Unidata Policy Committee

September 22, 2005

LeRoy Spayd

Chief, Meteorological Services Division

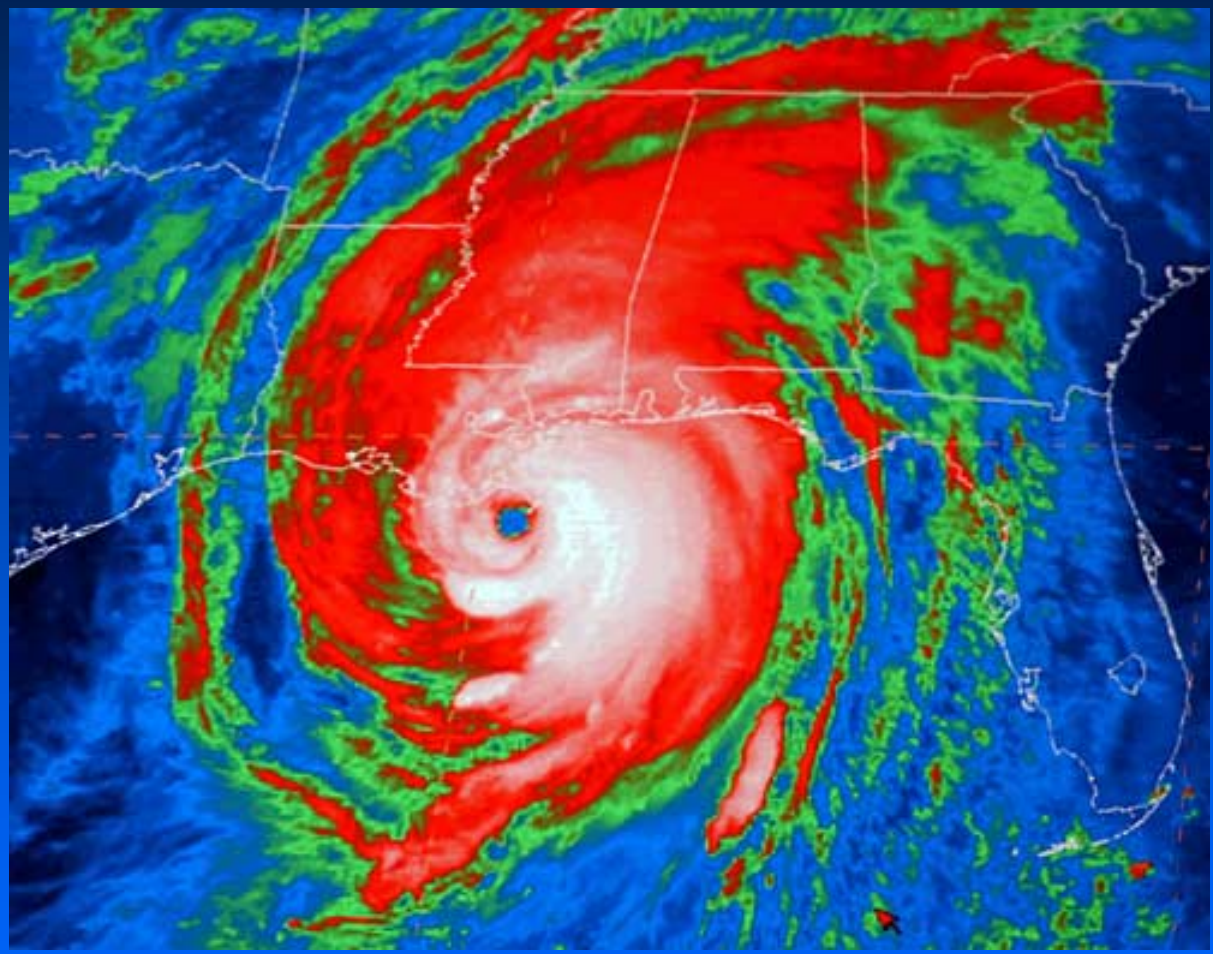
Office of Climate, Water, and Weather Services

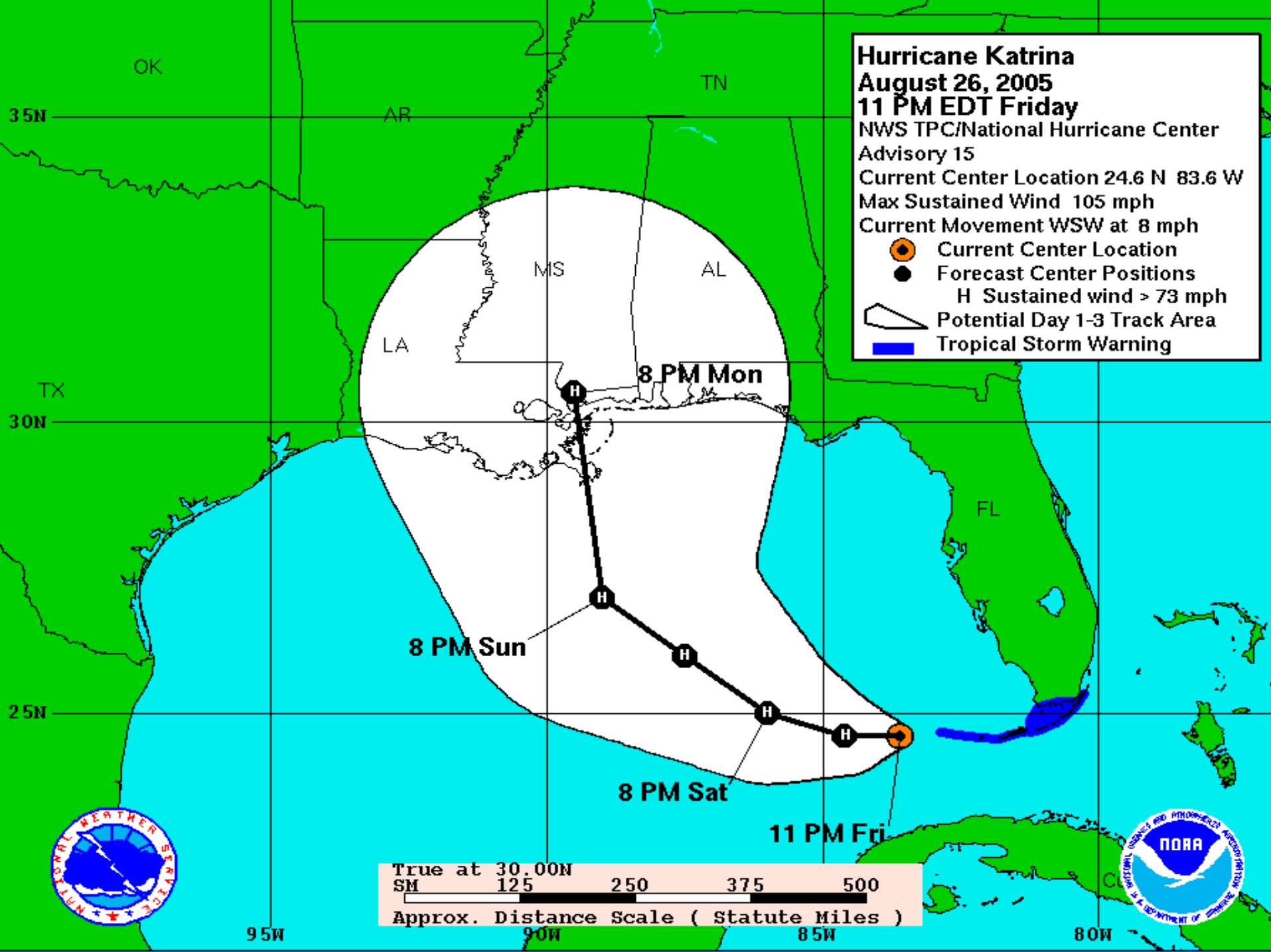
NOAA's National Weather Service

Outline

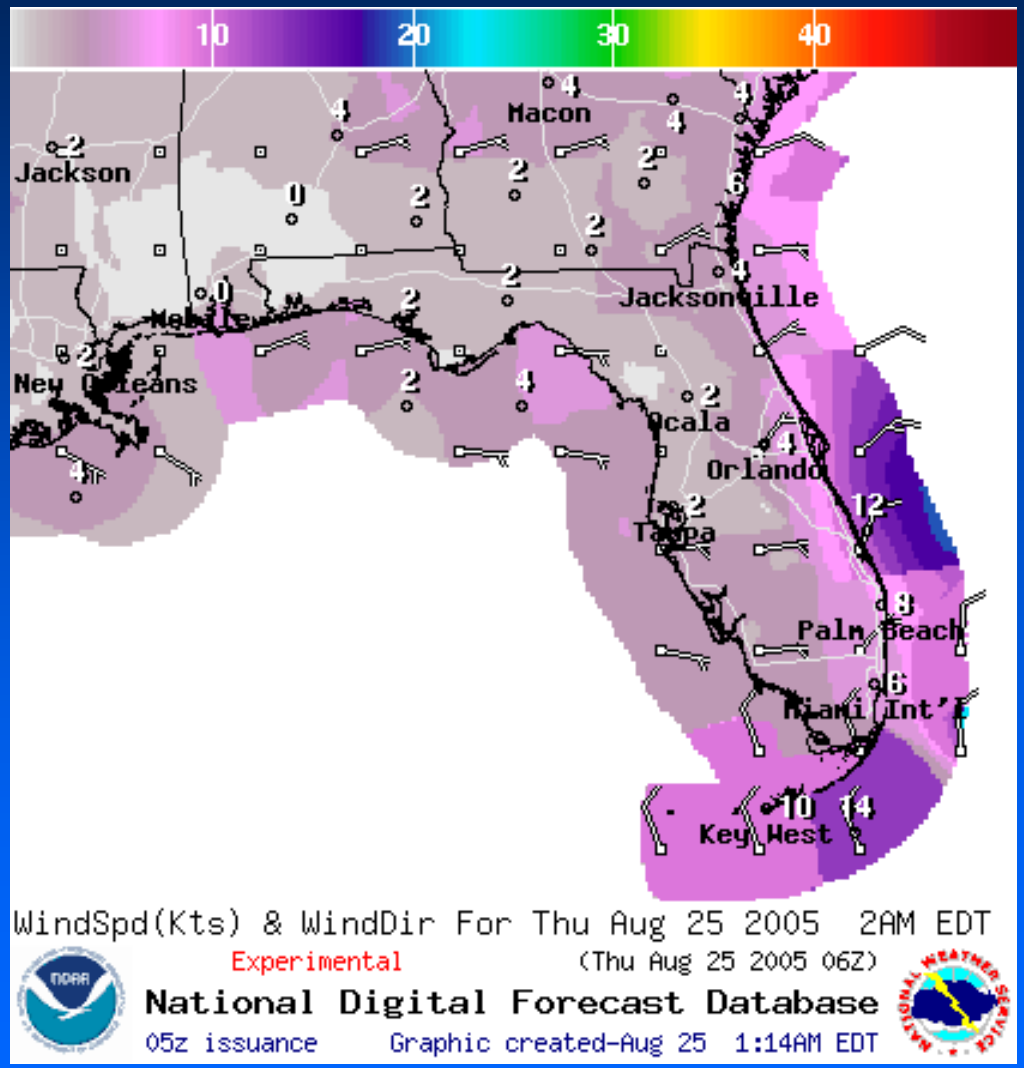
- Hurricane Katrina
- Cooperative Modernization - More Observation Data
- Terminal Doppler Weather Radar
- Budget Status
- Challenges

Hurricane Katrina in National Digital Forecast Database (NDFD)



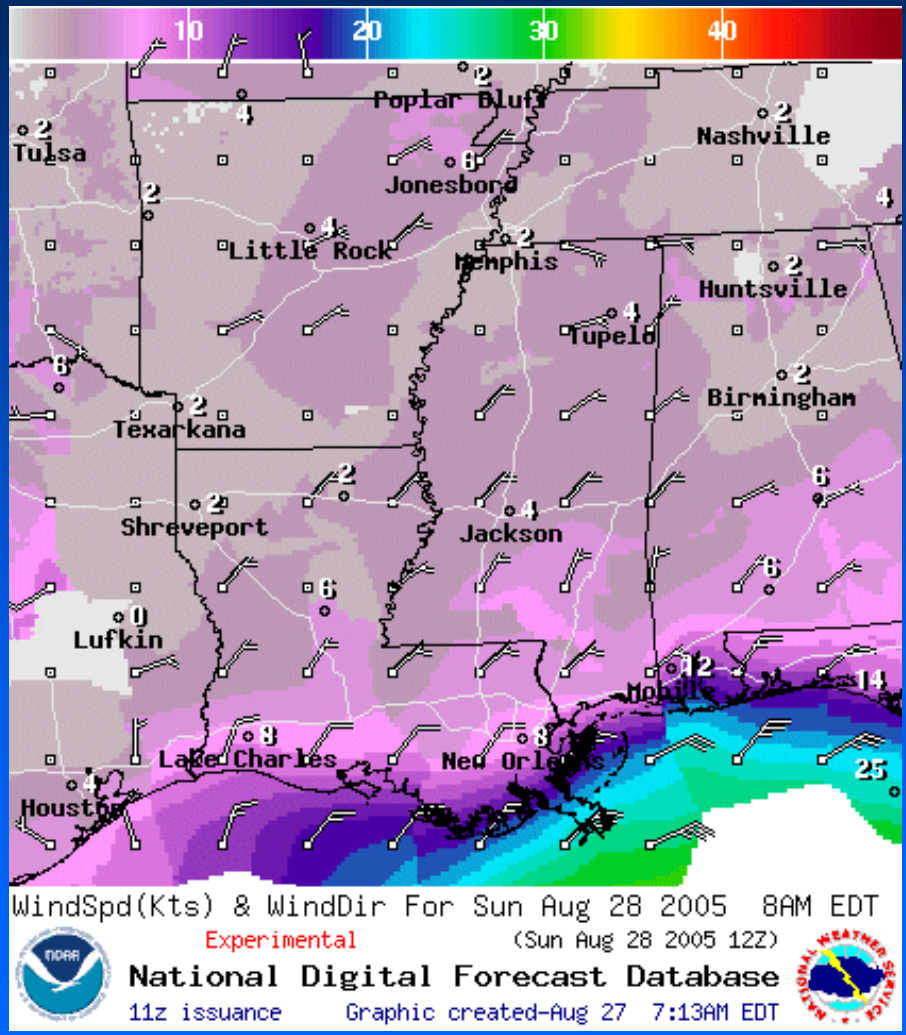

Hurricane Katrina
August 26, 2005
11 PM EDT Friday
NWS TPC/National Hurricane Center
Advisory 15
Current Center Location 24.6 N 83.6 W
Max Sustained Wind 105 mph
Current Movement WSW at 8 mph
Current Center Location
Forecast Center Positions
H Sustained wind > 73 mph
Potential Day 1-3 Track Area
Tropical Storm Warning
OK
TN
AR
MS
AL
LA
TX
FL
35N
30N
25N
95W
90W
85W
80W
8 PM Mon
8 PM Sun
8 PM Sat
11 PM Fri
True at 30.00N
SM 125 250 375 500
Approx. Distance Scale (Statute Miles)

Katrina visits Florida



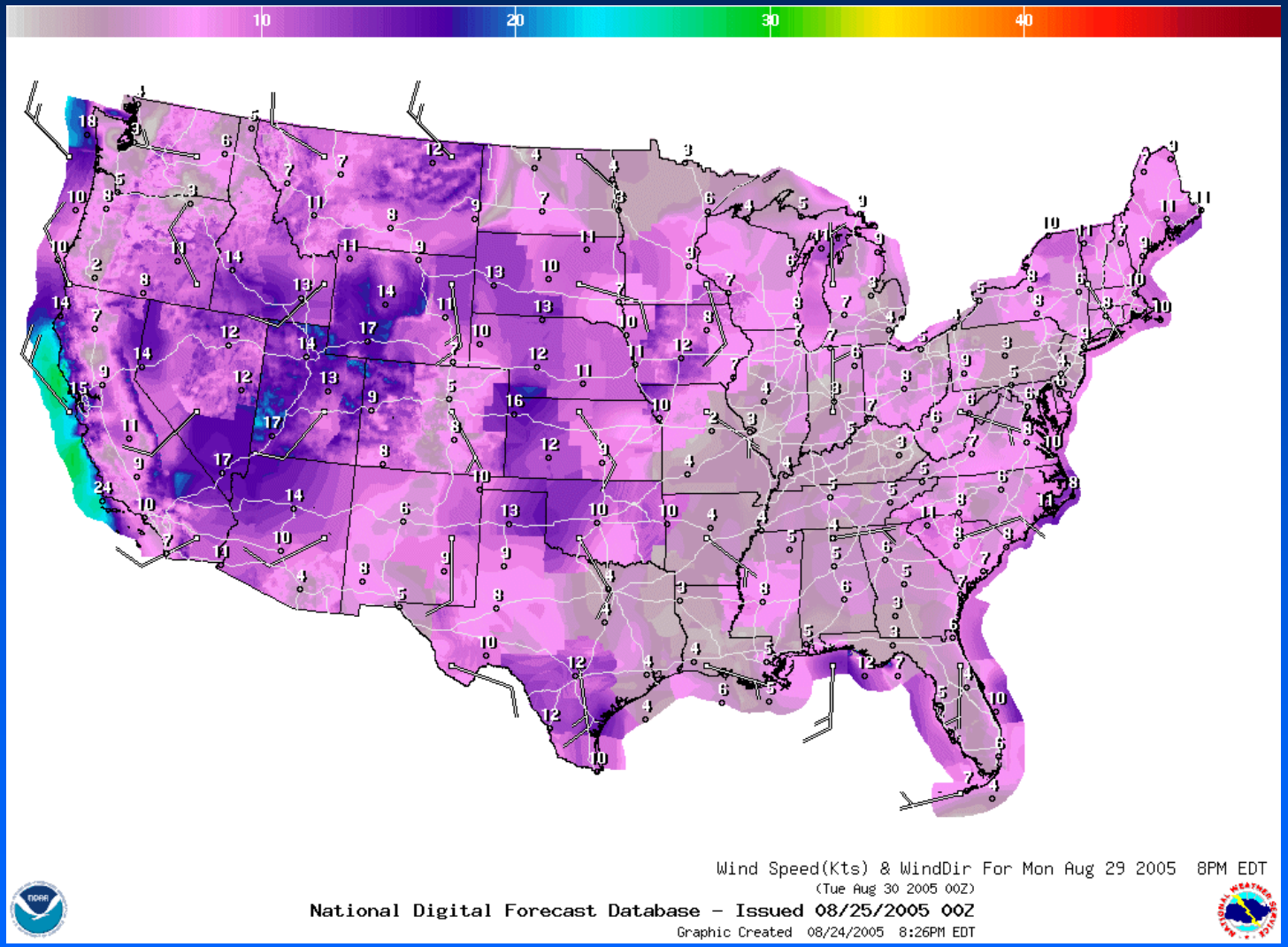
Forecast issued Thursday morning Aug 25

Katrina's eye forecast to pass over New Orleans



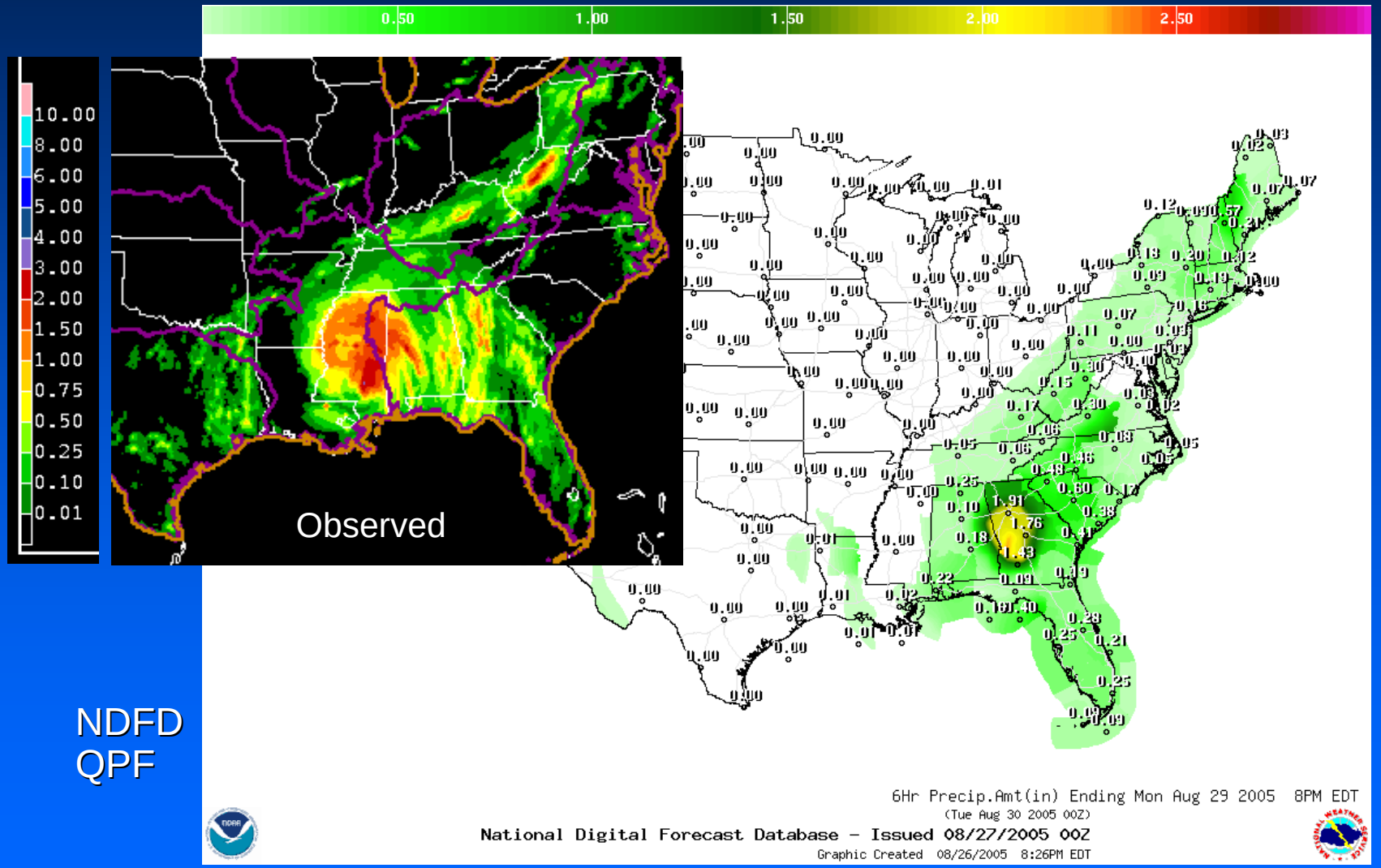
Forecast issued Saturday morning Aug 27

5 day hourly forecast evolution valid 00z Monday evening



NDFD Wind

3 day hourly forecast evolution valid Monday 18z-00z



NDFD QPF

NDFD ELEMENTS

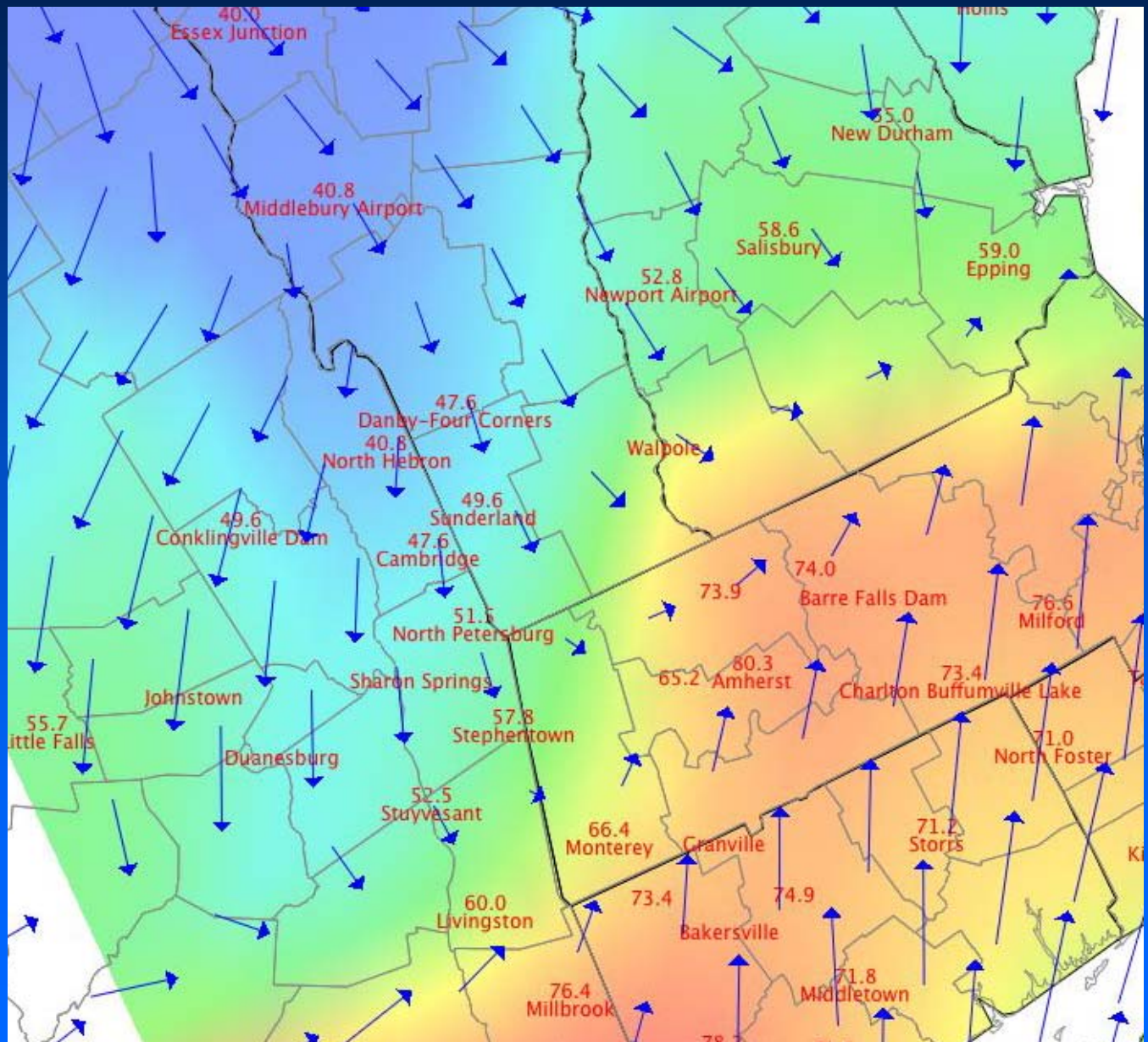
- Operational: Max & Min Temp, Pop, Temp, Dewpoint, Weather for CONUS + Hawaii
- Sept 22: Same Guam grids operational
- Dec 8: Snow, Wind Sp & Dir, QPF – may be made operational
- Waveheights, Sky cover, RH, Apparent Temp and RH still experimental status

COOP Modernization

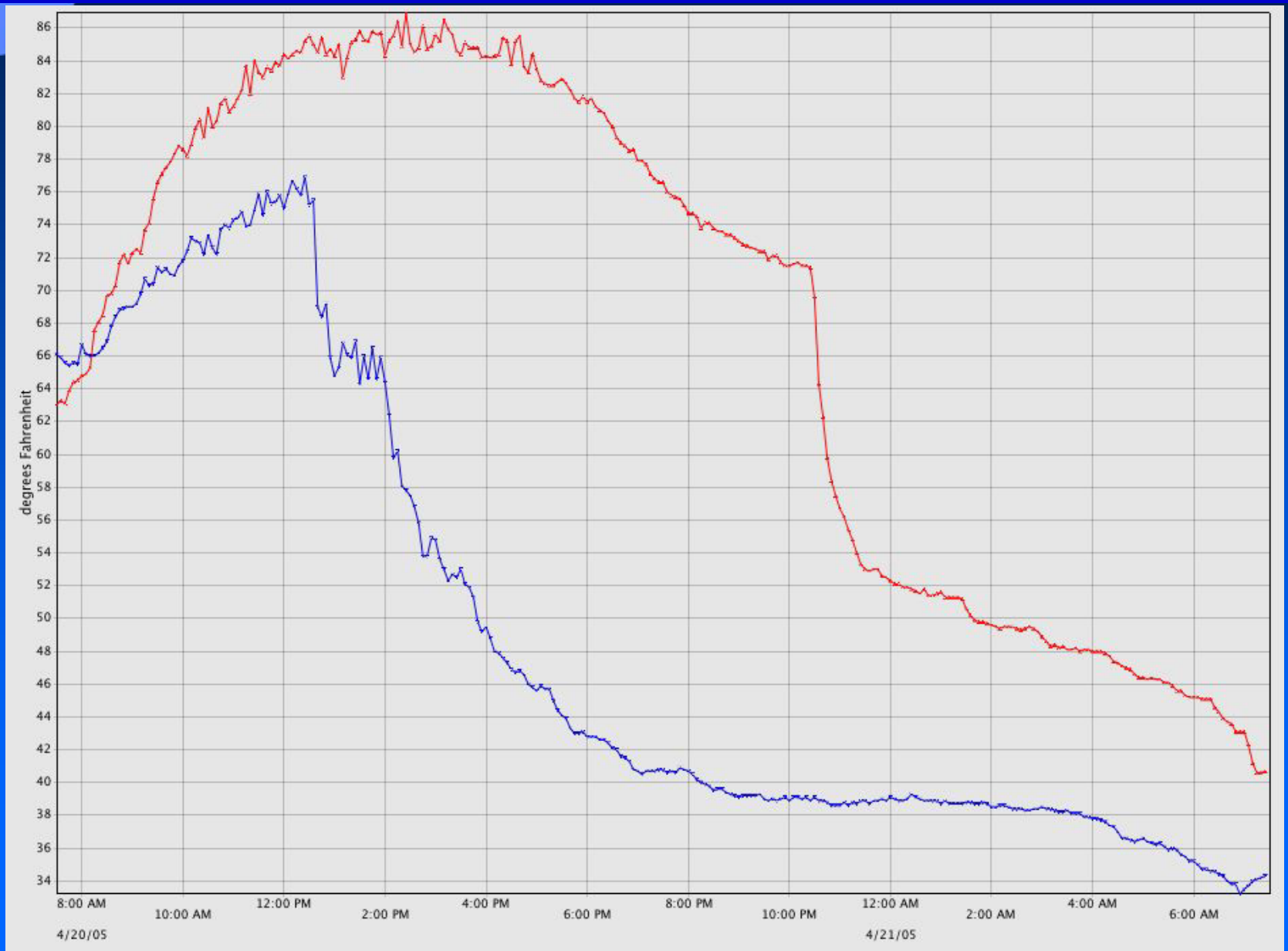
NOAA's Environmental Real-time Observation Network (NERON) in New England, the Southeast

Addressing National Integrated Drought Information System (NIDIS) in the West

Synoptic Plot of Air Temperature from Modernized COOP Sites 8:30 PM EDT on 4/20/05 (Color Fill: Blue = Cold; Red = Warm)



Time-Series Plot of Air Temperature from Modernized COOP Sites at Milford, MA (Red) and Middlebury, VT (Blue) — 4/20-21/05



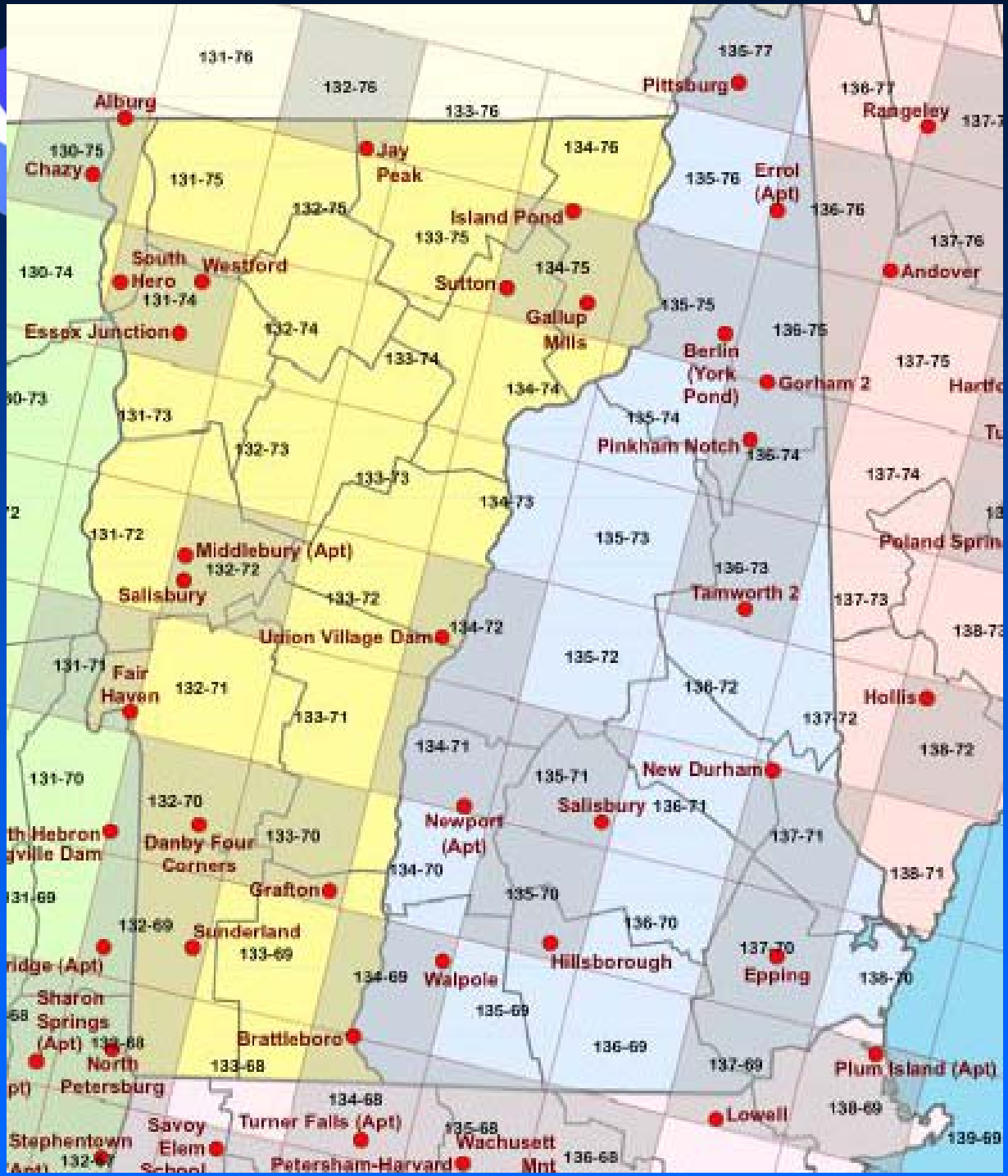
Salisbury, NH — Installed and Operational

October 2004 (View to North)

Status of COOP Modernization

Modernized COOP Sites Operating as of 8/18/2005:

- **~100 modernized & 3 beta sites operational in New England**
  - **10 meter winds being added at 23 sites**
  - ***Prototype 'Monitoring & Processing System' underway***
  - ***Operational home and how to merge with other NOAA systems will be determined by 2007***
  - ***Contract maintenance underway in New England***
  - ***Expansion with partners in the South is underway (GA & AL)***
  - ***LETS test-bed underway at 4 GA sites by 9/15/05***



A zoomed-in look at the NERON density for Vermont and New Hampshire relative to the spacing grid for NERON sites (20 mile by 20 mile). Sites selected (dots) from the Fall of 2004 in shaded grid cells. Non-shaded cells — the sites are TBD during FY06-07 with sensors added in either FY06-07.

ISOS Data Processing System

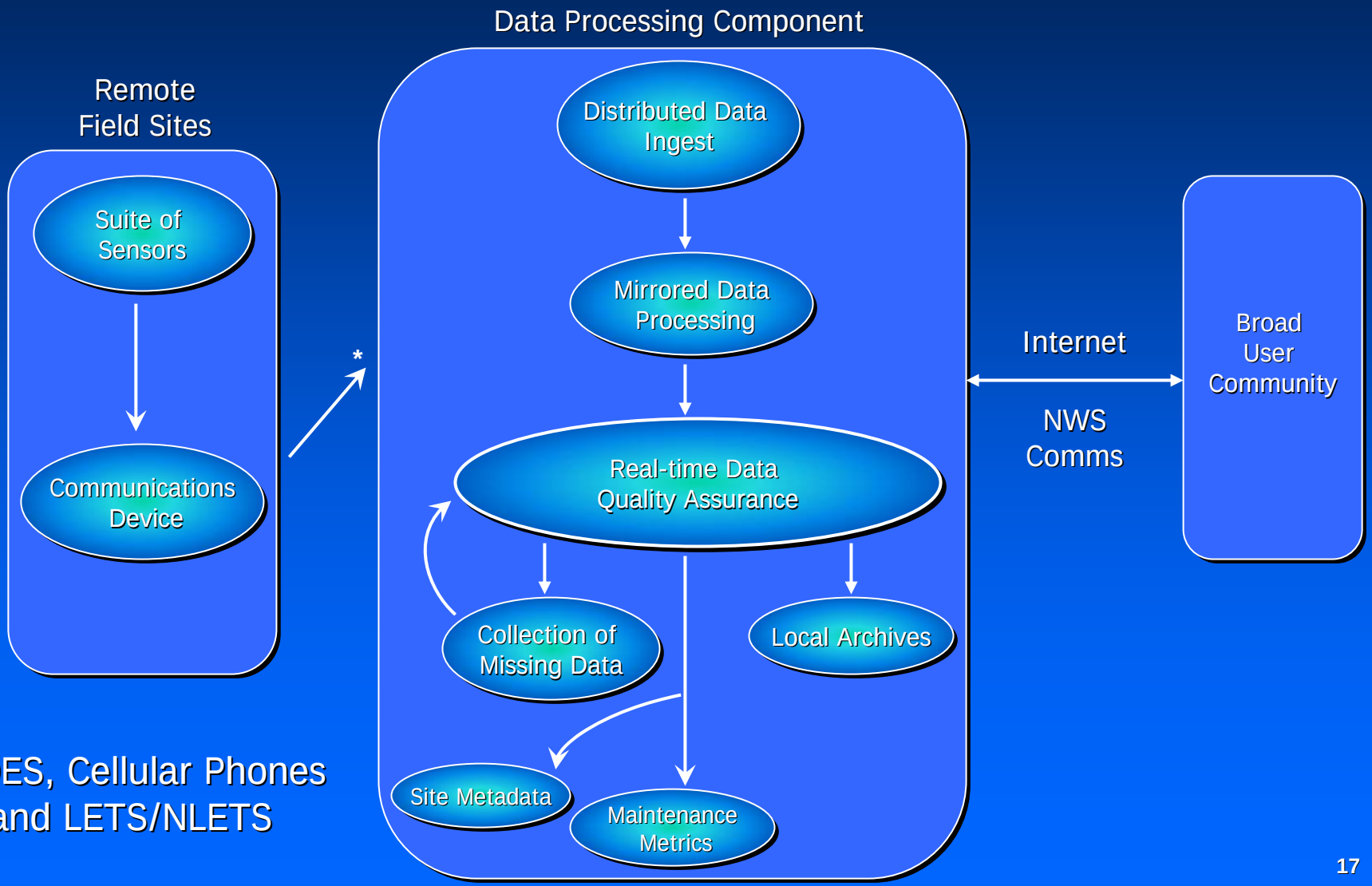
- Key feature of desired data-processing system for NERON: Quality control/quality assure observations with human intervention to:
  - Provide QC'd observations in real time (latency <5 minutes)
  - Not let 'bad data' go public
  - Provide QA metrics to monitor contract maintenance

- System must be end-to-end to include data ingest, dissemination and archiving

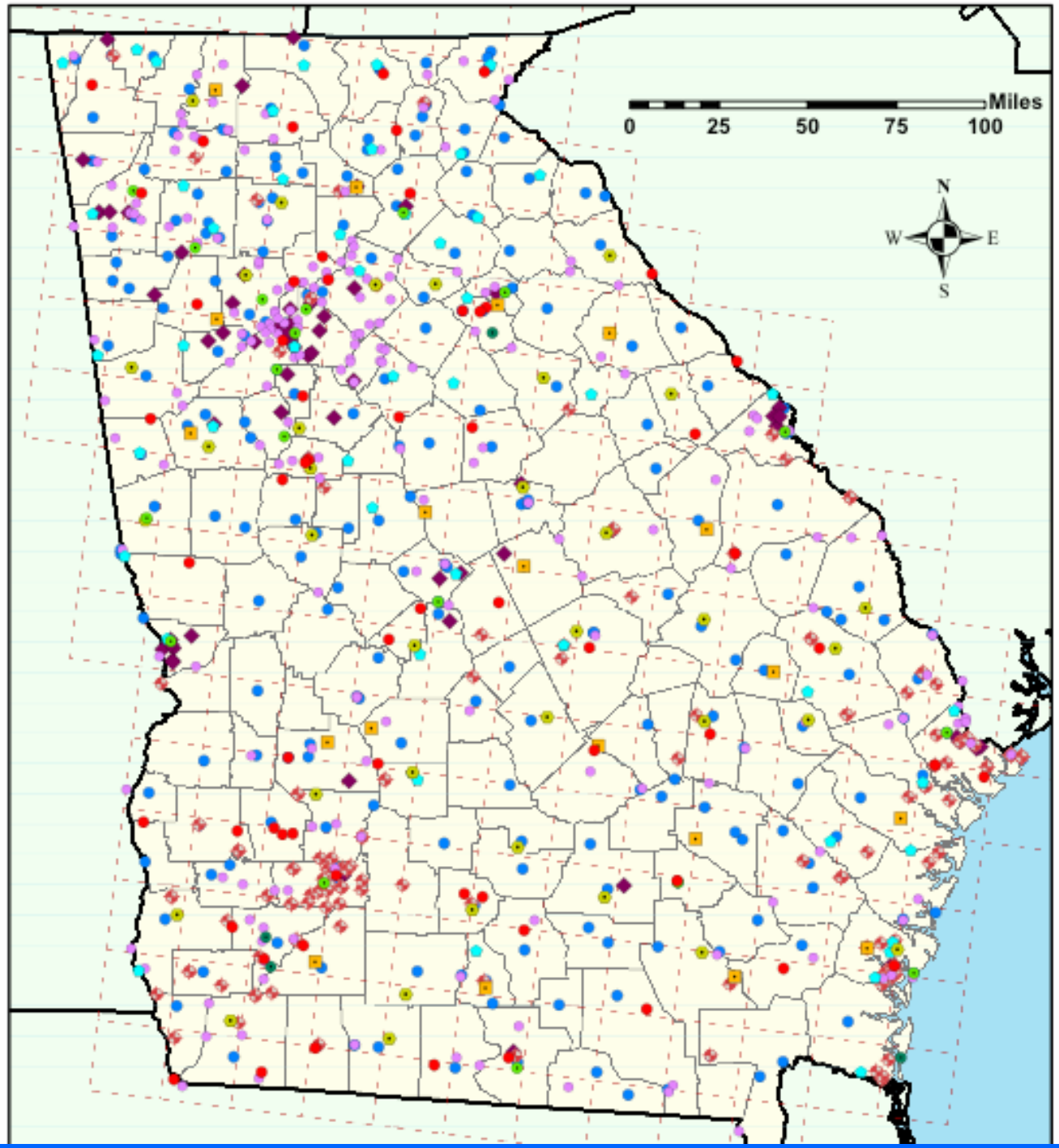
- The processing system will prove to be the 'lynch pin' that ties NERON with other forms of surface weather data to produce ISOS

NERON Data Ingest & Processing System

Concept of Operations



*GOES, Cellular Phones and LETS/NLETS

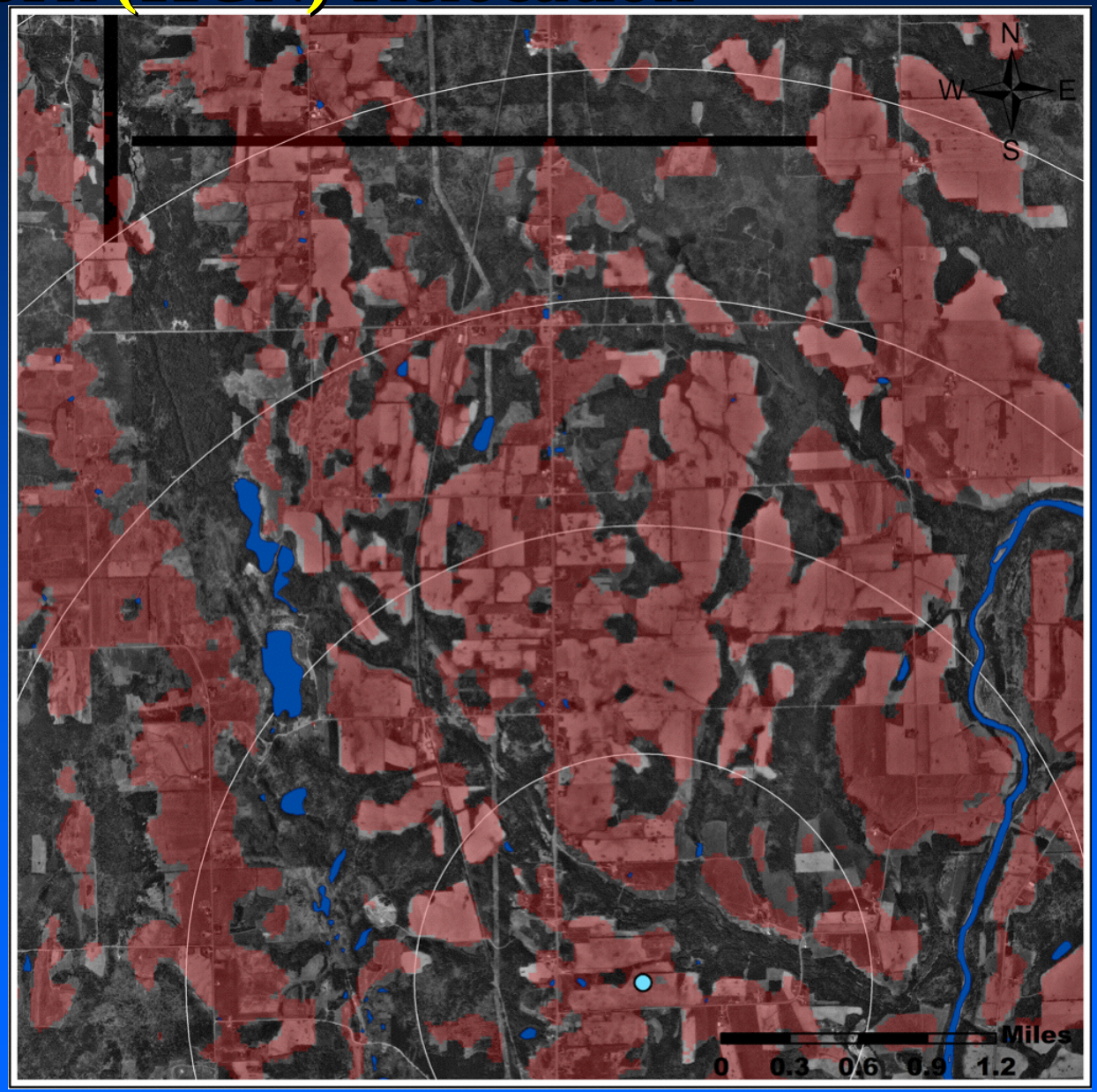


Potential NERON sites in GA

Based upon >250 operational weather sites owned by many potential partners

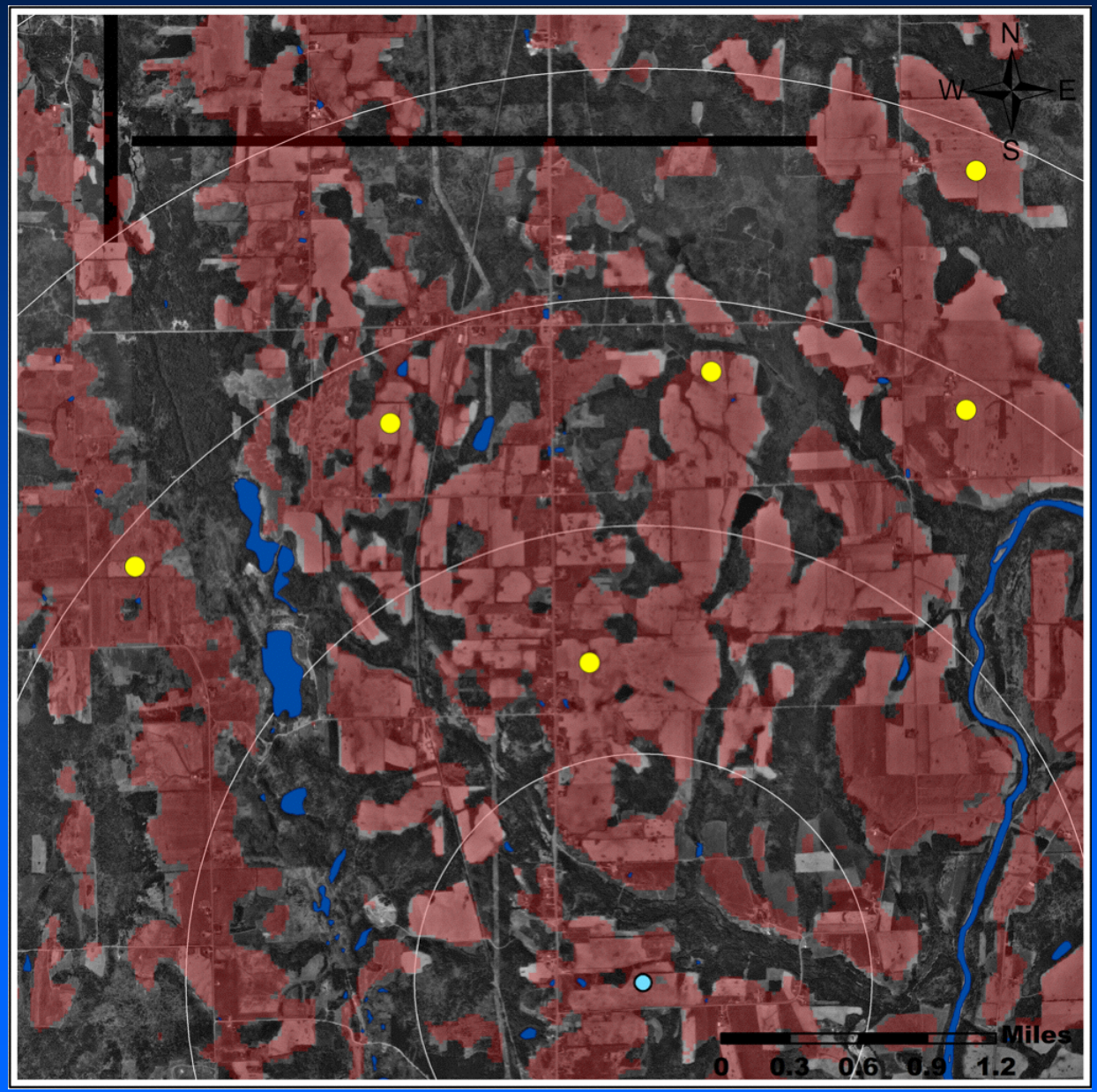
Selection Example – Historical Climate Network (HCN) Relocation

- Close-up of area north of an HCN site
- Concentric rings around the HCN every 1 mile
- Search for ‘suitable areas’ within 4 miles of the HCN site



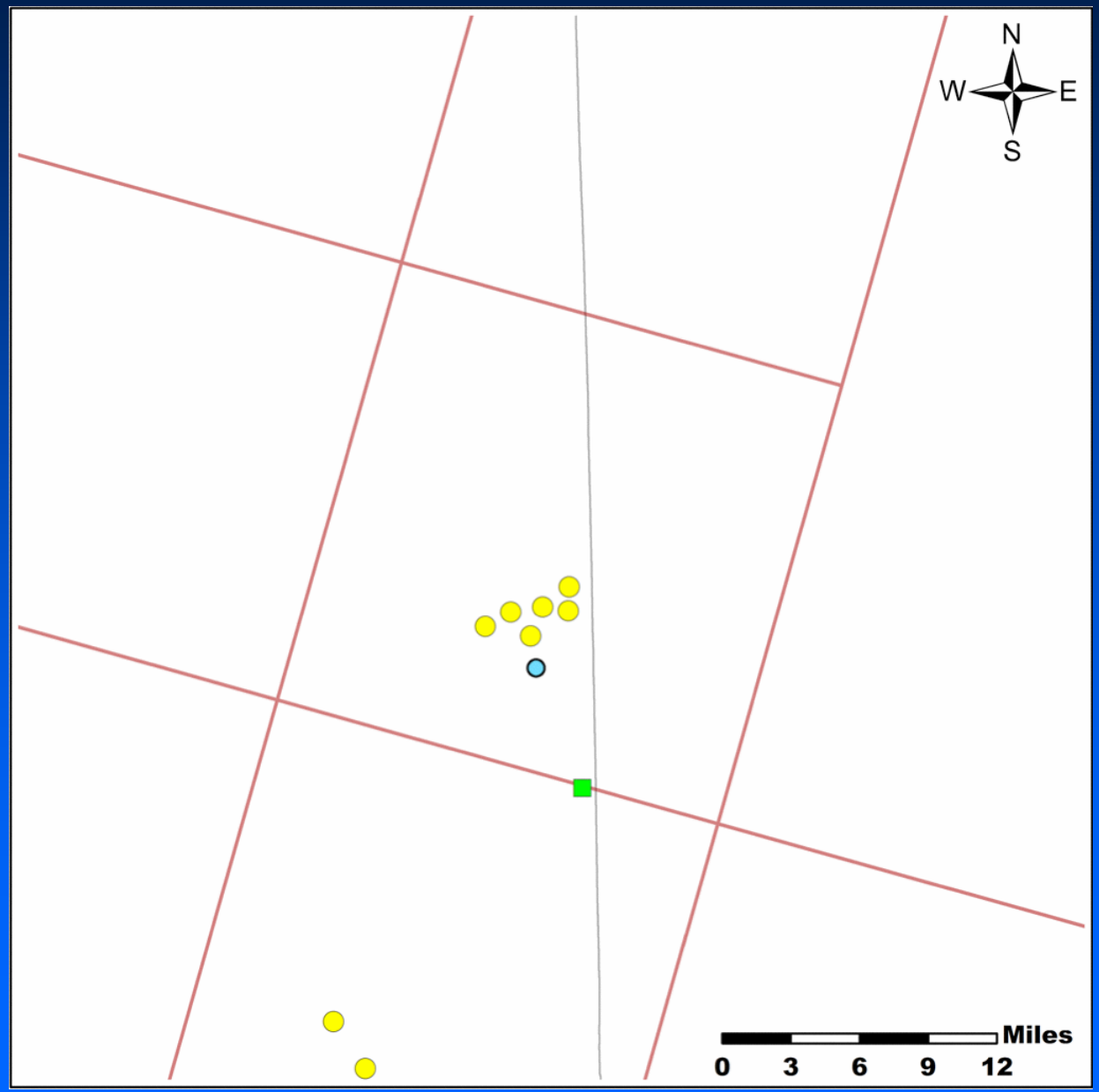
Selection Example - HCN

- Potential sites recommended in spacious open areas
- Selections are general – anywhere within the field is usable as a quality site



Selection Example - HCN

- Proposed sites within a grid cell
- Shows proximity to nearby HCN and ASOS sites



Benefits of a Comprehensive QA System

- Manual QA flags can be incorporated into the data processing in near real-time. If data are deemed erroneous by a WFO, RFC, SC and or site host, that information is immediately shared among all users.
- New metadata can be updated in near real-time so that data are processed properly with appropriate calibration coefficients.
- New maintenance information/findings can be analyzed so that appropriate observations are flagged as erroneous in near real-time.
- Maintenance metrics can be generated easily - How many sensors of a make/model have failed? How quickly are maintenance problems fixed? When is a given sensor is due for rotation? Why are observations for a given time period unavailable?
- Suspicious data are detected quickly before large chunks of additional data are collected and then determined unusable.
- Real, unique phenomena can be manually flagged as “good data” so that automated QA flags do not prevent those observations from reaching scientists.

Benefits of a Comprehensive QA System

- If data are not analyzed by humans, then NERON will not realize the entire dividend from the taxpayers' investment. For example, manual analysis of data from the newly modernized site in Stephentown, NY revealed a biased rain gauge had been installed. A trouble ticket let to a quick repair and the 'saving' of countless weeks of collecting bad data.
- If trouble tickets were automated, the contract maintainer could be sent to sites where extreme radiational cooling or strong sea breezes events occurred — expecting to find biased sensors.
- If trouble tickets were automated and communications failed, the maintainer might not know whether to replace the battery, the radio, the solar panel, or the voltage regulator, or just wait and see if the problem occurred within the HADS system.
- The savings in people hours and gasoline alone would pay for the human QA meteorologists overseeing a large multi-state network.

Benefits of a Comprehensive QA System

- Bottom Line: A comprehensive QA system provides data that can be trusted by real-time users now and by climatologists in 20 years.
- NERON can have numerous technicians roam across a multi-state region hoping to find all the problem sites and sensors or NERON can have a QA system that efficiently guides a few technicians in a cost-effective manner.
- Added Benefit: The QA team can monitor real-time data quality and ensure an accurate metadata archive.

Nightly Quality Control

- **All data reprocessed for past 30 days every night**
  - ***Accounts for all late-arriving data, hole collects, and any changes by QA personnel in the qualparm table***
- **Tests include:**
  - ***Persistence***
  - ***Missing***
  - ***Range***
  - ***Qualparm***
  - ***Step***
  - ***Spatial***
  - ***Step-to-normal***

Quality Control Flags

- Data Quality Flags are assigned to each observation

  0 = good observation

  1 = suspect (S)

  2 = warning (W)

  3 = failure (F)

- Data are NEVER altered in any way
- However, data quality flags can be changed
  - *Manual Quality Assurance*
  - *By later runs of the QC system*

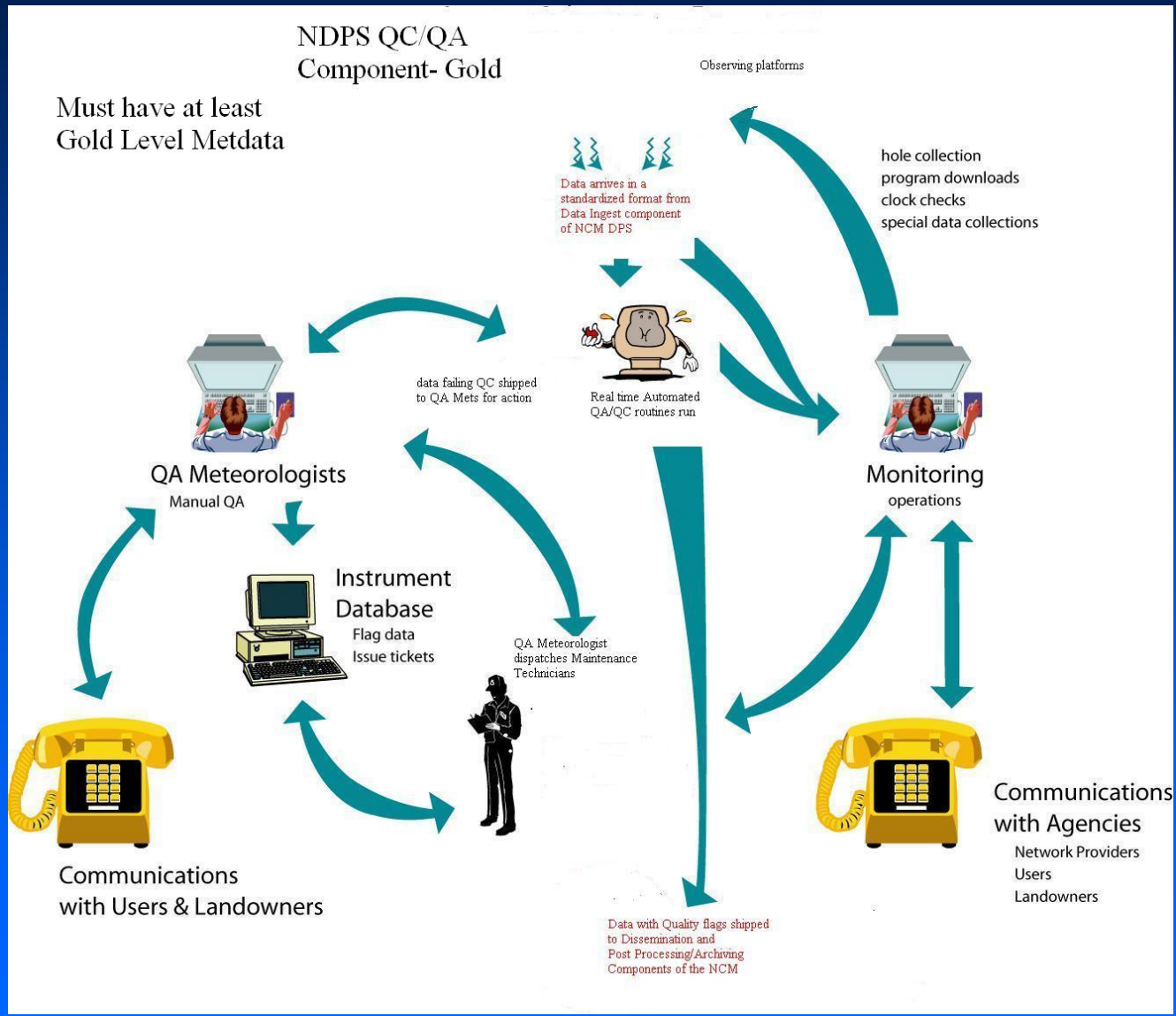
Manual Quality Assurance

- Even the best automated QC will
  - Miss some bad data
  - Flag extreme events that are real phenomena
- The Value of a QA Meteorologist
  - Research true trace date/time of sensor problem
  - Incorporate new manual QA flags into data processing in near real-time
  - Override automated flags for good events
    - Seabreezes, heatbursts, meso-lows, inversions
  - Find subtle problems that defy automated detection
    - Biased sensors
    - Gauge accumulations using radar estimates

Manual Quality Assurance

- **Site metadata**
  - *essential to data collected from a site*
  - *database stores enormous amount of metadata*
- **Equipment metadata**
  - *stored in database*
  - *tracks equipment based on serial number*
  - *locations*
  - *problems*
  - *calibration coefficients*
- **All databases are seamlessly integrated**

Seamlessly Integrated Network



Fire Island, NY COOP Site
(Aerial photo confirms correct lat/lon)

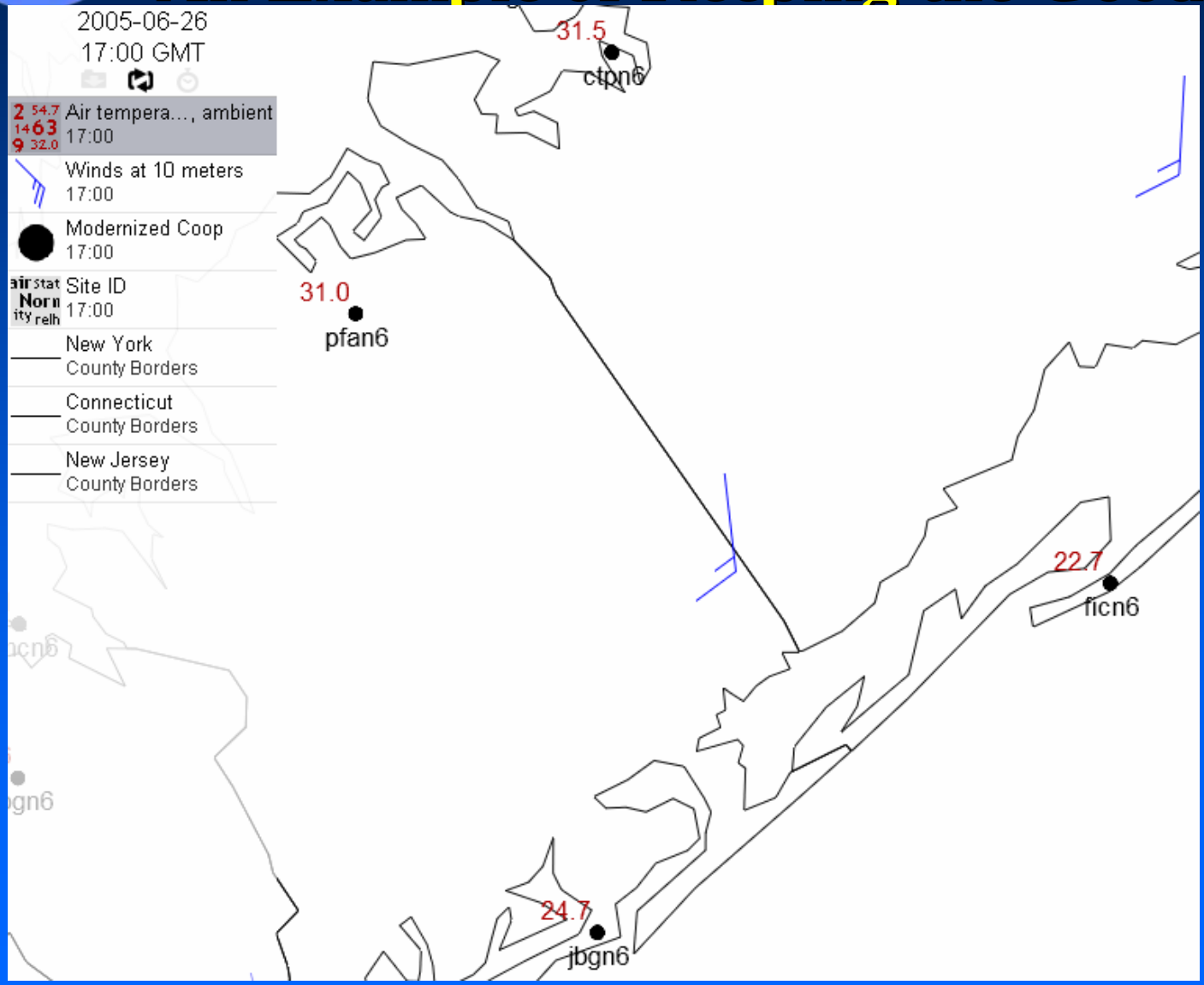
Photo of Fire Island COOP Site

Manual QA
Keeping the Good Data

- **Some observations are known to be "good", but fail automated QC test(s)**
  - ***Preserves the network's "golden nuggets"***
    - **Most meteorologically interesting data**
    - **Most difficult forecast challenges**

Manual QA

An Example of Keeping the Good Data



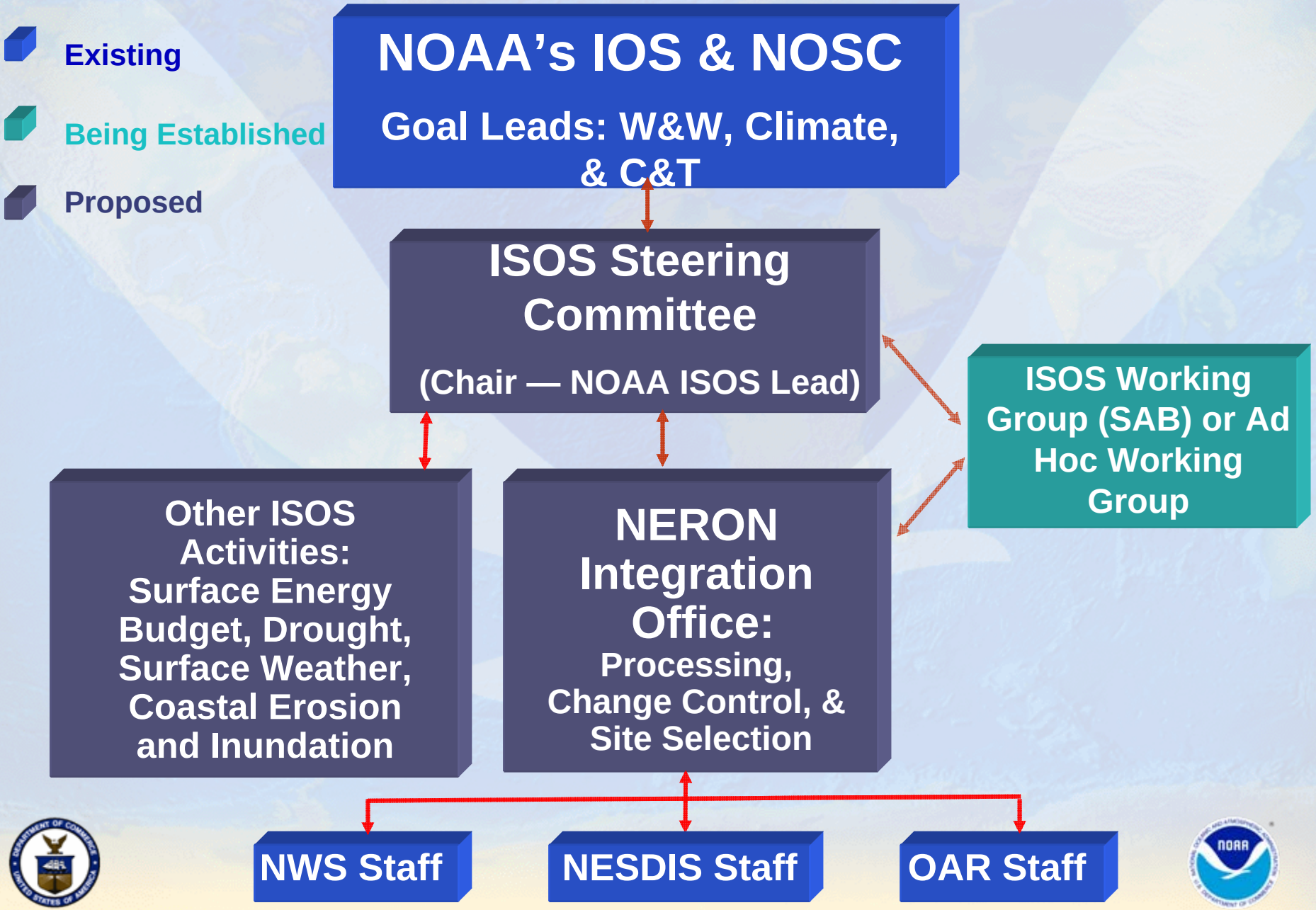
- Sea breeze 2005-06-26
- Data flagged by auto QC
- Manually flagged as “good”

Budget Realities

- **Total funds possibly available to NERON during FY06 and FY07 appears to be <$5 million/year**
- **Alternatives are realistic but not affordable**
- **Solutions to be fleshed out before October:**
  - ***Solution One:*** *~3000 NERON sites are NOAA-owned (many are expanded HCNs), ~1000 other NERON sites are federally owned (ASOS, CRN, USGS, COE, etc.) and ~4000 sites owned by NERON partners.*
  - ***Solution Two:*** *~1500 HCN sites are fully modernized; remaining 1500 NOAA sites are installed with precipitation sensors at 1/9th density (i.e., 60 mi x 60 mi; See Program Development Plan). ~3000 sites are NOAA partners.*
  - ***Solution Three:*** *Only 1500 NOAA-owned sites are installed and 1500 sites are owned by NOAA partners.*

Governance: NERON Management Relative to NOAA ISOS

- Existing
- Being Established
- Proposed



Next in the Queue: Northern Alabama

After That?

A Move West in Response to NIDIS

- Potential Partners - Depends on the Budget
  - The National Park Service
  - Possible: NM, AZ, CO and maybe MT
  - Focus on the HCN sites in each state

Reason: Limited funds, ~25 HCN sites/state, easy way to stretch resources/build political support

To look at the real-time aspects of NERON,

Visit the NERON Home Page

www.isos.noaa.gov

(a work in progress)

TDWR

TDWR

- Terminal Doppler Weather Radar
- Detects microbursts, gust fronts, wind shifts and precip.
- Improved redirection of air traffic flow and safety
- FAA deploying 45 operational systems

TDWR access

- FAA has given NWS permission to access TDWR data real-time
- 4 sites connected to date to nearest WFO – dedicated T1 lines
- 1 minute update info – lowest 3 scans
- NWS developing internal requirements for sharing among WFOs for backup operations
- NWS will be asking Partners for requirements for centralized TDWR data collection and archiving for input to FY 2009 budget planning

BUDGET STATUS

- $ 56 M cumulative multi-year underfunding of NWS Base Operations in FY 2005 (mostly unfunded pay raises – labor is 70% of base)
- FY 06 Senate budget for NOAA of $ 4.4B versus $3.4B for House
- Differences though in NWS Base Operations only about $19M
- Most congressional add-ons are earmarked for NWR, hydrology, ocean obs, tsunami etc.. Not base operations
- NWS received ZERO funding in Katrina supplements – no funds to repair equipment and facilities

Summary

- Katrina a huge success for weather enterprise
- Quality, quantity, and data delivery of observations will continue to be expanded and improved – NERON and ocean obs.
- Lack of funding for NWS core mission – NWS examining how to improve concepts of operations
- Unidata is a key partner