AUTOREFERAT

1. Name
   **Mariusz Majdański**

2. Scientific titles and degrees – including description, place and date, and PhD thesis title.

| | |
|---|---|
| PhD in Physics<br>2006 | Physics Department, University of Warsaw, specialization in Geophysics, PhD title: „ Modelling of the structure of the Earth's crust in the south western Poland - three dimensional methods"<br>Supervisor – prof. dr hab. Marek Grad.<br>Thesis with distinction . |
| Master<br>2002 | Physics Department, University of Warsaw, specialization in Geophysics Wydział Fizyki, Uniwersytet Warszawski, specjalność geofizyka |

3. Information about the scientific employment

| | |
|---|---|
| 2010 – up to now | Assistant professor in the Department of the Lithospheric Research, Institute of Geophysics, Polish Academy of Sciences, Warsaw. |
| 2008 – 2010 | Postdoc at the R&D centre Schlumberger Cambridge Research, Cambridge, UK |
| 2006 – 2008 | Assistant professor in the Department of the Lithospheric Research, Institute of Geophysics, Polish Academy of Sciences, Warsaw. |

4. Scientific achievement according to Dz. U. nr 65, poz. 595 ze zm.:

   a) Title of the scientific achievement

   ***„The estimation of the uncertainty of the Earth's crust models based on wide-angle seismic data for generation of the regional reference models of the crust"***

   b) (author, title of the publication, year, journal),

[I] *Majdański* M., Kozlovskaya E., Grad M. and SUDETES 2003 Working Group, 2007
*3D structure of the Earth's crust beneath the northern part of the Bohemian Massif*
Tectonophysics, 437, 17-36

[II] Majdański M., Sroda P., Malinowski M., Czuba W., Grad M., Guterch A., Hegedűs E., 2008
*3D seismic model of the uppermost crust of the Admiralty Bay, King George Islane, West Antarctica*
Polish Polar Research, 29, 303-318

[III] Majdański M., Kozlovskaya E., Świeczak M., Grad M., 2009
*Interpretation of geoid anomalies in the contact zone between the East European Craton and the Palaeozoic Platform - I. Estimation of effects of density inhomogeneities in the crust on geoid undulations*
Geophysical Journal International, 177, 321-333

[IV] Świeczak M., Kozlovskaya E., Majdański M., Grad M., 2009
*Interpretation of geoid anomalies in the contact zone between the East European Craton and the Palaeozoic Platform - II: Modelling of density in the lithospheric mantle*
Geophysical Journal International, 177, 334-346

[V] Grad M., Brűckl E., Majdanski M., Behm M., Guterch A. and CELEBRATION 2000 and ALP 2002 Working Groups, 2009
*Crustal structure of the Eastern Alps and its foreland: seismic model beneath the CEL10/Alp04 profile and tectonic implications*
Geophysical Journal International, 177, 279-295

[VI] Majdański M., 2012
*The structure of the crust in TESZ area by Kriging interpolation*
Acta Geophysica, 60, 1, 59-75

[VII] Majdański M., 2013
*The uncertainty in layered models from wide-angle seismic data*
Geophysics, 78, 3, WB31-WB36

c) Description of the scientific goal of the above papers and presented results including the discussion of application

Introduction

In my scientific carrier I worked with analysis and interpretation of the wide-angle refraction seismic experiments, resulting in the Earth's crust and the upper mantle models. This interpretation was done using different techniques including several types of travel times tomography, and seismic ray-tracing technique with trial and error method. The final models of seismic waves propagation velocity and the shape of reflecting boundaries are different depending on which method was used to generate them, and who was performing the modelling. Those differences are the result of a few reasons. First of all, they result from subjective selection of the model parameterization, the characteristic of used method e.g. smooth tomography or tomography that includes layers, or from used inversion parameters. In case of trial and error modelling with ray-tracing those differences results from a large ambiguity of this problem, and often from over interpretation of the data by the author. The final factor is the uncertainty in the data, that is often forgotten, but has a significant influence on the final result. It is extremely difficult to compare the results of different methods, and even more difficult which one of them is the best one. This problem convinced me to think about estimation of the uncertainty for all of those methods, and also to refer obtained results to the optimal reference models. This publication cycle, making my habilitation achievement, describes different methods used for modelling of the Earth's crust with the uncertainty analysis of the results, and also a method of determination of the regional reference model of the Earth's crust.
The seismic methods gives currently the most precise description of local and regional structure of the Earth's crust. This knowledge is essential in both scientific tasks like determination of tectonics and geodynamics of the area, and in practical application like estimation of the natural hazard, localization of critical objects like nuclear power plants or in the natural resources exploration like oil or gas. Acquaintance of the reference models, and more importantly their uncertainty is extremely important to perform those tasks.

Articles discussion

[I] The first article in my cycle is a direct reference to my PhD thesis. Its main target was to find three dimensional structure of the crust in the south-western Poland using seismic data from wide-angle refraction profile SUDETES 2003 (Grad 2003). Project SUDETES 2003 was one of a large refraction experiments realized in Central and Eastern Europe, as a land geometry wide-angle refraction experiment with chemical sources. I was personally involved in the field works in active part of the experiment, as well as in planning and the passive stations deployment field works in its passive part.

During the tomographic modelling I found a large dependence of the uncertainties calculated for the velocity field distribution in layers from used modelling strategy. The final modelling obtained with JIVE3D code by Hobro (1999) was done by inversion of travel times for seven separate seismic wave phases propagating in three dimensional model composed of four layers. This problem can be solved on several ways using different inversion paths. In this article some of this ways were described including the most common layer-stripping method or simultaneous multi parameter inversion. In the Layer stripping method the shallowest layer is inverted for velocity distribution using rays propagating in this layer, then process moves to deeper layer. The simultaneous inversion include all the data and invert for all parameters at once. Obtained models were slightly different, especially in deeper parts while corresponding uncertainties for velocities estimated using covariance matrixes (Tarantola, 1987) were significantly different. In single layer inversions the uncertainties were small (dV<0.2 km/s) in shallow parts and almost unknown (dV>1 km/s) in deeper parts. In simultaneous inversion including waves propagating through deeper layers and crossing all layers of the overburden gives in the result more smooth models, lacking some details, with larger uncertainty of velocities (dV<0.4 km/s), but uniformly distributed in the whole area. This result is important because it shows the necessity of presentation of the seismic tomography results with corresponding uncertainty estimation. Presentation of the results without the uncertainties may lead to incorrect geological interpretations. This conclusion is true also for other geophysical modelling results. In this paper there is no answer to the question which inversion path is optimal, but the answer will be given in paper [VII].

[II] This article is an example of application of seismic tomography for studying shallow structures at 2-3 km depths using wide-angle refraction seismic. This experiment was performed in the Admiralty Bay on the King George Island in West Antarctica during the International Polar Year project. Personally I was involved in both an expedition and field works. This experiment is different than the one described in (I), because it was performed using seismic stations localized on a complicated shore line of the bay, and using an air gun source operating from a vessel in the bay.

Despite the change in geometry, interpretation methods for wide-angle refraction seismic remains the same. For interpretation two methods were used: previously mentioned JIVE3D and smooth tomography IBP by Hole (1992). The tomographic methods from definition cannot precisely describe a sharp velocity changes at the interfaces between the layers or along faults. However, it is possible to interpret those rapid changes from the shape of velocity field isolines. Additionally, using two types of tomography resulting in similar final models improves the reliability of the interpretation. The main problem in marine seismic tomography interpretation is a layer of water with significantly lower velocities. Such a change in velocity is not possible to be described in parameterization used in any smooth tomography, and has significant influence on the uncertainty of the final result. To increase the precision of interpretation additional measurements of bathymetry were performed from the ship. I have estimated the shape of the bay bed and this information was used in tomographic analysis on two ways. In the smooth tomography the water layer was eliminated and corresponding propagation delay was subtracted from observed times. In tomography with layers the water layer was included as a separate layer. In both cases this procedure helped to image the detailed structures of the crust impossible to observe using standard tomography. The estimation of the uncertainties was performed using two approaches. In smooth tomography verification of reliability of the model was done based on number of seismic rays crossing gives area or inversion cell. The cells without or insufficient ray coverage were excluded from the final model. In case of JIVE3D code the uncertainty was quantitatively estimated using covariance matrices. Joint interpretation of the reliable areas in the results allows us to estimate localization of the Ezcurra fault. This work is an example of how additional a priori information may increase the resolution of used interpretation methods.

[III and IV] This is a double article describing joint interpretation of seismic and gravity data interpretation focused on the structure of the crust and the upper mantle of discussed area of TESZ. In any gravity field studies of the upper mantle the knowledge of the crust structure is very important, because it has the strongest influence on observed gravity anomalies. In the study area which is territory of Poland, Czech Republic, Slovakia we knew local structures of the crust along seismic profiles from large experiments POLONAISE'97 (Guterch 1999), CELEBRATION 2000 (Guterch 2003), SUDETES 2003 (Grad 2003), and a few smaller projects. However, there was no single reference model describing this structure. It is not strait forward to create such a model using existing two dimensional models because each of those models were prepared by different authors, with different amount of details and even different number of layers. To create this model I have invented a simple method. The method involves digitising of existing model with complicated velocity field and several layers to regular grid. This simplified regular velocity grid allows, with small decrease of resolution, describe the velocity field and a shape of interfaces. If such a regular grid is treated as an approximation of smooth velocity field it is possible to interpolate it between profiles in easy way. Even simple linear interpolation methods allows with small uncertainties estimate directions of dipping structures or describe the change of velocity in the volume. The uncertainty of this interpolation depends on the size of digitising grid. Obviously, this method is much more precise in case of simple structures, as known in discussed area. In case of rapid changes of velocity field like vertical faults it leads to smoothed models similar to once known in seismic tomography.

Obtained model was precise enough to use a single velocity density relation to explain main part of discussed shape of the geoid. Article describes more precise analysis that includes topography, a separate sediments layer, and finally various velocity density relations for known tectonic units. Remaining gravity residuum has sources below the crust in the upper mantle. To find distribution of densities below the Moho and down to 220 km the statistical inversion methods were used. Those methods describe probability density functions for each parameter of the model that allows an estimation of the uncertainty for each parameter. Additional sensitivity to changes of the single parameter were performed. The final isostatic compensation analysis led to coherent image of the upper mantle for the whole TESZ area.

[V] This article shows an analysis along profile being a combination of profile CEL10 from the CELEBRATION 2000 experiment and profile ALP04 from ALPS 2002 experiment (Bruckle et al, 2003), that crosses the East Alps from the Bohemian Massif to the Adriatic Sea. The article contains an interesting tectonic interpretation given by one of co-authors (E. Bruckl) that describes the boundary between the Adriatic and European crust. This interpretation was based on ray-tracing modelling and comparison with three dimensional first brakes tomography performed in the area by Behm (et al., 2007). The direct comparison of those results is difficult, because they contains significantly different amount of details in the structure. For this comparison and correct interpretation we need the uncertainty analysis as the one performed by Behm (et al. 2007), in which an optimal travel time fit and an inversion grid size is selected. This defines the size of the anomalies that are possible to be recognized in the structure. In case of ray-tracing modelling a single parameter change method was used. It is an qualitative method in which we observe the effect of a single parameter change e.g. the depth of one boundary for corresponding arrival times. Comparison on observed difference in the arrival times at gives offset with picking precision estimated from observed wave field allows to verify if given change was large enough to be noted during the modelling. An example given in the paper assumes ±2 km change of the Moho boundary, and presented hodographs shows visible difference for PmP phase arrival times against observed data. For intercrustal boundaries visible change was estimated as ±2-3 km. Similar tests were performed for the velocity field. It led to conclusion that visible change in P waves velocities are observed in the consolidated sediments layer and in the upper

mantle from Pn arrivals for ±0.1 km/s. The uncertainty on P waves velocities in the lower crust was estimated as ±0.2 km/s.
This method shows in convincing way how sensible this modeling technique is for a single parameter change observed along one seismic ray, and allows the uncertainty analysis in key areas of the final model. It is however difficult to apply it for the whole modeled area. Additionally, this method doesn't include the uncertainties of other parameters, nor cannot use more than a single seismic ray. An alternative method for estimation of the uncertainty for the whole area in this kind of modeling is presented in paper [VII].

[VI] This paper describes the method of creation of the crust reference model in the territory of Poland, Czech Republic, Slovakia and parts of territories of surrounding countries. In this territory we have many good quality interpretations along profiles from large refraction experiments: POLONAISE'97, CELEBRATION 2000, SUDETES 2003 and LT (Grad et al., 2005). Those interpretations gives a detailed information about the structure of the crust and P wave velocity distribution, but they are prepared by different interpreters and contains different amount of details, including number of layers. For combined interpretation I have used the method described in paper [III]. Each from 33 two dimensional models has been digitised to regular grid of P waves velocities using 10 km horizontal by 1 km vertical grid size, and further interpolated in three dimensional volume. For interpolation I have used linear interpolation, and also prepared an application of Ordinary Kriging method (Isaaks and Srivastava, 1989) for three dimensional velocity field. The result obtained with Kriging shows much smaller number of computational artefacts, and because the characteristic of Kriging method is available for the whole discussed space. Obtained model describes the main tectonic features of the area like the shape of the sediments in TESZ zone, the triple structure of velocity field in the East European Craton, the velocity field in Palaeozoic Platform, as well as the shape of the Moho boundary. Additionally, the paper presents the uncertainty analysis in form of standard Kriging deviation (SKD) for each parameter in the model. Taking into account used assumptions like isotropy in the velocity field and stationarity of the analysis in well resolved areas the uncertainty (SKD) of the velocity field was estimated as ±0.6 km/s.
The final reference model might be used in other geophysical interpretations. It was used for local event localization (lizurek et al., 2013), for interpretation of the deep seismic reflection profile POLCRUST (in preparation), and also in teleseismic tomography of the PASSEQ experiment data (in preparation).

[VII] The last paper in my habilitation cycle summarizes the uncertainty estimation methods and present missing estimation method for trial and error ray-tracing modelling technique. In the article I present simplified description of refraction and reflection wave propagation in layered model. Because this description is analytical it is possible to use a small error propagation theory to estimate the uncertainties for each of the model parameter. It gives the estimation for both velocity field and boundaries depths for given picking precision and known final model, being the result of an optimal travel time fit. Obtained analytical solutions are nonlinear. Interestingly, the uncertainty of velocity are getting smaller for larger offsets, but for depth of boundaries increase with offset. We can conclude, that the most precise determination of velocity is possible at large offsets, but for the cost of smoothing analysed structures. Naturally, for reflected waves the most precise determination of reflecting surfaces we will get from vertical reflections. My method is based on a local approximation of the model with one dimensional description. The analysis along profile is performed with gives step what in results gives an estimation for all parameters for the whole profile. The article also describes a statistical method for the uncertainty estimation. Using an analytical relation it is possible to generate statistical distributions of input travel times with gives standard deviation, and analyse distributions of the parameters of inverted models. A statistical test using a set of a few millions samples well confirms analytical results, confirming small correlation between the input data. Additionally, this paper describes the problem of error propagation in layer stripping inversion, in which a priori information like the shape and structure of the sedimentary layer is known with given precision, that should propagate to layers below. This is the question asked in paper [I]. If we include propagation of errors in seismic tomography with layer stripping inversion strategy, the final uncertainty will be larger than the one from simultaneous inversion of all available data. Because of that the strategy of simultaneous, multi parameter inversion is better tomographic method.

To study the uncertainty in tomographic models it is possible to apply more advanced statistical methods. For a few years I have been working in this subject with dr Richard Hobbs from Durham University in Great Britain, especially focusing on Bayesian methods. We managed to estimate the uncertainty of a simple, two dimensional tomographic model with layers using Monte Carlo Markov Chain method. Our results, the one of the first in this subject were presented in SEISMIX 2008 conference as a presentation by Majdański M., Hobbs R.W., "Bayesian determination of the uncertainty in the travel time inversion". For complicated models the computational complexity encourage to use estimated methods like covariant matrices that gives reliable estimations.

Conclusions

Presented cycle discuss the problem of estimation of the uncertainties in geophysical models based on seismic waves travel times. Because of several interpretation techniques and a number of interpreters it is difficult to compare and jointly interpret obtained results. It is especially difficult in the case of trial and error ray-tracing modelling, because this method strongly depends on the experience and the knowledge of the interpreter. In this cycle I discuss seismic tomography methods with the uncertainty analysis based on covariant matrices, statistical methods, and ray-tracing modelling with my uncertainty estimation method. Preparation of those methods and encouraging to use quantitative estimations of the uncertainty for every geophysical model will help to optimally use the field data, and according to the Occams razor rule to create the simplest possible models that can explain observed data. Thanks to that we can avoid over interpretation in ray-tracing models, as well as smooth, structureless results of mathematical optimisation in the first breaks tomography.
Having at our disposal optimal two and three dimensional models, and understanding their uncertainties we are able to create useful reference models of the crust, that have a wide application in other fields of the geophysics.

Referencje:

Amundsen L., 2001, Elimination of free-surface related multiples without need of the source wavelet, Geophysics, 66, 327-341.

Behm M., Bruckl E., Chwatal W., and Thybo H., 2007, Application of stacking and inversion techniques to three-dimensional wide-angle reflection and refraction seismic data of the Eastern Alps, Gophysical Journal International, 170, 275-298.

Bruckl E., Bodoky T., Hegedus E., Hrubcowa P., Gosar A., Grad M., Guterch A, Hajnal Z., Keller G.R., Spicak A., Sumanovac F., Thybo H., Weber F., and ALP 2002 Working Group, ALP 2002 seismic experiment, Studia Geophysica et Geodetica, 47, 671-679.

Grad M., Spicak A., Keller G.R., Guterch A., Broz M., Hegedus E., and Working Group, 2003, SUDETES 2003 seismic experiment, Studia Geophysica et Geodetica, 47, 3, 681-689.

Grad M., Guterch A., Polkowska-Purys A., 2005, Crustal struture of the Trans-European Suture Zone in central Poland – reinterpretation of LT-2, LT-4 and LT-5 deep seismic sounding profiles, Geological Quartarly, 49, 3, 243-252.

Guterch A., Grad M., Thybo H., Keller G.R., and the POLONAISE Working Gropu, 1999, POLONAISE'97 – An international seismic experiment between Precambrian and Variscan Europe in Poland, Tectonophysics, 314, 1-3, 101-121.

Guterch CELEBRATION 2003
Guterch A., Grad M., Keller G.R., Posgay K., Vozar J., Spicak A., Bruckl E., Hajnal Z., Thybo H., Selvi O., and CELEBRATION 2000 Experiment Team, 2003, CELEBRATION 2000 Seismic Experiment, Studia Geophysica et Geodetica, 47, 3, 659-669.

Hole J.R., 1992, Non-linear high resolution three-dimensional seismic travel time tomography, Journal of Geophysical Research, 97, 6553-6562.

Isaaks E.H., and Srivastava R.M., 1989, An Introduction to Applied Geostatistics, Oxford University Press, New York.

Hobro J.W.D., 1999, Three-dimensional tomographic inversion of combined reflection and refraction seismic travel-time data., Ph.D. Thesis, Department of Earth Sciences, University of Cambridge.

Lizurek G., Plesiewicz B., Wiejacz P., Wiszniowski J., Trojanowski J., 2013, Seismic event near Jarocin (Poland), Acta Geophysica, 61, 1, 26-36.

Tarantola A., 1987, Inverse Problem Theory: methods for data fitting and model parameter estimation, Elsevier, Amsterdam.

5. Discussion of the other scientific achievements

Interpretation of wide-angle seismic data in studies of the lithosphere in the area of the Central Europe

I was involved in the field works and interpretation of seismic data in a few large refraction experiments in the area of Central Europe, in particular: CELEBRATION 2000, SUDETES 2003, GRUNDY. I was also involved in interpretation of materials from POLONAISE'97 and ALP 2002 experiments Those experiments covers with profiles a large territory of Central Europe from the Baltic Sea to the Adriatic Sea and form an important input to solve structural and geodynamic problems of Europe.
Gathered data were used to create many publications describing the structure and evolution of the lithosphere of this part of Europe. My input was determination of the structure in the area of Sudetes and south-western Poland, what was my main

result presented in my PhD thesis and in paper by Majdanski (et al., 2006) and in article mentioned in my habilitation cycle (I).

Determination of the crustal structure and geodynamic in the area of Alps in which I participated was presented in the article by Bruckl (et al., 2007).

In my interpretations I have often used seismic tomography methods. I have studied the possibilities of more optimal usage of gathered data and optimisation of calculations. My results describing the use of later refraction arrivals in smooth tomography were presented in paper by Majdański and Grad (2005).

I was also involved in the field works and interpretation of data from the deep reflection profile POLCRUST. This 240 km long profile localized in south-eastern Poland crossed the TESZ zone and the Carpathian Mountains and is an unique set of data that allow much more precise description of the crustal structures comparing to previously mentioned wide-angle profiles. The publication based on this profile are being prepared.

Additionally, as a member of a Working Group of projects SUDETES 2003 and ALPS 2002 I am a co-author in a few publications, including two from JCR list. My results in this subject were presented in 13 international conference presentations and workshops.

Articles:

**Majdański M.**, Grad M., 2005, Application of second arrivals in seismic tomography inversion for the crustal structure study, Acta Geophysica Polonica, Vol. 53, No. 1, 13-26

**Majdański M.**, Grad M., Guterch A. and SUDETES 2003 Working Group, 2006, 2-D seismic tomographis and ray tracing modelling of the crustal structure across the Sudetes Mountains basing on SUDETES 2003 experiment data, Tectonophysics, 413, 249-269

Bruckl E., Bleibinhaus F., Gosar A., Grad M., Guterch A., Hrubcova P., Keller R.G., **Majdanski M.**, Sumanovac F., Tiira T., Yliniemi J., Hegedus E., and Thybo H., 2007 Crustal structure due to collisional and escape tectonics in the Eastern Alps region based on profiles Alp01 and Alp02 from the ALP 2002 seismic experiment Journal of Geophysical Research, 112, doi:10.1029/2006JB004687

<u>The marine seismic processing – advanced methods of multiples elimination</u>

In 2008-2010 I got a researcher post-doc position in Schlumberger Cambridge Research, Cambridge, Great Britain, where I got an experience in reflection seismic data processing and imaging. I have investigated an advanced method of elimination of free surface multiple reflections in marine seismic using the deconvolution method. To apply this method an advanced solution in terms of seismic data gathering are needed. We used a set of streamers towed at different depths. This leads to a wave field recorded at two or three different levels that allows separation of seismic energies for the up and down going components. The separated signals can be deconvolved, up going component by down doing one, that gives in the result the seismic signal without a free surface multiple reflections as well as pegleg reflections. This method was previously described by Amundsen (2001). The method prepared by me was the first successful application of deconvolution method in multiples elimination in streamer data. It was presented in paper by Majdanski (et al., 2011) and presented at the EAGE conference in extended abstract Majdanski (et al., 2010).

Article:

**Majdański M.**, Kostov C., Kragh E., Moore I., Thompson M., Mispel J., 2011, Attenuation of free-surface multiples by up/down deconvolution for marine towed-streamer data, Geophysics, 76, 6, 129-138

Extended abstract:

**Majdanski M.**, Kostov C., Kragh E., Moore I., Thompson M., Mispel J., 2010, Field Data Results of Elimination of Free-surface-related Events for Marine Over/Under Streamer Data, EAGE 2010

<u>The investigation of the Earth's mantle in the TESZ area using passive seismic</u>

I was one of the main contractor in the seismic passive experiment PASSEQ realised in 2005-2008. In this project performed on the territory of Poland, Germany, Czech Republic and Lithuania I was responsible for the field works in Poland. The first results were described in paper by Wilde-Piórko (et al., 2008). The publication describing the investigation of the upper mantle in the TESZ area using teleseismic tomography, that I was involved with, is being prepared.

I was also involved in determination of the structure of the upper mantle in TESZ area using joint interpretation of wide-angle refraction seismic and passive seismic. This was described in paper by Wilde-Piórko (et al., 2010), and also in joint interpretation of seismic and gravity data described in the article (IV) from my habilitation cycle. Additionally, as a member of the Working Group I am mentioned in one paper from JCR list. The results of my investigations in this field were presented in three international conferences.

Articles:

Wilde-Piórko M., Geissler W.H., Plomerová J., Grad M., Babuška V., Brückl E., Cyziene J., Czuba W., England R., Gaczyński E., Gazdova R., Gregersen S., Guterch A., Hanka W., Hegedűs E., Heuer B., Jedlička P., Lazauskiene J., Keller G.R., Kind R., Klinge K., Kolinsky P., Komminaho K., Kozlovskaya E., Krüger F., Larsen T., **Majdański M.**, Malek J., Motuza G., Novotný O., Pietrasiak R., Plenefisch T., Růžek B., Sliaupa S., Środa P., Świeczak M., Tiira T., Voss P., Wiejacz P., 2008. PASSEQ 2006-2008: Passive Seismic Experiment in Trans-European Suture Zone. Studia Geophysica et Geodaetica, 52, 439-448.

Wilde-Piorko M., Świeczak M., Grad M., **Majdański M.**, 2010, Integrated seismic model of the crust and upper mantle of the Trans-European Suture zone between the Precambrian craton and Phanerozoic terranes in Central Europe, Tectonophysics, 481, 1-4, 108-115

The interpretation of wide-angle marine seismic in the Arctic area

I participated in the expedition to the Svalbard archipelago in the Arctic in 2005 and also to the West Antarctica in 2008, and I was involved in analysis and interpretation of gathered marine seismic data. The experiment was performed using an airgun source and combination of the ocean bottom stations and a land stations as receivers. The interpretation of the crustal structure along the profile in the territory of Spitsbergen imaged an important tectonic structure in the vicinity on Knipovich ridge. Those results were presented in paper by Czuba (et al., 2008).

Article:

Czuba W., Grad M., Guterch A., **Majdanski M.**, Malinowski M., Mjelde R., Moskalik M., Sroda P., Wilde-Piorko M., Nishimura Y., 2008, Seismic crustal structure along the deep transect Horsted'05, Svalbard, Polish Polar Research, 29, 279-290

Monitoring and geophysical hazards estimation for the nuclear objects

I was involved in preparation of reports about seismic hazards for the nuclear object in Poland, and participated in creation of localization recommendations for the nuclear power plant in Poland requested by the National Atomic Energy Agency. During this cooperation I was co-author of report "Propozycja wytycznych do projektu rozporządzenia Rady Ministrów w sprawie szczegółowego zakresu przeprowadzania oceny terenu przeznaczonego pod lokalizację obiektu jądrowego, oraz w sprawie wymagań dotyczących raportu lokalizacyjnego dla obiektu jądrowego" describing detailed guidelines of the nuclear power plant localization selection. I have participated as an expert in the fields of geophysics in the European

Commission meeting in Luxemburg about so called stress-tests after the nuclear accident in Fukushima-Daichii. Was also a part of Polish delegation as an expert in the field of geophysics in the second extraordinary meeting and sixth nuclear safety convention in the International Agency of Atomic Energy in Vienna.

In 2012 I was a leader of a group of young scientist in the Institute of Geophysics focused on geophysical hazards for the nuclear objects. This program was financed by the Institute of Geophysics, Polish Academy of Sciences as a grant for the young scientists.

## Grants and awords

Besides grants mentioned above I was a principal investigator in four grants: the Iuventus plus in 2012 for young scientists financed by MNiSW, currently realised grant OPUS3 financed by NCN, and two grants for young scientists in 2011 and 2012 financed by Institute of Geophysics, PAS.

I was awarded with prof. Olczak award for the best master thesis in geophysics of the lithosphere in 2002 at the Warsaw University. I received a traveling grant from the British Council Young Scientist Programme in 2007, and was awarded with prestigious scholarship by MNiSW for outstanding young scientist in 2012.