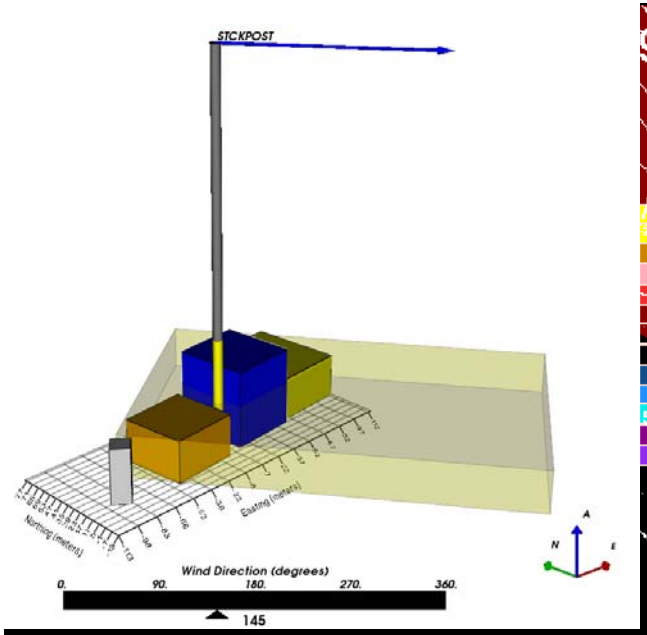
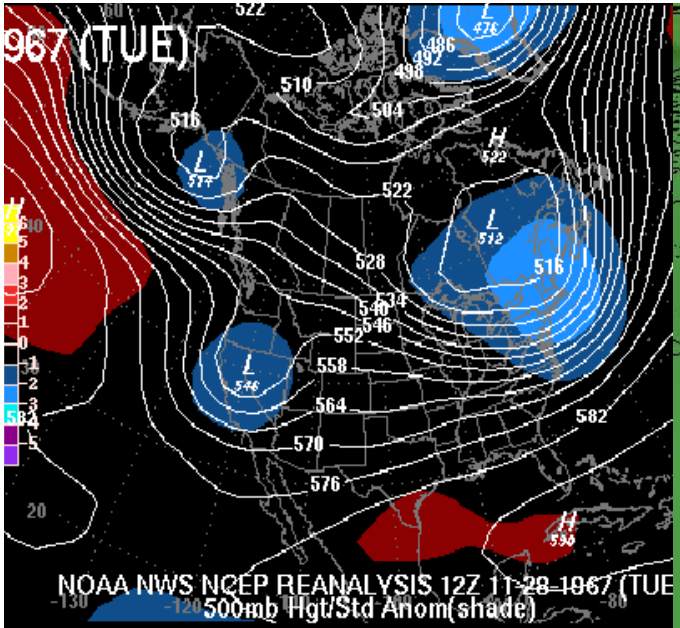
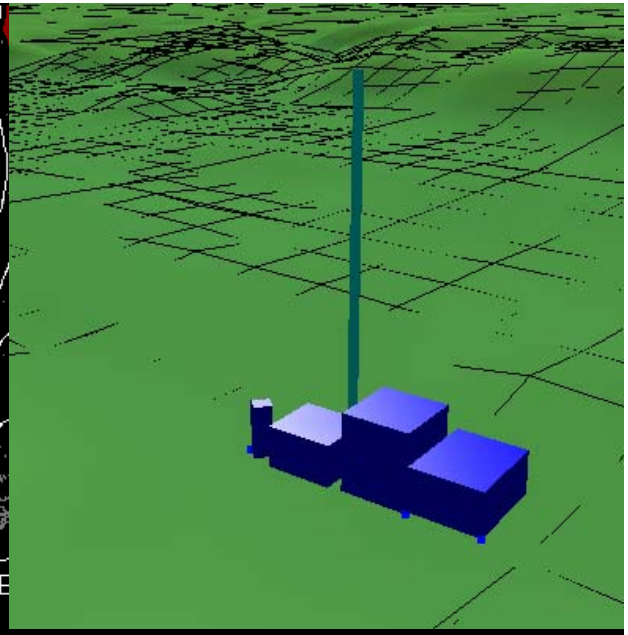






FirstEnergy

EPA
9th Conference
on Air Quality
Modeling
October 9-10, 2008

Quick Take – NOAA Reanalysis Data Sets for AERMOD

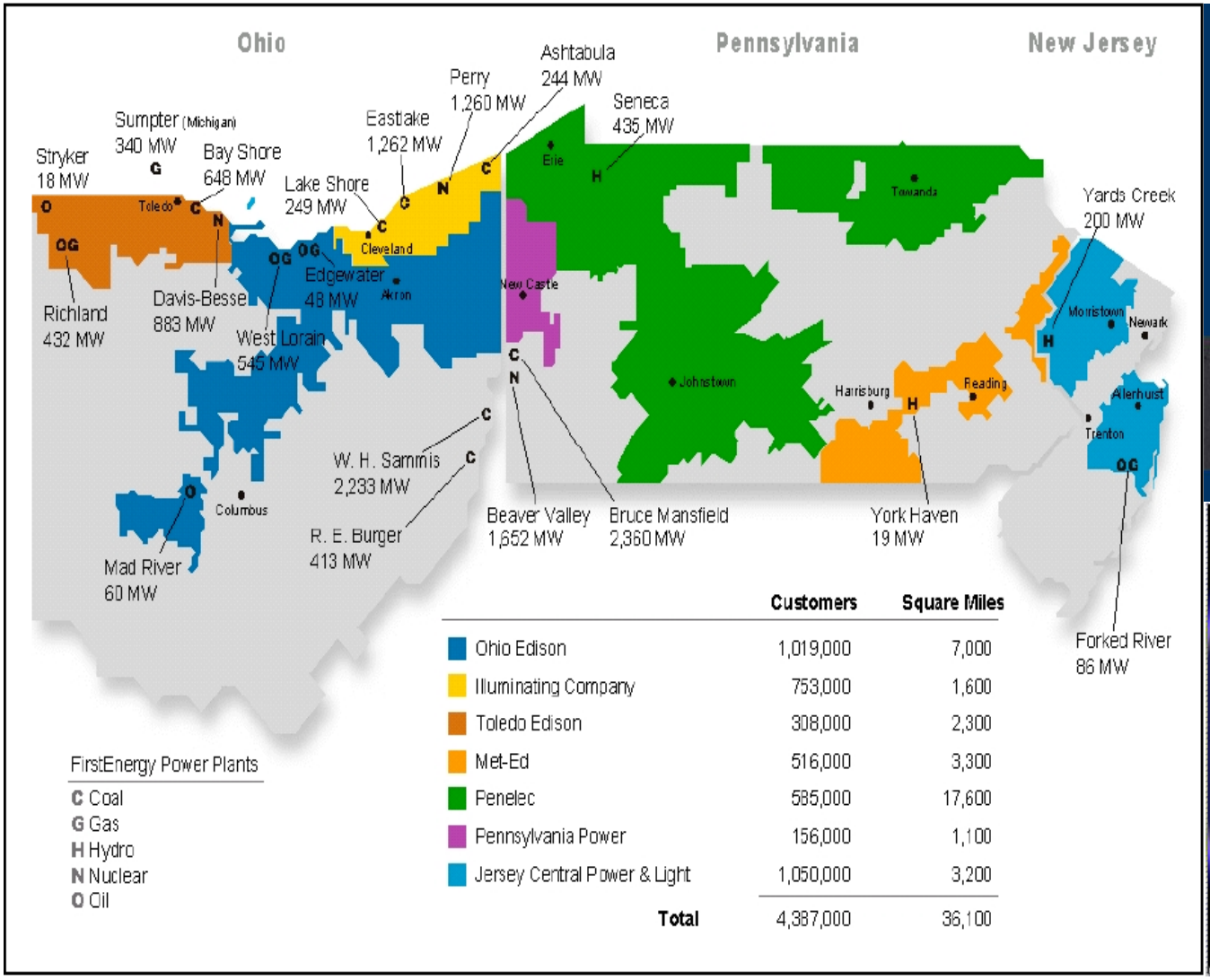
Peter Manousos

Sr. Scientist/Meteorologist - Environmental

Goals of Presentation

- **Show which freely available NOAA reanalysis data might be appropriate for use in AERMOD (AERMET)**
- **Not to put you to sleep**
- **Answer questions**

FirstEnergy

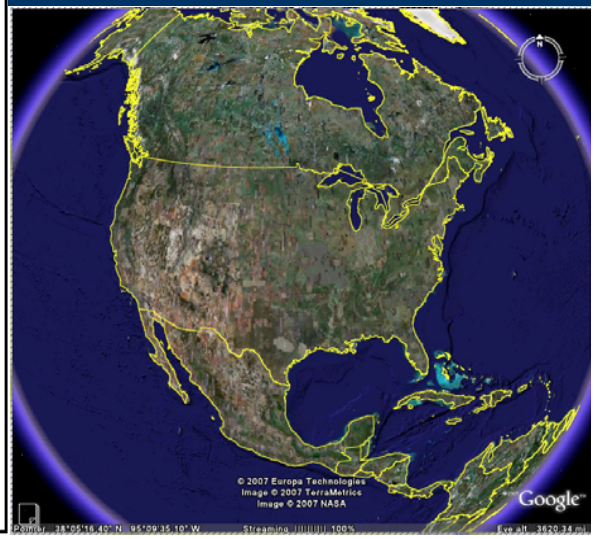


	Customers	Square Miles
Ohio Edison	1,019,000	7,000
Illuminating Company	753,000	1,600
Toledo Edison	308,000	2,300
Met-Ed	516,000	3,300
Penelec	585,000	17,600
Pennsylvania Power	156,000	1,100
Jersey Central Power & Light	1,050,000	3,200
Total	4,387,000	36,100

FirstEnergy

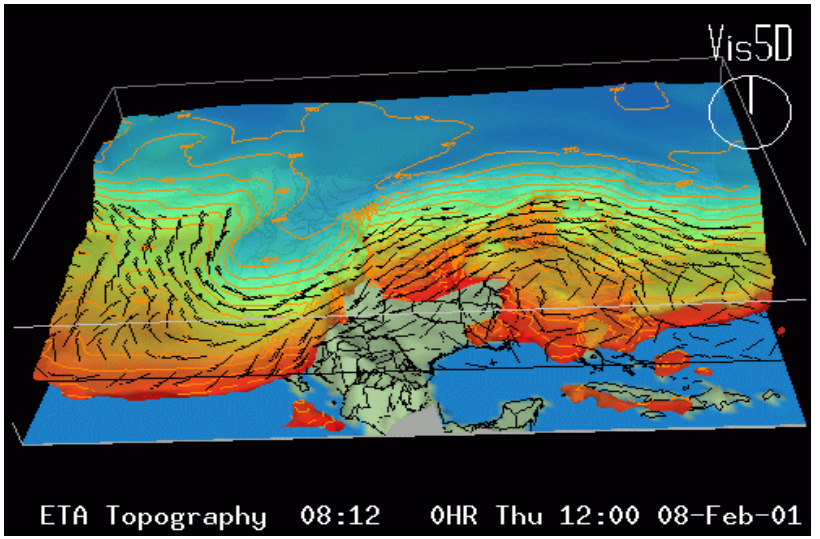
OUR STRATEGIC VISION

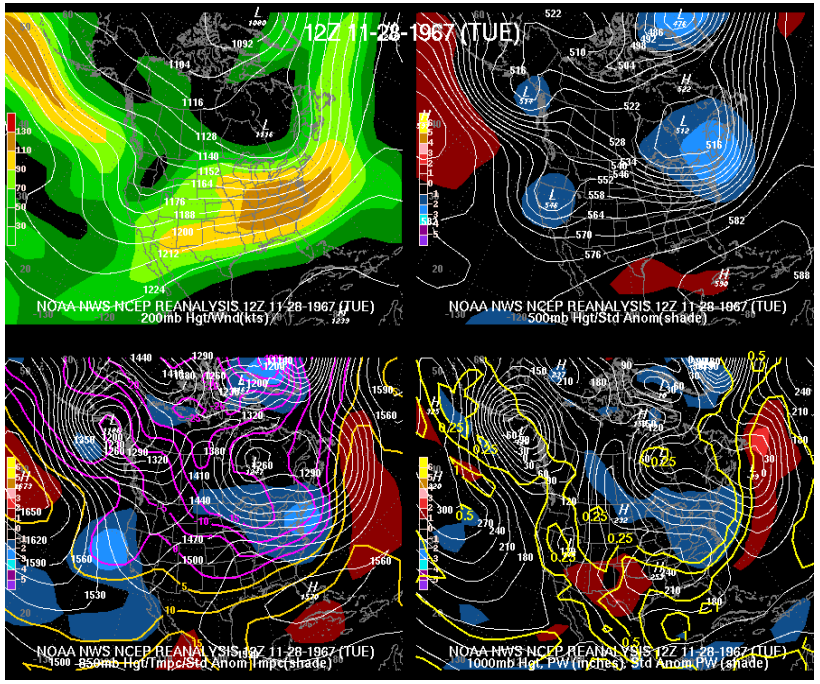
FirstEnergy will be a leading regional energy provider, recognized for operational excellence, customer service and its commitment to safety; the choice for long-term growth, investment value and financial strength; and a company driven by the leadership, skills, diversity and character of its employees.

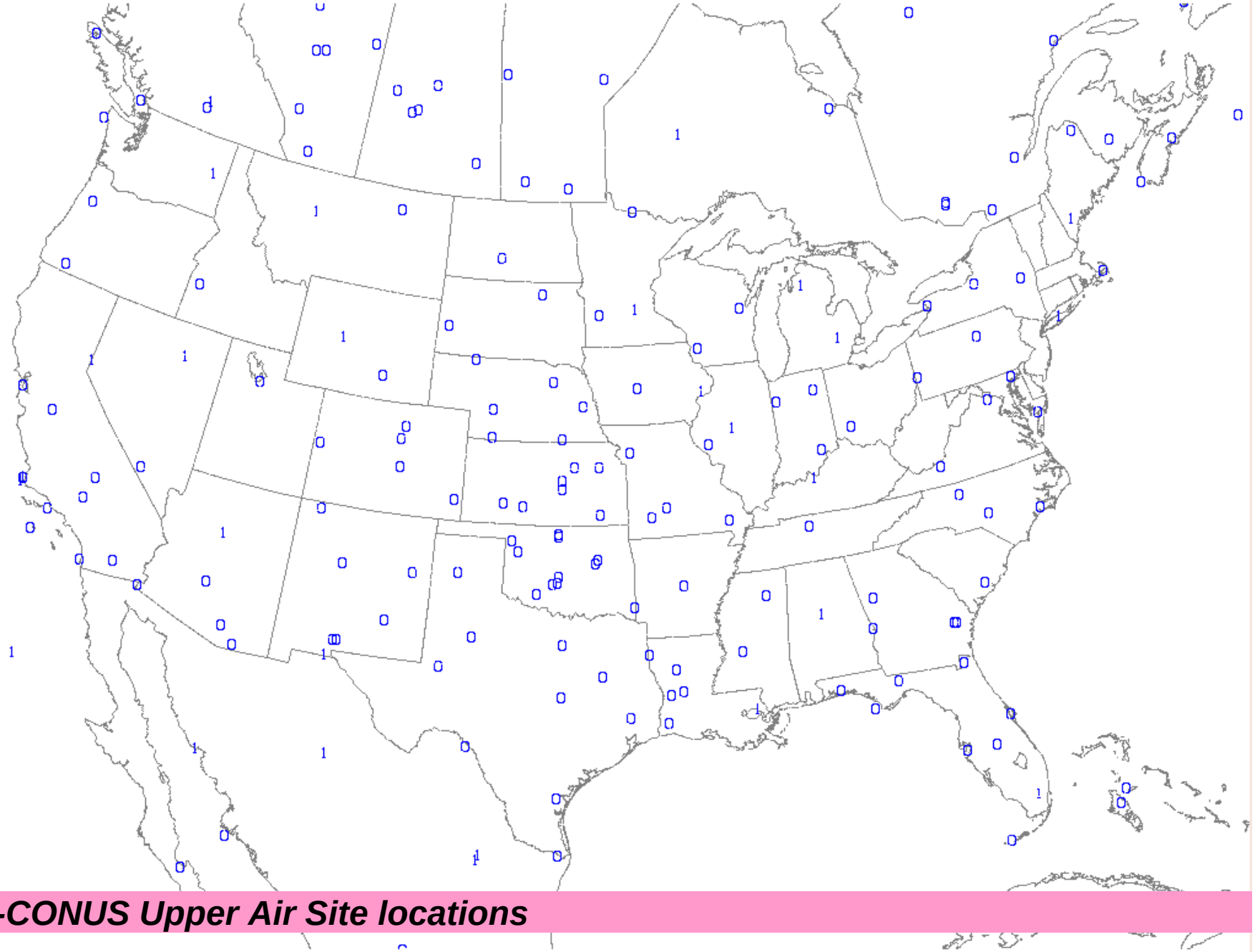


Reanalysis Data

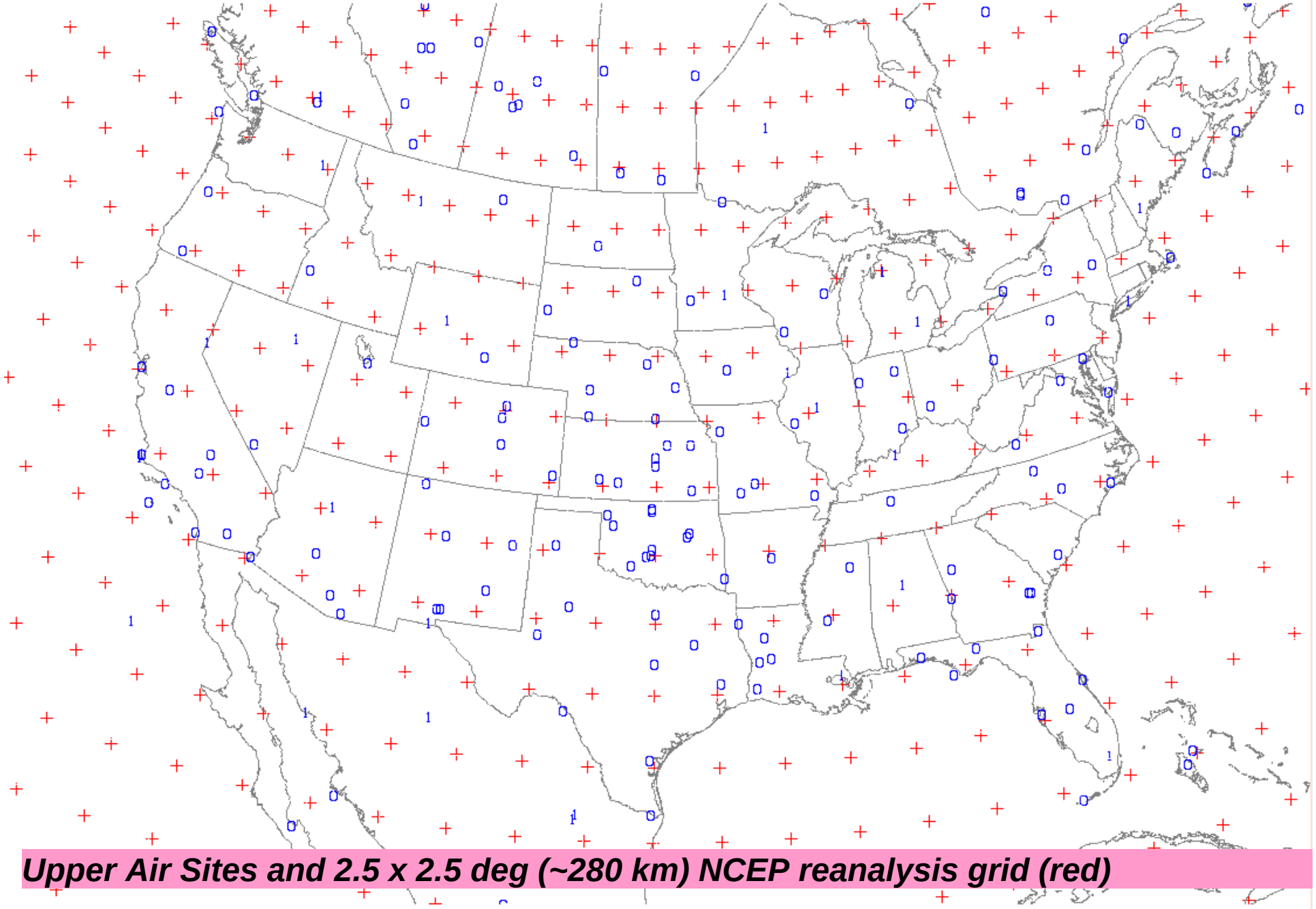
- **What is it**
  - *A dynamically consistent 3D analysis ("gridded snapshot") of the atmosphere for a given point in time*
  - *Produced by an automated assimilation system using all available pertinent meteorological data to capture the state of the atmosphere into a gridded form*
- **Who supplies it**
  - *NOAA and ECMWF*
- **Why the interest for AERMOD**
  - *Potentially a source for site specific data - more representative and more complete than standard upper air and surface observations sets*
  - *Public domain (data and conversion software)*
- **Recent activities**
  - *Brode EPA: JAWMA 2007 (prognostic MM5 output for AERMET input)*
  - *Atkinson EPA: 8th AQ Modeling Conf. 2005 .ppt (exploratory – some state awareness of gridded data existence, but little practical application)*
  - *Google on AERMET and Reanalysis gives only 4 relevant hits – an end to end process has not been formally outlined*



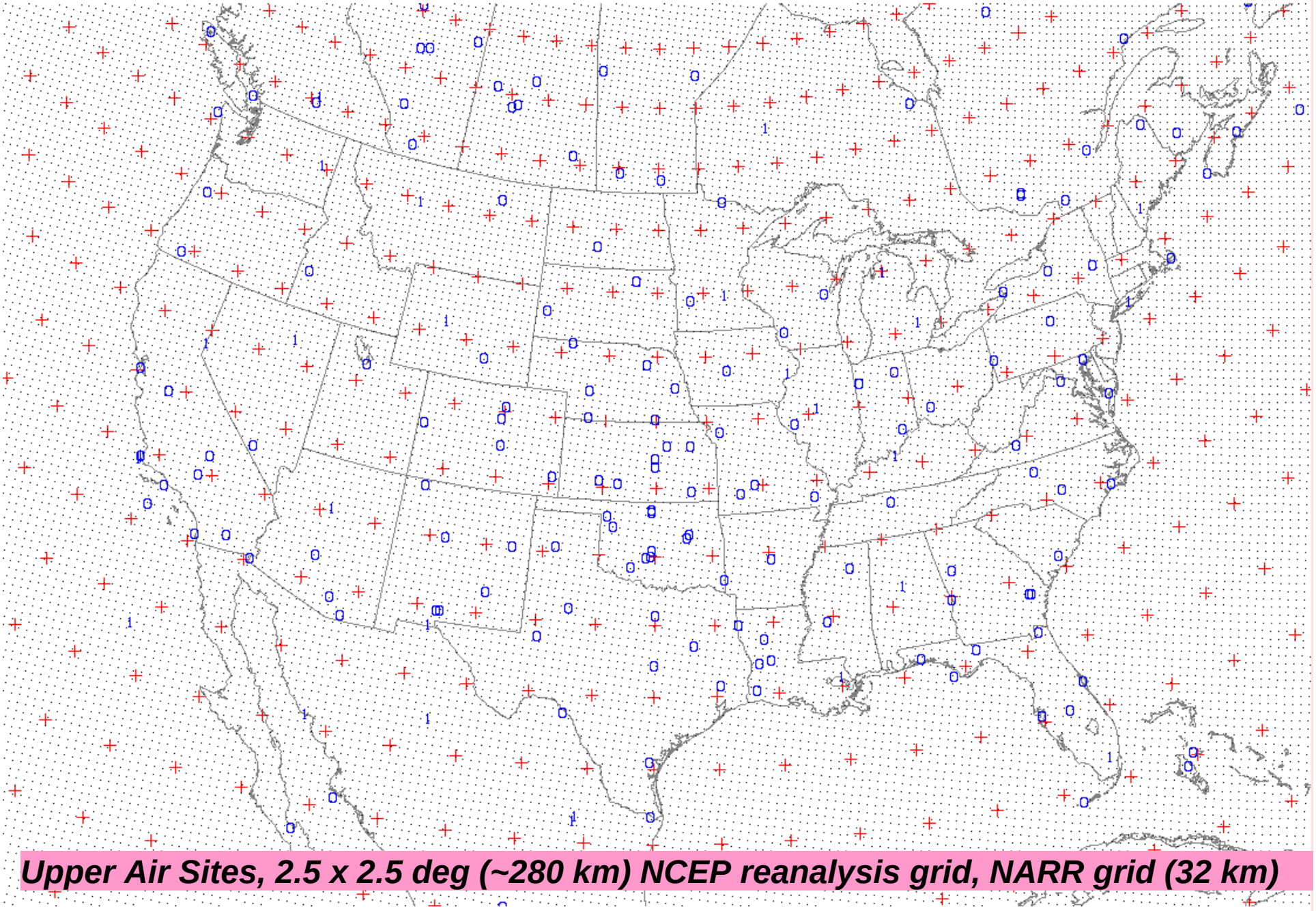




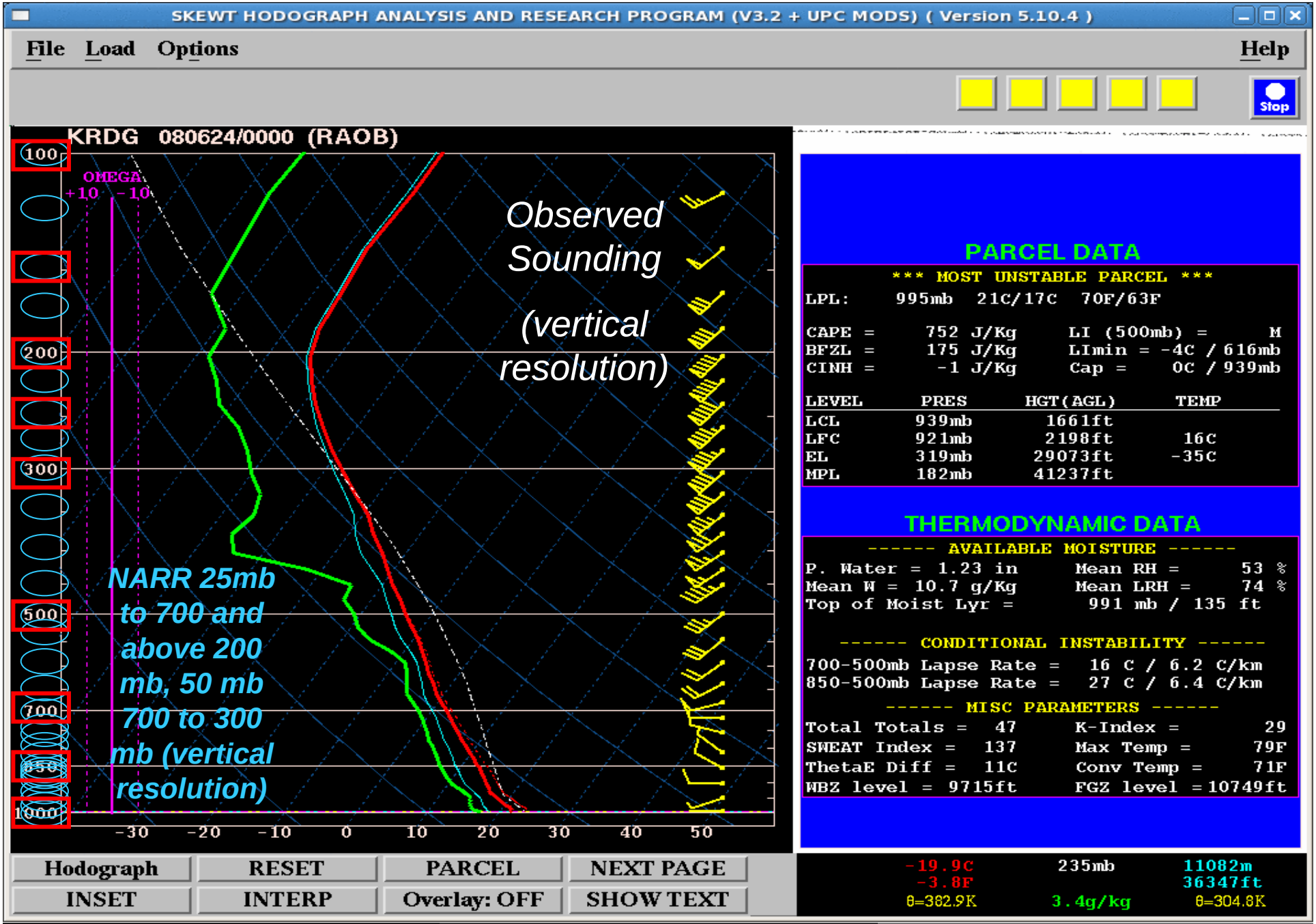
NEAR-CONUS Upper Air Site locations



Upper Air Sites and 2.5 x 2.5 deg (~280 km) NCEP reanalysis grid (red)



Upper Air Sites, 2.5 x 2.5 deg (~280 km) NCEP reanalysis grid, NARR grid (32 km)

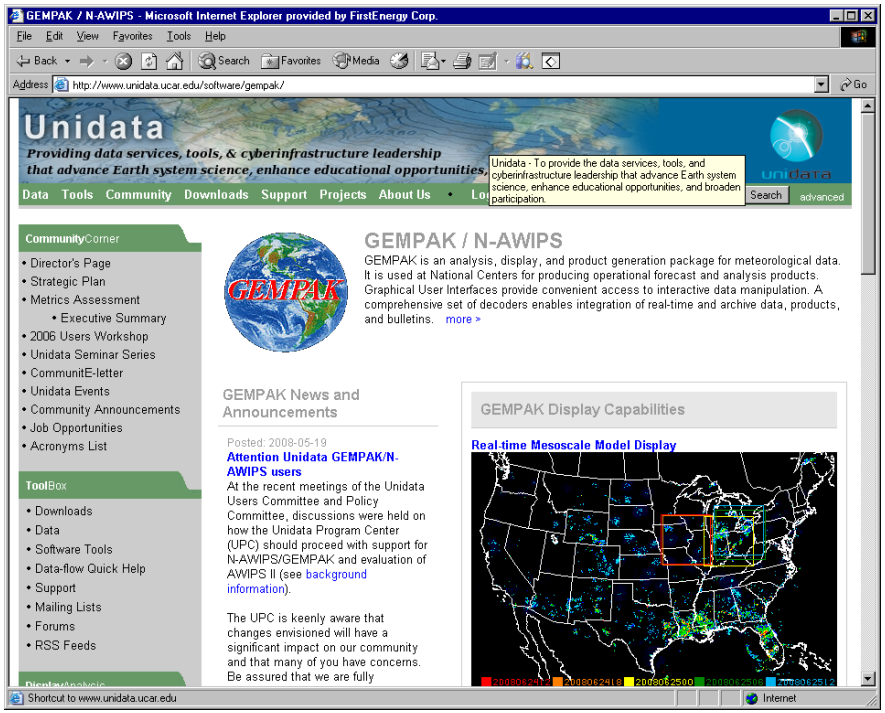

SKEWT HODOGRAPH ANALYSIS AND RESEARCH PROGRAM (V3.2 + UPC MODS) (Version 5.10.4)
File Load Options Help
Stop
KRDG 080624/0000 (RAOB)
OMEGA
+10 -10
Observed Sounding
(vertical resolution)
NARR 25mb to 700 and above 200 mb, 50 mb 700 to 300 mb (vertical resolution)
100
200
300
500
700
850
1000
-30 -20 -10 0 10 20 30 40 50
PARCEL DATA
*** MOST UNSTABLE PARCEL ***
LPL: 995mb 21C/17C 70F/63F
CAPE = 752 J/Kg LI (500mb) = M
BFZL = 175 J/Kg LImin = -4C / 616mb
CINH = -1 J/Kg Cap = 0C / 939mb
LEVEL PRES HGT(AGL) TEMP
LCL 939mb 1661ft
LFC 921mb 2198ft 16C
EL 319mb 29073ft -35C
MPL 182mb 41237ft
THERMODYNAMIC DATA
------ AVAILABLE MOISTURE ------
P. Water = 1.23 in Mean RH = 53 %
Mean W = 10.7 g/Kg Mean LRH = 74 %
Top of Moist Lyr = 991 mb / 135 ft
------ CONDITIONAL INSTABILITY ------
700-500mb Lapse Rate = 16 C / 6.2 C/km
850-500mb Lapse Rate = 27 C / 6.4 C/km
------ MISC PARAMETERS ------
Total Totals = 47 K-Index = 29
SWEAT Index = 137 Max Temp = 79F
ThetaE Diff = 11C Conv Temp = 71F
WBZ level = 9715ft FGZ level = 10749ft
Hodograph RESET PARCEL NEXT PAGE
INSET INTERP Overlay: OFF SHOW TEXT
-19.9C 235mb 11082m
-3.8F 36347ft
θ=382.9K 3.4g/kg θ=304.8K

Comparison Run

- **Control case "WAVCO"**
  - ***Available on SCRAM***
  - ***Uses Pittsburgh PA surface and upper air data (and on site data)***
- **Re-run with NARR**
  - ***Upper air data extracted from NARR grid and interpolated to a point at the location of Pittsburgh upper air site***
  - ***All other data remained consistent with control case***
- **Comparison of runs (24h max concentration for SO2)**
  - ***NARR run within 5% of control for 1st high***
  - ***NARR run within .07% for 2nd high***
  - ***Receptor location and data of 1st and 2nd high identical in both runs***

Reanalysis Data Summary

- **NCEP REANALYSIS**
  - *2.5 x 2.5 degree horizontal, "Mandatory level" vertical, 6h (back to 1948) temporal resolution*
- **NARR (North American Regional Reanalysis.. RTMA derivative)**
  - *32km horizontal, 25 mb vertical, 3h (back to 1979) temporal resolution*
  - *http://nomads.ncdc.noaa.gov/data/narr*
- **Neither satisfy the hourly temporal resolution requirement of surface data for AERMOD**
- **However, preliminary runs show NARR *may* be suitable as an upper air resource – need to formalize comparative testing**
  - *Mechanical process already tested*
  - *Grib ➔ Grid ➔ Text File ➔ AERMET ➔ AERMOD*
    - *GEMPAK tools convert grib to grid AND list output in text format at any lat/lon input by user (via interpolation)*



Freely Available

Questions & Answers

- pmanousos@firstenergycorp.com
- 330 761 4484
- http://www.firstenergycorp.com

Reminder

- **Integrated Global Radiosonde Archive (IGRA)**
  - *Freely available upper air data*
  - *Contains mandatory plus significant levels*
  - *2x/day (00Z and 12Z) temporal frequency*
  - *Available back through 1948*
  - *Can be converted to FSL format for AERMET ingest*
  - *ftp.ncdc.noaa.gov/pub/data/igra (anonymous login)*

- **Test case - "Example 5"**
  - *Swapped EPA supplied UA data with IGRA data*
  - *Identical location of max concentration*
  - *Max Concentration difference of .05%*