



# UPDATES ON OPERATIONAL PROCESSING FOR NOAA/NESDIS SOUNDING DATA PRODUCTS AND SERVICES

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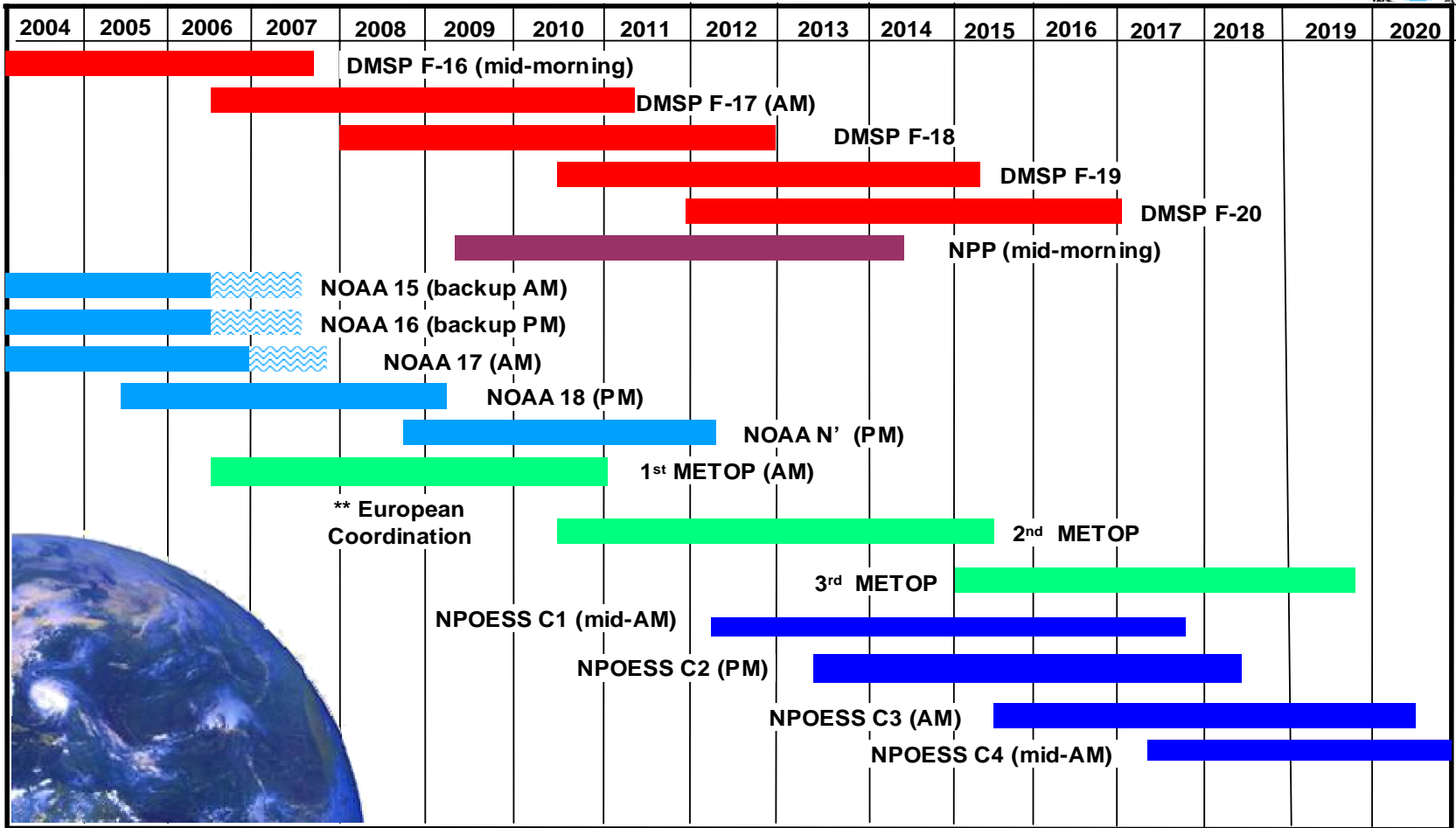
# NOAA/NESDIS Operation Updates



- POES Missions and Schedule (ATOVS... METOP ... NPOESS)
- Road Map for Atmospheric Soundings from IR and MW Sounders
- Products Processing Update
- Processing Changes
- Systems Changes
- Instruments Changes
- ATOVS Soundings System Changes
- Summary



# POES Satellite Launches\* Schedules (Calendar Year)



\* Actual launch dates are determined by the failure of on-orbit assets

\*\* Assumes METOP will provide the morning orbit and NOAA-N' will provide afternoon orbit instruments



# Upcoming Launches

- Metop
  - Readiness Date: October, 2006
  - Launch Date: Possible Oct 17, 2006
  - Operational Data Distribution – Launch + 90 days
- NPP Launch Date: 2009
- NOAA-N' Launch Date: March 2008
- NPOESS Launch: 2012
- Second Metop Launch Date: August 2010



# Product Processing Changes



ATOVS NOAA-15, 16 and 18 systems moved from IBM Mainframe (MVS Operating System) to IBM P570 (Unix System)

ATOVS Metop system is being developed on IBM P570 Unix System... similar to NPOESS



# IJPS, IPS Products Overview



- Level 1 Products  
Created at NOAA

- AVHRR
- AMSU-A
- HIRS
- MHS
- SBUV
- SEM
- [A]DCS
- SAR

- Level 1 Products  
Obtained from  
Eumetsat

- ASCAT
- IASI
- GOME
- GRAS

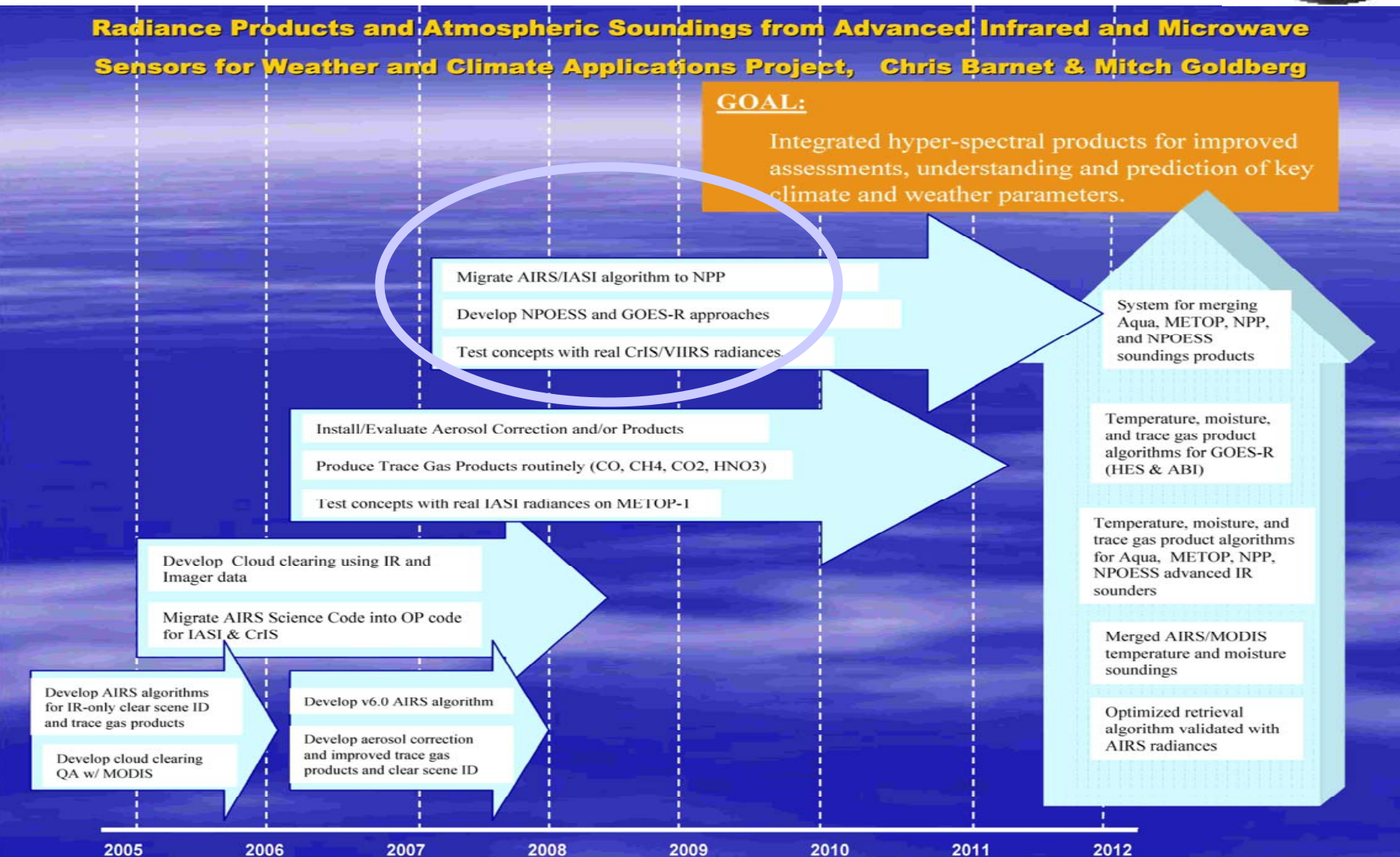


# CrIS/ATMS/VIIRS Product System is part of the NESDIS Advanced Product Roadmap

## Radiance Products and Atmospheric Soundings from Advanced Infrared and Microwave Sensors for Weather and Climate Applications Project, Chris Barnet & Mitch Goldberg

### GOAL:

Integrated hyper-spectral products for improved assessments, understanding and prediction of key climate and weather parameters.







# Instruments on Metop Used for Soundings



- AMSU-A: The Advanced Microwave Sounding Unit A1 and A2
  - » Microwave sounder with 15 channels in the spectral range of 23 to 89 GHz.
- MHS: The Microwave Humidity Sounder
  - » Microwave sounder with 5 channels from 89.0 GHz to 190.3 GHz.
- HIRS/4: High Resolution Infrared Radiation Sounder/4
  - » 19 infrared channel (3.8 – 15 microns) and one visible channel.
- AVHRR/3: Advanced Very High Resolution Radiometer/3
  - » 6-channel 1 km visible/IR (0.6-12 microns) imager





# Infrared Atmospheric Sounding

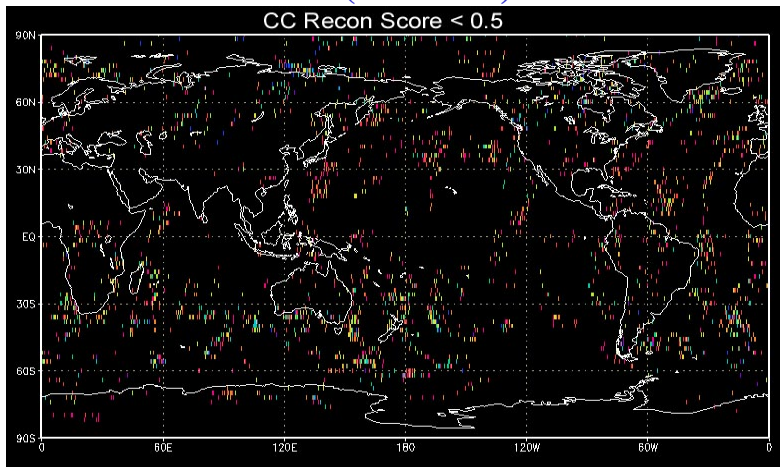


## Interferometer (IASI)

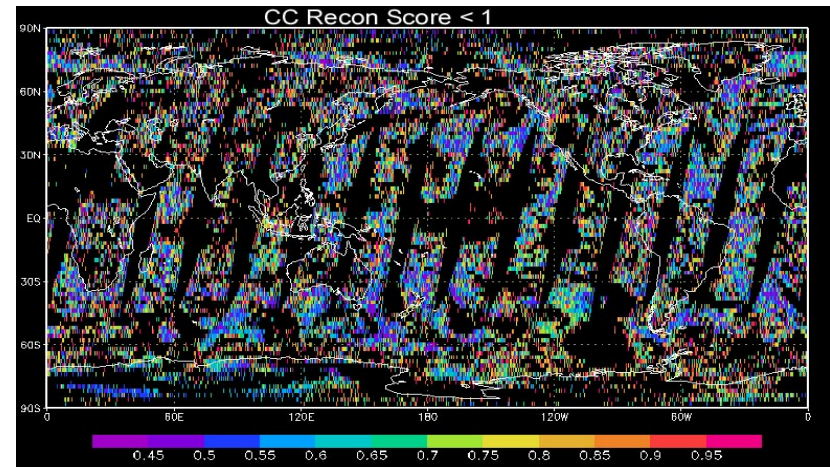
- Fourier Transform Spectrometer based upon a Michelson Interferometer (8461 channels)
  - Highly accurate atmospheric temperature and moisture data
- NESDIS products will include thinned radiances, principal component scores, cloud cleared radiances, carbon products, temperature, moisture, ozone profiles

## Cloud Cleared Radiances

Typically, less than 5% of a sensors Field of View's (13.5 km) are clear.



Cloud Clearing can increase yield to 50-80%.



*(Thomas King talk 12.3)*



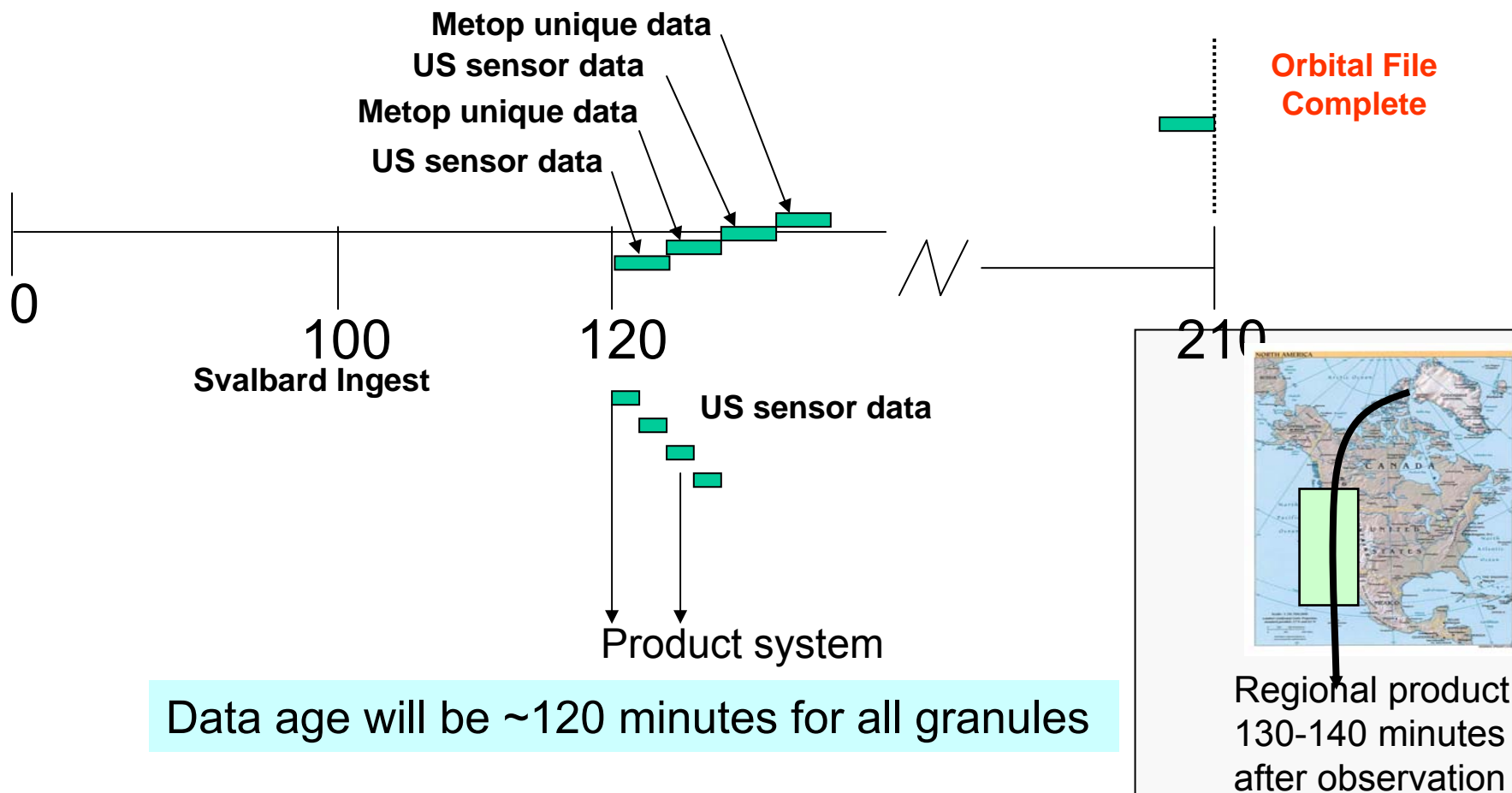
## IASI HIRS like OLR Products from Metop

- The IASI HIRS-like OLR Products would preserve the continuation of the HIRS OLR climate data record from future satellite instruments.
- The improved HIRS OLR will be the longest and continuous high quality satellite OLR product that has climate data record quality and would greatly complement the discontinuous broadband measurements.
- Improved and enhanced the capability in climate monitoring and climate analysis, especially through the implementation of the inter-satellite calibration and diurnal cycle adjustments.
- Improved quantitative accuracy and long-term stability in the Infrared Sounder OLR data record, which enables more accurate description and diagnostic studies of global climate.
- Data consistency can be preserved when AVHRR OLR is less likely available during NPOESS era.
- Data will be made available in December 2008



# METOP Pipeline Processing

- Pipeline processing: all data received ~120 minutes after observation
  - Applications with timeliness requirements will process in pipeline mode
- Orbital files generated ~210 minutes after observation





# NOAA-18 Updates

- MHS has shown improvement over AMSU-B
- N18 HIRS very unstable
- N18 HIRS is Frequently un useable
- HIRS-based operational products are not operationally produced.
- Improved timeliness for NOAA-18 blind orbits.

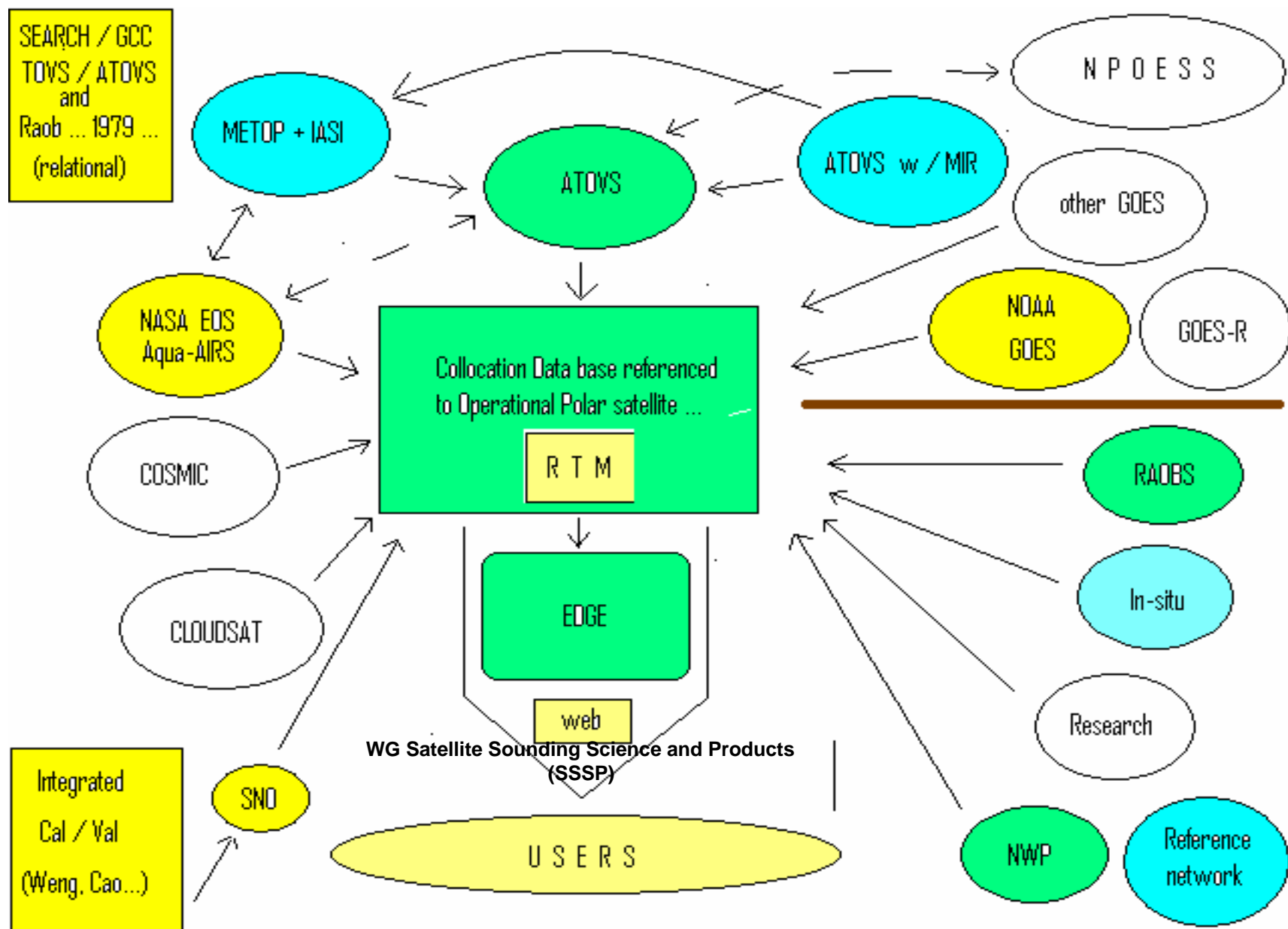
# ATOVS Surface / Sounding Products

(Fuzhong Weng, Tony Reale, Mitch Goldberg)

- *Incorporate MHS*
- Regression Guess replaces Library Search
  - Calculate First Guess Radiance (CRTM)
- *Integrate Microwave Integrated Retrieval System (MIRS) Products*
  - *TPW, CLW, Emissivity ... (Sid Boukabara talk 11.6)*
- Measurement (Radiance) Bias Adjustment
  - AMSU-A
  - MHS
  - HIRS
- *Integrate MIRS Retrieval Solution (CRTM) per sounding (Paul Van Delst, Fuzhong Weng, Yong Han)*
  - *based on Guess Temp and Moisture*
- *Baseline for NPOESS (... AIRS and IASI )*
- Peripheral Upgrades
  - Limb-adjustment
  - Complete NWP Profile (Srfc data, +/- 90 minutes, 3hr fcst ...)

Operational Product Environment  
to Provide  
Integrated Validation Datasets  
and  
Analysis

# Integrated Operational Product Data Validation (NPOESS IPO Award)

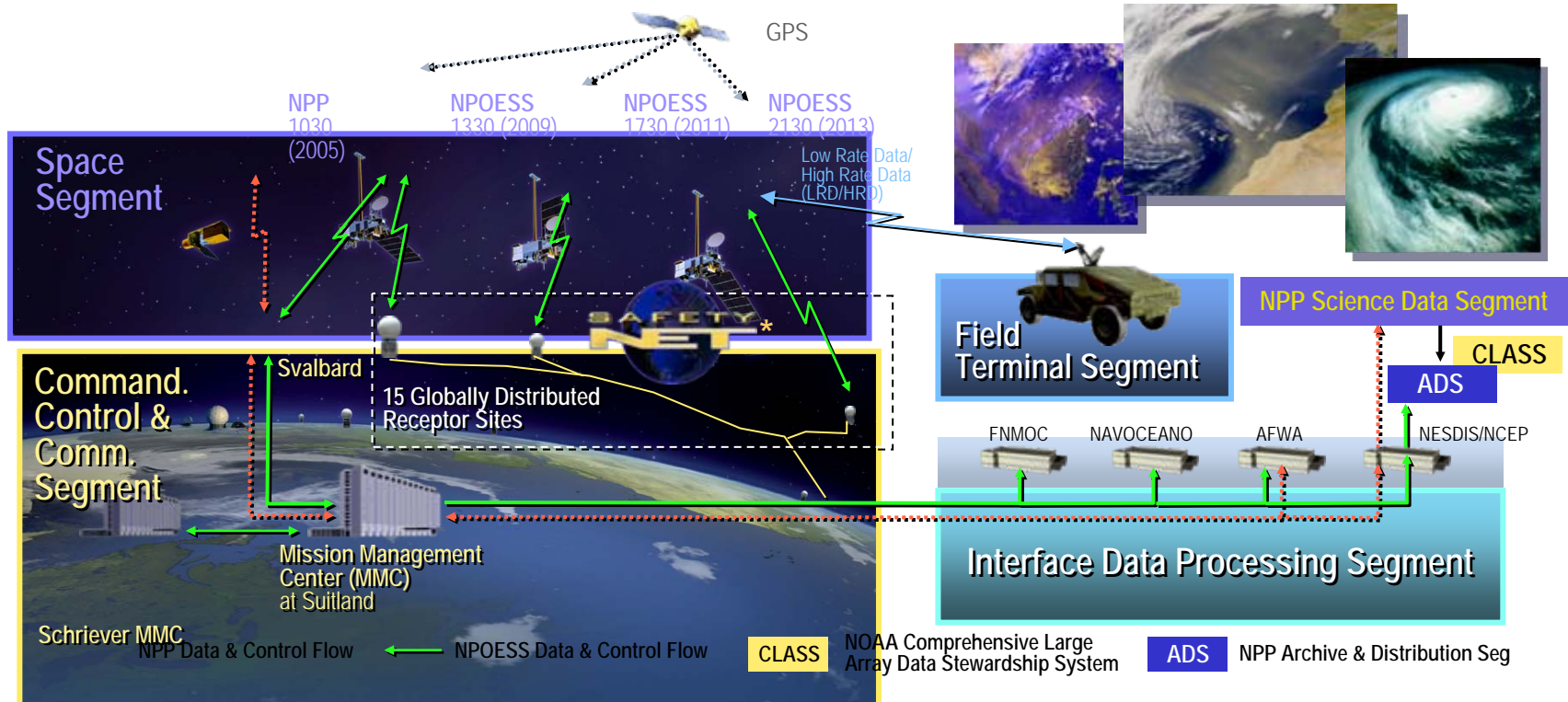






# NPOESS Mission

- Provide a national, operational, polar-orbiting remote sensing capability



A Tri-agency Effort to Leverage and Combine Environmental Satellite Activities

\* Patent Pending



# Open Issues

User receipt of IJPS products Granule vs Orbital

Shared Processing requirements

Dissemination of products generated in pipeline mode

Orbital to Granule Processing

Granule Size, Granule Naming convention, Missing Granules,  
Multiple Strings for operational and backlog processing,  
Granule Reprocessing, and Data Transmission Problems.

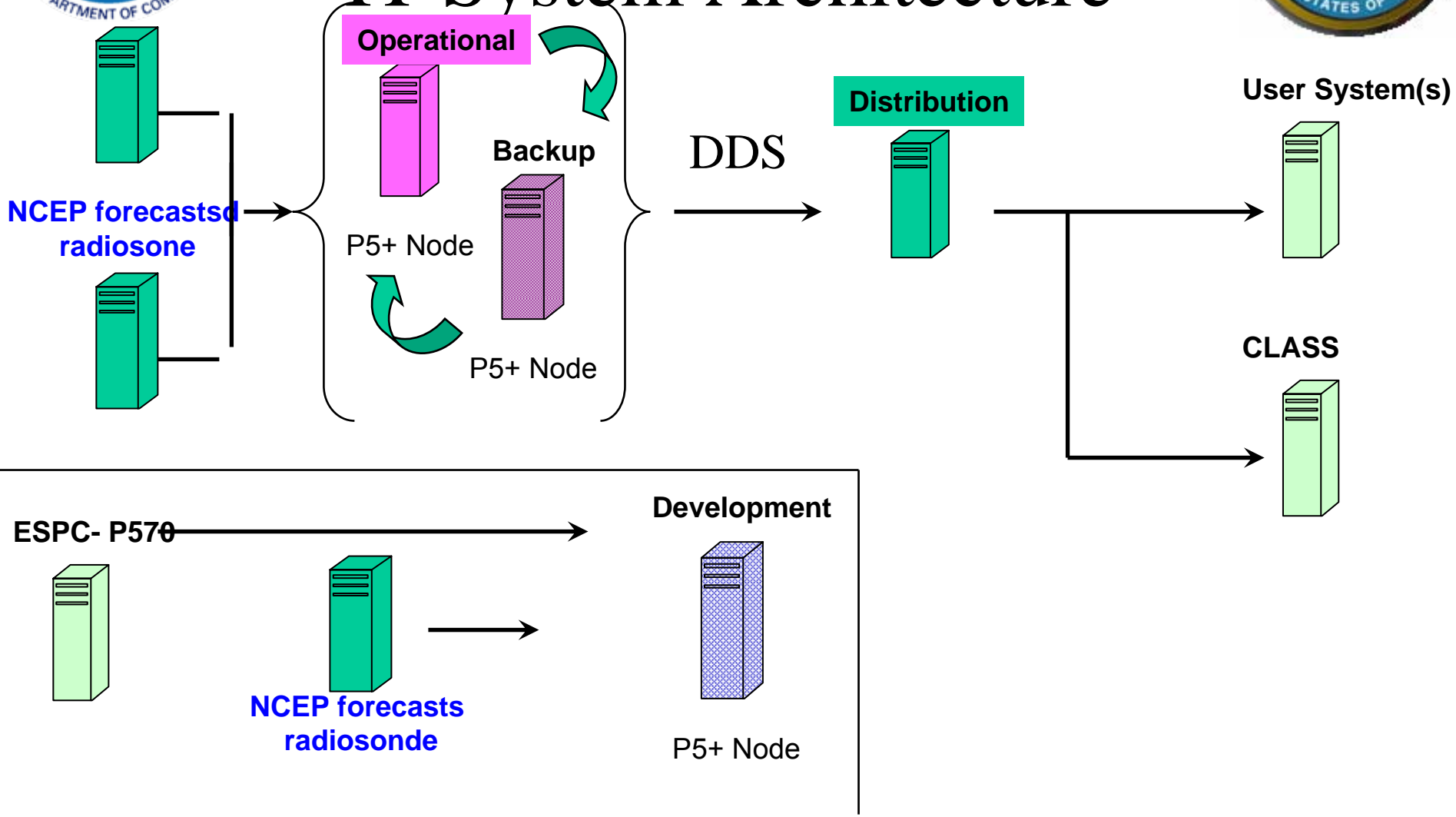
# Summary

- POES timelines ... ATOVS, DMSP, (AIRS), METOP, NPP, NPOESS
- Advanced Product Processing Roadmap (AIRS, IASI, Cris)
- NOAA will produce IASI-based Level-1 and Level-2 Products ... Distribution?... RARS
- ATOVS Operational Product Upgrades (w/ MIRS) and Integrated Product Validation
- Integrated NPOESS products for improved assessment, understanding and prediction of key weather and climate parameters

Extras



# IASI Product System IT System Architecture



Input Data Includes: **NCEP forecasts, and radiosonde data**



# IASI Capabilities Assessment

	Current Capabilities	Requested Capabilities				
Satellite Source (s)	AIRS (pseudo operational)	IASI	IASI	IASI	IASI	IASI
Product Name	AIRS Principal Components	IASI Principal Components	IASI Cloud Cleared Radiances	IASI Cloud Cleared PCA	IASI-ozone	IASI CO, CH4, CO2
Accuracy	n/a	n/a	≤ 1 K	n/a	20%/5-km near tropopause	CO: 40% mid-trop column (w/ 0.2 cm OPD SW band)
Latency	5 minutes after granule data is available	5 minutes after granule data is available	15 minutes after granule data is available	20 minutes after granule data is available	10% total column	CH4: 1% mid-trop column
Timeliness	3 hours	≤ 3 hours	≤ 3 hours	≤ 3 hours	15 minutes after granule data is available	CO2: 1% mid-trop column
Coverage	Global	Global	Global – scenes which satisfy cloud clearing assumptions	Global – scenes which satisfy cloud clearing assumptions	≤ 3 hours	15 minutes after granule data is available
Horiz Resolution	Every 5th AIRS FOV	Per IASI FOR	50 km (One IASI FOV collocated with AMSU FOV)	50 km (One IASI FOV collocated with AMSU FOV)	Global – scenes which satisfy cloud clearing assumptions	≤ 3 hours
Other attributes	2378 channels represented within 85 PC's	Compresses 8461 channels into N PC's. N needs to be determined, but it should be approximately 85 values	Optional QA w/ AVHRR clear masked pixels		50 km (One IASI FOV collocated with AMSU FOV)	Global – scenes which satisfy cloud clearing assumptions



# OSDPD Product Access



**<http://www.osdpd.noaa.gov/IPD/IPD.html>**

**<http://satprod.osd.noaa.gov/satprod/controlcenter.cfm>**

**<http://www.osdpd.noaa.gov/>**

**<http://www.oso.noaa.gov/>**

**<http://www.osd.noaa.gov/>**

**<http://www.class.noaa.gov/nsaa/products/welcome>**

**<http://www.ipo.noaa.gov/>**





# ATOVS System-200X

- Online and Offline Systems
  - Incorporate AMSU-B
  - Regression Guess replaces Library Search
  - Calculate First Guess Radiance (OPTRAN)
  - Measurement (Radiance) Bias Adjustment
  - “Unique” Retrieval Solution (OPTRAN)
  - Facilitate Channel Swapping



# ATOVS System-200X

## Continue ...



Regression Coefficients for First Guess Temperature and Moisture using AMSU-A/B

Retrievals Based on Channel Combinations, Predictors (ie, surface emissivity...)

Extended Validation ...

Radiance statistics ... including vs NWP

Product Grids

Instrument Health

Regression Coefficients for Radiance Bias Adjustment of AMSU-A, AMSU-B, and HIRS

MDB... First Guess and Bias Regressions

Radiance ... Gridding

Limb Adjustments



# IASI Hardware



Procured three sets of hardware (three IBM power 5 racks P570 with 16 CPUs in each).

3 TB of disk space for each machine (Operations, Test/Backup, and Development) on the SAN.

STAR is using one machine for development.

The other two will be used by OSDPD for operations and a test/backup.



# IJPS, IPS

## Overview of Upgrades for Metop (Continue)



- **New Preprocessor**
  - IBM RS/6000 (development) and P570 (operations) AIX platform for parallel processing
  - New Server for Data Distribution (DDS)
  - Processing based on Data Driven Scheduler (OPUS)
  - Processing on a distributed (scalable processor) UNIX platform for parallel operations
  - Preprocessing of blind orbit GAC in pipeline mode
  - Producing common instrument Level 1b's from Metop in pipeline mode
  - Producing new Level 1b's for MHS and Full Resolution GAC (FRAC)



# IJPS, IPS

## Overview of Upgrades for Metop



- New Ingestor and Front End Processor (FEP)
  - Ingest of common instrument data, from the GDS as CCSDS VCDUs, in pipeline mode
  - Frame synchronizing and filtering of GDS data at Ingest
  - Receipt and distribution of ASCAT, GOME and GRAS Level 1b and IASI Level 1c products
  - Ingest blind orbit GAC, in pipeline mode
  - Produce instrument (NOAA) Level 1a's (i.e., for POES data - decommutate the TDM stream)



# Metop Data Storage Requirements



## Unique EUMETSAT Level 1

File	Size (bytes)	Bytes/Day
ASCAT 1b	25,060,966	353,359,626
IASI 1c	2,083,059,139	29,371,133,854
GOME 1b	582,892,913	8,218,790,068
GRAS 1b	188,743,680	2,661,285,888
<b>TOTAL:</b>	<b>2,879,756,698</b>	<b>40,604,569,436</b>

File size and "Bytes/Day" are based on a 102-minute orbit and 14.1 orbits per day

# NPP RDR Sizing Estimates

Sensor	Granule Size (MB)	Granule Size with HDF5 (MB)	Total Size per Orbit (GB)	Total Size per Day (GB)
VIIRS	38.52	46.22	9.61	136.33
CrIS	2.66	3.19	2.37	33.62
ATMS	0.19	0.23	0.17	2.40
OMPS	1.26	1.51	0.24	3.34

- Numbers are based upon the IDPS Sizing models

Sensor	Granules per Orbit	Granule Length (sec)
CrIS/ATMS	761	8
VIIRS	213	28.58
OMPS	160	38





# Update Product Applications for Pipeline Processing



- Atmospheric Soundings, Real-time Ozone, Hazards, Microwave Surface and Precipitation, CLAVR Cloud Flags
- Applications that plan to use 1-km AVHRR data from Metop are CLAVR cloud flags, Aerosol, Imagery, CoastWatch, Radiation Budget, Sea Surface Temperature, Vegetation, Hazards, Snow/Ice & Significant Event Imagery
- Level 1 Metop Unique Products (IASI, ASCAT, GOME, and GRAS) EUMETSAT will process this data via pipeline mode and transmit 3-minute files as the data becomes available. These data are pushed to NOAA from EUMETSAT through the NOAA Gateway (NRT) in Darmstadt. The NRT will send the Level 1 Metop Unique Products (3-min. files) via FTP protocol to the GFT, which in turn will ship the data to the AIX for processing.



# ATOVS Porting

## **Porting ATOVS from IBM Mainframe to IBM Unix Platform**

- Old IBM Mainframe (Amdahl) MVS Operating System
- New IBM P570 (2 nodes) Unix Operating System

Diamond is Operational Production System

Emerald is a test and back system

OPUS Data Driven Scheduler

DDS Data Distribution System

- ATOVS systems running for NOAA Satellites (N15, 16, and 18) and will be extended for EUMETSAT (Metop-2)
- **AMSU-B Standalone System is terminated**