Space Weather in the World Meteorological Organization

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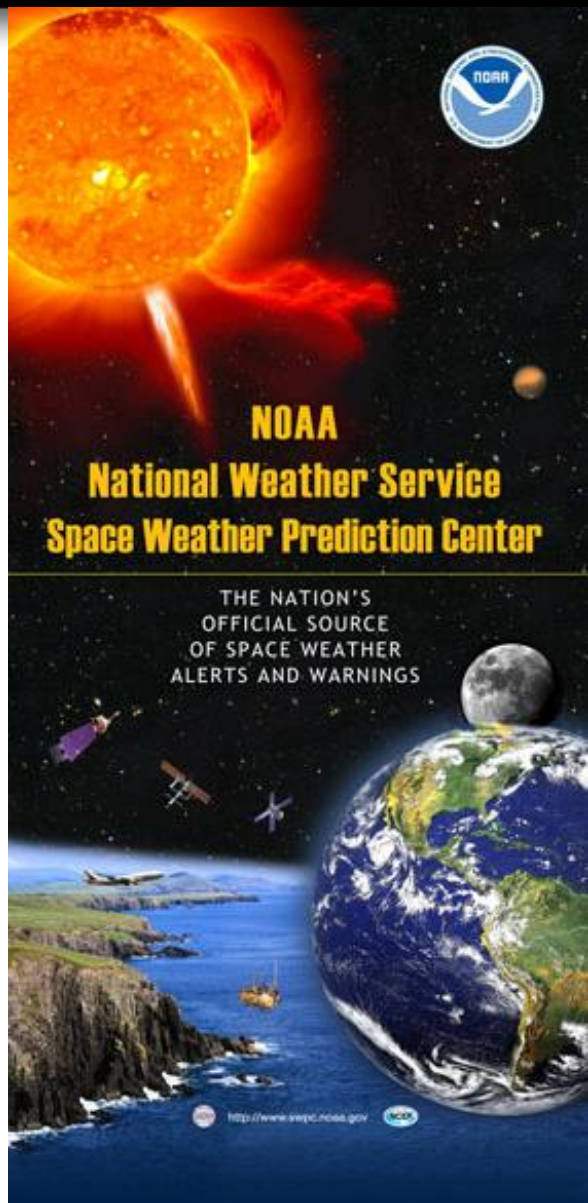
Outline

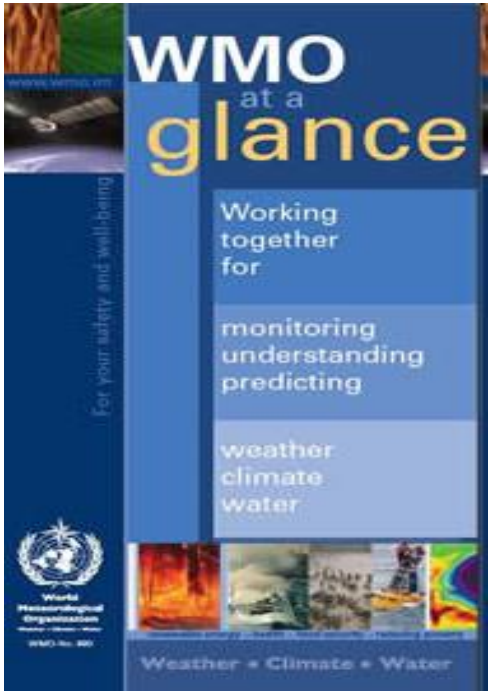
- The Role of the WMO
- WMO's Interest in Space Weather
- Inter-Programme Coordination Team on Space Weather
- WMO Integrated Global Observing System
- WMO Information System
- Next Steps



World Meteorological Organization

WMO is a specialized agency of the United Nations with 189 Members (States and Territories)

- Collaboration among the meteorological, hydrological (and now space weather) service providers
- Up-to-date, accurate information on the state of the environment
- Globally integrated mechanism for exchange of data, information, and products
- Fosters and encourages research activities



Committed to ensuring that all nations take full advantage of weather, climate, and water information and products

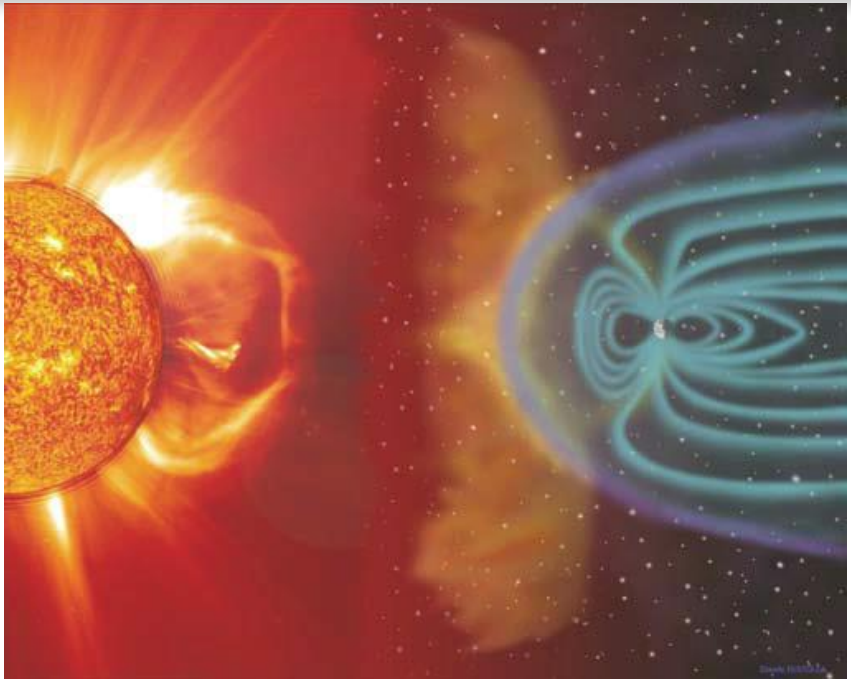
Opportunities for Improving Space Weather Products and Services

- Increase global awareness and advocacy
- Improve ground-based and space-based data coverage
- Utilize international networks to coordinate data and services
- Create partnerships to provide back-up and share responsibilities
- Foster research on the coupled Sun-Earth system
- Exploit synergies with weather and climate data, science, and services

Space Weather in the World Meteorological Organization (WMO)

Motivation for WMO:

- Space Weather impacts the Global Observing System and the WMO Information System
- Space Weather affects important economic activities (aviation, satellites, electric power, navigation, etc.)
- Synergy is possible with current WMO meteorological services and users, such as sharing observing platforms and issuing multi-hazard warnings
- Several WMO Members have Space Weather with Hydro-Met Agency



THE POTENTIAL ROLE OF WMO IN SPACE WEATHER

A REPORT ON THE POTENTIAL SCOPE, COST AND BENEFIT OF A WMO ACTIVITY IN SUPPORT OF INTERNATIONAL COORDINATION OF SPACE WEATHER SERVICES, PREPARED FOR THE SIXTIETH EXECUTIVE COUNCIL

April 2008

Space Weather in the WMO - Background

- 2007 - International Space Environment Service contacted WMO to explore collaboration
- 2007 - 15th WMO Congress requested WMO Space Programme to consider activities in the area of Space Weather
- 2008 - “Potential Role of WMO in Space Weather” was drafted
- 2009 - 61st Executive Council approved the Terms of Reference for the proposed Inter-Programme Coordination Team on Space Weather
- 2010 - Inter-Programme Coordination Team on Space Weather (ICTSW) established
- 2011 - 16th WMO Congress - Space Weather Side Meeting and Statement on Global Preparedness for Space Weather Hazards

Inter-Programme Coordination Team for Space Weather

Officially established: 3 May 2010

Terms of Reference:

- Integration of Space Weather observations within the WMO Integrated Global Observing System (WIGOS)

- Standardization and enhancement of Space Weather data exchange and product delivery through the WMO Information System

- Harmonize definition of end-products and services

- Encourage research and operations dialog

Inter-Programme Coordination Team for Space Weather

- Australia – Phil Wilkinson
- Belgium – Ronald Van der Linden
- Brazil – Hisao Takahashi
- Canada – Larisa Trichtchenko
- China (Co-chair) – Xiaoxin Zhang
- Colombia – Jaime Villalobos Velasco
- Ethiopia – Yitaktu Tesfatsion
- Finland – Kirsti Kauristie
- Japan – Ken Murata
- South Korea (will nominate soon)
- Russian Federation – Vyacheslav Burov
- United Kingdom – David Jackson
- United States (Co-chair) – Terry Onsager, Jim Head, Joe Davila, Kelly Hand

- European Space Agency – Alain Hilgers
- International Civil Aviation Organization – R. Romero
- International Space Environment Service – David Boteler
- International Telecommunication Union – Sergio Buonomo
- UN Office of Outer Space Affairs – Hans Haubold
- WMO – Jerome Lafeuille

Vision for the WMO Integrated Global Observing System (WIGOS)

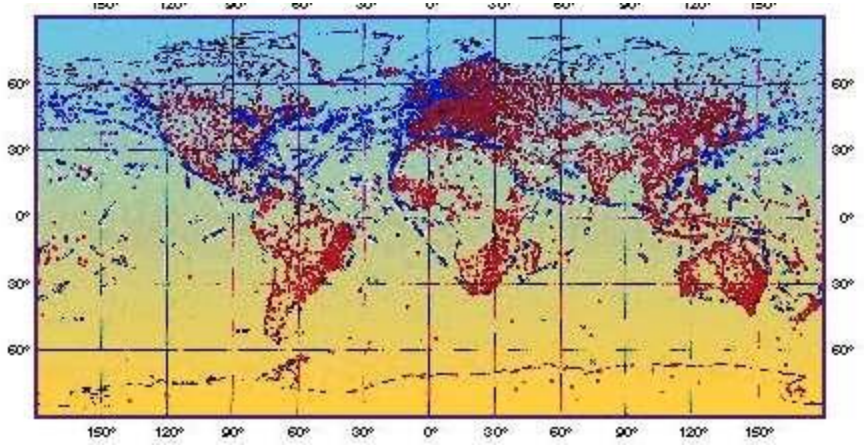
Establish an integrated, comprehensive, and coordinated observing system

- Homogeneous, interoperable, compatible observations
- Comprehensive, standard set of data and metadata
- Validation, maintenance, and calibration procedures
- High quality end-user products

Facilitates comprehensive knowledge of current conditions and the assimilation of data into numerical models

Global Observing System Components

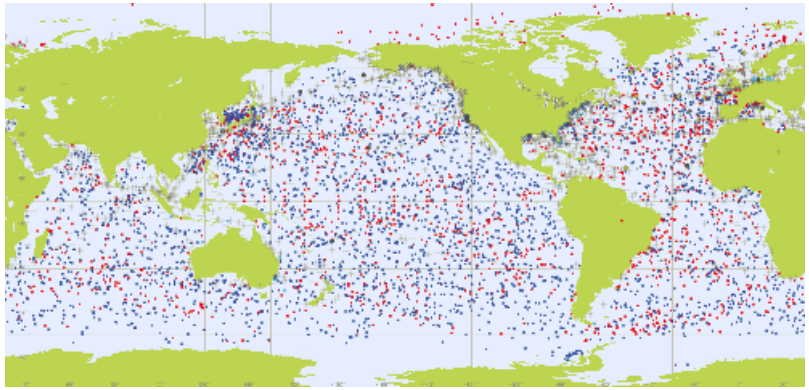
Surface Observations



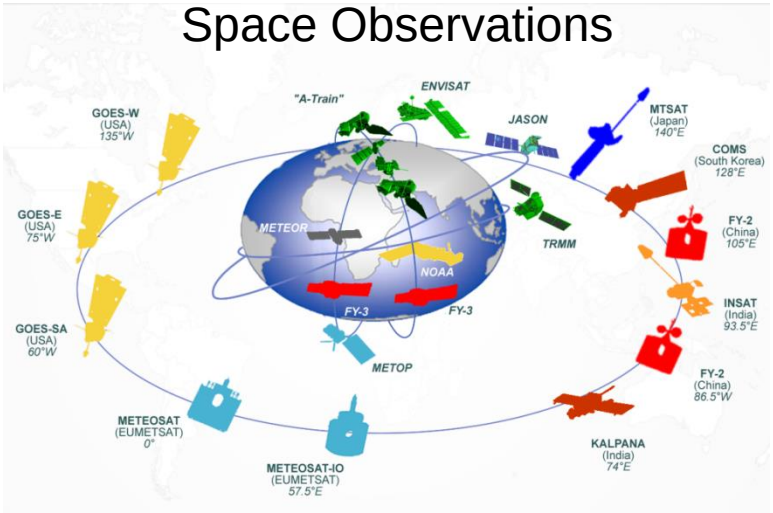
- 10,000 land stations
- 3,000 aircraft
- 1,000 upper-air stations
- 1,000 ships

- 16 operational meteorological satellites
- 50 environmental research satellites

Marine Observations



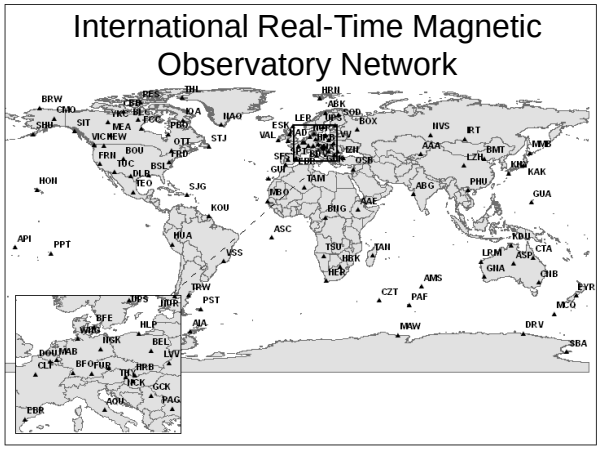
Space Observations

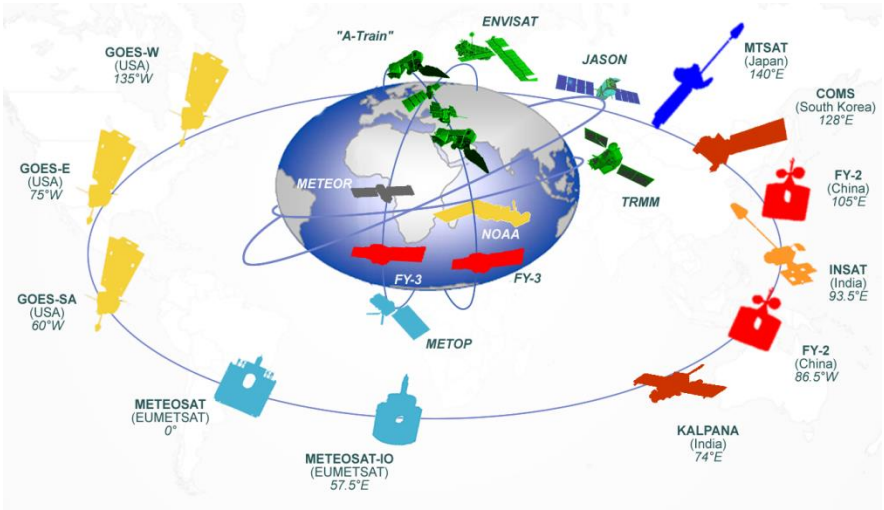


Integrating Space Weather Observations

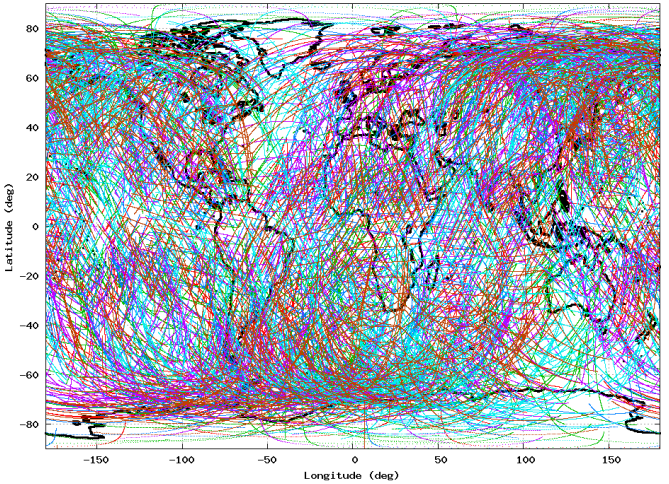
Ground-based and space-based data are increasingly available:

- Ground magnetometers, ionosondes, etc.
- International GNSS Service
- GNSS Radio Occultation
- Solar observations and space radiation





COSMIC Radio Occultation



Space Weather Integration in WIGOS

- Space weather requirements submitted to the Expert Team on Evolution of the Global Observing System prior to June meeting
- Space weather will be a new Application Area in the Global Observing System
- Requirements Review will be conducted
- Gaps will be identified and prioritized
- Advocacy will be pursued among Members

Vision for the WMO Information System (WIS)

Establish a single coordinated global infrastructure for telecommunications and data management functions

- Routine collection and dissemination service for time-critical and operation-critical data and products.
- Data discovery, access and retrieval service
- Timely delivery of data and products

Goal for Space Weather: Enhance data exchange, product generation, and regional coordination of forecast products

Coordination Among UN Organizations

Example: ICAO – WMO Coordination

- International Civil Aviation Organization
  - Develop operational requirements for space weather information
  - Develop space weather training materials
  - Coordinate operational service and data requirements with WMO team

- WMO Space Weather Team
  - Obtain service requirements from ICAO team
  - Identify observations required to provide services
  - Standardize data exchange
  - Harmonize end products and services

Actions for Advancing Space Weather

- Enable WMO Members to benefit from existing services
  - Provide training for the use of existing products
  - Develop services targeted to each WMO Region

- Foster the participation of WMO Members in data and service delivery
  - Identify data that can be added to the Global Observing System
  - Encourage a high-level coordination of observing assets
  - Develop a service-center concept similar to Regional Specialized Meteorological Centers and Volcanic Ash Advisory Centers
  - Coordinate the development of Sun-Earth coupled data-assimilation models

Summary

- WMO has the experience of operating a globally coordinated system of observations and services
- A growing number of Member states are recognizing the importance of space weather and are endorsing WMO participation
- Space weather observations are being integrated into the WMO Global Observing System
- Coordination of product generation and distribution is planned
- Near-term goal: Provide training to increase the benefit received by Members from services available today
- Long-term goal: Increase the contributions and the coordination among Members