

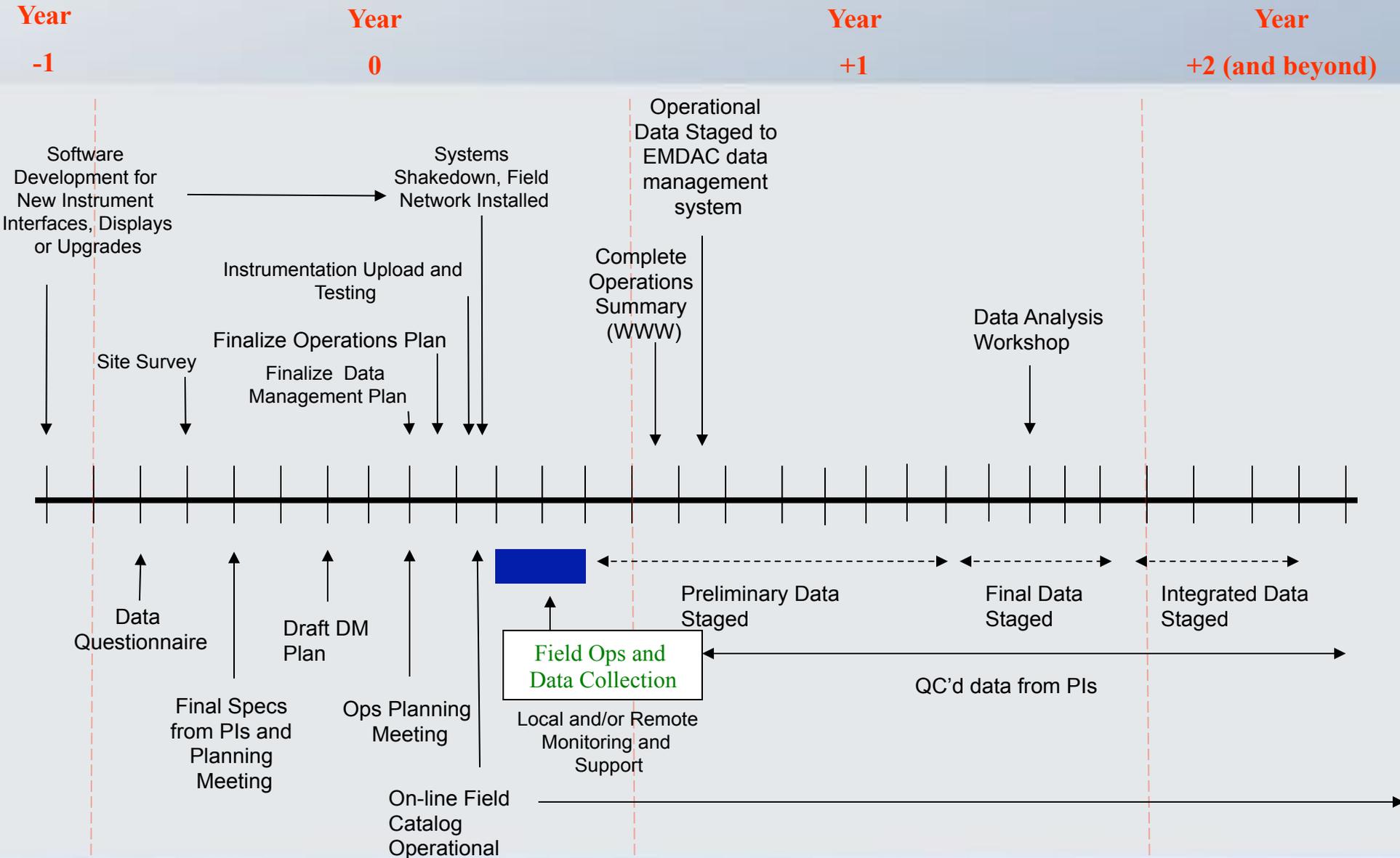
From Sensor to Archive: Data Services of NSF's Lower Atmosphere Observing Facilities

Mike Daniels

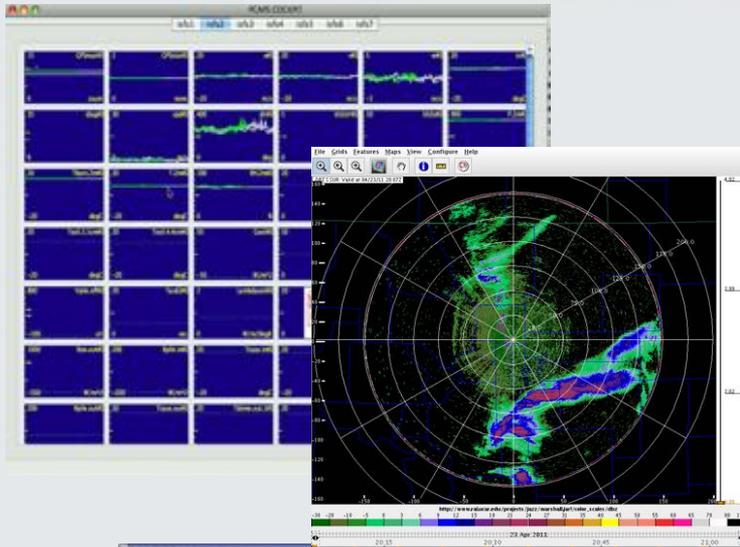
June 25th, 2012



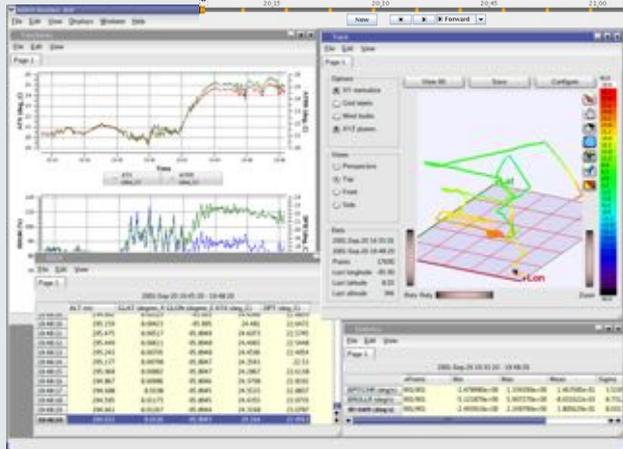
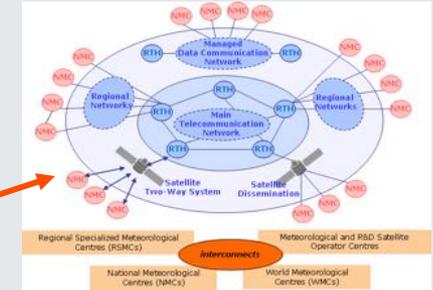
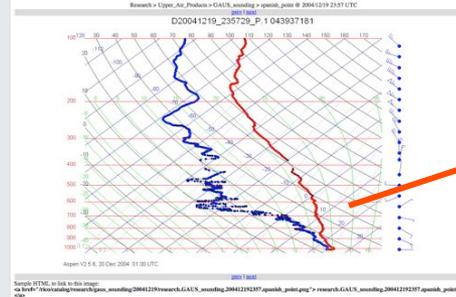
A Timeline for Field Data Services



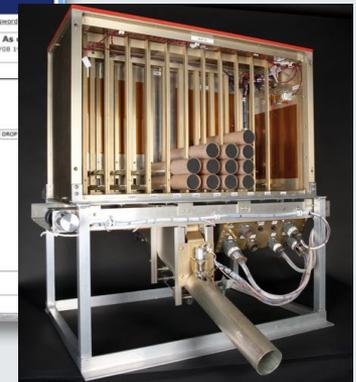
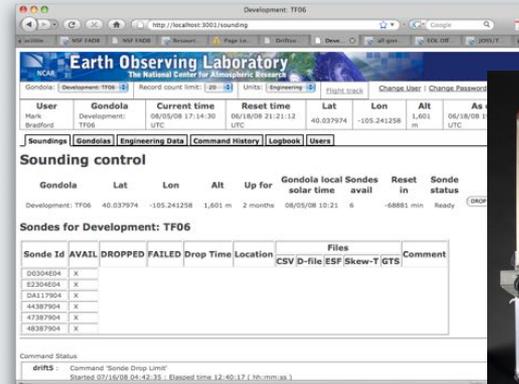
The LAOF Data System (part 1 of 3)



Sounding data ingested to GTS



Web-based Control of Instruments

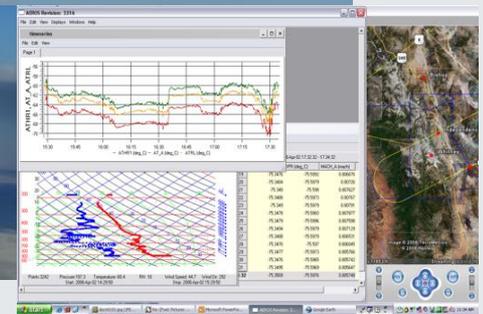
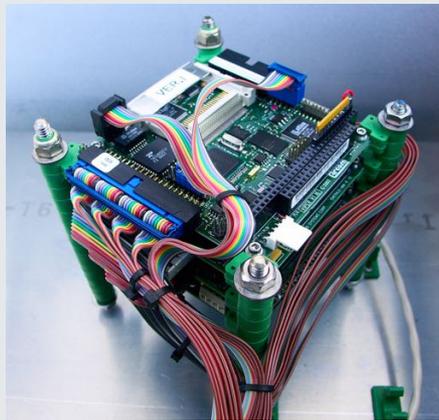


NSF LAOF Data Streamed in Real-time

Cross-platform data systems: NIDAS

NCAR In-situ Data Acquisition System

- Aircraft and surface systems
- G-V, C-130, Integrated Sounding System (ISS) and Integrated Surface Flux System (ISFS)
- Robust architecture for our time-series data systems based on the PC-104 stack



Expanding the Internet to New and Unusual Places



Kiribati (aka Christmas Island)



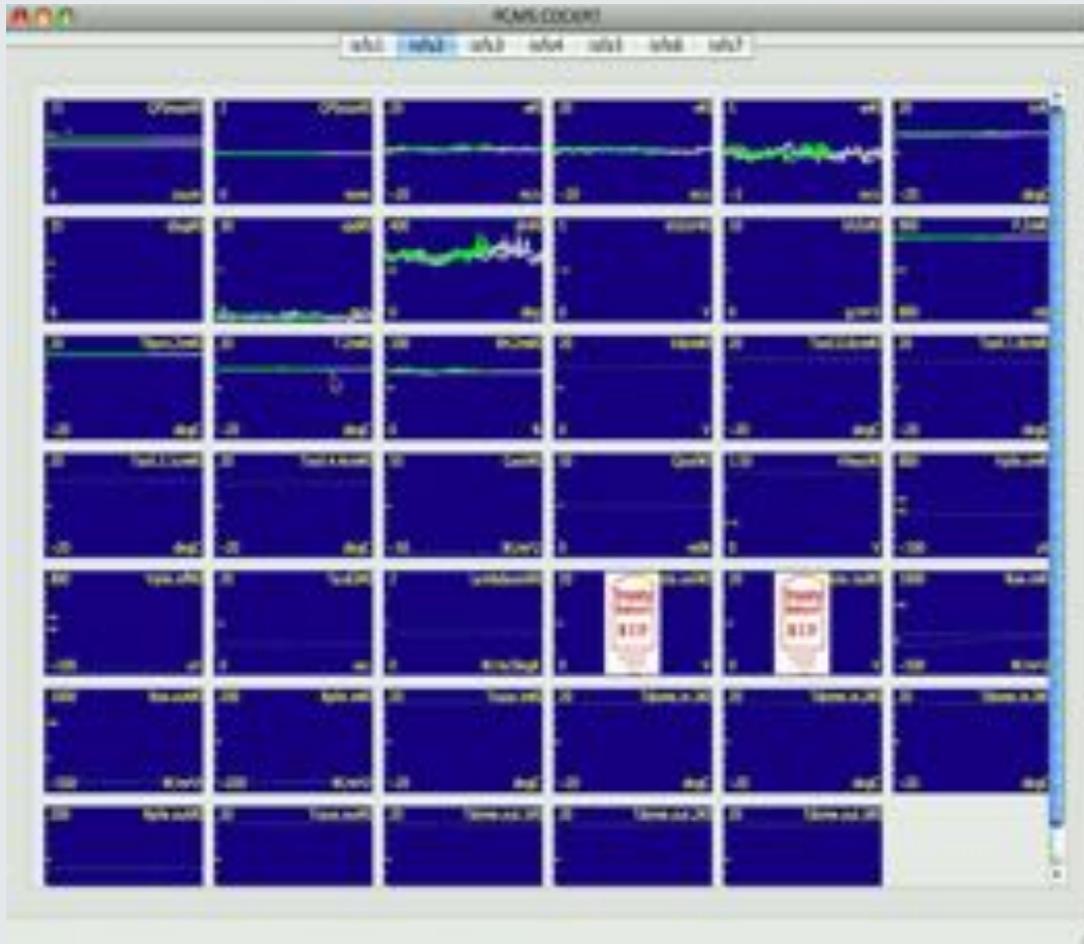
Aircraft



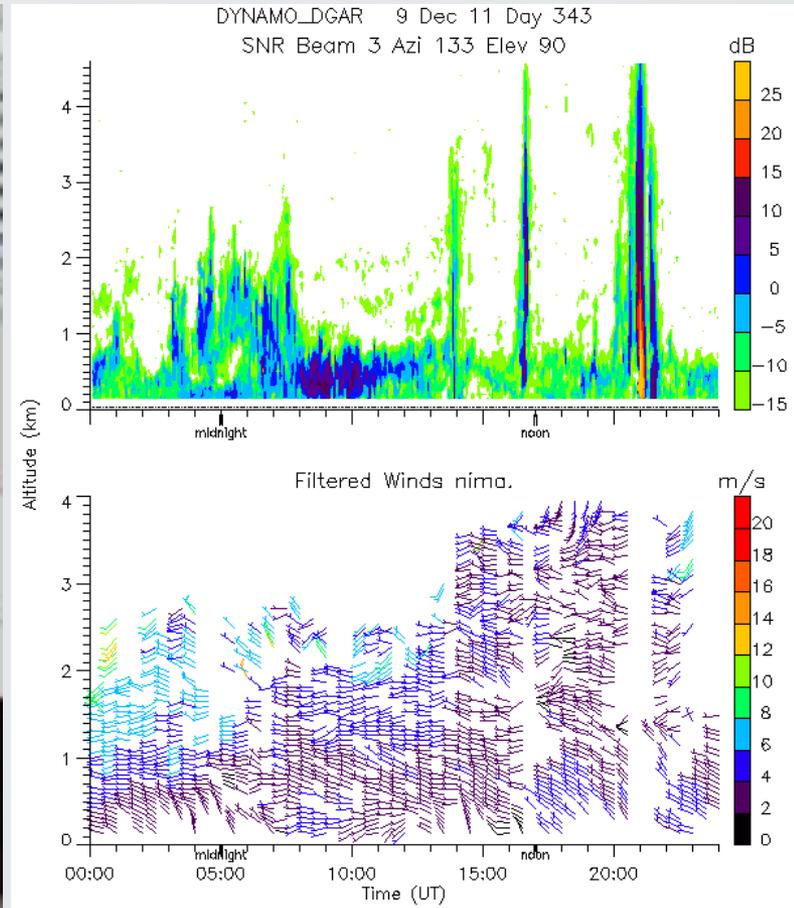
Balloons



Real-time Displays for Surface Deployments



Flux sensors being streamed and monitored

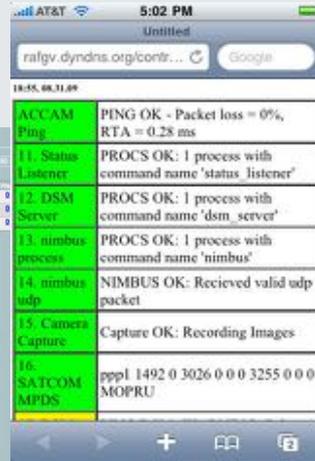


Profiler displays

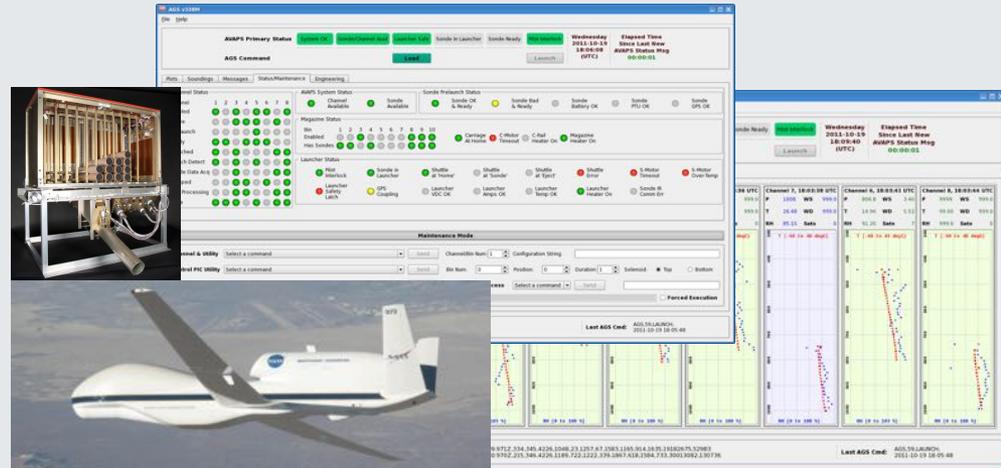


Remote Monitoring and Operations

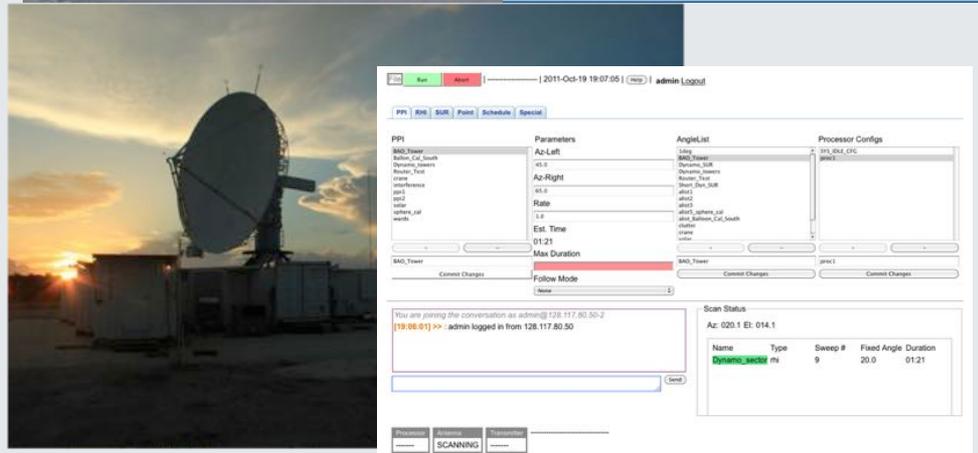
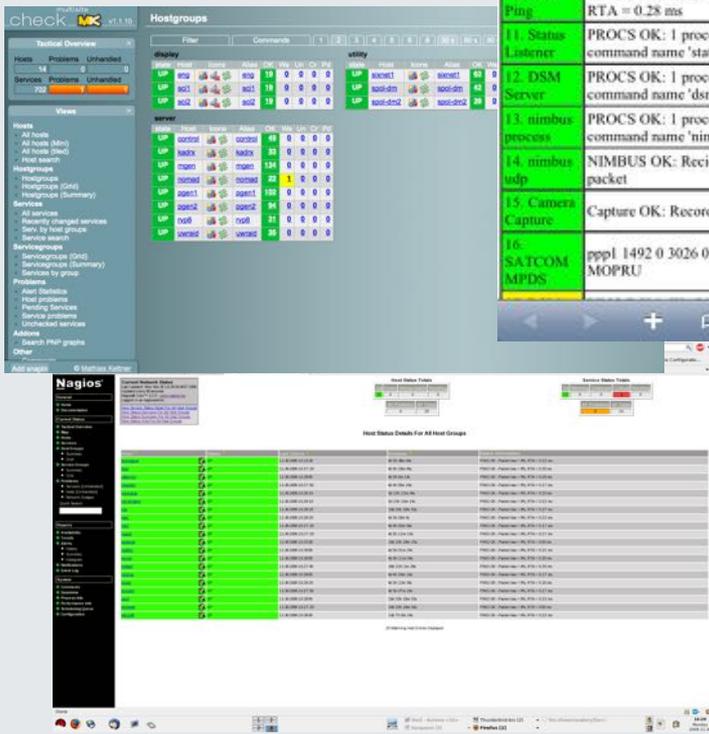
NSF Aircraft
(via smartphone)



Sonde drops initiated on the ground



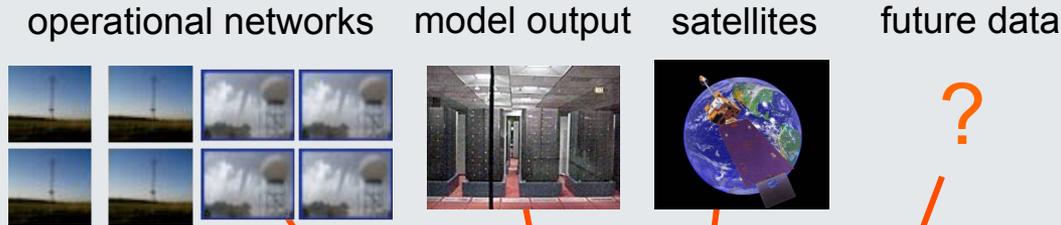
NSF S-PolKa Radar
(in the Maldives)



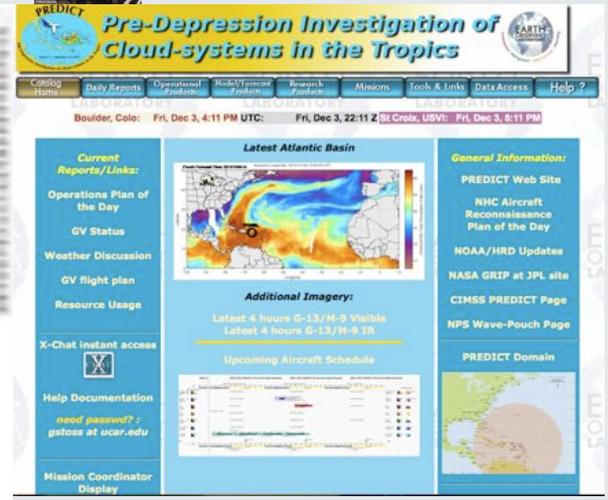
Field data processing systems (in Colorado)

S-PolKa remote control

The LAOF Data System (part 2 of 3)



Mission Guidance and Real-time Troubleshooting

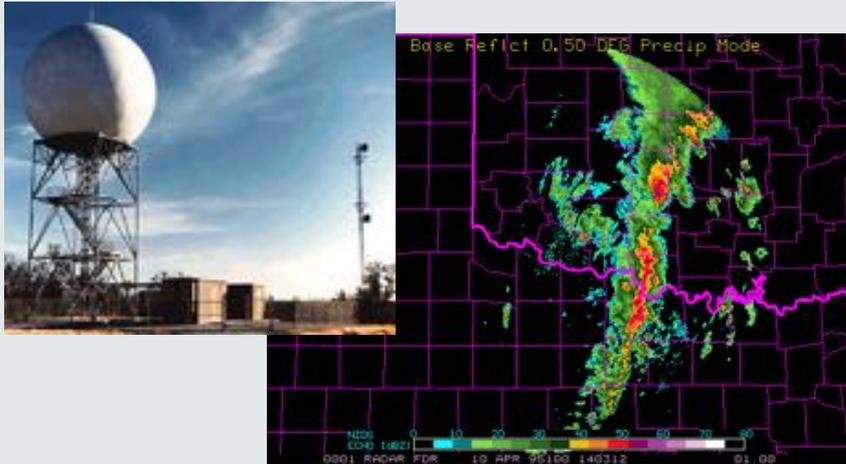


Integrated Displays

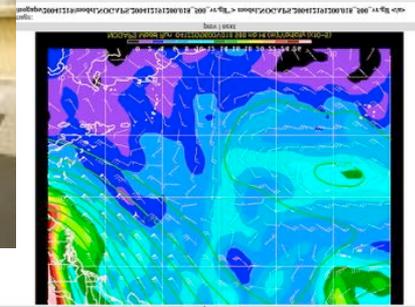
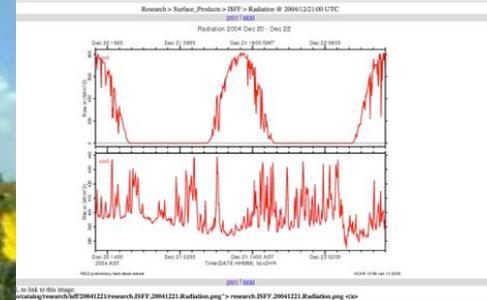
Internet Hub for Distributed Field Operations and Data Access

Other key data (domestic and foreign)

Radar networks



Mesonets

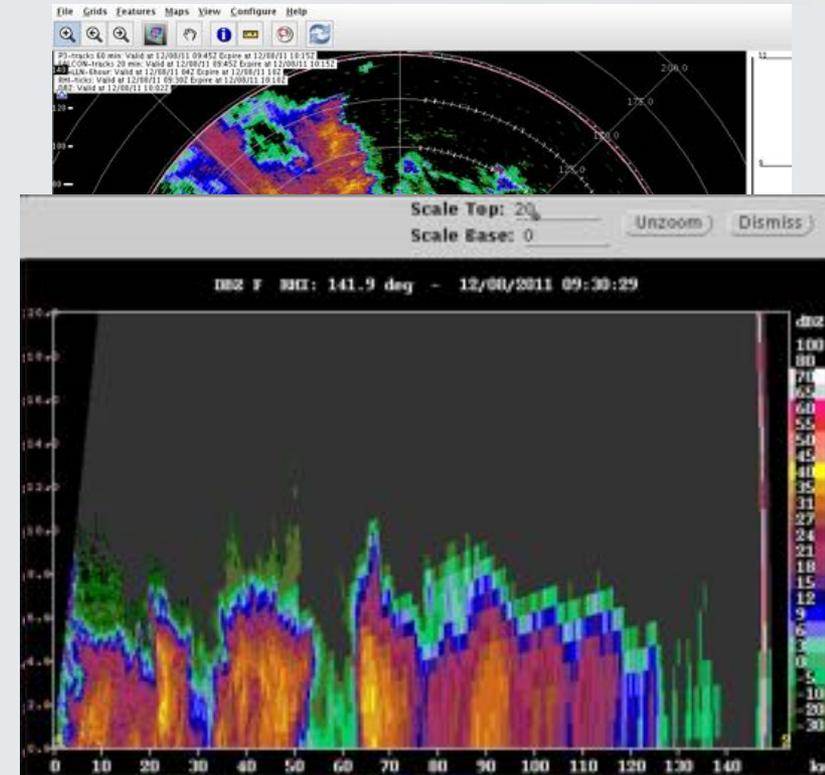
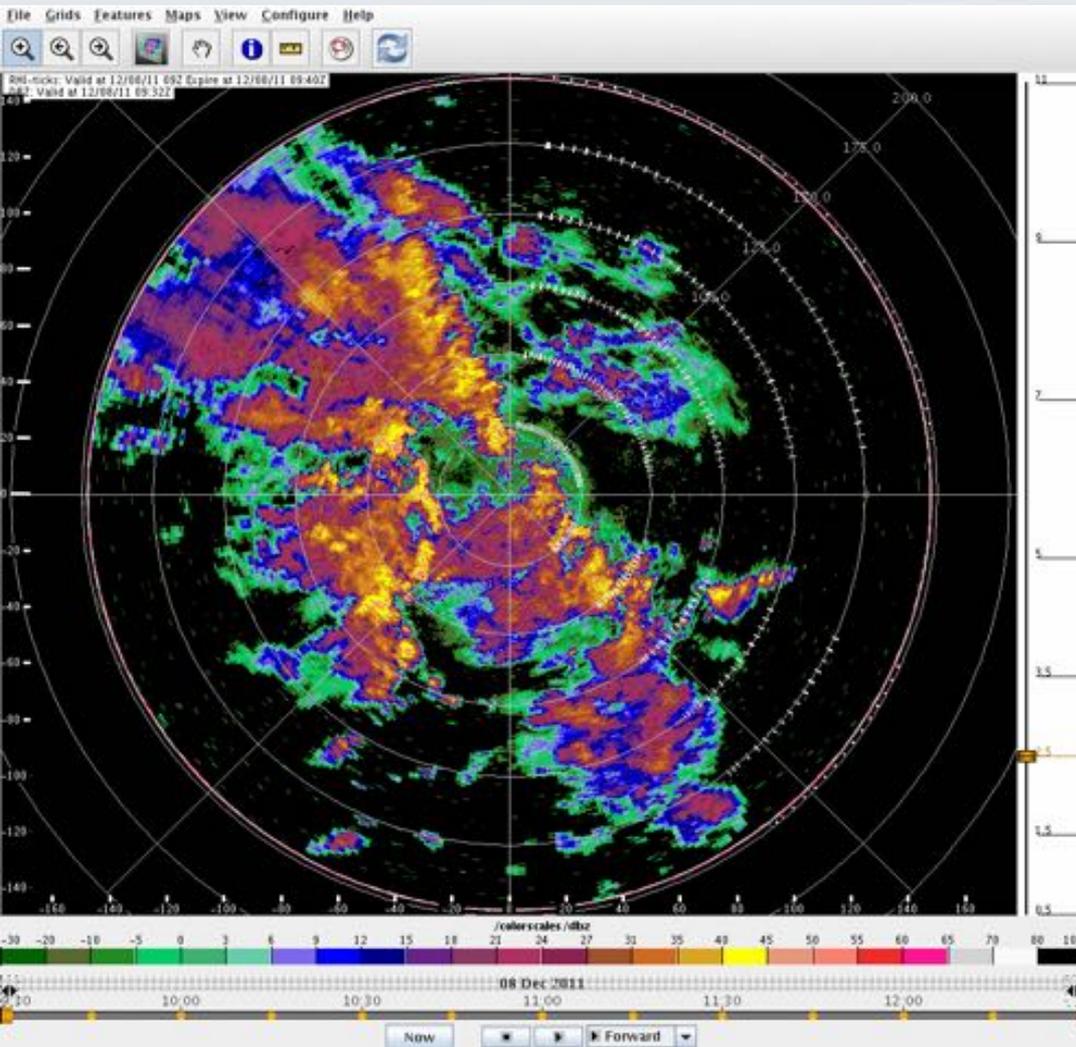


Satellite Data

Model Output



Real-time Displays for Radar Deployments



Particle identification: insects, ice, hail, rain, graupel, etc.

Aircraft tracks



Real-time Displays for Aircraft Deployments



Field Catalog: NSF's Internet Hub for Field Projects

Mission Summaries and Status Reports

Research Products

RICO Mission Table

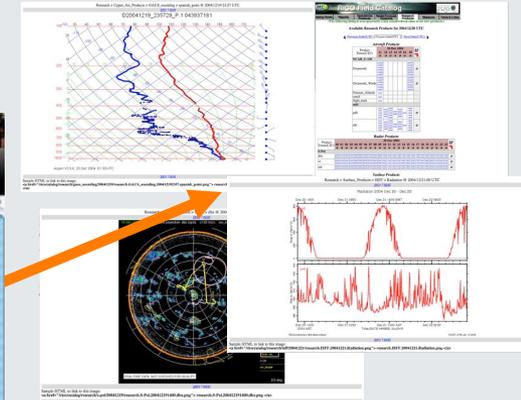
Mission ID	Name	Location	Status
1001
1002
1003

DC3 Field Catalog
Deep Convective Clouds & Chemistry Experiment

Current Reports:
 - Operations Plan of the Day
 - Facilities Status
 - Weather Discussion

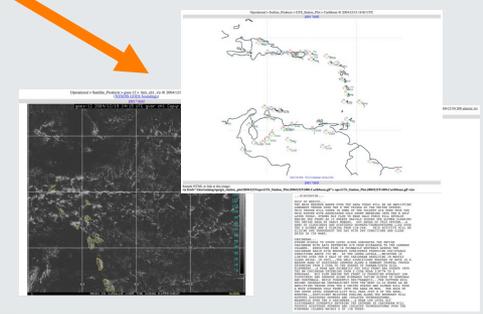
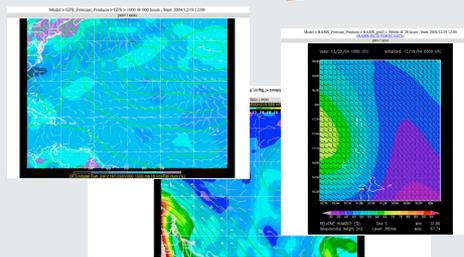
Latest National Radar Mission: [Map of US]

General Information:
 - DC3 web site
 - Ops Director Phone: 303-850-5454
 - Operations Status Message: 303-850-6354



Model and Forecast Products

Operational Products



...with links to Google Earth visualizations, data files, chat, forums, etc.

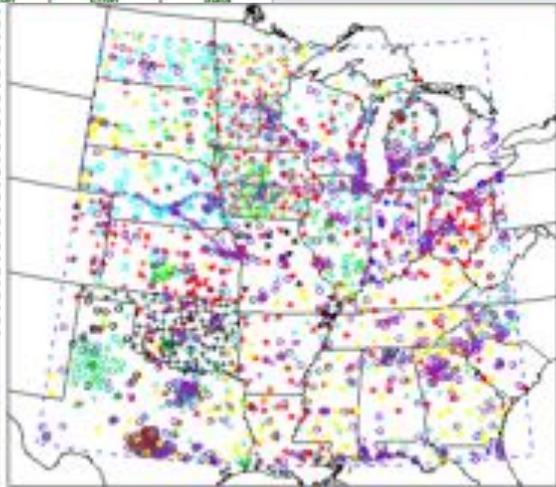
The LAOF Data System (part 3 of 3)

Secure, Easily Accessible Archive

DMG Data Tracking System
 Welcome to the DMG Data Tracking System

[HELP](#)

Active Projects	DLN	IVEN	Stats
ACE-1	Enter	Enter	Stats
ACE-ASIA	Enter	Enter	Stats
ADELE-SPRITE	Enter	Enter	Stats
AIRS-II	Enter	Enter	Stats
AMMA	En		
ARCS5	En		
ATLAS	En		
BAMEX	En		
BEST	En		
BNL_ARM	En		
BNIERP	En		
CASE-99	En		
CEOP	En		
CEOP/IEOP-1	En		
CHAPS	En		
CHATS	En		
Concordiasi	En		



VOCALS Data Access - Mozilla Firefox

http://data.ucar.edu/instr_30/project

UCAR/NCAR E-mail and... NOAA Locator (PUBS) AT&T Directory Direc... Systems Support Drive

VOCALS Data Access

Land Based: Precipitation

GPCP Global Daily 1-Degree Combination Data (NASA)	2003-06-03	Document
GPCP Global Daily Merged Precipitation Analyses Imagers (NASA)	2003-06-03	Document
GPCP Global Monthly 1-Degree Combination Data (NASA)	2003-06-03	Document
GPCP Global Monthly Merged Precipitation Analyses Climatology Data (NASA)	2003-06-03	Document
GPCP Global Monthly Merged Precipitation Analyses Imagers (NASA)	2003-06-03	Document
GPCP Global Pentad (5-Day) Precipitation Analysis (NASA)	2003-06-03	Document
MCEP/CPC Global CMAP Precipitation Analyses	2003-06-03	Document
MCEP/CPC Global CMORPH Precipitation Analyses	2003-06-03	Document
PERSIANN 1x1 Tropical Rainfall Data (NASA)	2003-06-03	Document
TRMM Real-time Rainfall Analyses (3-h) (NASA)	2003-06-03	Document

Model

[ECMWF Global](#)
[EDC 30 Arc-Sec](#)
[MCEP AVN Reg](#)

Small comments & questions to webmaster@colorado.ucar.edu

None

QA/QC Processing, Special Products and Detailed Tracking

Community Data Portal

NCAR | CDS | [CDP Home](#) | [Applications](#) | [Support](#) | [Login](#)

Search: [Search](#) [Advanced Search](#)

[Browse Themes](#) [Browse by Organization](#)

Climate
 Climate Change, Models, Data

Weather
 Weather Data, Events, Models

Models
 Climate, Atmospheric Chemistry, Weather Prediction Models

Sun-Earth and Space Weather
 Data about the Ionosphere, Solar Data

Polar
 Data from the Arctic and Antarctica

Field Campaigns and Observations
 Campaigns to Collect Measurements of Atmospheric Parameters

Human Dimensions, Environmental Impacts
 Interactions of Climate, and Weather and Human Activity

IPCC
 International Panel on Climate Change, Data, Reports

Software and Tools
 Model software, Visualization software

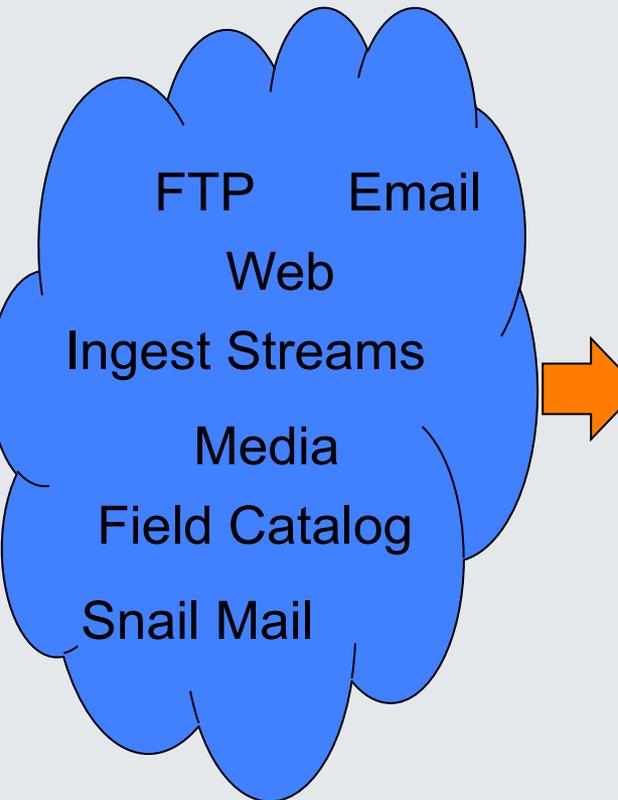
Visualizations
 2D and 3D Visualizations of Scientific Data and Models

The Community Data Portal (CDP) is a collection of earth science datasets from NCAR, UCAR, UDOP and participating organizations.

Statistics:
 8000+ Collections
 1,169,041 Files
 6.3TB Total Size
 4.3TB Downloaded
 2107 Registrations

The Community Data Portal is led by NCAR's Computational Science and Information Systems Laboratory (CSIS). Support is provided through NCAR's Cyberinfrastructure Strategic Initiative.

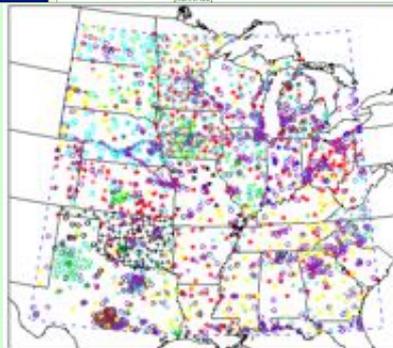
Post Project Data Management Flow



QA/QC Processing and Tracking

Data Tracking System - Data Loading Notes DMG DTB - DLN v2.0

ID	Status	Date	ID #	Name	Ingest	Load	(Checking)
1	✓	2007-06-18 10:00:00		NOAA/ERL/GOES MAGEC Data including Meteosat (netCDF format) (NCAR/EOL)	gotstein	paterson	
2	✓	2007-02-09 10:00:00		NAVY/NOGAPS Global Grids (NCAR/EOL)	detert	detert	
3	✓	2006-02-18 10:00:00		GOES-12 Multi-Spectral 100M TOP Data (NCAR/EOL)	paterson	gotstein	
4	✓	2007-06-18 10:00:00		UTLS LDR Surface Synoptic Observations (Global, GEMPAK) (NCAR/EOL)	paterson	paterson	
5	✓	2007-06-18 10:00:00		LDR Surface METAR Data (METAR format) (NCAR/EOL)	paterson	paterson	
6	✓	2007-10-19 21:00:00		NCEREMC U.S. Gage Only Hourly Precipitation Data (NCAR/EOL)			
7	✓	2007-10-19 21:00:00		NCEREMC U.S. Gage Only Daily Precipitation Data (NCAR/EOL)			
8	✓	2007-02-07 21:00:00		NCEREMC U.S. Gridded Gage Only Daily Precipitation 4 hrs 2000-Oct 2008 (NCAR/EOL)	gotstein	gotstein	
9	✓	2006-11-27 02:00:00		UK BAE-148 Navigation, State Parameters, Meteorology, Aerial, and Chemistry Data (UK Met Office)	detert	detert	
10	✓	2006-08-10 02:00:00		NCAR Mobile GAUS (MGAUS)/Rawinsonde Data (ESG Format) (NCAR/EOL)	stobher	paterson	
11	✓	2006-08-22 02:00:00		NAWS China Lake Rawinsonde Data (ESG Format) (NCAR/EOL)	stobher	paterson	
12	✓	2006-08-23 02:00:00		NCAR QV (HAPER) LRT (1 spec) Flight Level Data (NCAR/EOL)	detert	detert	
13	✓	2006-08-21 02:00:00		University of Utah HORO Data (U Utah)	rhhoba	detert	
14	✓	2006-08-23 02:00:00		Automated Surface Observing System (ASOS) 1-min Data (NCAR/EOL)	junet	detert	
15	✓	2006-08-23 02:00:00		ASOS China Lake, CA 1-minute Data (NAU/RWD) China Lake	paterson	detert	
16	✓	2006-08-23 02:00:00		NWS Rawinsonde Data (ESG Format, 6 second resolution) (NCAR/EOL)	stobher	paterson	
17	✓	2006-08-22 02:00:00		NCAR Mobile GAUS (MGAUS)/Rawinsonde Data (ESG format) (NCAR/EOL)	stobher	paterson	
18	✓	2006-08-22 02:00:00		NAS Lemmon Rawinsonde Data (ESG Format) (NCAR/EOL)	stobher	paterson	
19	✓	2006-08-23 02:00:00		NCAR QV (HAPER) Primary Left Side Camera Video (NCAR/EOL)	detert	detert	
20	✓	2006-11-27 02:00:00		NCAR QV (HAPER) Left Side Camera Imagery (NCAR/EOL)	detert	detert	
21	✓	2006-08-09 02:00:00		NCAR QV (HAPER) Left Side Camera Video (NCAR/EOL)	paterson	detert	
22	✓	2006-08-23 02:00:00		NCAR QV (HAPER) In-Situ Clone Data (NCAR/EOL)	detert	detert	



Composites and Format Conversions

PREDICT
Datasets
 39 datasets were found for the PREDICT project. Full dataset descriptions are available by selecting the dataset title. [Display datasets in groups.](#)

AGCS Analysis Products
 This dataset includes SST Analysis and Tropical Cyclone Heat Potential Imagery taken during the Pre-Depression Investigation of Cloud-systems in the Tropics (PREDICT) project. The PREDICT project took place during the summer and fall of 2010 in the...
 CIRA RAMMB TC Commission Probability Forecast Products
 This dataset includes CIRA RAMMB TC Commission Probability Forecast Products. The files are png images and were taken during the Pre-Depression Investigation of Cloud-systems in the Tropics (PREDICT) project. The PREDICT project took place during the...
 CMC Forecast Products
 This dataset includes CMC Forecast Products from the PREDICT field catalog. The files are png images and were taken during the Pre-Depression Investigation of Cloud-systems in the Tropics (PREDICT) project. The PREDICT project took place during the...
 ECHWF 0.25 Degree Forecast Sheds Grids (GDSB) (ESG/RAI)
 This dataset contains ECHWF 0.25 degree (lon x lat = 561 x 261 points) resolution forecast model grids in GRIB format from NPS. Forecasts are initiated at 00 and 12 UTC every day. Forecast times are 3-hourly out to 144 hours, then 6-hourly out to 240...
 Forward-Looking Digital Camera Imagery (ESG/RAI)
 During PREDICT the QV_M0777 flew a forward looking digital camera for in-flight video capture. Individual photo jpeg images were captured once per second during flights. The images have been combined into hour long tarfiles running from zero minutes...
 Forward-Looking Digital Camera Image Sheds 1208
 During PREDICT the QV_M0777 flew a forward looking digital camera for in-flight video capture. Individual photo jpeg images were captured once per second during flights. Images taken after dark have been stripped from this archive. Remaining images were...
 GOES-13 Imager 3 km Visible Data (ESG/RAI)
 This dataset contains full resolution GOES-13 satellite data collected during the PREDICT project. The University of Wisconsin Space Science and Engineering Center (SSEC) made available the full resolution GOES-13 imager data to the PREDICT investigators...
 GOES-13 Imager 4 km All Channels Data (ESG/RAI)
 This dataset contains full resolution GOES-13 satellite data collected during the PREDICT project. The University of Wisconsin Space Science and Engineering Center (SSEC) made available the full resolution GOES-13 imager data to the PREDICT investigators...
 GOES-13 Metadata-8 Products
 This dataset consists of GOES-13 Metadata-8 jpeg images from the Pre-Depression Investigation of Cloud-systems in the Tropics (PREDICT) project. This data covers July through October of 2010. This set is password protected...
 GOES-13 Visible, Thermal, Water Vapor Products
 This dataset consists of visible and thermal data in jpeg images of GOES products from the Pre-Depression Investigation of Cloud-systems in the Tropics (PREDICT) project. This data covers July through October of 2010...
 GRIP NASA DC-B Quality Controlled Dispensable Archive
 This dataset contains sounding files in QDL format, an ascii text format. These data were collected during NASA DC-B flights for the Genesis and Rapid Intensification Process (GRIP) experiment...
 GTS Metadata-9 Products
 This is one of the upper air data sets developed for the Pre-Depression Investigation of Cloud-systems in the Tropics (PREDICT) project. This data set includes 1287 GTS mandatory and significant level soundings from 24 stations in the Caribbean and Gulf...



Archive and Distribution

Steve Mesleard's Data Services

The screenshot shows the Wikipedia article for "The Cathedral and the Bazaar" by Eric S. Raymond. Overlaid on the page are several data service components:

- Top Left:** A grid of small data plots and a larger radar-style plot.
- Top Center:** A circular diagram with nodes and arrows, possibly representing a network or data flow.
- Left Side:** A sidebar with navigation links like "Featured content", "Community portal", and "Languages".
- Center:** The main text of the article, with a table of contents and a list of notes.
- Right Side:** A book cover for "The Cathedral and the Bazaar" by Eric S. Raymond, published by O'Reilly Media in 1999.
- Bottom Right:** A small table with metadata: Author (Eric S. Raymond), Publisher (O'Reilly Media), Publication date (1999), and ISBN (1-56592-724-9).

Through comprehensive data services, our mission is to improve the quality of datasets and metadata.

Our mission is to improve the quality of data files and the accuracy of the associated infrastructure.

CatB: "Given enough eyeballs, all bugs are shallow."
 Products, Revision, Tracking and Archiving

Arctic and Climate Related Datasets

- Coordinated Energy and water cycle Observations Project (CEOP) Global Reference Sites (2002-2009)
- Various Climate Studies (e.g. GCIP, PACS, GAPP, CPPA)
- Various Climate Process Study Field Projects (e.g. SALLJEX, EPIC)
- Various Arctic Field Projects and archives (e.g. SHEBA, ITEX, ARCSS, BEST, BSIERP, ATLAS, SBI)
- GOES Satellite Data Archives (1997-present)
- NWS high vertical resolution (6-sec) soundings (1995-present)
- NCEP National Precipitation data/products (1996-present)
- Various Legacy Field Project datasets (1968-present)

Bering Sea Project
Incorporating the BSS BSIERP Data Archives

Welcome to the Bering Sea Project Data Archive. This archive will facilitate the commitment of Bering Sea Project participants to long-term data storage, data sharing within the project, and eventual public data accessibility. Read more about the project data policy here.

The Bering Sea Project encompasses two programs — the NSF-funded BEST program and the NPSR-funded BSIERP program. This heritage is reflected in the data archives that you can access using the links below.

BEST [Access BEST Data](#)

The Bering Ecosystem Study (BEST) project is a multi-year, interdisciplinary program to develop an end-to-end mechanistic understanding of how climate change will affect the marine ecosystems of the eastern Bering Sea, the continued use of their resources, and the social, economic and cultural sustainability of the people who depend on them.

BEST is motivated by the realization that the Bering Sea is in the midst of significant, interrelated physical and biological change that may impact the region's carrying capacity and productivity, the sustainability of fish and shellfish stocks of great economic value for the nation, and the livelihoods of Native communities and fisheries. These changes involve climate forcing, physical properties and processes in the ocean, and biological responses from the level of the physiology of individual organisms to the structure and function of entire ecosystems.

BEST is supported by the National Science Foundation (NSF) Office of Polar Programs (OPP).

Project Contact: [BSI Wiseman](#)

BSIERP [Access BSIERP Data](#)

The Bering Sea Integrated Ecosystem Research Program (BSIERP) focuses on understanding trophic interactions among colony-based foragers, top spot foragers, pelagic forage species, pelagic predators and benthic predators.

Hypotheses are tested in a linked set of spatially explicit, competing models that connect climate scenarios, physical and biological oceanographic models, a lower and upper trophic level ecosystem model and economic and management models. Models forecast changes in abundance of pelagic piscivores in response to changes in predators and prey and attendant economic and management consequences. Two-way connections between the program and communities, stakeholders and the region's body of local and traditional knowledge are enabled by outreach, education and community involvement projects. Products of the project enable testing and improved understanding of effects of climate change and management actions on the Bering Sea ecosystem.

BSIERP is administered by the North Pacific Research Board (NPRB), Anchorage, Alaska.

Project Contact: [Tom Van Pelt](#)

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CEOP Reference Site Data Sets

last Updated: 7 March 2012.

Most recent updates: 7 Mar 2012 - You can now order the complete FLX/SFC/STM/TWR CEOP data set in netCDF or the CEOP ASCII formats here.

[Click here to order the complete FLX/SFC/STM/TWR CEOP data set in netCDF or the CEOP ASCII formats.](#)

You can still order individual data sets in either netCDF or CEOP ASCII formats by clicking on the appropriate "X" below. Note that the dates by the "X" are the dates the data set was last updated.

Additional documentation can be obtained by clicking on the Reference Site Name.

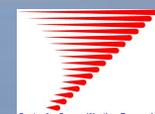
SFC - Surface Meteorology and Radiation TWR - Meteorological Tower
STM - Soil Temperature and Moisture FLX - Flux

For other ancillary data sets please click here.

The CEOP data formats are described in the [CEOP Reference Site Data Set Procedures Report](#)

To jump to a particular RHP click on the appropriate logo:

RHP	Reference Site Name	Data Set	Oct 2002 Dec 2003	2004	2005	2006	2007	2008	2009
Caboww		SFC				X (19 Nov 2010)			
		TWR				X (19 Nov 2010)			
		STM				X (19 Nov 2010)			
		FLX				X (19 Nov 2010)			
		Soundings (Raw)				X (17 Nov 2010)			
		TWE				X (10 Jan 2011)			



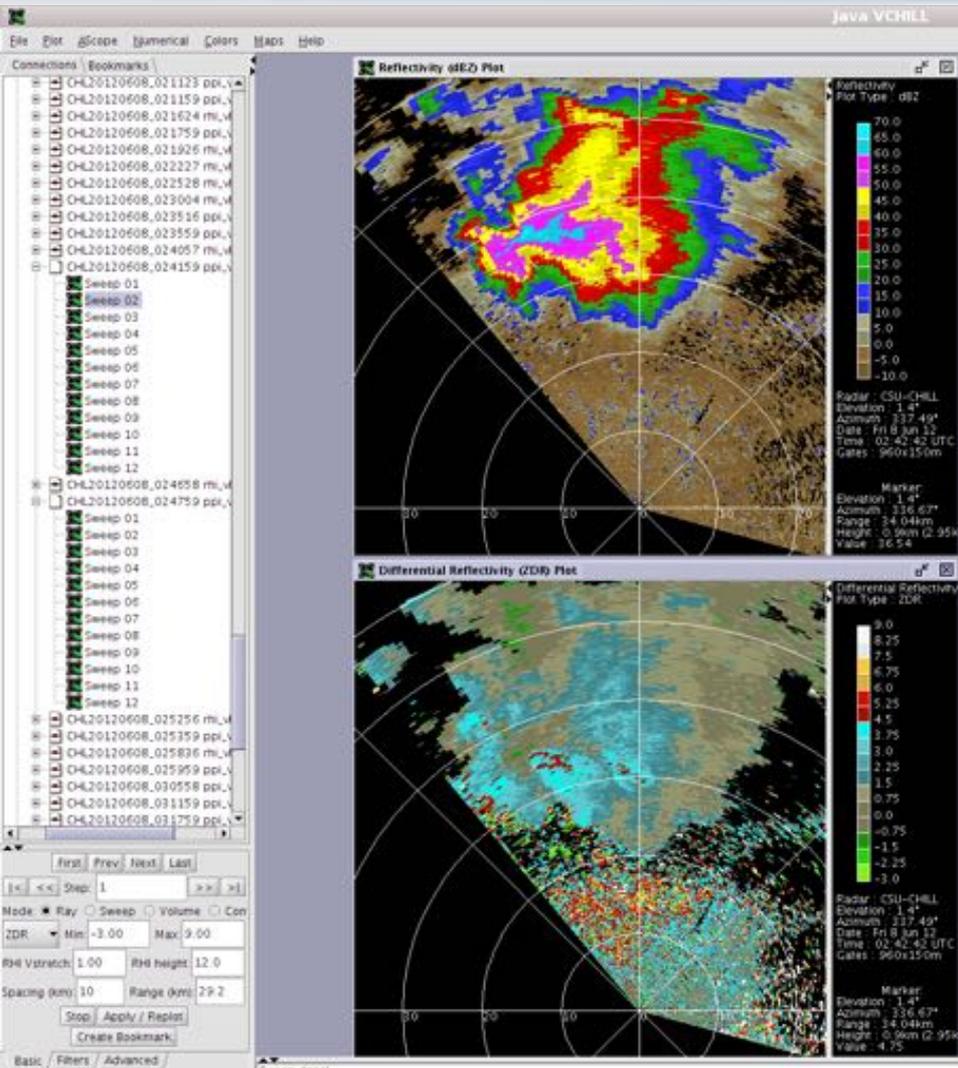
Legacy Data Activities



- Data and Metadata Rescue
- Project Documentation
 - Collect and digitize
 - Some lack of documentation
- Digitizing Aircraft Videos
- Media and Format Migration (e.g. GENPro to NetCDF)
- NCAR Iron Mountain Archives
- Sounding Legacy Project (CSU)
- T-28 Facility Archive



Innovation spreads among LAOF



- VCHILL provided a basis for current internet-based radar control interface
- Capable of both real-time display and playback
- Planned to be added as a feature for S-Pol for FRONT

Image shown is from a hail storm in northeastern Colorado on June 8, 2012 during DC3 operations



Shared LAOF services and infrastructure



- KingAir data formats match other NSF Aircraft
- DOW use common radar processing tools
- Crews use common communications and data display tools for mission coordination
- Data are archived on the NCAR/CISL large storage devices

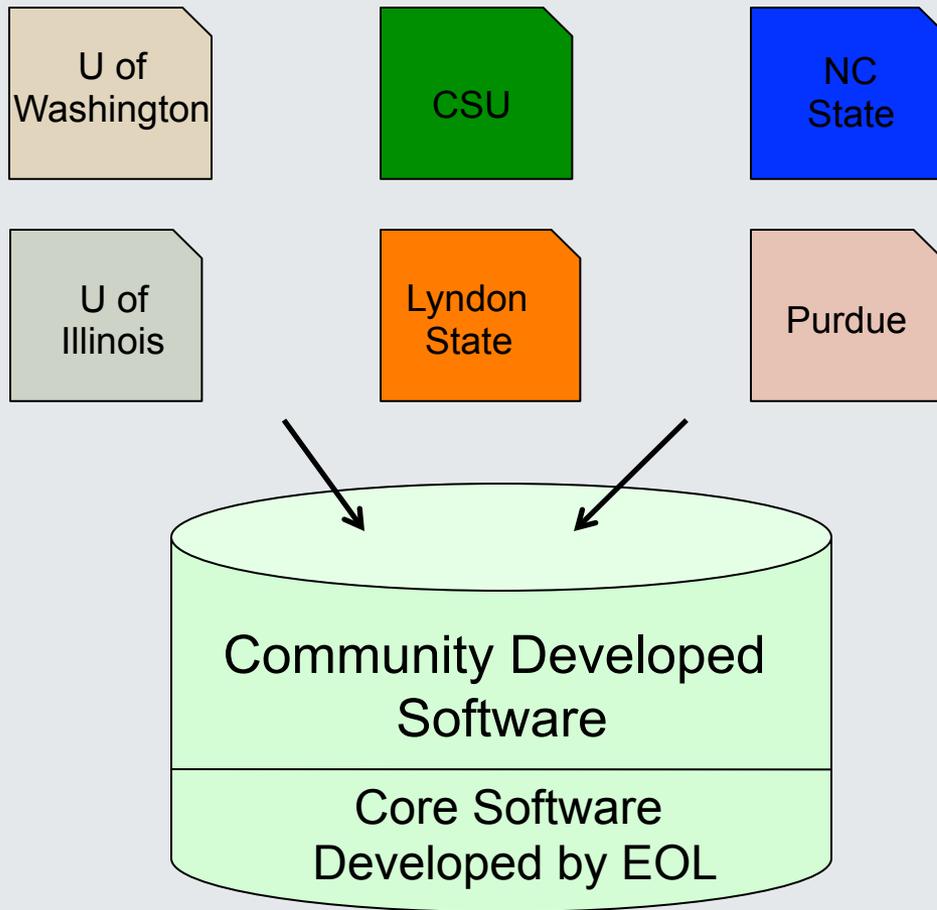


A Few Lessons Learned

- Go and visit your communities at their workplaces
- Use “code sprints” to allow bursts of development between deployments
- Keep staff present in the field (e.g. for Agile development)
- “If you build it, they will come.”
- Seek out and encourage student participation
- Build collaborations, aligning new projects with mission (our services are leveraged with substantial outside funding)



Future: A Shared Community Developed Software Model



- Central repository managed by EOL
- Based on data format standards
- Relies on community contributions
- Starting with radar tools and infrastructure



Other Future Directions

- Expanded development in remote operations
- More automated monitoring
- Digital Object Identifiers and data citations
- netCDF/Climate Forecasting (CF) conventions
- Refactoring of legacy tools
- New Collaborations (e.g. Federation of Earth Science Information Partners and EarthCube)



Thank you!
Mike Daniels, EOL/CDS
daniels@ucar.edu



NCAREOL



UNIVERSITY
of WYOMING

Colorado
State
University

CDS
COMPUTING, DATA
AND SOFTWARE FACILITY



NCAR
NATIONAL CENTER FOR ATMOSPHERIC RESEARCH

