

Applications of High Frequency Geostationary Satellite Data in Hurricane Surveillance and Research

by

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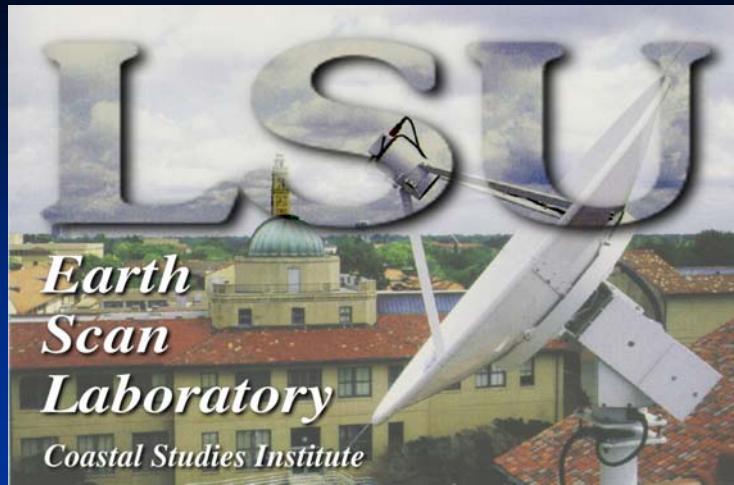
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PRESENTED AT THE *PETASHARE ALL HANDS MEETING* AT LSU

MARCH 3, 2008



LSU Earth Scan Laboratory

<http://www.esl.lsu.edu>

Missions:

Emergency Response
Research
Education

Real-time data:

NOAA AVHRR 1988
GOES-8 GVAR 1995
Orbview-2 SeaWiFS 1997
Terra/Aqua MODIS 2002
Oceansat-1 OCM 2003
RADARSAT/ERS-2 SAR 2003

Hurricane track and intensity forecasting using GOES GVAR

S.A. Hsu and N. D. Walker

*****Lack of sufficient atmospheric and oceanic data is a major obstacle to modeling hurricane intensity***

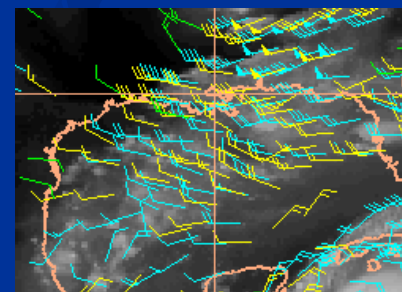
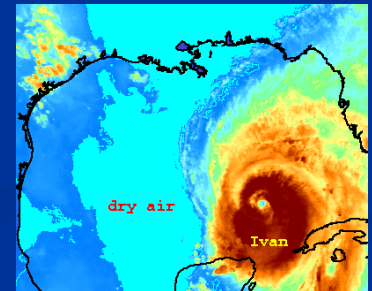
❖ Cloud Top Temperatures, Hurricane Intensity Changes, Radius of Maximum Wind

❖ Surveillance of Dry Air Advection in Mid and Upper Atmosphere

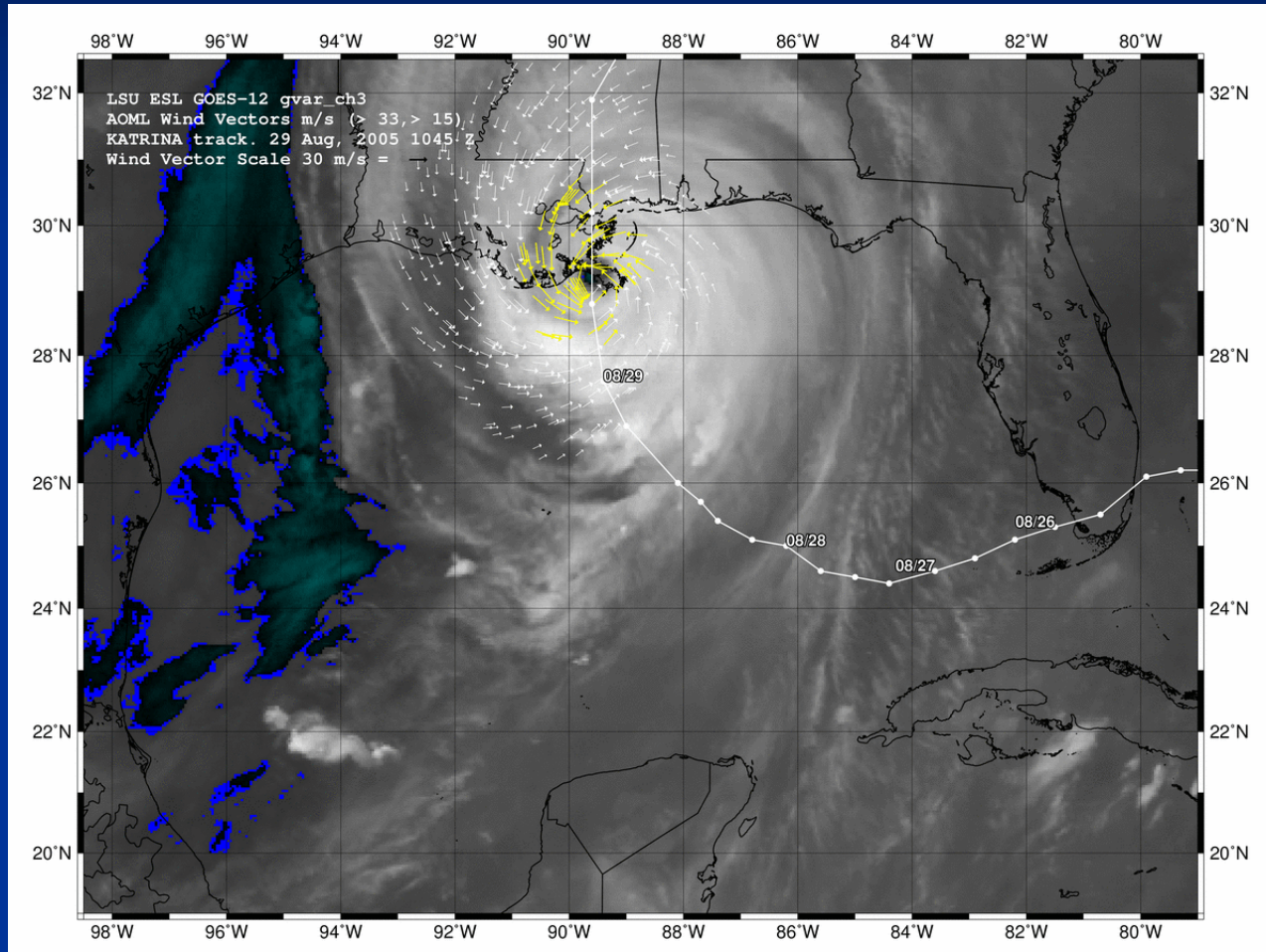
❖ Upper Level Winds using water vapor data

❖ Ocean feature detection/tracking

❖ Sea Surface Temperatures, Cool Wakes, Air-sea Interactions

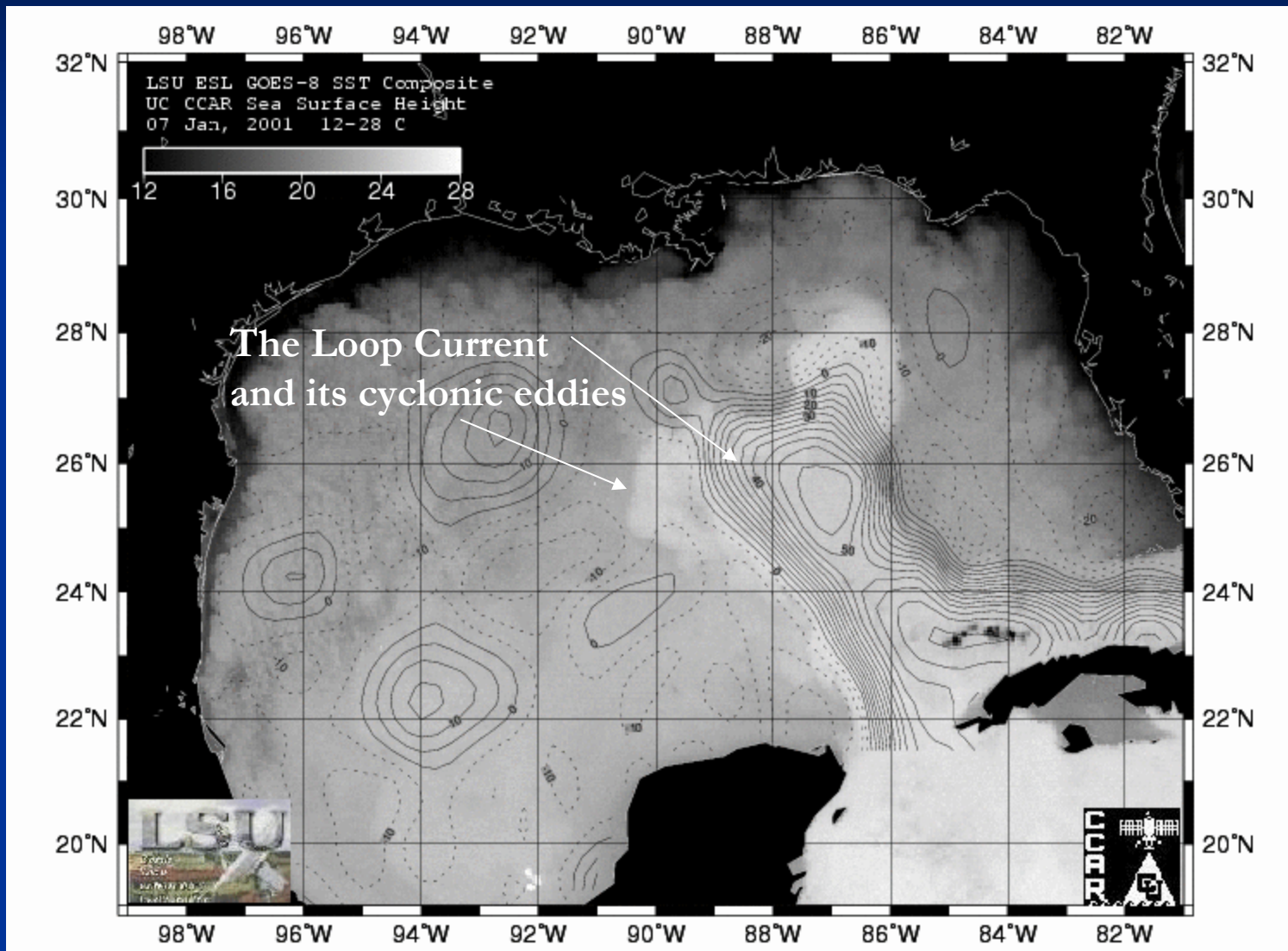


Hurricane Surveillance Using GOES GVAR Channel 3 (Mid-Upper Atmosphere Water Vapor)



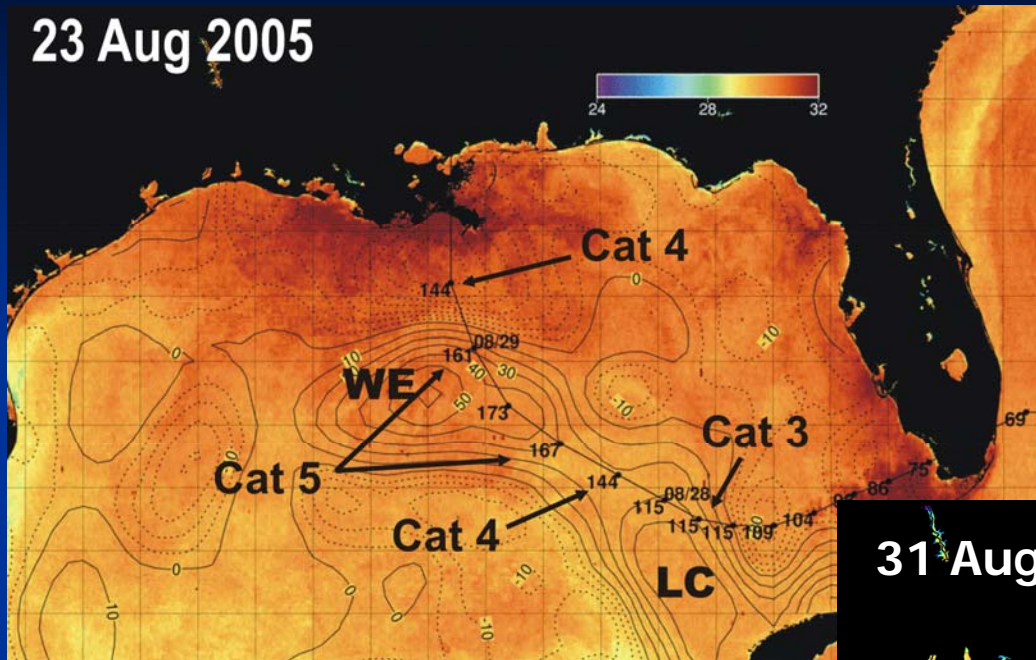
Surveillance of Gulf of Mexico Currents and Eddies

ESL “de-clouded” GOES Night-time Sea Surface Temperature Image



SST and SSH Pre-Katrina

23 Aug 2005

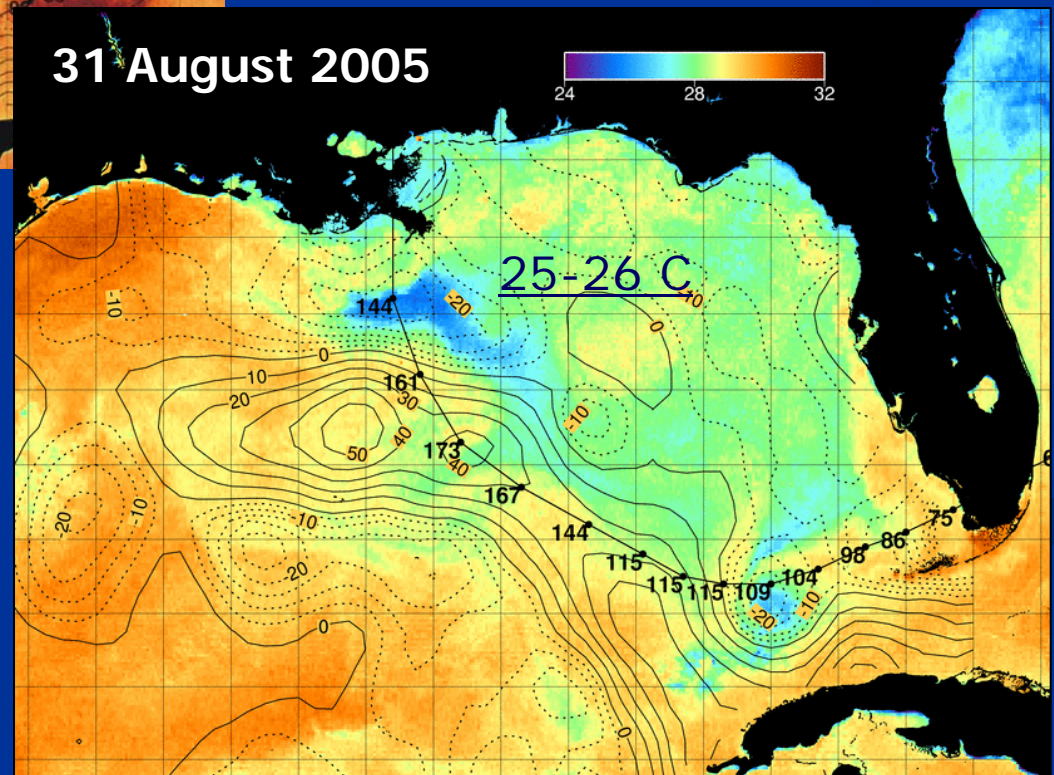


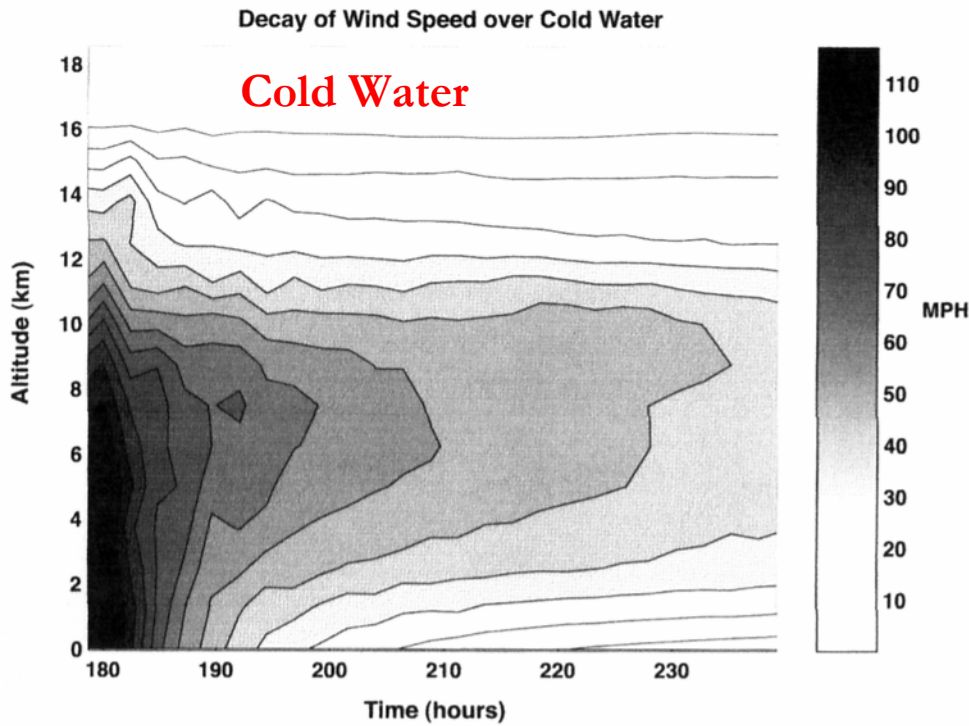
Daily Surveillance of

- Loop Current,
- Eddies
- Cool Wakes,
- Air-sea interactions

SST and SSH Post-Katrina

31 August 2005

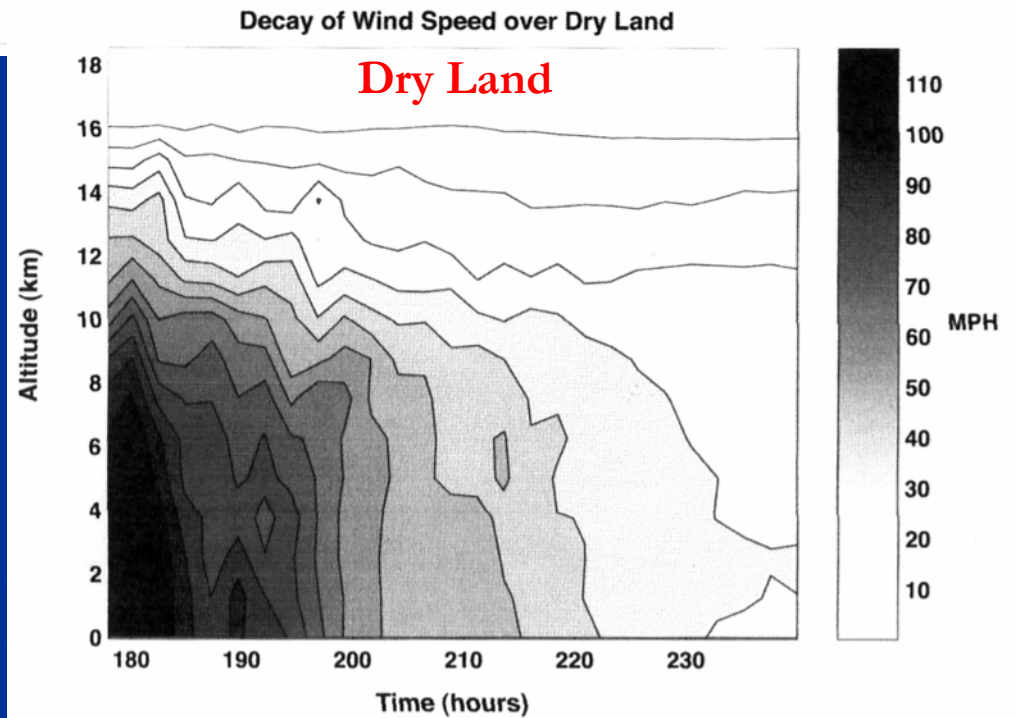




Model simulation of effects of cold water and dry land on hurricane wind speed

(From Emanuel, 2005)

Cold Water Rapidly Weakens the Hurricane in the Lower Levels



Priorities for Petashare

1. Future GOES-12 Expanded View to include SH to 20° S (30 minutes)
2. GOES-8 and GOES-12 NH since January 2001 (30 minutes)
3. Other datastreams:

NOAA AVHRR – 5 channels

SeaWiFS – 8 channels

MODIS- 36 channels

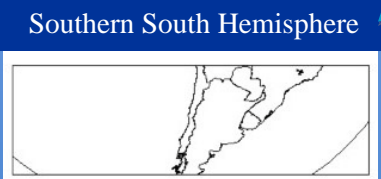
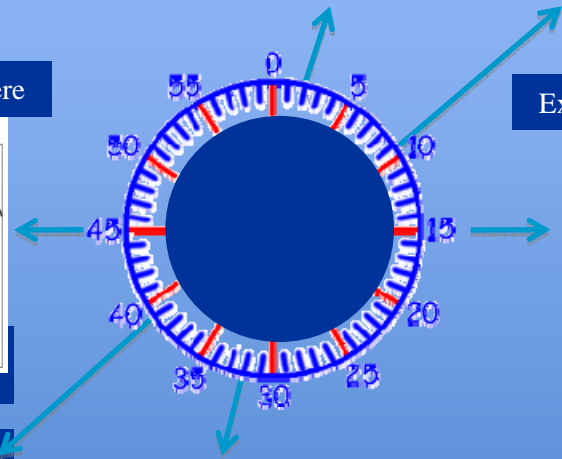
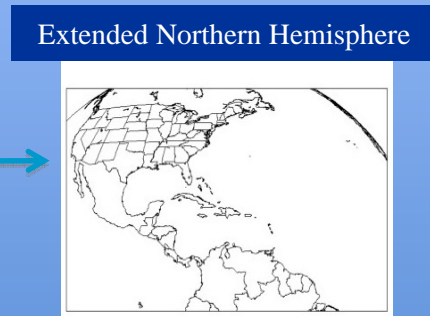
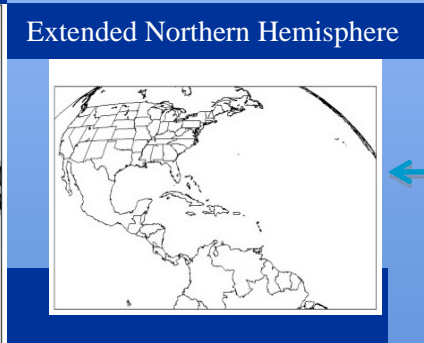
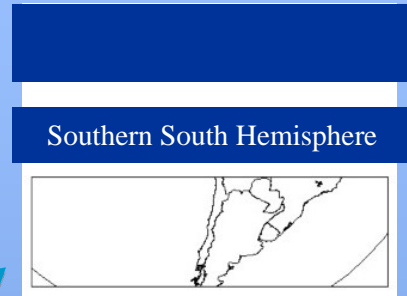
OCM – 8 channels

Advantages of Online

1. Time –series for research
2. Model initialization and validation
3. Rapid Access and Visualizations “on the fly”
4. Archive Integrity

Typical GOES Scanning Schedule

- Typical hour shown, w/Full Disk every third hour
- Varies with requested Rapid-Scan Operations (RSO) which take a CONUS scan every five minutes
- Rare occasions take SRSO (Super-RSO) which scan a tiny sector every minute for a short time period



02:45 05:45 08:45...

Single channel HDF file size:

| | IR | Vis |
|------------|-----|------|
| CONUS: | 4M | 60M |
| ExtNHem: | 13M | 200M |
| FullDisk: | 28M | 450M |
| SSouthHem: | 4M | 64M |

5 channels; 4 at IR res, 1 at Vis res.

Scenarios for the storage of GOES data

| Scenario | Details | Total Storage Requirements | |
|--|--|----------------------------|--------------------------------------|
| Half-hourly 1: ExtNorthHem scans, ignore Vis data | 48 scans / day, 4 channels @ 4km @ 13M / channel = 52M / scan | Daily | 2.5 GB |
| | | Weekly | 18 GB |
| | | Monthly | 72 GB |
| | | Yearly | .94 TB |
| Half-hourly: 2 ExtNorthHem scans with Vis data (daylight hours only) | Adding: 24 scans / day, 1 channel @ 1km @ 200M/channel = 200M/scan | Daily | 8 GB (includes totals immed. above) |
| | | Weekly | 57 GB |
| | | Monthly | 230 GB |
| | | Yearly | 2.96 TB |
| Quarter-hourly 1: ExtNHem + CONUS scans, ignore Vis data | 96 scans / day, 4 channels @ 4km @ 17M / channel = 68M / scan | Daily | 6.5 GB |
| | | Weekly | 46 GB |
| | | Monthly | 184 GB |
| | | Yearly | 2.4 TB |
| Quarter-hourly 2: ExtNHem + CONUS scans with Vis data | Adding: 48 scans / day, 1 channel @ 1km @ 200M / channel = 200M / scan | Daily | 16 GB (includes totals immed. above) |
| | | Weekly | 64 GB |
| | | Monthly | 256 GB |
| | | Yearly | 3.33 TB |
| Full Disk: Replaces one ExtNHem scan every three hours | 8 scans / day, all channels @ (450 + 28) MB / (Vis + other) channel = 562 MB / scan (daylight) = 112 MB / scan (night) = 4*562 + 4*112 – 8*200 / day | Daily | 17 GB (includes totals immed. above) |
| | | Weekly | 120 GB |
| | | Monthly | 480 GB |
| | | Yearly | 6.24 TB |
| All data: (Add Southern South Hem. Scans to above, for a total of 144 scans/day) | Adding: 48 scans / day, all channels @ (64 + 4) MB / (Vis + other) channel =64 MB / scan | Daily | 20 GB (includes totals immed. above) |
| | | Weekly | 140 GB |
| | | Monthly | 560 GB |
| | | Yearly | 7.28 TB |