Development of the NOAA/NESDIS IASI Product Processing System

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Outline

- Objectives

- Incoming Data for Operations

- System Design and Processing

- Products and Distribution

- Summary

Objectives

- Provide in near real-time the following products to NWP centers in the US
  - » Subset IASI level 1C radiances
  - » Reconstructed IASI radiances
  - » IASI Principal components
  - » Cloud cleared IASI radiances
  - » Trace gas profiles

- Build an IASI product processing system

- Simulate IASI, AMSU-A, and MHS data to test the product processing system ingestion, product generation, and distribution

- Use the AIRS/AQUA product processing and simulation system as a basis for IASI

Incoming Data for IASI Operations

- IASI Level 1C (EUMETSAT)

- AMSU-A Level 1B (NOAA)

- MHS Level 1B (NOAA)

- AVHRR Level 1B (NOAA)

Data from EUMETSAT

- EUMETSAT PFS files (~60 MB/granule)
- Granules 176 seconds in length
- 22 scans per granule (1 scan/data record)
- 4 IASI FOVs within a field of regard (FOR)
  - » 8700 IR channels with two guard bands around the standard 8461 channel set
  - » Scan geometry
  - » QC flags
  - » Calibrated IASI image on the IASI FOR
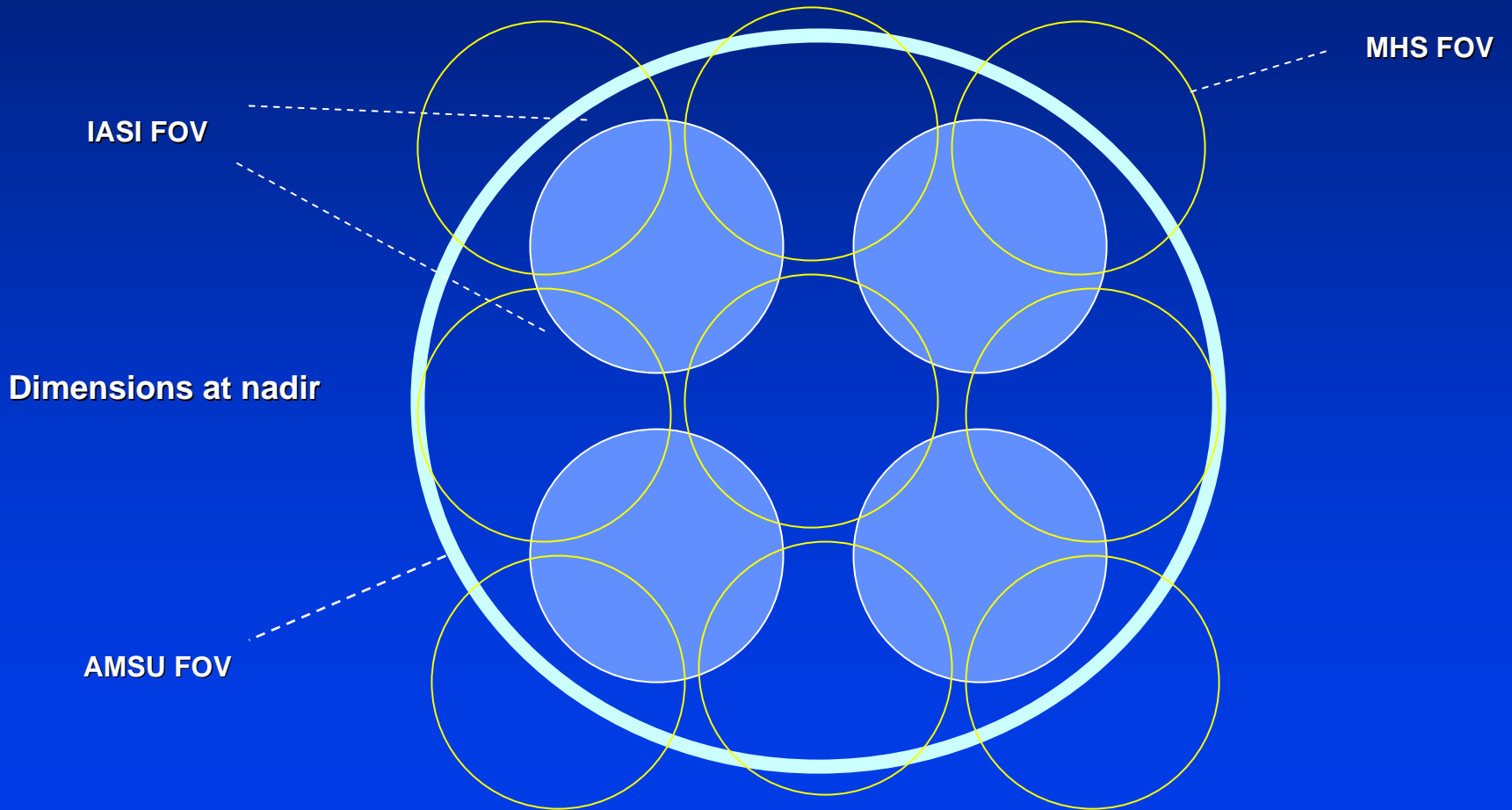- → Total of 29 GB/day …..this is why we subset!

Data from NOAA

- **AMSU-A**
  - » Level 1B orbital files
  - » 15 microwave channels

- **MHS**
  - » Level 1B orbital files
  - » 5 microwave channels

- **AVHRR**
  - » Level 1B orbital files
  - » 1 km global coverage
  - » 5 channels (IR and visible)
    - – 6 frequencies, 5 transmitted channels
  - » CLAVR cloud mask

The IASI Field of Regard

MHS FOV

IASI FOV

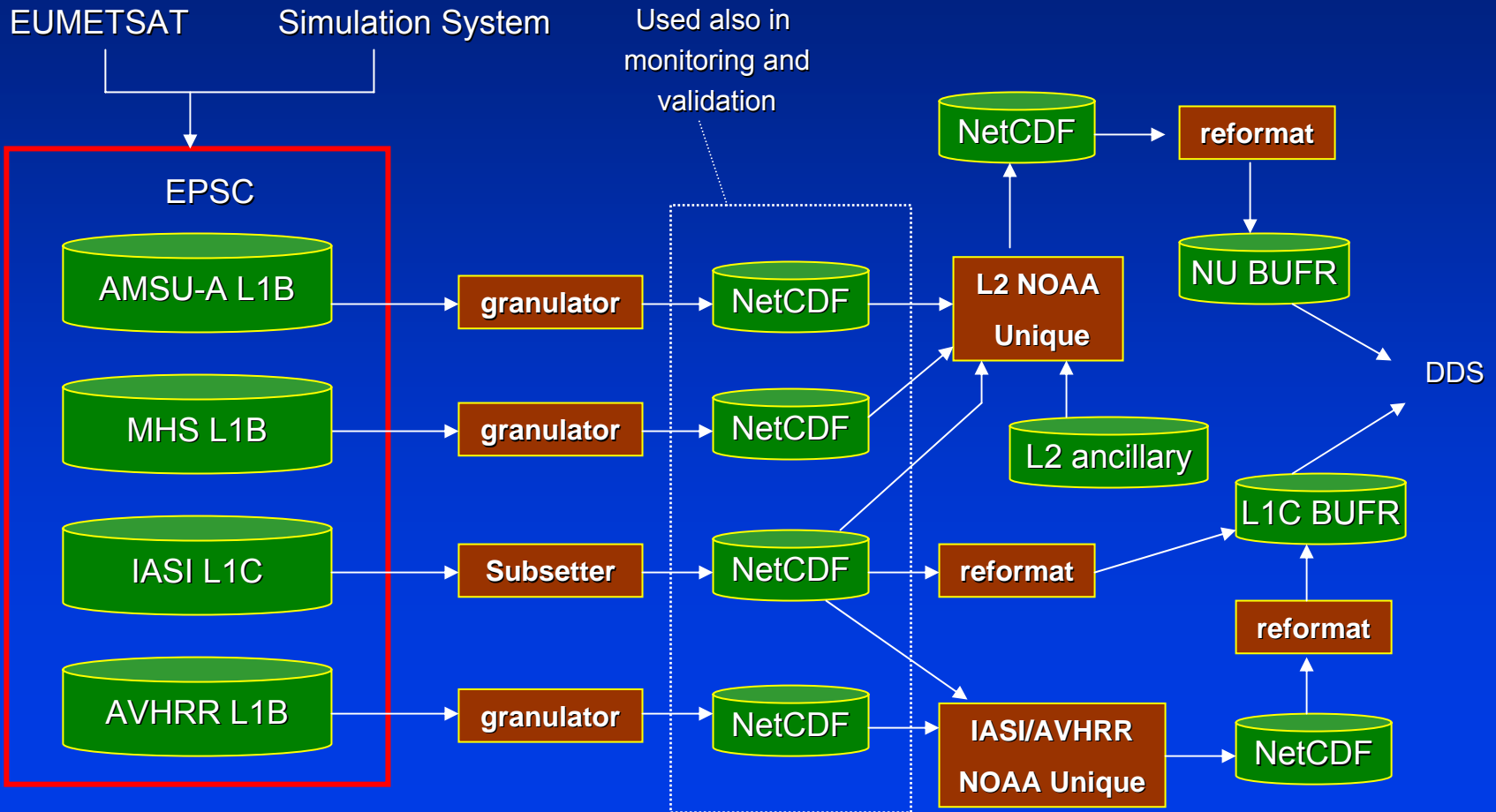Dimensions at nadir

AMSU FOV

System Hardware

- IBM Power 5
  - » 16 CPUs
  - » 2 GB memory/CPU (P5-570s)
  - » 8 GB of swap space
  - » 3 TB disk space

- 3 of these systems in total:
  - » Production machine
  - » Backup production/test machine
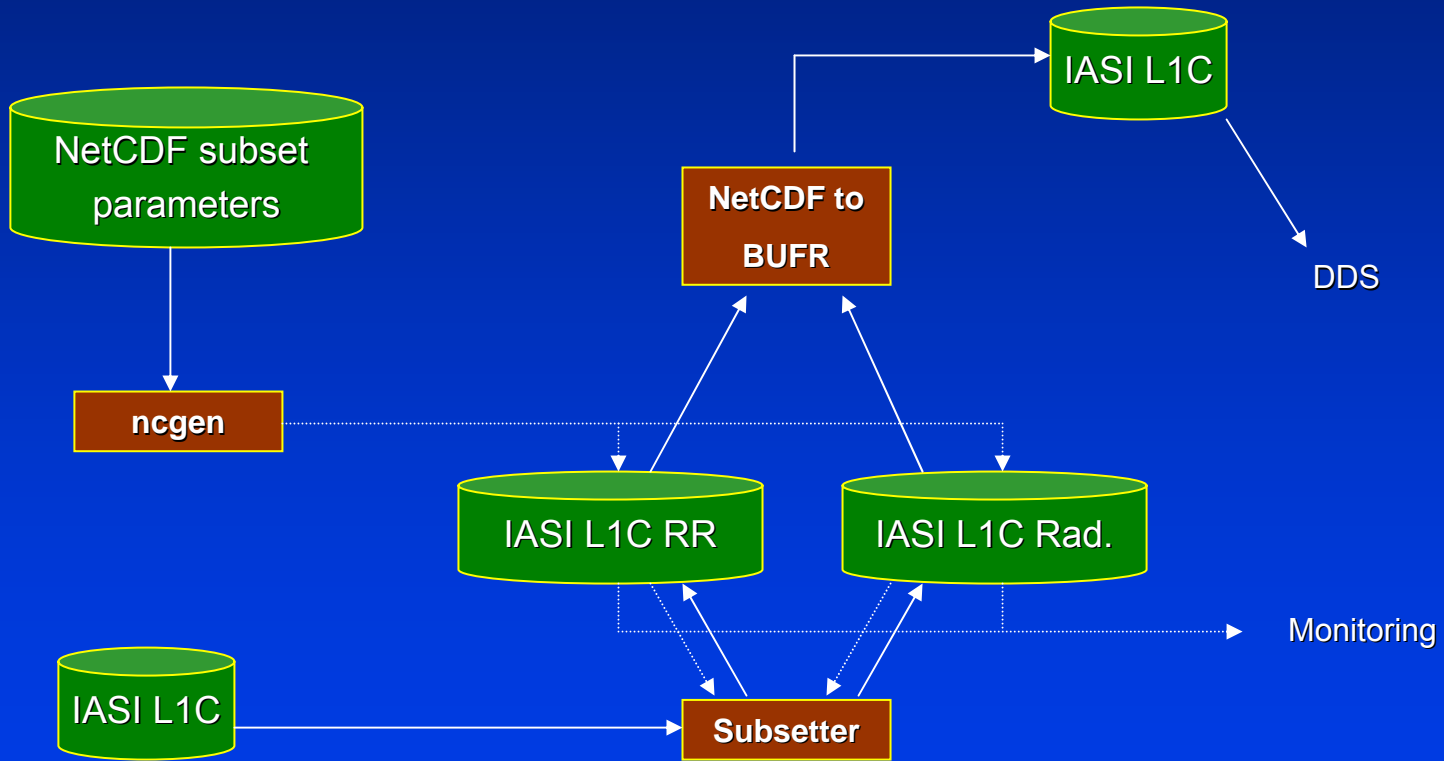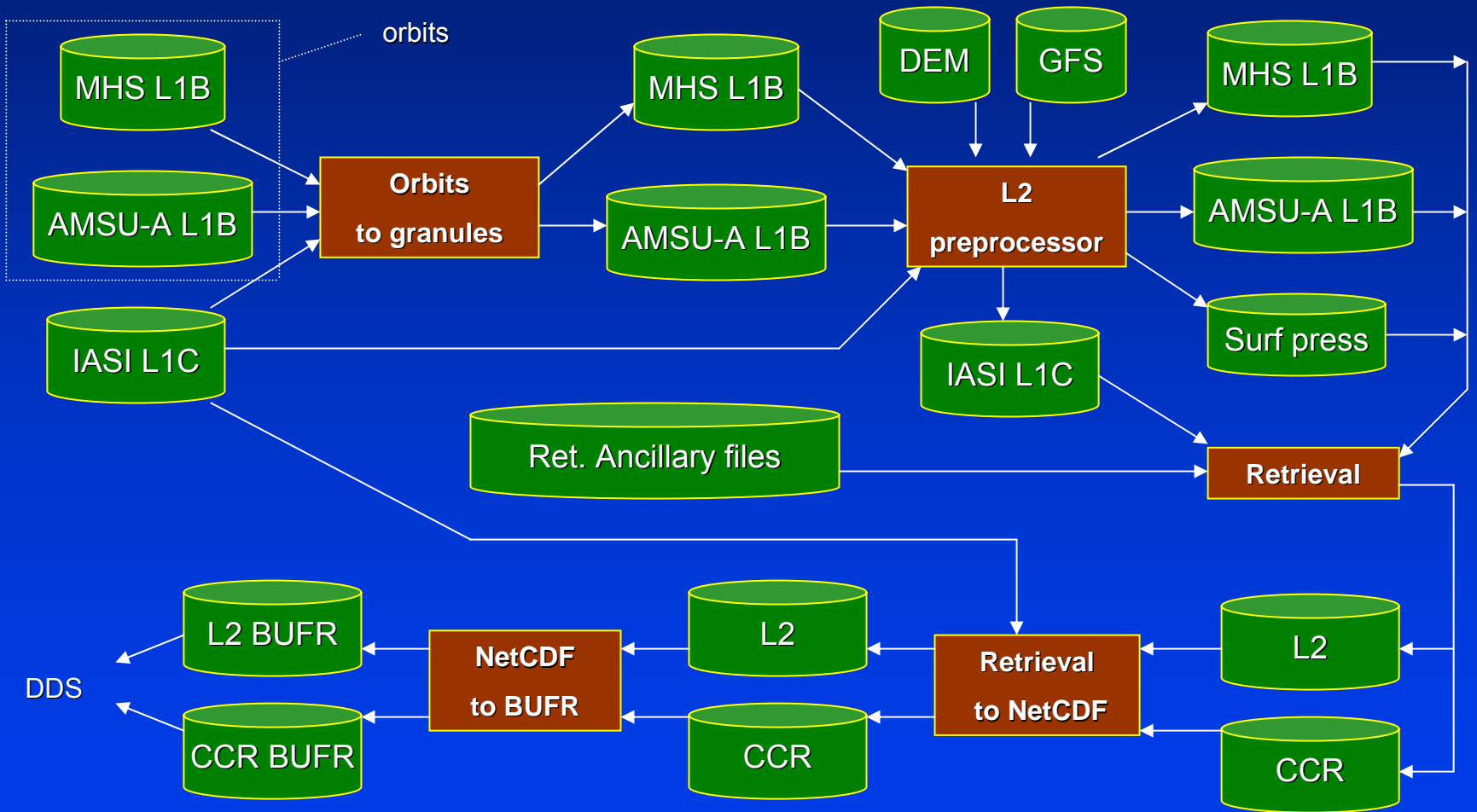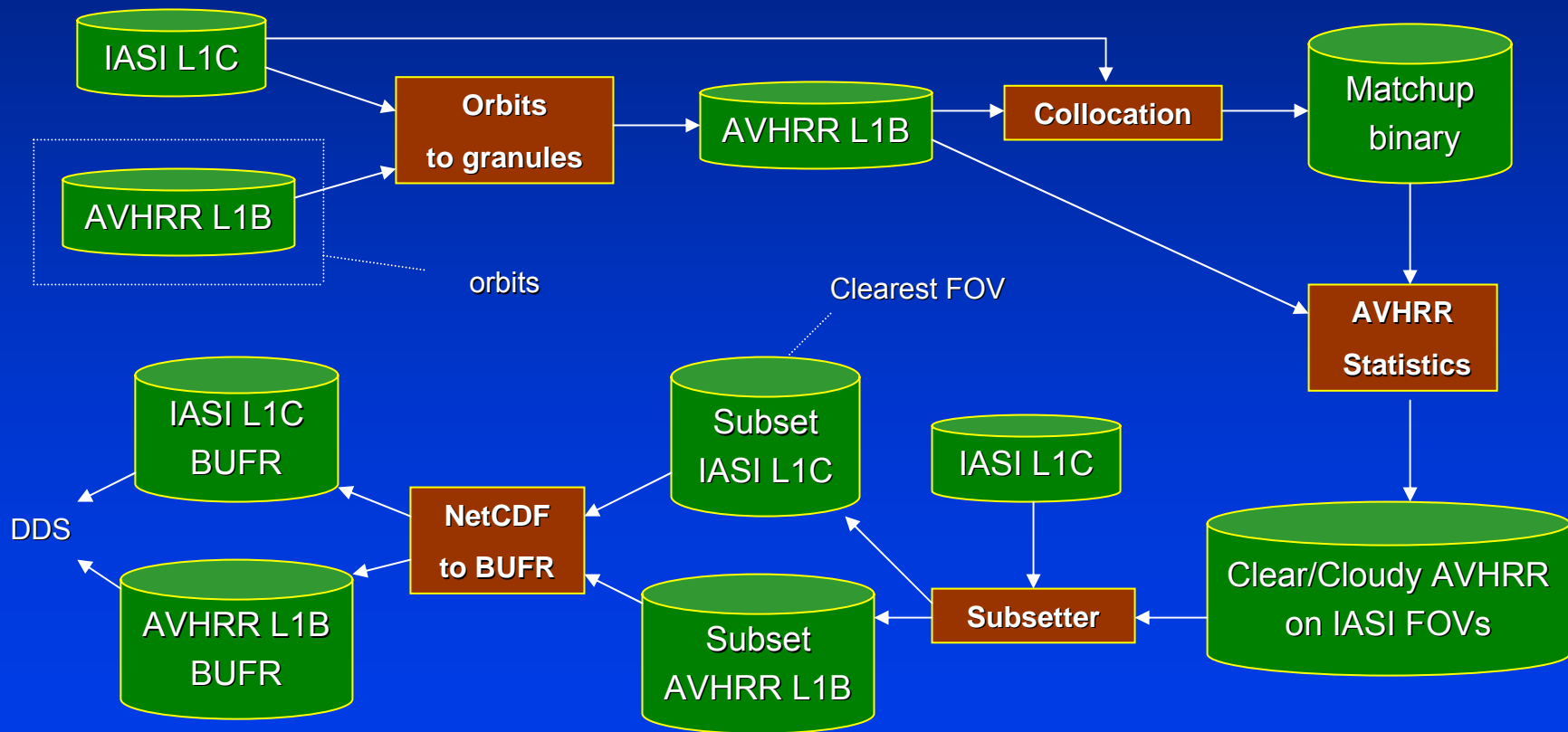 - » Development machine

Production System Design

IASI Level 1C Processing

IASI L2 NOAA Unique Processing

IASI/AVHRR NOAA Unique Processing

Subsetting

- **Spectral Subsets**
  - » Chosen using information content studies
  - » Extract a set of channels of the original 8461 set
  - » Collapse the 8461 channels into a set of principal components

- **Spatial Subsets**
  - » Select specified FOVs from the granule
  - » Spatial thinning scheme
  - » Clearest or warmest FOV

- The subsetting system uses CDL templates containing all the subset parameters. Modification of a template allows us to quickly change or generate new subsets.

Output File Formats

- BUFR
  - » The standard format for NWP centers
  - » Worked with EUMETSAT and NCEP on tables
  - » Level 1C table is complete; the Level 2 table is in progress
  - » Simulated near real time IASI BUFR files are currently available to the following NWP centers for evaluation:
    - – EUMETSAT, NCEP, GMAO, UK-Met, ECMWF, Meteo-France, CMC (Canada), JMA (Japan), NRL

- NetCDF
  - » Intermediate internal format that may be distributed to users

- Binary
  - » An internal final format for validation and monitoring
  - » Format is compact and I/O is simple
  - » No toolkits or APIs are necessary, just a reader and a writer are required

Current Products

Instrument	Channels	Data Type	IASI FORs	IASI FOV #	Format
IASI	*616	RAD	Every other FOR (330/granule)	1st	BUFR NetCDF
IASI	8461	RAD	All FORs (660/granule)	1 (warmest)	BUFR NetCDF
IASI	8461	RAD	All FORs (660/granule)	1,2,3,4	BUFR NetCDF
IASI	*616	RR (from 200 PCS, 1 band)	Every other FOR (330/granule)	1st	BUFR NetCDF
IASI	*616	RR (from 200 PCS, 1 band)	All FORs (660/granule)	1,2,3,4	BUFR NetCDF
IASI (using AVHRR)	8461	CCR	All FORs (660/granule)	1 (warmest or clearest)	BUFR NetCDF
AVHRR (on IASI FOVs)	5	RAD (clear and cloudy)	All FORs (660/granule)	1,2,3,4	BUFR NetCDF
IASI	8461	CCR from retrieval	All FORs (660/granule)	1,2,3,4	BUFR NetCDF
IASI	100 levels	L2 (CO_2, O_3, CH_4, CO)	All FORs (660/granule)	NA	BUFR NetCDF

PCS - Principal Components; RAD - Radiance; RR - Reconstructed Radiance; CCR – Cloud cleared radiance; FOR - Field of Regard; * 616 channel set determined through a NOAA/ECMWF collaborative effort.

Products for Validation/Monitoring

- **Daily Matchups**
  - » Radiosondes
  - » ATOVS
  - » Available for Level 1C and Level 2 data

- **Daily Global Grids for Validation**
  - » Gridded data from the IASI level 1C and Level 2 data
  - » Gridded forecast (GFS and GDAS) data

- **Daily Global Binaries for Monitoring**
  - » Eigenvector generation
  - » Monitoring

- **Granule-Level Binaries for Near Real Time Monitoring**
  - » Level 1C FOV spectra
  - » Level 2 profiles
  - » Granule images

Distribution

- The NOAA/NESDIS/ESPC DDS server will be the staging location for product distribution.

- Processing scripts and code can only copy (scp/ftp) data to this distribution server. They won't actually be sending data directly to users.

- Therefore, a separate set of scripts, managed by NOAA/NESDIS/ESPC, will handle the distribution server file management and the "pushes" of products to the various users. Or users may "pull" the data from the server.

- For DDS access, users will need to contact A.K. Sharma to obtain accounts (Awdhesh.Sharma@noaa.gov).

Current Distribution List

- NCEP
  - » Subset level IASI 1C radiances (BUFR)
  - » Subset IASI principal components (BUFR)
  - » Subset IASI reconstructed radiances (BUFR)
  - » Clearest/Warmest IASI FOVs from each field of regard (BUFR)
  - » IASI NOAA Unique products (BUFR)

- GMAO
  - » Subset IASI level 1C radiances (BUFR)
  - » Subset IASI principal components (BUFR)
  - » Subset IASI reconstructed radiances (BUFR)
  - » Clearest/Warmest IASI FOVs from each field of regard (BUFR)
  - » IASI NOAA Unique products (BUFR)

Current Distribution List (cont)

- AFWA
  - » A requested products list has been received and a distribution agreement is in progress.

- NRL
  - » Product list is yet to be determined

- NESDIS/STAR
  - » All level 1C and level 2 NOAA Unique products (BUFR, netCDF)
  - » Global grids (binary)
  - » Global binaries (binary)
  - » Matchups (binary)
  - » Forecast global grids (binary)

- NESDIS/NCDC/CLASS
  - » Level 1C EPS EUMETSAT and metadata
  - » 3 deg latitude x 3 deg longitude global grids and metadata
  - » IASI NOAA Unique (L2 and CCR) products and metadata

Summary

- A simulation system is currently running continuously simulating IASI/AMSU/MHS data.

- Status of product IASI product processing system:
  - » All hardware has been acquired.
  - » All high level scripts are ready for handling real data.
  - » IASI L1C subset, RR, PCS code is done.
  - » IASI L2 NOAA unique product (profiles and CCR) code is done.
  - » IASI/AVHRR NOAA code currently in development.

- All validation products listed are being generated from these simulated data.

- These data are available on the AIRS data server in BUFR format (since 10/25/2005).

- After launch, these products will be distributed operationally to the NWP centers through the ESPC DDS.