CWT Analysis to reduce geological risk of Drilling Operations:

"A case Study of Hiba 3D drilling "

Abdul Kohar[1], Abdul Rashid[1], Magid Abdu Magran[1], Sudarmaji[2], Budi Eka Nurcahya[2]

[1] APCO (Advance Petroleum Company) Khartoum, Sudan.

[2]Lab. Geofisika FMIPA Universitas Gadjah Mada, Yogyakarta Indonesia,

ajisoji@yahoo.com, budiekanurcahya@yahoo.com, akohar@apco-sd.com, ajuwaini@apco-sd.com, mmargan@apco-sd.com

Since Tanner and Sherif (1977) introduces complex seismic trace analysis in geophysical data processing, a multiuse of applications was found during the development of seismic attributes, especially for reservoir characterization. In general, many of attribute can be calculated from seismic measurements 2-D or 3-D, pre-stack or post-stack, time-migrated or un-migrated are seismic attributes Instantaneous attributes are calculated directly from the complex seismic trace by mean Hilbert transforms, that is used to transform seismic trace to complex trace. The complex seismic trace can be generated by the same way, either by Hilbert transform or continuous wavelet transform. While the Hilbert transform is only working in time domain by mean Fourier transform complex trace, complex continuous wavelet transforms is working in time-frequency domain for generating the complex trace.

While the Fourier transform decomposes a seismic signal from sinus or cosines waves to a different frequency, the wavelet transform decomposes a signal into dilated and translated wavelets. The wavelet transform is a method to provide a flexible time-frequency window that automatically is narrowed when observing high frequency phenomena and is widens when observing low-frequency environment. The integral wavelet transforms or wavelet transforms (WT) is decomposed signal by using dilated and translated wavelet.

Seismic attribute analysis based on continuous wavelet transforms (CWT) is a new method to enhance geological information, i.e.stratigraphy and structures, from seismic data. The method is developed by Budi Eka Nurcahya and Sudarmaji (2004), staff of Geophysics Lab., Gadjah Mada University, Yogyakarta, Indonesia. Recently, application of the attribute could also be used as DHI (direct hydrocarbon indicator). This study will use time- frequency derivative of use instantaneous amplitude for estimating the distribution of porous sand and time- frequency derivative instantaneous amplitude in low frequency (around 15hz) for estimating the existing of hydrocarbon. The results will be confirmed with AVO analysis, especially the pattern of increasing amplitude as a function of offset (angle), for checking the reservoir quality.

Based on our experiences in some fields, especially in Indonesia, and Sudan (of Hiba) prospect zones of hydrocarbon is usually indicated by high value of time-frequency derivative of instantaneous amplitude at low frequency anomaly especially around 15hz and increasing of reflection coefficient as increasing of offset (especially in regime of AVO anomaly class III or low acoustic impedance reservoir). Therefore, CWT analysis could be used to reduce geological risk of drilling operations, due to the pattern of reservoir distribution and its quality have been understood.