

Questionnaire

Summary of the main activities of a scientific Organisation of the Slovak Academy of Sciences

Period: January 1, 2003 - December 31, 2006

I. Formal information on the assessed Organisation:

1. Legal name and address

Geophysical Institute of the Slovak Academy of Sciences, Dúbravská cesta 9, 845 28
Bratislava, Slovak Republic

2. Executive body of the Organisation and its composition

Directoriat	name	age	years in the position
director	RNDr. Ladislav Brimich, CSc.	56	2005 -
deputy director	RNDr. František Matejka, CSc.	61	2005 -
scientific secretary	RNDr. Tatiana Hurtalová, CSc.	58	1997 -

3. Head of the Scientific Board

RNDr. Tatiana Hurtalová, CSc.

4. Basic information about the research personnel

- i. Number of employees with a university degree (PhD students excluded) engaged in research and development and their full time equivalent work capacity (FTE) in 2003, 2004, 2005, 2006 and average number during the assessment period

ii. Organisation units/departments and their FTE employees with the university degree engaged in research and development

Research staff	2003		2004		2005		2006		average	
	No.	FTE	No.	FTE	No.	FTE	No.	FTE	No.	FTE
organisation in whole	39	32	39	31	41	33	43	33	40,5	32,25
Dept. of Atmospheric Physics	4	3	4	3	5	4	6	5	4,75	3,75
Dept. of Geomagnetism	14	12	14	12	13	11	16	13	14,25	12
Dept. of Gravimetry and Geodynamics	9	9	9	9	10	9	9	8	9,25	8,75
Dept. of Seismology	12	8	12	7	13	9	12	8	12,25	8

5. Basic information on the funding

- i. Total salary budget¹ of the Organisation allocated from the institutional resources of the Slovak Academy of Sciences (SAS) in 2003, 2004, 2005, 2006, and average amount for the assessment period

Salary budget	2003	2004	2005	2006	average
total salary budget (millions of SKK)	12,497	12,697	13,496	14,032	13,181

6. URL of the Organisation's web site

<http://gpi.savba.sk>

¹ Sum of the brutto salaries without the fund contributions.

II. General information on the research and development activity of the Organisation:

1. Mission Statement of the Organisation as presented in its Foundation Charter

The institute is devoted to basic research of geophysical fields and the structure of the Earth body with a particular focus on the region of the Western Carpathians, the development of geophysical interpretive methods, the study of the energy balance and radiation processes in the atmosphere, and the study of atmosphere pollution mechanisms.

A significant part of the research activities is represented by original theoretical work regarding the properties of geophysical fields in inhomogeneous environments and mathematical modelling of meteorological processes in rugged terrain.

Our institute is the only one in Slovakia to conduct systematic measurements and continuous registration of seismic phenomena, of temporal and spatial changes of the geomagnetic field, of slow deformations of Earth's crust, and other non-standard meteorological investigations. The data from the observatories are ongoingly evaluated and serve as experimental basis for scientific research and expert activities for the territory of the Slovak Republic, and are also internationally shared, where they become part of databases in foreign data centres for global research.

2. Summary of R&D activity pursued by the Organisation during the assessed period, from both national and international aspects and its incorporation in the European Research Area (max. 10 pages)

Gravimetry and Geodynamics

The research and development activities carried out at the Department of Gravimetry and Geodynamics belong to the following subject areas:

(A) *Compilation procedures for precise gravity data for the gravimetric inverse problem*

From the international perspective, significant work was carried out in unifying gravimetric data internationally, resulting in producing the unified map of complete Bouguer anomalies of Poland, the Czech Republic, Austria, Hungary and Slovakia. Our institute was the chief coordinator of the project. The resulting map, in the scale 1:2 500 000, is unique in the 50-year history of geophysics in the central-european region. Several aspects of defining, and procedures for compiling and correcting the gravity data that become input data in solving the inverse problem of gravimetry have been revised and refined in order to comply with current accuracy and precision requirements. Several improvements were demonstrated to be needed, and improved procedures were proposed, such as the computation of topographic and atmospheric corrections, and several systematic errors, such as the geophysical indirect effect, and the secondary indirect effects were numerically assessed. This work was carried out under (non-financed) international cooperation with European and Canadian academic institutions. This work was partially supported by VEGA and APVT national grants.

(B) *Development and application of 2D and 3D forward modelling and integrated modelling methods for gravity data inversion*

Integrated geophysical modelling and interpretations: The complicated structure and geodynamic development of the lithosphere was investigated in the Carpatho-Pannonian region and other parts of the globe. A new map of the lithosphere thickness and the map of crustal thickness in the Carpathian-Pannonian Basin Region was constructed. Qualitative interpretation of seismic reflection profiles in Slovakia was performed. The determination of the tectonic setting of the area was refined in terms of (1) Late Alpine collision and the Neogene back arc basin development, (2) the Cretaceous thrust-stacking, (3) remnants of north-dipping reflectors. The compiled map of crustal thickness reflects the youngest deep-seated processes in the orogenic collision zone and high thermal stage of the Pannonian Basin system. The interpretation of the lithosphere thickness was significantly improved by the unique method of 2D integrated modeling that combines interpretation of surface heat flow, gravity and topography (local isostasy). This method was also applied along the Vrancea geotranssect in the Eastern Carpathian-Transylvanian-Apuseni-Pannonian region. The Neo-Alpine “soft” collision and retreating subduction of this orogen was determined by means of quantitative interpretation of observed gravity field. Solution of 3D forward gravimetric problem: For the first time the stripped gravity map was computed and produced for the whole Carpathian-Pannonian basin region in order to demonstrate the effect due to the density inhomogeneities located beneath the pre-Tertiary basement. The stripped gravity map is a result of removing density contrast of known surface density inhomogeneities from the map of Bouguer gravity anomalies, yielding new results related to the thickness of the sedimentary cover of the European platform. Density models of the whole lithosphere play an important role in forming geodynamic models and in reconstructing the lithosphere evolution. It was suggested to implement additional inhomogeneities into the former conception of the isostatic equilibrium, which is crucial for the gravitational instability of the lithosphere-asthenosphere system. This leads to more complex and complicated relationships between the model and its gravitational representation. Seismic activity and neotectonic character of the Western Carpathians: Study of the seismic activity and neotectonic character of the Western Carpathians focused mostly on the Mochovce nuclear power plant area. The seismo-tectonic model for this disturbed region was developed. The model represents the correlation between seismic activity and geological-tectonic setting. We also participated in exploring the sources of geothermal waters. Rheological properties of the Western Carpathian lithosphere show that the mechanical strengths decrease within the whole lithosphere from the area of the European platform through the Western Carpathians to the Pannonian basin. Map of neo-Alpine fault systems and neotectonic regions (blocks) of Slovakia was defined. Interpretation of potential fields in frame of Seismic refraction experiment CELEBRATION 2000: The interpretation of the gravity field in the 2D and 3D space was performed based on the Bouguer gravity anomaly map of the CELEBRATION region based on 1 620 000 measurement points. Density modelling incorporating seismic velocities was carried out. The interpretation indicates that the thickness of the crust beneath the TESZ and EEP is thinner than it was suggested in the former seismic interpretation. Red Sea lithosphere thickness: In frame of cooperation with National Research Institute of Astronomy and Geophysics, Cairo, Egypt, we calculated lithospheric thickness in the Red Sea area and in the Aswan region by means of the 2D integrated geophysical modelling.

(C) Development of the TFM pattern recognition methodology for interpreting gravity data

We are developing a new gravity data interpretation technique, the Truncation Filtering Methodology (TFM), based on data enhancement and pattern recognition. The TFM is based on filtering the gravity data by means of integral transforms – convolution integrals – with various kernels and one free parameter. Such filtering produces animated sequences of 3D surfaces of the post-filter quantities, in which dynamic patterns are observed. The patterns and their onsets are associated with features of geological formations. The knowledge of patterns and their onsets is acquired by means of synthetic modeling and case studies. Currently we model and study salt domes embedded in

sedimentary layers. In the future we want to study faults and other geological scenarios relevant to geophysical exploration for mineral and hydrocarbon resources, and to tectonic studies. This work is partially supported by VEGA and APVT national grants.

(D) Development of the “harmonic inversion” method for direct inversion of gravity data

The harmonic inversion method for solving the inverse gravimetric problem was successively improved. The first substantial improvement consists in ability to calculate the shape and dimensions of any number of anomalous subsurface bodies at once. The second improvement further advances the reliability of the resulting solution by using a different information function in the first step of the two-step inversion procedure. The third improvement (which is now in the stage of development) will allow to solve the inverse problem for the real situation - ellipsoidal shape of the Earth surface (the previous variants were constructed for the flat surface) and the real terrain. This task requires the development of the maximally regular net on the surface of the sphere and rotational ellipsoid. This work was partially supported by VEGA and APVT national grants.

(E) Development of new methods for interpreting temporal changes of gravity

We have participated in modelling and interpreting temporal changes of gravity and deformations of earth's surface, as indicators of dynamic processes inside the earth associated with movements of magma and volcanic eruptions, at two volcanoes, Mayon and Merapi. Their study contributes to understanding the physics of magma reservoirs and the processes associated with volcanic activity such as eruptions. Also the TFM methodology was tested for its potential in interpreting gravity changes. Case studies were performed for two volcanoes, Mayon in Philippines, and Merapi in Indonesia. This research was carried out under (non-financed) European cooperation with colleagues from Germany and Spain. Observed data from the two volcanoes were provided to us by the German colleagues. This work was partially supported by VEGA national grants.

(F) Interpretation of extensometric measurements

In the years 2003 and 2006 was realized last 2 stages in modernizations of the tidal station Vyhne:

- iii. the datalogger CR 10X from Campbell Scientific, inc. was installed,
- iv. on line connection of the tidal station in Vyhne with the main building of Geophysical Institute SAS in Bratislava was built.

The observed tidal deformations are characterized by a small positive anomalies which dominate in the regions characterized by the high heat flow. The neighbourhood of the tidal station Vyhne belongs to such regions. From the tidal characteristics of the waves K1 and O1 the liquid core resonance effect was confirmed. The periodic part of the slow deformations observed at the Vyhne tidal station (with the period about 1 year) is caused by thermoelastic deformations due to the annual variations of the air temperature. The model of the air pressure influences on the extensometric measurements was elaborated. This work was partially supported by VEGA and APVT national grants.

(G) Modelling of stress and strain fields and strength analysis

The research activities in this area focused on the finite element (FE) modelling of the displacement field and associated gravity change due to a deep heat source with its volcanological motivation, FE modelling of tidal deformation of an underground gallery with the aim to quantify the cavity effect on the tilt measurements, FE modelling of gravitational and inertial loading of speleothems, which is of strong paleoseismological interest. In parallel, analytical reference solutions of simple boundary value problems (rectangular linearly elastic body deformed by its own weight) were sought for. With regard to the applications in 2D plane strain/stress problems, the rock strength criteria were examined in more detail. This work was partially supported by VEGA and APVT national grants.

Seismology

The research and activities of the Department of Seismology were focused mainly on the following topics:

(A) Monitoring and analysis of earthquakes

A significant modernization and extension of the Slovak National Network of Seismic Stations was performed within a project supported by the Slovak government. The 14.2 mil. SK (approx. 300 000 EUR) allowed to extend the network from 6 stations to 12 and to start continuous monitoring and real-time data exchange. Consequently, the institute was invited to participate in the 5th FP EU project MEREDIAN (approx. 56 000 EUR). As a result of the project, the Slovak broad-band stations are included in the Virtual European Seismograph Network. The Regional Virtual Network of the Geophysical Institute was also created within the project. 75 seismic stations in 14 countries are used for the analysis of local, regional and teleseismic earthquakes by the data center at the institute. The data center started to perform automatic localization of earthquakes. The localizations are sent to European Mediterranean Seismological Centre within 10 minutes after the P-wave arrival, to the Office of the Civil Protection of the Slovak Republic and other partner institutions. The newly created web page www.seismology.sk includes localizations of earthquakes, live and archive seismograms from the national network and is also used for collecting of macroseismic data on earthquakes.

Within two projects of the Official Development Program of the Slovak Republic (DIRECTE and DIRECTE2, in total 180 000 USD) the institute performed modernisation of the seismic networks in Serbia and Macedonia. In total 13 stations were modernized in both countries and new data centers were created in Belgrade and Skopje.

The institute also serves as the National Data Center for the Comprehensive Nuclear Test-Ban Treaty (CTBT). The institute co-organized a controlled exercise for the on-site inspection purposes.

The institute is fully integrated in the European seismological community in the field of monitoring of earthquakes. The institute is a member of the European-Mediterranean Seismological Centre (EMSC), the representative of the institute is a member of the Executive Committee of the Organisation of Facilities for European Seismology (ORFEUS).

The Slovak National Network of Seismic Stations and the Virtual Seismic Network of the Geophysical Institute represent unique infrastructures in Slovakia. Their creation and co-operation with the partners in the Balkan area was honoured by the Prize of the Slovak Academy of Sciences for Infrastructure for Science in 2006.

(B) Numerical modelling of seismic source and seismic wave propagation in complex local geological structures

The basic theoretical and algorithmic aspects of memory-efficient implementation of realistic attenuation in the staggered-grid finite-difference modeling of seismic wave propagation in media with material discontinuities were addressed. If averaging is applied to viscoelastic moduli in the frequency domain, it is possible to determine anelastic coefficients of the averaged medium representing a material discontinuity. New anelastic functions were defined – as being independent of the anelastic coefficients. Also a new coarse spatial distribution of the anelastic functions was defined in order to properly account for material discontinuities and, at the same time, to have it memory-efficient. Numerical tests demonstrate that the approach enables more accurate viscoelastic modeling than other approaches. At the same time, the computational efficiency is the same as that of the previous finite-difference schemes. The new scheme enables unprecedented accurate numerical simulations of seismic motion.

Since 1987, after publications by Emmerich and Korn [1987] and Carcione et al. [1988a, b], authors who implemented realistic attenuation in the time-domain methods decided for either of two rheological models – generalized Maxwell body (as defined by Emmerich and Korn) or generalized Zener body. Two parallel sets of papers and

mathematical formalisms developed during the years. Therefore, the two models were reviewed and compared. It was shown that the two rheologies are identical.

A new 1D finite-difference (FD) scheme was developed and numerically tested. The scheme is based on the application of Geller and Takeuchi's (1998) optimally accurate FD operators to the heterogeneous strong-form equation of motion developed by Moczo et al. (2002). The scheme was numerically compared with two other FD schemes that approximate the heterogeneous strong-form equation of motion – one using conventional 2nd-order FD operators, the other using staggered-grid 4th-order FD operators. The numerical comparison was based on the envelope and phase misfits between tested and reference solutions. The new developed scheme is significantly more accurate than the schemes based on the application of the conventional 2nd-order and staggered-grid 4th-order operators. This is strong indication for development of such scheme for 3D problem.

(C) Signal analysis

New quantitative misfit criteria for comparison of seismograms was developed and numerically tested. The misfit criteria are based on the time-frequency representation of the seismograms obtained as the continuous wavelet transform with the analyzing Morlet wavelet. The misfit criteria include time-frequency envelope and phase misfits, time-dependent envelope and phase misfits, frequency-dependent envelope and phase misfits, and single-valued envelope and phase misfits. The misfit criteria are able properly quantify and characterize the misfits. The misfit criteria are used in the benchmark of numerical methods and codes, the SPICE Code Validation, and were also used by organizers of the ESG 2006 conference in Grenoble for evaluation of the international benchmark test.

The significant finding was that the standard root-mean-square (RMS) misfit matches the single-valued envelope misfit only in the case of a pure amplitude modification of the signal. In all other cases the RMS considerably overestimates the misfits and does not characterize them.

Geomagnetism

The research and development activities carried out at the Department of Geomagnetism belong to the following subject areas:

(A) Ground-based geomagnetic observations

The geomagnetic observations for the Slovak Republic territory are performed on a continuous regime at the Hurbanovo geomagnetic observatory (GO) ($\varphi=47.87^\circ$, $\lambda=18.18^\circ$). It operates at the same place since the year 1893 (with some interruptions due to first and second World wars and since the year 1998 it is also included into member of the excellent world-wide network of geomagnetic observatories IMO (in a frame of INTERMAGNET project). The geomagnetic data in one minute sampling interval are supplied via internet to the INTERMAGNET centre in Edinburgh and Paris. The one-minute means of X,Y,Z geomagnetic component are also published in the CD-ROM prepared according to INTERMAGNET rules. The members of the Hurbanovo Observatory staff regularly perform the field absolute geomagnetic measurements at the secular point network (they were selected 6 points according to the rules of MagNetE – European Magnetic Survey Network). These measurements are used also for analysis of the secular changes of GMF at the Slovak territory during the last 100 years. There was revealed that the declination increases about 5-6'/year, and total field intensity increases by 22 nT/year. These changes are in agreement with secular changes of GMF in the Central Europe. In the year 2006 there was started also the geomagnetic survey of Slovakia in a network of about 130 points – this project is supported mainly by the Slovak APVV grant agency and will be finished in the year 2008. GO is certificated as reference centre for magnetic declination and provided information for military and civil airports.

(B) Magnetotelluric and magnetovariational (MV) studies and theoretical EM modeling

The magnetotelluric investigations of the Košice Basin were applied for more detailed assessment of depth/lateral extension of the reservoir of geothermal water. During the years 2003-2004, magnetotelluric (MT) sounding measurements along 6 profiles running close to the seismic CELEBRATION profiles on the territory of Slovakia, and 11 sites of deep MT soundings were performed. The 1-D and 2-D inversion techniques applied to the measured data revealed various interesting differences in depth & lateral distribution of electrical conductivity of the Earth's crust and upper mantle on the territory of Slovakia, namely:

- the results from 1D OCCAM and D+ inversions estimate the lithosphere thickness from 100km to 160km for investigated region of western Slovakia.
- the 2D modeling in the eastern Slovakia confirmed existence of strong conductive zones represented by the Carpathian Conductivity Anomaly (CCA) and sedimentary basins with strong heat flow. The 3D image of geoelectrical structures from presented profiles show us border between Inner and Outer Carpathians.
- strong effect of CCA is visible in points close to the anomaly. Following 3D theoretical electromagnetic modeling of CCA shows some geometry effect of CCA bend.
- using application EMI2, Insight and mt3d fwd for 3D modeling enable to compare the results for two types of EM induction forward solutions.

The indications for the existence of both graphitic and mineralized water bearing layers below the Western Carpathians bow as the possible cause of the high conductive CCA were found. For purposes of geothermics in sedimentary basins with partly permeable perturbing body, the 2-D analytical approximation was solved and calculated the surface heat flow anomaly which can cause the increase of the electrical conductivity in such circumstances. For purposes of forward problems of magnetometry, analytical methods and boundary integral technique for calculations of curves ΔT and ΔI above the 2-D bodies of regular or irregular cross-sections (cylindrical, elliptical, polygonal) were adopted.

It is well-known that the results of the deep EM soundings can be distorted by the inhomogeneities of the shallow-surface conducting layer, the conductance of which varies globally from fractions of Siemens (S) inland up to tens thousand of S in the oceans. To demonstrate importance of the non-uniform conductance map for the deep electromagnetic soundings we present map of subsurface conductance (S-map) and the modeling results of Northern, Central and Eastern Europe for the long-period geomagnetic deep soundings (GDS) and magnetotelluric (MT) responses. Recently new regional S-map of the Central, Northern and the Eastern Europe was designed.

The horizontal spatial gradient method has been evaluated in accordance with the conventional and modern (including the spatial derivatives of impedances) approaches to compare their efficiency with the deep magnetotelluric (MT) sounding for the study of the heterogeneous media.

(C) *Paleo, rock and environmental magnetism*

In the field of paleomagnetism following geological sequences of the Slovak Western Carpathians were investigated: Central-Carpathian Paleogene of the Orava unit, the East Slovakian Neovolcanites, sedimentary rocks of the East Slovakian Neogene Basin, sedimentary rocks of the Triassic unit from Central Slovakia and the Paleozoic rocks of the Spiš-Gemer Ore Mountains. Obtained paleomagnetic directions show mostly counterclockwise rotations of blocks of the Western Carpathians. The most intensive tectonic activity was in the Tertiary.

Paleomagnetic research is performed in the close cooperation with paleomagnetic groups from Poland and Hungary. Common study provides information about tectonic development of collision zone between the African and Euroasian plates. The results are very important and useful for domestic and foreign specialists dealing in tectonic reconstruction of the European orogeny. During paleomagnetic investigation of the Paleozoic rocks of the Small Tatras Mts. the important stratigraphical marker so called Illawarra Reversal was found.

The relations of magnetic properties and a magnetic behavior of Fe-Ti magnetic minerals of volcanic and volcano-sedimentary rocks were studied. Very important statements and suggestions were derived to explain an origin and the source of reversed remanent magnetization of rocks, applying not the field-reversal but the self-reversal hypothesis.

The new, in many countries broadly used method for detecting the industrial heavy metal pollution of soils was introduced also in Slovakia. Its principle is based on the magnetic susceptibility measurement and the applicability of this technique was tested in the surroundings of a large dump (5.5 mill. tons of material) from the nickel factory near the town of Sered'. The results confirmed the strong correlation between magnetic susceptibility value and the nickel content in the soil, what enables to apply this very effective method in detailed horizontal and vertical mapping of pollution. The further environmental surveys are oriented to traffic pollution of soils along the mountain crossing road in the Malé Karpaty Mts. and to the industry fall-out around the iron works in the town of Košice.

The main goal of the study of magnetic fabrics of rocks is to reveal the tectonic development and tectonic deformation of geological units in individual Western Carpathians mountains. The basic research tool is the measurement of the anisotropy of the magnetic susceptibility – a very effective method for investigation of magnetic mineral preferred orientation (magnetic fabric) in the rocks.

The obtained results are based on the older primary studies from almost all Slovak Western Carpathians core mountains and the new detailed studies carried out in the Malé Karpaty Mts., in Veľká Fatra Mts. and in Považský Inovec Mts. The data comparison between the geological units of the certain mountains, or between different mountains significantly contributes to the analysis of the Variscan and Alpine tectonic development of the Western Carpathians.

(E) Solar Terrestrial Physics

In the field of Solar Terrestrial Physics (STP) studies the issue of space weather is investigated on the basis of existing links among physical processes of interaction in the Sun-Earth system. The plausible coupling of dynamical characteristics with turbulent processes in solar dynamo was shown. The neural network (NN) approach made it possible to distinguish the regularities/irregularities in formation of a magnetospheric disturbance, to predict magnetic storms and then to judge the geoefficiency of intermittent fluctuations. It was shown that interplanetary disturbances with a significant portion of intermittent fluctuations are more geoeffective. To better understand the relative contribution of intermittence to the efficiency of solar wind–magnetosphere, coupling of the correlations between the fluctuations and the mean values of some geoeffective parameters were investigated. As to qualitative multiscale and intermittent characteristics, magnetic fluctuations in the polar regions of the Earth and within the magnetotail and fluctuations in the solar wind are similar. However, scaling features typical only for the Earth's magnetosphere are also presented. A new NN model for prediction of Kp indices during geomagnetic storms was proposed using the one-hour averages of solar wind parameters Bz, n, and V measured at libration point L1. Within the final test of the NN model the prediction profiles during three storm intervals showed that the averaged statistical parameters indicate quite good coincidence of observed and modeled Kp values. The comparison with results of modeling based on three-hour averages gives evidence that in case of NN model based on the one-hour averages the more accurate Kp predictions during the selected storm intervals were obtained. The analysis of the magnetic storm development was realized within the multilateral co-operation on the ISSI (International Space Science Institute, Bern) project on modeling of the magnetospheric magnetic field during magnetic storms. The satellite data of monitoring the geomagnetic field (GOES data) and space measurements of particle precipitation (DMPS data) were used for the modeling of global magnetic disturbances using the so-called paraboloid model with its time-dependent input parameters, for estimation of the contribution of the magnetotail current to the Dst variation, for the study of dynamics of plasma precipitation

boundaries location at ionospheric altitudes, for explanation of the spiral distribution of most intense magnetic disturbances in daily variations of geomagnetic activity keeping in mind high-latitude electrojet dynamics. The results obtained outline their significance in space weather studies. The results of the extensive analysis of changes of most known meteorological characteristics (air temperature T and precipitation totals P) from meteorological stations were summarized within the world-wide network reveal the plausible modulation of the T and P profiles by solar forcing on the time scale of cyclic and secular changes. Some irregularities can be explained in terms of chaotic oscillations by means of the Feigenbaum mechanism.

(F) *The continual radon monitoring in rock environment*

The ^{222}Rn activity concentration changes in rock environment have been investigated. Since 2003 the monitoring of radon concentration in borehole air and borehole water has been performed in the area of Astronomical and Geophysical Observatory in Modra. The variations of the radon activity concentration have been studied in relation to the atmospheric pressure and temperature changes, depth of water level in boreholes, precipitation amount and the height of snow cover. Since 2006 the radon concentration has been monitored in relation to the earth tides observed at the tidal station of the Geophysical Institute in Vyhne.

Atmospheric Physics

Scientific activities of the department of atmospheric physics are focused to the study:

(A) *The energy balance of the earth surface and atmosphere*

The object of the grant project VEGA No. 2/2093/25 "Effect of atmospheric boundary layer on radiative fluxes and heat balance of Earth's surface" is to study transformation of solar radiation in the atmospheric boundary layer. In the practical meteorology is often important to know the change of radiative fields which is created by transformation of the short-wave radiative fluxes which is due to their absorption by greenhouse gases in atmosphere. Complexity of the transformation process of the short-wave radiation fluxes consists in their multiple correlations with the meteorological actions in the troposphere which are generally characterised by stochastic course. One of such processes which in substantial measure effects to the distribution of radiative fields in atmosphere, is rise and development of clouds. The measure of the deformation of radiative fields by clouds depends as on their type and total development as on their physical state – air temperature, water vapour content as well as on its phase structure. Solution of the mentioned problem comes out from the direct measurements of the global and diffuse radiation in the both levels at Skalnaté Pleso and Stará Lesná.

(B) *The radiative processes in atmosphere*

Scientific goals of VEGA project No. 2/5006/25 „Meteorological processes in the surface and boundary atmospheric layer“ are:

- to determine the climate characteristics of the long- and short-wave radiative fluxes at the clear, cloudy and overcast sky conditions,
- to study the fluxes and water vapour exchange processes between active surface of stand and adjacent air layers with aim to define the role of vegetation in the transfer processes between biosphere and atmosphere,
- to simulate the relationship between soil moisture and air humidity,
- to verify the results of model simulations of air humidity field in the surface layer of the atmosphere and to synthesize the obtained results,
- to determine the effect of atmospheric ozone variability on ultraviolet radiation in the surface layer of the atmosphere,
- to establish dependence of biologically effective UV radiation on altitude, on surface reflectivity (snow cover), on cloudiness, aerosol, etc.,
- obtained results have been involved in the forecasting model of damaging UV radiation for the public

(C) The regional (local) climate change

In the framework of the department the international project COST-727 „Measuring and forecasting atmospheric icing on structures“ is solved. The purpose of the project is to concentrate and analyze data of atmospheric icing in the Slovak territory. Atmospheric icing in the high-mountain positions represents an important contribution to their atmospheric regime. Within the framework of the project of the Slovak Research and Development Agency “Microclimate of windthrow in High Tatras” the continual monitoring of the local climate in the close neighbourhood of the gale - disaster area has been performed, hydrophysical characteristics of soils in selected experimental sites were determined and a mathematical model simulating the microclimate over the gale - disaster area was designed.

(D) The mathematical modelling of the interaction in the soil-vegetation-atmosphere system

Within the project VEGA No. 2/7064/20 “Effect of changes in the earth surface properties on the boundary layer of the atmosphere” and in the connection with international research programmes, an analysis of aerodynamic properties of plant canopies and of the seasonal dynamics of turbulent fluxes of mass and energy in the lowest atmospheric layers has been performed and microclimatic effects of changes in earth surface characteristics have been quantified. In accordance with an agreement concluded between the Institute of Landscape Ecology of the Academy of Sciences of the Czech Republic and the Geophysical Institute of the Slovak Academy of Sciences, the staff of the department participates in a wide aimed research programme which is realised within the framework of the project of the European Union CARBOEUROFLUX in highest parts of the Moravian-Silesian Beskydy Mts. Based on profile measurements of microclimatic characteristics, the microclimatic effects of a young spruce forest are investigated.

(E) The phenomena affecting variability of solar ultraviolet radiation and ground ozone in mountain environment

United calibration network of broadband UV-meters, involving also instruments operating at the meteorological observatories of the GPI SAS, was established in cooperation with the SHMI. Both institutions, SHMI and GPI SAS, have participated at international project COST-726 “Long-term changes and climatology of UV radiation over Europe”. Reconstruction of solar UV radiation time-series have been performed also at different localities in Slovakia.

The research of the solar UV radiation was aimed to study of factors affecting its variability. Effects of total ozone variability, altitude, changes of surface reflectivity and atmospheric turbidity were studied using broadband measurements of solar UV radiation performed by GPI SAS and SHMI. Results of UV radiation variability research have been involved in the UV-index forecast model and will be used for modelling of the solar UV radiation in the past.

The study of the air pollution and ground-level ozone are important in the High Tatras. This region together with the Bratislava region belongs to the most affected regions in Slovakia. Here are the most frequent exceeded air quality standards although Slovak emissions of ozone precursors have decreasing tendency. It also confirmed the O₃ measurements carried out by SHMI and Research Station of TANAP in vertical profile Poprad-Gánovce – Lomnický štít. By proceeding of these data from meteorological observatories Stará Lesná and Skalnaté Pleso was shown that in this region we can expected a contribution of long distance transport of air pollution and transmission of ozone from free troposphere.

Inseparable part of the department are two meteorological observatories:

- Meteorological Observatory at Stará Lesná,
- Meteorological Observatory at Skalnaté Pleso.

The research agency of these observatories is reach. Conditions and the course of the weather are monitoring. Measurements and observations of the basic meteorological

elements are carried out. Except the standard measurements in the professional station network the additional characteristics of the radiation, the atmosphere, as well as the soil are automatically or semi-automatically measured. On the whole, it is more than 30 meteorological parameters which are registered by the data logging system ESM 200. Some information is published in the yearbooks "Meteorological observatories Skalnaté Pleso and Stará Lesná". The international meteorological community is informed about these data in the framework of interchange among the libraries. At present the observatories are registered in "International research centers directory". Besides the scientific activities the meteorologists at observatories Stará Lesná and Skalnaté Pleso pay an attention also to the popularization of meteorology and climatology. They often prepare and organize numerous excursions and „Open days“ for students of primary and secondary schools as well as for the wide public. Educational presentations are such as „History of measurement at observatories in the High Tatras, Global climate change, Atmospheric ozone, Earth-Atmosphere-Meteorology“. Research workers take part in the field of different societies, expert groups and commissions. They also participate in organization of successful workshops e.g. „Poster day“ in Slovakia and domestic and international seminars, conferences e.g. International Bioclimatological Conference.

3. Concept of R&D activity of the Organisation for the next four years (max. 5 pages)

i. Present state of knowledge and status of ongoing research related to the subject of the Concept, from both international and national perspective

Gravimetry and Geodynamics

In the area of defining and compiling precise gravity data for the gravimetric inverse problem we have published results that are fundamental at the international level. In the area of the application of 2D and 3D forward modelling and integrated modelling methods for gravity data interpretation, improved and refined models of the lithosphere thickness and models of tectonic settings were obtained for the Carpatho-Pannonian, the Vrancea, and the Red Sea regions by means of the unique method of 2D integrated modeling that combines interpretation of surface heat flow, gravity and topography (local isostasy), and by means of quantitative 3D forward modeling inversion. These results are fundamental in tectonophysics at the international level. In the area of TFM methodology development, TFM patterns are known now for point mass representations of anomalous masses, and TFM patterns for salt domes are currently studied. The TFM methodology under development is unique at international level. The present state of development of the harmonic inversion method enables to find any number of anomalous subsurface bodies in the case of the planar Earth surface. The "harmonic inversion" method under development is unique at international level. In the area of interpreting temporal changes of gravity, although the TFM approach is unique at international level, it does not yield unequivocal realistic results. In the future we will have to resort ourselves to using joint 3D modeling of gravity changes and surface deformations. Improved values of tidal parameters and indicators of aperiodic extensions of tectonic origin were obtained by interpreting extensometric measurements. These results are significant at the European level, for the knowledge of the tectonic development of the Carpathian-Pannonian region. Modelling of stress and strain fields is in progress towards studying paleoseismicity by means of computational strength analysis of cave sinters (speleothems). This work is internationally quite unique.

Seismology

The existing infrastructure, i.e., the Slovak National Network of Seismic Stations and the Virtual Seismic Network of the Geophysical Institute changed the situation in the availability of real-time high-quality broad-band instrumental data in the Central and South-Eastern Europe. At the same time significant progress is under way in the developing the methods for the numerical modeling of seismic wave propagation and earthquake source dynamics.

Geomagnetism

The main task of the Hurbanovo Geomagnetic Observatory (GO) is the database acquisition of continuous registrations of the geomagnetic field performing by IMO observatories, i. e. observatories included into the worldwide INTERMAGNET project. The other activities are coordinated also by the international MagNetE group.

The current space weather research is aimed at building the model, which interconnects solar processes taking place on the solar surface and in the solar atmosphere, with their effect on near-earth space. The induced geophysical phenomena due to changing space weather conditions influence spaceprobes, ground-based technology, the Earth's climate, and probably the biosphere, too. The models for prediction of geomagnetic activity, based on the satellite measurements of the solar wind or on the direct observations of the sun are under further development recently. The research is coordinated within the frame of SCOSTEP, the COST Action 724 etc.

Paleomagnetism is in present one of the most intensively developed geophysical branches. Paleomagnetical investigations and anisotropy of magnetic susceptibility measurement offer the irreplaceable entries for geological and tectonic surveys. The measurement of magnetic properties of soils proved as an effective and cheap complementary method to the mapping of heavy metal pollution. The laboratory for paleo and rock magnetism of the Geophysical Institute SAS is on comparable level with such laboratories in other European countries.

Investigations of mantle structures by electromagnetic soundings are currently being conducted, judging from the regional project CEMES and the planned US-Array. Recently, a modern approach for MV HSG (horizontal space gradient) sounding was suggested, which has to be incorporated to processing and its ideas have to be included also in MT method. The MT soundings results from CELEBRATION 2000 profiles are prepared for final interpretation. Theoretical algorithms for study regional structures (CCA) and global EM effects (induction of the rotating Earth) are developed.

Atmospheric physics

Continuous meteorological measurements performed at both observatories of the GPI SAS Stará Lesná and Skalnaté Pleso have provided important information for microclimate-change study of in High Tatras with respect to change of local condition after wind-storm devastating large wood areas in 2004.

Increase of the solar ultraviolet irradiance B (UV-B) reaching the ground is a consequence of the global stratospheric ozone layer depletion, since it is strongly affected by the ozone absorption. Besides the total ozone, other meteorological characteristics (cloudiness, atmospheric turbidity, surface albedo) can also affect short-term and long-term variability of the UV-B radiation. Long-term changes of mentioned meteorological factors can accentuate or relieve increase of the solar UV-B radiation caused by stratospheric ozone depletion. Time series of UV-B radiation measurements with length and quality reliable for its long-term variability determination do not exist. Utilizing of the UV-B irradiance modeling is possibility how to obtain information on the solar UV-B irradiance in the past.

Monitoring of ground-level ozone is carried out at the most than 20 ozone stations in Slovakia. There are above all the stations of the SHMI, meteorological observatories of GPI SAS as well as stations of TANAP in the High Tatras region. Data evaluation has

shown that the air standards quality were the most frequently exceeded in the southwest part of Slovakia and the High Tatras region

ii. Organisation's role or significance in the overall research effort within the field of the Concept on both the national and international scales

Gravimetry and Geodynamics

On the national level the organisation is the leader in the field of gravimetry regarding the development of new methods and improvement and integration of existing methods for interpreting and inverting gravity data. The improved methods of 2D and 3D interpretation are applied to practical problems in tectonic studies, studies of deep earth interior, and to geophysical exploration and prospecting of natural resources. We also possess a worldwide most accurate relative gravity meter, the CG5 of Scintrex, being capable of the finest field gravity measurements of high national and international significance. Investigations in the area of geodynamics, in terms of analysing and interpreting gravity changes, and stress and strain fields are also nationally unmatched. The tidal station in Vyhne equipped with an extensometer serves as the nationally unique and internationally significant platform. On the international level the research conducted at our organisation in the area of gravimetry is at the forefront of international achievements in this field and that in the field of geodynamics is internationally recognized.

Seismology

The institute is the main body for the monitoring of the earthquakes on the national level. It has large co-operation in the monitoring with other institutions performing seismic monitoring in Slovakia (Faculty of Mathematics, Physics and Informatics, Comenius University Bratislava, Progseis Trnava). The institute also has a large real-time data exchange within the Central and South-Eastern Europe (14 institutes) and is a member of EMSC and ORFEUS.

The group of researcher focused on numerical modeling of seismic wave propagation is unique in Slovakia and belongs to the major contributors in the field in the world-wide context.

Geomagnetism

The Hurbanovo GO of the GPI SAS is a member of INTERMAGNET and contributor to the world-wide databases. It produces one-minute means of geomagnetic elements, which are sent to the World Data Centers in Edinburgh and Paris on the regular basis (every day). This data are permanently used in international research, e. g. for soundings deep conductive structures of the Earth (CEMES project), and for the space weather studies. As a member of the MagNetE group the staff of the Hurbanovo GO carries out regular measurements upon the magnetic repeat stations over the Slovak territory. The analyses of secular variations are performed regularly. GO is Slovak reference centre for magnetic declination it carry on setting up and controlling compass base on airports.

The GPI participates on the research of space weather within the frame of SCOSTEP and COST Action 724. The research is concentrated on the construction of a modified nonlinear model for prediction of geomagnetic activity using artificial neural networks. Paleomagnetic laboratory GPI SAS is only in the Slovak Republic, able to measure data on the magnetic characteristics of rocks. In the cooperation with laboratories of surrounding states it contributes to international paleomagnetic databases.

The new approaches to MV soundings and new horizontal space gradient method has to replace old one. Global scale of interpretation of deep MV soundings requires this world unique method for good unperturbed results. The recent MT results are used in

geological prospecting research and global soundings within the frame international projects (CEMES, CELEBRATION 2000, EMTESZ).

Atmospheric physics

Researchers of the department solve topical questions in the field of physics of the boundary layer of the atmosphere including energy budget of the Earth's surface, radiative processes in the atmosphere, ultraviolet radiation and ozone dynamics, regional and local climate variability, microclimate and phytoclimate, atmospheric icing.

The research has been frequently carried out within the framework of national and international scientific projects, e.g. VEGA, APVV, COST. An integral part of the department is created by the meteorological observatories at Stará Lesná and Skalnaté Pleso providing the continuous monitoring of physical characteristics of the boundary layer of the atmosphere.

iii. Objectives of the Concept

The main objectives of the research are:

Gravimetry and Geodynamics

- to improve and to integrate the existing 2D and 3D forward modeling methods of gravity data inversion,
- to develop new 3D inversion methods for gravity data interpretation: the TFM methodology and the 'harmonic inversion' methodology,
- to apply the improved and newly developed methods in practice, in tectonic studies, studies of the deep earth interior, and geophysical exploration,
- to improve interpretation of gravity changes, stress and strain fields in geodynamic investigations.

Seismology

- understanding of earthquake generation in the Carpatho-Pannonian area
- near-real time predicting of the earthquake effects

Geomagnetism

- to improve the monitoring of geomagnetic field by innovation in instrumentation in GO Hurbanovo and Šrobárová as well as new station in Kolonica
- in STP studies to construct a modified nonlinear model for prediction of geomagnetic activity based on the observations of solar energetic events (e. g. XRA, RSP etc), the physical magnetohydrodynamic processes associated with STP will be investigated
- to create an internet warning centre (in order to popularise space weather influence on high-tech society activities)
- by means of paleomagnetic investigation, to finalize of determination of paleodirections for important geological units of the Slovak Western Carpathians
- to involve soils magnetism into the environmental problematic as the method for detecting and mapping the heavy metal pollution
- to spread the application of anisotropy of magnetic susceptibility measurements (as the effective method for the deformation analysis) within geological survey and in the research of buildings materials
- in the theoretical application of paleomagnetism the measurement of paleointensity of the geomagnetic field is planed.
- the new algorithm for calculation of electromagnetic field on Earth surface with implemented additional rotational induction field has to be prepared
- the new mathematical and programming problems in brand new HSG MV methods has to be solved before planed large-scale international projects (EuroArray,

USarray) will start. The study of global MV sources is necessary for explaining origin of certain long periods

Atmospheric physics

- to perform continuous monitoring of the physical characteristics of atmospheric boundary layer at the Meteorological observatories GPI SAS Stará Lesná and Skalnaté Pleso
- to assess long-term variability and trend of total ozone and solar UV radiation over Slovakia and to establish atmospheric aerosols optical depth measurement to improve of UV radiation forecast and reconstruction models and compare measurements with indirect information on atmospheric turbidity
- to analyse results of ground-level ozone measurements in the High Tatras region
- to establish database of climatologic measurements and to perform evaluation of long-term climatologic data

iv. Proposed strategies and methods to be applied, and time schedule

The above set objectives shall be achieved by:

Gravimetry and Geodynamics

- a) analytical derivations
- b) numerical forward and inverse modelling of gravity data integrated with other geophysical fields data both in terms of synthetic computer simulations and case studies on observed data in selected regions of high tectonic, geologic, or volcanic relevance. One of the best 3D modelling packages, IGMAS, will be used for accomplishing the task.

Seismology

Since the main objectives of the concept in seismology are defined for longer period than four years, the following short-, medium- and long-term tasks are defined :

1. short term tasks (within 3 years)
 - a) upgrade of the database on historical earthquakes including all available intensity data points for all known historical earthquakes and investigation of selected historical earthquakes
 - b) continuous creation of the database of instrumentally recorded earthquakes
 - c) routine near-real time computation of the fault-plane solutions for regional earthquakes
2. medium-term tasks (within 5 years)
 - a) investigation of the crust structure in the regional scale , development of the seismic model of the Earth's crust in Slovak territory
 - b) developments of numerical methods for the near-real time simulation of the earthquakes (including source dynamics, path and site effects) and their effects
 - c) application of the methods for the near-real time simulation of the earthquakes on selected past and recent earthquakes
3. long-term tasks (within 8-10 years)
 - a) routine application of the methods for the near-real time simulation of the earthquake and their effects and providing the relevant tools to the Office of the Civil Protection for improving the decision making

The short-term tasks are addressed in part by participations in the existing projects (the 6th FP EU projects NERIES and SPICE – as a co-operating institute, and Slovak VEGA and APVV projects). The medium- and long-term tasks have to be addressed by new research projects. The upgrade of all seismic stations with the broad-band equipment (necessary to reach the objective 2a) should part of projects supported by the infrastructure funds of EU. The cooperation with the Faculty of Mathematics, Physics and

Informatics, Comenius University Bratislava will be essential for reaching objectives 2b and 3.

Geomagnetism

1. short term objectives

- a) establishment of continuous registrations of the total geomagnetic field intensity by the proton precession magnetometer (PPM) in Hurbanovo GO
- b) innovation of the geomagnetic station at Šrobárová, the house of the old variation pavilion will be employed, a portable variation station (digital Bobrov variation station) and one proton precession magnetometer (PPM) will be installed there
- c) a method for identification of artificial magnetic disturbances in Hurbanovo magnetograms will be developed
- d) improvement the network of magnetic repeat stations and carry out regular geomagnetic measurements on the two-year bases (2008 and 2010).
- e) stabilization of the network of magnetic repeat stations according to MagNetE rules (spring – autumn 2008)
- f) the estimation level of disturbances in deep EM soundings requires surface maps of conductivity anomalies
- g) new MT (EM) systems are necessary for shallow surveys (up to 1000m) and remote reference measurements
- h) identification of the geoeffective solar energetic events and development of a nonlinear NN-model for the prediction of geomagnetic activity, (it will be employed for planning field measurements (repeat station surveys))
- i) the establishment of the internet warning centre for aims of monitoring the space weather conditions on the daily basis and for aims of popularisation of the science

2. long term objectives

- a) continuation in registration of the geomagnetic field vector at Hurbanovo within the frame of INTERMAGNET
- b) continuing of measurements in registration national magnetic repeat stations
- c) building up the remote online geomagnetic station at Kolonica in eastern Slovakia
- d) modernization of instrumental equipments of the laboratory for paleo and rock magnetism
- e) continuation in the development of theory and mathematical modelling of geoelectromagnetic fields in non-uniform media and source field (planar and spherical)

Atmospheric physics

In 2007-2008:

- a) to create reconstruction model of total ozone over Slovakia
- b) to finish digitalisation of data for climatologic measurement database establishment.
- c) to evaluate long-term changes of solar UV radiation over Slovakia
- d) to perform aerosol optical depth measurement
- e) to evaluate long-term time series of climatologic parameters in the High Tatras
- f) to analyse microclimatic conditions in the High Tatras region effected by the destroying wind.

In 2009-2010:

- a) to establish calibration network of broadband UV-meters and database of UV radiation measurements
- b) to compare direct and indirect methods of aerosol optical depth determination
- c) to estimate the contribution of the individual factors which influenced the variability of total ozone in Slovakia
- d) to evaluate the effect of environmental conditions for formation of ground-level ozone after wind calamity in High Tatras in 2004.
- e) to specify meteorological conditions for the atmospheric icing creation
- f) to evaluate measurements of aerosol optical depth.

III. Partial indicators of the main activities:

1. Research output

- i. List of the selected publications documenting the most important results of basic research. Total number of publications in the whole assessed period should not exceed the average number of the research employees

- [1] BEAUVAL, Céline – BARD, Pierre Yves – MOCZO, Peter – KRISTEK, Jozef. Quantification of frequency-dependent lengthening of seismic ground-motion duration due to local geology : applications to the Volvi area (Greece). In *Bulletin of the Seismological Society of America*. ISSN 0037-1106. Vol. 93, no. 1 (2003), p. 371-385. IF: 1,256
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- [9] BIELIK, Miroslav – ŠEFARA, Ján – KOVÁČ, Michal – BEZÁK, Vladimír – PLAŠIENKA, Dušan. The Western Carpathians–interaction of Hercynian and Alpine processes. In *Tectonophysics*. ISSN 0040-1951. Vol. 393, no. special issue 1-4 (2004), p. 63-86. (1.838 – IF2004).

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ii. List of monographs/books published abroad

iii. List of monographs/books published in Slovakia

- [1] ŠEFARA, Ján – KUCHARIČ, Ľudovít – BIELIK, Miroslav (Eds) – DANIEL, Jozef – FILO, M. – HRIČKO, Jozef – LANC, Jozef – MARUŠIAK, Ivan – ORLICKÝ, Oto – PANÁČEK, Andrej – ŠÁLY, Silvo – TIRPÁK, Ján – TKÁČOVÁ, Helena – TÚNYI, Igor – JUŠTIN, L. História geofyziky na Slovensku. = History of Geophysics in Slovakia. In: História geológie na Slovensku = History of Geology in Slovakia, II. Vol, 2006. Bratislava : Štátny geologický ústav Dionýza Štúra, 2006. p. 139-246. ISBN 80-88974-89-5.

iv. List of other scientific outputs specifically important for the Organisation

- [1] Slovak National Network of Seismic Stations
- [2] INTERMAGNET - Geomagnetic observatory in Hurbanovo belongs to the world network of Geomagnetism observatories of the 1st order
- [3] National Data Centre for CTBT
- [4] Reference Centre of Magnetic Declination in Slovakia - Geomagnetic observatory in Hurbanovo

v. Table of research outputs

Table **Research outputs** shows research outputs in number of specified entries; these entries are then divided by FTE employees with a university degree (from Tab. Research staff) for all Organisation at the respective year; finally these entries are divided by the total salary budget (from Tab. Salary budget).

Research outputs	2003			2004			2005			2006			total			
	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	averaged number per year	av. No. / FTE	av. No. / salary budget
chapters in monographs, books published abroad	1	0,03	0,08	0	0,00	0,00	0	0,00	0,00	1	0,03	0,07	2	0,5	0,02	0,04
chapters in monographs, books published in Slovakia	0	0,00	0,00	0	0,00	0,00	0	0,00	0,00	0	0,00	0,00	0	0,0	0,00	0,00
CC publications	8	0,25	0,64	5	0,16	0,39	6	0,18	0,44	11	0,33	0,78	30	7,5	0,23	0,57
scientific publications indexed by other databases (specify)	15	0,47	1,20	17	0,55	1,34	25	0,76	1,85	26	0,79	1,85	83	20,8	0,64	1,57
scientific publications in other journals	12	0,38	0,96	13	0,42	1,02	13	0,39	0,96	1	0,03	0,07	39	9,8	0,30	0,74
publications in proc. of international scientific conferences	17	0,53	1,36	9	0,29	0,71	16	0,48	1,19	10	0,30	0,71	52	13,0	0,40	0,99
publications in proc. of nat. scientific conferences	14	0,44	1,12	14	0,45	1,10	11	0,33	0,82	10	0,30	0,71	49	12,3	0,38	0,93
active participations at international conferences	40	1,25	3,20	56	1,81	4,41	54	1,64	4,00	90	2,73	6,41	240	60,0	1,86	4,55
active participations at national conferences	41	1,28	3,28	2	0,06	0,16	29	0,88	2,15	8	0,24	0,57	80	20,0	0,62	1,52

vi. Renormalized publications²

Renormalized publications = number of CC publications in the given year times authorship's portion of the Organisation times the journal impact factor in 2005 divided by the median impact factor in the research field

² This information is required only from the Organisations of the Section 2 of the Slovak Academy of Sciences.

Renormalised publications	2003			2004			2005			2006		
	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget
Renormalized publications	0	0,00	0,00	0	0,00	0,00	0	0,00	0,00	0	0,00	0,00

vii. Standard manuscript page count³

Standard manuscript page count	2003			2004			2005			2006		
	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget
page count	0	0,0	0,0	0	0,0	0,0	0	0,0	0,0	0	0,0	0,0

0

viii. List of patents and patent applications

ix. Supplementary information and/or comments on the scientific output of the Organisation

The journal Contributions to Geophysics and Geodesy was integrated to the database SCOPUS.

The scientific workers of the institute made:

- 53 reviews of the papers in the CC journals
- 28 reviews of the papers in the SCOPUS journal
- 48 reviews of the projects
- 7 reviews of the PhD. Thesis.

³ This information is required only from the Organisations of the Section 3 of the Slovak Academy of Sciences.

2. Responses to the scientific output

Table **Citations** shows specified responses to the scientific outputs; these entries are then divided by the FTE employees with a university degree (from Tab. Research staff) for all Organisation at the respective year; finally these entries are divided by the total salary budget (from Tab. Salary budget).

Citations	2002			2003			2004			2005			total			
	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	averaged number per year	av. No. / FTE	av. No. / salary budget
Web of Science	75	2,3	6,0	85	2,7	6,7	70	2,1	5,2	57	1,7	4,1	287	71,8	2,2	5,4
SCOPUS	11	0,3	0,9	8	0,3	0,6	19	0,6	1,4	26	0,8	1,9	64	16,0	0,5	1,2
other Databases	0	0,0	0,0	15	0,5	1,2	11	0,3	0,8	8	0,2	0,6	34	8,5	0,3	0,6
in monographs, conf. proceedings and other publications abroad	11	0,3	0,9	8	0,3	0,6	9	0,3	0,7	14	0,4	1,0	42	10,5	0,3	0,8
in monographs, conf. proceedings and other publications in Slovakia	4	0,1	0,3	0	0,0	0,0	2	0,1	0,1	10	0,3	0,7	16	4,0	0,1	0,3

i. List of 10 top-cited publications and number of their citations in the assessment period

- [1] MOCZO, Peter - BYSTRICKÝ, Erik - KRISTEK, Jozef - CARCIONE, J. M. - BOUCHON, M. Hybrid modeling of P-SV seismic motion at inhomogeneous viscoelastic topographic structures. In *Bulletin of the Seismological Society of America*. ISSN 0037-1106. Vol. 87, no. 5 (1997), p. 1305-1323, WOS, Scopus

24 quotations in CC, WOS, Scopus

2 quotations in foreign monographs

- [2] MOCZO, Peter – KRISTEK, Jozef – HALADA, Ladislav. 3D Fourth-order staggered-grid finite-difference schemes: Stability and grid dispersion. In *Bulletin of the Seismological Society of America*. ISSN 0037-1106. Vol. 90, no. 3 (2000), p. 587-603, CC, WOS, Scopus
12 quotations in CC, WOS, Scopus
4 quotations in foreign monographs
- [3] MOCZO, Peter - LUCKÁ, Mária - KRISTEK, Jozef - KRISTEKOVÁ, Miriam. 3D displacement finite differences and a combined memory optimization. In *Bulletin of the Seismological Society of America*. ISSN 0037-1106. Vol. 89, no. 1 (1999), p. 69-79.
14 quotations in CC, WOS, Scopus
2 quotations in foreign monographs
- [4] MOCZO, Peter. Finite-difference technique for sh-waves in 2-d media using irregular grids application to the seismic response problem. In *Geophysical Journal International*. ISSN 0956-540X. Vol. 99, no. 2 (1989), p. 321-329, CC, WOS, Scopus
13 quotations in CC, WOS, Scopus
- [5] ZAHRADNÍK, J. – MOCZO, Peter – HRON, F. Testing four elastic finite-difference schemes for behavior at discontinuities. In *Bulletin of the Seismological Society of America*. ISSN 0037-1106. Vol. 83, no. 1 (1993), p. 107-129 CC, WOS, Scopus
9 quotations in CC, WOS, Scopus
- [6] MOCZO, Peter - BARD, Pierre Yves. Wave diffraction, amplification and differential motion near strong lateral discontinuities. In *Bulletin of the Seismological Society of America*. ISSN 0037-1106. Vol. 83, no. 1 (1993), p. 85-106, WOS, Scopus
7 quotations in CC, WOS, Scopus
1 quotation in foreign journal
- [7] MOCZO, Peter – KRISTEK, Jozef – VAVRYČUK, V. – ARCHULETA, Ralf J. – HALADA, Ladislav. 3D heterogeneous staggered-grid finite-difference modeling of seismic motion with volume harmonic and arithmetic averaging of elastic moduli and densities. In *Bulletin of the Seismological Society of America*. ISSN 0037-1106. Vol. 92, no. 8 (2002), p. 3042-3066, CC, WOS, Scopus
9 quotations in CC, WOS, Scopus
1 quotation in foreign journal - Scopus
- [8] POHÁNKA, Vladimír. Optimum expression for computation of the gravity field of a homogeneous polyhedral body. In *Geophysical Prospecting*. ISSN 0016-8025. Vol. 36, no. 7 (1988), p. 733-751, CC, WOS, Scopus
6 quotations in CC, WOS, Scopus
3 quotations in Slovak journals – Scopus
2 quotations in foreign journals – Scopus
1 quotation in foreign journal

- [9] VANÍČEK, Petr - SUN, W. - ONG, Peng - MARTINEC, Zdeněk - NAJAFI, Mehdi - VAJDA, Peter - Ter HORST, B. Downward continuation of Helmert's gravity.) In *Journal of Geodesy*. ISSN 0949-7714. Vol. 71, no. 1 (1996), p. 21-34. CC, WOS, Scopus

8 quotations in CC, WOS, Scopus

- [10] HURTALOVÁ, Tatiana - MATEJKA, František. Surface characteristics and energy fluxes above different plant canopies. In *Agricultural and Forest Meteorology*. ISSN 0168-1923. Vol. 98-99, no. 1-4 (1999), p. 491-500.

3 quotations CC, WOS, Scopus

3 quotations in foreign journals Scopus

1 quotation in foreign monographs

1 quotation in foreign journal

ii. List of top-cited authors from the Organisation (at most 10 % of the research employees) and their number of citations in the assessment period

- [1] Peter Moczo: 116 quotations in CC, WOS, Scopus
10 quotations in Scopus
17 quotations in monographs
13 quotations in others

- [2] Jozef Kristek: 85 quotations in CC, WOS, Scopus
1 quotation in Scopus
10 quotations in monographs
2 quotations in others

- [3] Miroslav Bielik: 38 quotations in CC, WOS, Scopus
10 quotations in Scopus
7 quotations in monographs
13 quotations in others

- [4] Miriam Kristekova: 28 quotations in CC, WOS, Scopus
2 quotations in monographs

- [5] Igor Túnyi: 21 quotations in CC, WOS, Scopus
5 quotations in Scopus
1 quotation in monographs
3 quotations in others

iii. Supplementary information and/or comments on responses to the scientific output of the Organisation

The institute contributes to the world databases of seismic, geomagnetic and meteorological data, which are not quoted.

3. Research status of the Organisation in the international and national context

- **International/European position of the Organisation**
- i. **List of the most important research activities documenting international importance of the research performed by the Organisation, incl. major projects (details of projects should be supplied under Indicator 4). Collective membership in the international research organisations, in particular within the European Research Area**

Collective membership in the IUGG

Collective membership in the ORFEUS

Collective membership in the EMSC

- [1] 5th FP of the EU
SESAME – Site effects assessment using ambient excitations
- [2] 5th FP of the EU
MEREDIAN II – Developing existing earthquake data infrastructures towards a Mediterranean – European rapid earthquake data information and Archiving Network
- [3] 5th FP of the EU
EUROSEISRISK –Seismic hazard assessment, site effects, and soil structure interaction studies in an instrumented basin
- [4] UNESCO
Mantle dynamic implications for the tectonic natural hazards mitigation
- [5] Multilateral project EU
INTERMAGNET – First order world network of geomagnetic observatories
- [6] Multilateral project EU
CELEBRATION 2000 – Central european lithospheric experiment based on refraction
- [7] COST 724
Quantification, qualification, and prediction of space weather development
Developing the scientific basis for monitoring, modelling, and predicting space weather
- [8] COST 726
Long term changes and climatology of UV radiation over Europe
- [9] COST 727
Measuring and forecasting of atmospheric icing

- [10] Project of official development aid
Development of infrastructure for rapid earthquake data collection and exchange
DIRECTE
- [11] Project of official development aid
Development of infrastructure for rapid earthquake data collection and exchange
DIRECTE – Part 2
- [12] Project of official development aid
Landslide monitoring program – LAMP
- [13] Project of official development aid
Sharing the data from the infrastructure for rapid Earthquake data collection and
exchange – ShareDIRECTE
- [14] Bilateral project: Slovak Republic – Italy
Contribution to the Euro-Mediterranean archive of historical macroseismic data
- [15] Bilateral project: Slovak Republic – Ukraine
Study of deepseated structure of the Carpathian-Pannonian basin lithosphere
utilising the method of 3D modelling of gravity, magnetic, and geothermic fields
- [16] Bilateral project: Slovak Republic – Austria
Study of multi-scale characteristics of MHD turbulence in cosmic plasma
- [17] Bilateral project: Slovak Republic – Czech Republic
Spectrogram simulations observed by MAGION 4 and 5 satellites

ii. List of international conferences (co-) organised by the Organisation

- [1] **Task C Working Meeting FP 5 SESAME Project**, Bratislava 2003, February 20 – 21.
- [2] **Training Course on the finite-difference modelling**, FP5 EUROSEISRISK Project, Bratislava 2003, May 12 – 16.
- [3] **ISCS 2003 Symposium Solar Variability as an Input to the Earth's Environment**, Stará Lesná 2003, June 23 – 28.
- [4] **NMESD 2003** - Numerical Modelling of Earthquake Source Dynamics, Smolenice 2003, September 1 – 3.
- [5] SESAME Project Workshop, Smolenice 2003, September 22 – 24.
-
- [6] **Czech and Slovak Seismological Days**, Smolenice 2004, June 1 – 6.
- [7] **New Trends in Geomagnetism**, Vysoké Tatry 2004, June 27 – July 3.
-
- [8] **Training workshop for real-time seismic data acquisition**, Bratislava 2005, May 30 – June 6.
- [9] **SPICE R&T Workshop II**, Smolenice 2005, September 4 – 10.
- [10] **Bioclimatology of present and future**, Czech Republic, Brno-Křtiny 2005, September 12 – 14.

- [11] **Science and Technology for Safe Development of Life Line Systems. Natural risks: Earthquakes and co-seismic associated risks, neotectonics, and seismic hazard assessment in the CEI Area**, Bratislava 2005, October 24 – 25.
 - [12] **6th Experimental Advance Course for Seismologists, OSI Division, CTBTO**, Stupava 2005, October 24 – 28.
 - [13] **13th Poster day: Transport of water, chemicals, and energy in the soil-plant-atmosphere system**, Bratislava 2005, November 10.
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- [14] **2nd Workshop on International Gravity Field Research**, Smolenice 2006, May 8 – 9.
 - [15] **Czech and Slovak Seismological Days**, Czech Republic, Škrdlovice 2006, May 5 – June 2.
 - [16] **New Trends in Geomagnetism**, Czech Republic, Valtice 2006, September 3 – 8.
 - [17] **Bioclimatology and Water in the Land**, Strečno 2006, September 11 – 14.
 - [18] **Workshop of APVT-51-002804 project and international group of potential field CELEBRATION 2000**, Bratislava 2006, October 27 – 28.
 - [19] **14th Poster day: Transport of water, chemicals, and energy in the soil-plant-atmosphere system**, Bratislava 2006, November 9.

iii. List of international journals edited/published by the Organisation

- [1] **Contributions to Geophysics & Geodesy**, ISSN 1335 – 2806.
 Edited from 1998
 Vol. 33, 2003; Vol. 34, 2004; Vol. 35, 2005; Vol. 36, 2006.
 Editor-in-Chief: Milan Hvoždara
 Executive Editor: Igor Kohút
 Advisory Board: Aleksander Guterch, Piotr Krzywiec, Milan Lapin, Gyula Mentes, Bruno Meurers, Peter Moczo, Eduard Petrovský, Jaroslav Rožnovský, Vladimír Semenov, Vitaly Starostenko, Ján Šefara, Péter Varga
 Editorial Board: Miroslav Bielik, Ladislav Brimich, Ján Hefty, Tatiana Hurtalová, Milan Hvoždara, Peter Labák, František Matejka, Roman Pašteka, Igor Túnyi, Peter Vajda
 Journal is integrated to the database SCOPUS.

iv. List of edited proceedings from international scientific conferences and other proceedings

2003 - - -

2004 - - -

- [1] BIELIK, Miroslav – MOCZO, Peter. (Eds) Proceedings of the Second international conference *Science and Technology for Safe Development of Lifeline Systems Natural Risks: Earthquakes and Co-seismic Associated Risks, Neotectonics and Seismic Hazard Assessment in the CEI Area*, October 24-25, 2005. Bratislava : Geophysical Institute of the Slovak Academy of Sciences and Comenius University, 2005. 203 p. ISBN: 80-223-2116-8 + CD-ROM. ISBN: 80-223-2117-6
 - [2] BIELIK, Miroslav - MOCZO, Peter (Eds). Proceedings of the Workshop. *Science and Technology for Safe Development of Lifeline Systems. Natural Risk: Earthquakes and Co-seismic Associated Risks, Neotectonics and Seismic Hazard Assessment in the CEI Area*. Bratislava : PRIF UK, FMFI UK a GFÚ SAV 2005. 204 p. ISBN 80-223-2116-8
 - [3] ČELKOVÁ, Anežka – MATEJKA, František *Transport of water, chemicals, and energy in the soil-plant-atmosphere system : 13th International Poster Day*, 10.11.2005. Bratislava : ÚH SAV and GFÚ SAV. CD-ROM. ISBN 80-85754-13-4.
 - [4] MOCZO, Peter – LABÁK, Peter – KRISTEK, Jozef (Eds). SPICE R&T Workshop II: proceedings of the Workshop – Abstract Book. *Seismic Wave Propagation and Imaging in Complex Media: a European Network – Spice R&T Workshop II*. September 4-10, 2005, Smolenice. Bratislava : FMFI UK and GFÚ SAV, 2005, 64 p. ISBN 80-223-2074-9
-
- [5] ČELKOVÁ, Anežka – MATEJKA, František *Transport of water, chemicals, and energy in the soil-plant-atmosphere system : 14th International Poster Day*, 9.11.2006. Bratislava : ÚH SAV and GFÚ SAV. CD-ROM. ISBN 80-85754-15-0.

- **National position of the Organisation**

- i. **List of selected most important national projects (Centres of Excellence, National Reference Laboratories, Agency for the Promotion of Research and Development (APVV/APVT), National Research Programmes, Scientific Grant Agency of the Slovak Academy of Sciences and the Ministry of Education (VEGA), and others)**

- [1] **Site effect investigation using seismic noise**
 prof. RNDr. Peter Moczo, DrSc., Faculty of Mathematics, Physics, and Informatics
 Comenius University (FMPI CU) in Bratislava , Mgr. Jozef Kristek, PhD.
 01/2001 – 12/2003
 VEGA 1/1090/23
- [2] **Extensive and intensive investigation of historical earthquakes in the focal zones Dobra Voda, Komarno and Central Slovakia**
 RNDr. Peter Labák, PhD.
 01/2001 – 12/2003
 VEGA 2/1091/23
- [3] **Geomagnetic field on the Slovak territory and its interpretation**
 RNDr. Igor Túnyi, CSc.
 01/2001 – 12/2003
 VEGA 2/1118/23

- [4] **Quantification, qualification, and prediction of cosmic weather development**
 RNDr. Zoltán Vörös, CSc., RNDr. Alina Prigancová, CSc.
 01/2002 – 12/2004
 VEGA 2/2009/23
- [5] **Effect of the atmospheric boundary layer on radiative fluxes and heat balance of Earth's surface**
 RNDr. Marian Ostrožlík, CSc.
 01/2002 – 12/2004
 VEGA 2/2093/23
- [6] **Lithosphere of the Carpathian-Pannonian basin region: integrated and multidisciplinary modelling of gravity field**
 RNDr. Miroslav Bielik, DrSc.
 01/2003 – 12/2005
 VEGA 2/3004/23
- [7] **Monitoring and interpretation of the long-periodical and non-periodical geodynamic phenomena in the Western Carpathian region**
 RNDr. Ladislav Brimich, CSc.
 01/2003 – 12/2005
 VEGA 2/3057/23
- [8] **Modernization and extension of the Slovak national network of seismic station**
 prof. RNDr. Peter Moczo, DrSc., FMPI CU, RNDr. Peter Labák, PhD.
 03/2001 – 02/2004
 Scientific-technic project (National Research Programme), 2/9011/23
- [9] **Monitoring of environment in SMI area in Bratislava**
 RNDr. Igor Túnyi, CSc., RNDr. Tatiana Hurtalová, CSc.
 01/2002 – 12/2006
 Government of the SR
- [10] **Seismic transect through the geological units of the Western Carpathians**
 RNDr. Miroslav Bielik, DrSc.
 01/1999 – 12/2003
 Ministry Environment of the SR
- [11] **Geophysical modelling of direct prospecting of hydrocarbon in the Trhovište-Pozdišovce locality within the Eastern Slovakian basin**
 doc. RNDr. Miroslav Bielik, DrSc.
 03/2003 – 03/2006
 Ministry of Education of the SR
-
- [12] **Electromagnetic field of the Earth and its relations with geological structure of the Western Carpathians**
 RNDr. Igor Túnyi, CSc.
 01/2004 – 12/2006
 VEGA 2/4042/24
-
- [13] **Meteorological processes in the surface and boundary atmospheric layer**
 RNDr. Marian Ostrožlík, CSc.
 01/2005 – 12/2007
 VEGA 2/5006/25

- [14] **Fluctuations in the evolution of space weather and environmental consequences**
Mgr. Fridrich Valach, PhD.
01/2005 – 12/2007
VEGA 2/5121/25
- [15] **Development, improvement, and application of progressive methods of 2D and 3D gravity field interpretation in geophysics and geology**
doc. RNDr. Miroslav Bielik, DrSc.
1.1.2005 – 31.12.2007
APVT-51-002804
-
- [16] **Development of modern methods for interpreting the Earth gravity field and their integration in studying the lithosphere**
RNDr. Peter Vajda, PhD.
01/2006 – 12/2008
VEGA 2/6019/26
- [17] **Study of the flexure contact North European platform vs. Carpathian lithospheric plate**
RNDr. Ján Vozár, PhD.
01/2006 – 12/2008
VEGA 2/6045/26
- [18] **Regularized solution of the direct and inverse gravimetric problems with the objective of improving the geophysical interpretation of the lithosphere of the Western Carpathians and their surrounding tectonic units**
RNDr. Roman Pašteka, PhD., Faculty of Natural Sciences CU, RNDr. Peter Vajda, PhD.
01/2006 – 12/2008
VEGA 1/2006 – 12/2008
- [19] **Microclimate of windthrows in High Tatras**
RNDr. František Matejka, CSc.
04/2006 – 03/2009
APVV-51-030205
- [20] **Integrated geomagnetic maps of the Slovak Republic territory and adjacent regions**
doc. RNDr. Milan Hvoždara, DrSc.
04/2006 – 03/2007
APVV-51-008505

ii. List of national scientific conferences (co)-organised by the Organisation

- [1] **5th Slovak Geophysical Conference**, Bratislava 2003, June 12 – 13.
- [2] **Transport of water, chemicals, and energy in the soil-plant-atmosphere system : 11th International Poster Day**, Bratislava 2003, November 20.
-
- [3] **Transport of water, chemicals, and energy in the soil-plant-atmosphere system : 12th International Poster Day**, Bratislava 2004, November 25.
-

[4] **6th Slovak Geophysical Conference**, Bratislava 2005, June 29 – 30.

2006 - - -

iii. List of national journals published by the Organisation

- - -

iv. List of edited proceedings of national scientific conferences/events

[1] HURTALOVÁ, Tatiana – ORFÁNUS, Tomáš – MIKULEC, Vladimír – BAČA, Peter – HORNÁČEK, Ľuboš – MATEJKA, František. *Transport of water, chemicals, and energy in the soil-plant-atmosphere system : 11th International Poster Day*. Bratislava : IH SAS, 20.11.2003, CD-ROM. ISBN 80-89 139-02-7.

[2] KOSORIN, Karol – NOVÁK, Viliam –...TÚNYI, Igor –...MATEJKA, František – ...HURTALOVÁ, Tatiana et al. *Transport of water, chemicals, and energy in the soil-plant-atmosphere system : 12th International Poster Day*. Bratislava : IH SAS and GPI SAS, 25.11.2004, CD-ROM. ISBN 80-89 139-05-1.

2005, 2006 - - -

• International/European position of the individual researchers

i. List of invited/keynote presentations at international conferences, documented by an invitation letter or programme

Microclimate of plants

Czech Republic, Brno 2003, March 26.

- [1] HURTALOVÁ, Tatiana – MATEJKA, František – JANOUŠ, Dalibor – ROŽNOVSKÝ, Jaroslav. Influence of spruce stand on air flow and on air temperature and moisture vertical stratification (in Slovak).
- [2] MATEJKA, František – ROŽNOVSKÝ, Jaroslav – HURTALOVÁ, Tatiana – JANOUŠ, Dalibor. Contemporary state and perspectives of the plant microclimate research (in Slovak).

8th Meeting of the Czech Tectonic Group and 1st Meeting of the Central European Tectonic Group

Hrubá Skála, Czech Republic, Hrubá Skála 2003, April 25-26.

- [3] BIELIK, Miroslav. Geophysical research of the lithosphere in the PANCARDI region: the recent results and knowledge of integrated interpretation of gravity field.

Science and Technology for safe development of lifeline systems. Natural risks : Developments, Tools and Techniques in the CEI area : CEI, CLSMEE, ICTP
Bulgaria, Sofia 2003.

- [4] BIELIK, Miroslav - ŠEFARA, Ján - VOZÁR, Ján. Integrated geophysical study of the lithosphere in the Carpathian orogen belt.

Freie Universität Berlin

Germany, Berlin 2003, December 7-11

- [5] BIELIK, Miroslav. Gravity research and isostasy in high mountains.
-

Institute for Geoscience, University of Potsdam

Germany, Potsdam 2004, February 18.

- [6] KRISTEKOVÁ, Miriam – FAH, D. The H/V Ratio Computation using Time-Frequency Analysis with Wavelet Transform.

Extremes of weather and climate

Czech Republic, Brno 2004, March 11.

- [7] MATEJKA, František – ROŽNOVSKÝ, Jaroslav – HURTALOVÁ, Tatiana – KOHUT, Mojmír. Atmospherical drought in the beginning of third millennium (in Slovak).
-

2nd Workshop on Earthquake Engineering for Nuclear Facilities, Uncertainties in Seismic Hazard Assessment

Italy, Trieste 2005, February 14 – 25.

- [8] LABÁK Peter. Probabilistic seismic hazard assessment for Bohunice and Mochovce nuclear power plant (Slovakia) sites.

Evapotranspiration and evaporation

Czech Republic, Brno 2005, March 23.

- [9] MATEJKA, František – HURTALOVÁ, Tatiana. Relationship between potential and reference evapotranspiration (in Slovak).

6th Experimental Advance Course for Seismologists, OSI Division, CTBTO

Stupava 2005, October 24 – 28.

- [10] LABÁK Peter. Overview of seismic investigation techniques: passive and active seismometry.

The SPICE R&T Workshop II

Smolenice 2005, September 4 – 10.

- [11] MOCZO Peter – AMPUERO, J.-P. – KRISTEK, Jozef – GÁLIS, Martin. The SPICE code validation.

Centro de Geofisica da Universidade de Lisboa

Portugal, Lisbon 2005, November 15.

- [12] BIELIK Miroslav. Integrated gravity studies of the lithosphere in the Central Europe.
-

11th Quadrennial General of Meeting SCOSTEP : Sun, Space Physics, and Climate STP Symposium

Brasil, Rio de Janeiro 2006, March 6 – 11.

- [13] PRIGANCOVÁ, Alina. STP (Solar Terrestrial Physics) activities in Slovakia – just at the beginning of the 21st century.

18th International Solar Seminar

Modra 2006, May 22 – 26.

- [14] PRIGANCOVÁ, Alina. **Magnetosphere disturbance due to extreme cosmic weather.**

Institute of Engineering Seismology and Earthquake Engineering ITSAK

Greese, Thessaloniki 2006, June 27

- [15] KRISTEK, Jozef – MOCZO, Peter. Conventional, staggered-gir, and optimally-accurate D schemes – Id problem. Part 2: Velocity-stress discontinuous staggered-gird FD scheme and MPI computer code.

Aristotle University

Greese, Thessaloniki 2006, June 29

- [16] KRISTEKOVÁ, Miriam – KRISTEK, Jozef – MOCZO, Peter – DAY, Steven M. Time-frequency quantitative criteria or comparison of seismograms.

University of Kiel

Germany, Kiel 2006, November 1

- [17] BIELIK, Miroslav. Integrated gravity studies of the lithosphere in the Carpathian-Pannonian region.

Present Research in Advanced Geodesy : lecture series

Institute of Geodesy and Geophysics TU

Austria, Wien 2006, November 29.

- [18] VAJDA, Peter. On the definition, use and inversion of anomalous gravity.

National Research Institute of Astronomy and Geophysics : Ministry of Scientific Research

Egypt, Kahira 2006, November 29

- [19] DÉREROVÁ, Jana. 2D integrated lithospheric modelling and its application in the Carpathian-Pannonian area.
- [20] BRIMICH, Ladislav. The results of the extensometric measurements in the Carpathian-Pannonian region.
- [21] BRIMICH, Ladislav. Geodynamic investigation in Geophysical Institute of the Slovak Academy of Sciences.

ii. List of employees who served as members of the organising and/or programme committees for international conferences

- [1] Bednárík Martin – member of the organizing committee 2nd Workshop on International Gravity Field Research, Smolenice, 8. – 9.5.2006
- [2] Bielik Miroslav – chairman International Workshop of APVT-51-002804 project and international group of potential fields CELEBRATION 2000, Bratislava, 27.28.10.2006
- [3] Brimich Ladislav – member of the organizing committee 2nd Workshop on International Gravity Field Research, Smolenice, 8. – 9.5.2006

- [4] Cipciar Andrej - member of the organizing committee SPICE Research and Training Workshop II, Smolenice, 4. – 10.9.2005
- [5] Dérerová Jana – chairman of the organizing committee 2nd Workshop on International Gravity Field Research, Smolenice, 8. – 9.5.2006
- [6] Dudášová Viera – member of the organizing committee 2nd Workshop on International Gravity Field Research, Smolenice, 8. – 9.5.2006
- [7] Fojtíková Lucia – member of the organizing committee SPICE Research and Training Workshop II, Smolenice, 4. – 10.9.2005
- [8] Franek Peter - member of the organizing committee SPICE Research and Training Workshop II, Smolenice, 4. – 10.9.2005
- [9] Gális Martin - member of the organizing committee SPICE Research and Training Workshop II, Smolenice, 4. – 10.9.2005
- [10] Gregorová Dagmar – member of the organizing committee New Trends in Geomagnetism, Valtice (Czech Republic), 3. – 8.9.2006
- [11] Hurlalová Tatiana – expert guarantor Internat. Conference: Bioclimatology at present and future, Brno-Křtiny, Czech Republic, 12.14.9.2005
- [12] Hvoždara Milan – member of the organizing committee New Trends in Geomagnetism, Valtice (Czech Republic), 3. – 8.9.2006
- [13] Kohút Igor – member of the organizing committee 2nd Workshop on International Gravity Field Research, Smolenice, 8. – 9.5.2006
- [14] Klučiarová Denisa – member of the organizing committee New Trends in Geomagnetism, Valtice (Czech Republic), 3. – 8.9.2006
- [15] Kristek Jozef - member of the organizing committee SPICE Research and Training Workshop II, Smolenice, 4. – 10.9.2005
- [16] Kristeková Miriam - member of the organizing committee SPICE Research and Training Workshop II, Smolenice, 4. – 10.9.2005
- [17] Labák Peter – co-organizer 1st European Conference on Earthquake Engineering and Seismology, Geneva, Switzerland, 38.9.2006
- [18] Matejka František expert guarantor Internat. Conference: Bioclimatology at present and future, Brno-Křtiny, Czech Republic, 12.14.9.2005
- [19] Moczo Peter – member of scientific committee Conference ESG 2006, Grenoble, France,
chairman of Organization Committee NMESD 2007
- [20] Orlický Oto – member of the organizing committee New Trends in Geomagnetism, Valtice (Czech Republic), 3. – 8.9.2006
- [21] Prigancová Alina – member of the organizing committee ISCS 2003 Symposium Solar Variability as an Input to the Earth's Environment, Stará Lesná, 23. – 28.6.2003
- [22] Tóthová Renáta – member of the organizing committee Science and Technology for Safe Development of Life Line Systems. Natural risks: Earthquakes and co-seismic associated risks, neotectonics and seismic hazard assessment in the CEI Area, Bratislava, 24. – 25.10.2005
- [23] Túnyi Igor – member of the organizing committee New Trends in Geomagnetism, Valtice (Czech Republic), 3. – 8.9.2006
- [24] Vajda Peter - chairman of Organization Committee New Trends in Paleomagnetism
- [25] Vozár Ján – member of the organizing committee New Trends in Geomagnetism, Valtice (Czech Republic), 3. – 8.9.2006

iii. List of employees who served as members of important international scientific bodies (e.g. boards, committees, editorial boards of scientific journals)

- [1] Bielík, Miroslav: member of Editorial Board Acta Geodaetica et Geophysica Hungarica, 2003 –
member of Editorial Board Geological Quarterly, 2003 –

- faculty member of academic community Oregon University, USA, 2003-
Visiting Professor of Council for M.Sc. and PhD. defence, Kahira University, Egypt, 2003 –
chairman of geophysical section of the Slovak National Committee for Carpathian-Balkanian Geological Society, 2003 –
secretary of Slovak National Committee for Geodesy and Geophysics (IUGG), 2003 –
- [2] Brimich Ladislav: national correspondent of International Association of Geodesy, 2003 –
- [3] Labák Peter: secretary of Subcommittee F: Engineering seismology of European Seismological Commission, 2003 – 2005
chairman of working group Historical Seismology of European Seismological Commission, 2004 –
member of Executive Committee ORFEUS, 2004 – 2005
president of Executive Committee ORFEUS, 2006 –
- [4] Moczo Peter: editor of *Studia Geophysica et Geodaetica*, 2005 –
chairman of Slovak National Committee IUGG, 2005 –
titular member of European Seismological Commission, 2005 –
- [5] Orlický Oto: member of Editorial Board *Geolines*, 2003 –
- [6] Prigancová Alina: chairman of Slovak National Committee SCOSTEP, 2003 –
secretary of Slovak National Committee COSPAR, 2003 –
member of expert council for cosmic physics – Committee for research and peaceful advantage of space, 2003 –
- [7] Túnyi, Igor: honour member of Hungarian Geophysical Association, 2003 –
- [8] Geophysical Institute: member of ORFEUS – Observatories and Research Facilities for European Seismology, 2003 –
member of EMSC/CSEM – European-Mediterranean Seismological Centre, (Peter Labák) 2003 –

iv. List of international scientific awards and distinctions

- [1] Matejka František: Honourable Mention for its contribution to development in meteorology and scientific cooperation with the Czech Hydro-meteorological Institute, Praha 2005

• National position of the individual researchers

- i. **List of invited/keynote presentations at national conferences documented by an invitation letter or programme**
- [1] Vajda, P., 2006. Inverse problem of gravimetry. 15-th Conference of Slovak Physicists, Stará Lesná, High Tatras, Slovak Republic, Sept. 11–14, 2006, (invited plenary talk)

- [2] Bielik, M., Vozár J. 2005: Čo je nové v medzinárodnom seizmickom projekte CELEBRATION 2000? (in Slovak) 6th Slovak Geophysical Conference. 29 June, 2005.

ii. List of employees who served as members of organising and programme committees of national conferences

Members of the organizing committee of the Slovak Geophysical Conference, Bratislava 2003 and 2005:

- [1] Bielik Miroslav
- [2] Brimich Ladislav
- [3] Dudášová Viera
- [4] Hvoždara Milan
- [5] Kohút Igor
- [6] Labák Peter
- [7] Túnyi Igor
- [8] Vajda Peter
- [9] Hortalová Tatiana – chairwoman of Organization Committee of 11th Poster day, Bratislava 2003, member of Organization Committee of 12th Poster day, Bratislava 2004
- [10] Matejka František – member of Organization Committee of 11th and 12th Poster Day, Bratislava 2003, 2004

Member of the organizing committee of the conference Glacial inceptions: Past and future, Bratislava, 2006

- [11] Ostrožlík Marian

iii. List of employees serving in important national scientific bodies (e.g. boards, committees, editorial boards of scientific journals)

- [1] Bielik Miroslav: member of Editorial Board Geologica Carpathica, 2003 – member of Editorial Board Contrib. to Geophysics & Geodesy, 2003 – member of Editorial Board Slovak Geological Magazine 2003 – member of Editorial Board Mineralia Slovaca, 2003 –
- [2] Brimich Ladislav: executive editor Contrib. to Geophysics & Geodesy, 2003 – 2004 member of Editorial Board Contrib. to Geophysics & Geodesy, 2005 – member of national grant agency committee VEGA (Commission 3)
- [3] Hortalová Tatiana: member of Editorial Board Contrib. to Geophysics & Geodesy, 2003 – member of Scientific Board Slovak Hydrometeorological Institute, 2003 – deputy-chairwoman Slovak Bioclimatological Society at SAS, 2003 –
- [4] Hvoždara Milan: editor-in-chief Contrib. to Geophysics & Geodesy, 2003 –
- [5] Kohút Igor: executive editor Contrib. to Geophysics & Geodesy, 2005 –
- [6] Labák Peter: member of Editorial Board Contrib. to Geophysics & Geodesy, 2005 –
- [7] Matejka František: member of Editorial Board Contrib. to Geophysics & Geodesy, 2005 –
- [8] Moczo Peter: member of Advisory Board Contrib. to Geophysics & Geodesy, 2005 –

- [9] Ostrožlík Marian: member of Editorial Board Meteorological Journal, 2003 –
scientific secretary of Slovak Meteorological Society, 2003 –
member of national grant agency committee VEGA (Commission 3)
- [10] Pribullová Anna: member of Editorial Board Kozmos, 2003 –
- [11] Prigancová Alina: member of Editorial Board Contrib. to Geophysics & Geodesy,
2003 –
- [12] Šefara Ján: member of Advisory Board Contrib. to Geophysics & Geodesy, 2005 –
- [13] Túnyi Igor: member of Editorial Board Contrib. to Geophysics & Geodesy, 2003 –
member of Editorial Board Geologica Carpathica, 2003 –
member of Editorial Board Kozmos, 2003 –
chiefman of Control Board Slovak Mining Society at SAS, 2003 –
- [14] Vajda Peter: member of Editorial Board Contrib. to Geophysics & Geodesy, 2005 –
member of national grant agency committee VEGA (Commission 3)

iv. List of national awards and distinctions

- [1] Túnyi Igor: Silver Medal of the Union of Slovak Scientific Technical Societies, 2003.
- [2] Bielik Miroslav, Šefara Ján, Kováč Michal, Plašienka Dušan. The Western Carpathians-interaction of Hercynian and Alpine processes. Tectonics, Vol. 393, 1-4 (2004), 63-89-6. In 2005 awarded by the Slovak Geological Society as the best paper published in 2001-2004.
- [3] Šefara Ján: Diploma of honour at the occasion of the 65th anniversary of establishing the Faculty of Natural Sciences, Comenius University, 2005.
- [4] Geophysical Institute of the SAS was awarded the Plaque of the Dean of the Faculty of Natural Sciences, Comenius University at the occasion of the 65th anniversary of establishing the Faculty, 2005.
- [5] The President Unit (Board of Chairmen) of the SAS financially awarded the research team of the Department of Seismology for a successful completion of the Modernization and Extension of the National Network of Seismic Stations project, 2005.
- [6] Moczo Peter: The Dionýz Štúr Plaque of Honour of the Slovak Academy of Sciences for achievements in natural sciences, 2006.
- [7] Collective of seismologists (P. Moczo, P. Labák, J. Kristek, M. Kristeková, M. Gális, P. Franek, L. Fojtíková)) were awarded the Prize of the Slovak Academy of Sciences for Building up the Science Infrastructure, for building the National Network of Seismic Stations, 2006.

Supplementary information and/or comments documenting international and national status of the Organisation

The institute participated in the Ukrainian Antarctic Expedition.

We have non-financed international cooperation in terms of joint research tasks or joint publications with the following organizations:

- Departement des Sciences de la Terre Universite de Paris-Sud, France
- Institute of Geophysics NAS of Ukraine

- National Research Institute of Astronomy and Geophysics in Cairo, Egypt
- Department of Civil Engineering, Tallinn University of Technology, Tallinn, Estonia
- Institute of Meteorology and Geophysics, University of Vienna, Vienna, Austria
- Department of Geodesy and Geomatics Engineering, University of New Brunswick, Fredericton, N.B., Canada
- Research Institute of Geodesy, Topography and Cartography, Ondřejov, Czech Republic
- University of Western Bohemia, Department of Mathematics, Pilsen, Czech Republic
- Faculty of Aerospace Engineering, Physical and Space Geodesy, DUT, Delft, Netherlands
- School of Civil Engineering and Geosciences, Newcastle University, Newcastle upon Tyne, United Kingdom
- Institute for Geosciences, FSU Jena, Jena, Germany
- Institute for Physical Geodesy, TU Darmstadt, Darmstadt, Germany
- Instituto de Astronomia y Geodesia, Universidad Complutense de Madrid (CSIC-UCM), Madrid, Spain
- Observatoire Royal de Belgique, Bruxelles, Belgium
- Institute of the Physics of the Earth, Russian Academy of Sciences, Moscow, Russia
- Geophysical Institute of the Academy of Sciences of the Czech Republic, Praha, Czech Republic
- Geodetical and Geophysical Research Institute of Hungarian Academy of Sciences, Sopron, Hungary
- Geophysical Institute of the Polish Academy of Sciences, Warszawa, Poland
- Polar Institute, Tokyo, Japan

4. Project structure, research grants and other funding resources

- **International projects and funding**
- i. **List of major projects within the European Research Area – 5th and 6th Framework Programme of the EU, European Science Foundation, NATO, COST, INTAS, CERN, etc. (here and in items below please specify: type of project, title, grant number, duration, funding, responsible person in the Organisation and his/her status in the project, e.g. coordinator, principal investigator, investigator)**

- [1] 5th FP of the EU
SESAME – Site effects assessment using ambient excitations
 EVG1-CT-2000-00026
 1.5.2001 – 30.4.2004
Funding: European Commission, DG XII-B SDME01/75, 200, Rue de la Loi, B-1049 Brussel (796.491 + 230.200 SKK)
Responsible person in GPI: Mgr. Jozef Kristek, PhD.
Coordinator: prof. RNDr. Peter Moczo, DrSc., FMPI CU
- [2] 5th FP of the EU
MEREDIAN II – Developing existing earthquake data infrastructures towards a Mediterranean – European rapid earthquake data information and Archiving Network
 EVRI-2002-00507, EVRI CT-2000-40007
 15.4.2002 – 30.4.2005

Funding: European Commission, DG XII-B SDME01/75, 200, Rue de la Loi, B-1049 Brussel (1 109.366 + 832.000 + 239.014 SKK)

Responsible person in Slovakia: RNDr. Peter Labák, PhD.

Coordinator: Dr. Torild van Eck – De Bilt, Netherlands

[3] 5th FP of the EU

EUROSEISRISK –Seismic hazard assessment, site effects, and soil structure interaction studies in an instrumented basin

EVG-CT-2001-00040

1.1.2002 – 30.6.2005

Funding: European Commission, DG XII-B SDME01/75, 200, Rue de la Loi, B-1049 Brussel (834.899 SKK)

Responsible person in Slovakia: prof. RNDr. Peter Moczo, DrSc., FMPI CU

Deputy for responsible person: Mgr. Jozef Kristek, PhD.

Coordinator: Dr. K. Ptilakis, Thessaloniki, Greece

[4] UNESCO

Mantle dynamic implications for the tectonic natural hazards mitigation

IGCP 430/UNESCO

1.1.2000 – 31.12.2005

Funding: no

Coordinator: doc. RNDr. Miroslav Bielik, DrSc., Bratislava, Slovakia

[5] Multilateral project EU

INTERMAGNET – First order world network of geomagnetic observatories

1.1.1998

Funding: no

Responsible person in Slovakia: RNDr. Magdaléna Váczyová, PhD.

Coordinator: Dr. R. Coles, Geological Survey of Canada

[6] Multilateral project EU

CELEBRATION 2000 – Central european lithospheric experiment based on refraction

1.1.2000 – 31.12.2006

Funding: no

Responsible person in Slovakia: doc. Miroslav Bielik, DrSc.

[7] COST

Developing the scientific basis for monitoring, modelling, and predicting space weather

COST 724

9.1.2002 – 23.11.200

Funding: mobility from COST Committee Brussel

Responsible person in Slovakia: Mgr. Frdriach Valach, PhD.

[8] COST

Long term changes and climatology of UV radiation over Europe

COST 726

1.1.2005 – 31.12.2009

Funding: mobility from COST Committee Brussel

Responsible person in Slovakia: Mgr. Anna Pribullová, PhD.

[9] COST

Measuring and forecasting of atmospheric icing

COST 727

1.3.2005 – 31.12.2009

Funding: mobility from COST Committee Brusel

Responsible person in Slovakia: RNDr. Marian Ostrožlík, CSc.

Coordinator: Dr. Bengt Tammelin, Finland

ii. List of other international projects incl. funding

- [1] Project of official development aid
Development of infrastructure for rapid earthquake data collection and exchange DIRECTE
 NPOA G 10/2004
 1.11.2004 – 31.8.2005
Funding: Ministry of Foreign Affairs of SR (1 500.000 + 3 158.797 SKK)
Responsible person in Slovakia: RNDr. Peter Labák, PhD.

- [2] Project of official development aid
Development of infrastructure for rapid earthquake data collection and exchange DIRECTE – Part 2
 ACU/2004/02/MK/02
 1.11.2004 – 31.8.2005
Funding: Ministry of Foreign Affairs of SR (1 183.000 + 2 794.200 SKK)
Responsible person in Slovakia: RNDr. Peter Labák, PhD.

- [3] Project of official development aid
Landslide monitoring program – LAMP
 ACU/2003/01/UZ/17
 1.7.2004 – 31.10.2006
Funding: Ministry of Foreign Affairs of SR (1 183.000 + 1 998.600 SKK)
Responsible person in Slovakia: RNDr. Peter Labák, PhD.

- [4] Project of official development aid
Sharing the data from the infrastructure for rapid Earthquake data collection and exchange – ShareDIRECTE
 NPOA G64/2006
 1.12.2006 – 29.2.2008
Funding: Ministry of Foreign Affairs of SR, CIDA Canada (533.392 SKK)
Responsible person in Slovakia: RNDr. Peter Labák, PhD.

- [5] Bilateral project: Slovak Republic – Italy
Contribution to the Euro-Mediterranean archive of historical macroseismic data
 1.6.2006 – 31.12.2010
Funding: INVG Milano, Italy (271.072 SKK)
Responsible person in Slovakia: RNDr. Peter Labák, PhD.

iii. List of other important projects and collaborations without direct funding

- [1] Bilateral project: Slovak Republic – Ukraine
Study of deepseated structure of the Carpathian-Pannonian basin lithosphere utilising the method of 3D modelling of gravity, magnetic, and geothermic fields
 1.1.2003 –
Funding: no

Coordinator: doc. RNDr. Miroslav Bielik, DrSc.

- [2] Bilateral project: Slovak Republic – Austria
Study of multi-scale characteristics of MHD turbulence in cosmic plasma
 1.2.2000 – 31.1.2004
Funding: no
Responsible persons in Slovakia: RNDr. Zoltán Vörös, CSc., RNDr. Alina Prigancová, CSc.
- [3] Bilateral project: Slovak Republic – Czech Republic
Spectrogram simulations observed by MAGION 4 and 5 satellites
 15.10.2002 – 30.6.2003
Funding: no
Responsible person in Slovakia: Mgr. Dana Jankovičová, PhD.

- **National projects and funding**

- i. **List of projects supported by the Agency for the Promotion of Research and Development (APVV/APVT), National Research Programmes, and their funding**

- [1] **Development, improvement, and application of progressive methods of 2D and 3D gravity field interpretation in geophysics and geology**
 2005 – 2008
 APVT-51-002804
Funding: 7 156 000,- SKK
- [2] **Microclimate of windthrows in High Tatras**
 04/2006 – 03/2009
 APVV-51-030205
Funding: 1 965 000,- SKK
- [3] **Integrated geomagnetic maps of the Slovak Republic territory and adjacent regions**
 04/2006 – 03/2007
 APVV-51-008505
Funding: 942 000,- SKK
- [4] **Modernization and extension of the Slovak national network of seismic stations**
 03/2001 – 02/2004
 National Research Programme
Funding: 11 972 000,- SKK
- [5] **Monitoring of environment in SMI area in Bratislava**
 01/2002 – 12/2006
Funding: Government of the SR (2003: 3 001.300 SKK; 2006: 542.000 SKK)
- [6] **Seismic transect through the geological units of the Western Carpathians**
 01/1999 – 12/2003
Funding: Ministry Environment of the SR (198.927 SKK)
- [7] **Geophysical modelling of direct prospecting of hydrocarbon in the Trhovište-Pozdišovce locality within the Eastern Slovakian basin**
 03/2003 – 03/2006
Funding: Ministry of Education of the SR (15.000 + 10.000 SKK)

- ii. Number of projects supported by the Scientific Grant Agency of the Slovak Academy of Sciences and the Ministry of Education (VEGA) for each year, and their funding

VEGA	2003	2004	2005	2006
number	7	5	6	7
funding (millions of SKK)	0,613	0,640	0,699	0,759

- Summary of funding from external resources

External resources	2003	2004	2005	2006	total	average
external resources (millions of SKK)	10,048	12,584	12,880	10,031	45,543	11,386
external resources transfered to cooperating research organisations (millions of SKK)	0,000	0,000	2,162	3,240	5,402	1,351
ratio between external resources and total salary budget	0,804	0,991	0,954	0,715	-	0,866
overall expenditures from external as well as institutional resources(millions of SKK)	22,405	21,671	29,105	28,221	101,402	25,351

Supplementary information and/or comments on research projects and funding resources

Additional resources were gained from commercial contracts and expertise activities.

5. Organisation of PhD studies, other pedagogical activities

- i. List of accredited programmes of doctoral studies (as stipulated in the previously effective legislation as well as in the recently amended Act on the Universities)

[1] Programme 11-45-9 Geophysics

[2] Programme 11-55-9 Meteorology and Climatology

[3] Programme 12-11-9 Applied Geophysics

[4] Programme 4.1.30 Applied Geophysics (since 2006)

- ii. Summary table on doctoral studies (number of internal/external PhD students; number of students who completed their study by a successful thesis defence; number of PhD students who quitted the programme)

PhD study	31.12.2003			31.12.2004			31.12.2005			31.12.2006		
number of potential PhD supervisors	13			12			11			12		
PhD students	number	defended thesis	students quitted	number	defended thesis	students quitted	number	defended thesis	students quitted	number	defended thesis	students quitted
internal	6	0	0	5	1	1	2	1	0	1	0	0
external	10	2	0	14	1	0	8	1	0	7	1	0
supervised at external institution by the research employees of the assessed organisation	0	0	0	0	0	0	0	0	0	0	0	0

Note: To avoid duplicity, 5 external PhD students were not recorded among PhD students of the Geophysical Institute of the SAS since 2005 because their supervisors left the Geophysical Institute (Prof. Peter Moczo – 5 PhD students, Assoc. Prof. Ferdinand Heseck – 1 PhD student).

iii. Postdoctoral positions supported by

a) external funding (specify the source)

b) internal funding - the Slovak Academy of Sciences Supporting Fund of Stefan Schwarz

Mgr. Jana Dérerová, PhD., 2005

RNDr. Ján Vozár, PhD., 2006

iv. Summary table on pedagogical activities in undergraduate programmes for each year

Teaching	2003	2004	2005	2006
lectures (hours/year)	315	270	255	60
practicum courses (hours/year)	120	235	75	290
supervised diploma works (in total)	4	2	7	2
members in PhD committees (in total)	7	9	8	3
members in DrSc. committees (in total)	0	2	4	0
members in university/faculty councils (in total)	0	0	0	0
members in habilitation/inauguration committees (in total)	0	0	2	0

v. List of published university textbooks

vi. Number of published academic course books

- [1] MOCZO, Peter - LABÁK, Peter. Earthquakes and seismic hazard: bachelor course, seismology. Bratislava : Geophysical Institute SAS, 2006, 24 p.
http://www.nuquake.eu/Earthquakes/Moczo_Labak_2000.pdf
- [2] LABÁK, Peter. Seismic hazard analysis and macroseismic effects of earthquakes: magister course, seismology. Bratislava : Geophysical Institute SAS , 2006, 29 p.
http://metanoon.dgp.fmph.uniba.sk/mainpage/stud_mat/seiz-ohr-makro.pdf
- [3] BRIMICH, Ladislav. Earth's gravity field: magister course: gravimetry and geodynamics. Bratislava : Geophysical Institute SAS, 2006, 129 p.
http://metanoon.dgp.fmph.uniba.sk/mainpage/stud_mat/tiaz_pole.pdf

vii. List of joint research laboratories/facilities with the universities

Faculty of Mathematics, Physics, and Informatics, Comenius University in Bratislava:

- [1] **Seismic Station Modra-Piesok**
- [2] **Paleomagnetic Laboratory Modra-Piesok**
- [3] **Radon Station Modra-Piesok**

viii. Supplementary information and/or comments on doctoral studies and pedagogical activities

6. Direct output to the society

(applications of results, popularisation and outreach activities)

i. List of the most important results of applied research projects

- [1] A new complex seismic hazard assessment has been performed for the Mochovce Nuclear Power Plant locality. 2003
User: Mochovce Nuclear Power Plant
- [2] An electronic system was created for disseminating of messages on earthquakes recorded by the Slovak National Network of Seismic Stations. Publicly available localizations, live, and archive seismograms are available on internet page: www.seismology.sk. 2004
User: Office of Civil Protection of the Slovak Republic

- [3] A directed experiment, organized by CTBTO, Institute of Nuclear Surveillance of the SR, and Geophysical Institute was performed in 2004. Two profiles with eight 3-component seismic stations with the spacing of 500 m and three tripartite mini-arrays were installed at the military test-site Turecký vrch, Slovak Republic. Seismic motions caused by the explosion were recorded and analyzed.

User: Comprehensive Nuclear-Test-Ban Treaty Organisation (CTBTO)

- [4] Reambulation of the methodology of direct prospecting for hydrocarbons by means of light geophysical methods. 2006

User: NAFTA Gbely, a.s.

- [5] Landslides monitoring program. 2006

User: UzbekHydrogeology, Taškent, Uzbekistan

- [6] Magnetotelluric measurements in the eastern part of the Western Carpathians. 2006

User: Ministry Environment of the SR

ii. List of the most important studies commissioned for the decision-making authorities, the government and NGOs, international and foreign organisations

- [1] Ministry of the Environment of the Slovak Republic – Monitoring of the environmental factors in the Slovak Metrological Institute

- [2] Ministry of Defence Slovak Republic – measurements of the declination on the military airports, determination of the perturbation of the ionosphere

- [3] Civil Aviation Authority of the Slovak Republic – measurements of the declination on the civil airports

- [4] Ministry of Foreign Affairs of SR - Development of infrastructure for rapid earthquake data collection and exchange DIRECTE

- [5] Ministry of Foreign Affairs of SR - Development of infrastructure for rapid earthquake data collection and exchange DIRECTE – Part 2

- [6] Ministry of Foreign Affairs of SR - Landslide monitoring program – LAMP

iii. List of the most important popularisation activities

- [1] Press conferences of Geophysical Institute of the SAS e.g.

- press conference to the Slovak national network of seismic stations
- press conference to the Sumatra earthquake

- [2] Open doors days in the observatories e.g.

- Geomagnetic observatory and seismic station in Hurbanovo
- Meteorological observatory Skalnaté Pleso
- Meteorological observatory Stará Lesná

More than 350 visitors participated in the excursion on each observatory yearly.

- [3] Presentations in TV (e.g. Sumatra earthquake 2004, wind storm in High Tatras)

- [4] Presentations in Slovak Radio

- [5] Popular science papers in the journals and magazines (e.g. paper about the participation in the Antarctic expedition)

iv. List of patents issued abroad, incl. revenues

v. List of the patents issued in Slovakia, incl. revenues

vi. List of licences sold abroad, incl. revenues

vii. List of licences sold in Slovakia, incl. revenues

viii. List of contracts with industrial partners, incl. revenues

- [1] RABIT-BKS, s.r.o. Bratislava (2 450.000,- SKK)
 - [2] ENVIGEO, a.s., Banská Bystrica (450.000,- SKK)
 - [3] Slovenské elektrárne a.s., Atómové elektrárne Mochovce (440.000,- SKK)
 - [4] Ministerstvo obrany SR [Ministry of Defence of the Slovak Republic], Bratislava (16.800,- SKK)
 - [5] Geologická služba [Geological Survey of Slovak Republic], Bratislava (348.787,- SKK)
 - [6] Veliteľstvo vzdušných síl, Zvolen (27.866,- SKK)
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- [7] RABIT-BKS, s.r.o. Bratislava (593.500,- SKK)
 - [8] Ministerstvo obrany SR [Ministry of Defence of the Slovak Republic], Bratislava (16.800,- SKK)
 - [9] ENVIGEO a.s., Banská Bystrica (250.000,- SKK)
 - [10] Štátny geologický ústav Dionýza Štúra [State Geological Institute of Dionyz Stur], Bratislava (146.860,- SKK)
 - [11] Vojenský útvar, Sliač (37.590,- SKK)
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- [12] Ministerstvo obrany SR [Ministry of Defence of the Slovak Republic], Bratislava (16.800,- SKK)
 - [13] Štátna geologická služba, Bratislava (180.000,- SKK)
 - [14] Veliteľstvo vzdušných síl, Zvolen (52.000,- SKK)
 - [15] Letové služby, Bratislava (150.000,- SKK)
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- [16] Ministerstvo obrany SR [Ministry of Defence of the Slovak Republic], Bratislava (16.800,- SKK)
 - [17] Štátny geologický ústav Dionýza Štúra [State Geological Institute of Dionyz Stur], Bratislava (807:921,- SKK)
 - [18] Letecké opravovne, Trenčín (36.000,- SKK)
 - [19] RABIT-BKS, s.r.o., Bratislava (556.000,- SKK)
 - [20] EQUIS, Bratislava (80.000,- SKK)
 - [21] Veliteľstvo vzdušných síl, Zvolen (76.000,- SKK)

ix. List of research projects with industrial partners, incl. revenues

- [1]] Seismic transects through geologic units of the Western Carpathians.
State Geological Institute of Dionýz Štúr (ŠGÚDŠ, geological survey), Bratislava
(198.927 SKK)

x. Summary of outreach activities

Outreach activities	2003	2004	2005	2006	total
studies for the decision sphere, government and NGOs, international and foreign organisations	4	4	7	6	21
articles in press media/internet popularising results of science, in particular those achieved by the Organization	10	13	4	23	50
appearances in telecommunication media popularising results of science, in particular those achieved by the Organization	3	17	28	13	61
public popularisation lectures	23	27	43	36	129

xi. Supplementary information and/or comments on applications and popularisation activities

The participation in the Ukrainian Expedition in Antarctica was presented in 2 popular magazines.

7. Background and management. Staffing policy and implementation of findings from previous assessments

i. Summary table of personnel

Personnel	2003	2004	2005	2006
all personnel	61	57	67	68
research employees from Tab. Research staff	39	39	41	43
FTE from Tab. Research staff	32	31	33	33
averaged age of research employees with university degree	52	51	50	49

ii. Professional qualification structure

Number of	2003	2004	2005	2006
DrSc.	5	4	5	5
PhD / CSc.	17	19	18	21
Prof.	1	0	2	2
Doc./Assoc. Prof.	3	2	3	3

iii. Status and development of research infrastructure incl. experimental, computing and technical base (description of the present infrastructure, premises, and material and technical resources. Infrastructure, instrumentation and major technical equipment necessary for the achievement of the objectives specified in the research Concept)

Gravimetry and Geodynamics

Vyhne tidal station is located underground, in the gallery of St. Anthony of Padua in the Vyhne valley, Štiavnické Mountains, Central Slovakia. Currently, it is equipped with quartz tube extensometer measuring the long-periodic (Earth's tides, annual temperature variations etc.) and aperiodic (tectonic) deformations of the Earth's crust, and, since end of 2005, with alpha particle counter to monitor the Rn emanation. In the beginning of 2006, a radio-frequency telemetric link connecting the seismological and tidal stations was established. With the satellite data connection of the seismic station Vyhne and the headquarters of the Geophysical Institute provided earlier, the data route from the tidal station's datalogger to our Bratislava workplace is now complete. Thus, the data acquisition process can be controlled better and the dropouts of data prevented or

minimized. To make the extensometric measurement more interpretable, inclusion of relatively simple measurements of outside temperature and air pressure would be very advisable. Nevertheless, as the distance from the gallery entrance to the datalogger at the extensometer site is far too large to be spanned by analog signal paths from the temperature and air pressure sensors, these measurements would require purchasing and installation, apart of the sensors themselves of a new datalogger and a new data router.

The Department of Gravimetry and Geodynamics possesses and operates the world's most accurate and precise relative gravity meter, the CG5 by Scintrex Ltd. This allows us to measure the gravity or the temporal changes of gravity with an accuracy of 5 microGal. Such observations are at the forefront of gravimetric field investigations. We plan to acquire field measurements in areas of particular interest to our ongoing research projects regarding geological and tectonic studies, as well as geodynamic investigations associated with volcanoes and magmatic processes, all this in Slovakia and other regions of Europe. We plan to utilise the meter also in cooperation with various European countries.

Seismology

The institute operates and maintains the Slovak National Network of Seismic Stations (SNNSS). SNNSS consists of 12 seismic stations deployed on the territory of Slovakia. The network enables to localize macroseismically felt earthquakes with epicenters in Slovakia using seismometric data. All seismic stations are registered in the International Seismological Centre in the Great Britain. They are Bratislava – Železná studnička (ZST), Modra – Piesky (MODS), Hurbanovo (HRB), Šrobárová (SRO), Iža (SRO1), Moča (SRO2), Likavka (LIKS), Vyhne (VYHS), Kečovo (KECS), Červenica (CRVS), Kolonické sedlo (KOLS) and Stebnícka huta (STHS). Five stations are equipped with broadband seismometers - four stations with the STS-2 seismometers (VYHS, CRVS, MODS, KOLS), one station with the SKD seismometers (ZST). Ground velocity is continuously recorded at all seismic stations. Live seismograms from the SNNSS are available at the <http://www.seismology.sk> web page. Live seismograms are archived for 30 days.

The data center collects waveforms from all stations of the SNNSS and from selected seismic stations of several institutions from the Central and Southeastern European countries. Data are collected in real time using the SeisComp/SeedLink or SEMS SeedLink software. Seismic waveforms from stations of the NNSS are exchanged with all institutions which supply data to the data center in Bratislava. In addition, the seismic waveforms are sent also to the Orfeus Data Center, De Bilt, Netherlands. The miniSeed format is used for both data collection and data exchange. In total, data from 75 seismic stations are collected. These stations create Regional Virtual Seismic Network of the Geophysical Institute. Collected data are automatically analyzed by AutoLoc package. The first automatic localization is available within 10 minutes after the P wave arrival. After fulfillment of alert criteria information is sent to the Office of the Civil Protection and other relevant authorities. Results of automatic localization of earthquakes are available also at the <http://www.seismology.sk> web page.

The archiving of the continuous waveforms is a two step procedure. First, the waveforms are stored in the 1.8 TB Raid field. Then data are copied to the 2.4 TB Jukebox NSM 3000. Records of local, regional and teleseismic earthquakes are archived. All waveform data are available upon request.

Geomagnetism

Main equipment of the Hurbanovo GO includes: digital variometer station TPM made in Belsk Observatory (Poland) and magnetoregistration device 3-axis fluxgate magnetometer Magson gained on the co-operation basis with GeoForschungsZentrum Potsdam and Volkswagen Stiftung (Germany). For the absolute geomagnetic measurements there are used mainly DI-fluxgate magnetometer, proton magnetometer ELSEC, QD declinometer. A new proton precession magnetometer (PPM) with high

accuracy is required (a standard equipment of IMO observatories). We need to build up geomagnetic pavilion in Kolonica and two new automatic digital variometer station for Kolonica and Šrobárová.

Main equipment of the Modra paleomagnetic laboratory includes: thermal demagnetizer MAVACS, kappabridge KLY2, spinner magnetometer JR4. The following instruments are necessary to fulfil main goal of planned modernization of laboratory: new demagnetizer and spinner magnetometer (LDA-3A, JR-6A), for measurement of all magnetic susceptibility methods – for rocks and soils: MFK1 Kappabridge, For measurements the temperature variation of magnetic susceptibility – additional apparatuses to the kappabridge: CS-3 furnace apparatus CS-L low temperature cryostat For measurement of anhysteretic magnetization: AMU-1A anhysteretic magnetizer

GPI SAS uses two types of magnetotelluric instruments. The first, newer one is induction short period system MI2002 for periods from 0.03 to 100 seconds. The second, older one is photo-electrical PSM system for long period measurements (5 sec and longer). It is necessary to obtain coil induction system to check shallow conductive structures. This allow remove static shift errors from MT measurement. For estimation of electromagnetic smog it is necessary to replace old RFI meters.

Atmospheric Physics

One part of the department is located in Bratislava and working conditions are appropriate. The other part of the department is detached at Stará Lesná and Skalnaté Pleso. Meteorological observatories are in the Astronomical Institute. The space conditions are suitable but some trouble is with the roof of the building at Stará Lesná. Repeating leaks in the room.

In the future it is necessary to provide for quantitative measurements of meteorological and radiative elements, to exchange radiative sensors by a new collection system. A deposition of the measured values, and to complete these measurements with the father measurements for example with the spectral radiative measurements by solar photometer those would be applied to direct measurement of aerosol optical depth.

In term of excursions it is necessary to provide the observatories by a suitable audio-visible arrangement.

iv. Status and development of bibliographic resources, activities of the Organisation's library and/or information centre

The institute possesses library resources of two scientific domains: geophysics, and meteorology and climatology, located in three institutional libraries. They are managed by a single basic information centre with one employee. The library processes the publication output of the institute with the software Advances Rapid Library – z39.50: ver. 1.1., ARL description ver. 1.0.67 (16.10.2002). The structure of records is based on the UNIMARC standard. For editing and creating of the EPCA records, the MARC editor is used. The ARL output is formatted according to STN – ISO 690.

The records in the modules ARL-EPCA and ARL are available via Internet: ON-LINE catalogue of publications and books on the webpage of Central Library of SAS.

The state of library resources (number of incoming journals, number of dissertations, photodocuments etc.):

The state of library resources in all three institutional libraries:	18.677
Discarded until 2002:	6.215
Discarded in 2003:	135

Total number of subscribed journals:	28
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v. Describe how the results and suggestions of the previous assessment were taken into account

In the period 2002 – 2006, the main objective of the Geophysical Institute SAS was to improve the quality of all research activities. The measures were taken to stimulate the publication output of the researchers of the Institute. The construction of the National Network of Seismic Stations was successfully accomplished. The tidal station Vyhne underwent a radical modernisation. The Department of Gravimetry and Geodynamics purchased a new gravimeter SCINTREX F5. The Institute was equipped with up to date personal computers. We supported the cooperation of the Institute with foreign partners. We encouraged our PhD. students and young graduates to go for short-term scientific stays abroad. The results of fundamental research were applied in monitoring of the geophysical fields for the purposes of the decision-making sphere.

vi. Supplementary information and/or comments on management, research infrastructure, and trends in personnel development

During the period to be evaluated, there was a change at the post of director of the Institute. From 1.3.1997 to 28.2.2005, RNDr. Igor Túnyi, CSc. was in charge. After the expiration of his mandate, RNDr. Ladislav Brimich, CSc. was elected and started his directorship 1.3.2005. Simultaneously, there were personal changes at the posts of deputy director and heads of the departments. From 1.3.2005, the post of the deputy director was taken by RNDr. František Matejka, CSc., the head of the Department of Gravimetry and Geodynamics became RNDr. Peter Vajda, PhD. From 1.6.2005, RNDr. Ján Vozár, PhD. started heading of the Geomagnetic Department. The modernisation of the observatory instrumentation made possible the decrease of technical staff.

Other information relevant to the assessment

Conclusion

Questionnaire was elaborated using source material about activities of the institute and negotiated with the scientific board.

Bratislava, February 2007.

RNDr. Ladislav Brimich, CSc.
director