

Comparison of one- and two-step seismic inversion for Lithology and Fluid prediction

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Lithology and fluid prediction from seismic data is traditionally done in two steps; first an inversion of the seismic data to elastic parameters and a low-frequency background model, and subsequently a prediction of lithology and fluid based on the inverted elastic parameters and a rock physics model for the individual lithology and fluid combinations.

Recently a number of algorithms have been developed that based on more sophisticated statistical models predict lithology and fluid directly from the seismic data. These models still rely on a known relationship between lithology and fluid and elastic parameters, but these models are only used indirectly in the inversion.

We compare the results from a state of the art two-step inversion (Buland et al 2008) with the results from an algorithm inverting directly for lithology and fluid (Kolbjørnsen et al 2016) for a synthetic data-sets. The direct inversion for lithology and fluid generally give better and sharper inversion results, but rely on more precise background information. With less geological information available or in areas with large heterogeneity in the geology it might be time-consuming to setup the sophisticated prior model for the geology that is needed to get good results from the direct inversion, compared with the effort needed to setup the simpler model needed for the two-step inversion.

References:

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Kolbjørnsen, O., Buland, A., Hauge, R., Røe, P., Jullum, M., Metcalfe, R.W., Skjæveland, Ø, 2016, Bayesian AVO inversion to rock properties using a local neighborhood in a spatial prior model. *The Leading Edge*, v. 35(5) pp 431-436.