

Analisa dekomposisi spektral continuous wavelet transform (CWT) untuk memetakan fluida Reservoir Paparan Karbonat Formasi Baturaja, Lapangan M, Cekungan Sumatera Selatan = The Analysis of continuous wavelet transform (CWT) spectral decomposition to map reservoir fluid of Carbonate Platform Reservoir, Baturaja Formation, Field M, South Sumatra Basin

Sri Andaryani, author

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Abstrak

Lapangan M merupakan lapangan gas yang terletak di Cekungan Sumatera Selatan dan sudah dikembangkan dengan pemboran 5 sumur pengembangan dari reservoir paparan karbonat Formasi Baturaja, dengan rata-rata produksi sebesar 4 MMCFPD per sumur. Berdasarkan hasil interpretasi seismik dan analog dengan lapangan minyak disebelah utara lapangan M, yaitu lapangan A, masih terdapat potensi reservoir minyak (oil rim) yang terletak downdip dari reservoir gas yaitu daerah yang belum dikembangkan di antara batas kontak gas dan minyak dengan batas kontak minyak dan air. Data produksi minyak sumur-sumur di lapangan A berkisar antara 100 - 800 BOPD per sumur. Hasil studi ini diharapkan dapat mengidentifikasi zona prospek minyak tersebut dan juga untuk pengembangan lebih lanjut zona gas.

Menggunakan data seismik 3D dan data sumur, dilakukan evaluasi melalui metode dekomposisi spektral Continuous Wavelet Transform (CWT) data seismogram sintetik sumur dan data tras seismik yang melewati sumur, kemudian hasilnya disebar ke seluruh lapangan untuk mengidentifikasi penyebaran lateral keberadaan zona anomali frekuensi rendah.

Hasil analisa dekomposisi spektral CWT pada data sumur dan data tras seismik yang ditunjukkan pada crossplot antara Amplitudo CWT dengan Frekuensi memperlihatkan korelasi yang cukup bagus. Sumur gas menunjukkan nilai amplitudo CWT paling tinggi pada frekuensi 10 - 13 Hz dan sumur minyak pada frekuensi 17 - 22 Hz. Nilai amplitudo menurun pada frekuensi yang lebih tinggi. Pada sumur air, nilai amplitudo CWT selalu paling rendah pada frekuensi rendah hingga tinggi, sehingga dari crossplot tersebut dapat disimpulkan bahwa cut-off amplitudo zona air adalah pada $1,0 \times 10^9$.

Berdasarkan hasil analisis CWT dari data sumur ini, analisa dekomposisi spektral CWT kemudian disebar ke seluruh lapangan untuk bisa mengidentifikasi zona prospek. Selain itu, hasil crossplot antara nilai amplitudo CWT dengan nilai Saturasi air (S_w) pada zona reservoir memperlihatkan adanya hubungan yaitu nilai amplitudo CWT yang tinggi berkorelasi dengan nilai saturasi air yang rendah, begitupun sebaliknya.

Field M is a gas field located in the South Sumatra Basin and has been developed by the drilling of five development wells from carbonate platform reservoir of Baturaja Formation, with average production of 4 MMCFPD per well. Based on the result of seismic interpretation and its analog to the oil field located to the north of field M, namely field A, there is still potential of oil reservoir (oil rim) located downdip from the gas reservoir. The potential area is limited in the area that has not been developed between gas and oil contact and between oil and water contact. The production of oil wells in the field A ranges between 100-800 BOPD per well. The result of this study is expected to identify the oil zone and other prospects for further gas development.

Based on 3D seismic data and well data, the evaluation was carried out using one of spectral decomposition methods, the Continuous Wavelet Transform (CWT). The analysis was done using both well synthetic seismogram data and seismic trace that crossing-through the wells. Then CWT was run on both data. Referring to the result of the analysis, CWT was distributed across the field to identify the presence of low-frequency zone.

The results of the CWT analysis from well data and seismic trace data are shown on the crossplots between the amplitude and the frequency. They show a fairly good correlation. Gas zone shows the highest value of CWT amplitude at a frequency of 10-13 Hz and oil zone shows the highest value at a frequency of 17- 22 Hz. Amplitude values decreased in the higher frequencies. In the water zone, the value of the CWT amplitude is always lower in low to high frequencies. From the crossplot it can be concluded that the cut-off amplitude value for water zone is at 1.0×10^9 . In any frequency, the CWT amplitudes below that value is nonhydrocarbon or water.

The result of spectral decomposition that is based the above analysis and distributed throughout the field is able to identify zones of prospects. In addition to that, the crossplot between the CWT value and the water saturation (S_w) in each oil, gas and water zone shows a correlation. High CWT amplitudes correlate to low water saturation, and vice versa.