International Association of Geomagnetism and Aeronomy

(IUGG)

Activity Report - Year 2023

Delegate: Umberto Villante

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on behalf of the IAGA Italian Committee

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 – 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”;

- S.Lepidi: INGV, L'Aquila, - Coordinator Division V “Geomagnetic Observatories, Surveys, and Analyses”;
- 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 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-Italia during 2023.

a) Management of Observatories and related activities.

- Management of a new continuous magnetotelluric monitoring station in the Gargano Promontory.

- Management of magnetic observatories at Duronia, Castello Tesino, Lampedusa (all three in Italy), Mario Zucchelli (Antarctica, 74.4 S, 164.1 E), Concordia (Antarctica, 75.1 S, 123.2 E) and publication of yearbooks, bulletins, and K indices. Management of magnetic stations at L’Aquila and Gagliano (both in Italy) and at the autonomous monitoring station at Talos Dome (Antarctica, 72.8 S, 159.2 E).

- 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 SEGMA (South European Geomagnetic Array) and ULF magnetic stations at Terra Nova Bay and Concordia (Antarctica).

- 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 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 four AIS-INGV ionosondes: two in Italy (Rome and Gibilmanna) and

two in Argentina (San Miguel de Tucumán and Bahia Blanca). One DPS4 digisonde is managed in Italy (Rome). A new DPS4D digisonde is about to be installed at Gibilmanna (June 2024) and a new AIS INGV ionosonde has been installed in July 2023 in Malindi, Kenya at the Broglio Space Center. Another AIS INGV ionosonde is going to be installed in Liguria, near La Spezia within September 2024.

- An All-Sky camera is about to be installed at Gibilmanna in collaboration with the Boston college (June 2024).

- Managements of multi-constellation receivers for measuring TEC and ionospheric scintillations: Africa (Abuja, Nigeria; Kilifi and Broglio Space Center, Kenia); Mediterranean (Pizzi Deneri and Lampedusa (2), Italy; Nicosia, Cyprus; Chania, Greece); Antarctica (Dome C (3), SANAE IV); Arctic (Ny Alesund (2), Norway; Thule, Greenland); South East Asia (Hanoi, Vietnam; Kenting, Taiwan; KLUniversity, India); Europe (Helsinki, Sodankyla and Suomussalmi, Finland); Central America (Saba and St. Eustatius, Caribbean Sea); South America (Sao Paolo, Brazil; Tucuman, Argentina).

- Management of continuous magnetotelluric monitoring in a site in Southern Italy (Val d'Agri).

- Management of DCE and DCN ionospheric radars of the SuperDARN international network at Concordia station (Antarctica, 75.1 S, 123.2 E).

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

- Underwater monitoring of the geomagnetic field in portual environment (high artificial noise) and development of the singularity measurements technique for the detection of local anomalies due to hostile operators (anti-intrusion system, anti-terrorism purposes, Min. Difesa financing) in the frame of the LAMA2.0 project.

b) Projects of interest in the framework of IAGA.
IAGA-Italia community is involved in several international programs such as:

- **AGATA** Antarctic Geospace and ATmosphere reseArch (AGATA) Programme Planning Group endorsed and funded by SCAR in 2022 to submit a new Scientific Research Programme to coordinate worldwide effort to monitor, investigate and better understand the physics of the polar atmosphere and the impact of the Sun-Earth interactions on the polar regions.

- **ARISTIDE** "Artificial Intelligence based Forecasting of Large-Scale Travelling Ionospheric Disturbances over Europe" funded by Regione Lazio 21/11/2023-21/05/2025

- **ASI/CUSP.** The CUbesat Solar Polarimeter (CUSP) project has the goal to measure the linear polarization of X rays during solar flares in order to improve the knowledge of physical phenomena responsible for the acceleration of particles originated from the Sun impacting the Earth.

- **ASPIS/CAESAR.** Realization of the ASPIS prototype data center in SSDC for the Italian community involved in Space Weather and Heliophysics Science. It includes the multidisciplinary studies of the chain of Space Weather phenomena occurring from the Sun to the Interplanetary medium, solar wind-magnetospheres-ionospheres at the Earth and the planets, as well as, cosmic rays modulation and impact of space weather events on technological and anthropic systems.

- **ASI-Helianthus.** Feasibility Study (Phase-A) for a Space Weather mission with "Solar Photonic Propulsion" (solar sail). INAF leads the definition of the strawman payload comprising a suite with "in situ" and "remote-sensing" instruments.

- **ASI/SEE** The Cubesat mission Sun CubE OnE (SEE) deals with the investigation of Gamma and X-ray fluxes and UV (Mg II Imager) solar emission to support studies in Sun-Earth interaction and Space Weather.

- **DRAGON5 2020 – 2024** international project (ID. 59236) " The cross-calibration and validation of CSES/Swarm magnetic field and plasma data" in the frame of the 2020-2024 cooperation between ESA and NRSCC of China (https://eo4society.esa.int/2020/02/20/dragon-5-cooperation-call-for-proposals/).

- **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.

- **EPOS**, TCS Multiscale Laboratories, EPOS MIUR.

- **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-Venus Express**, the community participates as Co-I at the ASPERA-4 instrument package

- **ESA-Mars Express**, the community participates as Co-I at the ASPERA-3 instrument package

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

- **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-Space Weather Service Network,** Development and Pre-Operation Part 1 (contract no. 4000134036/21/D/MRP). Development of INGV Space Weather products available on the ESA Space Weather Service Network portal.

- **ESA - AMIC** "Low Cost Ionospheric Monitoring and Observable Characterization: Proof of Concept"

- **ESA-Variability of Ionospheric Plasma (VIP) Swarm + 4DIonosphere**, AO/1-9660/19/I-DT – 4DIonosphere, to exploit the Swarm data to address the understanding of climate/weather in the ionosphere (under quiescent space climate/weather, extreme weather).

- **ESA-Venus Express**, the community participates as Co-I at the ASPERA-4 instrument package

- **ESA for the "Campaign: Nanosatellites for Space Weather Monitoring"** called "CUBE (CME Catcher Carousel)" (IDEA: I-2021-04591) – Cubesat mission selected for Implementation which will study the energy transfer from the magnetopause to the ionosphere during reconnection process.

- **ESA** "Space Weather Service Network Development and Pre-Operation Part 1 – PreOperational Activity Extension"

- **ESA M7 – Plasma Observatory (PO)**: PO is one of the three ESA M7 candidate missions selected in 2023 for the competitive Phase A study. Final selection of the ESA M7 mission will be announced in 2026. Plasma Observatory will unveil plasma energization and energy transport in the near-Earth plasma environment through the first multiscale observations in the Earth's Magnetospheric System. The communitity participates as Leading Proposer Scientist (Dr. M.F. Marcucci – INAF) with also the involvement of several Co-investigators.

- **EST** (European Solar Telescope), is a ESFRI European Project; the community participates for the design and realization of several subsystems, including: Fixed-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).

- **H2020-MSCA-RISE-2018.** “BE ARCHAEO-Beyond Archaeology: An advanced approach linking East to West through science, field archaeology, interactive museum experiences”. 2019-2023.

- **(HEliospheric pioNeer for sOlar and interplanetary threats defeNce)**: HENON will realize a quantum improvement in our capabilities to predict Space Weather, by proving that a revolutionary extension of the forecasting horizon can be enabled by the use of Distant Retrograde Orbit (DRO), which has never been explored before. The HENON mission is part of the Agenzia Spaziale Italiana ALCOR program and it is currently in Phase C within the European Space Agency GSTP program. AGOTEC is project Prime and the community participates with the scientific PI-ship (INAF-IAPS) and several Co-investigators

- **iFURTHER** (high FreqUency oveR The Horizon sensors’ cognitivE netwoRk), funded by the European Community, to perform a feasibility study of a OTH (Over the Horizon) radar over Europe.

- **INGV Department Strategic Project 2019 (Earthquake Department) FURTHER** (The role of FlUids in the pReparaTory pHase of EaRthquakes in Southern Apennines), in which a WP addresses the study of the different geolayers coupling (LAIC) before intermediate-large earthquakes using ground (seismic), atmospheric and satellite (magnetic field and plasma density) data.

- **INGV Strategic Project MACMAP** (A Multidisciplinary Analysis of Climate change indicators in the Mediterranean And Polar regions) in which a task addresses the identification of possible correlations between long-term trends in ionospheric/thermospheric parameters and the troposphere.

- **INGV Department Strategic Project 2019** (Environment Department): **TROPOMAG** - Influence of geomagnetic storms on the TROPOsphere dynamics: Can the Earth's MAGnetic field be considered a proxy of climate changes?

- **INGV Department Strategic Project 2019** (Environment Department): **AMUSED** - A MUltidisciplinary Study of past global climatc changes from continental and marine archives in the MeDiterranean region.

- **INGV Department Strategic Project:** The middle Eocene orbitally driven climate record at Gubbio (Umbrian Apennines, Italy): integrated astrochronology and environmental impact (EoGu_astro).

- **INGV Institutional Project "Rete Multiparametica" MARGE**. “Space Weather: Mappa di Rischio Geoelettromagnetico per l'Italia centrale" (A Magnetotelluric Survey in Central Italy).

- **INGV Institutional Project "Pianeta Dinamico 2023-2025". Theme ET - SESAR**: Space weather Effects on South Atlantic anomaly Region.

- **INGV Institutional Project "Pianeta Dinamico 2023-2025". Theme ST - UNITARY**: EarthqUake harbiNgers in the world from ground to space, with particular attention to ITAlian territoRY.

- **INGV Institutional Project "Pianeta Dinamico 2021-2023".** Theme 8 - **ATTEMPT**: integr**AT**ed sys**TE**m for **M**ulti-hazard from s**P**ace over medi**T**erranean.

- **INGV Institutional Project "Pianeta Dinamico 2021-2022"**. Theme 3 - **SERENA**: Space weather and climate change: the Solar wind - Earth's magnetosphere Relationships and their Effects on ioNosphere, and upper and lower Atmosphere at various temporal and spatial scales.

- **INGV Institutional Project "Pianeta Dinamico 2021-2022"**. Theme 5 - **CHOPIN**: volCano-atmospHereiOnosPhere connection.

- **INGV Institutional Project "Rete Multiparametica" SPACE WEATHER PECASUS**. The project aims to realize a research infrastructure to provide Space Weather information service to Civil Aviation and society.

- **INFRAIA** (2021-2025) Progetto dedicato all'integrazione in un'unica infrastruttura federata delle infrastrutture di ricerca europee, e di alcune altre extra-europee, dedicate al monitoraggio e allo studio e modellazione della plasmasfera, ionosfera e termosfera.

- **IRIDYA** (Integrated Reconstruction of Ice sheet DYnamics during late quaternary Arctic climatic transitions), PNRA-PROGRAMMA DI RICERCHE IN ARTICO.

- **ISSI** Project "Unravelling Solar Wind Microphysics in the Inner Heliosphere", https://www.issibern.ch/teams/unravelsolwind/

- **ISSI** Project "Solar sources and evolution of the Alfvénic slow wind", https://teams.issibern.ch/alfvenicslowwind/

- **ISSI** Project "Turbulence at the Edge of the Solar Corona: Constraining Available Theories Using the Latest Parker Solar Probe Measurements" https://teams.issibern.ch/turbulencesolarcorona/

- **ISSI** Project "Complex Systems Perspectives Pertaining top the Research of the Near-Earth Electromagnetic Environment".

- **ISSI** Project "Step forward in solar flare and coronal mass ejection (CME) forecasting".

• **ISSI** Team participation: “Modelling Mercury's Dynamic Magnetosphere in Anticipation of BepiColombo” (PI J Deca)

• **ISSI-Bj** project “The electromagnetic data validation and scientific application research based on CSES satellite” (http://www.ief.ac.cn/laimc_issi_bj/team.php.html)

• **ISSI** Project “Evolution of Turbulence in the Expanding Solar Wind” (PI L. Sorriso-Valvo (https://teams.issibern.ch/turbulencesolarwind)

• **LIMADOU SCIENZA +**: An Italian Space Agency funded project for exploiting CSES (Chinese Seismo-EM satellite) satellite electromagnetic data, which is the continuation of the former “LIMADOU SCIENZA” project. The aim of the project is the investigation of the Lithosphere-Ionosphere-Atmosphere-Magnetosphere coupling in search for earthquake related anomalies, and the characterisation of Magnetosphere-Ionosphere system in connection with solar activity.

• **MeCeMiBaCa.** The record of Meso-Cenozoic Milankovitch cycles in the Basque-Cantabrian area: astrochronology and environmental impact of orbitally driven climate change. Date: 2021-2024 Ente finanziatore: Ministerio de Ciencia, Innovación y Universidades, MICINN (Spain).

• **MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD, (Spain).** PALEOTRANS (Paleoenvironmental dynamics of transitional settings from Cretaceous to Eocene in the Southcentral Pyrenees)

• **MIUR PRIN 2017: 2019-2023.** CEI6: Circumterrestrial Environment: Impact of Sun-Earth Interaction.

• **MIUR PRIN 2017: 2019-2023** Detection and tracking of crustal fluid by multi-parametric methodologies and technologies.

• **MIUR PRIN 2020, Dynasty**: Neanderthals dynamic pathway and resilience in central europe through the chronometric sustainability. Magnetostratigrafia e RPI di sezioni di Loess da polonia e Ungheria.

• **MUR PRIN PNRR 2022, GREEN**: Geological stoRagE of hydrogEn and carboN: clean and efficient monitoring methods

• **MUR PRIN PNRR 2022, SUBGEO**: Submarine groundwater discharge analysis with an innovative geophysical approach (SUBGEO). Il progetto è focalizzato sullo sviluppo ed applicazione di metodi elettrici ed elettromagnetici in ambiente marino (soprattutto aree costiere)

- **MUR PRIN 2022, Modelling Interplanetary Coronal Mass Ejections**: The project aims to investigate the propagation in the interplanetary medium, the evolution and the geoeffectivenes of interplanetary coronal mass ejections (ICME).

- **MUR S-P-HERITAGE:** variazioni del livello del mare nel passato e nel futuro.

- **NORISK**: New Observatory for Real-time Ionospheric Sounding over Kenya. Funded by ASI.

- **PAGINA**: Pan-Arctic GNSS INfrastructure for Atmospheric Science project funded by Italian Arctic program.

- **PECASUS** (Partnership for Excellence in Civil Aviation Space weather User Services) global space weather service center designated by ICAO (Council of International Civil Aviation Organization).

- **PITHIA-NRF** (Plasmasphere Ionosphere Thermosphere Integrated Research Environment and Access services: a Network of Research Facilities), Call H2020-02 INFRAIA (2021-2025) Progetto dedicato all'integrazione in un'unica infrastruttura federata delle infrastrutture di ricerca europee, e di alcune altre extra-europee, dedicate al monitoraggio e allo studio e modellazione della plasmasfera, ionosfera e termosfera.

- **PNRA.** CHIMERA (CryptotepHra In Marine sEquences of the Ross Sea, Antarctica: implications and potential applications).

- **PNRA** COLLAPSE (Cook Glacier-Ocean system, sea LeveL and Antarctic Past Stability).

- **PNRA14_00097** - Linea A1 "Osservatorio geomagnetico presso la Stazione Concordia, Dome C, Antartide.

- **PNRA14_00106** - Linea A1 "Osservatorio Geomagnetico a Stazione Mario Zucchelli".

- **PNRA 22/50** "Upper Atmosphere Observation and Space Weather". The permanent observatory "Upper atmosphere observation and Space Weather" deals with the multiinstrumental monitoring of the ionized upper atmosphere over Antarctica and Arctic.

- **PNRA 22/00086** "SuperDARN: HF ionospheric radars, DCE e DCN, at Concordia" (Antarctica).

- **PNRA 15/00135 "**"ESCAPE: Solar Coronography fron Antarctica for Space Weather studies".

- **PNRA18_00289** "Space weather in Polar Ionosphere: the Role of Turbulence" (SPIRiT)

- **PNRA 2022/36** "Italian geomagnetic permanent observatories for solid Earth and Space Weather studies in Antarctica".

- **PNRR-MEET** is a Next Generation EU project - WP9 aims to realize a common platform of data and products of Earth observation and space weather.

- **PNRR** partecipazione (co-leadership INGV) a Spoke 5 (Planetary protection and geohazards mitigation) per la proposta SpaceItUp.

- **PNRR** partecipazione a Spoke 6 (Protezione Infrastrutture Critiche e Space Weather) per la proposta SpaceItUp.

- **PNRR** partecipazione a Spoke 3 (Rischi Naturali, Ambientali e Antropici) per la proposta RETURN.

- **PON InSea "**Iniziative in Supporto al consolidamento e potenziamento dell'infrastruttura EMSO e delle sue attività", 2019 – 2022. Potenziamento delle infrastrutture a mare e in prossimità della costa italiana con deposizione di SMART cable per scopi di monitoraggio geofisico e marino.

- **PROGETTO DI RICERCA LIBERA INGV (2022-2023)**, PaleoSecular Variations of the GEOmagnetic FIeld from the western SIcily Channel (PSVGEOFISIC).

- **ReCliAME.** Climatic-environmental feedback under global warming conditions: lessons from the Maastrichtian-Eocene of the Iberian peninsula. Ministerio de Economía y Competitividad, (Spain), Univ. Pais Vasco, UPV/EHU

- **RETURN (**multi-Risk sciEnce for resilienT commUnities undeR a changiNg climate). Date: 2022-2026. Piano Nazionale di Ripresa e Resilienza. Ente finanziatore: EU.

- **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).

- **SWEATERS** (Space WEATher Radiation Sensors) An Italian Space Agency funded project (ASI contract 2020-14-HH.0) for ENA (Energetic Neutral Atoms) instrument development devoted to Space Weather monitoring via ENA detection technique.

- **T-FORS** (Travelling Ionospheric Disturbances Forecasting System), funded by the European Community, aimed at developing a prototype system for Travelling Ionospheric Disturbances (Medium and Large scale) forecasting.

3. Italian attendance to international conferences.

- European Geosciences Union General Assembly (Vienna, Austria)
- AGU Fall meeting (San Francisco, USA)
- ICEAA 2023, October 9-13, Venice, Italy
- IRI workshop (Daejeon, South Korea)
- SuperDARN Workshop 2023 (29/5-2/6/2023, Ukhahlamba – Drakensberg Park, South Africa)
- URSI (International Union of Radio Science) GASS 2023 (Sapporo, Japan)
- ESWW 2023 – 19th European Space Weather Week, 20-24 November, Toulouse, France
- ICELLI (International Colloquium on Equatorial and Low Latitude Ionosphere) 2023, September 4 - 8, Ilorin, Nigeria.
- United Nations Workshop on the International Space Weather Initiative: the way forward, 26-30 June, 2023, Vienna, Austria.
- SOLARNET Meeting "Sun in Space and Society", Venezia-Mestre, Italy
- AGU Chapman Conference 'Advances in Understanding Alfvén Waves in the Sun and the Heliosphere' (Berlin)
- 28th IUGG General Assembly (Berlin)
- SoHE Fourth Meeting of the Italian Solar and Heliospheric Community (Arcetri, Firenze)
- 2023 Arcetri Workshop on Plasma Astrophysics (Arcetri, Firenze)
- Isradynamics 2023 Dynamical Processes in Space Plasmas (Dead Sea, Israel)
- 2023 International Conference on Statistical Physics (Crete, Greece)
- CDM FisMat 2023 (Milano)

4. Education, Outreach and Workshops.

IAGA-Italia pays particular attention to educational aspects and outreach.

a) Collaboration with the *International School of Space Science*.

In collaboration with other institutions and within the framework of the International School of Space Science (L'Aquila), directed by the **former** Italian delegate, the IAGA-Italy community has launched a program of schools dedicated to the training of young researchers in the area of the Solar Terrestrial Physics and Space Weather. During 2023 the following on-line course has been organized:

Frontend research at low radio frequency Radio astronomy: Science and technical challenges. L'Aquila (Italy) Directors: G. Brunetti, A. Mignone, R. Vermeulen. The course took place online from 3 to 7 April 2023; 34 young researchers participated from all over the world. As per tradition, the world's leading experts in the field participated as lecturers.

b) Collaboration with the *Space Weather Italian Community*.

IAGA – Italia continues to promote IAGA scientific interests to the national community. This activity is supported by the different institutions (universities, observatories,

institutes) through individual initiatives towards the general public and towards high-school and secondary school students. In the field of the Space Weather, on a national level, the activity is coordinated by the *Space Weather Italian Community* (*SWICo*; www.swico.it) which organized monthly webinars on topics mainly related to Space Weather and Sun-Earth relations.

SWICo community has been working also to organize the **Third Meeting of the Italian Space Weather Community** to be held in 2024 as a moment of encounter and discussion of the entire Italian community engaged in the disciplines in question.

SWICo, via the commission "National and International Collaborations" coordinated by Michele Piana, submitted the Italian candidacy to host the 2026 edition of the European Space Weather Week. The city selected to host the event is Florence.

c) Other activities.

Additional tutoring/teaching activities of IAGA members have been the following.

Claudio Cesaroni - Course on "Ionospheric modeling and monitoring" for National PhD on "Space Science and Technology", Università di Trento.

Teaching at the Master course "Science and technology in space" Università di Tor Vergata, Dip. Fisica on 'Plasma instrumentation, solar wind observations and space missions'

d) Collaboration with international entities.

- Collaboration with the University of Birmingham, the George Mason University, the Institut de Physique du Globe de Paris, the International Center of Theoretical Physics to develop a new NeQuick topside modelling.

- ISWI, the International Space Weather Initiative, supported by the United Nations. Among the others activities ISWI organizes schools and workshops.

- In the framework of the NORISK project, INGV (Claudio Cesaroni) in collaboration with ICTP (Bruno Nava), ASI (Giancarlo Santilli), Boston College (Keith Grooves), UNOOSA (Sharafat Gadimova) and ION (Jade Morton) organized the "Eastern Africa Capacity Building Workshop on Space Weather and Low-latitude Ionosphere" held from 3 to 12 October 2023 in the Luigi Broglio Space Center (Malindi, Kenya). The Capacity Building Workshop faced different aspects of Space Weather and ionospheric physics giving the possibility to more than 30 students from all over Africa to interact with more than 20 experts from all over the world.

- ICTP-SCOSTEP-ISWI Workshop on the Predictability of the Solar-Terrestrial Coupling - PRESTO | (smr 3898), 30 May - 2 June, 2023.

- Italy is again a member of SCOSTEP. Lucilla Alfonsi is the national delegate.

5. Activities carried on by the Italian Delegate and National Committee during 2022 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**.** The National Delegate has participated to the Meetings of the IAGA Delegates held during the 28th IUGG General Assembly (Berlin).

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

- Members of the IAGA National Committee are in the IUGG Network of Italian Experts.

- F. Florindo (INGV) is the chairman of the Working Group I.2 “Paleomagnetism” of the IAGA Division I - Internal Magnetic Fields and President of the Earth Magnetism and Rock Physics Division of European Geophysical Union.

- U. Villante (University of L’Aquila) is President of SWICo (Space Weather Italian Community).

- M. Casolino (INFN), D. Del Moro (U. Tor Vervagata), M. Laurenza (INAF), S. Lepidi (INGV) M. Piana U. (Genova), M. Piersanti (U. L’Aquila), R. Tozzi (INGV) are members of the Directive Board of SWICo (Space Weather Italian Community).

- I. Coco, M. Laurenza, L. Marcelli, M. Messerotti, M. Piana, M. Piersanti are members of the SWICo Committee “Commissione Collaborazioni Nazionali e Internazionali”. He is also member of the Data Analysis Working Group of the SuperDARN community.

- A. Greco (University of Cosenza), P. De Michelis (INGV), P. Romano (INAF), L. Giovannelli (University of Rome Tor Vergata), L. Alfonsi (INGV), M. Messerotti (INAF) and R. D’Amicis (INAF) are members of the SWICo working group ‘Outreach and Media Public Relations’.

- I. Ermolli, M. Laurenza, M. Messerotti, A. Pellizzoni, R. Susino are members of the INAF Advisory Committee for “Meteorologia e Climatologia dello Spazio” (Space Weather and Space Climate.

- D. Di Mauro (INGV) is the Italian reference for the Italian magnetic network which contributes to the European network. He also acts as reference for the Italian

geomagnetic observatories at Castello Tesino (North Italy), Duronia (Central Italy) and Lampedusa (South Italy).

- 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 chair for the period 2021-2023. She is the INGV Representative in the National Scientific Committee for Arctic. Lucilla Alfonsi (INGV) is her Deputy.

- V. Romano (INGV) is the Italian co-expert on Space Weather at ONU COPUOS (Committee on the Peaceful Uses of Outer Space), he is National co-coordinator for Italy in ISWI (International Space Weather Initiative), he is the Italian delegate in the Steeering Committee of the PECASUS Consortium, he is the INGV delegate in the COSPAR Panel for Space Weather.

- C. Scotto is the Italian National Deputy 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.

- R. D'Amicis (INAF-IAPS) is Vice-Chair of the Cospar Capacity Building and CoPI of the Solar Wind Analyser (SWA) onboard Solar Orbiter. She participated in the following proposals for future missions in response to the ESA call 2021 with the following roles: PI of the Particle Processing Unit (PPU) of the plasma instruments on board Plasma Observatory, proposed as M7 mission, selected for phase 0 studies; PI of the Data Processing Unit (DPU) of the plasma instruments on board M-MATISSE, proposed as M7 mission, selected for phase 0 studies; PI of the Particle Data Processing Unit (PSCU) of the plasma instruments on board Alfvén, proposed as M7 mission; PI of the Particle Data Processor (PDP) of the plasma suite on board Debye, proposed as F2 mission.

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

- B. Nava (ICTP) is Italian member of the International Reference Ionosphere Working Group and Co-Chair, Beacon Satellite Studies Working Group, URSI Commission G.

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

- A. Bemporad (INAF) is the Scientific Discipline Representative in the Scientific Committee on Solar-Terrestrial Physics (SCOSTEP).

- M. Pezzopane (INGV) is Italian member of the International Reference Ionosphere Working Group.

- I. Coco (INGV) is member of the Electric Field Instrument Science Discussion Group of the Swarm ESA mission, and of the ESA Swarm-CSES working group.

- C. Cesaroni (INGV) is the chair of the URSI Commission G working group "Capacity Building and training" and co-chair of the inter-commission (FCGEH) working group "Risk and Disaster Management (Inter URSI Commissions)". He is also member of the SWICo working group "Technological developments". He is member of the IGS Ionospheric working group and advisor for the Space Weather to the italian member of the ICAO MET Panel.

- C. Cesaroni is the Commission G representative in the URSI inter-commission working group (FCGEH) about Risk and Disaster Management (Inter URSI Commissions).

- D. Sabbagh (INGV) has been elected URSI Early Career Representative (ECR) of the Commission G for the years 2021-2026, and he is the Commission G representative in the URSI "Radio Science School for Young Scientists" Committee for the years 2023-2026.

- L. Spogli (INGV) was the President of the European Space Weather and Space Climate Association (E-SWAN) since 20 November 2023; since then, he is the Vice-President of E-SWAN. He is also the advisory for the Italian Member of the Meteorology Panel (METPANEL) of the International Civil Aviation Organization (ICAO) in the frame of the Meteorological Information Service Development Working Group (WG-MISD) (now WG-MOG) for Space Weather.

- L. Alfonsi is member of the Polar Expert Group (PEG) of the EU-PolarNet2 project (eu-polarnet.eu/) aiming at establishing a permanent European coordination of polar research. She sits in the SCOSTEP Bureau.

- A. Milillo (INAF) is member of ISWAT-COSPAR Cluster H4 team H4-01

- M. Piersanti (UnivAQ) is the Italian PI of the " The cross-calibration and validation of CSES/Swarm magnetic field and plasma data" in the frame of the 2020-2024 DRAGON 5 cooperation project (ID. 59236) between ESA and NRSCC of China (https://eo4society.esa.int/2020/02/20/dragon-5-cooperation-call-for-proposals/). He is also is the PI of the calibration/validation of the Electric Field instrument on board CSES-01 satellite in the frame of the SWARM/CSES satellites cal-val group and PI of the commissioning phase of the Electric Field instrument (EFD) on board the satellite CSES-02 in the frame of the CSES-Limadou collaboration.

- R. Bruno (INAF-IAPS) is one of the members of the Scientific Council of ISSI/ISSI-Beijing (2020-2023)

- L Perrone is the coordinator of the working team on 'MUF/foF2 depression' attended by representatives of the 4 Space Weather Global Centers-SWXC, selected by ICAO to emit real time advisories on space weather events which influence the communication, navigation and the health of the passengers and the crew.

- A. Pignalberi is co-chair of the IAGA Working Group II-E: Ionospheric Irregularities, Fields and Waves

- L. Sorriso-Valvo is Coordinator of the Solar Orbiter "In-Situ" Working Group: "Kinetic Physics, Turbulence, Waves, and Reconnection", and he is an ESA Astronaut Basic Training instructor, for the topics "The Sun" and "Earth-Sun Interactions".

7. Awards and Prizes.

International "Alexander Chizhevsky" Medal for Space Weather and Space Climate.
The Alexander Chizhevsky Medal is awarded to an early-career scientist in recognition of outstanding achievements in space weather and space climate with innovative approaches. The 2023 medal has been awarded to Dr. Claudio Cesaroni (INGV).

8. Concluding remarks.

As for previous years IAGA- Italia pursued its activity supporting the Italian participation in international programs and promoting the involvement of young researchers and doctoral students in the IAGA activities. IAGA-Italia is also pursuing in the organization of specific training paths for young researchers and PhD students.

As previously reminded, IAGA is one of the most important organizations in the field 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. The Italian community is involved in several international programs in these fields in several cases with leading roles (PI-ships). So, is important that the Italian community continues to have a strong participation in this association.

To stimulate a wider participation of PhD students, Post-Doc fellows and young researchers to IAGA activities, it might be useful a dedicated award to support the participation to the IAGA Scientific Assemblies.

On behalf of the IAGA Italian Committee
The IUGG/IAGA Delegate
Prof. U. Villante