

Space Weather: Outreach and Capacity Building Activities

**COSPAR Symposium
Space Weather and Small Satellites**

11 February 2019, Vienna, Austria

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Office for Outer Space Affairs**



UNITED NATIONS
Office for Outer Space Affairs



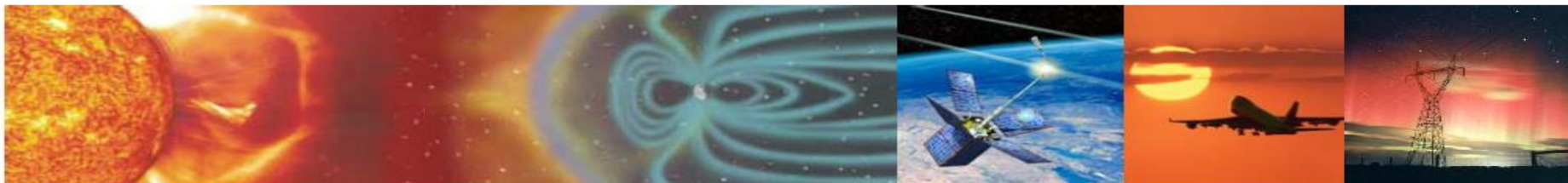
Background

- **1991-2004:** Basic Space Science (Telescope, Observing, Teaching)
- **2004:** COPUOS called for addressing solar-terrestrial interaction: global climate, **space weather**, Sun-Earth-heliosphere-system
- **2005 - 2009:** Workshops and Follow-up projects
 - IHY TRIPOD (2005 -2007): Low-cost, ground-based world-wide instrument arrays, GNSS on board of instrument arrays – Data taking and analysis – Capacity Building (Space Science Schools)
- **2010 - 2012:** STSC agenda item “International Space Weather Initiative” & ISWI Workshops (Egypt, Nigeria, Ecuador)
- *IHY and ISWI have contributed to significant progress in the development of space science schools that encourage students to consider a career in space science*
 - **2013:** STSC agenda item “Space Weather”



Space Weather: Capacity Building and Outreach

- **Training** in handling space-weather instruments and data; data analysis and interpretation
- Running **advanced schools** introducing topics from the solar interior to surface of Earth
 - ISWI School on Space Weather and GNSS 8 – 12 October 2018, Baku, Azerbaijan:
<http://www.unoosa.org/oosa/en/ourwork/icg/activities.html>
 - Hands-on experience to handle data sets
- Running ISWI workshops to advance the space weather science by combination of instrument deployment, analysis and interpretation of space weather data, including space weather and its effects on GNSS:
 - 2015 (Japan), 2017 (USA), 2019 (ICTP)





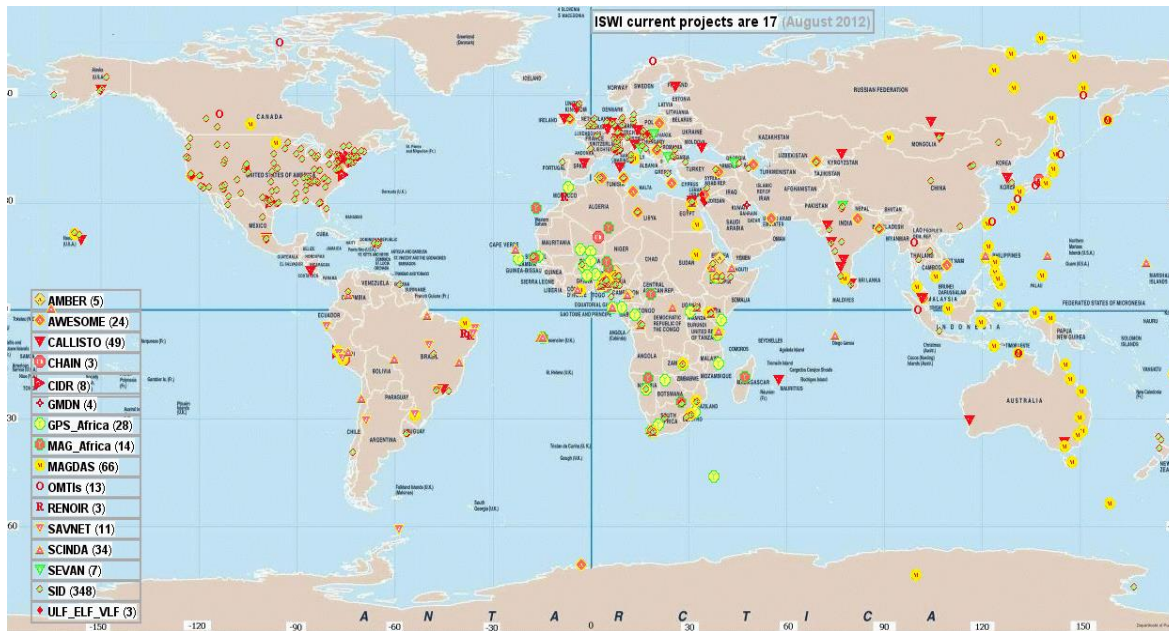
ISWI Workshop

- Workshop on ISWI, 20 – 24 May 2019, ICTP, Trieste, Italy
(UNOOSA, SCOSTEP, NASA and Boston college)
- A particular focus will be on new research results and findings and to encourage greater cooperation in developing partnerships and ISWI networks
- **Topics:** Instrumentation; • Solar Physics; • Magnetosphere, Ionosphere, and Thermosphere; • Solar-Terrestrial Coupling and Space Weather; • Space Weather effects on GNSS; • New Space Weather scientific results; • Capacity-Building, Education and Outreach
- **Application Deadline:** 15 February 2019
- <http://www.unoosa.org/oosa/en/ourwork/psa/schedule/2019/2019-iswi-workshop.html>





ISWI Instrument Sites

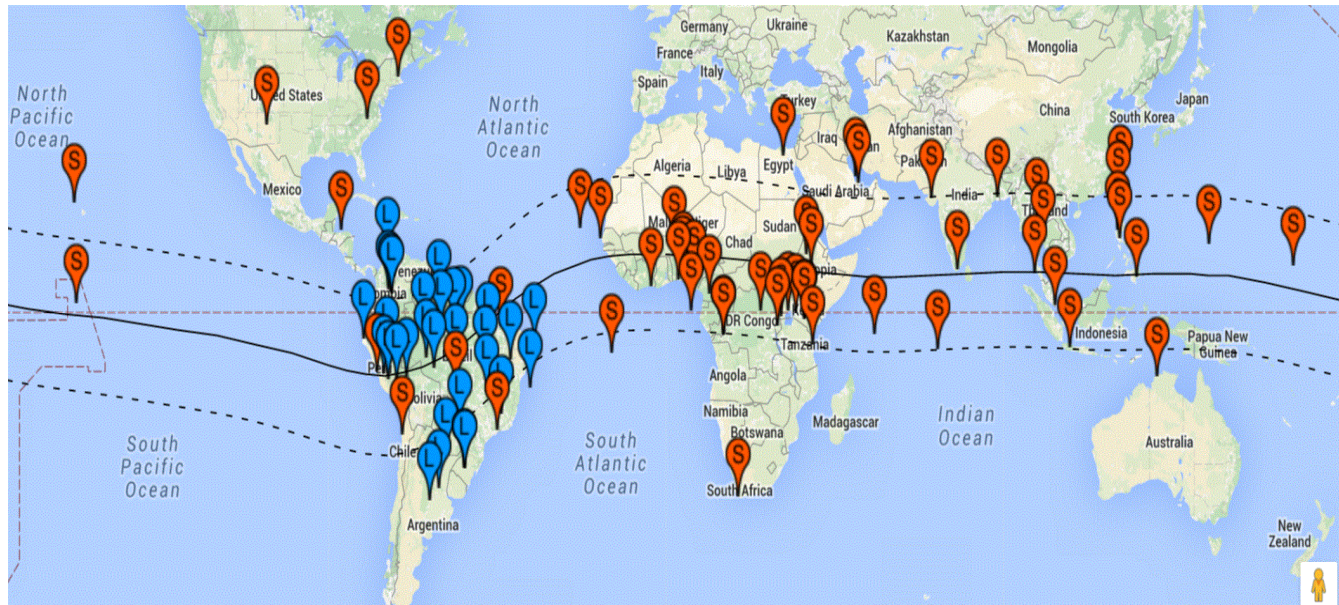


AMMA: African Dual-Frequency GPS Network

- Scientists from developing/developed nations work together in deploying and operating SW instruments: > 1000 deployments in >100 sites;
- Students and faculty participate at all levels of the instrument project and science;
- 19 instrument networks from 8 countries (USA, Germany, Japan, Brazil, France, Israel, Armenia, Switzerland)

Scintillation Network Decision Aid (SCINDA)

- Provides information on ionospheric conditions (e.g., scintillation) and hence forecasts communication degradation and outage in the equatorial region.
- Radio signals up to a few GHz frequency are affected
- The region affected corresponds to about 1/3 of the surface of the globe
- Important for transequatorial flights



K. Groves, C. Carrano, C. Bridgwood, P. Doherty
(Boston College)

Red – SCINDA

Blue – LISN (Low-latitude ionospheric sensor network), another ISWI network



ISWI and ISWI Steering Committee

- A programme of international cooperation to advance the space weather science by a combination of instrument deployment, analysis and interpretation of space weather data: *About 80 National Coordinators from Member countries*
- **Website** (Bulgarian Academy of Sciences): <http://www.iswi-secretariat.org/>
- **Newsletter** (International Centre for Space Weather Science and Education (ICSWSE) of Kyushu University)
- *ISWI SC meeting, 14 February 2019, VIC*

International Space Weather Initiative
ISWI

38,292 Visitors
19 April 2008 - 2 Dec 2018

About HOME Organization Projects Meetings Publications News&Blogs

ISWI current projects are 17 (May 16, 2018)

Good Evening.
Welcome to: **International Space Weather Initiative (ISWI)**

ISWI is a program of international cooperation to advance the space weather science by a combination of instrument deployment, analysis and interpretation of space weather data from the deployed instruments in conjunction with space data, and communicate the results to the public and students.

ISWI is a follow-up activity to the successful IHY 2007, but focusing exclusively on space weather.

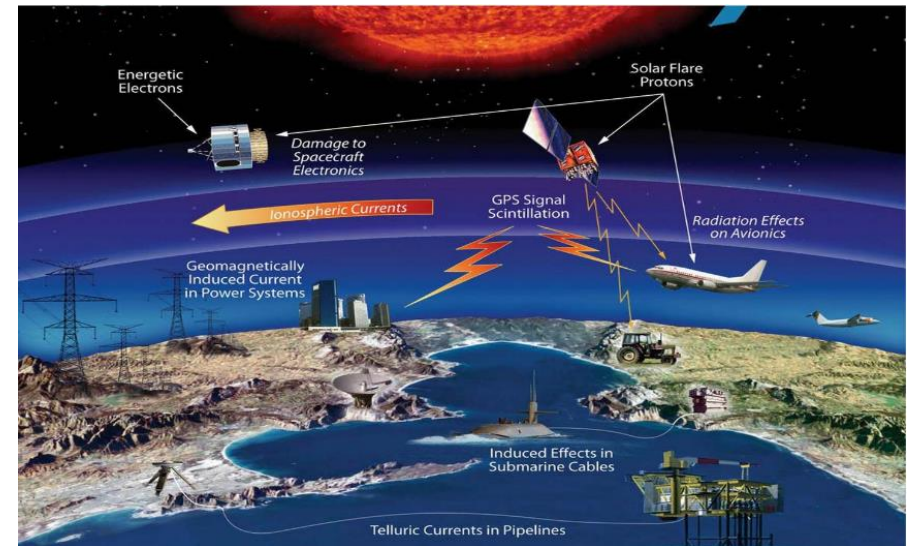
The goal of the ISWI is to develop the scientific insight necessary to understand the science, and to reconstruct and forecast near-Earth space weather. This includes instrumentation, data analysis, modeling, education, training, and public outreach.

© ISWI 2018



Space Weather: Research and Collaboration

- With increasing dependence on space based infrastructure in our society
 - Space weather is important for general understanding and to define, model, predict and mitigate very large events
- Space weather research and collaboration may help to
 - promote sustainable development through the prevention of catastrophic disruptions space critical infrastructure and space-based services





International Committee on GNSS (ICG)

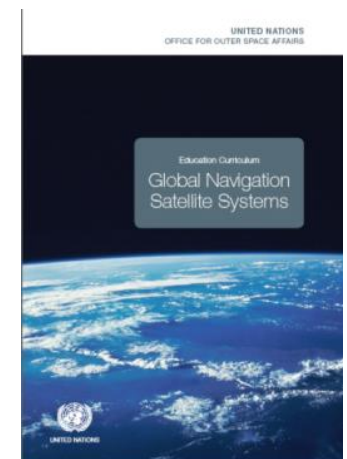
- UNOOSA serves as the executive secretariat of ICG
- The ICG promotes **voluntary cooperation** related to civil satellite-based positioning, navigation, timing, and value added services
- Encourages **coordination** among GNSS providers
- **Promotes** the introduction and utilization of GNSS services in developing countries
- **Assists** GNSS users with their development plans and applications
- Contributes to the **sustainable development** of the world
- Assure GNSS **interoperability and compatibility** among providers and users globally for enhanced services and applications





Information Centres for ICG

- The Programme of Space Applications established regional centres (**also acting as the ICG information centres**) in each region covered by the United Nations Economic Commissions: Africa, Asia and the Pacific, Latin America and the Caribbean, and Western Asia
 - **The Technical Level:** explore the benefits of GNSS technologies for regions and to spread their applications; exchange information and knowledge
 - **The Cooperative level:** facilitate collaboration with the GNSS providers (seminars/trainings and educational material), as well as communication and outreach to the wider community through the ICG information portal





Programme on GNSS applications

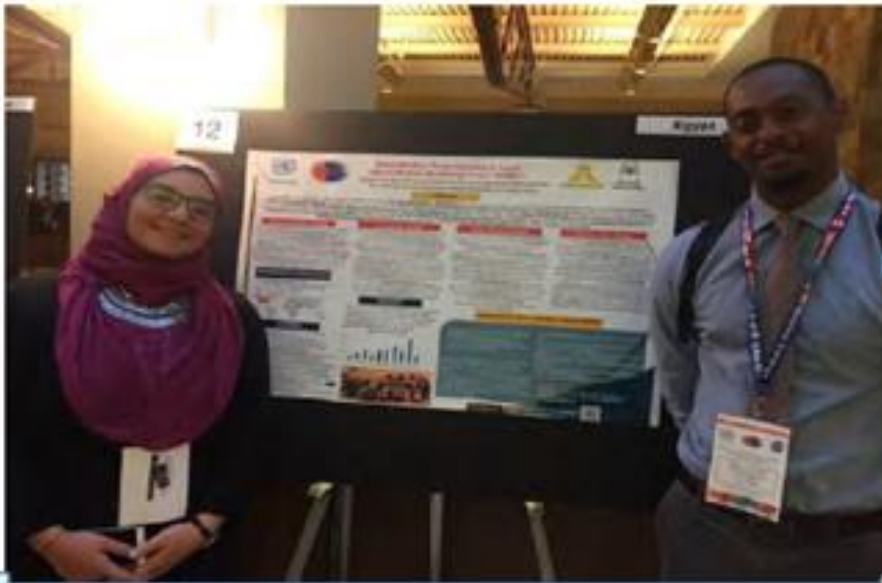
- **Space Weather and GNSS (WGC)** – Promotes the use of GNSS for scientific applications and space weather in developing countries (*ICTP and Boston College*)
 - Many opportunities for research (improved imaging of the ionosphere over the equatorial region, ionospheric effects on augmentation systems...)

Workshop on Ionospheric Forecasting for GNSS Operations in Developing Countries: Findings and Challenges, 27 -31 May 2019, Trieste, Italy (*ICTP, ION, Boston College*)

- The workshop will give an introduction to GNSS operations and the impact of the ionosphere on them. It will concentrate on forecasting ionosphere conditions with focus on TEC; Computer Laboratory Work (data analysis of different ionosphere scenarios)
- *Applications Deadline*: 15 February 2019 - <http://indico.ictp.it/event/8686/>



Those activities are increased number of students and young scientists studying space weather



and increased participation by women





ICG Information Portal



- About Us ▾
- Our Work ▾
- Benefits of Space ▾
- Information for... ▾
- Events ▾
- Space Object Register ▾
- Documents ▾
- COPUOS 2015 ▾

Our Work ▾ ICG

International Committee on Global Navigation Satellite Systems (ICG)

MISSION STATEMENT

The International Committee on Global Navigation Satellite Systems (ICG), established in 2005 under the umbrella of the United Nations, promotes voluntary cooperation on matters of mutual interest related to civil satellite-based positioning, navigation, timing, and value-added services. The ICG contributes to the sustainable development of the world. Among the core missions of the ICG are to encourage coordination among providers of global navigation satellite systems (GNSS), regional systems, and augmentations in order to ensure greater compatibility, interoperability, and transparency, and to promote the introduction and utilization of these services and their future enhancements, including in developing countries, through assistance, if necessary, with the integration into their infrastructures. The ICG also serves to assist GNSS users with their development plans and applications, by encouraging coordination and serving as a focal point for information exchange.



International Committee on
Global Navigation Satellite Systems

VISION STATEMENT

The International Committee on Global Navigation Satellite Systems (ICG) strives to encourage and facilitate compatibility, interoperability and transparency between all the satellite navigation systems, to promote and protect the use of their open service applications and thereby benefit the global community. Our vision is to ensure the best satellite based positioning, navigation and timing for peaceful uses for everybody, anywhere, any time.

At the "United Nations International Meeting for the Establishment of the International Committee on Global Navigation Satellite Systems (ICG)" held on 1-2 December 2005 in Vienna, Austria, the ICG was established on a voluntary basis as an informal body for the purpose of promoting cooperation, as appropriate, on matters of mutual interest related to civil satellite-based positioning, navigation, timing, and value-added services, as well as compatibility and interoperability among the GNSS systems, while increasing their use to support sustainable development, particularly in the developing countries. The participants in the meeting agreed on an establishment of the ICG information portal, to be hosted by UNOOSA, as a portal for users of GNSS services.

Our Work

Secretariat of COPUOS

Programme on Space Applications

UN-SPIDER

ICG

- Members
- Providers' Forum
- Working Groups
- ICG Annual Meetings
- ICG Programme on GNSS Applications
- Resources
- ICG Documents
- Space Weather & CNS
- Other Events
- ICG Timeline

UN-Space

Space Law

Topics

Photo Gallery

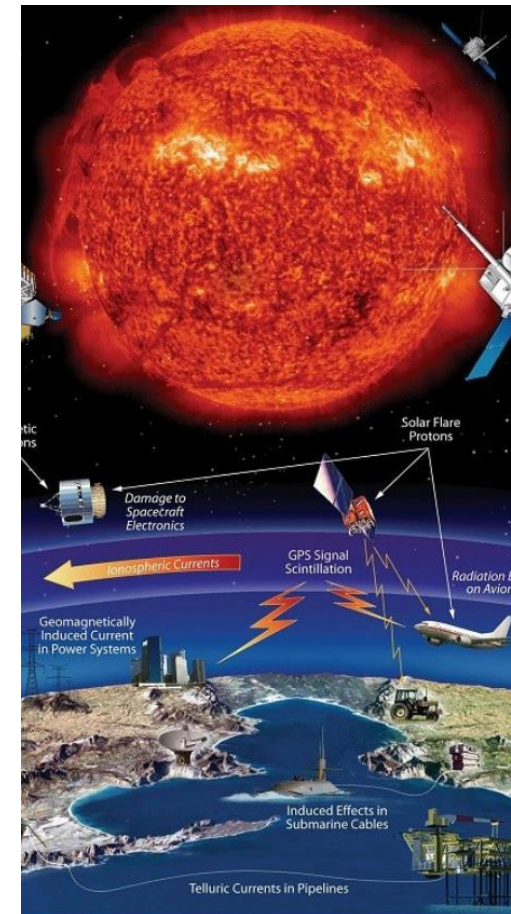
WWW.UNOOSA.ORG

WWW.UNOOSA.ORG/OOSA/EN/OURWORK/ICG/ICG.HTML



Conclusion

- **Space weather** is so critical because we are more dependent on space-based technology than ever before
 - Major effects include power grid damage, satellite damage, health risks due to radiation exposure, HF and satellite communication disruptions, climate change and GNSS navigation errors
- **GNSS** is a cost-effective and ubiquitous technology for discovering, characterizing, monitoring (and mitigating) key space weather impacts
- **The activities and opportunities provided through UNOOSA and ICG** result in the development and growth of capacities that will enable each country to enhance its knowledge, understanding and practical experience in those aspects of GNSS technology that have the potential for a greater impact on its economic and social development, including the preservation of its environment





ICG Publication

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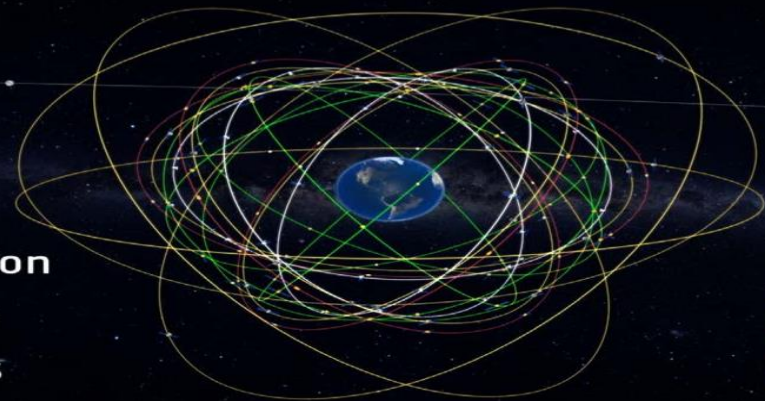
The Interoperable
Global Navigation
Satellite Systems
Space Service Volume



Humanity is now beginning to benefit from GNSS usage in the SSV, starting with applications that use only individual constellations, and ultimately expanding to multi-constellation GNSS. For example, weather satellites employing GNSS signals in the SSV will enhance weather prediction and public-safety situational awareness of fast-moving events, including hurricanes, flash floods, severe storms, tornadoes and wildfires.

http://www.unoosa.org/res/oosadoc/data/documents/2018/stspace/stspace75_0.html/st_space_75E.pdf

**Global
Navigation
Satellite
Systems**



■ GPS
■ GLONASS
■ GALILEO
■ BEIDOU

THANK YOU



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