GEODETIC AND GEOPHYSICAL INSTITUTE
RESEARCH CENTRE FOR ASTRONOMY AND EARTH SCIENCES
HUNGARIAN ACADEMY OF SCIENCES
9400 Sopron, Csatkai u. 6-8.
9401 Sopron, Pf.5.
Tel: 99-508343; Fax: 99-508350
e-mail: Wesztergom.Viktor@csfk.mta.hu web: www.ggki.hu

I. The main tasks of the research institute in 2015

The object of the current basic research in the Geodetic and Geophysical Institute is the observation, modelling and interpretation of the physical conditions and processes of planet Earth, as well as the development of the related theoretical (mathematical, physical) and experimental methods and test instruments. The public responsibilities covered by our basic activity are: continuous observation of the solid Earth and the space around Earth (geodynamics, geomagnetism and aeronomy), maintenance of the national seismological network and service, provision of data associated with international cooperation, as well as operation of periodic surveillance systems. The activities of the Institution that have direct economic importance are the search for natural resources and the analysis of geological earth-physical risks.
Research topics of the Institute that have traditionally outstanding success even by international standards are magnetotellurics, seismology, aeronomy and geodynamics. Through its broadband electromagnetic measurements the Széchenyi István Geophysical Observatory of the Hungarian Academy of Sciences has a significant role in global networks of observatories and in international projects diagnosing the plasma environment of the Earth.
National and European grants provide the financial resources for the constant renewal of research themes. Seismic based tomography for the purpose of exploration of the deep structure of the Earth (AlpArray), research on the impact of the Sun-Earth interactions on global changes, and the development and implementation of radar interferometry for geodynamic purposes in the field of space geodesy are some of the outstanding new research directions of recent years.

II. Outstanding results of research and other activities in 2015

a.) Outstanding results of research and other activities

AlpArray project: initiated by ETH Zurich and carried out with the participation of leading European institutions, the project's purpose is the structural and geodynamic study of the mountain range formed by the Alps - Apennines - Carpathian Mountains - Dinarides and their environment, and the assessment of the risk of earthquakes in the area. Mapping the deep structure of the Alps and their wider environment is realized through a broad-band seismological network with a high station density and functioning over at least three years continuously, whereby currently available information on the lithosphere and the upper mantle structure and their physical parameters will be expanded significantly. So far about 67 institutions from 18 countries have announced their intention to participate in the project. Participating institutions shall obtain the infrastructure of the project through national grants. From Hungary, the Geodetic and Geophysical Institute joined the European initiative, the acquisition of 11 broadband stations has been completed through the support of the Hungarian

Academy of Sciences. In addition to the pre-planned, optimal geometric configuration of the station network, selecting the right station locations with a stable, low seismic noise level over several years is also essential, in order to achieve the scientific objectives set out in the project. At the proposed station locations of the Hungarian station network, noise level measurements set out in the AlpArray technical documentation have been accomplished, and five AlpArray stations (A262A, A265A, A266A, A267A, A269A) were installed during the past year. The development of an IT system for the stations is essential, in order to fulfil the data reporting requirements undertaken in the international initiative. In the *Kövesligethy Radó Seismological Observatory* a new SeisComP3 computer system has been built to collect the observation data and to transmit them to the ORFEUS EIDA international data centre; in addition an online content management system has been developed that provides participants with uniform management and distribution of the information obtained in the AlpArray project.

Seismic noise tomography: The significant development of the Hungarian seismological network in recent years allowed the micro-seismic noise based tomographic examinations in the inner area of the Carpathian Basin, thereby significantly increasing the resolution of related group speed maps. The calculations took into account the curving paths of seismic waves as well. Based on experience gained in noise tomography at a regional level, an engineer-seismological method has been developed, which was recently field tested at the landslide-prone high riverbank at Dunaszekcső. Based on the local group speed map, reduced speed zones associated with the sliding surfaces were identified, and an area characterized by reduced group speeds was also identified, which may indicate cavity formation that had been unknown until now.

Focal mechanism studies: the hypocenter of 35 earthquakes that had occurred in Nógrád County between June 2013 and January 2015 was determined with some precision based on a probabilistic multi-event locating algorithm. The radius of the 95% confidence interval of the epicentres is approx. 1.8 km, the depth of the hypocenters was within the upper 3 km of the Earth's crust. A probabilistic waveform-inversion procedure (an in-house development) was used to determine the moment tensors of four earthquakes in order to determine local stress field. It was established that each examined event had a mechanism of lateral movement and their orientation closely matched the main compression direction characteristic of the epicentre area.

Macro-seismic examinations: The distance-attenuation of intensities caused by earthquakes of various magnitudes was analysed, based on the intensity data of the more significant earthquakes that occurred in the Pannonian Basin. The equation - magnitude, epicentre distance and depth-dependent - thus set up describes with good accuracy the attenuation of intensity of a significant majority of earthquakes occurring in the Pannonian Basin fairly well. In the case of those earthquakes, whose attenuation differed significantly from the average trend, a review of magnitudes and focal depths was started.

The seismic microzonation of Budapest: Micro-seismic background noise measurements were taken in Hűvösvölgy, and the resonance frequencies of the subsoil and the azimuth-dependent orientation of H/V ratios were calculated. At some locations a strong resonance was observed and the lateral modifying effect caused by topography was successfully determined. Active and passive seismic measurements were carried out in order to determine the speed distribution of upper layer S wave in Lágymányos and in Városliget. The common inversion of the various measurements that complement each other allows to determine the S-wave speed profile reliably.

Separation of earthquakes and explosions: The waveform database of blasts carried out in Hungarian mines was expanded, waveform correlation calculations were extended to the examination of all the three acceleration components. By analysing the cluster properties of aftershocks in Iliny, in Érsekvadkert and in Heves, several events of very similar waveforms were successfully paired with earthquakes with known nest properties.

Historical and prehistoric earthquakes: Covering the Carpathian Basin, the determination of the amplitude of the greatest horizontal soil accelerations created by paleoquakes has been continued by examining undamaged, upright stalagmites. Numerical modelling of dripstone vibration was carried out by geotechnical analysis and on-site measurements. Simulation calculations were made for assumed prehistoric earthquakes in the Vienna Basin, in order to determine the maximum horizontal ground acceleration that can occur. Based on the model calculations, macro-seismic isoseistic maps of the Vienna Basin were updated and the hypothesis that Carruntum in upper Pannonia had been destroyed by an earthquake (M> = 6,0-6,3 (± 1)) in 4th century C.E. was successfully refuted.

Environmental geophysical examinations: Numerical modelling has shown that the so-called *γ11n* geoelectric layouts are more efficient regarding both the horizontal and the vertical ability for resolution, in detecting inhomogenities that cause little potential space distortion on the surface, compared to widely applied traditional layouts. It was shown that the quality of the projection of such layouts can be further improved by the model summation procedure and by the use of their mirrored versions (*γm11n* with layouts). These results fully correspond to the results of earlier theoretical examinations, including the values of detecting depths.
Numerical results show that *γm11n* layouts can, in practice, be used particularly for the detection of small cross-sections, for example tunnels, forgotten mine shafts, caves discontinuities in impermeable soil layers, and detection of small changes over time (e.g. leakage) in areas where other geoelectric arrays cannot be laid out due to permanent structures or some other reason. Some of the numerical results have already been verified by analogous modelling comparable to on-site conditions.
The proprietary DC inversion program ERT2DInv has been developed further and was used successfully in the modelling of synthetic, analogous and on on-site measurement data.

Space Geodesy: The new space-geodetic method of studying surface movements is the Sentinel-1 satellite of the European Space Agency (ESA), whose images have been available to users since October, 2014. The establishment of radar interferometric research, and the development of combined geodetic and geodynamic methods (*Integrated Sentinel-1 and PSI GNSS technical facilities and procedures for determination of 3d surface deformations caused by environmental processes*) will begin in 2016 within the framework of an ESA grant. During the preparation of the ESA project the SAR images of the Sentinel-1 geodynamic network installed in Sopron for the purpose of methodological studies were processed. Data processing was carried out partly through the SNAP program system, developed by ESA, and partly through programs developed in-house. In image series taken in two ascending and one descending trajectory the integrated geodetic benchmarks of the network were determined. The backscattered energy of the reflected signals was determined in the case of VV and VH polarization, and at each satellite passing the azimuth of the satellite and the geodetic point and the incidence angle were also determined. The network consists of three facing base-points and one back-facing base-point, with dual-reflectors. The facing reflectors make possible the creation of a geometrically more optimal benchmark and reduce the unwanted impact of environmental reflections. The characteristics of the reflectors (backscatters) of various geometric arrangement have been examined through numerical modelling. It was established that phase distortion does not occur due to the

orientation of the reflector, the integrated point signals clearly stand out from their immediate surroundings.
At the same time, for the practical expansion and geodynamic use of the grant, an ESA Full Proposal grant was awarded for research based on archival data, under the title of *Initial assessments of recent surface evolution at the post-volcanic interior of the Carpathian bend using archive SAR acquisitions and geodetic data*. The geodynamic study of the inner Carpathian Bend is planned to be realized in cooperation between the University of Leeds, the University of Utrecht, the Eötvös Loránd University (ELTE), the Sapientia Hungarian University of Transylvania and the Babes-Bolyai University.

Monitoring temporal variations in the gravity field: For the geodynamic observation of the gravitational tidal range the scale factor corresponding to the entire measurement range of the available LCR G spring gravimeter must be known. The calibration methodology of spring gravimeters was studied, the extent (max. 4 μGal ≈ 4%) of the magnetic effects influencing the measurement results of the calibration of the mass-driven gravimeter has been determined indirectly, as a function of the relative position of the calibrating mass and the gravimeter. On this basis the calibration results (scale factors) were recalculated for each lift, showing a decrease of 1% on average. A program was developed to compensate for the calibration measurements based on the norm L2. It was established that although magnetic correction reduces the variance of the remaining signal to some extent, the signal still shows systematic effects. In order to examine the area dependence of the tidal range effect, the gravimeter tidal range timelines measured in the Conrad Observatory (on the north-eastern edge of the eastern Alps) and the Piszkéstető Observatory (on the northern edge of the Pannonian basin) were analysed, the day and half-day tidal wave amplitude show approx. 1% decrease progressing towards the interior of the Carpathian Basin.

Aeronomy, atmospheric physics: The Earth-ionosphere cavity electromagnetic own frequencies are the Schumann resonances (SR). The excitation source of the resonator is the Earth's thunderstorm activity, thus Schumann resonance data inversion reveals information about the source of global weather processes. The Schumann Resonance algorithm is based on the 2D spherical shell-shaped waveguide and on the differential equation well-known for linear waveguides, the so-called telegraph equation. The vertical component of the electric space was determined at the assumed source sites, by iterational linearized inversion, based on synthetic data. For some realistic sources the vertical component of the electric field and the horizontal component of the magnetic field have been modelled for the geographic coordinates of observatories carrying out Schumann-resonance measurements. Results were compared to the data sets of the observatory measurements.
The SR line-splitting described theoretically in literature, was verified for the first time in a complex way, by experiment, based on the different behaviour of the frequencies of N-S and E-W magnetic space components at Mitzpe Ramon, during the extreme geoeffective solar flare event series known as Halloween (in October/November, 2003).

Atmospheric radiation research: A mathematical model for the spread of radiative flux was set up in order to study the greenhouse effect of radiation, and lower as well as upper limits were introduced for the radiative flux captured by the athmosphere. Based on measured and calculated flux, the radioactive gain of greenhouse gases was calculated for the warming of the Earth that had been observed between 1880 and 2010.

Magnetosphere-physics: Based on magnetic and particle density measurements of the Cluster satellites, the characteristic profile distance of the density of so-called diffuse ions accelerated

by the Earth's Bow Shock, and the diffusion coefficient in the energy range 10-32 keV were determined perpendicularly to the surface of the Earth's Bow Shock for the first time. The results show that the dispersion of energized ions due to the particle-wave interaction is 10 to 40% more effective perpendicularly to the Earth's Bow Shock, compared to the dispersion along the magnetic line of force. It has been shown that the angle between the normal of the Bow Shock and the magnetic field does not affect significantly the effectiveness of dispersion. These findings contribute to the more precise mapping of the energy dissipation mechanisms of the Sun-Earth relationship and of other astrophysical processes.
"Hot flow" anomaly was shown in the distant geomagnetic tail observations of the probe STEREO B, more precisely on the part of the magnetopause that is about 300 R_{Earth} distance from the Earth. So far such phenomena had only been observed only near the points of the Earth's shockwave and the magnetopause close of the Sun. It is likely the remains of such a phenomenon were observed, suggesting that the process may take up to 50 minutes. Potential phenomena have been localized by a procedure based on magnetic measurements, then events have been identified by electron plasma momentums; this can be considered a new method, compared to the use of ion plasma momentums, that is speed, density and temperature. A similar but independently developed method was implemented by MESSENGER and Venus Express to show phenomena detected in the vicinity of Venus and Mercury.

Magneto-telluric inversion: A new procedure was developed for the series inversion of magneto-telluric measurements based on Legendre polynomes. In the case of conventional two- and three-dimensional inversions the number of model parameters may be quite large, which makes the inversion calculation-intensive and - in certain cases - makes it unstable. In the course of geophysical research there are often such two-dimensional geologic models that is essentially layered, but the characteristics of the layers (specific resistance, thickness) change along the profile. In this case, the traditional inversion task is usually underdetermined, while the series inversion of layer parameters according to appropriately chosen basis functions may lead to an overdetermined task. The number of coefficients necessary to describe the geologic model is far less than the number of measurements; the inversion variables are the Legendre polynomial coefficients.

Geomagnetism: Inversion-theory research began on Earth's (or of any planetary magnetic field) and the large wavelength anomalies present in it to determine their outer core source structure. Initially, a simplified model was used for the calculations that described the outer core magneto-hydrodynamic flow vortex and Taylor columns with flow loops. The possible mathematical solution of the inverse problem was studied, and a hybrid procedure was used to invert the synthetic magnetic data formed from the superposed magnetic fields of the flow loops, which is a combination of the genetic algorithms and the traditional inversion method using differentials. The source structure defined by inversion was compared to the source structure of the original direct problem and satisfactory correspondence was found when the number of sources was small (10-50). These findings may contribute to the research on the origin of large-scale geomagnetic anomalies and to the refinement of current MHD simulations applied to the outer core.

The internal structure of the Earth, mantle conventions. The thermal structure and surface phenomena of thermal columns was studied through numeric modelling, by systematically changing the Raleigh-number and the distribution of viscosity. Viscosity as a function of depth and consideration of the viscosity layers characteristic of the Earth are important in the development of the convection structure characteristic of the mantle. It was established that in order to

properly model the topographic and geoid anomaly developing above thermal columns it is essential to take into account viscosity that partly depends on temperature.

The definition of the lithosphere-asthenosphere boundary in the Pannonian Basin - Integrated geophysical and geochemical approach: In the Carpathian-Pannonian region there are five known areas where alkaline basalt is found on the surface, which - by shaping the mantle of the Earth - brought mantle xenoliths to the surface. The Nógrád-Gömör volcanic area located at the northern edge of the Pannonian Basin is one such area, where information on the upper mantle structure and its geophysical, geochemical properties (composition, current deformation state, seismic anisotropy, electrical conductivity), as well as information on the depth of the lithosphere-asthenosphere boundary (LAB) can be enhanced through the combined use of geophysical, petrological and geochemical methods. Magneto-telluric measurements have been performed along the approx. 60 km long section, in order to determine LAB depth, and the spatial distribution of electric conductivity. At the SEE end of the section LAB depth was between 69-80 km, whereas at the other end of the section depth was 90 km. At the central stages of the section, under the middle part of the area at a depth of 30-45 km, a body with small electrical resistance (~ 5-10 Ωm) was detected, which coincides with the wehrlit xenoliths, that is the surface scatter of rock formations that indicate metasomatism of the mantle (its change in mineral and chemical composition caused by melts). Accordingly, it is assumed that the low resistance body can be associated with the melts that had been trapped in the mantle - and had caused the earlier metasomatism - as well as with altered mineral composition. The lithosphere model of the area was created. Based on seismic data, S receiver function analysis of the Moho boundary was estimated to be 25 ± 5 km in depth, the LAB 65 ± 10 km. Based on rock samples and seismic data the state of mantle deformation and seismic anisotropy were studied. The results show that not only the lithosphere, but also the asthenosphere is significantly anisotropic beneath the volcanic area under investigation. The available data are insufficient to determine the structure (lineation and foliation direction) of the lithospheric mantle.

b.) Science and society

The seismotectonics; the vulnerability of geologic structures and formations and the analysis of emergency situations of Sun-Earth physical origin, their prevention and forecast are core responsibilities of the Institution. Maintenance of the National Seismology Service and diagnosis of space around the Earth are also essential public tasks. Extreme changes in the conditions occurring in the Earth's plasma environment due to extreme solar flares status changes, geomagnetic storms pose a real and steadily increasing risk to contemporary telecommunication technologies, navigation and energy-transmission systems.

The Institute of Geodesy and Geophysics carries out continuous data service and expert services for the Interior Ministry's Directorate General for Disaster Management in connection with seismotectonic events. The Institute was invited to participate in the "adaptation to climate change and promotion of risk prevention" project coordinated by the Interior Ministry's Directorate General for Disaster Management. Its aim is to develop a geoinformation system for the entire area of the country, which would be able to analyse and assess disaster risks of various scales simultaneously and in real time. The Institute contributes information and data on geological hazards and space weather to the development of the GIS database.

On the occasion of the 110th anniversary of the National Seismological Service and the institutionalized seismological research, the Geodetic and Geophysics Institute held in the

framework of the Hungarian Science Festival a scientific lecture session, where visitors could get acquainted with the results of seismology research from the domestic beginnings to the latest international cooperation.

The Hungarian Space Forum organised by the Geodetic and Geophysics Institute has made possible the exchange of scientific views about space research, and has also provided important information on ESA accession and on the national space research strategy to the actors of the space industry.

As part of the Space Camp organised by the Hungarian Astronautical Society, the youngest visitors spent a day in the Geodetic and Geophysics Institute, where in the course of lectures they learned about the structure and processes of the space surrounding the Earth and about research conducted at the institute.

III. The national and international partners of the research institute in 2015

Conrad Observatory, Austria: highly sensitive tiltmeters for the observation of tectonic processes;
Massachusetts Institute of *Technology*: research of aeronomy and the Schumann Resonance;
Finnish Meteorological Institute (Ilmatieteen Laitos): geomagnetic induction, magnetotelluric deep soundings;
The Catholic University of America, NASA Goddard Space Flight Center: solar wind-magnetosphere energy coupling;
Thunderstorm effects on the Earth-Ionosphere System (IS-TEA) European Science Foundation Research Networking Programme: aeronomy, observation and analysis of upper atmospheric electro-optical emissions;
Laboratoire de Physique et Chimie de l'Environnement et de l'Espace (LPC2E) / CNRS; Institut de Recherche en Astrophysique et Planétologie, Université de Toulouse: magnetosphere studies, magneto-hydrodynamic research;
INTERMAGNET: international geomagnetic observatory network;
AlpArray Steering Committee: ETH Zurich, University of Vienna, University of Berlin, National Institute of Oceanography and Experimental Geophysics (OGS), ISTerre Grenoble, Istituto Nazionale di Geofisica e Vulcanologia, Prague IG ASCR, GeoForschungsZentrum Potsdam, HAS RCAES GGI
Eötvös Loránd University TTK; Lithosphere Fluid Research Laboratory: research of the magneto-telluric deep structure and xenoliths of mantle origin for the research of the listosphere-asthenosphere boundary.

Visiting researchers from abroad:
14 visiting researchers spent 5 months at the institute in the framework of a research-collaboration.

Long-term foreign professional work of the researchers of the Institute:
Postdoctoral fellow: 2 people;
16 researchers of the Institute spent a total of 11 months abroad in the framework of research cooperation.

Organization of domestic events:

Hungarian Space Research Board, HAS RCAES Geodetic and Geophysics Institute, Sopron, May 7 to 9, 2015.

As a joint initiative of MANT and GGI, the space research event with the longest tradition has had a new name since 2015: Hungarian Space Research Forum, referring to the fact that the community maintaining the Ionosphere- and Magnetosphere Physics Seminar could create a forum for the actors of the Hungarian Space Research and Space Industry to support responsibilities related to the ESA-membership and to create a fruitful tendering activity.

Symposium on EM effects of thunderstorms and lightning, HAS RCAES Geodesy and Geophysics Institute, Sopron, October 20, 2015
Introducing the latest research results related to electrodynamic coupling between the ionosphere and thunderstorms.

110 years of the Kövesligethy Radó Seismological Observatory. Past, present and future. Science lecture session as part of the series of the events of the 2015 Hungarian Science Festival , HAS, November 17, 2015.

Organization of international events:

Falling Walls Lab selections in Hungary, HAS RCAES Geodetic and Geophysics Institute, Sopron, September 10, 2015
The "Falling Walls" conference is held every year on November 9, on the anniversary of the fall of the Berlin Wall in the capital of Germany. The competition of young innovators (researchers under 35, PhD and university students and entrepreneurs) is held under the title of Falling Walls Lab. Applications may be submitted by a specialist of any discipline, organizers expect answers to the question: "What is the next wall, that has to be demolished?" questions waiting for answers. The three best performers were given an opportunity to appear in Germany at the conference.

Participation in national higher education (occasional):
Habilitation Committee, PhD Thesis Defence 1 person.

Participation in national higher education (regular):
ELTE TTK: 6 theoretical courses, 2 practical courses;
NyME (EMK, KTK, FMK): 6 theoretical and 4 practical courses.

Educational activities in foreign universities
BBTE, Cluj-Napoca: 2 theoretical courses, 1 practical course.

Doctoral School core members:
NyME EMK Kitaibel Pál Doctoral School of Environmental Sciences: 1 person;
NyME FMK Cziráki József Wood Science and Technology Doctoral School: 1 person;
NyME KTK István Széchenyi Management and Business Administration Doctoral School: 1 person.

Education in the Doctoral School:
BME Vásárhelyi Pál Doctoral School: Inertial Structure of the Earth, Geophysical data processing.

NyME Cziráki József Wood Science and Technology Doctoral School: Measurement theory, Digital image processing.

NyME Kitaibel Pál Environmental Sciences Doctoral School: Modelling of geodynamic processes, Environmental science applications of GNSS systems, measurement of environmental movements, methodology of scientific research, Solar activity and weather, Geomagnetics, space weather and climate, Atmospheric electrodynamics, Structure of the Earth and its processes.

NyME Széchenyi István Doctoral School of Economic and Management Sciences: Theory of statistical analysis.

Thesis supervision (undergraduate paper):
ELTE TTK: 1 person.

Thesis supervision (BA, BSc degree):
ELTE TTK: 3 persons.

Thesis supervision (MA, MSc degree):
BME VIK: 1 person;
ELTE TTK: 4 persons.

Thesis supervision (PhD dissertation):
ELTE Doctoral School of Earth Sciences: 2 persons;
NyME (EMK, KTK, FMK): 7 persons.

IV. Brief introduction of major national and international grants won in 2015

HAS Featured Guest Professor Scholarship - Sierd Cloetingh 3-month guest research activities
Sierd Cloetingh is a renowned expert of large tectonics and litosphere research, president of the Academia Europaea, vice president of the ERC; during his stay he helps in the preparation of the international research project to study the structure, dynamics and neotectonic deformations of the litosphere.

Preparation to apply for grants

- *complex geodynamic research of the Inner Carpathian Bend (BEKK)*
- *for the installation of AlpArray measuring stations, and for participation in the work of the Steering Committee*
- *Plasmpause real-time data mapping based on surface VLF data - H2020-Protect-2016/2017 (PROTECTION OF EUROPEAN ASSETS IN AND FROM SPACE) consortium building*
- *for the geophysical examination of the planned venue - gravity wave detector (Einstein Telescope - ET)*
- *for the connection to the ARISE2 infrasound network*
- *for the initiation of the networking and harmonization of the INGEMM-ANES (Inventory of Geophysical Measurements and Models - Atmosphere and Near-Earth Space) scientific research related to the athmosphere and the space around the Earth.*

total grants won: 19.6 million HUF;

HAS general research site infrastructure grant, *IT equipment for specific tasks, related software*

for numerical modelling, data storage. Grant won: 3.5 million HUF.
HAS development of research infrastructure grant, *Purchase of magneto-telluric instrument*. Grant won: 6 million HUF

V. The most important scientific publications of 2015

Bondár I, Engdahl E Robert, Villaseñor A, Harris James, Storchak D: ISC-GEM: Global Instrumental Earthquake Catalogue (1900–2009), II. Location and seismicity patterns. PHYSICS OF THE EARTH AND PLANETARY INTERIORS 239: pp. 2-13. (2015)
http://real.mtak.hu/20760/

G Facskó, A Opitz, B Lavraud, J G Luhmann, C T Russell, J-A Sauvaud, A Fedorov, A Kis, V. Wesztergom: Hot flow anomaly remnant in the far geotail? JOURNAL OF ATMOSPHERIC AND SOLAR-TERRESTRIAL PHYSICS 124: pp. 39-43. (2015)
http://real.mtak.hu/33227/

Győri Erzsébet, Tóth László, Mónus Péter: Secondary effects generated by earthquakes: liquefaction occurrences in and around Hungary. ACTA GEODAETICA ET GEOPHYSICA 50:(1) pp. 79-95. (2015)
http://real.mtak.hu/32036/

Harangi S, Novák A, Kiss B, Seghedi I, Lukács R, Szarka L, Wesztergom V, Metwaly M, Gribovszki K: Combined magnetotelluric and petrologic constrains for the nature of the magma storage system beneath the Late Pleistocene Ciomadul volcano (SE Carpathians). JOURNAL OF VOLCANOLOGY AND GEOTHERMAL RESEARCH 290: pp. 82-96. (2015)
http://real.mtak.hu/27688/

Haszpra L, Barcza Z, Haszpra T, Pátkai Zs, Davis K J: How well do tall-tower measurements characterize the CO2 mole fraction distribution in the planetary boundary layer? ATMOSPHERIC MEASUREMENT TECHNIQUES 8:(4) pp. 1657-1671. (2015)
http://www.atmos-meas-tech.net/8/1657/2015/amt-8-1657-2015.pdf

Kallio E, Facskó G: Properties of plasma near the Moon in the magnetotail. PLANETARY AND SPACE SCIENCE 115:(1) pp. 69-76. (2015)
http://real.mtak.hu/20247/

Klébesz R, Gráczer Z, Szanyi Gy, Liptai N, Kovács I, Patkó L, Pintér Zs, Falus Gy, Wesztergom V, Szabó Cs: Constraints on the thickness and seismic properties of the lithosphere in an extensional setting (Nógrád-Gömör Volcanic Field, Northern Pannonian Basin). ACTA GEODAETICA ET GEOPHYSICA 50:(2) pp. 133-149. (2015)
http://real.mtak.hu/24361/

Prácser E, Dobróka M: Magnetotellurikus adatok sorfejtéses inverziója. MAGYAR GEOFIZIKA 56:(2) pp. 97-107. (2015)
http://real.mtak.hu/32382/

Süle Bálint: Mantle plume characteristics in three-dimensional depth- and temperature-dependent models. ACTA GEODAETICA ET GEOPHYSICA 50: pp. 403-417. (2015)
http://real.mtak.hu/32400/

Szalai S, Lemperger I, Metwaly M, Kis A, Westergom V, Szokoli K, Novák A: Increasing the effectiveness of electrical resistivity tomography using γ11n configurations. GEOPHYSICAL PROSPECTING 63:(2) pp. 508-524. (2015)
http://real.mtak.hu/33155/