



JOINT INVERSION OF SEISMIC AND GRAVITY DATA AS TOOL FOR IMPROVING OF SEISMIC STATIC CORRECTION ESTIMATION. EXAMPLE FROM POLISH LOWLAND – A REGIONAL AGH3 SEISMIC PROFILE

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Introduction

The main objective of the presented results is the assessment of usefulness in the utilization of archival, gravity data for supporting and complementing seismic measurements, aimed at defining the structure of formations representing the low-velocity zone. The presented results of seismic survey come from the regional seismic profile, named AGH-3. Measurements and interpretation have been carried out in the framework of the project entitled “Improvement of the effectiveness of seismic survey in prospecting, exploration and appraisal of gas fields in the Rotliegend formations” (Górecki et al., 2013).

The central and northern parts of Poland are covered by a thick blanket of Pleistocene post-glacial sediment. Directly beneath this material lie loose, or of early diagenetic overprint, Neogene formations, mainly Miocene sediment. The thickness of Quaternary sediments in the northern part of the country locally exceeds 300 m. The loose and highly, internally diverse subsurface complex considerably hampers the completion of seismic surveys, especially those including the seismic reflection method. The basic issue on this subject is the proper solution to the issue of implementing short and long wavelength, static correction (Cox, 1999) values for data from Polish Lowland (Cygals et al., 2016, Cygals et al., 2017).

Methods

Calculations have been compiled using the modern seismic data processing program TomoPlus2D/3D produced by GeoTomo LLC, which enables the integration of seismic data in the form of first breaks and gravity data, such as Bouguer anomalies and their residual values (Zhou et al., 2014). The term joint data inversion relates to the process of simultaneous estimation of result models for independent data, with the implementation of one calculation algorithm (Gallardo & Meju, 2004; Colombo et al., 2013, Moorkamp et al., 2013).

Results

The obtained results indicate that a joint geophysical data inversion enables obtaining much higher resolution results compared to classic solutions (Figure 1). Such output material allows detailed and complex interpretation of geophysical and geological data.

Conclusions

Combined inversion of seismic and gravity data enabled to obtain geophysical cross-sections of high resolution. Good quality of output material allowed complex interpretation of high detail, geological and geophysical data. Prospection of velocity and density variation distribution in Quaternary sediments proved beneficial in groundwater basin and mineral deposits prospecting. Insertions of lignite in the Miocene also turned out to be an interesting prospecting objective. The set range of their presence has been confirmed by borehole data from deposit documentations in this region.

Acknowledgements

This paper was based on results of investigations carried out in the framework of the project entitled "Improvement of the effectiveness of seismic survey in prospecting, exploration, and appraisal of gas fields in the Rotliegend formations" financed by European Fund for Regional Development in the framework of Operating Programme "Innovative Economy" and “Experimental, complex and multi-variant interpretation of seismic, magnetotelluric, gravity and borehole data as a tool to improve the effectiveness of structural and



CAGG-AGH-2019

reservoir research” – Applied Research Program III, financed by Minister of Science and Higher Education of Poland through National Centre of Research and Development.

We appreciate the support from GeoTomo for allowing us to use TomoPlus software package and Halliburton package to perform this study.

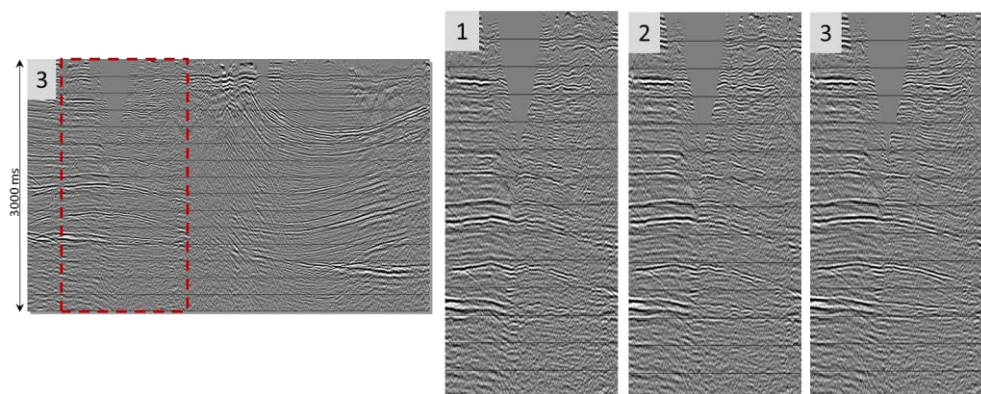


Figure 1. Example of seismic stack section used static corrections based on velocity model calculated as: 1- classic traveltome tomography, 2- joint inversion gravity and refraction data, 3- joint inversion gravity and refraction data with up-hole data as constraints.

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