FIMI-MPGI

Geostatistical Training & Consulting - Commercial Policy Jan 2009

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Consultants Fees
(applied hourly based on 8hr per day)

Senior/Specialised Consultant US$1000 per day
Course Synopsis (US $20000) 4 Weeks (Monday to Friday)

This course will cover basic theoretical and practical understanding concepts in geostatsitics and application to petroleum reservoir characterization using a variety of data such as core data, log data, 3D Seismic, production history etc. This course will introduce hands-on sessions for solving practical field problems using ISATIS or GSLIB Software. Many oil industries have started realizing the overall benefit of this technology recently. It is an introductory course with emphasis on the principles and practice of integrated studies and uncertainty analysis.

Statistical and geostatistical methodologies are increasingly being utilized in petroleum industries to quantify and measure geological and geophysical properties. A 3 day course is designed to provide integrated approach of spatial data analysis, spatial correlation with seismic data together with 3 D geostatistical modeling and reservoir simulation for the natural resources without entering into mathematical details. An optimizing oil recovery from limited and sparse well is critical and requires good understanding of geostatistical methodologies to establish and quantify spatial correlation between wells with help of seismic data. How to integrate all information from exploration phase (geological, seismic and sparse well data) and exploitation phase (production, well test and tracer data) is critical and challenging to geoscientists. Due to recent advances in geostatistical and computational power, one can apply the geostatistical tools with easily available public domain software to perform advanced 3D geostatistical modeling to optimize hydrocarbon resources. The course will focus on concepts and methods to manage resource risk in order to improve critical business decision. Time will be allocated in each day in the last house for participant questions and discussions. The course will cover geostatistical interpolation (kriging, etc.), heterogeneity modeling, uncertainty quantification (simulation, etc.), and data integration (cokriging, external drift, geostatistical inversion, etc.). A number of case studies are presented, covering examples from various parts of the world.

4 Weeks Course will comprise

- Introduction to Geostatistics for Oil & Gas,
- Advanced Geostatistics for the Oil & Gas Industry,
- Assessing Volumetric Uncertainties with the Simulations,
- Geostatistical Gridding for the Oil & Gas Industry,
- Geostatistical Simulations for Reservoir Characterization,
- Improving Seismic Data Quality with Geostatistics,
- ISATIS Essentials for Oil & Gas,
- Practising Geostatistical Simulations for Assessing Uncertainties,
- Time to Depth Conversion: The Geostatistical Approach.

WHO SHOULD ATTEND

Reservoir engineers, geophysicists, geologists, mining engineers. geoscientists and others involved in reservoir modeling of lithofacies, porosity and permeability and reservoir management.

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COURSE LEADER

Mr Suresh Tripathi is the CEO of Federation of Indian Mineral Industries - Mining and Petroleum Geostatistics India (MPGI) division based in New Delhi, India. He is an expert and professional senior geostatistician with more than 15 years of working experience in the field of statistics, geostatistics, geographic information system (GIS), conditional simulation, risk assessment & evaluation and reserve estimation in various industries.

He holds double master degrees in Statistics from BHU (India) and Geostatistics from ECU, Australia. After completing his master degrees in the area of geostatistics, he started his geostatistics career at Geoval Australia (Australia's Geostatistical Expert) as a trainee where he learnt geostatistical application to mining data using ISATIS software. After trainee he has worked as a consultant geostatistician for Delta Gold Lt (Australia) in the year 1998 based in Perth, Australia. In the last fifteen years, he has seen an emergence of a wealth of new geostatistical, conditional simulation and probabilistic methods (stochastic methods) applied to various sectors. Most of the courses taught can be also customized according to client requirement.

- Delta Gold Ltd, Western Australia
- Vulcan, Perth Australia
- Gemcom Perth Australia
- Department of Primary Industries, Bendigo, VIC, Ausrtalia
- Global Mining Services, Perth Australia
- Datamine International New Delhi India
- Federation of Indian Mineral Industries New Delhi India
- Indian Institute of coal management, Ranchi, India
- Associated Cement Ltd, Mumbai, India
- Hindustan Zinc Limited, India
- Rajasthan State Mines & Minerals Ltd, India.
- Hindustan Copper Limited, India
- Country Fire Authority, Melbourne Australia

Introduction

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OBJECTIVE

- To present the basic concepts and methods of geostatistics (variograms, kriging, multivariate geostatistics, simulations). The course highlights hints and pitfalls in geostatistical data analysis.
- The objective is to go beyond standard applications of geostatistics. This course presents advanced geostatistics applications such as:
- quality control and filtering of seismic attributes,
- uncertainty quantification on reservoir volumes through the stochastic simulations,
- facies simulations, ISATIS batch capabilities.
- Stochastic simulation, when characterising uncertainties in oil & gas volumetric estimates.
- Highlights the practice of the geostatistical analysis and how it provides satisfactory solutions for applications such as geological or property mapping.
- Provide an in-depth review of stochastic modeling methods for simulating geological facies.
- Present the added value of geostatistics for processing seismic data: data QC and filtering, seismic surveys merging, time lapse analysis of 4D seismic.
- the quality control of seismic data

KEY FEATURES

The capabilities of geostatistics to handle petroleum data characterised by their heterogeneous nature are particularly illustrated: integration of wells and seismic data, processing of data in presence of faults. Improve the use of ISATIS geostatistics software solution through various applications. The course emphasises the optimal use of wells and seismic data for generating a distribution of expected volumes and hydrocarbon reserves.

Week 1

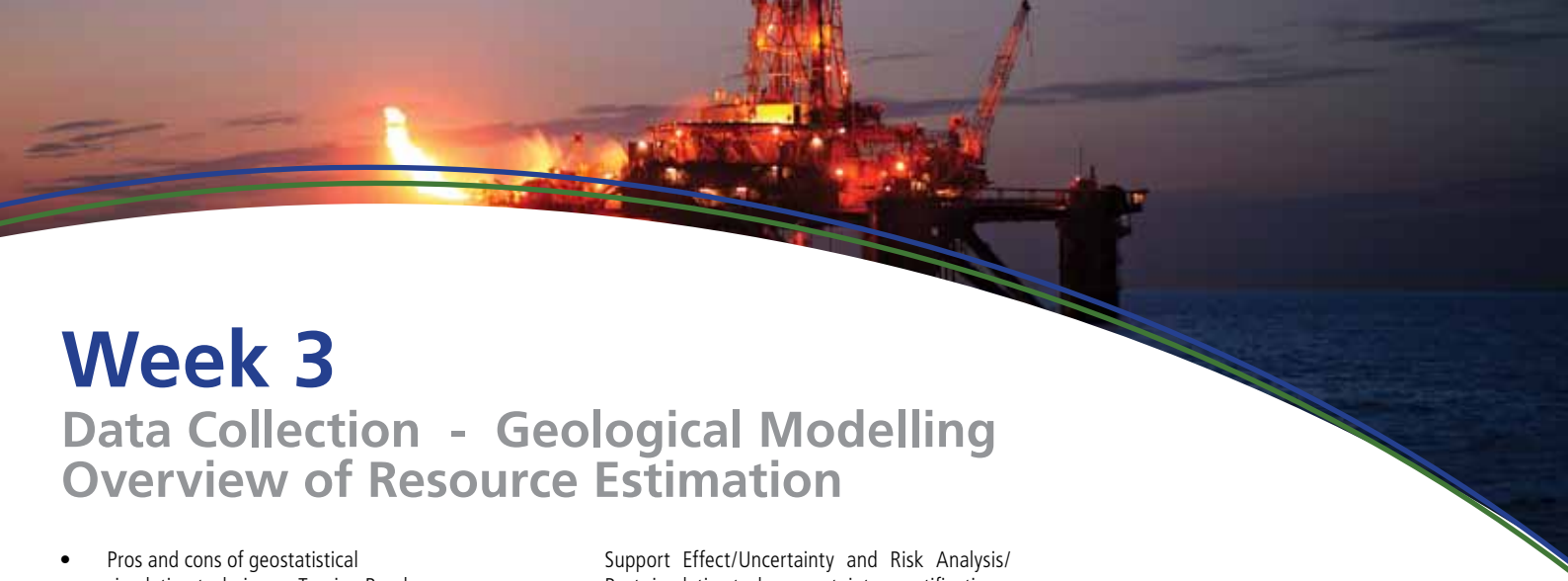
Data Collection - Modelling, Overview of Reserve Estimation

- Exchanging data with other software: loading data into the database.
- Data management inside Isatis.
- Classical statistics and Exploratory Data Analysis. Presentation of the concepts and tools around which Isatis is organised: User Interface, types of data manipulated and organisation of the database, graphical capabilities, HTML on-line manual, batch capabilities.
- Review of basic geostatistics, Main concepts of geostatistics, the variogram as the fundamental geostatistical tool. Variogram modelling. Theory and practice of kriging. Specific kriging methods: with faults, inequalities, measurement errors, filtering.
- What is reservoir characterization and modeling?
- What is reservoir heterogeneity?/ Scales of heterogeneities What is geostatistics/ Why learn Geostatistics/probability plot, mapping of spatial data
- Data analysis, QC and Preparation/Data analysis and QC tools/Applications
- Regionalized variable, introduction of variogram, elementary Statistical Analysis / Data Cleaning
- Declustering for Representative Statistics
- Coordinate Transformation / Geometric Modeling
- Model the Spatial variability of a reservoir attributes using variogram. Stationarity and domaining.
- What is kriging?/Different types of kriging/ Applications and limitations of kriging Experimental covariogram/Experimental Variogram Estimation and concepts, properties/behavior at origin/omnidirectional variogram/horizontal and vertical variogram/ Interpretation and Modeling/Cross Variogram estimation and modeling /integrate data from alternate sources for reservoir parameters estimations/wells designing/Anisotropy, geometric and zonal anisotropy.
- Modelling: theoretical (mathematical) model of variogram, fitting models to experimental variogram geometric and zonal anisotropy/ anisotropic ellipse/Introduction to GSLIB: data file format, parameters files/ computation workshop about data statistical analysis. Indicator Variogram estimation and modeling, kriging weight, Computer Case Study

Week 2

Data Collection - Geological Modelling, Overview of Resource Estimation

- Ordinary Kriging, change of support, volum-variance relationship.
- Quantifying Uncertainty with Ordinary and Indicator Kriging
- Conditonal Simulation/Seqiuential approaches Cross Validation
- Introduction of GSLIB and computer case study
- Multivariate geostatistics and cokriging.
- Introduction to non stationary geostatistics.
- Overview of geostatistical simulations.
- Half of the course is dedicated to practical computer exercises, using Isatis in order to reinforce the previously presented theoretical notions.
- Filtering of 3D seismic



Week 3

Data Collection - Geological Modelling Overview of Resource Estimation

- Pros and cons of geostatistical simulation techniques: Turning Bands and Sequential Gaussian.
- Integration of Seismic data during the simulation process: External Drift Simulation and Collocated Cosimulation.
- Introduction of various simulation methods for continuous and categorical parameters
- Apply stochastic simulation algorithms used for modeling reservoir description/ Basic concepts, simulation methods, uncertainty, Simulation techniques: Gaussian and simulated annealing/ Sequential Indicator Simulation (SIS)
- Simulation with Multiple Variables/Change of Support Effect/Uncertainty and Risk Analysis/ Post simulation tasks: uncertainty quantifications, probability maps.
- Probabilistic techniques for measuring the uncertainty associated with the reservoir descriptions / Decision Making in Presence of Uncertainty/ Multidisciplinary Data Integration/ Computational workshop about simulation methods Introduction of GSLIB software
- How to account for uncertainties in the reservoir size and in petrophysical properties.
- Identification of optimistic, most - likely, and pessimistic scenarios.
- Overview of geostatistics and its main methods.
- Variographic analysis of porosity data.
- How the cross validation works to help in choosing the variogram model.
- The practice of kriging.
- Multivariate geostatistics and cokriging.
- Integration of wells and seismic data for time to depth conversion
- Comparison of collocated cokriging and kriging with external drift
- Doing more with geostatistics

Week 4

Data Collection - Geological Modelling Overview of Resource Estimation

- Confidence Intervals
- Monte-Carlo Methods – Simulation Optimization
- Risk Assessment/Optimization
- Applications and Introduction of GSLIB software.
- Computing experimental variograms and introduction to variogram modelling.
- Applying Ordinary Kriging.
- Introduction to simulations.
- Graphics and reporting.
- Exchanging data with other software: saving results outside of Isatis.
- The first day is focused on simulations of continuous parameters (reservoir structures and properties). The second day deals with facies simulations. Real data will be used to illustrate how simulations can be handled in volumetric calculations.
- Recalls on the basic geostatistics: exploratory data analysis, variography, kriging.
- The problematic of time to depth conversion: time interpretation, evaluation of the information on velocities and standard models.
- Multivariate geostatistical models: cross variograms, cokriging.

MATERIALS NEEDED

Participants must bring a scientific calculator and a ruler and are encouraged to bring a laptop computer with a spreadsheet program.

BENEFITS:

- Know when geostatistical tools applied to quantify the connectivity of reservoir lithofacies, porosity and permeability;
- Know and experience the utilization of the geostatistical software of Stanford University
- Practical expertise through computational workshops
- Make decisions on when and where to apply reservoir description and modeling to support reservoir management,
- Understand the methodology of integrated studies
- Select the appropriate reservoir description and geostatistical modeling tools
- Analyze and QC data for reservoir modeling,
- Understand variogram analysis, kriging and stochastic simulation, integrated studies, uncertainty analysis; and
- Recognize the limitations and opportunities for reservoir modeling.