Space Weather:
Outreach and Capacity Building Activities

COSPAR Symposium
Space Weather and Small Satellites

11 February 2019, Vienna, Austria

Sharafat Gadimova
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

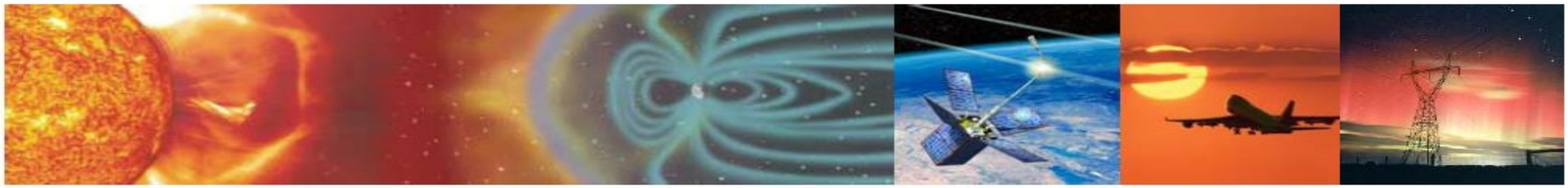
IHY TRIPOD (2005 -2007): Low-cost, ground-based world-wide instrument arrays, GNSS on board of instrument arrays – Data taking and analysis – Capacity Building (Space Science Schools)

- **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

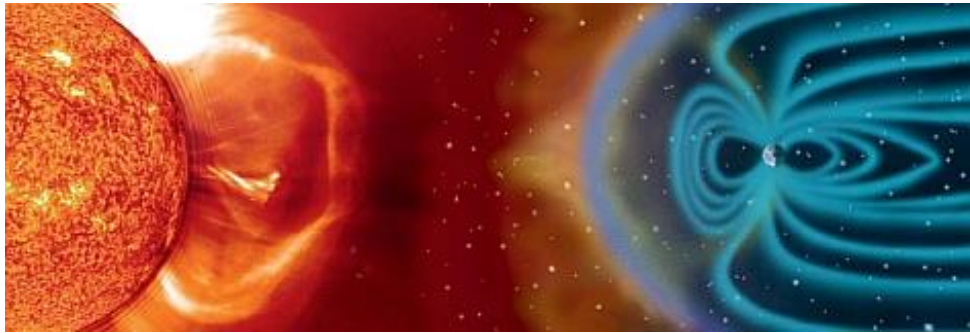
  (UNOOSA, SCOSTEP, NASA and Boston college)

- A particular focus will be on new research results and findings and to encourage greater cooperation in developing partnerships and ISWI networks

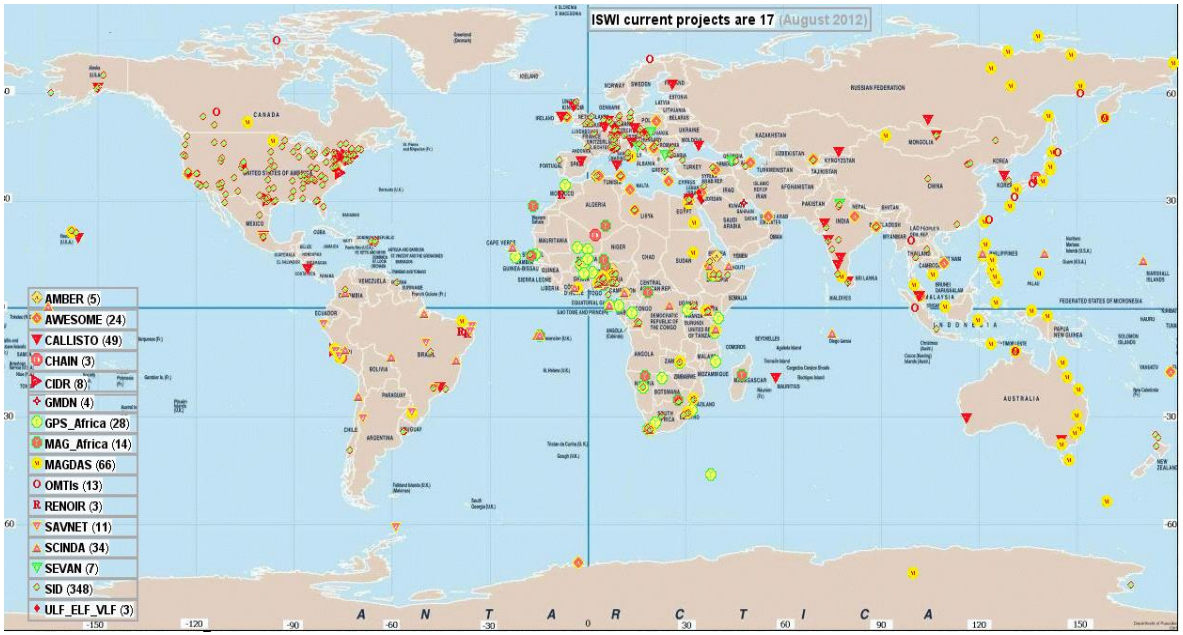
- Topics: Instrumentation;• Solar Physics;• Magnetosphere, Ionosphere, and Thermosphere;• Solar-Terrestrial Coupling and Space Weather;• Space Weather effects on GNSS;• New Space Weather scientific results; • Capacity-Building, Education and Outreach

- 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)

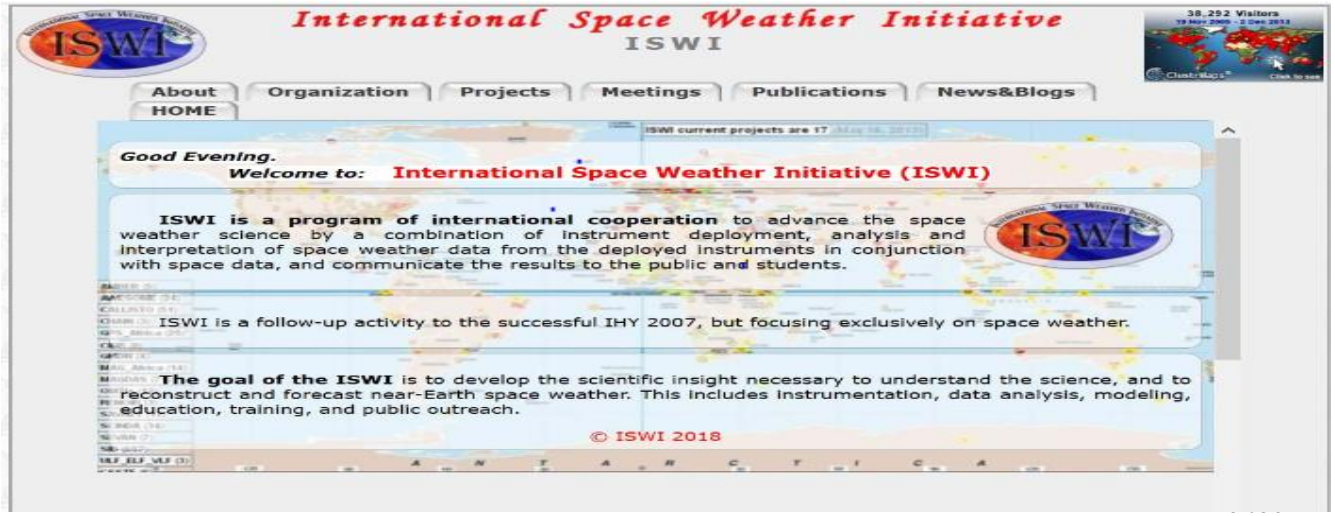
- Provides information on ionospheric conditions (e.g., scintillation) and hence forecasts communication degradation and outage in the equatorial region.
- Radio signals up to a few GHz frequency are affected
- The region affected corresponds to about 1/3 of the surface of the globe
- Important for transequatorial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

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

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

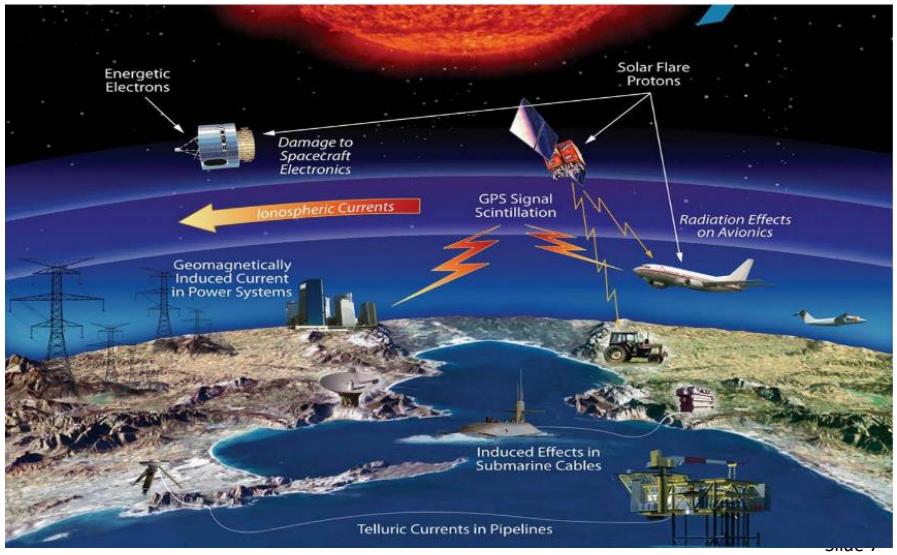
ISWI and ISWI Steering Committee

- 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*



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



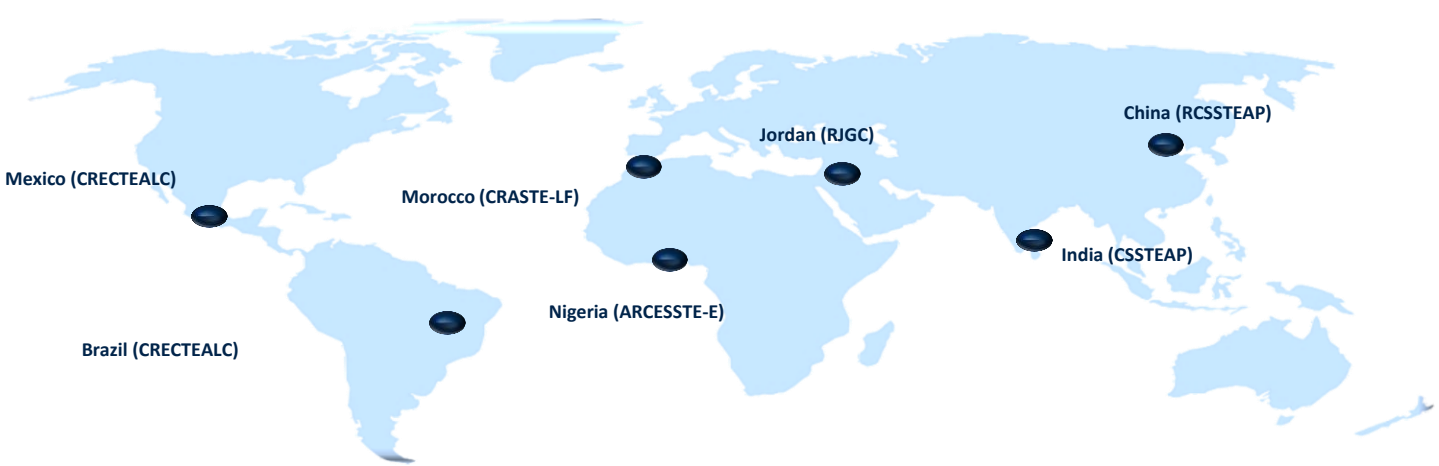
International Committee on GNSS (ICG)

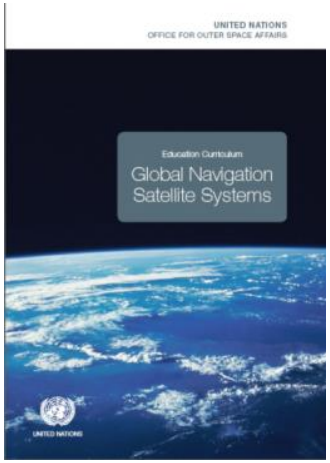
- UNOOSA serves as the executive secretariat of ICG
- The ICG promotes **voluntary cooperation** related to civil satellite-based positioning, navigation, timing, and value added services
- Encourages **coordination** among GNSS providers

- **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

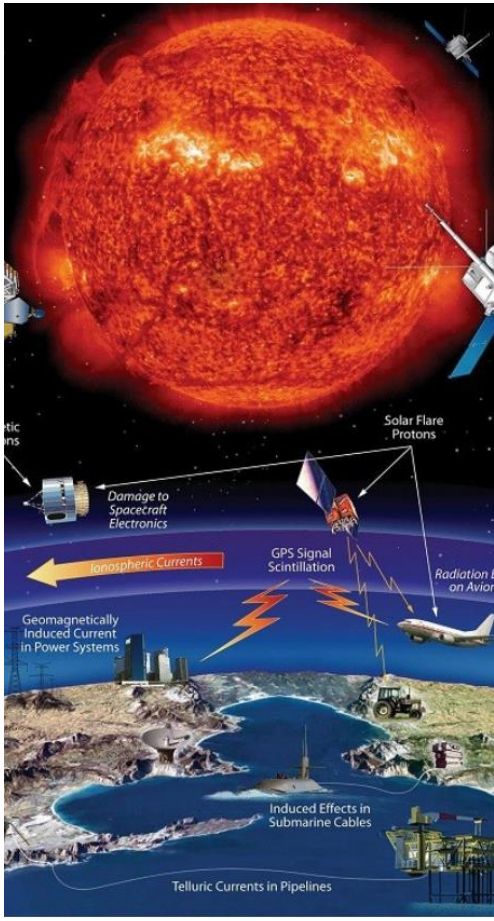
ICG Information Portal

WWW.UNOOSA.ORG

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

Conclusion

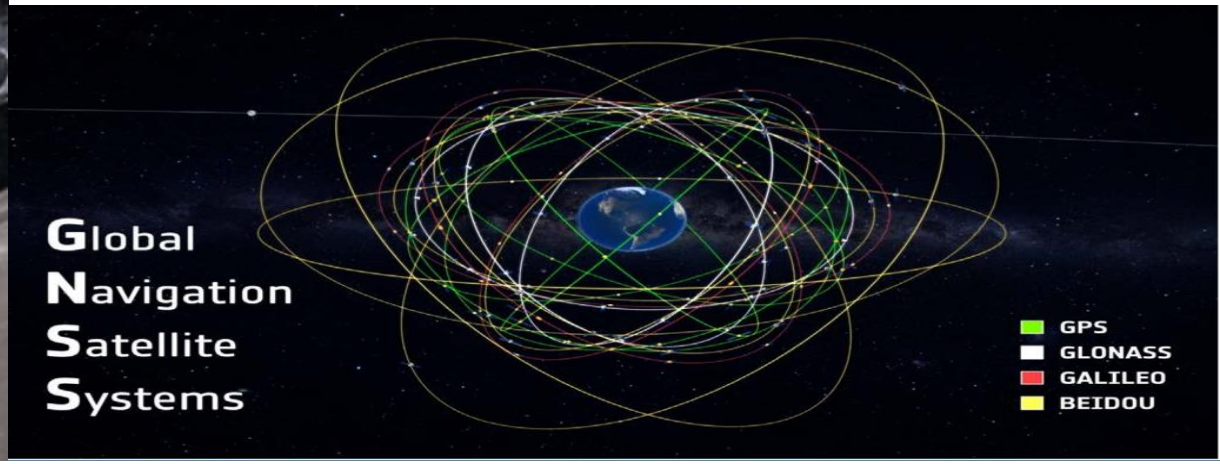
- ***Space weather*** is so critical because we are more dependent on space-based technology than ever before
  - Major effects include power grid damage, satellite damage, health risks due to radiation exposure, HF and satellite communication disruptions, climate change and GNSS navigation errors
- ***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

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



THANK YOU

UNITED NATIONS
Office for Outer Space Affairs
www.unoosa.org • @UNOOSA