Introduction

The ARC-L project is designed to better understand the environment of hydraulic systems of parts of the Great Artesian Basin. The outcome will help to protect groundwater resources and decision making of the Coal Seam Gas industry. The Project consists of three key topics:

- Isolation and completion decision: What parts of the "Springbok Sandstone" are permeable, calibrated brine flow properties in sandstone and non-sandstone
- Local area (field scale) modelling: How could we handle heterogeneity? What does this mean for local pressure transmission?
- Long range, wide area (groundwater scale) modelling: How could we correlate "Springbok Sandstone" over longer distance? How could we handle upscalled heterogeneity? How would this impact pressure transmission?

This poster is presenting results of the research commenced within the first two key topics.

Heterogeneity – Comparing Log “Signals”

We compare sections of wireline logs by calculating the Euclidean distance between them (Fig. 1).

- Lower Euclidean distance indicates more similar signals (zero would indicate identical signals)
- This is just about similarity — any output needs to be sense checked based on geological understanding

Rather than just comparing one well to all the wells, we can compare each well to its neighbours, then move to the most similar signal and repeat the process (Fig. 2). Using this sequential correlation method we generally identify the same tops as the geological picks.

Figure 3: Statistical comparison and introduction of Blue and Green zones. The data within the Red Zone appears more “Blue-like” and will be automatically put into the Blue Zone.

Figure 4: The deterministic interpretation of logs for one of the project wells. Calculating effective porosity in these strata is problematic as the range of clays varies significantly. The ratio of NMR effective porosity to NMR total porosity was calculated. A function to link shale volume to the ratio of effective and total porosity is generated for the blue and green zones. This function allows effective porosity directly to be calculated from total porosity and shale volume. The P10, Swanson mean, and P90 brine permeabilities are plotted in the second track from the right. Measured horizontal plug brine permeabilities are plotted as red dots in the same track.

Conclusions

- Heterogeneity analysis:
  - Euclidean distance can determine similarity of wireline logs
  - Independent evidence to support geological picks and representation of spatial dependence (pseudo-variogram)
- Statistical Correlation:
  - Statistical method to distinguish geological units
  - Objective and repeatable
- Petrophysical analysis:
  - Multimin/ELAN model gives a high-quality log interpretation in accuracy from the deterministic and Multimin models.

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