DATA FORMATS AT EOL

Steve Williams, Chris Webster, and Dennis Flanigan

EOL Computing, Data, and Software Facility

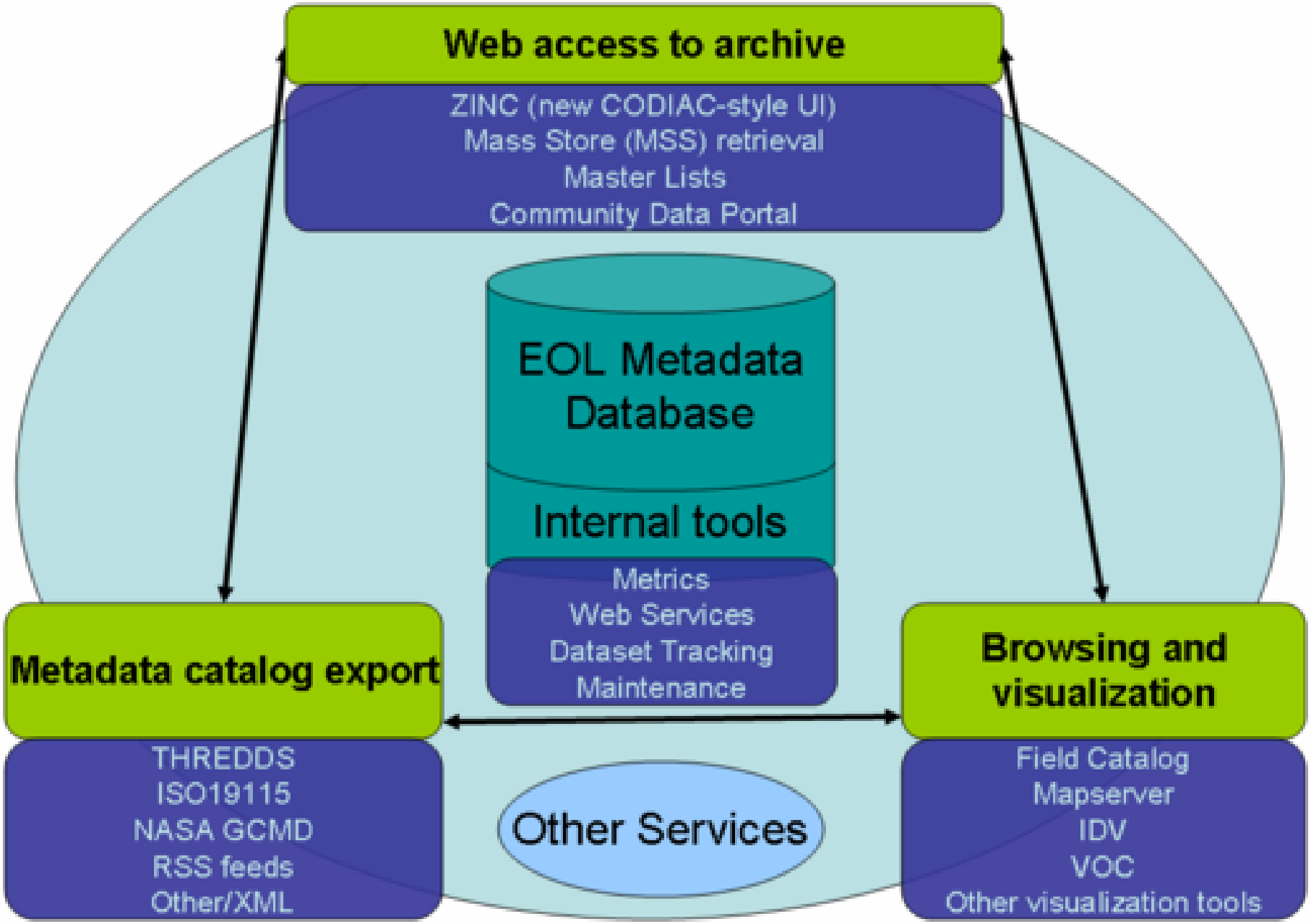
Joint EOL/Unidata Seminar

29 May 2007

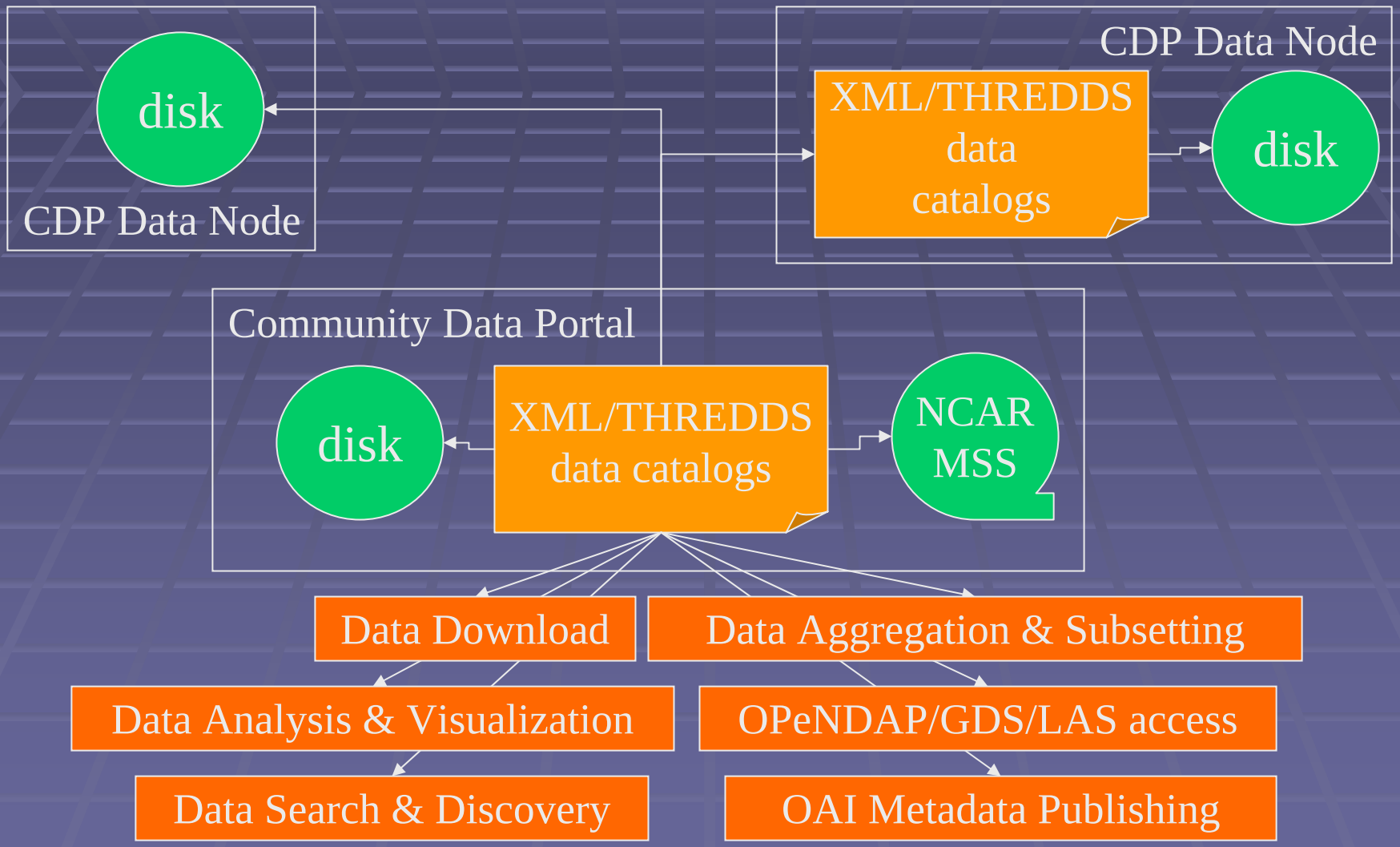
PRESENTERS AND TOPICS

- Steve Williams – EOL Overview of current Data Flow and Formats (EOL Platform and Supporting Field Project Data)
- Chris Webster – Using Databases in Aeros: SQL Aircraft Real-time Data acquisition
- Dennis Flanigan – Data Access for Remote Sensing Platforms: FORAY

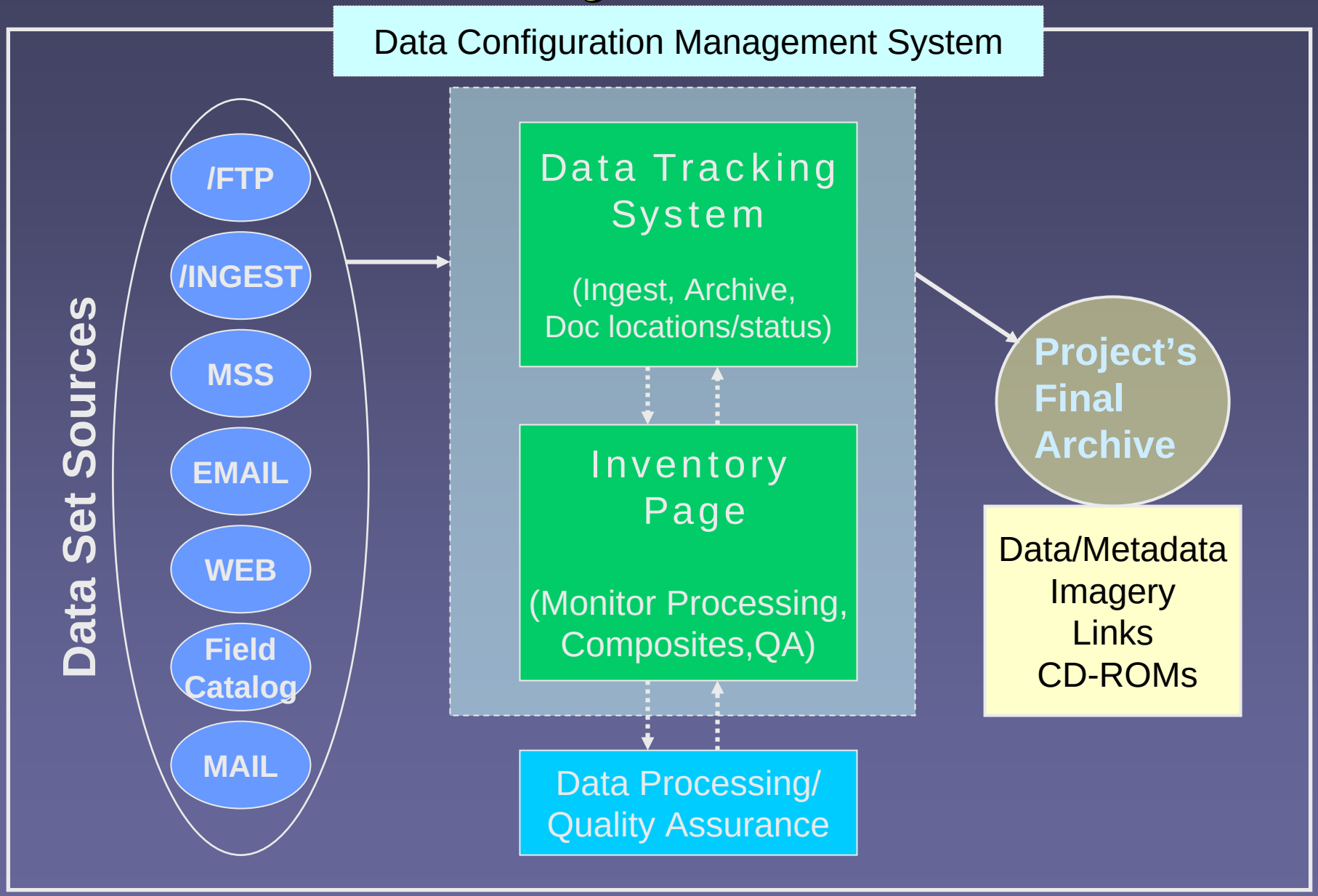
EOL Metadata Database and Cyberinfrastructure (EMDAC)



NCAR Community Data Portal (CDP) Architecture



Data Flow – Ingest to Final Archive



EOL Software

Aspen
Aspen is a program for applying quality control procedures to radiosonde soundings. It can process both upsonde and dropsonde data.

ncplot
ncplot is an interactive plotting tool for workstations that allows users to view time-series data stored in netCDF files that conform to the NCAR/ATD/RAF NIMBUS conventions. Both low-rate and mixed-rate files are supported, as well as files where the data have been reduced below 1 sample per second.

ncpp
ncpp is an interactive plotting tool for workstations that allows users to view histograms of PMS-1D probe data stored in netCDF files that conform to the NCAR/ATD/RAF NIMBUS conventions. Both low-rate and mixed-rate files are supported, as well as files where the data have been reduced below 1 sample per second.

NIMBUS
NIMBUS is a ATD/RAF software program that reads RAF's raw ADS aircraft data to produce an output netCDF data file with values in engineering units.

Reorder
Reorder is a ATD/RDP radar data processing tool which translates airborne and ground-based radar data in polar "radar space" into cartesian space or co-planer grids, using a distance smoothing algorithm.

Solo
Solo is a cooperative ATD/RDP and RSF software package for display and analysis of of airborne, WSR-88D, and other radar data. **Solo** addresses many of the problems found in the analysis of moving radar platforms, and works well for display of ELDORA and P3 radar data.

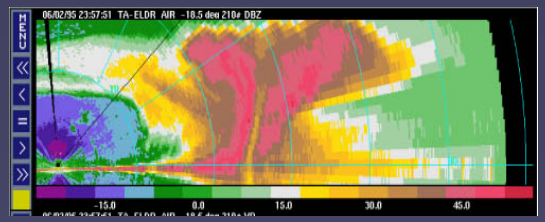
SUDS
SUDS is a ATD/RDP sounding data perusal and editing tool which allows the user to display, edit, and compute derived parameters from sounding data. SUDS runs on a variety of Unix platforms.

tklog tklog is an electronic logbook, providing plain-text entry, display and searching of logbook entries. Graphic images in PNG, GIF or JPEG form can associated with a logbook entry. The logbook can be converted to HTML for read-only display. tklog is written in TK/TCL, and should run on any system with TK/TCL/TCLx support. It has been used on Linux and Solaris.

WINDS
WINDS is an ATD/RAF software package for display of RAF's aircraft data in real-time, and of netCDF files in post-flight analysis mode. WINDS primary strengths lie in its intuitively learnable user interface, flexibility, and fast response to facilitate real-time decision making in-flight. While initially targeted for the aircraft platform, WINDS can handle any time-based datasets in the appropriate netCDF format.

AIRCRAFT DATA FORMATS

- State parameters, aerosol, cloud, precipitation, radiometers (UV, short- and long-wave, remote temp) final RAF Archive format NetCDF
- Other Agency Aircraft Formats vary (e.g. NetCDF, ASCII, ICARTT, etc). EOL working to standardize
- Some older archived RAF Datasets in Genpro format
- User's are responsible for their own instruments and data QA Formats vary; mainly ASCII



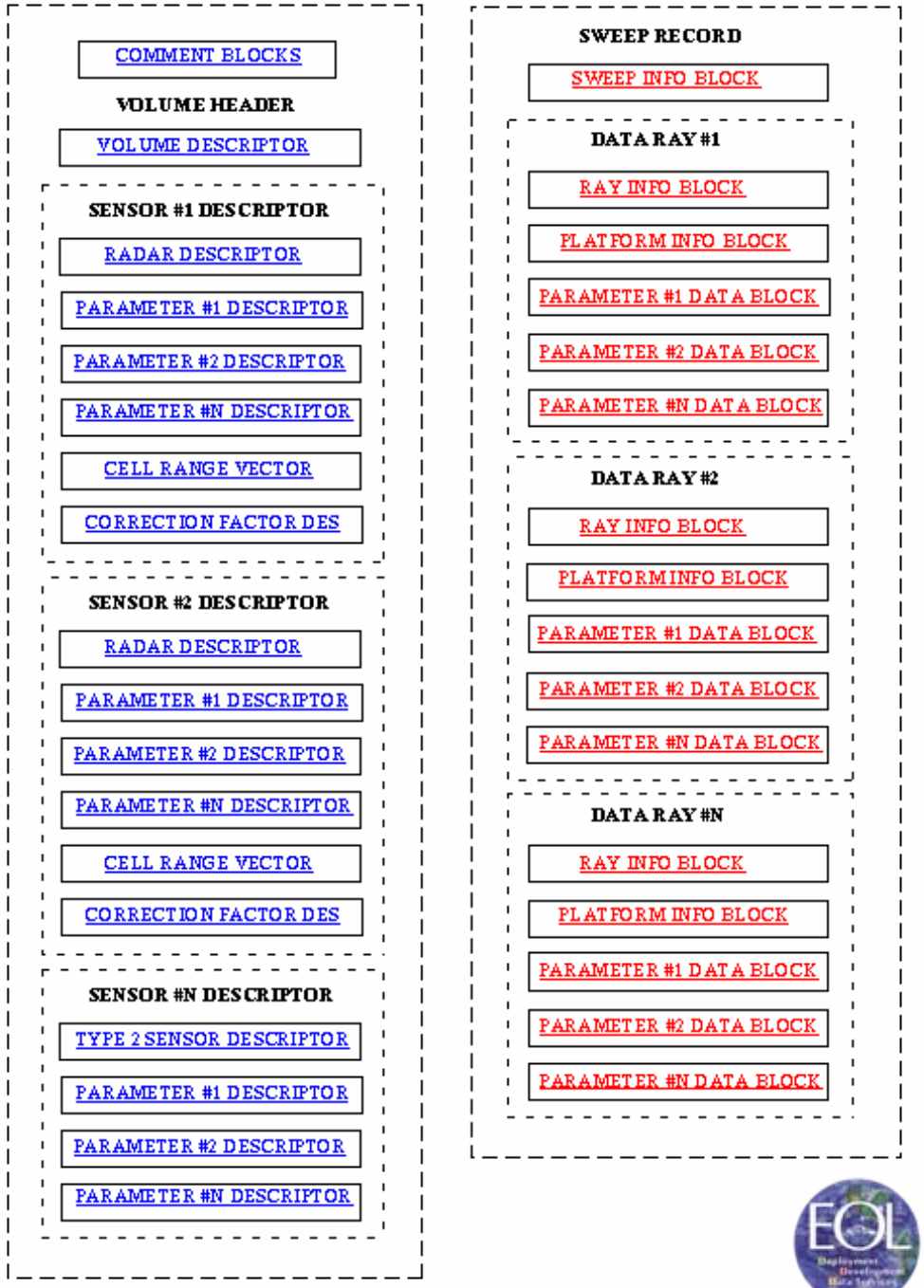
ELDORA Airborne Doppler Data Processing Steps

1. * Translate the raw ELDORA field format data into DORADE sweep files and inspect for errors.
2. * Calculate navigation correction factors (cfac files) for each flight
3. Fine-tune navigation corrections for each leg of data
4. Edit the data to remove ground echo, noise, clutter, and radar side-lobes, as well as velocity unfolding.
5. Interpolate and synthesize data to get 3-dimensional wind field and derived quantities.

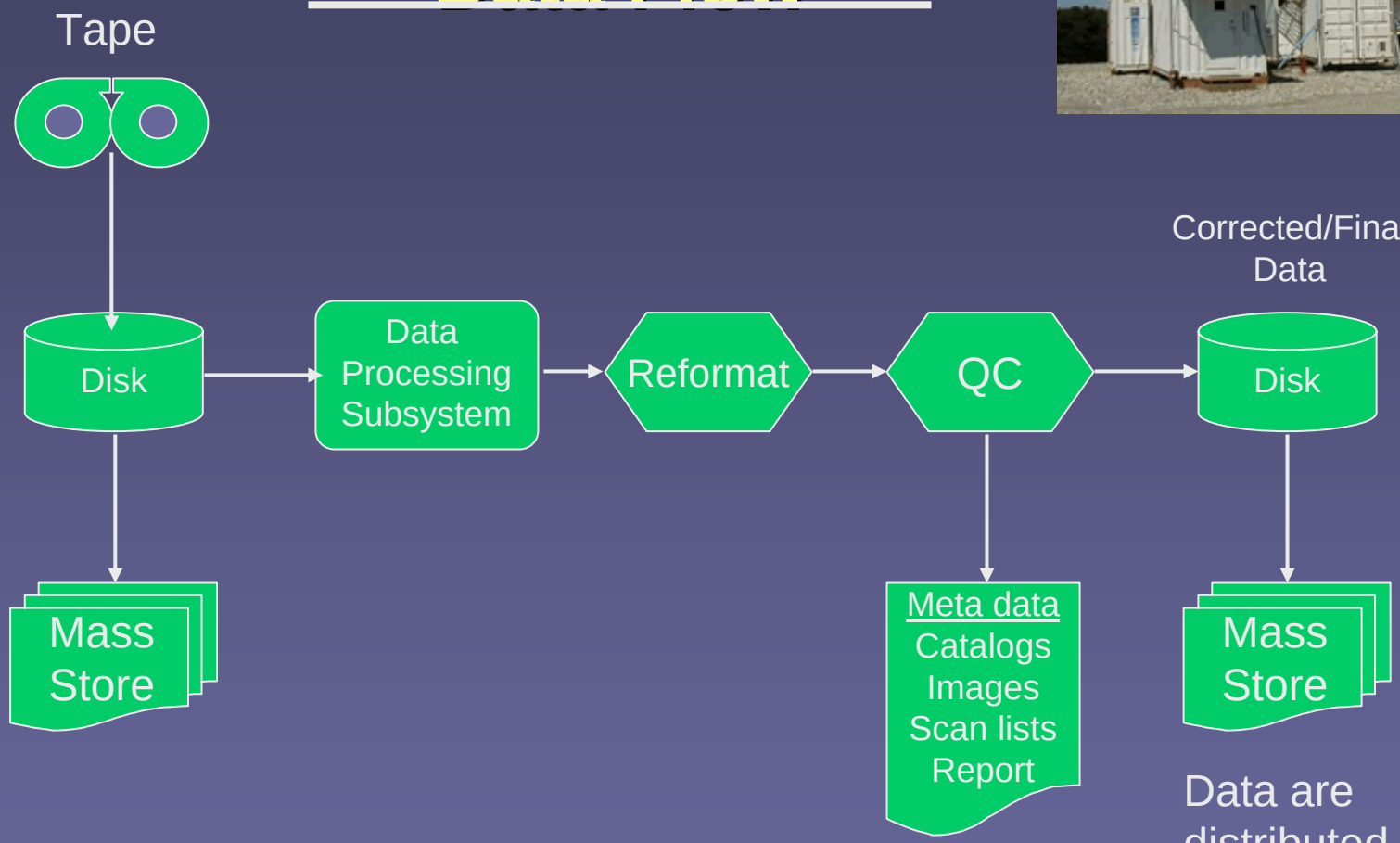
***** Steps performed at NCAR by EOL staff

DORADE FORMAT DESCRIPTION

- DOppler RAdar Data Exchange (DORADE) Format, developed by Wen-Chau Lee, Craig Walther, and Richard Oye of EOL for efficiently storing and exchanging airborne and ground-based radar data.
- A volume contains many sweeps of data. It can be a leg (in airborne radar), a sector scan (in ground based radars) or any other user selected block of data.
- DORADE format can be a single file or tape with multiple radar sweeps, or a *sweepfile* with one scan for use with the SOLO software package.



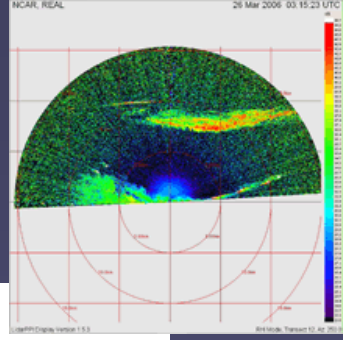
S-PolKa Data Flow

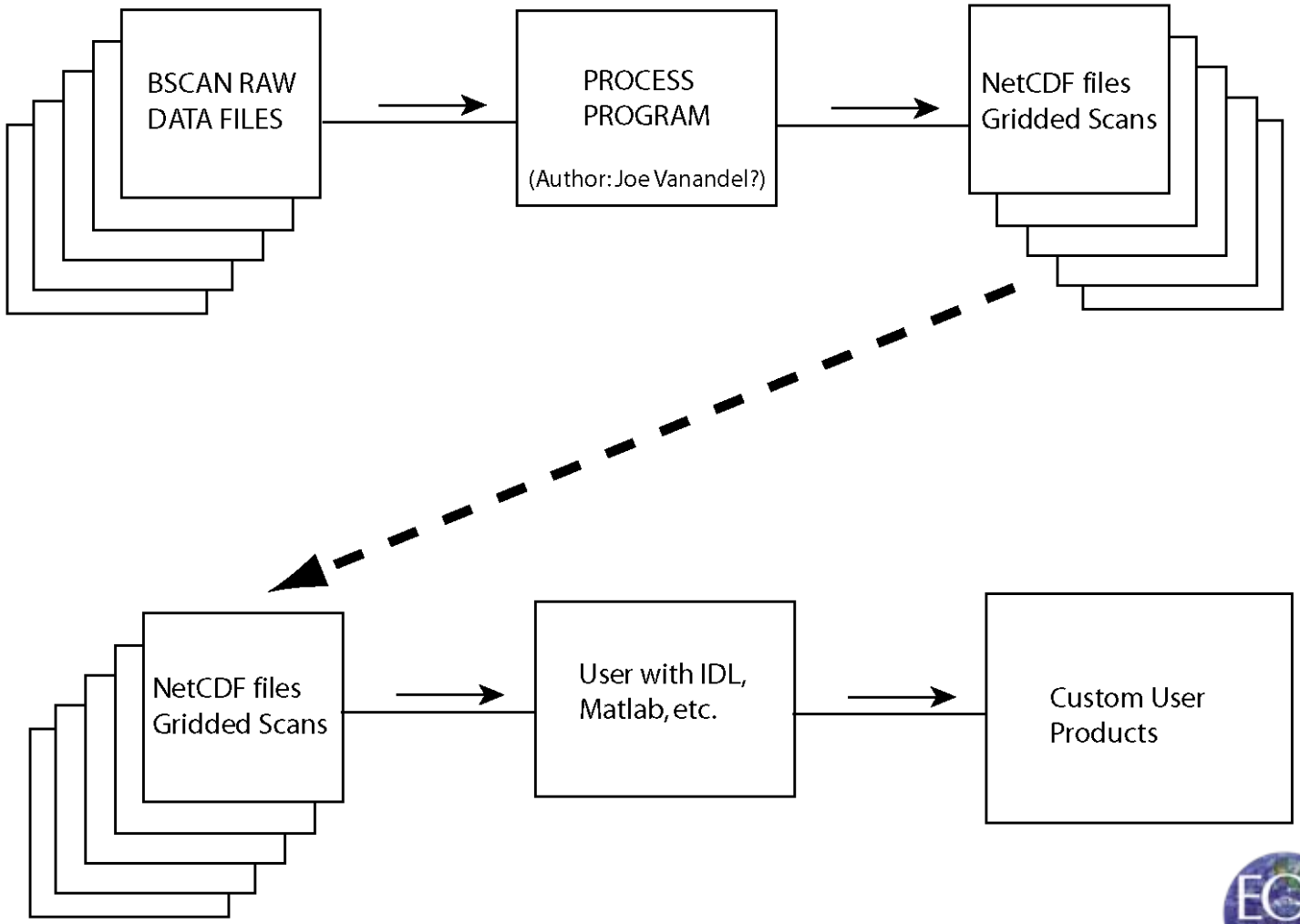


Meta-data are Web-based

Data are distributed from the Mass-Store

EOL REAL LIDAR PROPOSED DATA FLOW





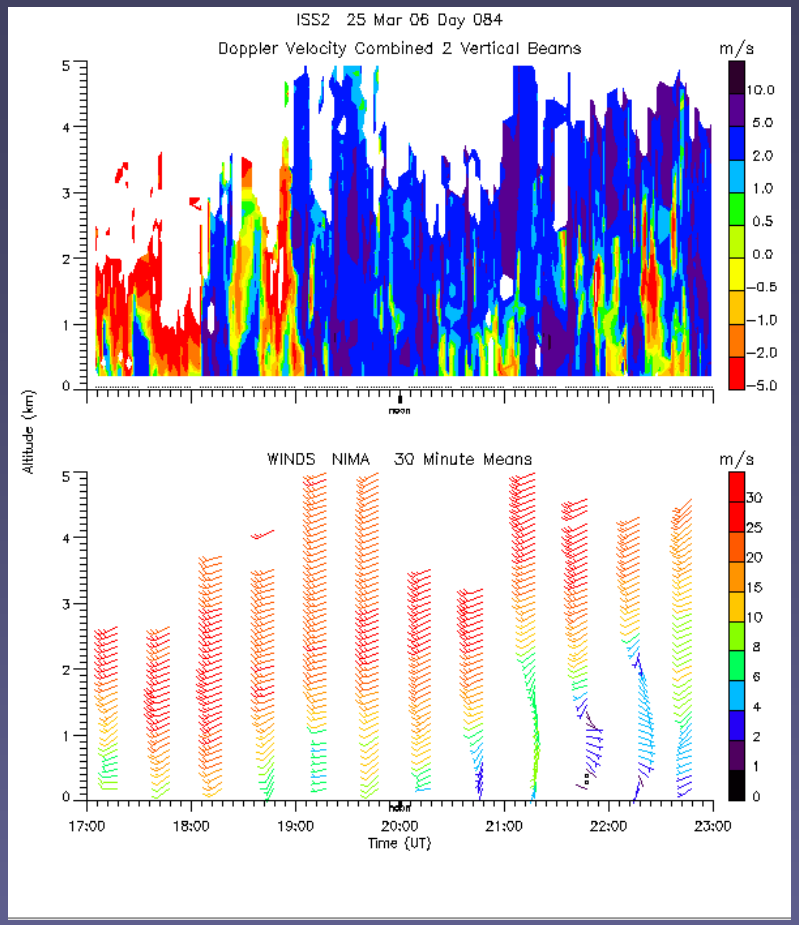
ISS
Integrated Sounding System

Suites of instruments to profile the lower atmosphere

Standard instruments : wind profiler radar, RASS, radiosondes (GAUS), surface met tower, solar radiation

Optional Extras: MAPR, sodar, ceilometer, lidar, snow gauges, stabilized platform for ship operations, Mobile ISS (MISS), and more.

ISS Data Flow



Final Archive is Primarily netCDF,

some ascii and binary

Data rate depends on config:

50 MB to 30 GB per day

Preliminary data products

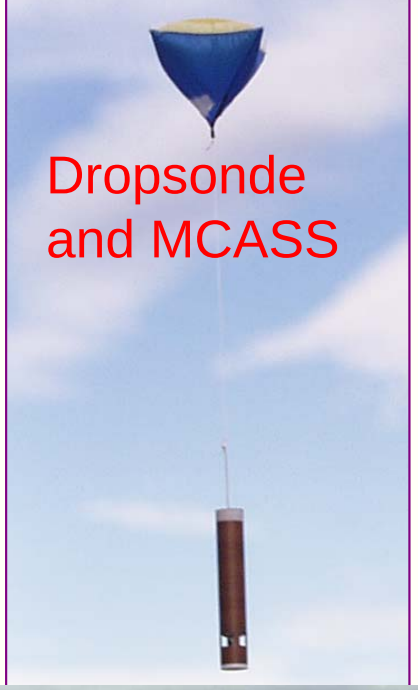
back to Boulder via satellite

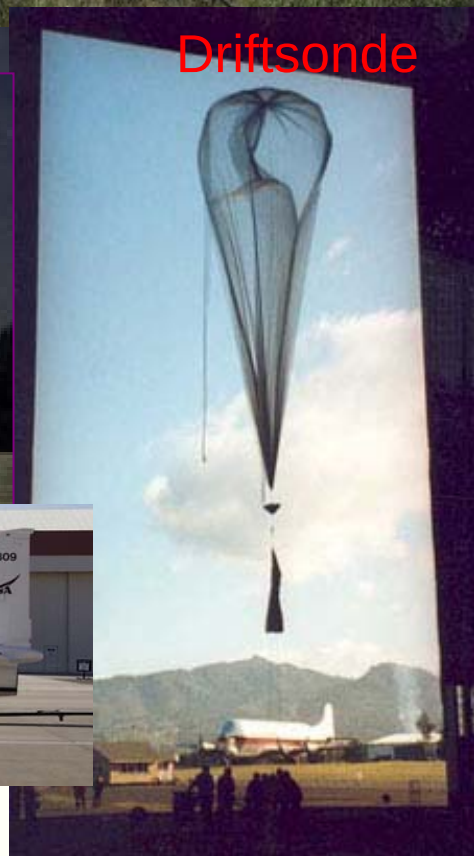
Archive using CDs, DVDs, RAID, SuperDLT, Mass Store

Radiosondes: QC processing using ASPEN

Wind Profiler: QC processing using NIMA

EOL Sounding Systems





ER-2 Dropsonde Pod

EOL Quality Control of Dropsonde Data

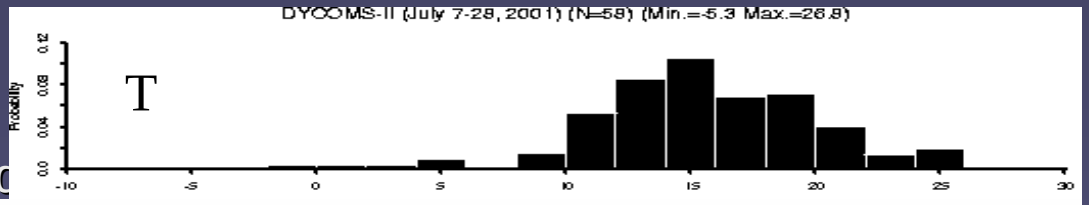
1. In flight data inspection
2. ASPEN
3. Individual Skew-t Examination
4. Histograms of PTU and Wind
5. Time series of PTU and Wind
6. Comparisons with other data

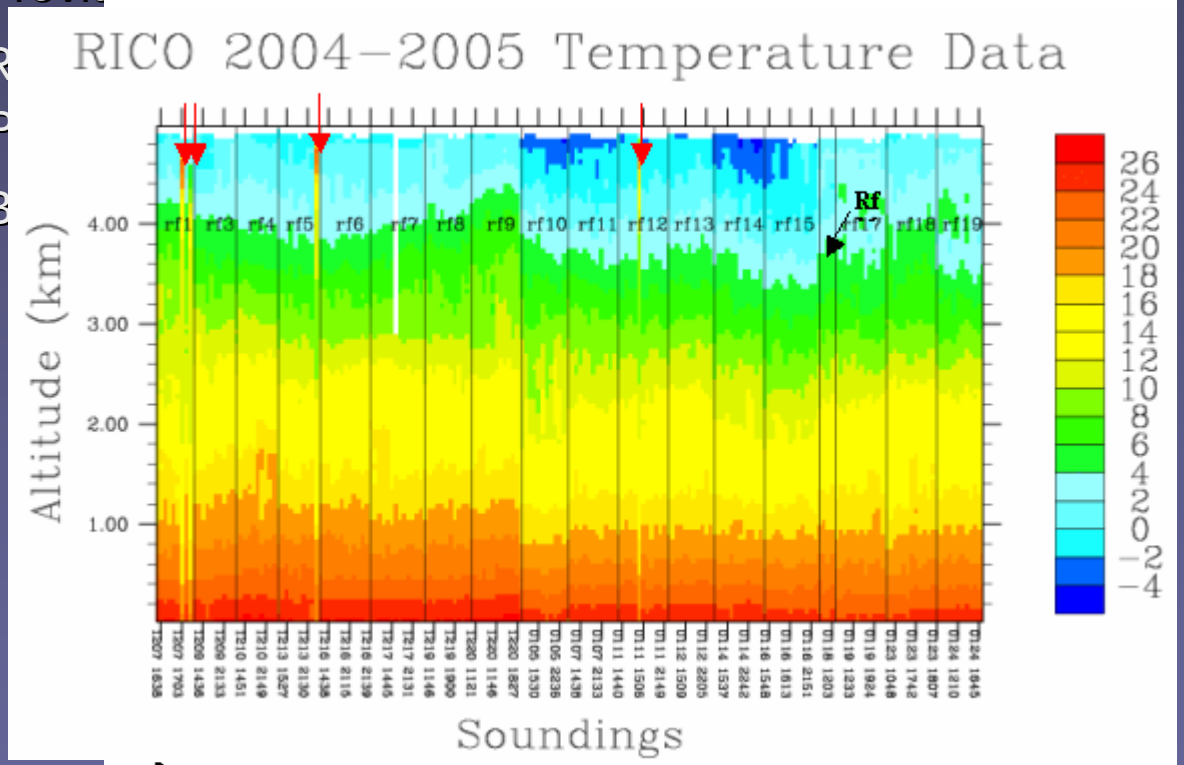
Provid

R

P

B





NCAR/EOL Atmospheric Sounding Processing Procedures

Observing System Output — **e.g. NWS Micro-ART**

Sample Record

```
Data Type:                          National Weather Service Sounding.
Project ID:                         0
Release Site Type/Site ID:          ABR Aberdeen, SD
Release Location (lon,lat,alt):     98 24.00'W, 45 30.00'N,  -98.4,  45.5,  397.0
UTC Release Time (y,m,d,h,m,s):     2003, 04, 30, 23:02:00
Ascension No:                       1240
Radiosonde Serial Number:           230504106
Radiosonde Manufacturer:            Vaisala
/
/
/
Nominal Release Time (y,m,d,h,m,s):2003, 05, 01, 00:00:00
```

Time sec	Press mb	Temp C	Dewpt C	RH %	Ucmp m/s	Vcmp m/s	spd m/s	dir deg	Wcmp m/s	Lon deg	Lat deg	Ele deg	Azi deg	Alt m	Qp code	Qt code	Qrh code	Qu code
0.0	964.3	15.6	2.1	40.0	-2.9	-1.1	3.1	69.2	999.0	-98.400	45.500	999.0	999.0	397.0	99.0	99.0	99.0	99.0
6.0	960.4	15.2	1.7	40.0	-2.9	-1.1	3.1	69.2	5.7	9999.000	999.000	999.0	999.0	431.0	99.0	99.0	99.0	4.0
12.0	956.4	14.9	1.1	39.0	-3.0	-1.1	3.2	69.9	6.0	-98.402	45.499	35.5	52.7	467.0	2.0	2.0	2.0	4.0
18.0	954.6	14.5	1.1	40.0	-3.0	-1.1	3.2	69.9	2.7	-98.403	45.498	34.3	55.5	483.0	2.0	2.0	2.0	4.0

Comparisons with Other Data Sources

High-resolution and/or Interpolated Vertical (e.g. 5 hPa) Composite

Inventory, Archive, and Develop Metadata

NAME Example:

35 sites

10 formats

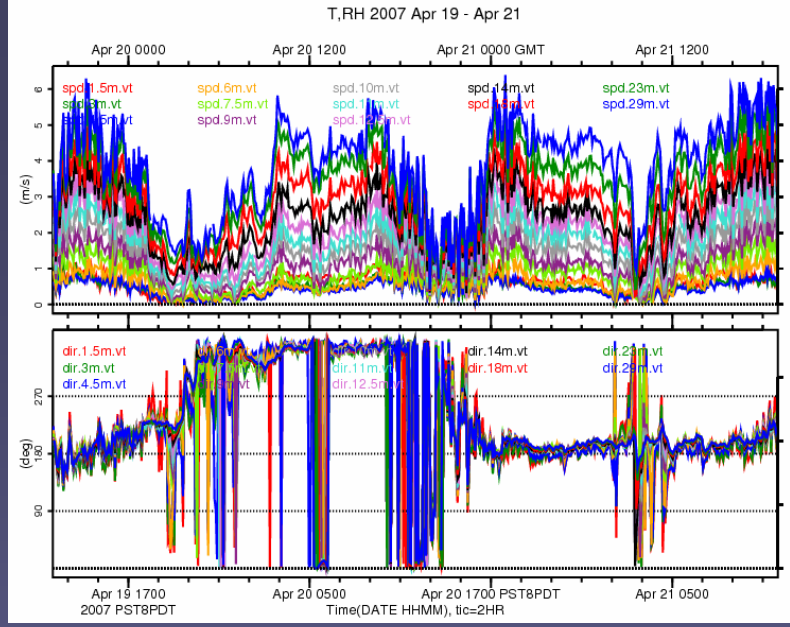
~7600 soundings

INTEGRATED SURFACE FLUX FACILITY (ISFF)

"The ISFF is designed to study exchange processes between the atmosphere and Earth's surface. This includes the direct measurement of fluxes of momentum, sensible and latent heat, trace gases, and radiation as well as standard atmospheric and surface variables"

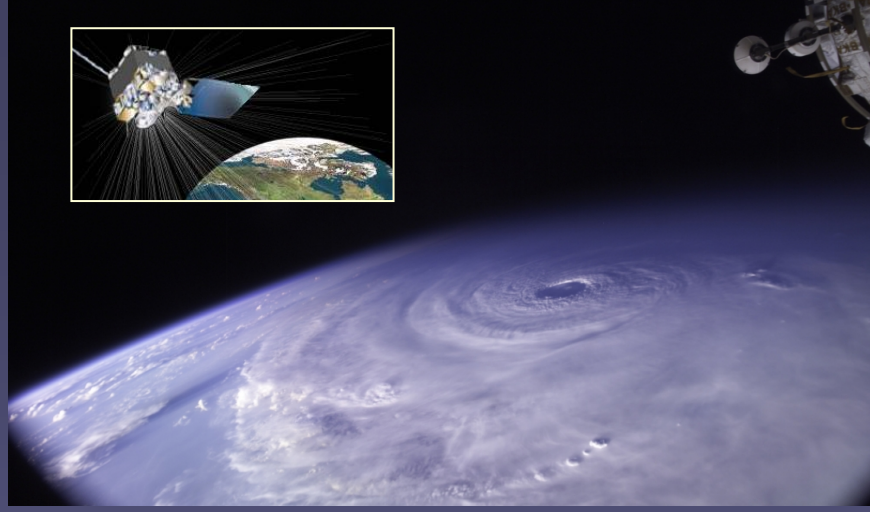
Sensor	Manufacturer	Model	Parameter	Rate	#
3-D sonic anemometer	CSI	CSAT3	u,v,w - m/s; Tvs - deg C	60sps	21
UV absorption hygrometer	CSI	KH20	vapor density - gm/m3	20Hz	12
H2O/CO2 Open-path Gas Analyzer	LI-COR	LI-7500	H2O/CO2 concentration	20sps	5
Prop-vane anemometer	NCAR/SSSF - R.M. Young		U, V - m/s	5Hz	7?
Prop-vane anemometer	R.M. Young	9101	U, V - m/s	5Hz	~10
Hygrothermometer	NCAR/SSSF - Vaisala	50Y Humitter	T - deg C; RH -%	1Hz	14?
Pressure sensor	Vaisala	PTB220B	Pressure - mb	1Hz	9?
Net Radiometer	Micromet Systems	Q*7	Net radiation - W/m2	1Hz	19
Pyranometer	Kipp & Zonen	CM 21	Global shortwave radiation - W/m2	1Hz	8
Pyranometer	Eppley	PSP	Global shortwave radiation - W/m2	1Hz	25?
Pyrgeometer	Kipp & Zonen	CG4	Global longwave radiation - W/m2	1Hz	6
Pyrgeometer	Eppley	PIR	Global longwave radiation - W/m2	1Hz	10
Soil temperature sensor	Micromet Systems (REBS)		Soil temperature - deg C	1Hz	>10
Heat flux plate	Micromet Systems (REBS)	HFT-3	Soil heat flux - W/m2	1Hz	>10
Soil moisture	Decagon	Ech2o	Soil moisture - % vol	1Hz	10
Soil thermal properties	Hukseflux	TP01	conductivity, diffusivity, heat capacity	1Hz	9
Surface temperature sensor	Everest Interscience	4000.4ZL	Surface temp. - deg C	1Hz	10

ISFF DATA FLOW



- Data and plots are available online including 5-minute average statistics (through 4th-order moments for turbulence variables) of all quantities measured. For some projects, "raw" time series of every sample from each sensor are also available.
- The project reports contain a description of the field site, instrumentation configuration, and data processing steps.
- The field logbook has all information logged by ISF staff and visitors before, during, and after the field campaign and used for QA purposes.
- Final Data Archive is NetCDF

SATELLITE DATA COLLECTION AND ARCHIVE

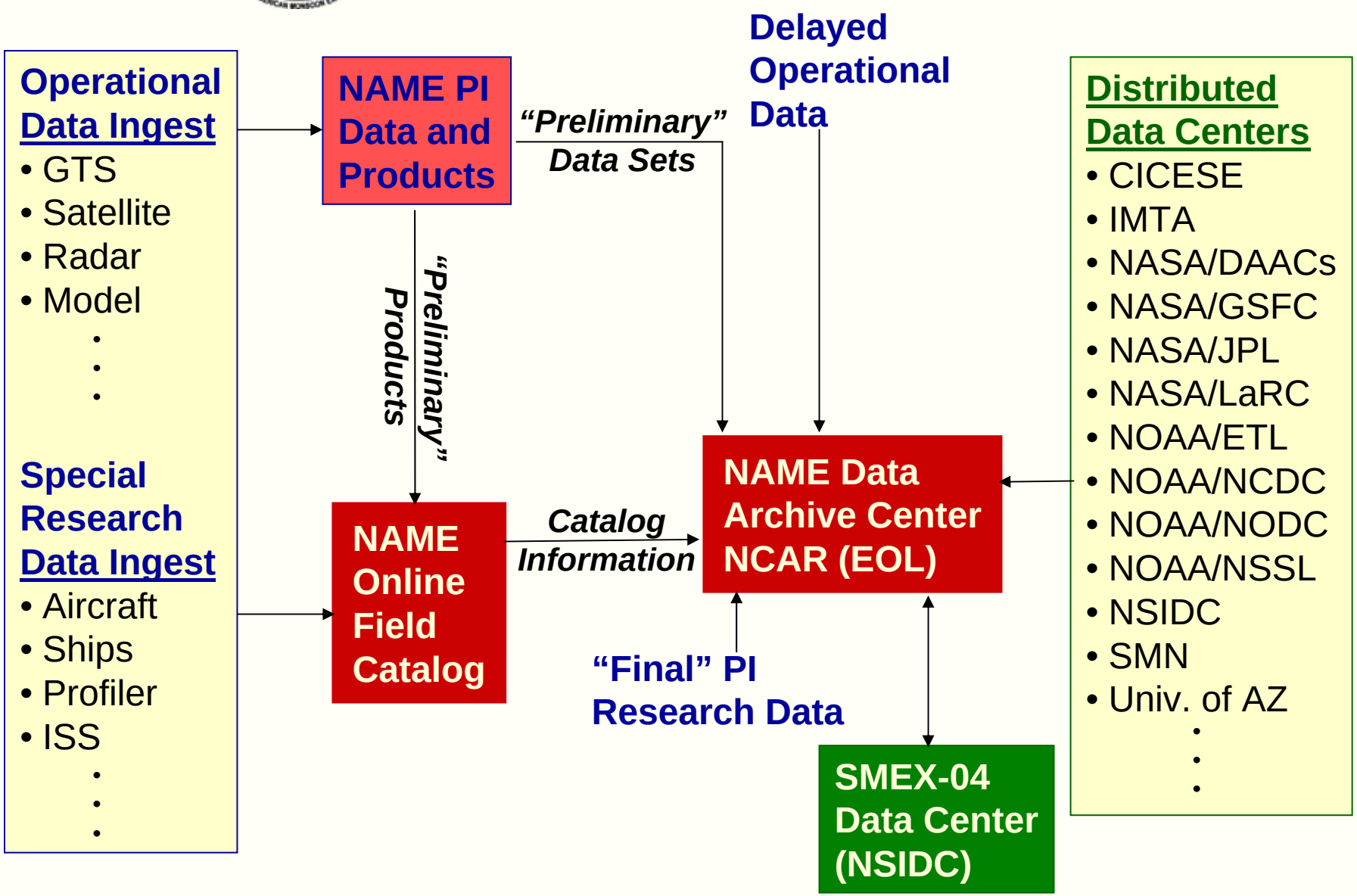


- GOES Data Collected from NCAR Ground Station (SeaSpace Inc.) in collaboration with Unidata and RAL
- GOES Archive on MSS in TDF Format (1998-Present). Some Project Archives in McIDAS AREA, NetCDF, and HDF
- POES Archives periodic for Field Projects only. Archive Formats in TDF, NetCDF, and NOAA Level 1B
- Satellite Imagery files maintained for Field Catalog and Special Project Browse

T-REX SATELLITE DATA ARCHIVED BY EOL

Instrument	Channel/ Product	Archived Resolution	Units	File Format	Comments
GOES-10	1	1, 4 km	Albedo	NetCDF,TDF	Raw data is not saved from GOES, only calibrated units. 15 min res, nominal
	2	4 km	Temp(C)	NetCDF,TDF	
	3	4 km	Temp(C)	NetCDF,TDF	
	4	4 km	Temp(C)	NetCDF,TDF	
	6	4 km	Temp(C)	NetCDF,TDF	
MODIS	True Color	250 m	Imagery	JPG	As Available
	Vapor	1000 m	Imagery	JPG	As Available
	COAMPS Winds (TC)	250 m	Imagery	JPG	As Available
AVHRR	1-5	1 km	Raw	Level 1B	As Available

NAME Data Flow



Composite Data Sets at NCAR/EOL

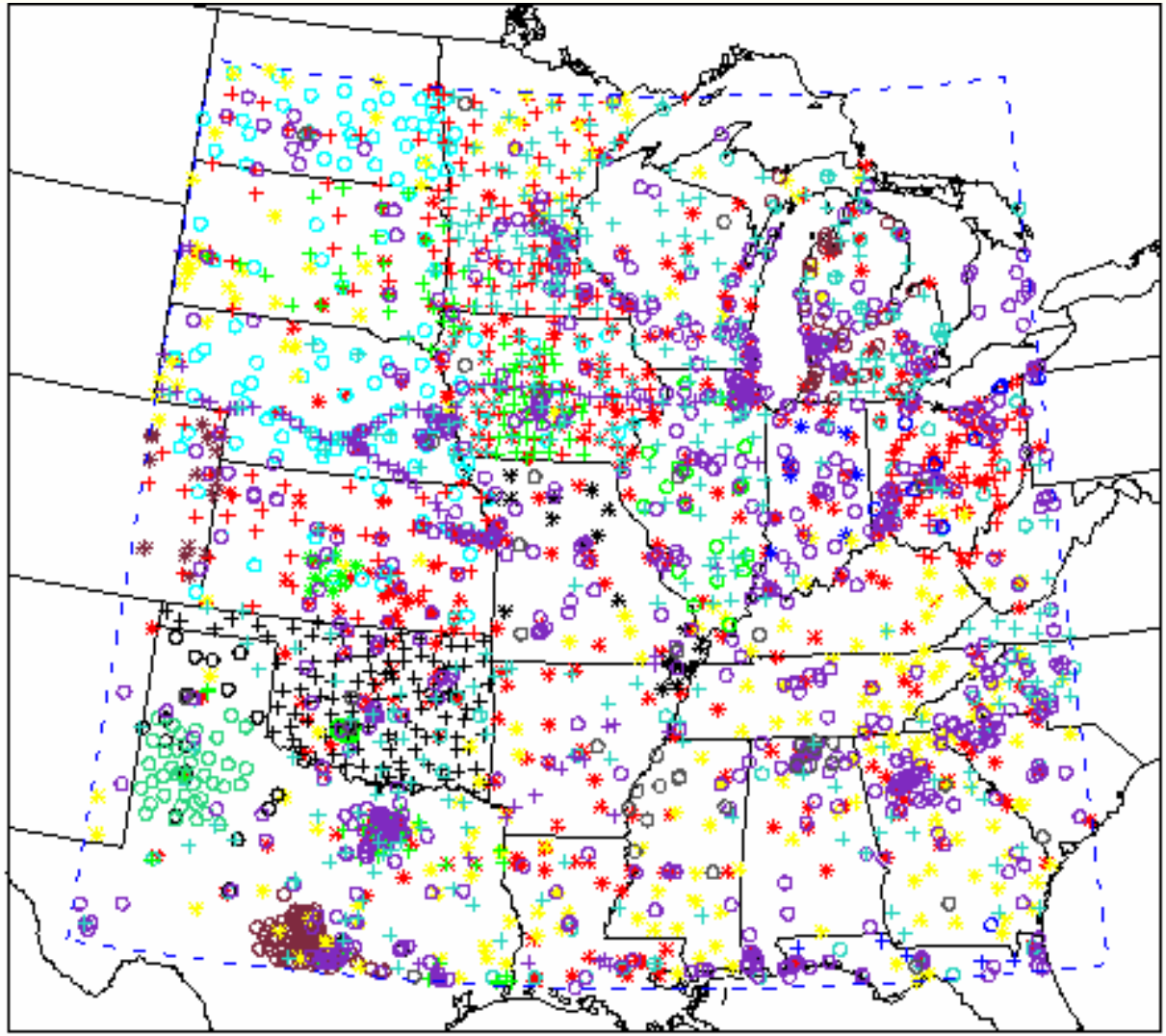
A composite dataset is a collection (over some time period and region) of similar data (e.g. surface meteorological) from a variety of sources, put into a common format, and passed through a uniform quality control.

Why does NCAR/EOL develop composites?

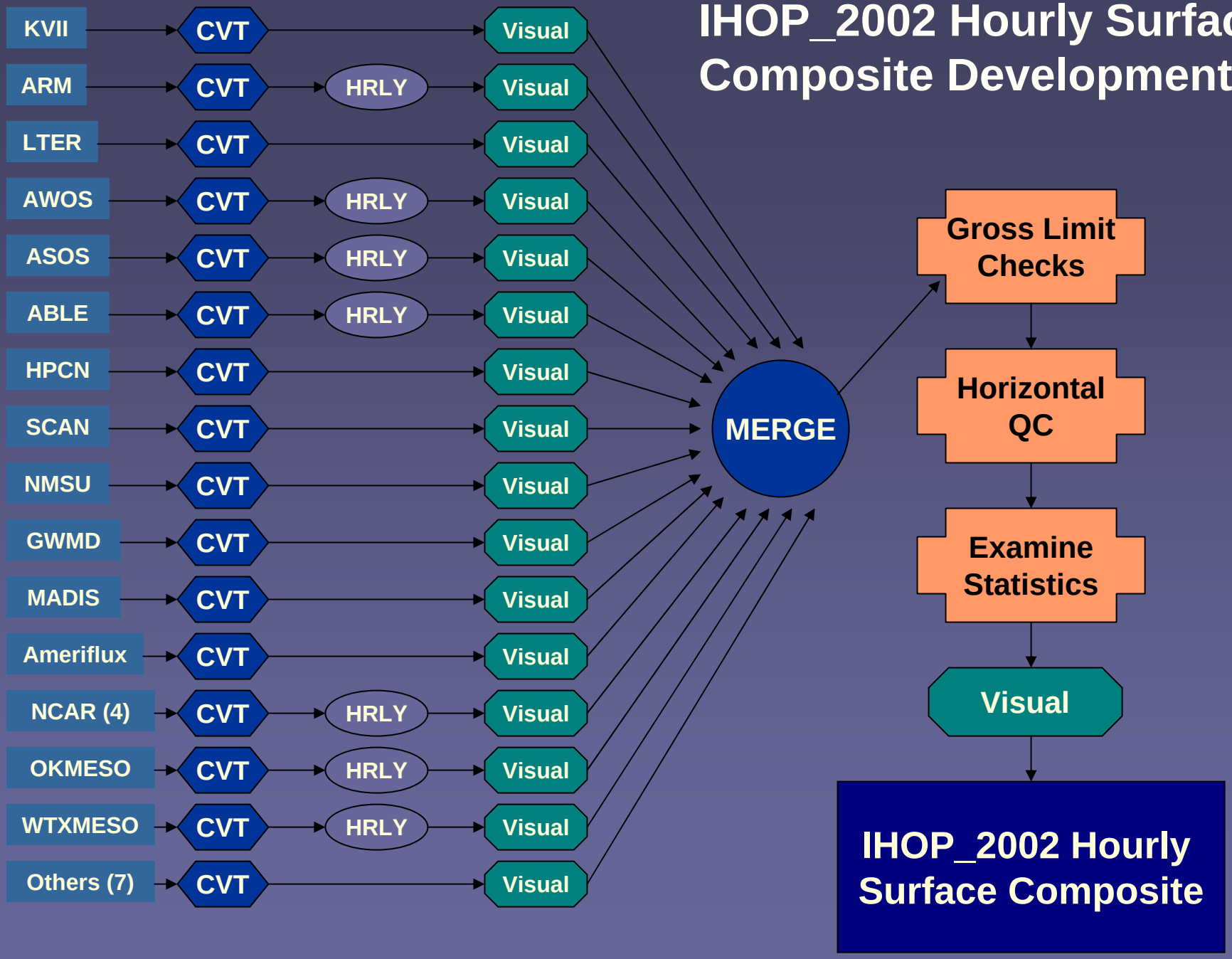
- Provides data in a uniform format with QC.
- Allows determination of network/site problems.
- Useful for model applications.
- Prevents duplication of effort.

Hourly Surface Meteorological Data Composite (2991 stations)

1-min sites (* 385)
AWOS (+ 335)
RAWS (* 220)
MesoWest (+ 94)
HPCN (o 138)
RWIS (+ 279)
GPSMET (o 153)
CO CoAgMet (* 17)
FL FAWN (+ 5)
IA IEM (+ 88)
IL ICN (o 19)
IN PAAWS (* 7)
KS GWMD5 (* 10)
MI MAWN (o 33)
MO CAWS (* 21)
OH OARDC (o 11)
OK ARS Micro (o 42)
OK Mesonet (+ 119)
TX LCRA (o 102)
TX TNRCC (+ 47)
West TX Meso (o 39)
Texas ET (o 23)
15 Other Networks (o 804)



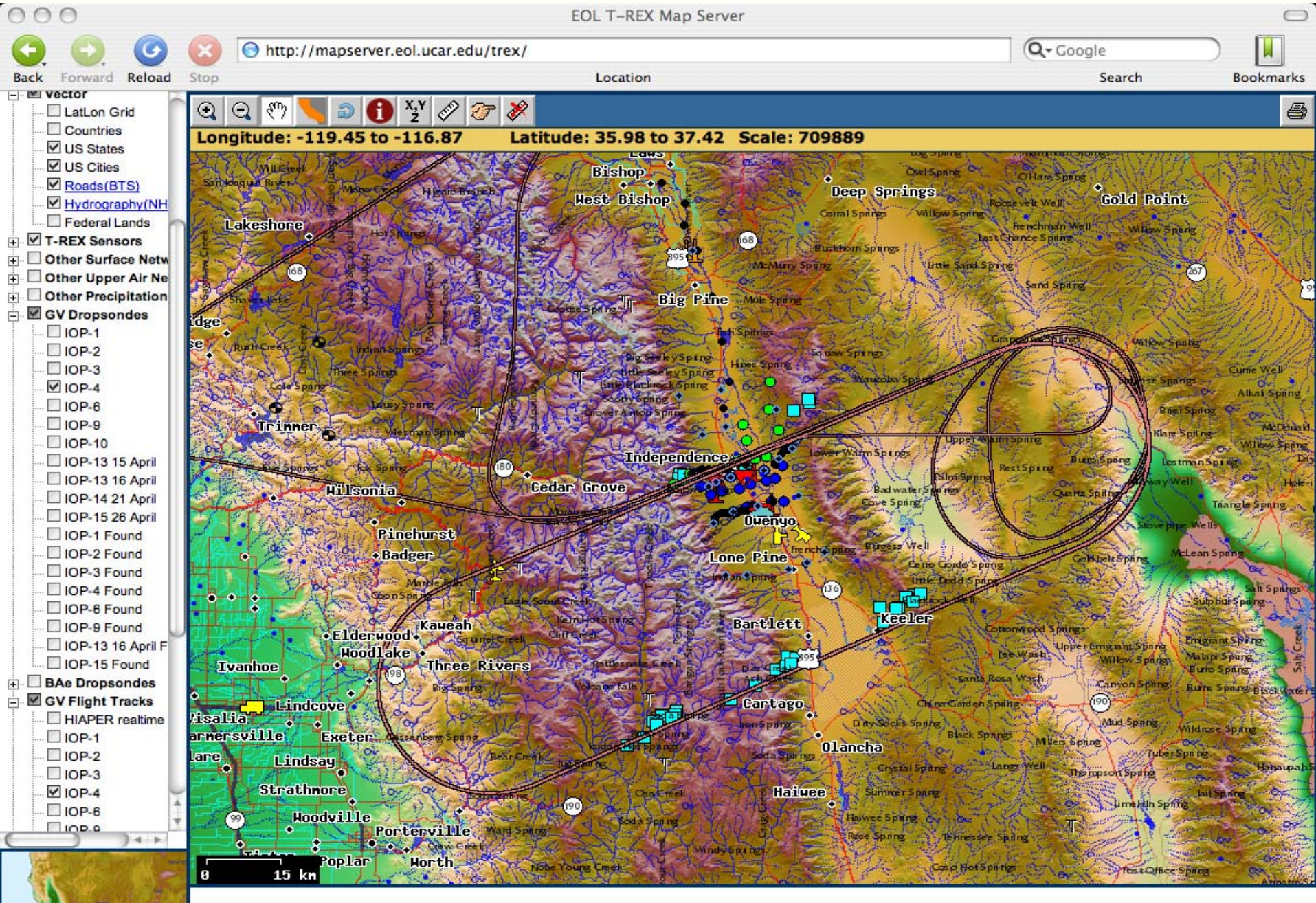
IHOP_2002 Hourly Surface Composite Development



REFERENCE SITE FLUX DATA SET FORMAT

Parameter	C Format	Missing Value	Final Units/Equations/Notes
UTC Nominal Date/Time	16 chars	N/A	yyyy/mm/dd HH:MM, where MM is 00 or 30, only
UTC Actual Date/Time	16 chars	N/A	yyyy/mm/dd HH:MM
CSE Identifier	10 chars	N/A	Fill name with underscores, not spaces.
Reference Site Identifier	15 chars	N/A	Fill name with underscores, not spaces.
Station Identifier	15 chars	N/A	Fill name with underscores, not spaces.
Latitude	f10.5	-99.99999	decimal degrees. South is negative.
Longitude	f11.5	-999.99999	decimal degrees. West is negative.
Elevation	f7.2	-999.99	meters
Sensor Height	f7.2	-999.99	meters; Height of sensor. Positive above ground level. Negative below ground.
Sensible Heat Flux	f8.2	-999.99	W/m^2
Sensible Heat Flux Flag	1 char	M	See Flag values.
Latent Heat Flux	f8.2	-999.99	W/m^2
Latent Heat Flux Flag	1 char	M	See Flag values.
CO2 Flux	f8.2	-999.99	$\mu mol/m^2/s$
CO2 Flux Flag	1 char	M	See Flag values.
Soil Heat Flux	f8.2	-999.99	W/m^2;
Soil Heat Flux Flag	1 char	M	See Flag values.

EOL MAPSERVERS



EOL/MILAGRO FIELD CATALOG - Home - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://catalog.eol.ucar.edu/milagro/

CNN.com | Weather and Climate F... | UCAR/NCAR E-mail and... | NOAA Locator (Public) | AT&T: Directory: Direc... | Systems Support Online

EOL/MILAGRO FIELD CAT... | Canyonlands river tour by nig...

Megacity Initiative: Local and Global Research Observations

NCAR Earth Observing Laboratory

MILAGRO Field Catalog

MILAGRO

Mexico City, DF March 2006

Catalog Home | Daily Reports | Operational Products | Model/Forecast Products | Research Products | Missions | Tools & Links

MILAGRO Quick Links:

Facilities Status

Operations Plan of the Day

MILAGRO Weather Discussion

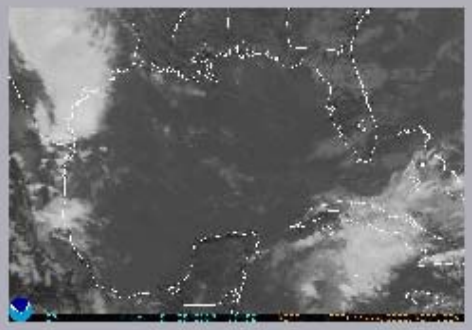
CMET Balloon Trajectories

20:06:35 Z

MILAGRO Home Page

MILAGRO flight operations have concluded

Gulf of Mexico Latest Infrared Image



Additional Satellite Imagery:

Latest 2 hours Visible
Latest 4 hours infrared
Latest 4 hours Water Vapor

Information from CNA / SMN:

Weather

Servicio Meteorológico Nacional

Mexico Radars

RAMA Advisories & Outlooks

Mexico City Pollution Indices

Veracruz Operations Center
(229) 923-5500 ext 3909

Done

NAME 2004 Field Catalog Statistics

http://www.joss.ucar.edu/name/catalog/

- **Reports/Summaries** (Status, Mission, and Operations)

  3,785 documents/imagery (0.27 GB)

- **Research Platform Products** (Aircraft, Surface, Upper Air, Ship)

  17,606 Imagery files (1.25 GB)

- **Operational Products** (Satellite, Surface, Upper Air)

  367,092 Imagery files (17.83 GB)

- **Model Output Imagery** (Analysis and Forecast Fields)

  99,387 imagery files (6.76 GB)

- **TOTALS: 487,870 Files (26.11 GB)**

“EXTERNAL” SUPPORTING PROJECT DATA FORMATS

Upper Air (Individual Networks and Composites)	ASCII, NetCDF
Surface (Individual Networks and Composites)	ASCII, NetCDF
Aircraft	NetCDF, Binary, ASCII
Model Output	GRIB, Binary, NetCDF
Oceanography	ASCII, Imagery
Radar	Binary, Imagery
Field Catalog	Imagery, Text
Mapserver	Binary

The Good ol’ Days of Data Formats….