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Seismic attributes in unconsolidated near-surface sediments

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The calculation, analysis and interpretation of seismic attributes is an important tool in reservoir seismology and has been used since the 1950's to improve the characterization of oil and gas fields around the world.

Recent applications of seismic attributes in the near surface use the coherency attribute to detect faults as well as average and normalized frequencies and similarity to map ground instability and image sinkholes. Seismic attributes are also used to assess unconsolidated oil sand reservoirs, to evaluate ocean/lake bottom responses from unconsolidated sediments, and to visualize the internal structure of mass transport deposits. In unconsolidated near-surface sediments seismic attributes are rarely used. This is likely due to the high variability present in the near surface.

Combined P-/S-attributes are difficult to obtain because of the large difference between P-wave and S-wave velocity, as well as frequency and resolution. Therefore, the most important step to obtain these combined attributes is performing depth conversions for the P- and S-wave reflection profiles that perfectly match horizons and features in the depth domain.

We present commonly used attributes calculated from a shear-wave reflection profile imaging the dome structure of an esker. Attributes calculated from the compressional-wave reflections are compared to the shear-wave attributes which benefit from higher resolution than P-wave attributes. We highlight the attributes which best enhance the general subsurface structure and list new information gained from different attributes.