

**SPE Reservoir Characterisation and
Simulation Conference and
Exhibition (RCSC 2013)**

**New Approaches in Characterisation
and Modelling of Complex Reservoirs**

**Abu Dhabi, United Arab Emirates
16-18 September 2013**

Volume 1 of 2

ISBN: 978-1-62993-144-9

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© (2013) by the Society of Petroleum Engineers
All rights reserved.

Printed by Curran Associates, Inc. (2013)

For permission requests, please contact the Society of Petroleum Engineers
at the address below.

Society of Petroleum Engineers
P. O. Box 833836
Richardson, Texas 75083-3836

Phone: (800) 456-6863
Fax: (972) 952-9435

books@spe.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: 845-758-2634
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

VOLUME 1

SPE 165935 Combining Design of Experiments and Streamline-Based Simulation for Efficient Thermal IOR Development Study in a Waterdrive Light Oil Reservoir	1
<i>Wathiq J. Al-Mudhafer</i>	
SPE 165936 A Practical Approach for Enhancing Model Accuracy Using Pressure and Permeability Function	21
<i>Tariq Al-Zahrani, Saud Al-Hoti</i>	
SPE 165938 Estimation of Water Saturation in Water Injector Wells, Drilled Across Tight Carbonate Formations, Using Resistivity Inversion	27
<i>Amr Mohamed Serry, Omar Al-Farisa, Mariam Al-Marzouqi, Sultan Budebes</i>	
SPE 165939 A Case Study from October Field: Modeling Heterogeneity Results in Improved Reservoir Management	42
<i>I. S. Nassar, M. Noueldien Darhim</i>	
SPE 165941 Reservoir Simulation of Shale Barrier Failure in Heterogeneous SAGD Reservoirs: A Case Study	52
<i>Yongbin Wu, Xiuluan Li, Youwei Jiang, Hongzhuang Wang, Wanjun He</i>	
SPE 165943 Evolution Strategy Algorithm through Assisted History Matching and Well Placement Optimization to Enhance Ultimate Recovery Factor of Naturally Fractured Reservoirs	66
<i>J. E. Paredes, R. Perez, C. J. Larez</i>	
SPE 165944 Spontaneous Imbibition Characteristics of Nano-Darcy Permeability, Shale Formations	80
<i>Samaha Morsy, J. J. Sheng</i>	
SPE 165945 A Case Study Underlying the Importance of Sound Reservoir Surveillance Practice to Maximize Recovery from an Onshore Oil Field of UAE	89
<i>M. Pratap, S. Al-Kendi</i>	
SPE 165946 Neural Network Prediction of Porosity and Permeability of Heterogeneous Gas Sand Reservoirs Using NMR Logging Data	100
<i>G. M. Hamada, M. A. Elshafei</i>	
SPE 165947 A New Approach to Measuring Rock Properties Data from Cores & Cuttings for Reservoir & Completions Characterization: an Example from the Bakken Formation	115
<i>Guy M. Oliver, Graham Spence, Howard Rael, Chi V. Ly</i>	
SPE 165949 Application of Real Time Well Site Tool for Enhanced Geosteering and Reservoir Characterisation	119
<i>Tom Ashton, Chi Vinh Ly, Graham Spence, Guy Oliver</i>	
SPE 165950 A Simplified Distributed Parameter Model For Predicting The Productivity Index For a Complex Commingled Well	130
<i>Edwin N. Ikezue</i>	
SPE 165951 A Simulation Approach for Optimization of Gas Lift Performance and Multi-Well Networking in an Egyptian Oil Field	142
<i>Mostafa S. Yakoot, Shedad A. Shedad</i>	
SPE 165952 Computational Fluid Dynamics (CFD) Study and Investigation of Proppant Transport and Distribution in Multistage Fractured Horizontal Wells	156
<i>Atul Bokane, Siddarth Jain, Yogesh Deshpande, Freddy Crespo</i>	
SPE 165954 Pressure Distribution in a Layered Reservoir with Letter 'F' Architecture and Horizontal Well Completions	170
<i>E. S. Adewole</i>	
SPE 165955 Effect of Some Parameters Influencing Enhanced Oil Recovery Process using Silica Nanoparticles: An Experimental Investigation	186
<i>Luky Hendraningrat, Shidong Li, Ole Torsaeter</i>	
SPE 165956 Successful Application Of Different QI Techniques To Improve The Static Reservoir Model For A Clastic Onshore Oil Field In Oman	196
<i>M. Scholten-Vissinga</i>	
SPE 165957 A Workflow for Developing Water-Oil Relative Permeability Hysteresis - Super Giant Carbonate Reservoir Case Study	201
<i>Ahmed Mohamed Mahmoud Ismail, Hafez H. Hafez, Mohammed Zubair Kalam</i>	
SPE 165958 Reservoir Characterization for Improved Petrophysical Properties Predictability & Validations: Capillary Pressures and Permeability (Niger Delta Province as Case Study)	211
<i>Onuh Haruna, David Ogbé, Nwosu Chike</i>	

SPE 165960 3-D Numerical Investigation of Subsurface Flow in Anisotropic Porous Media using Multipoint Flux Approximation Method	228
<i>Ardiansyah Negara, Amgad Salama, Shuyu Sun</i>	
SPE 165962 ICD Completions` Optimization for an Offshore Abu Dhabi Well Using Dynamic Modeling	241
<i>Mohamed Al Hashemi, Samir Bellah, Sule Gurses, Muhammad Nadeem Akhtar</i>	
SPE 165966 Minimum Miscibility Pressure Measurement with Slim Tube Apparatus - How Unique is the Value?	250
<i>Jamiu M. Ekundayo, Shawket G. Ghedan</i>	
SPE 165967 Safeguarding Reserves of a Large Carbonate Waterflood Field by Preventing Induced Fractures	260
<i>Hamed Al Waheibi, Sai Garimella, Widad Wardy</i>	
SPE 165968 Enhancing Reservoir Understanding by Utilizing Business Intelligence in History Match Quality Check	270
<i>Tariq Al-Zahrani, Tariq Al-Ghamdi, Saad Al-Qarni, Ali Al-Tiban, Bader Al-Harbi</i>	
SPE 165969 Success and Challenges in Gathering Dynamic Data in Tight Gas Condensate Fields - Lessons Learnt	276
<i>M. A. Urquhart, M. Harrasi</i>	
SPE 165970 Reservoir Model History-Matching and Uncertainty Quantification in Reservoir Performance Forecast Using Bayesian Framework	284
<i>H. Okano</i>	
SPE 165972 A New Method of Numerical Simulation for Viscoelastic Polymer Flooding	298
<i>Z. B. Wang, Q. Wang, D. S. Ma, Y. Z. Ye, Z. X. Liu</i>	
SPE 165973 Geomodel Geometry Distorted by Seismic Velocity Uncertainties	310
<i>G. Piquet, F. Pivot, A. Forge</i>	
SPE 165974 Does the Double Layer Expansion Mechanism Contribute to the LSWI Effect on Hydrocarbon Recovery from Carbonate Rocks?	319
<i>Emad W. Al-Shalabi, Kamy Sepehrmoori, Mojdeh Delshad</i>	
SPE 165975 Analytical Models for Well Test Analysis in Class 3 Gas Hydrate Reservoirs	336
<i>M. Kome, M. Amro, Y. Cinar</i>	
SPE 165976 Integrated Three Phase Fluid Analysis Approach of PNC in Miscible Gas and WAG Injections of Complex Carbonate Reservoir	370
<i>Muhammad A. Gibrata, M. Zubair Kalam, A. Mohsen, S. Ashraf, M. Basoni, Ahmed E. Mahdi</i>	
SPE 165977 Effect of Coupling Black Oil and Compositional Reservoirs and Networks on Hydrocarbon Production and Optimization	383
<i>S. Z. Jilani, A. Alvi, H. Abbas</i>	
SPE 165978 Risk Analysis for a Fracture Offshore Abu Dhabi Reservoir	396
<i>Mouyha Abou Ali, Federico German Games, Gilles Jean Bourdarot</i>	
SPE 165979 Computer Assisted History Matching - A Field Example	407
<i>R. H. Lind, O. Allottai, A. M. Gaaim, H. Almuallim</i>	
SPE 165980 Engineering Workflow for Probabilistic Assisted History Matching and Production Forecasting: Application to a Middle East Carbonate Reservoir	422
<i>M. Maucec, A. P. Singh, G. A. Carvajal, S. Mirzadeh, S. P. Knabe, R. L. Chambers, G. Shi, A. K. Al-Jasmi, I. H. El Din, H. Nasr</i>	
SPE 165981 Determination of Waterflooding Residual Oil Saturation for Mixed to Oil-Wet Carbonate Reservoir and its Impact on EOR	442
<i>S. K. Masalmeh</i>	
SPE 165982 Coupled Geomechanical and Reactive Geochemical Model for Fluid and Heat Flow: Application for Enhanced Geothermal Reservoir	456
<i>Yi Xiong, Perapon Fakcharoenphol, Philip Winterfeld, Ronglei Zhang, Yu-Shu Wu</i>	
SPE 165983 Compositional Phase Trapping in CO2 WAG Simulation	470
<i>J. S. Brown, M. S. Al-Kobaisi, H. Kazemi</i>	
SPE 165985 Multiscale Lattice Boltzmann Method for Flow Simulations in Highly Heterogenous Porous Media	484
<i>Jun Li, Donald Brown, Victor M. Calo, Yalchin Efendiev, Oleg Iliev</i>	
SPE 165986 Well Inflow Modelling for Wells Not Aligned to a Numerical Grid	496
<i>P. J. P. Egberts, I. Shatyrbayeva, P. A. Fokker</i>	
SPE 165987 Pore-Scale Simulation of Viscoelastic Polymer Flow using a Stabilised Finite Element Method	505
<i>Meishan Qi, Jonas Wegner, Lisa Falco, Leonhard Ganzer</i>	
SPE 165989 Rock-Typing Using the Complete Set of Additive Morphological Descriptors	517
<i>Nurul Izza Ismail, Shane Latham, Christoph H. Arns</i>	

SPE 165990 A Comprehensive Approach for History Matching A Giant and Complex Oil Reservoir	528
<i>Karim Aïssaoui, Manuel Morena</i>	
SPE 165991 A Multiple-Continuum Model for Simulation of Gas Production from Shale Gas Reservoirs	542
<i>Ning Li, Qiquan Ran, Jianfang Li, Jiangru Yuan, Cong Wang, Yu-Shu Wu</i>	
SPE 165992 Investigation of Optimum Salinity of Injected Water in Carbonate Reservoirs using Wettability Measurement and Core Flooding	555
<i>Mohammad Sharifi, Murtdha Shaikh</i>	
SPE 165993 Nested Karst Simulations and Uncertainty Quantification - Application Case Study from a Kazakhstan Field	566
<i>R. Labourdette, L. W. Glass, P. A. Lapointe</i>	
SPE 165995 Understanding Well and Reservoir Performance with Modern Analytical Techniques	576
<i>Lakshi Konwar, Ahmed Mohsin Al Hendi, Syed Tariq</i>	
SPE 165996 Developing a Methodology To Detect Non Drained Sandbodies Using Geology Techniques in Mature Reservoirs To Increase Recovery Factor	589
<i>R. Ch. Sablit</i>	
SPE 165997 Pore-Scale Visualisation of Two-Phase Fluid Displacement Processes in a Carbonate Rock using X-ray micro-Tomography Technique	595
<i>Tannaz Pak, Ian B. Butler, Sebastian Geiger, Rink Van Dijke, Zeyun Jiang, Stephen Elphick, Ken Sorbie</i>	
SPE 165998 Textural and Mineralogical Characteristics of Chicotepec Reservoirs in Mexico; Keys to Understanding Oil Productivity	604
<i>Juan-Carlos Granados-Hernandez</i>	

VOLUME 2

SPE 165999 Development of Mature Fields Using Reservoir Opportunity Index: A Case Study from a Saudi Field	615
<i>Alfonso Varela-Pineda, Ahmed H. Hutheli, Saad M. Mutairi</i>	
SPE 166000 Improving the Estimation of Porosity and Permeability Distribution by Linking Basin Modelling to Diagenetic Evolution of Carbonate Reservoirs	626
<i>Alessandro Mangione, Helen Lewis, Sebastian Geiger, Cees Van Der Land</i>	
SPE 166001 Impact of the Spatial Correlation of Microporosity on Fluid Flow in Carbonate Rocks	637
<i>Zeyun Jiang, Marinus I. J. Van Dijke, Sebastian Geiger, Denise Kronbauer, Iara Frangiotti Mantovani, Celso Peres Fernandes</i>	
SPE 166002 High-Resolution Numerical Simulations of Capillary Trapping for Carbon Dioxide in Fractured Formations	647
<i>R. Annewandter, I. Main, S. Geiger</i>	
SPE 166004 Fast-Track Modeling Approach: An Alternative Workflow for Reservoir Simulation Modeling	668
<i>Faisal Al-Jenaibi, Sebastien Lacroix, Said Meziani, Shamsudin Bugio, Riyadh Ben Salem</i>	
SPE 166005 Improved Reservoir Surveillance through Injected Tracers in a Saudi Arabian Oil Field: Case Study	684
<i>Husain Zuberi, Muhanad Ali Almosa, O. Huseby</i>	
SPE 166006 History Match of a DST Using a Turbidite Elementary Channels Modelling Technique, Deep Offshore Congo	699
<i>Richard Labourdette, M. C. Devilliers, T. Bui</i>	
SPE 166007 Evaluating Injection Performance With High-precision Temperature Logging And Numerical Temperature Modelling	710
<i>Arthur Aslanyan, Michael Wilson, Abdullah Al-Shammakhy, Sergey Aristov</i>	
SPE 166008 Optimisation of Smart Well Completion Design in the Presence of Uncertainty	724
<i>Baijayanta Ghosh, Peter King</i>	
SPE 166010 Accounting for Regional Aquifer Data in a Simulation Model of the Burgan Minagish Reservoir - A Novel Approach	741
<i>F. A. Al-Faresi, D. J. Bond, J. T. Wang</i>	
SPE 166011 Multilevel Preconditioners for a New Generation Reservoir Simulator	748
<i>Shuhong Wu, Jinchao Xu, Chen-Song Zhang, Qiaoyun Li, Baohua Wang, Xiaobo Li, Hua Li</i>	
SPE 166013 Fracture System in the Carbonate Reservoirs of Abu Dhabi: Implications for Field Development	760
<i>Manhal Sirat, Edison Sembiring, Mohamed I. Al-Hammadi, Boussad Baguenane, Amer Elbekshi</i>	

SPE 166014 Integrated Workflow Towards Characterizing Hydraulic Fractures in Tight Gas Reservoirs-Modeling, Uncertainty Analysis, History Matching & Production Forecasting	772
<i>Tony Thomas, Natela Belova, Andrey Goloborodko</i>	
SPE 166015 Seismic Attribute Utilization for FFDP Well Placement Optimization, Upper Cretaceous Fractured Complex Carbonate Reservoir, Onshore Oil Field, U.A.E.	779
<i>Sabry L. Mahmoud, Magdy Hozayen, El Sayed Radwan</i>	
SPE 166016 Integration of Permeability Derived From Well Pressure Transient Analysis To Improve Prediction Model Permeability In High Heterogeneous Carbonates Reservoir - Case Study-offshore Abu Dhabi, UAE.	791
<i>S. Khemissa, Alexander Lesage, Fazeel Ahmed Akram, Elyes Draoui, Shinichi Nakamura, Abass Al-Alyak, Samir Walia, Surya Das</i>	
SPE 166018 Simulation Study on Waterflood Front: Block Hade of Tarim Oilfield in Northwest China.	803
<i>Wei Zhou, D. S. Ma, D. Oyinkepreye Orodu</i>	
SPE 166019 A System of Key Performance Indicators in Intelligent Fields	814
<i>Cenk Temizel, Serkan Dursun, Suryansh Purwar, Baris Hancioglu</i>	
SPE 166022 Using 4D Seismic to Validate the Geomodel for the South Arne Chalk Field	829
<i>M. Luthje, J. Stokkendal, C. C. Lindelow-Marsden, K. Johansen, L. J. K. Jensen</i>	
SPE 166023 Multiscale Characterization On The Pore Network In Carbonate Rocks	844
<i>Theis Solling, Xiomara Marquez, Thomas McKay, Andrew Fogden</i>	
SPE 166024 Safe-Guarding Oil Recovery Through Implementation of Cyclic Production in Short Circuited Patterns.	858
<i>A. Adhooi, A. Ramli, A. Ghufaili, G. Bacic, K. Belushi, M. Van Koolwijk</i>	
SPE 166025 Quantifying Gas Saturation with Pulsed Neutron Logging-An Innovative Approach	867
<i>Mamdouh N. Al-Nasser, S. Mark Ma, Nedhal M. Al-Mushrafī, Ahmed S. Al-Muthana, Steve Riley, Abel I. Geevarghese</i>	
SPE 166027 Decision Analysis for Long-term and Short-term Production Optimization Applied to the Voador	877
<i>Agus Hasan, Bjarne Foss, Stein Krogstad, Vidar Gunnerud, Alex Teixeira</i>	
SPE 166028 Reservoir Simulations of a Polymer Flood Pilot in the Pelican Lake Heavy Oil Field (Canada): A Step Forward.	892
<i>P. Delaplace, G. Renard, E. Delamaide, T. Euzen, F. Roggero, P. Kopecný</i>	
SPE 166029 The Use of Geophysical Data in MPS Facies Simulation in a Seismically Tuned Reservoir - A New Approach Based on the Direct Sampling Algorithm	906
<i>H. Kombrink, F. Lallier, S. Vignau</i>	
SPE 166030 Effects of Segmentation and Skeletonisation Algorithms on Pore Networks and Predicted Multiphase Transport Properties on Reservoir Rock Samples.	914
<i>N. A. Idowu, C. Nardi, H. Long, T. Varslot, P. E. Oren</i>	
SPE 166032 Simulation Techniques for Surfactant Phase Behavior and Foam Flow Modeling in Fractured Reservoirs	927
<i>Maghsood Abbazadeh, Guangwei Ren</i>	
SPE 166033 Using Near Wellbore Upscaling to Improve Reservoir Characterization and Simulation in Highly Heterogeneous Carbonate Reservoirs	943
<i>V. Chandra, S. Geiger, P. W. M. Corbett, R. Steele, P. Milroy, A. Barnett, P. Wright, P. Jain</i>	
SPE 166034 Application of Enhanced Vertical Permeability Resulting from the Deeply Penetrating Thalassinoides Burrows in Dual-Porosity / Dual-Permeability Modeling of a Fractured Middle East Oil Reservoir	957
<i>Zaki Ali Al-Ali, Orji Ukaegbu, E. A. Clerke, Abdullatif Al-Omair, Mohammed Ragab</i>	
SPE 166035 Insight into Smart-Water Recovery Mechanism through Detailed History Matching of Coreflood Experiments	965
<i>Abdulkareem M. Alsofi, Ali A. Yousef</i>	
SPE 166036 Investigation of Large Scale CO2 EOR and Sequestration Potential in Northern China	977
<i>Y. Zhang, J. Miller, L. Roman, L. Hoffman</i>	
SPE 166037 Minimization of Disparity between Well Test and Log Driven Permeabilities through Combination of Rock-physics And Advanced Logs with Proper Averaging Technique	983
<i>Sergey Vorobiev, Michael M. Altunbay, Vladimir Vorobyev, Azlan Shah M. Johari</i>	
SPE 166041 Evaluating Possible Solutions to Enhancing Injectivity in Low Permeability Reservoirs - A Modeling Perspective.	997
<i>Obinna Akuanyionwu, Mark Norris</i>	
SPE 166042 A Quantitative Approach to Analyze Fracture Area Loss in Shale Gas Reservoirs	1007
<i>Hamed Lawal, Nnamdi Abolo, Greg Jackson, Vivek Sahai, Cecilia Flores</i>	

SPE 166043 Use of Well Test Interpretations to Constrain the Small Scale Petrophysical Anisotropy (k_v/k_h)	1020
<i>Eric Wigniolle, Gerard Massonnat</i>	
SPE 166045 Thin Beds And Cut-Offs: A Probabilistic Approach For An Improved Assessment And Modelling Of The Net Porous Volume	1029
<i>J. Clavel, P. Ruelland</i>	
SPE 166046 Geostatistical Modeling with Seismic Characterization of Wara/Burgan Sands, Minagish Field, West Kuwait	1039
<i>K. Al-Anezi, S. Kumar, A. Ebaid, A. Bonnel, N. Lucet, G. Lecante, S. Ortet</i>	
SPE 166047 Mathematical Modelling of Carbonated Water Injection Including Mass Transfer Kinetics	1052
<i>Jalal Foroozesh, Mahmoud Jamiolahmadi, Mehran Sohrabi, Shaun Ireland</i>	
SPE 166048 Application of Integrated Asset Modeling Approach in a Multi-Reservoir Gas Condensate Field	1059
<i>Noureddine Rahmouni, Tariq Ali Al-Shabibi, Salem Al Khanbashi, Ahmed Amtereg, Mohamed Bouaouaja, Feddy Himawan Soendoro</i>	
SPE 166049 Combining Unstructured Grids, Discrete Fracture Representation and Dual-Porosity Models for Improved Simulation of Naturally Fractured Reservoirs	1076
<i>Christine Maier, Sebastian Geiger</i>	
SPE 166050 Stacked Reservoirs Development Optimization Based on a Fully Implicit Surface-Subsurface Nexus Modelling - A Case Study from the UAE	1089
<i>Cedric Clara, Mohamed Sherief, Tee Sin Chong, Medhat Abdou, Nigel Brock</i>	
SPE 166051 Multi-Objectives Constrained Waterflood Optimization in Tight Carbonates	1100
<i>H. Khan, L. Saputelli, G. A. Carvajal, P. Ranjan, F. Wang, S. Knabe</i>	
SPE 166052 Optimized Modeling Workflows for Designing Passive Flow Control Devices in Horizontal Wells	1111
<i>Sule Gurses, Adam Vasper</i>	
SPE 166053 Control of Facies Geomodel Properties by Seismic Information	1121
<i>Frederik Pivot, Pierre Biver</i>	
SPE 166054 Effect of Rock and Wettability Heterogeneity on the Efficiency of WAG Flooding in Carbonate Reservoirs	1126
<i>M. O. Ahmed Elfeel, A. Al-Dhahli, Z. Jiang, S. Geiger, M. I. Van Dijke</i>	
SPE 166055 Narrowing the Loop for Microporosity Quantification in Carbonate Reservoirs	1143
<i>A. A. Al Ratrouf, M. Z. Kalam, J. S. Gomes, M. S. Jouini</i>	
SPE 166056 When a Good History-Matched Model Results in a Bad Forecast; Question your Petrophysical Data	1156
<i>Hani H. Qutob, Abdelaziz Khlaifat, Mohamed S. Efnik</i>	
SPE 166057 Mechanistic Modeling for Well Configuration Screening in EOR Pilot	1162
<i>Tawfic Obeida, Nidhal Al Alawi, Hani Al Sahn</i>	
SPE 166058 Parallel Adaptive Mesh Refinement for Capturing Front Displacements: Application to Thermal EOR Processes	1169
<i>Youssef Mesri, Jean Marc Gratien, Olivier Ricois, Raphael Gayno</i>	
SPE 166060 Revealing Relative Permeability Uncertainties through Integrated Experimental and Modeling Workflow	1181
<i>Maged Yaslam, Shawket G. Ghedan, Zubair Kalam</i>	
SPE 166061 Optimising Gas Injection in Carbonate Reservoirs Using High-Resolution Outcrop Analogue Models	1192
<i>Simeon Agada, Sebastian Geiger</i>	
SPE 166062 Fully Implicit Two-phase Reservoir Simulation with the Additive Schwarz Preconditioned Inexact Newton Method	1205
<i>Lulu Liu, David E. Keyes, Shuyu Sun</i>	
SPE 166063 Water-Encroachment Monitoring Applied to Offshore Oil Field	1216
<i>A. M. Al-Dhafeeri, F. S. Al-Beshri, A. Al-Sadah, J. S. Kottuthala, L. R. Diaz Teran Orregon, H. Shaqlouf, H. Azam</i>	
SPE 166065 Use of Digital Imaging for Improved Evaluation of Unconventional Reservoirs	1224
<i>Michael Dixon, Barry Newton, Angela Schwartz, Erin Smart, Kultaransingh Hooghan</i>	
Author Index	