IAGA
RESEARCH ACTIVITIES IN GREECE
FOR THE PERIOD 2015-2018

Edited by
Prof. J. Daglis
IAGA National Correspondent
Contributions by:

**Division 1: Internal Magnetic Fields**
Prof Kanaris Tsinganos
National & Kapodistrian University of Athens and National Observatory of Athens

**Division 2: Aeronomic Phenomena**
Assoc. Prof. Theodoros Sarris
Democritus University of Thrace

**Division 3: Magnetospheric Phenomena**
Space Physics Group: Prof. Ioannis A. Daglis, Dr Marina Georgiou, Dr. Christos Tsironis, Dr. Ingmar Sandberg, Christos Katsavrias.

*National & Kapodistrian University of Athens, Department of Physics,*

Dr Anastasios Anastasiadis, Dr Athanasios Papaioannou, Dr Georgios Balasis, Dr Anna Belehaki and the Ionospheric Group of IAASARS,

National Observatory of Athens
Theodoros Sarris, Associate Professor,

Democritus University of Thrace

**Division 4: Solar Wind and Interplanetary Field**
Panagiota Preka-Papadema, Assistant Professor, and the ARTEMIS team

National and Kapodistrian University of Athens, Department of Physics


University of Ioannina, Department of Physics, Section of Astro-geophysics, Laboratory of Astronomy

Costis Gontikakis and Manolis Georgoulis, both Senior Researchers.

Research Center for Astronomy and Applied Mathematics of the Academy of Athens

**Division 5: Geomagnetic Observatories, Surveys and Analyses**
Dr. Georgios Balasis and Prof. Ioannis A. Daglis

National Observatory of Athens / National and Kapodistrian University of Athens
Division 6: Electromagnetic Induction in the Earth and Planetary Bodies

Prof. Konstantinos Kourtidis

Democritus University of Thrace,

Prof. Filippos Vallianatos, Prof. John P. Makris and the TEICR-LGS team

Technological Education Institute of Crete.
Infrastructures:

Radon network for detecting pre-seismic phenomena

We have developed a multiparameter network infrastructure aiming towards the monitoring and thorough study of earthquake precursor phenomena at the high seismicity area of the Western Hellenic Arc (SW Peloponnese, Greece). We conducted a continuous real-time monitoring of Radon accumulation in the ground by using a network of radon sensors. The radon monitoring network consists of three gamma radiation detectors [NaI(Tl) scintillators] placed at Methoni, Kyparissia and Zakynthos and one alpha radiation spectrometer (Kalamata area). All gamma-ray sensors have been placed in the ground at a depth of 1 m. Local meteorological parameters for atmospheric corrections are also continuously monitored and analysed. Radon measurements are performed indirectly by means of gamma ray spectrometry of its radioactive progenies 214Pb and 214Bi (emitted at 351 keV and 609 keV, respectively). The alpha spectrometer was initially used for the inter-calibration of all gamma radiation monitoring stations after their installation.

The first results showed that a number of pre-seismic radon variation anomalies have been observed before several earthquakes (M>3.6). After compensating the daily tidal effects the data showed a clear indication of the dependence of radon release on the earthquake occurrence. The radon increases systematically before the larger events. For example a radon anomaly was predominant before the event of Sep 28, M 5.0 (36.73°N, 21.87°E), 18 km ESE of Methoni. A good correlation can also be seen with the smaller events.

A nine-station seismic array was additionally installed at the Pylos area, in order to detect and accurately locate microseismic events of less than 1.0 R magnitude in the offshore area. At this specific area the absence of stations west of the coast, at the sea area, causes difficulties to detect and accurately locate the low magnitude seismic events only by the use of the National Unified Seismological Network of Greece recording, since both the epicentral distances and the azimuthal gap of these earthquakes are very large. The seismic array assists to the evaluation of the current seismicity at this area and in some cases the identification of a possible foreshock activity.

The method of thermal anomalies in satellite images is also applied in a regular basis as a second tool for evaluation of the Radon increase. According to the Lithosphere-Atmosphere-Lonosphere Coupling (LAIC) model, atmospheric thermal anomalies observed before strong events can be attributed to an increased of the radon concentration. This is also supported by the statistical analysis of AVHRR/NOAA-18 satellite thermal infrared (TIR) daily records. We performed satellite thermal monitoring over the area of SW Hellenic Arc, by analyzing nighttime images of POES polar orbit satellites to verify the correlation of the thermal anomalies and the radon pre-earthquake emission.

Contribution to international associations:

- Member of the SOC of the Solar Orbiter Mission, Metis experiment
- Greek PI of the Proba 3 mission
• Member of the steering committee of the European project ERA-Planet (http://www.era-planet.eu/).

Publications:

Division 2: Aeronomic Phenomena

Democritus University of Thrace

Theodoros Sarris, Associate Professor

International Research Programs:

- Development and launch of DUTHSat-GR01, a CubeSat that was developed as part of the QB50 project to study the Earth’s upper atmosphere
- Participation as lead institution in “Daedalus”, a candidate mission for ESA’s Earth Explorer 10. Daedalus would carry a suite of instruments to provide measurements in a largely unexplored area between the Earth’s upper atmosphere and space. Here, intriguing and complex processes govern the deposition, transformation and transport of some of the Sun and solar wind’s energy. The aim is to quantify amounts of energy deposited in the upper atmosphere by measuring, for example, effects caused by the electrodynamic processes in this region. The concept is based on a mother satellite, which carries a suite of instruments along with four small satellites carrying a subset of instruments that are released into the atmosphere. https://www.esa.int/Our_Activities/Observing_the_Earth/Three_Earth_Explorer_ideas_selected

Publications:

Division 3: Magnetospheric Phenomena

National & Kapodistrian University of Athens, Department of Physics

Space Physics Group: Prof. Ioannis A. Daglis (IAD), Dr Marina Georgiou (MG), Dr. Christos Tsironis (CT), Dr. Ingmar Sandberg (IS), Christos Katsavrias, MSc (CK)

Contribution to international associations:

- IAD: Editor-in-Chief of Annales Geophysicae journal, European Geosciences Union (EGU)
- IAD: Scientific Discipline Representative to SCOSTEP (Scientific Committee on Solar-Terrestrial Physics)
- IAD: Chair of the Next Scientific Program (NSP) Committee of SCOSTEP.
- IAD: Steering Board Member of the Space Weather Working Team, European Space Agency.
- IAD: Full Member of the International Academy of Astronautics (IAA).
- IAD: Member of the International Living With a Star Working Group.

Community service:

MG: Fred L. Scarf Award Committee Member (https://honors.agu.org/sfg-award-lecture/fred-l-scarf-award/)

International Research Programs:

- G4G (Geant4-based Particle Simulation Facility in Greece for Future Science Mission Support) project, funded by the European Space Agency (2018-2022)
- VALIRENE ( Radiation Belt Model Development and Validation: AP9/AE9/SPM models) project, funded by the European Space Agency (2016-2018)
- HERMES (Hellenic Evolution of Radiation data processing and Modelling of the Environment in Space) project, funded by the European Space Agency (2015-2018)
- SREMDC (SREM and REM Data Consolidation) project, funded by the European Space Agency (2015-2018)

Publications:

- Arruda, Luisa, Patricia Goncalves, Ingmar Sandberg, Sigiava Giamini, Ioannis Daglis, Arlindo Marques, Joao Pinto, Adolfo Aguilar, Pedro Marinho, Tiago Sousa, Hugh Evans, Piers Jiggens, Alessandra Menicucci, and Petteri Nieminen, SEP


Invited talks at International Conferences:

- I.A. Daglis: “Radiation belts and ring current during geospace magnetic storms”, 2015 International Workshop on the Interrelationship between Plasma Experiments in the Laboratory and in Space (IPELS2015), Pitlochry (Scotland), United Kingdom, 23-28 August 2015


- I.A. Daglis: “Space activities in Greece”, Annual Meeting of the European Space Sciences Committee, Athens, Greece, 1 June 2017.

- I.A. Daglis: “Storm-substorm relation and its connection to geospace energetic particles”, 20th anniversary symposium of Rikubetsu Observatory “From Space to the Earth”, Rikubetsu (Hokkaido), Japan, 8-9 November 2017
• I.A. Daglis: “Dynamics of energetic particles in the inner magnetosphere and role of wave-particle interactions”, AOGS (Asia Oceania Geosciences Society) 15th Annual Meeting, Honolulu (Hawaii), USA, 3-8 June 2018

National Observatory of Athens

Dr Anastasios Anastasiadis and Dr Athanasios Papaioannou

Infrastructures:

FORSPEF Tool: Web-based open access tool (24/7) that provides forecasting of solar eruptive events, such as solar flares with a projection to coronal mass ejections (CMEs) (occurrence and velocity) and the likelihood of occurrence of a solar energetic proton (SEP) event. The tool also provides nowcasting of SEP events based on actual solar flare and CME near real-time alerts, as well as SEP characteristics (peak flux, fluence, rise time, duration) per parent solar event [ESA Contract No. 4000109641/13/NL/AK] (http://tromos.space.noa.gr/forspef/)

ASPECS Tool: A novel tool that aims at advancing the technology development for the forecasting of solar energetic particles and flares, with the implementation of a web based advanced warning system able to provide outputs tailored to the needs of spacecraft and launch operators, as well as aviators [ESA Contract No. 4000120480/17/NL/LF/hh] (http://tromos.space.noa.gr/aspecs/)

Contribution to International Associations:

Editorial Boards
• International Review of Physics
• Entropy
Guest Editor of:
Liaison Officer for:
• News, Media, Education: Division of Solar-Terrestrial (ST) Sciences (European Geosciences Union - EGU), 2014 - present

Invited talks in International Conferences:
Flares, coronal mass ejections and solar energetic particles: Space Weather Impact, Oostende, Belgium, 15/11/2016


- A. Papaioannou: Neutron Monitors and the Heliosphere: past, present and future, Seminar at the Physics Department, University of Athens, Athens, Greece, 19/10/2017

- A. Papaioannou: Solar Eruptions and their Heliospheric Imprint, Seminar at the National Observatory of Athens, Pedeli, Greece, 03/11/2017

- A. Papaioannou: The dynamic influence of the Sun in the inner heliosphere, Institut de Ciencies del Cosmos, University of Barcelona, Barcelona, Spain, 16/07/2018

Publications:


International Research Projects:

• Multivariate Statistical Analysis applied to Solar Energetic Particle Events Forecasting, State Scholarship Foundation, IKY, 2017-2018

National Observatory of Athens
Dr Georgios Balasis

Contribution to International Associations:

• Secretary, Earth Magnetism and Rock Physics (EMRP) Division, European Geosciences Union (EGU).
• National Delegate of Greece to the Programme Board of European Space Agency (ESA) Space Situational Awareness (SSA) Programme.
• Scientific Committee. ESA Living Planet Symposium 2016, Prague, Czech Republic, 9–13 May 2016.
• Convener/Co-convener of Conference Session (last ones): European Geosciences Union (EGU) General Assembly [2015-2018], European Space Weather Week [2017], International Union of Geodesy and Geophysics (IUGG) [2015]
• Editor of European Geosciences Union (EGU) journal Annales Geophysicae in Magnetosphere and Space Plasma Physics section.
• Review Editor, Frontiers in Physics; Frontiers in Astronomy and Space Sciences.
• Guest Editor, Journal of Space Weather and Space Climate.

Publications:


**Invited talks:**

• Keynote Lecture, 13th European Space Weather Week, Ostend, Belgium, 14–18 November 2016.

International Research Projects:

• “Swarm Investigation of the Role of High-Frequency (0.1-5 Hz) ULF Waves in Magnetosphere-Ionosphere Coupling”, Coordinator: University of Alberta, Canada, Funding: European Space Agency, 19.09.2015–23.10.2016.

National Observatory of Athens

Dr Anna Belehaki and the Ionospheric Group of IAASARS

Infrastructures:
The Ionospheric Group of IAASARS/NOA operates the following facilities:

• The Athens Digisonde: A research infrastructure for remote sensing of the Earth’s Ionosphere is operating in the National Observatory of Athens since September 2000. The ionospheric station is upgraded to a Digital Portable Sounder 4D with an 128 chip transmitter allowing operation in bi-static link with receivers and transmitters having the same operational capabilities. The station can operate in many different modes: 1) Scanning ionogram, 2) Drift ionogram 3) Fixed Frequency ionogram 4) Oblique ionogram 5) Digisonde-to-Digisonde operations. All data are processed in real-time and the results are available in the main web site of the Ionospheric Group of IAASARS/NOA (http://www.iono.noa.gr), are also transmitted to the WDC-Chilton and to the Global Ionospheric Radio Observatory of UMASS (GIRO).

• DIAS system: The European Digital Upper Atmosphere Server (DIAS) is the European provider for alerts, nowcasts and forecasts for ionospheric and thermospheric conditions. The service is based on data from 10 European Digisondes (Athens, Rome, Ebre, Arenosillo, Chilton, Juliusruh, Pruhonice, Moscow, Dourbes, Tromso), data from ground-based GNSS receivers and solar wind data from the Lagrange 1 vantage point. The DIAS portal is accessible at http://dias.space.noa.gr.

• The European Ionosonde Service (EIS): this service provides ionospheric services to fulfill the requirements of the Space Situational Awareness Programme of the European Space Agency (ESA). The EIS is a federated service and provides ionospheric characteristics mostly based on DIAS products, adapted to cover the whole European region, including Scandinavia.

• Net-TIDE database: it has been developed in the framework of the NATO SPS project “Pilot network for the identification of travelling ionospheric disturbances” and collects recording from the Digisonde-to-Digisonde oblique skymap drift data and the processed values which specify the TID characteristics such as Doppler shift, azimuth, elevation and group path. The visualization of these results is provided in http://tid.space.noa.gr and it is updated every 5 minutes.

• TechTIDE open access software and data: This is the repository of the TechTIDE project (http://www.tech-tide.eu). It is gradually populated with the list of TID active periods identified with the TechTIDE methods and with open access codes for the identification of TIDs with a observations from Digisondes, Continuous Doppler Sounding, and GNSS data.
Anna Belehaki is:

- Editor in Chief for the Journal of Space Weather and Space Climate (Publisher: EDP Science, IF=2.5)
- Member of the Space Weather Birkeland Medal Committee of the Norwegian Academy of Science
- Member of the Space Weather Working Team Board of the European Space Agency
- Member of the Programme Committee of the European Space Weather Week

Publications:

- Kutiev, I., P. Marinov, A. Belehaki (2016) Real time 3-D electron density reconstruction over Europe by using TaD profiler, Radio Science, 51, 7, 1176-1187, DOI: 10.1002/2015RS005932
- Tsagouri I., A. Belehaki, Ionospheric forecasts for the European region for space weather applications, J. Space Weather Space Clim. 5 A9 (2015), DOI: 10.1051/swsc/2015010

Invited talks to international Conferences:
- Belehaki, A., "Ionospheric specification services from the DIAS ionosonde network", URSI AT-RASC Gran Canaria, 18-22 May 2015
- Belehaki, A., “Identification of travelling ionospheric disturbances and perspectives for the development of warning services”, Keynote at the 14th European Space Weather Week, Oostende, Belgium, 14 November 2017, Oostende, Belgium
- Belehaki, A., “Detection of travelling ionospheric disturbances in TechTIDE EC H2020 project and perspectives for the development of mitigation strategies”, EGU General Assembly, Vienna, 8-13 April 2018
- Belehaki, A., “Identification of travelling ionospheric disturbances with HF and GNSS experiments”, URSI AT-RASC, Gran Canaria, 28 May – 1 June 2018

International Research Projects:
- "Warning and Mitigation of Travelling Ionospheric Disturbances Effects", European Commission Horizon 2020 TechTIDE Project (2017 - 2020), Total Budget 1.6 Meuro, Project Coordinator: Dr Anna Belehaki
- “ESA SSA Expert Center Coordination, Phase 3” 2018 – 2019, Consortium built around the Ionospheric Expert Center Groups, coordinated by DLR, Total budget: 4.5 Meuro
- " Pilot Network for the Identification of Travelling Ionospheric Disturbances " (SPS 984894) NATO Science for Peace and Security multi-year project, 2014 - 2017, https://sites.google.com/site/spsionosphere/, Total budget: 400 k euro, Project Director: Dr Anna Belehaki
- “ESA SSA Expert Center Coordination” 2015 – 2017, Consortium built around all ESA member states coordinated by Airbus, Total budget: 4 M euro
- " Identification and tracking of LSTID exploiting 3D electron density distributions ", USAF Grant, 2014 - 2016, Total budget: 130 k USD, Principal Investigator: Anna Belehaki

Democritus University of Thrace
Theodoros Sarris, Associate Professor

Publications:

National and Kapodistrian University of Athens, Department of Physics

Panagiota Preka-Papadema, Assistant Professor, and the ARTEMIS team

Infrastructures:

The Solar Radiospectrograph ARTEMIS-Jean Luis Steinberg (ARTEMIS–IV)

The Solar Radiospectrograph ARTEMIS–IV of the University of Athens is in operation at the Thermopylae Satellite Communication Station since 1996.

The observations extend from the base of the Solar Corona (650 MHz) to about 2 Solar Radii (20 MHz) with time resolution 1/10-1/100s. The recordings in the form of dynamic spectra, measure radio flux as a function of height in the corona; our observations are combined with spatial data from the Nancay Radioheliograph (NRH) whenever the need for 3D positional information arises.

The ARTEMIS-IV contribution in the study of Solar Radio Radiation, Energetic Events and Interplanetary Space Extensions include:

Research Using ARTEMIS-Jean Luis Steinberg (ARTEMIS–IV) in 2015-2018

The ARTEMIS-JLS is out of service since September 2013 due to a malfunction of the Antenna Steering System, therefore research work was based on the data archive of the instrument.

Future Perspectives

Restoration work on the Antenna System and modernization of the receivers is expected to begin in 2019 and restart of operations is envisaged within 2020. This project is funded by Onassis Foundation.

At this time the ARTEMIS-JLS web page provides on-line access to spectral data. These include the daily spectra of the ASG with a reduced time resolution of 5 seconds (Quick Looks) and the Type II List from 1998 to 2011; FITS data files are available with the latter. Although data of different time periods or higher resolution data are available on request, an extension of the on-line data availability is planned for the future as storage space in the University of Athens servers will become available. This work is also funded by the same grant.

We expect to continue obtaining high quality data to be used in improving our understanding of solar radio bursts and of the underlying physics of the corona and the interplanetary medium. The particular areas of interest include transient activity and flares, energy dissipation, electron acceleration and transport during flares, radio signatures of CMEs and coronal radio radiation amongst others. A major part of this work is expected to be based on comparisons of the ARTEMIS-JLS Radio Data with observations of HXR, energetic electrons, etc. The EUV and SXR imaging can put coherent emissions into context and may open exciting new possibilities for radio diagnostics unfolding their full potential as a tool for understanding plasma processes and energy release in the solar corona.

Publications:


Investigation of fine structures in radio events due to high sampling rate; small scale features of radio bursts are thus analyzed.

Study of the association of solar bursts with interplanetary phenomena because of its extended frequency coverage which complements the WIND/WAVES receivers. The combined spectral data range from the base of the Solar Corona to the near Earth space.

Examination of the radio signatures of solar energetic events, such as flares, CMEs and SEP events; the ARTEMIS-IV data are combined, in this case with GOES, SOHO/LASCO, STEREO/WAVES etc observations.


University of Ioannina, Department of Physics, Section of Astrophyysics, Laboratory of Astronomy

Costas Alissandrakis (CA), Professor Emeritus of Astrophysics; Alexander Nindos (AN), Associate Professor; Spiros Patsourakos (SP), Associate Professor.

Infrastructures:
The Laboratory of Astronomy participates in the operation of the ARTEMIS-IV/Jean-Louis Steinberg solar radiospectrograph at Thermopylae, together with the National and Kapodistrian University of Athens and the Technological Educational Institute of Central Greece.

Contribution to International Associations:
• AN has been member of the Board of the Community of European Solar Radio Astronomers (CESRA).
• SP is the chair of Division IV of the International Association of Geomagnetism and Aeronomy (IAGA) since 2015.

Publications:

• Bogod, V. M.; Alissandrakis, C. E.; Kaltman, T. I.; Tokchchukova, S. K., RATAN-600 Observations of Small-Scale Structures with High Spectral Resolution, 2015, Solar Physics, Volume 290, Issue 1, pp.7-20
• Patsourakos, S.; Georgoulis, M. K.; Vourlidas, A.; Nindos, A.; Sarris, T.; Anagnostopoulos, G.; Anastasiadis, A.; Chintzoglou, G.; Daglis, I. A.; Gontikakis,
• Nindos, A; Kontar, E.P; Oberoi, D., Solar Physics with the Kilometre Square Array, 2018, Advances in Space Research (accepted for publication)


• A. Nindos: “Cool and Hot Flux Ropes, Their Helicity” in COSPAR 42nd Assembly, Pasadena (USA), July 2018.


International Research Projects:

• Collaboration with the St Petersburg Branch of the Special Astronomical Observatory (SAO) of the Russian Academy of Sciences on Solar observations and analysis with the RATAN-600 radio telescope.

• WG5 (Bs Challenge Group) of Variability of the Sun and Its Terrestrial Impact (VarSITI) International Study of Earth-affecting Solar Transients International initiative.

• International Study Team on the “Decoding the Pre-Eruptive Magnetic Configurations of Coronal Mass Ejections” of the International Space Science Institute

Research Center for Astronomy and Applied Mathematics of the Academy of Athens

Costis Gontikakis (CG) and Manolis Georgoulis (MG), both Senior Researchers.

Infrastructures:

RCAAM is an Expert Group of the ESA Space Situational Awareness (SSA) Solar Weather Expert Service Center (S-ESC). It hosts and maintains the Athens Effective Solar Flare Forecasting (A-EFFort) facility that is a federated ESA SSA/SWE service and provides near-realtime 24-hour forecasts for four classes of major solar refreshed every 3 hours. MG serves as the A-EFFort Project Manager.

Moreover, RCAAM is the Coordinator institution of the Flare Likelihood and Region Eruption Forecasting (FLARECAST), again on solar flare prediction, with its computing facility based at Universite Parid-Sud, France. MG served as the FLARECAST Project Coordinator.
Contribution to International Associations:

- CG is currently the Secretary of the Hellenic Astronomical Society (Hel.A.S.).
- MG is the current National Delegate for Greece in the Committee on Space Research (COSPAR). He is also the Executive Director of the Local Organizing Committee from COSPAR General Assembly 2022, that will be organized in Athens, Greece.
- MG is the current Vice-President of Commission E2 on Solar Activity of the International Astronomical Union (IAU).

Publications:


Invited talks in International Conferences:
• MG: Greece and ESA’s Science Programme Committee: National Involvement, 12th Hellenic Astronomical Conference, Thessaloniki, Greece, June 28 – July 2, 2015
• MG: Electric Currents in the Solar Atmosphere, American Geophysical Union (AGU) Chapman Meeting in Currents in Geospace and Beyond, Dubrovnik, Croatia, May 23 – 27, 2016
• MG: The Path of Certain Active Regions Toward Eruptions and Implications for Solar-Eruptions Forecasting, 2016 European Week of Astronomy and Space Science (EWASS), Athens, Greece, July 4 – 8, 2016
• MG: Comparing Different Solar Flare Prediction Methods (Keynote), 13th European Space Weather Week (ESWW13), Ostend, Belgium, November 14 – 18, 2016
• MG: Introduction to FLARECAST, 13th European Space Weather Week (ESWW13), Ostend, Belgium, November 14 – 18, 2016
• MG: ISSI Pre-Eruptive Stage Part II, ISSI Workshop on Decoding the Pre-Eruptive Magnetic Configuration of Coronal Mass Ejections, May 8 – 11, 2017
• MG: FLARECAST: The Fully Automated Solar Flare Forecasting System, PROGRESS Summer School, Majorca, Spain, July 26 – 28, 2017
• MG: Progress and Challenges Toward a Future Integrated Space Weather Forecasting System, SEPRAD Expert Workshop, Vienna, Austria, September 18 – 19, 2017
• MG: ESA/SSA SWE A-EFFort Service, PSTEP Flare Prediction Workshop, Nagoya, Japan, October 31 – November 3, 2017
• MG: FLARECAST Status Update, PSTEP Flare Prediction Workshop, Nagoya, Japan, October 31 – November 3, 2017
• MG: Magnetic Helicity in the Solar Atmosphere: Much Gained, Still a Lot to Learn, Third Helicity Thinkshop, Tokyo, Japan, November 19 – 23, 2017
• MG: Coupling Heliophysics With Machine-Learning to Address Contemporary Space Weather Forecasting Problems (Keynote), High-Performance Computing at Sheffield University Workshop, Sheffield, UK, March 26, 2018
• MG: Pre-Eruption Conditions in Solar Active Regions: O2R and a Meaningful EST Role, European Solar Telescope Science Meeting, Giardini Naxos, Italy, June 11 – 15, 2018
• MG: Solar Radiation, First EMF and Health Symposium, Athens, Greece, September 14 – 15, 2018
• MG: Tools and Results of the FLARECAST Project Useful to Solar Orbiter Operations, Solar Orbiter MADAWG Meeting, Athens, Greece, September 26 – 28, 2018
• MG: European Efforts for Heliophysics Data Integration and Assimilation, EarthCube RCN Workshop: “Toward Integration of Heliophysics Data, Modeling and Analysis Tools”, New Jersey Institute of Technology, Newark, NJ, USA, November 14 – 16, 2018

International Research Projects:
• MG – Project Coordinator, Flare Likelihood and Region Eruption Forecasting (FLARECAST), EU Horizon 2020, 2015 – 2018
• CG – Team Member, Flare Likelihood and Region Eruption Forecasting (FLARECAST), EU Horizon 2020, 2015 – 2018
• MG – Project Manager, Athens Effective Solar Flare Forecasting, ESA SSA/SWE, 2014 – 2018
• MG – Team Member, ISSI Team on Magnetic Helicity, ISSI Bern, 2014 – 2016
• MG – Team Member, Forecasting Solar Particle Events and Flares (FORSPEF), ESA, Implemented by the National Observatory of Athens, 2014 – 2015
• MG – Local Team Leader, Hellenic National Space Weather Research Network, “Thales” Project of the GSRT, Implemented by the University of Thessaloniki, 2012 – 2016
• CG – Team Member, Hellenic National Space Weather Research Network, “Thales” Project of the GSRT, Implemented by the University of Thessaloniki, 2012 – 2016
• MG – Project Member, ISSI Team on Study of Magnetic Flux Ropes Before and During Onset of Solar Coronal Mass Ejections, ISSI Bern, 2016 – 2017
• MG – Team Member, Advanced Solar Particle Events Casting System (ASPECS), ESA, Implemented by the National Observatory of Athens, 2017 – 2019

Division 5: Geomagnetic Observatories, Surveys and Analyses

National Observatory of Athens / National and Kapodistrian University of Athens

Dr. Georgios Balasis and Prof. Ioannis A. Daglis

ENIGMA

The National Observatory of Athens (NOA) currently operates ENIGMA (Hellenic GeoMagnetic Array), an array of 4 ground-based magnetometer stations in the areas of Trikala (Klokotos), Attiki (Dionysos), Lakonia (Velies) and Lasithi (Finokalia) that provides measurements for the study of geomagnetic pulsations, resulting from the solar wind - magnetosphere coupling (http://enigma.space.noa.gr/). ENIGMA is the first magnetometer station array to operate in Greece, and within a few years of operation has achieved the status of a SuperMAG contributor. ENIGMA monitors the variations of the geomagnetic field associated with the occurrence of geospace magnetic storms and magnetospheric ultra low frequency (ULF) electromagnetic waves. One of the ENIGMA main research objectives is the study of space weather effects on the ground, i.e., Geomagnetically Induced Currents (GIC).
Democritus University of Thrace

Prof Konstantinos Kourtidis

Infrastructures:

Demokritus University of Thrace (DUTH) XANTHI Site of Atmospheric electricity measurements:

<table>
<thead>
<tr>
<th>Name of site</th>
<th>DUTH Xanthi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site location (including lat/lon)</td>
<td>Demokritus University of Thrace, Campus, 67100 Kimeria-Xanthi, Greece 41.15° N, 24.92° E, 75 m ASL</td>
</tr>
<tr>
<td>Host institute for the site</td>
<td>Demokritus University of Thrace</td>
</tr>
<tr>
<td>Site point of contact</td>
<td>Prof. Konstantinos Kourtidis</td>
</tr>
<tr>
<td>Site point of contact email</td>
<td><a href="mailto:kourtidi@env.duth.gr">kourtidi@env.duth.gr</a></td>
</tr>
</tbody>
</table>
| Short summary of the site characteristics | Type: rural  
Location: At the edge of a smooth, S-facing slope with a valley reaching the seashore about 20 km to the S and the E-W oriented Rodopi Mountain Range located to the N. 1.7 km from Xanthi (population 65,000)  
Ground surface: Soil and grass  
Light-traffic road oriented east– west [traffic density of 10 (nighttime) to 150 (rush hours) cars/hr 120 m to the S  
No obstacles closer than 30 m, protruding <18° above the horizon |

<table>
<thead>
<tr>
<th>Variable</th>
<th>Device</th>
<th>Data logging</th>
<th>Sampling rate</th>
<th>Transmission</th>
<th>Retrieval and Recording</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atmospheric electric field (PG)</td>
<td>CS110 Campbell Sci.</td>
<td>Onboard CR1000 Campbell Sci.</td>
<td>1 Hz</td>
<td>Every 2min</td>
<td>Via intranet using Loggernet</td>
</tr>
<tr>
<td>Meteo (WV, Wdir, T, RH, P, Rain)</td>
<td>Wind Sentry Young (MODEL 03002L), Rotronic Hygroclip (S3), Barometer Vaisala (PTB110), Rain gauge Young (MODEL</td>
<td>No data logging. Signal digitization using ADAM modules and on line transmission to PC</td>
<td>1 Hz</td>
<td>constantly</td>
<td>Via intranet using Dasylab</td>
</tr>
</tbody>
</table>
CO2

<table>
<thead>
<tr>
<th>CO2</th>
<th>Schumann Analytics</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1-K,</td>
<td>No data logging, A/D conversion and cable connection to PC</td>
</tr>
<tr>
<td></td>
<td>1 Hz constantly</td>
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<tr>
<td></td>
<td>Cable connection using Dasylab</td>
</tr>
</tbody>
</table>

1-min data (for PG also 1 sec data) are stored at a PC which is periodically synchronized with the NIST time server.

**International Research Programs:**


**Publications:**


**Technological Education Institute of Crete**

**Prof. Filippos Vallianatos, Prof. John P. Makris and the TEICR-LGS team**

The Geophysics and Seismology Laboratory of the Technological Educational Institute of Crete (LGS-TEICR) has been ceaselessly contributing the last two decades to the advancements made in Geophysics and Seismology with emphasis to the study of broad region of Crete accumulating years of experience. Major advances were made in the field of Geophysics, based on the application of seismic and electromagnetic methods with special focus on magnetotellurics and seismoelectromagnetism.

LGS-TEICR employs advanced technology in Seismology and Geophysics and its greatest research strengths are in network seismology, tectonics, earthquake source physics, non-extensive statistical physics in seismology and geophysics, physics of geomaterials, earthquake hazard and risk assessment and mitigation, exploration and engineering seismology, theoretical seismic wave propagation, remote sensing and GIS, seismoelectromagnetism and earthquake prediction.

LGS-TEICR is concerned with the understanding the cause and mechanism of earthquakes and with determining the structure of the Earth's interior, using seismic waves and geophysical methods with emphasis to time domain electromagnetics and magnetotellurics. Its research group comprises an effective blend of scientists in the research topics of seismology, geophysics, geophysical instrumentation and geoinformatics.

LGS-TEICR coordinates or participates to a great number of national & international research programs and projects and collaborates with numerous Universities and Research Institutes abroad (mainly European and Japanese).
Affiliated with LGS-TEICR is UNESCO Chair on “Solid Earth Physics and Geohazards Risk Reduction”, holder Prof. Filippos Vallianatos, and its mission is to provide leadership, expertise and research into creating a sustainable geoenvironment through the understanding of Earth Physics laws.

**IAGA related activities in the recent past:**

Since 2012 a great number of onshore magnetotelluric (MT) and Transient Electromagnetic (TEM) measurements have been conducted in Southern Aegean, Greece. The survey included Crete, almost all the islands of Dodecanese and Southern Cyclades, Southern Peloponnese, and the islands Kithira, Antikithira and Gavdos. The bi-annual campaign comprised more than 40 broad-band MT soundings combined in most cases with TEM, in order to contribute to the investigation of the geoelectric structure of Southern Aegean, and particularly of the Hellenic Subduction Zone.

A number of seismoelectromagnetic (SEM) stations have been installed and continuously operated until the end of 2015 in the south front of the Hellenic Arc. The first one installed in early 2013 at Omalos plateau, W. Crete (N35.33, E23.89). The second one installed on April 2014 in Rhodes Island (N36.17, E27.97). By constraining the study of seismicity in the geographical window N34.5 – 37.0, E22.5 – 29.0 and for the time period from July 2013 till April 2015, there is manifestation of possible precursory seismoelectric signatures observed at either station for the majority of earthquakes above M 4.5.

LGS-TEICR collaborated with INGV’s Project Unit “Measurements and Methods in Environmental Geophysics” for the implementation in Crete of ELF-VLF seismo-electromagnetic stations based on a prototype system with a customized broadband antenna (Nardi et al, 2007) aiming to investigate the existence VLF signals similar to VLF electromagnetic emissions from rock samples with various lithologies subjected to fracture to uniaxial compression in the laboratory.

Since April 2005 and for more than six years, there was a fruitful collaboration between LGS-TEICR and the Project Unit “Physics of the Upper Atmosphere” of INGV for oblique-incidence ionospheric sounding as a tool to test ionospheric radio propagation prediction methods. Several oblique sounding campaigns were conducted using Barry Research transmitters/receivers located in UK, Italy and Greece. Regular ionospheric measurements have been performed over the radiolinks Inskip (N53.51, W2.51, UK) – Rome (N41.81, E12.51, Italy) and Inskip – Chania (N35.71, E24.01, Greece) where the receivers were placed. Different long-term (i.e. monthly median) ionospheric predictions and nowcasting techniques and models have been applied and compared with the oblique-incidence radio sounding measurements, as well as the test and validation of the innovative IONORT-ISP system.

During the period 2007 till 2012 INGV and TEI of Crete managed a network of two high sampling rate (50 Hz) GNSS receivers at low latitude Mediterranean sites: Lampedusa (Sicily) and Chania (Crete). The research activities focused on the morphology and dynamics of the ionospheric plasma to improve the capabilities of TEC and scintillation mapping and modelling. The collaboration was extended into the MIRTO (Mediterranean Ionosphere with Real-time TOmography) project aimed to realize a prototype system able to produce real-time imaging of the ionosphere over the Mediterranean region.