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Assessing Reservoir Connectivity Uncertainty in Geostatistical Models

There are two basic uncertainty ''types'' in earth models – volume uncertainty (which affects OOIP) and connectivity uncertainty (which affects recovery). Volume uncertainty is routinely assessed using Monte Carlo type approaches whereas connectedness uncertainty is rarely appraised in detail due to the time and expense of generating and history matching multiple reservoir flow models. Fast 3-D streamline simulation without history matching can be used to scan numerous realizations to find representative high, middle, and low connectivity models, but even this takes considerable time and effort. Using data from two reservoirs, the Eunice Monument South Unit in New Mexico (Permian Basin carbonate reservoir) and the LL-652 Field in Venezuela (Middle Eocene estuarine clastic reservoir), various proxies based on model porosity and permeability distribution have been examined in an effort to find a fast and reliable measure of connectivity. Average geobody length based on appropriate permeability cutoffs (both high end and low end permeability geobodies) is one proxy that has been investigated in detail and appears to be reasonably reliable on a ''full field'' basis. The sensitivity of geobody length to model ''workflow'' (e.g. the use of lithofacies as a modeling constraint and semivariogram range parameters) and up-scaling has also been investigated to further assess the reliability of this proxy for reservoir connectivity.