Contents

Part I Advances in Classical Statistics Relevant to the Geosciences

Performance Evaluation of Swanson’s Rule for the Case of Log-Normal Populations ........................................ 1
Maryam Moghadasi and Jerry L. Jensen

Modelling Ore Bodies of High-Nugget Gold Using Conditional Probability .................................................. 5
Evelyn June Hill, Nicholas H. S. Oliver, James Cleverley and Michael Nugus

The Extraction of Long-Term Distribution Trends of Ore-Sourced Geochemical Elements from an Drill Core in the Loess Covered Area ......................................................... 9
Deyi Xu, Hongwei Pei, Ningqiang Liu, Zhaoxian Yuan, Shuyun Xie and Qiuming Cheng

Evaluating Predictive Performance ........................................ 15
Michael Scheuerer and Tilmann Gneiting

At the Interface Between Mathematical Geoscience and Classical Statistics .................................................. 19
Frits Agterberg

Estimating the Number and Locations of Euler Poles ................. 23
Florian Bachmann, Peter Jupp and Helmut Schaeben

Testing for Microhomogeneity in Reference Materials for Microanalytical Methods ........................................ 27
R. Tolosana-Delgado, A. D. Renno, P. P. Michalak and K. G. van den Boogaart
Recent Univariate and Multivariate Statistical Techniques
Applied to Gold Exploration in the Amapari Area,
Amazon Region, Brazil ........................................... 33
Luis Paulo Braga, Francisco José da Silva and Claudio Gerheim Porto

Maximum Likelihood Inference of Spatial Covariance
Parameters of Large Data Sets in Geosciences ................. 37
Kanti V. Mardia and Eulogio Pardo-Igúzquiza

A Cross-Polar Modeling Approach to Hindcast Paleo-Arctic
Mega Icebergs: A Storyboard .................................... 41
Reinhard Furrer, Nina Kirchner and Martin Jakobsson

Towards a Statistical Treatment of Images Acquired
by Automated Mineralogy ........................................ 45
Sandra Birtel, Raimon Tolosana Delgado, Stephan Matos Camacho,
Jens Gutzmer and K. Gerald van den Boogaart

Distributional Assumptions and Parametric Uncertainties
in the Aggregation of Geologic Resources ....................... 49
John H. Schuenemeyer and Ricardo A. Olea

Modeling Extremal Dependence Using Copulas. Application
to Rainfall Data .................................................. 53
M. I. Ortego, J. J. Egozcue and R. Tolosana-Delgado

Part II Frontier Geostatistics

Revisiting “Estimating and Choosing” .......................... 57
Jean Serra

Pragmatic Bayesian Kriging for Non-Stationary
and Moderately Non-Gaussian Data ............................ 61
Konstantin Krivoruchko and Alexander Gribov

Geostatistical History Matching Conditioned to Seismic Data .... 65
Amílcar Soares, Leonardo Azevedo, Sara Focaccia and João Carneiro

Handling Soft Probabilities in Multiple Point Statistics Simulation . . 69
Pierre Biver, Gregoire Mariethoz, Julien Straubhaar,
Tatiana Chugunova and Philippe Renard
An Application of Equal-Area-Growing Window for Calculating Local Singularity for Mapping Granites in Inner Mongolia ........ 73
Daojun Zhang, Qiuming Cheng and Frits Agterberg

Semi-Variogram Model Inference Using a Median Bootstrap Statistics .............................................. 79
Eulogio Pardo-Igúzquiza, Ricardo A. Olea and Peter A. Dowd

Part III  Compositional Data Analysis Applied to Geochemistry

Geometric and Statistical Modeling of Fractures in the 3D Disturbed Zone of a Claystone Around a Cylindrical Gallery (Meuse-Haute Marne Underground Research Laboratory, France) ..................................... 83
Rachid Ababou, Israel Cañamón and Adrien Poutrel

Robust Regression with Compositional Response: Application to Geosciences ........................................ 87
Karel Hron, Peter Filzmoser, Matthias Templ, Karl Gerald van den Boogaart and Raimon Tolosana-Delgado

Compositional Analysis in the Study of Mineralization Based on Stream Sediment Data ......................... 91
Renguang Zuo

Modelling World Energy Applying Simplicial Linear Ordinary Differential Equations .............................. 95
Eusebi Jarauta-Bragulat, Carme Hervada-Sala and Juan José Egozcue

Structural Analysis of the National Geochemical Survey of Australia Data ........................................ 99
Ute Mueller, Johnny Lo, Patrice de Caritat and Eric Grunsky

Discriminant Analysis of Palaeogene Basalt Lavas, Northern Ireland, Using Soil Geochemistry .............. 103
Jennifer M. McKinley, Sam Roberson, Mark Cooper and Raimon Tolosana-Delgado

Chemical Equilibria in Compositional Data ...................... 107
K. Gerald van den Boogaart, Raimon Tolosana Delgado and Silke Konsulke
Analysis of Total Abundances of Phytoplankton Compositions in a River
Vera Pawlowsky-Glahn, Juan J. Egozcue and David Lovell

Part IV Data Assimilation in Geoosciences

Recursive Upward Sweeping and Updating Method on Ensemble Based Multiscale Algorithm in Data Assimilation
Chen Li, Shihua Chen, Chunlin Huang and Wei Gong

Corrected Kriging Update Formulae for Batch-Sequential Data Assimilation
Clément Chevalier, David Ginsbourger and Xavier Emery

Part V Machine Learning Geoscience Applications

Analysis of the Parametrization Needs of Different Land Cover Classifiers: The Case Study of Granda Province (Spain)
Victor F. Rodriguez-Galiano and Mario Chica-Olmo

Automatic Raman Spectra Processing for Exomars
Isaac Hermosilla Rodriguez, Guillermo Lopez-Reyes, D. R. Llanos and Fernando Rull Perez

Fuzzy Parameterization of a Filtration Model for a Non-homogeneous Sedimentary Rock
Elena Savelyeva and Aleksander Rastorguyev

Application of Multivariate Analysis Techniques for the Identification of Sulfates From Raman Spectra
Guillermo Lopez-Reyes, Pablo Sobron, Catherine Lefebvre and Fernando Rull

Comparison of Micro X-ray Computer Tomography Image Segmentation Methods: Artificial Neural Networks Versus Least Square Support Vector Machine
Swarup Chauhan, Wolfram Rühaak, Frieder Enzmann, Faisal Khan, Philipp Mielke, Michael Kersten and Ingo Sass
Learning Uncertainty from Training Images for Reservoir Predictions ............................................ 147
Temitocles Rojas, Varily Demyanov, Mike Christie and Darn Arnold

A Particle Swarm Optimization for Parameter Estimation of a Rainfall-Runoff Model ........................ 153
Frédéric Bardolle, Frédérick Delay, Francis Bichot, Gilles Porel and Nathalie Dörfliger

Sequential Weights of Evidence as a Machine Learning Model for Mineral Deposits Prediction .......... 157
Qiuming Cheng

Identification of Spatial Models of $\delta^{18}$O in Precipitation of the Wet Season Over Spain Using Genetic Algorithms ..................... 163
Javier Heredia, Eulogio Pardo-Igúzquiza, Javier Rodríguez-Arévalo, Silvino Castaño, Maria F. Díaz-Teijeiro, Jose E. Capilla, Aantonio Prado and Lara Bardasano

Part VI Spatiotemporal Analysis: Structural Complexity and Extreme Behaviour

Space-Time Prediction of Extreme Events by Using Mathematical Logic Modeling of Cause-Effect Relations ............................. 167
Susanna Sirotinskaya

Local Clustering in Spatio-Temporal Point Patterns ...................... 171
Jorge Mateu and Francisco J. Rodríguez-Cortés

The Use of Remote Sensing Data in a Colombian Andean Basin for Risk Analysis ........................................ 175
Olga Lucía Ocampo López and Jorge Julián Vélez Upegui

Spatio-Temporal Analysis of Earthquake Occurrences Using a Multiresolution Approach ....................... 179
Orietta Nicolis

Statistical Complexity Analysis of Spatiotemporal Dynamics .......... 185
José M. Angulo and Francisco J. Esquivel
Part VII  Parameterization of Soil Systems at Different Scales

Frequency Distributions and Scaling of Soil Texture and Hydraulic Properties in a Stratified Deep Vadose Zone Near Maricopa, Arizona ................................. 189
Alberto Guadagnini, Shlomo P. Neuman, Marcel G. Schaap and Monica Riva

Cascade of Proppant-Sandwiched Silt Blocks as a Double-Continuum: From Discovery to Mathematical Modeling ............................. 193
Anvar Kacimov, Said Al-Ismaily, Ali Al-Maktoumi, Hamed Al-Busaidi and Said Al-Saqri

Parameterization of Soil Thermal Diffusivity Versus Moisture Content Dependencies and Modeling Spatial Heterogeneity of Soil Temperature ................................................ 197
Tatiana Arkhangelskaya

A Packing Computational Method Relating Fractal Particle Size Distribution and Void Fraction in Granular Media ............................. 201
Carlos García-Gutiérrez, Miguel A. Martín, Francisco Muñoz, Miguel Reyes and Francisco J. Taguas

Parallel Sets and Morphological Measurements of CT Images of Soil Pore Structure in a Vineyard ................................. 205
Fernando San José Martínez, Francisco J. Muñoz, Francisco J. Caniego and Fernando Peregrina

Part VIII  Fractal, Chaos, and Complexity in the Earth System

Evaluation of Fractal Dimension in Karst Aquifers ................................. 211
Pedro A. Robledo Ardila, Juan José Durán Valsero and Eulogio Pardo Igúzquiza

Fractal Modelling of Karst Conduits ................................. 217
Eulogio Pardo-Igúzquiza, Juan José Durán, Pedro Robledo, Carolina Guardiola, Juan Antonio Luque and y Sergio Martos

Frequency–Area Distribution of Historical Landslides in the Sannio Apennine (Southern Italy) ................................. 221
Angelo Donnarumma, Paola Revellino and Francesco Maria Guadagno
Part IX Remote Sensing a Changing World

A Spatiotemporal Remotely-Sensed Assessment of Peat Covered Areas Using Airborne Radiometrics .......................... 225
Jennifer M. McKinley, Antoinette Keaney and Alastair Ruffell

Monitoring of Urban-Damaging Landslides with Satellite Radar Missions: Arcos de la Frontera (Spain) .................. 229
Guadalupe Bru, José Fernández, Pablo J. González and Kristy F. Tiampo

Multivariate Variogram and Madogram: Tools for Quantifying Diversity/Dissimilarity in Spatiotemporal Data ........ 235
Phaedon Kyriakidis, Dimitra Kitsiou and Dimitris Kavroudakis

Spatiotemporal Interactions for Daily Mapping of $PM_{10}$ with MODIS and Meteorological Data .......................... 239
Piero Campalani, Simone Mantovani and Peter Baumann

Part X Radar Remote Sensing for the Detection, Monitoring and Modelling of Ground Instabilities

Non Linear PS Time Series: Analysis and Post-Processing for Landslides Studies .................................................... 245
Davide Notti, Claudia Meisina, Francesco Zucca and Alessio Colombo

Observation of the Mining-Induced Surface Deformations Using C and L SAR Bands: The Upper Silesian Coal Basin (Poland) Case Study ................................................................. 249
Marek Graniczny, Zbigniew Kowalski, Anna Piątkowska and Maria Przyłucka

Multi-Temporal Evaluation of Landslide-Induced Movements and Damage Assessment in San Fratello (Italy) by Means of C- and X-Band PSI Data .................................................. 257
Silvia Bianchini, Deodato Tapete, Andrea Ciampalini, Federico Di Traglia, Chiara Del Ventisette, Sandro Moretti and Nicola Casagli

Integration of Earth Observation and Ground-Based HR Data in the Civil Protection Emergency Cycle: The Case of the DORIS Project ................................................................. 263
Paola Pagliara, Giuseppe Basile, Pierluigi Cara, Angelo Corazza, Andrea Duro, Bruno Manfrè, Roberta Onori, Chiara Proietti and Vincenzo Sansone
Geostatistical Analysis of PSI Radar Data: A Methodology to Assess Serviceable Limit State of Buildings ........................................ 267
Margarita P. Sanabria, Carolina Guardiola-Albert, Roberto S. Tomás, Geraint Cooksley and Gerardo Herrera

Using Modern Sensor Data and Advanced Numerical Modelling for Slow Landslides Motion Forecasting ............................... 271
Jose A. Fernández-Merodo, Juan C. García-Davalillo and Gerardo Herrera

Characterization of Underground Cellars in the Duero Basin by GNSS, LIDAR and GPR Techniques ..................................... 277
Miguel Angel Conejo-Martín, Tomás Ramón Herrero-Tejedor, Enrique Pérez-Martín, Javier Lapazaran-Izargain, Jaime Otero-García, Juan Francisco Prieto-Morín and Jesús Velasco-Gómez

Study of Subsidence on Aquifers Having Undergone Extraction and Inactive Cycles .................................................. 281
Rubén Martínez-Marín, Pablo Ezquerro-Martín, Juan Carlos Ibáñez-Carranza, Juan Gregorio Rejas-Ayuga and Maguel Marchamalo-Sacristán

Advanced InSAR Techniques to Support Landslide Monitoring .......................................................... 287
Fernando Bellotti, Marco Bianchi, Davide Colombo, Alessandro Ferretti and Andrea Tamburini

Part XI Geographic Information Systems/Geoinformatics

Estimation of Information Loss When Masking Conditional Dependence and Categorizing Continuous Data: Further Experiments on a Database for Spatial Prediction Modelling in Northern Italy ........................................... 291
Andrea G. Fabbri, Simone Poli, Antonio Patera, Angelo Cavallin and Chang-Jo Chung

3D-GIS Analysis for Mineral Resources Exploration in Luanchuan, China ................................................ 295
Gongwen Wang, Shouting Zhang, Changhai Yan, Yaowu Song, Jianan Qu, Yanyan Zhu and Dong Li

Animation of Groundwater Flow with STRING ........................................ 299
Isabel Ostermann and Torsten Seidel
SHEE Program, a Tool for the Display, Analysis and Interpretation of Hydrological Processes in Watersheds .......... 303
Jesús Mateo Lázaro, José Ángel Sánchez Navarro, Alejandro García Gil and Vanesa Edo Romero

Mathematical Methods of the Data Analysis in a Prospecting Database for Geological Mapping ................. 309
Oleg Mironov

Geoprocessing Tool Regenerat: Characterization of Mineral Resource Quality of Renewable Sediment Deposits .......... 315
Heinz Reitner, Sebastian Pfleiderer, Maria Heinrich, Irena Lipiarska, Piotr Lipiarski, Julia Rabeder, Thomas Untersweg and Ingeborg Wimmer-Frey

Spatiotemporal Data Model for Multi-factor Geological Process Analysis with Case Study .......... 319
Gang Liu, Xiang Que, Xiaonan Hu, Shanjun Tian and Jiacheng Zhu

Use of Variational Methods in Geological Mapping ............... 325
Andrey N. Sidorov, Andrey G. Plavnik, Andrei A. Sidorov and Michail S. Shutov

Comparison of Methods for Depth to Groundwater Calculation in Hard Rock Areas ....................... 329
Ronny Laehne, Dorothee Altenstein and Wolfgang Gossel

Part XII Quantitative Methods in Geomorphology and Land Surface Processes

Line-Geometry-Based Inverse Distance Weighted Interpolation (L-IDW): Geoscientific Case Studies .......... 333
Wolfgang Gossel and Michael Falkenhagen

Two-Dimensional Hydraulic Modeling and Analysis of Morphological Changes in the Palancia River (Spain) During a Severe Flood Event on October 2000 .......... 339
Beatriz Nácher-Rodríguez, Ignacio Andrés-Doménech, Carles Sanchis-Ibor, Francisca Segura-Beltrán, Francisco J. Vallés-Morán and Eduardo Albentosa Hernández
Stream Length-Gradient Index Mapping as a Tool for Landslides Identification .................................. 343
Jorge Pedro Galve, Daniela Piacentini, Francesco Troiani and Marta Della Seta

Quantitative Method on Historical Reconstruction of Coastal Geomorphological Change on Wave-Dominated Coast: A Case Study of the Pomeranian Bay, Southern Baltic Sea ............. 347
Junjie Deng, Jan Harff and Joanna Dudzinska-Nowak

Linfo: A Visual Basic Program for Analysis of Spatial Properties of Lineaments .................................. 351
A. C. Dinesh, Vipin Joseph Markose and K. S. Jayappa

Numerical Karst: Spatio-temporal Modelling of Karst Aquifer Systems ........................................ 355
Eulogio Pardo-Igúzquiza, Sergio Martos, Juan Antonio Luque, Juan José Durán, Carolina Guardiola-Alberto and Pedro Robledo

Surface Insights of Structural Relief Distribution Within the Madrid Cenozoic Basin from Fluvial and Terrain Morphometric Index ..................................... 359
Julio Garrote and Guillermina Garzón

Part XIII Deformation Modeling, Geodynamics and Natural Hazards

Reinterpretation of Teide 2004–2005 Gravity Changes by 3D Line Segments Approximation .......................... 363
Peter Vajda, Ilya Prutkin and Jo Gottsmann

An Update GPS Velocity and Strain Rate Fields for the Iberian Region .................................................. 369
Mimmo Palano, Pablo J. González and José Fernández

The 2012 Kilauea Volcano, Hawai‘i, Slow-Slip Event Captured by cGPS and Satellite Radar Interferometry ................................. 373
Pablo J. González, Sergey V. Samsonov and Mimmo Palano

Spatiotemporal Analysis of Ground Deformation at Campi Flegrei and Mt Vesuvius, Italy, Observed by Envisat and Radarsat-2 InSAR During 2003–2013 ........................... 377
Sergey V. Samsonov, Pablo J. González, Kristy F. Tiampo, Antonio G. Camacho and José Fernández
Anthropogenic and Natural Ground Deformation Near Bologna, Italy Observed by Radarsat-2 InSAR During 2008–2013
Sergey V. Samsonov, Pablo J. González and Kristy F. Tiampo

Surface Displacements, Deformations and Gravity Changes Due to Underground Heat Source
Ladislav Brimich and Igor Kohut

Polarization Persistent Scatterer InSAR Analysis on the Hayward Fault, CA, 2008–2011
Kristy F. Tiampo, Pablo J. González and Sergey S. Samsonov

Earth Models at the Low Andarax River Valley (SE Spain) by Means of Cross-Correlation of Ambient Noise
Abigail Jiménez, Antonio García-Jerez, Enrique Carmona, Francisco Sánchez-Martos and Francisco Luzón

Some Insights About Volcano Deformation Interpretation
María Charco and Pedro Galán del Sastre

Part XIV Hydrogeology: From Process Understanding to Improved Predictions

Ensemble Kalman Filter Assimilation of Transient Groundwater Flow Data: Stochastic Moment Solution Versus Traditional Monte Carlo Approach
Marco Panzeri, Monica Riva, Alberto Guadagnini and Shlomo P. Neuman

New Analytical Solutions for Phreatic Darcian Flows Over Non-Planar Bedrocks
Anvar Kacimov, Yurii Obnosov and Osman Abdalla

When Steady-State is Not Enough
J. Jaime Gómez-Hernández, Teng Xu, Haiyan Zhou and Liangping Li

Hydrogeological and Thermal Modelling of an Underground Mining Reservoir
Clara Andrés Arias, Almudena Ordóñez Alonso and Rodrigo Álvarez García
Effect of Entrapped Gas Below the Phreatic Surface on Pressure Propagation and Soil Deformation ........................................... 425
Héctor Montenegro, Oliver Stelzer and Bernhard Odenwald

Time Series Analysis of Groundwater Hydrographs: Case Study From a Hardrock Area ........................................... 431
Wolfgang Gossel and Ronny Laehne

Coupled Hydrogeophysical Simulation of a Pumping Test in an Unconfined Aquifer and its Associated Gravimetric Anomaly .... 435
Andrés González-Quirós and José Paulino Fernández-Álvarez

Oscar David Álvarez-Villa, Eduardo Cassiraga and Andrés Sahuquillo

Rational Lanczos Reduction of Groundwater Flow Models to Perform Efficient Simulations of Surface-Ground Water Interaction in Conjunctive Use Systems ........................................... 443
Oscar David Álvarez-Villa, Eduardo Cassiraga and Andrés Sahuquillo

Efficient Generation of Effective Modes and Spectral Masks to Build Reduced Groundwater Flow Models Using the Eigenvalue Method with Selective Compression and Modal Masking ........................................... 447
Oscar David Álvarez-Villa, Eduardo Cassiraga and Andrés Sahuquillo

Application of Eigenvalue Method with Selective Compression and Modal Masking and Rational Lanczos Reduction Method to the Efficient Simulation of Surface–Ground Water Interactions in Heterogeneous Aquifers ........................................... 451
Oscar David Álvarez-Villa, Eduardo Cassiraga and Andrés Sahuquillo

A Multipoint Flux Domain Decomposition Method for Transient Flow Modeling in Complex Porous Media ................. 457
Andrés Arrarás, Laura Portero and Ivan Yotov

Optimal Reconstruction of 3D Fracture Networks (FEBEX Field Test, Grimsel Site, Swiss Alps) ................................... 463
Israel Cañamón, Rachid Ababou and F. Javier Elorza
Part XV  Quantitative Hydrology: Working Across Scientific Disciplines and Time-space Scales

Numerical Analysis of Stream–Groundwater Exchange in a Floodplain Following a Dike Opening .......................... 467
Héctor Montenegro

Models of Parallel Linear Reservoirs (PLR) with Watershed Traversal Algorithm (WTA) in Behaviour Research of Hydrological Processes in Catchments .......................... 471
Jesús Mateo Lázaro, José Ángel Sánchez Navarro, Vanesa Edo Romero and Alejandro García Gil

An Analytical Solution of Tide-Induced Head Fluctuations in an Inhomogeneous Coastal Aquifer .......................... 475
Luis Guarracino and Leonardo Monachesi

Mapping of Flood-Plain by Processing of Elevation Data from Remote Sensing ............................................. 481
Viviana Aguilar Muñoz and Márcio de Morisson Valeriano

Effect of Spatial Heterogeneity on Rate of Sedimentary O2 Consumption Reaction ............................. 485
Tanushree Dutta and Simonetta Rubol

Optimal Development of Regional Rain Network Using Entropy and Geostatistics ............................. 491
Hadi Mahmoudi-Meimand, Sara Nazif and Hasan-Ali Faraji-Sabokbar

Part XVI  Quantitative Environmental Geology

Application of Drastic Methodology for Evaluation of Guarani Aquifer Vulnerability: Study Case in Ribeirão Bonito, SP, Brazil .... 497
Rafael Gonçalves Santos, Mara Lúcia Marques, Gabriela Trigo Ferreira and José Ricardo Sturaro

A Case Study of Geometric Modelling via 3-D Point Interpolation for the Bathymetry of the Rabasa Lakes (Alicante, Spain) .... 503
África de la Hera, Enrique López-Pamo, Esther Santofimia, Guillermo Gallego, Raquel Morales, Juan José Durán-Valsero and José Manuel Murillo-Díaz
Analysis of Groundwater Monitoring Data Sets with Non-Detect Observations: Application to the Plana de Sagunto (Valencia, Spain) Groundwater Body .......................... 507
Juan Grima, Juan Antonio Luque-Espinar, Juan Ángel Mejía-Gómez and Ramiro Rodríguez

The Mesh Optimization of the Environmental Investigation Applied to the Diagnosis of the Quality of the Basement (Algerian Experience) .......................... 513
Abderrahim Gheris

Data Archives: Development and Application in Environmental Management .................................. 517
Konstantin Alexeev

Ecological Remediation Volume (ERV) in Coastal Aquifers Affected by Seawater Intrusion. Methodology and Application in the Oropesa-Torreblanca Plain (Spain) ........................................ 521
Arianna Renau-Pruñonosa, Ignacio Morell, David Pulido and Jorge Mateu

A Radon Risk Map of Germany Based on the Geogenic Radon Potential ........................................ 527
Peter Bossew

Quantitative Risk Management of Groundwater Contamination by Nitrates Using Indicator Geostatistics ........................................ 533
Mario Chica-Olmo, Eulogio Pardo-Igúzquiza, Juan Antonio Luque-Espinar, Víctor Rodríguez-Galiano and Lucía Chica-Rivas

Geologically Constrained Groundwater Monitoring Network Optimization in Halle (Germany): A Case Study with Saltwater Intrusion Along a Fault System .......................... 537
Thomas Horschig, Ronny Lähne, Michael Falkenhagen and Wolfgang Gossel

Informative Trace-Element Features of Cassiterite from Tin Mineralized Zones and Breccias in the Russian Far East: Application of Logic-Informational Analysis ............... 541
Nina Gorelikova, Irina Chizhova and Filipp Balashov

A Spatial Statistical Approach for Sedimentary Gold Exploration: A Portuguese Case Study .......................... 545
Pierre Goovaerts, Teresa Albuquerque and Margarida Antunes
Contents

Part XVII Modeling of Energy Resources

Coalbed Methane Production Analysis and Filter Simulation for Quantifying Gas Drainage from Coal Seams .................. 549
C. Özgen Karacan and Ricardo A. Olea

The Relationship Between Skin and Apparent Wellbore Radius in Fractal Drainage Areas ........................................ 553
Tom Aage Jelmert

Parameterization of Channelized Training Images: A Novel Approach for Multiple-Point Simulations of Fluvial Reservoirs ...... 557
Mohamed M. Fadlelmula, Serhat Akin and Sebnem Duzgun

George Galanis, George Emmanouil, Christina Kalogerieri and George Kallos

Geostatistical AVO Direct Facies Inversion ................................. 565
Leonardo Azevedo, Pedro Correia, Rúben Nunes and Amílcar Soares

Optimized History Matching with Stochastic Image Transforming of a Deltaic Reservoir ............................................. 571
Maria Helena Caeiro, Amilcar Soares, Vasily Demyanov and Mike Christie

Conditioning 3D Object Based Models to a Large Number of Wells: A Channel Example .................................................. 575
Jeff B. Boisvert and Michael J. Pyrcz

Modeling Channel Forms Using a Boundary Representation Based on Non-uniform Rational B-Splines .............................. 581
Jeremy Ruiu, Guillaume Caumon, Sophie Viseur and Christophe Antoine

Moving Away from Distance Classifications as Measures of Resource Uncertainty ......................................................... 585
Ricardo A. Olea, James A. Luppens and Susan J. Tewalt

Part XVIII New Developments in Oil and Gas Discovery Modeling

Reliability Analysis of Least Squares Estimation and Prediction of a Non-parametric Discovery Process Model .................. 589
Mi Shi-yun and Zhang Qian
Application and Comparison of Discovery Model
and Others in Petroleum Resource Assessment ................. 595
Guo Qiu-Lin, Yan Wei and Chen Zhuo-Heng

Handling Seismic Anomalies in Multiple Segment Prospects
with Graphical Models ........................................... 601
Gabriele Martinelli, Charles Stabell and Espen Langlie

The North American Shale Resource: Characterization
of Spatial and Temporal Variation in Productivity ............. 607
Qudsia Ejaz and Francis O’Sullivan

A Pyramid Scheme: Integrating Petroleum Systems Analysis
into Probabilistic Petroleum Resource Assessments ............. 613
Kirk G. Osadetz and Zhuoheng Chen

Application of a Least Square Non-parametric Discovery
Process Model to Colorado Group Mixed Conventional
and Unconventional Oil Plays, Western Canada
Sedimentary Basin .................................................. 617
Zhuoheng Chen, Kirk G. Osadetz and Gemai Chen

A Further Investigation of Local Nonparametric Estimation
Techniques in Shale Gas Resource Assessment ................. 621
Emil D. Attanasi, Timothy C. Coburn and Philip A. Freeman

Part XIX Open Session on Mathematics of Oil Recovery (OSMOR)

Fractal Analysis of AVO Seismic Attributes for Oil/Water
Contact Identification ............................................. 625
Sid-Ali Ouadfeul and Leila Aliouane

Upscaling on Anelastic Vertically Heterogeneous Reservoirs .... 629
Alexey Stovas

Lithofacies Prediction from Well-Logs Data Using Hybrid
Neural Network Model: A Case Study from Algerian Sahara .... 633
Sid-Ali Ouadfeul and Leila Aliouane

Stochastic Simulation of the Morphology of Fluvial Sand
Channel Reservoirs ................................................. 639
Alexandra Kuznetsova, José A. Almeida and Paulo Legoinha
Sorting Reservoir Models According to Flow Criteria: A Methodology, Using Fast Marching Methods and Multi-Dimensional Scaling ............................. 643
Gaétan Bardy and Pierre Biver

Integrate Facies Clustering Feature Information in Reservoir Modeling .................................... 647
Yupeng Li and Lihui Geng

Permeability Prediction Using Artificial Neural Networks. A Comparative Study Between Back Propagation and Levenberg–Marquardt Learning Algorithms ................ 653
Leila Aliouane, Sid-Ali Ouadfeul, Noureddine Djarfour and Amar Boudella

A Method for Multi-Level Probabilistic History Matching and Production Forecasting: Application in a Major Middle East Carbonate Reservoir ........................... 659
Marko Maučec, Ajay Singh, Gustavo Carvajal, Seyed Mirzadeh, Steven Knabe, Richard Chambers, Genbao Shi, Ahmad Al-Jasmi, Harish Kumar Goel and Hossam El-Din

Causal Analysis and Data Mining of Well Stimulation Data Using Classification and Regression Tree with Enhancements ......... 665
Srimoyee Bhattacharya, Marko Maučec, Jeffrey Yarus, Dwight Fulton, Jon Orth and Ajay Singh

Seismic Data Interpretation Improvement by the Multiscale Analysis of Gravity Data Using the Wavelet Transform: Application to Algerian Sahara ................................. 669
Sid-Ali Ouadfeul and Leila Aliouane

Part XX Geostatistical Priors in Inversion of Geophysical and Engineering Data

History Matching of Channelized Reservoir Using Ensemble Smoother with Clustered Covariance ............................. 675
Kyungbook Lee and Jonggeun Choe

Assessing the Probability of Training Image-Based Geological Scenarios Using Geophysical Data ............................. 679
Thomas Hermans, Jef Caers and Frédéric Nguyen
Reservoir Modeling Combining Geostatistics with Markov Chain Monte Carlo Inversion ........................................... 683
Andrea Zunino, Katrine Lange, Yulia Melnikova,
Thomas Mejer Hansen and Klaus Mosegaard

Geostatistical Inversion of 3D Post-stack Seismic and Well Data for the Characterization of Acoustic Impedance in Oil Fields ........ 689
Fernando Alves, José A. Almeida and António Ferreira

The Effect of the Noise and the Regularization in Inverse Problems: Geophysical Implications ............................................. 695
José Luis García Pallero, Juan Luis Fernández-Martínez,
Zulima Fernández-Muñiz and Luis Mariano Pedruelo-González

A Generalized Local Gradual Deformation Method for History Matching ................................................................. 699
Benjamin Marteau, Didier Yu Ding and Laurent Dumas

History Matching with Geostatistical Prior: A Smooth Formulation .............................................................. 703
Yulia Melnikova, Katrine Lange, Andrea Zunino, Knud Skou Cordua and Klaus Mosegaard

Part XXI Mineral and Energy Resources for Planet Earth: Evaluations, Extraction and Optimal Management

Factor Analysis for Metal Grade Exploration at Pallancata Vein in Peru ............................................................... 709
Jorge E. Gamarra-Urrunaga, Ricardo Castroviejo and Jesús Domínguez

Compositional Block Cokriging .................................................. 713
Raimon Tolosana-Delgado, Ute Mueller, K. Gerald van den Boogaart and Clint Ward

Milling Result Prediction .......................................................... 717
Stephen Matos Camacho, Thomas Leißner, Petya Atanasova,
Andre Kampner, Martin Rudolph, Urs Alaxander Peuker and K. Gerald van den Boogaart

A Geostatistical Study of Tertiary Coal Fields in Turkey ............ 723
Fırat Atalay, A. Erhan Tercan, Bahtiyar Ünver, Mehmet Ali Hindistan and Güneş Ertunç
**Placer Deposit: From Modeling to Evaluation** ............................................. 727
Nikolay Laverov, Irina Chizhova and Elena Matveeva

**Uncertainty Assessment of the Orebodies Geometry**
**by Using Block Indicator Simulation** ...................................................... 731
Julia Carvalho, Pedro Correia, Sofia Menezes, Cláudia Peixoto
and Amilcar Soares

**Part XXII Recent Advances in Quantitative Methods Applied to Stratigraphy and Paleontology**

**“Horse-Shoe” Cu-Au Porphyry O orebody Modeling Based on Blasthole Data Using Unfolding Technique** ......................................................... 735
Mohamad Nur Heriawan, Loya Jirga and Anton Perdana

**A New Mathematical Approach to Model Trophic Dynamics of Mammalian Palaeocommunities. The Case of Atapuerca-TD6** ................. 739
Guillermo Rodríguez-Gómez, Jesús A. Martín-González,
Idoia Goikoetxea, Ana Mateos and Jesús Rodríguez

**Multifractals and Capacity Dimension as Measures of Disturbance Patch Dynamics in Daedalus Ichnofabrics** ................................................. 747
Carlos Neto de Carvalho and Andrea Baucon

**Part XXIII Geo-mathematical Models of Folds and Folding**

**Non-Linear Thermo-Mechanics of Folding in Geomaterials** .............. 753
Martin K. Paesold, Ali Karrech, Tim Dodwell,
Klaus Regenauer-Lieb, Andrew P. Bassom, Alison Ord
and Bruce E. Hobbs

**Analytical and Numerical Investigation of 3D Multilayer Detachment Folding** .............................................................. 757
Naiara Fernández and Boris Kaus

**Mechanics of Fold Development in Pure- and Simple Shear** .......... 763
Maria-Gema Llorens, Paul D. Bons, Albert Griera
and Enrique Gomez-Rivas

**Stochastic Modelling of the 3D Geometry of a Faulted and Folded Deep Carbonate Aquifer: Loma de Úbeda (Southern Spain)** ........ 767
Javier Heredia, Eulogio Pardo-Igúzquiza and Antonio González-Ramón
3D Geometry of an Active Shale-Cored Anticline in the Western South Caspian Basin
Idaira Santos-Betancor, Juan Ignacio Soto, Lidia Lonergan, Ismael Sánchez-Borrego and Carlos Macellari

Gravity-Instabilities Processes and Mass-Transport Complexes During Folding: The Case of a Shale-Cored Anticline in the Western South Caspian Basin
Idaira Santos-Betancor, Juan Ignacio Soto, Lidia Lonergan and Carlos Macellari

Part XXIV Mathematical Geosciences and Planetary Geology

Domaining Bi-modal Data Sets Geostatistically Using a Directional Neighborhood Search
Steffen Brammer

FRISER-IRMIX Database: A Web-based Support System with Implications in Planetary Mineralogical Studies, Ground Temperature Measurements and Astrobiology
Jesús Martínez-Frias, María Serrano Rubio, F. Javier Martín-Torres, María Paz Zorzano, José A. Rodríguez-Manfredi, Javier Gómez-Elvira and REMS Team

Spectral Analysis for Anomaly Detection in the Central Volcanic Range, Costa Rica. Implications for Planetary Geology
Juan Gregario Rejas, Ruben Martínez, Miguel Marchamalo, Javier Bonatti and Jesús Martínez-Frias

A Mathematical Algorithm to Simulate the Growth and Transformation of Framboidal Pyrite: Characterization of the Biogenic Influence in Their Size Distributions
Raúl Merinero Palomares, Rosario Lunar Hernández, Francisco-Javier González-Sanz, Luis Somoza Losada and Jesús Martínez-Frias

Computational Models and Simulations of Meteor Impacts as Tools for Analysing and Evaluating Management of Crisis Scenarios
Jesús Martínez-Frias and Alain Leppinette Malvite
In-situ Raman Analysis of the Precipitation Sequence of Sulphate Minerals Using Small Droplets: Application to Rio Tinto (Spain) ................................. 801
Fernando Rull, Francisco Sobrón, Julia Guerrero, Jesús Medina, Gloria Venegas, Fernando Gázquez and Jesús Martínez-Frías

Part XXV Mathematics of Planet Earth

Signal Analysis by Means of Multi-Scale Methods .............................. 807
Christian Blick

Modeling and Simulation of Forest Fire Spreading ......................... 811
Sarah Eberle

The Finite Pointset Method (FPM) and an Application in Soil Mechanics ......................................................... 815
Jörg Kuhnert and Isabel Ostermann

Geostatistical Estimation of the Crustal Thickness Inferred from the Geometry of Monogenetic Volcanoes (Central Mexico Case) ......................... 819
Raúl Pérez-López, Carolina Guardiola-Albert and José Luis Macias

Mathematical Modelling of Geochemical Processes Applied to Cenozoic Iberian Volcanics: A Review ......................... 823
Raúl Benito and Jesús Martínez-Frías

Part XXVI Geoscience Data Models for Practical Interoperability

Management of Geological Field Data: The Open Solution MO2GEO FieldModule ......................................................... 827
Lars Schimpf and Wolfgang Gossel

Swiss Data Models for Geology: from 2D Data Towards Geological 3D Models ................................................................. 831
Cristina Salomè Michael, Nils Oesterling, Stefan Strasky and Roland Baumberger

Virtual Collaboration of Geoscientists of Russian Academy of Sciences in the Far East of Russia ......................................................... 835
Vera V. Naumova, Mike I. Patuk and Valentin V. Nichepkov
Geological 3D Modeling (Processes) and Future Needs for 3D Data and Model Storage at Geological Survey of Finland

Eevaliisa Laine

---

Part XXVII Advances on Stochastic Non Linear Methods and Inverse Problems for Dynamic Models

Estimation of Parameters in Random Dynamical Systems
Silke Konsulke, K. Gerard van den Boogaart, Fellix Ballani, Markus Franke and Martin Sauke

Nonlinear Estimation with Gaussian Kriging and Riemann Sums
K. Daniel Khan

Modeling Trace Element Concentration in Vertical Regolith Profile Over Mineral Deposits
Qiuming Cheng

Unified Principles for Nonlinear Nonstationary Random Fields in Stochastic Geosciences
José A. Vargas-Guzmán
Mathematics of Planet Earth
Proceedings of the 15th Annual Conference of the
International Association for Mathematical Geosciences
Moreno-Merino, L.; Durán, J.J.; Vargas-Guzmán, J.A.
(Eds.)
2014, XXXVI, 861 p. 368 illus., 311 illus. in color. With
online files/update., Hardcover
ISBN: 978-3-642-32407-9