Exploring ArcIMS Services to Deliver National Weather Service Datasets in Support of Decision-Makers

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PS Institutes of Energy & the Environment
The Pennsylvania State University

Overview

- National Weather Service (NWS) Structure and tie to Decision-Makers
- Exploratory NWS Collaborative GIS/IMS Efforts
- Lessons Learned from PSU Serving NWS NDFD via ArcIMS

Department of Commerce (DOC)

www.doc.gov

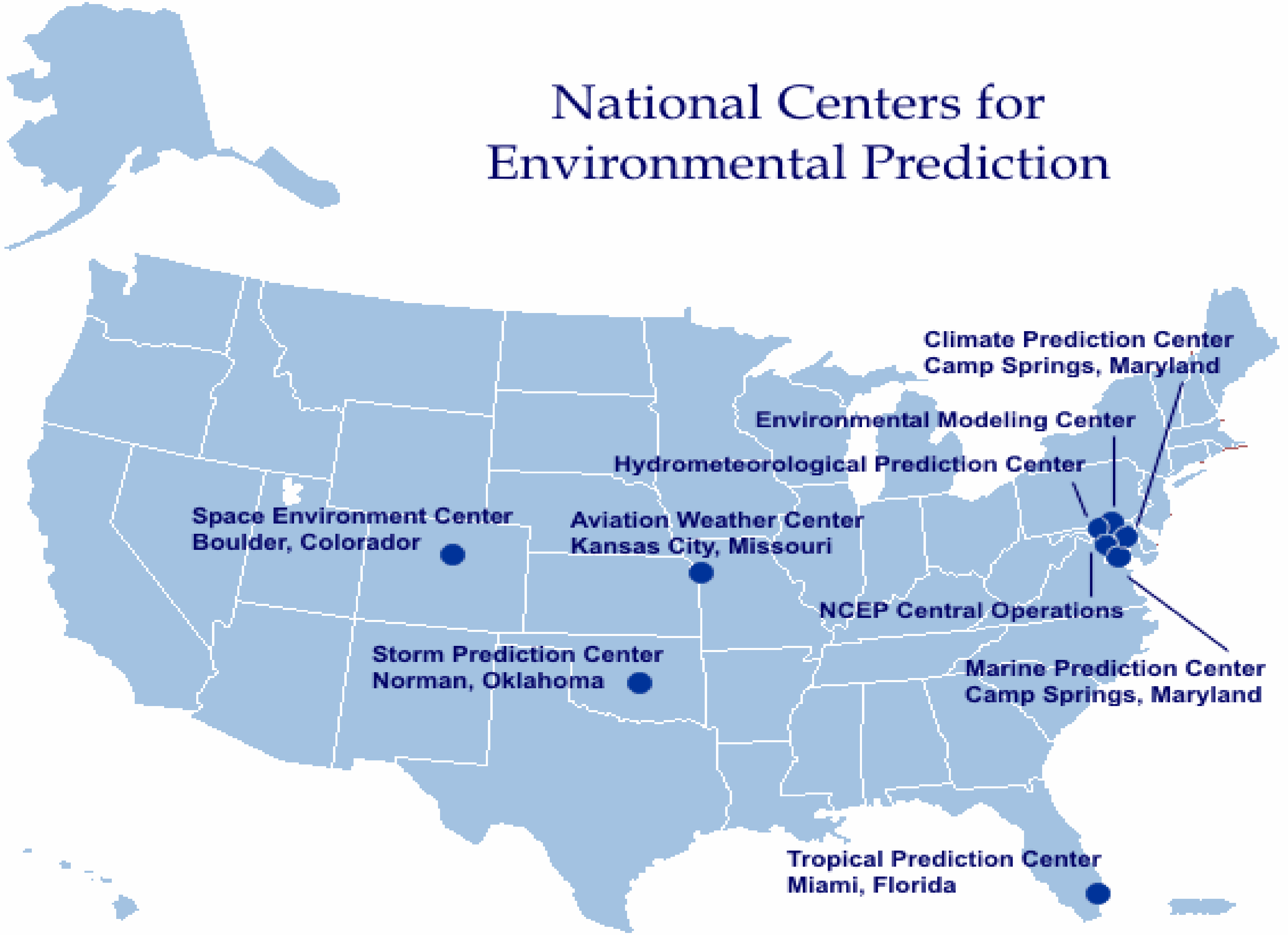
National Oceanic and Atmospheric Administration (NOAA)

www.noaa.gov

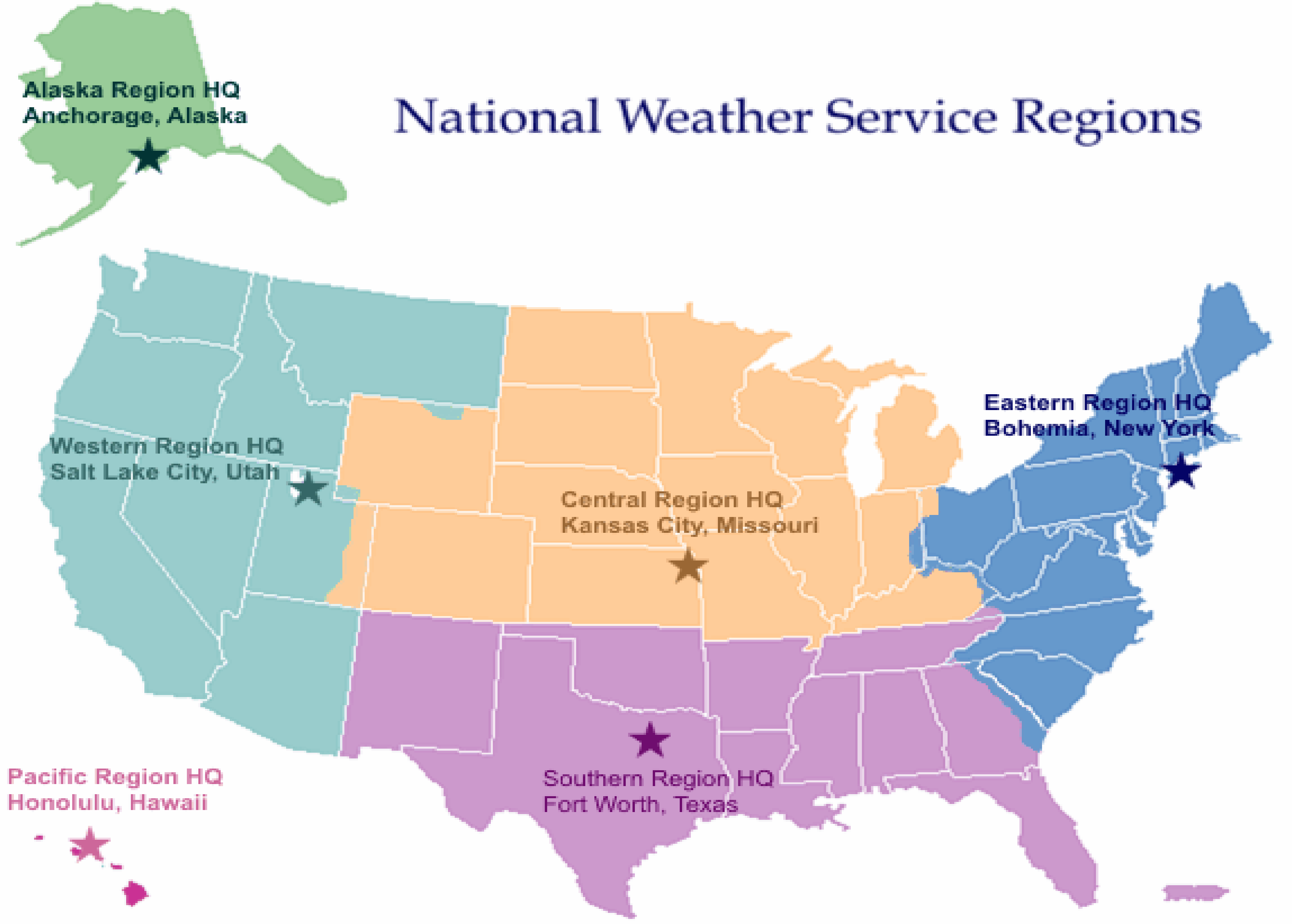
Booth 617

National Weather Service Structure

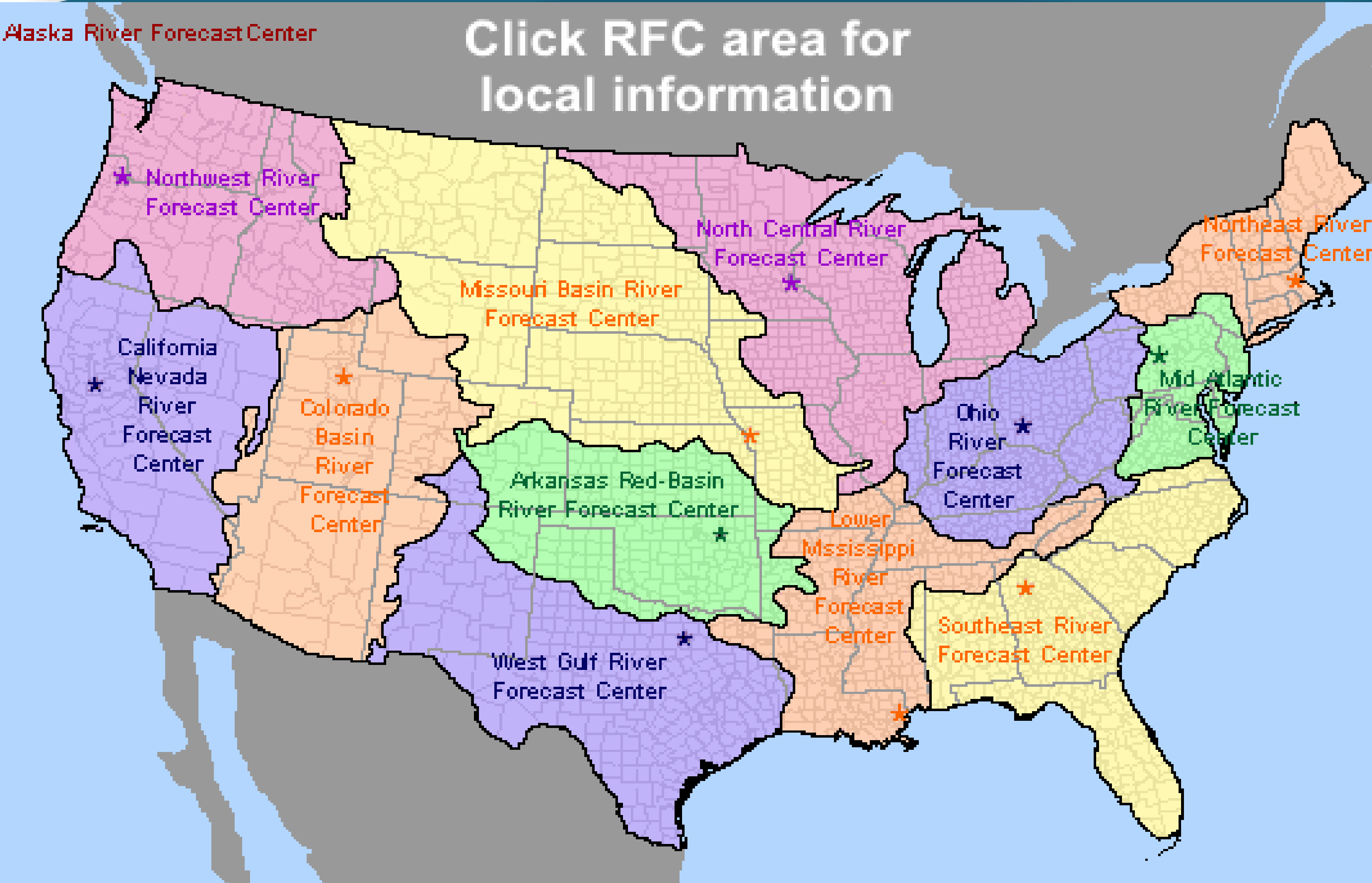
National Centers for Environmental Prediction



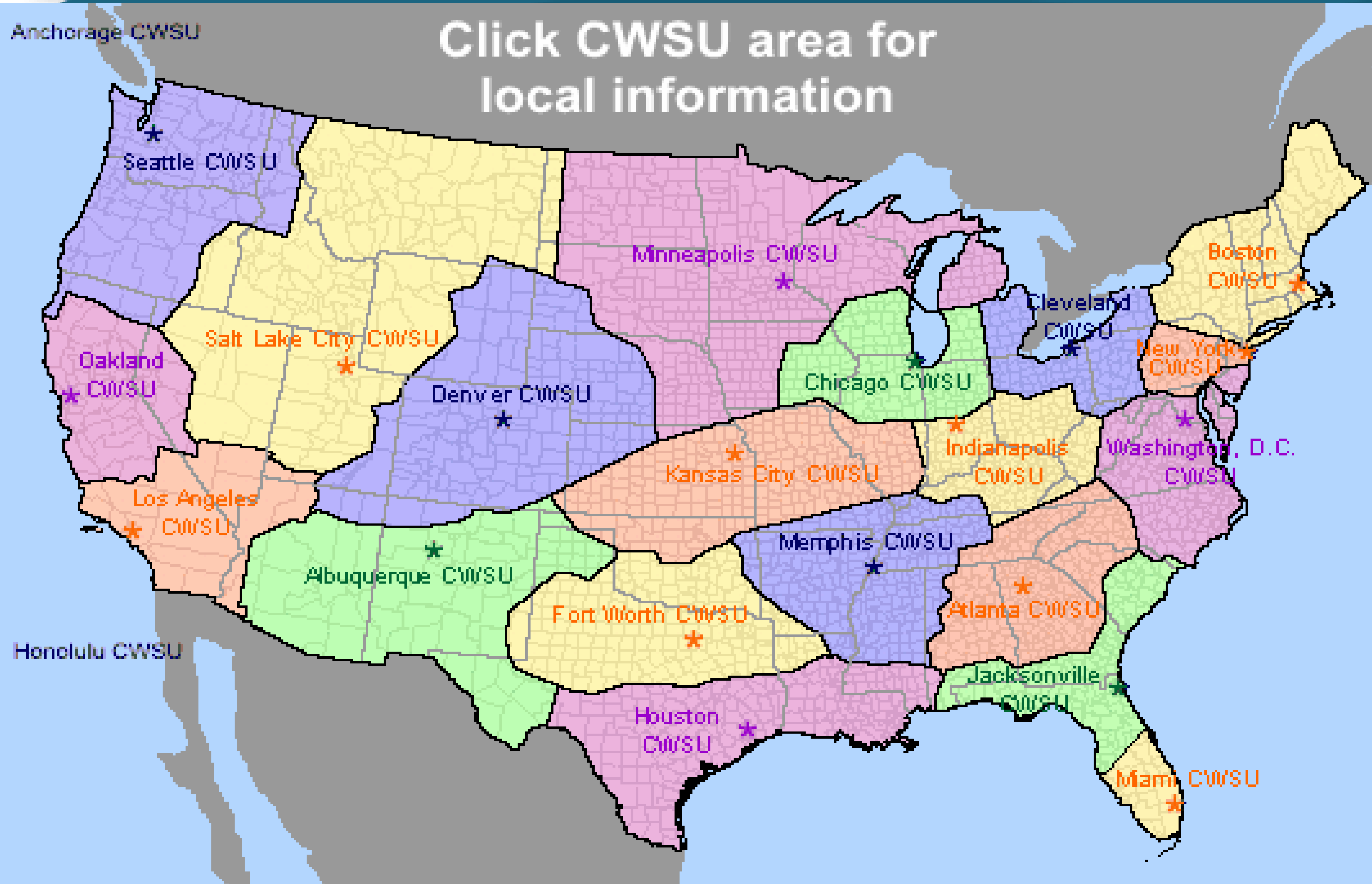
National Weather Service Regions



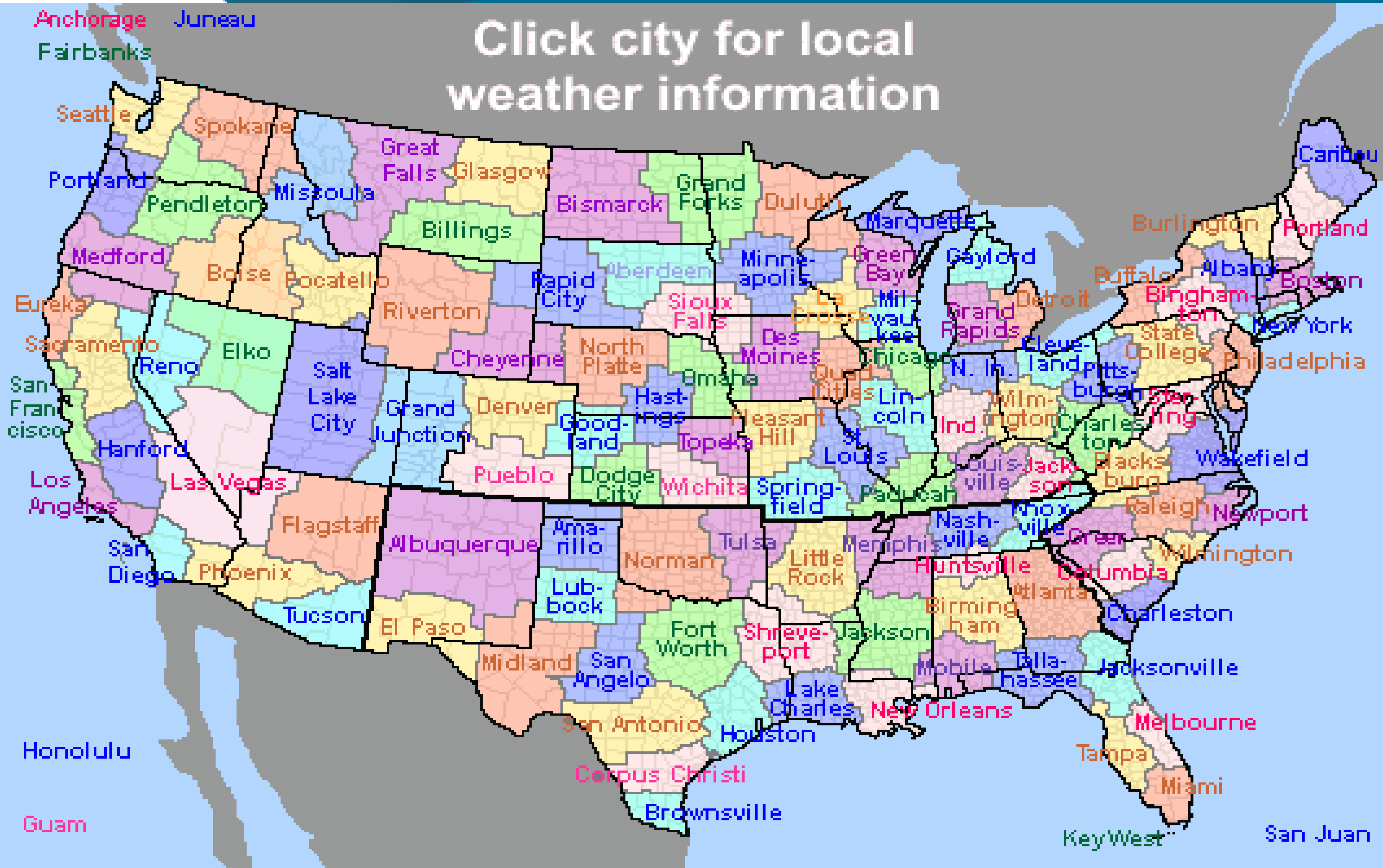
13 River Forecast Centers



21 Center Weather Service Units

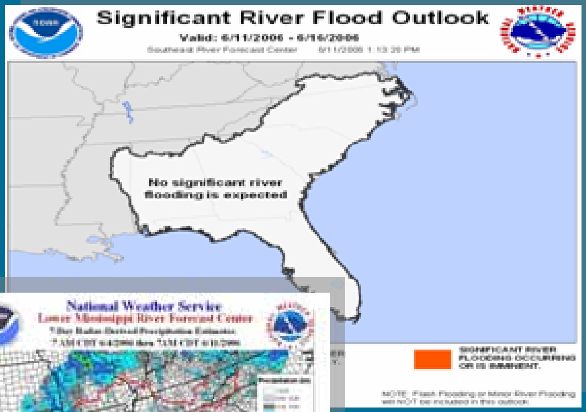


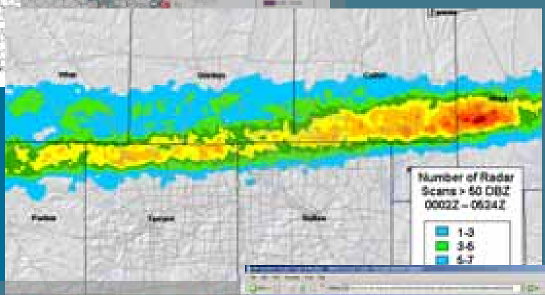
122 NWS Weather Forecast Offices



What Can the NWS (and others) do with GIS-encoded weather information?

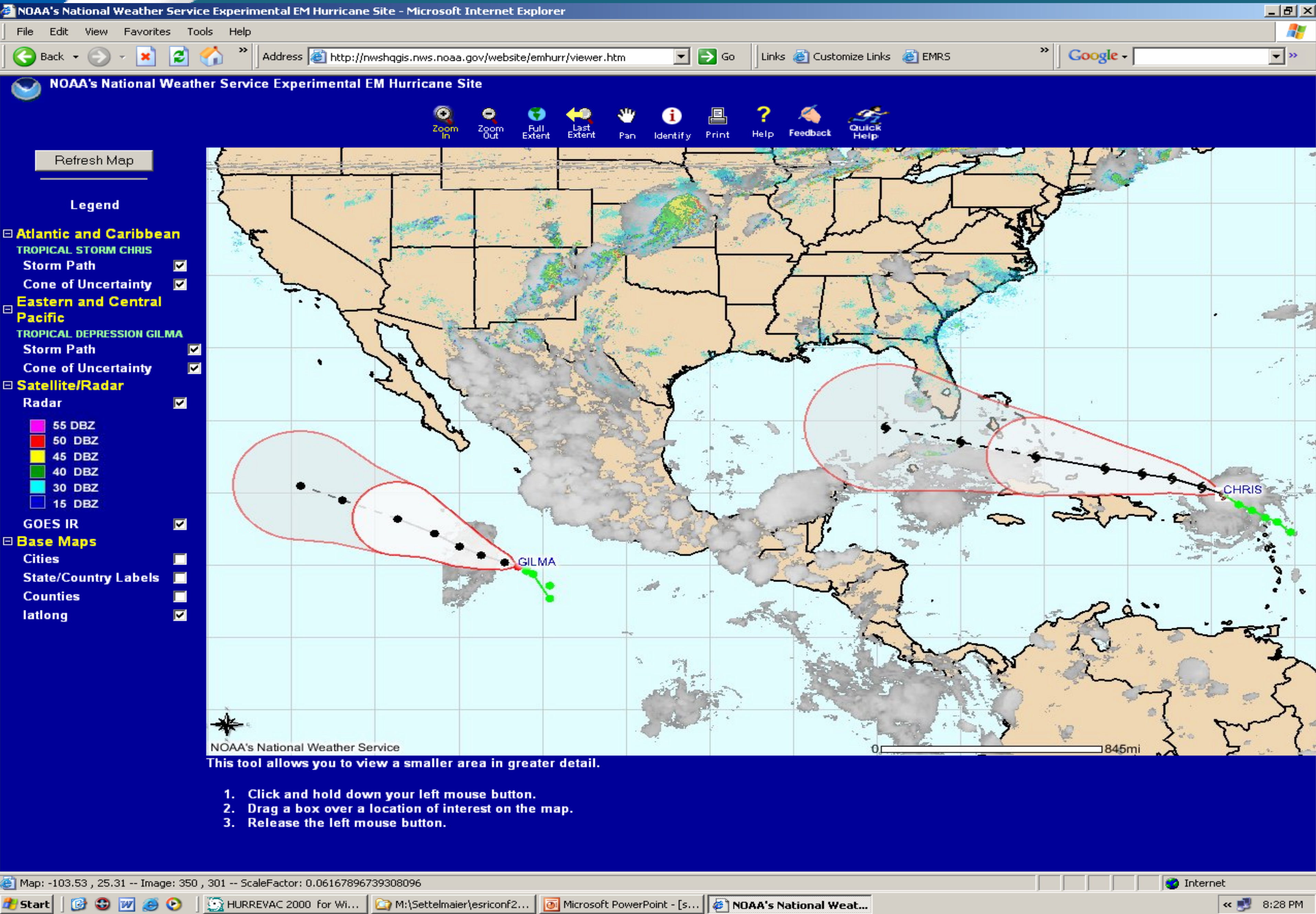
- Customized Projects/Products/Data Analysis and Display
- Research, Analysis and Verification
- Real – Time SA
- Centralize Storage and Standardized Dissemination



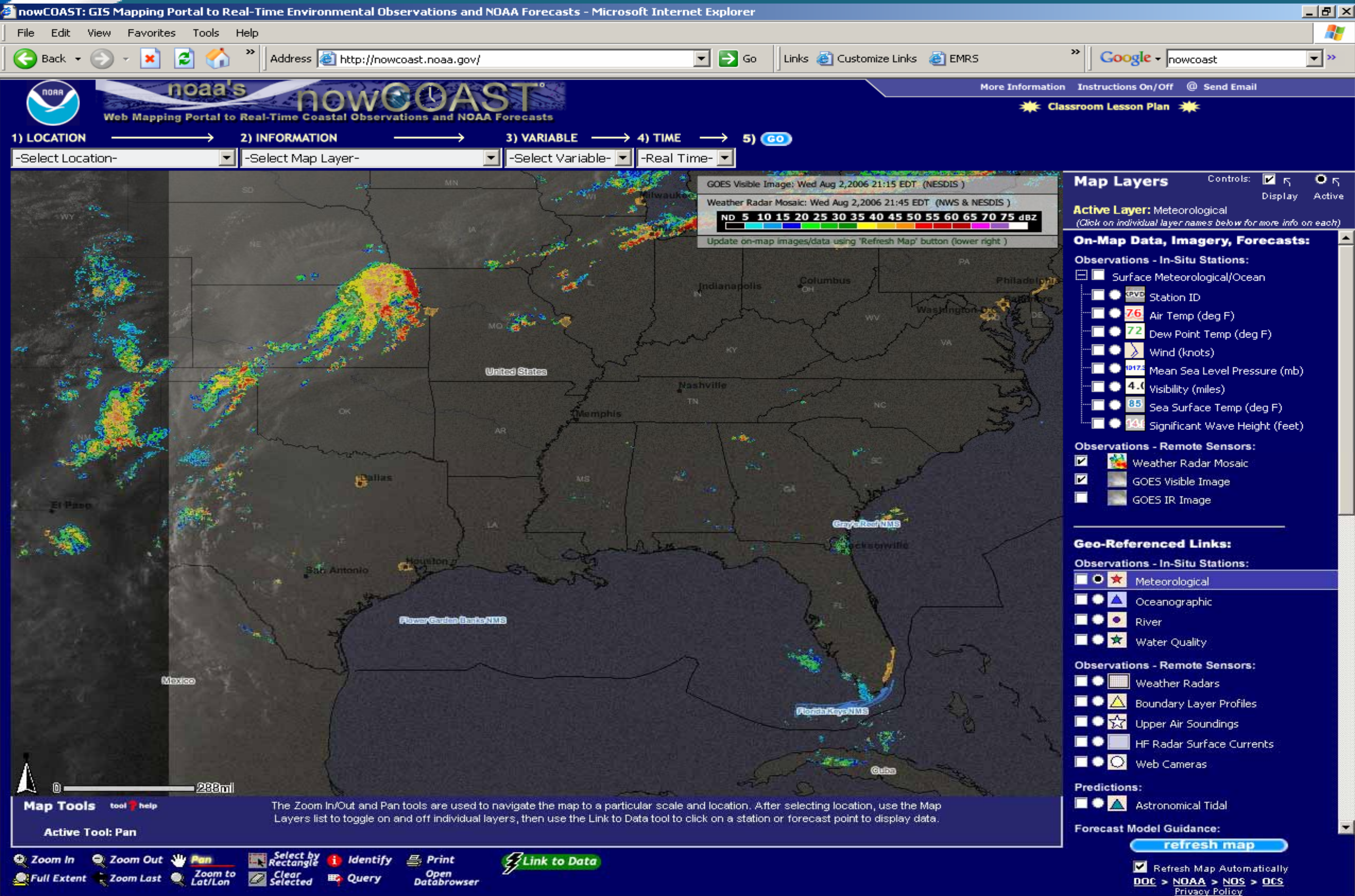


Exploratory National Weather Service Collaborative GIS/IMS Efforts

NOAA/NWS/EMHURR IMS

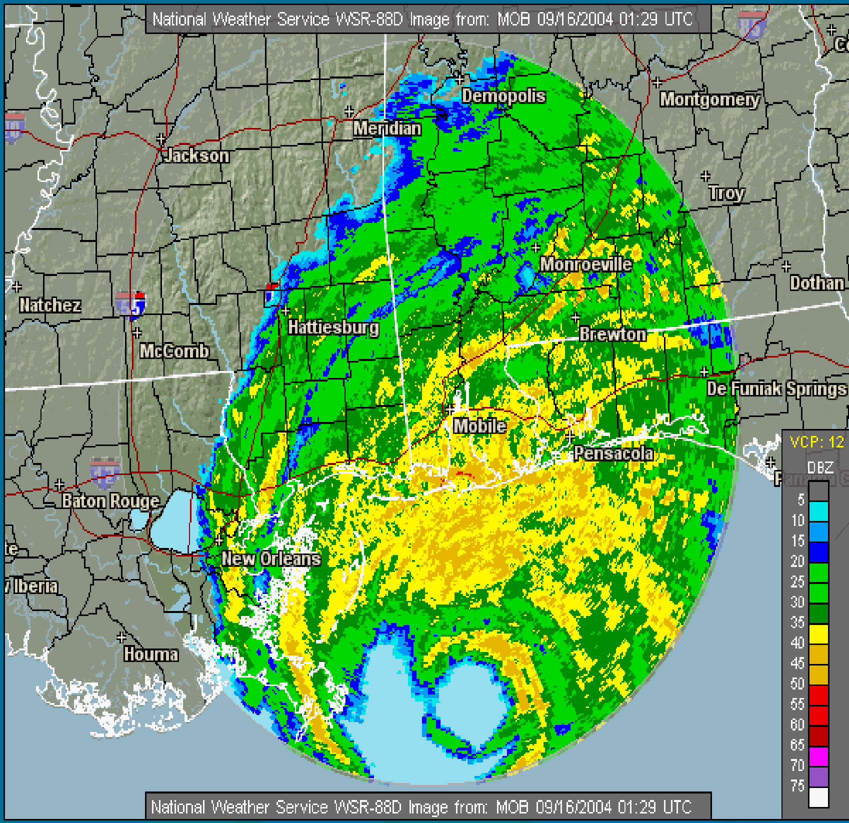


NOAA/NOS/NowCOAST IMS



New GIS-ready Radar Imagery

- **Available as time loops for Weather Service Radars**
- **New GIS Topographic Base Map**
- **Provides real time storm, movement, precipitation and now, *velocity* data!**

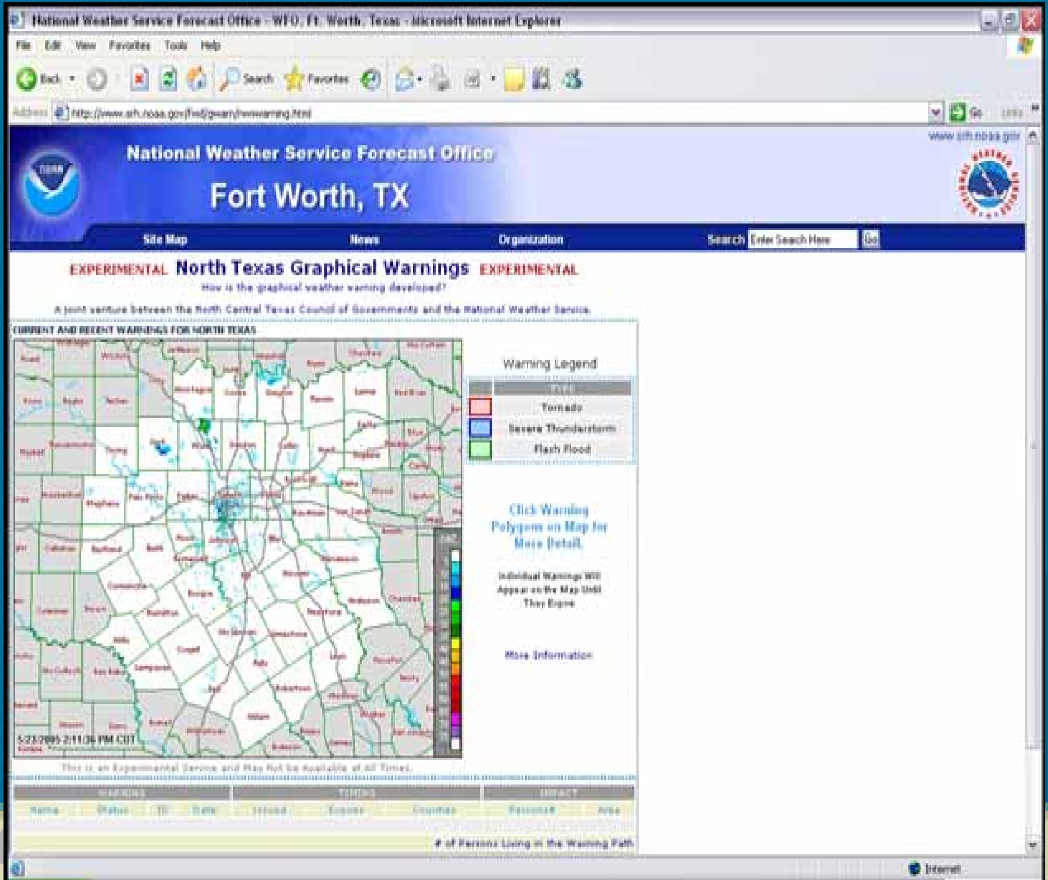


www.srh.weather.gov/ridge

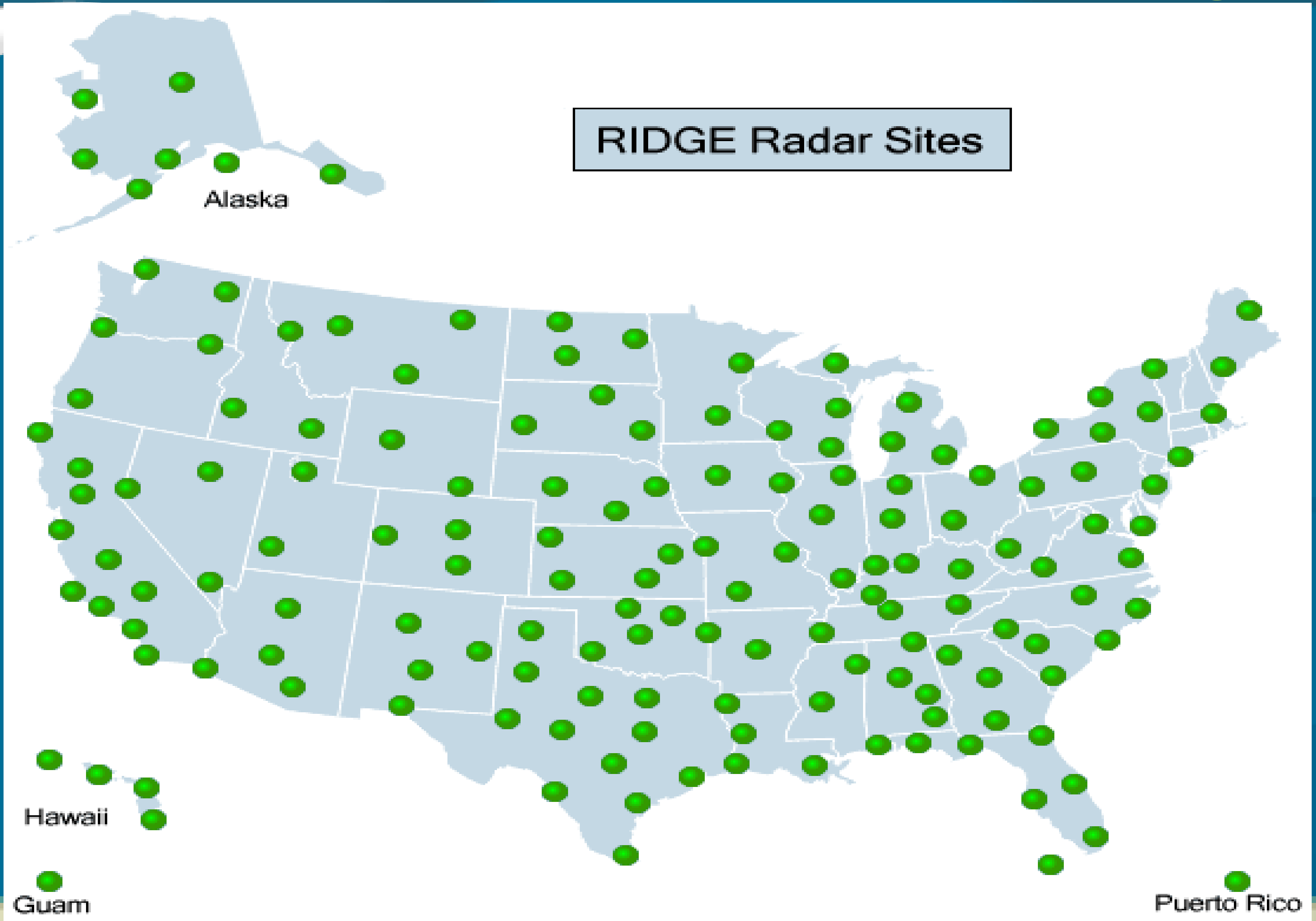
Paul.Kirkwood@noaa.gov Keith.Stellman@noaa.gov

RIDGE (Radar Integrated Display with Geospatial Elements)

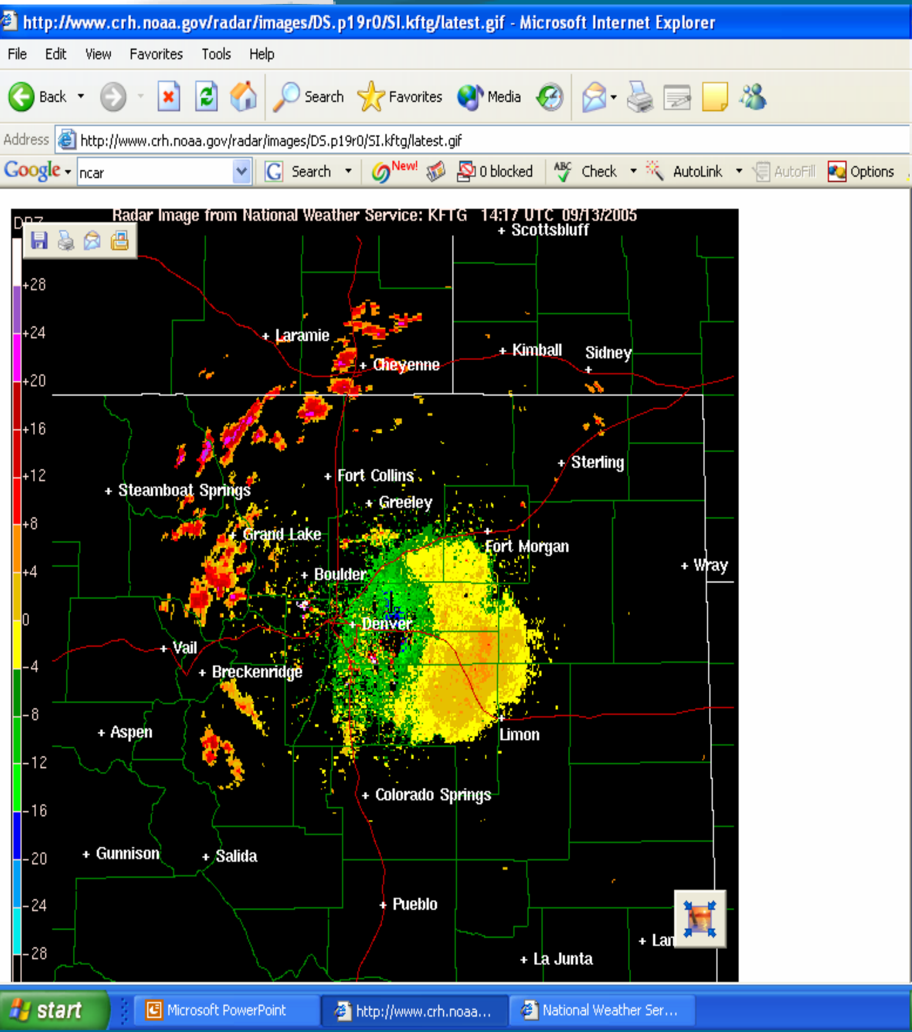
- Collaborative Effort with NCTCOG using technology found in FWD graphical warning project.

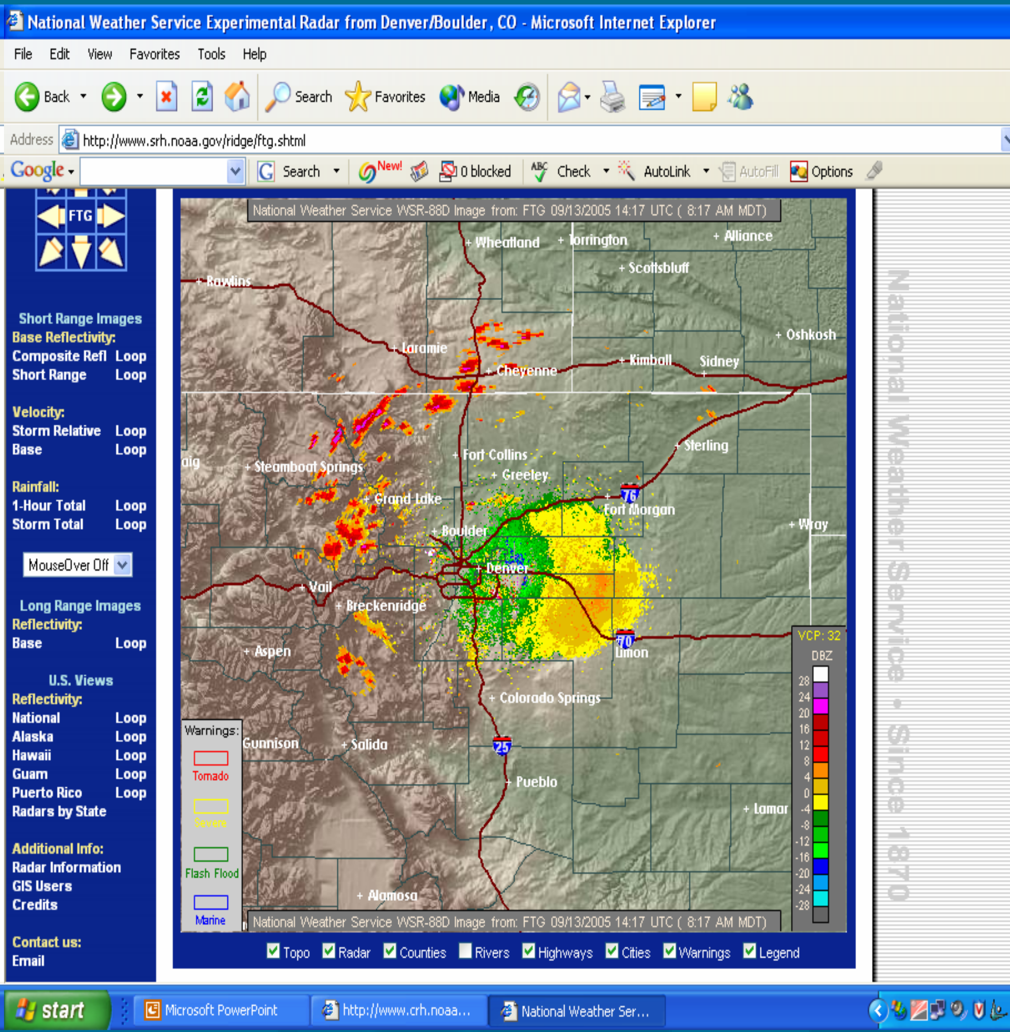


Georeferenced Radar Images



Old vs New Radar Imagery





NWS Southern Region Tropical Weather - CHRIS Forecast Tracks - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back | Address http://www.srh.noaa.gov/srh/tropicalwx/forecasttrack.php?basin=ATL&stormid=03&date=2006080300 | Go | Google | Links

weather.gov

National Weather Service

Southern Region Headquarters

Go to: Tropical Weather Home | Local weather forecast by "City, St" City, St Go

August Tropical Climatology

Tropical Discussion
Atlantic | Alt. link
Pacific | Alt. link

Tropical Outlook
Atlantic | Alt. link
En Español
Pacific | Alt. link
2006 Atlantic Season

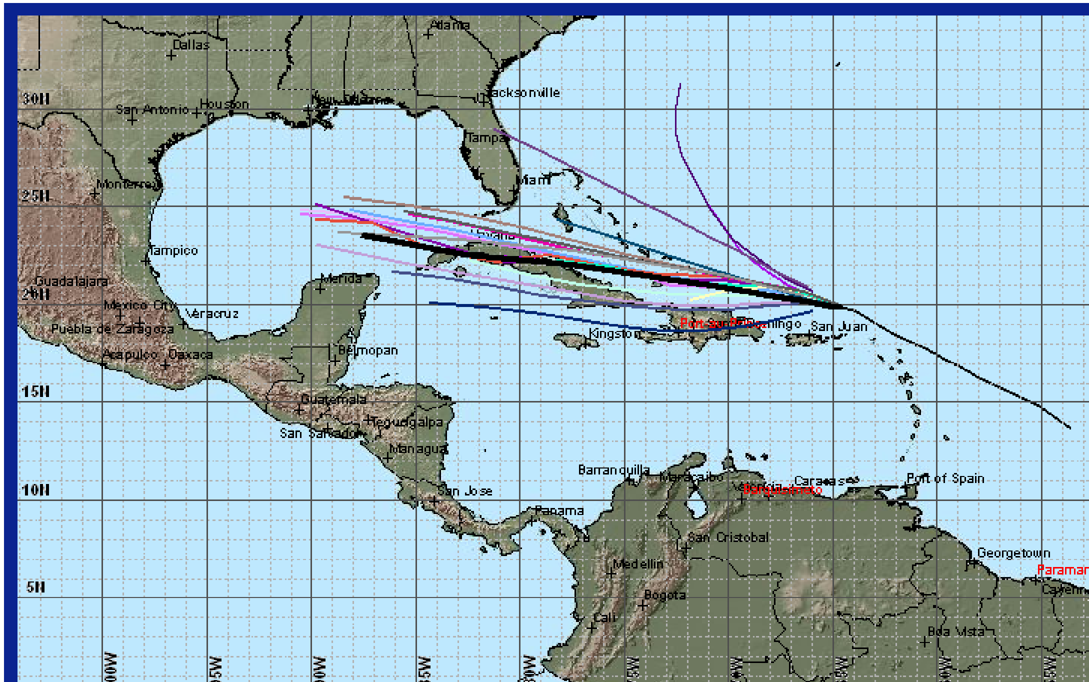
Hurricane U.
Tropical Training
Are You Prepared?
Hurr. Intensity Scale
Past Hurr. Tracks

Hurricane Centers
National
Central Pacific

Additional Info
Satellite Imagery
Local Radars
More links
SR Tropical Home
SR Homepage

Tropical Cyclone Forecast Tracks - Tropical Storm CHRIS

Current Active Storms: Tropical Storm CHRIS



☑ Topography ☑ Storm History ☑ State/Country ☑ Lat/Long ☑ Cities/Highways

Model Runs
08/03/2006-00Z
Go

Forecast Tracks
☑ Official Forecast
☑ HPC Forecast
☑ Previous Fcst.

Models
☑ Dynamic #1
☑ Dynamic #2
☑ GFS Ensembles
☑ Climo - Statistical

Views
Atlantic Ocean
Central Atlantic
Western Atlantic
Gulf of Mexico
Caribbean

Dynamical Models #1	
A9UK	
AC00	
AVNO	GFS model
CGUN	Average of GDFI, UKMI, NGPI and GFSI
CMC	
COA2	
	Decay SHIPS - SHIPS intensity

Dynamical Models #2	
CONU	
DSNS	
ICON	Average of GFDI and DSHIP intensity forecasts
MRCL	Wind radii cliper (McCadie - Atlantic Ocean)
NGM	
NGPS	NOGAPS - Navy global model

GFS Ensembles	
AEMN	GFS Ensemble Mean, adjusted to current storm position
AP01	GFS Ensemble Member
AP02	GFS Ensemble Member
AP03	GFS Ensemble Member
AP04	GFS Ensemble Member
AP05	GFS Ensemble Member
AP06	GFS Ensemble Member

Climo/Statistical	
A90E	An obsolete statistical-dynamic model
A98E	Current statistical-dynamic model
DRCL	Recently integrated wind radii CLIPER model (DRCL)
BAMD	Beta and Advection Model (deep layer)
	Beta & Advection Model

National Weather Service • Since 1870

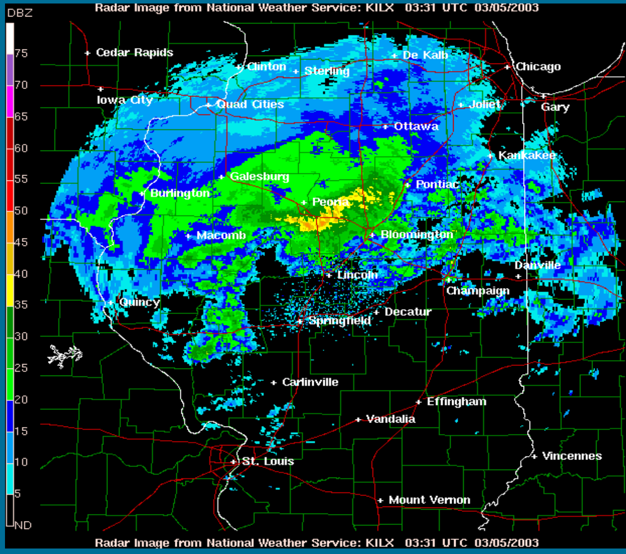
Internet

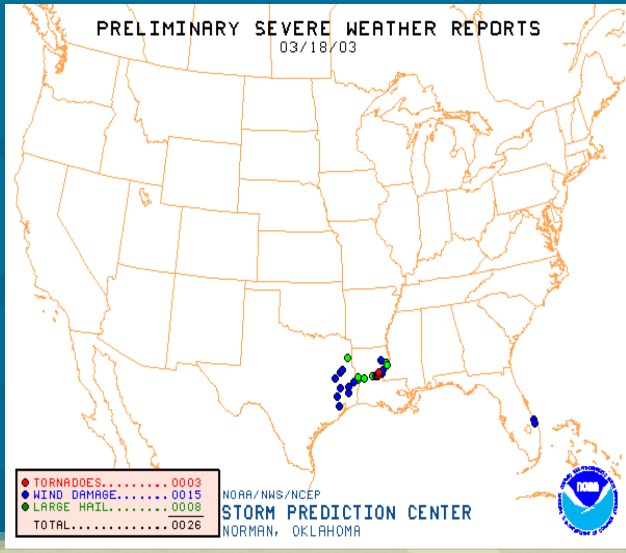
Start | Model Analyse... | Model compari... | HURREVAC 20... | Untitled - Arc... | M:\Settelmaie... | John Wayne A... | NWS Souther... | Microsoft Pow... | 11:44 PM

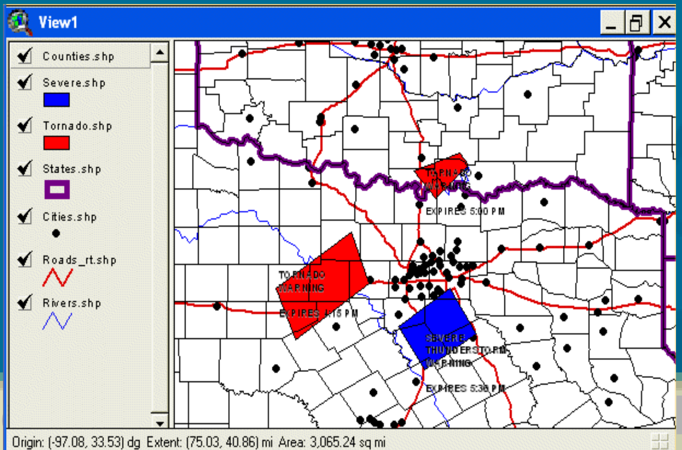
Severe Weather Prototype

Live IMS for Severe Weather Season 2004 (geared towards emergency managers)

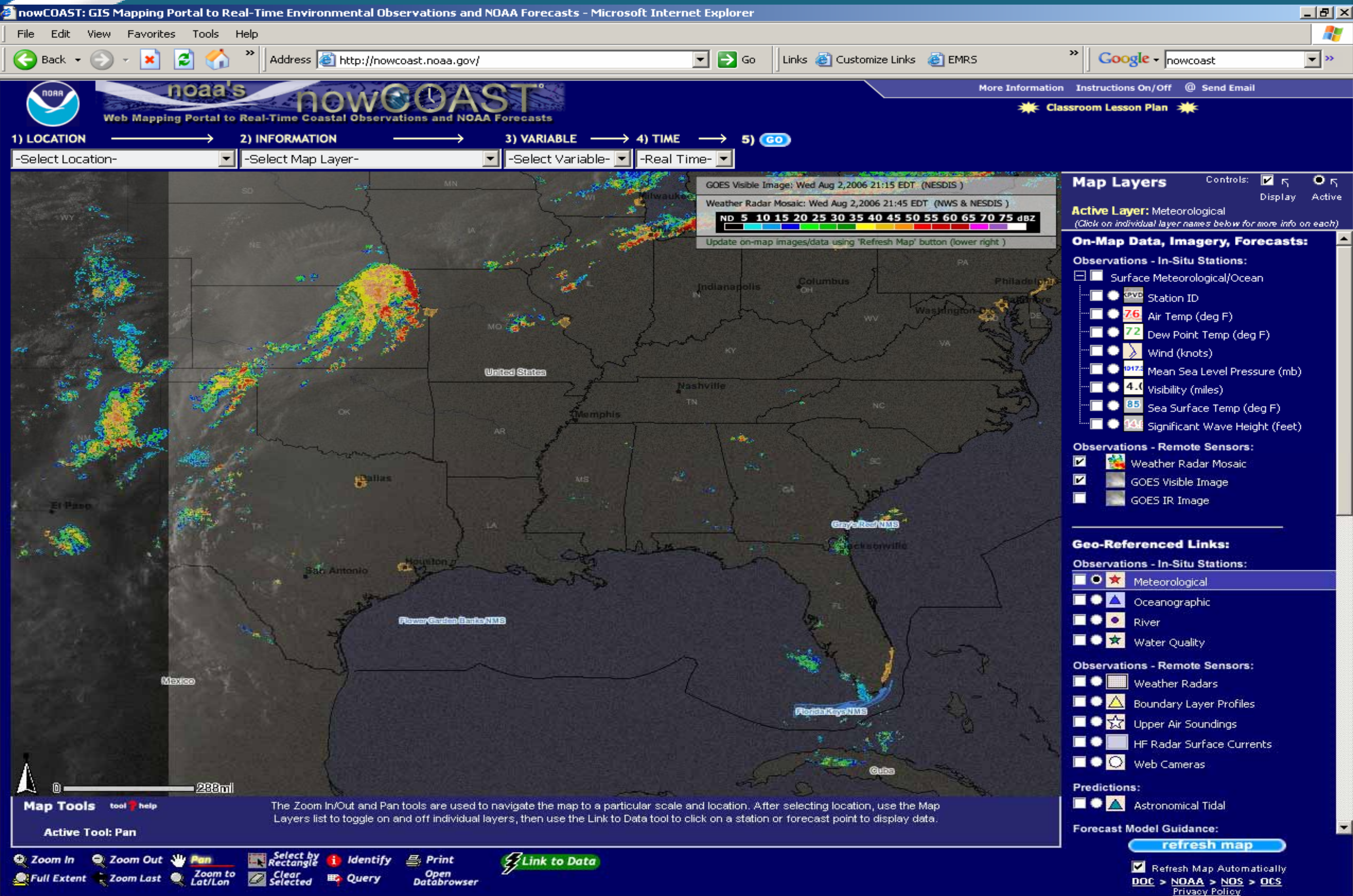
- Expected Nationwide Coverage
- Radar and Satellite Data
- Severe Weather (wind, hail, tornado) watches/warnings
- Observed Severe Weather Reports







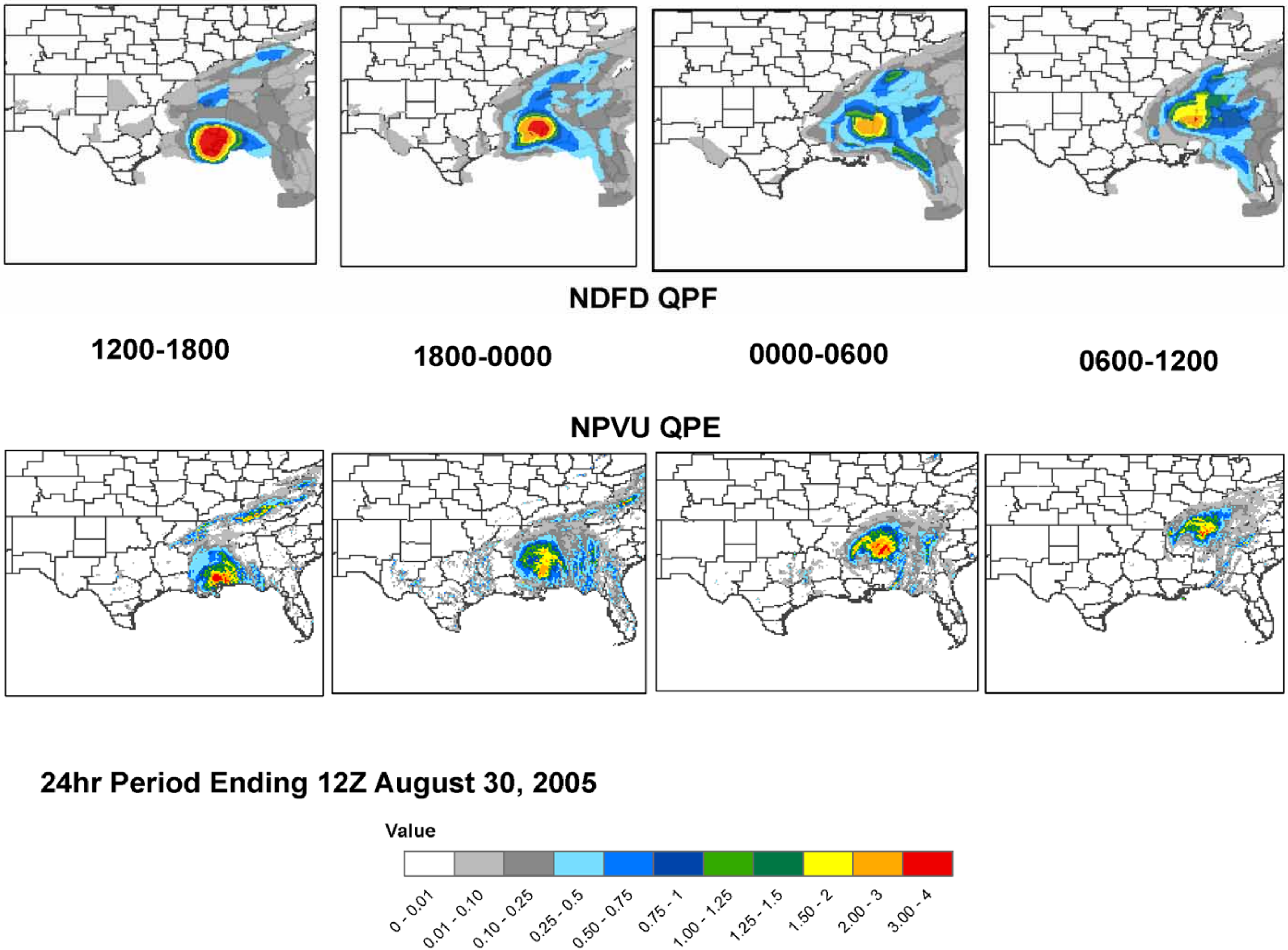
NOAA/NOS/NowCOAST IMS



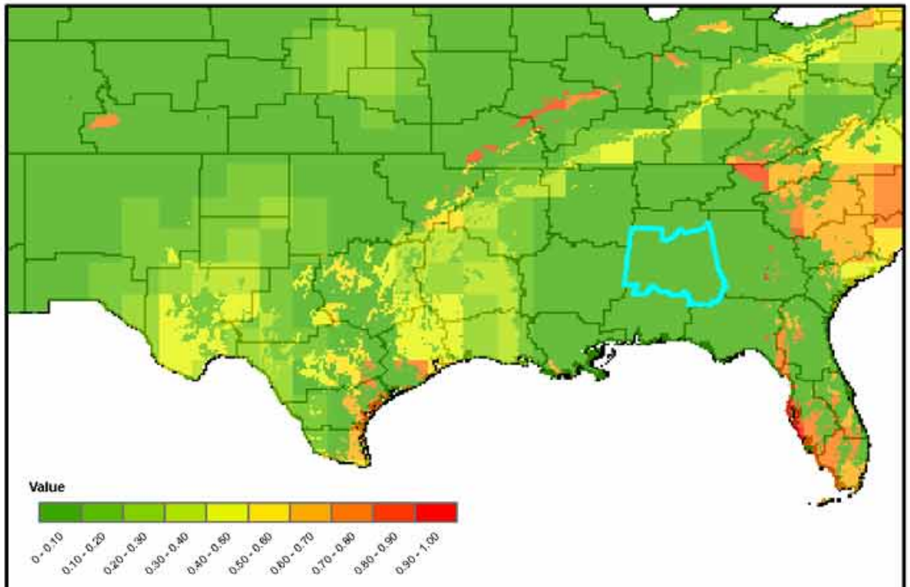
Automated Geoprocessing as a Tool to Assess NWS Forecast Quality

Benefits

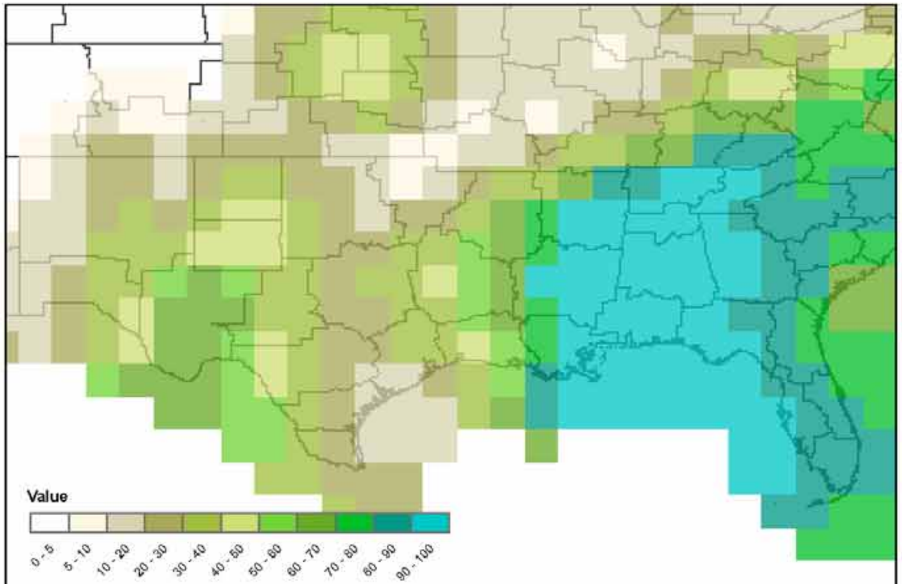
- Geospatial Depiction of Gridded PoP/QPF Forecasts
- Tabular Summaries/Statistics of Data
- Useful for Generating Post-event Recaps
- Encourages GIS Usage/Exploration
- Helps Sell Need for Enterprise Solution Across NOAA


NDFD QPF
1200-1800
1800-0000
0000-0600
0600-1200
NPVU QPE
24hr Period Ending 12Z August 30, 2005
Value
0 - 0.01
0.01 - 0.10
0.10 - 0.25
0.25 - 0.5
0.50 - 0.75
0.75 - 1
1.00 - 1.25
1.25 - 1.5
1.50 - 2
2.00 - 3
3.00 - 4

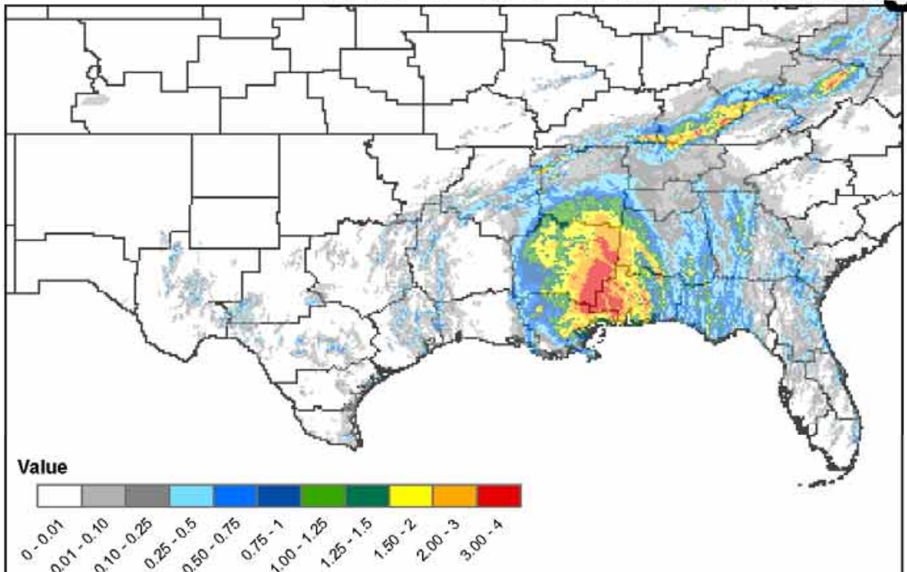
12Hr Period Ending 00Z August 30, 2005



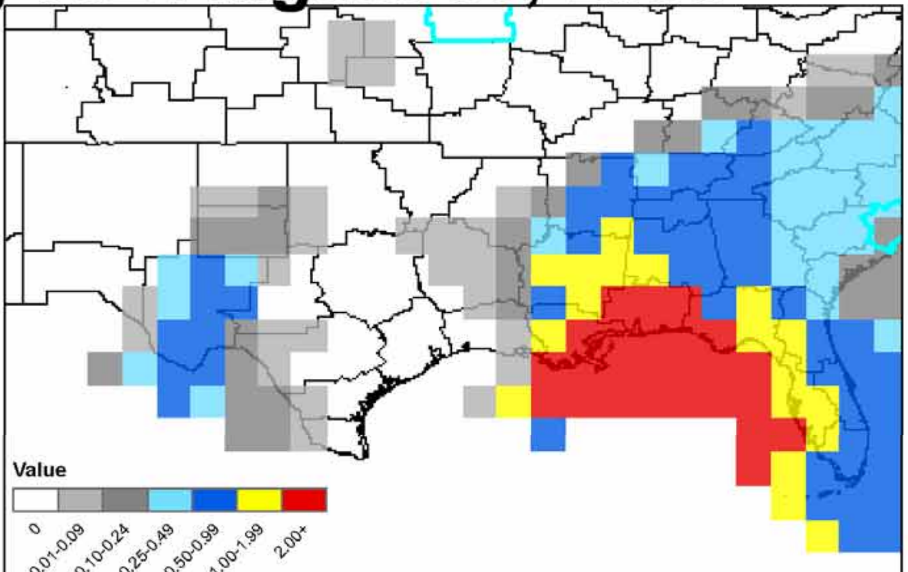
MOS Brier Score



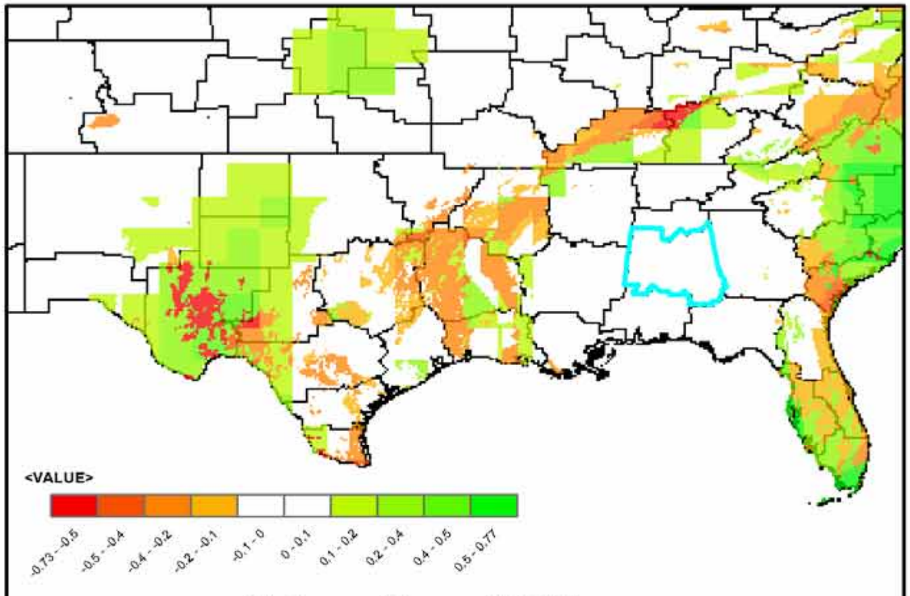
MOS PoP12



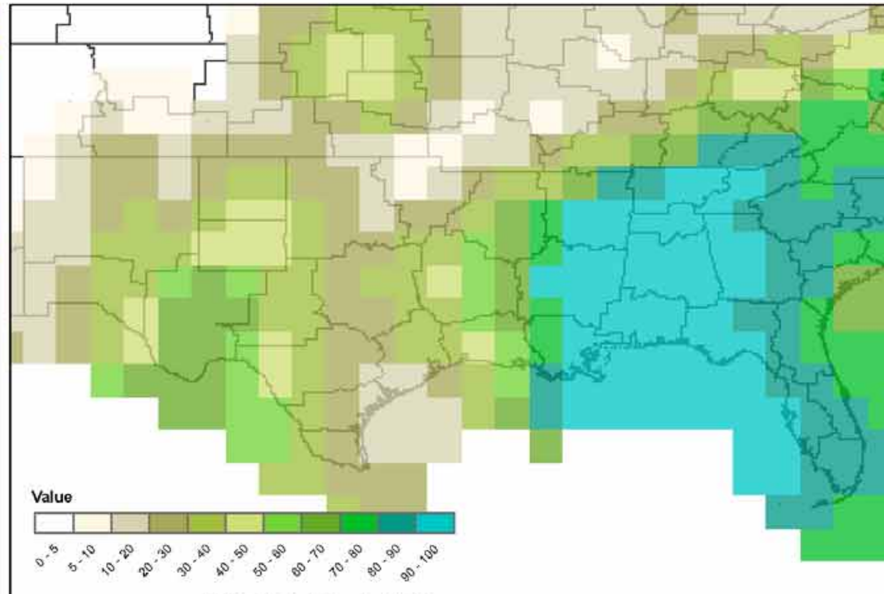
NPVU QPE12



MOS BQPF12

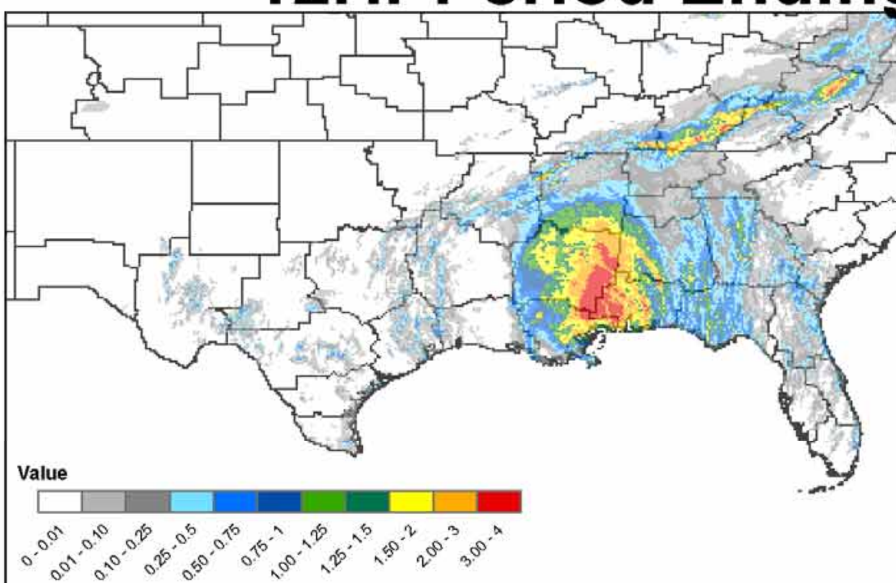


% Imp Over MOS

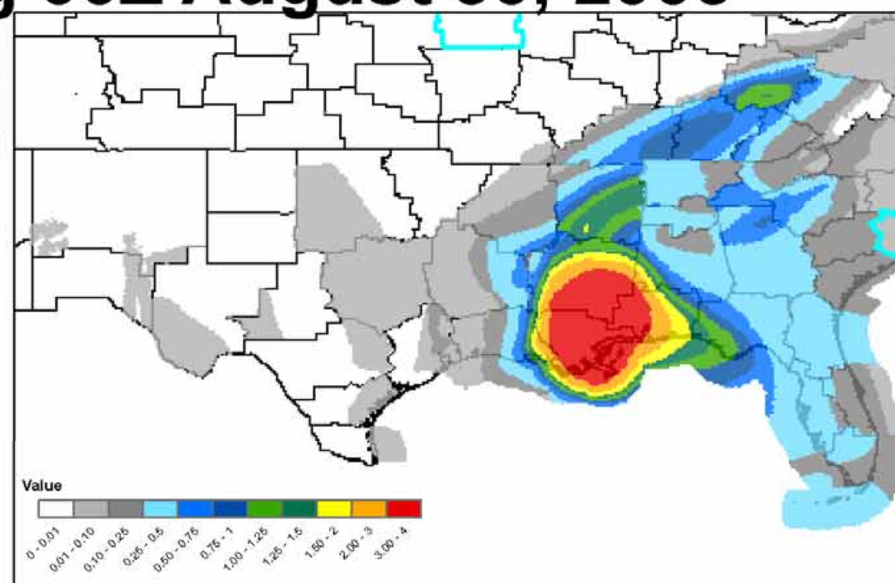


MOS PoP12

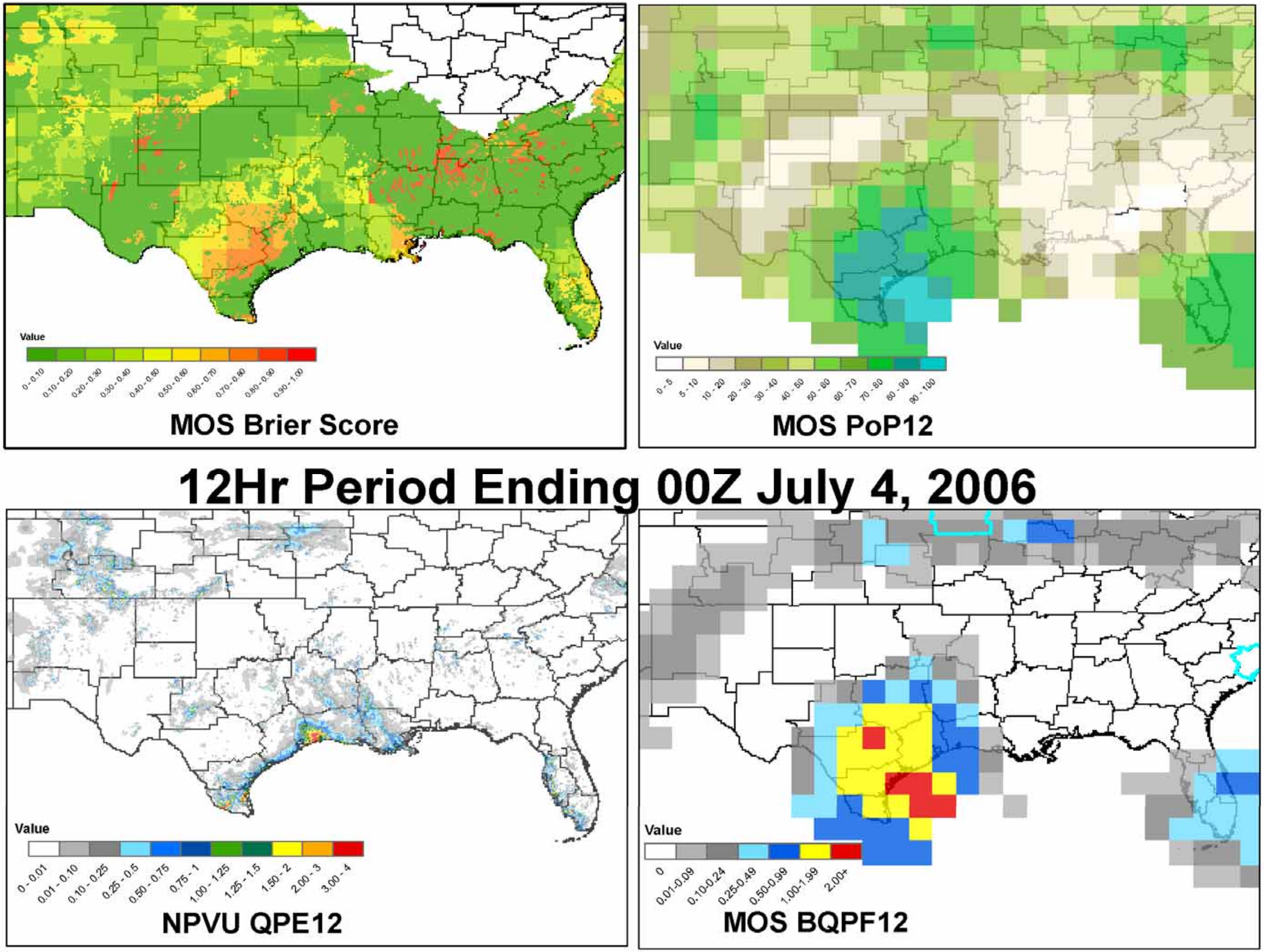
12Hr Period Ending 00Z August 30, 2005

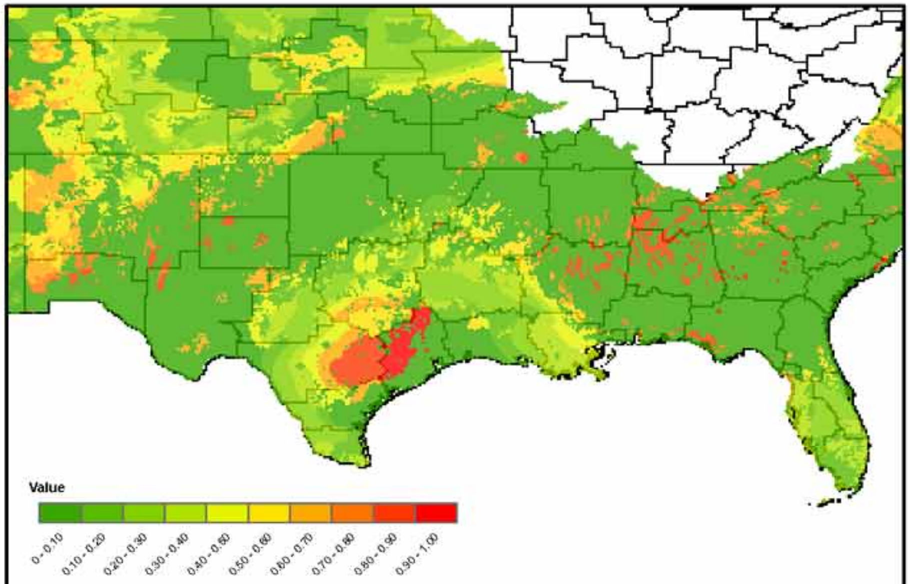


NPVU QPE12

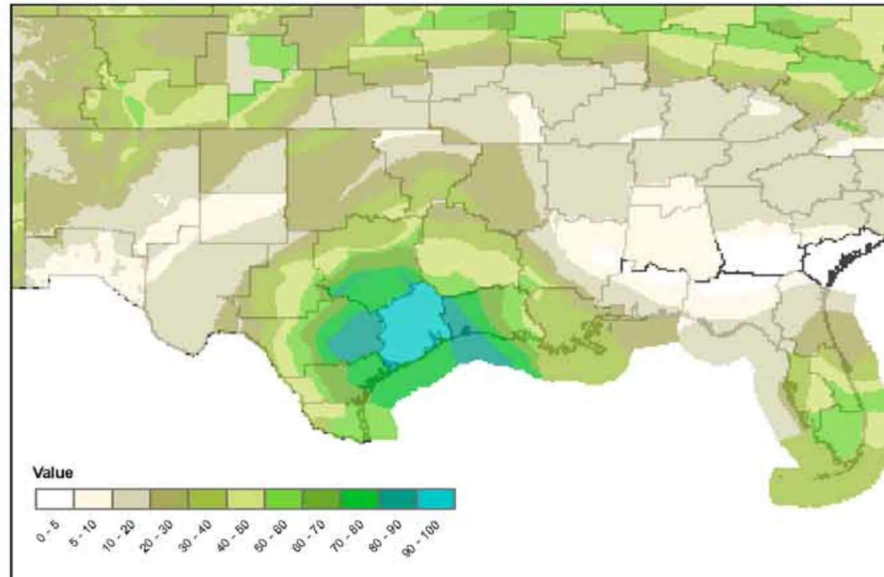


NDFD QPF12


Value
0-0.10
0.10-0.20
0.20-0.30
0.30-0.40
0.40-0.50
0.50-0.60
0.60-0.70
0.70-0.80
0.80-0.90
0.90-1.00
MOS Brier Score
Value
0-5
5-10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-100
MOS PoP12
12Hr Period Ending 00Z July 4, 2006
Value
0-0.01
0.01-0.10
0.10-0.25
0.25-0.5
0.50-0.75
0.75-1
1.00-1.25
1.25-1.5
1.50-2
2.00-3
3.00-4
NPVU QPE12
Value
0
0.01-0.09
0.10-0.24
0.25-0.49
0.50-0.99
1.00-1.99
2.00+
MOS BQPF12

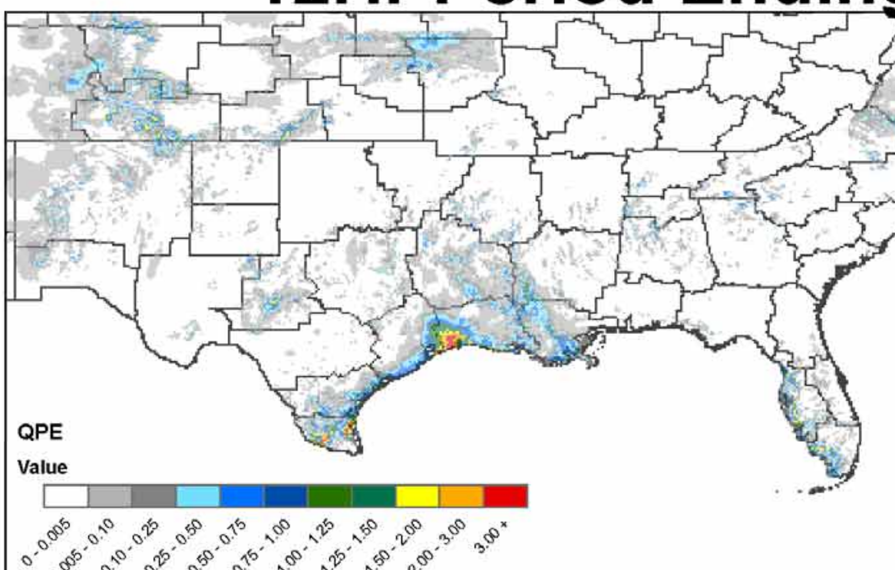


NDFD Brier Score



NDFD PoP12

12Hr Period Ending 00Z July 4, 2006



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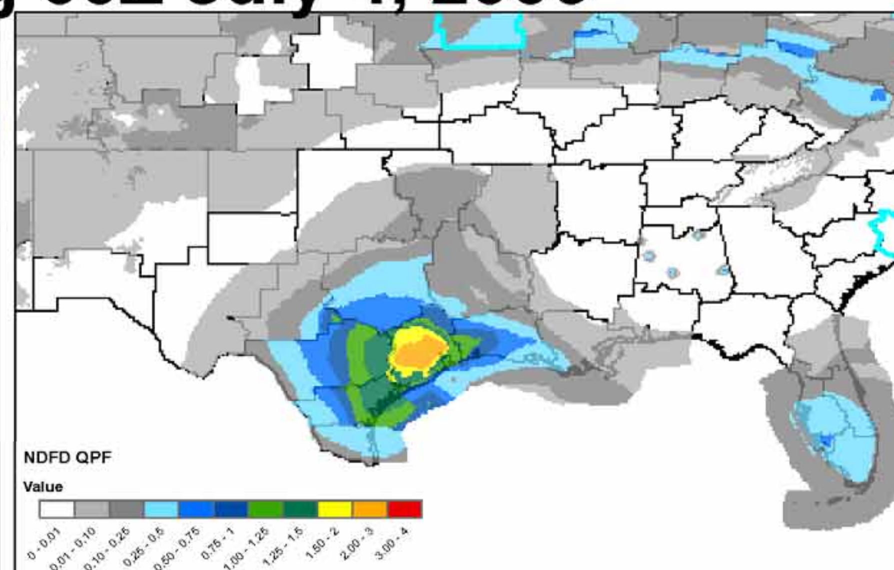


NDFD QPF12

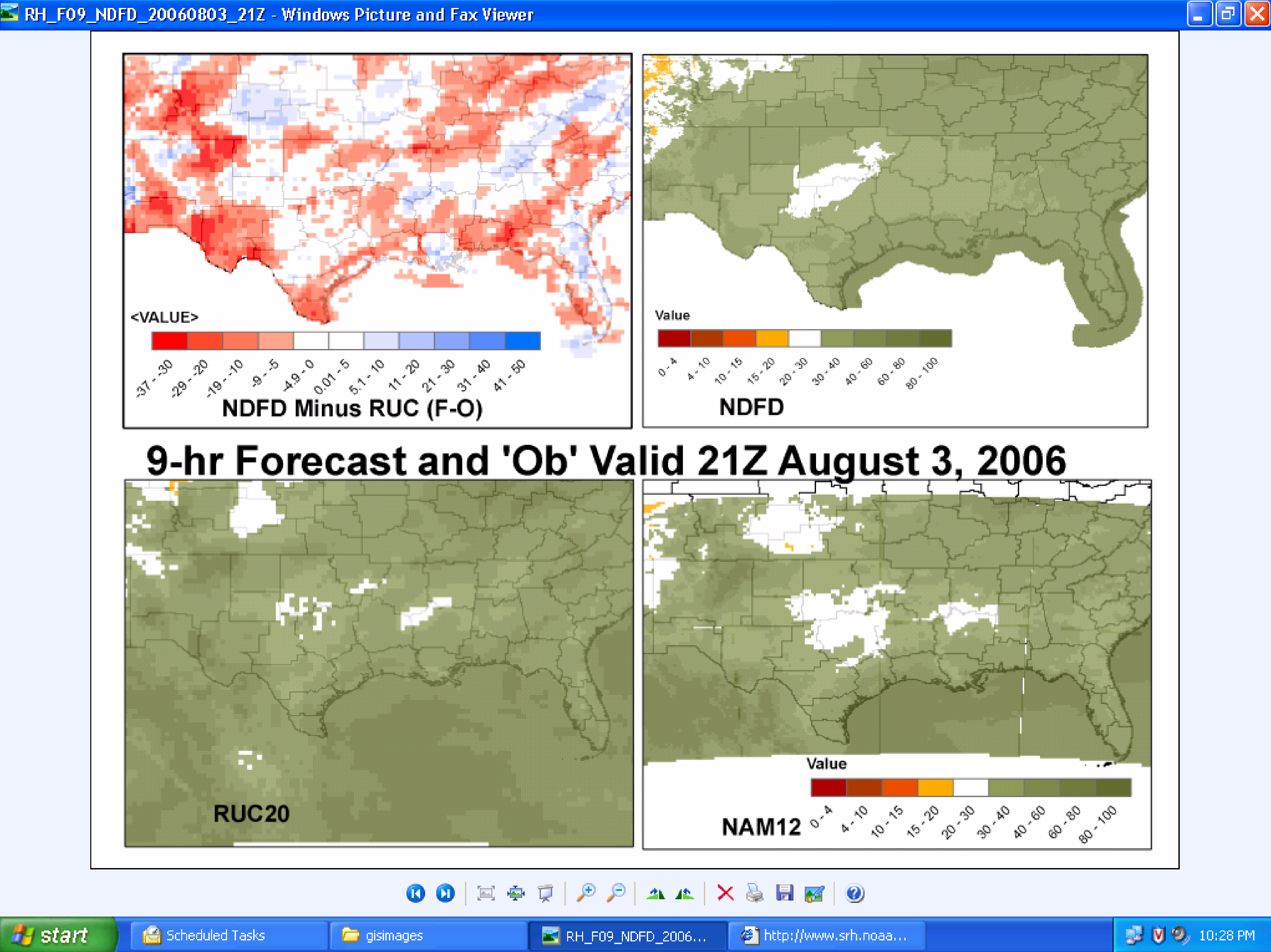
Microsoft Excel - ndfdqpf00_0704.dbf

A2 HGX

	A	B	C	D	E	F	G	H	I	J	K	L
1	CWA	ZONE_COI	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM		
2	HGX	109	978	4.93010000000	0.36000000000	2.76000000000	2.40000000000	1.61295000000	0.53840600000	##############		
3	CRP	111	782	3.94206000000	0.22000000000	1.41000000000	1.19000000000	0.87372100000	0.38763100000	##############		
4	EWX	110	1711	8.62515000000	0.16000000000	1.77000000000	1.61000000000	0.74551700000	0.39795300000	##############		
5	LCH	66	957	4.82424000000	0.08000000000	1.31000000000	1.23000000000	0.57863100000	0.28110900000	##############		
6	MKX	115	678	3.41780000000	0.20000000000	0.57000000000	0.37000000000	0.40769900000	0.04740480000	##############		
7	TBW	30	569	2.86833000000	0.08000000000	0.60000000000	0.52000000000	0.36370800000	0.13620200000	##############		
8	GRB	114	1025	5.16703000000	0.09000000000	0.43000000000	0.34000000000	0.35859500000	0.05893670000	##############		
9	FWD	108	1947	9.81483000000	0.03000000000	0.92000000000	0.89000000000	0.35002600000	0.20293000000	##############		
10	MFL	32	495	2.49530000000	0.10000000000	0.60000000000	0.50000000000	0.32474800000	0.07861610000	##############		
11	BRO	106	411	2.07185000000	0.12000000000	0.46000000000	0.34000000000	0.29041400000	0.07587980000	##############		
12	RLX	63	1176	5.92822000000	0.00000000000	0.66000000000	0.66000000000	0.25872500000	0.17592100000	##############		
13	MLB	31	426	2.14747000000	0.09000000000	0.50000000000	0.41000000000	0.25504700000	0.09771390000	##############		
14	LOT	51	797	4.01768000000	0.08000000000	0.56000000000	0.48000000000	0.20680100000	0.10156900000	##############		
15	DMX	40	1580	7.96478000000	0.07000000000	0.44000000000	0.37000000000	0.20603200000	0.07929280000	##############		
16	CLE	97	805	4.05800000000	0.01000000000	0.69000000000	0.68000000000	0.19741600000	0.19171500000	##############		
17	IND	54	864	4.35542000000	0.00000000000	0.52000000000	0.52000000000	0.17969900000	0.16727300000	##############		
18	SJT	105	1305	6.57851000000	0.01000000000	1.04000000000	1.03000000000	0.16977800000	0.19929000000	##############		
19	DVN	39	1125	5.67112000000	0.07000000000	0.58000000000	0.51000000000	0.16448900000	0.07944160000	##############		
20	ILN	55	1095	5.51990000000	0.00000000000	0.39000000000	0.39000000000	0.16171700000	0.11681800000	##############		
21	IWX	53	891	4.49153000000	0.06000000000	0.53000000000	0.47000000000	0.15882200000	0.04206860000	##############		
22	MQT	71	856	4.31510000000	0.06000000000	0.40000000000	0.34000000000	0.14824800000	0.05168170000	##############		
23	ILX	50	1052	5.30313000000	0.01000000000	0.68000000000	0.67000000000	0.14157800000	0.14836600000	##############		
24	OAX	41	1212	6.10969000000	0.02000000000	0.30000000000	0.28000000000	0.14077600000	0.05280630000	##############		
25	SHV	8	1759	8.86712000000	0.02000000000	0.52000000000	0.50000000000	0.13670300000	0.06717510000	##############		
26	PUB	23	1749	8.81671000000	0.01000000000	0.24000000000	0.23000000000	0.13473400000	0.06453420000	##############		
27	CTP	102	1275	6.42728000000	0.03000000000	0.30000000000	0.27000000000	0.13084700000	0.09549250000	##############		
28	PBZ	67	1043	5.25776000000	0.02000000000	0.30000000000	0.28000000000	0.11815000000	0.01594360000	##############		
29	ARX	42	1127	5.68121000000	0.06000000000	0.46000000000	0.40000000000	0.11205900000	0.03678550000	##############		
30	LBF	88	1872	9.43675000000	0.01000000000	0.25000000000	0.24000000000	0.11180000000	0.07158330000	##############		
31	TSA	7	1316	6.63396000000	0.00000000000	0.22000000000	0.22000000000	0.10784200000	0.06208190000	##############		
32	PHI	29	834	4.20419000000	0.03000000000	0.14000000000	0.11000000000	0.10784200000	0.02093480000	##############		
33	EYW	34	6	0.03024600000	0.10000000000	0.10000000000	0.00000000000	0.10000000000	0.00000000000	0.60000000000		
34	ESD	43	1631	8.22187000000	0.02000000000	0.20000000000	0.18000000000	0.09897610000	0.06491700000	##############		

ndfdqpf00_0704

Ready Sum=2687



RH_F09_NDFD_20060803_21Z - Windows Picture and Fax Viewer
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-29 - -20
-19 - -10
-9 - -5
-4.9 - 0
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5.1 - 10
11 - 20
21 - 30
31 - 40
41 - 50
NDFD Minus RUC (F-O)
Value
0 - 4
4 - 10
10 - 15
15 - 20
20 - 30
30 - 40
40 - 60
60 - 80
80 - 100
NDFD
9-hr Forecast and 'Ob' Valid 21Z August 3, 2006
RUC20
Value
0 - 4
4 - 10
10 - 15
15 - 20
20 - 30
30 - 40
40 - 60
60 - 80
80 - 100
NAM12
start
Scheduled Tasks
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RH_F09_NDFD_2006...
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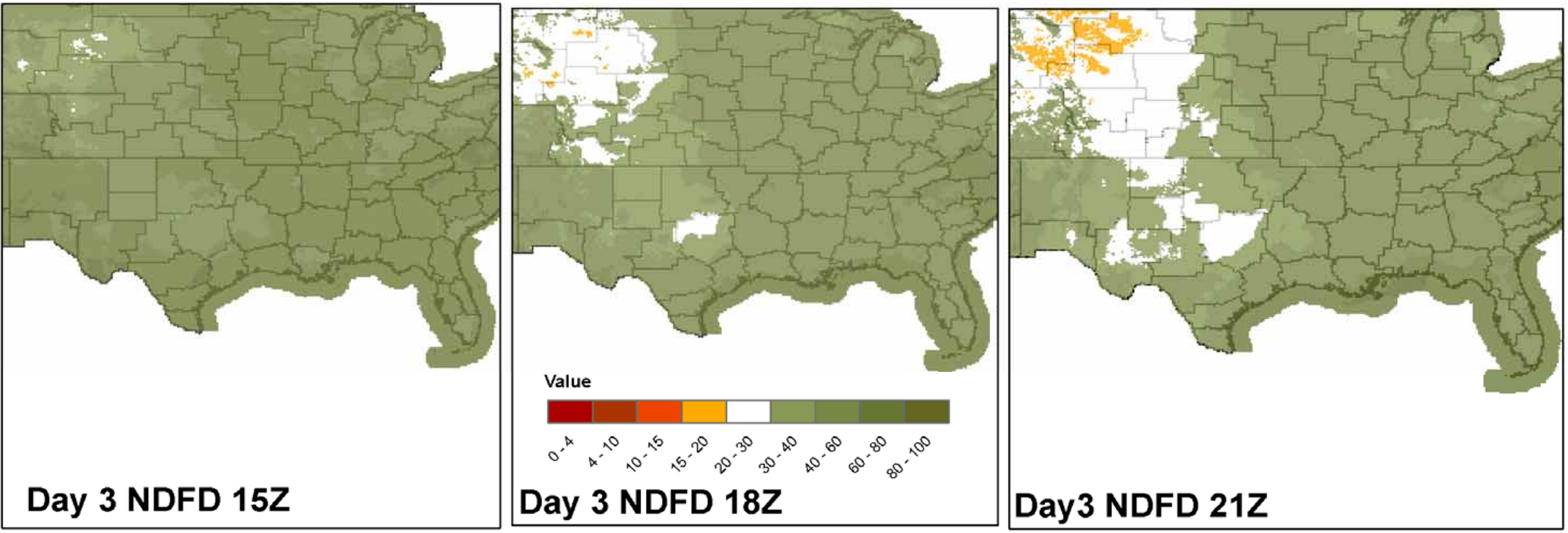
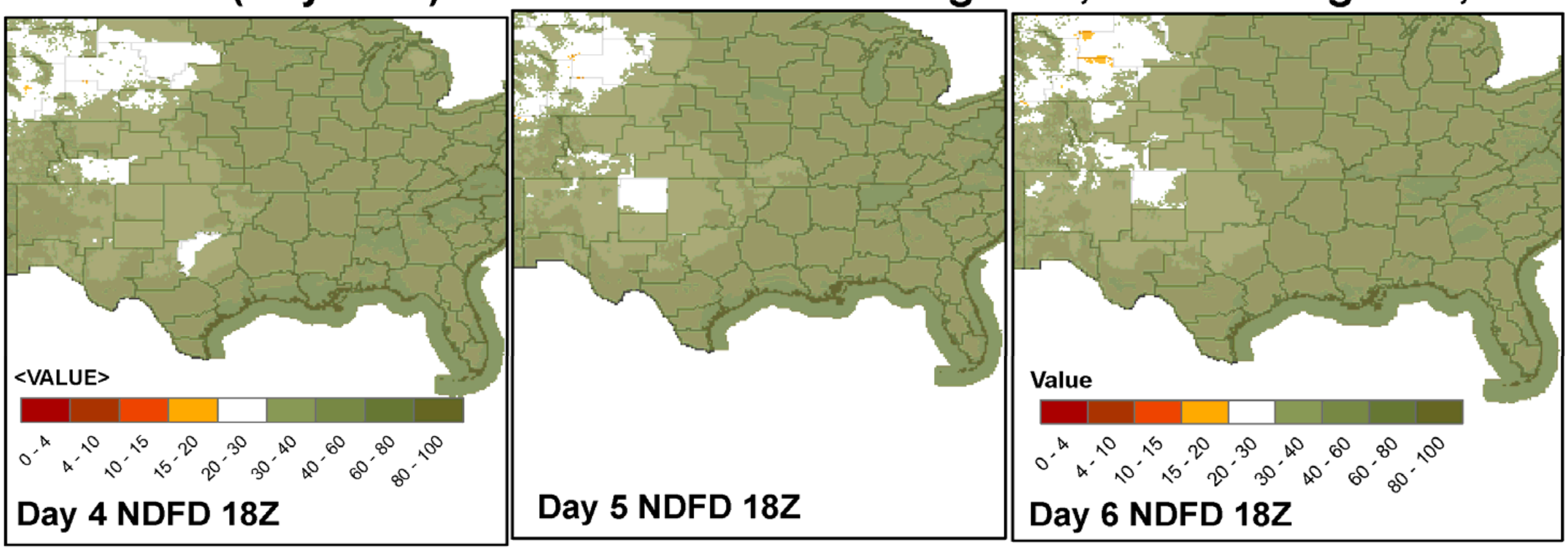
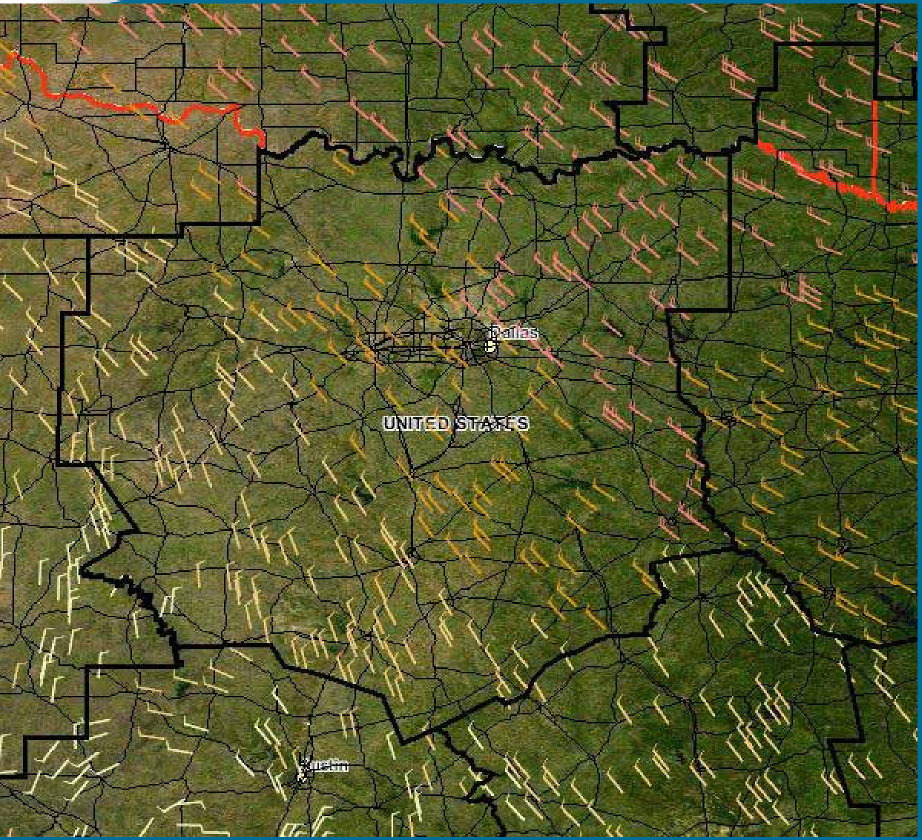


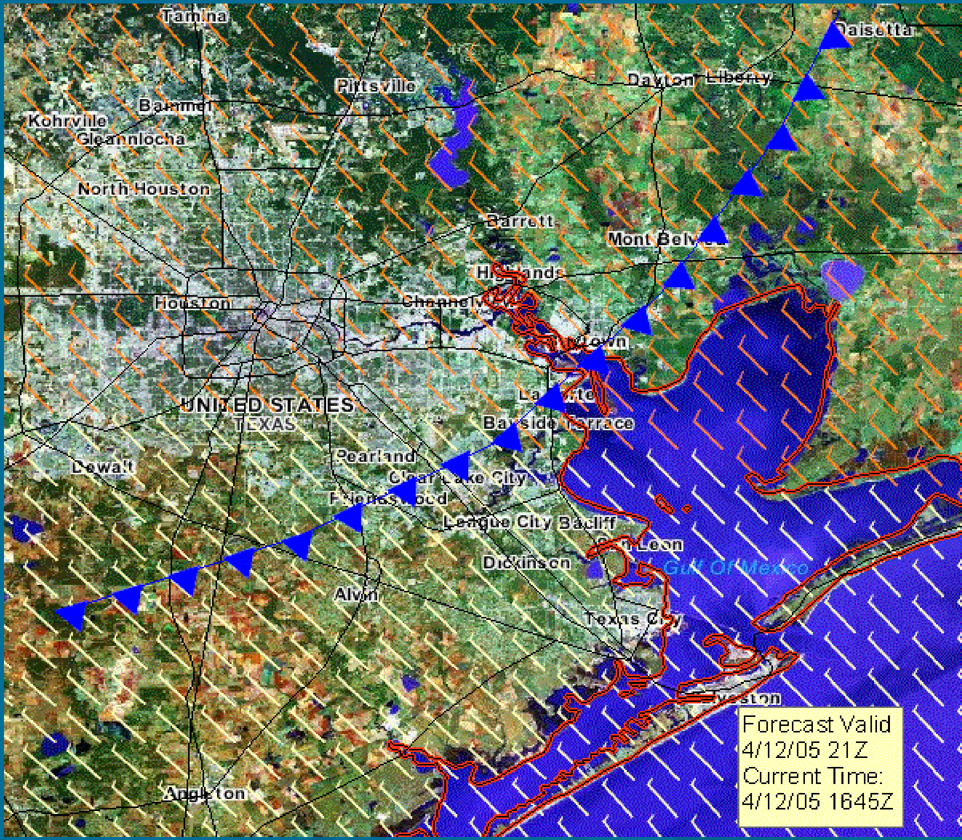
Extended (Days 3-6) NDFD RH Forecasts August 6, 2006 to August 9, 2006



National Digital Forecast Database (NDFD)



NDFD surface winds



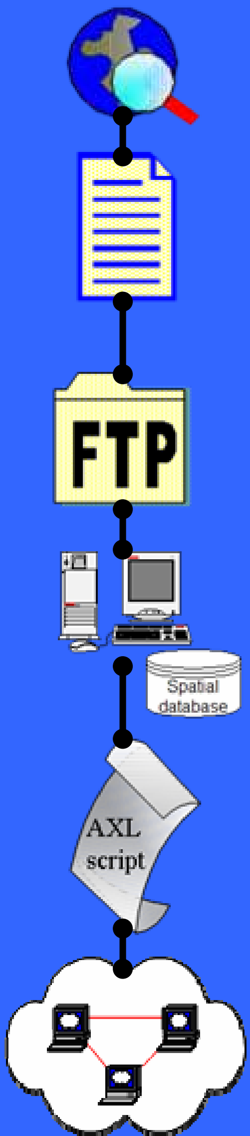
Winds with annotation

What Can't the NWS do with GIS?

SERVE IT!

What can PSU (and others?) do with weather data in GIS?

Segue to PSU portion on
Serving NDFD via IMS



Developing Internet Map Services with NDFD (NOAA/NWS)

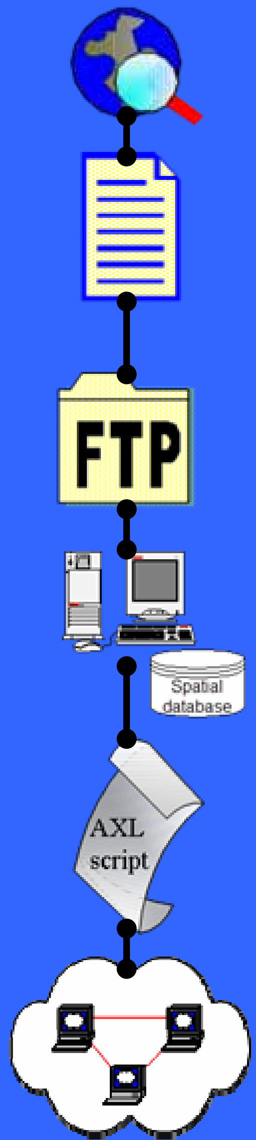
- **Dr. Bernd J. Haupt**, *Earth & Environmental Systems Institute*
- **Maurie Caitlin Kelly**, *PS Institutes of Energy & the Environment*
- **Ryan E. Baxter**, *PS Institutes of Energy & the Environment*
- **James F. Spayd**, *PS Institutes of Energy & the Environment*

The Pennsylvania State University PENNSTATE 1855

In collaboration with

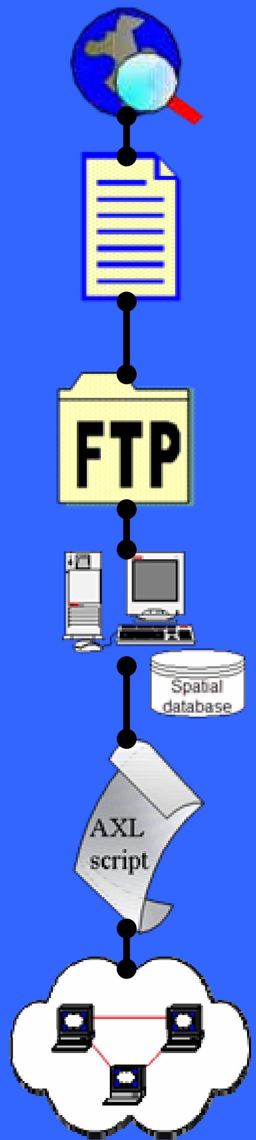
Jack Settelmaier *(NOAA/NWS)*, Ken Waters *(NOAA/NWS)*

Presentation for ESRI Federal Users Conference, January 10, 2007



Who We Are…

- PSIEE & EESI faculty collaborate on several GIS related projects.
- Project team works with Federal agencies such as the US Geological Survey (USGS); state agencies such as the PA Office of Information Technology, and non profit organizations such as the American Fisheries Society.
- Currently, project team members manage spatial databases that houses approximately 8 terabytes of data and imagery.
- Project team members manage the Pennsylvania Geospatial Data Clearinghouse, PASDA, http://www.pasda.psu.edu, and the geospatial component of the Mid-Atlantic Information Node, MAIN, http://main.nbii.org.
- *Initial funding was provided from the Penn State University GIS Council to develop proof of concept for climate and weather data.*

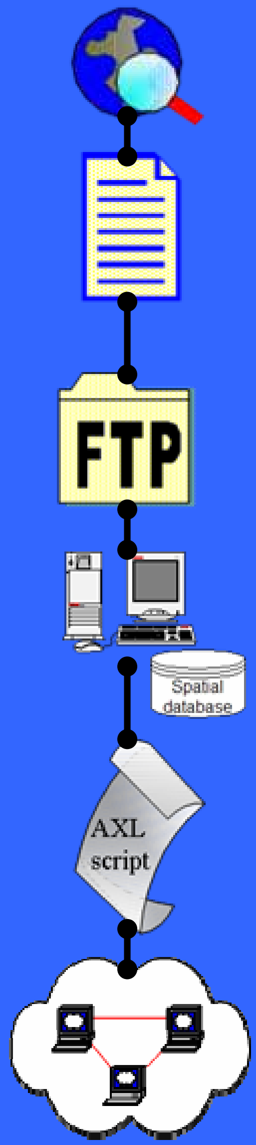


Framework for Pilot Project … (Why do we need it?)

The NDFD (National Digital Forecast Data) Pilot project was developed by PSIEE and EESI faculty for the following reasons:

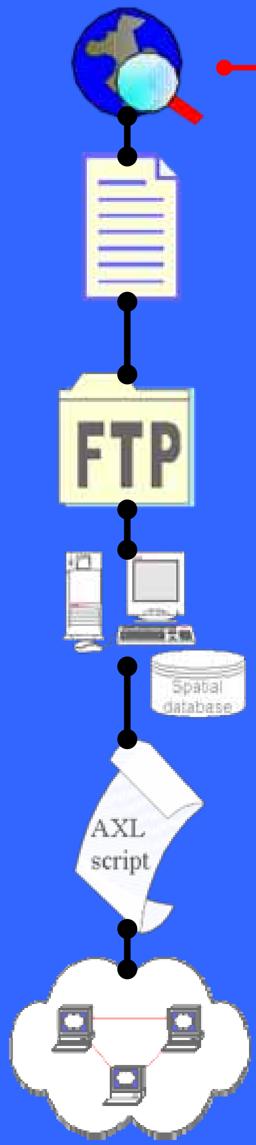
- Most users are unfamiliar with the NDFD data or the types of data formats that weather data come in.
- Most users do not have the processing capabilities or knowledge to acquire and convert and store this data for their own use.
- *We have developed a way for users to incorporate this data into their desktop GIS with a click of a button. This eliminates the need for them to process this data themselves.*
- Emergency managers and response support agencies need this vital information to cope with potential emergency situations. In Pennsylvania, flooding is the primary natural disaster with which emergency managers cope with.

Process Steps… (6 in total) Overview



- Identify sources of spatial and temporal data from agencies, organizations, or academic institutions.
- Develop partnership with data provider.
- Acquire data from provider or from public access site such as an FTP site (Automate this process where possible).
- QA/QC data for completeness; convert to GIS format; create metadata; load into ArcSDE (spatial data engine).
- Create ArcIMS Image and Feature Services which are updated when data is updated in database. (new AXL files with new datasets).
- Users can bring Image and Feature services directly into their desktop GIS software.

Process Steps… (step 1)



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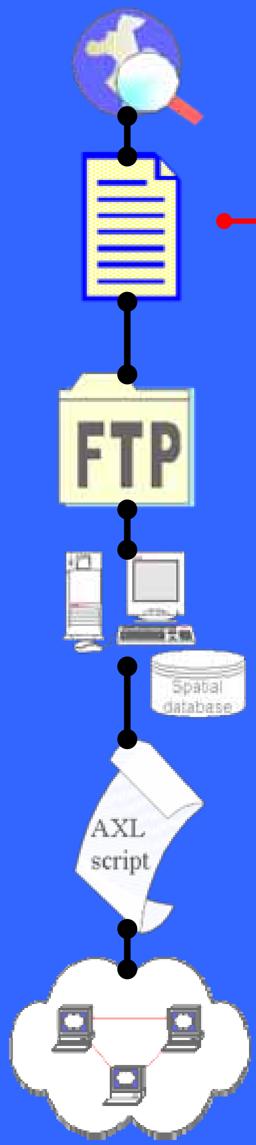
Process Steps… (step 2)



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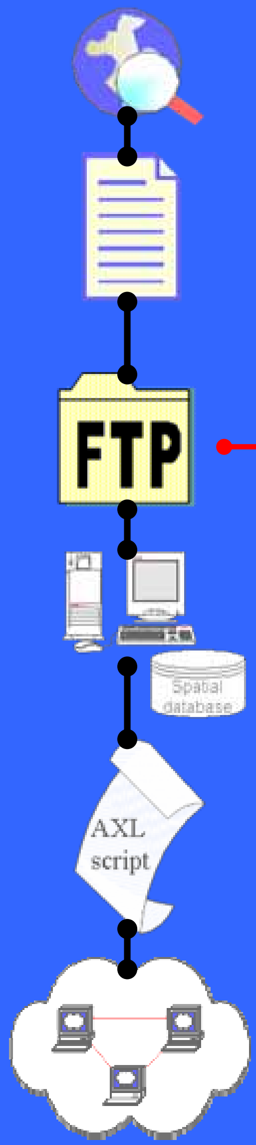
Process Steps… (step 3)



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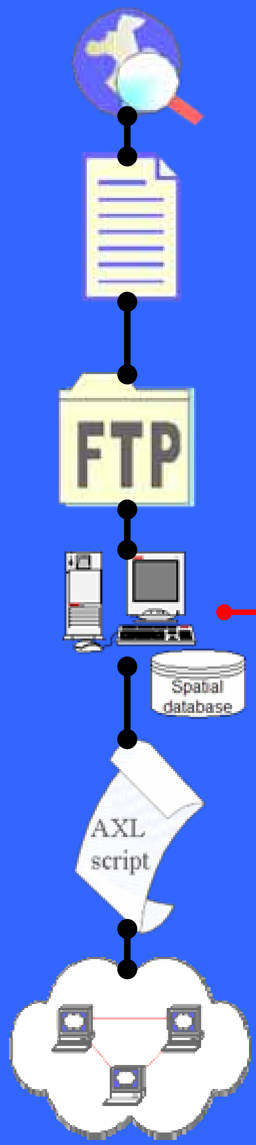

Process Steps… (step 4)

- Identify sources of spatial and temporal data from agencies, organizations, or academic institutions.
- Develop partnership with data provider.
- Acquire data from provider or from public access site such as an FTP site (Automate this process where possible).
- QA/QC data for completeness; convert to GIS format; create metadata; load into ArcSDE (spatial data engine).
- Create ArcIMS Image and Feature Services which are updated when data is updated in database. (new AXL files with new datasets).
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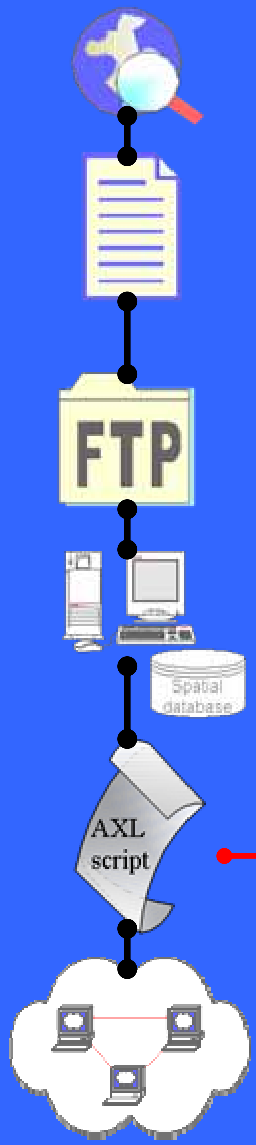

Process Steps… (step 5)

- Identify sources of spatial and temporal data from agencies, organizations, or academic institutions.
- Develop partnership with data provider.
- Acquire data from provider or from public access site such as an FTP site (Automate this process where possible).
- QA/QC data for completeness; convert to GIS format; create metadata; load into ArcSDE (spatial data engine).
- Create ArcIMS Image and Feature Services which are updated when data is updated in database. (new AXL files with new datasets).
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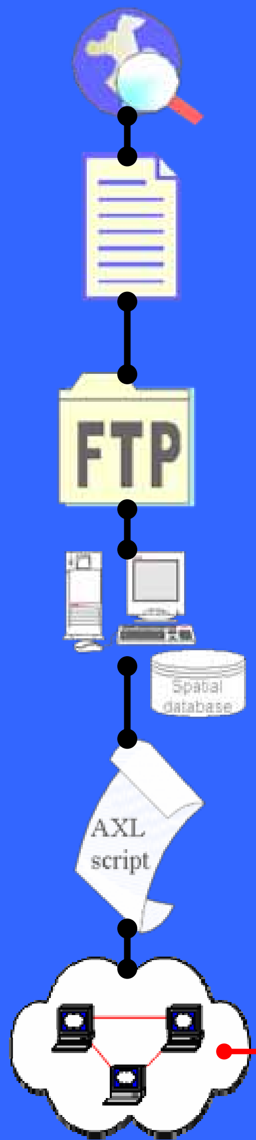
Process Steps… (step 6)



- Identify sources of spatial and temporal data from agencies, organizations, or academic institutions.
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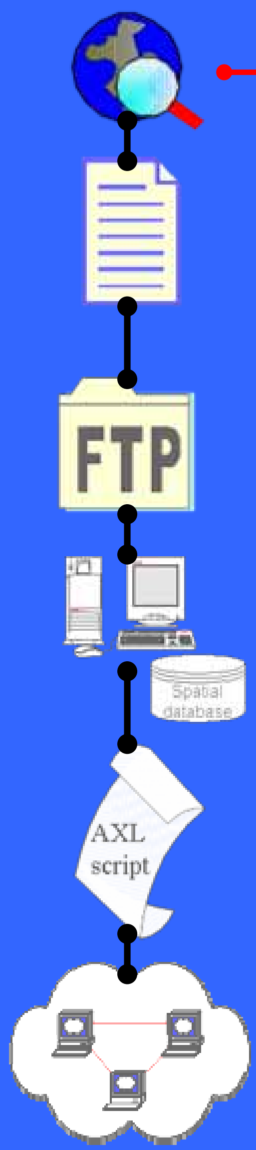


Process Steps… (step 1a)

- Identify sources of spatial and temporal data from agencies, organizations, or academic institutions.

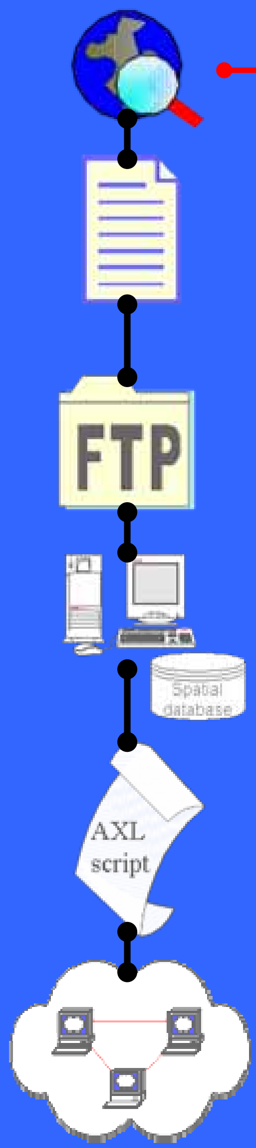
There are plenty of temporal data available from various sources like:

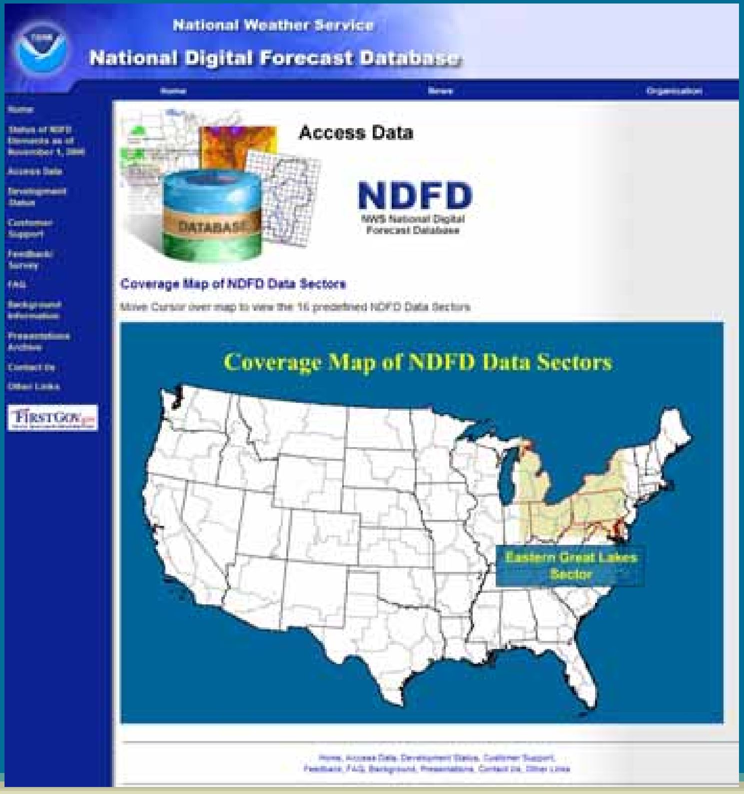
- National Oceanic & Atmospheric Administration (NOAA)
  - National Weather Service (NOAA/NWS) ⇔ *today's example*
- US Geological Service (USGS)
- National Biological Information Infrastructure (NBII)
- Multi-State Aquatic Resources Information System (MARIS)
- Universities
- Government
- …

- Today, we'll use NOAA/NWS NDFD data as one possible example (NDFD = National Digital Forecast Data; http://www.weather.gov/ndfd).

Process Steps… (step 1b)

- Identify sources of spatial and temporal data from agencies, organizations, or academic institutions.
  - The National Digital Forecast Database (NDFD) broke the CONUS (Continental Unitied States) into sixteen geographic sub-sectors.

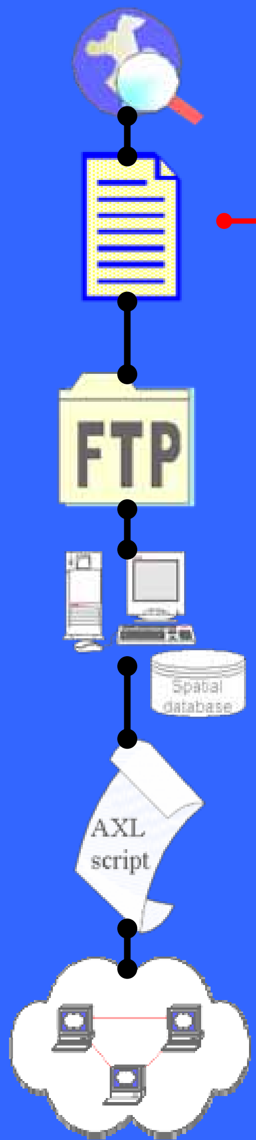




Available variables we are currently serving to the GIS community are:

min. & max. temp., 12-hour probability of precipitation, temp., dewpoint, quantitative precipitation forecast (QPF), snow amount, wind direction & speed, significant wave height, sky cover, apparent temp., rel. humidity, wind gust

More variables provided by NOAA/NWS and others are hopefully coming soon (depends on interest and time available -- non-funded enterprise)



Process Steps… (step 2)

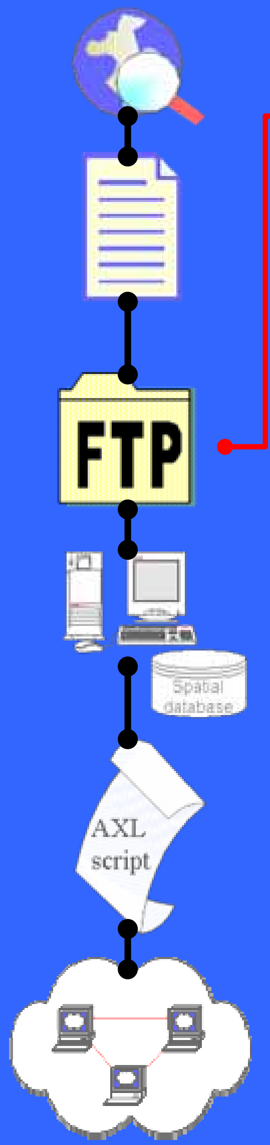
- Develop partnership with data provider.

Developing a relationship with a data provider gives the project a more sustainable base, allows data to be updated more readily, and encourages further cooperation should additional data become available.

The following step should be made once a dataset has been identified:

- The data provider should be contacted to ensure that he/she agrees to the distribution of his/her data by another institution.
- Appropriate credit should be given in the metadata to the data provider.
- Disclaimer and use constraints can also be included in the metadata where applicable.

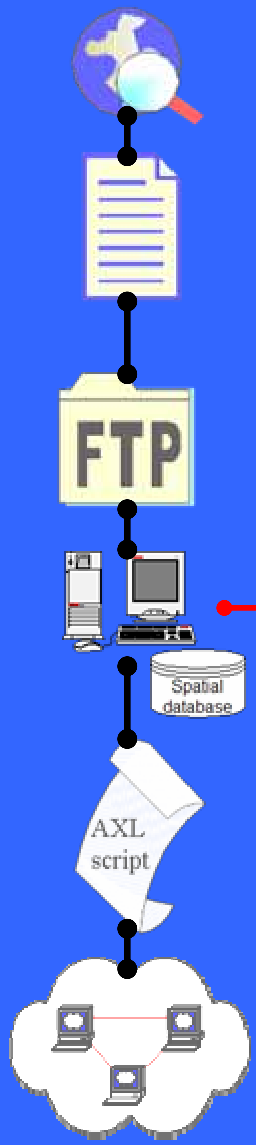
Process Steps… (step 3)



- Acquire data from provider or from public access site such as an FTP site (Automate this process where possible).

Some details that the normal user will not get to see and does not have to worry about:

- Data (e.g., NDFD; ~ 75 MB -- compressed) will be downloaded from the data provider at ***predetermined time intervals (e.g., every 1-3 hours)*** via either anonymous FTP or HTTP (Unix, Linux, Cygwin).
- Parallel downloads immensely speed up data transfer (frequently datasets are split into chunks, which is preferable; note: datasets need to be concatenated to become usable).
- Avoid sequential data downloads
- If downloads require a username and password other than an anonymous login, *make sure that files are read and write protected, especially on multi-user systems.*



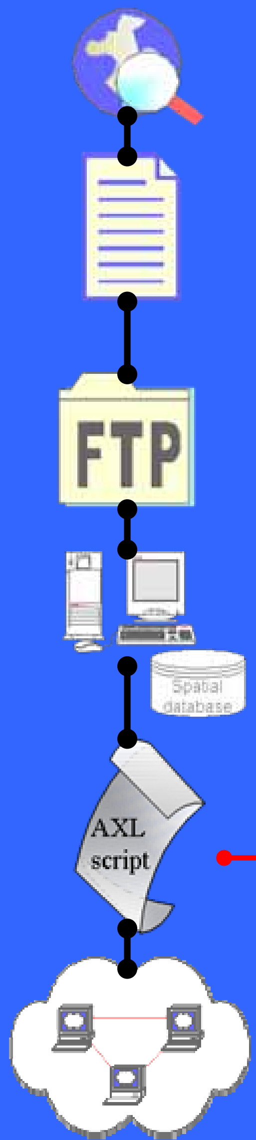
Process Steps… (step 4)

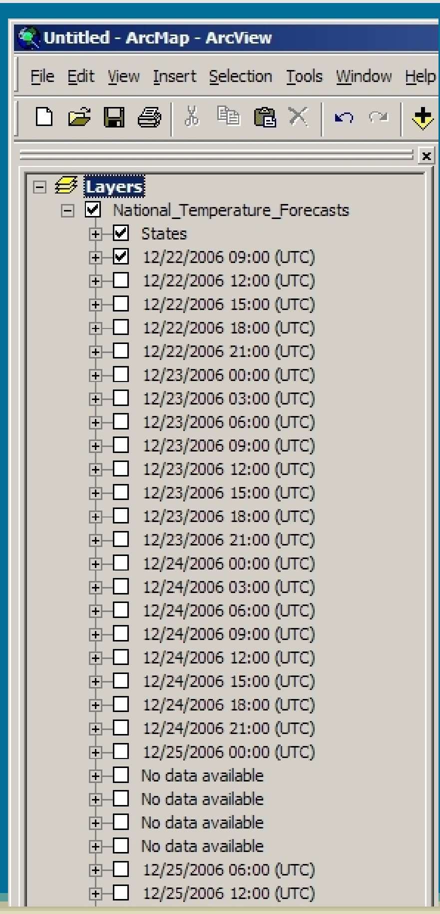
QA/QC data for completeness; convert to GIS format; create metadata; load into ArcSDE (spatial data engine).

- Check data for completeness
- Data come in compressed format => "Degrib" data and convert to ESRI shape files (GRIB2 is the second version of the World Meterological Organization's (WMO) standard for distributing gridded data).
- Upload ESRI shape files/layers into "Spatial Database", e.g., 40 forecast layers for "temperature" (26 x every 3h = 78h; then 14 x 6h = 84h; forecast for about 1 week)
- Repeat for all other variables

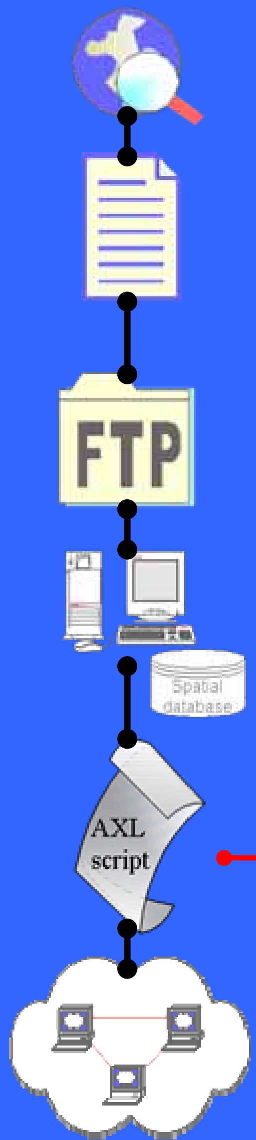
Process Steps… (step 5a)

- Create ArcIMS Image and Feature Services which are updated when data is updated in database. (new AXL files with new datasets).





- *Update time stamp (BONUS; tricky; wait for next slide)*
- Usually timestamps say, e.g. 3, 6, 9, … , 150 hours from now; *ours* do show real times.
- Problem: A users saves a map and reopens it without remembering the time he saved the map ➔ ideally the timestamp should show the forecast time.



Process Steps… (step 5b)

- Create ArcIMS Image and Feature Services which are updated when data is updated in database. (new AXL files with new datasets).

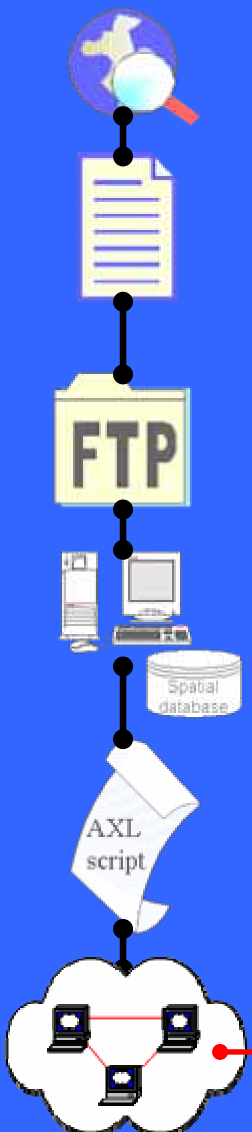
```
/cygdrive/d/noaa.conus/data-archive/2007010301/conus
$ degrib vp004-007/ds.temp.bin -I
MsgNum, Byte, GRIB-Version, elem, level, reference(UTC), valid(UTC), Proj(hr)
1.0, 0, 2, T="Temperature [K]", 0-SFC, 01/03/2007 06:00, 01/06/2007 06:00, 72.00
2.0, 255958, 2, T="Temperature [K]", 0-SFC, 01/03/2007 06:00, 01/06/2007 12:00, 78.00
3.0, 511415, 2, T="Temperature [K]", 0-SFC, 01/03/2007 06:00, 01/06/2007 18:00, 84.00
4.0, 767703, 2, T="Temperature [K]", 0-SFC, 01/03/2007 06:00, 01/07/2007 00:00, 90.00
5.0, 1027690, 2, T="Temperature [K]", 0-SFC, 01/03/2007 06:00, 01/07/2007 06:00, 96.00
6.0, 1285997, 2, T="Temperature [K]", 0-SFC, 01/03/2007 06:00, 01/07/2007 12:00, 102.00
7.0, 1544605, 2, T="Temperature [K]", 0-SFC, 01/03/2007 06:00, 01/07/2007 18:00, 108.00
8.0, 1800934, 2, T="Temperature [K]", 0-SFC, 01/03/2007 06:00, 01/08/2007 00:00, 114.00
9.0, 2061530, 2, T="Temperature [K]", 0-SFC, 01/03/2007 06:00, 01/08/2007 06:00, 120.00
10.0, 2323549, 2, T="Temperature [K]", 0-SFC, 01/03/2007 06:00, 01/08/2007 12:00, 126.00
11.0, 2586626, 2, T="Temperature [K]", 0-SFC, 01/03/2007 06:00, 01/08/2007 18:00, 132.00
12.0, 2845848, 2, T="Temperature [K]", 0-SFC, 01/03/2007 06:00, 01/09/2007 00:00, 138.00
13.0, 3108526, 2, T="Temperature [K]", 0-SFC, 01/03/2007 06:00, 01/09/2007 06:00, 144.00
14.0, 3371488, 2, T="Temperature [K]", 0-SFC, 01/03/2007 06:00, 01/09/2007 12:00, 150.00
```

Example of metadata

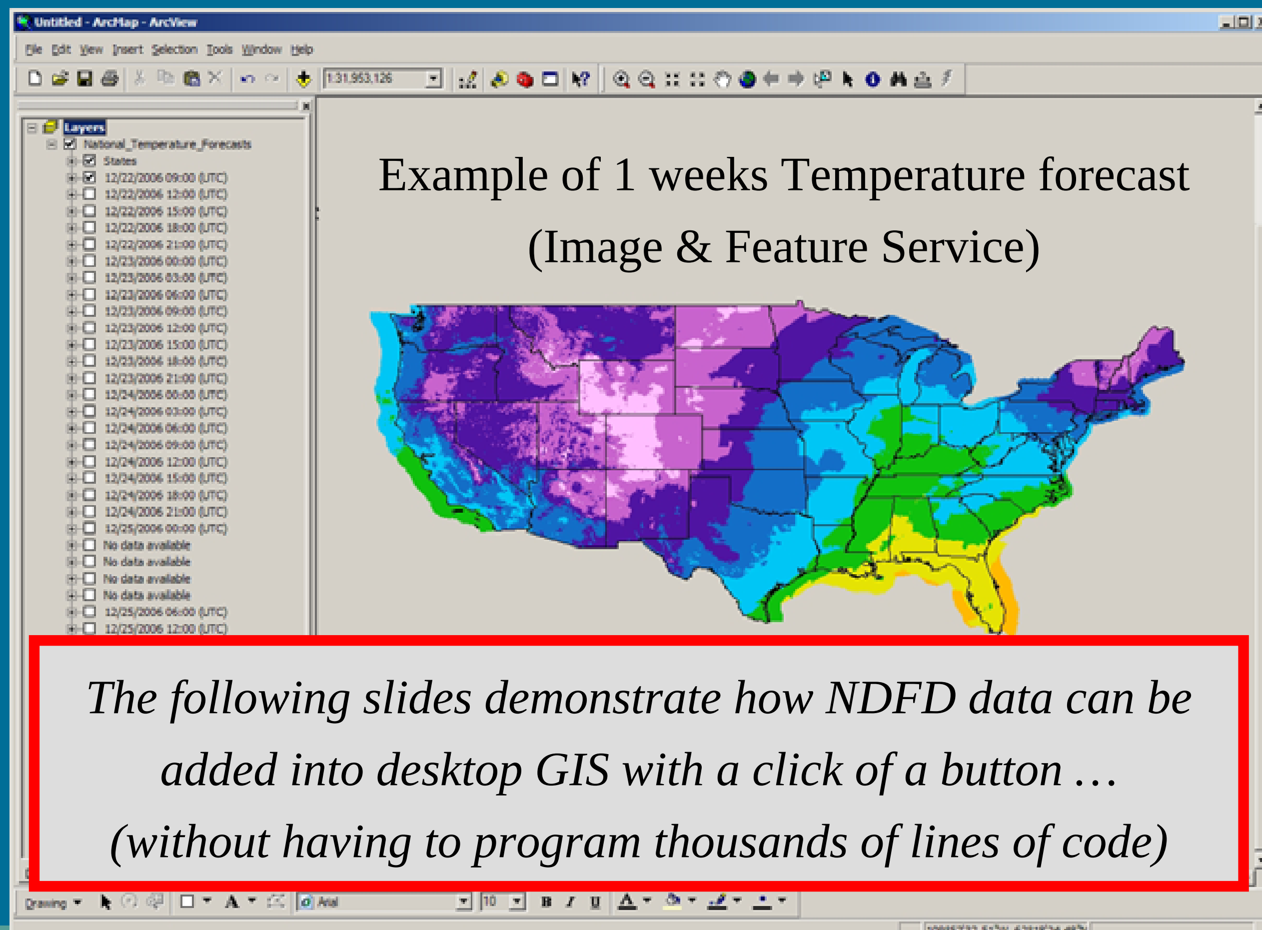
- degrib ds.temp.bin -I

- Here is how we *update the time stamp* …
  1. Extract timestamp from data archive/metadata
  2. Update AXL file with the “real” time information
  3. Stop Feature and Image Service
  4. Replace old AXL file with new updated file
  5. Restart Feature and Image Service
  6. Repeat for all other variables
  7. DONE

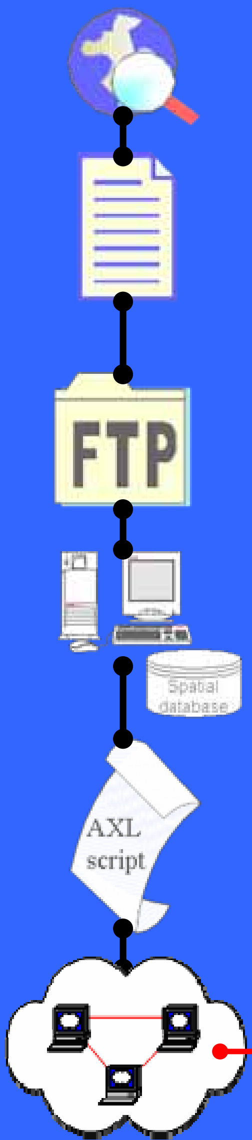
Process Steps… (step 6a)



- Users can bring Image and Feature services directly into their desktop GIS software.

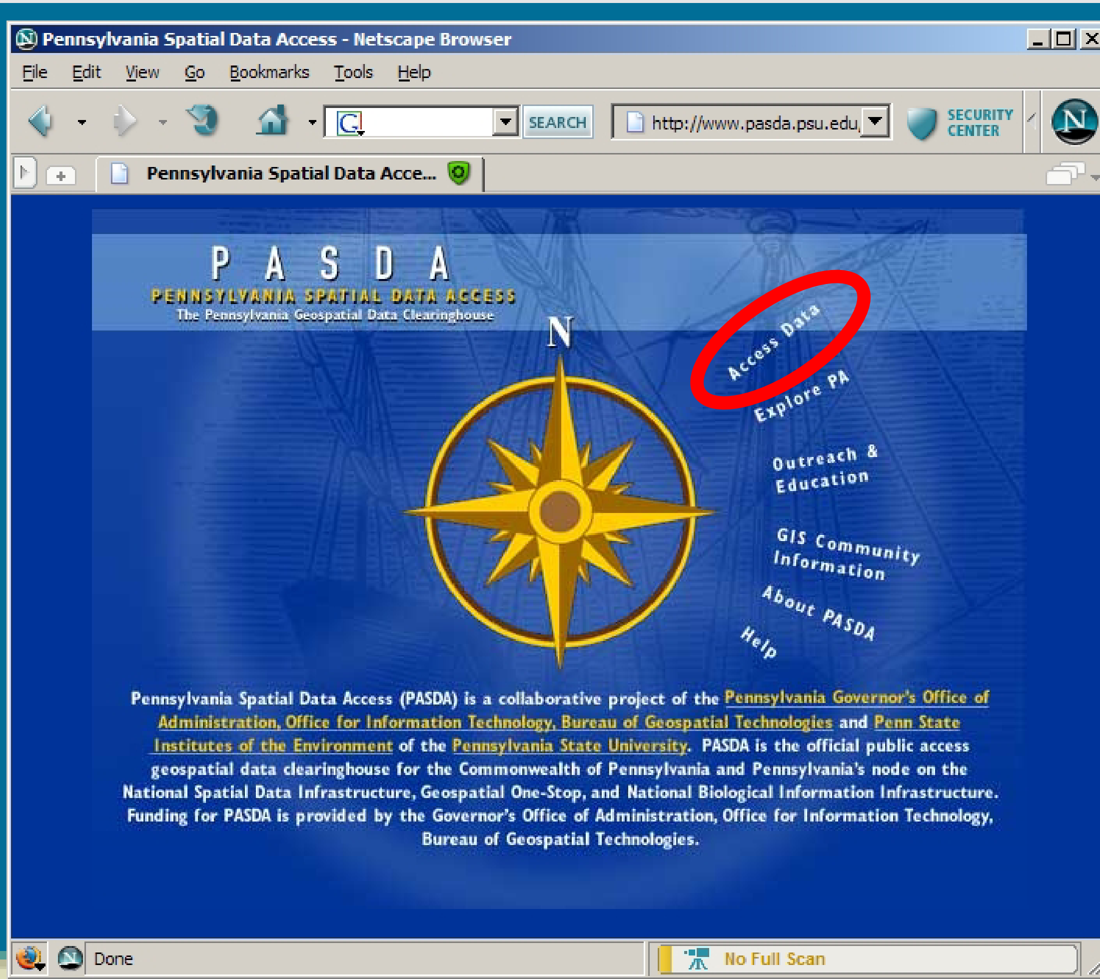


The following slides demonstrate how NDFD data can be added into desktop GIS with a click of a button …
(without having to program thousands of lines of code)



Process Steps… (step 6b)

- Users can bring Image and Feature services directly into their desktop GIS software.

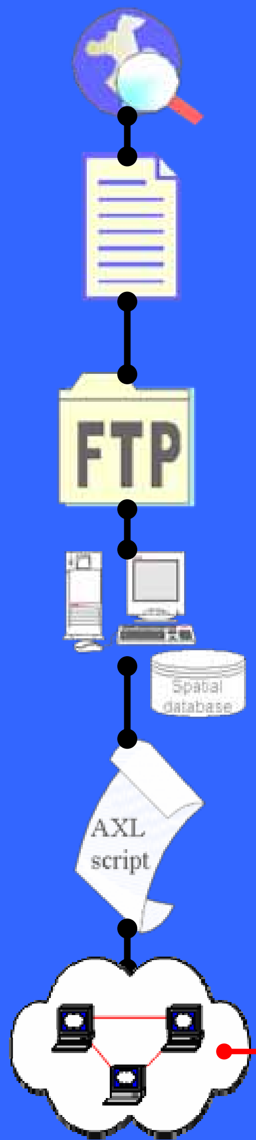


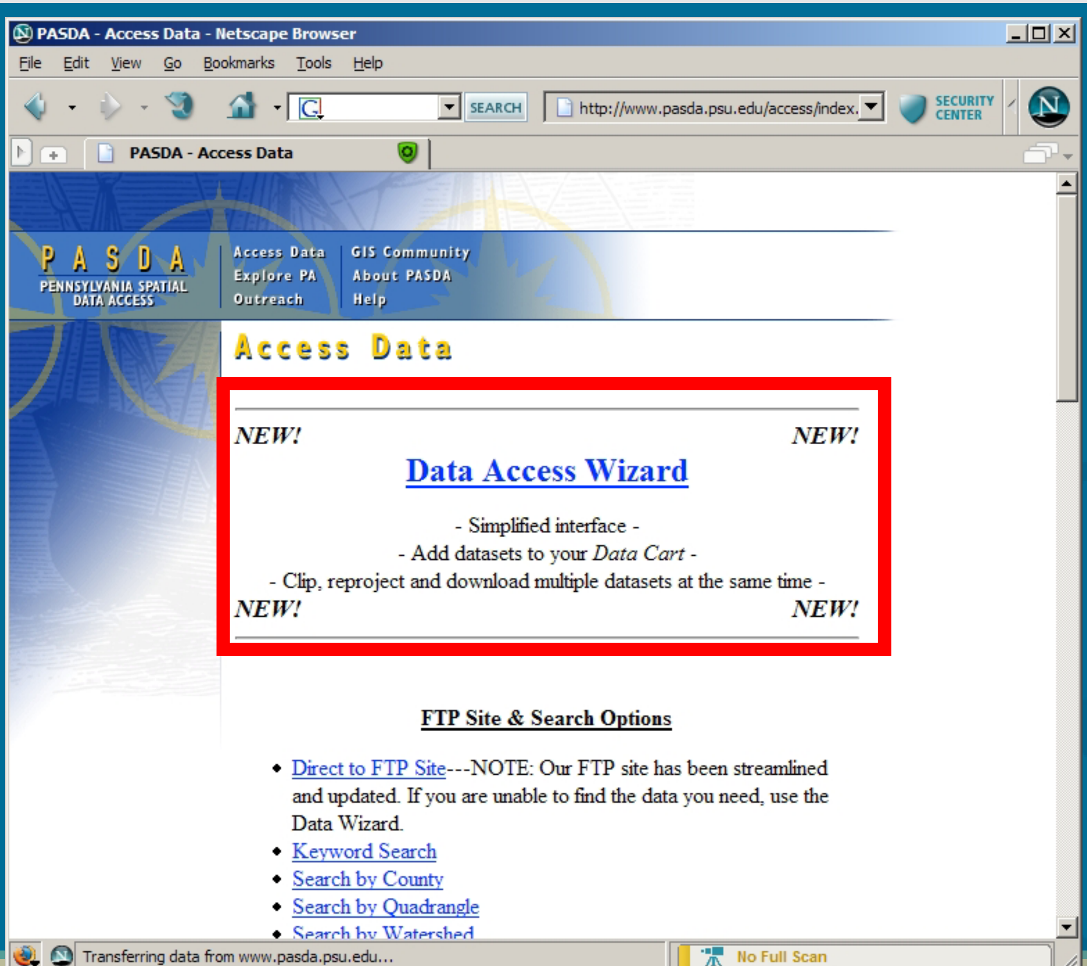
GIS weather data with a click of a button!

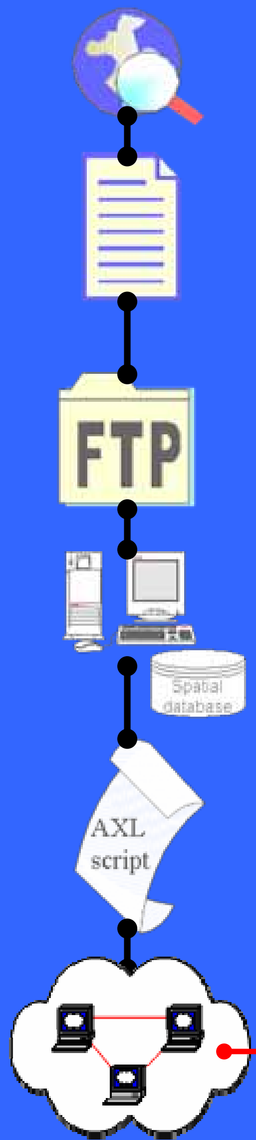
PASDA is funded by the Geospatial Technologies Office of the PA Office for Information Technology

Process Steps… (step 6c)

- Users can bring Image and Feature services directly into their desktop GIS software.

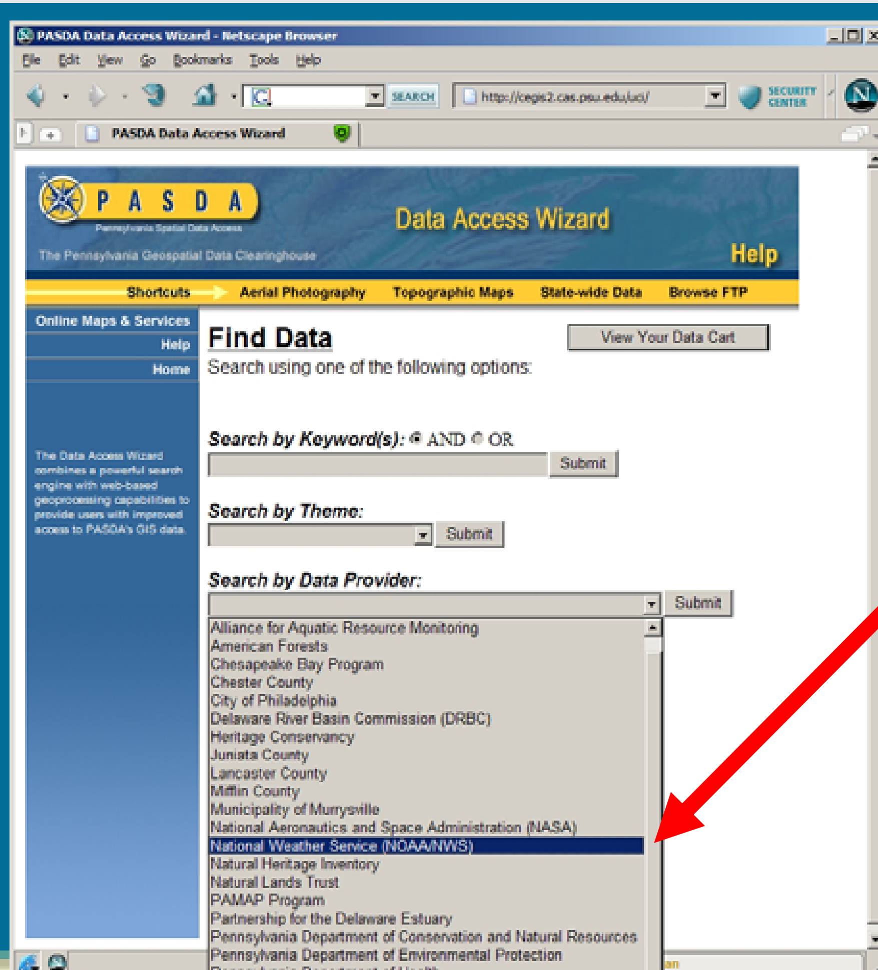






Process Steps… (step 6d)

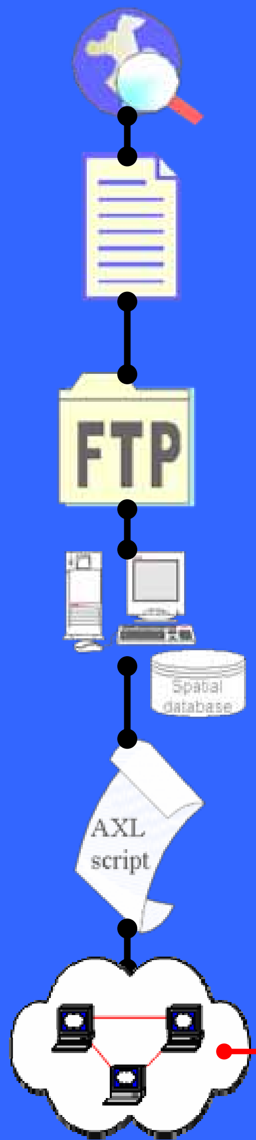
- Users can bring Image and Feature services directly into their desktop GIS software.

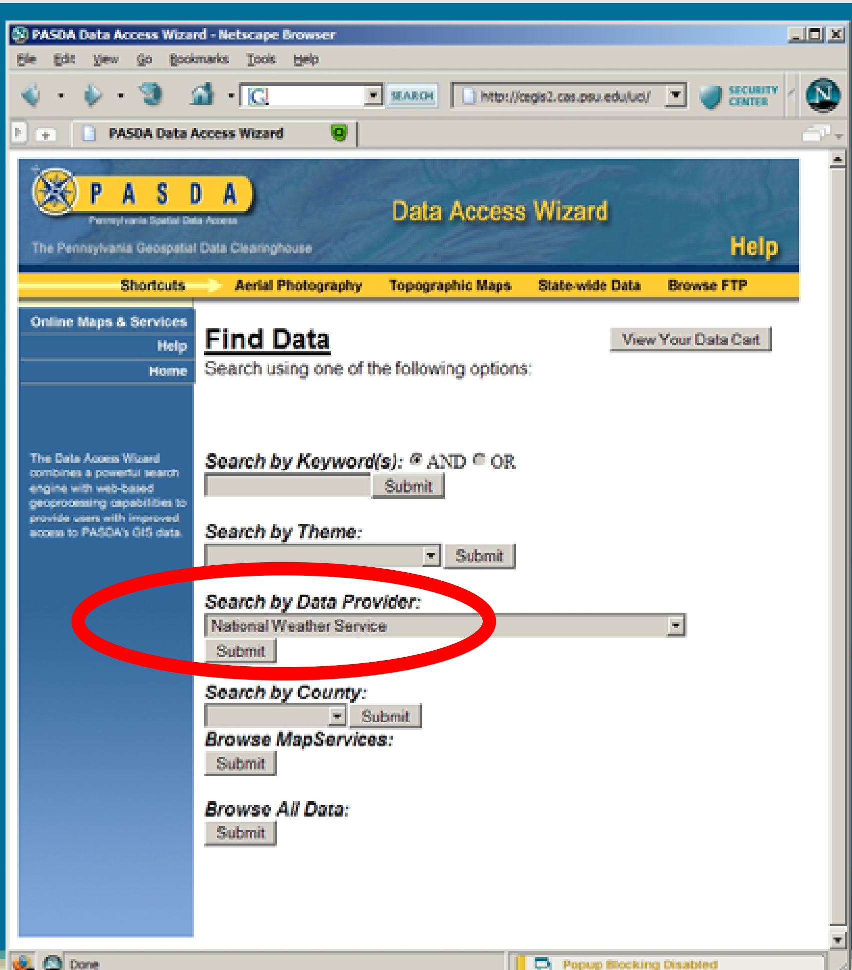


Today's example: NOAA/NWS

Process Steps… (step 6e)

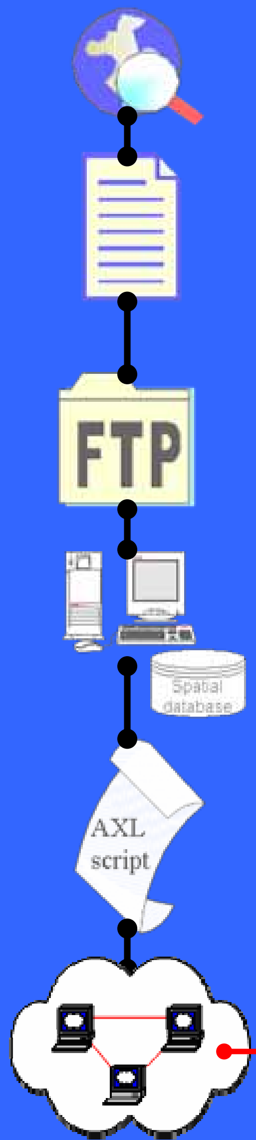
- Users can bring Image and Feature services directly into their desktop GIS software.





Process Steps… (step 6f)

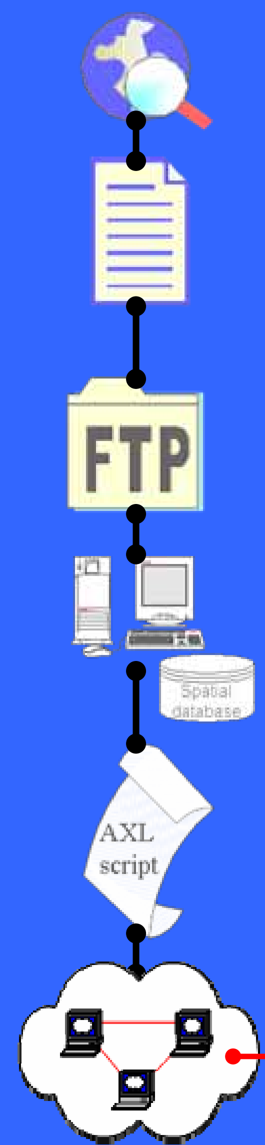
- Users can bring Image and Feature services directly into their desktop GIS software.



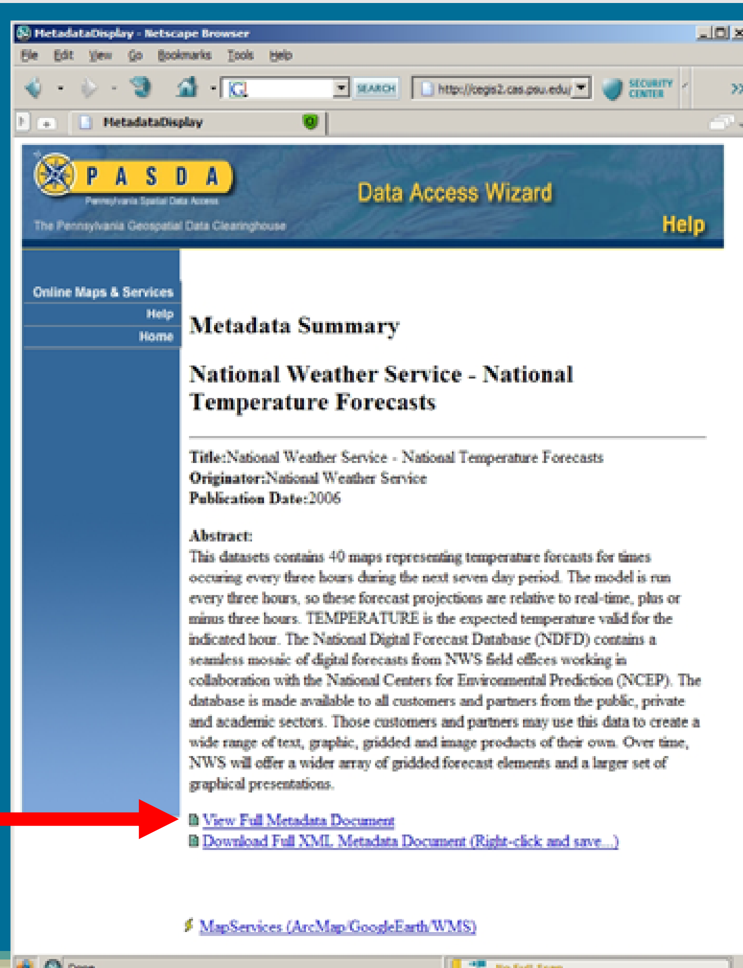
14 + 3 = 17 variables

- 3 temporal images
- 14 NDFD datasets

Process Steps… (step 6g)



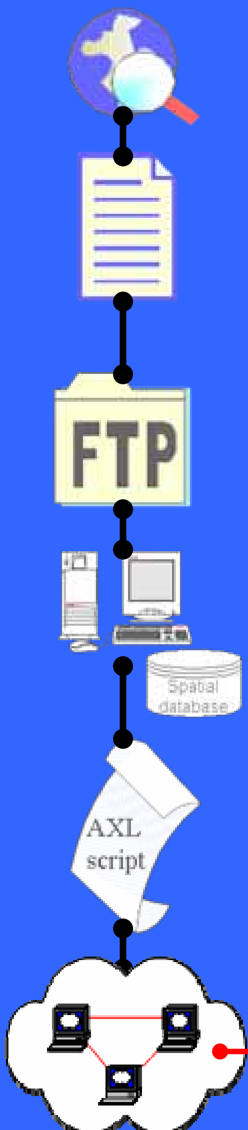
- Users can bring Image and Feature services directly into their desktop GIS software.

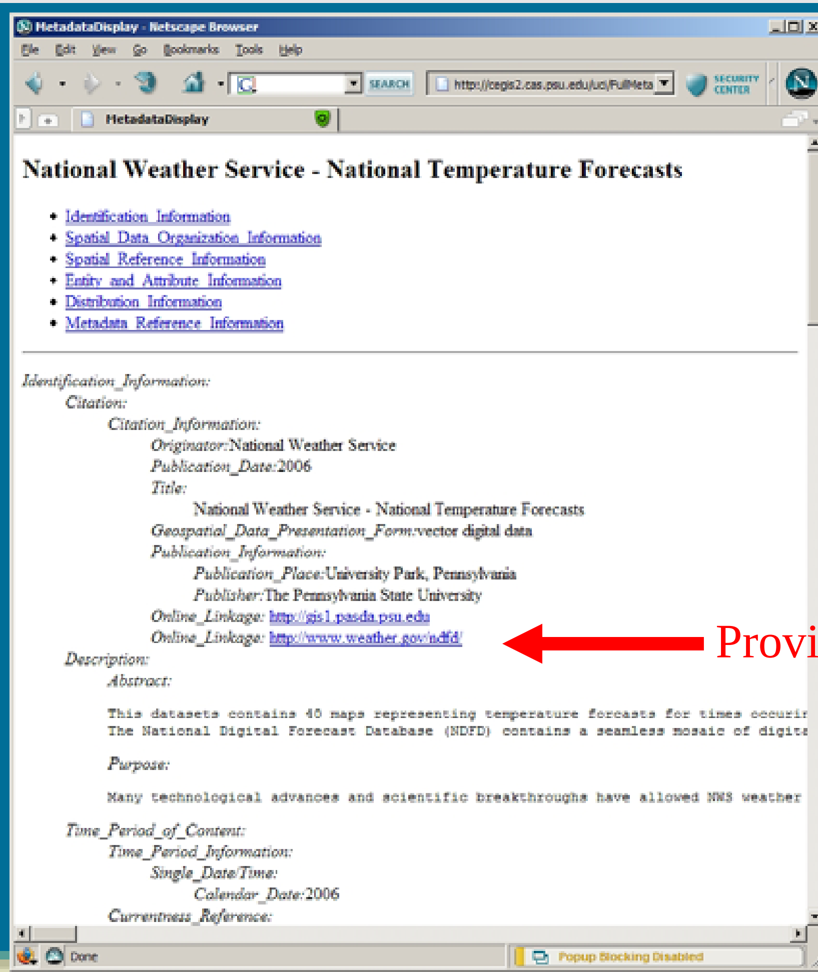


Keep slide in mind, we'll return to it.

Process Steps… (step 6h)

- Users can bring Image and Feature services directly into their desktop GIS software.





National Weather Service - National Temperature Forecasts

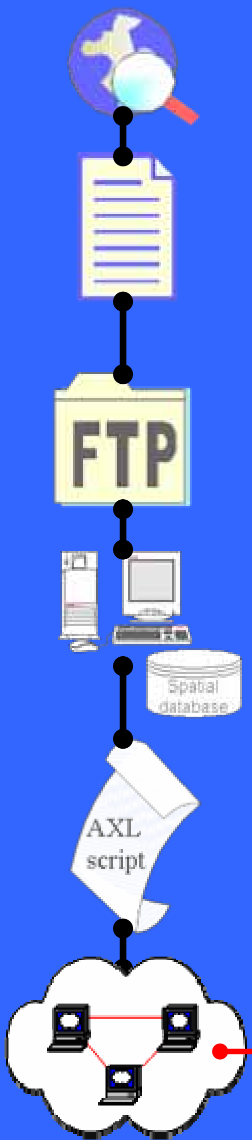
- Identification_Information
- Spatial_Data_Organization_Information
- Spatial_Reference_Information
- Entity_and_Attribute_Information
- Distribution_Information
- Metadata_Reference_Information

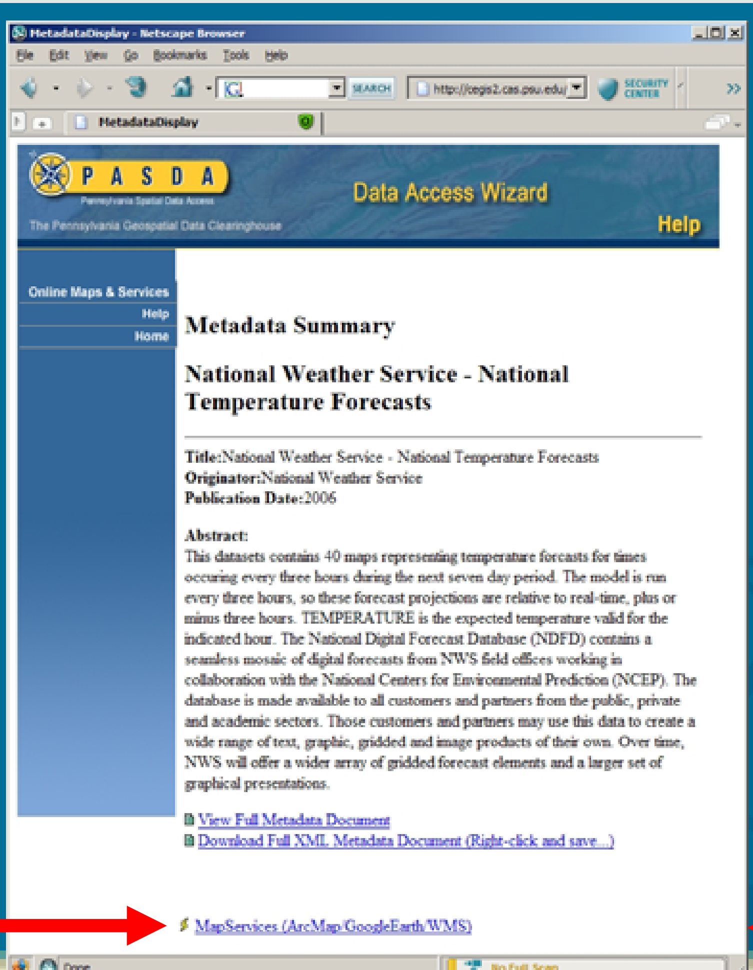
Identification_Information:
Citation:
Citation_Information:
Originator: National Weather Service
Publication_Date: 2006
Title:
National Weather Service - National Temperature Forecasts
Geospatial_Data_Presentation_Form: vector digital data
Publication_Information:
Publication_Place: University Park, Pennsylvania
Publisher: The Pennsylvania State University
Online_Linkage: http://gis1.pasda.psu.edu
Online_Linkage: http://www.weather.gov/ndfd/
Description:
Abstract:
This datasets contains 40 maps representing temperature forcasts for times occurir
The National Digital Forecast Database (NDFD) contains a seamless mosaic of digita
Purpose:
Many technological advances and scientific breakthroughs have allowed NWS weather
Time_Period_of_Content:
Time_Period_Information:
Single_Date/Time:
Calendar_Date: 2006
Currentness_Reference:

Provide appropriate credit

Process Steps… (step 6i)

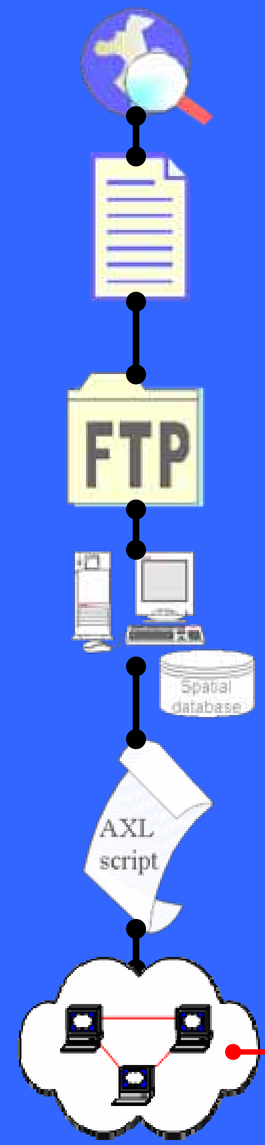
- Users can bring Image and Feature services directly into their desktop GIS software.

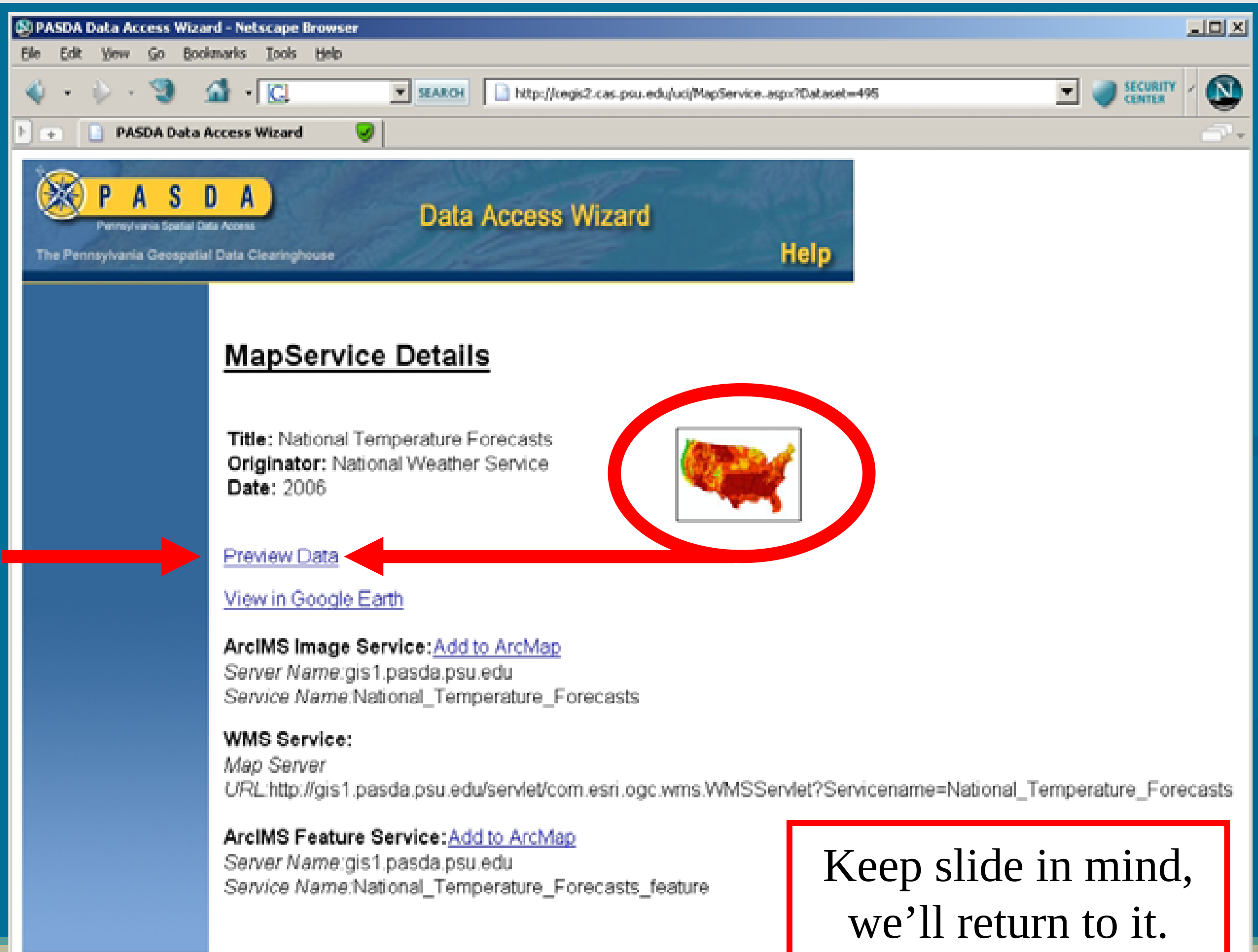




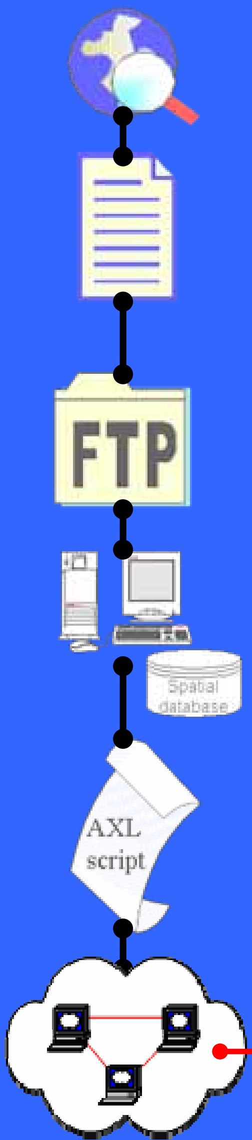
Process Steps… (step 6j)

- Users can bring Image and Feature services directly into their desktop GIS software.



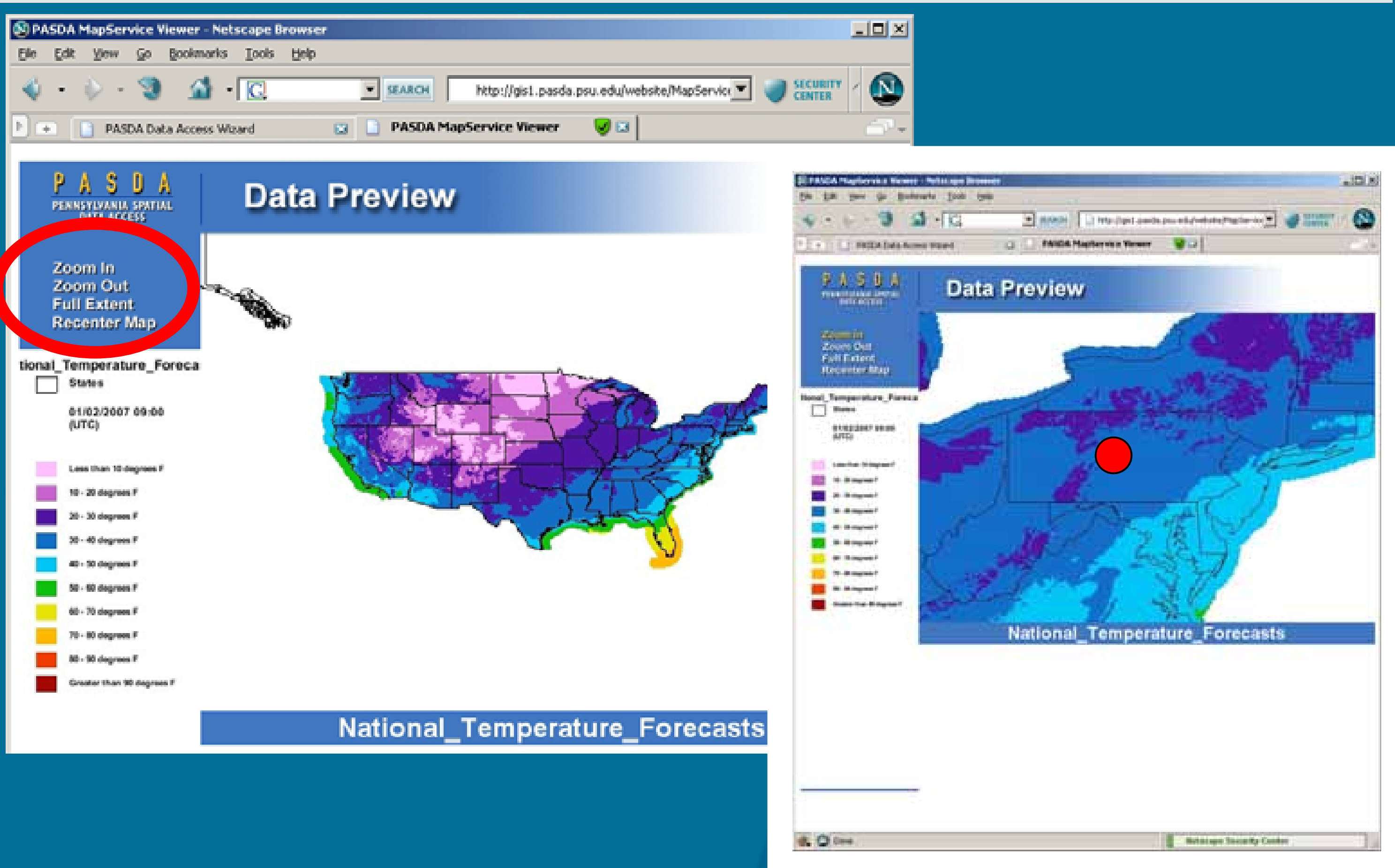


Keep slide in mind, we'll return to it.

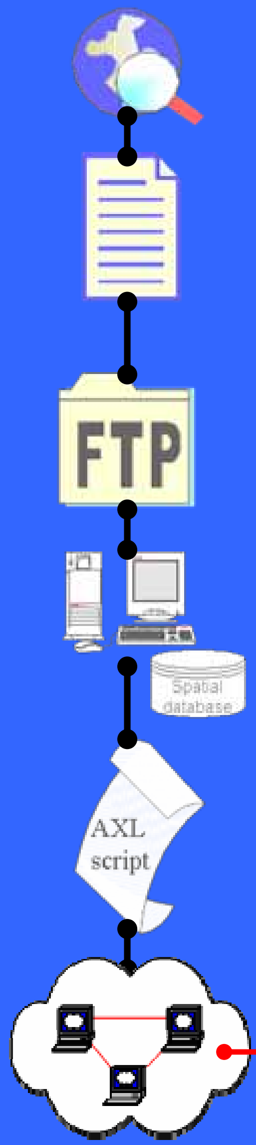


Process Steps… (step 6k)

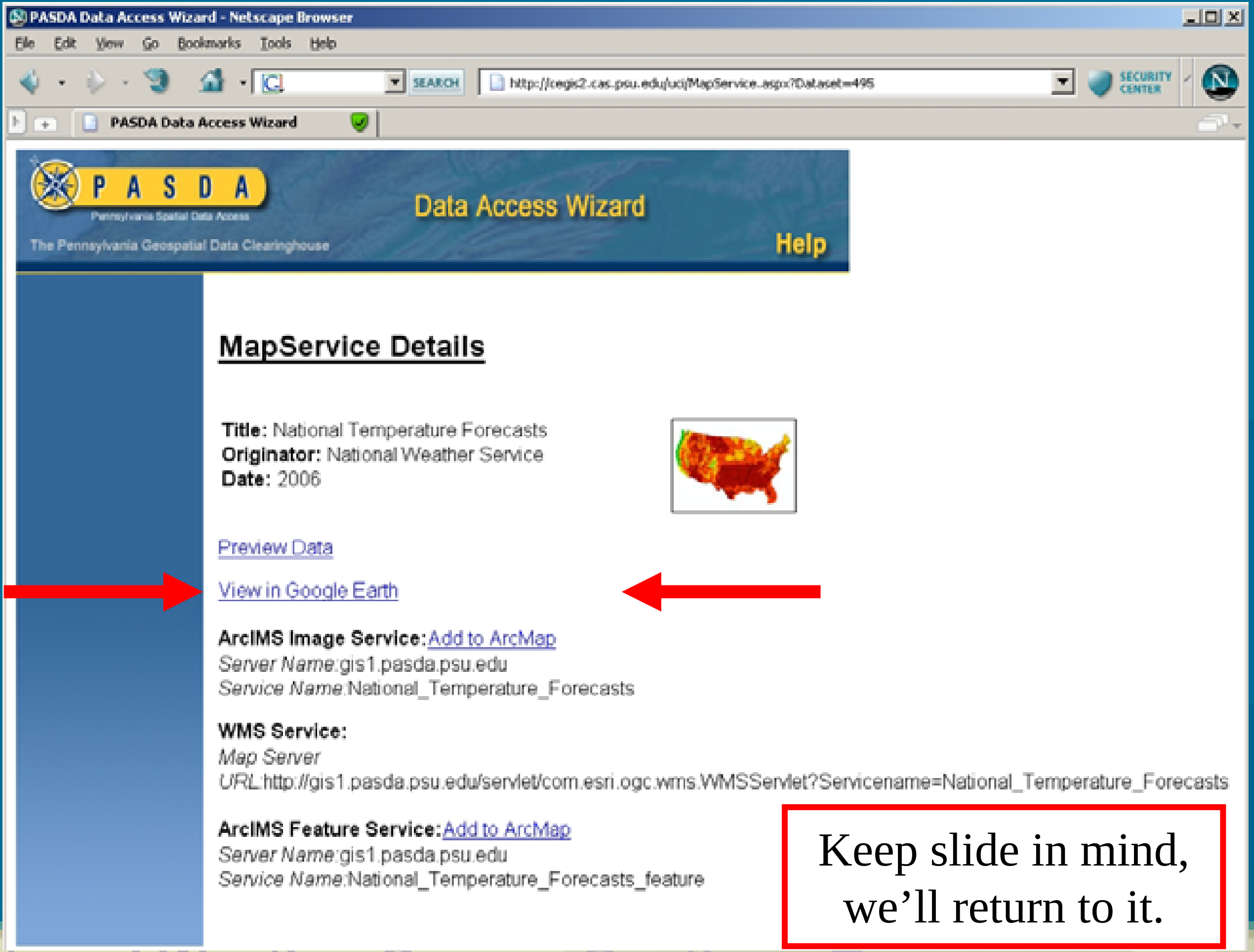
- Users can bring Image and Feature services directly into their desktop GIS software.



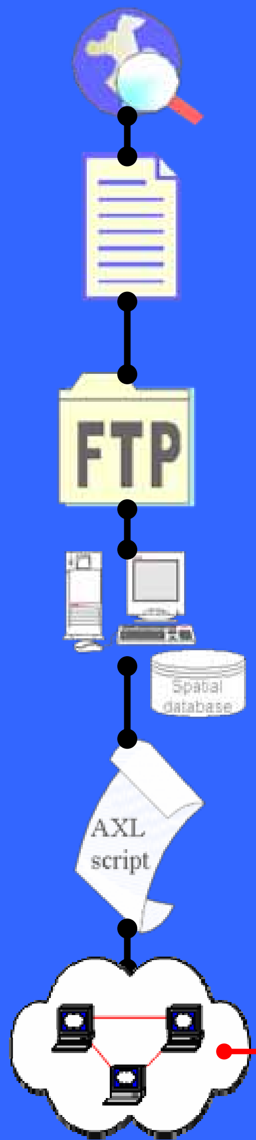
Process Steps… (step 6l)



- Users can bring Image and Feature services directly into their desktop GIS software.

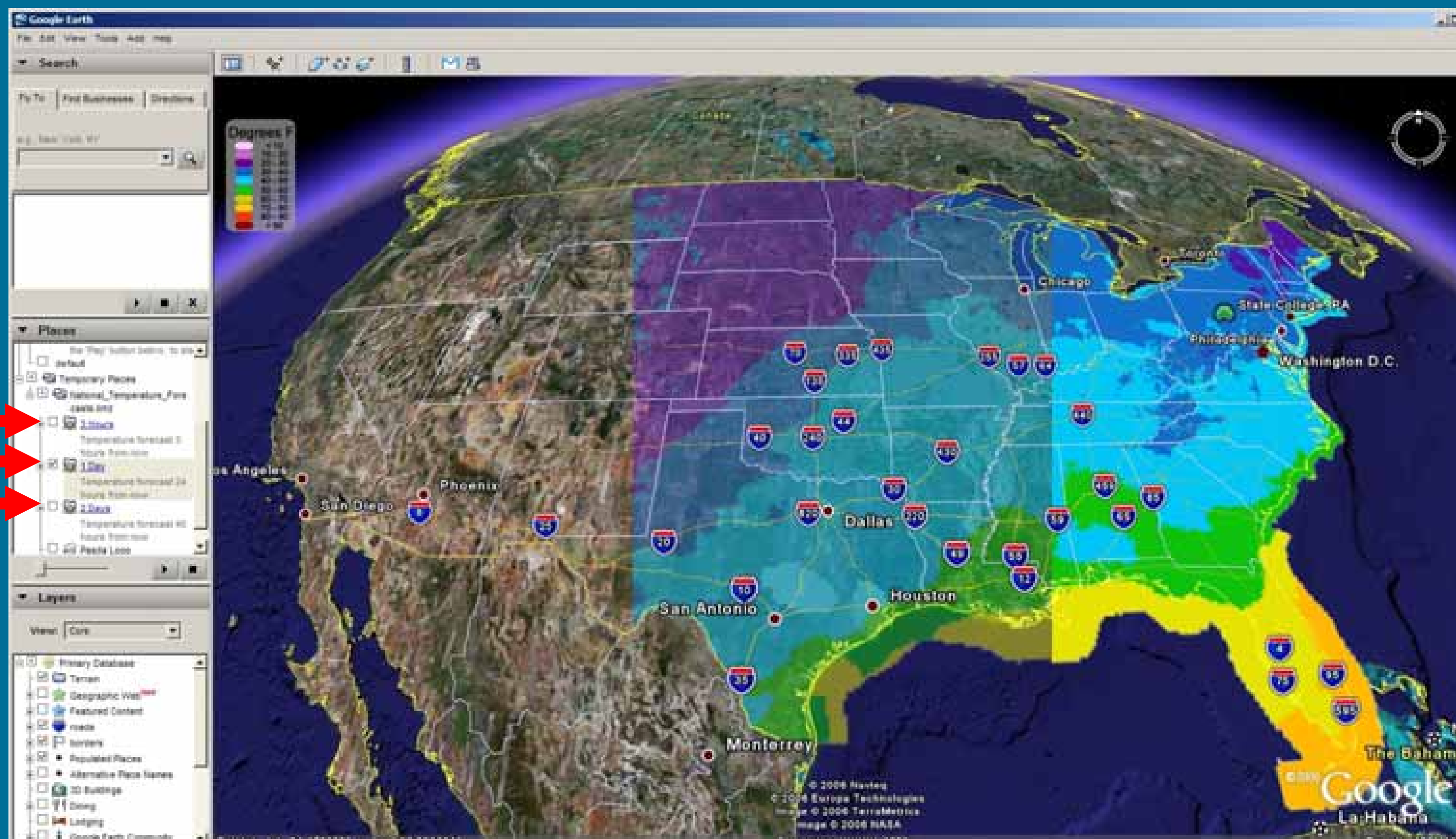


Keep slide in mind, we'll return to it.



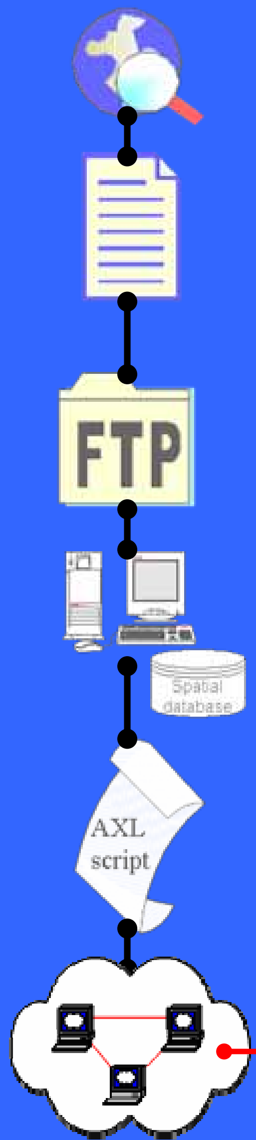
Process Steps… (step 6m)

- Users can bring Image and Feature services directly into their desktop GIS software.

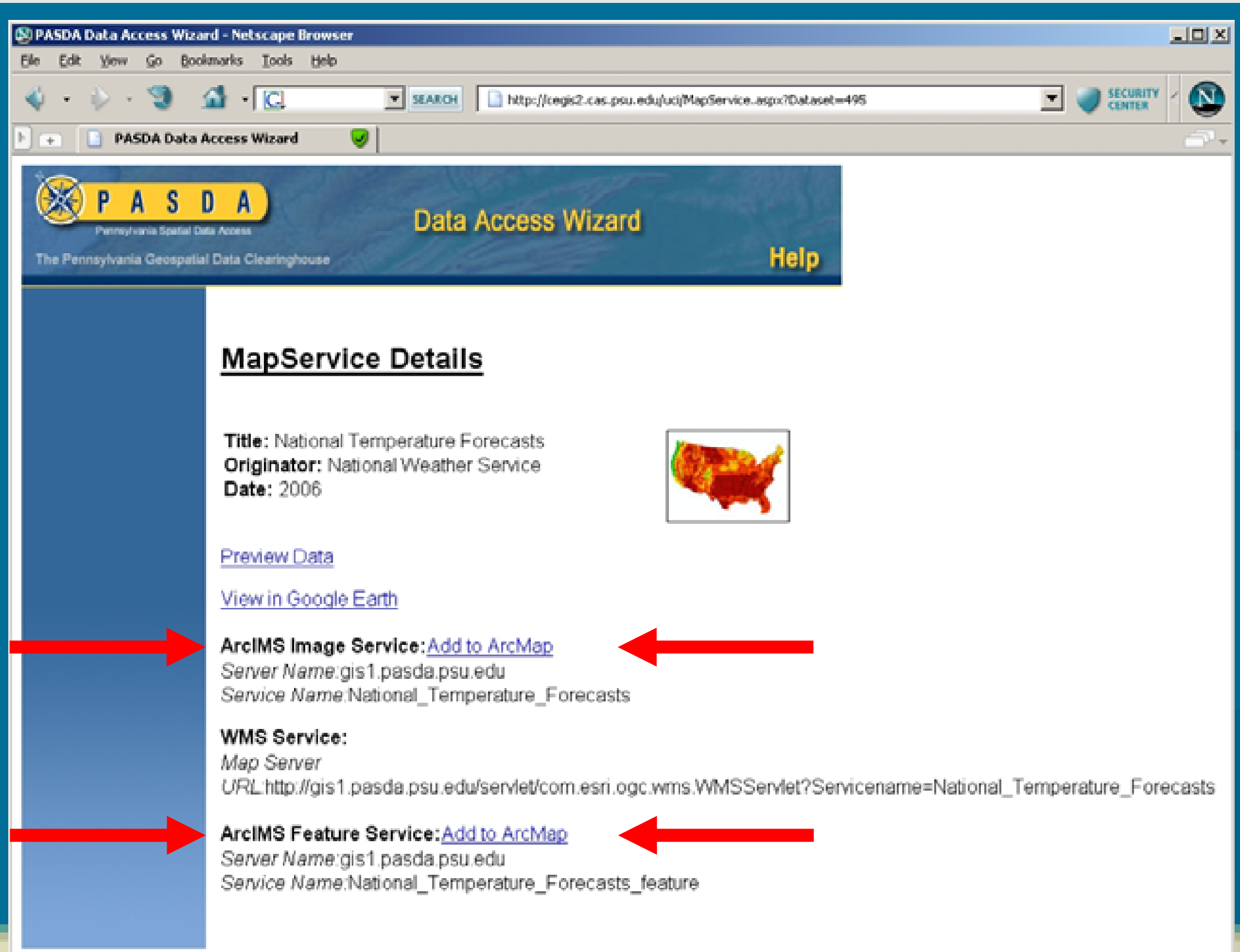


Three NDFD forecast layers are available for each variable at 3h, 1d, & 2d

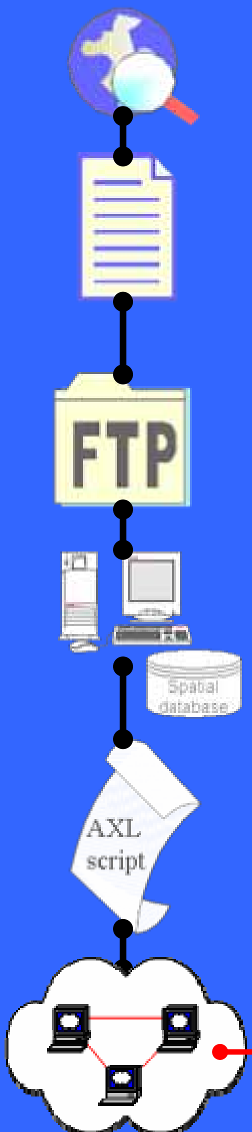
Process Steps… (step 6n)



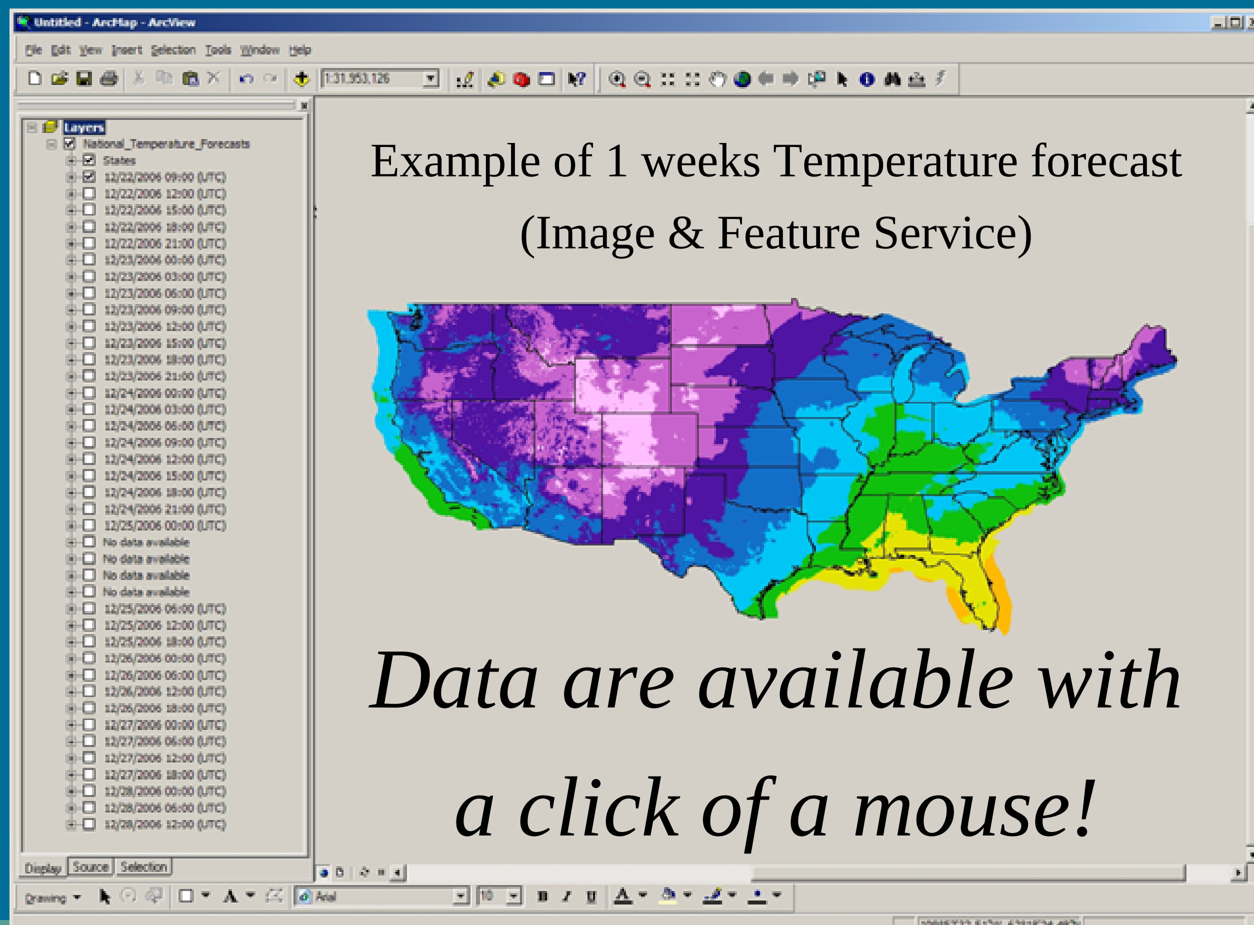
- Users can bring Image and Feature services directly into their desktop GIS software.

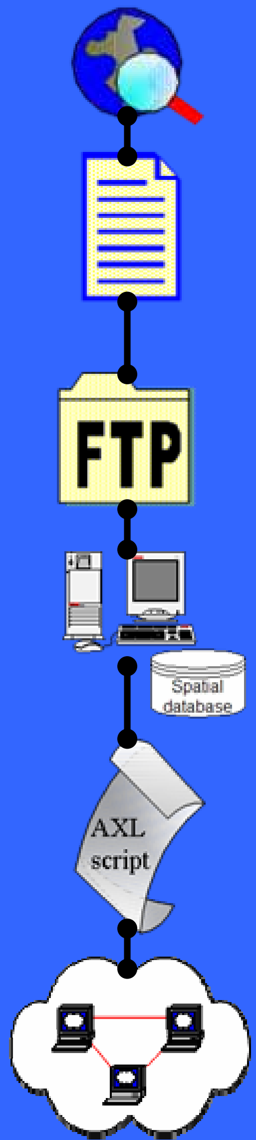


Process Steps… (step 6o)



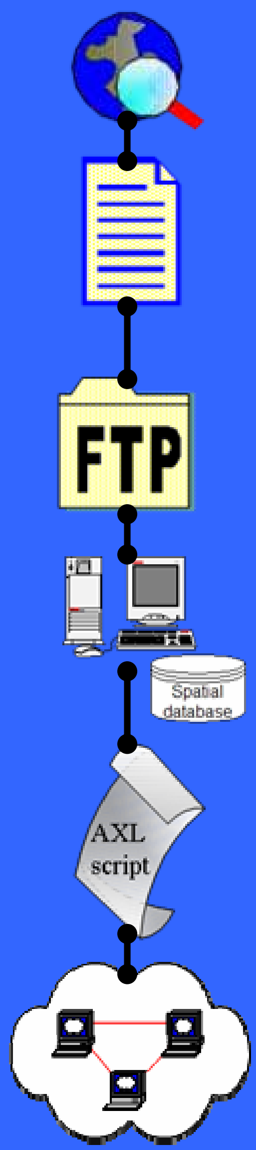
- Users can bring Image and Feature services directly into their desktop GIS software.





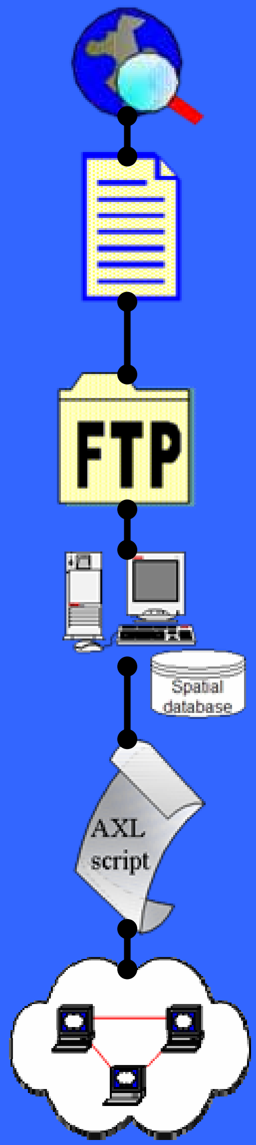
Conclusions

- PSIEE & EESI (PSU) team communicates and collaborates with NOAA/NWS on GIS projects.
- Together, we, PSIEE, EESI, and NOAA/NWS can grow together for a greater benefit to anyone tapping in ➔
- We provide continuously updated NOAA/NWS weather data *in GIS format* to emergency managers and response support agencies as well as the general public.
- *With a click of a mouse users can bring our Image and Feature services directly into their desktop GIS software.*



Conclusions II

- Collaboration works!!
- Further exploration/resources needed
- http://www.weather.gov/gis
- http://www.pasda.psu.edu



Questions & Comments

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