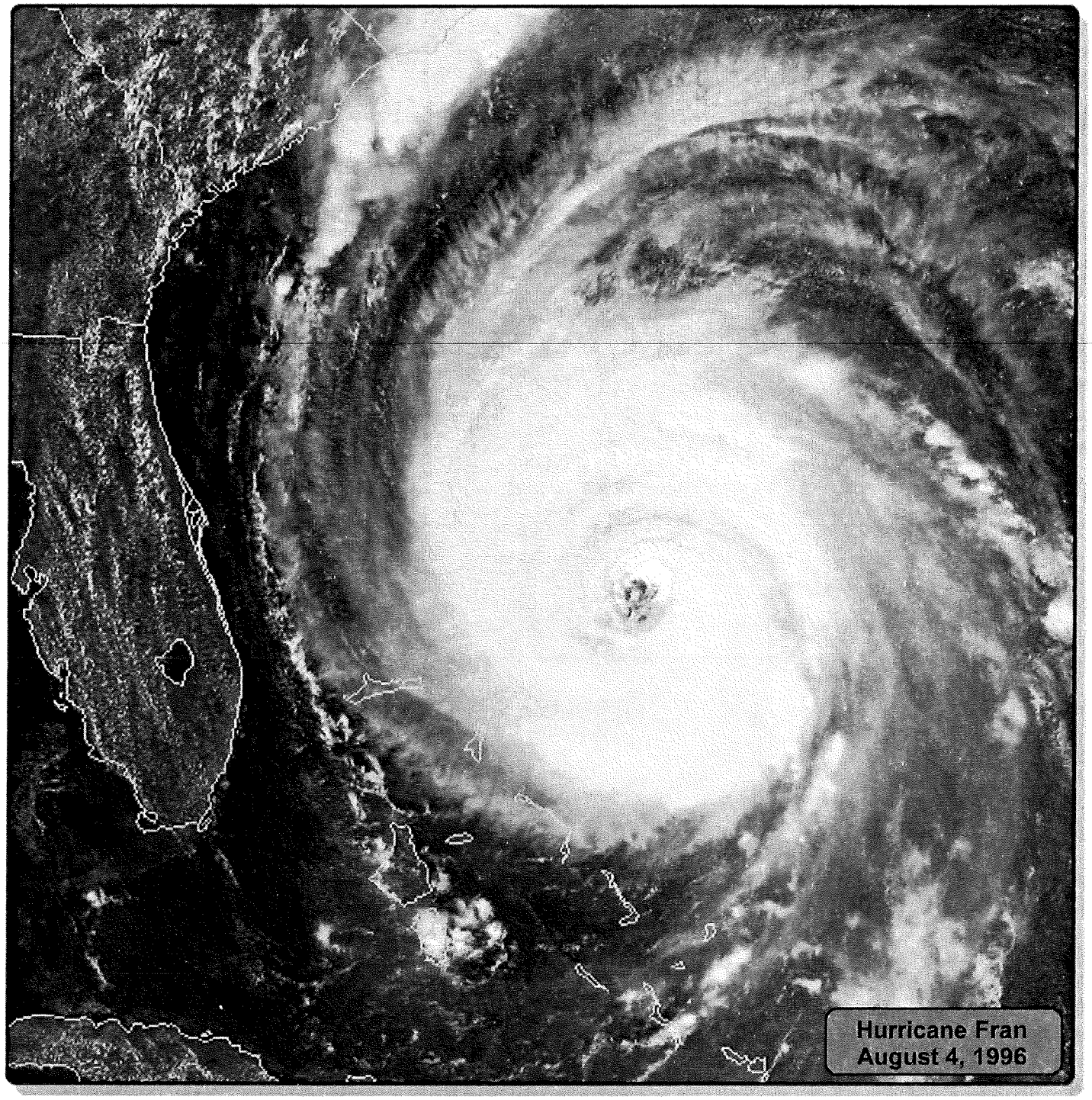
ENVIRONMENTAL INFORMATION SUMMARY C-16

ENVIRONMENTAL SATELLITE DATA AND INFORMATION

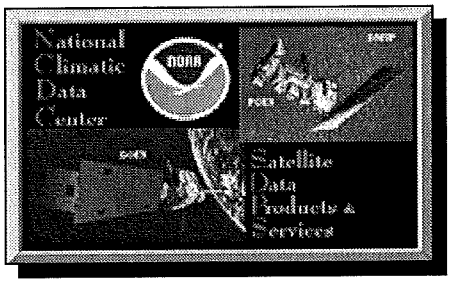


Introduction

The National Climatic Data Center (NCDC) manages a unique source of environmental satellite data and information, and it services requests from this database to a wide range of users. The NCDC environmental satellite database is an element of the overall National Environmental Satellite Data and Information Service (NESDIS) environmental database. There are over 230 terabytes of digital satellite information and countless hard copies of satellite imagery collected from the National Oceanic and Atmospheric Administration (NOAA) operational environmental satellites and selected data from various National Aeronautics and Space Administration (NASA) research satellites, the Department of Defense Meteorological Satellite Program (DMSP) satellites, and the Canadian Space Agency RADARSAT satellite. Tables 1 and 2 provide a listing of satellites, launch dates, archive dates, and instrument data archived at NCDC. While much of the data are meteorological, the oceanographic, agronomic, and geographic applications have been extensive.

Requests for data are serviced by the Satellite Services Group located at the NCDC in Asheville, North Carolina. In light of the explosive activity on the Internet, NCDC's satellite services are meeting the needs of the research and educational community by providing an increasing amount of qualitative and quantitative products on-line. More information, as well as a complete data and product listing, is found after the overview of each of the satellite systems.

Requests for environmental satellite data, products and documentation should be addressed to:



Visit NCDC web site at www.ncdc.noaa.gov

National Climatic Data Center
Attn: Satellite Services Group
151 Patton Avenue, Room 120
Asheville, North Carolina 28801

Phone number: 704 271-4850
Facsimile number:704 271-4876
E-Mail address: satorder@ncdc.noaa.gov

For high resolution satellite imagery of the earth collected by the LANDSAT satellite series please contact the EROS Data Center, Sioux Falls, SD 57198 (Tel: 605-594-6151/Fax: 605-594-6589, e-mail: custserv@edcserver1.cr.usgs.gov)

About NOAA's Satellites

NOAA manages two primary satellite systems: the Polar-orbiting Operational Environmental Satellite (POES) and the Geostationary Operational Environmental Satellite (GOES). Although the Defense Meteorological Satellite Program (DMSP) series is not part of the NOAA satellite series, NOAA also receives, processes and archives data collected from the three sensors. NOAA is currently acquiring limited data from the new Canadian RADARSAT satellite for distribution to authorized users only.

Polar-orbiting Operational Environmental Satellite (POES)

Background

The first NOAA series of polar orbiting satellites began with the launch of the Television Infrared Operational System (TIROS) satellite on April 1, 1960. Its mission was to provide global meteorological data for research and forecasting. These satellites carried a Vidicon Camera with an array of lenses. The Vidicon was essentially a television camera which provided visible data at a maximum spatial resolution of 3.8 km.

The second series of polar orbiting satellites were those of the Environmental Science Services Administration (ESSA), NOAA's predecessor. These satellites were considered the first generation of "operational" polar orbiters. The ESSA series lasted three years after the launch of ESSA-1 on February 3, 1966. Placed in near sun-synchronous orbits, these satellites operated in pairs, making daily passes over much of the globe during the morning and afternoon hours. The afternoon satellite was equipped with the Advanced Vidicon Camera System (AVCS), which provided visible data at a maximum spatial resolution of 2.2 km, and a Low Resolution Infrared Radiometer (LRIR) which provided infrared measurements at varying spatial resolutions. The morning satellite was equipped with an Automatic Picture Transmission (APT) system which provided local imagery (at spatial resolutions of 3.8 to 7.4 km) to suitably equipped ground stations.

The second generation of operational polar orbiters began on January 23, 1970, with the launch of ITOS-1 (Improved TIROS Operational System) and continued with NOAA-1 through NOAA-5. NOAA-5 was launched July 29, 1976. These satellites were also placed in near sun-synchronous orbits with equatorial passes at 0900 Universal Coordinated Time (UTC) and 2100 UTC. Sensors on ITOS-1 and NOAA-1 included an AVCS and a Scanning Radiometer (SR). A Very High Resolution Radiometer (VHRR), and a Vertical Temperature Profile Radiometer (VTPR) were part of the payload for NOAA-2 through NOAA-5. The SR provided global visible and infrared data at 4 and 8 km spatial resolutions, respectively, while the VHRR provided higher resolution data for designated areas. The VTPR was an eight channel radiometer that provided infrared measurements at 68 km resolution.

Table 1 Polar-orbiting Satellites

Satellite Name	Launch Date	Period of Record Archived	Archive Form*	Instrument Data
TIROS-1	04/01/60	04/01/60 - 06/14/60	I	Vidicon (TV camera System)
TIROS-2	11/23/60	11/23/60 - 09/27/61	I	Vidicon, IR Radiometer
TIROS-3	07/12/61	07/12/61 - 01/23/62	I	Vidicon
TIROS-4	02/08/62	02/08/62 - 06/18/62	I	Vidicon, IR Radiometer
TIROS-5	06/19/62	06/09/62 - 05/14/63	I	Vidicon
TIROS-6	09/18/62	09/18/62 - 10/21/63	I	Vidicon
TIROS-7	06/19/63	06/19/63 - 02/26/66	I	Vidicon, IR Radiometer
TIROS-8	12/21/63	12/21/63 - 02/12/66	I	Vidicon
TIROS-9	01/22/65	01/23/65 - 09/09/66	I	Vidicon
TIROS-10	07/02/65	07/02/65 - 04/02/66	I	Vidicon
ESSA-1	02/03/66	02/04/66 - 10/06/66	I	Advanced Vidicon Camera System (AVCS)
ESSA-3	10/02/66	10/04/66 - 06/01/67	I	AVCS and Low Resolution IR Radiometer (LRIR)
ESSA-5	04/20/67	06/01/67 - 12/03/68	I	AVCS, LRIR
ESSA-7	04/16/68	04/16/68 - 03/13/69	I	AVCS, LRIR
ESSA-9	02/26/69	04/01/69 - 11/15/72	I	AVCS, LRIR
ITOS-1	01/23/70	04/28/70 - 06/17/71	I	Scanning Radiometer (SR)
NOAA-1	12/11/70	04/26/71 - 06/20/71	I	SR, VHRR, VTPR
NOAA-2	10/15/72	11/16/72 - 03/19/74	I	SR, VHRR, VTPR
NOAA-3	11/06/73	03/26/74 - 12/17/74	I	SR, VHRR, VTPR
NOAA-4	11/15/74	12/17/74 - 09/15/76	I	SR, VHRR, VTPR
NOAA-5	07/29/76	09/15/76 - 03/16/78	I	SR, VHRR, VTPR
GEOS-3	04/09/75	04/14/75 - 12/01/78	I/D	Radar Altimeter
SEASAT	06/27/78	07/07/78 - 10/09/78	I/D	(see SEASAT description)
TIROS-N	10/13/78	10/30/78 - 11/01/80	I/D	AVHRR, TOVS
NIMBUS-7	10/24/78	10/24/78 - 06/23/86	I/D	Coastal Zone Color Scanner
NOAA-6	06/27/79	06/27/79 - 06/20/83	I/D	AVHRR, TOVS
NOAA-7	06/23/81	06/23/81 - 02/25/85	I/D	AVHRR, TOVS
NOAA-8	03/28/83	06/20/83 - 10/31/85	I/D	AVHRR, TOVS
NOAA-9	12/12/84	02/25/85 - 11/07/88	I/D	AVHRR, TOVS
NOAA-10	09/17/86	11/17/86 - 09/16/91	I/D	AVHRR, TOVS
DMSP F-8	06/19/87	06/25/87 - 08/01/94	D	SSM/I, SSM/T
NOAA-11	09/24/88	11/08/88 - 09/12/94	I/D	AVHRR, TOVS, SBUV
DMSP F-10	12/01/90	12/01/90 - present	D	SSM/I, SSM/T
NOAA-12	05/14/91	09/01/91 - present	D	AVHRR, TOVS
DMSP F-11	11/28/91	12/06/91 - present	D	SSM/I, SSM/T, SSM/T2
DMSP F-12	08/29/94	09/08/94 - present	D	SSM/I, SSM/T, SSM/T2
NOAA-14	12/30/94	01/30/95 - present	D	AVHRR, TOVS, SBUV
DMSP F-13	03/24/95	04/01/95 - present	D	SSM/I, SSM/T, SSM/T2
RADARSAT	11/04/95	Not at Present	D	SAR
DMSP F-14	04/15/97	04/28/97 - present	D	SSM/I, SSM/T, SSM/T2

(Legend on next page)

* Older images archived offsite and limited

Table 1 (continued)

Legend

I - Hard copy images
D - Digital
VHRR - Very High Resolution Radiometer
AVHRR - Advanced VHRR
VTPR - Vertical Temperature Profile Radiometer
TOVS - TIROS Operational Vertical Sounder
SAR - Synthetic Aperature Radar
SBUV - Solar Backscatter Ultra Violet Radiometer
SSM/I - Special Sensor Microwave Imager
SSM/T - Special Sensor Microwave Temperature Sounder
SSM/T2 - Special Sensor Microwave Water Vapor Profiler

Today's generation of polar orbiting satellites (Figure 1) was initiated with the launch of TIROS-N on October 13, 1978. These satellites, like their predecessors, operate in near sun-synchronous orbits. Consecutive equatorial crossings are separated by about 25 degrees of longitude. This produces up to 14.1 orbits per day. Orbital tracks do not repeat on a daily basis, but similar equatorial node crossings occur every nine days. The two main sensors on board these satellites include the Advanced Very High Resolution Radiometer (AVHRR) and the TIROS Operational Vertical Sounder (TOVS). The AVHRR is a four/five channel radiometer (four channels for the morning satellite and five channels for the afternoon satellite). Spectral bands range from the visible through the thermal infrared. The TOVS is composed of three different sensors, all measuring incoming radiation in the infrared or passive microwave portion of the electromagnetic spectrum. The 3 components of the TOVS are the Microwave Sounding Unit (MSU) with 4 microwave channels, the Stratospheric Sounding Unit (SSU) with 3 infrared channels, and the High Resolution Infrared Sounder/2 (HIRS/2) with 20 infrared channels.

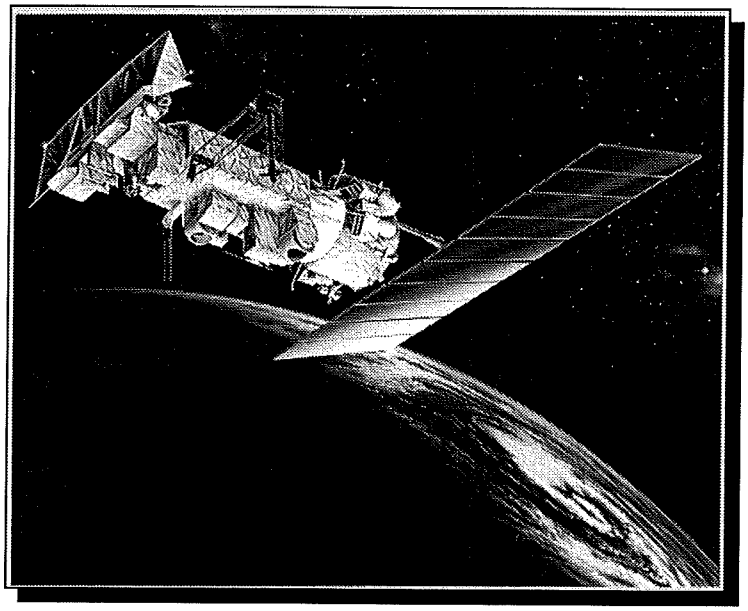


Figure 1. POES Satellite

The next generation of polar orbiting satellites will begin with the launch of NOAA-K, planned for September 1997. NOAA-K and its successors, NOAA-L and NOAA-M, represent an improvement over the previous series. There will be more passive microwave instruments and channels. The new Advanced Microwave Sounding Units (AMSU-A1, AMSU-A2, AMSU-B) are

state-of-the-art passive microwave sounders that will significantly enhance NOAA'S atmospheric sounding and non-sounding products suite. The AMSU instruments have better spatial resolution and upper atmospheric sounding capabilities than the previous MSU instruments flown on the TIROS-N series. The Advanced Very High Resolution Radiometer (AVHRR/3) will provide improved low energy/light detection. Channel 3 will be split into two time-shared channels, 3A and 3B, with wavelengths of 1.6 and 3.7 microns, respectively. Channel 3A will be used for snow and ice discrimination, whereas, channel 3B will be used for detection of bio-mass burning. The High resolution Infrared Radiation Sounder (HIRS/3) has spectral channel changes that were made primarily to improve soundings and to be congruent with the specifications developed for the new GOES Sounders.

In 1994 Congress ordered the merging of the Defense Meteorological Satellite Program (DMSP) and the POES program into the National Polar-orbiting Operational Environmental Satellite System (NPOESS). The first converged satellite is expected to be available sometime toward the middle to latter half of the next decade (year 2005-2010) depending on when the current NOAA and DMSP programmed satellite assets are exhausted. Convergence of these programs is the most significant change in U.S. operational remote sensing since the launching of the first weather satellite in April 1960. For the first time, the U.S. government is taking an integrated approach to identifying and meeting the operational satellite needs of both the civil and national security communities. The program is expected to provide up to $300 million in government cost savings through the year 1999 and up to $1 billion over the life of the program.

Purpose

The POES satellite system offers the advantage of daily global coverage despite lower temporal resolution. As a result, the POES series satellites are able to collect data for a variety of land, ocean, and atmospheric applications. Data from the POES series supports a broad range of environmental monitoring applications, including weather analysis and forecasting, climate research and prediction, ocean dynamics research, volcanic eruption monitoring, forest fire detection, global vegetation monitoring, global sea surface temperature measurements, coral reef hotspots, aerosol depth measurements, atmospheric soundings of temperature and moisture, total atmospheric ozone monitoring, and many other applications. Detailed information on the AVHRR and TOVS instruments, digital formats, data, and products is described in the **NOAA Polar Orbiter Data Users Guide**, available from the NCDC in hardcopy format, or on-line at www.ncdc.noaa.gov.

Geostationary Environmental Satellite

Background

On December 7, 1966, NASA launched the first geostationary Applications Technology Satellite (ATS-1), which had the ability to see weather systems in motion. The ATS-1 was capable of full-disk Earth imaging every half hour. The National Severe Storm Forecast Center (NSSFC) and the National Hurricane Center (NHC) benefited from imagery taken by ATS-3 in the early 1970's.

On May 5, 1974, the first prototype GOES satellite, the Synchronous Meteorological Satellite (SMS-1) was launched. Shortly thereafter, NOAA's operation of a GOES series began with the launch of GOES-1 on October 16, 1975. The primary instrument on board the SMS and the earliest GOES satellites was the Visible and Infrared Spin Scan Radiometer (VISSR). The VISSR provided 1 km resolution visible data (6 bit precision) and 8 km IR data (8 bit precision), and was used primarily to produce time sequences of visible and IR imagery in support of severe weather forecasting and warning activities. GOES-4, launched on September 9, 1980, carried the VISSR Atmospheric Sounder (VAS), which provided 1 km visible data and multi-channel IR data at 7 km and 14 km resolution. The VAS had four IR detectors: two at 7 km and two at 14 km resolution. A filter wheel positioned in the optical path permitted selection from any of 12 IR spectral bands ranging from 3.95 μm to 14.73 μm. At any given time, three or four IR channels were transmitted. Since one instrument was tasked to do imaging and sounding scans separately, the sounding data were too limited to be of operational use in the model runs.

With the launch of GOES-I (GOES-8) in April 1994, a new generation of geostationary satellites was born. The GOES I-M series of geostationary satellites (Figure 2) are a total redesign from the previous GOES series. These satellites are three-axis body stabilized and equipped with a separate Imager and Sounder, replacing the old VAS instrument on the last generation spinning GOES satellites. GOES-9 joined GOES-8 on May 23, 1995, and was moved over to 135 degrees West longitude by early 1996. For the first time since January 1989, NOAA has full time GOES-WEST and GOES-EAST coverage. The latest GOES, GOES-10, was launched on April 25, 1997. It will be placed in a sleep mode until it is necessary to replace either GOES-8 or GOES-9, whichever fails first.

The Imager instrument on the GOES I-M series consists of five channels ranging from the visible to the longwave infrared channel. The visible channel has a resolution of 1 km while most of the infrared channels have an improved resolution of 4 km at nadir. The Sounder, carrying 18 thermal infrared channels, is capable of making over 50,000 soundings per hour, which is particularly useful over data sparse regions of the Western Hemisphere. Each of the current GOES satellites scans pre-determined areas of the Earth from the mid-Pacific region to the eastern Atlantic region. During routine mode of operation, observations are taken over the northern western hemisphere up to four times every hour while full earth scans are taken every three hours. When severe weather threatens, the GOES Imager is capable of one minute interval scanning over a smaller area.

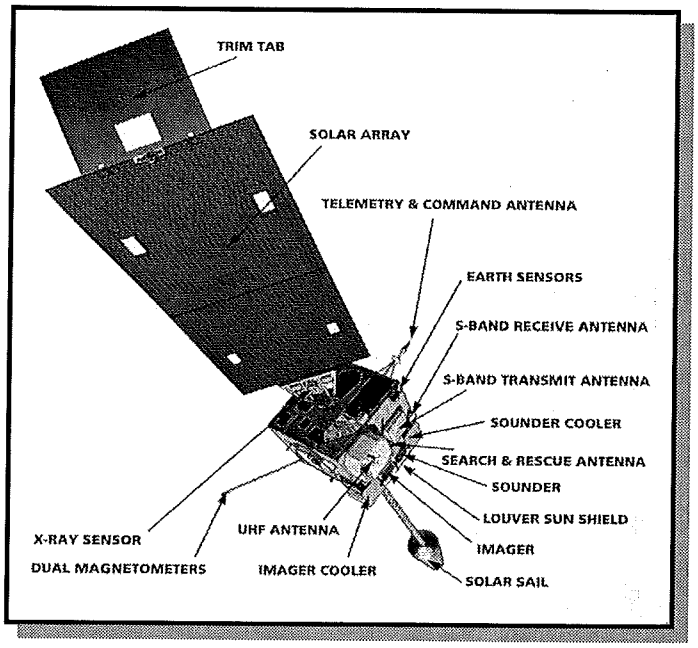


Figure 2. GOES Satellite

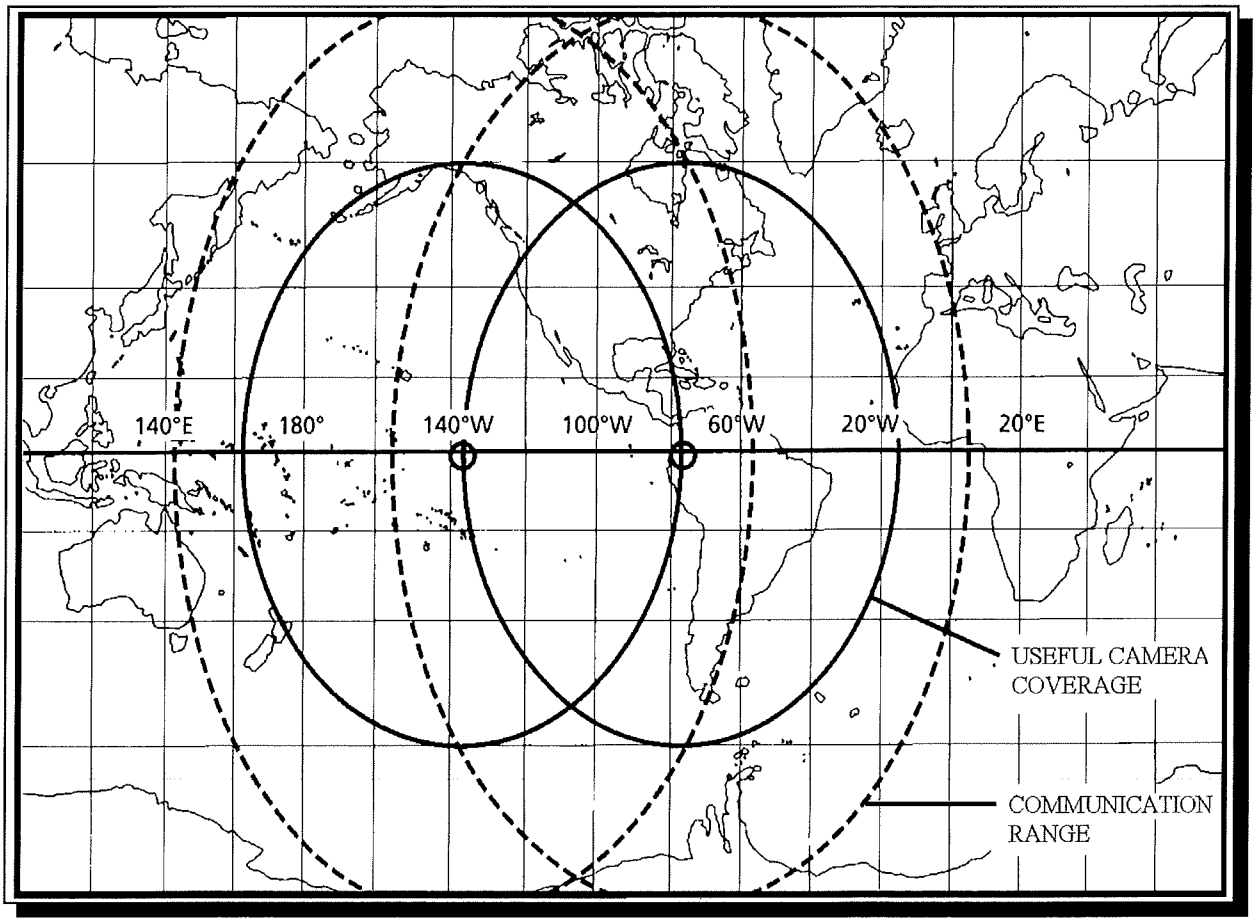


Figure 3. GOES WEST-EAST Coverage

Purpose

Unlike the polar-orbiting satellites, the GOES satellites can provide continuous monitoring of the Earth's atmosphere and surface over a large region of the Western Hemisphere (Figure 3). They circle above the Earth in a geosynchronous orbit at the Earth's equatorial plane, matching exactly the Earth's rotation about its axis. This configuration allows each satellite to view the same regions at all times from an altitude of 35,800 km (22,300 miles) above the surface. These satellites spot potential severe weather conditions, including tornadic producing super-cells, squall lines, flash floods, and hurricanes. When these conditions develop, the GOES satellites can track their development and movements as often as every 60 seconds.

GOES satellite imagery is also used to estimate rainfall during thunderstorms and hurricanes for flash flood warnings, as well as to estimate snowfall accumulations and overall extent of snow cover. Such data enable forecasters to issue timely winter storm warnings and spring snow melt advisories. Satellite sensors can also detect ice fields and map the movements of sea and lake ice and slower moving icebergs. With the improved resolution of the infrared channels of today's GOES satellites, detection of forest fires, nighttime fog, volcano plumes, and the ability to distinguish between water and ice clouds are now possible. A variety of products from the Sounder and Imager are created operationally to improve near real-time and long range forecasts.

Table 2. Geostationary Satellites

Satellite Name	Launch Date	Period of Record Archived	Archive Form*	Instrument Data
ATS-1	12/06/66	01/01/67 - 10/16/72	I	Spin Scan Cloud Camera
ATS-3	11/05/67	03/02/68 - 09/02/74	I	Spin Scan Cloud Camera
SMS-1	05/17/74	06/27/74 - 01/07/76	I	VISSR
SMS-2**	02/06/75	03/10/75 - 08/05/81	I/D	VISSR
GOES-1	10/16/75	01/08/76 - 03/15/80	I/D	VISSR
GOES-2	06/16/77	08/15/77 - 09/15/80	I/D	VISSR
GOES-3	06/15/78	07/13/78 - 03/05/81	I/D	VISSR
GOES-4	09/09/80	03/05/81 - 11/26/82	I/D	VISSR/VAS
GOES-5	05/15/81	08/05/81 - 07/30/84	I/D	VISSR/VAS
GOES-6	04/25/83	06/01/83 - 01/21/89	I/D	VISSER/VAS
GOES-7	02/26/87	03/25/87 - 01/17/96	I/D	VISSR/VAS
Meteosat-3#	06/15/88	01/01/93 - 05/30/95	I/D	VISSR/VAS
GOES-8	04/13/94	06/01/94 - Present	D	GVAR
GOES-9	05/13/95	01/17/96 - Present	D	GVAR
GOES-10	04/25/97	N/A	D	GVAR

Legend

I = Hard copy images
D = Digital
VISSR - Visible and IR Spin Scan Radiometer
VAS - VISSR Atmospheric Sounder
GVAR - GOES VARiable Format

* Older images archived offsite and limited
**SMS-2 Operation was intermittent
Loaned to U.S. by EUMETSAT while only one GOES was operating.

Defense Meteorological Satellite Program (DMSP)

The DMSP is a Department of Defense (DoD) program which is responsible for designing, building, launching, and operating polar-orbiting environmental satellites. The DMSP satellites collect environmental data to monitor meteorological, oceanographic, and space weather conditions in support of operational requirements of the DoD, as well as other sectors of the government. Data from three instruments: Special Sensor Microwave Imager (SSM/I), Special Sensor Microwave Sounder (SSM/T), and the Special Sensor Microwave Water Vapor Profiler (SSM/T2), are archived at the NCDC for dissemination to users. The SSM/I is a seven channel, four frequency, linearly-polarized, passive microwave radiometric system which measures atmospheric, ocean, and terrain microwave brightness temperatures at 19.35, 22.24, 37.00, and 85.80. The SSM/T is a seven channel microwave sounder designed to provide global, synoptic scale soundings of temperature throughout the troposphere and lower stratosphere. The seven channels are located in the oxygen band at 50.50, 53.20, 54.35, 54.90, 58.40, 58.83, and 59.40 Ghz. The SSM/T2 is a five channel, total power, microwave radiometer with three channels situated symmetrically about the 183.31 Ghz water vapor resonance line, and two window channels. This instrument was flown starting with the F-11 launched in 1991.

The Operational Line Scanner (OLS) instrument is a high resolution oscillating scan radiometer which produces 0.5 km resolution and 3 km resolution visible and IR imagery, respectively. The data are archived at the NOAA National Geophysical Data Center (NGDC). To obtain data from the OLS instrument contact NGDC at Customer Services, Mail Code E/GCA, 325 Broadway, Boulder, CO 80303. Phone number 303-497-6826, e-mail address: info@ngdc.noaa.gov.

As mentioned earlier, by the year 2010 the military and civilian operational meteorological satellite systems will be merged into a single, national program. This program is known as the National Polar-orbiting Operational Environmental Satellite System (NPOESS), and is designed to employ three or more satellites to integrate remote sensing, surface data collection, and search and rescue payloads. This system will replace both the POES and the DMSP series.

SEASAT, NIMBUS-7, GEOS, and RADARSAT

The NCDC satellite data base also includes data and products from three NASA satellites: 1) SEASAT (data from all instruments); 2) NIMBUS-7 (data from the Coastal Zone Color Scanner (CZCS) only); and 3) GEOS-3 (data from the Radar Altimeter). NCDC is archiving selected data from the Canadian satellite RADARSAT, as well. The data are available only to authorized users. A brief description of each satellite is provided below. Detailed user guides are available from the NCDC.

SEASAT

The SEASAT spacecraft was launched in late June 1978 and was the first earth-orbiting satellite designed for remote sensing of the earth's oceans. It had onboard the first space borne Synthetic Aperture Radar (SAR). During its brief 110-day lifetime, it collected 90 days of nearly continuous radar altimeter data between the latitudes of 72 deg S and 72 deg N.

Instruments on the SEASAT included: the SEASAT-A Scatterometer System (SASS), an active backscatter scatterometer operating at a frequency of 13.0 Ghz. The SASS produced earth location and time tagged backscatter coefficients, surface wind stresses, and surface wind vectors (with 180 degree directional ambiguity). The SEASAT Altimeter was an active radar altimeter which produced earth location and time tagged satellite heights, significant wave heights, and geoid information. The Scanning Multichannel Microwave Radiometer (SMMR), identical to the SMMR instrument aboard the NIMBUS-7, produced earth location and time tagged sea surface temperature, surface wind stress, atmospheric water vapor, liquid water content, and precipitation rate. The Synthetic Aperture Radar (SAR) produced 25 meter resolution surface roughness imagery at a swath width of 100 km for selected areas. The fifth instrument, Visible and IR Radiometer (VIRR), produced imagery for identification of cloud and geographical features. Time and earth location tagged sensor and geophysical data from the SEASAT instruments are available in digital form, and limited SAR data are available both in digital and image form.

NIMBUS-7

For most regions of the world's oceans, its color is determined primarily by the abundance of phytoplankton and their associated photosynthetic pigments. As the concentration of phytoplankton pigments increases, ocean color shifts from blue to green. Ocean color may thus be used to derive estimates of plankton abundance and primary productivity. Designed to detect these small changes in ocean color, the Coastal Zone Color Scanner (CZCS) is a multi-spectral line scanner with six spectral channels centered at 0.443, 0.520, 0.550, 0.670, 0.750, and 11.5 micrometers. CZCS data are available in 1,600 km wide by 800 km along-track scenes with a resolution of 800 meters. CZCS digital data include Level 1 calibrated radiance files which contain time and earth location tagged values for each of eight derived parameters: sub-surface radiances for three channels, aerosol radiance, surface temperature, chlorophyll concentration, diffuse attenuation, and a land or sea flag.

Each Level I and Level II image product contains, for one CZCS scene, separate panels for each of the parameters noted above. Radar Altimeter data collected by the NASA GEOS-3 satellite comparable to the SEASAT altimeter data are available from NCDC.

Two products are available; "G Tapes" which contain only geophysical products (smoothed sea surface height and oceanographic parameters) and "I Tapes" which contain the products and the data from which they are produced.

RADARSAT

RADARSAT is a Canadian satellite that is equipped with an advanced radar sensor called a Synthetic Aperture Radar (SAR). The SAR is a powerful microwave instrument that sends pulsed signals to Earth and processes the received reflected pulses (back scatter). Different surfaces produce different variations in the returned signal, so surface roughness, topography, land/water boundaries, certain man made features, and moisture content are distinguishable in SAR imagery. Since SAR is a microwave sensor, darkness, clouds, rain, dust, and haze are practically impervious to the sensor's signals, enabling RADARSAT to collect data under any atmospheric conditions. Applications for RADARSAT data include: ice reconnaissance, coastal surveillance, oceanography, cartography, geology, environmental monitoring, hydrology, agriculture and forestry. RADARSAT is a polar-orbiting satellite, but does not continuously take data measurements to produce global datasets. The satellite must be scheduled to collect data at desired times and locations. It can use seven different beam modes to acquire data, resulting in seven possible image sizes from 10 meter resolution to 100 meter resolution. Limited RADARSAT data will be distributed via the NOAA Satellite Active Archive (www.saa.noaa.gov) and will be restricted to authorized subscribers only. Others can contact the Canadian Space Agency for more information on the RADARSAT program at http://radarsat.space.gc.ca/.

NCDC Satellite Services

NCDC has several trained personnel ready to assist you in fulfilling your satellite needs. If the satellite data you need are not available from NCDC, we will make every effort to direct you to the right source. Data can be provided in either digital or analog form, and in a variety of formats. Digital data may be obtained through ftp or on any number of digital media, including 8mm exabyte tapes, 4mm DAT tapes and CD-ROM. Analog data may be obtained in various photographic formats, or in many graphic formats (such as GIF or JPEG). Below is a listing of digital and non-digital satellite data and products available from NCDC. Please contact NCDC's Satellite Services Group for specific price quotes or availability of custom satellite imagery. NCDC also provides retrospective satellite imagery on-line. A brief description of these services is provided after the dataset listings. Many types of satellite derived products are offered via the Internet by other NOAA agencies. Only those directly supported by NCDC are mentioned. To reach the many sites, it is suggested that you start from the NOAA web site at www.noaa.gov.

For more information, or to obtain documentation, contact NCDC. The **International Satellite Cloud Climatology Product** documentation and **Polar Orbiter Data User's Guide** are available on-line at www.ncdc.noaa.gov. Just click on NCDC's Satellite Resources from the main page.

Digital Satellite Data and Products

Polar-orbiting Operational Environmental Satellite (POES):

LEVEL 1b DATASETS:	**Period of Record**
AVHRR GAC, LAC, and HRPT	10/78 - Present
TOVS MSU, SSU, HIRS/2	10/78 - Present
SBUV/2	03/85 - Present

PRODUCTS:

TOVS Sounding Product	01/01/79 - Present
Vegetation Index/AVHRR (3rd Generation) (Plate Carree Projection only. 16km gridded) Weekly Composite (B-level) Monthly Product (C-level) Climatology (D-level)	04/01/85 - Present
Heat Budget Data--	
Monthly Mean	01/01/79 - Present
Seasonal	06/01/74 - Present
Mapped GAC Imagery--	

Polar Stereographic	12/22/78 - Present
Mercator	06/24/85 - Present
Sea Surface Temperature Data--	
7 - 8 Day Observation File/AVHRR	12/01/78 - Present
250 km Monthly Mean Data from AVHRR	01/31/79 - Present
100 km Analysis (Global Scale) from AVHRR	12/01/72 - Present
50 km (Regional Scale) and 500 km	03/01/74 - Present
14 km Analysis (Local-Scale)	01/01/86 - Present
Aerosols--	
Optical Thickness (OT) Observations	06/87 - Present
OT Weekly Analyzed Fields	06/87 - Present
OT Monthly Analyzed Fields	06/87 - Present
SBUV Historical Instrument File	03/14/85- Present
SBUV Ozone Products	03/14/85- Present

Geostationary Operational Environmental Satellite (GOES):

GVAS & GVAR DATA:

Full Disk and Sectors	03/01/78 - Present

PRODUCTS:

GOES Sounding Products	02/01/95 - Present
Cloud and Moisture Drift Winds	02/01/95 - Present

Defense Meteorological Satellite Program (DMSP):

LEVEL 1b DATASETS:

Special Sensor Microwave/ Temperature(SSM/T)	08/18/87 - Present
Special Sensor Microwave/ Water vapor Profiler (SSM/T2)	06/01/94 - Present
Special Sensor Microwave/Imager (SSM/I)	12/12/89 - 06/06/96

DMSP PRODUCTS:

Temperature, Sensor, and Environmental Data Records (TDR,SDR,EDR)	07/16/87 - Present
SSM/T Sounding Product	01/01/89 - Present
SSM/I Monthly Gridded Products-- Precipitation Snow Cover/Sea ice Total Precipitable Water Cloud Liquid Water Oceanic Surface Wind Speed	01/01/87 - Present
RTNEPH Layered Cloud Amount, Type, Base, Height	01/01/84 - Present
(Global analysis on 40km grid, every 3 hours)	

International Satellite Cloud Climatology Project (ISCCP):

B1 Radiance Data (10km) from GOES VISSR/VAS	07/01/83 - Present
B1 Radiance Data (10km) from GMS	07/01/83 - Present
B1 Radiance Data (10km) from METEOSAT	07/01/83 - Present
B2 Radiance Data (30km) from NOAA Polar Orbiters	07/01/83 - Present
B3 Radiance Data (30km, 3hr) from NOAA Polar Orbiters	07/01/83 - 06/30/94
B3 Radiance Data (30km, 3hr) from GOES	07/01/83 - 06/30/94
B3 Radiance Data (30km, 3hr) from METEOSAT	07/01/83 - 06/30/94
B3 Radiance Calibration Tables (3hr for each satellite)	07/01/83 - 06/30/94
C1 Global Cloud Data (3hr, 280km grid, satellites merged)all	07/01/83 - 06/30/91
C2 Global Cloud Data (monthly, 280km grid, all satellites merged)	07/01/83 - 06/30/91
D1 Global Cloud Data (3hr, 280km grid) (*replaces C1 Data-will be processed back to 1983*, gap in yrs 1987-89)	06/01/86 - 12/31/92
D2 Global Cloud Data (monthly, 280km grid) (*replaces C2 Data-will be processed back to 1983*, gap in yrs 1987-89)	01/01/90 - 12/31/92

Non-digital Satellite Products

AVHRR Imagery:

Local Area Coverage (LAC)	04/01/85 - Present
High Resolution Picture Transmission (HRPT)	04/01/85 - Present
Global Area Coverage (GAC) by satellite pass	10/30/78 - Present

GOES Imagery:

Visible and Infrared Hardcopy Imagery	01/01/78 - Present

Sea Surface Temperature Charts:

250km Global Monthly Mean Charts	07/01/81 - Present
100km Weekly MCSST World	12/01/78 - Present
50km Regional Charts (selected regions)	04/01/76 - Present
14km Local Charts (mainly U.S. coastal areas)	01/01/86 - Present
Gulf Stream Anal. Charts-North/South Panels	10/19/78 - 09/30/95

Aerosol Charts:

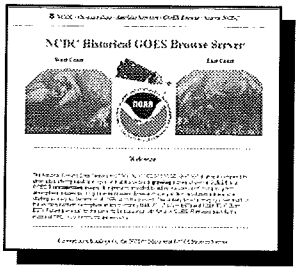
100 km Weekly Contour	10/19/78 - Present
Monthly Mean	10/19/78 - Present

On-line Satellite Services

A growing number of satellite datasets and products are available on-line via the World Wide Web. Since the number of web pages are growing, the main NCDC web address is provided: www.ncdc.noaa.gov. Just click on "Satellite Resources" to get to the following links.

Description

1) Historical GOES Browse Server



Early in 1997, NCDC added the Historical GOES Browse Server. The server is unique compared to other sites offering satellite images in that it provides a growing archive of on-line retrospective images. The server is primarily intended to aid researchers performing long term atmospheric studies involving satellite imagery. Browse imagery at 8 km resolution or lower are available starting from October 1995 up to the present. These daily browse imagery cover either the full earth or the western northern hemisphere, depending on the year.

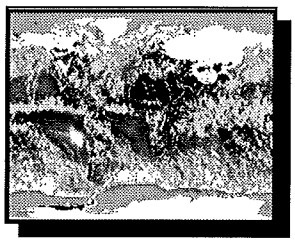
2) Satellite Active Archive

NOAA's Satellite Active Archive (SAA) provides easy access to digital Polar-orbiting satellite data. The system allows users to search inventories of selected instrument data, preview representative Earth images of that data, and to download the data via ftp for further processing and analyses. Data available on the SAA include: POES AVHRR and TOVS level 1b data from July 1, 1995, to present; DMSP SSM/T1 level 1b, SSM/T2 level 1b, and SSM/I TDR, SDR, EDR data from February 17, 1997, to present; and TOVS Deep Layer Mean Temperature Product from January 1, 1987, to December 31, 1994. Visit this site often to keep abreast of the latest products available.

3) Satellite's Eye Art Gallery

This site contains hundreds of historical satellite imagery as far back as 1960. Textual and satellite instrument information for some of the more unique images are included. Many MPEGS (small movie files) are available, too. There is no charge for using these images, however, we do ask that you properly credit the source as "NOAA/National Climatic Data Center."

4) Gridded SSM/I Products



The NOAA Microwave Sensing Group has assembled a time series of the entire SSM/I archive, which includes 1.0 and 2.5 degree gridded data from July 1987 to the present. Monthly average products are produced for precipitation, cloud liquid water, total precipitable water, snow cover, sea-ice cover, and oceanic surface wind speed. The SSM/I products are useful for evaluating the mean climate state, its interannual and seasonal variations, and the detection of anomalies associated with ENSO and regional climatic variations.