

GEOMODELING:

A Team Effort to Better Understand Our Reservoirs

By Thomas Jerome, Reservoir Modeling Manager, RPS, Calgary, AB



INTRODUCTION

I'm a geologist by background and a reservoir modeling fanatic at heart.

My university in France is a center of excellence for reservoir modeling. It gave me the opportunity to specialize in this domain early in my career. It was about 15 years ago. Since 2008, and for the last seven years, I've practiced my art as a consultant in Calgary.

The first important lesson I've learned is that the models were better when everyone in the team understood what we wanted to achieve and how they could help. The second important lesson I've learned is that, unfortunately, many of my co-workers didn't know enough about reservoir modeling. To be fair, I probably didn't know as much about their work either and I should have!.

The series I'm starting today aims at providing solutions to these problems.

I'll describe, month after month, what reservoir modeling is all about. My goal is to give some practical ideas on what the role of every type of expert (geoscientist and engineer) is in a modeling project.

And again to be fair, I solemnly promise to the people I'll work with in the future that I will continue learning more about their own specialities and about how I can help them better. Coffee is on me if you catch me not caring about your work! ☺

LEARNING ABOUT RESERVOIR MODELING

Calgary has a lot to offer for reservoir modeling beginners and experts alike, and I believe this will continue to grow in the coming years.

I had an opportunity to attend the two Gusow Conferences on geomodeling, organized by the CSPG, in 2011 and in 2014. Both were great successes! Many experts from Calgary, from other parts of Canada and from other countries, gathered to listen to high-quality presentations. I can't thank enough the organizers of these two events.

These conferences were great places to promote geomodeling. They were perfectly in line with what the Geomodeling Division of the CSPG has been doing in Calgary for years now: organizing free monthly talks, as well as annual sessions at the GeoConvention, to give a place for reservoir modeling experts to gather and learn. I also thank deeply everyone who ever got, or will get, involved in this Division. Thank you for your efforts. I know that your work is very much appreciated by our community.

All these presentations allow experts like me to increase their skills. Each talk tells me something more about how other geomodelers are integrating the numerous types of data available to them and how their models help their team make better decisions about their reservoir.

Those who want to become experts in reservoir modeling have also many resources available in Calgary. They can/should learn how to use the diverse geomodeling packages available to us. They can/should also take modeling courses such as those organized by the CSPG.

REACHING OUT TO NON-SPECIALISTS

CSPG events and conferences are most often attended only by people already interested in reservoir modeling. It is unfortunate, but quite normal: engineers are the main audience of engineering talks, as are petrophysicists to presentations about petrophysics.

Also, while courses such as "Geophysics for Non-Geophysicists" or "Engineering for Geoscientists" exist, I'm not aware of anything equivalent for geomodeling.

I came to think that a series on "reservoir modeling for non-reservoir modelers" in the Reservoir magazine might be an additional way to reach out to geoscientists and engineers who are currently not drawn to attend to geomodeling presentations.

Of course, I can only reach out to people reading the magazine Reservoir... and, while I know that I don't open magazines about engineering or petrophysics as often as I should, chances are that many in your teams don't open the Reservoir as much as they should either.

For that reason, I will require your help. If you like this series and if you think it could benefit your whole team, share it with your colleagues and let's *Reach Out To Non-Specialists together!*

FORMAT OF THE SERIES

I will publish one article monthly until the end of 2015. Some of my colleagues in RPS and/or some of my contacts will co-author the papers with me.

This series is meant for every geoscientist and engineer working in the oil and gas industry. Reservoir modelers will probably find the content too general for them but I encourage them to read it nevertheless. It might give them some ideas on how non-specialists perceive what we do.

While being published in the magazine of the CSPG, this series is not meant exclusively for geologists. The link between reservoir modeling and geology will be described, but the articles will also include topics related to petrophysics, geophysics and diverse aspects of engineering.

The fundamentals of reservoir modeling are, more or less, the same for every type of reservoir. I believe that a significant part of what I will present in this series can be applied everywhere. My goal is to introduce some practical concepts, with as little theory as possible. Each paper will suggest where the reader can read more about each topic.

SERIES OVERVIEW

The series is structured in four parts.

Firstly, I'll explain what reservoir modelers are doing.

In March, I'll build a model of the Teapot dome oil field in the U.S. I'll give an overview of a typical reservoir modeling workflow, from gathering data to building the three-dimensional grid. This dataset being public, anyone interested will be able to redo some this work himself.

In April, I'll cover the fundamentals of statistics and geostatistics as applied to reservoir modeling. I'll explain those mathematically-complex topics with as few equations as possible. I'll focus on practical issues such as bias in the data and the impact of trends in modeling. I'll also insist on the importance of taking uncertainty into account, something for which both statistics and geostatistics are very strong at. Moving forward in this series, uncertainty management will be a transversal aspect of every article.

In the second part, I'll focus on what geoscientists can bring to a reservoir modeling project.

In May, the article will focus on how geologists and reservoir modelers can work together. Often, the reservoir modeler is the geologist, but not always. Among other things, the article will insist on how geologists must make sure that their understanding of the geological environment is incorporated into the model. Using geological hypotheses to make sense of the data is crucial. Diverse aspects of uncertainty will be discussed as well.

In June, we'll talk about petrophysics. Petrophysicists are providing the logs we need as input for our models (v-shale, porosity, water saturation...). Recently, reservoir modelers have started asking more of their petrophysicists. We want to understand what uncertainties the petrophysicists faced when creating their logs and we want to incorporate these uncertainties in our reservoir models.

In the double issue of July/August, we'll have a look at geophysics. Geophysical data is essential to give some insight about what is happening between the wells. Geophysicists must make sure that their data is properly used in the geomodel. This paper will discuss aspects such as time-depth conversion and the associated uncertainties in velocity modeling. It will also discuss how seismic inversion can be used as an input to geostatistical algorithms.

In the third part, I'll explain how engineers can be involved in reservoir modeling.

In September, I'll start with reservoir engineers. Reservoir engineers are often those for whom the reservoir model is created in the first place. They need it for tasks such as flow simulation and history matching. Traditionally, they don't get involved in the modeling though, they just receive the model once completed. Experience has shown that much better results can be achieved if engineers ask to get involved in the modeling process itself. Among other things, it will allow them to better understand the uncertainty embedded in the reservoir

model they receive, and how they can take this uncertainty into account in their studies.

In October, I'll have a look at how reservoir modeling can be used as input for reserve computations. Companies are not reporting a single number for their reserves anymore. They report a range of volumes (P10-P50-P90). The range captures the uncertainty they have about everything from future taxes to production costs. Reservoir models can be of great help, as good models capture the uncertainty about the reservoir that the team has identified.

In November, I'll discuss about production engineering. I'll explain how using a good presentation of the reservoir can lead to better results in the modeling of natural fractures and hydraulic fractures, two aspects of our reservoirs on which production engineers work more and more.

At last, I'll discuss about the role of asset team managers.

In December, it will be time to conclude this series by discussing how asset managers influence modeling projects. I'm convinced that better communication leads to better models...and good communication within a team starts with its manager. I'll review some aspects of team and project management that I found useful through the years. This last paper will be also the occasion to summarize the main points developed in the series.

WHILE WAITING FOR THE NEXT ISSUE...

Feel free to email me if you have questions about what has been presented so far or what will be presented next. As the series will run for a year, I might have time to include some of your comments and/or some of my answers into a future article.

I'm looking forward to have you as a reader next month. ☺

BIOGRAPHY

Thomas Jerome (jeromet@rpsgroup.com) graduated from the Nancy School of Geology in France in 1999 with a Master degree in Engineering and Earth Sciences. A Geologist by background, Thomas specialized early on in geomodeling. He first worked 5 years in the GOCAD Research Group located in Nancy. As an employee of Earth Decision and Paradigm, Thomas continued, for the next three years, with onsite geomodeling consulting at Saudi Aramco. In 2008, Thomas moved to Calgary and to RPS in 2011. Now, as Manager of the Reservoir Modeling team in RPS, he is working on various projects with Petrel, SKUA and GOCAD. Thomas has close to 15 years of geomodeling experience with conventional and unconventional reservoirs, the last 7 years focusing largely on Western Canadian reservoirs. His current interests are in improving the integration of geomodeling in waterflood and fracking studies and in improving workflows applied to oil sands reservoirs.

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