Attenuation of Scholte Waves from OBC Data Using Polarization Filtering

Yong Qing Chen[1], Mamadou Diallo[1], Mustafa A Marzooq[1], Faisal M Qahtani[1]

[1]Saudi Aramco

Abstract

Objectives
Scholte wave constitutes a type of seismic wave that originates at the interface between a water and a solid layer. In OBC seismic data, these waves form prominent dispersive noise arrivals that contaminate reflection arrivals. The polarization filter operates on P and Vz components in the time-frequency domain using Continuous Wavelet Transform (CWT) to attenuate these coherent noise arrivals generated at seafloor interface.

Procedures
To demonstrate the benefit of using polarization filtering in a production mode, we choose a multicomponent 3D OBC shallow water survey (water depth is between 40 to 60 meters) that had strong Scholte wave's noise characterized by slow propagation, dispersive nature and large amplitude. We show comparisons of the polarization filtering results to those of the frequency-wavenumber (F-k) filtering approach to illustrate the performance of the method.

Results
After extensive testing, we optimized the work into two steps. First, we apply an adequate constant scale factor to the hydrophone for computing the ellipticity ratio. A scale factor globally brings the amplitude level of the Scholte waves' noise in the geophone and hydrophone to the same order of magnitude, and then we determine the threshold needed for the filter. Second, estimate the Scholte wave noise and subtract from the input. The results are effective as it is working on each multicomponent traces independently without spatial aliasing issue. This is the main advantage over most conventional multichannel filtering methods such as Frequency-Wave number approach. We illustrate the effectiveness in detail on pre-stack and stack data using frequency and F-K spectra.

Conclusions
The polarization filter results show effective attenuation of Scholte waves from multi-component OBC data in shallow marine environments. It improves the low frequency, which adds significant impact on inversion results.