

Azerbaijan National Committee (ANC) for IUGG

Azerbaijan National Academy of Sciences (ANAS)

**Activity Report of Azerbaijan National Committee (ANC) ANAS for
IUGG in 2016**

President of ANC ANAS,
Vice-president ANAS, academician



Guliyev I. S.

General-Secretary of ANC ANAS,
PhD in Earth sciences, Assoc. Prof.

Babayev G. R.

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Azerbaijan National Committee at Azerbaijan National Academy of Sciences (ANC ANAS) conducts the representativeness of Azerbaijan in International Union of Geodesy and Geophysics (IUGG) and its six associations: International Association of Geodesy (IAG), International Association of Seismology and Physics of Earth's Interior (IASPEI), International Association of Volcanology and Chemistry of Earth's Interior (IAVCEI), International Association of Geomagnetism and Aeronomy (IAGA), International Association of Hydrological Sciences (IAHS), International Association of Physical Sciences of Ocean (IAPSO). ANC coordinates participation of the respective Institutes of ANAS in the various international projects and programs conducted by the Committees of Union.

In 2016 the main efforts of ANC ANAS, and also the national representatives of Association were directed towards researching airspace geodesy, hydrological sciences, and physics of Earth, radon estimation in the regions of Azerbaijan, geo-ecological assessment of the river basins, mud volcanology and chemistry of Earth, magnetism and aeronomy.

In 2016, the current cooperation with the scientific community of Russia further strengthened. The joint call between Russian Foundation of Fundamental Researches (RFFR) and Science Development Foundation at the President of Azerbaijan was agreed to launch in 2017. Besides, scientific cooperation within the fields of Earth's sciences with the institutions of Ukraine, Kazakhstan and Georgia continued. During 2016, Azerbaijan National Committee continued cooperation with the world-known international organizations, such as The University of Geophysics and Oceanography (LEGOS) in Toulouse (France), Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO), ILP (International Lithospheric Program), IUGS (International Union of Geological Sciences), Yildiz Technical University (Turkey), Massachusetts Institute of Technology (USA), Friedrich-Schiller-University Jena (Germany), International Institute of Seismology and Earthquake Engineering, OYO Corporation (Japan), European Seismological Committee, Deutsche GeoForschungsZentrum (GFZ), Shanghai Astronomical Observatory of the Chinese Academy of Sciences.

With the efforts of three institutions of Azerbaijan National Academy of Sciences (Geology and Geophysics Institute, Geography Institute and Institute of Physics) together with the scientists from the respective sections there continued works towards compiling "Atlas of Solar Energy of Azerbaijan", which is planned to be finalized at the end of 2017.

GEODESY SECTION

In 2016 Geodesy association continued an active cooperation with the Massachusetts Institute of Technology (MIT), Istanbul Technical Institute (ITI) and with the leading Institutions of Italy, France and Japan.

In 2016, there continued functioning of two international laboratories. The laboratory of Massachusetts Institute of Technology USA and Geology and Geophysics Institute under the name "Modern movements of Earth's surface and geodynamics hazards" continued researching GPS monitoring on the Azerbaijan polygons within the subject framework "Modern kinematics and dynamics of the eastern part of the Mediterranean and Caucasus". Researches within "Estimation of the space-time analysis of the earthquakes and seismic hazard" (ESTAHL) international laboratory also continued in 2016. This laboratory functions within the agreement framework between Institute of Methodologies for Environmental Analysis at National Research Council (CNR) Italy and Geology and Geophysics Institute (GGI) ANAS Azerbaijan. In 2016, the scientists of the ESTAHL laboratory dealt with the studying time-space analysis of the seismicity of Azerbaijan using the mathematical and multi-parametric statistical methods together with the Professor of Institute of Methodologies for Environmental Analysis at National Research Council (CNR, Italy), Luciano Telesca.

In 2016 cooperation in the research framework of National Center of Scientific Researches (Centre National de la Recherche Scientifique, CNRS) of France continued. Within the framework of the cooperation, geological structure and stratigraphy of Nakhchivan Autonomous Republic and Talysh zone (Azerbaijan) was modeled with the elements of tectonic and seismic zoning of the studied territories, and relationship of the seismic processes with the geodynamics of the region was analyzed. Within the subject framework entitled "Geological sciences in South Caucasus", monitoring of horizontal movements of GPS measurements was continued, also done within international laboratory "Modern movements of Earth's surface and geodynamics hazards". Besides, within the project, magmatic properties of the studied region were researched.

The "Modern movements of Earth's surface and geodynamics hazards" laboratory continued collaboration with National Academy of Sciences of USA (NAS) and USAID within Partnerships for Enhanced Engagement in Research (PEER) program under the title "Active geodynamics of Caucasus region". Within the laboratory, it was researched the variations of the gravitational field with the seismic events, the analysis of the time and space clusters of the seismicity of the Absheron-Prebalkhan tectonic structure, the stress map of the Azerbaijan territory. Within the Section, scientists collaborated with Ilya

University of Georgia under the research “The map of GPS velocities of Caucasus region”. Massachusetts Institute of Technology purchased four GPS TopCon stations which were installed in Geology and Geophysics Institute, with the total number of GPS stations reaching to the 10 units.

Members of the Section took an active part in many international scientific events organized in Russia and abroad, and among them there are as follows:

- 7th International Geology and Geophysics Conference and Exhibition EAGE, Geosciences and Union of European Engineers, Saint-Petersburg, April, 2016;
- 1st International Conference on GNSS (ICG+2016) - Advances, Opportunity and Challenges, Shanghai, China, July 2016.
- 35th General Assembly of European Seismological Commission, Trieste, Italy, September, 2016.
- XX International Russian Conference “Deep structure, mineralogy, modern geodynamics and seismicity of Eastern-European platform and adjacent regions”, Voronezh, Russia, September, 2016.
- Joint seminar/workshop by Ilya State University (Georgia) and Massachusetts Institute of Technology (MIT, USA) within PEER grant program, Tbilisi, Kvareli, Georgia, October, 2016.

In 2016, the scientists of the Section worked on the Book “Geosciences of Azerbaijan” and published it as follows:

Alizadeh, A.A., Guliyev, I.S., Kadirov, F.A., Eppelbaum, L.V. Geosciences of Azerbaijan. Volume I: Geology. 2016. Springer International Publishing. DOI 10.1007/978-3-319-27395-2. 239 p.

Besides, in 2016 there are a number of publications in peer-reviewed journals.

GEOMAGNETISM AND AERONOMY SECTION

The activity of the geomagnetism and aeronomy section at ANC was performed through the activity of Shamakhi Astrophysical Observatory named after N. Tusi at Azerbaijan National Academy of Sciences (ANAS).

During the 2016 period, the Observatory developed further researches in various fields of astrophysics, completed the process of modernization of astronomical devices available in the country (installation of the FOCES - a fibre optics Cassegrain echelle spectrograph for 2-metre telescope) and determined capabilities of artificial satellites in the space sector. Association of geomagnetism and aeronomy continued working in the field of physics solar-terrestrial relations aiming to create and develop international network of magnetic observatories.

In 2016, the Section obtained a number of scientific results in such important areas as the problems of theoretical astrophysics and cosmology, especially the various stages of stellar evolution, actual problems of solar physics and solar-terrestrial relations, including security issues of Earth and artificial satellites.

The scientists of the Section carried out the photometric experiments on artificial satellites and spectral synchronous experiments in ground-based telescopes. The Section continued working with the University of Montreal (Canada) under investigation massive hot Wolf-Rayet stars cooperating with the Moscow State University (Russia) on the study of Seyfert galaxies. The researches were continued in the field of physics of the interstellar medium together with Copernicus University (Poland) and the Special Astrophysical Observatory (Russia).

Due to the changes in the structure of Shamakhi Astrophysical Observatory of ANAS in 2015, it is planned to make election of the national representative of IAGA in ANC in 2017.

Within the fields of solar magnetism, physics of solar-terrestrial relations, influence of space weather on the biological systems of Earth, heliobiological studies, solar systems tendencies and some others, Shamakhi Astrophysical Observatory continued collaborating with more than 20 scientific organizations and institutions, such as Leibniz Institute for Astrophysics Potsdam (AIP) (Germany), Aarhus University (Denmark), Odessa National Maritime University (Ukraine), Space Research and Technology Institute, Bulgarian Academy of Sciences (Bulgaria), NASA Ames Research Center (USA), Sternberg Astronomical Institute, Moscow State University (Russia).

Members of geomagnetism and aeronomy section continued cooperating with the representatives of European Astronomical Society, scientists from Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation named after N. V. Pushkov of the Russian Academy of Sciences.

SECTION OF HYDROLOGICAL SCIENCES

The Association of Hydrological Sciences continued participating in the international workshops, projects, conferences linked with trans-border water resources, thermal waters researches, climate change influence on the water resources.

In 2016, the Section carried out a number of researches into geothermal waters and geothermal energy resources of Azerbaijan, the estimation of the renewable thermodynamic potential of the thermal waters and the technological basis of the beneficial usage for sustainable development of the energy security in

Azerbaijan, the development of the optimal methods for the estimation of the exploration reserves of the underground waters taking into account the environment restrictions.

SECTION OF PHYSICAL SCIENCES OF OCEAN

In 2016, Institute of Geography of ANAS which is the basic organization conducting researches within IAPSO thematic continued performing the respective researches, especially within the Azerbaijan aquatorium of the Caspian Sea researching the hydrophysical fields.

In January of 2016, in the Institute of Geography ANAS there was a presentation of the project of international program entitled "Biodiversity in the Ponto-Caspian basin". Within the project the Institute administration and members of the Association met with the scientific fellows from the Center "Biodiversity of the Nature" from Netherlands, "Gordost" program director Dr. Fran Vesseling and researcher from the Utrecht University Dr. Christian van Baak. The met with the National Representative of the Association, academician Ramiz Mammadov and members of the Association and discussed the project issues. The main purpose of the program is the research of the biodiversity development of the Ponto-Caspian basin in the Quaternary period (in Caspian, Black and Marmara Seas). The project manager spoke about the research meaning which will be conducted within the project with participation of the 15 postgraduates from Romania, England, Holland, Iran, Russia and Spain in line with the scientists-specialists from the various countries. He mentioned that palynological, geochemical and other researches of micro- and macro fauna of the Ponto-Caspian basin and definition of their migration paths play an important role for the studying of the climate, water level changes and other attributes of the Ponto-Caspian basin in the Quaternary. The members of the Section and the scientists of the Institute will participate in the conferences, workshops within this project and will publish their research outcomes in the peer-reviewed international journals.

In 2016, scientists from Section met in the Institute of Geography with the delegation from Inter-Islamic Science and Technology Network on Oceanography, namely Executive Director, Prof. Mustafa Ergun and professor Gunay Chifchi from Marine Sciences and Technology Institute of Dokkuz Eylul University in Turkey. The delegation's main objective was to bring together scientists, practitioners and the public to discuss and advance understanding of the issues surrounding the importance of biodiversity in the aquatic environment. The meeting had addressed issues of marine biodiversity across a deliberately wide range of relevant spheres and interacting topics. The Institute arranged a seminar

for M. Ergun with the presentation entitled "Inter-Islamic Science and Technology Network on Oceanography". The identical project was agreed to launch in Azerbaijan with the signing Intent Protocol as a start.

In 2016, the Section's scientists were involved in arranging an electronic version of the "Hydrometeorology of Caspian Sea" Atlas. The Atlas contains three chapters and 270 maps with various respective scientific attributes.

The Section, namely the Institute signed an Agreement between Institute of Ecology management and region development of University of Geneva (Switzerland) to carry out the project entitled "Support for sustainable development of the Caucasus mountainous region". Besides, scientists from the Section continued working with the Laboratory Studies in Geophysics and Space Oceanography (LEGOS) situated in Toulouse (France) under the agreement between Centre National de la Recherche Scientifique (CNRS) and Azerbaijan National Academy of Sciences (ANAS) within the title "Studying the level of Caspian Sea by the satellite altimeter". "Caspian Sea Problems" Department of the Institute of Geography ANAS was assigned the executive of the IODE (International Oceanographic Data and Information Exchange) Program of the International Oceanographic Commission (IOC) UNESCO.

In 2016 Section of physical sciences of ocean constantly carries out its participation in ICOPMAS (International Conference on Coasts, Ports and Marine Structures) concerning the problems of studying variation of the Caspian Sea level linked with the plate tectonics in the region, Caspian geo-system.

SECTION OF SEISMOLOGY AND PHYSICS OF EARTH INTERIOR

In 2016, there continued cooperation of the Association within the membership framework with the representatives of American Geophysical Union (AGU), Incorporated Research Institutions for Seismology (IRIS), Observatories and Research Facilities for European Seismology (ORFEUS), European Mediterranean Seismological Centre (EMSC), European Seismological Commission (ESC). The big data archive of the Republican Center of Seismic Service ANAS which is basic organization conducting researches within IASPEI thematic was modified, improved and positioned on the portal of the Data Center of Information Technology Institute ANAS. Within Association, during 2016 macroseismic and seismological researches continued.

Scientists from the Republican Center of Seismic Service ANAS which are members of the Section participated in the conferences in 2016 according to the IASPEI subject:

- Conference in Rome (Italy) organized by the societies within Antelope User Group (AUG);
- 35th General Assembly of European Seismological Commission, Trieste (Italy);
- 5th International training in Berkley Seismological Laboratory at California University of USA on seismological analysis of Azerbaijan territory, methods and techniques, seismotography method, calculation of Mw magnitude and moment tensor;
- Training with the representative of Geodesy Section of Earthquake Research Institute of Kandilli Observatory at Turkey Bogazici University, professor Semih Ergintav on the programs of GPS stations.
- Earthquake Research Institute of Kandilli Observatory at Turkey Bogazici University, training on processing of GPS network stations results, testing and primary data receipts.

Consequently, Section's scientists continued actively cooperating with the scientists of Geophysical Monitoring Center of Academy of Sciences of Belorussia, Institute of Geophysics of Academy of Sciences of Bulgaria, Geophysical Institute named after M. Nodia of Academy of Sciences of Georgia, Ilya State University Georgia, Institute of Seismology of Academy of Sciences of Uzbekistan, Institute of Earth's Physics named after O. Y. Shmidt Russian Academy of Sciences, Scientific Technological University of Missouri of USA, Lawrence Livermore National Laboratory of USA, Kandilli Observatory and Earthquake Research Institute (KOERI) of Turkey.

Besides, the scientists from Republican Center of Seismic Survey worked with the scientists from Missouri University to obtain the tomography data based on the material of P-wave and S-wave velocities (V_p/V_s) for the Azerbaijan earthquakes and learning the techniques of programs HypoInverse, HypoDD, TomoDD. Additionally, scientists from National Committee of IASPEI worked closely with the President of Kinemetrix USA, Ogie Kuraica and representative of Kinemetrix, Mr. Tofiq Elili for learning the programs for seismic data processing. Based on that, there arranged two international seminars with the participation of scientists and specialists from Ilya State University (Georgia) and Livermore Laboratory (USA) on the title "Probabilistic seismic hazard assessment in the Caucasus".

National Committee of IASPEI worked with the scientists from Deutsche GeoForschungsZentrum (GFZ) outlining the research plan on seismic hazard and risk assessment in Baku city.

In 2016, scientific research at the joint international laboratory "Seismic tomography of Earth's interior", carried out on the basis of agreement between Republican Center of Seismic Service at ANAS and Department of Geological

Sciences of the Missouri University (Columbia, USA) continued. The main research subject was to study and analyze the researching methods of Earth's structure on the basis of ground noise and earthquake data in order to effectively model of geodynamics of regional and local structures. Application of the seismic tomography method to research the deep structure of the Earth's interior allows structuring the physical peculiarities of crust and mantle. Besides, based on the arrival time of surface waves velocity heterogeneity of Upper Mantle of the Earth's crust of the Azerbaijan territory.

In 2016, there were more than 16 publications on various scientific directions of the National Committee of IASPE and 11 of them were published in peer-reviewed editions.

SECTION OF VOLCANOLOGY AND CHEMISTRY OF EARTH INTERIOR

The Section collaborated with "Total E&P Azerbaijan B.V/Total E&P Absheron B.V" company and with the specialists of Toulouse University (France) to research the geological structure of one of the mud volcanos in Gobustan-Absheron area (Azerbaijan) using the contemporary approaches, methods and analysis. In 2016, the section scientists cooperated with the academicians of the National Academy of Sciences of Ukraine within the field of marine geology and depression to study the comparative analysis of mud volcanoes of Azov-Black Sea and Caucasus regions. The analysis was mainly based on the research of the mineral content of the mud volcano emissions. These researches will allow obtaining new results about mineralogy and chemistry of mud volcanoes which would allow to discover the new peculiarities of the mud volcano genetics.

During 2016, a number of research in the Azerbaijan mud volcano area was done to reveal the new mineral contents, and titanium, nickel, cuprum, ferrium in the breccia. Besides, the researches with Florence University at National Research Council (CNR) Italy were continued to study isotopic and geochemistry content of the thermal waters and gases in the Azerbaijani regions.

In 2016, there continued researches with the scientists from Institute of Geology at Russian Academy of Sciences within the framework of researching modern geodynamics, fluid-regime and oil and gas bearing of Caucasus region. Researches for the study of geothermal conditions of mud volcano reservoirs' formation of the Caucasus region continued. The scientists of the Section managed to publish a number of papers in the peer-reviewed international journals.