

Using the velocity of seismic waves estimated from ambient seismic noise to assess the results of hydro-fracturing and the exploitation of shale-rock formations

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Wysin-2-H is a well drilled in the so-called shale gas region of Pomerania, northern Poland. A seismic network was constructed around the well to study the seismic effects of activating of shale gas deposits by hydro-fracturing. The network was also used for the measurements of seismic noise, although the net was not specifically designed for this purpose.

The seismic noise directivity strongly influences the structure of correlograms. Therefore, this issue was researched intensively. It is presented that arrival times of strong signals in the time intervals greater than 1 month in frequency range 0,1 – 0,4 Hz are not disturbed by movement of source of seismic noise.

Due to presence of strong reflector in geological structure of Wysin region, the coda waves are reflected downward and cannot be recorded by the network. It is shown that the only waves recorded in longer time lags, which have signals visible on the correlograms, are horizontal waves recorded in one station. Using these waves, accuracy of estimation of the relative velocity changes in geological strata is approximately 0,05 %.

Despite the depth of the shale gas deposits estimated for about 4000 m, it was assumed that correlograms calculated for the seismic data before hydro-fracturing and correlograms for the data after activation of shale gas deposits, with high gas production rate, should vary significantly and provide useful information about velocity changes.

Due to complicated structure of shale gas deposits there was no meaningful gas output from the Wysin well. Hence, the measurements of seismic noise have not indicate the changes of the velocity distribution before and after hydro-fracturing.