Data Spacing for Geological Modelling

Steve Lyster and Kelsey MacCormack
Alberta Energy Regulator / Alberta Geological Survey

Introduction

One of the most frequently asked questions to geomodellers is, “How much data do you need?” Knowing how many picks are necessary, how much log analysis should be done, how many core samples must be collected is an open question. The answer is not straightforward due to changes in the variables being modelled, the geology under consideration, the scale of investigation, and the objective of the model. This work seeks to produce a general rule of thumb for how many geological picks or net thickness data points are needed per given area, for example, “X picks per township”.

Method

This work uses the method of Wilde (2010) and Wilde and Deutsch (2013) to quantify the relationship between data spacing and uncertainty. This is a geostatistical simulation-based approach that resamples reference realizations at a variety of data spacings to quantify uncertainty in further conditional realizations.

In addition, synthetic grids were created to allow sampling at different spacings and for different sampling schemes; Figure 1 shows an example of four different data spacings in three different arrangements for one of the synthetic grids. Geostatistical simulation using these different arrangements for the same true reference grids will be used to provide quantification of uncertainty and modelling error.

Examples

Examples will be presented using both synthetic and real data. The synthetic data was constructed to represent four increasingly complex geological scenarios. The advantage of synthetic data is that the modelling results can be compared to the true original reference grids. Considering that synthetic data often appears idealistic and less complex than real geology, real data from the Duvernay and Cardium formations were tested. The real data provide a good field test for the method, but the modelling results cannot be compared to the true values at unsampled locations. Testing both synthetic and real data cases will allow the strengths of each approach to be utilized.

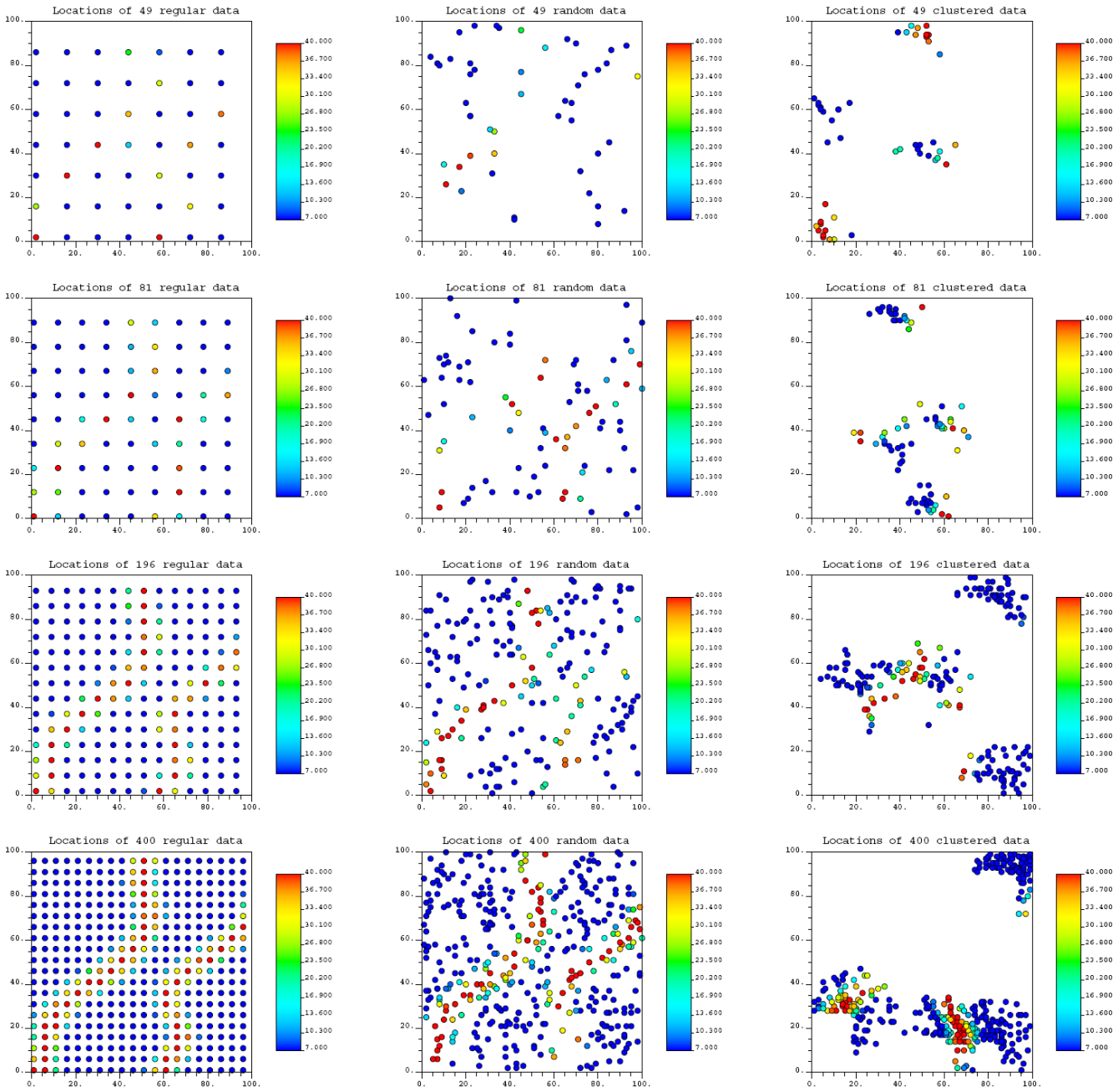

Figure 1: Four different data spacings in three different arrangements.

References

Wilde, B.J. (2010): Data Spacing and Uncertainty; M.Sc. thesis, University of Alberta, 103 p.

Wilde, B.J. and Deutsch, C.V. (2013): Methodology for quantifying uncertainty versus data spacing applied to the oil sands; CIM Journal, vol. 4, no. 4, p. 211-219.