The SSEC Data Center

2009 MUG Meeting

June 2, 2009

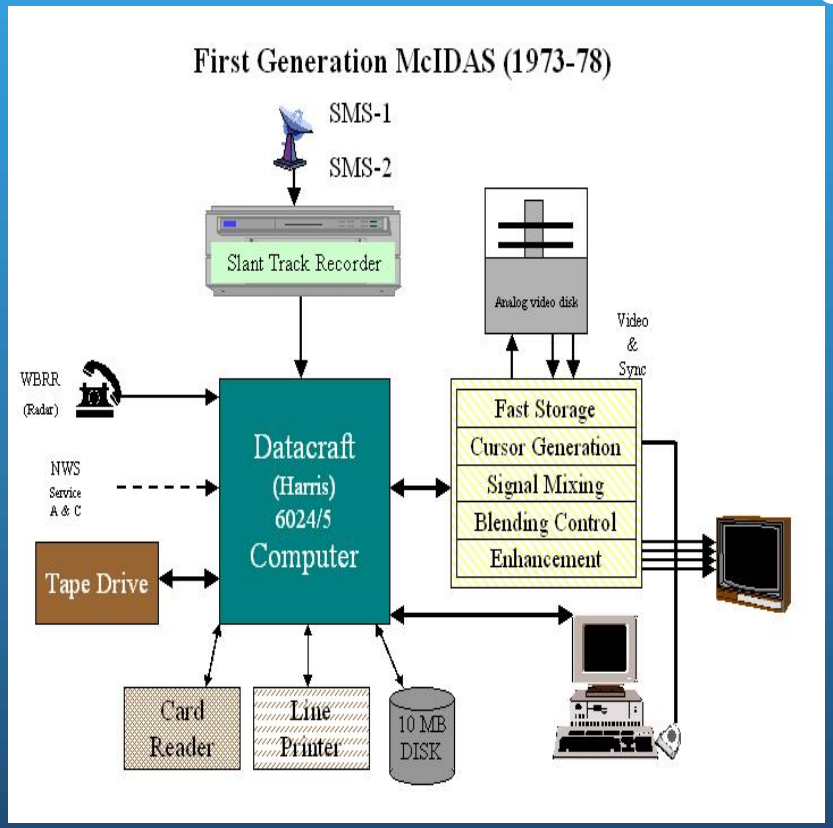
Jerrold Robaidek

- Data Center Mission and Funding
- History
- Staffing, Activities, Facilities, Data holdings
- Custom Products
- Monitoring
- Future

SSEC Data Center

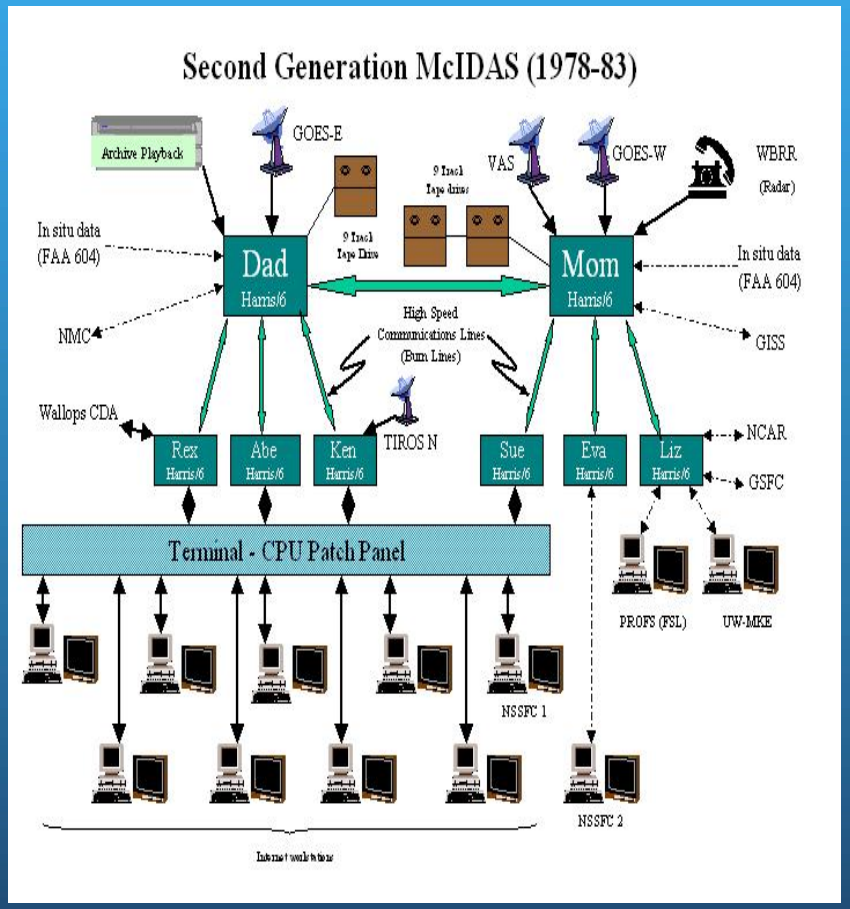
- The SSEC Data Center mission is to create and maintain the facilities, human expertise and technology necessary to provide SSEC scientists and collaborators with the highest quality geophysical data in a timely fashion and to provide real-time data access, archive and retrieval services as necessary to support SSEC's scientific programs.
- The Data Center is treated as a project and is expected to breakeven.
- The Data Center is supported through data sales. ALL users pay for data, both internal to SSEC and to the outside community.

SSEC Data Center - History



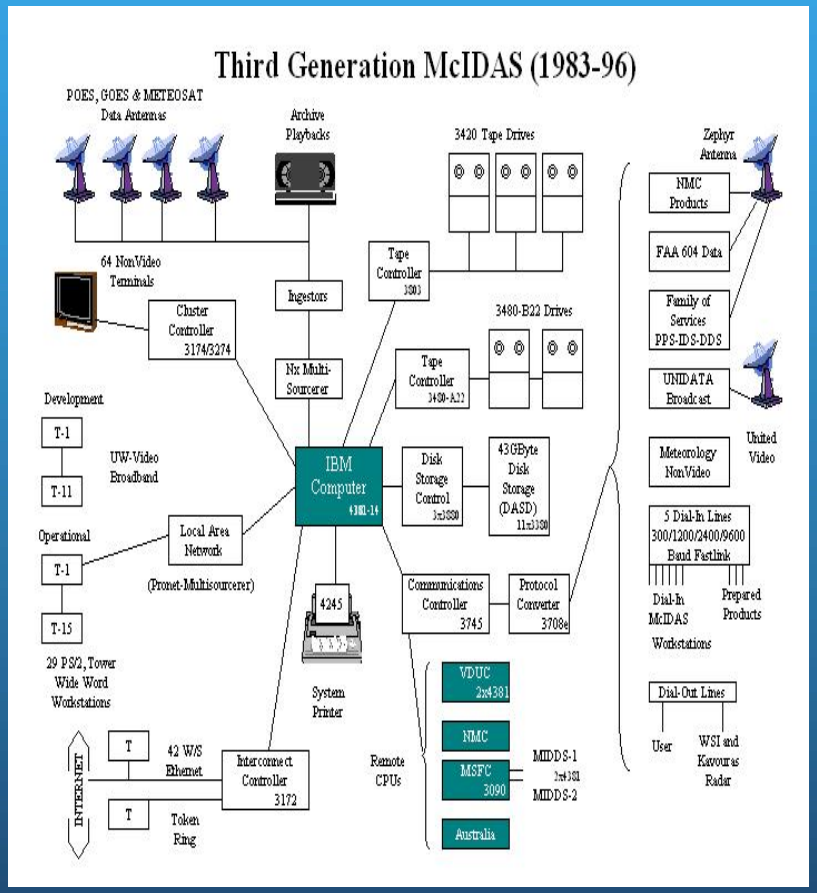
- 1973-1978
  - Began as McIDAS Operations
  - First Generation
    - Harris Datacraft Computer
    - 64 KB memory
    - 10 MB disk drive
    - 9 track tape drive
    - Analog disk for imagery

SSEC Data Center - History



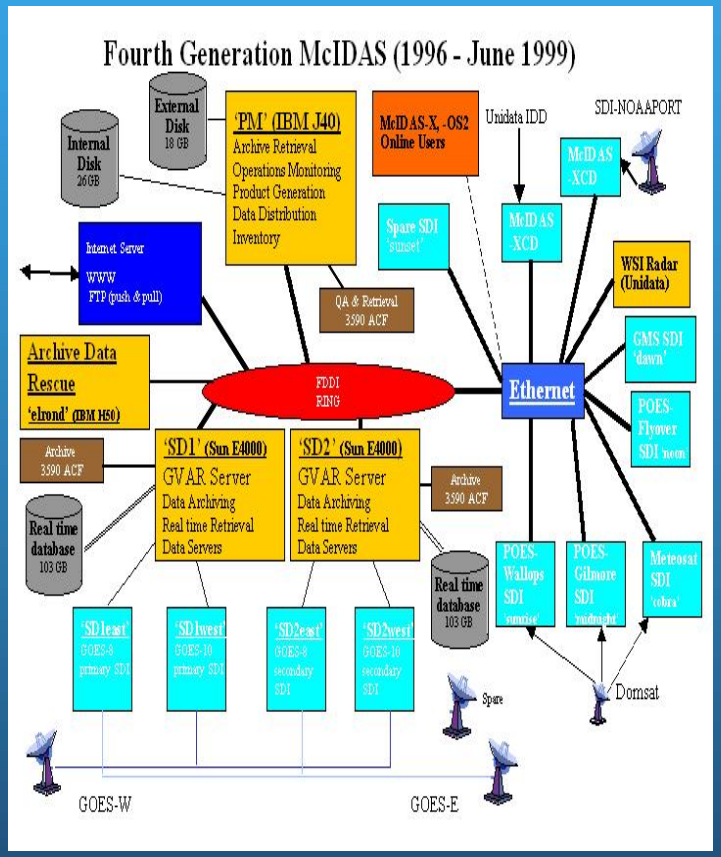
- 1978 – 1983
  - Second Generation McIDAS
    - Distributed system
    - 2 Harris/6 computers (hosts)
      - Ingested satellite data
      - “Burn Boxes” moved data
    - 6 Harris/6 computers
      - Processing machines
      - Multiple users

SSEC Data Center - History



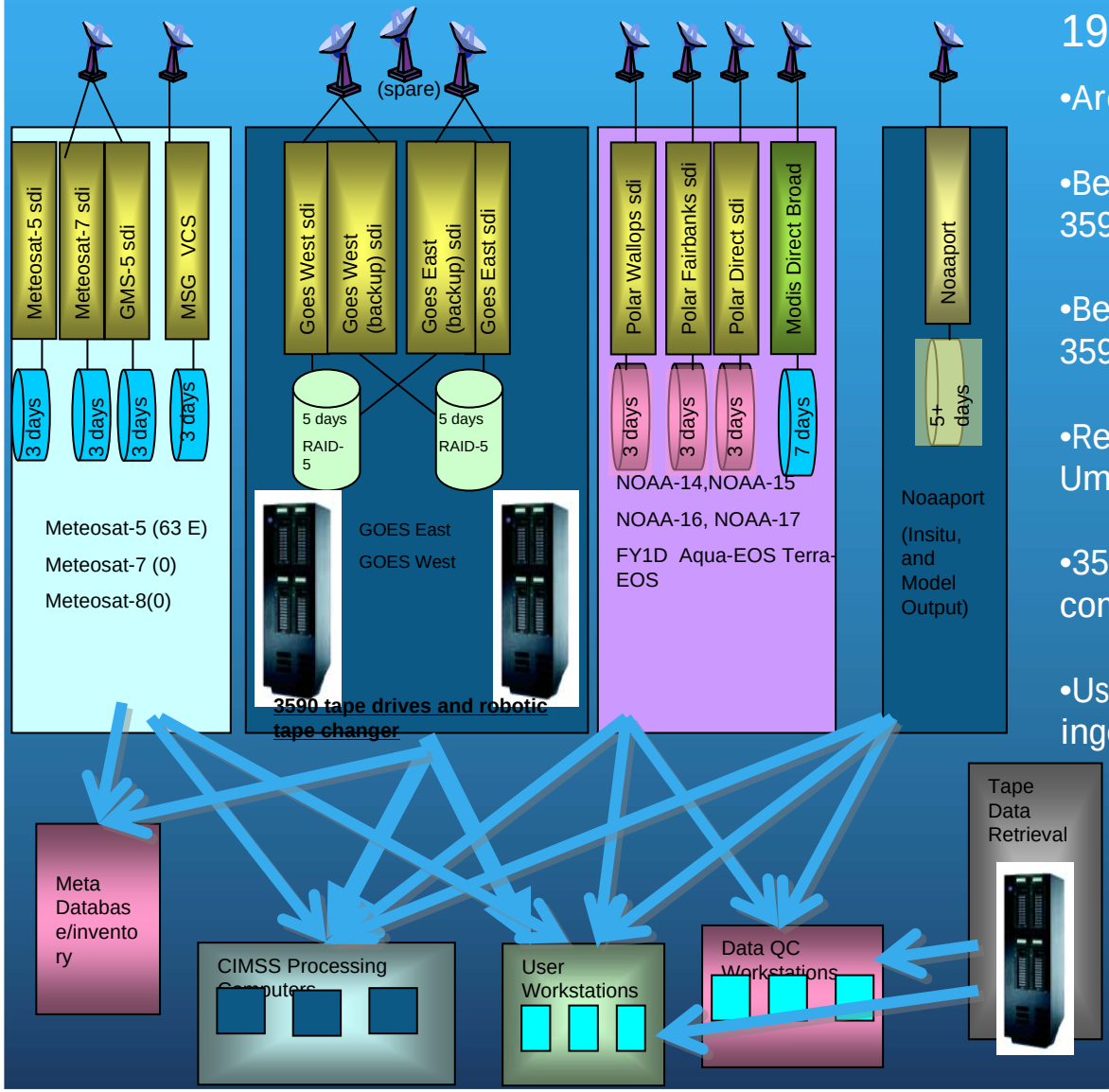
- 1983-1996
  - Third Generation McIDAS
    - Centralized processing
    - IBM 4381 Mainframe
    - Begin GOES archive
      - Data archived on Sony U-matic cassettes
        - 1978-1981 Low density (3GB/tape)
        - 1981-1997 High density (6.85 GB/tape)
    - Multiple local and remote users

SSEC Data Center - History



- 1996 – 1999
  - Fourth Generation McIDAS
  - McIDAS separates from Operations, now Data Center
  - Moved from mainframe to distributed UNIX system
  - Hired two programmers for Data Center to aid operations staff with transition
  - Archive moves to computer compatible tape (3590) and adds redundancy
  - Began using SSEC SDI ingestors

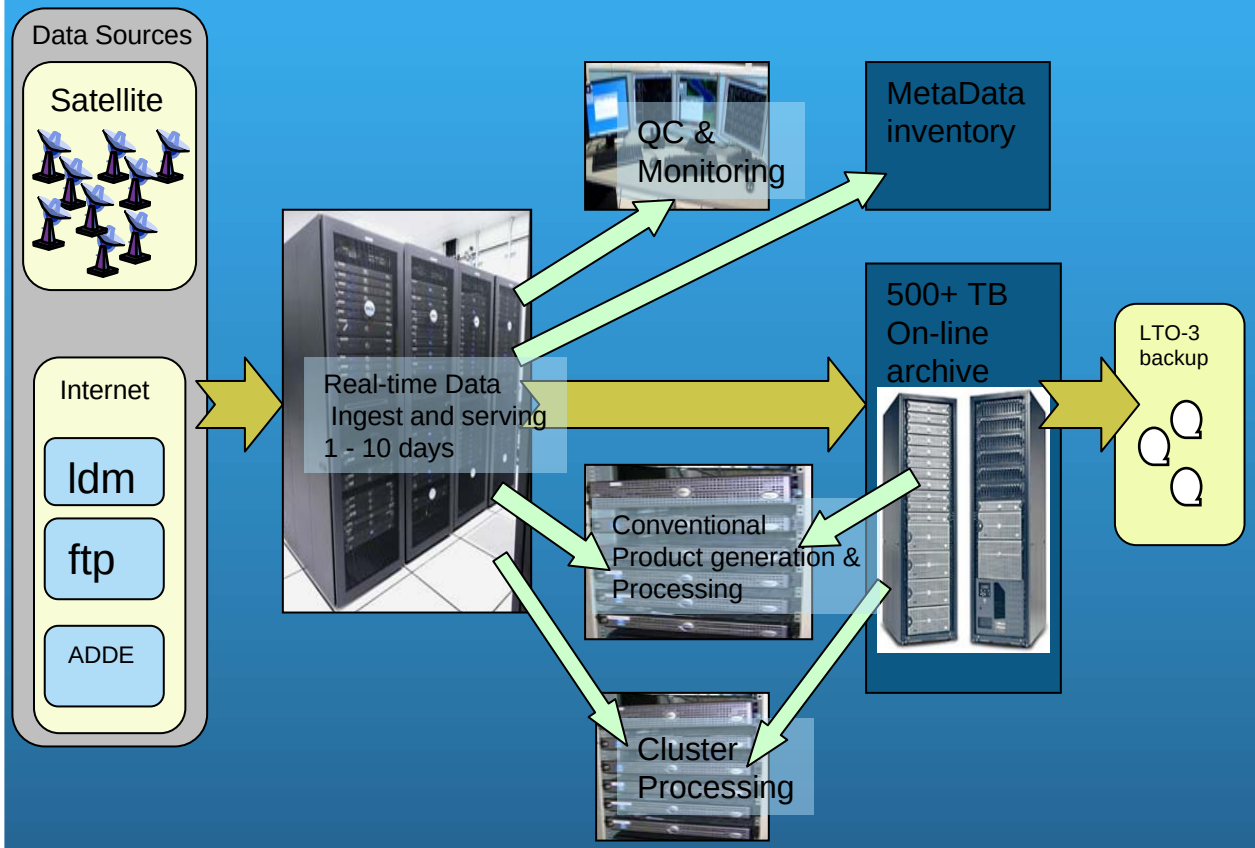
SSEC Data Center - History



1999-2005

- Archiving GOES GVAR on 3590
- Began archiving Meteosat and GMS on 3590
- Began archiving Grids and In situ data on 3590
- Rescued old GOES (1978-1996) from Umatic and moved to 3590
- 3590 capacity was 10 GB, 20 GB compressed
- Using SSEC SDIs for most satellite data ingest

SSEC Data Center - History



2005-Present

- Began migrating all data from tape to large Online Raid-5 systems 500 + TB

- Tape only used for emergency backup

- LTO-3 tapes used for backup (400 GB capacity 800 GB compressed)

- Moving older SDI systems to newer SSEC SDI-104 ingestors

- Computer room staff moved to an adjoining control room

SSEC Data Center - Staff

Staffed M-F , 7:30 AM - 11:00 pm Central time.

- 3 FTE ~100% time
  - Archivist & Computer Operator (1st shift)
  - Computer Operator (1st shift)
  - Computer Operator (2nd shift)

- 5 FTE ~portions of their time
  - Program Manager
  - System Programmer
  - Data Base Programmer
  - Research Specialist (PM assistant)
  - Antenna/Communication technician
- 2 Student programmers

Data Center Facilities

- Currently the Data Center has 26 racks representing about 1100 rack units of space. (Currently about 80% are filled.)
- Data Center staff monitors 60+ servers and over 650 TB of disk.
- The entire room is on two 72 KW UPSs, of which, about 80-85 KW are in use.
- Cooling provided by a mixture of campus chilled water and outside air in the winter. We are currently very close to the maximum cooling capacity of the room.

Data Center Antennas

Data Center Antennas

- C-Band
  - 11 meter (87° West - POES Wallops Relay, MSG)
  - 7.3 meter (101° West – POES Fairbanks Relay, MTSAT, Noaaport)
- L-Band
  - 7.3 meter (75° West –GOES-East Primary)
  - 4.6 meter (135° West –GOES-West Primary)
  - 4.5 meter (60° West –GOES-SA auto tracking)
  - 4.5 meter (105° West –GOES-test/spare)
  - 3.7 meter (offline spare)
- X-Band
  - 4.4 meter (Tracking – EOS)

Rooftop Antenna Challenges

SSEC Data Center - Incoming Data Spring 2009

150+ GB/day
via Satellite
(C-band. L-band, X-band)

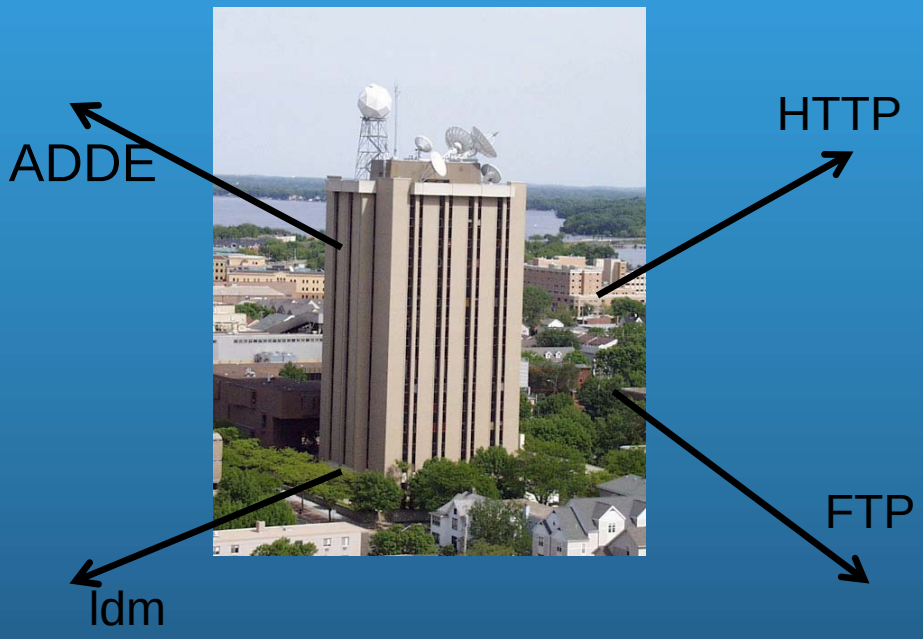
•Online Archive grows ~150+ GB/day

85+ GB/day
via Internet
(ftp, LDM, ADDE, http)

SSEC Data Center - Outgoing Data

Methods of Data delivery

- ADDE
- HTTP
- FTP
- LDM (Unidata local data manager)



May 2009
ADDE Data Usage Statistics

Real-Time ADDE average daily data access	408 GB
Archive ADDE average daily data access	76 GB
Average # of daily transactions	450,000+
Average MB sent /minute	336
Average #/transactions per second	5.3
Latest month total data sent	14.3 TB

SSEC Data Center – Activities

- Currently ingesting, serving and archiving 9 geostationary satellites
  - GOES-10, GOES-11, GOES-12, GOES-test, MET-7, MET-9, MTSAT, Kalpana, FY-2C, FY-2D
- Currently ingesting and serving 8 polar orbiting satellites
  - NOAA-15, NOAA-16, NOAA-17, NOAA-18, NOAA-19, AQUA-MODIS, AQUA-AIRS, TERRA-MODIS, METOP
- We are the primary feed for the Unidata Satellite Data broadcast over the IDD to University Community (150+ U.S. Universities)
- Generate customized weather data products for users
- Process and provide NWS AWIPS system with EOS products

SSEC Data Center - Activities

- Assist Satellite Operations Control Center and other agencies in satellite checkout and troubleshooting of related problems
- Support to field experiments
  - Special archiving
  - Extended staffing, either on-call or on-site
- Provide large dataset backups for users
  - Read, write, and copy tapes
  - Provide specialized archives of user data
- Provide Help Desk support to users of the SSEC SDI, and assist in the generation of SDI user documentation
- Assist McIDAS User Services team with McIDAS testing for system upgrades
- Provide archive data to in-house and external users

SSEC Data Center – Real-Time Data

- Real-Time satellite data online:
  - GOES-Test/O 3 days
  - GOES-12 (EAST) 6 days
  - GOES-11 (WEST) 6 days
  - GOES-10 (South Am.) 3 days
  - MET-7(Indoex) 7 day
  - MET-9 (0E) 2 days
  - MTSAT-1R 5 days
  - Kalpana 30 days
  - FY-2C 3 days
  - FY-2D 3 days
  - NOAA POES (relay) 3 days
  - Metop 7 days
  - TERRA (MODIS) 7 days
  - AQUA (MODIS) 7 days
  - AQUA (AIRS) 7 days

SSEC Data Center – Conventional Data

- Real-Time conventional data online:
  - Point — 9.0 days + current
  - Grids — 5.0 days + current
  - Text — 9.0 days + current
  - Radar — most recent 8 hours

SSEC Data Center – Archive

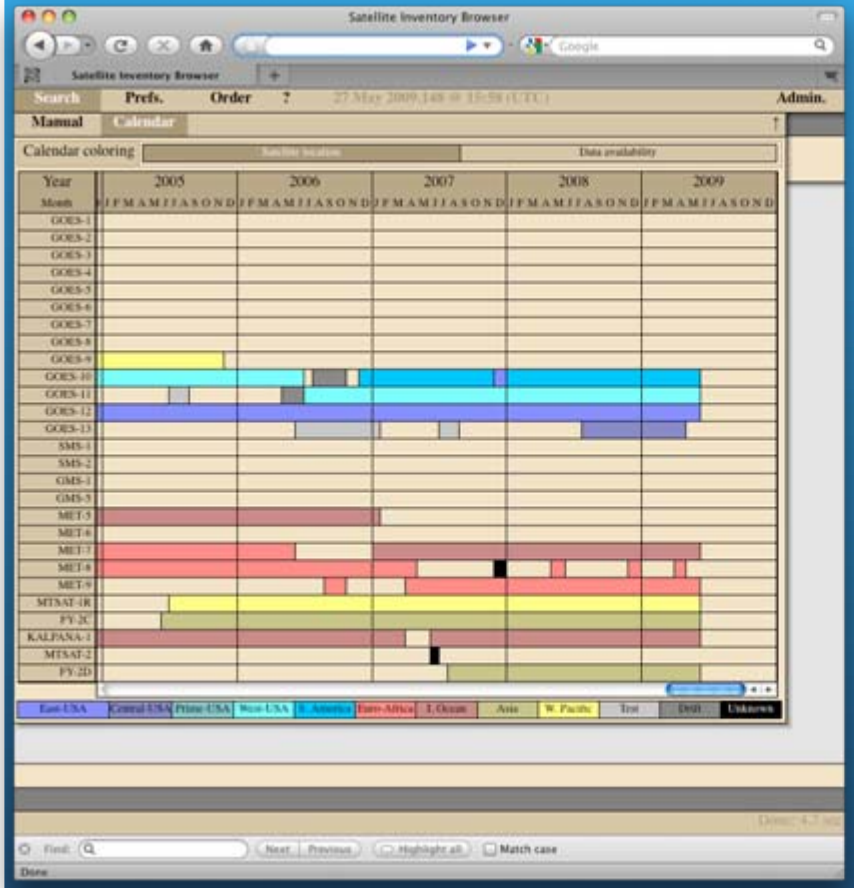
Satellites	Data Archive Format	Status	Period of Record
GOES-1 – GOES-7	RAW MODE A, AA, AAA	On-line, but needs indexing	Jan 1979 – Jan 1996
GOES-8 – GOES-13	RAW GVAR	On-line	Jun 1995 – present
GMS-5	AREA	On-line	Nov 1998 – May 2003
MTSAT	AREA and HRIT	On-line	Jul 2005 – present
MET-7 at 0°E	PDUS	On-line	Mar 1999 – May 2006
MET-5/7 (Indoex 63/57°E)	PDUS and OpenMTP	On-line	Mar 1999 – present
MET-8/9	HRIT	On-line	Mar 2004 – present
Kalpana	HDF	On-line	Dec 2004 – present
FY-2C/D	AREA	On-line	Jun 2005 – present

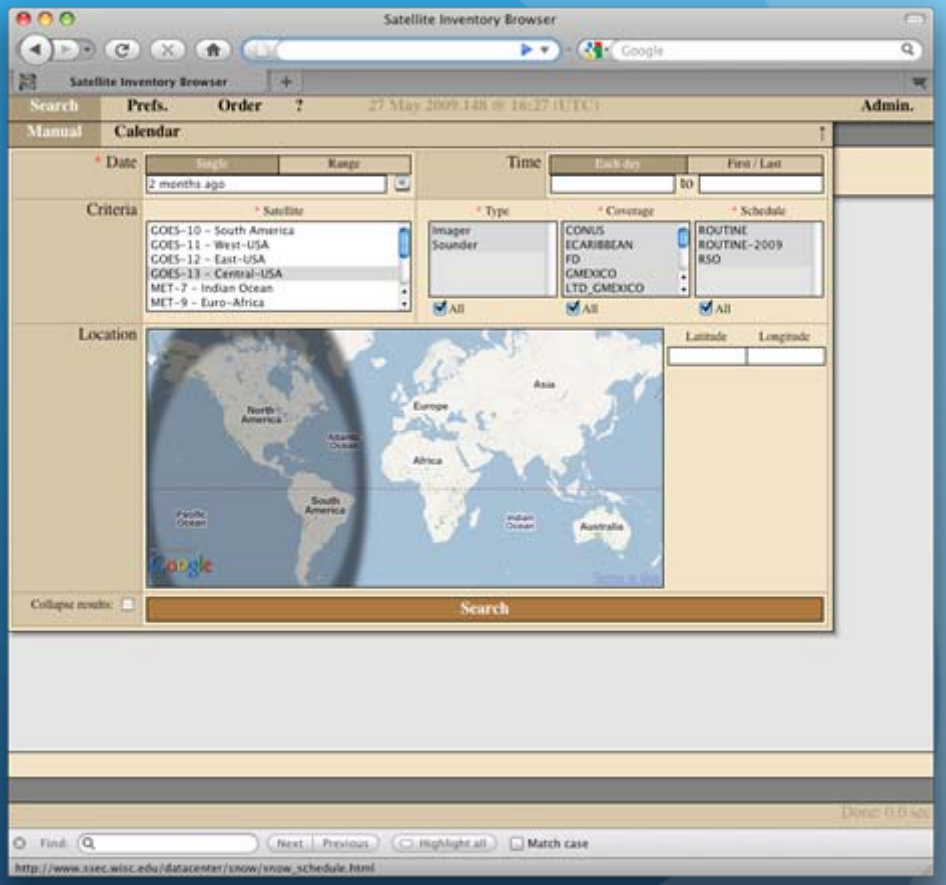
SSEC Data Center – Archive

Conventional Data archive holdings

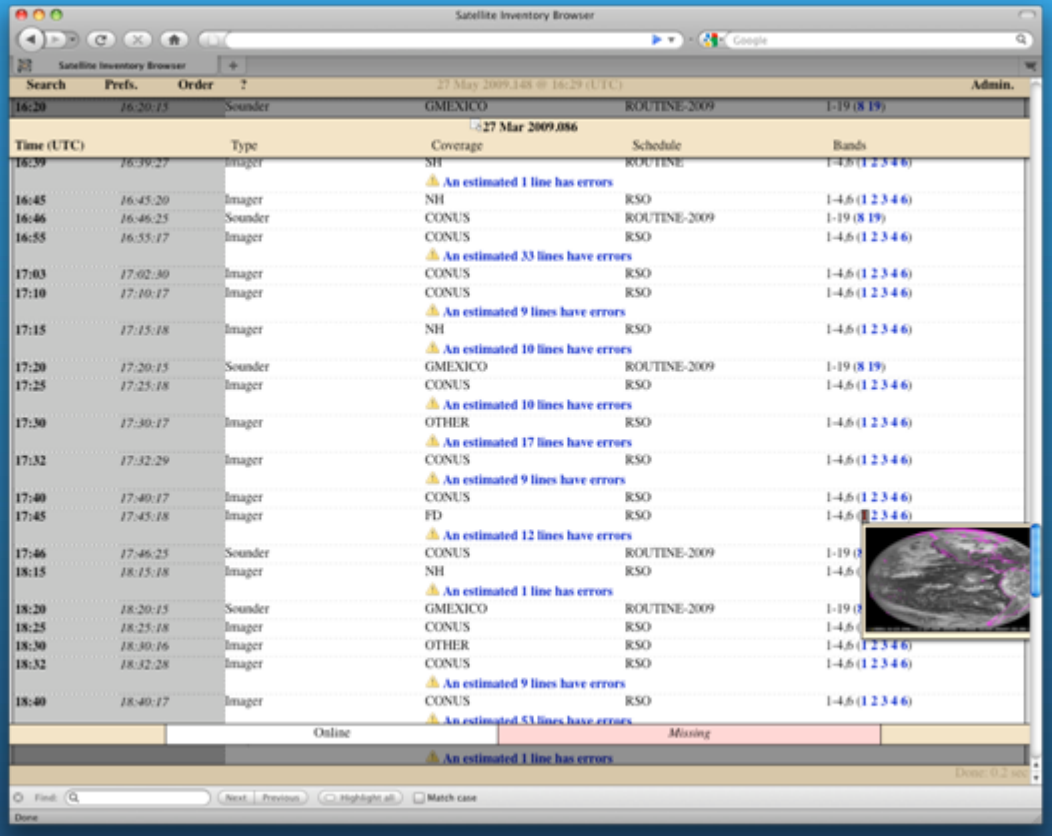
Data	Data Archive Format	Status	Period of Record
Point data	McIDAS MD	On-line	Mar 1976 – present
Model GRIDs	McIDAS GRID	On-line	Sep 1996 – Aug 2004
Model GRIDs	GRIB	On-line	Jul 2003 – present
Weather Text	Daily Binary File	On-line	Sep 1996 – present

Geostationary Satellite Inventory

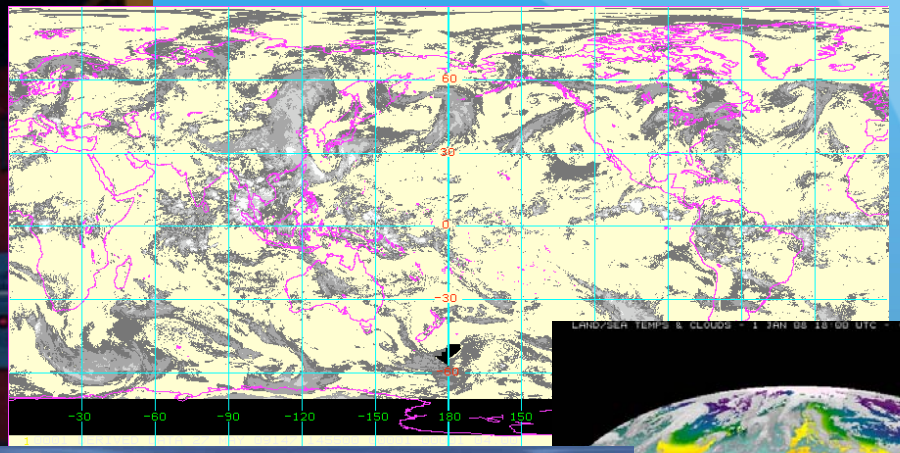


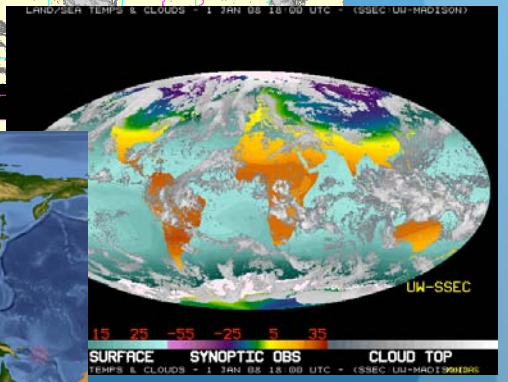


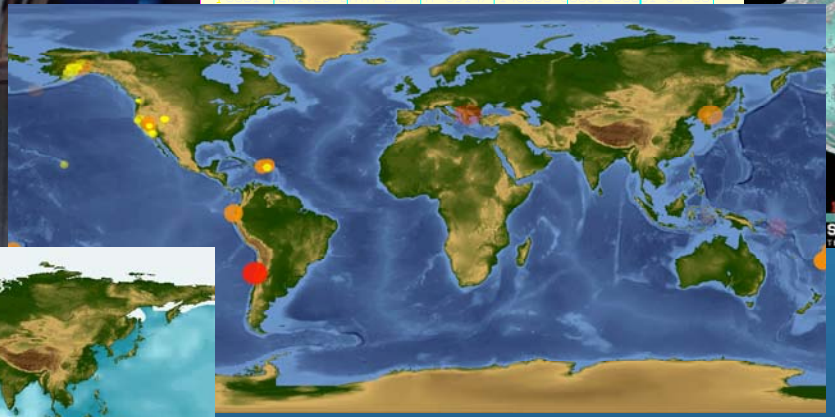
Inventory Search Results

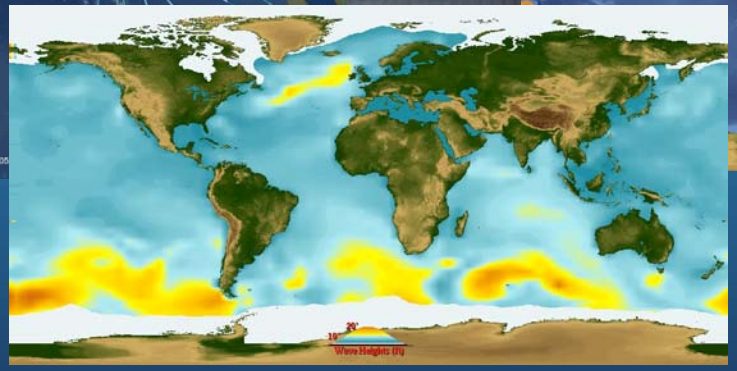


Special Products





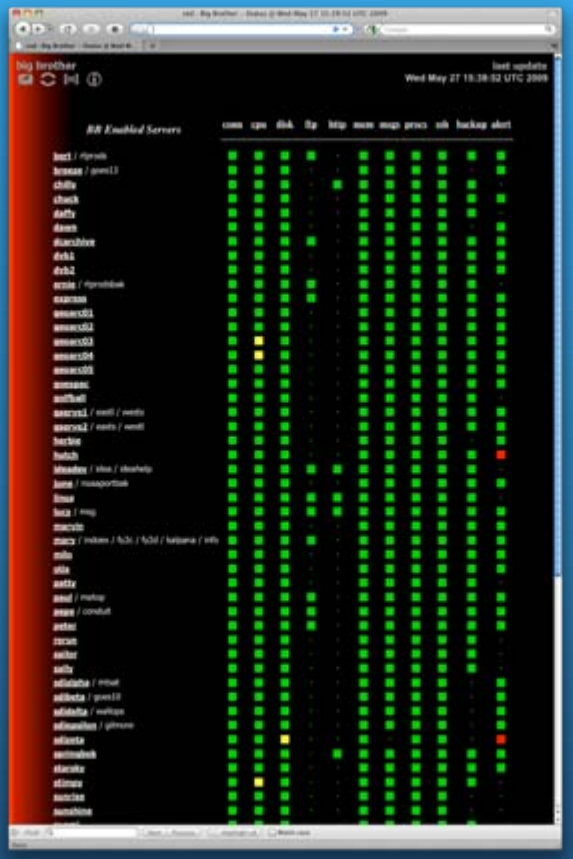




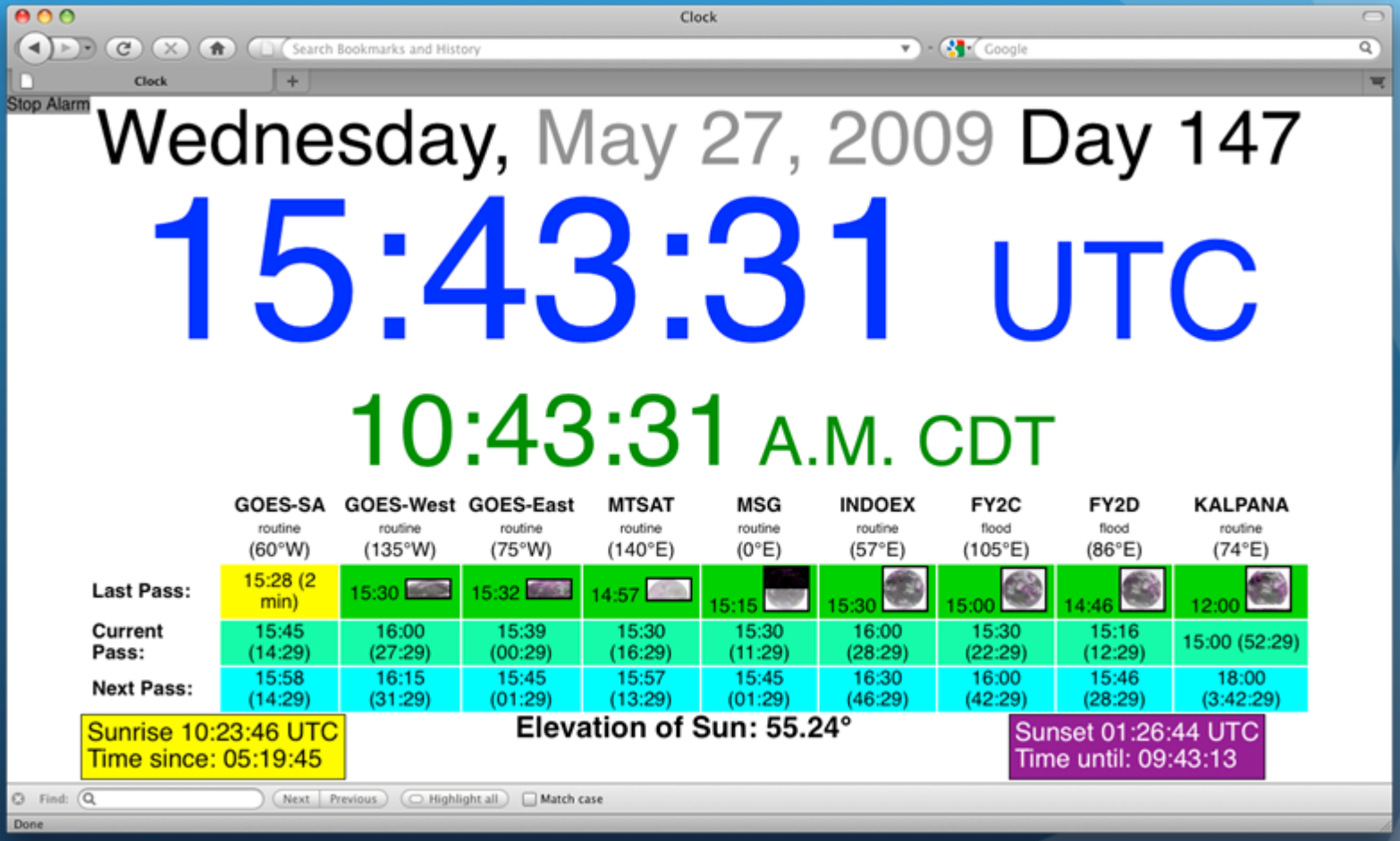
Monitoring Tools

- Big Brother
- GEO Clock
- Grib Monitor
- Antenna Signal Strength
- Individual Product QC
- Power, temperature

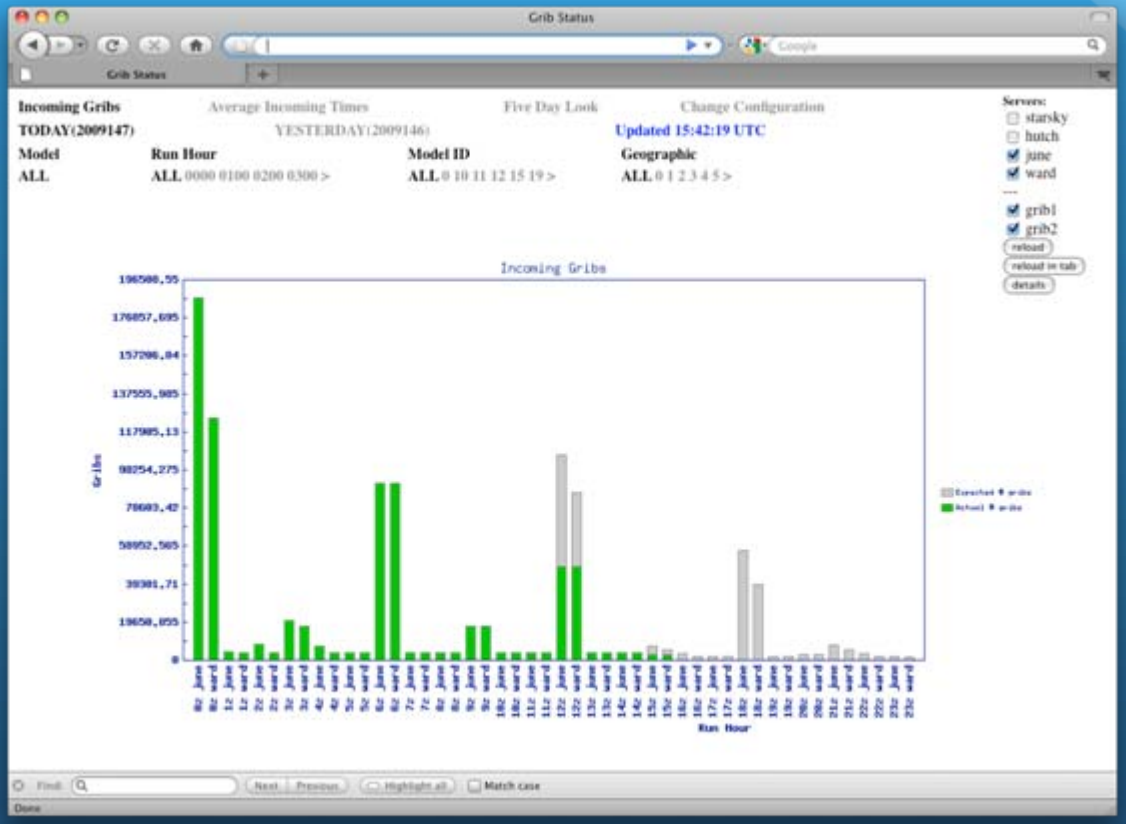
Big Brother for Server Monitoring



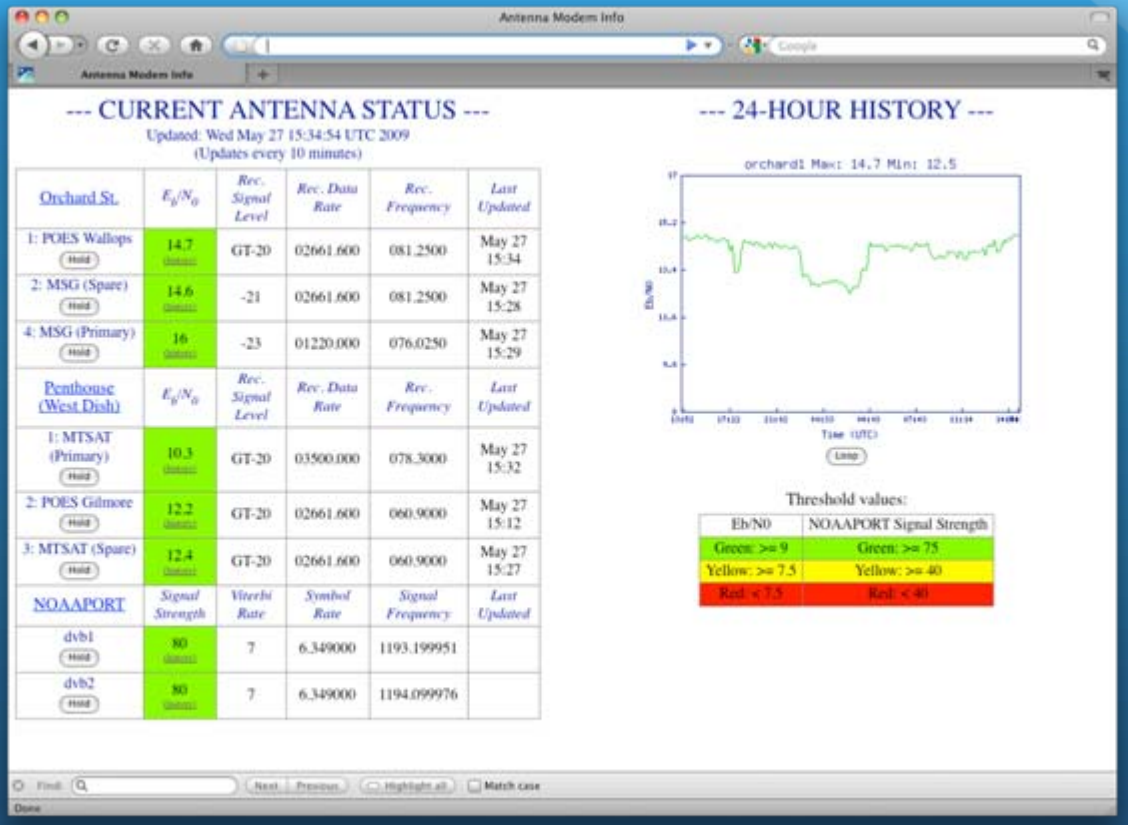
GEO Clock


Clock
Search Bookmarks and History
Google
Clock
Stop Alarm
Wednesday, May 27, 2009 Day 147
15:43:31 UTC
10:43:31 A.M. CDT
GOES-SA routine (60°W)
GOES-West routine (135°W)
GOES-East routine (75°W)
MTSAT routine (140°E)
MSG routine (0°E)
INDOEX routine (57°E)
FY2C flood (105°E)
FY2D flood (86°E)
KALPANA routine (74°E)
Last Pass: 15:28 (2 min) | 15:30 | 15:32 | 14:57 | 15:15 | 15:30 | 15:00 | 14:46 | 12:00
Current Pass: 15:45 (14:29) | 16:00 (27:29) | 15:39 (00:29) | 15:30 (16:29) | 15:30 (11:29) | 16:00 (28:29) | 15:30 (22:29) | 15:16 (12:29) | 15:00 (52:29)
Next Pass: 15:58 (14:29) | 16:15 (31:29) | 15:45 (01:29) | 15:57 (13:29) | 15:45 (01:29) | 16:30 (46:29) | 16:00 (42:29) | 15:46 (28:29) | 18:00 (3:42:29)
Sunrise 10:23:46 UTC
Time since: 05:19:45
Elevation of Sun: 55.24°
Sunset 01:26:44 UTC
Time until: 09:43:13
Find:
Next
Previous
Highlight all
Match case
Done

Grib Ingest Monitoring

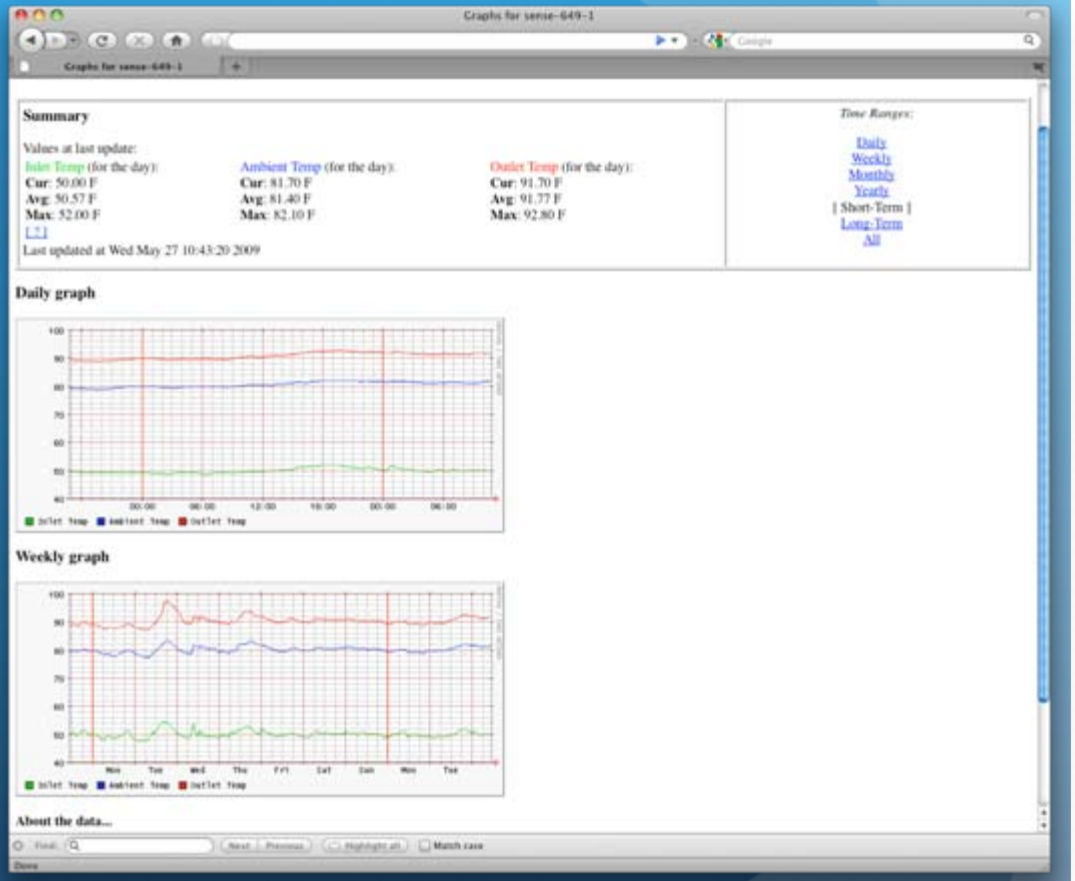


Antenna Signal Monitor



Orchard St.	E_b/N_0	Rec. Signal Level	Rec. Data Rate	Rec. Frequency	Last Updated
1: POES Wallops (Hold)	14.7	GT-20	02661.600	081.2500	May 27 15:34
2: MSG (Spare) (Hold)	14.6	-21	02661.600	081.2500	May 27 15:28
4: MSG (Primary) (Hold)	16	-23	01220.000	076.0250	May 27 15:29
Penthouse (West Dish)	E_b/N_0	Rec. Signal Level	Rec. Data Rate	Rec. Frequency	Last Updated
1: MTSAT (Primary) (Hold)	10.3	GT-20	03500.000	078.3000	May 27 15:32
2: POES Gilmore (Hold)	12.2	GT-20	02661.600	060.9000	May 27 15:12
3: MTSAT (Spare) (Hold)	12.4	GT-20	02661.600	060.9000	May 27 15:27
NOAAPORT	Signal Strength	Viterbi Rate	Symbol Rate	Signal Frequency	Last Updated
dvb1 (Hold)	80	7	6.349000	1193.199951	
dvb2 (Hold)	80	7	6.349000	1194.099976	

UPS Power and Room Temperature



SSEC Data Center - Near Term Goals

- Complete satellite archive indexing for older GOES data
- Complete servers for ADDE access to archived GRID and GRIB data
- Triple cooling capacity of the Data Center
- Increase the power capacity of the Data Center an additional 72 KW
- Continue to migrate from older storage technology to smaller faster systems

SSEC Data Center - Future

- Expand use of clusters for inter-satellite data comparisons, climate studies, PEATE/DMS etc.
- Expand data use in new technologies, GIS, McIDAS-V
- Build new technologies for seamless data distribution, and leverage existing technologies, ADDE, LDM, http, etc

THANKS!