Abstract – Effective Geophysics models leading to Business Decisions

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Introduction

The title of this workshop, “Effective models leading to business solutions”, gives a good description of the purpose of modelling. The modelling should address the important uncertainties we want to reduce. It should give the result of integration of all the separate knowledge pieces that we have into a response which can’t be predicted from individual information pieces on their own.

The main three key learning points for this talk will be:

- I. What is the uncertainty we want to address by modelling?
- II. Does the model contain the complexity that we try to understand and is the modelling tool appropriate?
- III. How to integrate the geophysical data and observations with the geological understanding and the challenges in the flow model?

The question in the first bullet is normally a geological or business related one, like what is the pore fluid, where is the contact, or how much and where is the depletion or saturation change during the last two seismic surveys? These questions may be answered by people using phrases like “1D full wave form modelling” or “Gassmann fluid substitution”, instead of analysing how to reduce the uncertainty raised by the question.

Regarding the second bullet, we should be aware that a model only models what we put into the model. Making the model or the modelling software complex, does not mean that we will get more out than we put into the process. If we model a seismic fluid contact with the most advanced algorithm, but forget to put in the heterogeneity of the geology in 1D or 2D, or the saturation change from FWL to full saturation, than the answer may not give the required accuracy needed for a good business decision. Or if we model the local seismic response of a complex fluid contact in a 1D model, but do not include the 3D complexity of the overburden, we may end up with the wrong conclusion.

Regarding the last point, it does not help to get a perfect geophysical model which describes the seismic response, if this can’t be used to improve the geological model or the simulation model. As example we have to be careful to do a seismic forward modelling of a (course) simulation grid if the goal is quantitative integration of 4D difference with production data, since the seismic data will have a much higher lateral resolution (which will cause major problems in the quantitative integration). On the other hand the seismic vertical resolution may be a bottleneck to update a flow model. But geological constraints through rock physics to update a geomodel, such that this becomes consistent with the seismic response, can be a win-win situation for both the stability of the seismic inversion and the lateral resolution of the final geomodel.

In conclusion we can state that the integration of geophysical, petrophysical, geological and dynamic information is greater than the sum of these disciplines alone. The challenge is to find a workflow to integrate these disciplines since they are on different scales and properties, and the need for specialists who understand the important basics of other disciplines.

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