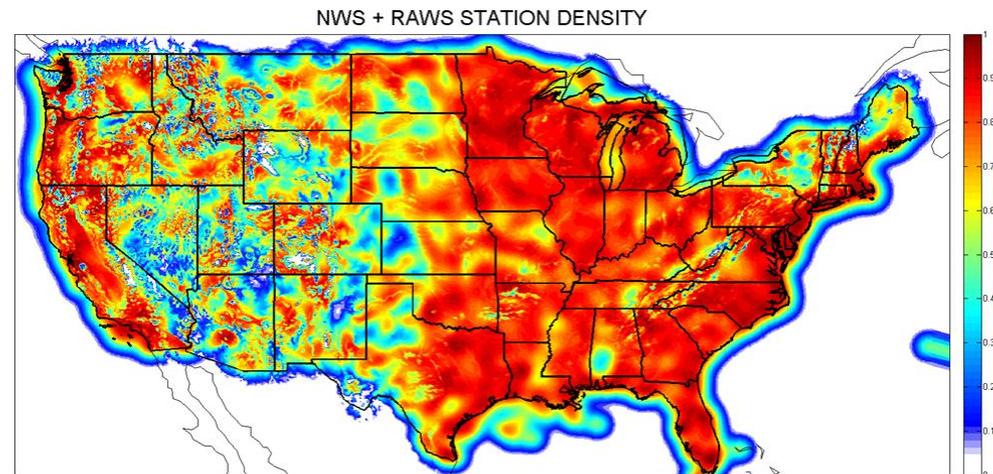
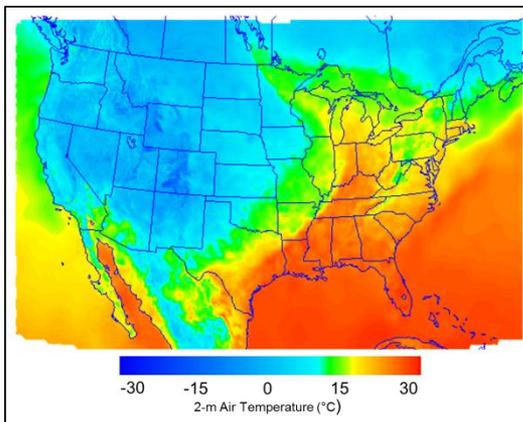
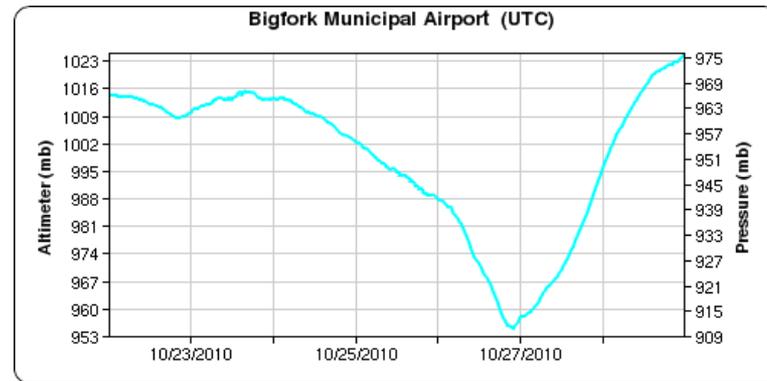


# Analyzing & Forecasting High Impact Events- CSTAR Activities at the University of Utah

John Horel  
john.horel@utah.edu



The screenshot shows the MesoWest website interface. At the top, there is a navigation bar with 'Station Search' and 'Help' links, and a search box for 'Address'. Below this is a 'LINKS' section with 'Status', 'Help', and 'ROMAN' options. A 'Login to My MesoWest' section includes fields for 'Login:' and 'Password:', a 'Login' button, and a 'Create a User' link. A Facebook logo is also present with the text 'Find us on Facebook'. The main content area features a map of the United States with the title 'States' and the instruction 'Click on a State to access weather observations'. The MesoWest logo and the University of Utah logo are also visible.



# Outline

- **Quick topics**
  - U/Utah CSTAR project
  - Related fire weather efforts: ROMAN and GLFFC
- MesoWest
- Development of an efficient 2D variational approach comparable to the NCEP Real Time Mesoscale Analysis (RTMA)
  - Use analyses to estimate sensitivity of high impact weather events to mesonet type

# NWS Collaborative Science, Technology, and Applied Research (CSTAR) Program



The [CSTAR Program](#) creates a cost-effective transition from basic and applied research to operations and services through collaborative research between operational forecasters and academic institutions which have expertise in the environmental sciences

- **1996-2007:** NOAA Cooperative Institute for Regional Prediction. Co-PIs Horel and Steenburgh
- **2007-2010:** Improved Monitoring, Analysis, and Prediction of High Impact Weather. Co-PIs John Horel, Jim Steenburgh, David Whiteman
- **2010-2013:** *Advancing Analysis, Forecast and Warning Capabilities for High Impact Weather Events. Co-PIs John Horel & Jim Steenburgh*



- Ten academic and six research faculty
- Wide ranging basic and applied research supported (~\$4 million annually) by federal agencies and other sources
- Mountain Meteorology Group
  - foster R&D to improve understanding and prediction of weather and climate processes in regions of complex terrain



Three NWS SCEP Students presently: Trevor Alcott, Jon Rutz, Kristen Yeager

# CSTAR Project Goals

- identify high impact weather events through the continued development of data mining software using MesoWest & MADIS
- improve four dimensional analysis systems through R&D on sensitivity to boundary layer data assets, quality control procedures, and characteristics of the analysis systems in complex terrain
- advance short-to-medium range forecast capabilities for high-impact weather events over the western United States

# Transfer of Applied Research To Operations

- MesoWest is a successful example of R&D supported by CSTAR
  - MesoWest is more than one of the many data pipes to MADIS
  - MySql relational database of current and archived data, metadata, software, and web displays integral to WFO office and IMET operations
- Evaluating the utility of mesonet observations for use in surface analyses and verification efforts (Myrick and Horel 2008; Horel and Dong 2010)
- Participating in the development and evaluation of the RTMA (Tyndall 2008; Tyndall et al. 2010)
- Quantitative forecasting of snowfall and liquid water equivalent, which is critical for preparing winter storm watches and warnings (Alcott and Steenburgh 2010)
- Identifying and predicting high impact weather events (Shafer and Steenburgh 2008, Steenburgh et al. 2009; West and Steenburgh 2010)

- Climatological study of SLR at Alta and Salt Lake City used to develop SLR algorithm for all of western Utah

- Snow-to-Liquid Ratio Variability and Prediction at a High-Elevation Site in Utah's Wasatch Mountains. Alcott & Steenburgh. Feb 2010. *WAF*

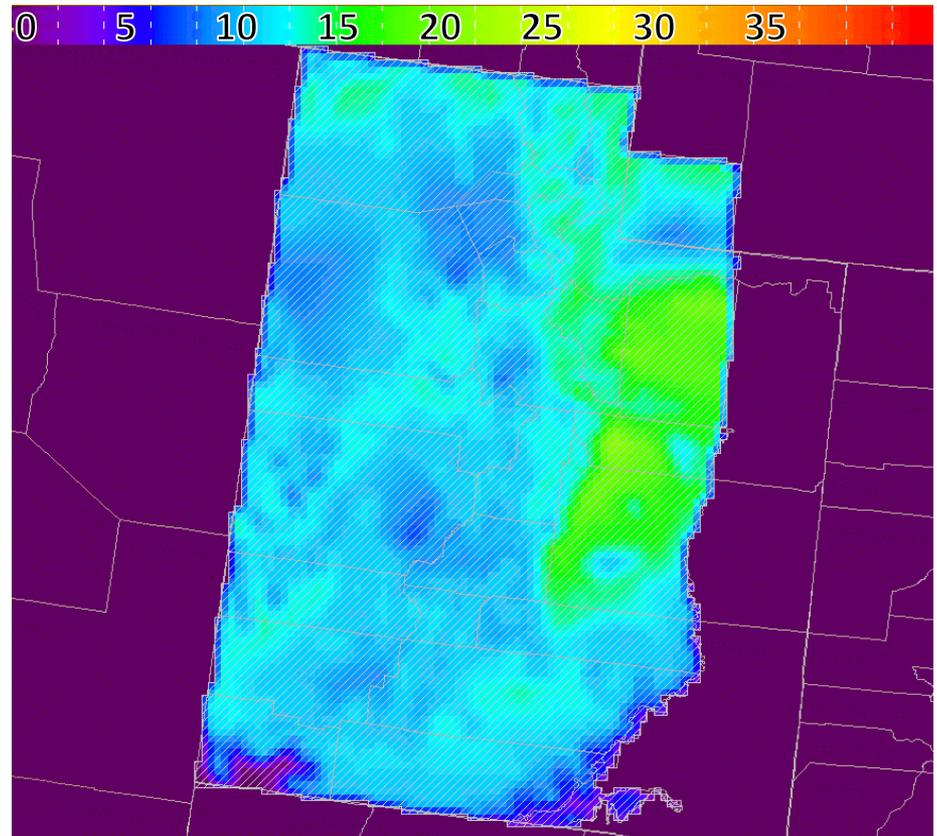
- Algorithm has been coded into a GFE (graphical forecast editor) smart tool to produce gridded forecasts of SLR, and in turn, snowfall amount.

- Replaces use of a single fixed ratio or unskillful empirical methods

- SLR tool is being used by most forecasters at WFO SLC, who report that it is improving (particularly mountain) snowfall forecasts.

## Forecasting snow-to-liquid ratio

SCEP Student. Trevor Alcott



6-h SLR forecast valid 25-Dec-2008 6-12 UTC

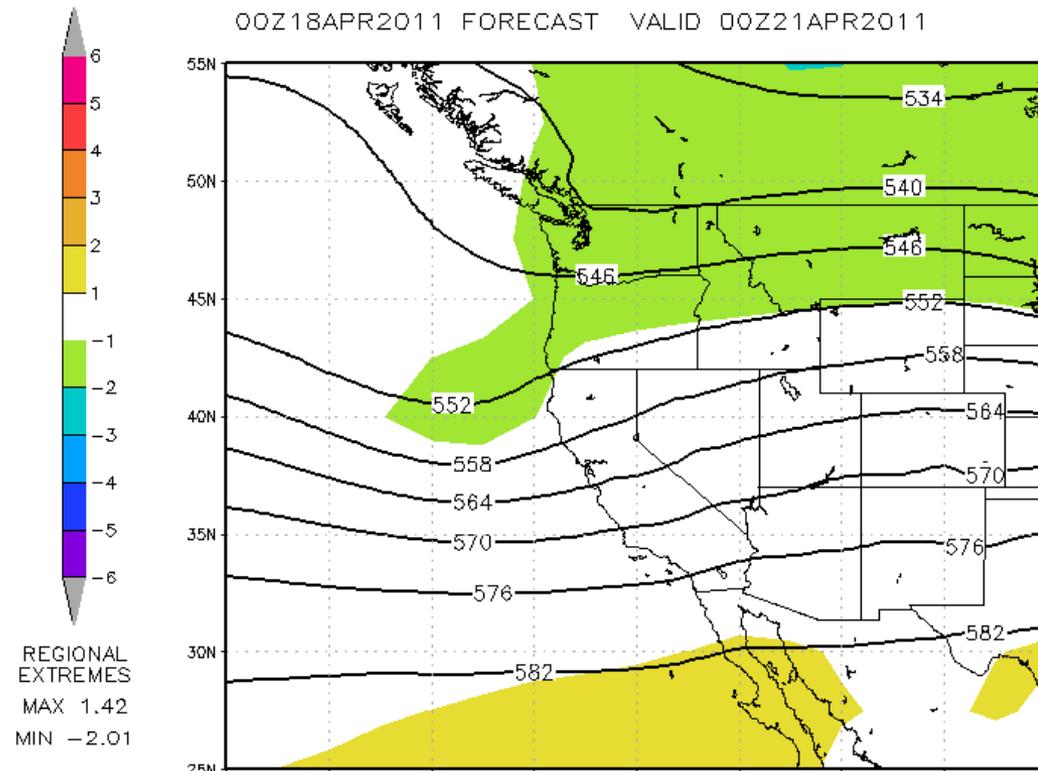
# Identification of High Impact Events with Standardized Anomalies

SCEP student Trevor Alcott & SLC SOO Randy Graham integrated standardized anomaly analyses and forecast products into operations (following work by Grumm)

<http://www.wrh.noaa.gov/slc/projects/anomalies/index.htm>

GEFS EM 500 MB HEIGHT (DM) AND STANDARDIZED ANOMALY

00Z18APR2011 FORECAST VALID 00Z21APR2011



# High Impact Weather: Fire Weather

- ROMAN:  
<http://raws.wrh.noaa.gov/roman/>
- NWS and land agency support
- Transitioning from NWS Western Region to Forest Service Kansas City IT hub
- Extensive use at WFOs and by IMETs

QUICK LINKS help  
Zipcode

ROMAN  
Real-time Observation Monitor and Analysis Network

**Geographic Coordinating Areas**  
*Click in a Geographic Coordinating Area or use the menu below to access weather information*

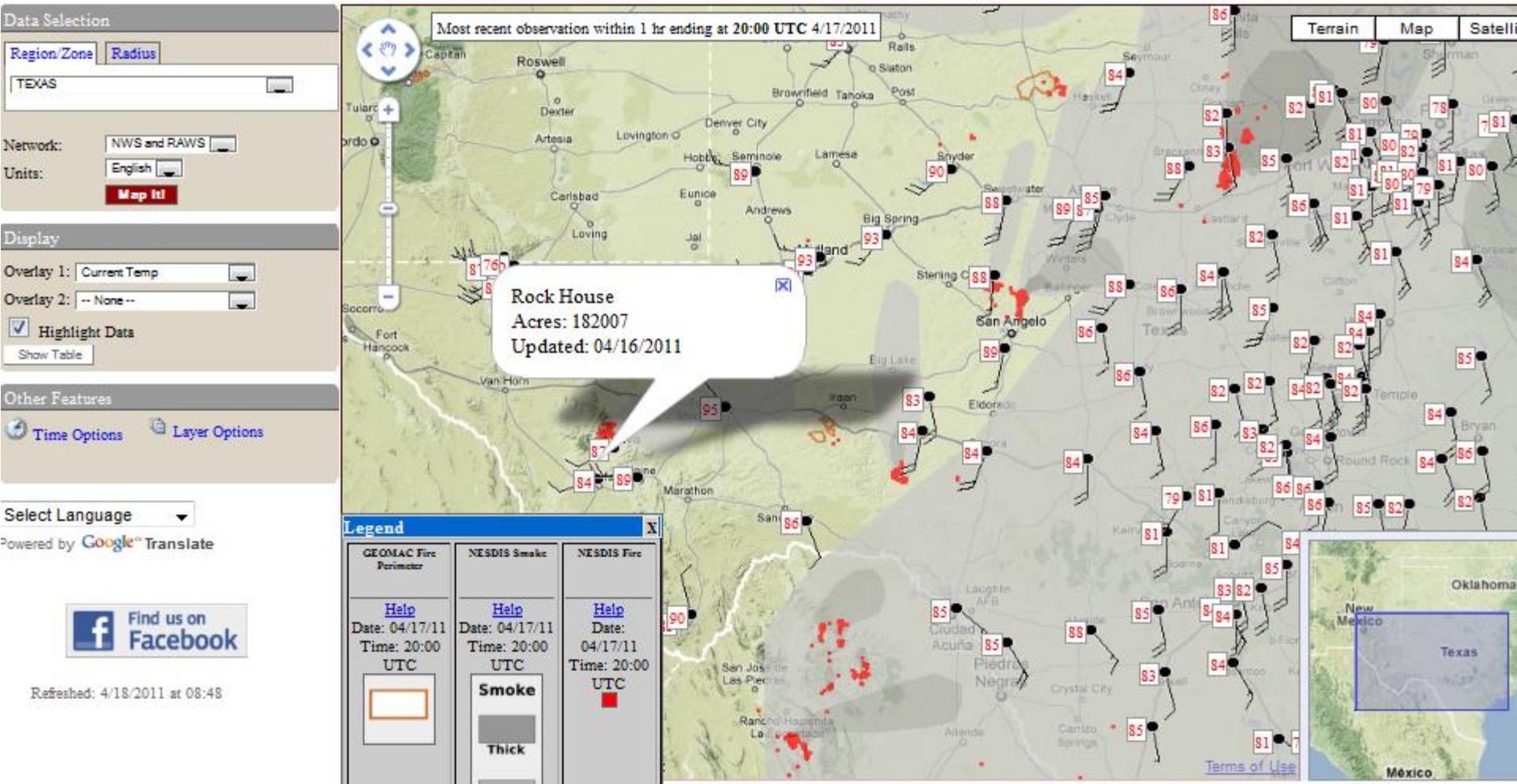
LINKS  
Status & News  
MesoWest  
GCAs  
NWS Fire Weather  
Help  
Contact Us

FOREST SERVICE  
U.S. DEPARTMENT OF AGRICULTURE

- As soon as RAWS deployed, information available for field use

# High Impact Weather: Fire Weather

- MesoWest: Integrating Weather and Other GIS Products

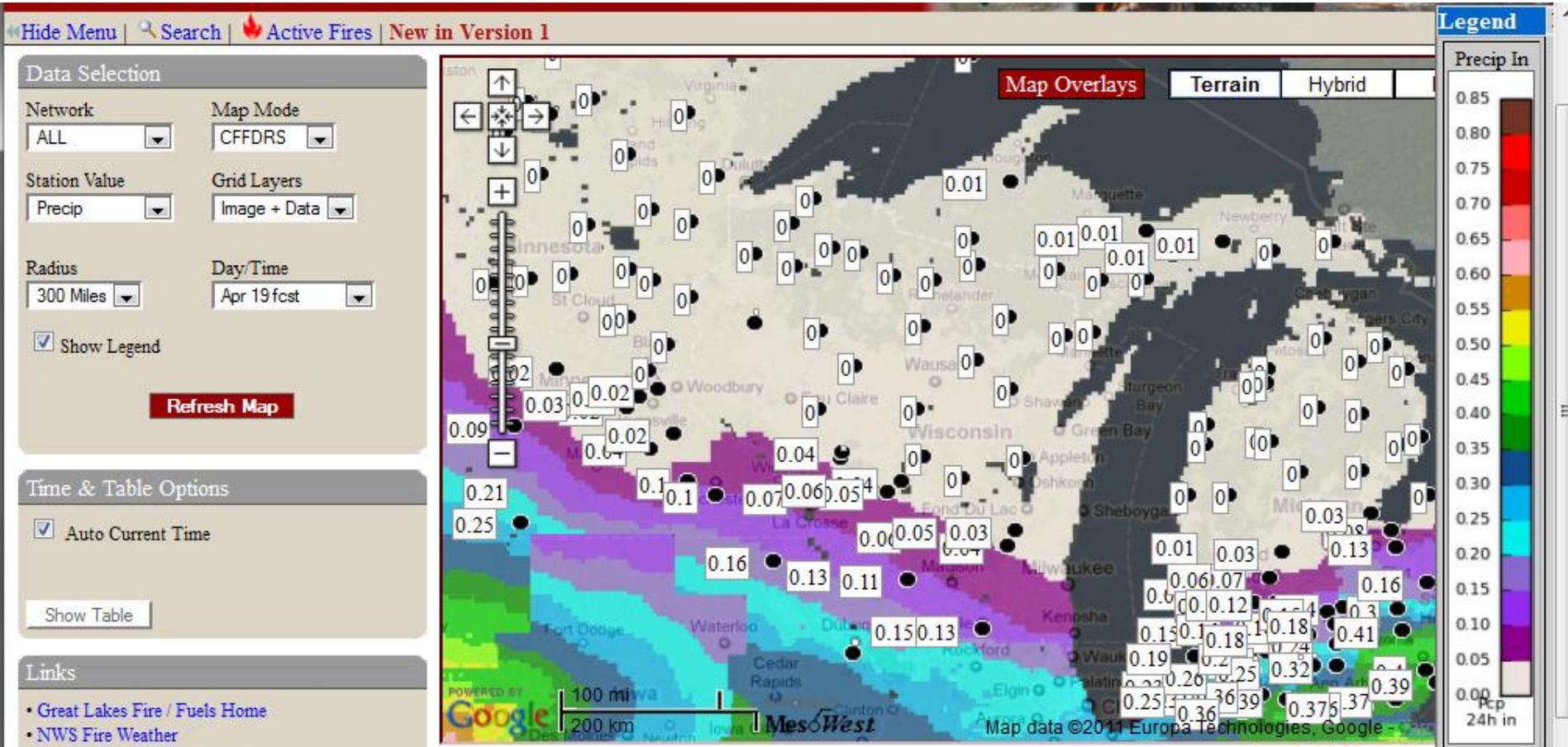


# High Impact Weather: Fire Weather

- [GLFFC:](http://glffc.utah.edu)  
<http://glffc.utah.edu>
- R&D support by Michigan, Minnesota, Wisconsin fire agencies via Great Lakes Forest Fire Compact
- Demonstrates developing tools that integrate observations and NWS forecast guidance for specific user applications

The screenshot displays the 'Great Lakes Fire / Fuels' website. The top navigation bar includes 'Login | Create a User!' and the 'MESO WEST' logo. The main heading is 'Great Lakes Surface Weather and Fire Indices'. Below this, there is a section titled 'Click Map For Current Fire Weather' which contains a map of the Great Lakes region. The map is color-coded to show fire weather indices, with yellow and orange indicating higher risk areas. To the left of the map is a sidebar with a 'LINKS' menu containing: 'MesoWest', 'ROMAN', 'Help', 'Great Lakes Forest Fire Compact', 'U of Utah Dept. of Atmospheric Sciences', and 'NWS Fire Weather'. At the bottom of the sidebar is a 'Login to Great Lakes' button. Below the map, a note states: 'If logged in, your default profile will be used'.

# NDFD QPF 2 Day Forecast



# 2 Day Forecast of Fine Fuel Moisture Code

**Data Selection**

Network: ALL  
 Map Mode: CFFDRS  
 Station Value: FFM  
 Grid Layers: Image + Data  
 Radius: 300 Miles  
 Day/Time: Apr 19 fcst

Show Legend

**Refresh Map**

---

**Time & Table Options**

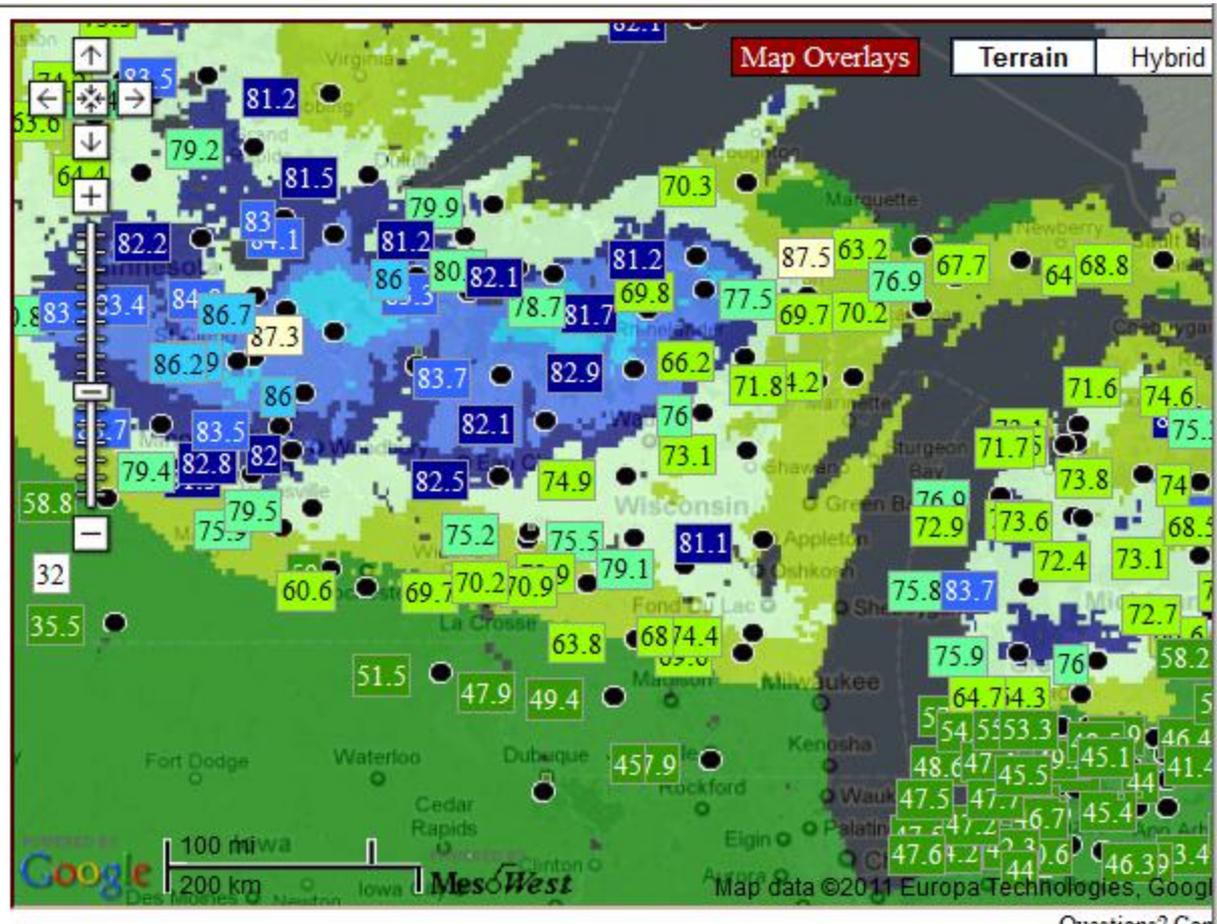
Auto Current Time

Show Table

---

**Links**

- Great Lakes Fire / Fuels Home
- NWS Fire Weather



FFMC
0.0-59.9
60.0-74.9
75.0-80.9
81.0-82.9
83.0-84.9
85.0-86.9
87.0-87.9
88.0-88.9
89.0-89.9
90.0-90.9
91.0-91.9

# Outline

- Quick topics
  - U/Utah CSTAR project
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- **MesoWest**
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# **OBSERVING WEATHER AND CLIMATE FROM THE GROUND UP**

**A NATIONWIDE NETWORK OF NETWORKS**

Released December 2008

Committee on Developing Mesoscale Meteorological  
Observational Capabilities to Meet Multiple National Needs

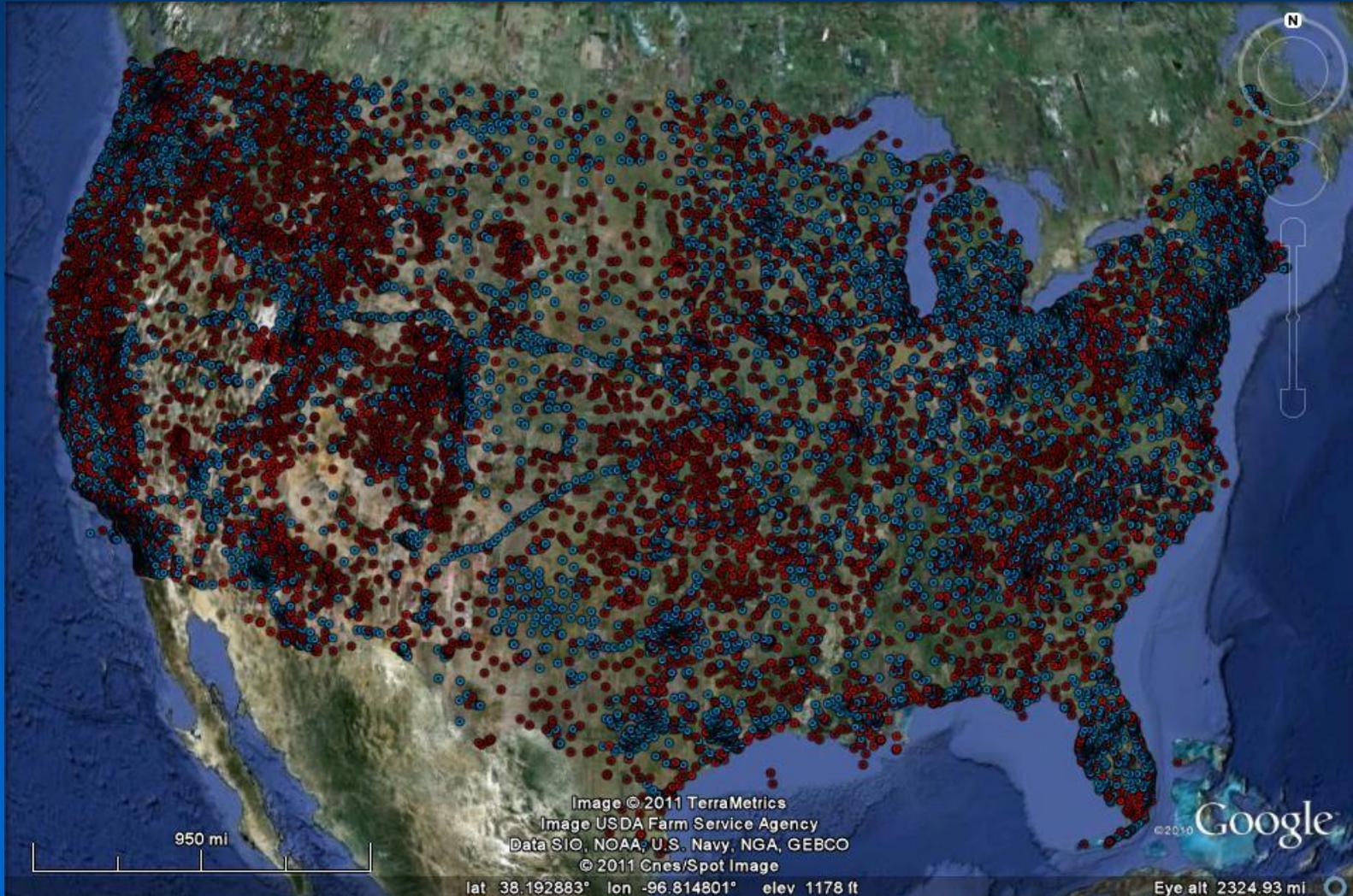
Board on Atmospheric Sciences and Climate



## Meteorological Assimilation Data Ingest System

- NOAA MADIS supports collection, integration, quality control, and distribution of NOAA and non-NOAA observations from over 60,000 surface stations from local, state, and federal agencies, and private networks, as well as upper-air datasets
- Access to an integrated, reliable, QC'd database containing real-time and archived datasets
- Runs operationally in real-time with a distributed architecture consisting of ingest and distribution services at the NWS TOC and processing at NCEP Central Operations

# MADIS stations available publicly

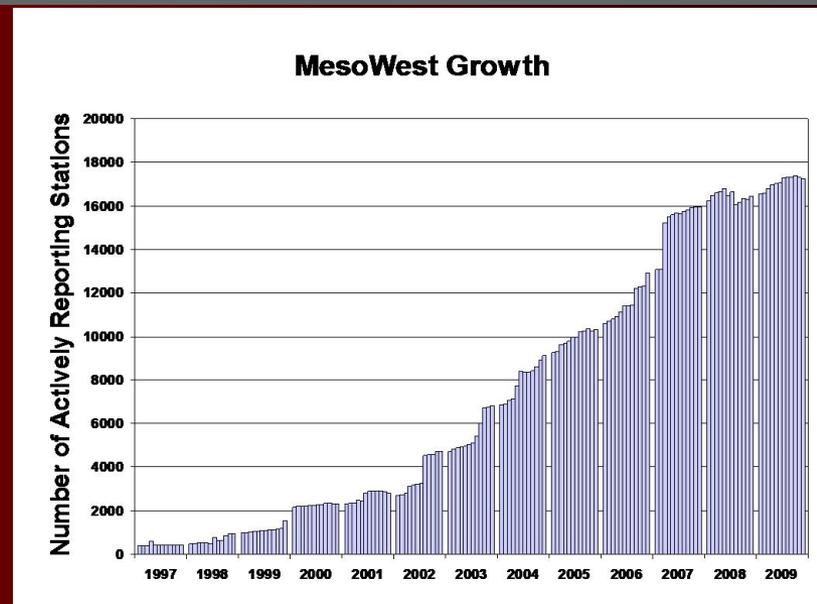


Federal vs. non-Federal

## Existing Strengths on Which NNoN Can Build

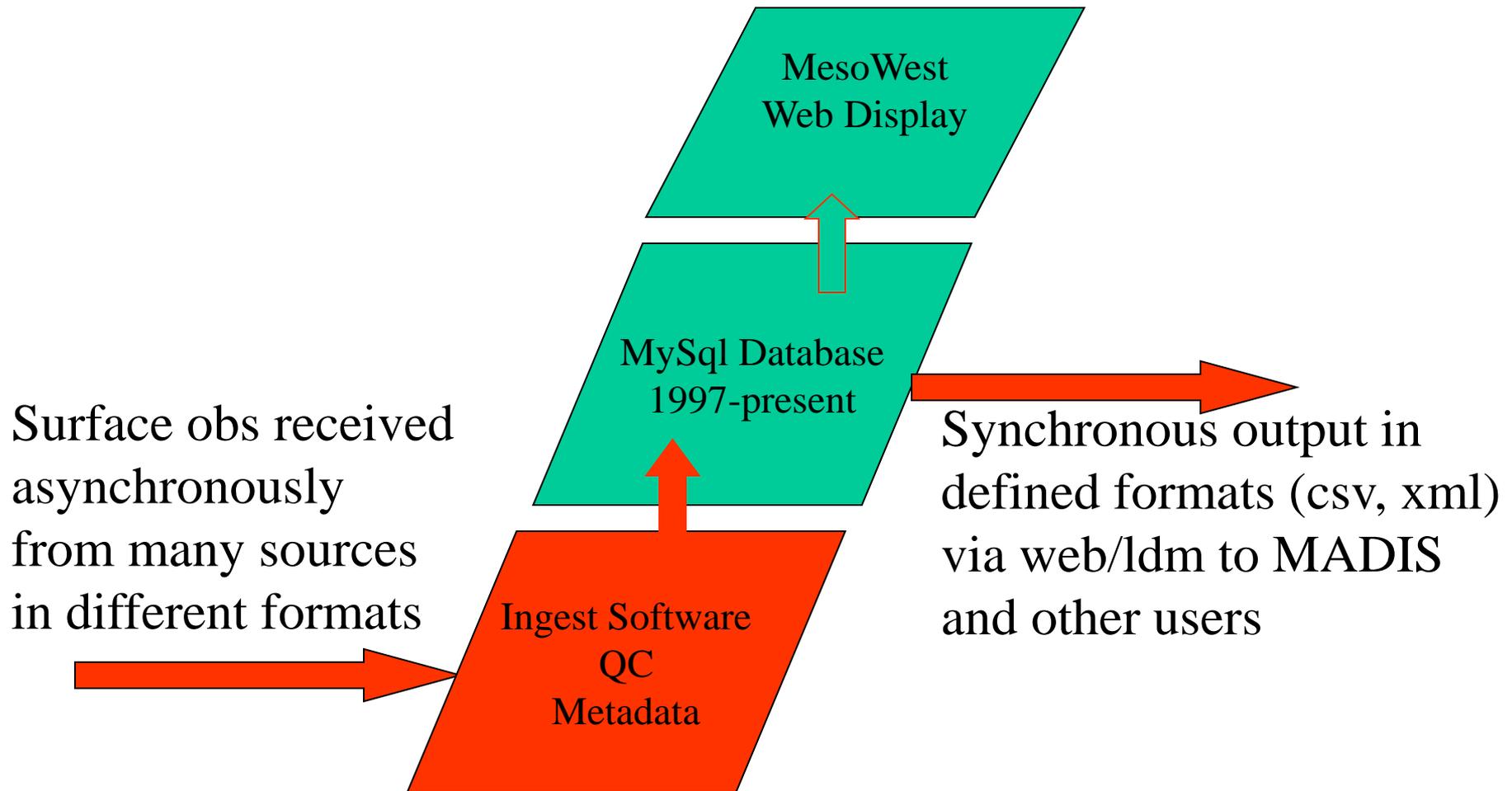
- National framework in place: MADIS
- Procedures to move data from local data sources to central repository in place: LDM
- Personal relationships that foster acquisition and growth of data assets in place: local and regional mesonets
  
- All politics is local...
- All observations are local...  
but coordination at a national level is essential

- MesoWest began fifteen years ago as grassroots effort to integrate the collection, archival, and distribution of weather observations available from now hundreds of sources
- MesoWest is used extensively in U.S. for operational, research, and educational use with specific applications developed for fire weather operations
- Based on coordination with staff of Western Region of the NWS, many WFOs, MADIS/ESRL, and data providers
- Provide access to nonproprietary data sources with very basic usage restrictions
- MesoWest supported by NWS, land agencies, other federal & state agencies, and, to a much more limited extent, commercial firms



Access to current and retrospective data from 1997 to present

# MesoWest Overview



## Mesonet Status for past 2 hours (as of 10:30 AM MDT)

The number of stations that have reported divided by the total number of active stations.  
Mesonets with summaries longer than 2 hours are indicated.

<a href="#">NWS_FAA</a>	1959/2037	<a href="#">RAWS</a>	1914/2148 1.5 hrs	<a href="#">DUGWAY</a>	27/27	30 min
<a href="#">UTAH_DOT</a>	60/68 1 hr	<a href="#">ARL_FRD</a>	34/35 30 min	<a href="#">AVALANCHE</a>	23/26	
<a href="#">TOOELE</a>	24/24	<a href="#">SNOWNET</a>	26/31 1.5 hrs	<a href="#">AQ</a>	15/19	
<a href="#">ARL_SORD</a>	26/28 1 hr	<a href="#">AGRIMET</a>	88/90 12 hrs	<a href="#">MISC</a>	3/5	
<a href="#">CAMPBELL</a>	4/4	<a href="#">CANADA</a>	561/579	<a href="#">MT_DOT</a>	57/61	4 hrs
<a href="#">WY_DOT</a>	64/65 1 hr	<a href="#">LOXWFO</a>	19/26 3 hrs	<a href="#">REC</a>	0/0	4 hrs
<a href="#">CUP</a>	0/0	<a href="#">KENNECOTT</a>	0/7	<a href="#">AZ_ALERT</a>	37/37	30 min
<a href="#">NV_DOT</a>	62/73 1 hr	<a href="#">CBRFC</a>	5/5 4 hrs	<a href="#">LAS_VEGAS</a>	53/54	1 hr
<a href="#">SNOTEL</a>	729/756 4 hrs	<a href="#">MCSCN</a>	13/20 24 hrs	<a href="#">MEXICO</a>	60/60	1.5 hrs
<a href="#">SCAN</a>	128/154 6 hrs	<a href="#">CLR</a>	0/0 30 min	<a href="#">UDWR</a>	0/0	
<a href="#">SARC</a>	1/1 12 min	<a href="#">MSI</a>	1/2 1 hr	<a href="#">WX4U</a>	0/0	
<a href="#">WA_DOT</a>	91/98 3 hrs	<a href="#">NWAVAL</a>	26/32 3 hrs	<a href="#">HMMN</a>	30/30	1.5 hrs
<a href="#">AZMET</a>	23/23 24 hrs	<a href="#">WAAQ</a>	17/19	<a href="#">IID</a>	76/78	
<a href="#">CNRFC</a>	16/29 4 hrs	<a href="#">DUDFCD</a>	20/24 30 min	<a href="#">BWFO_NWS</a>	7/13	
<a href="#">CAIC</a>	7/13	<a href="#">KSL</a>	1/2 30 min	<a href="#">BTAVAL</a>	12/17	
<a href="#">ODOT</a>	55/67 30 min	<a href="#">CEMP</a>	19/22 3 hrs	<a href="#">LANL</a>	5/5	
<a href="#">GSE</a>	8/8 12 hrs	<a href="#">PDTWFO</a>	24/30 1 hr	<a href="#">MSOWFO</a>	2/10	4 hrs
<a href="#">GTFWFO</a>	0/0	<a href="#">CARB</a>	135/142 4 hrs	<a href="#">SHASAVL</a>	4/4	6 hrs
<a href="#">CALTRANS</a>	16/17 1 hr	<a href="#">FAWN</a>	36/36 1 hr	<a href="#">DOERD</a>	0/0	30 min
<a href="#">DRI</a>	40/59 4 hrs	<a href="#">CDOT</a>	73/78	<a href="#">UPR</a>	355/406	
<a href="#">APRSWXNET</a>	5521/6525	<a href="#">CIMIS</a>	129/129 24 hrs	<a href="#">WHITEPINE</a>	0/0	3 hrs
<a href="#">GNP</a>	2/1 12 hrs	<a href="#">GPSMET</a>	75/88	<a href="#">WTEXAS</a>	59/59	1 hr
<a href="#">WIDOT</a>	50/53 4 hrs	<a href="#">NWS_COOP</a>	47/51 1.5 hrs	<a href="#">HPWREN</a>	2/2	12 min

# Contributing Networks to MesoWest/MADIS

<a href="#">PIHWFO</a>	1/1	<a href="#">HNXWFO</a>	8/12 1 hr	<a href="#">GGWWFO</a>	10/13	1.5 hrs
<a href="#">SGXWFO</a>	62/68	<a href="#">SNOWBIRD</a>	2/2 4 hrs	<a href="#">SUNCREST</a>	0/0	
<a href="#">FGZWFO</a>	3/5 30 min	<a href="#">ODEQ</a>	14/14 3 hrs	<a href="#">AKDOT</a>	40/43	
<a href="#">IADOT</a>	54/58 1 hr	<a href="#">PQRWFO</a>	13/18	<a href="#">MFRWFO</a>	1/1	
<a href="#">CPCRC</a>	3/3 4 hrs	<a href="#">MAMMOTH</a>	3/5	<a href="#">MARITIME</a>	294/347	
<a href="#">MEDOT</a>	3/4	<a href="#">KYDOT</a>	12/17	<a href="#">MDDOT</a>	47/52	
<a href="#">MNDOT</a>	78/83	<a href="#">NDDOT</a>	19/24	<a href="#">NEDOR</a>	46/48	
<a href="#">OHDOT</a>	156/163	<a href="#">VADOT</a>	38/44	<a href="#">NHDOT</a>	16/16	
<a href="#">HADS</a>	2551/2623 4 hrs	<a href="#">AFGWFO</a>	8/12	<a href="#">NCAWOS</a>	105/117	
<a href="#">NJNET</a>	36/40	<a href="#">LKNWFO</a>	0/2	<a href="#">PCMR</a>	8/9	30 min
<a href="#">DEERVLY</a>	0/6	<a href="#">SBCAPCD</a>	14/15 1.5 hrs	<a href="#">PAWS</a>	0/0	3 hrs
<a href="#">BCHYDRO</a>	76/79 12 hrs	<a href="#">YAKIMA</a>	6/7	<a href="#">USCG_PUGET</a>	0/0	12 hrs
<a href="#">INDOT</a>	25/26	<a href="#">AZDOT</a>	17/17	<a href="#">MAWN</a>	58/60	
<a href="#">NOS-PORTS</a>	64/64	<a href="#">NOS-NWLN</a>	157/157	<a href="#">CRN</a>	96/97	
<a href="#">ODA</a>	0/0 4 hrs	<a href="#">SFWMD</a>	23/26	<a href="#">DCFW</a>	0/3	12 hrs
<a href="#">CDPHE</a>	8/9	<a href="#">MTRWFO</a>	25/26 12 hrs	<a href="#">HNLWFO</a>	18/21	
<a href="#">HILL</a>	1/1	<a href="#">NEMPPA</a>	0/4	<a href="#">VTRANS</a>	13/14	
<a href="#">SCHWEITZER</a>	1/2	<a href="#">SEWWFO</a>	5/6	<a href="#">ME-CAR-Meso</a>	5/5	
<a href="#">AIRNOW</a>	503/562 6 hrs	<a href="#">CA_HYDRO</a>	35/84 4 hrs	<a href="#">FGNet</a>	15/15	
<a href="#">SDGE</a>	88/88	<a href="#">CDEC</a>	6/6	<a href="#">WUNDERG</a>	4/28	
<a href="#">PCAPS</a>	0/8	<a href="#">DEOS</a>	28/30	<a href="#">WSMR</a>	14/22	
<a href="#">EDW</a>	14/14					

# MesoWest paradigm:

## Faciliate access to all available data & minimize hassle to data providers

- Give us basic metadata: lat/lon/elev/station name
- Tell us what variables you are measuring and in what format
- Do you want to push data to NWS WR or do we pull it?
- We'll do the rest
- We encourage local data providers to sign a data sharing agreement with the local WFO
- Ownership of data remains with the data provider
- Data are considered provisional- owner may wish to provide QC'd data to end users at later date

**MESO WEST** Region WISCONSIN Product Surface Weather Maps Go

Hide Menu Show Tables Search Active Fires Map Product: Default Save

Data Selection  
 Region/Zone Radius  
 25 Miles Click Point on Map →

Network: All Networks  
 Units: English Map It!

Display  
 Overlay 1: Current Temp  
 Overlay 2: -- None --  
 Highlight Data Show Table

Other Features  
 Time Options Layer Options

Select Language

Powered by Google Translate

Find us on Facebook

Refreshed: 10/13/2010 at 09:29

**Current Station Observations**

Rt 66 @ Rosslyn

Observation Time: 10/13/10 @ 10:41 EDT 14:41 UTC Elevation: 132 ft OK

**Weather Conditions**

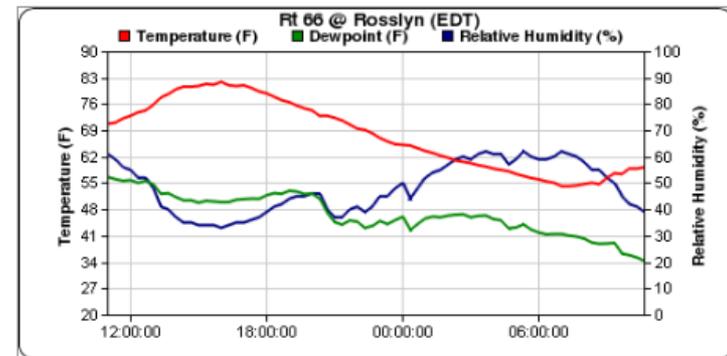
Temperature: 59 °F  
 Dew Point: 34 °F  
 Humidity: 39 %  
 Wind: E at 4 MPH  
 Peak Gust: 6 MPH

**24 Hour Max/Min Events**

Max Temperature: 82 °F  
 Min Temperature: 54 °F  
 Max RH: 62 %  
 Min RH: 33 %  
 Max Dew Point: 56 °F  
 Min Dew Point: 34 °F  
 Max Gust: 16 MPH

View: Temp Wet Bulb Wind Vector Wind Wind Rose Pressure Precip Snow Solar

Help



[Change to UTC Time](#) [Additional Tabular and Graphical Displays](#) [Download Data](#)

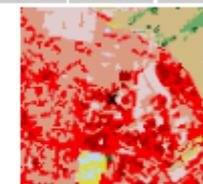
Waiting for gg.google.com...

**Land cover data for WBB/U UTAH (WBB)**

Class	Percent of area
Developed, Open Space	13%
Developed, Low Intensity	40%
Developed, Med Intensity	35%
Developed, High Intensity	12%

Percent computed based on 1km x 1km box around station

3km x 3km grid with an 'x' to mark station location



**STATION INFO**

VA033  
 NAME: Rt 66 @ Rosslyn  
 ALTITUDE: 38.89828  
 ONGTITUDE: -77.07061  
 LEVATION: 132 ft  
 NET: VADOT  
 AND COVER: 2001 USGS  
 DATA COURTESY OF:  
 Virginia Department of  
 Transportation  
 and  
 Meteorological Assimilation  
 Data Ingest System (MADIS)

Find us on Facebook

**OTHER DISPLAYS**

XML RSS



**Weather Conditions for VA033**

Current time: October 13, 2010 - 11:31 EDT  
 Most Recent Observations at October 13, 2010 - 10:41 EDT

Graphical Links	With Prior Obs	10:41	Max since Midnight	Min since Midnight	24 Hour Max	24 Hour Min
Temperature	Temperature	59.2° F	65.1 at 0:01	54.2 at 7:01	81.9 at 16:01	54.2 at 7:01
Dew Point	Dew Point	34.3° F	46.7 at 2:41	34.3 at 10:41	55.8 at 12:01	34.3 at 10:41
Wet Bulb Temperature	Wet Bulb Temperature	47.2° F	54.5 at 0:01	46.8 at 8:41	62.6 at 13:01	46.8 at 8:41
Relative Humidity	Relative Humidity	39%	62 at 3:41	39 at 9:21	62 at 3:41	33 at 16:01
Wind Speed	Wind Speed	4 mph from E	6 at 5:01	2 at 9:21	8 at 15:41	1 at 18:41
Wind Gust	Wind Gust	6 mph	15 at 4:41	5 at 7:21	16 at 14:41	5 at 18:21

Tabular Listing: October 12, 2010 - 11:31 through October 13, 2010 - 11:31 EDT

Time(EDT)	Temperature	Dew	Wet Bulb	Relative Humidity	Wind Speed	Wind Gust	Wind Direction	Quality
	° F	° F	° F	%	mph	mph		
10:41	59.2	34.3	47.2	39	4	6	E	OK
10:21	58.8	35.2	47.4	41	2	6	NNE	OK
10:01	58.8	35.8	47.6	42	3	11	E	OK
9:41	57.4	36.2	47.1	45	5	11	NNW	OK
9:21	57.6	39.1	48.3	50	2	8	WNW	OK
9:01	56.3	38.9	47.6	52	3	8	NNE	OK
8:41	54.7	38.9	46.8	55	4	11	N	OK

# MesoWest Questions?

- Send email to [atmos-mesowest@lists.utah.edu](mailto:atmos-mesowest@lists.utah.edu)
- MADIS or MesoWest teams can facilitate access to additional data assets
- We work with data providers who are willing to share their provisional data with limited restrictions on use of their weather information

# Outline

- Quick topics
  - U/Utah CSTAR project
  - Related fire weather efforts: ROMAN and GLFFC
- MesoWest
- Development of an efficient 2D variational approach comparable to the NCEP Real Time Mesoscale Analysis (RTMA)
  - Use analyses to estimate sensitivity of high impact weather events to mesonet type

# Motivation For Developing 2D Analyses

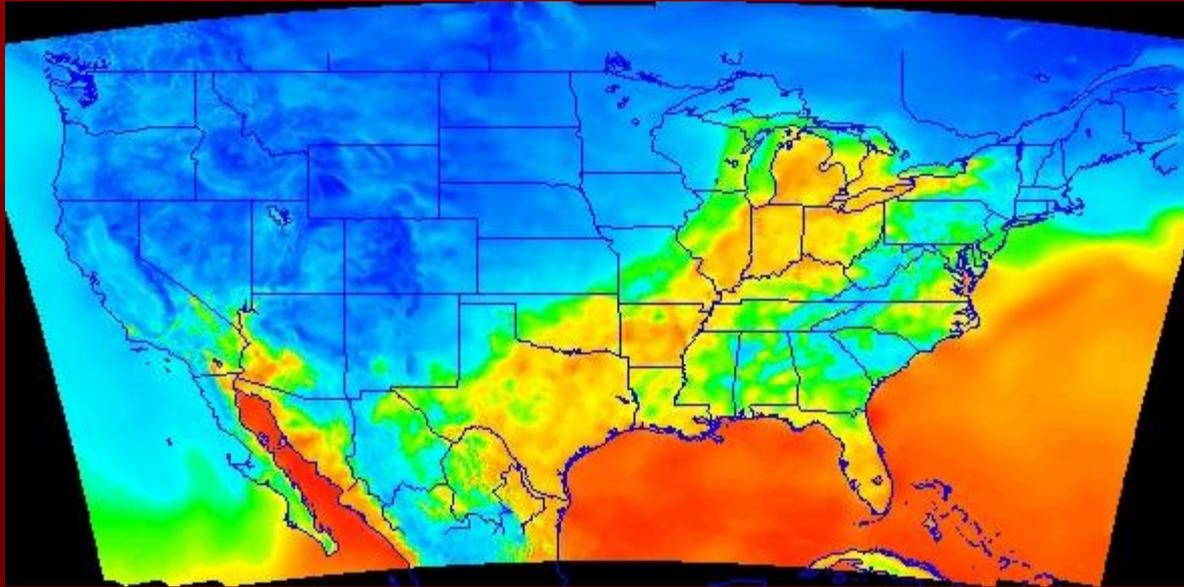
- High resolution ( $\leq 5$  km) real-time surface analyses needed by forecasting community
  - NWS nowcasts, forecasts, and forecast verification
  - Wildfire management
  - Wind power forecasting
  - Transportation safety and management
  - Dispersion modeling
- NCEP's Real-Time Mesoscale Analysis (RTMA) developed in 2006 to meet these needs
  - 2DVar analysis of  $T$ ,  $T_D$ ,  $u$ ,  $v$ , and  $p_s$
  - Assimilates  $\sim 15,000$  surface mesonet observations each hour

# Analysis Approach

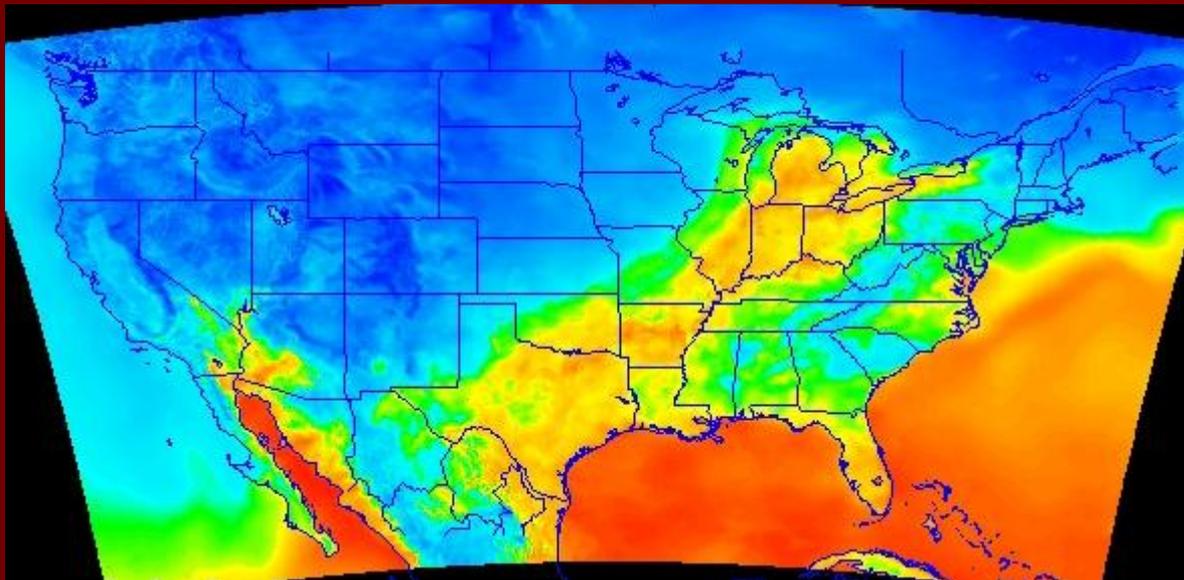
- Our prior research oriented towards improving the RTMA (Tyndall 2008; Tyndall et al. 2010) but difficult to use RTMA source code remotely
- Graduate student Dan Tyndall developed a 2D Variational analysis system in MATLAB
  - Utilizes observations background fields used by RTMA and observations available via MesoWest
  - Can generate CONUS scale analysis efficiently taking advantage of advanced MATLAB features:
    - Parallel processing
    - Code optimization through vectorization
    - Sparse matrices

# Efficient 2D-Var analyses on CONUS Scale @ 5km

D. Tyndall (2011), Ph.D. Thesis. U/U



NCEP RTMA  
Temperature



2DVAR U/U  
Temperature

# Outline

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# One Contribution Towards Cost Effective Designs for National Networks

- Horel and Dong (JACM 2010)
- Provide guidance to land agencies on present distribution of Remote Automated Weather Stations (RAWS) with annual maintenance costs ~\$3 million
- Can NWS/FAA observations be used to supplement RAWS network?
- If other RAWS or NWS nearby, could some RAWS stations be less critical than others based on data denial experiments and other metrics and where are the critical gaps in the existing network?
- Final report led by Tim Brown, DRI, to NWCG Fire Environment Committee by April 30

# An Efficient Objective Approach for Assessing the Impact of Mesonets

- A necessary step to integrate existing and future networks into a national network of networks is to assess the impact of existing mesonets
- The adjoint of the two-dimensional variational analysis system developed at the UU surface weather parameters can be used to assess objectively the sensitivity of the resulting CONUS-scale analyses to the source of the observations used in the analyses (Baker and Daley 2000 QJRMS; Zhu and Gelaro 2008, MWR)
- The analysis system uses the 5 km resolution background fields used by the RTMA
- Roughly 12000 observations available each hour from many different mesonets are then used to modify the background grids and obtain hourly analyses

# An Efficient Objective Approach for Assessing the Impact of Mesonets

- The sensitivity of the differences in weather parameters between the resulting analyses and the background fields are examined as a function of the various data assets:
  - NWS
  - RAWS
  - Air quality
  - Agriculture and hydro
  - Transportation
  - Local, state and regional networks (West Texas Mesonet or Oklahoma Mesonet)
  - Buoys and coastal observations
  - Public
  - Other federal and commercial networks
- Statistics for individual stations as well as for entire networks are obtained that help to identify network characteristics that strongly influence analyses
- Technique will be illustrated here in terms of a single analysis

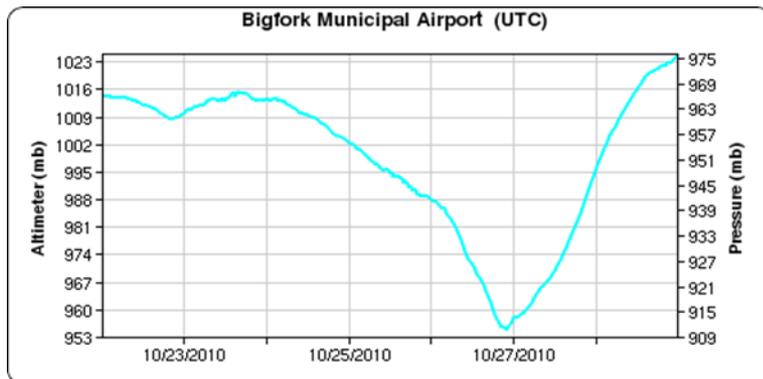
# Consider a Specific High Impact Weather Event: Event: October 26-27 2010



Figure 18. Visible satellite image of the "October Bomb" or the "Superstorm of October 2010" from 26 October 2010. [Return to text.](#)



Grand Marais, MN  
October 27 15 UTC





**Data Selection**

Region/Zone Radius

150 Miles Click Point on Map →

Network: All Networks

Units: Metric

**Map It!**

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**Display**

Overlay 1: Current Wind Speed

Overlay 2: -- None --

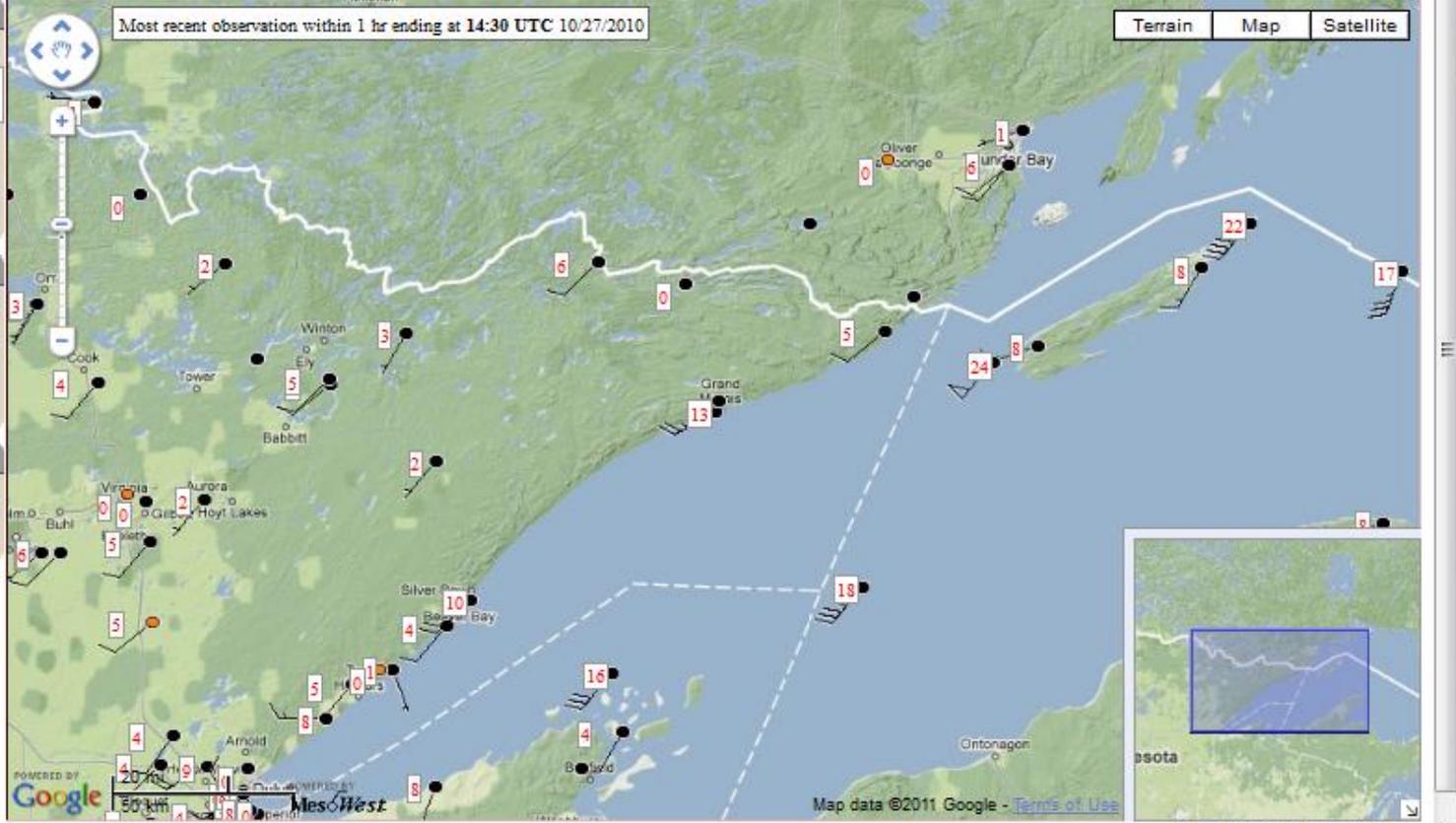
Highlight Data

Show Table

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**Other Features**

Time Options Layer Options

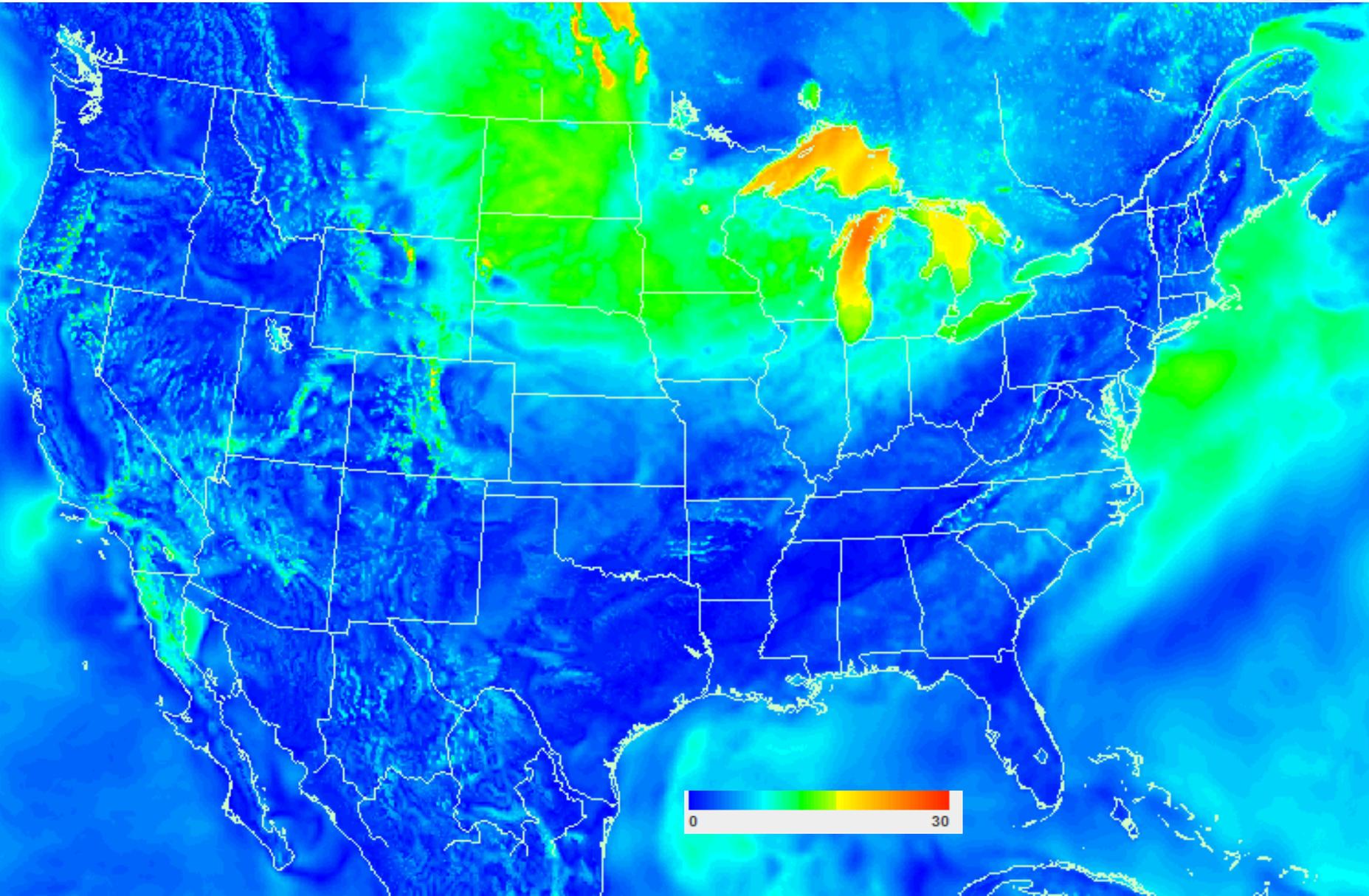


Select Language Powered by Google Translate

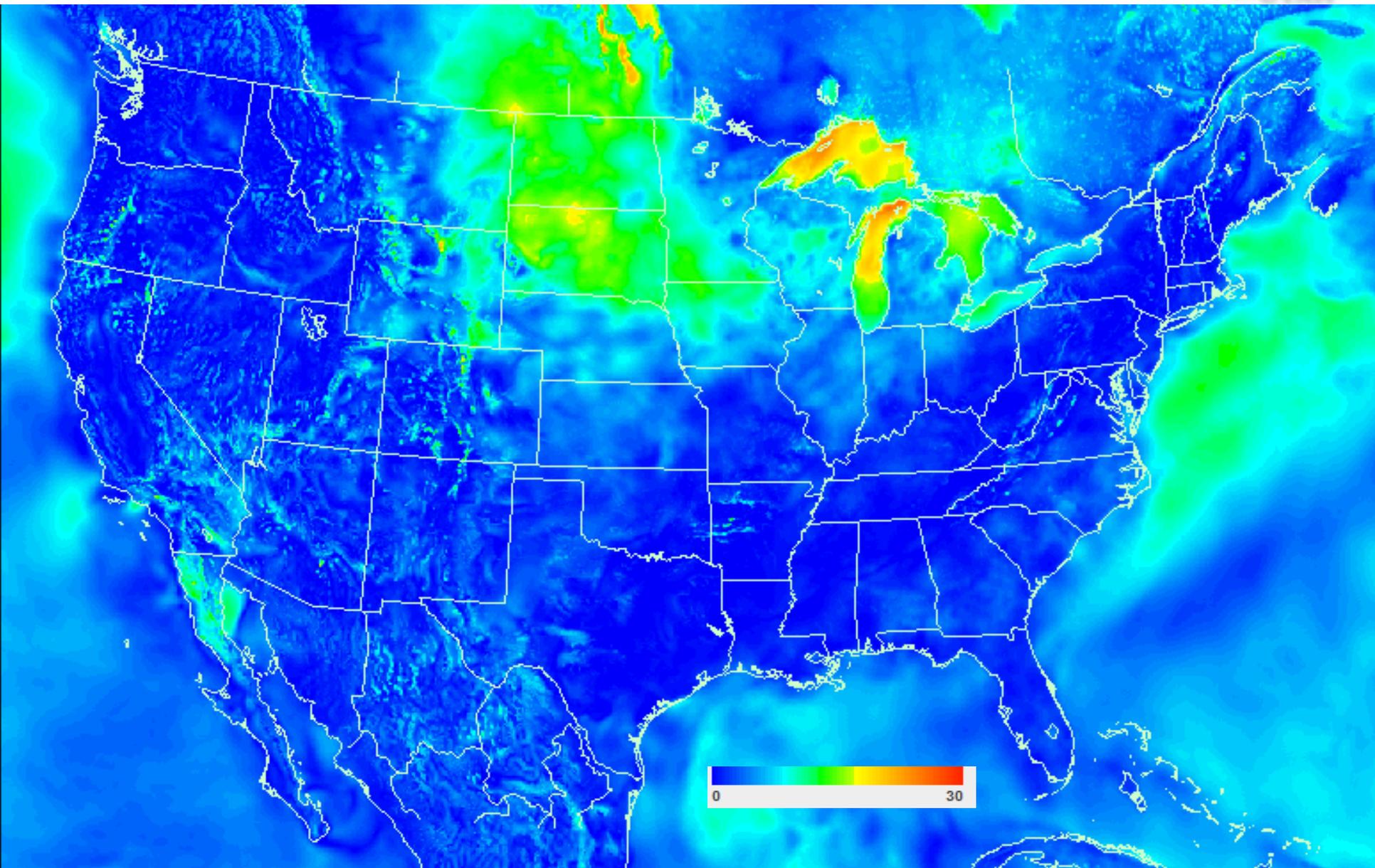


Refreshed: 4/18/2011 at 12:44

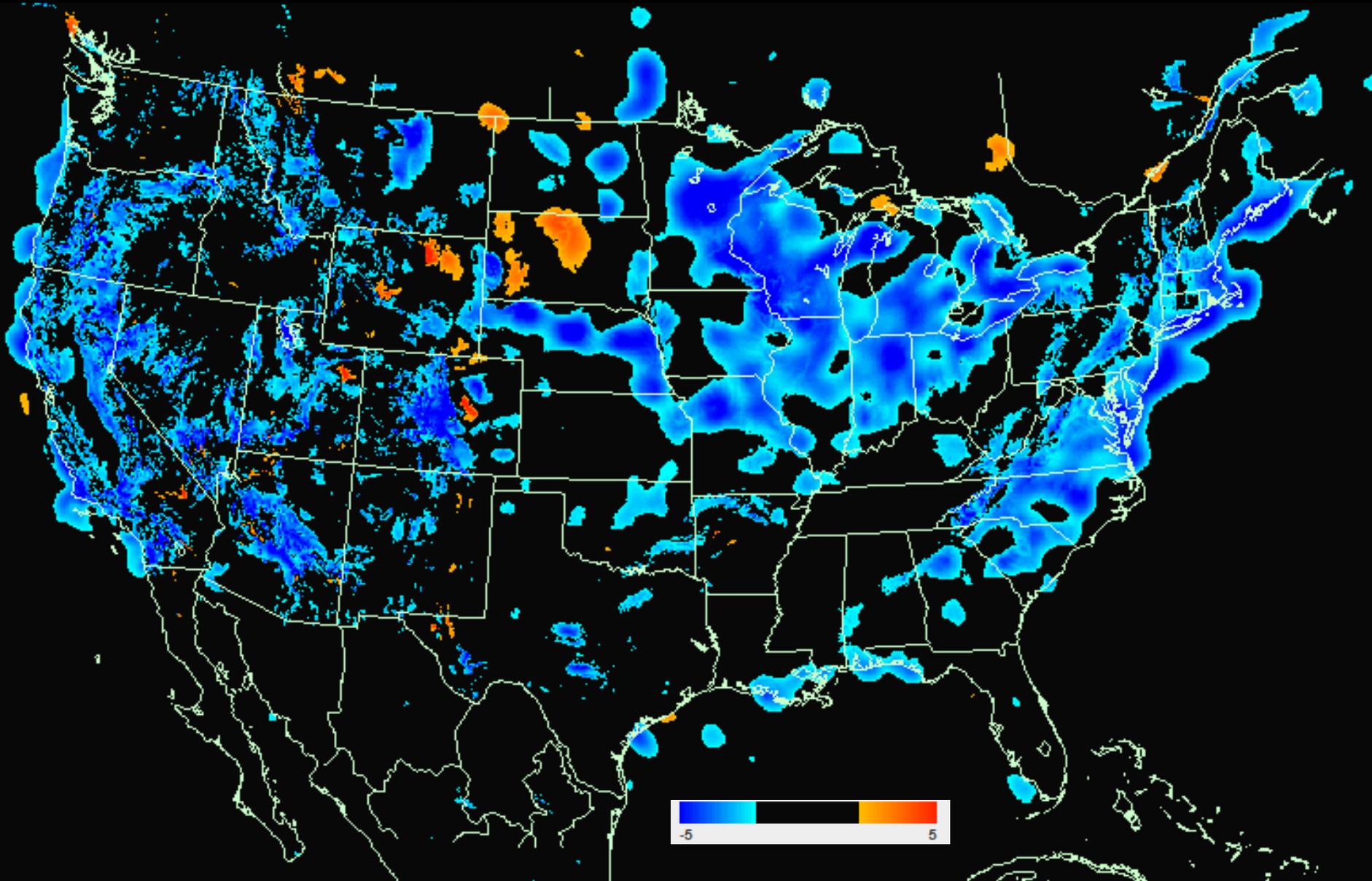
# RUC Wind Speed Downscaled to RTMA Grid (m/s): 14 UTC 27 Oct 2010



# UU Analysis Wind Speed (m/s): 14 UTC 27 Oct 2010



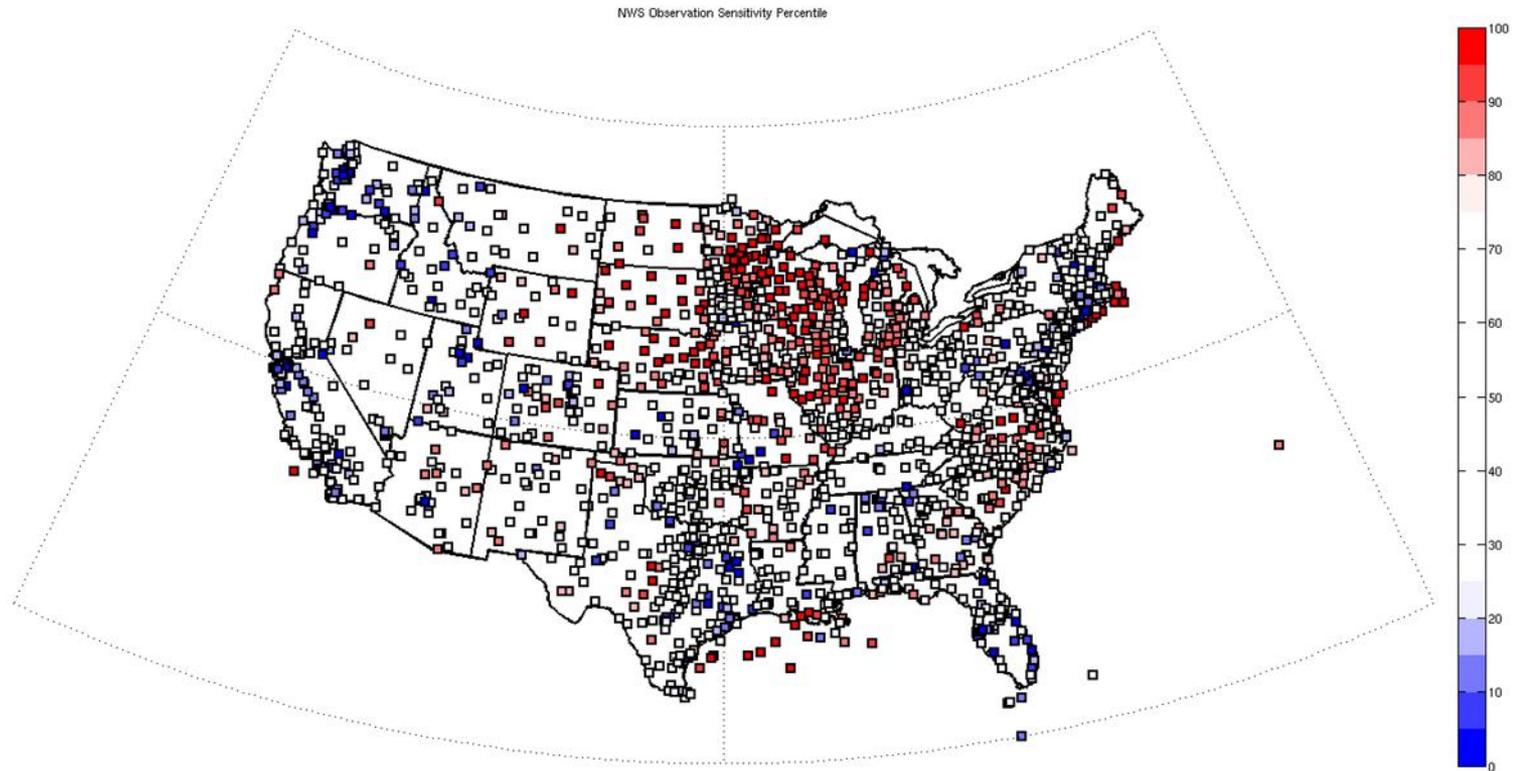
# Adjustment of Background Wind Speeds by Observations (m/s):14 UTC 27 Oct 2010



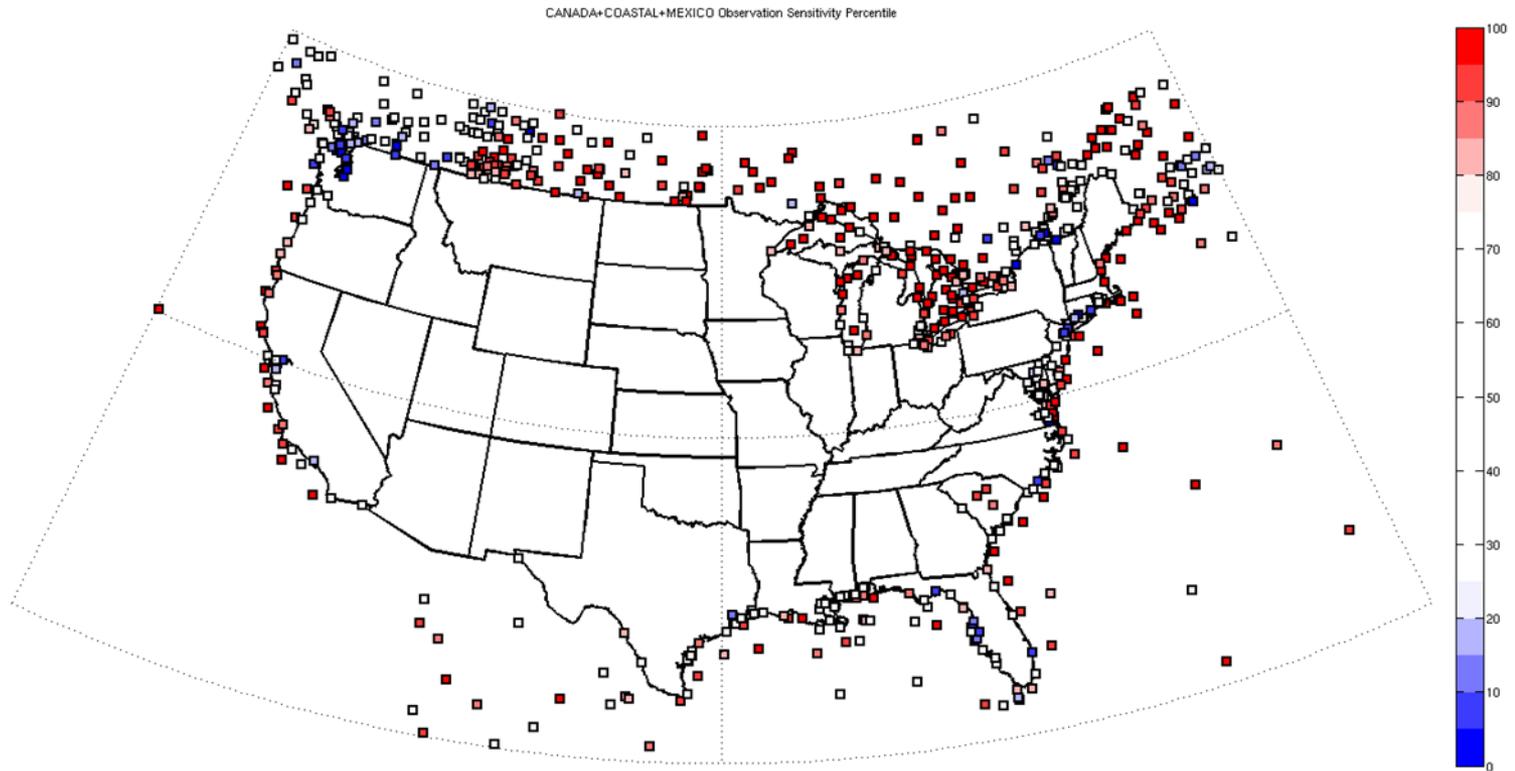
# Summarizing Analysis Sensitivity as a Function of Network Type

- Define scalar aspect metric: root-mean squared difference between analysis and background
- Sensitivity computed from adjoint at each observation location (~11500 for wind)
  - depends on the analysis system characteristics (e.g., assumed background and observation errors)
  - **not** on the actual observed values
- Most sensitive locations: top 20 percent of the sensitivity values (**red**)
- Least sensitive locations: lowest 20 percent (**blue**)

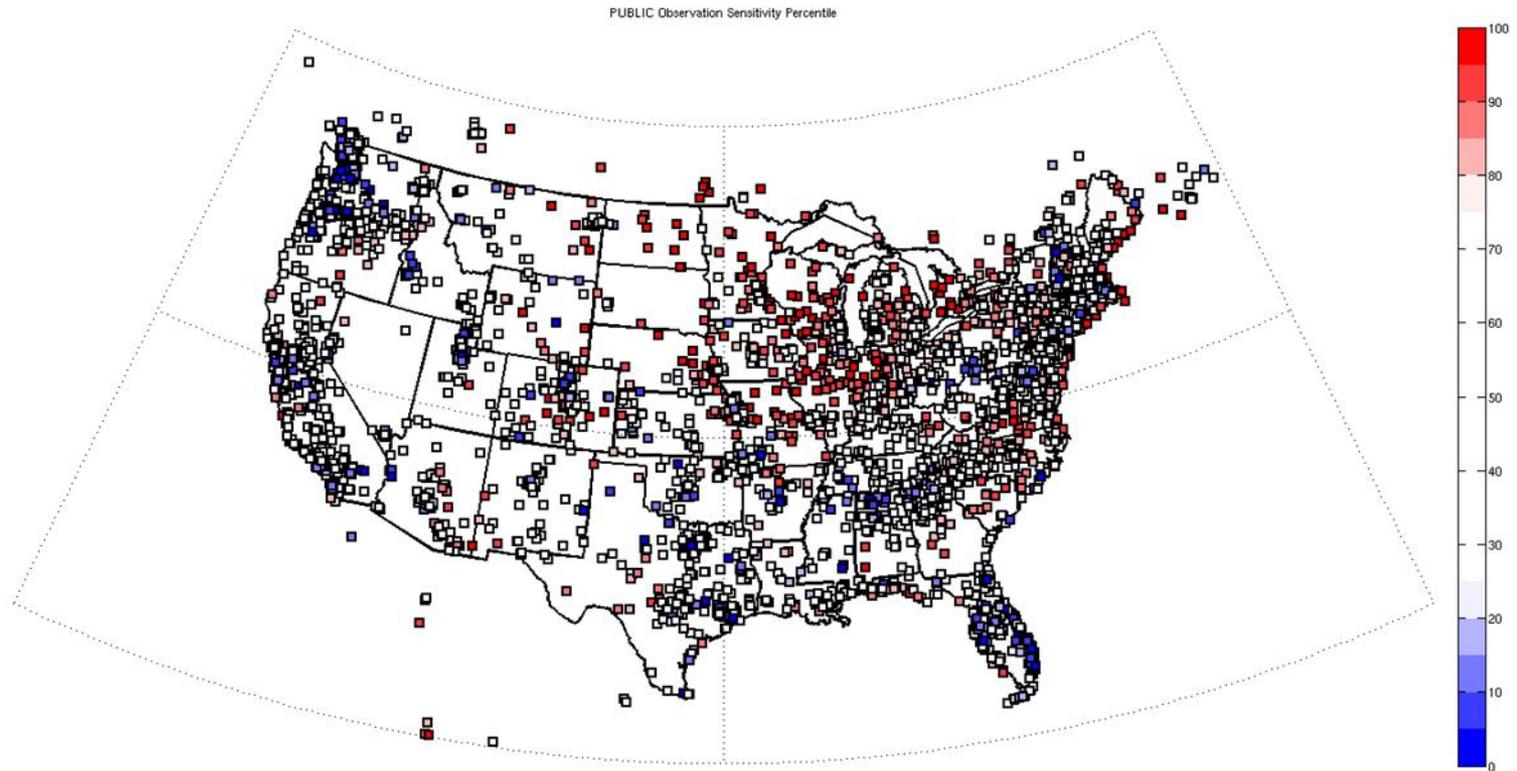
# Sensitivity of 14 UTC 27 Oct 2010 Wind Speed to: NWS Observations



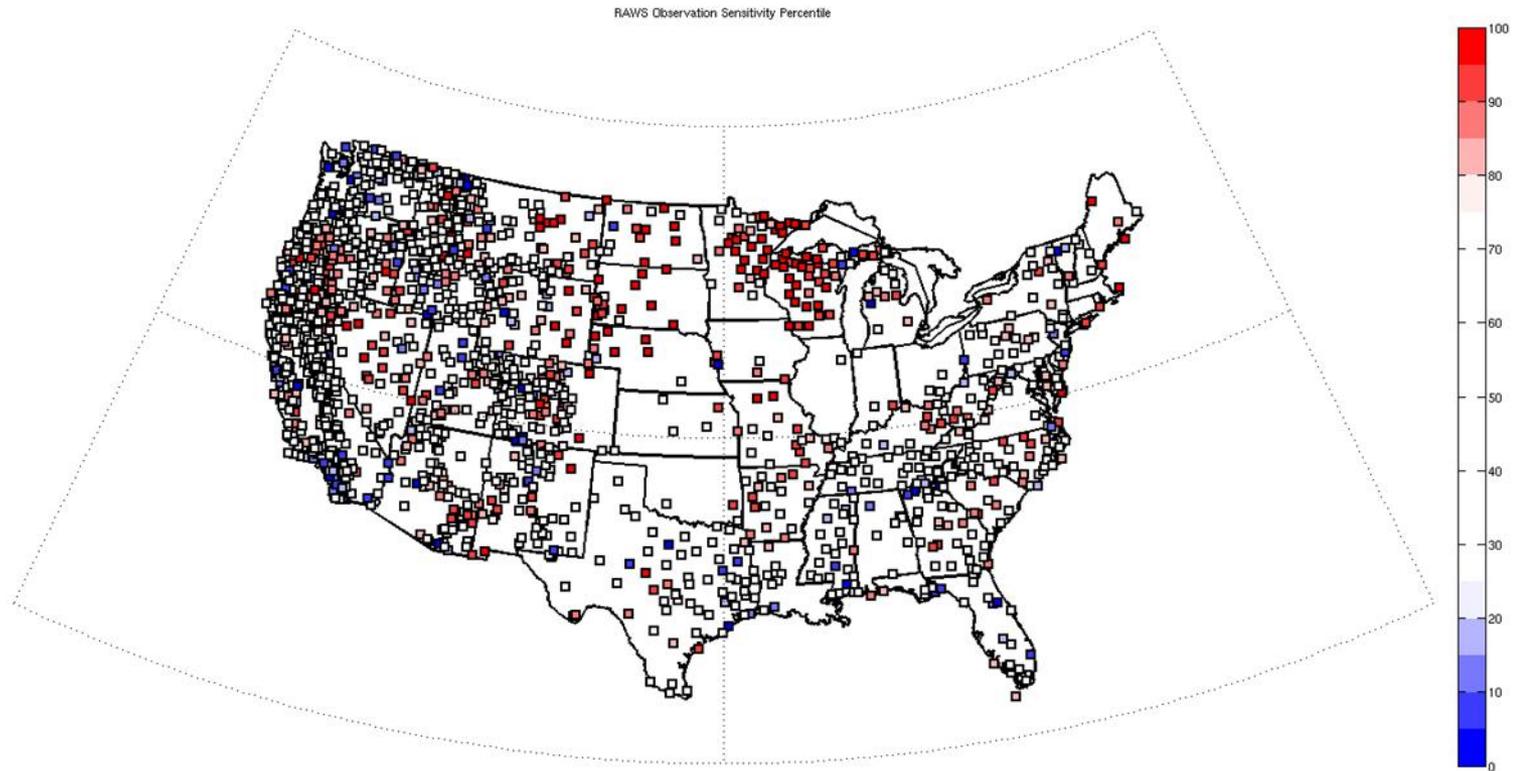
# Sensitivity of 14 UTC 27 Oct 2010 Wind Speed to: Canadian, Mexican, and Coastal Observations



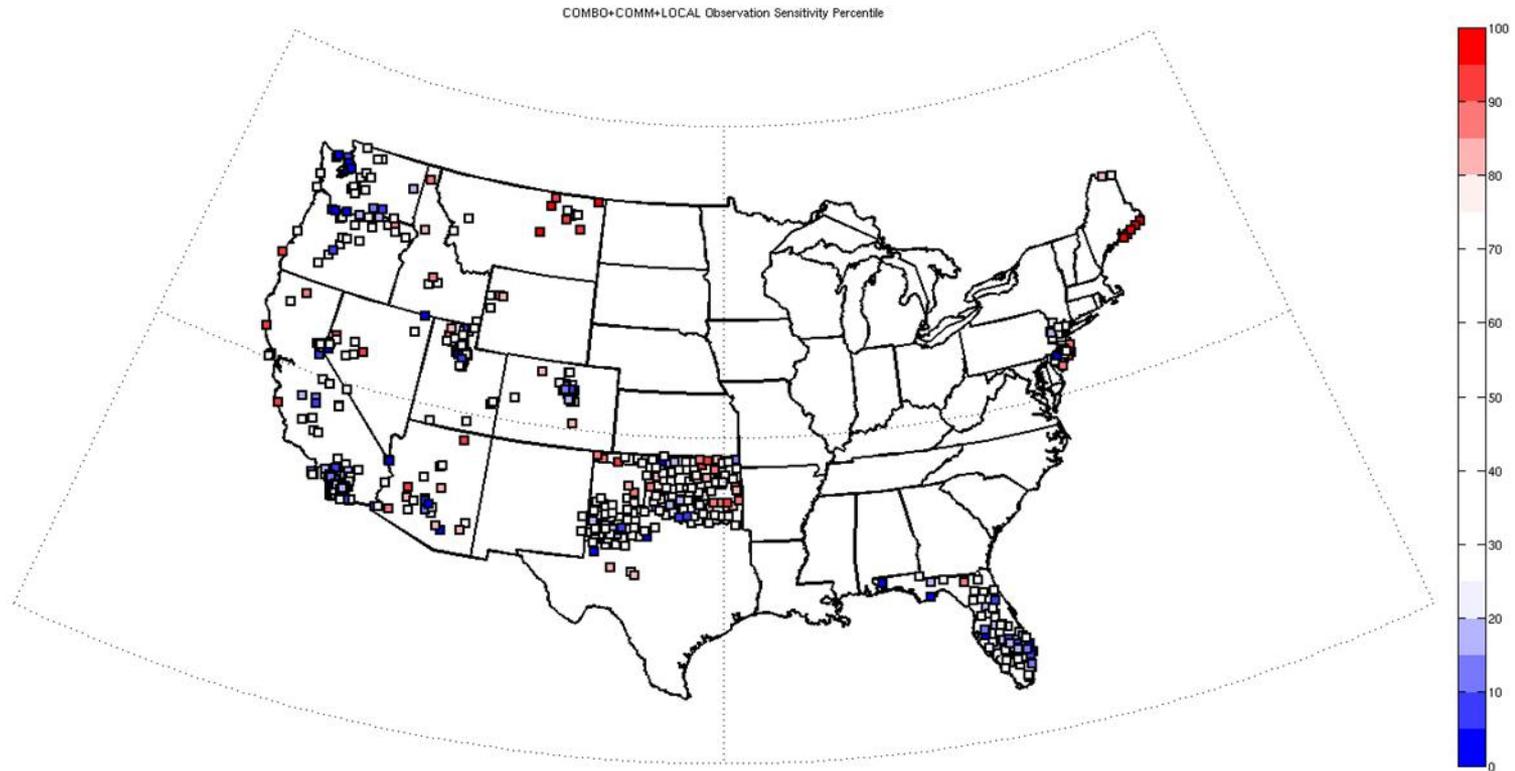
# Sensitivity of 14 UTC 27 Oct 2010 Wind Speed to: Public Observations



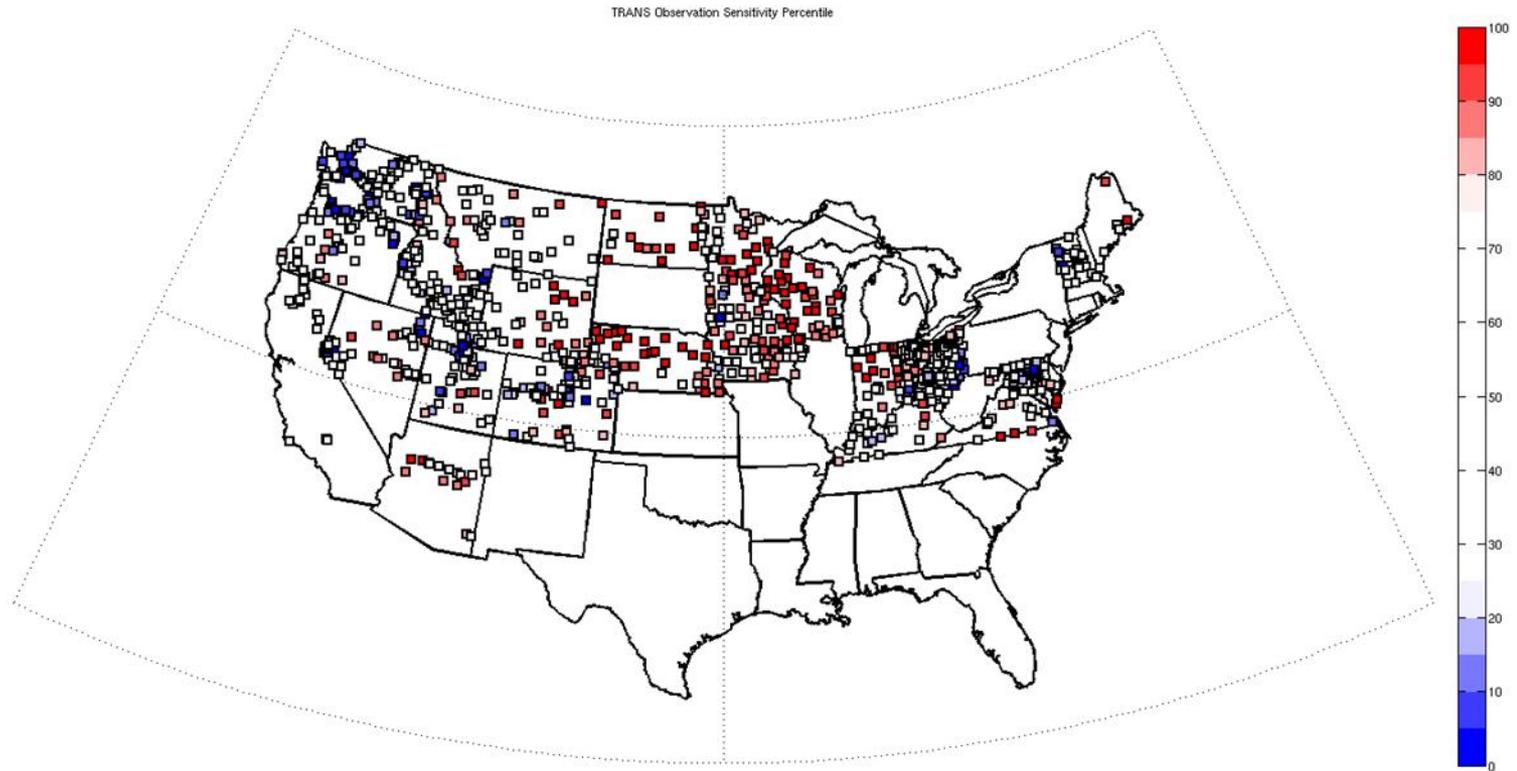
# Sensitivity of 14 UTC 27 Oct 2010 Wind Speed to: RAWS Observations



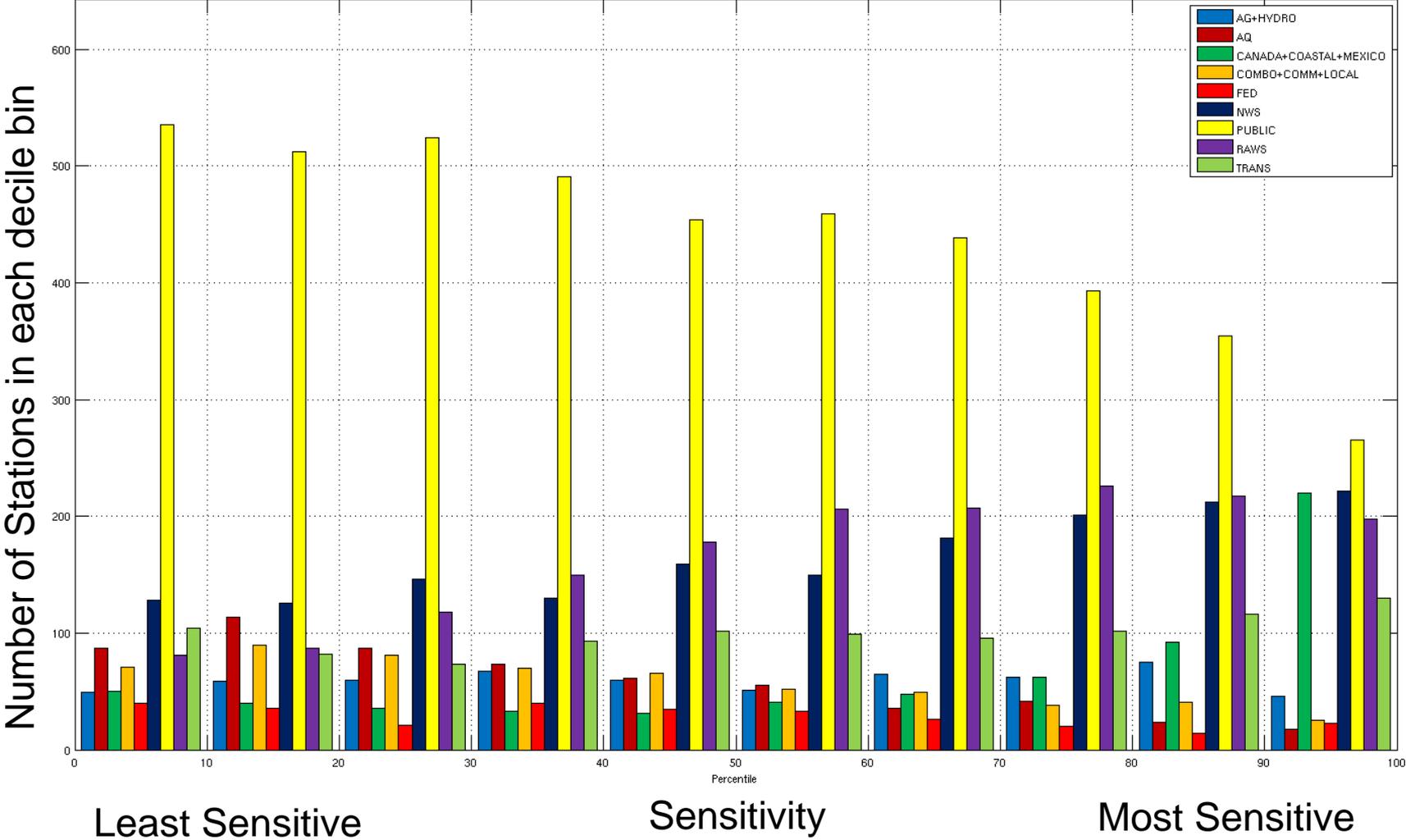
# Sensitivity of 14 UTC 27 Oct 2010 Wind Speed to: Local, Regional, and Commercial Networks



# Sensitivity of 14 UTC 27 Oct 2010 Wind Speed to: Transportation Observations



# Summary of Sensitivity of 14 UTC 27 Oct CONUS Wind Speed Analysis to Network Type



# Summary

- CSTAR program has led to:
  - extensive training of existing and future NWS employees
  - transfer to operations of basic and applied research from universities to national centers and field offices
- MesoWest is successful example of R&D of high relevance to the NWS
  - transfer to operations of some aspects of UU/MesoWest effort remain ill-defined
- UU analysis approach is highly efficient and portable
  - Can be run on linux or other operating environments with data supplied via THREDDS catalog and MesoWest database query
- Procedures in place to help assess sensitivity to network type on the basis of large samples of high-impact events
  - Results depend on appropriate choices for observational and background error
  - Critical step for design and implementation of national network of networks