

International Association of Geomagnetism and Aeronomy

Activities' Report - Year 2016

Delegate: U. Villante

1. Introduction.

IAGA is concerned with the understanding and knowledge that result from studies of the magnetic and electrical properties of:

- the Earth's core, mantle and crust
- the middle and upper atmosphere
- the ionosphere and the magnetosphere
- the Sun, the solar wind, the planets and interplanetary bodies.

Research activities in these fields are developed in Italy at several universities and major national research organizations, such as the National Institute of Geophysics and Volcanology (INGV), the National Institute for Astrophysics (INAF), the National Research Council (CNR). These activities are usually conducted in the frame of international projects and collaborations and in the context of the traditional Divisions, Interdivisional Committees and Working Groups of IAGA. They involve relevant numbers of researchers, technicians, doctoral students; this broad involvement of institutions, facilities and networks testifies the high degree of interdisciplinarity and the need for a relevant expertise.

IAGA-Italia promotes the coordination of such activities, the development of new ones, the organization of workshops, meetings and schools. For these scopes, the IAGA-Italia community is coordinated by a National Committee, currently composed as follows:

President:

- U. Villante: Università degli Studi dell'Aquila – National Delegate.

Members:

- L. Vigliotti: CNR/Istituto di Scienze Marine (ISMAR), Bologna – Vice-Delegate, Coordinator Division I “Internal Magnetic Field”;
- M. Pezzopane: INGV, Roma, - Coordinator Division II “Aeronomical Phenomena”;
- G. Consolini: INAF-IAPS, Roma, Coordinator Division III “Magnetospheric Phenomena”;
- R. Bruno: INAF-IAPS Roma, Coordinator Division IV “Solar Wind and Interplanetary Magnetic Field”;
- L. Cafarella: INGV, Roma, Coordinator Division V “Geomagnetic Observatories, Surveys, and Analyses”;
- A. Siniscalchi: Università di Bari, Coordinator Division VI “Electromagnetic Induction in the Earth and Planetary Bodies”;
- A. De Santis: INGV, Roma, Coordinator Interdivisional Commission on “History”;
- F. Berrilli: Università Roma Tor Vergata, Coordinator Interdivisional Commission on “Education and Outreach”.

IAGA-Italia has also activated its own website at <http://www.iagaitalia.it> for the dissemination of data, news and documentation related to IAGA.

2. Main activities carried on by IAGA during 2016 relevant for Italy.

MT3DINV3: 3rd Workshop on 3-D Magnetotelluric Inversion (Bari, May, 15-18 <https://www.dias.ie/mt3dinv3/Home.html>); organized by A. Siniscalchi, Coordinator Division VI. The workshop has given the opportunity to bring together code writers and users and assess how well the codes are performing as well as how they are understood from the users. All the attendees earned a place at the workshop by performing one or both of the following tasks: forward modeling a test model (DTM3), or inverting the secret model (DSM3). The workshop has been web-cast in order to give the opportunity to all the scientists not able to attend to follow the event (<https://www.youtube.com/user/unialdomoro/videos>). The workshop was preceded by a training day on ModEM, a 3D magnetotelluric inversion code made by G. Egbert, A. Kelbert and N. Meqbel. The code, free available for the whole electromagnetic community for academic purpose, is becoming one of the most used tool for performing 3D MT inversions. The workshop, highly succesful, was attended by participants from Australia, Canada, China, France, Germany, Iran, Ireland, Italy, Japan, Poland, Russia, Spain, Switzerland, United Kingdom, USA. It received financial support by several private companies and scientific entities (IAGA, EGU, IMAA/ CNR, University of Bari).

International conferences with a relevant Italian participation:

- International EMSEV-CSES 2016 workshop (Beijing and Lanzhou)
- Open Study Conference (Rome) of the ESA-funded project SAFE on the Swarm data analysis in searching pre-earthquake EM signals.
- European Geophysical Union General Assembly (Vienna).
- SCAR General Assembly(Kuala Lumpur).
- AGU General Assembly (San Francisco)
- UN COPUOS Space Weather Workshop: "From Scientific Discovery to Applications, Services, and Infrastructure Protection" (Vienna).
- 13th European Space Weather Week (Oostende).
- International Beacon Satellite Symposium (Trieste).

Main activities of IAGA-ITALIA:

- Management of magnetic observatories at Durlin, Castello Tesino, Lampedusa, Baia Terra Nova (Antarctica, 74.4 S, 164.1 E), Concordia (Antarctica, 75.1 S, 123.2 E) and publication of yearbooks, bulletins, K indices, SSC and solar flare list.
- Management of paleomagnetic laboratory at Rome (INGV), Peveragno (Ciman-ALP CIMAN - Centro Interuniversitario di Magnetismo Naturale "Roberto Lanza", Universities of Milano, Torino, Urbino, Parma, RomaTre, Chieti-Pescara, and INRIM Institute of Turin), Bologna (ISMAR-CNR).
- Management of radars of the SuperDARN international network at Concordia station (Antarctica, 75.1 S, 123.2 E).
- Management of the Italian cosmic ray observatory of Rome, SVIRCO, and publication of monthly/annual reports of cosmic ray measurements, multiplicity and diurnal wave. Data are also provided in real time to the Neutron Monitor Database web site (www.nmdb.eu) and to ESA SSA Space Radiation Expert Service Centre (swe.ssa.esa.int/space-radiation) for space weather applications.
- Management of ITACA² auroral all-sky camera at Ny-Alesund (Svalbard). This is the Italian contribution to MIRACLE network.
- Management of the surveys for the publication of Italian magnetic cartography.
- Management of the permanent magnetic network of Etna volcano area, with the aim to detect and isolate local magnetic variations related to volcanic activity.
- Lampedusa observatory started its operations as observatory.
- A new AIS-INGV ionosonde was installed at Bahia Blanca, Argentina (38.7 S, 62.3 W).

- Two new multi-constellation receivers for measuring TEC and ionospheric scintillations were installed at Baia Terra Nova and Concordia. These receivers integrate themselves in the INGV ISACCO network operating since 2003.
- South Pole Solar Observatory installed at Amundsen–Scott South Pole Station (NSF project with Italian participation) for the multispectral observation of solar magnetic field and dynamics.

3. Activities carried on by the Italian Delegate and National Committee during 2016 and impact on the Italian scientific community.

As in the past, the Italian Delegate and the National Committee have developed their activity paying attention mainly to the following aspects: participation of IAGA-Italia to scientific programs and international meetings; development of new initiatives at national level, with particular reference to the cooperation between universities, research institutions and industries; tutoring and training of young researchers and students, encouraging their participation to IAGA activities. It should be stressed that the Italian presence, often with major responsibilities, is particularly active and qualified in international programs devoted to the study of the Earth and the circumterrestrial space, to space missions related to Earth Observations, to the physics of the Sun, to the Interplanetary Space, to the Sun-Earth Relations.

Pursuing the efforts developed during 2015, the new

- Division VI: "Electromagnetic induction in the Earth and Planetary Bodies"
 - Interdivisional Commission on "Space Weather"
- have been established in IAGA-Italia.

The coordination of the research activity of IAGA-Italia has been promoted by two meetings of the National Committee. The National Committee has also promoted a new call among scientists that matched the interest in joining IAGA of several new researchers.

Regarding the training activities, in the frame of the International School of Space Science, the following courses were organized:

- "Ground based and space instruments for future researches in Solar-Terrestrial physics". L'Aquila 6-11 June 2016 (20 Italian participants).
- "Planetary Interiors, L'Aquila 11-17 Sept. 2016 (22 Italian participants).

Both schools were attended also by many IAGA participants from other countries.

4. Evaluation of Italian attendance and how to improve interest and involvement.

The Italian attendance in IAGA activities, and in particular at the General Assembly, is generally high. Several Italian researchers are routinely involved as organizers of workshops and chairmen in IAGA sessions. G. Consolini (IAPS/INAF), coordinator of Division III, will be co-convenor of the joint IAGA-IAMAS session: "Space weather throughout the solar system: Bringing data and models together" at the IAPSO/IAMAS/IAGA Assembly in Cape Town (27 August-1 Sept., 2017).

One of the priorities of IAGA-Italia is to give a better visibility of the Association within the scientific world and toward the young scientists. To improve the relationships with other IUGG Associations is one of the challenges of the IAGA-Italia strategy. In particular, IAGA-Italia is planning the organization of a National Conference (mostly devoted to young researchers), open to scientific communities working in related areas. The conference aims also to bring together scientists with different expertise focusing on interdisciplinary work related to magnetism, atmosphere, ionosphere, space-plasma physics, gravity field, geophysics, geodynamics, geology, etc.

5. Italian experts with important roles within the Union or within related Commissions and Programs.

- F. Florindo (INGV) is the chairman of the Working Group I.2 “Paleomagnetism” of the IAGA Division I - Internal Magnetic Fields.
- Members of the IAGA National Committee have been included in the IUGG Network of Italian Experts.
- A. De Santis (INGV) is President of Earth Magnetism & Rock Physics Division of European Geophysical Union and Member in the ASI Committee on ESA satellite Earth Observation Missions.
- A. Meloni is President of the National Scientific Commission for Antarctica.
- L. Cafarella (INGV) and D. Di Mauro (INGV) are Italian references for the European magnetic network.
- G. De Franceschi (INGV) is the leader of the SCAR expert group GRAPE (GNSS Research and Application for Polar Environment).
- V. Romano (INGV) is the Italian expert on Space Weather at ONU COPUOS (Committee on the Peaceful Uses of Outer Space) and Italian co-coordinator of ISWI (International Space Weather Initiative).
- F. Berrilli (University of Rome Tor Vergata) is Delegate for Space Science in ASI Planetary Science Board, and SPIN-IT/CTNA Delegate in “PROTECTION of European assets in and from space” in ASI-H2020 Team.
- V. Carbone (University of Calabria) is President of SWICO-Italian Space Weather Community (www.swico.it)

6. Projects of interest in the framework of IAGA (and related IUGG Associations).

IAGA-Italia community is involved in several international programs such as:

- **EMSO and EPOS ERICs.** Some of the IAGA activities are performed within the framework of these two European Research Infrastructure Consortia that have their main centre at INGV.
- **ESA-BEPI-COLOMBO-MPO**, the community participates with several PI-ships and CoI-ships (SIMBIO_SYS, SERENA, ISA, MORE).
- **ESA-Solar Orbiter**, the community participates with one PI-ship and several CoI-ships for the coronagraph spectrometer METIS, one CoPI-ship and several CoI-ships for the plasma suite SWA.
- **ESA-PROBA-3**, the community participates with one Lead CoI-ship and several CoI-ships for the coronagraph ASPICS.
- **ESA-Cluster**, the community participates with several CoI-ships for the ion spectrometer, CIS, and actively in the analysis of data and related scientific works.
- **ESA-THOR** (M4 candidate), the community participates with a PI-ship and several Co-ships for the PPU (Particle Processing Unit) and PIship and several CoI-ships for numerical simulations.
- **ESA-IBISCO** (Ionospheric environment characterization for Biomass Calibration over South East Asia) funded in the *framework* Alcantara aimed to the study of the ionospheric morphology at low latitudes in the South East Asian sector as a support to the satellite mission BIOMASS.
- **ESA-IRIS** (Ionospheric Research for Biomass in South America) funded in the *framework* Alcantara aimed to the study of the ionospheric morphology at low latitudes in the South America sector as a support to the satellite mission BIOMASS.
- **ESA-SAFE** (Swarm for Earthquake study): to study Swarm satellite electromagnetic data for searching earthquake related anomalies with INGV leadership.

- **ESA-TEMPO**: to study the South Atlantic anomaly and its future evolution.
- **ESA ITT No. AO/1-7699/13/D/MRP Space Situational Awareness Programme P2-SWE-1**, Space Weather Expert Service Centers: Definition and Development.
- **ESPAS** (near-Earth SPace data infrastructure for e-Science, FP7-INFRASTRUCTURES-2011/2012), aimed to the implementation of an e-Infrastructure necessary to support the access to observations, the modeling and prediction of the Near-Earth Space environment.
- **EST** (European Solar Telescope), is a ESFRI European Project ; the community participates for the design and realization of several subsystems, including: Broad Band Imager, Spectropolarimeter, Heat rejector, Multi-Conjugate Adaptive Optics, Telescope Control, Data Handling and VO, with the leadership in some of these.
- **FWF** (Austrian Science Fundation). Cyclostratigraphy and the astronomical time scale for the Tethyan Campanian (Late Cretaceous).
- **GENERALITAT DE CATALUNYA**. Dinàmica ecològica de la darrera extinció en massa: el Pirineu com a laboratori fòssil.
- **GENERALITAT DE CATALUNYA**. Evolució dels ecosistemes amb faunes de vertebrats del Permian i el Triàsic de Catalunya.
- **GRAPE** (GNSS Research and Application for Polar Environment) Expert Group funded by SCAR.
- **INSIEME** (Induced Seismicity in Italy: Estimation, Monitoring, and sEismic risk mitigation), Project supported by the SIR-MIUR research program.
- **IPS** (Ionospheric Prediction Service)-EC project to translate the prediction and forecast of the ionosphere into tangible results and user-devoted metrics. Realization of ionospheric prediction service prototype and provision of a service, with early warning and predictions on the ionospheric events.
- **LIMADOU-SCIENCE**: An Italian Space Agency funded project for studying CSES (Chinese Seismo-EM satellite) satellite electromagnetic data for searching earthquake related anomalies.
- **MED-SUV** (MEDiterranean Supersite Volcanoes) FP7 project.
- **MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD, (Spain)**. Climatic-environmental feedback under global warming conditions: lessons from the Maastrichtian-Eocene of the Iberian peninsula (ReCliAME).
- **MISW** (Mitigation of space weather threats to GNSS services - FP7-SPACE-2013-1) will tackle the research challenges associated with GNSS (Global Navigation Satellite System) and Space Weather to bring practical solutions right into the forefront of European Industry.
- **Mitigation of space weather threats to GNSS services (MISW)**, the community participates with one PI_ship and several Col_ships
- **MIUR PRIN**. Birth of an ocean in the Red Sea: Geodynamics, geochemistry, and high-resolution plate kinematics.
- **MIUR PRIN**. GSSP (Global Stratigraphic Section and Point) del Piano Burdigaliano: il tassello mancante all'intervallo Neogenico della Scala del Tempo Geologico.
- **MIUR PRIN** The active sun and its effects on space and Earth climate
- **PNRA**. TRACERS (TephRoChronology and mArker events for the CorrElation of natural archives in the Ross Sea, Antarctica).
- **PNRA**. ODYSSEA (PNRA D.D. 651 del 05/04/2016, PNRA16_00205 - A4). Resp. A. Winkler (INGV)
- **PNRA14_00097** - Linea A1 "Osservatorio geomagnetico presso la Stazione Concordia, Dome C, Antartide; responsabile: S. Lepidi (INGV).
- **PNRA14_00106** - Linea A1 "Osservatorio Geomagnetico a Stazione Mario Zucchelli"; responsabile: D. Di Mauro (INGV).

- **PNRA 14/110** "Upper Atmosphere Observation and Space Weather".
- **PNRA 14/00133** "Bipolar Ionospheric Scintillation and TEC"
- **PNRa.** Project concerning SuperDARN DCE-radar at Concordia station (Antarctica).
- **PNRA.** Bipolar study of magnetospheric phenomena using SuperDARN and optical and magnetic observations (PNRA 2013/AC3.08) Resp. M.F. Marcucci.
- **SOPRINTENDENZA ARCHEOLOGIA BELLE ARTI E PAESAGGIO PER LE PROVINCE DI ALESSANDRIA, ASTI E CUNEO:** "Megalopolis and Kozarnica: the oldest archeological sites in the Balkans: Dating earliest human presence in Europe during the Pleistocene". (Resp. G. Muttoni, Università di Milano).
- **SWERTO** (Space-Weather at the University of Rome Tor Vergata) financed by LazioInnova Regione Lazio. On-line data-base for space (e.g., PAMELA, ALTEA) or ground-based instruments (e.g., IBIS, MOTH) relevant to the determination of Space-Weather conditions (www.spaceweather.roma2.infn.it).

7. Conclusions.

Supporting the Italian participation in IAGA is an important strategic decision for our Country. This participation must be encouraged by supporting young Italian researchers (fellowships; awards) and facilitating their international mobility. It is also important to create awareness in the national scientific community about the role that Italy can play internationally on the basis of the remarkable scientific skills and of the availability of high standard instrumentations and observational networks. To improve the visibility of the Italian scientific community it would be useful to provide the co-financing of IAGA initiatives and thematic workshops to be organized in Italy. To develop among young researchers more interest and involvement it should be permanently established an award for their participation at the General Assembly.

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L'Aquila, 5 Maggio, 2017