
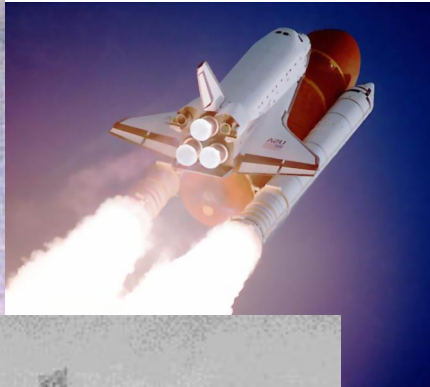


SPACE WEATHER ACTIVITIES WITHIN NASA

A silhouette of a person standing on a dark surface, holding a glowing sphere with both hands. The sphere is bright and appears to be the sun, set against a warm, orange-hued sky. In the background, there are faint silhouettes of trees and buildings, suggesting an urban or suburban setting at dusk or dawn.

Joseph M Davila
Senior Scientist, Heliophysics Division
NASA Goddard Space Flight Center

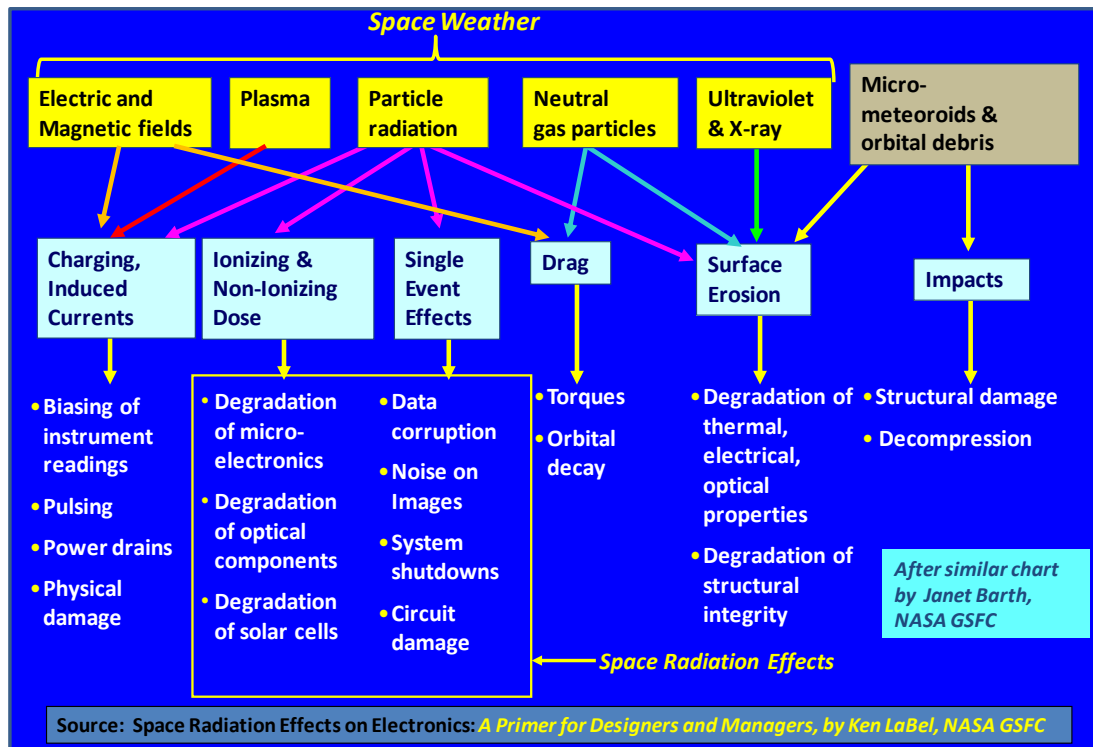
Exploration Leads to the Need for New Knowledge



1520 Magellan Sails around the World

- 16th century voyages of exploration opened the way for commerce across the oceans
- Knowledge of currents, tides, seasons, and storms was needed
- Today we stand at a similar point with regard to space travel
- The development of Space Weather as a science is just beginning with similar motivations

Why do we care?



Space Weather affects:

Whatever NASA Operates

- Human
- Robotic
- Launch
- Aeronautics

Wherever NASA Operates

- In the Atmosphere
- “Geospace”
 - Low Earth Orbit
 - Medium Earth Orbit
 - Geostationary Orbit

- Moon Surface and Orbit
- Heliosphere
- Planetary Orbits and Surface

Whenever NASA Operates

- Solar Minimum
- Solar Maximum

Space Weather affects Modern Life on Earth

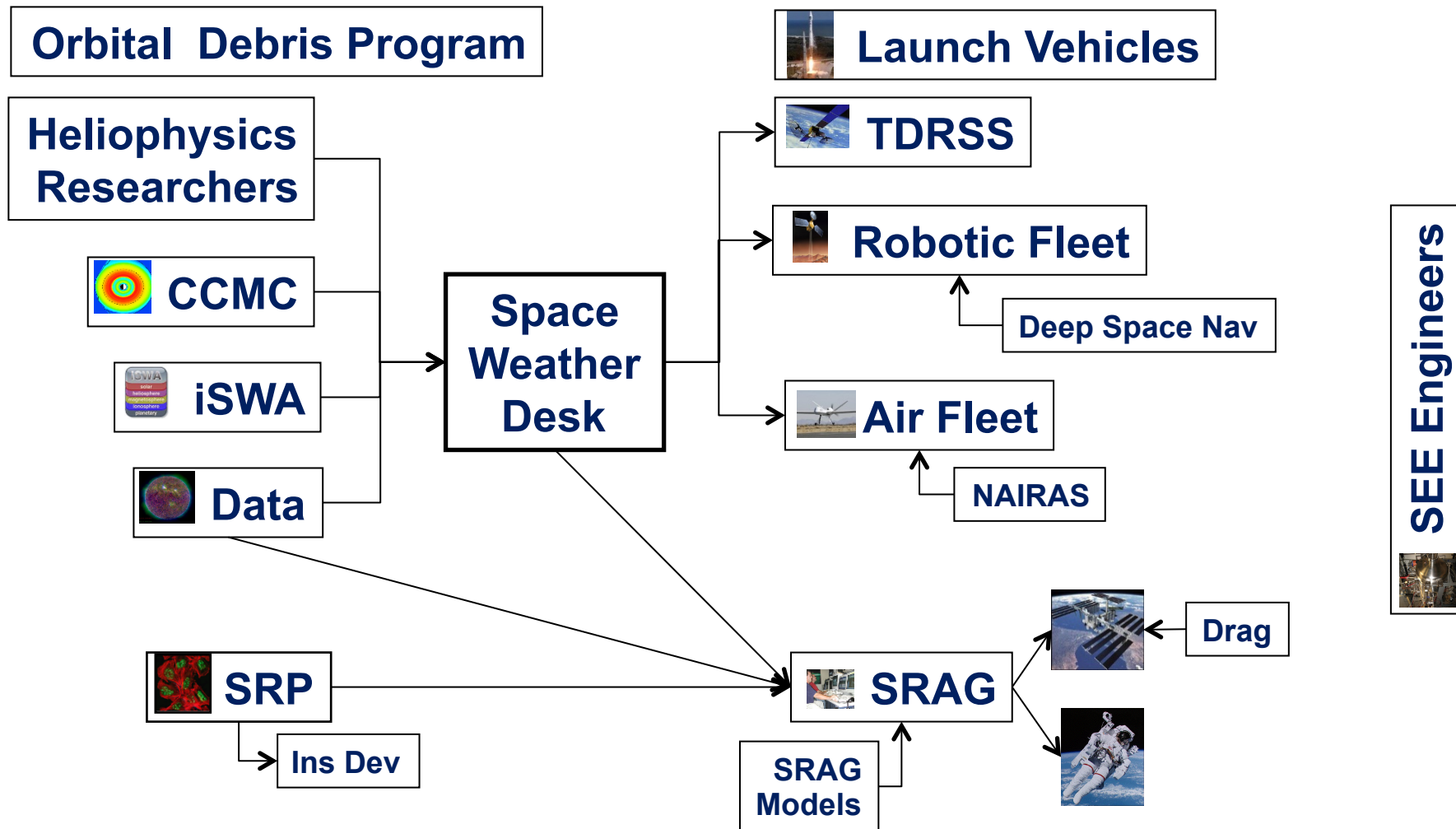


NASA Space Weather Activities

Research

Operations

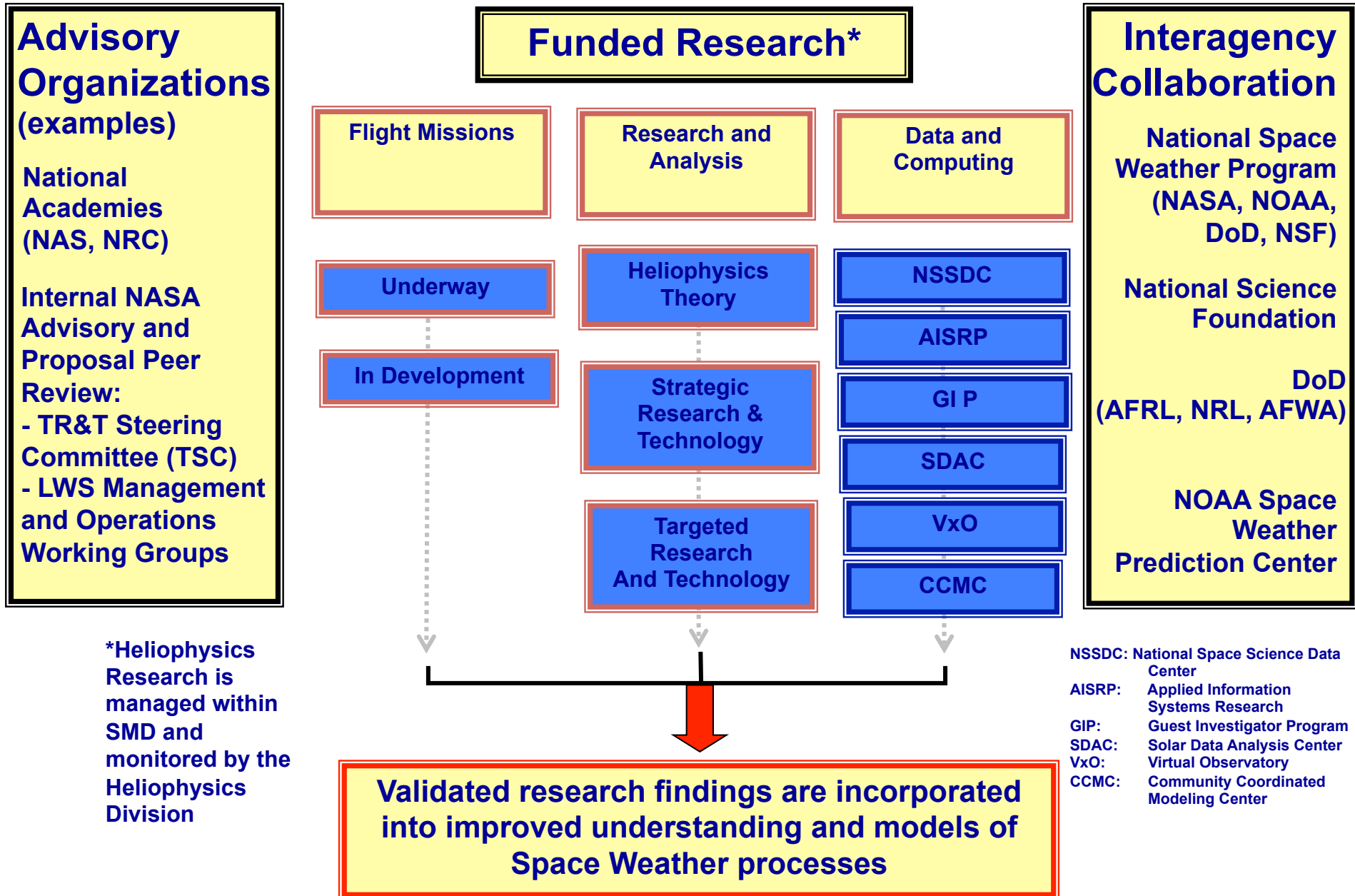
Engineering



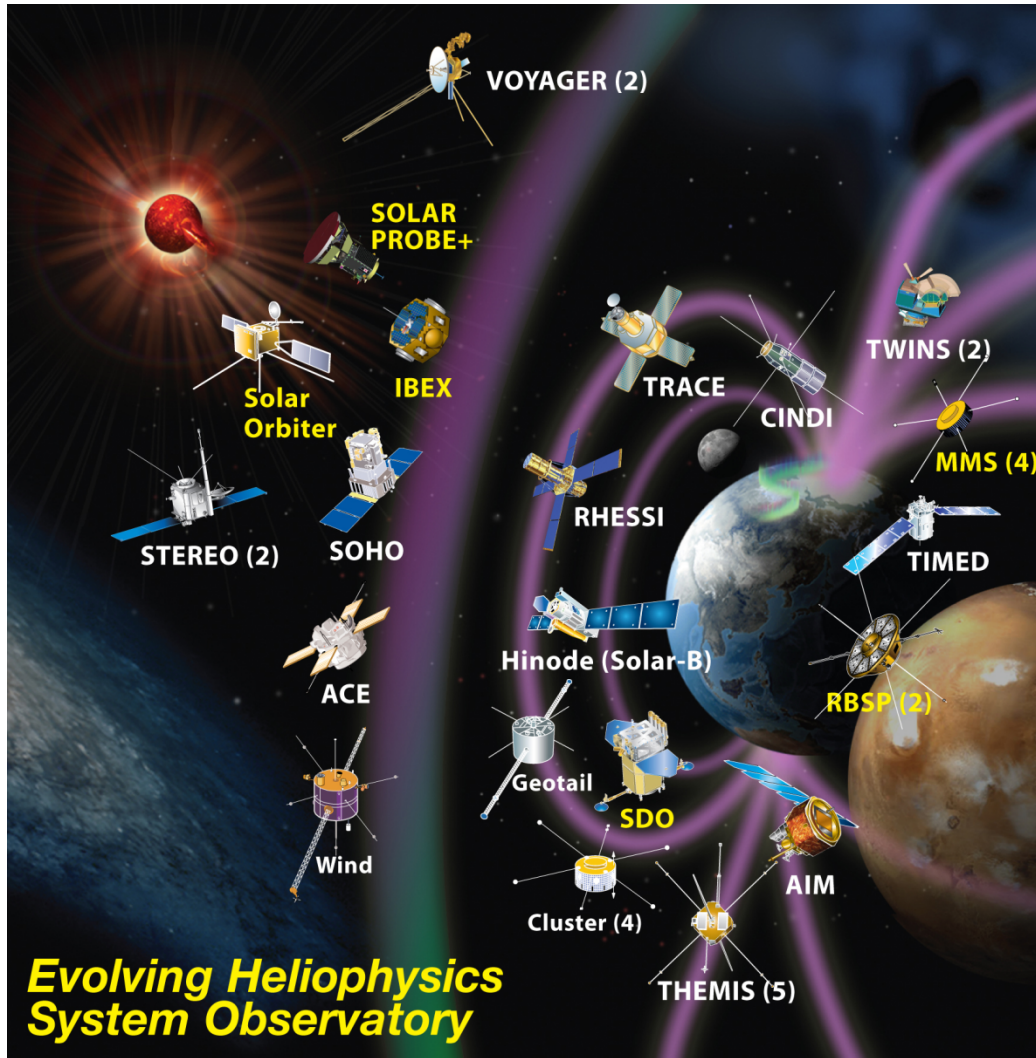
NASA Heliophysics Division Programs/Projects Related to SWx Activities

- **Data** – The NASA mission data available via VxO s and mission data bases
- **Theory** – Active ROSES and TRT programs
- **Models** – available on line from CCME
- **Education** – UCAR/NASA Summer School for LWS Program, materials on line
- **NASA Heliophysics Fellowships 2010**
- **Citizen Science** – Internet Access to Theory/Models/
Data - - 24/7

NASA Heliophysics Research Program

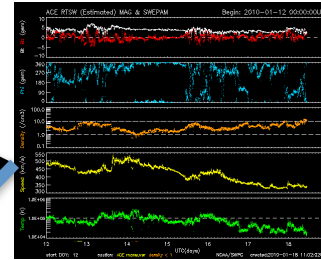
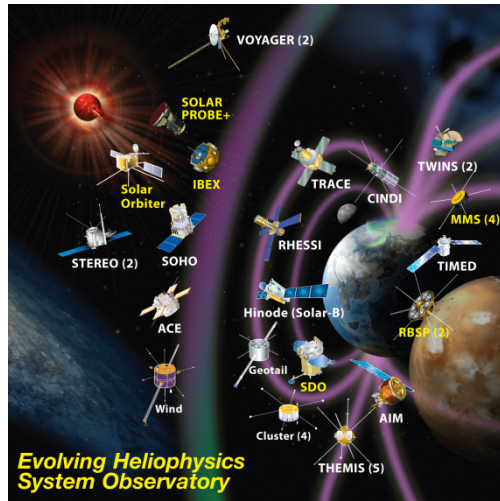


NASA Space Weather Missions

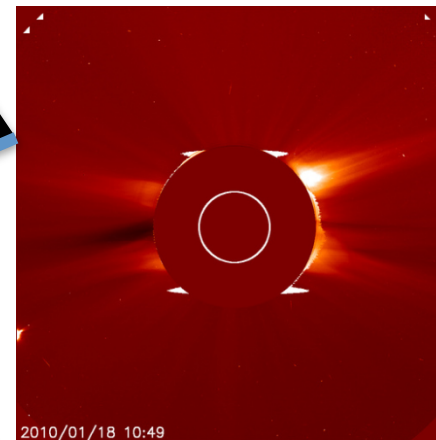


- ~ \$4B S/C Heliophysics System Observatory
- Yearly Ops ~\$40M (excluding SDO and RBSP) TRT & ROSES ~ 45M\$
- Heliophysics Data Bases available via internet
- CCMC online 24/7
- iSWA Situational Awareness system now available via internet
- LWS Summer school

NASA Heliospheric System Observatory (HSO): SWx Today



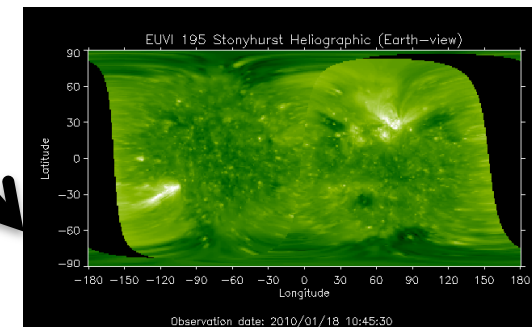
ACE



SOHO

CCMC data
Models+Theory

SWx Users



STEREO

The State of Space Weather Science

- **Significant progress over the past decade in developing physics-based space weather models. Enter large-scale coupled (real-time) space plasma simulations.**
- **Significant progress in, for example, 3D imaging of the solar phenomena.**
- **Still data starved in various spatial space weather domains. Need guaranteed continuity for critical space weather data streams.**

Humans in Space (Today)

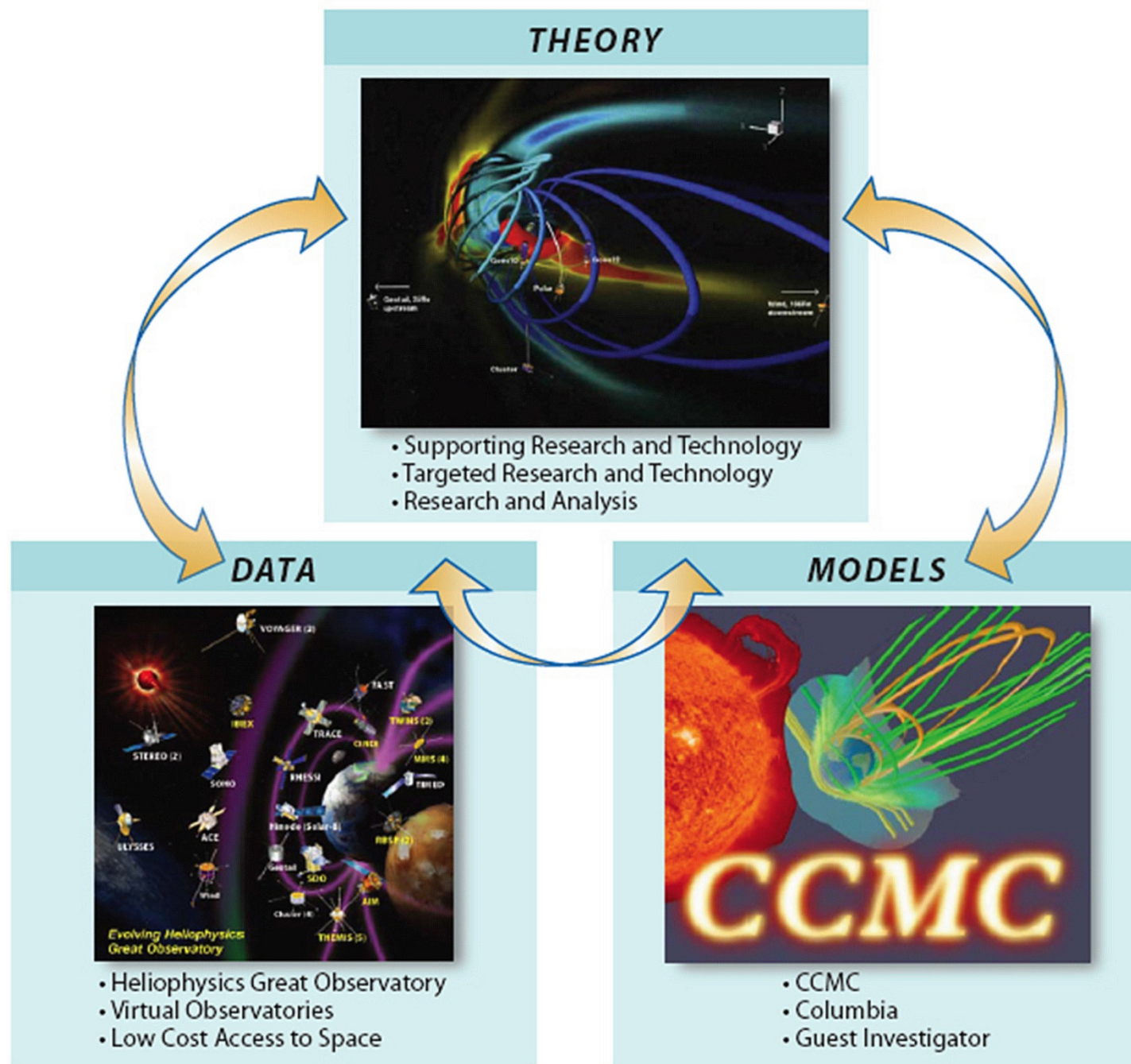
- **Operational space weather support to human space flight is provided through a close working relationship of:**
 - The NOAA Space Weather Prediction Center
 - The NASA Space Radiation Analysis Group
- **The NOAA Space Weather Prediction Center (SWPC) monitors and forecasts the space weather environment; SWPC works closely with the Space Radiation Analysis Group (SRAG) and with other operational NASA missions**
- **Operational support to human space flight is provided by a well-coordinated effort centered around the Space Radiation Analysis Group at NASA JSC**
- **Robotic mission support is focused on designing spacecraft to survive the space radiation environment; Operational support varies from mission to mission**



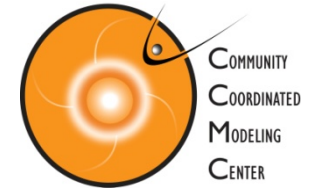
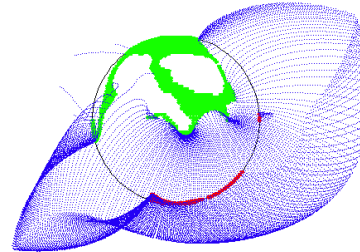
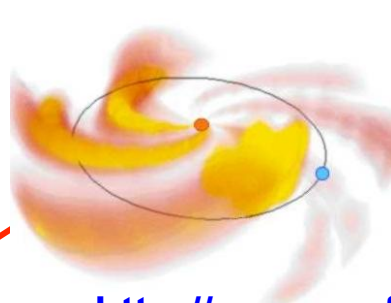
SRAG's Multi-Purpose Support Room in the Mission Control Center at the Johnson Space Center

Humans in Space -- Exploration

- **Radiation effects on humans remains one of the most significant challenges to long duration exploration missions**
- **There is a continuing need to improve our ability to forecast solar storms, and to use physics-based forecasts of “all clear” periods to keep our astronauts out of harm’s way**
- **Current limits on radiation exposure from the deeply penetrating Galactic Cosmic Rays constrains crews to no more than about 150 days in deep space (detailed limitations are age and sex dependent)**
- **There is growing recognition that space radiation impacts are more extensive than the well known acute risk and risk of cancer, but also may have a significant impact on the central nervous system, the immune system, and the cardiovascular system**
- **NASA is investigating these effects through a comprehensive ground-based program at the NASA Space Radiation Laboratory at Brookhaven National Lab**



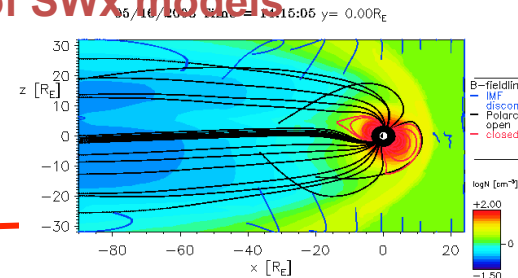
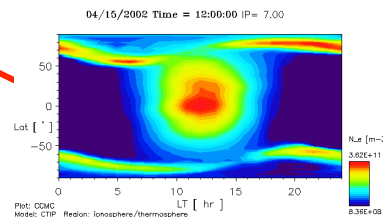
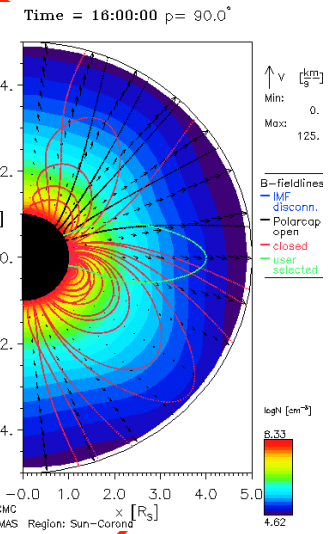
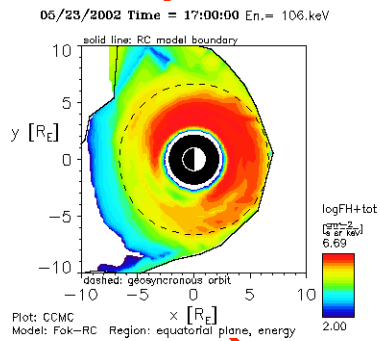
Community Coordinated Modeling Center



• <http://ccmc.gsfc.nasa.gov>

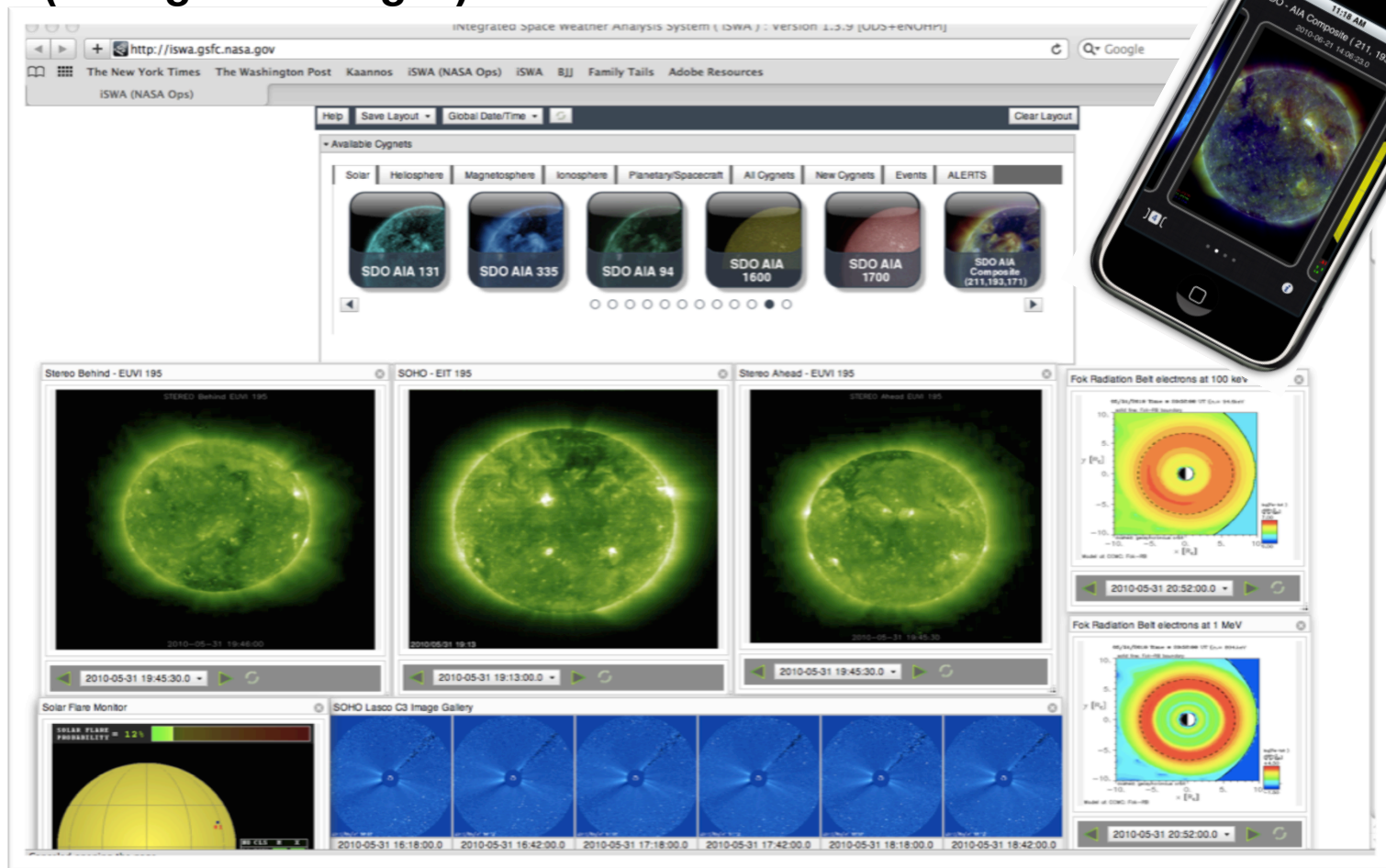
Facilitate Community Research

- Execute simulations on request
- Tailored analysis and visualization
- Education support
- Support Space Weather Operations
 - Transition of research models to operations
 - Test and evaluate models
 - Real-time execution of SWx models



Integrated Space Weather Analysis (iSWA) System

- One-stop shop for 200+ real-time space weather products (iswa.gsfc.nasa.gov).



• <http://nswp.gov>

• U.S. Inter-agency coordination

• NASA Co-Chair



National Space Weather Program

AGENCY PARTICIPANTS



AGENCIES
ACTIVITIES
DOCUMENTS
COMMITTEE MEMBERS
RELATED SITES
CONTACT

Space weather refers to conditions on the Sun and in the space environment that can influence the performance and reliability of space-borne and ground-based technological systems, and can endanger human life or health.

The National Space Weather Program (NSWP) is an interagency initiative to speed improvement of space weather services. It emerged in 1994 from the efforts of several U.S. government agencies to prepare the country to deal with technological vulnerabilities associated with the space environment. **The overarching goal of the NSWP is to achieve an active, synergistic, interagency system to provide timely, accurate, and reliable space weather warnings, observations, specifications, and forecasts.** It will build on existing capabilities and establish an aggressive, coordinated process to set national priorities, focus agency efforts, and leverage resources. The Program includes contributions from the user community, operational forecasters, researchers, modelers, and experts in instruments, communications, and data processing and analysis. **It is a partnership between academia, industry, and government.** The vehicle to implement and manage the Program is the National Space Weather Program Council (NSWPC) within the [Office of the Federal Coordinator for Meteorology](#) under guidance of the **Federal Committee for Meteorological Services and Supporting Research (FCMSSR)**. The Council, which consists of representatives from Federal agencies involved in space weather activities, provides oversight and policy guidance to ensure common needs are met and the interests of each agency are addressed. Under guidance of the NSWPC, the **Committee for Space Weather (CSW)** is the principal agent for advancing the goals of the program.



Last Updated: 02/11/09, [Curator](#)

International Living With a Star

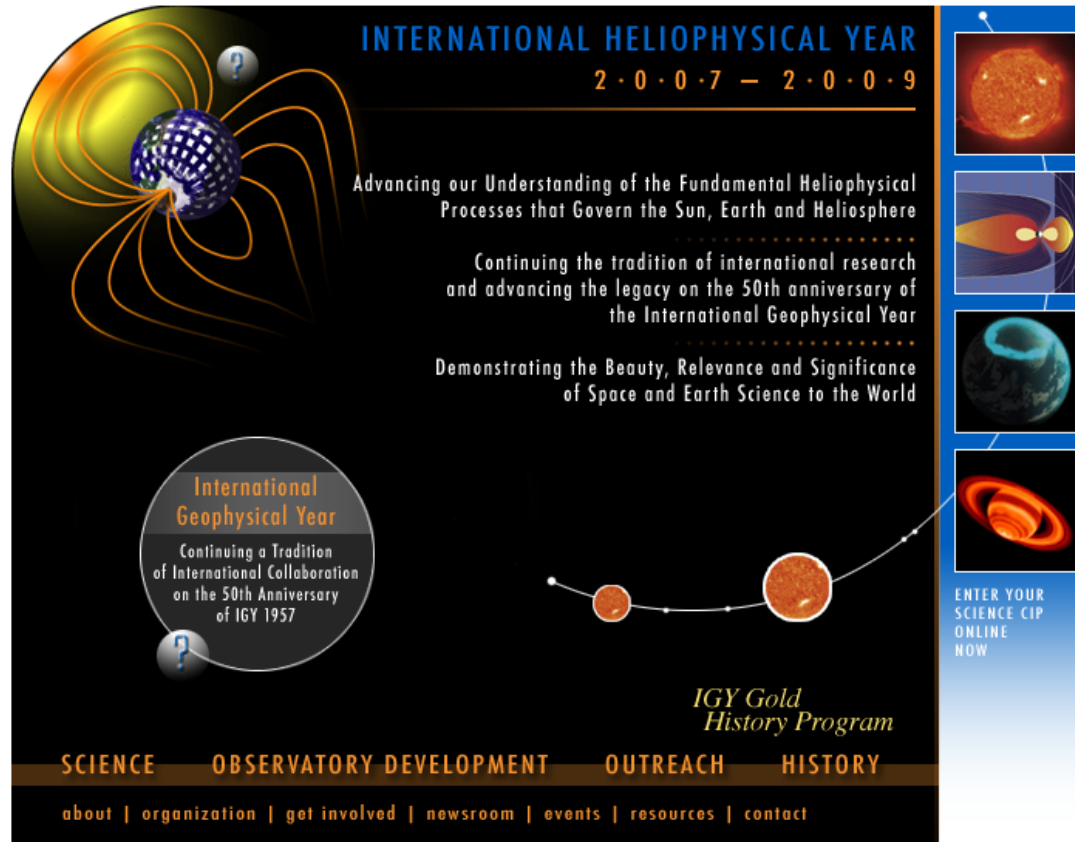
<http://ilws.gsfc.nasa.gov/>

NASA Chair



International Heliophysical Year

<http://ihy2007.org/>



INTERNATIONAL HELIOPHYSICAL YEAR
2 · 0 · 0 · 7 — 2 · 0 · 0 · 9

Advancing our Understanding of the Fundamental Heliophysical Processes that Govern the Sun, Earth and Heliosphere

Continuing the tradition of international research and advancing the legacy on the 50th anniversary of the International Geophysical Year

Demonstrating the Beauty, Relevance and Significance of Space and Earth Science to the World

International Geophysical Year
Continuing a Tradition of International Collaboration on the 50th Anniversary of IGY 1957

IGY Gold History Program

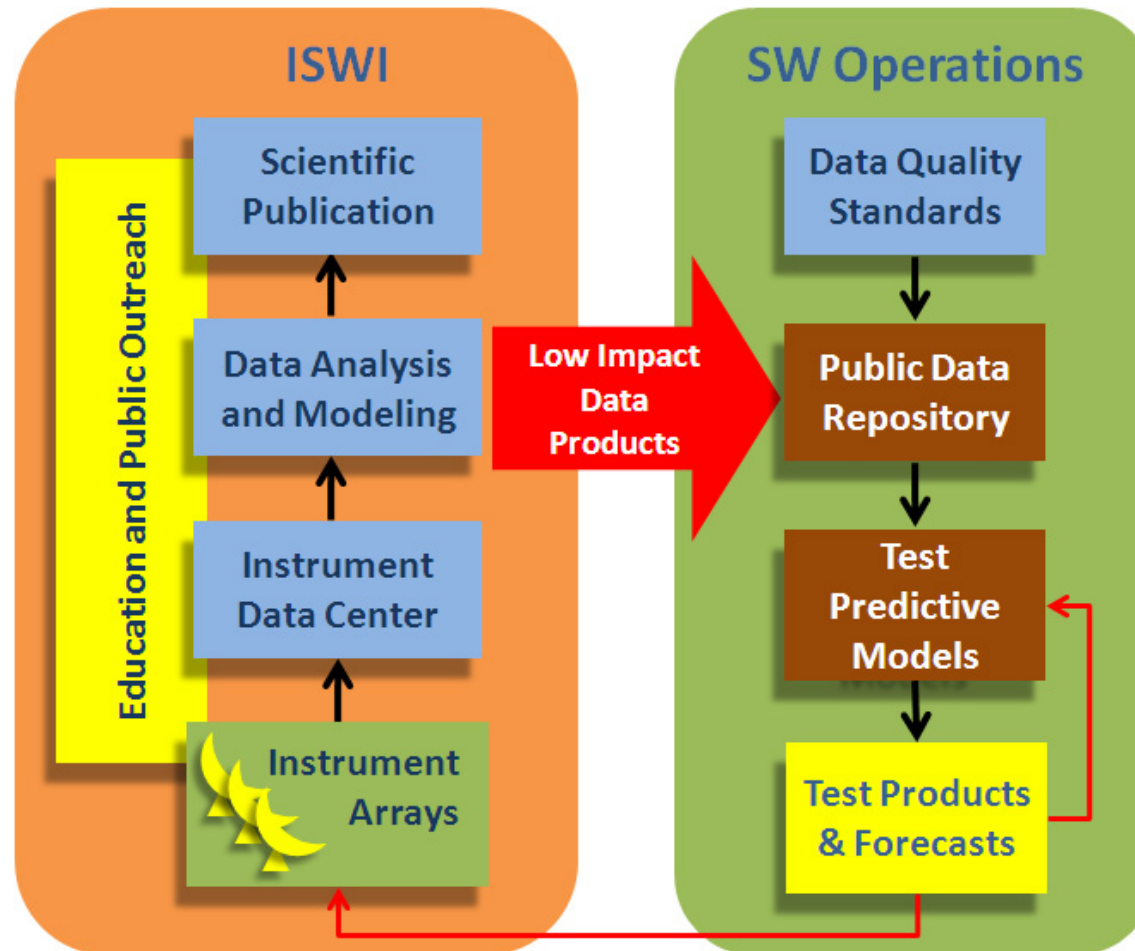
SCIENCE OBSERVATORY DEVELOPMENT OUTREACH HISTORY

about | organization | get involved | newsroom | events | resources | contact

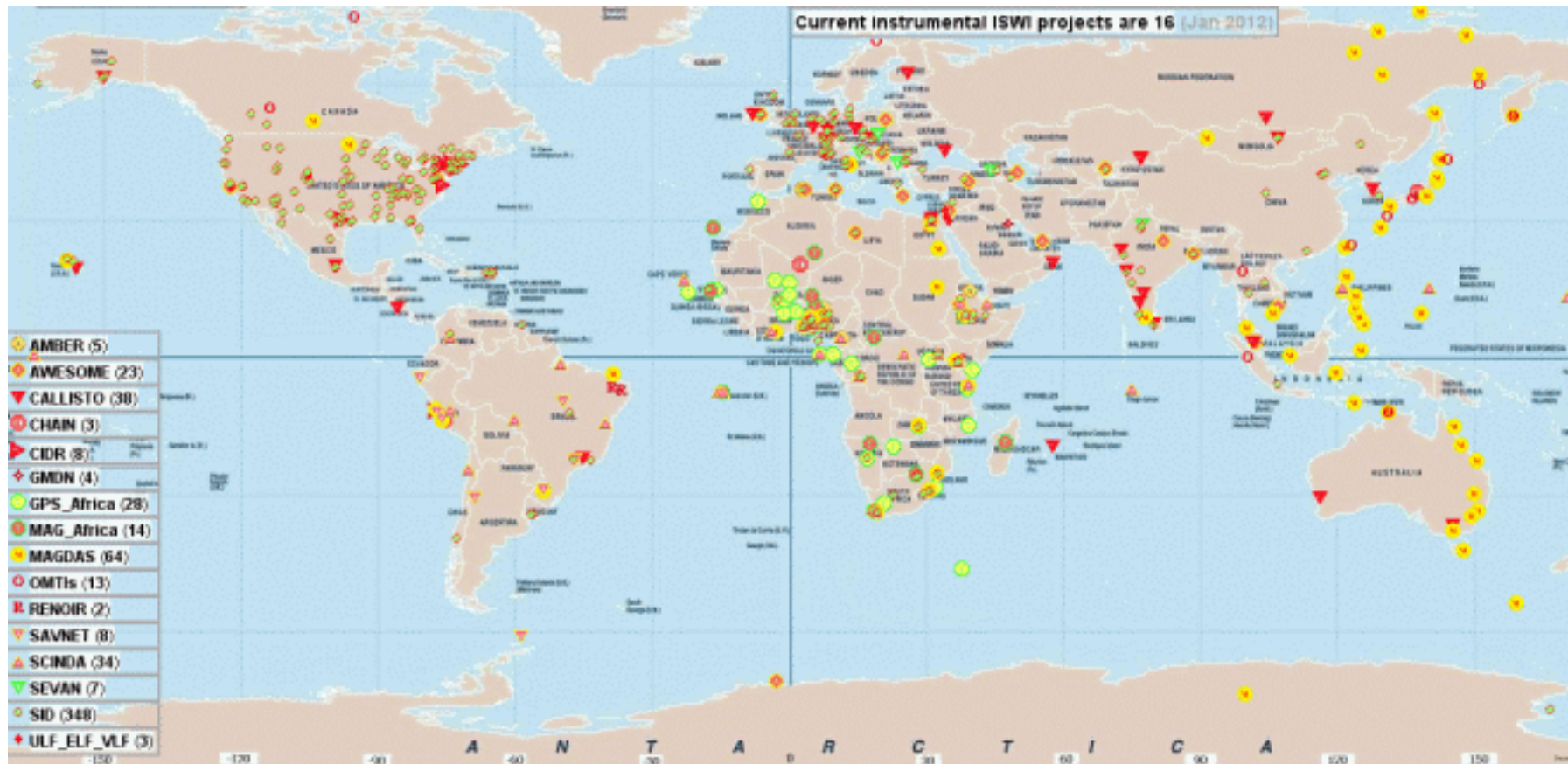
ENTER YOUR SCIENCE CIP ONLINE NOW



International Space Weather Initiative



ISWI Participation (Jan 2012)



- 14 Distributed instrument teams observatory program
- ~1000 participating locations
- More than 100 Countries participating

Summary

- The challenges associated with space weather affect all developed and developing countries
- Work on space weather specification, modeling, and forecasting has great societal benefit: **It is basic research with a high public purpose**
- Future space exploration and most human endeavors will require major advances in physical understanding and improved transition of space research to operations
- Targeted Research & Analysis offer real hope of Sun-to-Earth space weather models and forecasts