

REVIEW OF DIFFRACTION IMAGING AND MODELING METHODS

T.J. Moser, Moser Geophysical Services, The Hague, The Netherlands
t.j.moser@mgeoph.com

Over the past ten years a vast amount of publications has appeared devoted to methods for diffraction imaging. In the wake of these publications, diffraction imaging is becoming recognized as a technique for high-resolution imaging of small-scale structural details which - despite their small size - are essential for applications such as fracture detection, near-surface studies and hydrocarbon reservoir characterization, but which are usually overshadowed by standard processing/imaging geared towards reflections. Publications on diffraction imaging cover a number of recurrent themes: treatment of diffractions by standard processing/imaging, illumination properties of diffraction imaging, and its ability to achieve high- or even super-resolution. In an early paper these first principles have been set out (Khaidukov et al., 2004), and subsequent papers have expanded on them. In Moser and Howard (2008) diffraction imaging techniques are taken to depth domain and embedded in a workflow of pre-stack depth migration and migration velocity analysis. In Moser (2011), properties and aspects of diffractions and diffraction imaging in 3D are discussed. Sturzu et al. (2013) introduce specularly gather analysis for diffraction imaging. The interpretation value of diffraction images is an active topic of current research (Sturzu et al. 2014). Their kinematic properties are important for structural interpretation, but their dynamic properties (amplitude and polarity) are equally important for e.g. reservoir characterization. Diffractivity (the local amplitude of a diffraction image) can be assigned a precise physical meaning, namely classical reflectivity with specular reflections taken out. Diffraction modeling (Grasmueck et al. 2015; Moser, 2012) has developed into a separate tool for interpretation and analysis of the diffraction response of small-scale structural features, and as a validation of the details seen in the diffraction image.

References

- Grasmueck, M., Moser T.J., Pelissier M.A., Pajchel J. and Pomar K. 2015. Diffraction signatures of fracture intersections, *Interpretation*, **3**, SF55–SF68.
- Khaidukov V., Landa E. and Moser T.J. 2004. Diffraction imaging by focusing-defocusing: an outlook on seismic superresolution, *Geophysics*, **69**, 1478-1490.
- Moser T.J. and C.B. Howard 2008. Diffraction imaging in depth, *Geophysical Prospecting*, **56**, 627–641.
- Moser T.J. 2011. Edge and Tip Diffraction Imaging in Three Dimensions, *EAGE Expanded Abstracts, Vienna*.
- Moser T.J. 2012. Review of ray-Born modeling for migration and diffraction modeling, *Studia Geophysica et Geodætica*, **56**, 411-432.
- Sturzu I., Popovici A.M., Pelissier M.A., Wolak J.M. and Moser T.J. 2014. Diffraction Imaging of the Eagle Ford Shale, *First Break*, **32**, 49–59.
- Sturzu I., Popovici A.M., Tanushev N., Musat I., Pelissier M.A., Moser T.J. 2013. Specularity Gathers for Diffraction Imaging, *EAGE Expanded Abstracts, London*.