

80th EAGE Conference and Exhibition 2018 Workshop

Copenhagen, Denmark
11 - 14 June 2018

ISBN: 978-1-5108-8239-3

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2018) by the European Association of Geoscientists & Engineers (EAGE)
All rights reserved.

Printed by Curran Associates, Inc. (2019)

For permission requests, please contact by the European Association of Geoscientists & Engineers (EAGE)
at the address below.

European Association of Geoscientists & Engineers (EAGE)
PO Box 59
3990 DB Houten
The Netherlands

Phone: +31 88 995 5055
Fax: +31 30 634 3524

eage@eage.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

DIFFRACTION WAVEFRONT TOMOGRAPHY - EFFICIENT AUTOMATED VELOCITY INVERSION FOR MULTI-FOLD AND SINGLE-CHANNEL DATA	1
<i>A. B. Bauer, B. S. Schwarz, D. G. Gajewski</i>	
MULTI-SCALE TRAVELTIME INVERSION: A ROBUST METHOD FOR VELOCITY ESTIMATION IN DIFFICULT GEOLOGICAL CONTEXT	4
<i>C. Barnes, M. Charara</i>	
INTEGRATING REFLECTION-FWI IN DEPTH IMAGING VELOCITY MODEL BUILDING WORKFLOWS	9
<i>C. R. Rivera, E. Bergounioux, D. Otriz-Rubio, F. Audebert</i>	
TRAVELTIME BASED REFLECTION FULL WAVEFORM INVERSION	14
<i>C. Wang, P. Farmer, D. Yingst, I. Jones, G. Martin, J. Leveille</i>	
UNDERSTANDING RESOLUTION AND SHARPNESS IN RAY BASED TOMOGRAPHY	19
<i>D. E. Nichols, Y. You</i>	
SHAPING THE VELOCITY MODEL BEYOND THE DIVING WAVE PENETRATION	23
<i>D. Vigh, K. Jiao, D. Sun, X. Cheng</i>	
RAY VERSUS FULL WAVE VELOCITY MODEL BUILDING: STATUS AND CHALLENGES	28
<i>G. Lambaré</i>	
MACHINE LEARNING AND WAVE EQUATION INVERSION OF SKELETONIZED DATA	33
<i>G. T. S. Schuster</i>	
EXAMPLES OF ASYMPTOTIC ANALYSIS FOR UNDERSTANDING AND BUILDING SEISMIC WAVE-EQUATION IMAGING TOOLS	38
<i>H. J. Chauris, T. Zhou, E. Cocher, Y. Li</i>	
THE EVOLUTION OF TOMOGRAPHY AND FWI: AN EXAMPLE OF HIGH RESOLUTION VELOCITY ESTIMATION USING REFRACTION AND REFLECTION FWI	43
<i>I. F. Jones, J. Singh, P. Cox, M. Warner, C. Hawke, D. Harger, S. Greenwood</i>	
AN ACCURATE EULERIAN TRAVEL-TIME COMPUTATION: IMPLICATION FOR SLOPE TOMOGRAPHY	48
<i>J. V. Virieux, S. Sambolian, P. Le Bouteiller, S. Operto, A. Ribodetti, B. Tavakoli</i>	
NONLINEAR SLOPE TOMOGRAPHY: A VERSATILE DATA- AND CHALLENGE-DRIVEN VELOCITY MODEL BUILDING TECHNIQUE	53
<i>T. Allemand, P. Guillaume, F. Gamar, G. Lambaré, O. Leblanc, J. Messud, J. P. Montel</i>	
DIRECT INVERSION OF SEISMIC REFLECTION DATA	55
<i>P. B. Hardy</i>	
BORROWING INSIGHT FROM TRAVEL-TIME REFLECTION TOMOGRAPHY TO SOLVE THE DEPTH REFLECTIVITY-VELOCITY COUPLING ISSUE OF RFWI	60
<i>R. Baina, R. Valensi</i>	
MIGRATION VELOCITY ANALYSIS WITH A SECOND-ORDER GAUSS-NEWTON SCHEME: A 2D REAL DATA EXAMPLE	65
<i>R. Soubaras, B. Gratacos</i>	
INTEGRATING GRADIENT INFORMATION WITH PROBABILISTIC TRAVELTIME TOMOGRAPHY USING THE HAMILTONIAN MONTE CARLO ALGORITHM	67
<i>A. Zunino, K. Mosegaard</i>	
LOCAL PROBABILISTIC INVERSION OF SEISMIC AVO DATA	72
<i>H. J. Hansen, A. F. Jakobsen</i>	
GRAIN-GRAIN CONTACTS EVALUATION IN CARBONATE RESERVOIRS	77
<i>J. A. Soares, R. L. C. Coura, N. M. Oliveira, L. C. Medeiros, J. J. Silva, L. Landau, A. P. Martins Neta</i>	
NON-GAUSSIAN LINEAR INVERSION OF REFLECTION SEISMIC DATA	82
<i>P. S. Christiansen, T. M. Hansen, H. J. Hansen</i>	
INTERPRETATION BENEFITS FROM A FLEXIBLE MULTI-PHYSICS JOINT INVERSION APPROACH	87
<i>P. L. Smilde, C. Mueller, M. H. Kringer, S. Petersen</i>	
NONLINEAR 3D FE-STABILITY ANALYSIS OF SUCTION PILE	92
<i>R. Schlegel, R. Lampert, S. Eckardt, K. Rognlien, F. Halvorsen</i>	
LIDAR AND UAV FOR ROCK MASS GEOMECHANICAL CHARACTERISATION - SUPPORT TO FRACTURE STUDIES OF OUTCROP ANALOGUES	97
<i>A. Tamburini</i>	

REMOTE SENSING FROM SPACE FOR OIL PROSPECTING	99
<i>F. Rocca</i>	
VIDEO FROM SPACE - A NEW DIMENSION IN EARTH OBSERVATION.....	104
<i>G. Hausknecht</i>	
REMOTE SENSING CLOUD TOOLS IN THE GEOLOGICAL WORKFLOW	109
<i>L. Turon, J. Dupuy, D. Dhont, E. Blancart</i>	
THE USE OF REMOTE SENSING PRODUCTS FOR ENHANCING THE ENVIRONMENT PROTECTION AND OF OFFSHORE OPERATIONS SAFETY	114
<i>M. Fragoso</i>	
ASSET DIGITALIZATION AND INTEGRITY MONITORING - A UAS BASED APPROACH	119
<i>S. Liu</i>	
SUBTLE INTERSEISMIC STRAIN RATE DISTRIBUTION DETECTED FROM A SPATIAL FREQUENCY ANALYSIS OF INSAR	123
<i>T. Maurin, J. Berthelon, D. Dhont, F. Koudogbo, A. Urdiruz</i>	
PROBABILISTIC INVERSION INTO LITHOLOGY AND FLUID CLASSES IN THE NORTH SEA – COMPARISON OF ONE- AND TWO-STEP APPROACH	127
<i>E. Aker, H. Kjøsberg, P. Røe, Ø. Krøsnes</i>	
SOLVING FOR FACIES IN SEISMIC INVERSION AS ESSENTIAL FOR REALISTIC RESERVOIR MODELS	132
<i>H. W. J. Debeye</i>	
FACIES-BASED RESERVOIR CHARACTERISATION THROUGH THE ASSET LIFECYCLE	137
<i>M. A. C. Kemper</i>	
FLUID PREDICTION FROM TIME-LAPSE SEISMIC AVO DATA	140
<i>O. B. Forberg, Ø. Kjøsnes, H. Omre</i>	
INVESTIGATING THE RELATIONSHIP BETWEEN PRIOR INFORMATION AND SEISMIC RESOLUTION IN A BAYESIAN SETTING.	145
<i>P. E. Harris</i>	
PROBABILISTIC SEISMIC INVERSION OF FACIES AND PETROPHYSICAL PROPERTIES USING GAUSSIAN MIXTURE AND MARKOV CHAIN PRIOR MODELS	150
<i>T. Fjeldstad, P. Avseth</i>	
4D SEISMIC CODA WAVES	155
<i>D. E. Lumley</i>	
TARGET-ORIENTED ELASTIC FULL-WAVEFORM INVERSION THROUGH ACOUSTIC EXTENDED MIGRATION REDATUMING	157
<i>E. Biondi, B. Biondi, G. Barnier</i>	
USING ONE-WAY PROPAGATORS TO BUILD A FULL WAVEFIELD INVERSION PROCESS	159
<i>E. J. Verschuur, M. Davydenko, A. Garg</i>	
REVIEW OF DIFFERENT EXPRESSIONS FOR THE EXTENDED BORN APPROXIMATE INVERSE OPERATOR.....	164
<i>H. J. Chauris, E. Cocher</i>	
MULTIPLE-PARAMETERS INVERSION: ENHANCING WAVE-MATTER INTERACTION	169
<i>J. Virieux, R. Brossier, L. Métivier, P. Trinh, W. Zhou, P. Yang</i>	
LEAST-SQUARES IMAGING WITH MULTIPLES	174
<i>R. Soubaras, B. Gratacos</i>	
LEAST-SQUARES REVERSE-TIME MIGRATION WITH DYNAMIC TIME WARPING.....	176
<i>W. Dai, X. Cheng, K. Jiao, D. Vigh</i>	
Q-LEAST-SQUARES REVERSE TIME MIGRATION WITH VISCOACOUSTIC DEBLURRING FILTERS	181
<i>C. Y. Q. Chen</i>	
FWI VELOCITY MODELS FOR QUANTITATIVE INTERPRETATION OF A DEEP WATER GOM DATASET	186
<i>Y. Cobo, C. Calderon-Macias, S. Chi</i>	
Q TOMOGRAPHY WITH RAY AND WAVES	190
<i>Y. Shen, K. Bao, H. Kuehl</i>	
RECENT ADVANCES IN Q MODEL BUILDING AND Q-COMPENSATING MIGRATION FOR IMAGING IN THE PRESENCE OF COMPLEX GAS CLOUDS USING P WAVES	195
<i>N. I. L. Xie, N. I. L. Wang, N. I. L. Xiao, N. I. L. Latter</i>	
RESERVOIR MONITORING THROUGH DAS MEASUREMENTS.....	199
<i>J. Chavarria</i>	
CONTINUOUS DAS VSP MONITORING USING SURFACE ORBITAL VIBRATORS: FIELD TRIALS FOR OPTIMAL CONFIGURATION AT THE CO2CRC OTWAY PROJECT.....	202
<i>J. Correa, B. M. Freifeld, R. Pevzner, T. Wood, K. Tertyshnikov, A. Bona</i>	

VERTICAL SEISMIC PROFILING COMBINING THREE-COMPONENT GEOPHONES WITH SINGLE-AXIS DAS SENSORS	206
<i>J. B. U. Haldorsen, L. Jahren, M. Milenkovic, T. Hilton</i>	
RESULTS FROM A CLAIR DAS VSP PILOT AND LESSONS LEARNED FOR DAS SURVEILLANCE ON CLAIR RIDGE.....	209
<i>L. M. Saxton, M. Ball, S. Soulas, G. Zhan, M. Webster</i>	
LOOKING BEYOND SEISMIC SENSORS: ENGINEERING CONSIDERATIONS FOR TOPSIDE AND SUBSEA PRM INTERFACES.....	214
<i>L. A. Woodhouse, H. Frøyshov, M. Thompson</i>	
SEISMIC AND MICROSEISMIC DETECTION USING A WIDE DYNAMIC-RANGE DISTRIBUTED AN ENGINEERED FIBER OPTIC ACOUSTIC SENSOR	219
<i>M. Farhadiroushan</i>	
EFFECT OF THE ANGULAR RESPONSE OF A FIBER-OPTIC CABLE ON DAS VSP RECORDINGS IN LATERAL WELLS.....	222
<i>M. E. Willis, X. Wu, A. Padhi, A. Ellmauthaler, M. Leblanc</i>	
OPTIMISING DAS VSP DATA ACQUISITION PARAMETERS: THEORY AND EXPERIMENTS AT CURTIN TRAINING WELL FACILITY.....	227
<i>R. Pevzner, A. Bona, J. Correa, K. Tertyshnikov, G. Palmer, O. Valishin</i>	
COMPARATIVE STUDY OF DAS AND GEOPHONE VSP DATA	230
<i>Y. Z. Chen, G. Yu, Y. P. Li, X. L. Guo, J. H. Huang, J. J. Wu</i>	
THE WINNER STRATEGY OF PETROPHYSICAL DRIVEN SEISMIC RESERVOIR CHARACTERISATION.....	235
<i>C. T. Tarchiani, R. L. Tagliamonte, G. Carrasquero, M. Catanzaro</i>	
IMPROVING STATIC MODELO ROBUSTNESS OF PRE-SALT RESERVOIR.....	238
<i>C. E. B. S. Abreu, C. E. L. Pereira, P. H. S. Sales, M. P. A. Júnior, R. S. M. Corrêa</i>	
INTEGRATED 4D QUANTITATIVE INTERPRETATION FOR ASSISTED RESERVOIR MODEL UPDATING	241
<i>H. J. Hansen</i>	
GEOSTATISTICAL SEISMIC INVERSION: A REVIEW AND THE ROAD AHEAD	244
<i>L. A. Azevedo, R. Nunes, A. Soares, V. Demyanov</i>	
PRAGMATIC USE OF A MASSIVE PERMANENT RESERVOIR MONITORING SEISMIC LIBRARY FOR RESERVOIR MODEL UPDATE AND WELL PLANNING: EXAMPLES FROM THE VALHALL FIELD.....	247
<i>N. H. Haller, F. I. Ifi, P. R. Paton</i>	
EFFICIENT INTEGRATION OF 4D SEISMIC DATA IN HISTORY MATCHING WITH ENSEMBLE METHODS.....	250
<i>T. A. Alsos, M. Heide, B. T. Samuelsen</i>	
POTENTIAL PITFALLS RELATED TO THE USE OF SEISMIC CONSTRAINT DURING GEOLOGICAL MODEL INFILLING	254
<i>T. Cadoret</i>	
4D SEISMIC - SOME EXAMPLES OF REPEATED SEISMIC AND PERMANENT RESERVOIR MONITORING.....	258
<i>T. Coleou</i>	
INCLUDING INTERNAL MULTIPLES IN IMAGING MARINE DATA WITH ANISOTROPY - A JOINT MIGRATION INVERSION APPLICATION.....	260
<i>A. Alshuhail, E. Verschuur</i>	
SHALLOW WATER ATTENUATION OF MULTIPLES BY INVERSION (SWAMI).....	265
<i>G. Hampson, A. Kumar, T. Thompson</i>	
UTILIZING SURFACE MULTIPLES IN SPARSE DEEPWATER OBN SURVEYS.....	268
<i>A. M. Mahdad, P. Docherty, K. Craft</i>	
USING SURFACE MULTIPLES TO IMAGE ACROSS LARGE ACQUISITION GAPS	273
<i>A. Nath, E. J. Verschuur</i>	
INTERNAL MULTIPLE MODELLING AND SUBTRACTION TO REDUCE THE RISK IN QUANTITATIVE INTERPRETATION: AN OVERVIEW OF THE CHALLENGE, INITIAL ASSESSMENT, AND WAY FORWARD.....	278
<i>A. C. Ramirez, E. Sadhikov, L. T. W. Sigernes</i>	
DATA ENHANCEMENT THROUGH IMPROVED ATTENUATION OF INTERNAL MULTIPLES IN THE STACK DOMAIN.....	283
<i>E. S. Sadhikov, A. C. Ramirez, L. T. W. Sigernes, S. K. Foss</i>	

SEISMIC INTERPRETATION WHEN SHORT-PERIOD INTERNAL MULTIPLES ARE PRESENT	287
<i>J. Hilterman, F. I. Nicholson, M. Pareja, C. Qi</i>	
ATTENUATION OF NEAR-SURFACE MULTIPLES ON LAND SEISMIC DATA: CHALLENGES, PRACTICAL ASPECTS AND OPEN ISSUES	292
<i>F. X. De Melo, C. Kostov, A. El-Emam, H. Bayri</i>	
FOCUSING CONDITIONS: A COMPARISON BETWEEN DIFFERENT MARCHENKO IMAGING STRATEGIES	295
<i>G. A. Meles, C. Reinicke, K. Wapenaar, J. Brackenhoff, J. W. Thorbecke</i>	
WAVE-EQUATION DISPERSION INVERSION OF GUIDED P WAVES IN A WAVEGUIDE OF ARBITRARY GEOMETRY	300
<i>J. Li, S. Hanafy, G. Schuster</i>	
UNDERSTANDING MULTIPLES IN LAND SEISMIC DATA	305
<i>K. De Vos, M. Jahdhami, M. Azam, F. Ernst, S. Rawahi, H. Rynja</i>	
MAKING ACOUSTIC AND ELASTIC INTERNAL MULTIPLE PREDICTION WORK EFFICIENTLY AND WITHOUT ARTIFACTS	308
<i>K. A. Innanen, J. Sun, A. S. Iverson</i>	
A SINGLE-SIDED REPRESENTATION FOR THE HOMOGENEOUS GREEN'S FUNCTION, ACCOUNTING FOR ALL MULTIPLES	313
<i>K. Wapenaar, J. Brackenhoff, J. Thorbecke, J. Van Der Neut, E. Slob</i>	
APPLICATIONS OF THE MARCHENKO METHOD IN THE DATA DOMAIN	318
<i>J. A. Brackenhoff, M. Stating, L. Zhang</i>	
AN OVERVIEW OF MARCHENKO-BASED REDATUMING: PAST, PRESENT, (AND FUTURE)	323
<i>M. Ravasi</i>	
TOWARDS THE PREDICTION OF INTERNAL MULTIPLES FROM THIN LAYERING BY MARCHENKO	328
<i>R. F. Hegge, G. A. Meles, C. P. A. Wapenaar</i>	
LEAST-SQUARES FULL WAVEFIELD MIGRATION	333
<i>S. Lu, F. Liu, N. Chemingui</i>	
LONG-RANGE SEISMIC SOUND MEASUREMENTS AND MODELING – WHAT DOES IT TAKE TO GET IT RIGHT?	338
<i>B. Martin, L. Horwich, C. Morris, M. N. Matthews, K. Broker</i>	
RAPID AUTONOMOUS MARINE 4D (RAM4D) – AN UNMANNED, TIME-LAPSE OFFSHORE SEISMIC ACQUISITION SYSTEM	343
<i>D. A. Chalenski, P. J. Hatchell, J. L. Lopez, K. Broker</i>	
ENVIRONMENTAL IMPACT OF A SET OF MARINE COMPRESSED AIR SOURCE CONFIGURATIONS – A COMPARATIVE STUDY	346
<i>J. F. Wisløff, M. Bastard, E. Asgedom</i>	
THE IOGP E&P SOUND & MARINE LIFE JOINT INDUSTRY PROGRAMME – AN INTERNATIONAL RESEARCH PROGRAMME TO FILL KEY DATA GAPS	350
<i>K. Bröker, K. Speirs, D. Hedgeland, G. Wolinsky, B. Gisiner, G. Adams, M. Jenkerson</i>	
SEISMIC SURVEYS AND THE GREENLAND REGULATION	355
<i>L. K. Y. A. Kyhn, D. M. Wisniewska, K. Beedholm, M. P. Heide-Jørgensen, R. G. Hansen, J. Tougaard, D. Boertmann</i>	
THE MARINE VIBRATOR JIP AND ONGOING MARINE VIBROSEIS DEVELOPMENT	360
<i>M. R. Jenkerson, A. J. Feltham, N. Henderson, V. E. Nechayuk, M. Girard, A. J. Cozzens</i>	
MODELLING PROPAGATION OF SOUND EMITTED BY MINI-AIRGUNS	364
<i>M. K. Prior, H. W. Jansen</i>	
METHODOLOGY FOR ASSESSMENT OF CUMULATIVE EFFECTS OF IMPULSIVE SOUNDS	369
<i>N. A. Kinneging, R. P. A. Dekeling, A. M. Von Benda Beckmann</i>	
ECONOMICAL VIABILITY UTILIZING ENVIRONMENTALLY FRIENDLIER ACQUISITION STRATEGIES	373
<i>P. H. Hansen</i>	
TOWARDS A MARINE SEISMIC POINT SOURCE	378
<i>P. E. Dhelie, V. Danielsen, M. Branston, R. Campbell, R. Ford</i>	
THE EVIDENCE FOR ENVIRONMENTAL EFFECTS FROM SEISMIC SURVEY SOUND: WHAT TO MITIGATE, MONITOR, AND REGULATE, AND WHY?	383
<i>B. Gisiner</i>	
EFFECTIVE MONITORING OF NEARSHORE SEISMIC SURVEYS OFF SAKHALIN AND MITIGATION OF SOUND EXPOSURE FOR A FEEDING WHALE POPULATION	388
<i>R. Rocca</i>	

REVIEW AND EVALUATION OF LOW VISIBILITY REAL-TIME MONITORING TECHNIQUES	393
<i>U. K. Verfuss, D. Gillespie, J. Gordon, T. A. Marques, B. Miller, R. Plunkett, J. Theriault</i>	
EXPLORATION SUCCESS EQUATION	398
<i>A. V. Milkov</i>	
THE OIL INDUSTRY IS NOTORIOUSLY POOR AT PREDICTION - MODERN SOFTWARE IS PARTLY TO BLAME	402
<i>C. S. Meulengracht</i>	
THE OIL INDUSTRY IS NOTORIOUSLY POOR AT PREDICTION - MODERN SOFTWARE IS PARTLY TO BLAME	407
<i>D. Quirk</i>	
OVERCONFIDENCE AND OPTIMISM IN THE OIL INDUSTRY: SURFACING SYSTEMATIC BIASES AND DISTORTIONS IN PROBABILISTIC PRACTICE	413
<i>G. Keith</i>	
ANALOGUE PLAY STATISTICS FOR IMPROVED PRE-DRILL RISKING: NORTH SEA CASE STUDY	415
<i>K. Myers</i>	
ADDRESSING THE CAUSES OF UNCALIBRATED PREDICTIONS & UNDERPERFORMANCE IN OIL & GAS VENTURES	417
<i>M. Bond, P. D. Carragher</i>	
NORTH SEA EXPLORATION PERFORMANCE - HOW HAVE WE DONE?	419
<i>D. Dickson</i>	
Author Index	