

# Space Weather Services: Building Resilience through International Partnerships



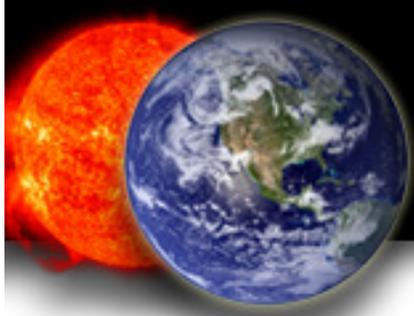
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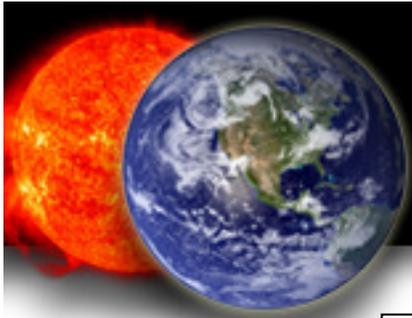
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# Main Points



- Global service demand
- National civil contingencies
- International coordination efforts
- Future goals and challenges
- Role of COPUOS





# Electric Power Impacts – October, 2003

## Sweden:

- Power outage
- Transformer heating in nuclear plant



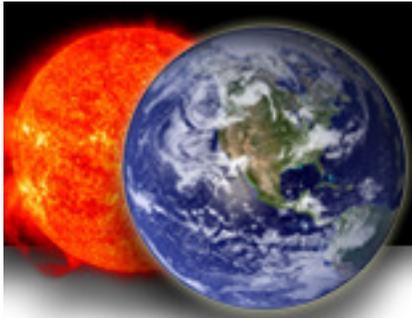
## United States:

- Power reduced to mitigate impact on generation facilities



## South Africa:

- 14 transformers damaged
- \$60 million impact
- Basic commerce and security impaired



# Spacecraft Operations and Aviation Impacts

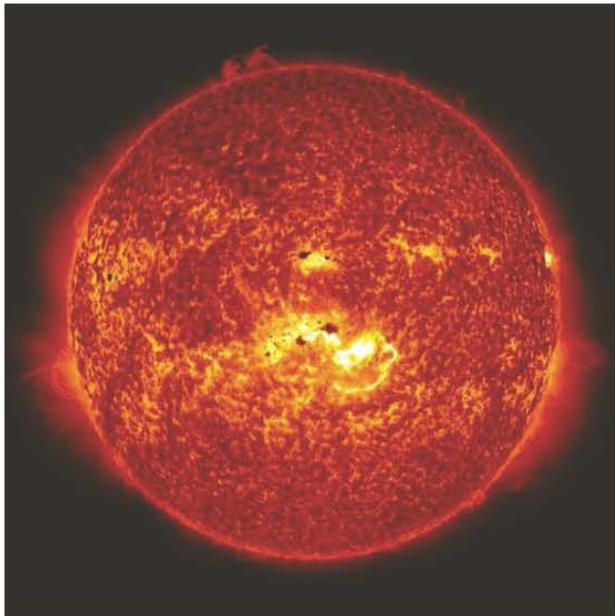
## January 8, 2014

NBCnews.com

### Huge solar flare delays private rocket launch to Space Station

Tariq Mallik, Space.com

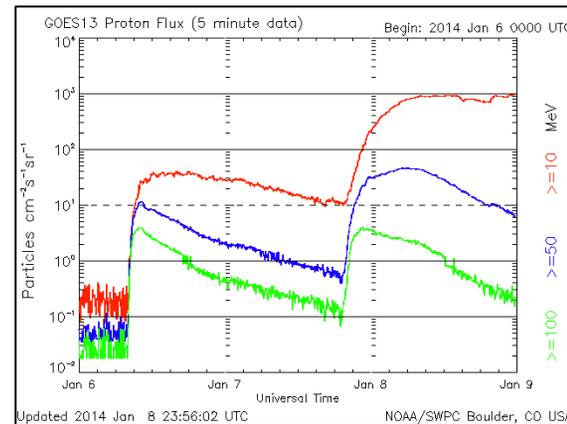
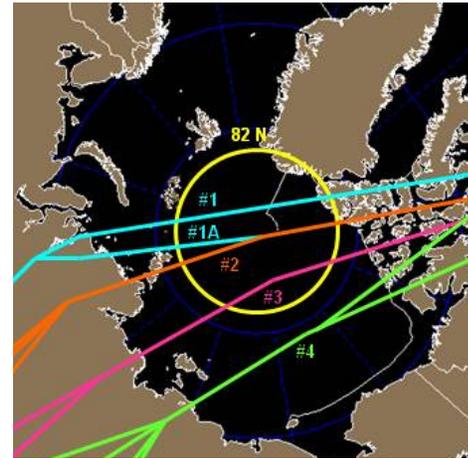
35 minutes ago



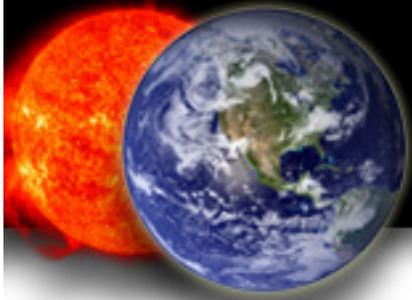
NASA/SDO

Orbital Sciences cargo  
delivery to ISS

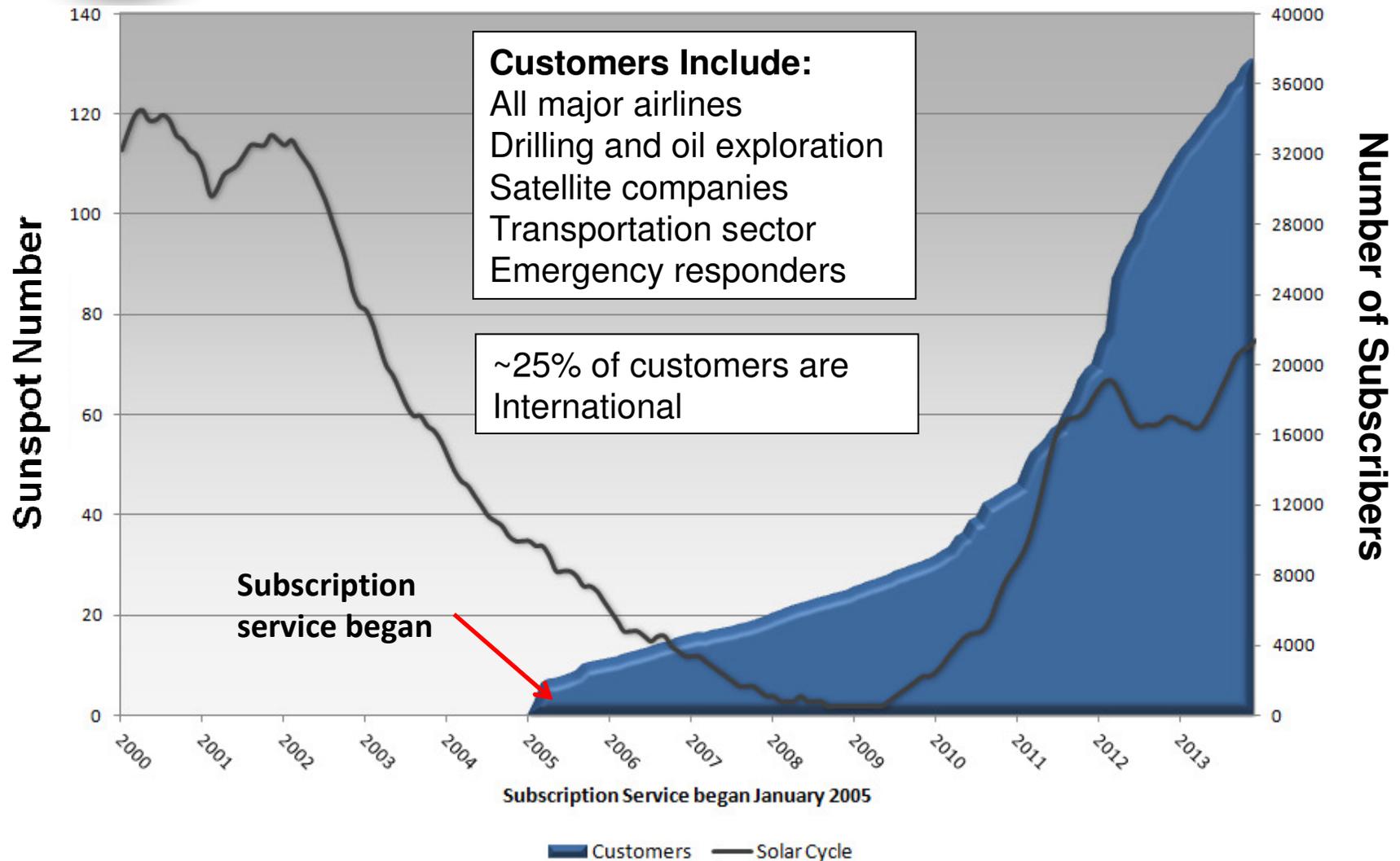
Polar Airline Flights Re-routed

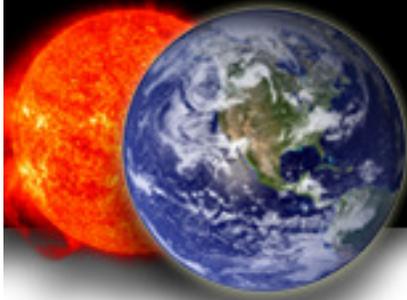


Energetic Proton Flux  
Geostationary Orbit



# Growth in Subscribers to U.S. Space Weather Products





# Space Weather Risks are Recognized - National Mitigation Plans are being Developed

## South Korea:

- Space Weather included in National Risk Profile
- Roles and responsibilities of agencies and ministries defined



Korea Space Weather Center

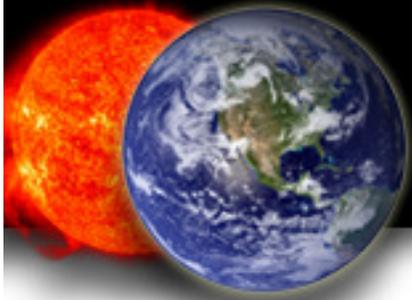
## United Kingdom:

National Register Recognizes  
Space Weather Risks

 **Cabinet**Office

National Risk  
Register of  
Civil Emergencies

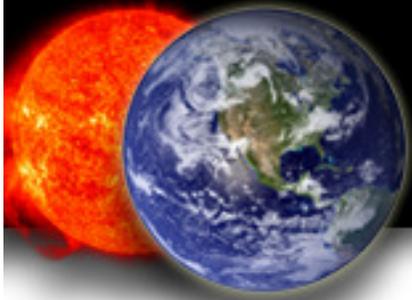
2012 edition



# Overarching Goal: Strengthen Resilience Through Improved Services

Four elements needed to improve space weather capabilities:

1. User Needs: Understand the risks and the actions that need to be taken
2. Targeted Services: Develop useable capabilities from basic science knowledge
3. Observing Infrastructure: Distributed space-based and ground-based
4. Global Coordination: Consistent, accurate message



# International Space Environment Service

Coordinating space weather services since 1962



**ISES**  
International Space  
Environment Service



World Meteorological  
Organisation

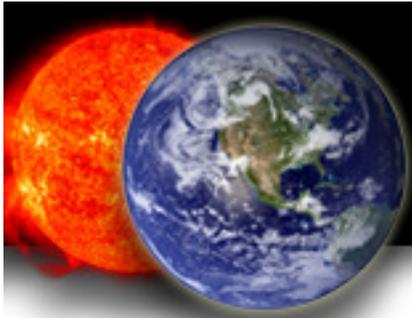
- Endorsed by national governments as space weather service providers
- Provide local users with targeted services
- Promote exchange of data and information
- New members are welcome

15 Regional Warning Centers

4 Associate Warning Centers

1 Collaborative Expert Center





# World Meteorological Organization

Specialized Agency of the United Nations with 191 Members

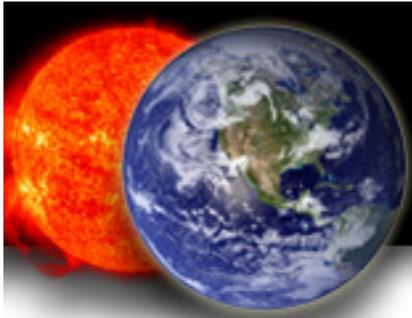
- Combine meteorology and space weather communities
- Integrate space weather in global observing system
- Foster development of new service organizations
- New members are encouraged to participate

WMO Inter-Programme Coordination  
Team on Space Weather (ICTSW)

22 Member Countries

7 International Organizations





# Additional Organizations Involved in Space Weather Services



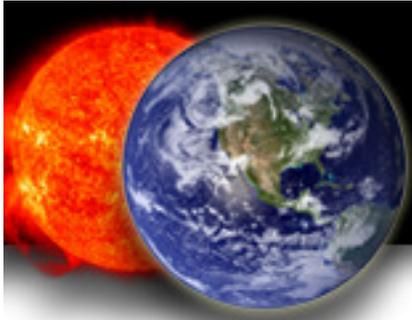
## Coordination Group for Meteorological Satellites:

- Maintain awareness of operational service needs
- Coordinate observing capabilities and foster interoperability
- Report on spacecraft anomalies and resolution studies
- Support dual use of GNSS for meteorology and space weather



## International Civil Aviation Organization:

- Defining civil aviation requirements for space weather services
- Coordinate with WMO to recommend global configuration of service providers

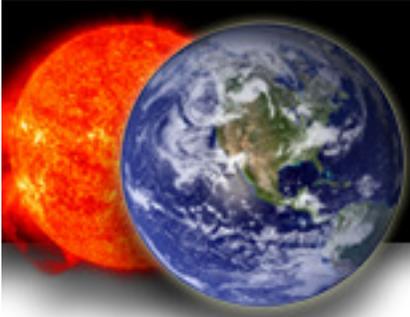


# Goals and Challenges

- Maintain long-term continuity of key observations – with open access to all Members
- Establish coordination procedures for extreme events
- Promote utilization of mature research to improve services
- Develop training materials to assist new Members to become service providers



2013 ISES Meeting and Panel Discussion on International Coordination on Extreme Events



# Role of COPUOS

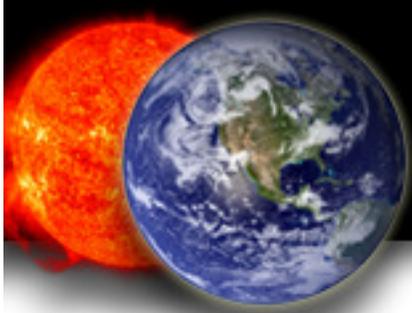
COPUOS STSC is uniquely positioned to facilitate communication from basic science to operational services

COPUOS interests cover the full range of issues:

- Space research and education
- Space weather services
- Capacity building
- Broad government and space agency participation

COPUOS can serve as a focal point for international space weather information exchange and coordination action

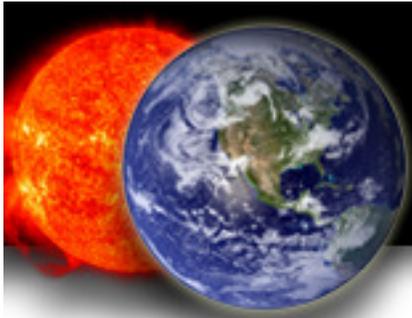




## Draft Guidelines – Working Group on the Long-term Sustainability of Outer Space Activities

Actions of space weather service agencies are well aligned with the LTSSA Space Weather Expert Group draft guidelines:

- Promote sharing, intercalibration, and dissemination of space weather observations
- Coordinate to maintain long-term continuity of space weather observations
- Promote development of advanced forecasting tools
- Coordinate sharing and dissemination of space weather model outputs and forecasts

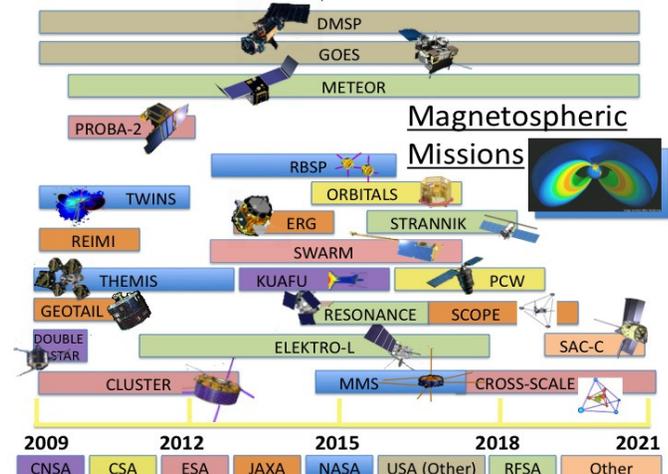


# Challenge for COPUOS Members – Transition of Data from Research to Operations

## Networks of Ground-Based Data UN International Space Weather Initiative



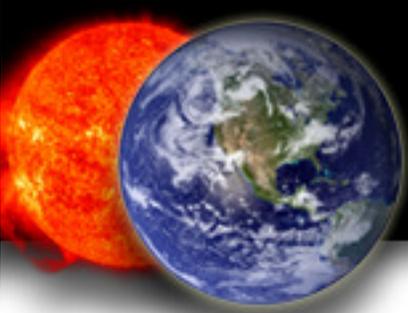
## Distributed Space-Based Assets International Living With a Star



More than 25 Space Agencies

## Challenges:

- Utilizing existing research data for space weather services
- Maintaining long-term continuity of key parameters



## Summary

- There is a growing, global need for improved services and for consistent, coordinated observations and information
- Coordination on observations, research, and services is essential to improve our global resilience to space weather
- Numerous international organizations are becoming engaged in space weather in complementary ways
- COPUOS STSC is uniquely positioned to facilitate broad awareness and promote coordinated actions
- Members are encouraged to join the activities of ISES and WMO and to coordinate efforts through COPOUS