Institute for Astronomy, Astrophysics, Space Applications and Remote Sensing

IAASARS

Executive Summary

Evaluation

2013 - 2017

IAASARS

Institute for Astronomy, Astrophysics, Space Applications and Remote Sensing

NATIONAL OBSERVATORY OF ATHENS

I. Metaxa & Vas. Pavlou str., 15236, Penteli, Attiki, Greece

IAASARS Evaluation 2013 – 2017

Executive Summary

The Institute for Astronomy, Astrophysics, Space Applications and Remote Sensing (IAASARS) is one of the three institutes of the National Observatory of Athens (NOA). It obtained its current structure in 2012, after the merging of two Institutes: the Institute of Astronomy and Astrophysics, which carried on the tradition of optical astronomy in Greece since the establishment of the Observatory of Athens in 1842, and the Institute for Space Applications and Remote Sensing, which evolved from the old Ionospheric Institute, founded in 1955.

Scientific mission and disciplines

IAASARS mission is to carry out state-of-the-art basic and applied research in ground-based and space-borne astrophysics, from distant galaxies to the solar neighborhood, as well as near-Earth space physics, remote sensing, earth observation and signal processing. In particular, the three (3) main scientific disciplines represented by the Institute are: (i) Observational Astrophysics using both space and ground-based facilities, (ii) Solar-Terrestrial Environment - Space Physics, encompassing Solar and Heliospheric Physics and Ionospheric Physics, and (iii) Remote Sensing and Machine Learning for Signal/Image Processing.

Staff

Each discipline is supported by the scientific and technical staff who are responsible for boosting cutting-edge research as well as scientific and technological excellence. At the end of 2017 the permanent staff of the institute consisted of the Director, 23 researchers, 2 functional scientific personnel, 3 research support specialists and 2 technicians. Moreover, 27 postdoctoral researchers and 21 scientists & engineers under research training (i.e. students) were on term contracts, making IAASARS the largest institute in its field in Greece.

Infrastructure

The Institute operates a wide range of national facilities aiming to support research and services in the respective disciplines, including: (a) the Aristarchos 2.3m and Kryoneri 1.2m telescopes and corresponding instrumentation; (b) the European Digital Upper Atmosphere Server System - DIAS and the Athens Digisonde DPS4D station for monitoring the ionosphere; (c) the BEYOND Center of Excellence maintaining satellite acquisition antennas and computational infrastructure; (d) the remote sensing part of the PANGEA climate observatory of Antikythera; (e) the ENIGMA Hellenic GeoMagnetic Array; (f) the Optical and Electronic Laboratory in Penteli.

Excellence

The excellence of the Institute is demonstrated by the two ERC Grants received in the past two years, one in the field of Astrophysics and the other in Earth System Sciences. In addition, members of the Institute coordinate competitive H2020 projects in the area of Space Weather and Earth System Sciences, indicating European leadership in the specific fields of expertise. Through the TechTIDE H2020 Research and Innovation Action, IAASARS is developing the first worldwide warning system for Travelling Ionospheric Disturbances exploiting the expertise of 13 organizations in Europe and in US and to support operators for the development of mitigation technologies able to protect critical aerospace and ground infrastructures from ionospheric disturbances triggered by space weather effects. Furthermore, under the leadership of IAASARS and with the participation of 8 European partners, HESPERIA H2020 Research and Innovation Action develops novel and unique worldwide forecasting tools for High-Energy Solar Energetic Particles (SEPs). Finally, IAASARS is a regional coordinator of the GEO-GRADLE Coordination and Support Action, integrating the Earth Observation activities in the regions of North Africa, Middle East and Balkans, establishing links with GEO related initiatives and Copernicus. The coordination role for IAASARS on space science activities is also critical as it concerns its role as a national hub for the Space Agencies (ESA, EUMETSAT) and other relevant organizations and bodies within the European Union (GEO, WMO). Some highlights include the activity of IAASARS in the ESA Space Situational Awareness programme to improve the monitoring and understanding of potential Earth hazards by developing experimental methods and analysis techniques to study the Impact of asteroids on the Moon. ESA has also singled out IAASARS to produce time-domain value-added products for the Hubble Space Telescope Archive. Last but not least, IAASARS has increased its competitiveness in all H2020 Excellence frameworks such as the ERC, Marie Curie and COST actions, while the Institute successfully participates in important Space/Copernicus initiatives and programs as well as large European Research Infrastructures (ESFRIs) such as ACTRIS and EST, or to funded European networks such as OPTICON and AHEAD.

Technology and innovation

IAASARS is active in converting basic and applied research into services and technological developments, connecting the research outcomes with entrepreneurship and the Greek industry. Within the evaluation period, IAASARS has provided knowhow to the Greek Industry for developing sophisticated surface-based and airborne remote sensors, including prototypes such as advanced ground-based polarization lidar systems for atmospheric research (WALL-E, EVE, EMORAL systems). Moreover, IAASARS has been designing and developing instrumentation for astronomical observations, such wide-field imaging cameras (e.g. MAWFC, AWFC) and spectrographs (ATS). Researchers of the Institute are members of the consortium that develops and tests the Wide-Field Imager detector for the ATHENA

mission. ATHENA is an ESA L-class X-ray Astronomy mission that will launched in 2028

Services to the State and the public

IAASARS offers critical information to the Greek State Authorities and the public, through the operation of its centers for providing dedicated services on Natural Disasters, Climate Change and Space Weather. This mission of IAASARS is largely fulfilled by the BEYOND Center of Excellence for the provision of services in the framework of the European Union's flagship program Copernicus. The emphasis of the Center's activity is on Emergency Response (Copernicus/Emergency Management Support), monitoring and protection of the Marine and Atmospheric Environment, as well as applications on Agriculture, Renewable Energy, and Climate Change Adaptation and Resilience, including a vast portfolio of natural disasters. Another flagship initiative of NOA is the establishment of the "PANhellenic GEophysical observatory of Antikythera (PANGEA)" in 2017, following the monitoring standards of the World Meteorological Organization (GAW/WMO), for the continuous observation of Essential Climate Variables representative for the Mediterranean. PANGEA aims to address a number of societal objectives related to challenges such as the climate change and its impact on severe weather and natural disasters in Greece and the Eastern Mediterranean. IAASARS has the major contribution to PANGEA through the operation of the remote sensing facilities. Furthermore, IAASARS is providing continuously and in real-time, innovative standardized and validated services to the European Space Agency Space Situational Awareness Programme for the Space Weather System of Federated Services, through the European Ionosonde Service that is supported from the DIAS system.

Outreach and Education

The Institute has a solid record of nearly 20 years of a public outreach and science education program. This includes special seminars, talks, and observations with the historic telescopes of the Institute. During the 5-year period, the Visitor Centers of IAASARS in Penteli and Thiseio were totally refurbished and since then, the Centers attracted more than 200.000 people and about 3000 schools. Other educational activities of the Institute include the annual astrophysics summer school for high-school seniors, regular organization of international conferences and a vigorous seminar program. Starting from 2016, IAASARS co-organizes with the University of Peloponnesus the Master’s Degree program "Space Science Technologies and Applications".

Performance metrics

(please also refer to the diagrams included in the Appendix)

The scientific activity within the evaluation period 2013-2017, resulted in more than 300 papers in refereed scientific journals with more than 15000 citations from third-parties. IAASARS has been also granted one patent for its Service on forest fire detection FireHub. Moreover, despite

the economic crisis during the evaluation period, the scientists of the Institute have been successful in attracting on average more than 2 M€ per year in national and European competitive research grants, which is almost double than the income. Specifically, IAASARS attracted a total of 10.4 M€ within the period 2013-2017, while received 5.7 M€ from the Greek State (that is salaries of the permanent personnel). Thus IAASARS, provided novel applied and basic research results, services and public outreach activities, supporting at the same time nearly 50 full-time soft money positions (postdocs, engineers and IT support) at zero cost to the taxpayers.

SWOT analysis

Strengths

- Scientific excellence (e.g. observational astrophysics, space physics, earth system sciences) with extended network of collaborations worldwide.
- State-of-the-art instrumentation (Aristarchos Telescope, refurbished 1.2m Kryoneri Telescope, Upgraded Athens Digisonde DPS4D, BEYOND infrastructure, DIAS infrastructure, PANGEA observatory)
- Operational Centers and flagship initiatives for real time provision of services to the State and the public (BEYOND, DIAS, PANGEA)
- Participation in large European Research Infrastructures (ACTRIS, EST) and funded networks (OPTICON, AHEAD)
- Participation in large consortia and to key international activities (GEO, WMO)
- Coordination of large consortia funded by the European Commission and the European Space Agency
- The diversity of the Institute expertise that creates opportunities for cross-field collaborations

Weaknesses

- Limited manpower at the permanent-staff level. Key members of IAASARS will be retiring by the end of 2018 (Dapergolas, Bellas).
- Lack of systematic technical support, e.g. for server maintenance and upgrades, operation of large infrastructures (e.g. NOA telescopes, BEYOND, PANGEA, DIAS, DPS4D).
- The IAASARS premises require significant upgrades and extensions to ease severe pressure on working-space produced by the large number of contractors employed by the Institute.
- The administrative, grant management and legal support by NOA does not meet expectations despite the high overhead rate.

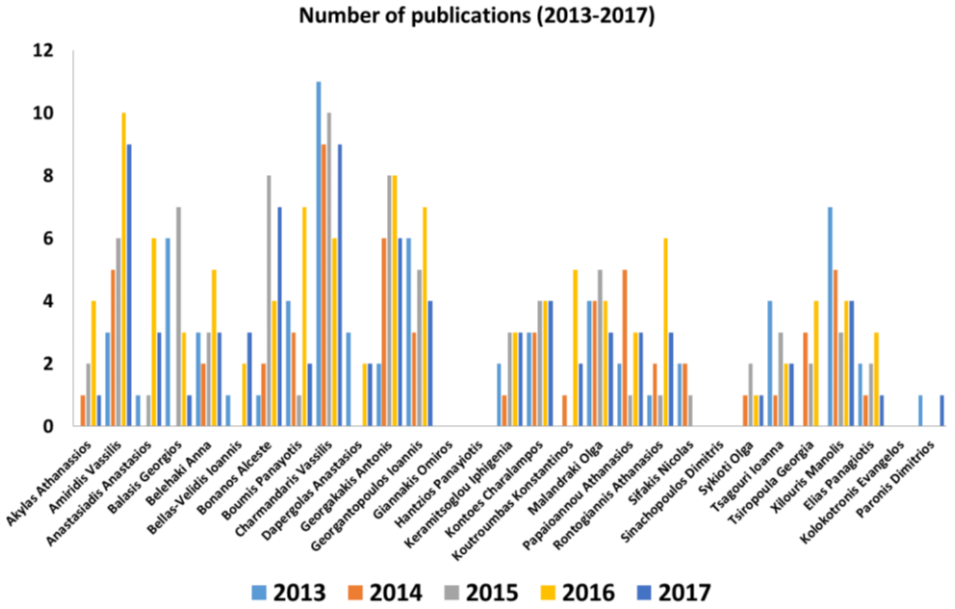
Opportunities

- Involvement of the Institute researchers in many major upcoming and future missions and international collaborative programmes.
- The refurbished 1.2m Kryoneri telescope, the upgraded Athens Digisonde, the BEYOND center of excellence and the PANGEA observatory are attractive to various science projects which can support their operation.
- BEYOND may develop as the focal point for monitoring of the environment and management of natural disasters in the Mediterranean.
- PANGEA will contribute substantially to the development of Antikythera as “the island of science”, capable of offering Physical Access to scientists and young researchers for using the research equipment for their scientific projects.
- Open Access scientific data and model infrastructures such as DIAS, BEYOND and PANGEA, that can be used as a test bed for testing and validating the performance of new scientific models, expandable to integrate new data from ground-based facilities and space missions.
- IAASARS researchers are able to provide consultancy to space agencies and large organizations for the planning of space missions and the optimum exploitation of data.

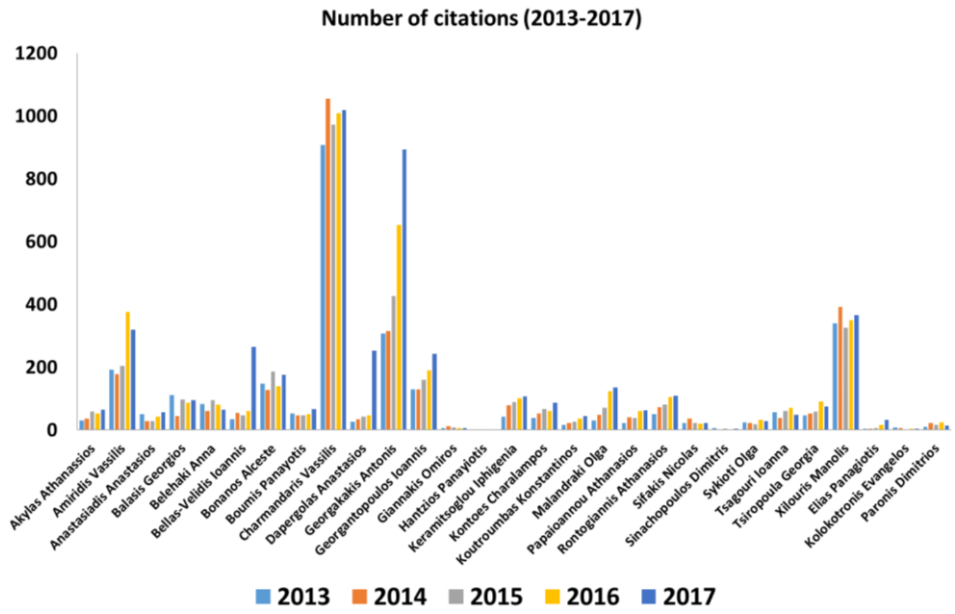
Threats

- Ability to maintain the technological and scientific expertise and know-how in the Institute, given funding fluctuations and the large number of scientists employed on short-time contracts.
- Low-level of funding available to support and maintain the large research infrastructures (Aristarchos, PANGEA, DIAS etc) as well as obtain new instrumentation.
- Probability of failure to meet the operating costs due to the crisis
- Serious competition in Europe and worldwide in seeking funding from new research projects – national support is required at EC and ESA level.
- Increasing bureaucracy.

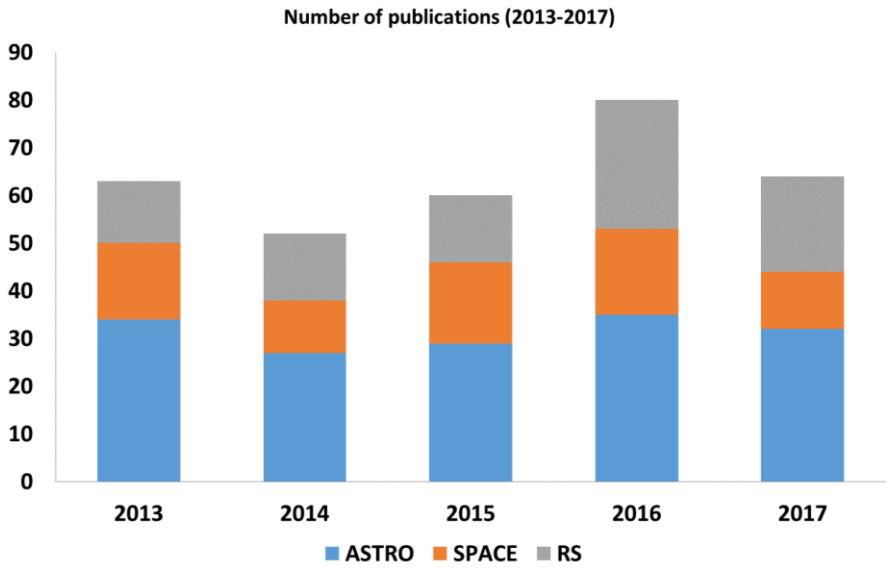
APPENDIX
Diagrams of the IAASARS performance metrics



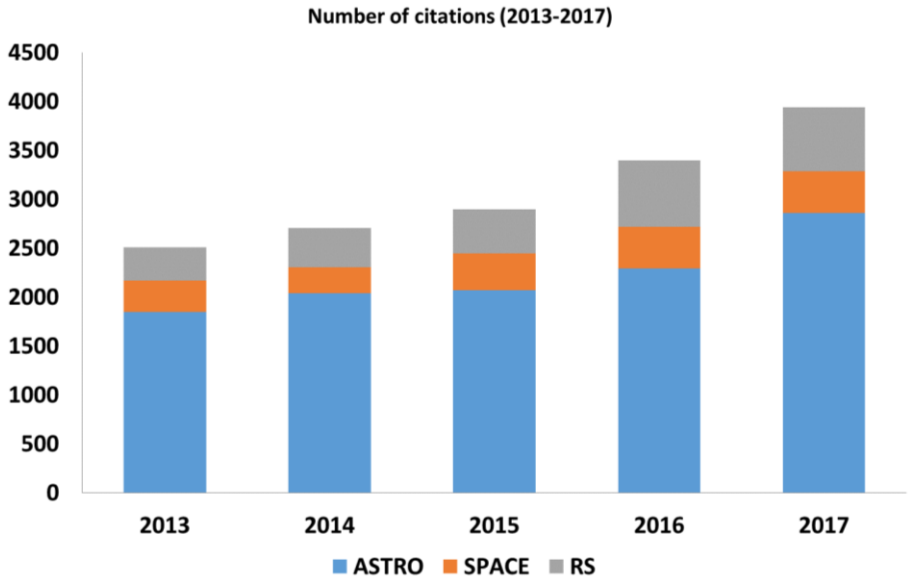
A histogram of the refereed papers published by the research personnel *(source ISI-Web of Science)*



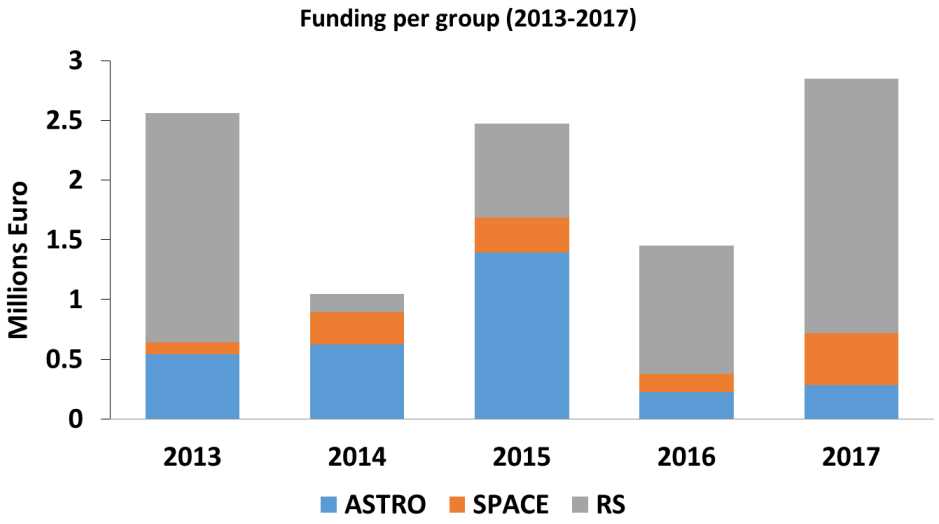
A histogram of the citations to refereed papers published by the research personnel *(source ISI-Web of Science)*



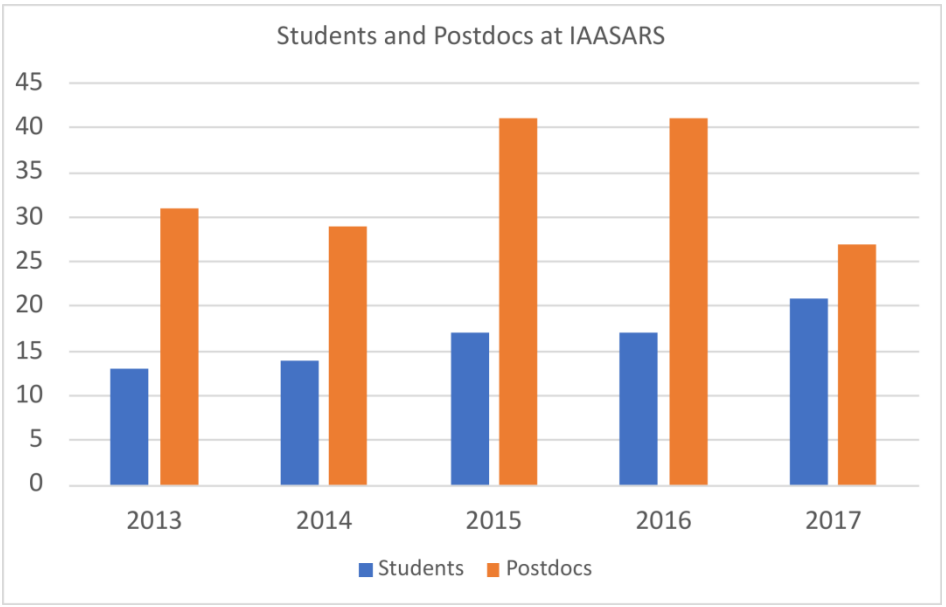
A histogram of the refereed papers per IAASARS discipline *(source ISI-Web of Science)*



A histogram of the citations per IAASARS discipline *(source ISI-Web of Science)*



A histogram of the external funding from competitive grants awarded to researchers *(per IAASARS discipline)*



A histogram of PhD students and postdoctoral researchers of IAASARS