International Association of Geomagnetism and Aeronomy

Activities' Report - Year 2017

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

and their possible interconnections.

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:

IAGA Italian Committee

President: U. Villante: Universiy of L'Aquila – National Delegate.

Members:

- L. Vigliotti: CNR/ISMAR, Bologna – Vice-Delegate, Coordinator Division I "Internal Magnetic Field";
- M. Pezzopane: INGV, Roma, - Coordinator Division II "Aeronomic 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 Analysises";

- A. Siniscalchi: University of Bari, - Coordinator Division VI "Electromagnetic Induction in the Earth and Planetary Bodies";
- A. De Santis: INGV, Roma, - Coordinator Interdivisional Commission on "History";
- F. Berrilli: University of 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 2017 relevant for Italy.

The main activities carried on by IAGA Italia have been the following:

a) SuperDARN Workshop 2017, 4-9 June, 2017, San Quirico d'Orcia (Siena). Hosted and organized by INAF-Istituto di Astrofica e Planetologia Spaziali (Roma), the workshop, which is an annual event of the SuperDARN community, has represented the occasion to gather the scientific community involved in SuperDARN and high latitude ionospheric studies coming from more than 10 countries, in order to fruitfully discuss new science results, share technical and data analysis developments, and coordinate the SuperDARN activities. More in general, researchers presenting studies and exchanging knowledge in the upper atmosphere, ionosphere and magnetosphere physics, which are central for SuperDARN investigation field, had the opportunity to confront on the recent advancements in the related fields.

b) International conferences with a relevant Italian participation:

- Joint Assembly IAGA-IAMAS-IAPSO (Cape Town).
- IAU Symposium, Space Weather of the Heliosphere: Process and Forecast (Exeter), UK.
- Swarm satellite Mission Science Conference, Bath (Canada)
- Swarm 4D-Ionosphere science meeting, ESTEC (Eindhoven).
- Panamerican Geomagnetism and Paleomagnetism Conference, Vassouras (Brazil).
- International Conference on Rock Magnetism 2017 (Utrecht).
- European Geophysical Union General Assembly (Vienna).
- AGU General Assembly (New Orleans).
- 14th European Space Weather Week (Oostende).
- 7th Solar Orbiter Workshop (Granada).
- Our mysterious Sun: magnetic coupling between solar interior and atmosphere (Tbilisi).
- Parker Solar Probe-Solar Orbiter Joint Meeting (Baltimore).
- AOGS 2017 (Singapore).
- 6th Int. Colloquium: scientific and fundamental aspects of GNSS/Galileo (Valencia).
- International Reference Ionosphere workshop (Taoyuan City) Taiwan.
- Workshop "Space Weather: A Multi-Disciplinary Approach" (Leiden).
- ICRC - International Cosmic Ray Conference (ICRC) (Seoul), Korea.
- URSI GASS (Montreal), Canada.
- 16th Annual International Astrophysics Conference (Santa Fe).
- Arcetri 2017 Workshop on Plasma Astrophysics.
- Fourth Swarm Science Meeting and Geodetic Missions Workshop (Banff) Canada.
- 103° Congresso Nazionale della Società Italiana di Fisica (Trento).

2b) Management of Observatories and related activities.

- Management of magnetic observatories at Duronia, 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.

- Magnetic and electromagnetic surveys in archeological area of Hadrianopolis and Antigonea (Albania), and Villa Adriana, Tivoli.

- 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 ITACA^2 auroral all-sky camera at Ny-Alesund (Svalbard). This is the Italian contribution to MIRACLE network.

- Management of the reduced surveys for the updating of the Italian magnetic cartography. Publication of the new magnetic cartography in collaboration with Istituto Geografico Militare (IGM).

- Management of the permanent magnetic network of Etna volcano area, with the aim to detect and isolate local magnetic variations related to volcanic activity.

- Management of four AIS-INGV ionosondes: two in Italy (Rome and Gibilmanna) and two in Argentina (Tucumán and Bahia Blanca). One digisonde is managed in Italy (Rome).

- Managements of multi-constellation receivers for measuring TEC and ionospheric scintillations are managed at Baia Terra Nova and Concordia (Antarctica), at Ny Alesund and Longyearbean (Svalbard, Norvegia), Lampedusa and Rome (Italy), Tucumán (Argentina), and Crete (Greece). A multi-constellation receiver, formerly installed at the Brazilian base in Antarctica, has been moved to Sao Paulo (Brazil).

- Management of SEGMA (South European Geomagnetic Array).

- Co-PI of EMMA (European quasi-Meridional Magnetometer Array).

- Participation to the activities of the International Consortium ULTIMA (Ultra Large Terrestrial International Magnetic Array).

- 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.

- Co-organization of the II Pan-american conference on Geomagnetism and Paleomagnetism in Vassouras (Brazil).

3. Activities carried on by the Italian Delegate and National Committee during 2017 and impact on the Italian scientific community.

a) 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.

b) **IAGA National Conference.** The Committe IAGA-Italia has planned for February, 2018 a National Conference "From the Sun to the Earth's interior" (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, geophysics, geodynamics, geology, etc. To stimulate and recognize the contribution of young researchers, the IAGA-Italia Committee has decided to provide awards for the best communications; this initiative has been much appreciated by IAGA.

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

- 11-16 June: “Cosmic Ray Physics in Space”; Directors: M. Boezio (INFN, Trieste), S. Coutu (Penn State University, PA, USA) e R. Sparvoli (University of Tor Vergata).

- 18-22 September: “Complexity and Turbulence in Space Plasmas”; Directors: G. Consolini (INAF-Istituto di Astrofisica e Planetologia Spaziali, Roma) e M. Echim (Belgian Institute for Space Aeronomy). This course has been endorsed and supported by the European Geophysical Union.

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 at the IAPSO/IAMAS/IAGA Assembly in Cape Town has been good. G. Consolini (IAPS/INAF), coordinator of Division III, has been co-convenor of the joint IAGA-IAMAS session: "Space weather throughout the solar system: Bringing data and models together".

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.

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). She has been appointed URSI (International Union of Radio Science) delegate to SCAR since 2014. She has been elected URSI Commission G vice chair for the triennium 2017-2020.

- 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).

- M. Materassi is the Italian national delegate to Commission G of URSI (Union Radio-Scientifique Internationale).

- Y. Migoya Orue' (ICTP) is National co-coordinator for Italy in 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.

- R. D'Amicis (SERCO, INAF-IAPS) is Vice-Chair of the Cospar Capacity Building.

- F. Zuccarello (University of Catania) is member of the European Solar Physics Division of the European Physics Society.

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

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

- **ASI-INAF 2015-039-R.O** "Missione M4 di ESA: Partecipazione Italiana alla fase di assessment della missione THOR"; responsabile: M.F. Marcucci (INAF-IAPS).

- **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**, the community participates with several PI-ships MPO/SIMBIO_SYS, MPO/SERENA, MPO/ISA, MPO/MORE) and CoI-ships (MPO/SIXS, MPO/PHEBUS e MMO/MPPE).

- **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-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-ICTP TECA** ("Total Electron Content Characterization Study over Africa and Application to BIOMASS mission") was a Pilot Study in the framework of the ALCANTARA Studies that involved ICTP and African researchers.

- **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-PROBA-3**, the community participates with one Lead CoI-ship and several CoI-ships for the coronograph ASPIICS.

- **ESA-SAFE** (Swarm for Earthquake study): to study Swarm satellite electromagnetic data for searching earthquake related anomalies with INGV leadership.

• **ESA-Solar Orbiter**, the community participates with one PI-ship and several CoI-ships for the coronograph spectrometer METIS, one CoPI-ship and several CoI-ships for the plasma suite SWA.

• **ESA-TEMPO:** to study the South Atlantic anomaly and its future evolution.

• **ESA Space Situational Awareness (SSA) Programme**. (contract no. 4000113184/15/D/MRP).
• **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.

• **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 Permià 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.

• **ISSI** Project (Switzerland) “Multi-technique characterization of near-Earth space environment”.

• **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).

- **MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD, (Spain**). 'Rapid geomagnetic field intensity events in the Mediterranean: trends from Late Bronze settlements and Late Roman fine wares'. Programa Estatal de I+D+i Orientada a los Retos de la Sociedad.

- **MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD, (Spain**). 'Archaeomagnetism and other analytical techniques applied to the valorization of the archaeological and historical heritage'. Programa Estatal de Investigación Científica y Técnica de Excelencia

- **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, Responsabile V. Carbone (University of Calabria).

- **MIUR PRIN** Geochemical and isotopic budget of highly metasomatised sub-continental mantle in the Africa and Europe geodynamic systems: modern and fossil analogues.

- **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).

- **PNRA - WHISPER** (West Antarctic Ice Sheet HIstory from Slope Processes – Eastern Ross Sea). D.D. 651/2016_PNRA16_00016. L. De Santis, INOGS, Trieste.

- **PNRA14_00097** - Linea A1 "Osservatorio geomagnetico presso la Stazione Concordia, Dome C, Antartide; responsabile: D. Di Mauro (INGV).

- **PNRA14_00106** - Linea A1 "Osservatorio Geomagnetico a Stazione Mario Zucchelli"; responsabile: S. Lepidi (INGV).

- **PNRA 14/110** "Upper Atmosphere Observation and Space Weather".

- **PNRA 14/00133** "Bipolar Ionospheric Scintillation and TEC".

- **PNRA 14/00085** "SuperDARN: HF ionospheric radars, DCE e DCN, at Concordia" (Antarctica), responsabile S. Massetti (INAF-IAPS, Roma).

- **PNRA16_00204 "**Temporary magnetometer network for longitudinal and latitudinal

monitoring in Antarctica"”; responsabile: Lucia Santarelli (INGV).

- **PNRA.** Project concerning SuperDARN DCE-radar at Concordia station (Antarctica).

- **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).

- **TREASURE** project n. 722023 (Training REsearch and Applications network to Support the Ultimate Real time high accuracy EGNSS solution), is a prestigious Marie Skłodowska-Curie Actions (MSCA) Innovative Training Network (ITN), funded through the European Union's Horizon 2020 Research and Innovation Programme.

- **Università di Camerino - Università di Macerata**: Acquisizione, processing e modelling di dati magnetici e GPR dei siti archeologici di Adrianopolis, Antigonea ed Urbs Salvia.

- **Università di Camerino - Università di Pavia - Oxford University:** Acquisizione, processing e modelling di dati magnetici, paleomagnetici e GPR del Sito archeologico di Villa Adriana, Tivoli.

- **Investigating the Magnetosphere through Magnetoseismology**, supported by the “International Space Science Institute” (ISSI, Bern).

7. Conclusions.

As underlined in previous activities reports, 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 and doctoral students more interest and involvement it should be permanently established an award for their participation at the General Assembly. In this sense IAGA-Italy has organized for 2018 a National Conference, with awards for young scientists.