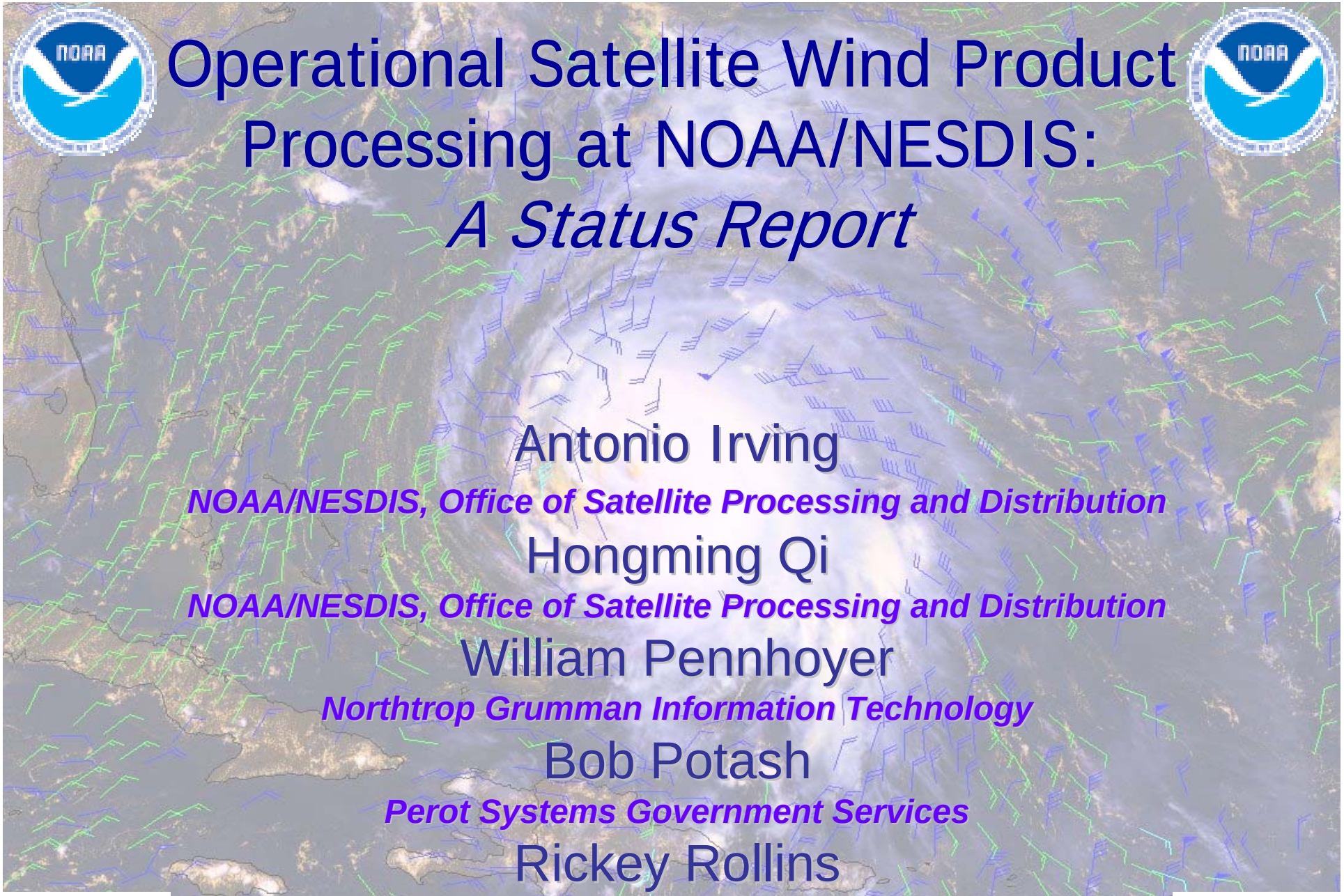


Operational Satellite Wind Product Processing at NOAA/NESDIS: *A Status Report*

Antonio Irving

NOAA/NESDIS, Office of Satellite Processing and Distribution

Hongming Qi

NOAA/NESDIS, Office of Satellite Processing and Distribution

William Pennhoyer

Northtrop Grumman Information Technology

Bob Potash

Perot Systems Government Services

Rickey Rollins

SM Research Corporation

TOPICS

- **Status of NESDIS' geostationary satellites**
- **Operational AMV System**
  - **System Architecture/Current configuration**
  - **Wind products**
  - **Formats and dissemination**
  - **Product monitoring**
  - **AMV processing updates**
- **Research to Operations**

  - The SPSRB process

NESDIS Operations Status Report
Status of GOES Satellites

http://www.oso.noaa.gov/goesstatus/

Status of NESDIS' Geostationary Satellites

Spacecraft	Launched	Status (Effective Date)
GOES-8	4/13/1994	De-Orbited (May 4, 2004)
GOES-9	5/23/1995	*Decommissioned* (June 15, 2007)
GOES-10	4/25/1997	*Operational @ 60W* (July 27, 1998)
		On loan to South America (Dec 02, 2006)
GOES-11	5/03/2000	*Operational @ 135W* (July 20, 2006)
GOES-12	7/23/2001	*Operational @ 75W* (May 1, 2003)
GOES 13	5/24/2006	On Orbit Storage @ 105W

Spacecraft	Launch Date
GOES-O	August 2008
GOES-P	TBD
GOES-R	December 2014

NESDIS Operations Status Report

Operational AMV System:
System Architecture, Wind products, dissemination, product monitoring, and updates

Operational AMV System Architecture

System Architecture Changes (~1978 – 2008)

- ~ 1978 – 1994 IBM 360 Mainframe (MVS) (MIDAS and VDUC)
- 1994 – 1997 IBM Servers (AIX)
- 1997 – 2001 SGI Origin 2000 (IRIX)
- 2001 – 2008 Dell Servers (LINUX)
- April 2008 and beyond IBM P570 Server with Linux Partitions (Linux)

SATEPS Operational Hardware/Physical Environment at ESPC/NSOF

SATEPSDEVx IBM 9117-p570

16 Processors
1.65 Ghz CPU 64Bit
32 GB of Memory
8 – 73 GB Hdisk and 2 TB SAN Disk

SATEPSDEV1
AIX5.3
McIDAS 2007
Fortran, C, Shell, Script

SATEPSDEV2
LINUX RHEL4 WS
McIDAS 2007
Fortran, C, Shell, Script

SATEPSDEV3
LINUX RHEL4 WS
McIDAS 2007
Fortran, C, Shell, Script

SATEPSDEV4
LINUX RHEL4 WS
McIDAS 2007
Fortran, C, Shell, Script

SATEPSDEV5
LINUX RHEL4 WS
McIDAS 2007
Fortran, C, Shell, Script

SATEPSDEV6
LINUX RHEL4 WS
McIDAS 2007
Fortran, C, Shell, Script

SATEPSDEV7
LINUX RHEL4 WS
McIDAS 2007
Fortran, C, Shell, Script

SATEPSDEV8
LINUX RHEL4 WS
McIDAS 2007
Fortran, C, Shell, Script

SATEPSDEV9
LINUX RHEL4 WS
McIDAS 2007
Fortran, C, Shell, Script

SATEPSPRODx IBM 9117-p570

16 Processors
1.9 Ghz CPU 64Bit
256 GB of Memory
2 - 73GB Hdisk and 1 TB SAN Disk

SATEPSPROD1
LINUX RHEL4 WS
McIDAS 2007
Fortran
C
Shell
LINUX Script

SATEPSPROD2
LINUX RHEL4 WS
McIDAS 2007
Fortran
C
Shell
LINUX Script

SATEPSPROD3
LINUX RHEL4 WS
McIDAS 2007
Fortran
C
Shell
LINUX Script

SATEPSPROD4
LINUX RHEL4 WS
McIDAS 2007
Fortran
C
Shell
LINUX Script

SATEPSPROD5

SATEPSNIM

SATEPSDISTx IBM P55A

Formerly GP12

8 Processors
1.65 Ghz CPU 64 bit
16 GB of Memory
4-146 GB HDisk / 2-73 GB Hdisk
2 TB SAN Disk

SATEPSDIST1
AIX 5.3
McIDAS 2007
Fortran
C
Shell

SATEPSDIST2
AIX 5.3
McIDAS 2007
Fortran
C
Shell

SATEPSDIST3
AIX 5.3
McIDAS 2007
Fortran
C
Shell

SATEPSDIST4
LINUX
McIDAS 2007
Fortran
C
Shell

SATEPSDIST5
LINUX
McIDAS 2007
Fortran
C
Shell

SATEPSDIST6
LINUX
McIDAS 2007
Fortran
C
Shell

SATEPSDIST7
LINUX
McIDAS 2007
Fortran
C
Shell

Formerly GP16

SATEPSANON IBM P52A

AIX 5.3
2 Processor
1.65 Ghz CPU 64 Bit
3 GB of Memory
2-73 GB HDisk 1-146 GB HDisk

DRAFT

SATEPSPROD P570 (LPARS)

System	Products	IP Address
SATEPSPROD1 (LINUX)	Imager ASOS,DPI,Hyrdo-Estimator,SPE(AWIPS), GICP,GSIP,ABBA,Volcano PCI,Volcano Imagery, GOES-SST,MTSAT SST, MSG SST	SATEPSPROD1 10.144.2.101
SATEPSPROD2 (LINUX)	CSBT,GASP,Genesis Parameter,AWIPS Composite	SATEPSPROD2 10.144.2.102
SATEPSPROD3 (LINUX)	Polar Mapping,**HD Winds PolarWinds**,TRaP,FIMMA	SATEPSPROD3 10.144.2.103
SATEPSPROD4 (LINUX)	SFOV, Gridded Cloud Product,Lightning,Profiler Winds,Radar Data	SATEPSPROD4 10.144.2.104
SATEPSPROD5 (LINUX)		SATEPSPROD5 10.144.2.105
SATEPSPROD5 (AIX NIM)		SATEPSAIX 10.144.2.100

NESDIS Operations Status Report

Operational AMV System:
System Architecture, Wind products, dissemination, product monitoring, and updates

AMV Product	*Frequency (Hours)*	*Image Sector (s)*	*Image Interval (min)*	*GTS WMO Header*
GOES IMAGER				
LWIR (11um) Cloud-drift	**3**	**RISOP**	**7.5**	**JACX11- GOES-E JCCX11-GOES-W**
	3	**CONUS**	**15**	
	3	**Extended NH: SH**	**30**	
SWIR (3.9um) Cloud-drift	**3 (Night-time)**	**RISOP**	**7.5**	**JQCX11- GOES-E JRCX11- GOES-W**
	3 (Night-time)	**CONUS**	**15**	
	3 (Night-time)	**Extended NH: SH**	**30**	
Water Vapor (6.7um)	**3**	**Extended NH; SH**	**60**	**JECX11- GOES-E JGCX11- GOES-W**
Vis Cloud-drift (0.65um)	**3 (Daytime)**	**RISOP**	**7.5**	**JHCX11- GOES-E JJCX11- GOES-W**
	3 (Daytime)	**PACU/CONUS**	**15**	
	3 (Daytime)	**Extended NH; SH**	**30**	

Wind Product	*Frequency (Hours)*	*Image Sector (s)*	*Image Interval (min)*	*GTS WMO Header*
GOES SOUNDER				
Sounder WV (7.4um)	**3,6**	**CONUS/Tropical**	**60**	**JKCX11- GOES-E JMCX11-GOES-W**
Sounder WV (7.0um)	**3,6**	**CONUS/Tropical**	**60**	**JNCX11- GOES-E JPCX11- GOES-W**
TERRA/AQUA MODIS				
LWIR (11um) Cloud-drift	**2**	**NHEM; SHEM (poleward 65^{o} Lat)**	**100**	**JBCX11- Terra JICX11- Aqua**
Water Vapor (6.7um)	**2**	**NHEM; SHEM (poleward 65^{o} Lat)**	**100**	**JFCX11- Terra JLCX11- Aqua**

NESDIS Operations Status Report

Operational AMV System:
System Architecture, Wind products, dissemination, product monitoring, and updates

Dissemination of NESDIS Operational Wind Products and Formats Supported

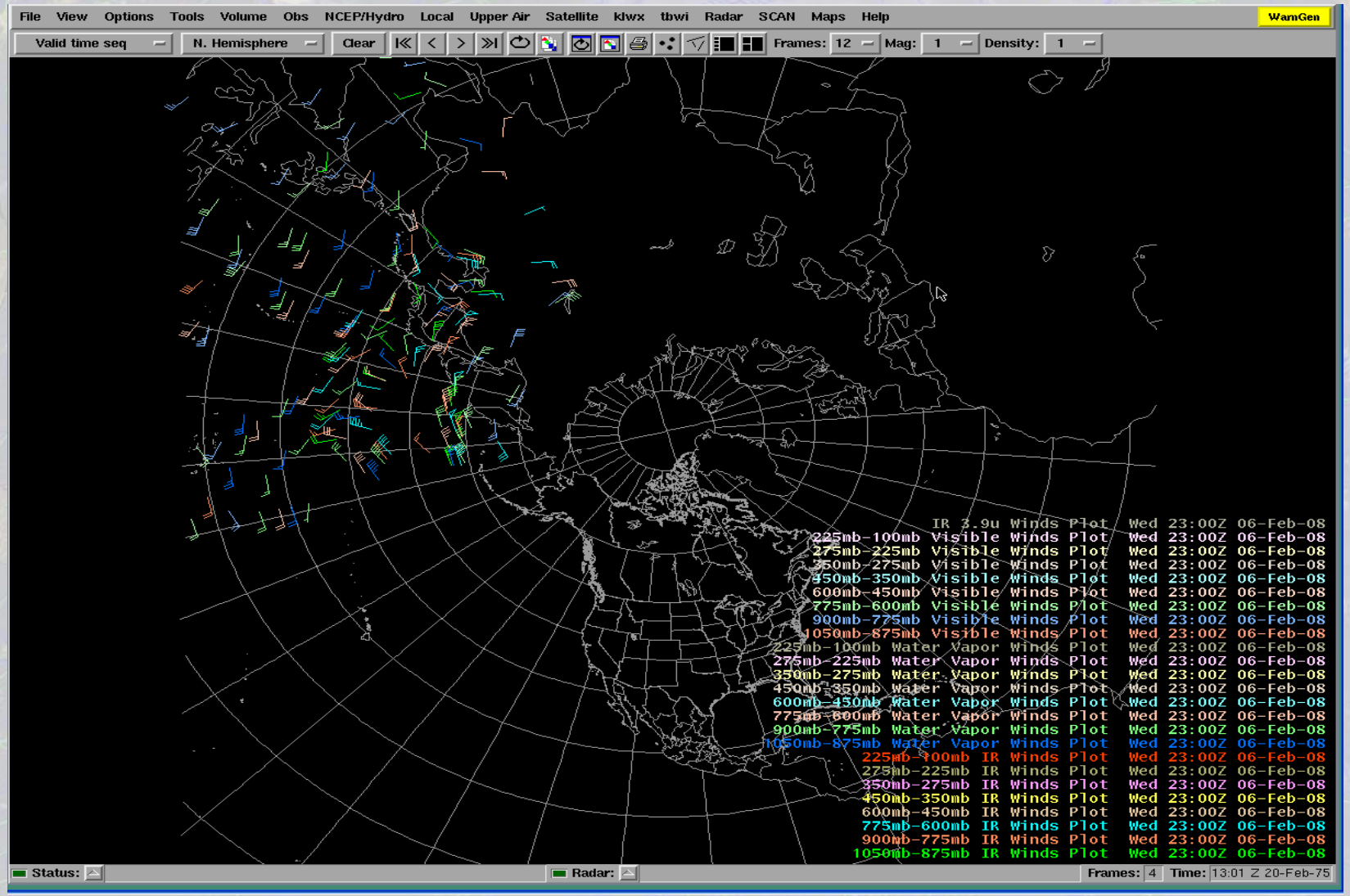
	LWIR (11um)	SWIR **(3.9 um)**	WV **(6.7um)**	Visible	LWIR MODIS	WV MODIS	**Sounder** Ch. 10	**Sounder** Ch. 11	**MTSAT ***	**ASCAT ***	**QUICKSCAT**
Internet Files	Y		Y								
BUFR WMO FM 94	Y R G B	Y R G B	Y R G B	Y R G B	Y R G	Y R G	Y R G B	Y R G B	B	B	B
McIDAS MD File	Y G	Y G	Y G	Y G							
Binary (Archive)	G		G								
ASCII WMO No 306	Y R G		Y R G	Y R G							

Y = GP16 G = GP12 R = GTS B = AWIPS

Dissemination of NESDIS Operational Wind Products

- *GOES AMVs are routinely disseminated to the National Weather Service (NWS) Advanced Weather Interactive Processing System (AWIPS)*
  - **AWIPS is an operationally supported network that gives NWS field forecasters access to a multitude of digital data to help them in their daily forecast preparation**
  - **AWIPS display software allows for easy integration of GOES AMVs with a multitude of other data sources (model analyses/fcsts, observations from other observation systems)**
  - **OB9.0 (Operational Build) last build schedule for deployment (January 2009) before AWIPS moratorium. MTSAT high density winds currently in end to end test mode will be included in OB9.**

Integration of GOES MTSAT Satellite Winds within the NOAA/NWS Advanced Weather Interactive Processing System (AWIPS)



NESDIS Operations Status Report

Operational AMV System:

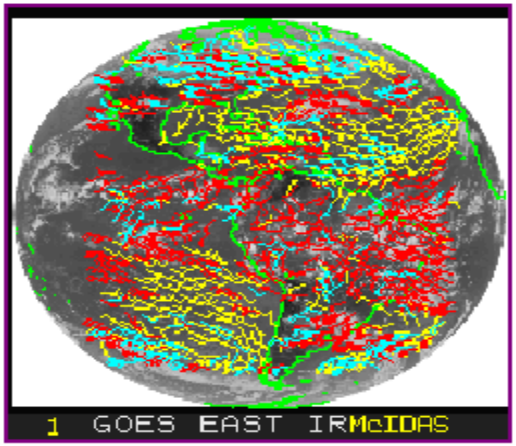
System Architecture, Wind products, dissemination, product monitoring, and updates

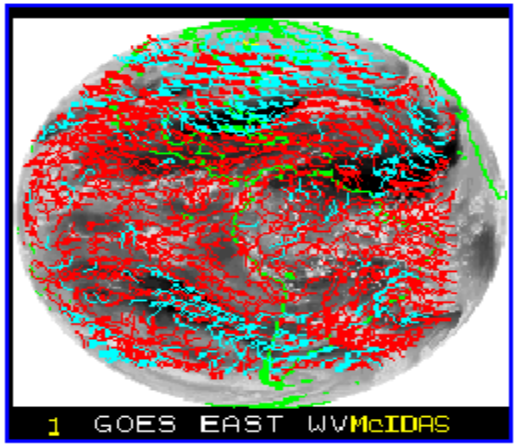
High Density Winds

- GOES East
  - Infrared
    - Northern Hemisphere
      - Loop
    - Southern Hemisphere
      - Loop
  - Water Vapor
    - Northern Hemisphere
      - Loop
    - Southern Hemisphere
      - Loop

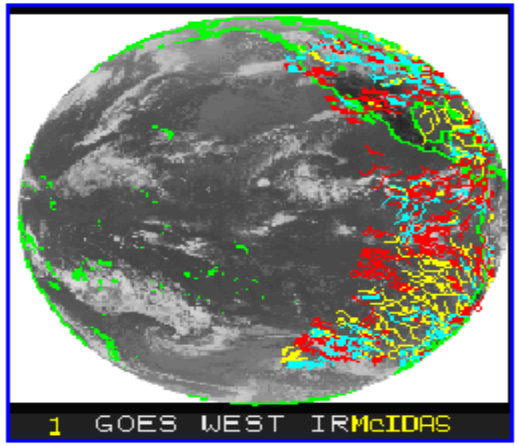
- GOES West
  - Infrared
    - Northern Hemisphere
      - Loop
    - Southern Hemisphere
      - Loop
  - Water Vapor
    - Northern Hemisphere
      - Loop
    - Southern Hemisphere
      - Loop

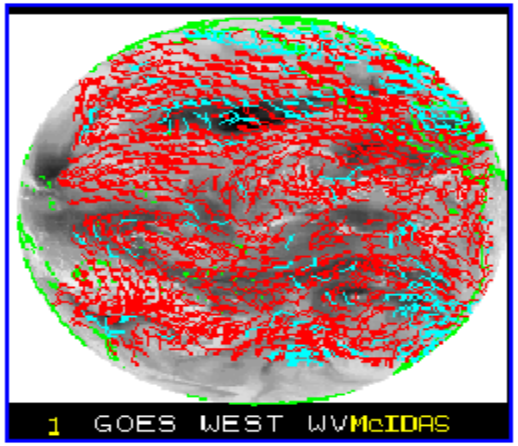
GOES East Full Disk





GOES West Full Disk





High Density Winds

- GOES East
  - Infrared
    - Northern Hemisphere
    - Southern Hemisphere
  - Water Vapor
    - Northern Hemisphere
    - Southern Hemisphere
- GOES West
  - Infrared
    - Northern Hemisphere
    - Southern Hemisphere
  - Water Vapor
    - Northern Hemisphere
    - Southern Hemisphere

Statistics

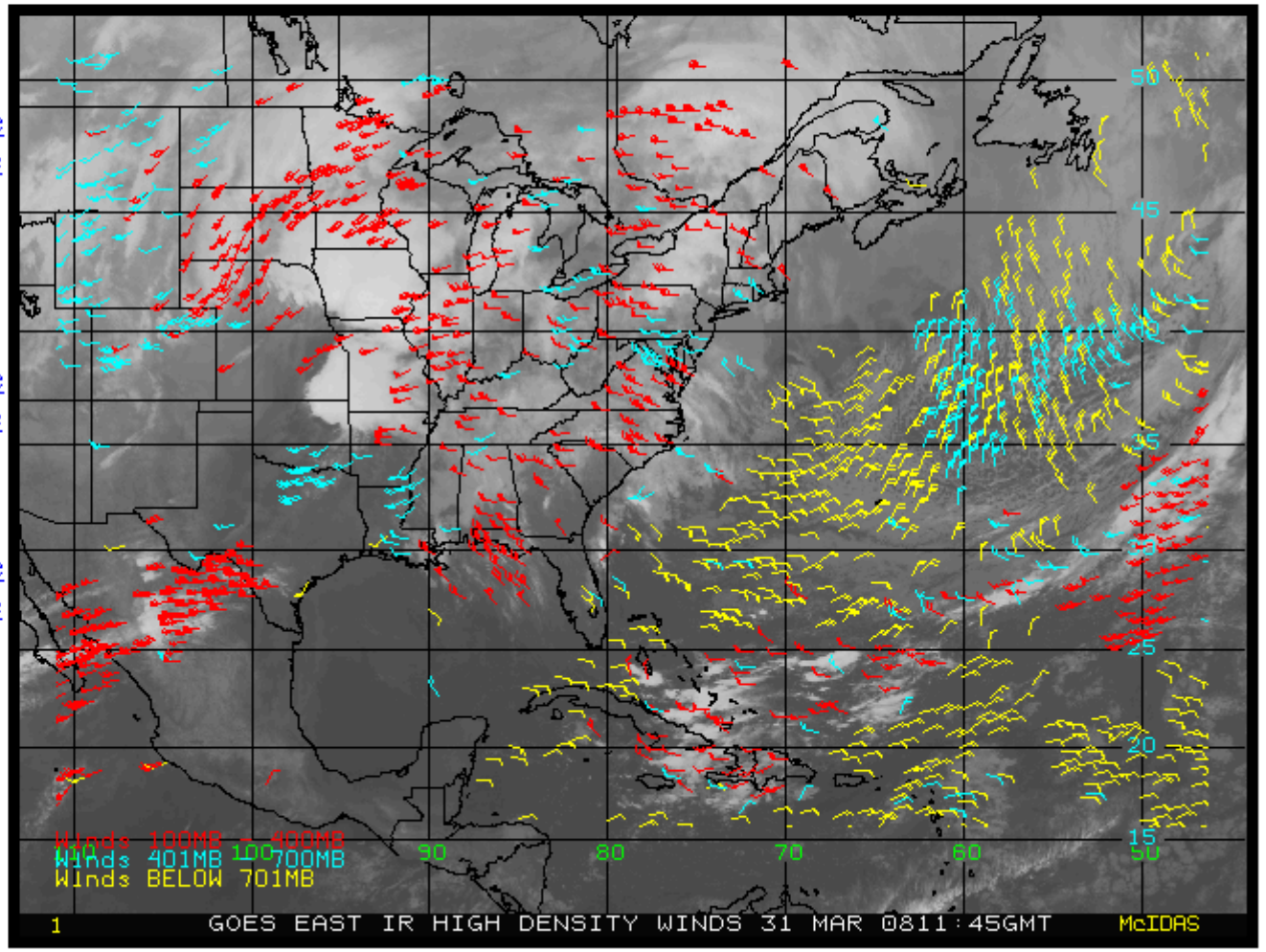
Wind data available in McIDAS MD file and ASCII formats via FTP.

GOES East Northern Hemisphere Infrared Winds

Current cycle is 12Z

Select another time

00Z
03Z
06Z



GOES West

CDALL	CDNH	CDSH	WVALL	WVNH	WVSH
00Z	00Z	00Z	00Z	00Z	00Z
03Z	03Z	03Z	03Z	03Z	03Z
06Z	06Z	06Z	06Z	06Z	06Z
09Z	09Z	09Z	09Z	09Z	09Z
12Z	12Z	12Z	12Z	12Z	12Z
15Z	15Z	15Z	15Z	15Z	15Z
18Z	18Z	18Z	18Z	18Z	18Z
21Z	21Z	21Z	21Z	21Z	21Z

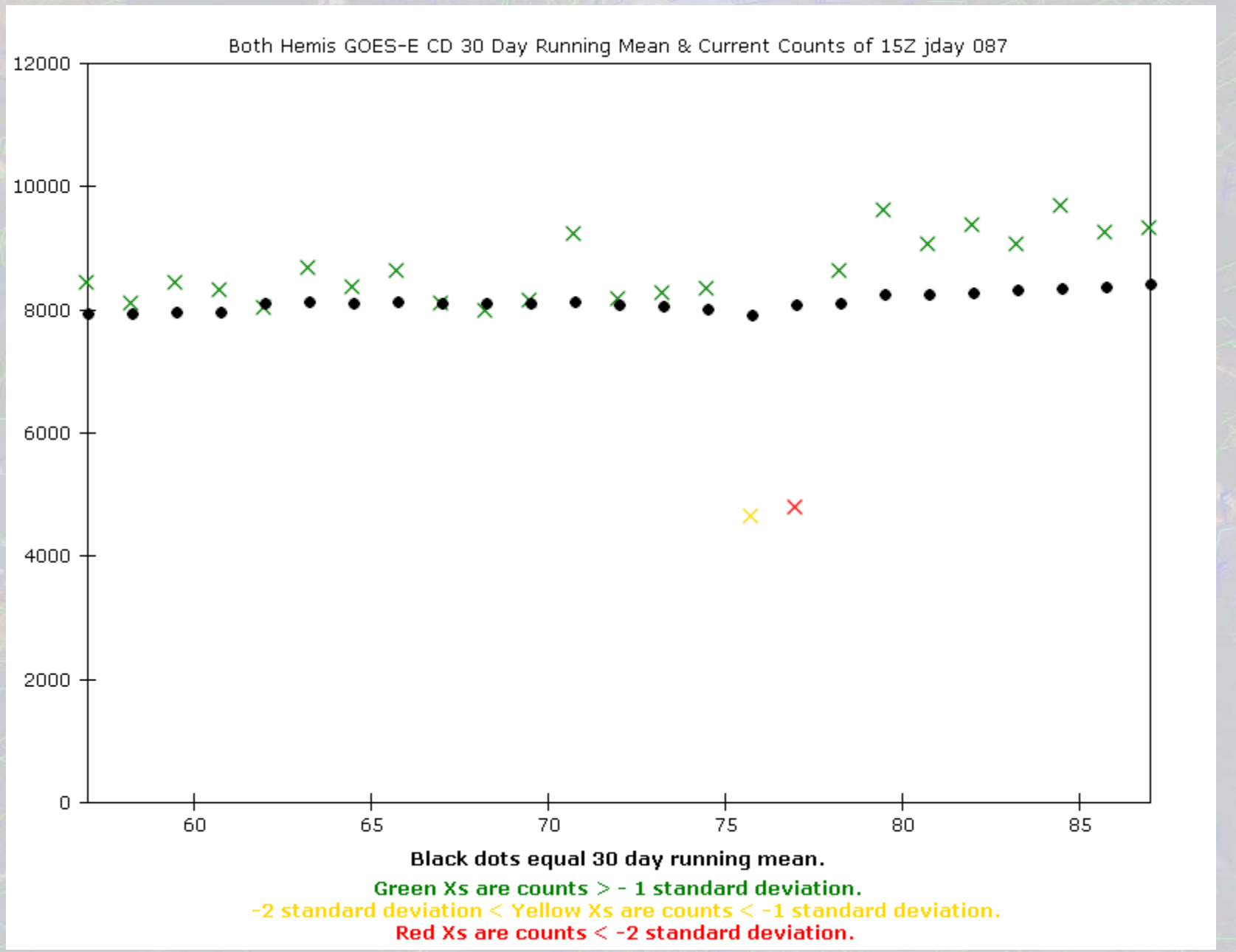
GOES East

CDALL	CDNH	CDSH	WVALL	WVNH	WVSH
00Z	00Z	00Z	00Z	00Z	00Z
03Z	03Z	03Z	03Z	03Z	03Z
06Z	06Z	06Z	06Z	06Z	06Z
09Z	09Z	09Z	09Z	09Z	09Z
12Z	12Z	12Z	12Z	12Z	12Z
15Z	15Z	15Z	15Z	15Z	15Z
18Z	18Z	18Z	18Z	18Z	18Z
21Z	21Z	21Z	21Z	21Z	21Z

A green background indicates the latest run is > -1 standard deviation of the 30 day running mean.

A yellow background indicates the latest run is < -1 standard deviation and > -2 standard deviations of the 30 day running mean.

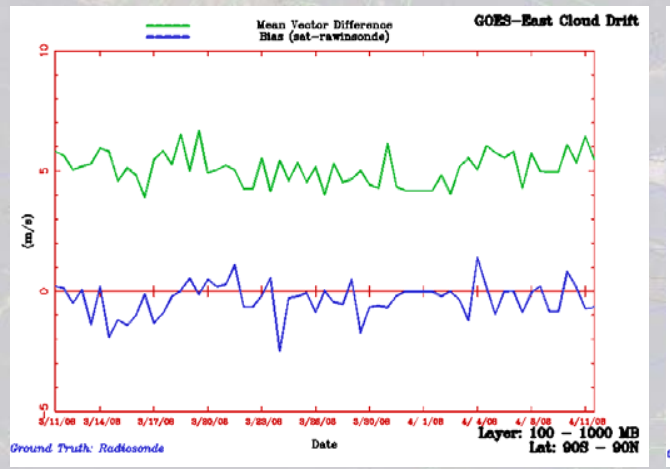
A red background indicates the latest run is < -2 standard deviation of the 30 day running mean
or the latest run failed.

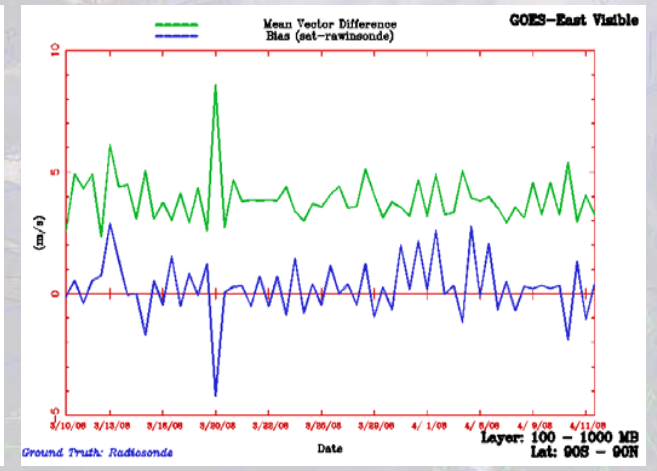

Both Hemis GOES-E CD 30 Day Running Mean & Current Counts of 15Z jday 087
12000
10000
8000
6000
4000
2000
0
60
65
70
75
80
85
Black dots equal 30 day running mean.
Green Xs are counts > - 1 standard deviation.
-2 standard deviation < Yellow Xs are counts < -1 standard deviation.
Red Xs are counts < -2 standard deviation.

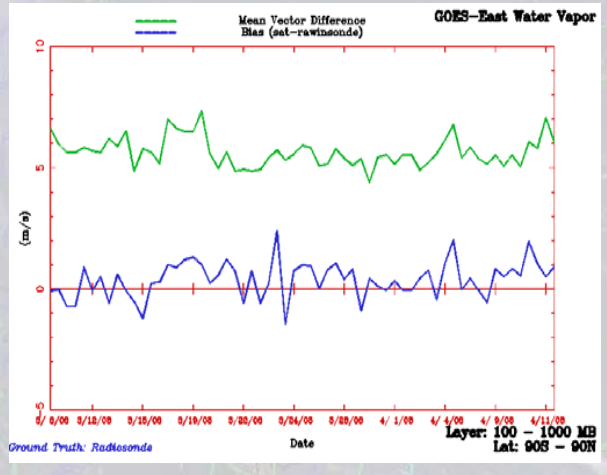
AMV Product Quality Monitoring

Daily Comparisons of AMVs with…

- **Radiosonde Observations**
  - ➢ **Statistics reported quarterly to CGMS**







NESDIS Operations Status Report

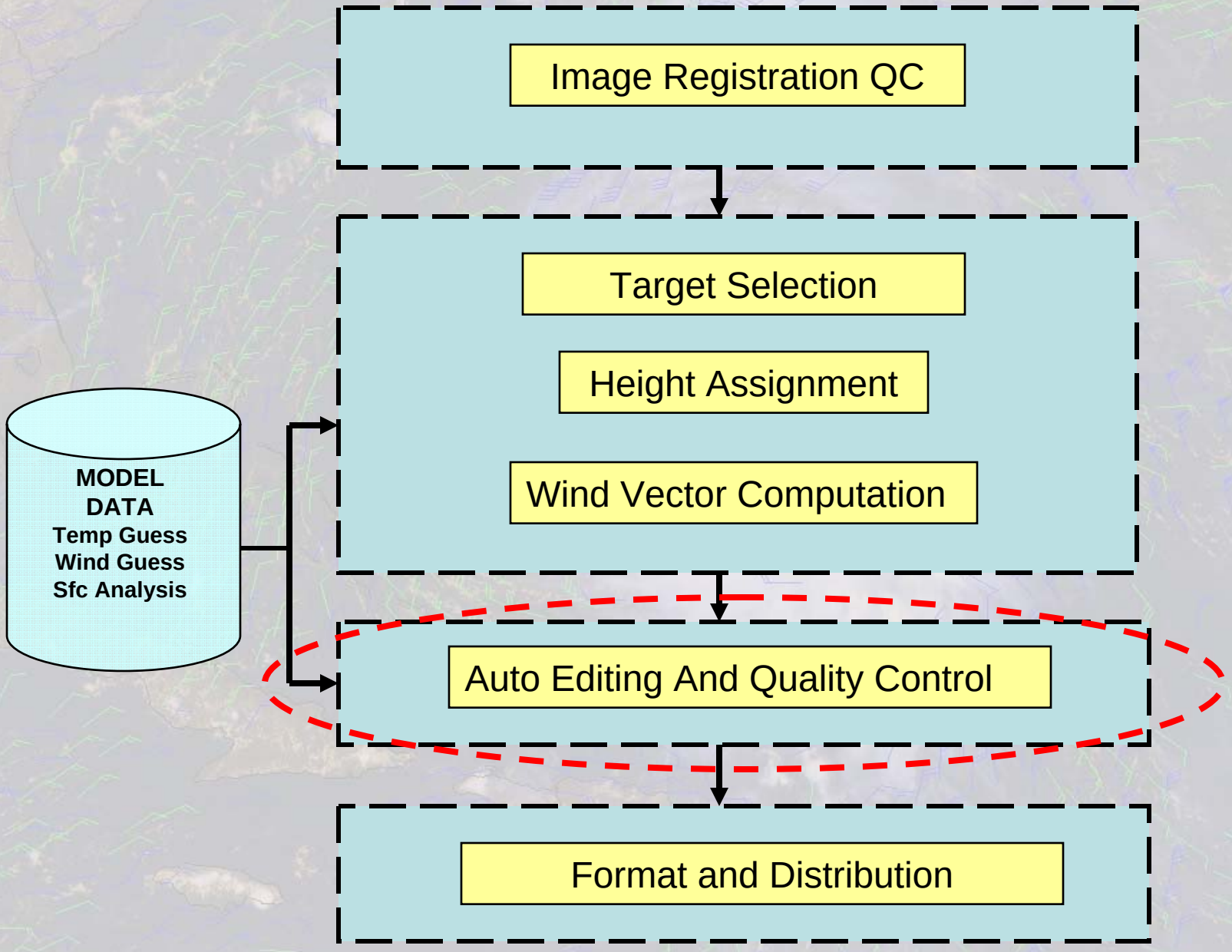
Operational AMV System:

System Architecture, Wind products, dissemination, product monitoring, and updates

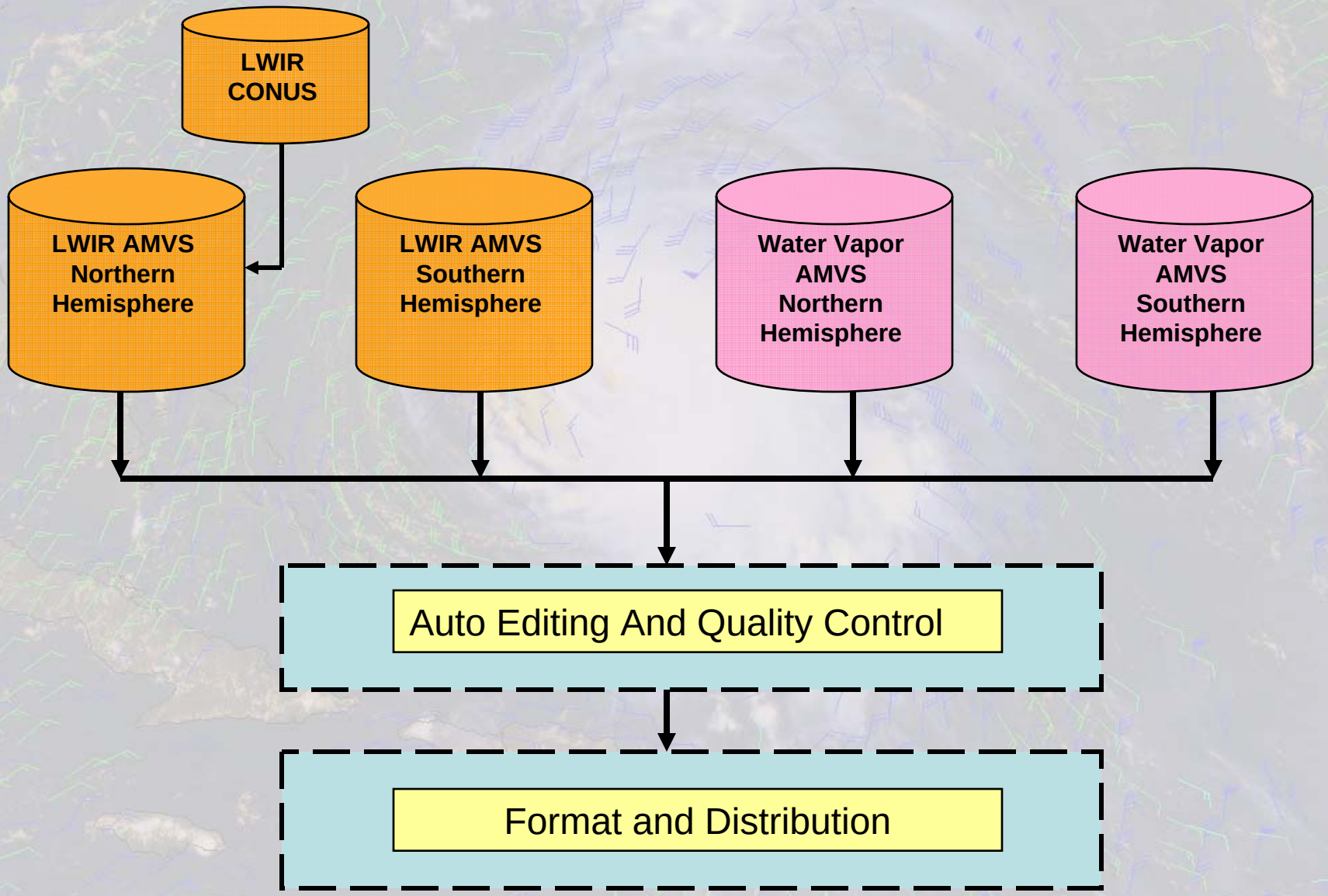
Opnl AMV System: **Updates Coming**

- **Implementation of Expected Error (EE) Technique (Jan 2008)**
  - Proposed by J. LeMarshall and developed at Australian BoM
  - Extension of EUMETSAT QI
  - At NESDIS we have integrated the EE software within our winds processing system
    - Executing routinely within our experimental parallel systems
    - Modified BUFR encoder to include EE after other quality indicators in BUFR message
    - Collecting AMV/Rawinsonde collocations and “tuning” up coefficients
    - Supporting JCSDA efforts to assess impact of MODIS AMV data thinning based on EE
- **MODIS Winds Upgrades (April 2008)**
  - Parallax correction
    - Pre-cursor for mixed Terra & Aqua winds processing
- **AVHRR Winds Capability (2008)**
  - **Serving CIMSS derived AMVS on GP16 (Summer 2006)**
  - **NESDIS in house processing to begin May 2008**
- **Hourly Winds**
  - **Demonstrated capability (April 2008)**
  - **Routine processing (2009)**
    - **Challenges**
      - **Need to prepare user community for increase in volume**
      - **Need to retool software to be more sensitive to timeliness issues**
      - **Need to possibly upgrade systems for increase storage and CPU capacity**

NESDIS AMV Processing



Ensemble Auto Editing For Operational AMVS



NESDIS Operations Status Report

Research To Operations

Research to Operations

- Three Distinct Paths

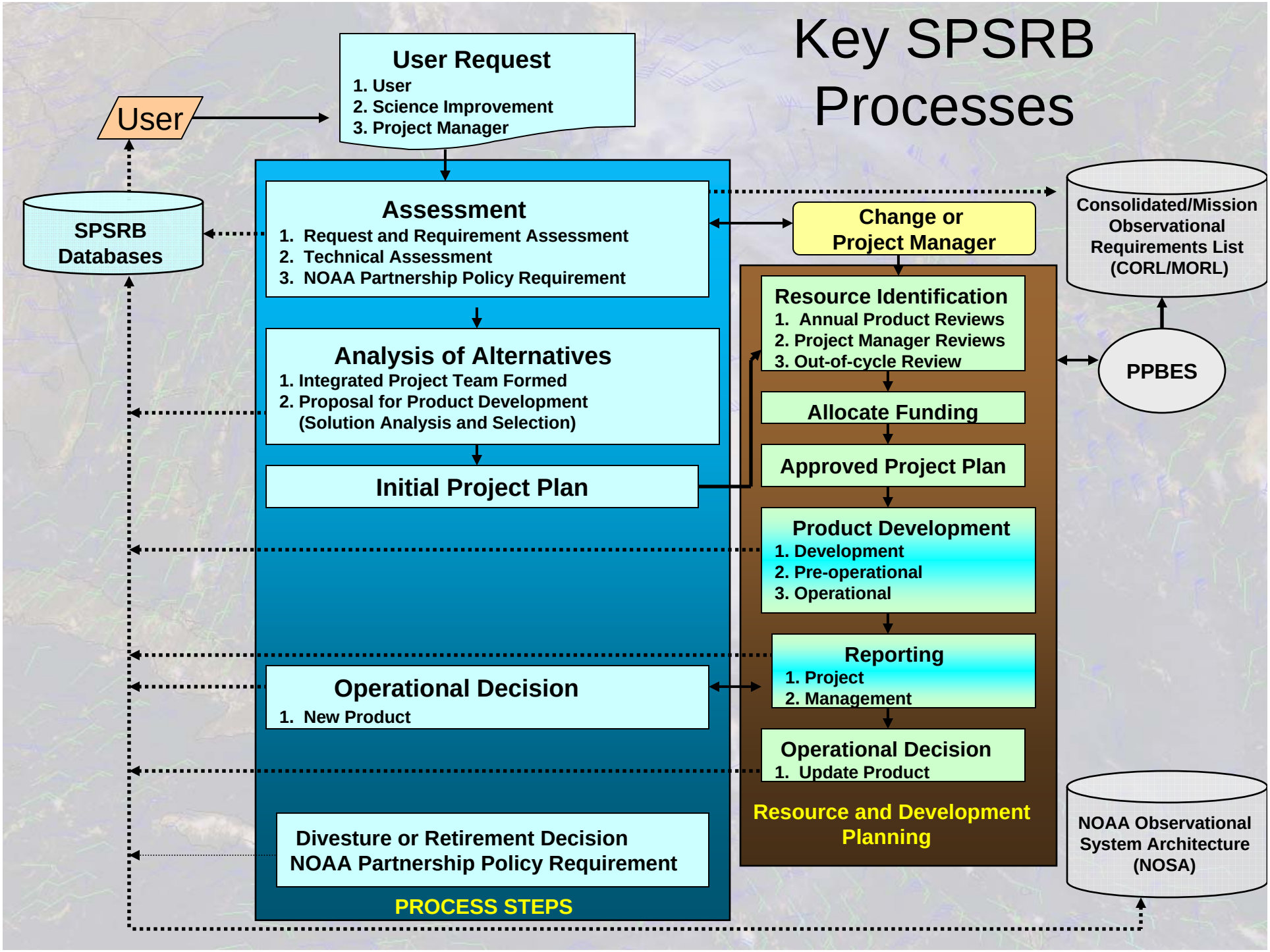
  - **User Request:** Users can identify a need for new or improved observations or products.

  - **Mature Science Development:** Scientists can identify maturing scientific development or algorithm thought to provide significant user benefit.

  - **NOAA *Program/NESDIS Project Manager Directed Project:*** NOAA/NESDIS program or project managers can provide requirements to develop new or improved products. These acquisition managers formulate plans to acquire the new products

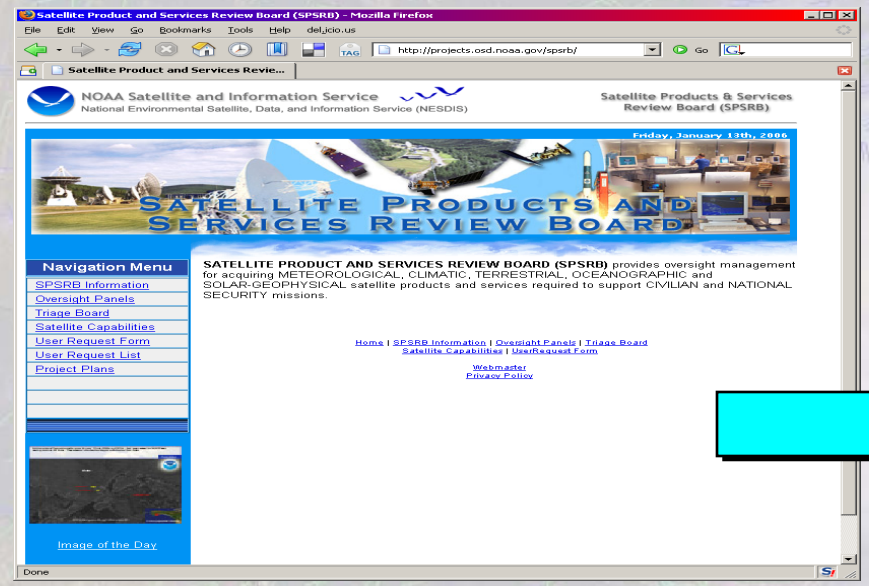
Satellite Products and Services Review Board (SPSRB)

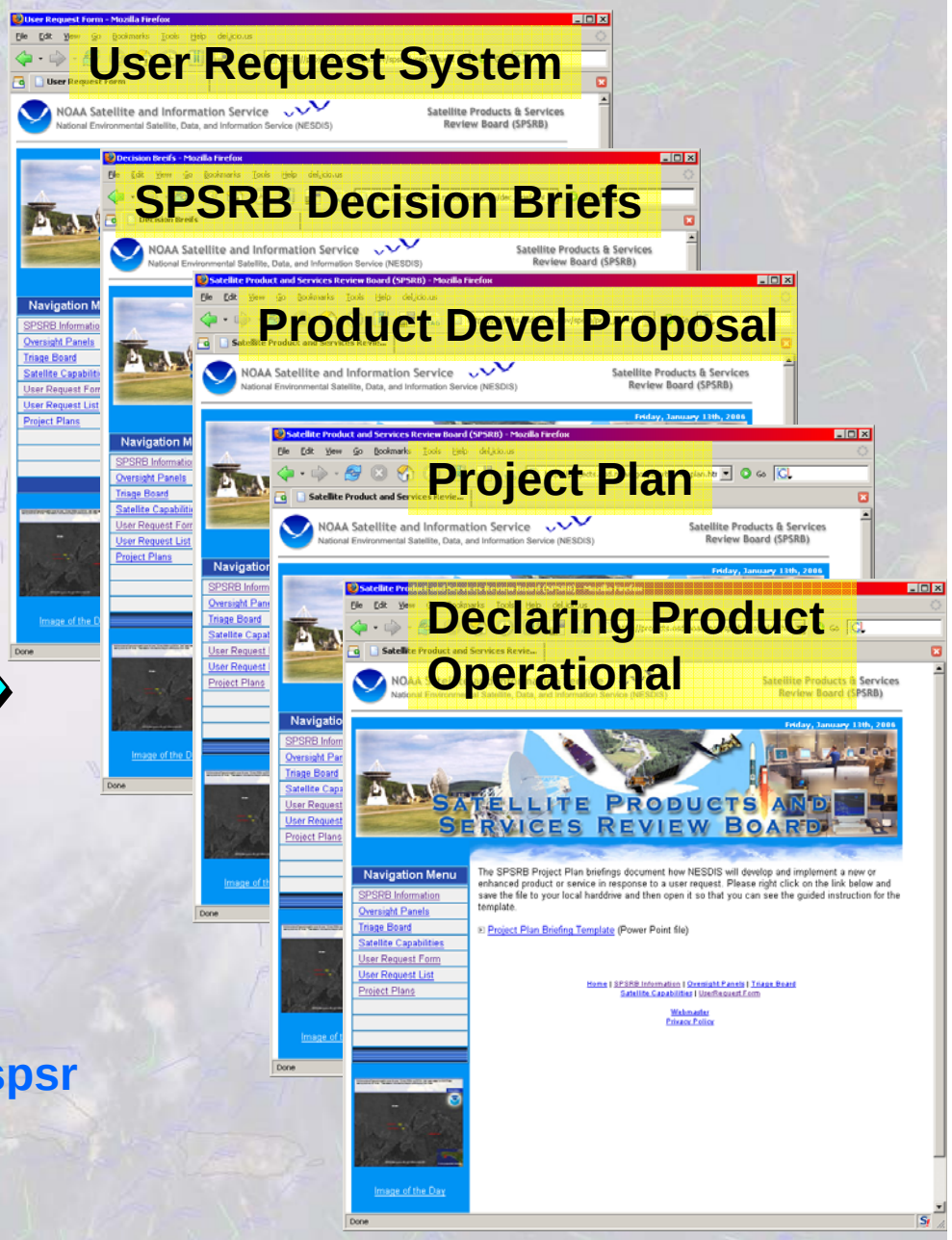
- Composed of principals from OSDPD, STAR and OSD
- Provides oversight and decision authority to effectively manage NOAA's satellite product life cycle process
  - Addresses user requests to enhance current products or generate new products in line with requirements of NOAA Mission Goals
  - Focuses on the transition of research into operations
  - Manages product development projects
  - Allows for divestiture and retirement of products
- Provides a powerful evaluation mechanism
  - Enables a more efficient use of personnel, fiscal and information technology resources
- Meets monthly (third Wednesday in Room 707 NSC) and moderated by executive secretary


Key SPSRB Processes
User
User Request
1. User
2. Science Improvement
3. Project Manager
SPSRB Databases
Assessment
1. Request and Requirement Assessment
2. Technical Assessment
3. NOAA Partnership Policy Requirement
Analysis of Alternatives
1. Integrated Project Team Formed
2. Proposal for Product Development (Solution Analysis and Selection)
Initial Project Plan
Operational Decision
1. New Product
Divesture or Retirement Decision
NOAA Partnership Policy Requirement
PROCESS STEPS
Change or Project Manager
Resource Identification
1. Annual Product Reviews
2. Project Manager Reviews
3. Out-of-cycle Review
Allocate Funding
Approved Project Plan
Product Development
1. Development
2. Pre-operational
3. Operational
Reporting
1. Project
2. Management
Operational Decision
1. Update Product
Resource and Development Planning
Consolidated/Mission Observational Requirements List (CORL/MORL)
PPBES
NOAA Observational System Architecture (NOSA)

SPSRB Web Site

http://projects.osd.noaa.gov/spsrb/





SPSRB Process Paper:
http://projects.osd.noaa.gov/spsrb/spsrb_info.htm