SEPARATION OF SEISMIC DIFFRACTIONS AND SPECULAR REFLECTIONS: A TOOL FOR IMPROVED PROCESSING, IMAGING AND INTERPRETATION

Riaz Alai[1], M Hafizal Mad Zahir[1], Amar Ghaziah[1] & Eric Verschuur[2]

[1]Petronas Research Sdn. Bhd., Lot 3288 & 3289, off Jalan Ayer Itam, Kawasan Institusi Bangi, 43000 Kajang, Selangor Darul Ehsan, Malaysia.
[2]Delft University of Technology, Department of Applied Physics, Lorentzweg 1, 2628 CJ, Delft, The Netherlands.

Complex subsurface structures often generate complex seismic data that may produce inaccurate seismic images affecting the risk factor and success in exploration of oil and gas reservoirs. Therefore, it is important to analyze the character of seismic reflection data and to facilitate this analysis; we can divide the total recorded data into suitable sub-components. As seismic waves reach local discontinuities in the subsurface, new energy is initiated and waves are generated as if a pseudo secondary point source is buried in the subsurface and is emitting diffracted energy. On the other hand, when there is a change of rock type in the subsurface giving an impedance contrast, waves will be partly reflected back at the interface and partly transmitted further into the subsurface.

In detailed seismic reflection data studies in the search for coherent energy, one can observe two kinds of "seismic data events" that are generated in the subsurface and being recorded during seismic data acquisition: 1) seismic diffractions and 2) specular reflections. For better identification and understanding of recorded seismic data, it is beneficial to categorize the effect of subsurface discontinuities into these two categories and process them separately (several researchers have developed methods for this separation). Seismic interpretation is often done on specular reflection data and the effect of diffractions might be neglected in many cases, especially when they are not separated from the data and conventional seismic data processing is applied on the total recorded data. On the other hand, the diffraction energy can be instrumental in fault and fractures identification and characterization.

In this abstract we review a method and implementation for the separation of diffracted energy from specular reflections and illustrate the successful application on a deepwater marine data with a complex seabottom surface. The field data example illustrates improved velocity picking on specular reflections in comparison with velocity analysis on the total recorded data (without separation). The examples confirm that a systematic methodology to separate seismic diffractions from the total recorded wave fields is essential and provides better control of locating faults and fractures optimally.