Monte Carlo simulations for model uncertainty and model automation

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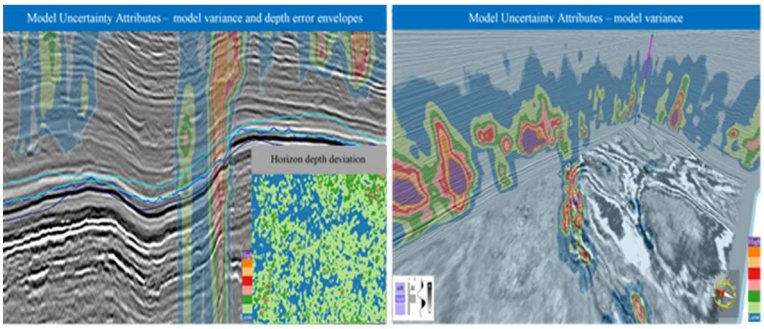

Figure 1. Examples from the Taranaki Basin, New Zealand (Lewis et al, 2018). Left shows the model variance along an inline. These variances and deviations can be mapped in 3D (right) to give a measure of uncertainty and risk.

The velocity model is a key component in effective reservoir evaluation; when used in the migration, it controls the spatial positioning of the seismic data. Typically, only one model is built and only one migrated seismic image is created. Auxiliary data may constrain the model and image, but they provide sparse uncertainty in the model.

To provide a measure of uncertainty, we use a Monte Carlo simulation (Bell et al, 2016); a method that enables an understanding of possible outcomes from a random population of inputs. The workflow produces attributes such as spatial positioning error bars. These metrics lead to an understanding of structural ambiguity and risk (Figure 1).

Pressure is mounting to reduce the turnaround time of seismic processing projects. As an extension of the model uncertainty workflow (Martin & Bell, 2019), we demonstrate an automated velocity model building tool that can accelerate Velocity Model Building (VMB), reducing turnaround time. We validate this approach on a data set, and compare results of this automated method with a model built in traditional way (Figure 2).

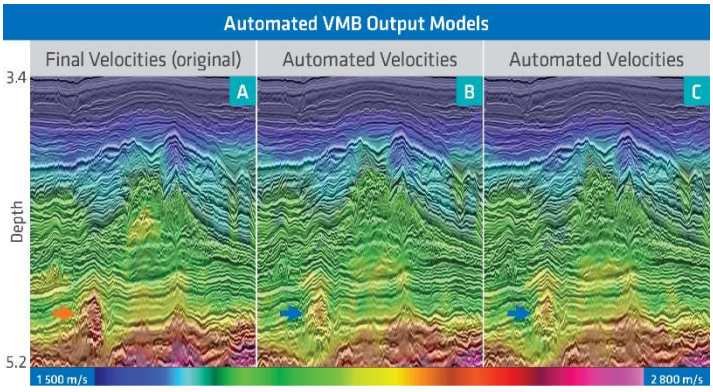

Figure 2. Automated VMB; panel A showing the final velocity model built in traditional waterfall approach, alongside panels B & C built from the automatic approach.

References
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