture of where downlap termination is occurring.

anomalies from affecting the results.

- Flatten the section on the unconformity horizon.
- Apply an FK fan filter, keeping dips of +1 to +20 ms/trace.
- Unflatten the section.
- Extract RMS amplitudes above the unconformity horizon and output this new horizon.

Although this flow describes only the downlap horizon, poststack processing can be used to generate a series of maps. Maps of onlapping and subparallel zones can be made by changing the FK dip range to enhance onlap or subparallel terminations. Maps of events terminating underneath the unconformity can be made by using an attribute enhancing windows below the unconformity. Terminating events maps on neighboring unconformities can be made by changing the horizon used for flattening and RMS extraction.

Continued from page 7

whom they'd acquired earlier that year. Fred formed an R&D group specializing in data acquisition technology. That group remained intact as Western Geophysical purchased Halliburton Geophysical in 1993. Fred has enjoyed the good fortune of continuing as its manager.

Fred has authored and presented 22 papers at SEG and EAGE technical meetings. His paper on Dual-Sensor ocean-bottom cable technology at the 1989 Annual SEG Meeting received honorable mention for best presentation. Halliburton honored his technical contributions to seismic data acquisition technology by designating him a Senior Member, Technical Staff in 1990. The SEG further honored Fred by presenting him a Virgil Kauffman Gold Medal Award in 1995 for his work on the Dual-Sensor ocean-bottom cable method.

Dr. Barr is committed to the development of seismic data acquisition technology that improves data resolution and the efficiency with which it is recorded. He is a member of the SEG, EAGE and IEEE.

GEOPHYSICAL SOCIETY HOUSTON

Attention

GSH Members

If your address label on this GSH Newsletter has a blue stripe on it, your membership is expiring.

Please take a few moments and renew your GSH membership. You can do so by contacting the GSH office or Steven Starr.

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NOVEMBER 1996

Submittals and suggestions should be sent to the GSH Editor at 7457 Harwin, Suite 301, Houston, TX 77036, or call Cliff Kelley, Editor, at 368-8103, or Fax to 368-8182. Deadline for submission is the 1st of the month preceding publication: e.g., September 1 for the October issue. Digital or electronic submittals required.

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
					1	**2**
3	**4**	**5**	**6**	**7**	**8**	**9**
10	**11** ***HGS General Meeting Dinner*** *Dr. Carl Fiduk/UnivColo: Modeling Giant Structural Traps in Perdido Fold Belt, GoM* **SEG/Denver**	**12** **SEG/Denver**	**13** ***HGS Environment Engineering*** *John B. McVaugh, P.E., R.E.M. The ISO 14000 Environmental Management Standards Steak & Ale @ 8135 Katy Frwy.* **SEG/Denver**	**14** **SEG/Denver**	**15** **SEG/Denver**	**16** ***HGS Charisma Wrkstn Course***
17	**18** ***HGS International*** *UMC: Discovery off Ivory Coast* *5:30 p.m.* *Westchase Hilton* **GSH Technical Luncheon** 11:30 a.m. HESS	**19**	**20** **GSH Seismic Data Processing SIG** 4:00 p.m. Exxon Production Research Company Rm. S-202	**21** **GSH Potential Fields SIG** 5:30 p.m. HESS ***HGS General Meeting*** *Lunch (SIPES)* *Lillian Flakes & Ricard Fillon/* ***HGS Emerging Technology*** *Dan Morris* *Coherency Technology Co* *5:30 p.m.* *Radisson Suite Hotel*	**22**	**23**
24	**25**	**26**	**27**	**28**	**29**	**30**

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