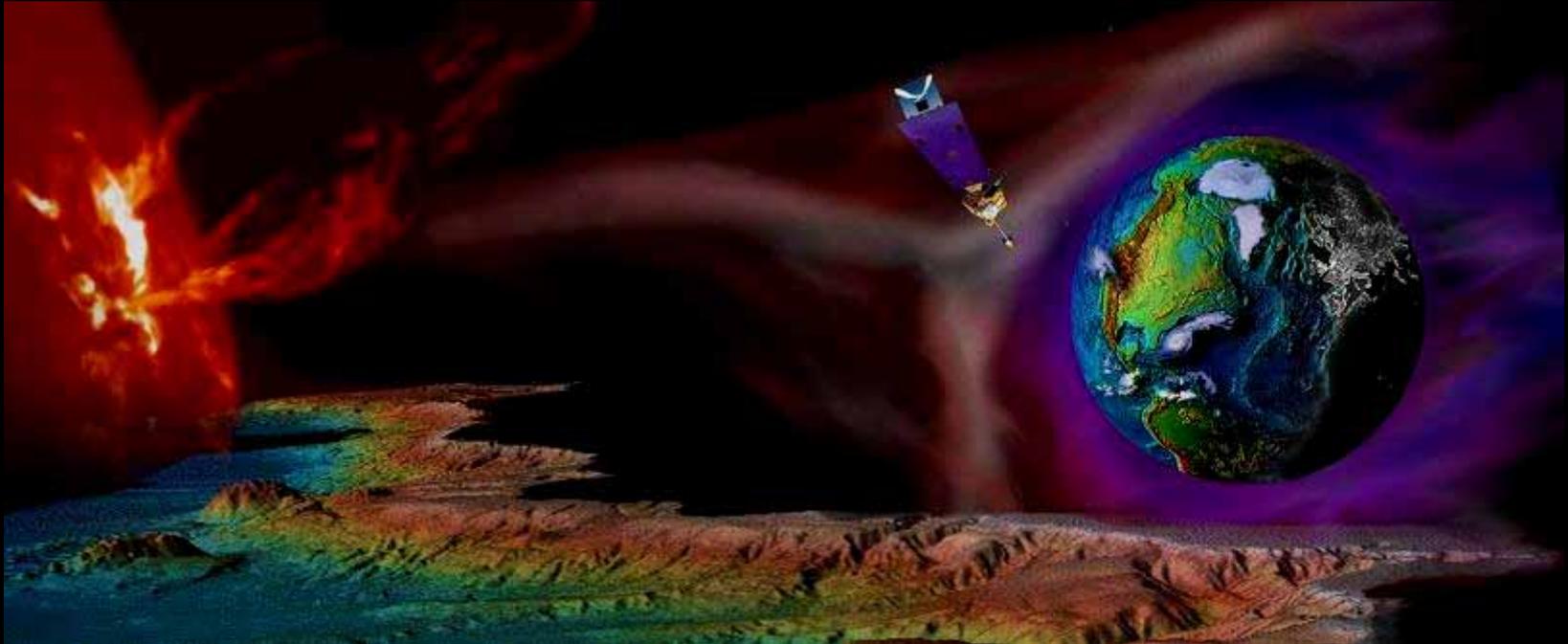




**U.S. Department of Commerce**



**National Oceanic & Atmospheric Administration**



**National Geophysical Data Center (NGDC)**

*Stewarding data from the surface of the Sun to the core of the Earth*

<http://ngdc.noaa.gov/>



# Three National Data Centers



## Climatic Data

A composite image for the Climatic Data center. It features a large globe of Earth with various weather-related elements overlaid: a lightning bolt, a satellite, a tropical storm, and a small inset image of a white building. At the bottom, there is a line graph showing data trends over time.

## Geophysical Data

A composite image for the Geophysical Data center. It shows a dark map of the United States with white data points, a glowing orange and red planet (likely Mars), and a globe of Earth with a color-coded topographic map.

## Oceanographic Data

A composite image for the Oceanographic Data center. It features a large blue ocean with a colorful sea level deviation map. On the right, there are three circular maps labeled 'July 96 Normal', 'July 97 El Niño', and 'July 98 La Niña'. Below these is a color scale legend for 'NOAA Laboratory Sea Surface Anomaly' ranging from -11 to 11 cm. At the bottom right is the NOAA logo.

# NOAA National Data Centers





# Long-Term Archive



**NGDC provides stewardship, products and services for geophysical data describing the solid earth, marine, and solar-terrestrial environment, as well as earth observations from space.**



**Data Holdings**  
*> 400 digital and analog collections*

**NAO 212-15 and NSF-04**  
*Designated archive for NSF Academic and NOAA Geophysical data.*

## Archive

*We're in it for the long haul, preserving data for your great-grandchildren*

## Data Rescue & Digitizing

*Rescuing data from old and obsolete media and formats*

## Data Access

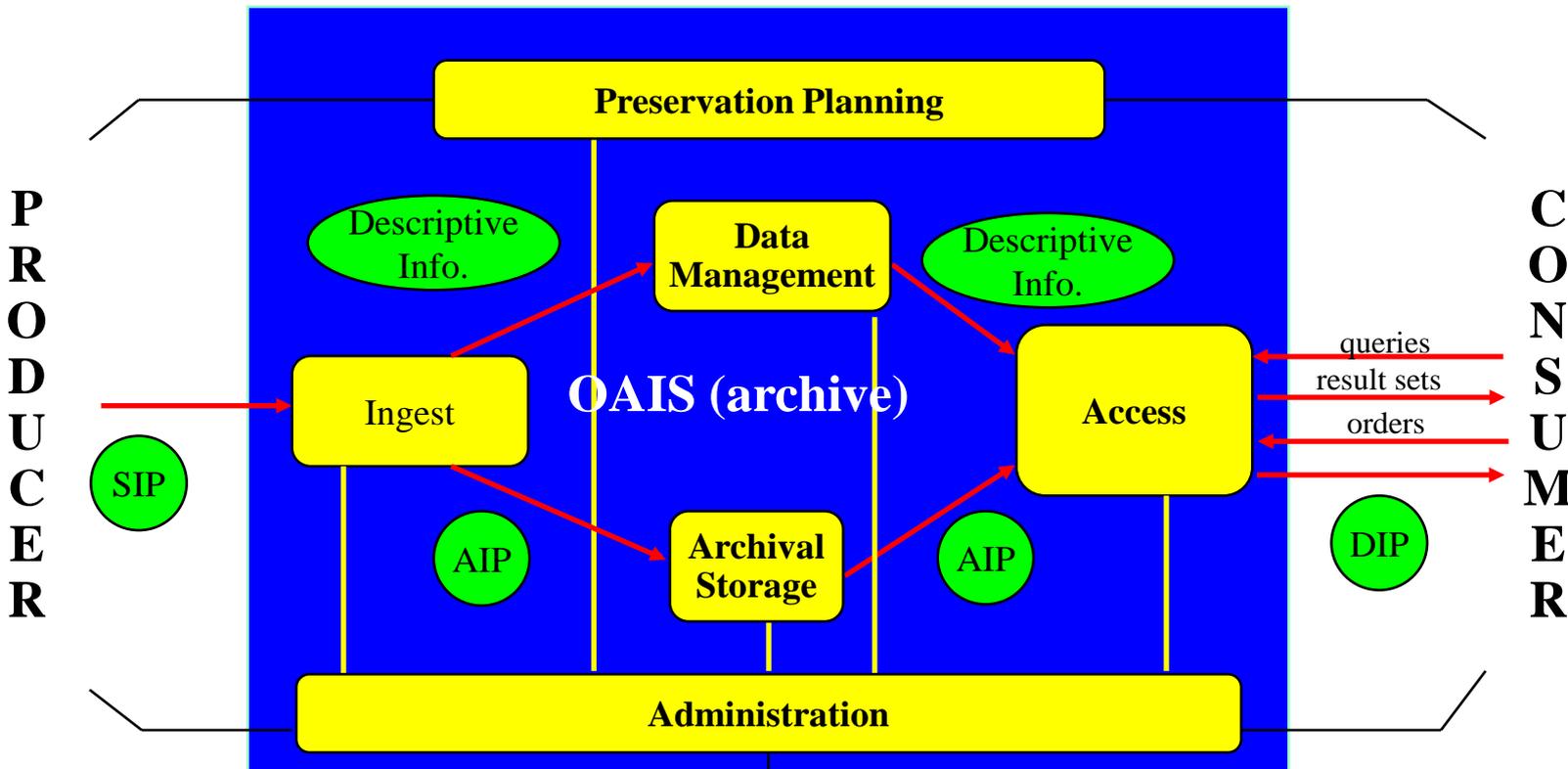
*Using standards to make data freely & publicly available*





# Archive vs archive

NGDC and the Open Archive Information System (ISO 14721:2003)



## MANAGEMENT

- SIP = Submission Information Package
- AIP = Archival Information Package
- DIP = Dissemination Information Package

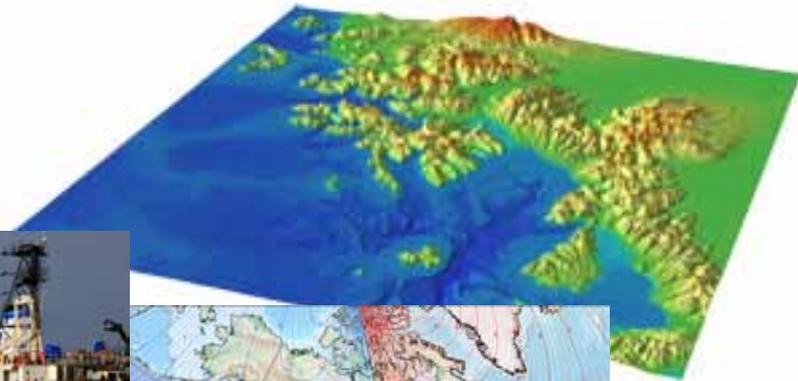
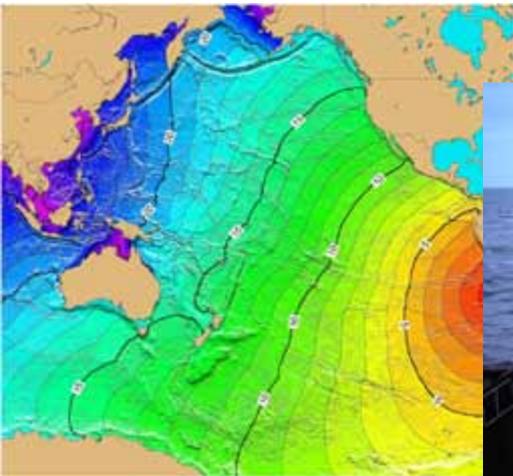


# Marine Geology & Geophysics



**NGDC's MGG Division provides scientific stewardship for geophysical data supporting:**

- Coastal resiliency, hazard warning & mitigation
- Ocean and coastal charting and mapping
- Exploration of the U.S. outer continental shelf





# Data & Information

<http://www.ngdc.noaa.gov/mgg/mggd.html>



## DATA TYPES

**Bathymetry / LIDAR**

**Digital Elevation Models**

DART & Tide Gauge

Tsunami Events / Impacts

Significant Earthquakes

Volcanic Eruptions

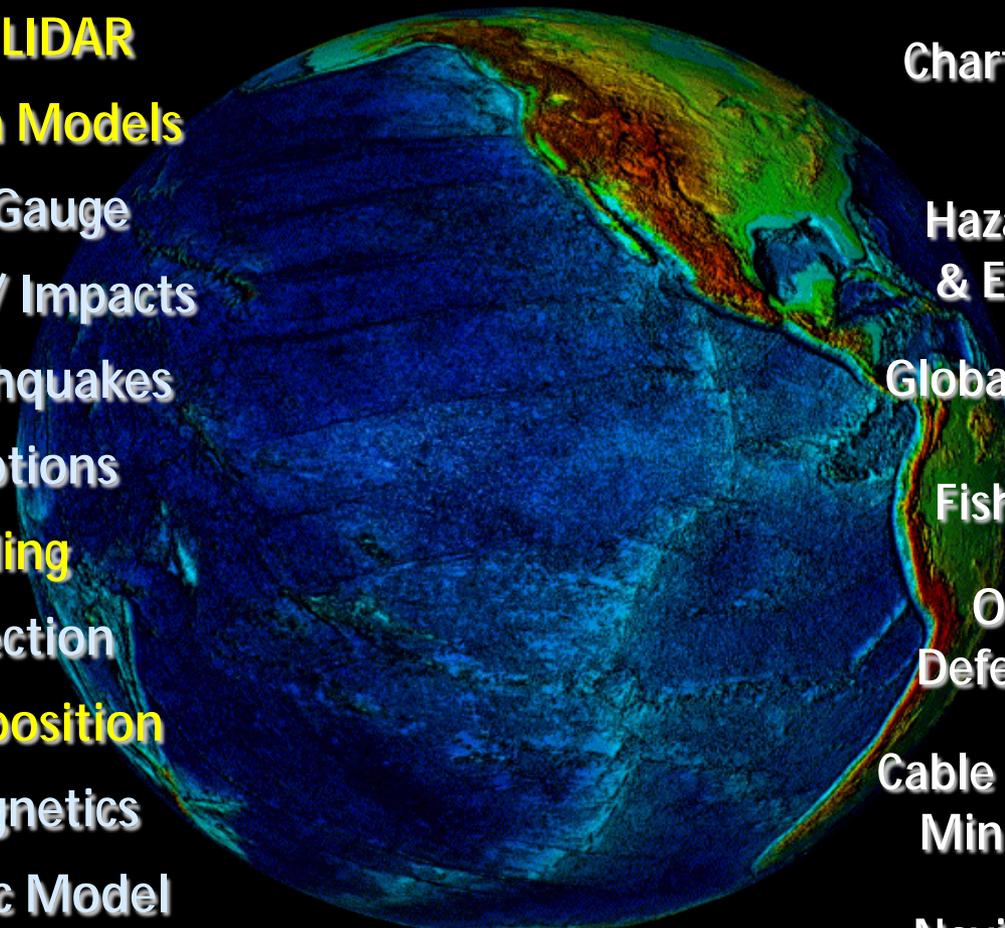
**Ocean Drilling**

Seismic Reflection

**Sea Floor Composition**

Gravity & Magnetics

World Magnetic Model



## APPLICATIONS

Charting & Inundation  
Modeling

Hazards Assessment  
& Economic Impact

Global Change Research

Fisheries / Habitats

Ocean Mapping  
Defense Applications

Cable & Pipeline Routing  
Minerals Exploration

Navigation / Charting



# Marine Modeling

<http://www.ngdc.noaa.gov/mgg/coastal/>



**MGG develops, archives, and provides access to global, regional, and community level bathymetric-topographic digital elevation models (DEMs)**

**Products:** 10-m coastal inundation DEMs, DART buoy deployment maps, Coastal Relief Models (30m-90m) for the U.S., ETOPO1, and Great Lakes bathymetry

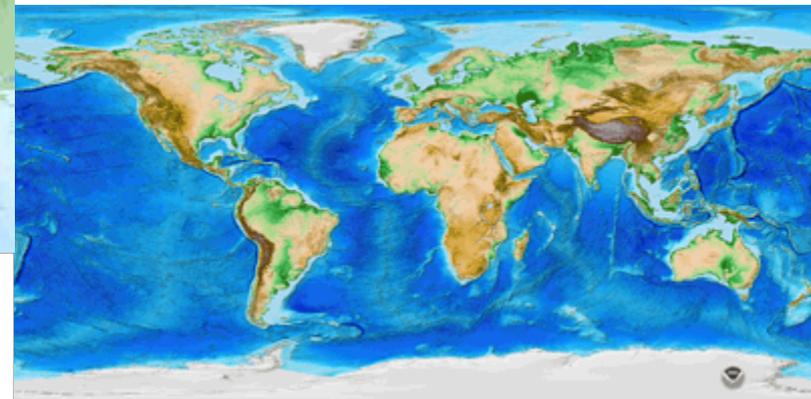
**Users:** Coastal modeling, habitat characterization, circulation, climate change, community planning, forecast & warning, response & recovery



*Tsunami inundation grid, 1/3 arc-second, Monterey Bay, CA*



*Northern Gulf of Mexico CRM, 1 arc-second covering portions of Louisiana, Mississippi, Alabama, and Florida*



*ETOPO1 - Global 1-km bathymetry and elevation*



# Hydrographic & Bathymetric Survey Data



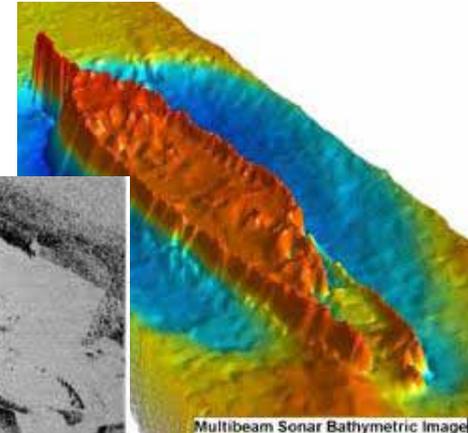
## Partnerships in Action

- NOS Hydrographic Office Conducts Surveys

- Acquire multibeam sonar and related data
- Ship sends data to NGDC
  - Safe, secure storage against loss
- And to Hydrographic Processing Center
  - Processing and charting product development



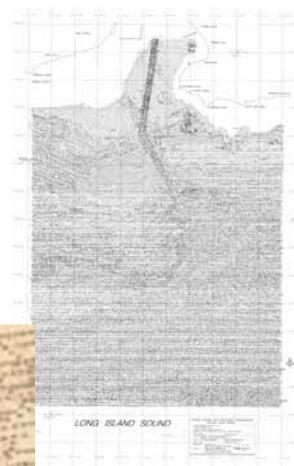
Side Scan Sonar Image



Multibeam Sonar Bathymetric Image

- NGDC Archives and Delivers Data and NOS-derived Products

- Raw data archived immediately
- Processed data and products archive when complete from Hydrographic Center
- NOS determines what data and products are public according to NOAA Administrative Orders and Policy
- Public data and documentation incorporated into Web Services



LONG ISLAND SOUND

- NOS Hydrographic Office Plans Surveys

- Inventory of archived data helps identify gaps





# Bathymetric Data Viewer



NOAA NATIONAL GEOPHYSICAL DATA CENTER

### Bathymetry Data Viewer

Layers

- Multibeam Bathymetry
- Trackline Bathymetry
- NOS Hydrographic Surveys
- Digital Elevation Models
- Shaded Relief Imagery
  - Local (high-resolution)
  - Regional

Identified Features (25)

F00074_ML_2m_MLLW_1sf1	NOAA Hydrographic Survey, 1997
F00074_ML_2m_MLLW_1sf2	NOAA Hydrographic Survey, 1997
F00074_ML_2m_MLLW_combined	NOAA Hydrographic Survey, 1997
H11274_2m_MLLW_1sf1	NOAA Hydrographic Survey, 1997
H00176_1m_MLLW_1sf2	NOAA Hydrographic Survey, 1997
H00176_50m_MLLW_1sf2	NOAA Hydrographic Survey, 1997
H10763 (1997)	NO Hydrographic Survey, 1997
H10771 (1997)	NO Hydrographic Survey, 1997
H00140 (1995)	NO Hydrographic Survey, 1995
H00092 (1994)	NO Hydrographic Survey, 1994

Legend  
Credits  
Help

- Displays location and information about all bathymetry in archive
- Enables download of descriptions, products, and data
- Web services can be ingested into any viewer



# Functional Elements NGDC Space Weather Program

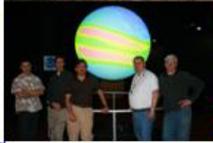
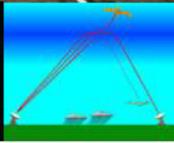


### Ionospheric Data Services Data Acquisition and Field Work

NGDC acquires, processes and distributes approximately 6,000 real-time ionosonde observations per day from over 50 instruments worldwide. Ionosonde data sent to SWPC are used primarily to serve the general public, both industry and private citizens. Data from SWPC's servers indicate that about 12,000 unique customers access 650,000 to 825,000 ionosonde observations per month. NGDC serves real-time ionospheric data through the Mirrion system.

<http://www.ngdc.noaa.gov/wef/IONQ/IONhome.html>

Space Weather Workshop – 27-30 Apr 2010

Science On a Sphere      Ionospheric Sounding

### Solar Data Services Safeguarding Historical Datasets

Archives include a variety of solar synoptic drawings, sunspot images and photographs derived from mostly ground observatories. Digitization done through the Climate Database Modernization Program.

Wendelstein Observatory (1947-1997)

Boulder Composites Drawings (1972-present)

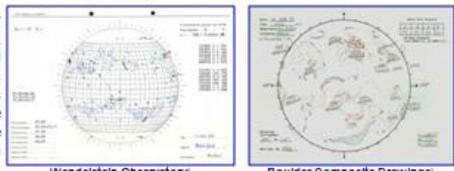
Fraunhofer Institute (1956 - 1973)

Northwestern Observatory (1958 - 1970)

Drawings from the IGY (1957 - 1958)

Space Weather Workshop – 27-30 Apr 2010

Recently added to the archives (2009-2010)




### Satellite Data Services NOAA Operational Datasets

**GOES Space Environment Monitor**

- Geosynchronous Orbit, since 1974
- Elements: In Situ Magnetic Fields  
Whole Sun X-ray Flux  
Energetic Particles
- All Data are Online

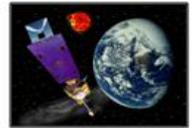
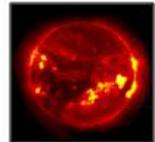
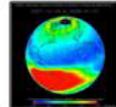
**GOES Solar X-ray Imager – GOES 12-15**

- Geosynchronous Orbit, since 2003
- X-ray Images taken every minute
- All Data Are Online (once operational)

**POES/MetOp Energetic Particle Detector**

- Polar Low Earth Orbit
- Energetic Particles Archived Since 1979
- All Data Are Online

Space Weather Workshop – 27-30 Apr 2010

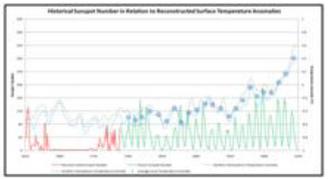




### Indices Data Services Geomagnetic Indices and Sunspot

NGDC acquires and archives a variety of solar and geomagnetic indices which are made available in tabular format or as time-series data. Archived indices include:

- Daily/monthly/yearly sunspot numbers
- Solar radio flux,  $F_{10.7}$ , USAF data
- Geomagnetic  $K_p$ ,  $A_p$ , Dst, AA, AA'
- AMIE derived indices (SWx Climatology)
- Cosmic ray datasets

Space Weather Workshop – 27-30 Apr 2010





# Satellite Data Services

## NOAA Operational Datasets



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Whole Sun X-ray Flux  
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<http://www.ngdc.noaa.gov/stp/satellite/goes/dataaccess.html>



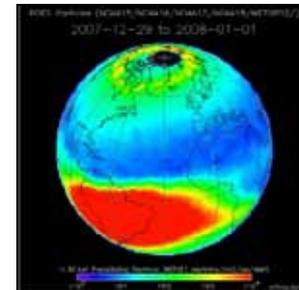
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<http://sxi.ngdc.noaa.gov/>



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<http://www.ngdc.noaa.gov/stp/satellite/poes/index.html>



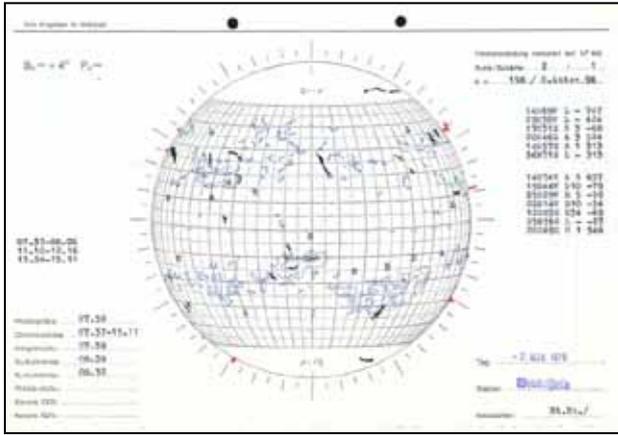


# Solar Data Services

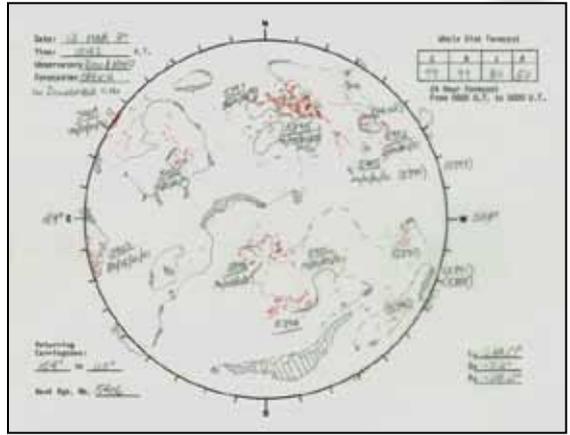
## Safeguarding Historical Datasets



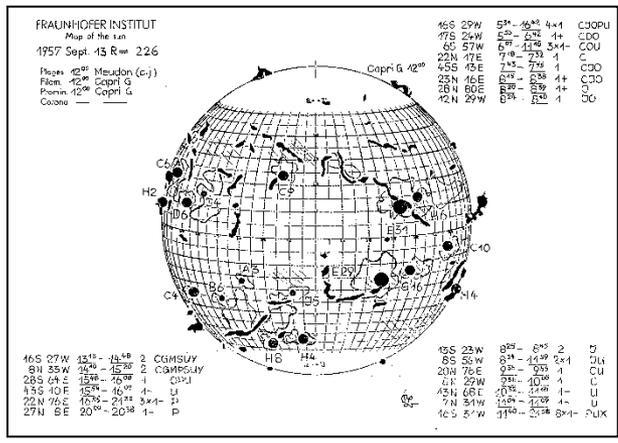
Archives include a variety of solar synoptic drawings, sunspot images and photographs derived from mostly ground observatories. Digitization done through the Climate Database Modernization Program.



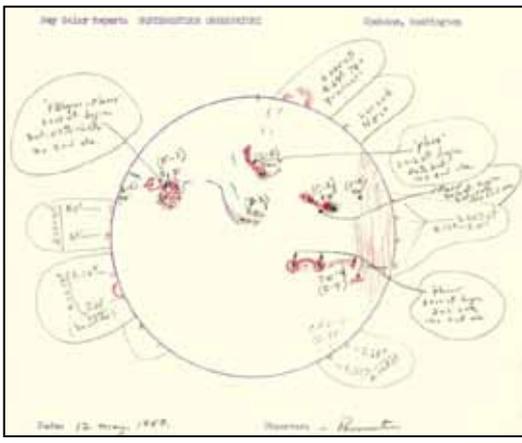
Wendelstein Observatory\*  
(1947-1987)



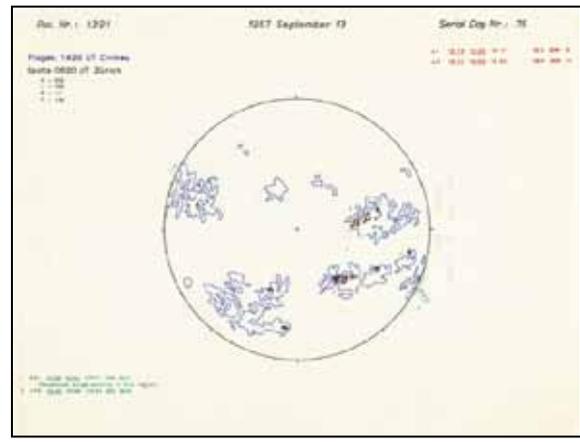
Boulder Composite Drawings\*  
(1972-present)



Fraunhofer Institute  
(1956 - 1973)



Northwestern Observatory\*  
(1958-1970)



Drawings from the IGY  
(1957 - 1958)

\*Recently added to the archives (2009-2010)



# Indices Data Services

## Geomagnetic Indices and Sunspot



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- Geomagnetic  $K_p$ ,  $A_p$ , Dst, AA, AA\*
- AMIE derived indices (SWx Climatology)
- Cosmic ray datasets

GEOMAGNETIC INDICES BULLETIN

NATIONAL GEOPHYSICAL DATA CENTER  
Telephone 303-497-6135  
Solar-Terrestrial Physics Division (R/SGZ)  
325 Broadway, Boulder, Colorado 80502 USA

MONTHLY SUMMARY OF GEOMAGNETIC ACTIVITY

**THE GEOMAGNETIC FIELD.** The intensity of the Earth's magnetic field at any point in space and time arises from the MAIN field internal to the planet; from the electrical currents flowing in the ionized upper atmosphere; and from the currents induced within the Earth's crust. The main field component varies slowly in time and can be grossly described as a bar magnet with north and south poles that extend well out into space.

The main field creates a cavity in interplanetary space called the magnetosphere, where the Earth's magnetic field dominates any field carried by the charged particles of the solar wind. The magnetosphere shape resembles a comet-tail shape owing to the interaction with the solar wind; it is compressed on the side toward the sun and the side away from the sun. The magnetosphere also directs the flow of the particles about the Earth.

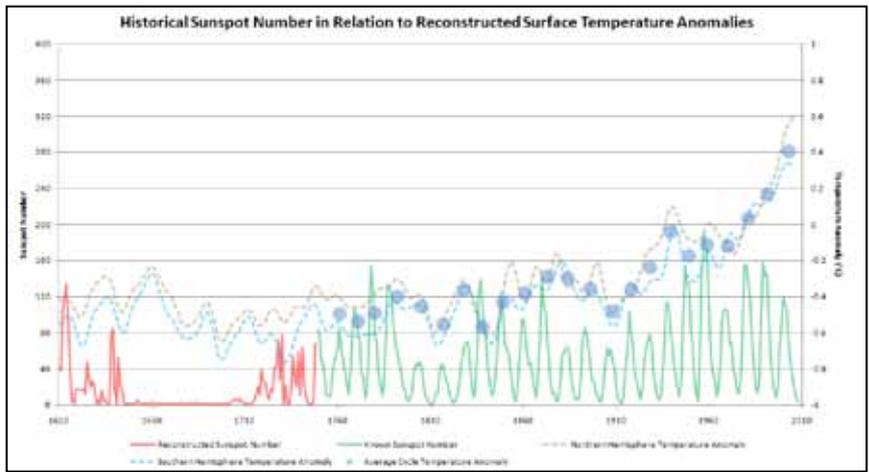
**Particles flowing in the magnetosphere and ionosphere generate currents, which in turn cause variations in the intensity of the Earth's magnetic field.** These EXTERNAL currents generate additional currents in the Earth's upper atmospheric layers, which vary on much shorter time scales than the main field, and they create magnetic changes as large as 10% of the main field.

Certain current systems derive their energy from the regular changing solar radiation throughout the day and year. Other irregular current systems obtain their energy from the interaction of the solar wind with the magnetosphere, from the magnetosphere itself, from the interaction between the magnetosphere and the ionosphere, and from the ionosphere itself. Magnetic activity indices - including those reported below, are designed to describe variations in the Earth's main field caused by these irregular currents.

MARCH 1980

Day	Rank	Co	Three-hour Indices	Kp	ap	ap (UT)	AFR	Am	As	Am	W	Provisional				
Cal	Jul	Bart	0-9	1 2 3 4 5 6 7 8	Sat	Ap	Cp					W1	W2			
1	60	18	62A	3+ 3 2 3- 3+ 3- 2	21+	12	0.7	11	23	24	24	24	30	24	30	
2	61	19		3+ 6- 4- 3+ 4 3+ 3	30-	25	1.2	0247	19	43	45	44	44	51	53	42
3	62	20		3 5 6- 5- 5- 5 4 3	35	37	1.4	27	50	53	52	42	55	48	49	
4	63	21	65A	3+ 2+ 2 3+ 4+ 3 1	1-	20	13	0.8	9	21	22	22	25	23	24	25
5	64	22		3- 4 5 5+ 5- 3+ 4- 3+	32	30	1.3	28	48	38	43	54	42	54	41	
6	65	23		4 3 3+ 4- 5- 4 4 3+	30	24	1.2	22	38	36	37	42	28	31	39	
7	66	24	69A	4 4+ 3+ 3 3- 3 2 3	25+	18	1.0	12	20	25	27	40	21	35	26	
8	67	25		2+ 2 3- 0+ 1- 4+ 5+ 6-	24-	24	1.1	1755	20	40	36	38	51	35	13	73
9	68	26		5+ 5 3+ 3+ 4- 4 4- 5-	33	31	1.3	21	48	49	48	52	51	46	58	
10	69	27	613A	4+ 4 4- 3- 3- 3 3 3+	27-	19	1.0	17	31	32	32	31	28	31	28	
11	70	1	68A	3- 3 3 4- 3 3 3- 4	25	17	0.9	12	27	33	30	32	29	33	28	
12	71	2		5 3 3 3- 3 3 3- 4	3	28+	21	1.1	56	35	39	37	40	36	37	39
13	72	3	61	4 6 8- 9+ 8+ 8+ 8+ 9+	65	24+	2.2	0127	240	397	390	393	357	340	244	432
14	73	4	62	9 8- 8- 6- 5 5+ 8- 7+	55+	158	2.0	125	230	228	229	214	291	307	108	
15	74	5		7- 6 5- 5 4+ 5- 4 3	38+	49	1.6	28	70	67	69	71	78	103	45	
16	75	6	65	3 5 5+ 7- 5+ 5 5 4-	38	50	1.6	0532	38	79	72	76	69	71	78	63
17	76	7		4+ 5+ 5+ 4+ 4+ 4+ 3-	34+	34	1.4	21	51	53	52	48	47	58	38	
18	77	8	64A	1 2 2 2 4 2+ 1 2	26-	15	0.8	18	28	25	24	17	23	11	39	
19	78	9		1 4 6+ 6+ 7- 6 3+ 3+	36+	55	1.6	0425	30	72	77	75	61	88	78	72
20	79	10	65A	2+ 4- 3+ 2+ 2+ 2+ 2- 4	22	14	0.8	12	25	18	21	27	16	19	24	
21	80	11		4 4 4+ 4- 4- 3 3 4-	29	22	1.1	20	36	32	34	35	28	37	26	
22	81	12		3 3 3- 4 4+ 5- 6 6- 3+	35+	39	1.4	26	50	49	50	69	42	34	77	
23	82	13		4+ 5 3 4+ 5 6- 3- 3-	35-	36	1.4	19	56	56	56	48	58	33	74	
24	83	14	67A	5+ 3+ 2+ 2 2+ 1 2	26-	16	0.8	14	27	25	25	24	25	37	32	
25	84	15	61A	1+ 1+ 2+ 1- 3- 4 3	17	10	0.6	8	19	18	19	28	20	12	28	
26	85	16	66A	3- 3 2- 3 4- 2+ 2 4	22+	14	0.8	2249	12	27	22	24	30	24	20	34
27	86	17		3+ 3+ 4+ 6- 6+ 5 5+	36+	44	1.5	1342	37	69	55	62	74	60	40	94
28	87	18		4+ 3+ 4+ 6- 6- 5 4 6-	34	39	1.4	33	64	54	59	52	57	46	63	
29	88	19	63	6+ 6 3+ 4+ 5- 5+ 7 6	45	71	1.8	38	81	84	82	85	72	74	84	
30	89	20		4+ 5+ 4- 3 3+ 4- 7+	37+	47	1.5	35	62	64	64	56	67	58	65	
31	90	21	64	5+ 6+ 4+ 5 6- 6+	37	41	1.4	38	64	77	77	59	72	54	77	
MEAN						41	1.26		62	61	62	61	59	60		

See back side for definitions of column heading.





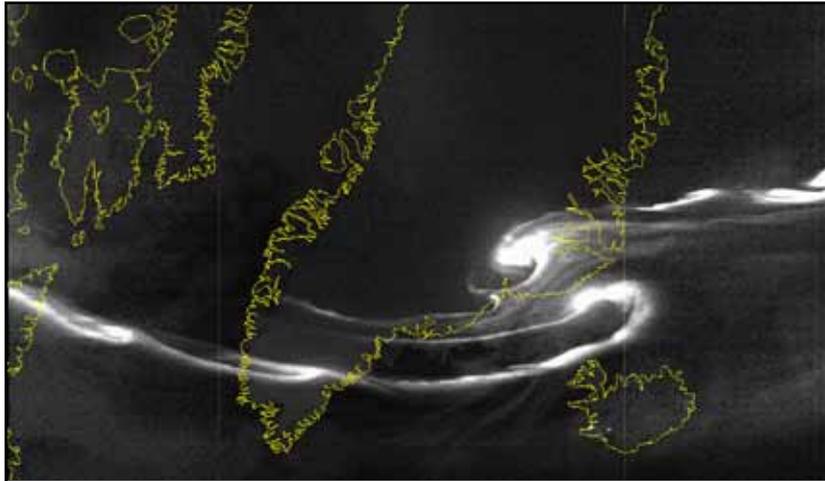
# Operational SWx Datasets

## USAF SWx Datasets – Satellite & Ground



### Solar Electro-Optical Network (SEON)

- Solar Optical Observing Network (SOON) – daily sunspot drawings from 4+ SEON sites
- Radio Solar Telescope Network (RSTN) – Solar radio noise backgrounds at selected frequencies (245 MHz – 15.4 GHz)

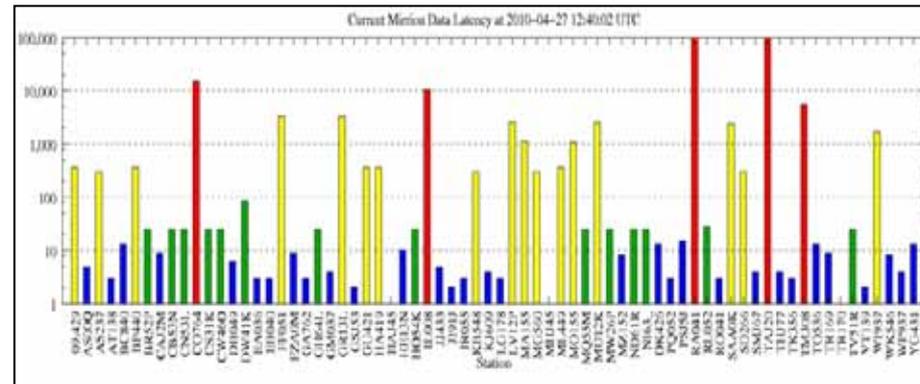


### Defense Meteorological Satellite Program (DMSP)

- Operational Linescan System auroral imagery
- Space Weather Sensors – SSJ / SSIES / SSM
- SSUSI / SSULI *tbd*

### MIRRION Ionosonde Data System

- Digital Ionospheric Sounding System (DISS)
- Vertical Incidence Pulsed Ionospheric Radar (VIPIR)
- International ionosonde datasets





# National Geodetic Survey (NGS) Continuously Operating Reference Stations (CORS)

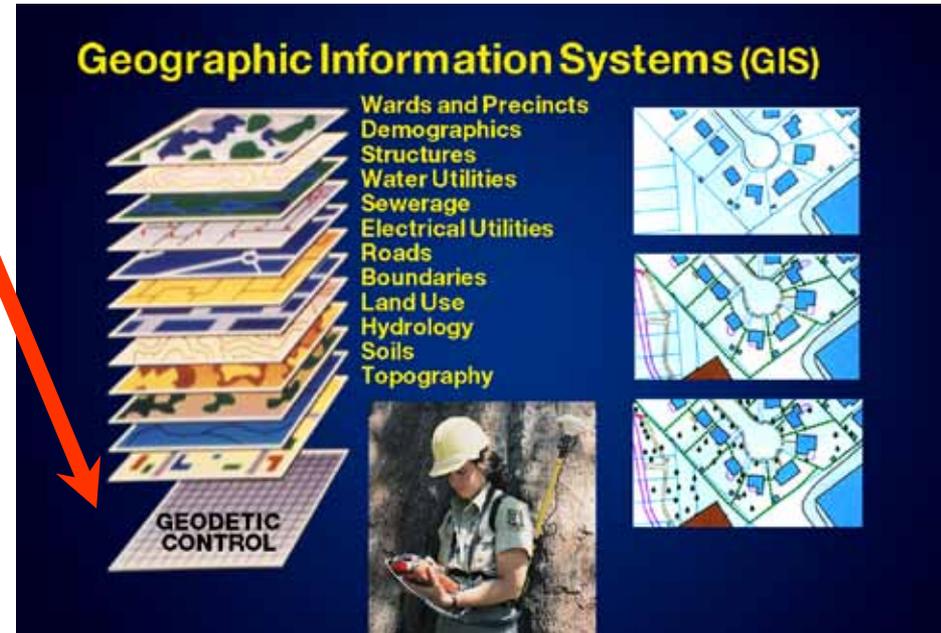
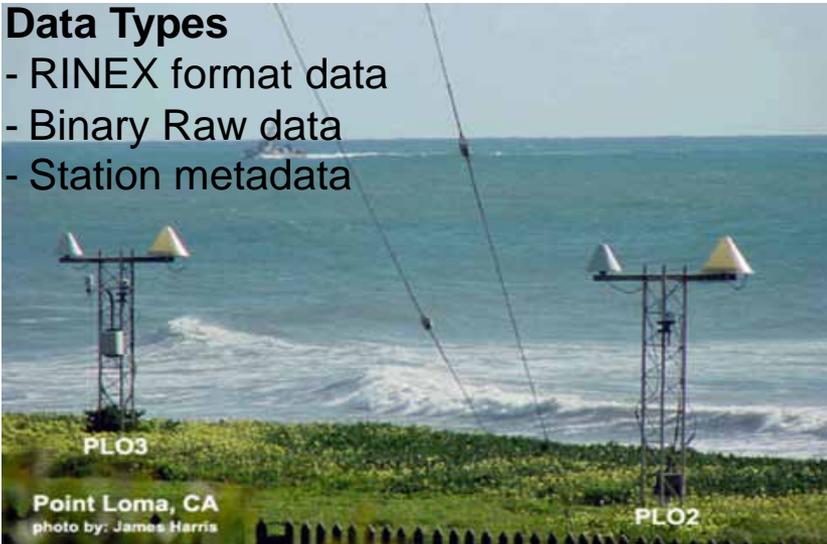


## Background

- CORS helps define the National Spatial Reference System. Provides the foundation for positioning in the nation.
- In 2003, Parallel CORS facility and archive established at NGDC.
- NGDC is the designated archive for NGS GPS data according to NOS Records Disposition Schedule 1602-12.
- Migrating to CLASS IT Systems in 2011.

## Data Types

- RINEX format data
- Binary Raw data
- Station metadata



## Uses and the Future.

- The positions from CORS data are used as input for essential NOAA activities such as monitoring water vapor in the atmosphere and total electron content in the ionosphere.
- Future Global Navigation Satellite Systems (GNSS) satellite systems data such as Russia's GLONASS and China's COMPASS will be incorporated into CORS.

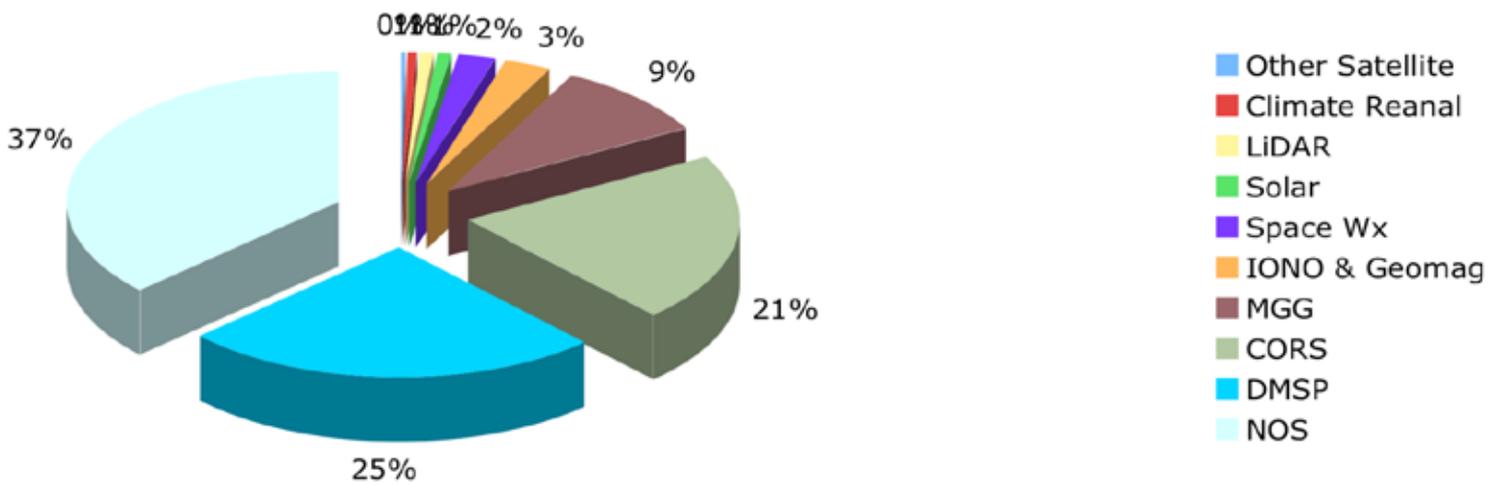


# NGDC Archive Status



FY11 3rd QTR Highlights:

**Archive Breakdown:  
422 TB as of 7/1/11**



**Top Three:**  
 NOS - 156.1 TB  
 DMSP - 104.7 TB  
 CORS - 89.9 TB



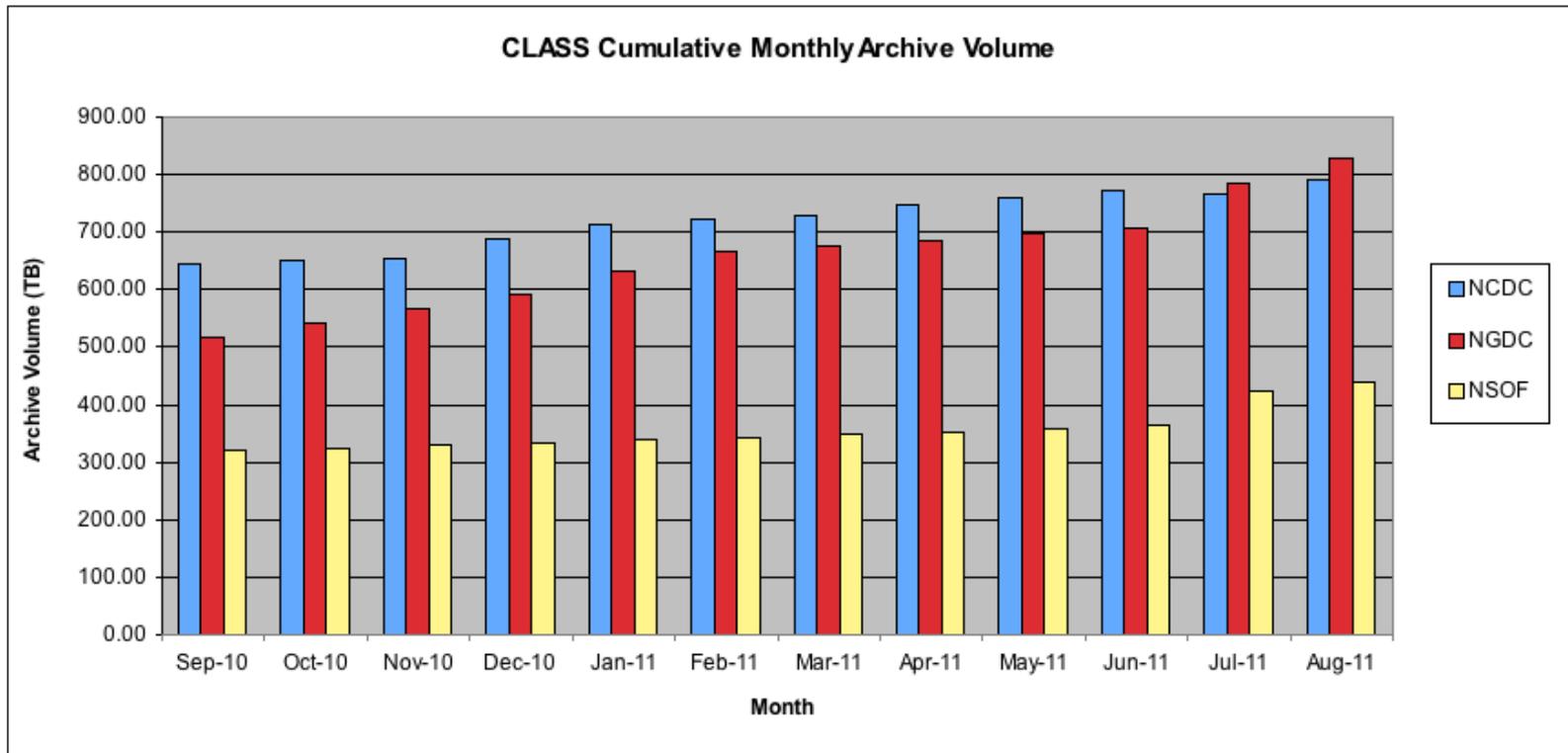
# CLASS-NGDC Archive



## Total CLASS -NGDC Archive Volume

- FY10 Q4 = 515 TB
- FY11 Q1 = 590 TB
- FY11 Q2 = 676 TB
- FY11 Q3 = 705 TB

NPP ingest volume will be 4-5 TB/day at each node

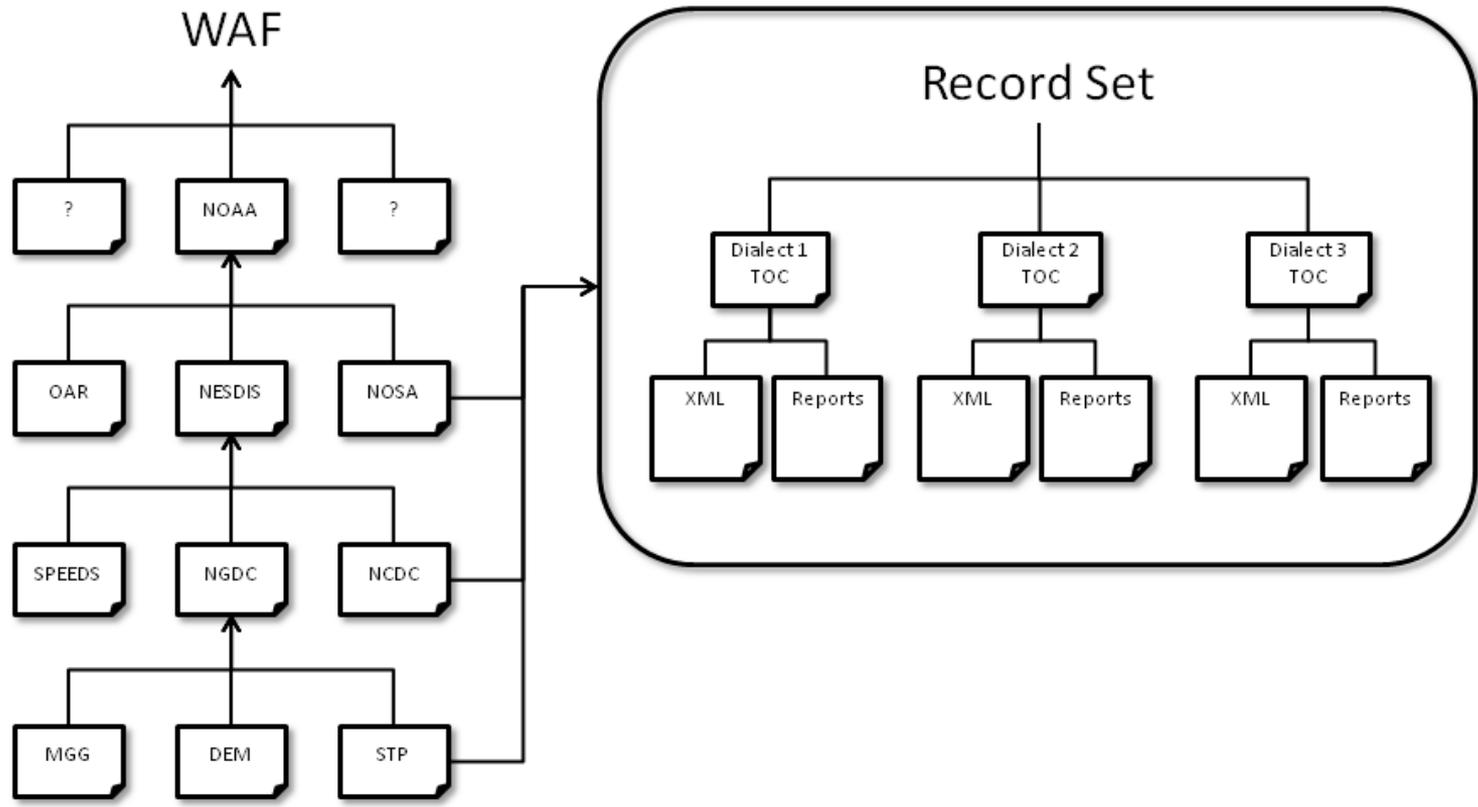




# Metadata

- Data Centers transitioning from FGDC to ISO 19115/19115-2
- Can Support Multiple Views of Metadata and Quality Reports

## Enterprise Directory Structure





# Metadata



## NetCDF Attribute Convention for Dataset Discovery Report

The Unidata Attribute Convention for Data Discovery provides recommendations for netCDF attributes that can be added to netCDF files to facilitate discovery of those files using standard metadata searches. This tool tests conformance with those recommendations. More [Information on Convention and Tool](#).

**Title: Ionosonde Data**

**Total Score: 40/45**

### General File Characteristics

Number of Global Attributes 49  
Number of Variables 146  
Number of Variable Attributes 281  
Number of Standard Names 0

	Spiral	None	1-33%	34-66%	67-99%	All
<a href="#">Total</a>					X	
<a href="#">Identification and Metadata Reference</a>					X	
<a href="#">Text Search</a>						X
<a href="#">Extent Search</a>						X
<a href="#">Other Extent Information</a>					X	
<a href="#">Creator</a>					X	
<a href="#">Contributor</a>						X
<a href="#">Publisher</a>				X		
<a href="#">Other Attributes</a>						X

[Identification](#) | [Text Search](#) | [Extent Search](#) | [Other Extent Information](#) | [Creator Search](#) | [Contributor Search](#) | [Publisher Search](#) | [Other Attributes](#)

### Identification / Metadata Reference Score: 3/4

As metadata are shared between National and International repositories it is becoming increasingly important to be able to unambiguously identify and refer to specific records. This is facilitated by including an identifier in the metadata. Some mechanism must exist for ensuring that these identifiers are unique. This is accomplished by specifying the naming authority or namespace for the identifier. It is the responsibility of the manager of the namespace to ensure that the identifiers in that namespace are unique. Identifying the Metadata Convention being used in the file and providing a link to more complete metadata, possibly using a different convention, are also important.



# Summary



- NGDC is 1 of 3 NOAA National Data Centers
- We are responsible for the long-term stewardship of data from the surface of the Sun to the core of the Earth (except the wet ocean & weather layer)
- NGDC delivers over 100 Tb per year (use and re-use) to a diverse set of customers.
- NOAA Hydrographic data is one of the fastest growing data streams stewarded by NGDC