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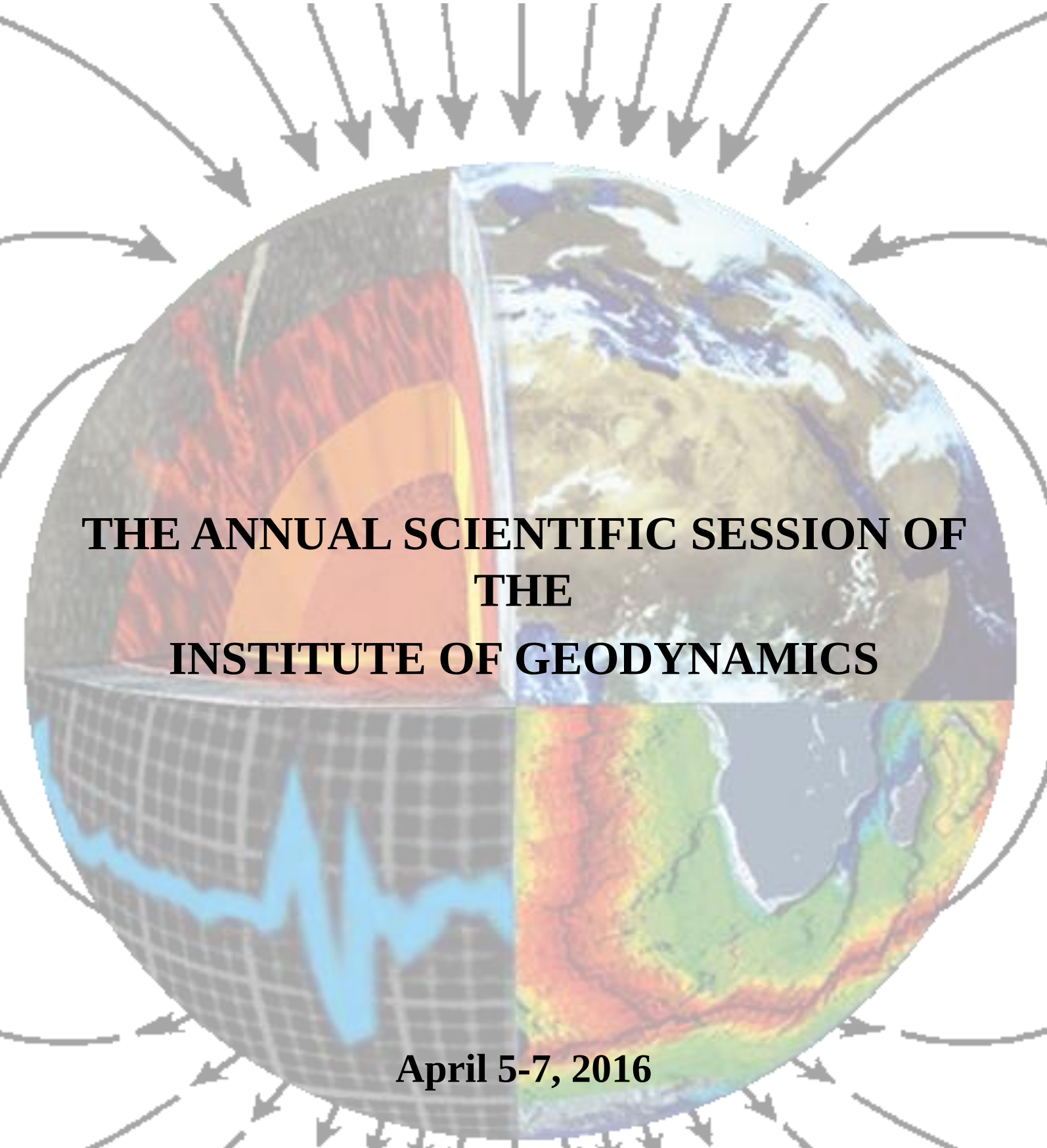

THE ANNUAL SCIENTIFIC SESSION OF THE INSTITUTE OF GEODYNAMICS

April 5-7, 2016

Romanian Academy
Institute of Geodynamics
„Sabba S.Ștefănescu”

2016 SCIENTIFIC SESSION PROGRAM

Tuesday, April 5th, 2016

Presentation of research reports on the the tasks implied by the Priority Program of the Romanian Academy
"*Complex geophysical research in geodynamically active areas concerning especially the Vrancea seismogenic area"*

Chairman Crișan Demetrescu

9:00-9:30 **Lucian Beşuţiu**, Complex research on relations between internal geodynamic processes and seismicity

9:30-10:00 **Venera Dobrică**, Studies on heliospheric and magnetospheric processes in relation to the main geomagnetic field at global and national scales and to the terrestrial climate

10:00-10:30 **Dumitru Stănică**, Electromagnetic studies carried out to emphasize the geodynamic activity in Vrancea zone, with possible implications in seismic events triggering

10:30-11:00 *Coffee break*

11:00-11:30 **Mihai Tatu**, Natural hazard and risc în Carpathian area

11:30-12:00 **Nicoleta Cadicheanu**, Monitoring Earth’s deformation at Romanian observatories for geodynamics in relation to regional and global seismic activity

12:00-12:30 **Nuțu-Dragomir Maria-Lidia**, Endogenic fluid flow in the East Carpathians and Apuseni Mountains as reflected by the fluids – rock relationship: geodynamical contributions, fluidization processes and geochemical evolution of fluids

12:30-13:00 **Florin Munteanu**, Studies on methodologies to approach variations of some geophysical and biological parameters, toward the multi-dimensional characterization of the environment in areas with intense anthropogenic activity

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9:20-9:40 **Stochici R., Popescu M.,** Magnetotteluric soundings deployded in Buzău county to identify deep structures

9:40-10:00 **Diacopolos C, Stochici R.,** Applications of the vertical electrical sounding (VES) in areas with mud volcanoes. Case Study: Big Muddy Volcanoes of Pâclele

10:00-10:20 **Stochici R.,** Methodological contributions to the interpretation of the gamma spectrometry in the area of the Curvature Carpathians

10:20-10:40 **Beșuțiu L.[1], Orlyuk M.[2], Zlăgnean L.[1], Romenets A.[2], Atanasiu L.[1], Makarenko I.[2],** Cross-border geophysical and geological models between Romania and Ukraine in the low Danube area
[1]Institute of Geodynamics, Romanian Academy
[2]Institute of Geophysics of the National Academy of Sciences of Ukraine

10:40-11:00 *Coffee break*

Chairman Mihai Tatu

11:00-11:20 **Nuțu-Dragomir M.-L.[1], Vaselli O.[2],** Fault-related fluid flow within the Subcarpathian nappe domain (East Carpathians) during the post-collision stage
[1]Institute of Geodynamics, Romanian Academy
[2]Earth Science Department, University of Florence, Italy

11:20-11:40 **Mitrofan H., Marin C., Chitea Fl., Olariu A., Tudorache A., Barla A., Enacheoaie A., Serban A.,** Possible significance of the distinct geochemical signatures displayed by nearby mineral springs located in Balvanyos area (Ciomadul volcano)

11:40-12:00 **Anghelache M. A., Mitrofan H., Vişan M., Chitea Fl.,** Peculiarities of the crustal seismic activity along the contact between the Moesian and East European plates

12:00-12:20 **Niculae L.**, The morpho-dynamic analysis of hydrographi basins. Case study – the Sărațel basin

12:20-12:40 **Furnică V**., The tectonic vortex

12:40-13:00 **Munteanu F., Zugrăvescu D., Udriște C.,** Smart system for multiparameter monitoring of a seismic active area

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Chairman Ioan Seghedi

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9:20-9:40 **Luffi P.**[1], **Seghedi I.**[1], **Ducea M.**[2], Garnet Pyroxenite Xenoliths From Quaternary Alkali Basalts of the Perșani Mts.: Evidence of Subcreted Oceanic Crust Melting Beneath the Eastern Carpathians
[1]Institute of Geodynamics, Romanian Academy
[2]Department of Geosciences, University of Arizona, Tucson, USA

9:40-10:00 **Seghedi I.**, The generation of mud volcanoes in the Buzau county area – preliminary approach

10:00-10:20 **Berbeleac I., Nuțu-Dragomir M.-L., Chitea Fl.,** Deep Neogene structure of Voia area (Metaliferi Mountains, Romania) inferred from magnetotelluric and diamond drillings data

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11:20-11:40 **Mariș Muntean G., Tălpeanu D., Ionescu D.**, Analysis of high-speed streams in the solar wind responsible for geomagnetic storms in the descending phase of the solar cycle 23

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12:00-12:20 **Tălpeanu D.[1], Rachmeler L.[2]**, Investigation of coronal fans
[1]Institute of Geodynamics, Romanian Academy
[2] NASA, Marshall Space Flight Center, USA

Complex research on the connection between geodynamic processes of the Earth's interior and seismicity

Project leader: Dr.ing.Lucian Beșuțiu

The research is mainly aimed at revealing the impact of the active processes in the Earth's interior on the lithosphere dynamics and its seismic consequences.

During 2015, our efforts focused on the unusual craton crust seismicity of the Eastern Moesian Plate (MoP), along with the occurrence of intermediate-depth seismic events within full intra-continental environment in the Vrancea zone.

Field activities consisted of high accuracy observations conducted on the special infrastructure implemented in the area by the Solid Earth Dynamics Department:

(i) crust deformation along the Peceneaga-Camena Fault (PCF), as a result of changes in the intensity of tectonic forces in the area, has been monitored by geodetic means at the Baspunar Geodynamic Observatory (BGO);

(ii) non-tidal gravity changes, as a consequence of masses re-distribution in the bending zone of East Carpathians, has been observed within epicentre area of the intermediate-depth earthquakes by using the Vrancea gravity dedicated network (VGN).

Field observations were accompanied by studies on the location and energy released by the both crust earthquakes (EQs) of the Carpathians foreland and intermediate-depth events located within Vrancea zone.

Based on the seismic studies and geodetic records at BGO, attempts have been made to correlate the PCF slip monthly rate with monthly released seismic energy by the both MoP crust and upper mantle Vrancea EQs. Daily correlations, and even individual events echoes were also studied.

High accuracy repeated gravity observations within VGN have revealed the continuation of the gravity lowering within epicentre area of the intermediate-depth EQs.

The phenomenon has been attributed to the vertical stretching of the crust as a consequence of the gravity pull created by the densification of the lower crust of the sinking lithosphere in the Vrancea zone under the action of tangential tectonic forces.

The thermo-baric accommodation phenomena taking place in the lithosphere sunken into the upper mantle may be responsible for the Vrancea both intermediate-depth seismicity and crustal EQs with vertical extension mechanisms. The amount of seismic energy released strongly depends on the volume of lithosphere brought into thermo-baric disequilibrium, which, in turn, depends on the sinking velocity governed by the intensity of tangential tectonic forces acting in the Carpathians foreland.

Studies on some heliospheric and magnetopsheric processes in relation with the main geomagnetic field at national and global scale and with terrestrial climate

Project leader: Dr. Venera Dobrică

The project no. 3 within the frame of the Priority Program of the Romanian Academy ”Complex geophysical research in geodynamically active areas, with a special emphasis on the Vrancea seismogenic area”, has been approached during 2015 along three different directions: geomagnetic research; research on solar and heliospheric processes; research on the terrestrial climate. Therefore, the ~80-year variation, a constituent of the main geomagnetic field, has been analyzed in terms of the movements of corresponding magnetic flux at the outer core surface, based on Time-Longitude and Time-Latitude diagrams, and in terms of the movement velocity, based on the Radon transform. The solar and heliospheric processes (solar flares, solar jets, coronal mass ejections and high sped streams in the solar wind), in the period of solar minimum 2007-2008, have been analyzed from both solar point of view, and in terms of their geoeffectiveness, based on the relation between the south component of the interplanetary magnetic field (Bz) and the Dst geomagnetic index. Starting from this year, research regarding solar signal in the recorded air temperature data from the Earth’s surface has also been approached within the frame of the project. A first topic along this line has been the description of the surface air temperature monitoring system, located in our institute, and data validation by means of data from meteorological station București Băneasa. The temperature data from several meteorological stations in Europe, with long records (more than 150 years), have been studied in relationship with the sunspot number in each of more than 24 solar cycles available from the first observations.

Electromagnetic studies for to emphasize the geodynamic activity in the Vrancea area, with possible implications in the seismic events triggering

Project leader: Dr.ing. Dumitru Stănică

Known as a zone with high level of seismic risk, Vrancea is going on to be a great challenge for geosciences. Thus, for to obtain information regarding the triggering mechanisms of the intermediate depth earthquakes, the magnetotelluric soundings has been done to elaborate 3D tomographyc images with the resistivity distribution into lithosphere. Taking into account the placement of the magnetotelluric (MT) profiles that crosses the three main types of crust (Precambrian for the East European and Moesian Platforms and "Transylvanian" for Transylvanian Depression, respectively), the MT data give the possibility to obtain the useful information regarding the geodynamic processes related to the seismic-active Vrancea zone, as follows:

- The continental origin of the seismogenic volume;
- Structural relationship (thickness and resistivity) between: a) sedimentary cover-crystalline basement; b) crust-upper mantle; c) lithosphere-asthenosphere;
- The inactive seismic interval, placed between the crustal and intermediate depth earthquakes, is characterized by the low resistivity (about 0.4 Ωm) that was obtained from 1D inversion and modeling of the two MT soundings carried out at the Lopătari and Vintilă Vodă localities;
- The existence of a possible triggering mechanism of the intermediate depth earthquakes due to the torsion effect, induced by the asthenospheric descending currents, associated with increased stress and, implicitly, by the dehydration-fracturing processes of the rocks and fluids migration along the lithospheric faulting system, which in their turn may generate the pre-seismic electromagnetic (EM) perturbations.

The real-time EM data, associated with the new information obtained during the research theme, have contributed to emphasize the geodynamic activity in the Vrancea area, with possible implications in the seismic events triggering. Thus, the temporal connections between Bzn* time series and the intermediary depth earthquakes of M ≥3, on the interval January 01- December 31, 2015, has been emphasizing by using the two kind of analysis: FFT Band–Pass Filtering (0.001-0.0083 Hz) and statistics (a standardized random variable Equation). These results are presented as graphics and tables with the following conclusions:

- The Bzn* parameter presents systematically a pre-seismic anomalous behaviour, some times a superposition effect of more earthquakes (Eqs) being observed;
- 11 anomalous intervals of Bzn* have been correlated with 20 Eqs with M ≥3.7 (5 reflected superposition effect of 2 Eqs, 1 the effect of 4 Eqs and another 5 the effect of 5 Eqs).

Keywords: Vrancea zone, MT soundings, Torsion process, Intermediate depth earthquakes, EM precursors

Natural hazard and risk in the Carpathian area (First phase, 2015)

Project leader: Dr. Mihai Tatu

In the last decades human society faces a number of imbalances in social and natural planetary each other there is a clear interdependent. The second category includes natural disasters that constitute the so-called natural hazard, fractal evolving, making it difficult to control and predict. Natural hazard is also of two types: one, endogenously, driven by the internal planet (volcanism, earthquakes) and other external, on surface, (landslides, floods, desertification and soil degradation, chemical contamination) of production to which they are responsible by many natural factors (climate, geological composed) and anthropogenic (industrial, construction, deforestation, etc.).

In Romania landslides is in length of with floods and earthquakes, natural processes with the greatest impact on the environment, infrastructure and human settlements. They occur more frequently as a consequence of "relationship" between the natural factors (geodynamic activity, major climate changes) with anthropogenic (deforestation).

A particular approach to the issues related to the landslides in the purely geomorphological is introducing and treatment the notion of *geomorphological hazard* that is focus on the anthropogenic activity, which from this perspective becomes the most important factor.

Another category of natural hazard is due to volcanic activity. It is recognized that in Romania, in the East Carpathians, the longest segment of the Neogene volcanic chain in Europe is present. Although all volcanoes enclosed inside the chain are extinct, the youngest, located in the south-eastern region, Ciomadul shows more components of an dormant activity in the magma chamber (emissions of CO2 and SO2, mineralized springs high heat flux) in addition the young age in the range 27-35 Ka, which gives the structure a specific potential hazard of volcanic areas.

Another type of hazard is anthropogenic, due to the incidence of various types of human activities on the environment and communities, sometimes with serious consequences and high costs on reduction or cancellation of risk. One of these activities is mining. Due to operating activity in ore deposits, in Romania were built over time more than 550 dumps, occupying hundreds of hectares areas where stores hundred million cubic meters of tailings.

Monitoring of the Earth deformations at the level of the geodynamical observatories in Romania in parallel with the local seismic activity and of the other regions on the Earth - 2015

Project leader: Dr. Nicoleta Cadicheanu

The project "Monitoring of the Earth deformations at the level of the geodynamical observatories in Romania in parallel with the local seismic activity and of the other regions on the Earth" has as goal to study the continuity of records at the level of the geodynamical observatories of our institute, observatories located in tectonic areas with important geonomical signal, in order to improve these recordings and presenting their geophysical information, in particular, the one related to the occurrence of the seismic events in Romania and the very strong events on the Earth.

The specific objectives pursued were:

1. continuous monitoring of local deformation using sensors placed both at the level of the underground geodynamical observatories (U.G. O.Ursoiu, U.G.O. Crăciunești), as well as of the surface geodynamical observatories (G.O. Căldăruşani);
2. the identification of seismic events more important that have taken place on the Earth and in Romania in the year 2015 and their location on the curves of variation of the data recorded at the level of the geodynamical observatories.

The observations used for this study were recorded in the period during January – December 2015.

Key words: monitoring, geodynamical observatories, crustal deformation, records, earthquakes

Endogenous fluid circulation in the East Carpathians and the Southern Apuseni Mountains reflected from rock-fluid relationship: conditions geodynamic, geochemical processes and developments fluidized fluids

Project leader: Dr.Maria-Lidia Nuțu-Dragomir

The major objectives of the research theme of the Academy were to identify: i. the chemistry and the origin of the migrating fluids along faults system and in sedimentary basins; ii. the particularities that encourage "seismo-sensitivity" of the mineral waters by diagnosing the source of mineralized fluids; iii. the formation and distribution of fluids in magmatic and hydrothermal systems.

The surveyed areas were both located in the South Apuseni Mountains - the Metaliferi Mountain in particular, and in the East Carpathians - Vrancea area and the southern part of the Harghita Mountains.

For the Metaliferi Mountains, the research studies have focused on: i. Fluid movement patterns, especially in relation to volcanism; ii. evolution of hydrothermal fluid regimes, within and above a magma chamber, leading to the development of intrusion-related mineral systems; iii. the mineral associations and their relative distribution in relation with their location within the magma chambers.

Vrancea area was subject of studies concerning: i. the migration and geochemical manifestation of endogenous fluid along the faults system; ii. the spatio-temporal interactions and possible seismic precursors occurrences in connection with the activity geodynamics; iii. assessing pollution risks.

Harghita Mountains, particularly the Ciomadul volcano and the surrounding areas, were studied in terms of hydro-geochemical evolution of the mineral springs in areas with post-volcanic activity.

Research methodologies to approach variations of geophysical and biological parameters, to characterize the multidimensional environment in areas with intense human activities

Project leader: Dr.ing. Florin Munteanu

Supporting the programs of sustainable development implicates a better knowledge of the interactions between geosphere and biosphere on one hand and between the environment and the socio-economic, cultural and scientific on the other. Geonomic expertise acquired along the last decades becomes essential in developing a new inter- and transdisciplinary vision of the planetary geostasis, near sociophysics, jurisdynamics, ecolonomie (ecosophy), neurosciences.

The development of models and techniques approach to the evolution of nonlinear systems, with the help of computational science (neural networks, data mining) enables the design of new hypotheses, models and theories capable of providing a consistent – coherent conceptual framework in terms of which to be defined, evaluated and monitored quality of life, especially in large urban areas.

The coupling between the biosphere dynamics and evolution of the biosphere, plus the increasingly accentuated intervention of the artifacts generated by the presence of the noosphere, require the involvement of *Information* as ontological dimension, nearby energy and matter.

In this context, the studies and researches carried out in 2015 followed:

- the development of techniques for testing the characteristics of fragmentation process in order to validate the model "dichotomous";
- the accumulation of data on temporal variation of the power spectrum of micro-mechanical oscillations of the curst- atmosphere interface, mainly those of 48-49.7Hz frequency band (a frequency close to the network 50Hz, with implications for the dynamics of biochemical reactions);
- the development of techniques for time series analysis: Wigner-Ville, respectively Wavelet techniques, based on neural networks pattern-recognition hardware;
- the formalizing of *the Information* as a essential ingredient of the morphogenesis process in terms of dynamic geometry

The results obtained allowed to redefine the framework in which this priority theme will be further developed in the UNESCO Chair of Geodynamics, which now include 14 experts from various fields as partners into the program "Planet Earth-a living planet".

ULF geomagnetic anomalous behavior related to M8.3 Coquimbo earthquake on September 16-th, 2015

Stănică D. A., Stănică D., Vladimirescu N.

In this paper, we retrospectively analysed the geomagnetic data collected via internet (www.intermagnet.com), on the interval 01 July-21 September 2015 at the geomagnetic observatories Easter Island (IMP) and Pilar (PIL), placed in Chile and Argentina, respectively, to emphasize a possible relationship between the pre-seismic anomalous behavior of the polarisation parameter (BPOL) and M8.3 earthquake, that occurred in Offshore Coquimbo (Chile) on September 16-th, 2015. The daily mean distributions of the polarization parameter BPOL=Bz/SQR(Bx^2+ By^2) (where: Bz is vertical geomagnetic component and Bx, By are horizontal geomagnetic components) and its standard deviation (STDEV) are performed in the ULF frequency range 0.001Hz to 0.0083Hz by using the FFT band-pass filter analysis. It was already demonstrated that in pre-seismic conditions the BPOL has a significant enhancement due to the crustal electrical conductivity changes, possibly associated with the earthquake-induced rupture-processes and high-pressure fluid flow through the faulting system developed inside the foci and its neighbouring area. After analyzing the anomalous intervals of the polarization parameter (BPOL) obtained at Easter Island and Pilar observatories, the second one taken as reference, we used a statistical analysis based on a standardized random variable equation to identify on 2 September 2015 a pre-seismic signature related to the M8.3 earthquake and the lead time was 14 days before the earthquake occurrence. The final conclusion is that the proposed geomagnetic methodology might be used to provide suitable information for the extreme earthquakes hazard assessment.

Keywords: Polarization parameter, Pre-seismic anomalous behavior, M8.3 Chile earthquake, 2015

Magnetotelluric soundings deployded in Buzău county to identify deep structures

Stochici R., Popescu M.

Until the half of the previous century, the western part of Buzău County, represented by mountain and hill areas, has been the object of certain general or strictly economical geological investigations, related to the existence of some important mineral resources (petroleum, gases, salt, etc.) in the Carpathian and Subcarpathian underground. The evolution of the data on Paleogene and Neogene deposits from the Carpathian Bend region has undergone some successive phases: a) division of the levels and their lithological and paleontological characterization; b) attempts of aligning horizontally the already established levels and tectonic deciphering based on facies and fauna; c) setting the limits of the formations upon paleontological and stratigraphical criteria. The huge effort owed to various generations of geologists and geophysicists is materialized into regional syntheses which overlap this area from a geodynamical perspective. In the area there are a high number of seismic events, which still concerns the geoscientists. In this scientific context we have reached the conclusion that there is necessary a field research activity by using magnetotelluric method, taking into account also previous results obtained by Stănică et al. (1986). In the area, destructive processes like earthquakes which have a triggering role in the geohazard episodes (Zugrăvescu, 1985) are taking place. Four magnetotelluric soundings are placed and installed along a East-West profile with the aim to detail the geoelectrical structure at the crustal level.

Keywords: geotectonics, earthquakes, magnetotellurics

Applications of the vertical electrical sounding (VES) in areas with mud volcanoes. Case Study: Big Muddy Volcanoes of Pâclele Mari

Diacopolos C., Stochici R.

The mud volcanoes at Pâclele Mari is one of the most interesting natural reserves in Europe. Volcanoes Muddy formations are created by natural gas from more than 3,000 meters deep, passing through a clay soil, in combination with water from groundwater. Push to the surface water mixed gases with clay. Sludge formed at the surface and leaving them in those places, dry in contact with air to form cone-like structures some volcanoes. It has craters up to 6 m tall with permanent or intermittent eruptions, whose intensity is dependent on the amount of rainwater that infiltrates into the soil. In the Paclelor Mari were conducted measurements geoelectrical (Vertical Electrical Sounding) for detection of faults longitudinal and cross the waters meteoric infiltrates the horizons permeable until their way across this fault line in the anticline where it forms with rocks soft mud which is driven upward from the deep gas coming to the surface in the form of mud volcanoes. Measurements of apparent resistivity (ρa) were performed for a set of distances AB, keeping constant distance MN in general and the central position of the measuring device. For each length AB measured electric potential difference between the points M and N in the soil created by injecting electrodes A and B by an electric current of 10 mA and 20 mA. To achieve geoelectrical measurements (VES) was used. Resistivimeter IntV3, using Schlumberger device type. Resistivimeter IntV3 is an apparatus for geophysical applications Allowing measurements of soil resistivity in natural climate conditions and land configuration. For the geoelectrical measurements made in the Pâclelor Mari, we realized three sections oriented N -S AB / 2 for the first profile maximum 50 m for Profile 2 AB / 2 up to 30 m and 3 profile AB / 2 up to 50 m. From field observations obtained we see that the geologically interesting is in the range 0-20 m depth where there is very low resistivities 1-5 Ωm due to the water containing large amounts of sodium chloride. In the first phase, to highlight the distribution of resistivity with depth we applied the geoelectrical profiling method by using Schlumberger device of AMNB type.

The results reveal that it is helpful to use this method in the fault zones, because this is easy to use, taking into account the technical possibilities in measuring, data processing and interpretation.

Methodological contributions to the interpretation of the gamma-ray spectrometry in the area of the East Carpathians Bend

Stochici R.

The application of the geophysical methods to investigate some inaccessible areas with important topographic relief variation and complex geological structure rises problems which are complicated and difficult. The methodology refers to the spectral gamma method adapted to the purpose of investigating the natural sources of gamma radiation and extension of K, U, Th, as well as the impact on the population. The detection of the spectral gamma anomalies has been possible with the portable device Gama Survey II. The interpretive aspects of this type of geophysical data highlight the possibilities of using the relations between the natural radioelements and the anomalies influenced by the anthropic activities that affect the geological environment. The methodology of application, the interpretation of data observed on the field, have contributed to the adaptation of the data acquisition and interpretation method to possible and feasible developments of the anthropogenic activity. The present work combines theoretical information about disintegration, which leads to the spontaneous transformation in other atomic nuclei, with practical activities, the geophysical with the geological information and the scientific imagination with the pragmatic rationality, and highlights the usefulness of this method of identifying the level of natural radioactivity that affect people and animals of the studied area of interest. Buzău Land Geopark is a 1036 km^2 territory located in Romania, at the Carpathians' Bend, in the close proximity of Vrancea seismogenic area.

Key-words: disintegration, natural radioactivity, natural radioelements

Cross-border geophysical and geological models between Romania and Ukraine in the Lower Danube area

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The paper deals with preliminary results obtained within the international **LODES** project ("**LO**wer **D**anube area **E**arth's crust **S**tructure from 3D magnetic and gravitational modelling"), a joint venture of the Solid Earth Dynamics Department in the Institute of Geodynamics of the Romanian Academy (IGAR) and the Department of Geomagnetism in the Institute of Geophysics of the National Academy of Sciences of Ukraine (IG-NASU).

A joint topography model and cross-border consistent geomagnetic and gravity composite maps between Romania and Ukraine in the Lower Danube area have been constructed and, based on the information obtained, several 2D tentative interpretative models have been achieved.

Attempts for 3D modelling within the cross-border area were also performed and some synthetic geological bloc-diagrams are presented.

Fault-related fluid flow within the Subcarpathian nappe domain (East Carpathians) during the post-collision stage

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At the end of the Sarmatian, the continental collision between the East European and Tisza-Dacia plates triggered the uplift of the Subcarpathian nappe together with other nappes belonging to External Moldavides (East Carpathians). During collision and post-collision stages, a wide system of thrusting faults and microfractures developed within the Miocene siliciclastic and evaporite deposits of the Subcarpathian nappe.

Different fracture-filling cements associated with this system evidenced that faults and microfractures acted as conduits for fluid migration. The relationship between faults, fluid flow and fracture-filling cement was investigated by petrographic combined with elemental and isotopic geochemistry and microthermometry on fluid inclusions.

The fluid migration occurred synchronously with both the development of major faults and the uplift of the Subcarpathian nappe. Some of these faults were the preferential pathways for the uprising fluids until the end of the Pliocene. Extensive fluid circulation along thrusting faults provoked massive cementation that filled the fracture system network and host sandstones with calcite, quartz, pyrite or gypsum. The cements were likely resulting by the precipitation of Fe-rich basinal brines of meteoric origin. The large interval of the equilibrium temperatures estimated for these fluids (105 to 237.1 ˚C) indicates that their circulation occurred at remarkable depths in the thrust belt. Simultaneously, limited fluid migration took place throughout the Subcarpathian nappe mainly along a system of minor faults and microfractures, which only produced fracture-filling cements. The interaction between the basinal brines with the evaporitic deposits significantly modified the redox conditions from highly reducing to transitional oxidizing-reducing, i.e. low Mn-Fe, environments. The presence of hydrocarbon-bearing inclusions in the fracture-filling cements suggests that the major faults and microfractures were also favoring the migration of hydrocarbons during the Subcarpathian nappe uplift.

Due to the lack of evidence of subaerial exposure prior the Subcarpathian nappe exhumation, it can be assumed that the basinal brines circulated at great burial depths in the thrust belt, and entered the system from the neighboring nappe or foreland, as a result of tectonic movements.

Possible significance of the distinct geochemical signatures displayed by nearby mineral springs located in Balvanyos area (Ciomadul volcano)

Mitrofan H.[1], Marin C.[2], Chitea Fl.[1,3], Olariu A.[3], Tudorache A.[2], Bârlă A.[3], Enăcheoaie A.[3], Şerban A.[4]

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The most recently extinct volcano of the East Carpathians igneous range is Ciomadul, for which radiocarbon dating has indicated that it had last erupted about 32 kyrs ago. The corresponding volcanic edifice has been built on Early Cretaceous flysch deposits, which belonged to the East Carpathians fold and thrust belt. The area surrounding the volcano hosts a multitude of mineral groundwater discharges, most of them occurring not within igneous terrains, but within the underlying, Cretaceus age sedimentary formations.

The concerned outlets usually occur as clusters that are situated about 1 km away from each other. Within each specific cluster, some discharges are acid (pH from 1.35 to 4.1), while others display near-neutral pH (in the range 5.5 to 6.5), the distance between such adjoining outlets ranging from a few meters to a few tens of meters. A common parent-water was involved in both types of discharges, yet in the acid outlets this parent water was additionally diluted by a fluid enriched in base-metals (Ti, V, Co, Ni, Cd, Cr, Zn, Pb) and in As. When the acid discharges composition is compared to the composition of the formations with which they could possibly interact, a good similarity is noticed with the Cretaceous sedimentary series of the volcano basement, while correlation with igneous rocks present in the area is poor. It is hence suggested that base-metals are scavenged, by acid fluids, from the sedimentary formations which underlie the volcano edifice.

Peculiarities of the crustal seismic activity along the contact between the Moesian and East European plates

Anghelache M.-A., Mitrofan H., Vişan M., Chitea Fl.

The so-called Carpathians Bend area – at the junction between the Eastern and the Southern sections of the mountains arc – is well-known for its persistent and strong seismicity. In particular, each century there are generated at intermediate depths (>60 km) several earthquakes with magnitudes in excess of 7.

That seismogenic volume, designated as the Vrancea Seismic Zone, corresponds to the collisional contact between the subducted Moesian plate and the overriding Intra-Alpine plate. At shallow (crustal) levels, a significant seismic activity was triggered in response to the major earthquakes generated at intermediate depth in Vrancea area. The crustal region which we identified as being concerned by that seismic triggering processes is located along the so-called "Mărăşeşti–Galaţi Brăila Lineament". In this region, there has been analyzed the 1965-2015 time-series of shallow (<60 km) earthquakes. It seems that each of the major (Mw 6.9) Vrancea earthquakes having occurred nearby, at intermediate-depths, during the 1977-1990 time interval, succeeded to trigger a subsequent enhancement of that shallow seismicity. As well, for the time interval 1976-1995, the correlation between the intermediate and crustal depth seismic activity can be illustrated by the similarities between auto normalised Benioff curves for each certain zone. There could be inferred the presence of an atypical situation, when the occurrence of a major earthquake triggers at long distances and time intervals one or several significant earthquakes. Presumably, this takes place because of episodically unblocking channels along which high-pressure/ultra-highpressure rocks were ascending, in a discontinuous process of exhumation, by the present time.

Morphodynamics of drainage basins
Case Study - Sărățel hydrographical basin

Niculae L.

The relief forms are evidence of the morphogenetic processes action carried out on the surface of the earth's crust over a specific time period (era, period, phase). The current relief development process continues with new agents and processes, but on the background of inherited older “patterns”, setting its own evolution directions, evidenced by new relief forms.

The relief dynamics of a region requires the knowledge of: morphodynamic potential/morphodynamic risk, determining agents and processes acting on the relief, land use consequences and their development perspective (the current morphodynamics).

Morphodynamic potential. Any topographic surface exposed to the geomorphological processes shows a specific morphodynamic potential, determined by the slope, the geological features (tectonic, lithologic and structural). We add to these the special features of the local climate, the hydrological and land use factors.

The current morphodynamics determines the real relationship between relief forms and anthropogenic activities. The development of settlements and the optimal land use must take into account the relief features (elevation, fragmentation, slopes, slopes exposure, etc.), consequence of the fact that the forced anthropization could lead to the disruption of the natural balances and trigger destructive processes, most often irreversible (erosions, collapses, landslides, floods, etc.).

The morphometric parameters of drainage are of particular importance in assessing the overall morphology of the region, but also in assessing the overall morphodynamic potential of a particular region.

Sărățel hydrographical basin, with an impressive number of inferior river segments, falls into the category of areas with a rich morphodynamic potential, determining a wide range of processes and relief forms, as well as a current complex shaping.

Keywords: morphogenetic process, morphodynamic potential, drainage morphometry

The tectonic vortex

Furnică V.-C.

Within the frame of condensed matter physics, the vortex movement seems to characterize flow processes at all scales that can be approached by specific observation techniques, from the sub-microscopic and microscopic domains of optical beams, respectively super-fluids and superconductors, to the vast structures of the macroscopic domain, such as the galactic ones.

The tectonic vortex is characterized by the vorticeal movement of a geological structure as it can be derived from morphological, geological, geophysical, seismic, relative displacement etc data. It has dimensions from tens of meters to planetary extension, the implicated ages spanning from Palaeosoic to Cainosoic. To the tectonic vortex the solid matter is associated, at odds to the liquid, gaseous, or plasma ones characteristic for other density, or scale, or time domains, which it can however influence.

The results presented concern several lines of interest related to the existence of planetary (the Pacific vortex), regional (the Egean vortex connected to the Vrancea seismogenic zone), or local (possible tectonic vortices such as the Apuseni Mts., Oltenia area, Danube Delta, Vrancea) vortex structures, as well as some geometric arguments that allow approaching the vortex with a nucleus, associated to cyclonic movement. The research might be oriented to *in situ* recognition of similar structures, of nucleus, enhancement, peripheral type, vortex lines, surface of the vortex tube, elements of the fluid etc. Based on the principle of similarity between two vortices, some properties discovered in laboratories in the sub-microscopic and microscopic domains, such as electric, electromagnetic, acoustic, thermal, gravity, characteristic movement (to left), the resultant movement, interactions of the vortex resulting from its position and locking, merging, annihilation, collision, disturbances, distant interaction, could be detected in natural conditions.

The analysis of the electric signal obtained in the study of the electrode effect of the global tectonic activity in the context of the presence on the Romanian territory of several tectonic vortices interacting with similar structures at large or very large distances, for a time-span of about 15 years, might bring new information related to great seismic events and their preparation moments.

Smart system for multiparameter monitoring of a seismic active area

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The earthquake was re-interpreted as an expression of the **geocomplexity**, and this new point of view reoriented the research in this area towards understanding complex phenomena. Specifically, this marked the beginning of a new stage in geosciences in general, and in seismologic research in particular, especially regarding the practical application of the main concepts, models, theories and methods provided by the new paradigm of Complexity.

For our desired application, if one assimilates a seismically active region with a nonlinear complex and hierarchically structured system, then the following features can be deduced or assumed as characterizing this system:

a) Each seismic event modifies irreversibly the system's structure;

b) Each seismic event discharges a specific amount of energy that modifies the internal state of the system and provides new and different initial conditions;

c) The energy discharged by each seismic event that 'resets' the local system is radiated/transferred to neighboring systems of equal or inferior hierarchical position;

d) When the system is in the critical state preceding the seismic discharge, the triggering factors can alternate or combine with inhibiting ones, resulting in a reduced classic predictability of the seismic event;

e) The monitored seismic region is just another element of a larger and also hierarchically organized system (Gaia), being coupled and interdependent on the interaction with other similar systems in this meta-system.

This paper systematizes extremely large information in this new field of research and defines the theoretical frame for the use of the intelligent monitoring, based on a neural network. Developed working hypothesis states that, under the influence of particularly convenient data flow, a system equipped with artificial intelligence, that manifests itself self-organizing properties, tends to approach asymptotic (to sync with) to the monitored reality.

In this context, instead of a single rigid model for any geodynamic active area, derived from the general theory of fracture mechanics, we obtain an "evolutionary model" self-adaptable to specific condition determined by the specific evolution of seismogenic monitored zone, model that can provide better opportunities for seismic risk assessment and identification of precursor seismic events.

Keywords: geocomplexity, geostasis, neural networks, smart monitoring.

Landslide inventory map for Buzau Land area (second phase, 2015)

Tatu M., Niculae L., Popa R. G.

Generally, the **landslide inventory maps** certificate the level of landslide phenomena in a region, and prove fact that can be used to study the distribution, types and frequency of these processes, in order to establish for affected region the susceptibility, vulnerability and risk. During the preparation of this map arise a lot of the difficulties and intrinsic uncertainties do to the huge and fast variation in time of these phenomena. Nevertheless, the landslide inventory map is a necessary instrument anywhere landslides are active, abundant and their activities are frequent. The accuracy of the landslide inventory map derives from the quality, type and confidence of the data exposed in the maps. Actual mapping methods, based essentially on satellite, aerial and terrestrial observations, can significantly assist the creation and the update of landslide inventory maps. Combining these methods represents the most favourable solution for landslide revealing and mapping, in different regions tacking account by physiographic and land cover conditions. This activity will have positive feedbacks as respects the hazard and risk assessments, mitigation and restore the damages and emergency in case of disasters.

Garnet Pyroxenite Xenoliths From Quaternary Alkali Basalts of the Perşani Mts.: Evidence of Subcreted Oceanic Crust Melting Beneath the Eastern Carpathians

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Ultramafic xenoliths hosted in Quaternary alkali basalts of the Perşani Mts. document the petrogenetic and tectonic processes shaping the southeastern extremity of the Carpathian-Pannonian lithospheric mantle. Previously studies on peridotite xenoliths and basalts shed light on the pre-eruption mantle's thermal state and on its melting, metasomatism, and deformation history. In contrast, the origin and significance of less-common pyroxenite xenoliths remained so far unaddressed. Using petrographic and geochemical data from garnet pyroxenite xenoliths, we refine the current view on the thermal state of the shallow mantle beneath the region and identify an altered oceanic crust component in the lower lithosphere. We constrain the geotherm beneath the Perşani Mts. by combining major and trace element thermobarometry on twenty garnet clinopyroxenites and garnet websterites. Two-pyroxene thermometry and garnet-pyroxene barometry indicate that these xenoliths equilibrated at 800–1050°C and 8–12 kbar, corresponding to the near-Moho mantle at 30–42 km depths. Equilibrium temperatures overlap with those previously obtained from peridotites, suggesting that the pyroxenites represent-as revealed by rare composite xenoliths-veins and dykes in the peridotite-dominated mantle lithosphere. The xenolith P-T data define a ~100 mW/m^2 conductive geotherm which coincides with the geotherm imposed by the tectonothermal event that generated the host basalts by adiabatically decompressing the asthenosphere at a ~1350°C potential temperature. For the estimated lithospheric thickness of 60–70 km, the transition from any stable continental conductive geotherm to a 100 mW/m^2 geotherm is accomplished in less than 10 Ma regardless of the invoked geodynamic scenario. It is thus plausible that the xenoliths record the thermal perturbation induced by the asthenospheric upwelling that accompanied the foundering of the Vrancea seismogenic block. Microtextural features and compositional zonation of minerals from the pyroxenites indicate cooling, suggesting that these rocks formed in response to the above-mentioned tectonothermal event, i.e. the melts from which they originate were produced by fusion ultimately triggered by the sinking Vrancea block. We constrain the source of these melts relying on O, Sr, and Nd isotope analyses on minerals making up the garnet pyroxenites. $^{143/144}$Nd (0.51179–0.51295) and $^{87/86}$Sr (0.7032–0.7088) isotope systematics indicate subducted crustal components in the source, while ^{18}O (3.5–6.7‰) strongly suggests that one of these components must have been a hydrothermally altered oceanic crust. Therefore, it is likely that the studied pyroxenites represent reaction products between silicic melts resulted from the partial fusion of a subducted oceanic crust and lithospheric mantle peridotites through which they percolated. One possibility is that this crust represents leftover fragments of the steepening oceanic Vrancea block. Alternatively, the involved oceanic crust may represent relics of an ancient subducted slab accreted to the lower lithosphere, which partially melted during the invoked recent tectonothermal event. Distinguishing the two possibilities requires further investigations.

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The generation of mud volcanoes in the Buzău county area – preliminary approach

Seghedi I.

The mud volcanoes in the Buzău county area are known from immemorial times. The previous studies were concentrated on the geological situation and the geochemical properties of the products. Here we attempt a preliminary methodical approach of the "volcanic" activity, based on the morphological characteristics, as it was developed and associated to each volcanic field along the faulted anticline between Berca and Beciu towns. The shape and size of the mud volcanoes depends on the: released methane gas pressure, the amount of water present in the underground phreatic levels (controlling the viscosity of the ejected materials), the presence of mudstone and shale in the sedimentary deposits (the source of the mud that generate volcanoes), but also other constituents as oil and salt. The basic rules are simple: as the pore gas pressure is higher, the eruption will be more violent, and as long the frequency of the activity is longer, the larger and complex structures are generating. The main morphological forms are domes and cones, showing variable slope geometry, from the steep to the shield types. The generation of mud volcanoes is immediately followed by their degradation (weathering), so each edifice has a short life, commonly seasonal; Later on, the alternation of erupted mud material and weathering processes generates permanently new forms and structures.

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Deep Neogene structure of Voia area (Metaliferi Mountains, Romania) inferred from magnetotelluric and diamond drillings data

Berbeleac I., Nuţu-Dragomir M.-L., Chitea Fl.

Voia region is located in the southeastern part of the so called "Golden Quadrilateral" of Metaliferi Mountains. The geological structure is formed from Sarmatian-Pannonian andesitic stocks and dykes, disposed in a quasi circular shape. The main purpose of this study was to obtain enhanced information about the deep volcanic structure and associated mineralization from the Voia region.

A total number of 29 magnetotelluric soundings (MTS) were performed near the Voia Valley and its surroundings, with the depth of investigation of ~5km. Generally, the distance between MTS and boreholes was of 75-100 m, as imposed by the terrain conditions. The geophysical data interpretation was sustained by detailed geological information obtained from borehole data. Both, MTS and new executed boreholes were placed along three profiles: Profile I with a length of 1100m, Profile II having a length of 1400m and Profile III of 300m

By integrating the geophysical-geological-mineralogical data, the local tectonics and economical potential of Voia region was revealed as following:

- From electrical resistivity data the architecture of sub-horizontal plane napes was disclosed;
- Mini-magmatic shallow chambers were detected at the contact between crustal fault sets and sub-horizontal plane nappes; the mini-magmatic chambers suggests a high degree of changes in time of magmas composition and circulation of associated fluids;
- The observed quartz andesitic-microdiorite subvolcanic body had a poli-stadial evolution. It presents booth vertical and horizontal alteration products of argillic-allunitic types in the upper part, and potasic and propilitic towards of the external parts of the body;
- The gold resources are mainly associated with assemblages of high sulfidation minerals, mainly anhydrite±gypsum, quartz, iron oxides, chalcopyrite and pyrite;

Graphical integration of borehole and geophysical data disposed considering the terrain elevation model, allowed us to conclude that the deep structure of Voia region is characterized by the presence of a quartz andesitic and microdiorite subvolcanic body located at the conjunction of crustal fault sets and sub-horizontal plane nappes, as well as the existence of mini-magmatic chambers. We may assume that the subvolcanic body is part of a fossil magmatic chamber.

Long-term variation of temperature at mean latitudes of Northern Hemisphere from reanalyzed data. Relationship with solar variability

Pîrloagă R., Dobrică V.

Possible long-term effects of solar variability found in annual means of reanalyzed (mainly NCEP/NCAR, and ERA-40) and observed (ECA&D) temperature data over the temperate zone of the Northern Hemisphere (Europe, Northern America, Asia) are discussed. Comparisons of the reanalyzed time series with each other and with observed ones have been made for all areas mentioned (35 – 65°N band) and the differences/similarities have been discussed. The temperature data have been processed to obtain signals at 11 and 22-year solar cycle timescales, thus the effects of solar variability over temperature have been inferred. The connection between solar/geomagnetic variability, described by solar and geomagnetic indices (the sunspot number R and, respectively the aa geomagnetic index), and reanalyzed temperature data is investigated by correlation maps at the scale of northern temperate climate area.

Energy transfer from the solar wind into the magnetosphere during geomagnetic storms. A case study

Ionescu D., Mariș Muntean G., Mierlă M.

The transfer of energy from the solar wind into the magnetosphere depends both of solar wind characteristics, as well as the magnetosphere configuration of that moment. During geomagnetic storms this transfer becomes significant (as possible effects over our daily lives). A correct estimation of this quantity can lead to a better understanding of the processes involved in the magnetosphere dynamics of could contribute to an improvement of the risk geomagnetic storm predictions.

We will present a detailed study of this transfer during a moderate geomagnetic storm Dst-min = -130 nT) from January 22, 2004. We will compare energy values, as well as temporal profiles of the energy transfer, using well-known formulas (Akasofu, 1981; Kan and Lee, 1979; Newell et al., 2007) or more recent ones (Wang et al., 2014). We will compute the total energy transferred during this storm and we will compare it with other values from the literature.

Analysis of high speed stream currents from solar wind responsible for geomagnetic storms in the descending phase of solar cycle 23

Mariș Muntean G., Beșliu-Ionescu D., Tălpeanu D.

The solar wind, plasma continuous flux from the solar corona, is an inhomogeneous medium structured by various parameters (density, plasma speed, heliospheric magnetic field structure) and because of this, it is hard to predict its behaviour in the near-Earth medium. However, some of its structures, emitted and “controlled” by solar their sources, can be predicted with sufficient precision (between 70-95%). Thus, the high speed streams from the solar wind (HSS) with the origin in coronal holes (CH) represents a repeatable structure during several solar rotations and possible to predict. Their geoeffectiveness is directly dependant of the solar source being influenced by the heliographic position and the morphologic structure of the CH. For detailed analysis of the links between HSS and their effect in the magnetosphere (geomagnetic storms) one needs processing date available in various stages of the cycle. In the present paper we have considered HSS that have produces in the Earth's magnetosphere storms of moderate intensity (-150 nT< Dst < -50 nT) and we have outlined by means of correlation analysis the HSS and the interplanetary magnetic field parameters that have influenced the intensity of the geomagnetic storm measured by the Dst index. Taking into consideration that the storm intensity is determined by the energy transferred from HSS in the magnetosphere, which in its turn depends on the HSS parameters and Bz, we analysed their degree of linear dependence (by means of correlation analysis). The results thus obtained are integrated in a similar study carried out for the minimum, descendent and maximum phase of the solar cycle 23, highlighting each phase's characteristics.

Analyze of the temporal delay between the geomagnetic Dst(min) and the interplanetary Bz(min) during cycle 23

Pătroi A.-C.

Solar Cycle 23 is characterized by an intense geomagnetic activity represented by the large number of geomagnetic storms. In this study I analyzed minor geomagnetic storms defined with a minimum Dst contained (-30nT and -50 nT) occurring in this solar cycle.

I analyzed the distribution of these storms during this cycle depending of its phases and I determined the minimum value of the Z component of the interplanetary magnetic field (Bz).

Also, I analyzed the temporal delay between the geomagnetic Dst (min) and the interplanetary Bz(min) for the minor geomagnetic storms and I compared the results obtained with results obtained by Kane (2010).

The data used in this study (Dst and Bz) are data with hourly frequency and are available online at the web site: omniweb.gsfc.nasa.gov/form/dx1.html.

Coronal Fan Analysis

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The high resolution of the instruments onboard recent missions contributed to the discovery of new solar structures, including coronal fans. Coronal fans are structures of large dimensions on the Sun, that have a long life duration (at least one full Carrington rotation) and which are usually situated at the boundary between open and closed field lines regions.

We identified these fans, observed in the extreme ultra-violet images taken by SWAP onboard PROBA2, during 2015. This paper presents the analysis using data stored in continuous movies that covers the entire period of a Carrington rotation. For this purpose, we also analysed images taken by AIA (EUV wavelengths) and HMI (magnetograms) onboard SDO, as well as Hα images available from ground-based observatories. Using solar soft routines, under the programming language IDL, we identified the foot-points of the coronal loops that belong to these fans, and their location has been over-plotted on all images used. Thus we correlated for each fan structure a corresponding Sun structure (such as an active region, a filament or a coronal hole) if there was any. Also, we have analysed the structure of the magnetic field lines as it is inferred by the PFSS model, in order to correlate them with magnetic field line from the separatrix surfaces.