Broadband Seismic – What Are the Benefits and Pitfalls for E&P Geoscience Workflows

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ABSTRACT

Getting the optimal seismic image of the subsurface is a key challenge for many geoscientists in their day to day project work in order to: perform an accurate stratigraphic and structural seismic interpretation, derive reliable and predictable elastic properties, delineate a reservoir, identify leads and evaluate volumes. Over the last decade or so, marine seismic underwent a technology step change with the development and adoption of broadband seismic and more particularly with the towed dual-sensor streamer seismic (Tenghamn et al., 2007), delivering extensions of the seismic frequency on the low and high side of the amplitude spectrum. This broadband seismic is designed to offer a broader seismic bandwidth resulting in sharper seismic signal with significantly less side-lobe artefacts (ten Kroode et al., 2013). This significantly changes not only the seismic character but the way seismic interpretation, quantification and assessment of the seismic is conducted (Reiser et al, 2016). These additional frequencies offer, if acquired and processed correctly, significant opportunities for more reliable, predictable estimates of the seismic elastic properties - that can be related to rock physical properties and reservoir parameters. There are pitfalls and caveats with most new technologies: having frequencies below 6-8 Hz brings significant benefits and value for the geoscientist in exploration and production settings. However this potential is critically dependent on having reliable and trustworthy seismic information across all frequency bands and for all the offset-angles. This is important to bear in mind as decisions will be based on richer pre-stack broadband seismic information. The emphasis of this paper will be on the demonstration, by means of case studies in various geological settings and areas, of the benefits as well as the pitfalls, as they relate to seismic interpretation, but also the impact and implications for pre-stack seismic analysis applied to prospect delineation, reservoir characterisation and de-risking through the use of quantitative pre-stack seismic interpretation workflows and technologies.