APPLICATION OF ARTIFICIAL NEURAL NETWORKS TO DEVELOP INPUT DATA FOR ACOUSTIC AND ELASTIC INVERSION IN THE WYSIN 1 WELL AND FOR PART OF THE WYSIN-3D SEISMIC IMAGE

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Introduction

As part of a comprehensive interpretation of the geological medium, artificial neural networks (ANN) method was used to estimate the value of DT travel time in Wysin 1 well from the Pomeranian region in the northern part of Poland. The aim of the work was to assess the usefulness of artificial neural networks as an estimator of DT travel time which, as an input data, is the basis for conducting acoustic and elastic inversion in the Wysin 1 well and in part of the Wysin-3D seismic image.

Samples and methods

As a set of input signals for creating of an artificial neural network, data from the Wysin 1 well: depth, borehole diameter profiling, two sets of resistivity (measured with LLD and LLS), medium density and natural radioactivity profiling data was used. A MLP 6-11-1 neural network was created, estimating DT travel time values in the Wysin 1 well. A series of comparative statistical analyzes were carried out with respect to measured data, achieving excellent results (correlation coefficient between measured and computed data *r* was 0.9899).

In the next step, elementary signals for both sets were extracted by Roy White's proposed method (1974), using density profiling from Wysin 1 and data from Wysin-3D seismic image.

In the final stage of work, a seismic inversion was carried out on the basis of both sets of data. Chronostratigraphic data and checkshot from the Wysin 1 well was used. An inversion was carried out in the borehole's pathway, using a 30 Hz Rieker signal. Borehole inversion was the basis for inversion on a part of Wysin-3D seismic image.

Results and conclusions

Extraction of the elementary signal based on the profiling of DT (measured and calculated), density profiling from the Wysin 1 well as well as the Wysin-3D seismic picture gave comparable results. The relative amplitude of the obtained wavelet was similar, and the signal strength spectra and its phases showed slight differences. The discrepancy between the prediction values between measured and calculated data was only 6%. The adaptation of the inversion model to synthetic data and the correlation of synthetic seismograms was at a high level. Inversion into a part of the seismic image in combination with borehole data exhibited high correlation of seismic reflections compared to the results of vertical (borehole) inversion itself.

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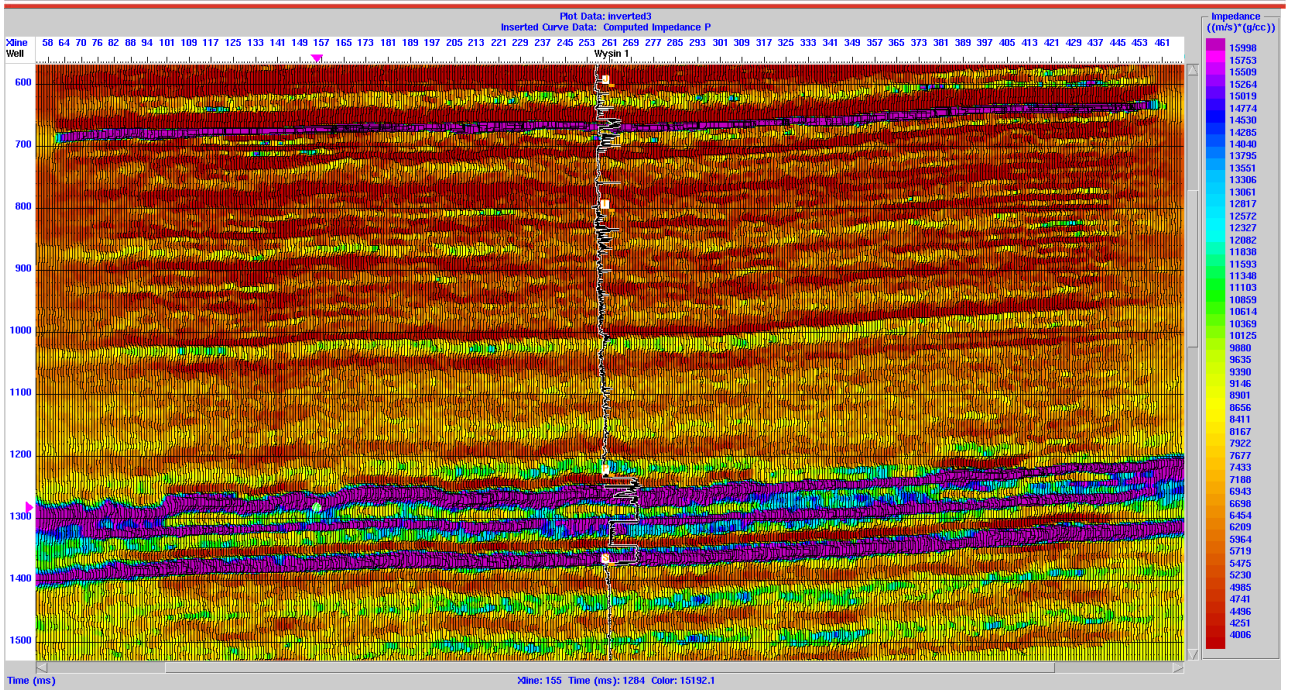

Figure. 1. *The result of detailed inversion from Jurassic and 100 ms above to Permian and 300 ms below interval; time domain, acoustic impedance distribution.*

References

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