Texas Consortium for Computational Seismology

Fall 2017 Newsletter

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Texas Consortium for Computational Seismology • The University of Texas at Austin

Welcome to the twelfth *TCCS Newsletter*!

The Texas Consortium for Computational Seismology (TCCS) is a joint initiative of the Bureau of Economic Geology and the Institute for Computational Engineering and Sciences (ICES) at The University of Texas at Austin. Its mission is to address the most important and challenging research problems in computational geophysics as experienced by the energy industry, while educating the next generation of research geophysicists and computational scientists.

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Fall Meeting

The TCCS Fall 2017 Research Meeting will take place in Austin on October 16–17. Hosted by the ICES, it will be held in the Peter O'Donnell Building (POB) at The University of Texas at Austin main campus.

Representatives of participating companies are invited to register for the meeting by following the link at: http://www.beg.utexas.edu/tccs/.

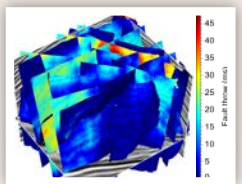
Presentations at SEG in Houston

TCCS members and collaborators will make the following presentations at the upcoming SEG 2017 Annual Meeting in Houston.

Monday, Sept. 25	1:50 pm	INT 1: Interpretation Workflows and Techniques	X. Wu	3D seismic image processing for interpretation and subsurface modeling
	1:50 pm	AVOSI 1: New Methods	M. Phillips	Automatic gather flattening for AVO analysis using amplitude-adjusted plane-wave destruction filters
	2:40 pm	ST P1: Heterogeneity, Compression, and Marchenko Applications	Y. Sripanich, S. Fomel, and A. Stovas	Effects of lateral heterogeneity on reflection traveltimes
	2:40 pm	FWI 1: Methodology 1	L. Qiu, J. Ramos-Martinez, A. Valenciano, Y. Yang, and B. Engquist	Full-waveform inversion with an exponentially encoded optimal-transport norm
	3:05 pm	FWI 1: Methodology 1	Y. Yang and B. Engquist	Analysis of optimal transport and related misfit functions in full-waveform inversion
	3:05 pm	SS 5: Emerging Professionals, Emerging Technologies	L. Decker, D. Merzlikin, and S. Fomel	Enhancing seismic-diffraction images using semblance-weighted least-squares migration
Tuesday, Sept. 26	8:30 am	INT 2: Event-picking and Chronostratigraphy	Z. Xue, X. Wu, and S. Fomel	Predictive painting across faults
	11:00 am	INT 2: Event-picking and Chronostratigraphy	Y. Shi, X. Wu, and S. Fomel	Well-log interpolation guided by geologic distance
	11:25 am	INT 2: Event-picking and Chronostratigraphy	X. Wu, Y. Shi, S. Fomel, and F. Li	Incremental correlation of multiple well logs following geologically optimal neighbors
	3:05 pm	SPMI P2: Other Imaging Methods	D. Merzlikin, S. Fomel, and Y. Sripanich	Oriented anisotropy continuation using shifted hyperbola traveltime approximation
	3:55 pm	INT 3: Stratigraphic and Facies Interpretation	Y. Shi, X. Wu, and S. Fomel	Finding an optimal well-log correlation sequence using coherence-weighted graphs
	4:20 pm	ANI 3: Azimuthal Anisotropy	S. Xu, A. Stovas, and Y. Sripanich	An anelliptic approximation for geometrical spreading in transversely isotropic and orthorhombic media
	4:45 pm	SPIR 1: Reconstruction and Interpolation	S. Greer and S. Fomel	Balancing local frequency content in seismic data using nonstationary smoothing
Wednesday, Sept. 27	9:20 am	DIM 1: Diffraction Imaging and Modeling 1	D. Merzlikin and S. Fomel	Diffraction-based migration velocity analysis using double-path summation
	9:45 am	FWI P1: Methodology 5	H. Chen and H. Zhou	Estimating velocity and Q by fractional Laplacian constant-Q wave equation-based full-waveform inversion
	10:10 am	SVE 3: Tomography and Uncertainty	Y. Sripanich and S. Fomel	Fast time-to-depth conversion and interval velocity estimation with weak lateral variations
	10:10 am	INT 5: Fault and Salt	X. Wu, S. Fomel, and M. Hudec	Fast salt-boundary interpretation with optimal path picking
	10:35 am	INT P2: Interpretation Methods	S. Bader, X. Wu, and S. Fomel	Semiautomatic seismic well ties and log data interpolation
	11:25 am	TL E-P1: Technology and Methods	S. Greer and S. Fomel	Matching and merging high-resolution and legacy seismic images
	11:25 am	SPNA 3: Noise Suppression and Signal Processing	X. Wang, C. Yang, X. Li, W. Chen, and H. Zhao	An iterative method for well-pump noise attenuation in the time-frequency domain
	3:05 pm	TL 2: Analysis	M. Phillips and S. Fomel	Estimation of time shifts between time-lapse seismic images using spectral decomposition

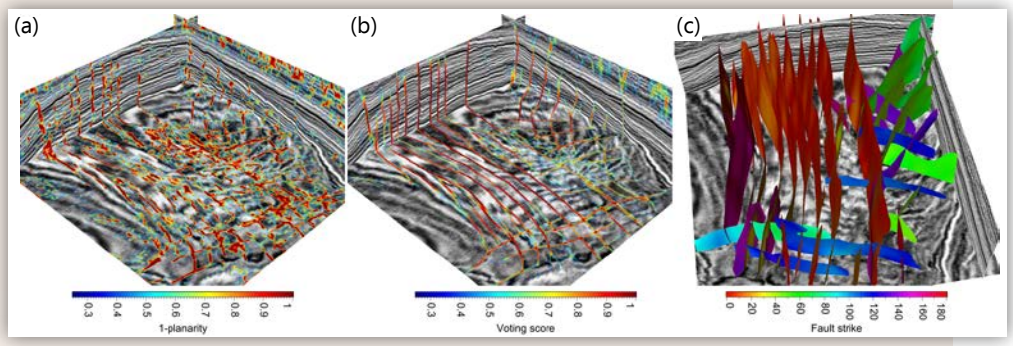
Professional Award

Ximning Wu received the 2016 Best Paper Award in Geophysics for "3D seismic image processing for faults" co-authored by Dr. Dave Hale. In this paper, they propose to use a convenient linked data structure to construct complicated 3D fault surfaces and to robustly estimate fault slip vectors. The constructed fault surfaces and estimated fault slips are further used to remove the faulting in a 3D seismic image, which greatly facilitates seismic horizon picking from the seismic image complicated by faults.

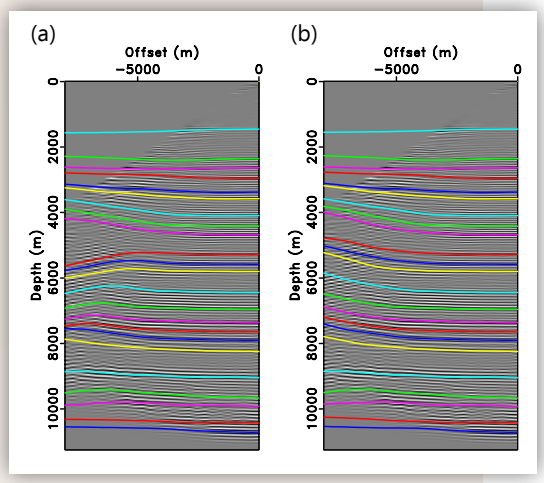


Research Highlights

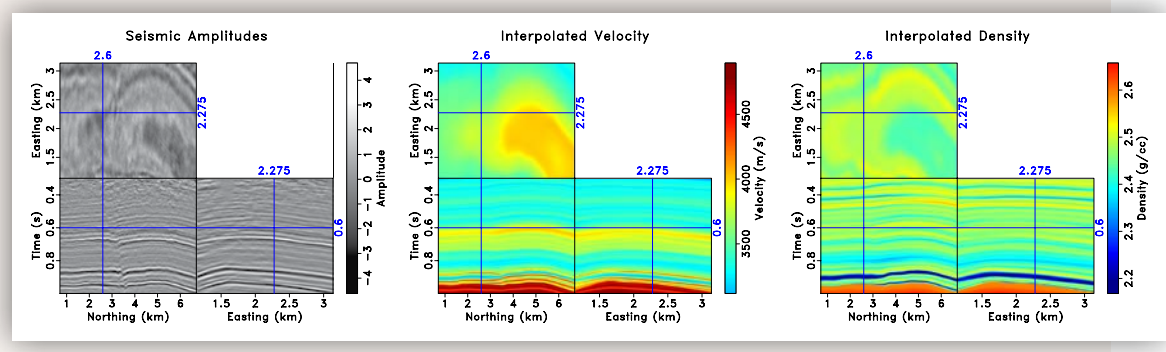
Xinming Wu has developed a new method for extracting fault surfaces. From an input image (a) of seismic discontinuity (1-planarity) attribute, a map of voting scores (b) is first computed by using the optimal surface voting method. Fault surfaces (colored by fault strikes in [c]) are then automatically extracted from the voting score map.



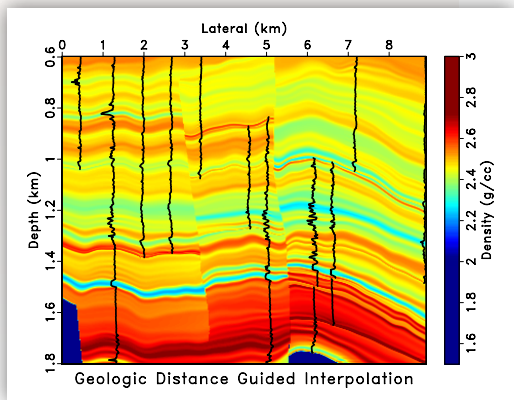
Zhiguang Xue has applied predictive painting to pick the residual moveouts in common image gathers (CIGs) and proposed using pattern information of CIG events to guide the picking process in order to avoid picking aliased events. Predictive painting has difficulty when applied to pick residual moveouts of CIGs suffering from severe aliasing caused by sparsely sampling in the extended direction (angle or offset) to lessen computational cost. This problem is addressed by pattern-guided predictive painting. Figure (a) shows the picking result of standard predictive painting on an aliasing-affected surface-offset CIG where picking at the large offsets suffers from severe aliasing, and figure (b) shows the picking result of pattern-guided predictive painting where the aliasing problem has been mitigated.



Sean Bader has been working on a semiautomatic method to efficiently and consistently tie available well-log data to seismic. Time shifts to align a synthetic seismogram modeled from log data are automatically estimated using a local similarity scan. The shifts estimated from local similarity are used to update the time-to-depth relationship to interpolate the available log data to time. Once tied to the seismic, the available log data can be interpolated along seismic structure using predictive painting to generate log-property volumes, which are used to quality check seismic well ties through a blind well test. Applied to a 3D seismic volume and available well-log data, we achieve consistent and verifiably accurate seismic well ties.



Yunzhi Shi has been working on an application of a modified image-guided well log interpolation method for initial subsurface model construction. He has suggested the use of "geologic distance" to represent the coherence between subsurface measurements. The predictive-painting method spreads lithological information along seismic horizons from well locations to interpolate the model, but it is difficult to incorporate geologic structures such as faults and unconformities. The problem can be mitigated by measuring geologic distance following horizons and modifying distance across faults based on fault attributes.



Papers Accepted and Published 2016–2017

http://www.beg.utexas.edu/tccs/publications

Accepted

M. Phillips and S. Fomel, 2017, Plane-wave Sobel attribute for discontinuity enhancement in seismic images: Geophysics.

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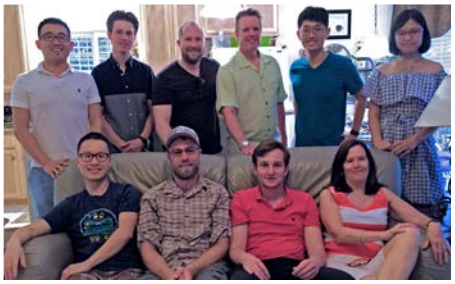
TCCS Staff

The TCCS group consists of scholars from six countries who have come together to move science forward. Our research staff includes two principal investigators, seven Ph.D. students, three M.S. students, a postdoc, a B.S. student, and a senior research fellow:

Sean Bader (M.S. 2nd year)
Luke Decker (Ph.D. 2nd year)
Björn Engquist (PI)
Sergey Fomel (PI)
Zhicheng Geng (Ph.D. 1st year)
Sarah Greer (B.S. 4th year)
Ben Gremillion (M.S. 1st year)
Harpreet Kaur (Ph.D. 1st year)
Dmitrii Merzlikin (Ph.D. 4th year)
Nam Pham (M.S. 1st year)
Karl Schleicher (senior research fellow)
Yunzhi Shi (Ph.D. 3rd year)
Xinming Wu (postdoc)
Zhiguang Xue (Ph.D. 5th year)
Yunan Yang (Ph.D. 5th year)

For more information, see http://www.beg.utexas.edu/tccs/staff.



TCCS Summer Social 2017 held in Houston for former and current students and researchers.

Testimonials

Yanadet Sripanich

I have had an incredible 6-year journey at TCCS. I started off as an undergraduate research assistant and was fortunate enough to get to interact with many of the TCCS pioneers. What an amazing group of inspirational scientists they are. Because of them, I discovered my passion for geophysics and my first baby step in the world of scientific research was always full of warm support.

Many people have joined the TCCS family since then, but I always feel that, regardless of how much we grow, our spirit never changes. We are still a family of young, fun-loving, and passionate research scientists who enjoy seeking answers to the most challenging problems in geophysics. We share not only our best times but also our toughest moments together. I will cherish that bond for many years to come.

I can honestly say that joining TCCS is one of the best decisions I have ever made in my life. I hope that TCCS will always be a warm and nurturing family for many future generations of geophysicists.

Hook' em Horns !

Mason Phillips

I was very fortunate to be surrounded by a knowledgeable and passionate cohort of technical experts during my time at TCCS. Sergey and his students have created a tremendously supportive, helpful, and encouraging environment for impactful research in exploration geophysics with an emphasis on reproducibility. I am continuously amazed by the incredible output of this highly productive group and look forward to future collaborations with TCCS members and alumni.

Hanming Chen

I stayed with TCCS from September 2016 to August 2017. TCCS researchers have developed a great software package, Madagascar, and are continuing to enrich it. Madagascar provides new geophysical students like me a direct and fast platform to learn and innovate. I feel very lucky to have worked with TCCS in the past year, just before I join China University of Petroleum (Beijing) as a teacher. I believe I will always benefit in the future from what I learned from TCCS. Really hope to meet members of TCCS again.

New Faces

Zicheng Geng is currently a Ph.D. student under the supervision of Sergey Fomel. Zhicheng graduated from Tongji University with a bachelor's degree in geophysics in July 2017. During his undergraduate studies, he worked with Prof. Yuzhu Liu on seismic inversion. He chose The University of Texas at Austin for its outstanding academic atmosphere and excellent research opportunities.

Ben Gremillion received a Bachelor of Science in geophysics and mathematics from Texas A&M University in May 2017. He is currently an M.S. student working with Sergey Fomel, and his interests include seismic imaging, migration, and seismic data processing. His previous research included searching for evidence of slow-slip events in the Cascadia subduction zone using ocean-bottom pressure data and performing mineral separation for detrital zircon age dating. Ben hopes to work in the oil and gas industry after graduation.

Harpreet Kaur graduated from the Indian School of Mines with a master's degree in geophysics in 2014. She worked with Schlumberger as an access engineer and with the Geological Survey of India as a geophysicist. Currently, she is a Ph.D. student supervised by Sergey Fomel.

Nam Pham received a bachelor's degree in geophysics and mathematics from the University of Tulsa in May 2017. His previous experience is with seismic and well-log interpretation in Taranaki Basin, New Zealand. He is currently a first-year M.S. working with Sergey Fomel. His interests are in implementing deep learning in seismic pattern detection and reservoir characterization. After graduation, he hopes to find a job with an oil company.