Seismic Attributes used for Reservoir Simulation: Application to a Heavy Oil Reservoir in Canada

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Abstract/Excerpt

Cold heavy oil production with sand has become one of the main non-thermal schemes for developing heavy oil reservoirs in Canada. One challenge in modeling the fluid flow in the reservoir simulation studies is reservoir heterogeneity. Several seismic attributes were used to estimate the porosity (ranging from 19% to 35%) at the Plover Lake oil sands reservoir in Canada.

First, the top and the base of the reservoir were mapped based on several seismic attribute volumes that include the density. From petrophysical analysis we learned that density is a key physical property in differentiating between sand and shale within the oil sands. Probabilistic neural network (PNN) analysis was used to derive the relationship between density log data and external attributes (PP and PS migrated stacks, AVO attributes and inversion results).

Secondly, we used geostatistics to estimate a porosity map within the reservoir. The study is based on a set of porosity logs at well locations and several seismic attribute maps. Kriging, cokriging, kriging with external drift (KED) and multiattribute analysis for maps plus KED, were tested in order to improve the results. The KED with porosity from multiattribute analysis is the most realistic, honoring the wells and the seismic.