

NOAA Space Environmental Data



Paper 2.3 - AMS

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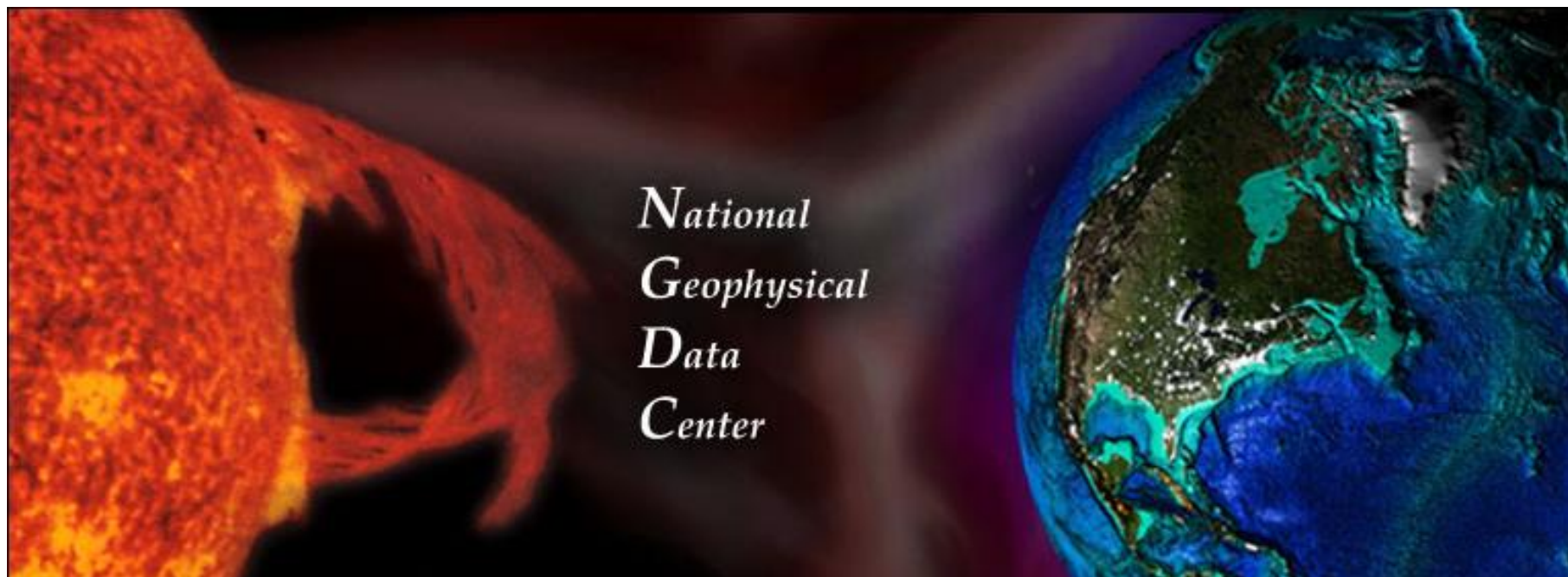
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Data Stewardship

NOAA National Geophysical Data Center

NGDC provides stewardship, products and services for geophysical data from our Sun to Earth and Earth's sea floor and solid earth environment, including Earth observations from space.



The STP Division is responsible for the archive and access of solar and space environmental data and derived products collected by NOAA observing systems and acquired through the former World Data Center for Solar and Terrestrial Physics (Boulder).

NOAA Observing Systems: GOES & POES-MetOp (Current)



NRC Whitepaper - 2011

Benefits of Operational SWx Monitors



It keeps going and going and going

Over 30 years of operational space environmental data is available for heliophysics research. For the most part the measurement parameters have remained the same except for some improvements in sensor design and performance – sometimes, much to the angst of the operational agencies:

NOAA GOES – particles, fields, solar observation

Date range: 1974 – present

of satellites: 15 (not counting 1 failure)

Availability: on-line

NOAA POES – energetic charged particles

Date range: 1978 – present

of satellites: 12 (not counting 1 failure)

Availability: on-line

USAF DMSP – particles & fields, UV imagery

Date range: 1976 – present

of satellites: 17 (not counting 1 failure)

Availability: on-line (F6 and beyond only)

DOE LANL – particles (GEO and GPS)

Data range: 1976 – present

of satellites: Unknown

Availability: restricted

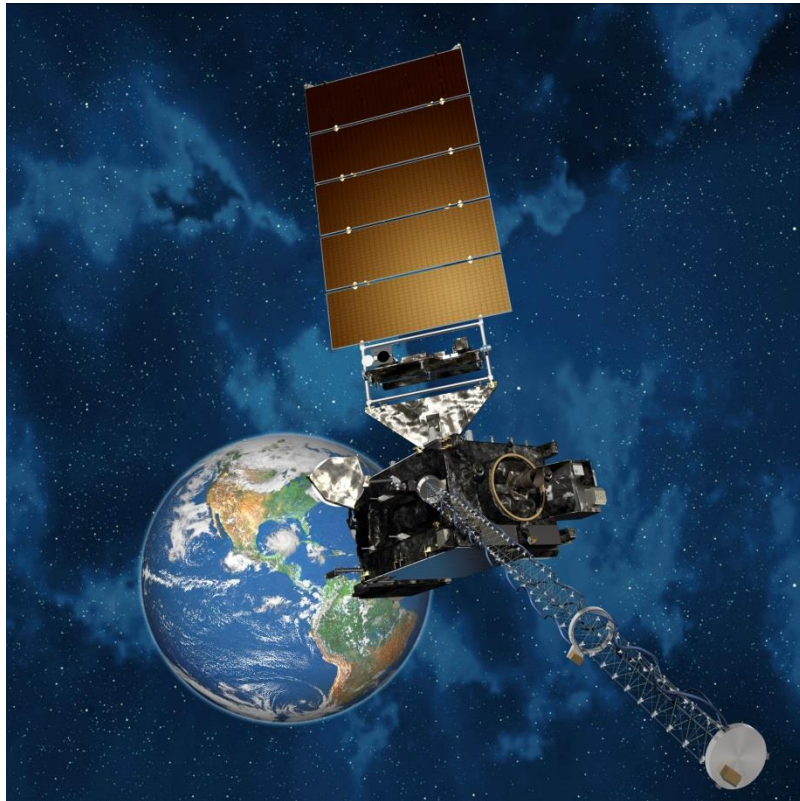


Current NOAA Observing Systems

GOES Satellites - Geostationary

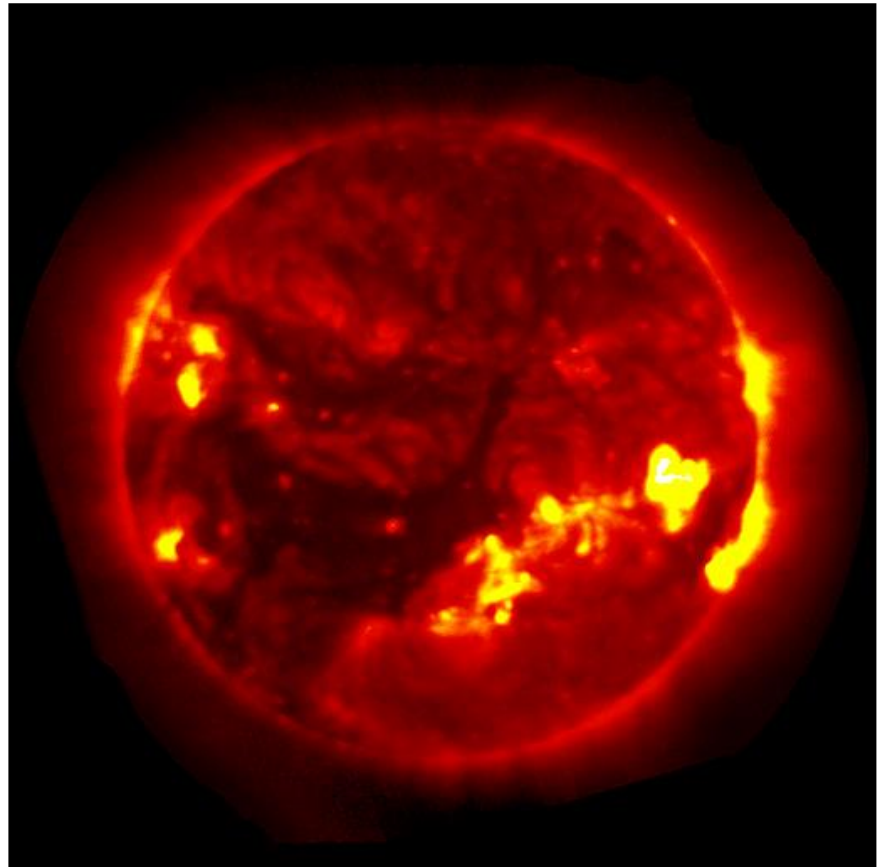
Space Environment Monitor

- Geosynchronous Orbit, Since 1974
- Parameters: In Situ Magnetic Fields
Whole Sun X-ray Flux
Energetic Particles



Solar X-ray Imager

- Data available since 2003
- Full sun solar image (~1 per minute)



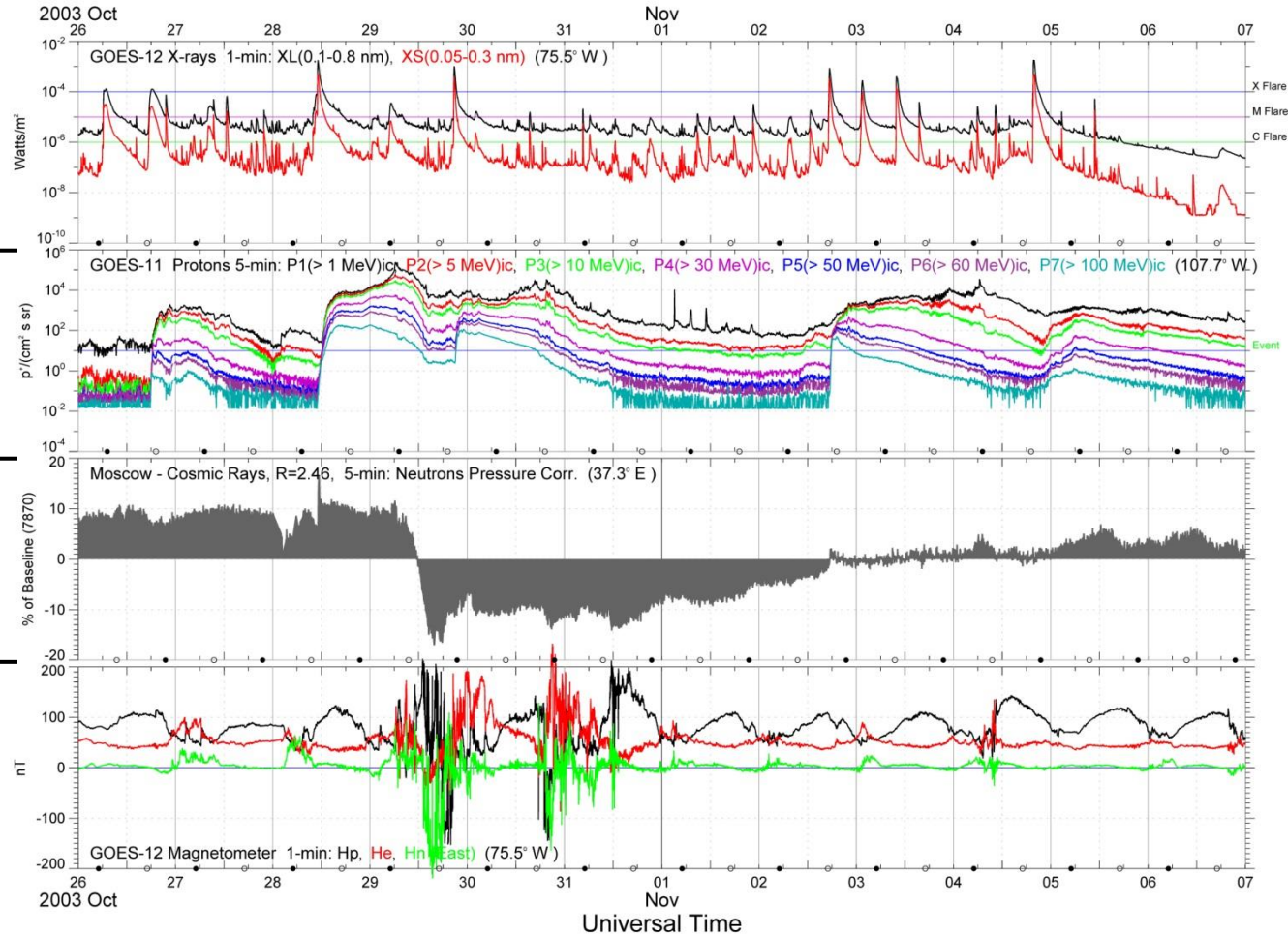


Current NOAA Observing Systems

GOES – Extreme Events (Survey Plots)

Halloween Storm – Oct/Nov 2003

Extreme Event: 2003-10-26 00h - 2003-11-06 24h



Numerous X-class flares starting on 28 Oct 2003

Solar proton event – S4 on NOAA Space Weather Scale

Neutron Monitor Forbush Decrease (Moscow)

In-situ GEO magnetic field structure

See AMS Poster 313 “Extreme Space Weather Events Measured by GOES – 1974-2013”

ver: 2012-04-23 14:34:00 UT



Current NOAA Observing Systems

POES/Metop Satellite System



POES on Orbit

Measurement Description & Data Availability

POES/SEM-1 – TIROS-N/NOAA 6-14 - 1978 to 2004

POES/SEM-2 – NOAA 15-19/MetOp – 1998 – present

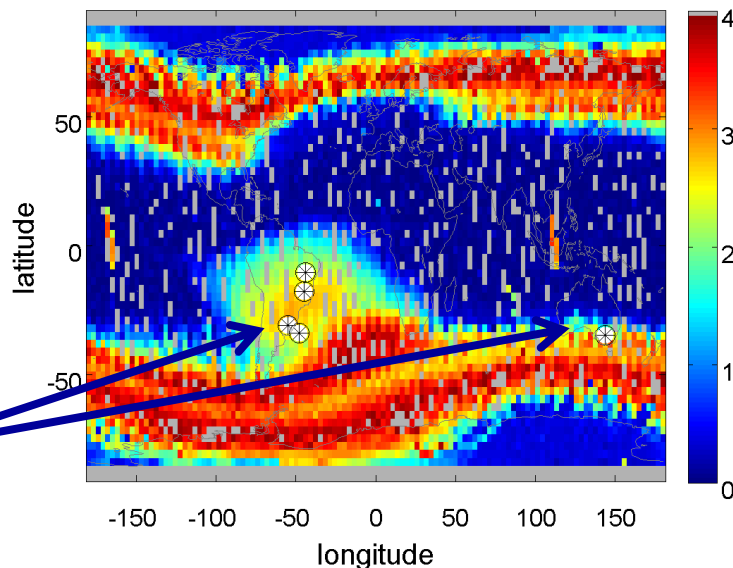
TED	ions	50 eV to 20 keV	16 channels / 2 FOV
	e-	50 eV to 20 keV	16 channels / 2 FOV
MEPED	p+	30 keV to 200 MeV	10 channels / 2 FOV
	e-	30 keV to 1 MeV	3 channels / 2 FOV

METOP – Will carry on after POES – Same SEM-2

Data from POES/MetOp SEM can be used to assess the LEO radiation environment. After MetOp the availability of energetic particle measurements in LEO will be very limited.

VIIRS Anomalies

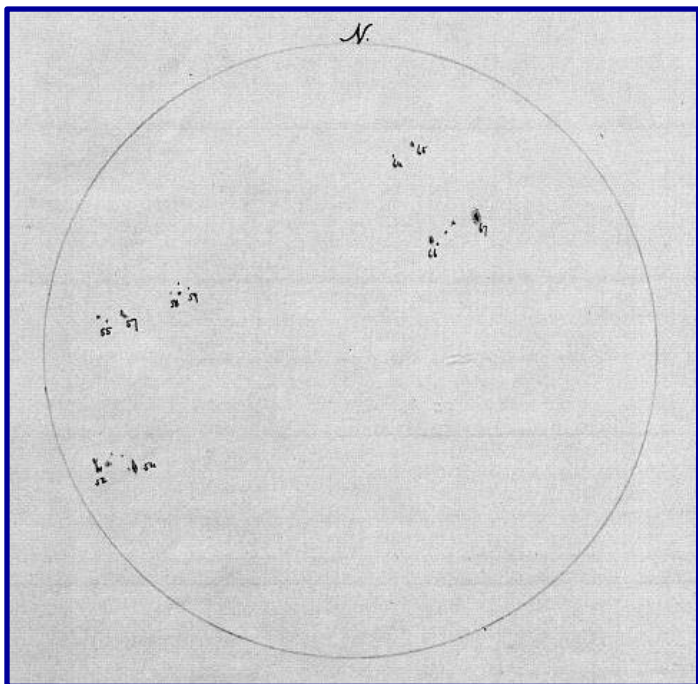
>30 keV electron flux (#/cm²-s-str-keV)



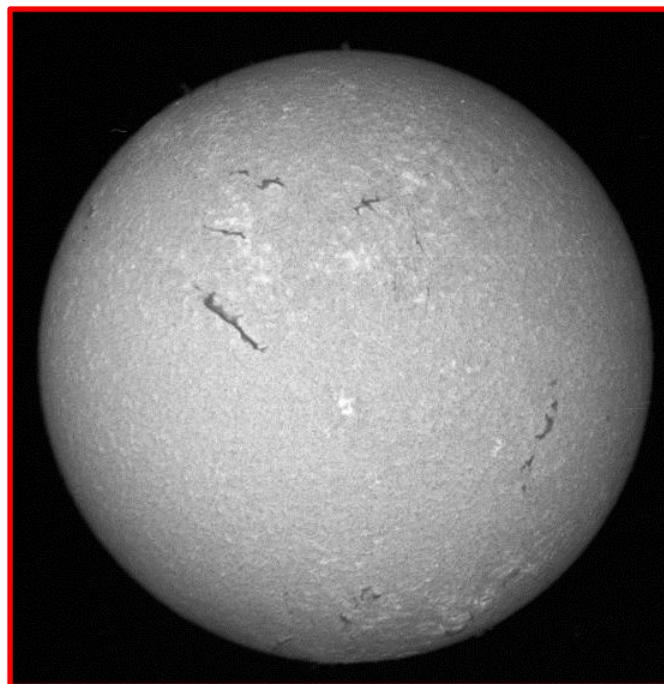


Improved SWx Monitoring

NOAA Historical Solar Observations



Observations of sunspots in white light made by [Charles Anthony Schott](#) of the Coast Survey, 1859-1860 plus data from other [providers](#). The daily sunspot number ([SSN](#)) from multiple sources has been a consistent solar index from the early 1800's to present.

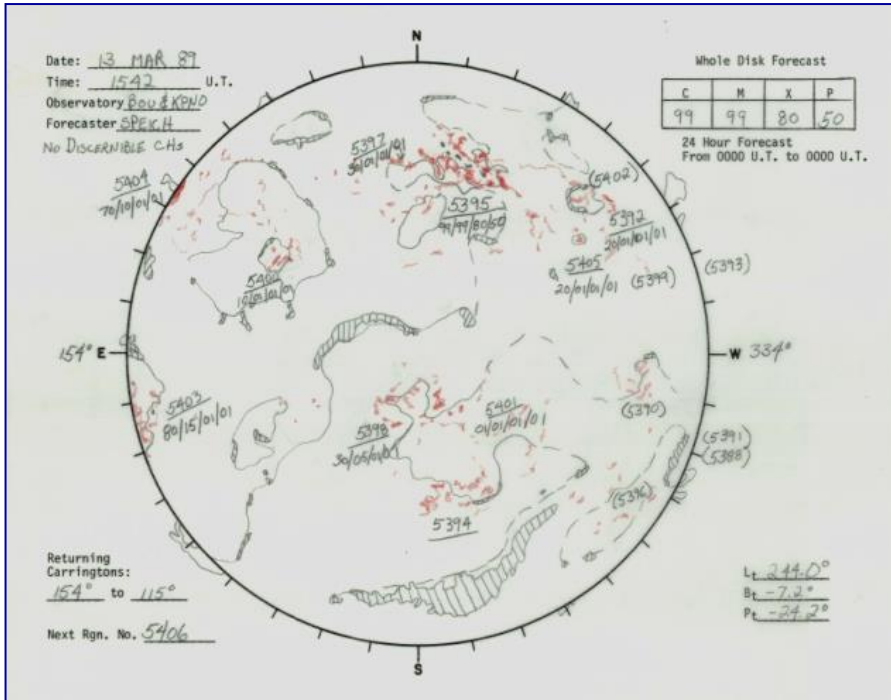


From 1967 to 1994 the NOAA Space Environment Center observed the sun in [H-alpha](#) (656.3 nm). Chromospheric observations of prominences, filaments, plague and the chromospheric network. Daily observations of the sun for SWx operations transitioned to the [USAF](#) starting in 1979.



Current NOAA Archived Products

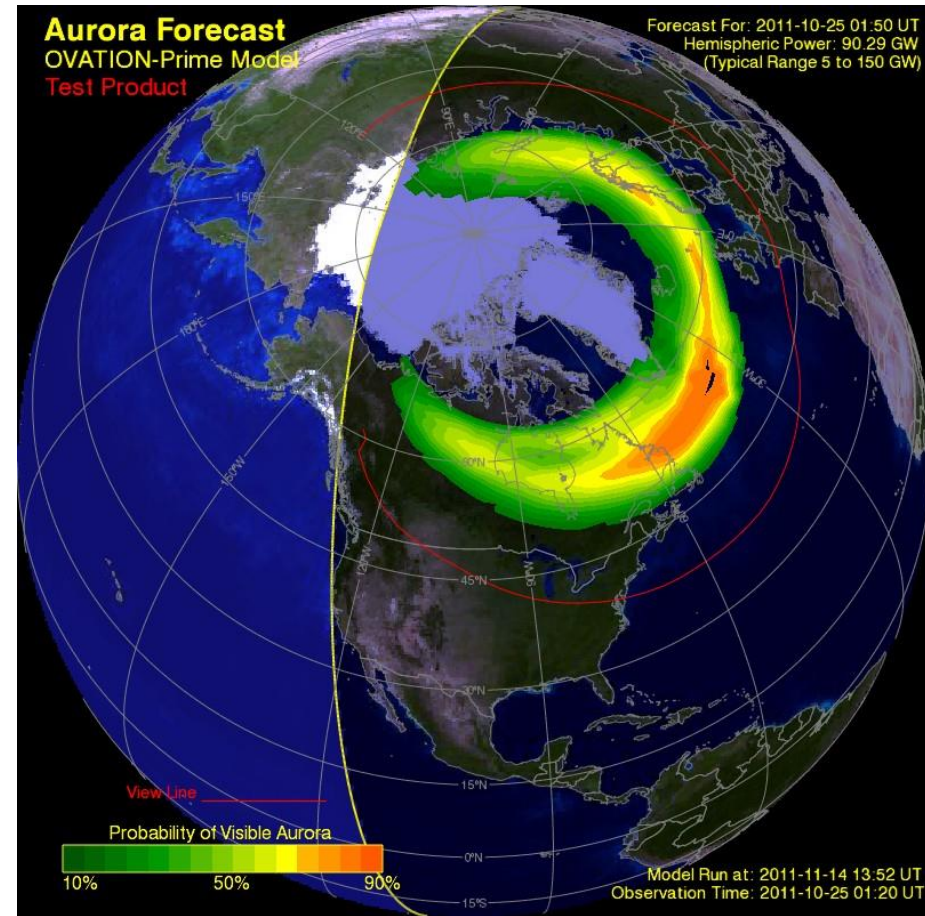
Provider: Space Weather Prediction Center



Boulder Composite Drawings

Trained operator assembles data from multiple sources to describe features on the sun (1972-present).

. . . Plus daily space weather reports



SWx models:

US-TEC, DRAP, Ovation, ENLIL¹



USAF SWx Observing Systems

Defense Meteorological Satellite Program

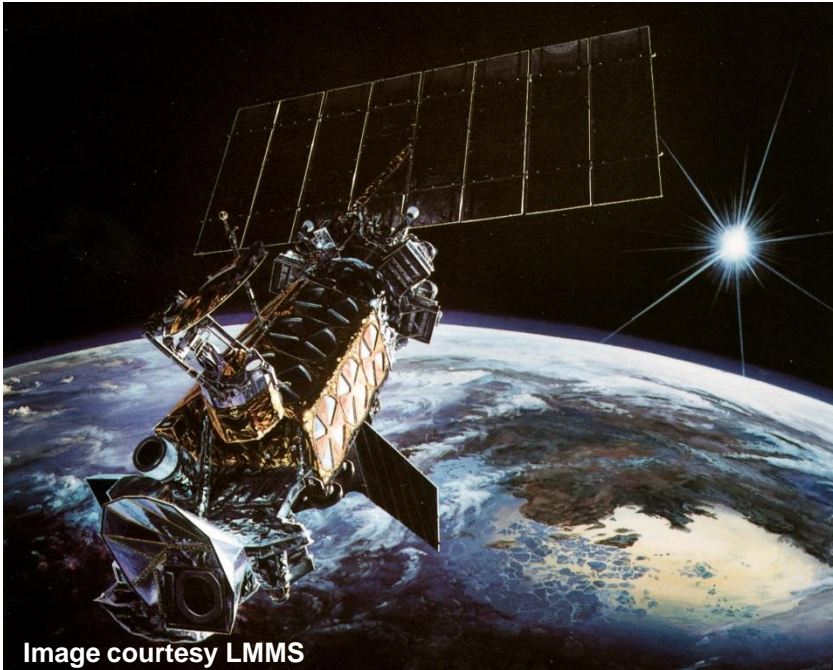
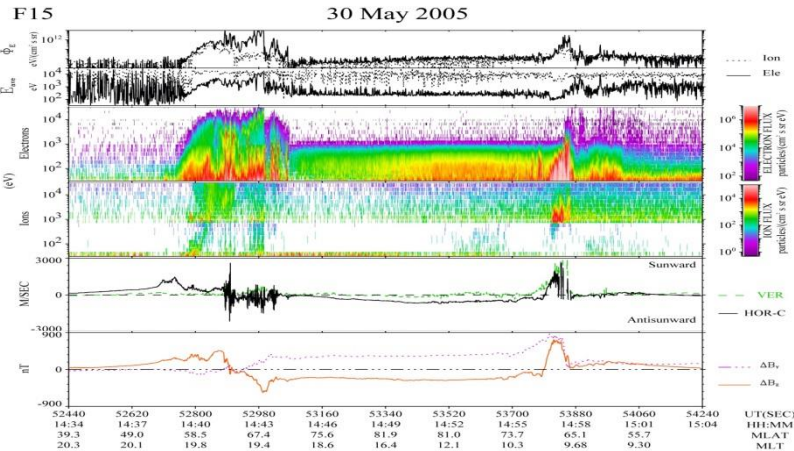


Image courtesy LMMS



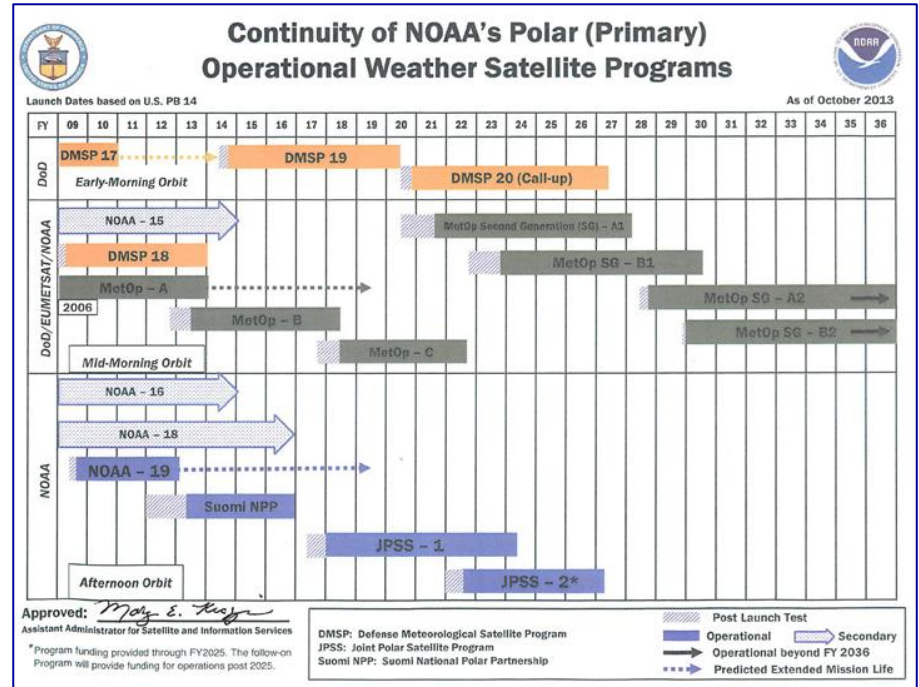
DMSP Space Weather Sensors (AFRL)

Sensors:

- SSJ – Electron/Ion Spectrometer
- SSIES – Cold Plasma Sensor (Driftmeter)
- SSM – Magnetometer

Satellites: F06-F18 (1982 – Present)

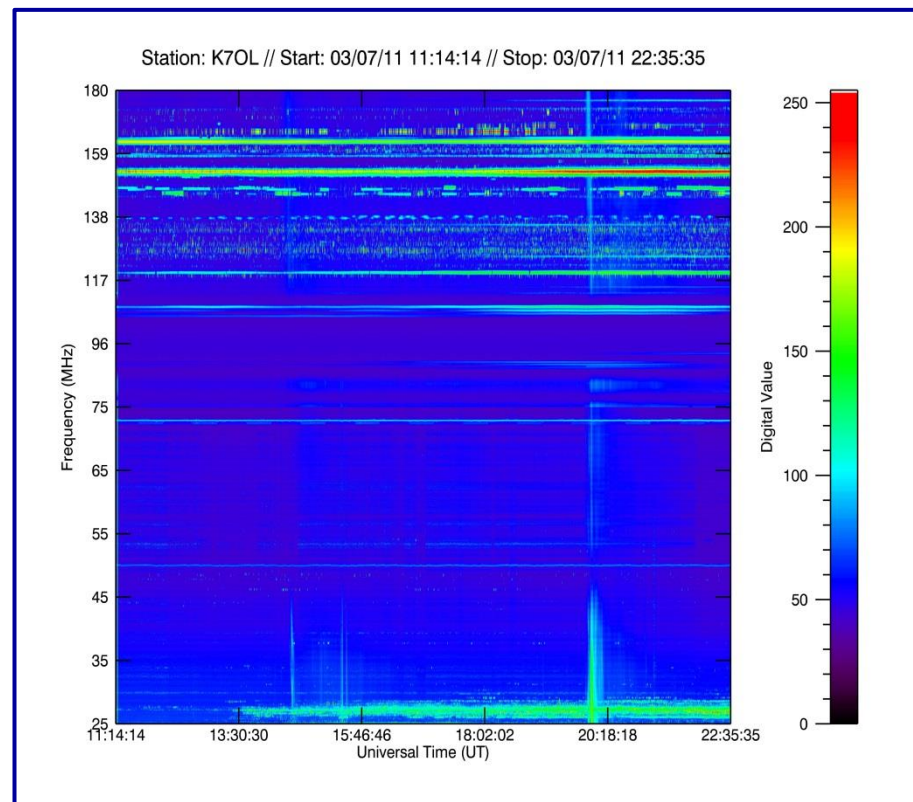
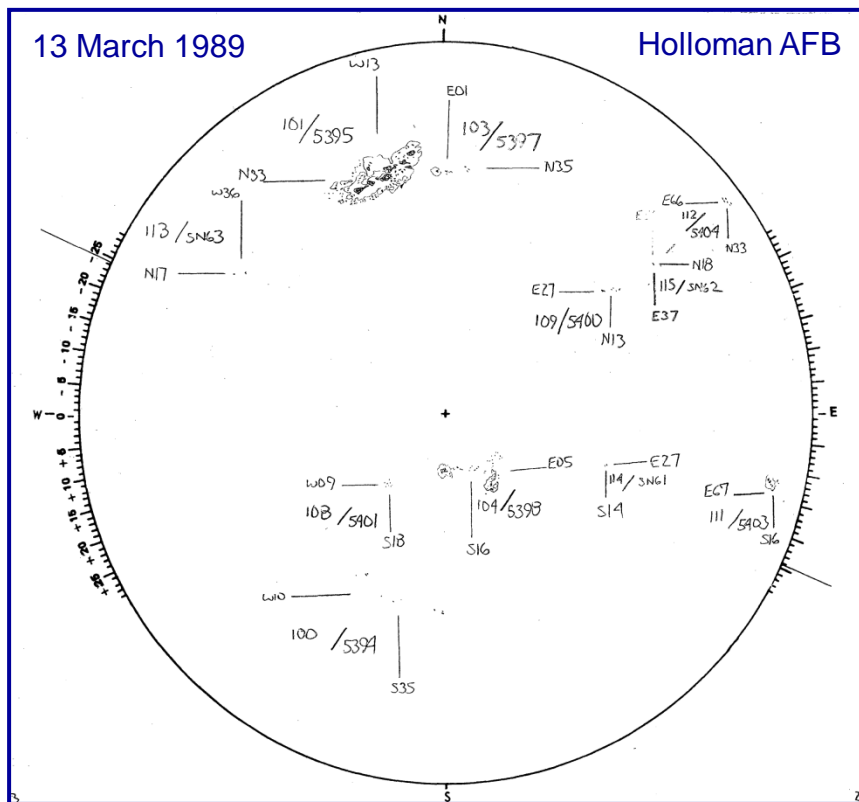
Comment: Data provider: AFRL





USAF SWx Observing Systems

Solar Electro-Optical Network (SEON)



Solar Observing Optical Network

Daily solar sunspot [drawings](#) from 5 SOON sites from 1979 to present. Additional data on H-alpha flare [reports](#).

Radio Solar Telescope Network (RSTN)

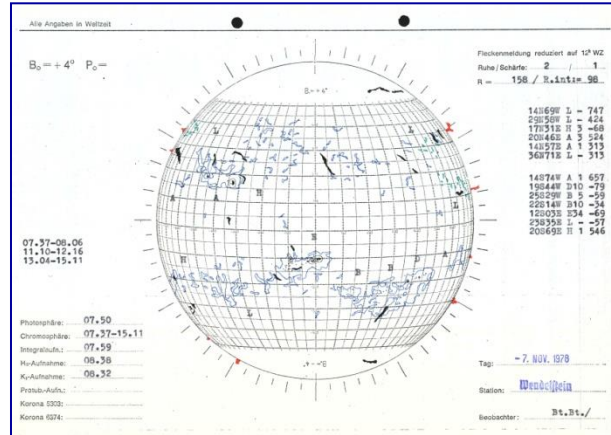
Daily solar radio [fixed frequency](#) and [spectral](#) measurements from 5 RSTN sites from 2000 to present.



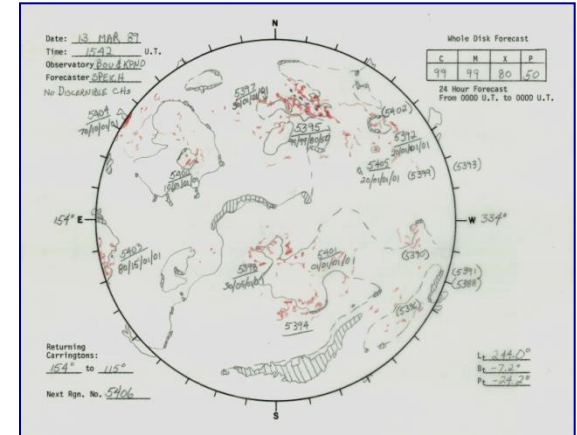
WDC for Solar-Terrestrial Physics

A Legacy from the 1957-59 IGY

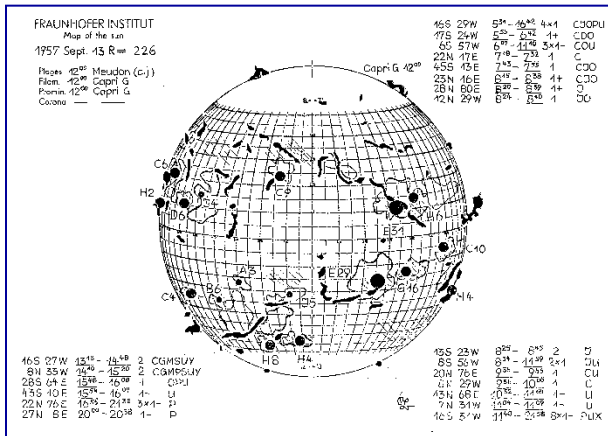
Under the auspices of the former World Data Center for Solar-Terrestrial Physics (now the [World Data Service for Geophysics](#)) NGDC assumed responsibility for numerous datasets related to solar phenomena, the ionosphere, cosmic rays, geomagnetic field, aurora and airglow. Included here is a sample of available solar composite drawings.



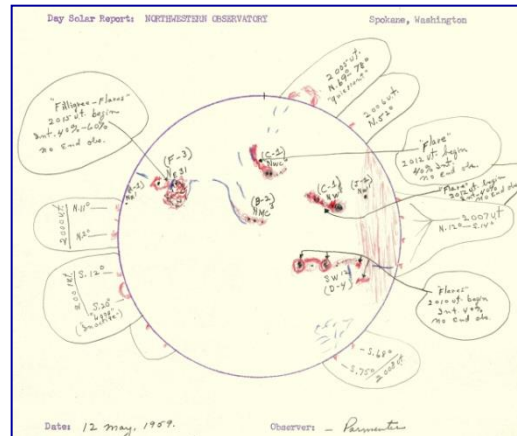
Wendelstein Observatory
(1947-1987)



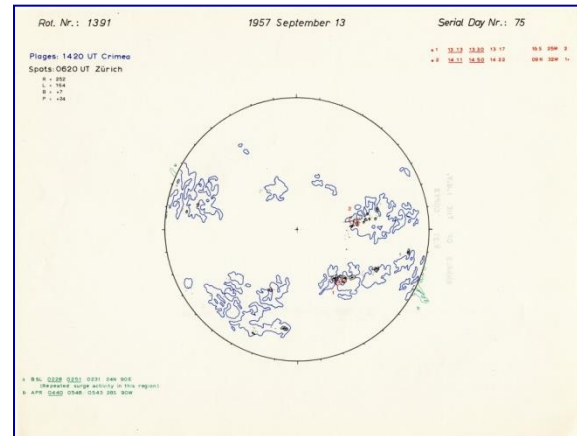
Boulder Daily Composites
(1972-present)



Fraunhofer Institute
(1956 - 1973)



Northwestern Observatory
(1958 - 1970)



Drawings from the IGY
(1957 - 1958)

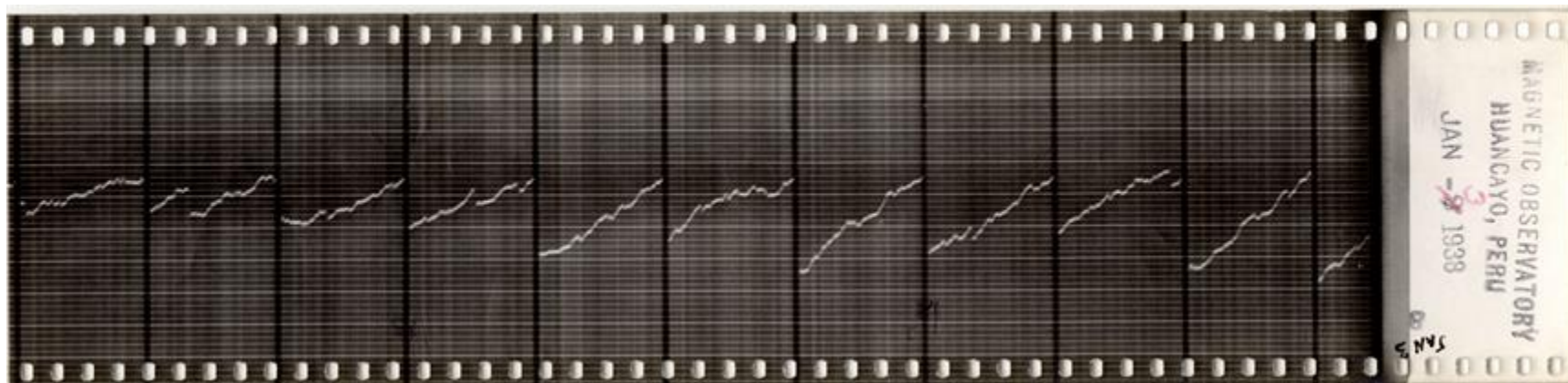
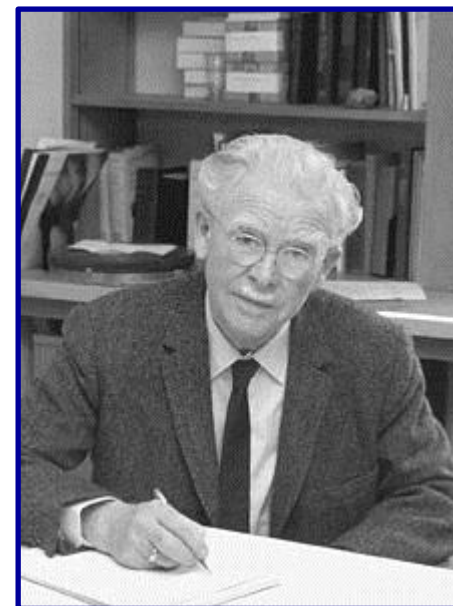


WDC for Solar-Terrestrial Physics

Interesting Historical Record – Scott Forbush

Original dataset “rescued” from destruction were the original records of Scott Forbush, an early cosmic ray physicist.

- 114 station-years of data from Cheltenham, Christchurch, Godhavn, Climax, Huancayo and Mexico City (1936-1968)
- Discoveries attributed to Forbush include;
 - Decrease in cosmic rays during solar storms (Forbush Effect)
 - Anti-correlation between the 11-yr solar cycle and the cosmic ray flux
 - Association of increased cosmic radiation (solar energetic particles) correlated with solar flares



Ionization Chamber – Huancayo (Peru) – 03 Jan1938



Main Access Portal – SWx

<http://www.ngdc.noaa.gov/stp/spaceweather.html>



NOAA NATIONAL GEOPHYSICAL DATA CENTER
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

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Mailing Address:
National Geophysical Data Center
Solar - Terrestrial Physics Division
325 Broadway
Boulder, CO 80305-3328 USA

Space Weather

The STP Division is responsible for the archive and access of solar and space environmental data and derived products collected by NOAA observing systems and acquired through the World Data Center for Solar and Terrestrial Physics (Boulder). Archives include extensive collections of data from solar observatories, ground ionospheric sounders, and satellites plus modeled space climatologies.

Aeronomy and Geomagnetism

- | | |
|--------------------|--------------------------------|
| Aurorae Data | Auroral Probability Calculator |
| Auroral Images | Airglow IGY |
| Airglow IQSY | Geomagnetic Indices |
| Noctilucent Clouds | |

Solar Data Services

- | | |
|--------------------------|------------------------|
| Solar Features | Solar Indices Data |
| Solar Imagery | Solar Indices Bulletin |
| Miscellaneous Solar Data | |

Satellite Data Services

- | | |
|---------------------|----------------------|
| POES/MetOp SEM | GOES SEM |
| GOES SXI | DMSP (Space Weather) |
| Satellite Anomalies | DSCOVR |
| SUNJAMMER | |

Ionospheric Data Services

- | | |
|-----------------|------------------------------|
| Ionosonde | CORS-GPS |
| US-TEC archives | FIRST Scintillation Forecast |
| D-RAP archives | |

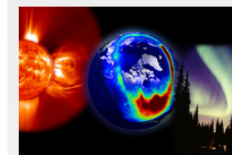
SWx Climatology

Interplanetary

- | | |
|---------------------|-------------|
| Forbush Archives | Cosmic Rays |
| Solar Proton Events | |

NOAA Space Weather Products

- | | |
|------------------------|------------------|
| Daily Reports | Periodic Reports |
| Annual Summaries (TBD) | |



Educational Resources:

- [Space Weather Educational Material & Other Data Resources](#)
- [NOAA Space Weather Prediction Center Educational Website](#)

Auroral Resources:

- [Ovation](#)
- [Chapman Conference, Fairbanks, AK, 2011](#)

The online availability of historical Space Weather datasets is supported by the NOAA Climate Data Modernization Program (CDMP).





Concluding Thoughts

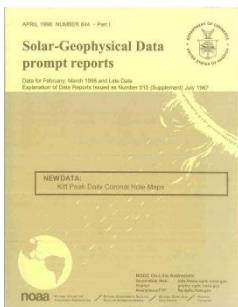
NOAA SWx Data Stewardship

1. The NGDC Solar & Terrestrial Physics (STP) division within NGDC is responsible for stewarding NOAA's SWx datasets and related information
 - Current focus is the archive, access and assessment (AAA) of SWx data from NOAA's fleet of operational environmental satellites
 - STP also stewards operational SWx data provided from USAF satellites and ground systems.
 - Division continues to manage a variety of historical SWx data collected through the World Data Service for Geophysics, formerly the WDC-STP (Boulder).

2. Challenges

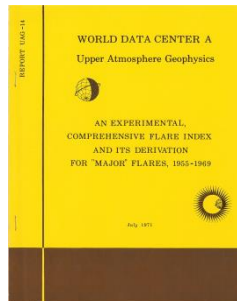
- While the first priority is NOAA's satellite data, retaining the personnel (number and skillsets) needed to steward the breadth of technical data available is difficult.
- There are limited opportunities to digitize historical paper, microfiche and film records

3. Some historical publications (available online) not discussed here:

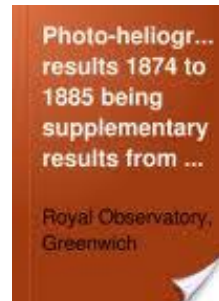


Solar Geophysical Data
(1957-2009)

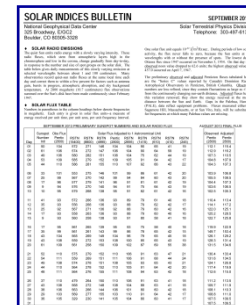
AMS – 02-06 Feb 2014



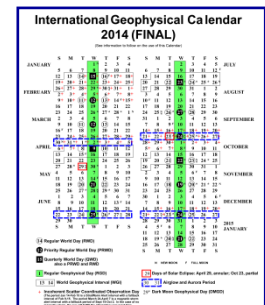
Upper Atmosphere Geophysics
(1968-1996)



Greenwich Photo-heliographic Results
(1874-1982)



Solar/Geomagnetic Indices Bulletins
(1985-Present)



International Geophysical Calendar
(1957-Present)



Thank You!

A graphic for the NOAA National Geophysical Data Center. It features a central image of Earth with a color-coded bathymetry map, showing the Atlantic Ocean and surrounding continents. To the upper left of Earth is a glowing orange and red sun. The background is a light gray map of the world with a grid of latitude and longitude lines. Text is overlaid on the graphic.

THE NOAA NATIONAL
GEOPHYSICAL DATA CENTER

Supporting Informed Decisions
with Authoritative Data

Over 600 data types - from the core of the Earth to the surface of the Sun