Karakterisasi reservoir hidrokarbon menggunakan inversi AI, multiatribut seismik dan probabilistic neural network pada lapangan ‘B’ cekungan Kutai, Kalimantan Timur = Characterization of hydrocarbon reservoir using AI inversion seismic multiattribute and probabilistic neural network of ‘B’ Field, Kutai Basin, East Kalimantan

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Abstrak

Lapangan ‘B’ merupakan lapangan prospek hidrokarbon yang berlokasi di offshore cekungan Kutai, Kalimantan Timur. Untuk mengetahui karakterisasi reservoir lapangan ‘B’, dilakukan pemodelan porositas dan saturasi air menggunakan inversi AI, multiatribut seismik dan probabilistic neural network. Penelitian ini menggunakan data seismik 3D PSTM dan data sumur (AND-1, AND-2, AND-3 dan AND-4). Pada data seismik dan data sumur dilakukan inversi AI untuk mengetahui sifat litologi area penelitian. Kemudian, hasil AI ditransformasikan untuk mendapatkan model porositas. Metode multiatribut seismik menggunakan beberapa atribut untuk memprediksi model porositas dan saturasi air. Setelah itu, diaplikasikan sifat non-linear dari probabilistic neural network sehingga menghasilkan model porositas dan saturasi air hasil probabilistic neural network (PNN). Model porositas dan saturasi air transformasi AI, multiatribut seismik dan PNN divalidasi dengan nilai porositas dan saturasi air data sumur untuk mengetahui apakah model porositas dan saturasi air tersebut merepresentatifkan nilai data sumur. Validasi dilakukan pada sumur AND-1 dan AND-2. Nilai porositas dan saturasi air data sumur untuk AND-1 adalah 25.3 – 35.9% dan 45 – 60%, dan nilai porositas dan saturasi air AND-2 adalah 11 – 35% dan 15 – 82%. Nilai porositas AND-1 hasil transformasi AI sekitar 16 – 67%, multiatribut seismik sekitar 11.5 – 27% dan PNN sekitar 11.5 – 27%. Nilai saturasi air AND-1 hasil multiatribut seismik sekitar 4 – 63% dan PNN sekitar 18 – 63%. Nilai porositas AND-2 hasil transformasi AI sekitar 52 – 72%, multiatribut seismik sekitar 11 – 21.5% dan PNN sekitar 11 – 21.5%. Nilai saturasi air AND-2 hasil multiatribut seismik sekitar 63 – 85% dan PNN sekitar 63 – 85%. Kemudian, metode multiatribut seismik dan PNN didapatkan nilai korelasi antara parameter target dengan parameter prediksi. Model porositas multiatribut seismik memiliki korelasi 0.840836 dan PNN memiliki korelasi 0.936868. Model saturasi air multiatribut seismik memiliki korelasi 0.915254 dan PNN memiliki korelasi 0.994566. Model porositas transformasi AI memiliki rentang yang lebih tinggi dibandingkan dengan data sumur. Model porositas dan saturasi air metode PNN memiliki rentang nilai yang cukup dekat dengan data sumur dan memiliki korelasi yang lebih tinggi dibandingkan dengan metode multiatribut seismik. Oleh sebab itu, model porositas dan saturasi air metode PNN merupakan model prediksi terbaik. Berdasarkan model PNN, reservoir zona target lapangan ‘B’ memiliki nilai impedansi akustik 25384 – 26133 ((ft/s)*(g/cc)), porositas sekitar 15 – 27% dan nilai saturasi air sekitar 11 – 63%.

.....The 'B' field is a hydrocarbon prospect field located in the offshore Kutai Basin, East Kalimantan. To determine the characterization of the ‘B’ field reservoir, porosity and water saturation modeling was carried out using AI inversion, seismic multiattribute and probabilistic neural network. This study uses 3D PSTM seismic data and wells data (AND-1, AND-2, AND-3 and AND-4). In seismic data and wells data, AI inversion was carried out to determine the lithological characteristics of the research area. Then, the AI results were transformed to obtain a porosity model. The seismic multiattribute method uses several attributes to predict the porosity and water saturation model. After that, the non-linear properties of the probabilistic neural network were applied to produce the porosity and water saturation model of the probabilistic neural network (PNN). The porosity and water saturation model of AI transformation, seismic multiattribute and PNN were validated with the porosity and water saturation values of the wells data to determine whether the porosity and water saturation models represent the wells data values. Validation was carried out on AND-1 and AND-2 wells. The porosity and water saturation value of the well data for AND-1 around 25.3 - 35.9% and 45 - 60%, and the porosity and water saturation value of AND-2 around 11 - 35% and 15 - 82%. The porosity value of AND-1 as a result of AI transformation is around 16 - 67%, the seismic multiattribute about 11.5 - 27% and the PNN about 11.5 - 27%. The water saturation value of AND-1 resulted from seismic multiattribute around 4 - 63% and PNN around 18 - 63%. The porosity value of AND-2 transformed by AI around 52 - 72%, the seismic multiattribute around 11 - 21.5% and the PNN around 11 - 21.5%. The water saturation value of AND-2 result from the seismic multiattribute around 63 - 85% and PNN around 63 - 85%. Then, the multiattribute seismic and PNN methods obtained the correlation value between the target parameter and the predicted parameter. The seismic multiattribute porosity model has a correlation of 0.840836 and PNN has a correlation of 0.936868. The multiattribute seismic water saturation model has a correlation of 0.915254 and PNN has a correlation of 0.994566. The AI transformation porosity model has a higher range than the wells data. The PNN method of porosity and water saturation model has a fairly close range of values to wells data and has a higher correlation than the multiattribute seismic method. Therefore, the porosity and water saturation model of the PNN method is the best prediction model. Based on the PNN model, the field target zone reservoir 'B' has an acoustic impedance value about 25384 – 26133 ((ft/s) * (g/cc)), a porosity of 15 - 27% and a water saturation of 11 - 63%.