Near surface challenges for processing 3D seismic surveys
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Around the world, low-relief structures and stratigraphic traps are becoming more important since most of the large structural traps have been drilled. These play types require accurate near surface velocity models for depth conversion. Reservoir characterization is also a key goal. The use of horizontal wells for field development continues to grow at an accelerating pace. Seismic attribute maps can be extremely valuable for placing horizontal wells. But these attributes will be of little value if their quality is degraded by near surface effects.

Energy penetration, scattering, source generated noise, surface generated multiples, statics, and source and receiver coupling are some of the long standing near surface issues that continue to present challenges for land seismic imaging. In arid environments, the near surface can be up to 700m thick with near surface challenges such as sand dunes, topography, karsted carbonates, dry river beds, outcropping refractors, velocity reversals, anhydrites, and layered basalts. Karsts can be cavernous, but are usually collapsed and filled. Air filled karsts above the water table are particularly problematic.

A wide range of technologies are now being pursued to better characterize the near surface. These include traveltime tomography, early arrival waveform inversion, joint inversion of seismic data with gravity and electromagnetic data, and surface wave inversion. For complex near surfaces that require these technologies to define the velocity model, the conventional statics approach will not be valid. Imaging technologies such as redatuming will be required. Advances in seismic acquisition technology such as ultra-high channel, high density, single sensor recording, and low frequency vibrators, will play a key role in developing solutions for near surface characterization.