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Lin Deng and Feng Shen, E&P Tech Inc, Houston, TX

Integrated Fractured Reservoir Characterization with Multiple Attributes and Forward Modeling

Fractured reservoir on the basement rock constitutes significant challenges in quantitative seismic reservoir characterization. We describe an approach for characterizing the fractured reservoir by integrating multiple attributes derived from geophysical attributes along with structure, geological, and reservoir engineering. Considering the offset and azimuth coverage of seismic data on the target zone, the field seismic data is sorted as five-azimuth data cubes. The elastic impedance inversion is applied to calibrating seismic data volume. The inverted P-wave impedance attribute is used for amplitude ellipse analysis and S-wave impedance is used to calibrate the fracture intensity. Other seismic attributes, seismic energy, frequency and instantaneous frequency estimated form seismic data, are integrated to assess the occurrence of fractures using existing well information. These attributes are calibrated based on their geological and geophysical meaning associated with lithological properties and wave scattering and attenuation. Furthermore, we use rock physics model and seismic forward modeling technique to validate the interpretation on the orientation and aspect ratio of fitted ellipses. The effect of saturating fluids on azimuthal AVO variations is investigated and as an indirect indicator for open fracture identification. Our results show that the orientations of fractures are dominated by the structure and fracture density is correlated with structure curvature and well producibility.