

International Committee on Global Navigation Satellite Systems: SPACE WEATHER

**United Nations/Germany High level Forum:
The way forward after UNISPACE+50 and on Space2030**

13 – 16 November 2018, Bonn, Germany

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Office for Outer Space Affairs**





ICG: Background

- Emerged from the recommendations of UNISPACE III, 1999, Vienna

The assumption was that current and future system operators would soon move from a competitive to a collaborative mode where there is a shared interest in the universal use of GNSS services regardless of the system

- **2005: Establishment of the ICG** (*noted by UNGA 61/111 of 14 December 2006*)
 - Promote the use of GNSS and its integration into infrastructure, particularly in developing countries;
 - Encourage **compatibility and interoperability** among global and regional systems
- Main challenge is to provide assistance and information for those countries seeking to integrate GNSS into their basic infrastructure, including at governmental, scientific and commercial levels



International Committee on
Global Navigation Satellite Systems



ICG: Annual meetings

UNOOSA (2006) - China (2018), India (2019), Vienna (2020), UAE (2021) ...

- **Systems, Signals and Services (*United States & Russian Federation*):** Compatibility and spectrum protection; interoperability and service standards; system-of-system operations
- **Enhancement of GNSS Performance, New Services and Capabilities (*India, China & ESA*):** Future & novel integrity solutions; implementation of interoperable GNSS Space Service Volume (SSV) and its evolution; *examination of performance of atmospheric models, establish dialogue with space weather/RS community*
- **Information Dissemination and Capacity Building (*UNOOSA*):** Focused on education and training programmes, *promoting GNSS for scientific exploration (incl., space weather and its effects on GNSS)*
- **Reference Frames, Timing and Applications (*IAG, IGS & FIG*):** Focused on monitoring and reference station networks



ICG: Providers' Forum

- PF provides ways and means of promoting communication among system providers on key technical issues and operational concepts such as the GNSS spectrum protection, orbital debris, and orbit de-confliction
- Scientific and Technical Subcommittee of UNCOPUOS (UN GA Res. 62/217 of 1 February 2008) started consideration of an agenda item “Recent developments in GNSS”
- **Specialized SW data** collected by **GPS satellite over the preceding 16 years** released to be used to improve our understanding of SW: <http://www.lanl.gov/discover/news-release-archive/2017/January/01.30-space-weather-science.php>
- European Commission H2020 project: "**Ionosphere Prediction Service**" (IPS): monitors and forecasts the solar and ionospheric activity and its well-known effect on GNSS signals and on the final performances of user applications. The predictions are delivered in real time, 24/7, for both ionosphere-related parameters and GNSS performance indicators, and over two geometric scales (the European region and globally) and three time scales (now-cast, 30 minutes and 24h ahead): <https://www.ips.telespazio.com>



UNOOSA: Space Weather

- **2004:** Session of the Committee on the Peaceful Uses of Outer Space (COPUOS) called for addressing solar-terrestrial interaction: global climate, **space weather**, Sun-Earth-heliosphere-system
- **2005 - 2009:** Workshops and Follow-up projects: low-cost, ground-based world-wide instrument arrays, GNSS on board of instrument arrays (IHY: Instrument Array, Data, Teaching)
- **2010 - 2012:** STSC agenda item “International Space Weather Initiative” & ISWI Workshops (Egypt, Nigeria, Ecuador)
- **2013: STSC agenda item “Space Weather”**
- **2014:** Establishment of the “Expert Group on Space Weather”



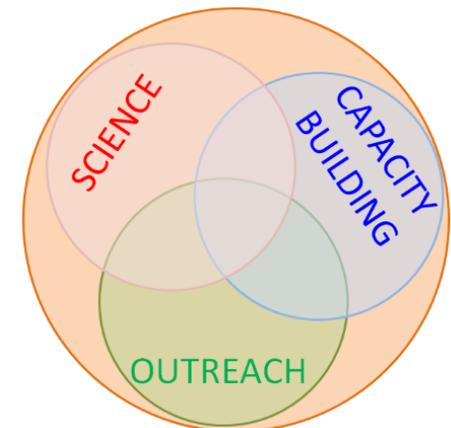


Science, Capacity Building and Outreach

▪ 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
- Grass-roots organization – *bottoms-up approach* to produce a space-weather-literate communities especially in developing countries
- Accomplished via *workshops, schools, and training courses*
- Collaboration: SCOSTEP, COSPAR
- **Website** (Bulgarian Academy of Sciences): <http://www.iswi-secretariat.org/>





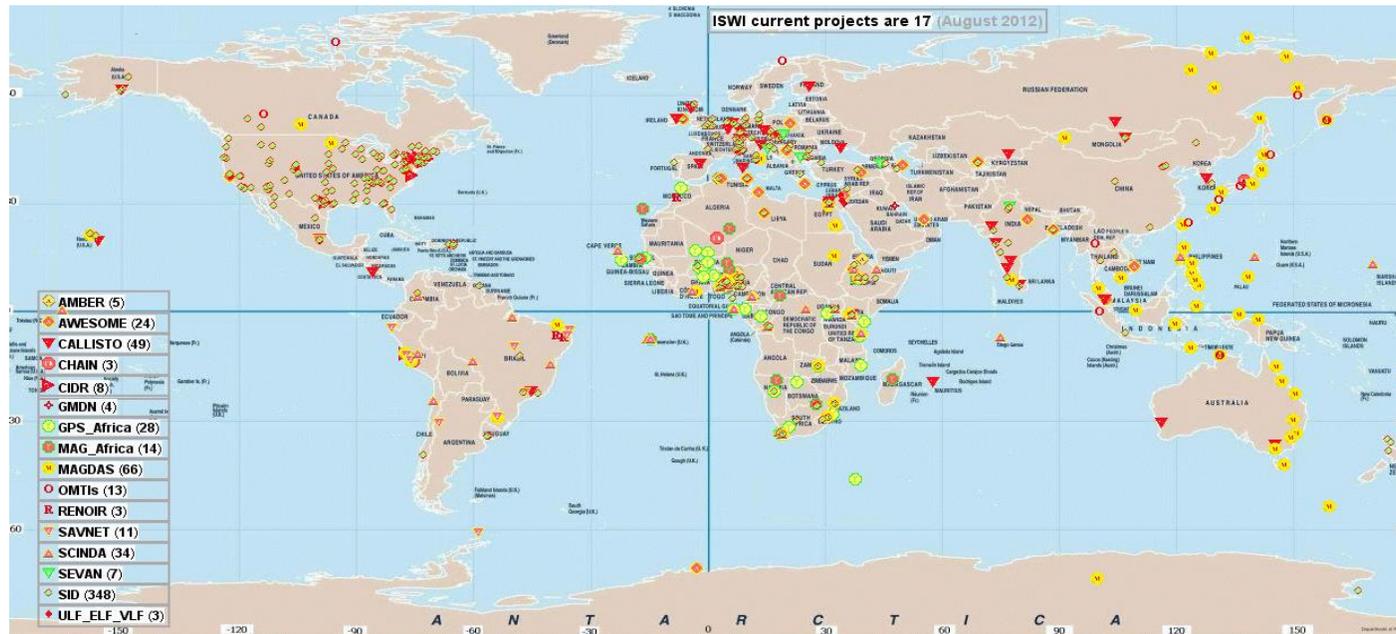
Science, Capacity Building and Outreach

- Training in handling space-weather instruments
- Training in data handling
- Training in 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 instruments and data sets
- Running intense mini workshops to target students/faculty handling a specific instrument group (OMTI, MAGDAS, SCINDA, CALLISTO, ...)
- Running ISWI workshops to enhance the general background in space weather
 - ICTP Workshop on ISWI, 20 – 24 May 2019, Trieste, Italy





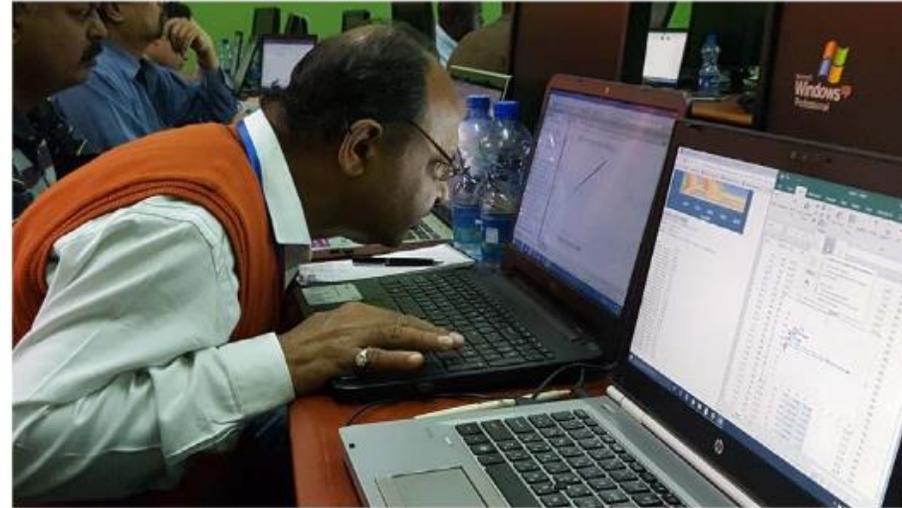
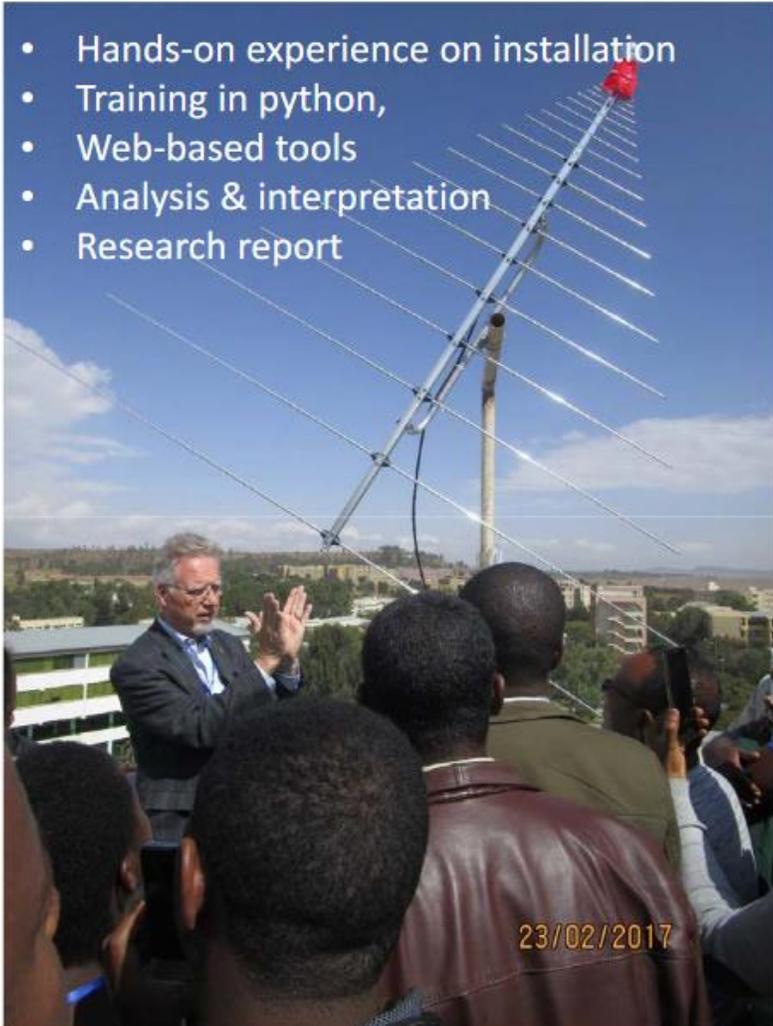
ISWI Instrument Sites



- 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)



- Hands-on experience on installation
- Training in python,
- Web-based tools
- Analysis & interpretation
- Research report



ISWI Mini Workshop – Mekelle University Feb 19-25, 2017





Space Weather Effects on Society – The Big 3 !

- Damage to Electric Power Grids
 - Changes in the magnetic field can produce surges in power lines and transformers.
 - National Academies Report 2009 – estimated the impact of a space weather induced grid collapse to be ~\$1trillion dollars
- Damage to Satellites
 - Energetic ions can damage solar panels
 - Energized plasmas can cause electrical charges that can damage the electronics
 - Increase satellite drag
 - Economic value of satellite enterprise >\$100Billion
- Health Risks due to Radiation Hazards
 - Exposure at high altitudes
 - Astronauts
 - High flying jets
 - Crews/passengers flying over the poles
 - Redirecting these flights can cost \$100,000+
 - What about space travel – mission to Mars???



Damage to power grids.



Damage to satellites.



Radiation exposure.



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

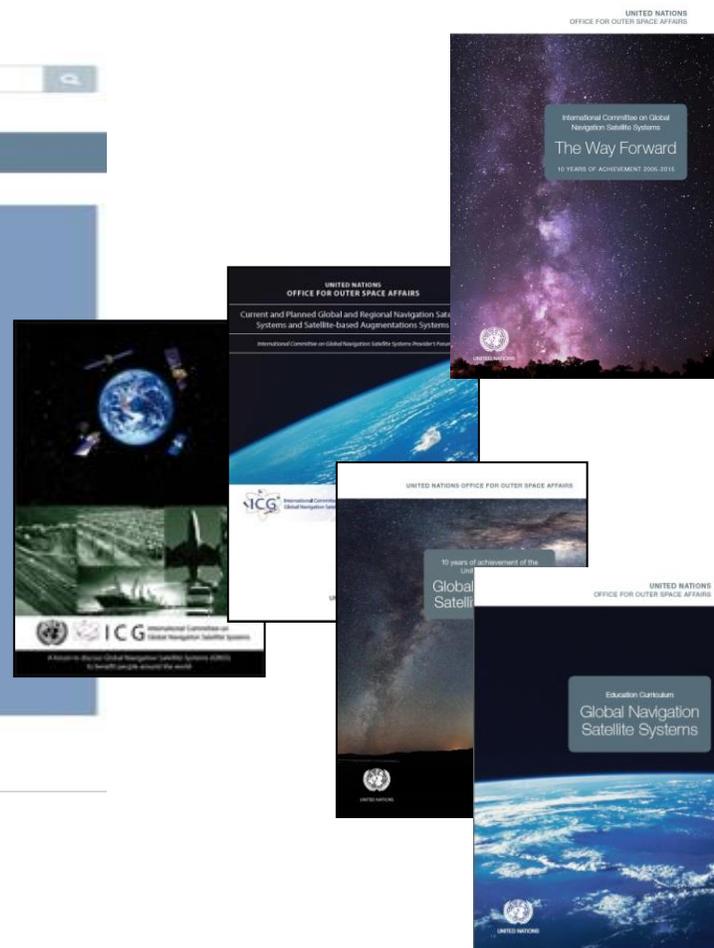
VISION STATEMENT

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 & GNSS
 - Other Events
 - ICG Timeline
- UN-Space
- Space Law
- Topics
- Photo Gallery



WWW.UNOOSA.ORG

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



ICG Publication: The Interoperable GNSS SSV

UNITED NATIONS
OFFICE FOR OUTER SPACE AFFAIRS

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.

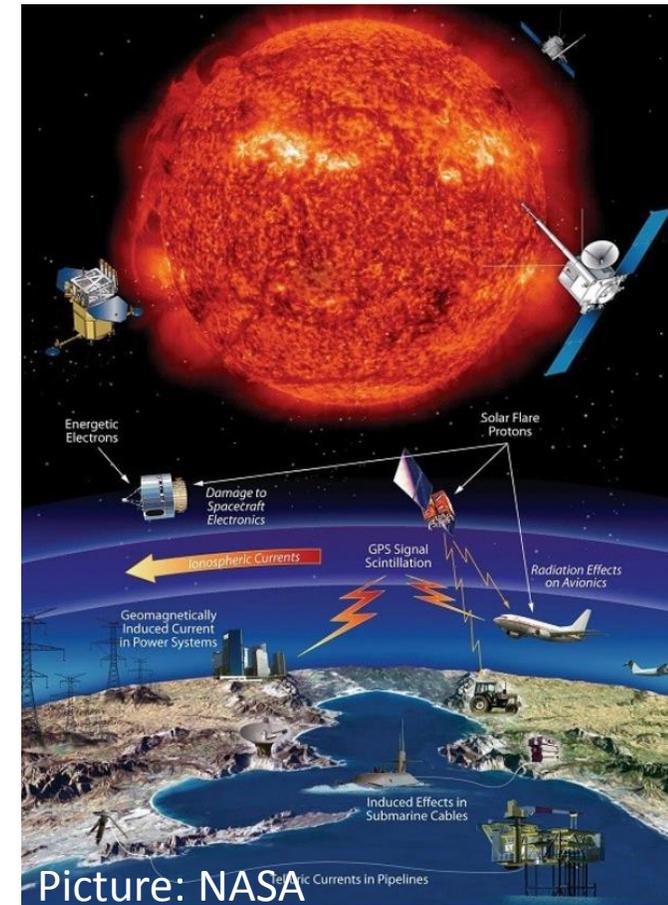
**Global
Navigation
Satellite
Systems**

■ GPS
■ GLONASS
■ GALILEO
■ BEIDOU



Conclusion

- **The activities and opportunities provided through the 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
- **Space weather** is so critical because we are more dependent on space-based technology than ever before
- **GNSS** is a cost-effective and ubiquitous technology for discovering, characterizing, monitoring (and mitigating) key space weather impacts.



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

THANK YOU



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