

APPLIED PETROLEUM GEOSTATISTICS

16 - 20 January 2012 Kuala Lumpur, Malaysia



With Dr. Barrie Wells

He holds a B.Sc. in Mathematics and Statistics from the University of Bath, an M.Sc. from Cranfield Institute of Technology and a Ph.D. in Underground Stress Analysis from the University of Nottingham.

For the last 12 years he has managed an independent company in North Wales, with clients including 5 of the top 10 oil and gas exploration companies worldwide for services involving mathematical and statistical analysis.

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About this intensive 5 day training course

An appreciation of what geostatistics can achieve is now essential in nearly all important aspects of exploration and production: gridding and contouring for making maps, upscaling for reservoir simulation and basin modelling, as well as the analysis of spatially referenced data of all kinds. Without needing to know the details of the algorithms and the mathematics behind them, being able to choose the most appropriate techniques and apply them correctly is fundamental to best practice throughout E&P.

The course aims to provide knowledge of how to apply the various tools known as geostatistics, using both readily available software and more specialist packages.

Learning methods and tools

The emphasis is on practical application and understanding of context over a consideration of the mathematics. The course includes using software for worked exercises, which give a practical introduction to what is available as well as providing useful tools to take back to the workplace. All participants will be required to bring a laptop for this course.

Who should attend

Before attending the course it is expected that participants will have been working as a geologist, petrophysicist, geophysicist or engineer, following successful completion of at least an undergraduate course. Whilst no prior knowledge is assumed, even those with a basic knowledge of statistics and geostatistics will find the majority of the course content to be new, very useful and interesting.

The aim of the course is to relate techniques and tools to applications and tasks, so mathematical prowess is less of a pre-condition than is an open, enquiring mind and a desire to build better geological models. Petroleum geologists and other geoscientists preparing data for use in reservoir simulators; engineers involved with exploration and development of oil and gas reservoirs; anyone wishing to gain the best insight into and obtain the most value from their geo-spatial data.

Course content in summary:

- Examining the application of geostatistics, and how does it change our appreciation of familiar tasks and tools?
- How geostatistics aids in understanding trends in spatial data-sets:
 - Classical multivariate statistics
 - Conditional distributions
 - Direct simulations
 - Variogram analysis
 - Modelling anisotropy
- Understanding the effects of scale:
 - Heterogeneity and discontinuity
 - Data scale versus modelling scale
 - Upscaling for efficient modelling
- Allowing for spatial trends in gridding & contouring:
 - Honouring data or minimising errors
 - Using kriging to make better maps
- Making use of new data:
 - Bayesian and geo- statistics;
 - History matching
 - Sequential / Indicator simulation
- Quantifying uncertainty:
 - How geostatistics includes methods for uncertainty quantification
 - Using Monte Carlo and other stochastic simulations

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5 Day Course Plan

Overall goals: Establish why stochastic and geostatistical methods are useful in reservoir characterisation. Hence look at what tools and techniques can be used to construct models which better characterise uncertainty and which include more of the available geological knowledge, through information on spatial trends and continuity.

Day 1:

Establish why stochastic methods are useful in reservoir characterisation: by looking at what a reservoir model is, use this to plan which statistical ideas and methods we need to study. Distinguish between descriptive and predictive requirements: first, understand the data, and ensure it will support the analyses. Data: preparation, exploratory analysis. Statistical basics; use of basic tools for summarising and understanding data; use of basic tools for preparing data for further statistical analysis or for geological analysis.

At the end of the module you should:

- ❖ be able place the remainder of the course in a context of what is useful geologically
- ❖ be good at summarising large datasets and preparing them for further analyses
- ❖ be able to choose suitable techniques for analysis of data
- ❖ use everyday tools, such as Microsoft's Excel, to check data quality and undertake the basic statistical analyses
- ❖ prepare data, using such common tools, for input to specialist software.

Day 2

Use basic statistical tools for prediction. Characterise and measure uncertainty in predicted values. Understand distinctions among different ways of characterising and measuring confidence and uncertainty.

At the end of the module you should:

- ❖ understand what to do when inferring from incomplete data: e.g. knowing values at wells, predict what happens between
- ❖ know what to do when we cannot measure a parameter directly but have to predict from one we can measure
- ❖ be able to identify sources of error: confidence, variance, reliability
- ❖ be able to quantify the confidence in a prediction
- ❖ know the limitations of techniques and their software implementation.

Day 3

Introducing spatial awareness; quantifying trends, continuity and range of influence. Incorporating spatial awareness in maps. Looking at limitations of mapping and extensions of geostatistics to Sequential Simulation for better prediction of dynamic simulator variables. Direct ('object') versus indirect (semivariogram) incorporation of continuity in models.

At the end of the module you should:

- ❖ be able to choose suitable techniques for analysis of data
- ❖ understand the consequences (for output maps) of decisions made when modelling spatial variability
- ❖ know when to use stochastic and deterministic tools,
- ❖ appreciate the advantages of each of sequential simulation and kriging and how to combine the benefits of both.

Day 4

More advanced application of techniques introduced so far: multivariate analysis as an extension of bivariate analysis, multi-point statistics as an extension of Sequential Gaussian Simulation

At the end of the module you should:

- ❖ be familiar with the various options for simplifying large amounts of data, including seismic attributes and suites of logs;
- ❖ know how to work with data sets which have missing values;
- ❖ make the best use of incomplete data sets, including missing entire traces or mis-matched suites of logs;
- ❖ from large, complex data sets, choose the best subsets for making predictions.

Day 5

Other useful techniques and tools:

- ❖ Upscaling:
 - upscaling for reducing data density and
 - upscaling to account for support effects
- ❖ Making use of new data:
 - Bayesian statistics
 - History matching

Summary and integration using different types of simulation, including reservoir simulation and Monte Carlo simulation

At the end of the module you should:

Be able to use appropriately and efficiently all of the techniques covered in the course, in everyday work, and understand them well enough to relate geology and physics to theory.

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About your Expert Trainer: Barrie Wells



Barrie Wells holds a B.Sc. in Mathematics and Statistics from the University of Bath, an M.Sc. from Cranfield Institute of Technology and a Ph.D. in Underground Stress Analysis from the University of Nottingham, England. He has worked for government agencies and commercial organisations in Australia, North America and Europe, as well as acting as visiting lecturer in geostatistics at Nottingham University. For the last 12 years he has managed an independent company in North Wales, with clients including 5 of the top 10 oil and gas exploration companies worldwide for services involving mathematical and statistical analysis.

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16 – 20 January 2012, Kuala Lumpur, Malaysia	Early Bird Price	√	Normal Price	√	TEAM DISCOUNTS
5 – Day, Applied Petroleum Geostatistics	SGD\$ 4599		SGD\$ 4799		PetroEdge recognises the value of learning in teams. Group bookings at the same time from the same company receive the following: 3 or more at 5% off 5 or more at 7% off 8 or more at 10% off All other promotions including early bird is exclusive of the group discount.
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Mr Mrs Ms Dr Other

Telephone: _____

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