A comparative study of seismic inversion methods.

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As determination of lithology and fluid content distribution is a desirable objective for reservoir characterization and subsequent reservoir management, we adopt AVO inversion and post-stack impedance inversion methods to achieve this goal. Due to the access to available inversion methods, it is advisable on finding out the best method. To this end, we present a comparative performance of the available model based seismic acoustic impedance inversion methods. In this study, we start with the traditional model based seismic acoustic impedance inversion and compare its result with equivalent results from elastic impedance, the separate or independent impedance inversion carried out as a post stack process and simultaneous inversion. This comparative study makes it possible to conclude the following points:

1. Only using acoustic impedance may not be sufficient for delineating a reservoir.
2. Elastic impedance inversion provides a noticeable discrimination between lithology and the fluid content of a reservoir.
3. The computed P- and S-impedance data derived using independent and simultaneous inversion methods were inconclusive about their accuracy.
4. The cross-plotting of the derived λρ and μρ attributes reveals the superiority of the simultaneous inversion method.

In addition to this, it is also important to know the relative quality of the reservoir in terms of sandstone content. To address this, two attributes namely Poisson impedance (PI) and Poisson dampening factor (PDF) were considered. Poisson impedance incorporates both Poisson's ratio and density into a single attribute that could be useful for reservoir delineation. Thus, a reservoir can be considered of good quality if it contains lower value of this parameter. A relative decrease in PI, Poisson's ratio and density in gas sands makes it possible to discriminate them from shales, though, it may not be possible to gauge any information whatsoever about the quality of such pay gas sands. Poisson dampening factor helps in characterizing the quality of pay sands. It reduces the uncertainty in identifying various lithologies as lithology range in PDF space is narrower than in PI space. Hence, PI with PDF can add subtle information essential for differentiating lithology and fluid content of a reservoir. As these two attributes were derivable from seismic, we have demonstrated that these attributes also adhere to the superiority of simultaneous inversion.