

# Selecting a geological realization for SAGD simulation

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SAGD process is a heavy oil recovery technology commonly applied in Athabasca oil sands reservoirs in western Canada. SAGD performance is largely affected by reservoir heterogeneity at different levels. Although dense delineation wells are generally available for SAGD planning, subsurface geological uncertainty is still quite significant. Multiple geostatistical realizations are generated to represent geological uncertainty. However, it is common that only one realization is practically needed for SAGD simulation because such simulation is highly CPU-time demanding. Selecting a realization for SAGD simulation must be based on both geological uncertainty and a close match to production history data. Ranking all realizations using good static geological measures allows realizations to be aligned with the order of SAGD production performance. The first round selection of realizations is focusing on possible “best technique cases” given the geological uncertainty. The second round or final selection is based on quick and short-period simulations on the first round selected realizations. The reservoir simulation based screening is performed to pick the “one” realization that has the highest potential for history matching and presumably close to true geology.

In ranking realizations, a good static geological measure tailored to SAGD performance is the key. The geobody connectivity, possible steam swept hydrocarbon volume, and vertical permeability must be considered in the ranking measure. The resulting ranking order is model scale-dependent. In other words, the ranking orders at single well-pair level and multi-well-pair level may be quite different because of averaging effect of high and low values of single-well-pairs over multi-well-pair model. Hybrid models suffer boundary effect when interference of multiple well pairs is an important objective of SAGD simulation. Consistency of realization used for SAGD simulation at both levels requires ranking performed at both levels and choosing realizations based on combined ranking results.

Matching SAGD history data can be quite complex if there are lots of production data to match, such as the injection and production rates of all fluids and flow ratios (Steam Oil Ratios, Water Steam Ratios, water-cut), the steam chamber front and geometry from thermal logging data, piezometers and 4D seismic, and so on. Screening is a common pass based on calibration of all matching required data.

This paper is to present current methods used in ranking and screening realizations for SAGD simulations. Some simulation results have shown a good preliminary history matching using concurrent reservoir parameters between different models. These models will be used for further detailed history matching.

