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Qualifying interpretation assets

3D prestack depth migration is routinely used to image complex subsurface structures in the search for economic hydrocarbons. Although the resulting seismic image volumes help interpreters unravel and understand subsurface complexity, reflector positions and amplitudes carry uncertainties that must be tested against the imaging velocity model and seismic acquisition.

Subsurface illumination analysis provides a technology bridge for understanding the dependencies of the velocity model and seismic acquisition on the seismic image. However, according to Duane Dopkin, Senior Vice President of Technology at Paradigm, contrary to these well understood dependencies, illumination analysis is typically carried out as a post-interpretation process and conducted outside of the core interpretation scene. Additionally, illumination engines are rarely formulated to "map" the full distribution of source-receiver azimuths along the acquisition surface to the full azimuth local angles in the subsurface, leaving the interpreter with insufficient information to qualify subsurface reflectors.

Paradigm says that, to overcome these limitations, it has created a full azimuth, angle domain illumination analysis system (EarthStudy 360™ Illumination) that resides within its interpretation canvas. By carrying out this rich ray tracing procedure in a special reference framework (local angle domain) inside the interpretation canvas, geoscientists are able to qualify illumination deficiencies or anomalies with high degrees of confidence during the interpretation process.

This full azimuth, full angle illumination engine can be executed interactively along interpretation surfaces, or it can be run as a background task, returning full azimuth angle domain gathers and volumes of physical ray attributes and surface acquisition parameters. Attributes can be extracted from these volumes at reflectors or reflector patches and investigated with interactive common reflection point of diffraction point ray tracing. With the system, interpreters can use these attributes to evaluate questions such as: What percentage of my rays successfully reach the acquisition surface? Do I have missing near/far offset or small/large angle data? Do measured in-situ azimuths correlate to surface acquisition azimuths? Do I have phase reversals due to caustics? Is the reflector properly illuminated in azimuth and angle? A special ray attribute analysis tool allows geoscientists to display different physical parameters or the same physical parameters from successive rays. To strengthen this analysis, the system provides visualization in forward (subsurface to surface) mode, in which ray attributes are interpolated and displayed as a function of take-off polar angles; or visualization in inverse (surface to subsurface) mode in which the ray attributes generated by two-point ray tracing are filtered by the acquisition geometry and displayed as a function of the local angle domain angles. Special reliability analysis displays, based on ray interpolation, allow the interpreter to qualify the amplitude signatures present in the image volume.

Paradigm says that by providing subsurface illumination in the interpretation canvas, geoscientists are able to further qualify their interpretation assets and qualify their interpretation prospects. For more info visit booth 420.