Best-Practice Principles of Seismic Imaging for Resource Exploration



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Abstract: Seismic imaging is among the most useful tools in the exploration and production of petroleum and other subsurface resources. The quality of seismic images is measured by their fidelity with three elements: High resolution, correct position, and recognition of imaging artifacts (Zhou, 2014). In field applications, insufficient data coverage and signal to noise ratio not only reduce the resolution, but also produce misleading position errors and imaging artifacts (Zhou, 2011). Therefore, it is critical to follow the best-practice principles in applying seismic imaging for resource exploration. While we must understand each imaging method in terms of its idea, functionality and limitations, there are practical principles useful in most applications. Some of the best-practice principles of seismic imaging include: We favor target-oriented approaches since each method chosen must be aligned with the scientific and business objectives; We prefer data-driven methodology because the applicability is measured by data; We want to follow the principle of from known to unknown in imaging processing and interpretation, use more signals to reduce artifacts, and apply geologic constraints whenever possible; Finally, a seismic image is not useful until its fidelity in terms of resolution, uncertainty and artifacts are properly assessed. These principles are illustrated using examples of seismic imaging for subsurface structures, reservoirs and micro-earthquakes (Zhang et al., 2014; Zou et al., 2014; Zhou et al., 2018).

Key words: high-fidelity seismic imaging, best-practice principles, resource exploration, imaging artifact

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