The 9th International Conference on Applied Geophysics
(GEOPHYSICS CHIANG MAI 2023)
Chiang Mai, Thailand

Advanced Wavelet Analysis for Seismic Inversion, a Case Study of the North Malay Basin, Gulf of Thailand

Thanyanat Akarapatima* and Ratchadaporn Uttareun

PTT Exploration and Production Public Company Limited, Bangkok 10900, Thailand
* Corresponding author. E-mail address: thanyanata@pttep.com

Abstract

The study successfully implements time-varying wavelet analysis and illustrates a better seismic inversion product both computational time and accuracy as compared to the conventional seismic deterministic version that used a single wavelet. This advanced wavelet analysis technique provides flexibility to each subsurface layer's seismic information. Thus, its wavelet compromises seismic with obvious frequency variation which the single wavelet does not.

To validate the benefit of wavelet variation, the study chooses a sufficiently large target interval (about 1800 ms). The selected area found high frequency absorption through the process of seismic-to-well tie step, especially at the far-angle seismic stack and deep target interval. As a result, the study divides the target intervals into shallow and deep sections. The two sections will then have individual suitable wavelets by performing seismic-to-well ties twice. The next step is to fine tune seismic inversion parameters to have the least error in objective functions. These optimized objective functions will then be applied to produce elastic properties and reservoir rock properties.

Once performing wavelet varying seismic inversion, resulting elastic properties (inverted acoustic impedance and velocity ratio) show clearer geological features as compared to the one, inverted using a single wavelet. This can be confirmed by both qualitatively and quantitatively. The qualitative way is an overall good matching between elastic properties and lithofacies at the well locations. The quantitative way is to observe cross-correlation values between measured and inverted values. Cross-correlation(s) between measured and inverted acoustic impedance (AI) and Vp/Vs are approximately 1.32% and 5.87% higher than using the single wavelet (conventional) method. This prediction improvement is the result of better frequency matching at both target intervals. Channel features/geo-bodies, thus, are easier to be observed throughout depth intervals. In addition, the improvement leads to more accurate lithofacies prediction and the following well targeting.

Keywords: time-varying wavelet, seismic inversion