Multiples and their Generators Identification from VSP: Case Study from Oman

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ABSTRACT

Multiple reflections continue to mask land seismic data. While our industry continues to deal with multiples through advance processing algorithms (multiple suppressions) there have been successes to a certain degree, but we have not yet fully eliminated the multiples in all cases. Therefore, there is a need to understand the multiple generators, to potentially be able to design an algorithm to define its trains for better removal. Borehole seismic and well logs can potentially be used for the identifications of the multiples generators. A case study was carried out into two areas in PDO, trialing a technique to identify multiples generators from VSP upgoing and downgoing wavefields.

In VSP upgoing energy, multiple reflections do not reach the direct downgoing arrivals trend. Hence, the generator can be detected by extending a vertical imaginary line from the multiple's deepest point to the direct downgoing arrival, and then the interception point indicates its generator. Detecting generators from the VSP downgoing wavefield is achieved by first aligning the reflections using the first arrivals time picking, then autocorrelation of the data to enhance the reflections. The shallowest depth at which any downgoing multiple terminates indicates its generator depth. The theory behind this is that no downgoing multiple can exist above its generator.

This paper will outline data requirements, describe the VSP techniques and present results with learnings for multiples and their respective generators identification from two PDO case study areas. This will include integration with surface seismic and well logs.