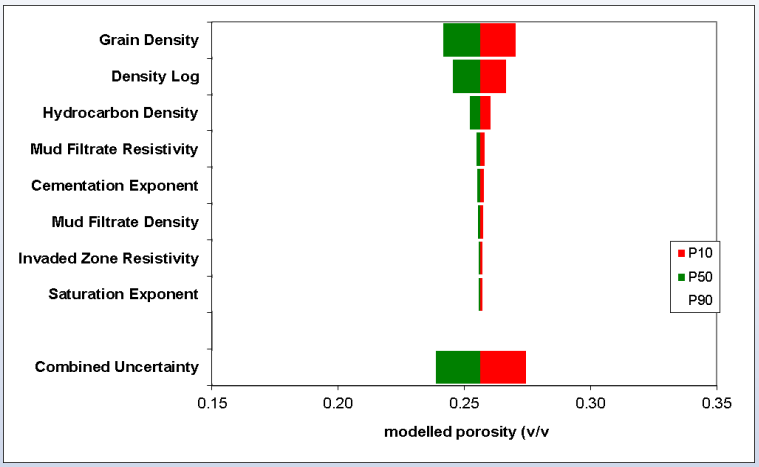
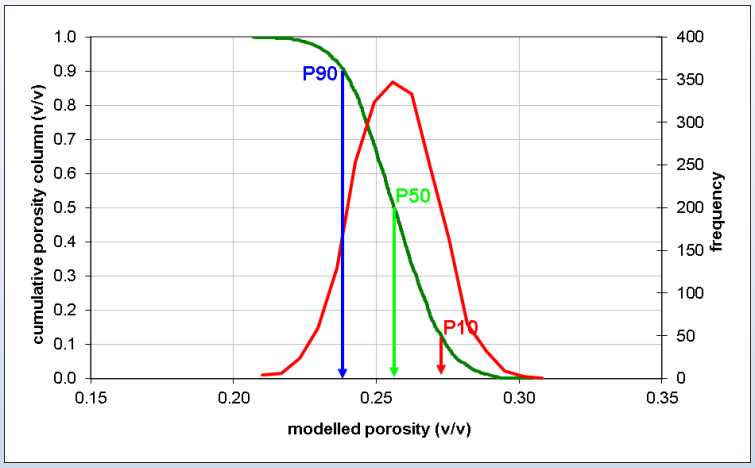
Short Course 1.10

The Petrophysicist Limited

Petrophysical Uncertainty Workshop





presented by Stephen Adams, The Petrophysicist Ltd.

HOW WELL DO I KNOW MY RESERVOIR PROPERTIES?

We acquire a large number of measurements during the drilling and logging operations. Petrophysicists interpret these data to estimate reservoir properties. Just how good are these estimates? And what uncertainties should be passed on to volumetric, static & dynamic modelling?

COURSE OBJECTIVES

This course will enable participants to quantify and understand the main causes of uncertainty in their reservoir properties. A number of different methodologies will be discussed, along with when it is appropriate to use each. How to combine uncertainties across wells and formation units will be covered.

Emphasis will be placed on methodologies which can be satisfactorily audited by external technical experts and joint venture partners. Participants are encouraged to share their own experiences on the course.

AUDIENCE

Petrophysicists, Geologists, Geophysicists, Reservoir & Production Engineers and others involved in formation evaluation and/or reservoir modelling are the most likely audience. In particular, people who work with petrophysically derived properties will find this course of considerable benefit . Reserves Auditors may also find this course beneficial.

SKILL PROPOSITION

Participants will develop hands-on skills in quantifying uncertainty in Petrophysical estimates. They will also know how to propagate those uncertainties into volumetric, static & dynamic models.

VALUE PROPOSITION

Knowing where the most significant uncertainties arise will enable study to focus on those items which can be better understood and actually have an impact on decision-making. Faster decisions should be made, along with more quantitively assessments of uncertainty.

COURSE PROGRAMME

The following programme outline describes a 1 day workshop covering theory and hands-on interpretation skills. Training will cover the subject by alternating between lecturing and exercises with real data from clastic and carbonate oil and gas reservoirs, worldwide. A training manual will be provided to facilitate learning and use of the techniques. The exercises are intended to reinforce the methodologies discussed. MS-Excel will be used for the exercises rather than dedicated Petrophysics software so that the participants understand which algorithms they should use and why. Attendees will be encouraged to take their spreadsheets with them to use in the future.

Attendees will also be prepared to discuss their own thoughts and examples in order to reach a combined view of the best way to implement uncertainty in a consistent and straightforward manner.

COURSE SYNPOSIS

Introduction: why does this matter? Some basic formulae and methodologies for combining uncertainties (analytical, comparative, stochastic). Uncertainties in the literature. Do-It-Yourself Monte-Carlo.

Part 1 – Contributions from Participants

Real World Examples: How some participants have managed uncertainty previously. What are users of Petrophysical Data expecting?

Part 2 – Measurement Uncertainty

Experimental Measurement: wireline measurements, core measurements, depth uncertainty.

Part 3 – Model Uncertainty

Impact of Equations: Equations used are "models". Models are imperfect, so what is the impact of different models?

Representative Data: How representative are these measurements, even if perfect? Impact of geological variation and determining likely variation.

Part 4 – Uncertainties in Derived Reservoir Properties

Reservoir Properties: porosity, permeability, water saturation. Dependencies in uncertainty. Estimating uncertainty.

Saturation-Height Uncertainty: Model and performance based. Drainage, imbibition & residual hydrocarbons. Contact uncertainty.

Part 5 – Uncertainties for Formations/Units, Volumetrics, Static & Dynamic Modelling

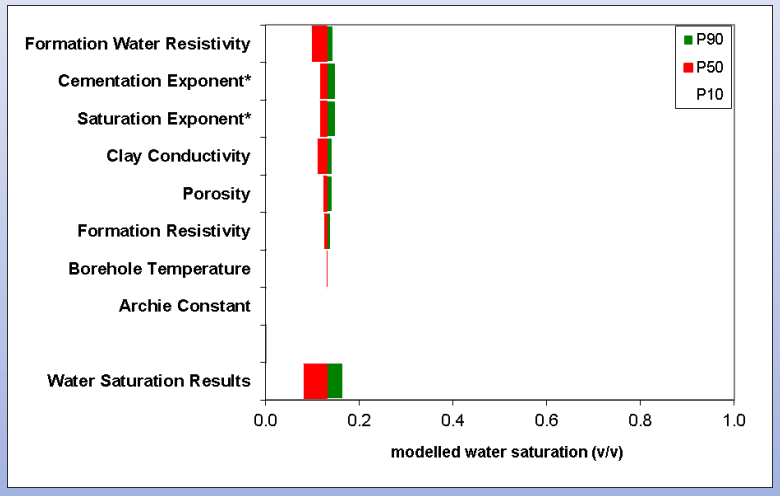
Efficient Uncertainty Estimation: Uncertainties for use in volumetrics & modelling. Put in perspective.

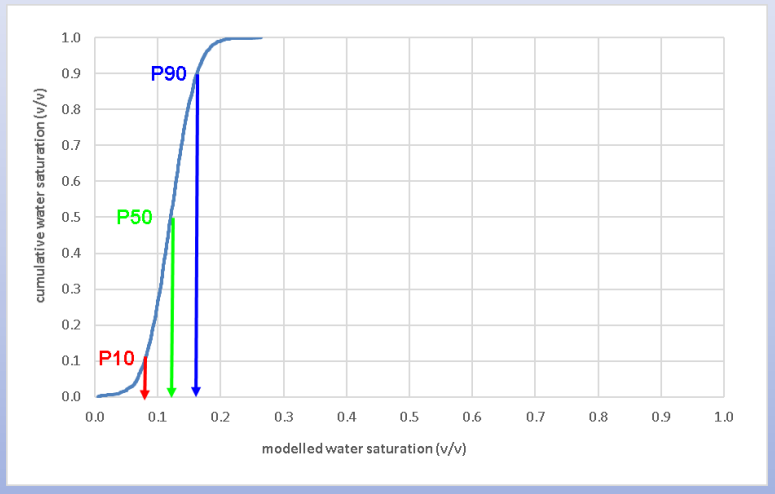
Combining Values: For averaging wells/units/Formations, how should uncertainties be combined?

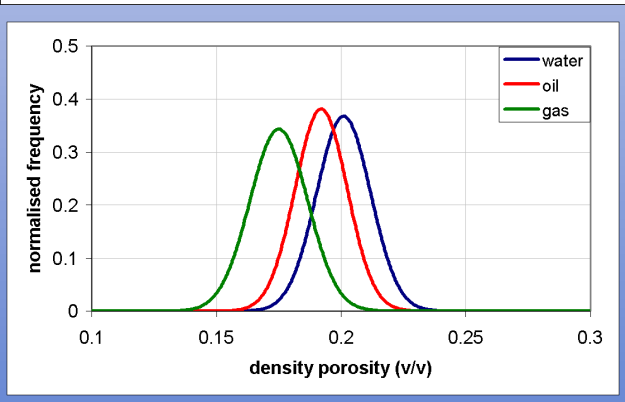
Implementation in Reservoir Modelling: What ranges to use and how to verify models are realistic?

Part 6 – Further Discussion

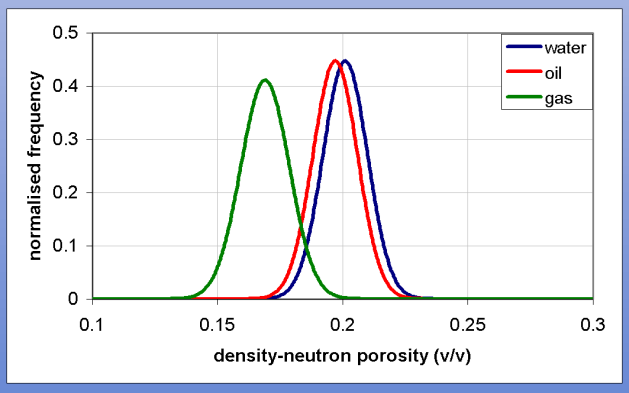
Real World Implementation: How will we do it? Recommended workflow.







Same density log in density only (LHS) and density-neutron (RHS) - different fluids assumed in the volume of investigation.



Stephen Adams

Steve has been a Petrophysicist since 1987. Following training and an initial 7 years with Shell, he has worked as an independent consultant with clients in Australasia, Asia, the Middle East and elsewhere. He has been providing petrophysically focussed training courses since 2001.

Steve has more than 19 papers published and is well known in the industry as a Specialist in Saturation-Height Modelling. His 2016 book "Saturation-Height Modelling for Reservoir Description" has been well received by the Industry.

During his career, Steve has had a great deal of exposure to some challenging problems involving capillary pressure in different lithologies. Much of this work has been "leading edge" in that similar cases have not been described in the literature previously. Some of these examples will be referred to in the training where the work has been published or permission has been otherwise received.

The Petrophysicist Limited
438 Urquhart Road, RD1 Karaka,
Auckland 2580, New Zealand
www.thepetrophysicist.com
Email: steve.adams@thepetrophysicist.com
+64.21.760.858 tel.

TPL Professional Development