Title:
Does short-correlation length heterogeneity really matter?

Abstract:
Reservoir modelling workflows typically produce models in which rock properties such as porosity and permeability are represented on a simple Cartesian or cornerpoint grid. Geostatistical methods used to populate the grid blocks with rock property values yield models in which every grid block contains a different value from its neighbour. Yet the size of the grid blocks is not related to the actual length scales over which the rock properties vary; consequently, the variability seen in models constructed using these methods is an artefact of the modelling process. The geostatistical methods used ubiquitously in modelling workflows produce short-correlation length (grid block scale) variability in rock properties that is not representative of the modelled rocks. Questions remain concerning the flow relevance of these short-correlation length variabilities; are we capturing too much heterogeneity or not enough of the correct type of heterogeneity in our models?

A simple numerical algorithm was developed that captures the key geometric heterogeneities with an associated averaged petrophysical property. These rock property domains which now have a longer correlation length are also internally homogeneous. The effect of eliminating the short-correlation length heterogeneity is tested on synthetic and real field reservoir models. The synthetic field case is the well-known SPE10 model, a classic benchmark case of a complex reservoir. We also apply the technique on a complex, multi-facies real field model of a North Sea Reservoir.

A quantitative assessment showed that eliminating the short-correlation length heterogeneities had a very limited impact on flow. The results highlight the importance of long-correlation length heterogeneities i.e. variability between rock property domains and the relative insignificance of short-correlation length heterogeneities i.e. variability within rock property domains. These results also support the concept of surface-based reservoir modelling in which geologically meaningful domains with uniform petrophysical properties are defined using surfaces.

Bio:
An Imperial College alumni, Hossam completed his MEng in Chemical Engineering in 2010 before moving to Saudi Arabia for an MSc in Earth Science and Engineering at KAUST. He then spent 3 years as a research reservoir engineer with Saudi Aramco. His work involved the study of enhanced oil recovery in Aramco’s massive carbonate fields; including low salinity and chemical flooding. Hossam joined the NORMS group at Imperial College in January 2015 as part of the NERC CDT in oil and gas; supervised by Prof Matthew Jackson and Prof Chris Pain at Imperial and Prof Sebastian Geiger at Heriot-Watt.