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**Seismic Heterogeneity Cubes and Corresponding Equiprobable Simulations**

Seismic heterogeneity cubes are attributes which measure local second-order statistics of seismic heterogeneity from 3-D datacubes. Seismic heterogeneity could relate to acquisition and processing footprints which are removable, structural features such as fracture zones, or stratigraphic and lithologic heterogeneity. Raw second-order statistics estimated from seismic data contain too many parameters to form useful seismic attributes. Instead, model statistics with only six parameters are fitted to the raw statistics. These six parameters include three orthogonal correlation lengths and three orientations. From the stratigraphic viewpoint, the seismic heterogeneity denote average dimensions and orientations of small sedimentary bodies.

The six parameters are seismic attributes which can be visualized and directly used for interpretation purposes. However, these attributes have a physical meaning because they can quantify local second-order statistics of, e.g., sedimentary bodies. One may perform geostatistic simulations to obtain reservoir realizations which could be used for fluid flow modeling, risk analysis, etc. Commercial tools for geostatistical simulation are often based on the assumption of stationarity, i.e., the statistics are invariant within a simulation volume. Heterogeneity cubes of different datasets show that this assumption is almost never justifiable. Hence, the convolutional approach of geostatistical simulation is modified to take advantage of the instationary statistics provided by the heterogeneity cubes. The resulting algorithm allows computation of reservoir realizations with spatially variant statistics. This project is funded by the U.S. Department of Energy under contract DE-FC26-00BC15301.