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# Reliable determination of density attribute from impedance inversion methods

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## Summary

Reliable determination of density from vertical component seismic requires noise-free long offset seismic data, which is rarely available. It can also be determined from multi-component seismic data. However, the extra time and cost involved with the acquisition, processing and interpretation of multi-component seismic data has historically made the industry somewhat reluctant to use them. Nevertheless, if we consider the availability of either noise-free seismic (PP) data with long offsets or multi-component seismic data, there are two conventional approaches for estimating density, namely, using simultaneous inversion (PP) and/or PP-PS joint inversion. Considering the importance of multicomponent data for deriving the different elastic parameters (P-impedance, S-impedance, density, Young's modulus, Poisson's ratio, etc.), prestack joint inversion was considered along with simultaneous inversion for a 3C3D seismic data acquired in 2015, in order to characterize the Duvernay shale play in Alberta, Canada. Though a better-quality estimation of impedance was noticed with prestack joint inversion, this method was not able to provide reliable estimation of density from seismic data. The reason for multicomponent seismic data falling short of reliable determination of density is explored in this study. Thereafter, a novel approach for estimating reliable density attribute from seismic data is also proposed.