# University of Wisconsin SSEC Datacenter

2015 McIDAS Users Group Meeting

June 8, 2015

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# SSEC Data Center Mission Statement

- 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.

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# SSEC Data Center

- Provide timely, high quality real-time and archive data, reliably to SSEC scientists and collaborators.

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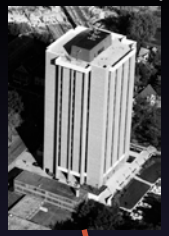
# Data Center History

New building
at 1225 W Dayto

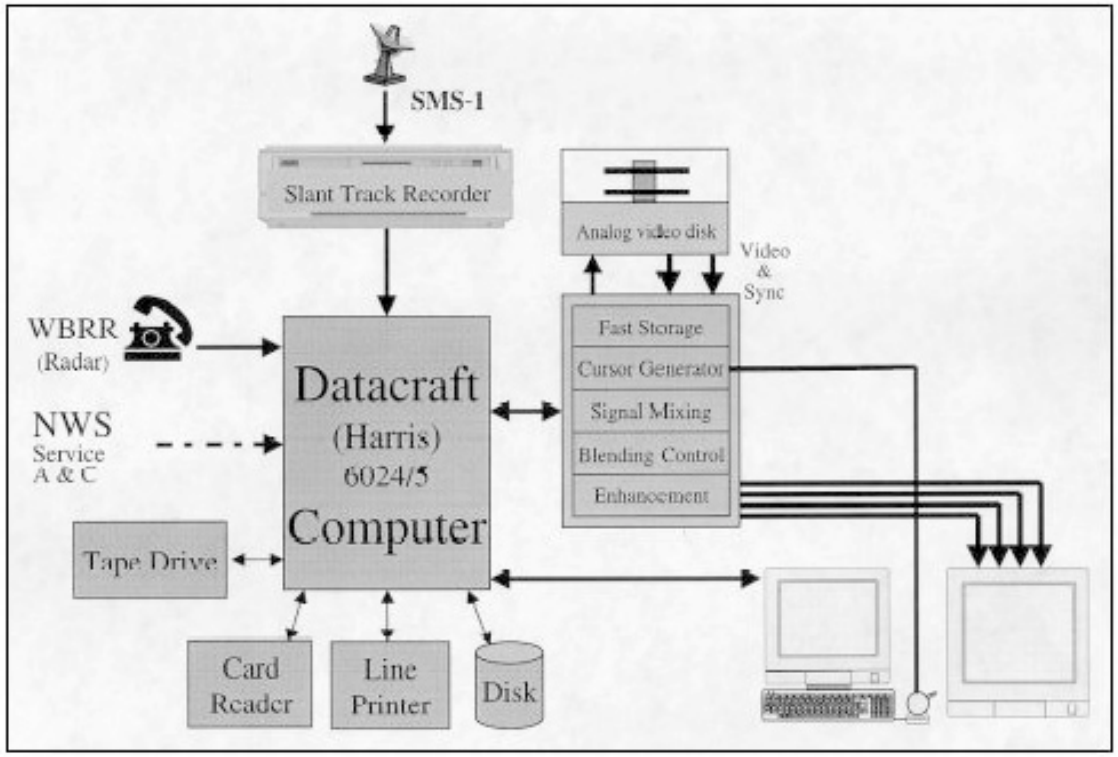


1969

Ja

1970

McIDAS first used
in Data Center




2010

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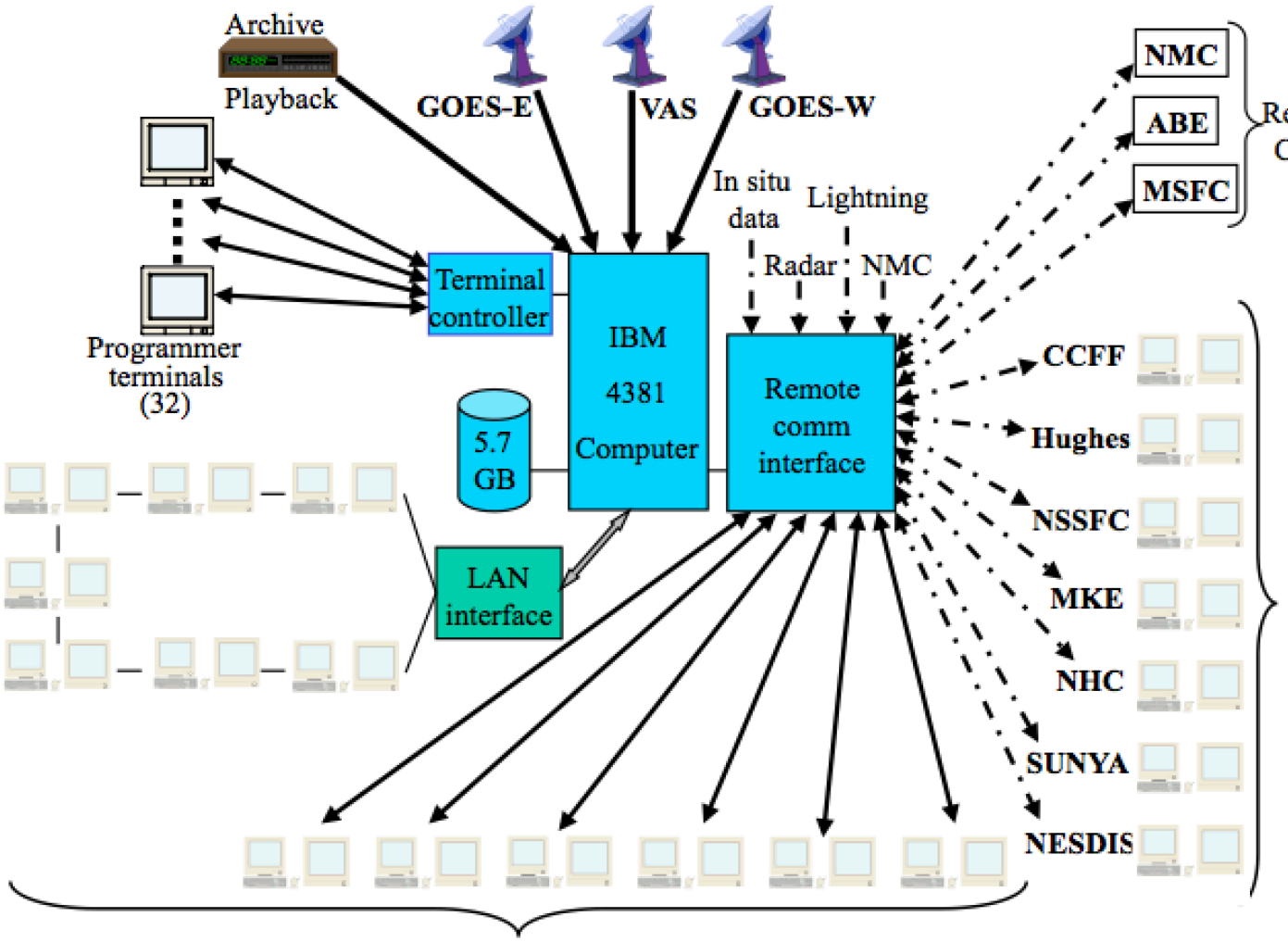
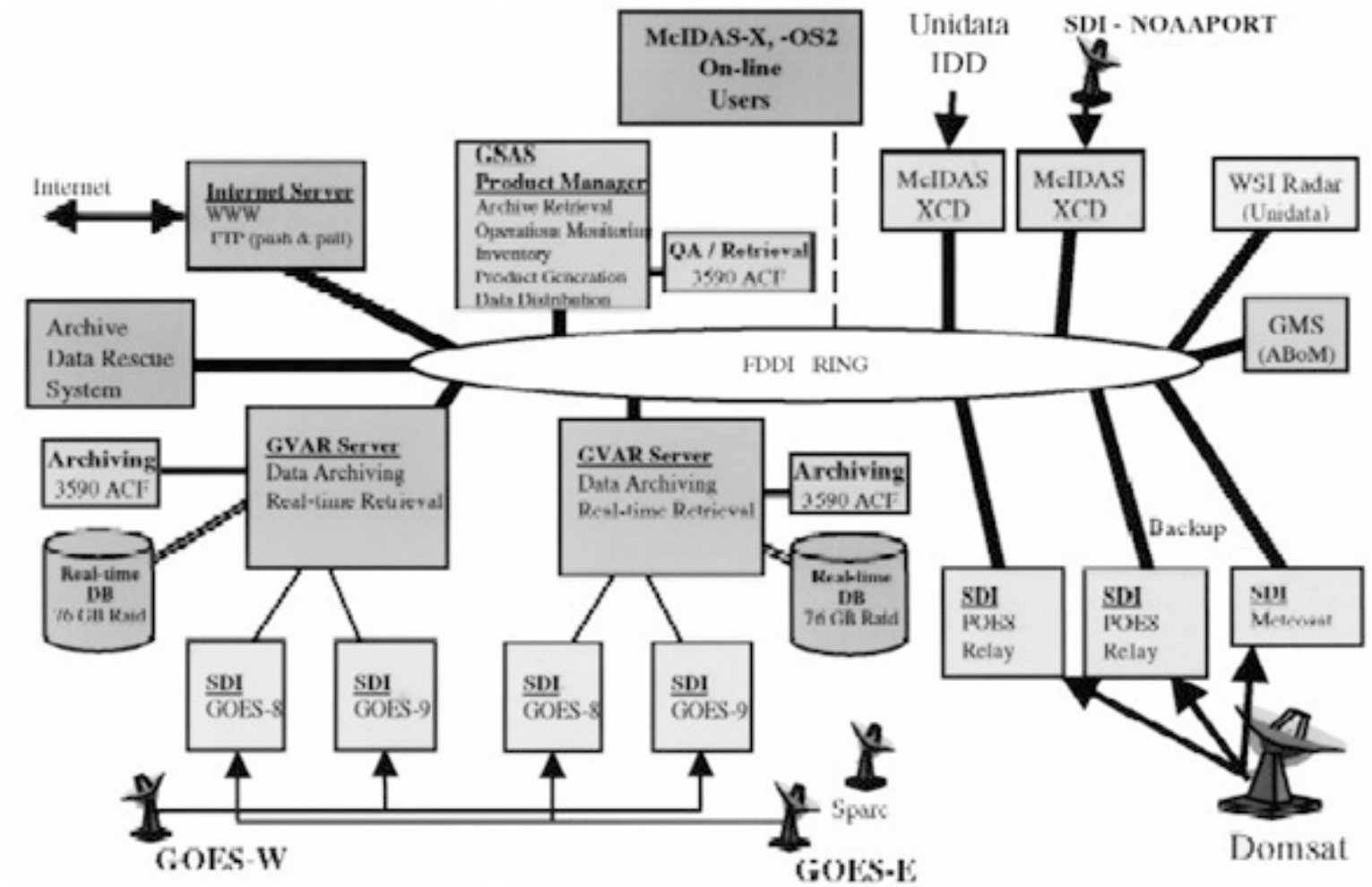
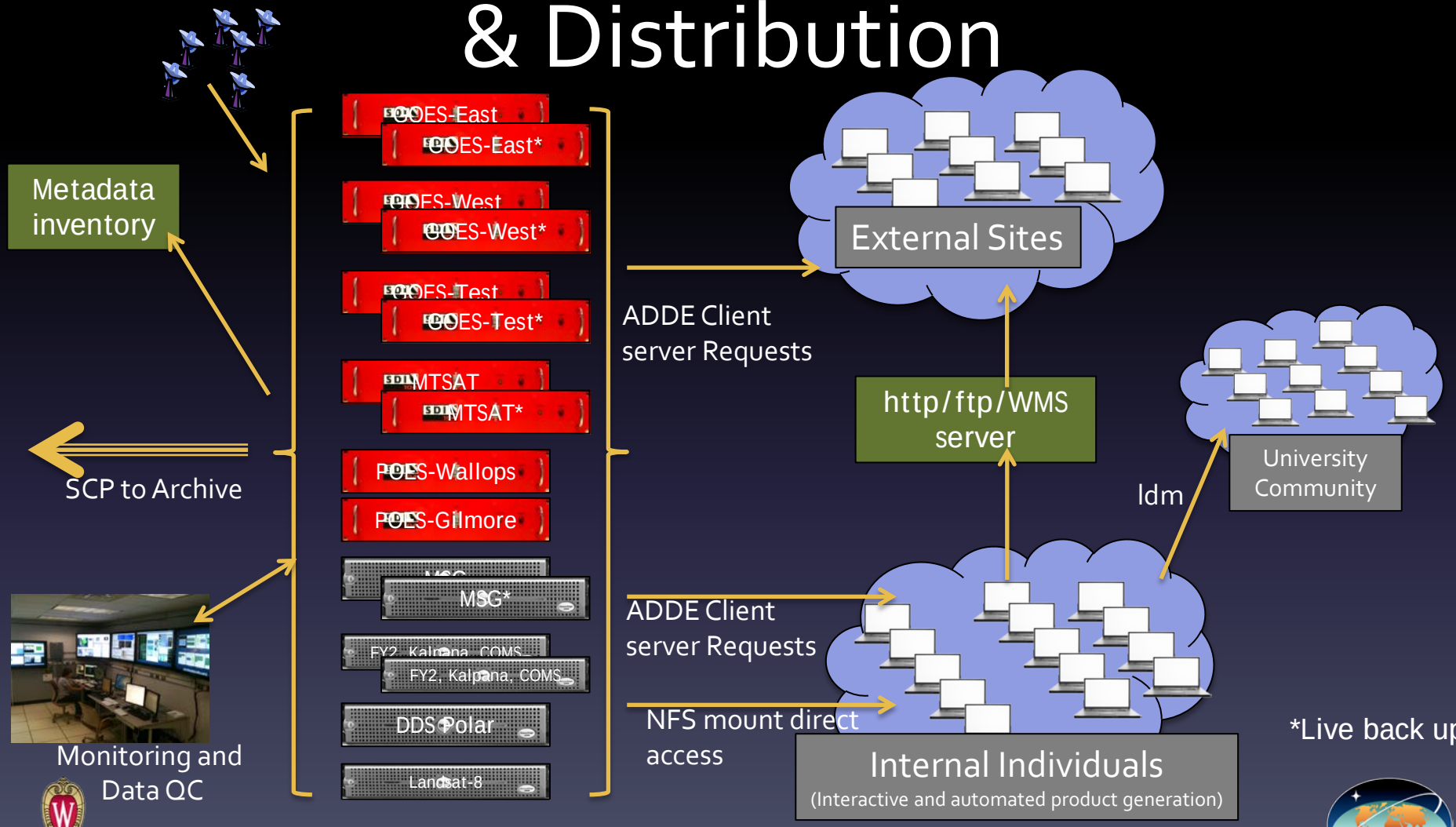

Archive
Playback
GOES-E
VAS
GOES-W
NMC
ABE
MSFC
Remote CPUs
In situ data
Lightning
Radar
NMC
Terminal controller
IBM 4381 Computer
Programmer terminals (32)
5.7 GB
Remote comm interface
LAN interface
CCFF
Hughes
NSSFC
MKE
NHC
SUNYA
NESDIS


McIDAS-X, -OS2
On-line
Users
Unidata
IDD
SDI - NOAAPORT
Internet
Internet Server
WWW
FTP (push & pull)
GSAS
Product Manager
Archive Retrieval
Operations Monitoring
Inventory
Product Generation
Data Distribution
QA / Retrieval
3590 ACT
McIDAS
XCD
McIDAS
XCD
WSI Radar
(Unidata)
Archive
Data Rescue
System
FDDI RING
GMS
(ABoM)
Archiving
3590 ACT
GVAR Server
Data Archiving
Real-time Retrieval
GVAR Server
Data Archiving
Real-time Retrieval
Archiving
3590 ACT
Backup
Real-time
DB
76 GB Raid
Real-time
DB
76 GB Raid
SDI
POES
Relay
SDI
POES
Relay
SDI
Meteosat
SDI
GOES-8
SDI
GOES-9
SDI
GOES-8
SDI
GOES-9
Spare
GOES-W
GOES-E
Domsat

# Current Satellite Real-time Ingest & Distribution

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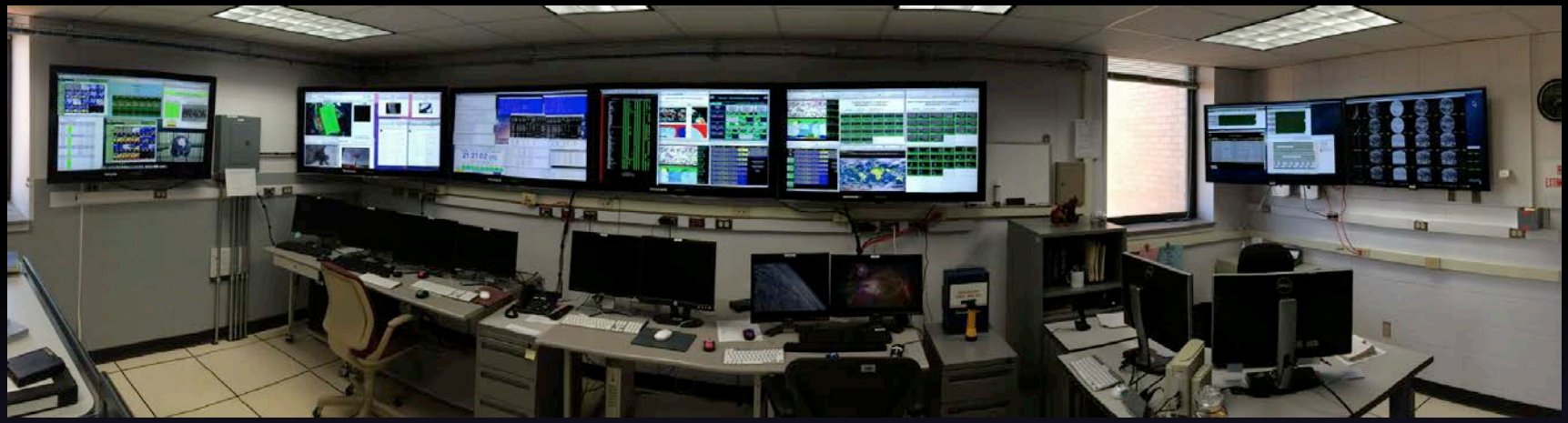
# SSEC Data Center



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

- 3 FTE ~100% time
  - Computer Operator (1st shift)
  - Computer Operator (1st shift)
  - Research Intern
- 5 FTE ~portions of their time
  - Program Manager
  - System Programmer
  - Data Base Programmer
  - Research Specialist (PM assistant)
  - Antenna/Communication technician
- 2 Student programmers
- 2 student QC assistants (2nd shift)

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# Data Center Facilities

- Over 2100 ft.
- Currently the Data Center has 44 racks representing over 1840 rack units of space.
- The Data Center's disk storage exceed 8 PBs.
- The entire room is on three 72 KW UPSs, of which, about 155 KW are in use. Non UPS power usage is ~17 KW. An additional 72 KW UPS for a smaller 5 th floor computer room
- Cooling provided by campus chilled water and outside air in the winter. Racks are cooled by 16 in row APC coolers.
- Gigabit and 10 Gigabit network (also 100 MB admin network, 40 Gigabit InfiniBand).

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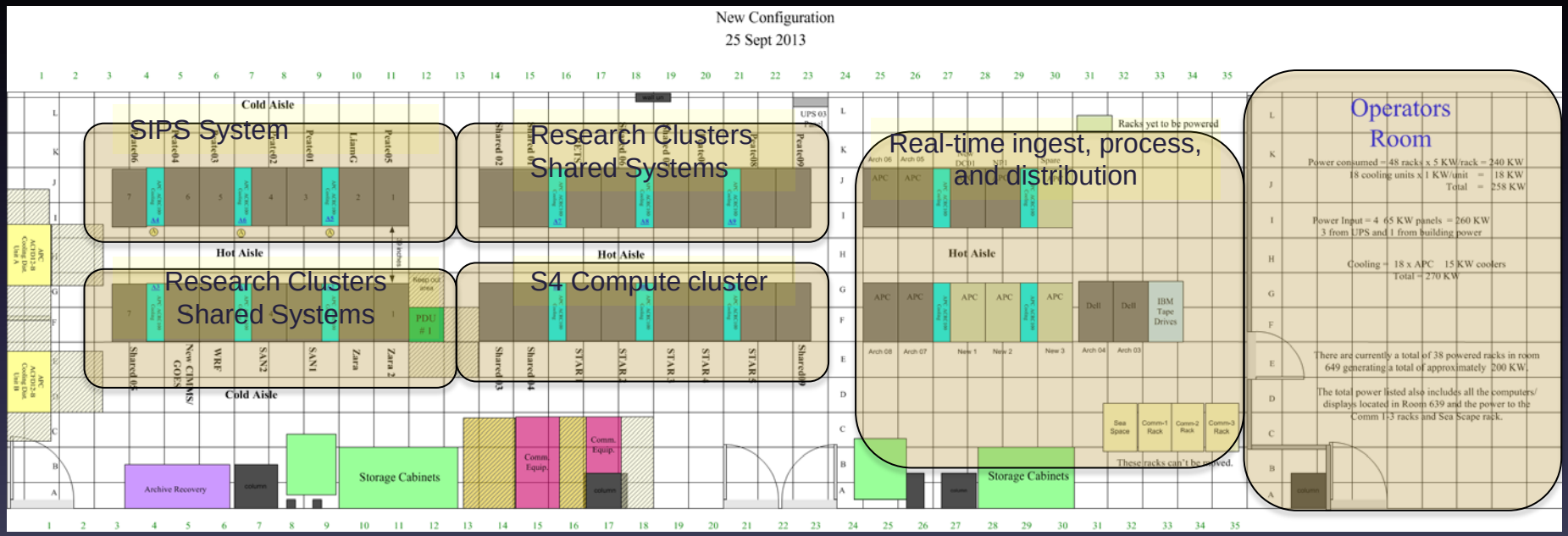
# Server room layout

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# S4 Supercomputing Cluster

- Total compute: 3072 cores, 8TB memory
- Total storage: 456 TB
- 40 Gigabit/s InfiniBand Network Interconnect
- Funded by the NOAA & used by NOAA and UW researchers to run data assimilation experiments
- The system was designed, installed, and is maintained by the UW SSEC Technical Computing Group.
- S4 expansion complete.  Additional 1600 cores, 10 TB memory and 1 PB storage.

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# Data Center Antennas

- C-Band
  - 11 meter heated (87° West – SES-2, POES Wallops Relay, MSG)
  - 7.3 meter backup (101° West – SES-1, POES Fairbanks Relay, MTSAT, Noaaport)
  - 6.3 meter heated (101° West – SES-1, 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 (90° West –GOES-test/spare)
  - 3.7 meter (offline spare)
- X-Band
  - 4.4 meter (Tracking – EOS)
- X/L Band
  - 2.4 meter (Tracking – Suomi NPP, EOS, Metop A&B, NOAA-18, 19 and FY3)

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# SSEC Data Center Incoming Data

May, 2015

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

| | |
|---|---|
| GOES satellites | ~96 GB/day |
| International Geo Satellites | ~360 GB/day |
| NOAA Polar | ~27 GB/day |
| Landsat-8 | ~50 GB/day |
| Miscellaneous Polar and Non satellite | ~85 GB/day |
| MODIS polar from NASA archive | ~150 GB/day |
| NPP (VIIRS CrIS ATMS) | ~1,800 |
| GB/day | |

2,300+ GB/day
via Internet
(ftp, LDM, ADDE, http)

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# SSEC Data Center Outgoing Data

Four primary methods of Data delivery
1.ADDE
2.HTTP
3.FTP
4.LDM (Unidata local data manager)


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# Outgoing Data

May 2015

- On average over 890,000 ADDE transactions per day
- Over 2.2 TB data distributed per day via ADDE
- In addition over 1 TB data distributed via ftp, http, and ldm

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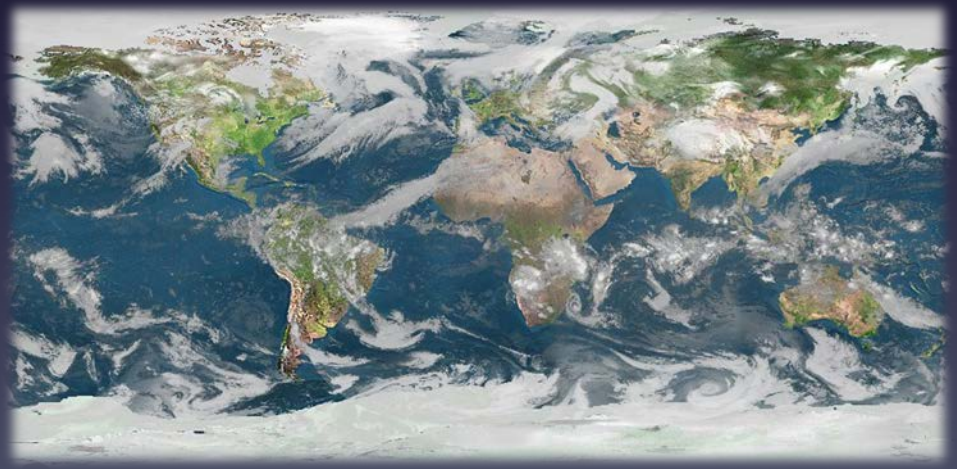
# Real-time Data

The SSEC Data Center receives data from 12 different geostationary satellites and 11 different polar orbiting satellites. Most data are available in near real-time via ADDE. Other methods of data access are available upon request.



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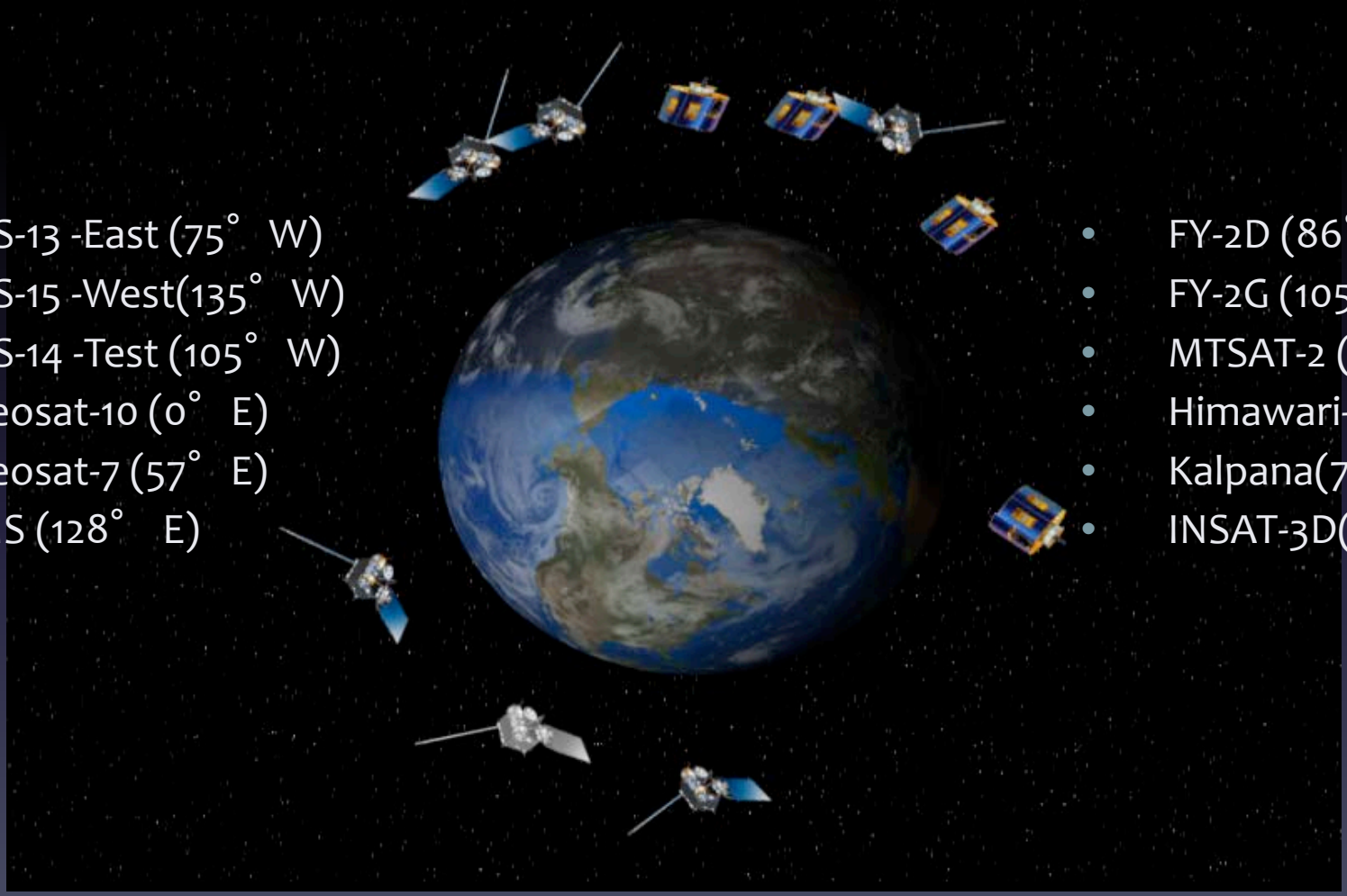
# Geostationary Satellites received



- GOES-13 -East (75° W)
- GOES-15 -West(135° W)
- GOES-14 -Test (105° W)
- Meteosat-10 (0° E)
- Meteosat-7 (57° E)
- COMS (128° E)

- FY-2D (86° E)
- FY-2G (105° E)
- MTSAT-2 (145° E)
- Himawari-8 (140° E
- Kalpana(74° E)
- INSAT-3D(83° E)

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# Geostationary Satellites Received at UW SSEC in 2015

| | Sub-Point | Reception Method | Source | Latency | Daily Volume |
|---|---|---|---|---|---|
| GOES-13 | 75° West | L-Band | DB | <2 minutes | 23 GB |
| GOES-14 | 105° West | L-Band | DB | <2 minutes | 23 GB |
| GOES-15 | 135° West | L-Band | DB | <2 minutes | 23 GB |
| Meteosat-10 | 0° East | C-Band Relay | DB Relay | <15 minutes | 24 GB |
| Meteosat-7 | 57° East | Network Relay | NESDIS | ~30 minutes | 2 GB |
| Himawari-8 | 140° East | Network Relay | NOAA STAR | ~ 10 minutes | 300 GB |
| MTSAT-2 | 145° East | C-Band Relay | DB Relay | ~ 6 minutes | 12GB |
| Kalpana | 74° East | Network Relay | ISRO | 45-120 minutes | 1.4 GB |
| Insat-3D | 83° East | Network Relay | ISRO | 45-180 min | 19 GB |
| FY2D | 86° East | Network Relay | ABOM | 15-30 minutes | 4.7 GB |
| FY2G | 105° East | Network Relay | ABOM | 15-30 minutes | 4.7 GB |
| COMS | 128° East | Network Relay | KMA | 9-24 minutes | 11 GB |

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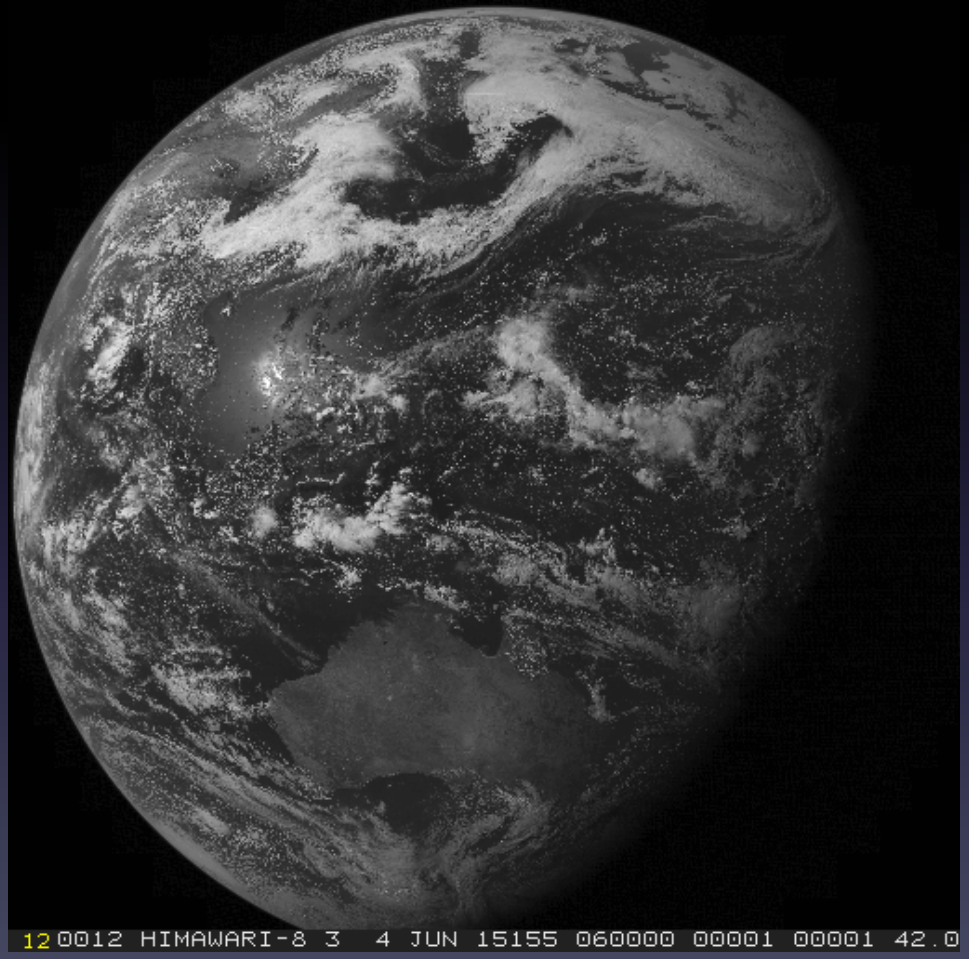
# Himawari-8

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# Himawari-8

- Started receiving it routinely in March, 2015 via NOAA STAR
- HSF format data
- Archive on line March 2015 – Present (~ 300 GB/day)
- Data are available via ADDE ~10 minutes after end of Image
- Receiving 10 minute Full Disks and 2.5 minute Target Sectors
- Operational after July 7, 2015

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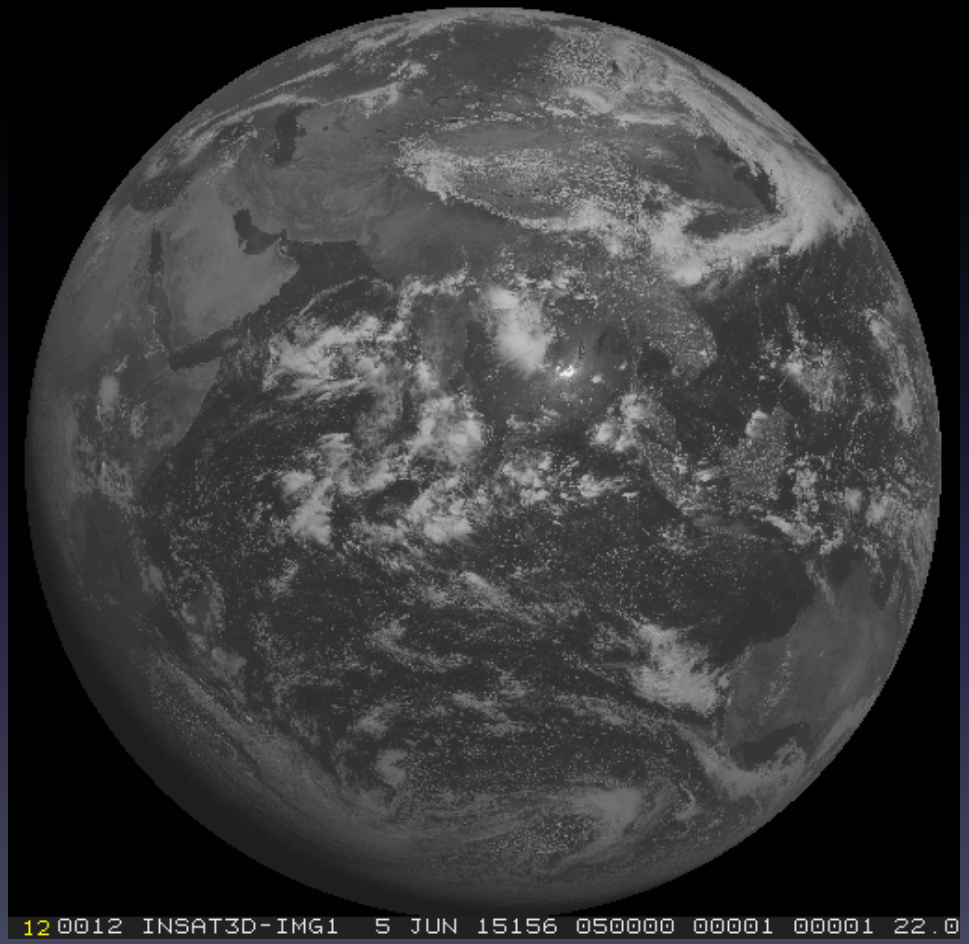
# Insat-3D

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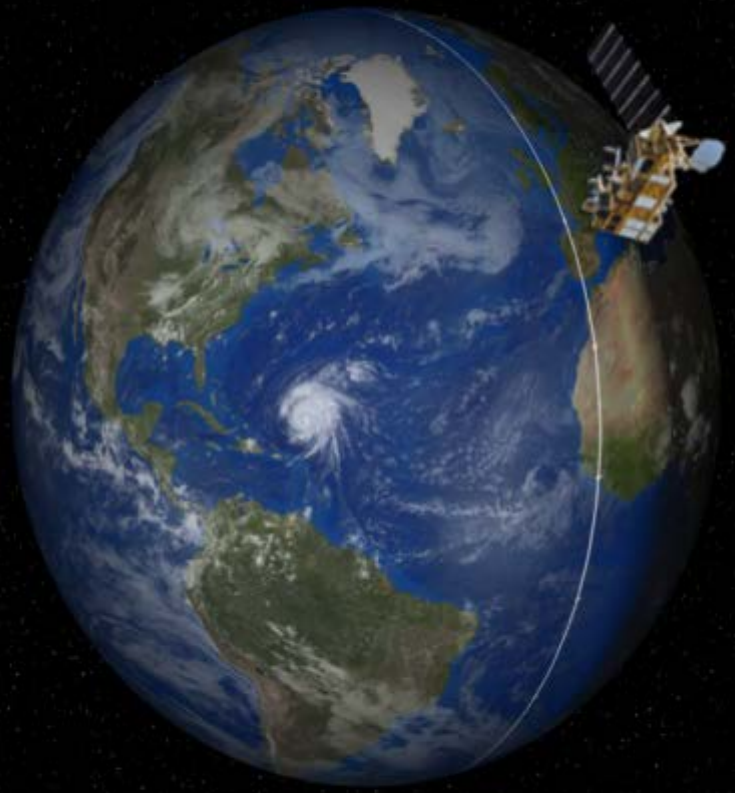
# Insat-3D

- Started receiving it routinely in April, 2014
- HDF5 format data
- Archive on line April 2014 – Present
- Data are available via ADDE 30 minutes to several hours after end of Image
- NASA LaRC funded ADDE server work. Should be in the first fasttrack release after Himawari fasttrack

# Polar Satellites received

- NOAA-15
- NOAA-18
- NOAA-19
- METOP-A
- METOP-B



- Aqua
- Terra
- Suomi-NPP
- Landsat-8

- FY-3B
- GCOM-W1

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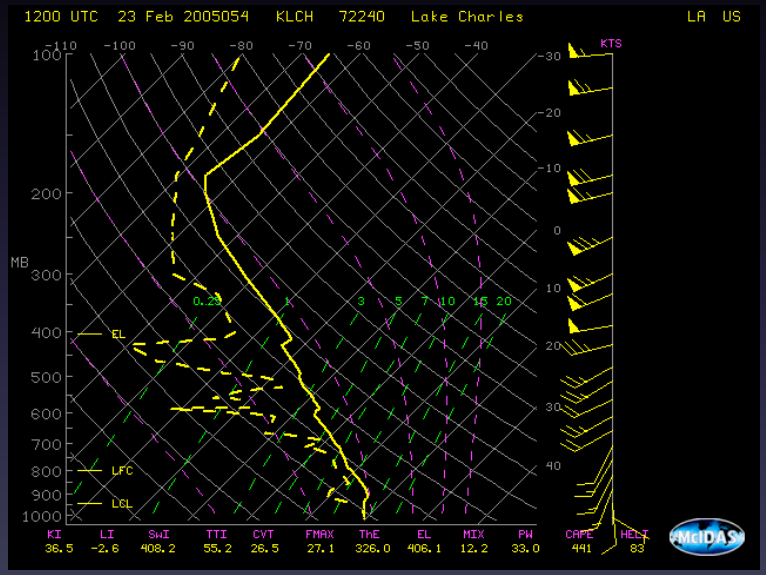
# Polar Satellites Received at UW SSEC in 2015

| | Reception Method | Domain | ADDE Latency | Instruments | External Access |
|---|---|---|---|---|---|
| NOAA-15 | C-Band relay, DDS | DB CONUS Global | DB <1 minutes after pass | AVHRR, AMSU, DCS->level-1 | **ADDE** |
| | | | | All other instruments Level-0 | NA |
| NOAA-18 | DB L-Band, C-Band relay, DDS | DB CONUS Global | DB <1 minutes after pass | AVHRR->level-1 | **ADDE** |
| | | | | All other instruments Level-0 | NA |
| NOAA-19 | DB L-Band, C-Band relay, DDS | DB CONUS Global | DB <1 minutes after pass | AVHRR->level-1 | **ADDE** |
| | | | | All other instruments Level-0 | NA |
| Metop-A | DB L-Band, NOAA DDS | DB CONUS Global | CONUS <15 minutes after pass | AVHRR ->level-1 | **ADDE** |
| | | | | AVHRR, IASI | DB ftp (sips) |
| Metop-B | DB L-Band, NOAA DDS | DB CONUS Global | CONUS <15 minutes after pass | AVHRR ->level-1 | **ADDE** |
| | | | | AVHRR,IASI | DB ftp (sips) |
| Suomi-NPP | DB X/L Band, NASA Relay | DB CONUS Global | CONUS <15 minutes after pass | VIIRS | **ADDE** |
| | | | | VIIRS,ATMS, CrIS | DB ftp (sips) |
| Aqua | DB X-Band, NASA Relay | DB CONUS Global | DB <15 minutes after pass | AIRS, MODIS -> Level-1 | **ADDE** |
| | | | | AIRS, MODIS | DB ftp (sips) |
| Terra | DB X-Band, NASA Relay | DB CONUS Global | DB <15 minutes after pass | MODIS -> Level-1 | **ADDE** |
| | | | | MODIS | DB ftp (sips) |
| Landsat-8 | Network Relay (USGS) | CONUS | 22-24 hours | Level-1 | **ADDE**, WMS |
| Shizuku GCOM-W1 | DB X-Band | CONUS | DB <1 min after pass | Level-0 | SSEC ftp |
| FY-3C | DB X/L Band | CONUS | DB <1 min after pass | Level-0 | SSEC ftp |

# NOAAPORT/Conventional Data

- Model Output (GFS, RAP, etc)
- NEXRAD
- NWS Text output

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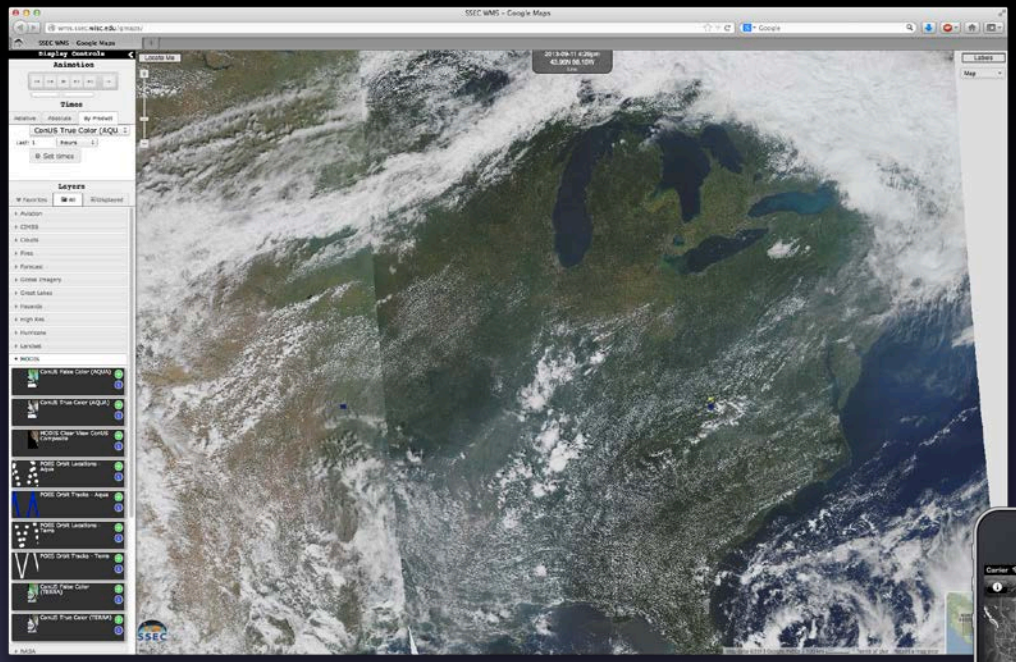
# Real-time Data Custom Products



SSEC RealEarth
via WMS

WxSat
Available on the App Store

WxSat
Google play

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# Archive Data

As of May 2015, over 1,450 TBs online. (much of this is redundant)
Grows approximately about ~150 TB/year

**US Geostationary Satellites**

- GOES-8 through GOES-15 ***(1994-Present)*** (East, West , South America and test)
- GOES-1 through GOES-7 ***(1978-1996)***
- SMS-1&2 *(1978-1981)*

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# Archive Data

## International Geostationary Satellites

- GMS/MTSAT ***(1998-Present)***
- Meteosat/Meteosat IODC ***(1998-Present)***
- FY2 (2004-Present)
- Kalpana ***(2005-Present)***
- Insat-3D ***(June 2014-Present)***
- COMS (June 2012 – Present)
- Himawari-8 (March 2015 – Present)

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# Archive Data

**NOAAPORT/Conventional Data**

- Model Output ***(1996-Present)****
- In situ Point Observations ***(1976-Present)***

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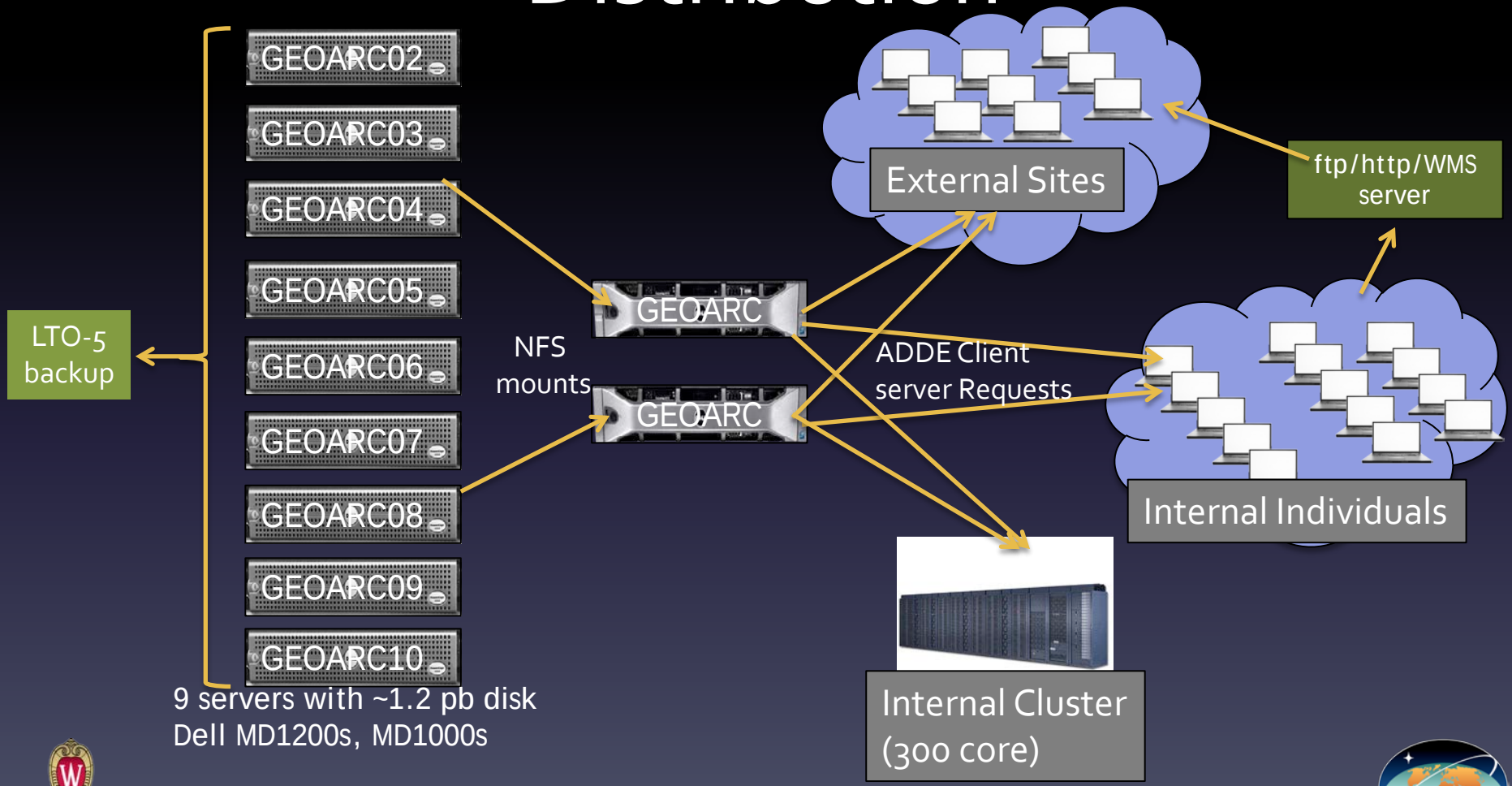
# Current Satellite Archive Distribution

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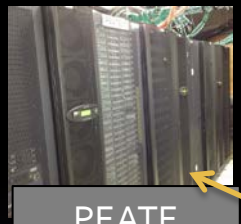
# New Satellite Archive Distribution



PEATE
(1000 cores)

Lustre mount
over Infiniband

Lustre
Satellite
Archive

- Lustre 2.4 on ZFS
- 30 DELL MD1200s (4 TB disks)
- 12 DELL R720s OSS
- 2 DELL R720s MDS

*(Designed by Scott Nolin, Jesse Stroik, and John Lalande)*

Zara Cluster
(300 cores)

Lustre mount
over Infiniband
and local ADDE

Lustre mount
over Infiniband

s4 Cluster & S4 expansion
(4,672 cores)

GEOARC

NFS mounts

GEOARC

FUSE mount

dawgfs
server

NFS
mount

External Sites

ADDE Client
server Requests

ftp/http/WMS
server(s)

Internal Individuals
(5000+ cores)

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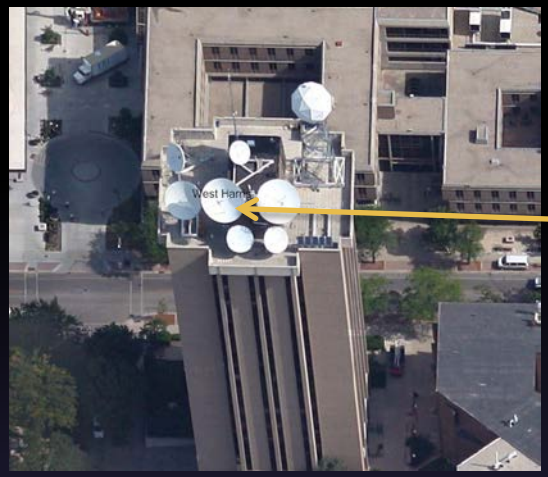
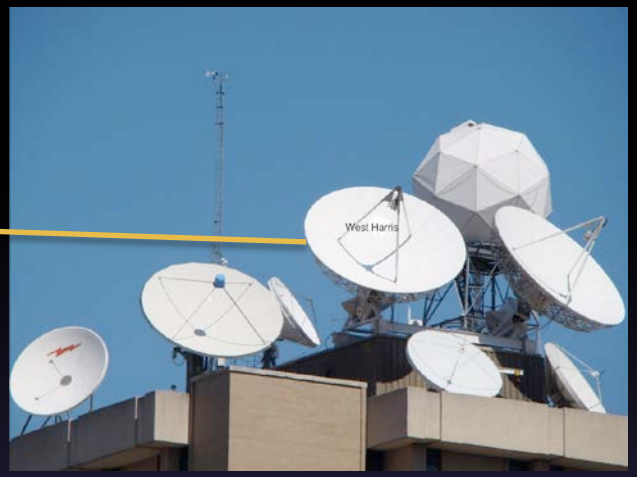
# New Stuff

# GOES-R






- Antenna Upgrade Summer 2015
  - New Feed
  - DVB-S2 demodulator
- 7.3 meter diameter

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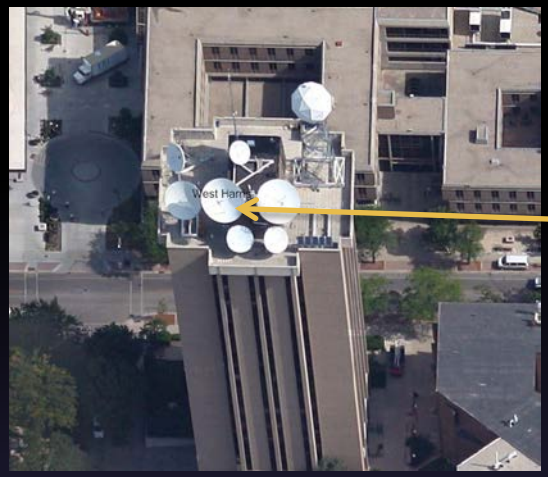
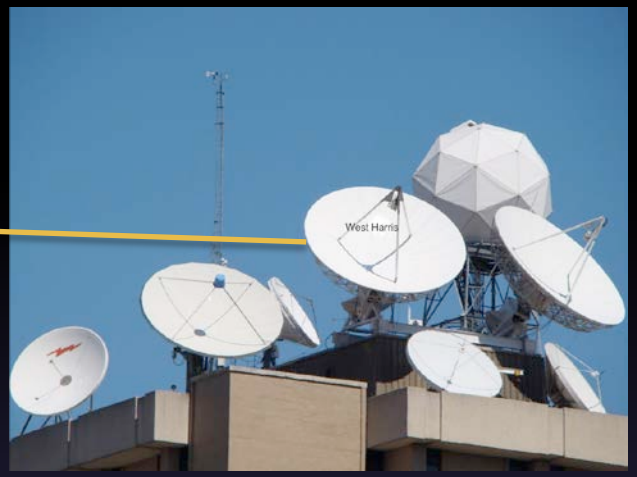
# GOES-R






- ADDE access to ABI (with tracking)
- Level-2 products via CSPP GEO (ADDE access when available)
- Archive CADU CCSDS and level-1 netcdf

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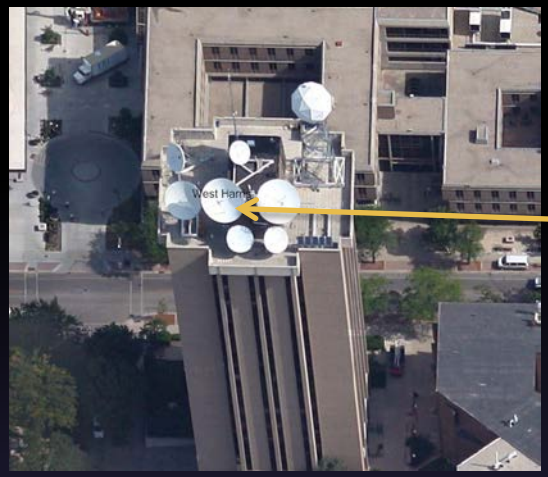
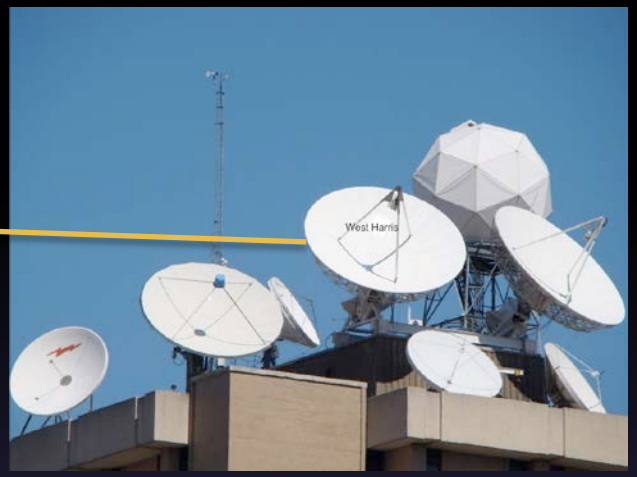
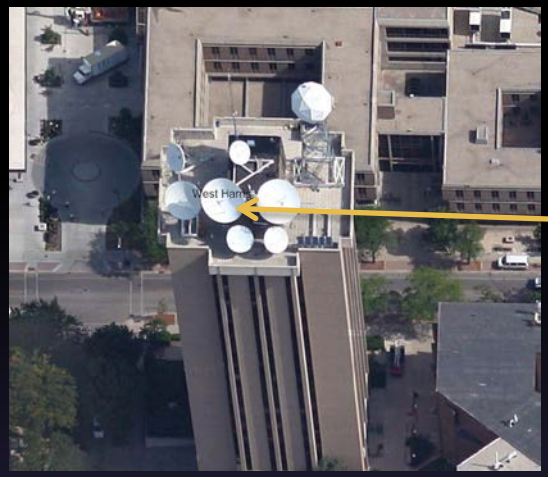
# GOES-R

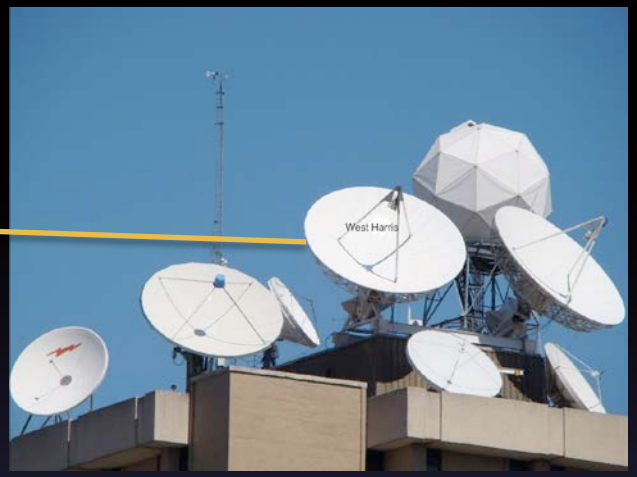





- Archive level 0
- No ADDE service

# GOES-R






- Testing with GRB simulator now
- Developing new SDI for Ingest and serving

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# Event Handler

- Satellite Imagery Event Handler
- Provides users with notification of data availability
- Users will be able to subscribe and trigger processing based on event attributes
- Internal testing now.  External access in 2016
- Utilizes RabbitMQ

# More methods of data access

- ADDE interface that returns netCDF
- McIDAS-X scripts in Python
- WMS server direct access to ADDE archive

# Opening up the archive

- Starting in 2011, active McIDAS-X sites have access to archive data older than the previous month (limit of 5 GB/month) per site.
- Beginning in 2016, any user will have access to ADDE data older than 6 months in our satellite archive up to 5 GB/day.

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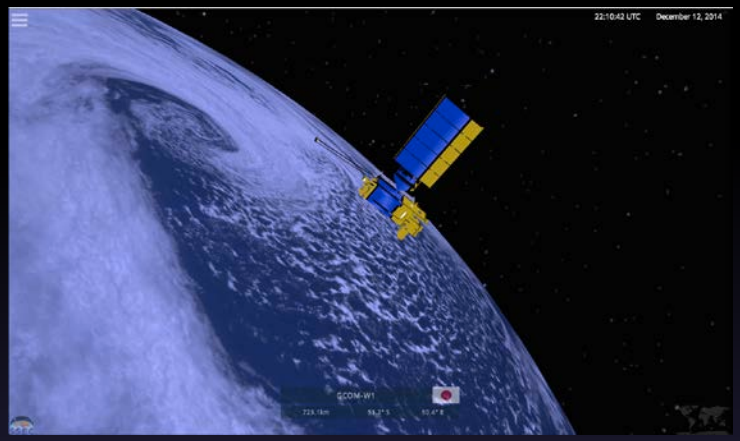
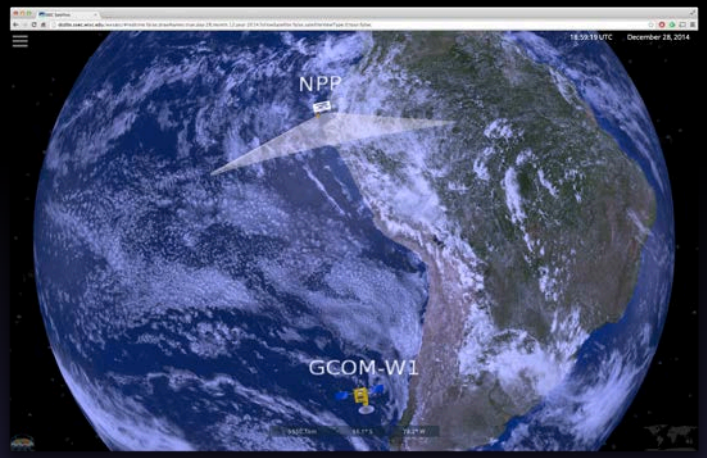
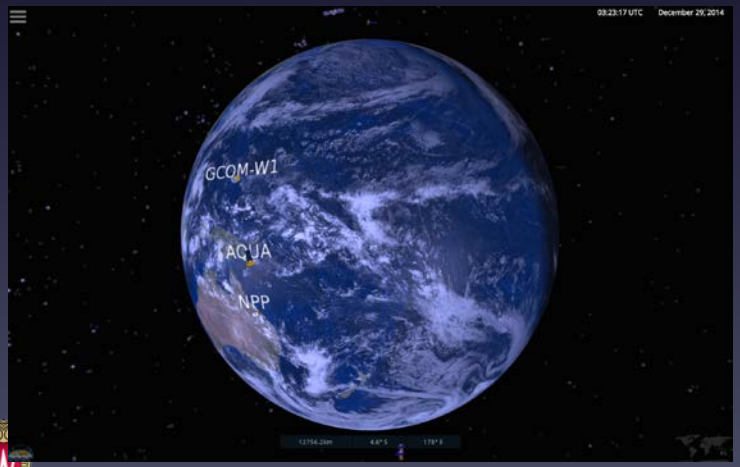
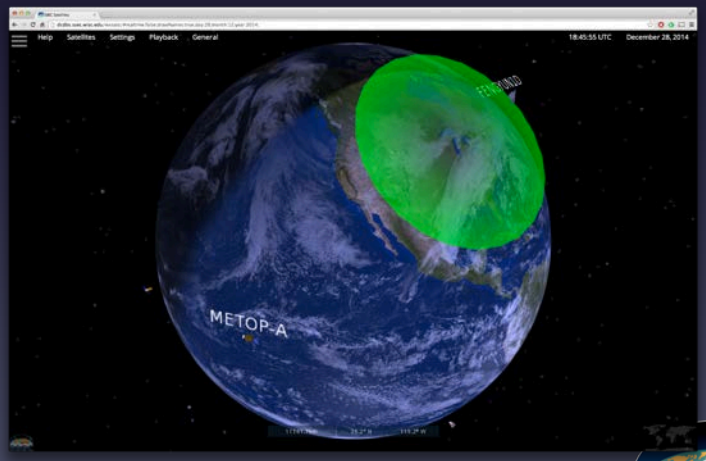
# Visualizing Operational Leo and Geo Satellites in Real-time Utilizing WebGL




http://www.ssec.wisc.edu/datacenter/wxsats

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# SMS 1 & 2 Rescue

- SMS-1 &2 data for May 1974 – July 1981
- 1480 tapes
- Joint effort with NASA GSFC

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End