

IEM Potpourri

(combine a bunch of unrelated stuff and see if it smells good at the end)

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The next 50 minutes of your life will consist of:

- The IEM and its many daily features
- Fun with ASOS data
- Assembling unique datasets
- NWS Storm Based Warning verification
- A movie, if you are lucky

<http://mesonet.agron.iastate.edu>

Ooooo, I have a website....

- ~ 100 interactive web applications of IEM Data
- 2 terabytes of “stuff”
- 70 gigabytes daily input
- 150 gigabytes daily output

Website Hits Per Day



Iowa Environmental Mesonet
Iowa State University Department of Agronomy

Iowa Mesonet Iowa CoCoRaHS Daily Erosion Project SchoolNet8.com
Plot carbon and radiation [flux time series](#)

Archive
Current
Climatology
Info
IEM Networks
GIS
Roads
Severe Weather
Web Cams

ASOS
AWOS
NWS COOP
DCP
ISU AG
NSTL Flux
RWIS
SCAN
SchoolNet
Other

The Iowa Environmental Mesonet (IEM) collects environmental data from cooperating members with observing networks. The data are stored and made available on this website.

Daily IEM Feature: RSS

Lack of 80+
Posted: 09 Sep 2009 06:01 AM
[Permalink](#) | [Past Features](#) | [Tags](#)

Just about any way you slice it, the summer of 2009 has been exceptionally cool. The featured graphic tallies the number of days between 1 May and 9 Sep that had a high temperature below 80 degrees. With unofficial data, the total for 2009 dwarfs the next highest value and nearly doubles the average value. The next two highest years and lowest two years are shown for comparison. Cedar Rapids has a chance to hit 80 today!

May 1 - Sep 9 Days Below 80°F
Based on Cedar Rapids data 1893-2009

2009 *	95
1982	73
1902	72
Average	49
1991	27
1988	26

* 2009 Data Preliminary (period is 130 days)

Marion Corn Field, IA Webcam:

(MNE) Marion Field Cam 8:10:07 AM - 09 Sep 2009

• [View other webcams](#)

Most Popular Links:

- [Iowa Mesonet Plot \[Loop\]](#)
- [Current NEXRAD \[Loop\]](#)
- [IEM Freeze](#)
- [IEM GIS Rainfall](#)
- [Sortable Currents](#)
- [Parkersburg EF5 Info](#)

News & Notes: RSS

[August AWOS data uploaded](#)
Posted: 08 Sep 01:01 PM

[March COOP data uploaded](#)
Posted: 24 Aug 09:36 AM

[July ASOS data uploaded](#)
Posted: 10 Aug 09:29 PM

[July AWOS data uploaded](#)
Posted: 06 Aug 12:39 PM

[Server outage](#)

Rate Feature: [Good](#) (8 votes) or [Bad](#) (3 votes)

Tags: [summer09](#)

Previous Years' Features

2008: Before the first 32	2005: Direct Hit
2003: It's coming	2002: One more day...

IEM Data Networks:

ASOS + AWOS	Airport stations reporting atmospheric.
DCP	River gauges.
IaDOT RWIS	Weather and roadway pavement data.
ISU AgClimate	Ag, soil, & weather data.
NRCS SCAN	Current soil and weather data.
USDA-ARS-NSTL Flux	Various heat and CO2 fluxes
NWS COOP	Climate observations

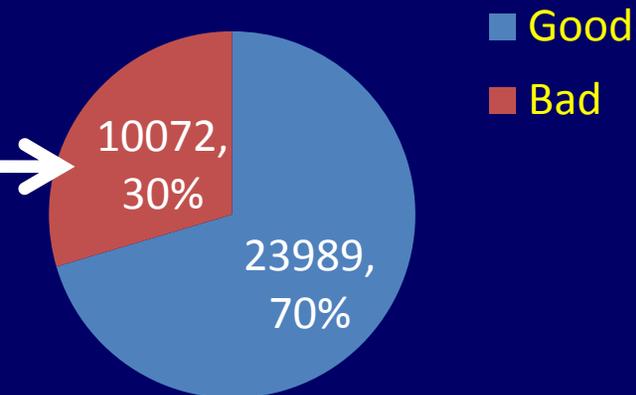
IEM Daily Feature

- Daily “blog” post of something hopefully interesting
- Generated 1905 of these since 2002
- Users can rate the feature as “good” or “bad”

Most bad votes come from this guy...



Summary of Feature Voting

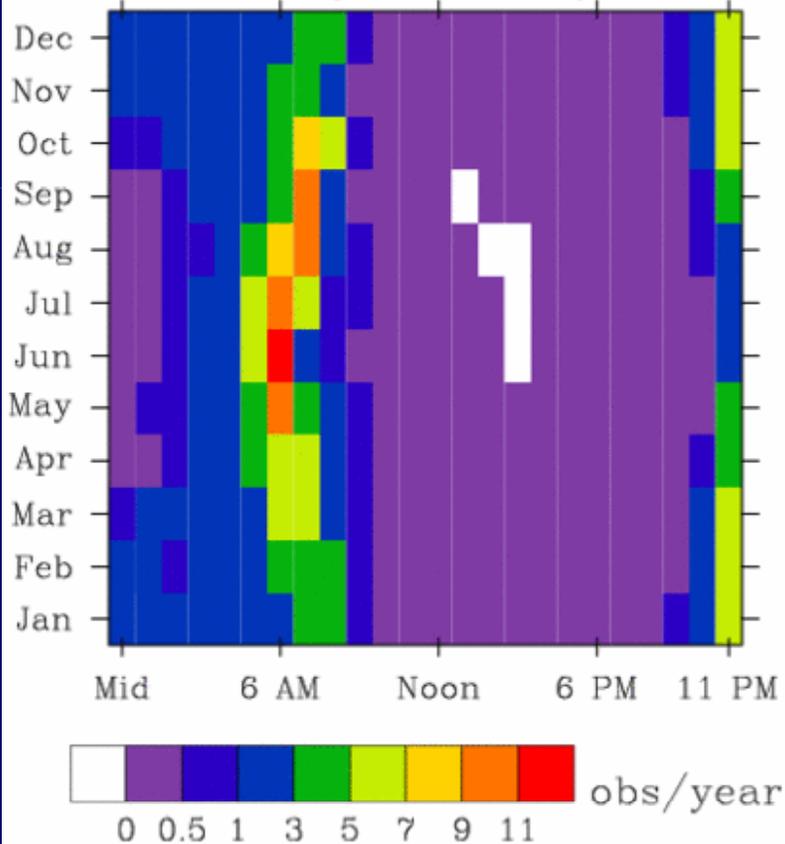


Show Something Interesting

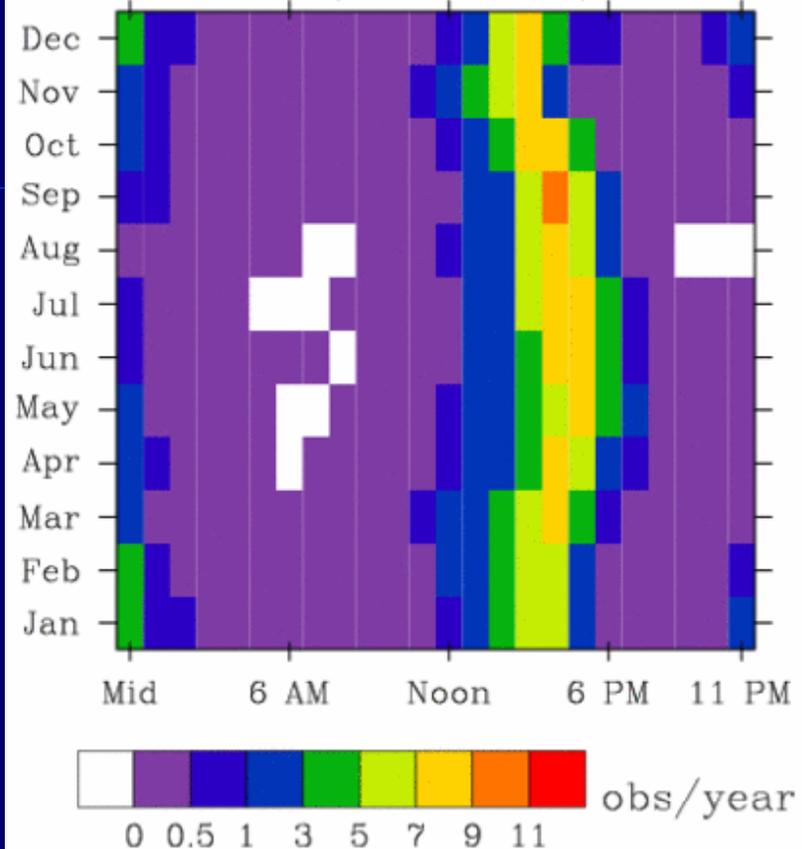


Climate Features

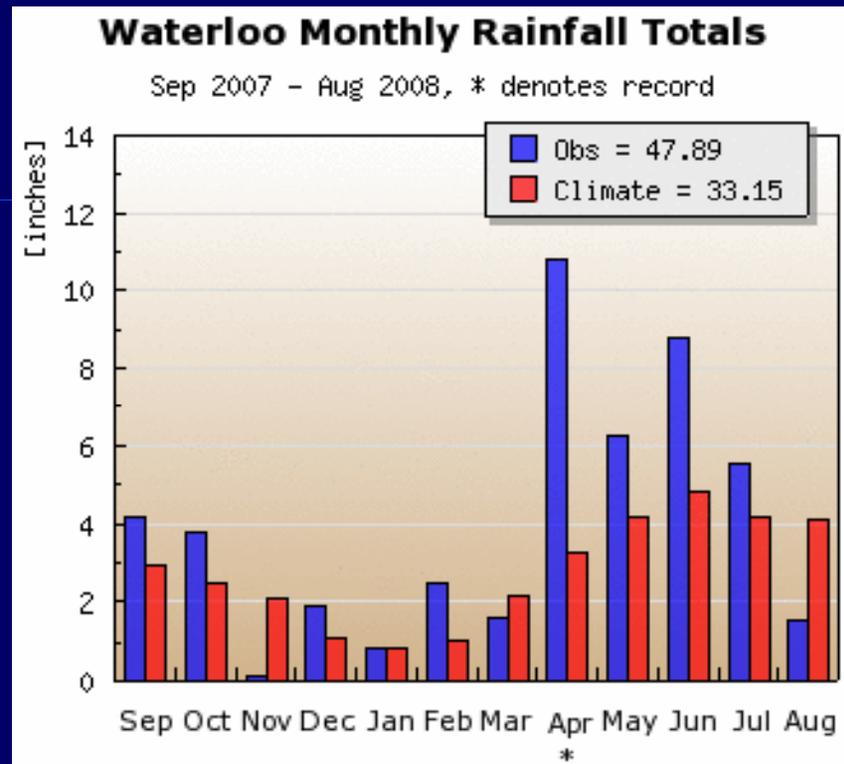
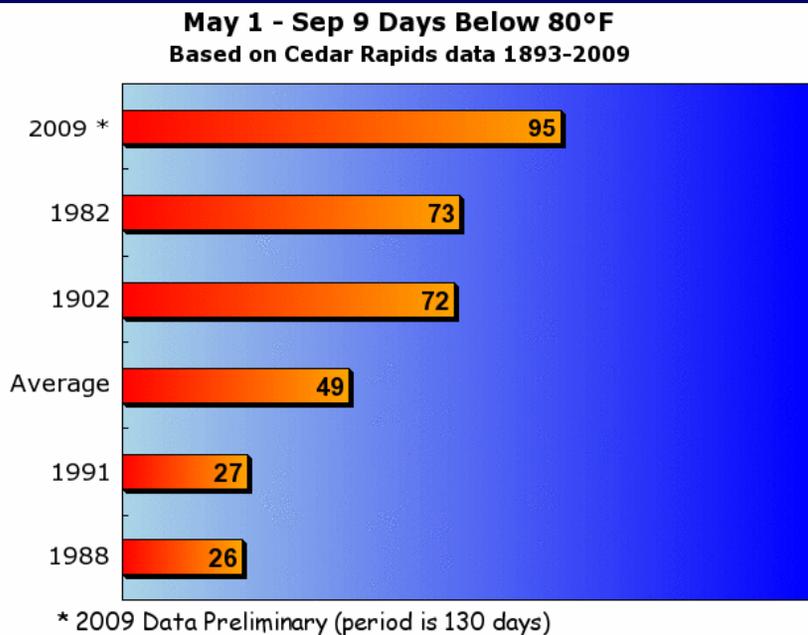
When does the Low Temp Occur?
Des Moines (1973–2008)



When does the High Temp Occur?
Des Moines (1973–2008)



Comparison Features



Fun with ASOS Temperatures

- ASOS weather stations are the high end sensors at larger airports
- We've all seen the hourly METARs

```
KDSM 091354Z 00000KT 10SM CLR 20/14 A3014  
RMK AO2 SLP202 T02000144
```

- What units and precision are the temperatures reported in? What are they actually internally recorded in?

KDSM 091354Z 00000KT 10SM CLR 20/14 A3014
RMK AO2 SLP202 T02000144

- The “T-group” implies a precision of 0.1°C
- Running a script against a database of observations yields these distinct values:
22.8 22.2 21.7 21.1 20.6 20.0 19.4
18.9 18.3 17.8 17.2 16.7 16.1
- What is 14°C in °F -> 57.2
- What is 14.4°C in °F -> 57.9
- The ASOS guide also notes the sensor accuracy at 0.9°F on air temp

Distinct Celsius Values reported in "T-group"	Converted To Fahrenheit	Which is actually in F
22.8	73.04	73
22.2	71.96	72
21.7	71.06	71
21.1	69.98	70
20.6	69.08	69
20.0	68	68
19.4	66.92	67
18.9	66.02	66
18.3	64.94	65
17.8	64.04	64

“These 5-minute averages are rounded to the nearest degree Fahrenheit, converted to the nearest 0.1 degree Celsius, and reported...”

– ASOS Users Guide 1998

The T-group is necessary to make sure the Fahrenheit conversion works.

Thought Experiment: What was the “average temperature” on 26 Jul 2009 for Cedar Rapids?

Hourly Obs: 60, 60, 59, 58, 59, 58, 58, 62, 66, 70, 73, 75,
75, 77, 79, 76, 79, 78, 75, 72, 68, 66, 65, 63

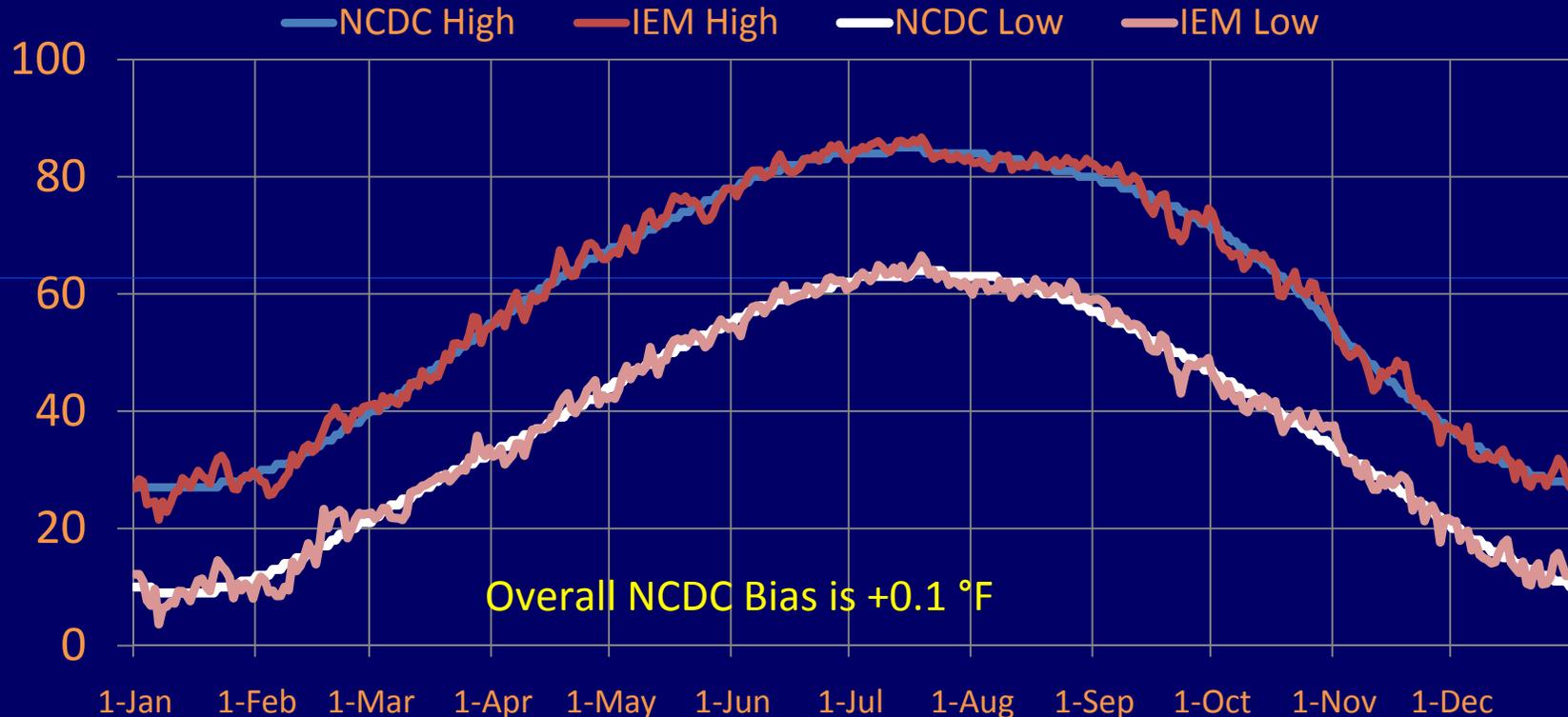
- Sum of the obs was 1631, so which is right?
 - $1631 / 24 = 67$
 - $1631.0 / 24.0 = 67.96$
- Or what about mean of high and low?
 - $(79 + 56) / 2 = 67$
 - $(79.0 + 56.0) / 2.0 = 67.5$
- Or using the 1 minute interval data?
 - $97781 / 1440 = 67$
 - $97781.0 / 1440.0 = 67.9$
- Who remembers the “Significant Figures” rules? What a buzz-kill....

One Minute Interval Archives

- ASOS (At the larger airports) [2000-]
 - Provided once monthly by NCDC
- AWOS (Smaller airports, non Federal) [1995-]
 - Provided once monthly by the Iowa DOT
- SchoolNets [2002-]
 - Collected in real time
 - 6 second interval data available as well

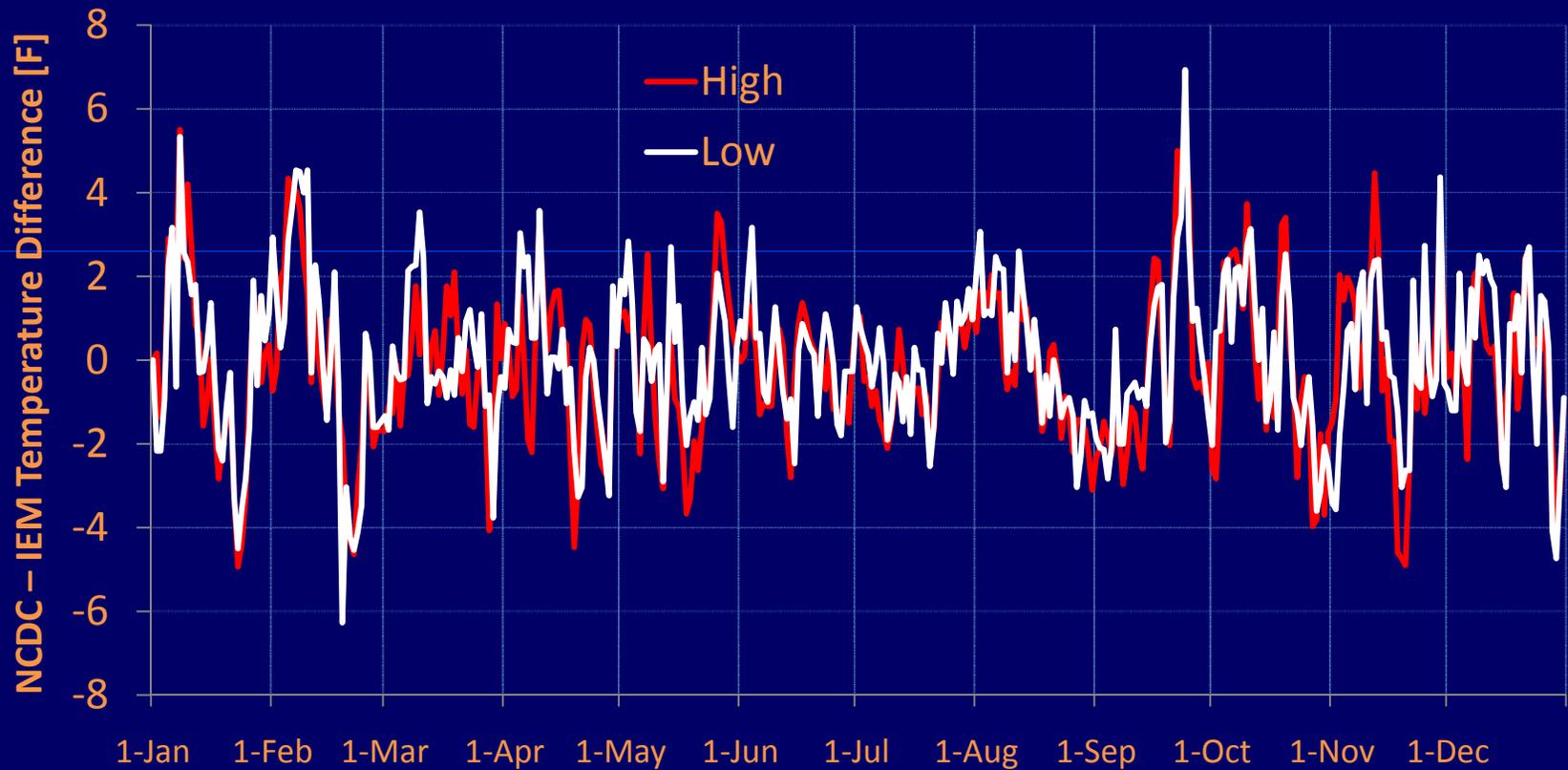
What about the daily “normals”?

IEM Daily Computed versus NCDC Interpolated 1971-2000 Ames

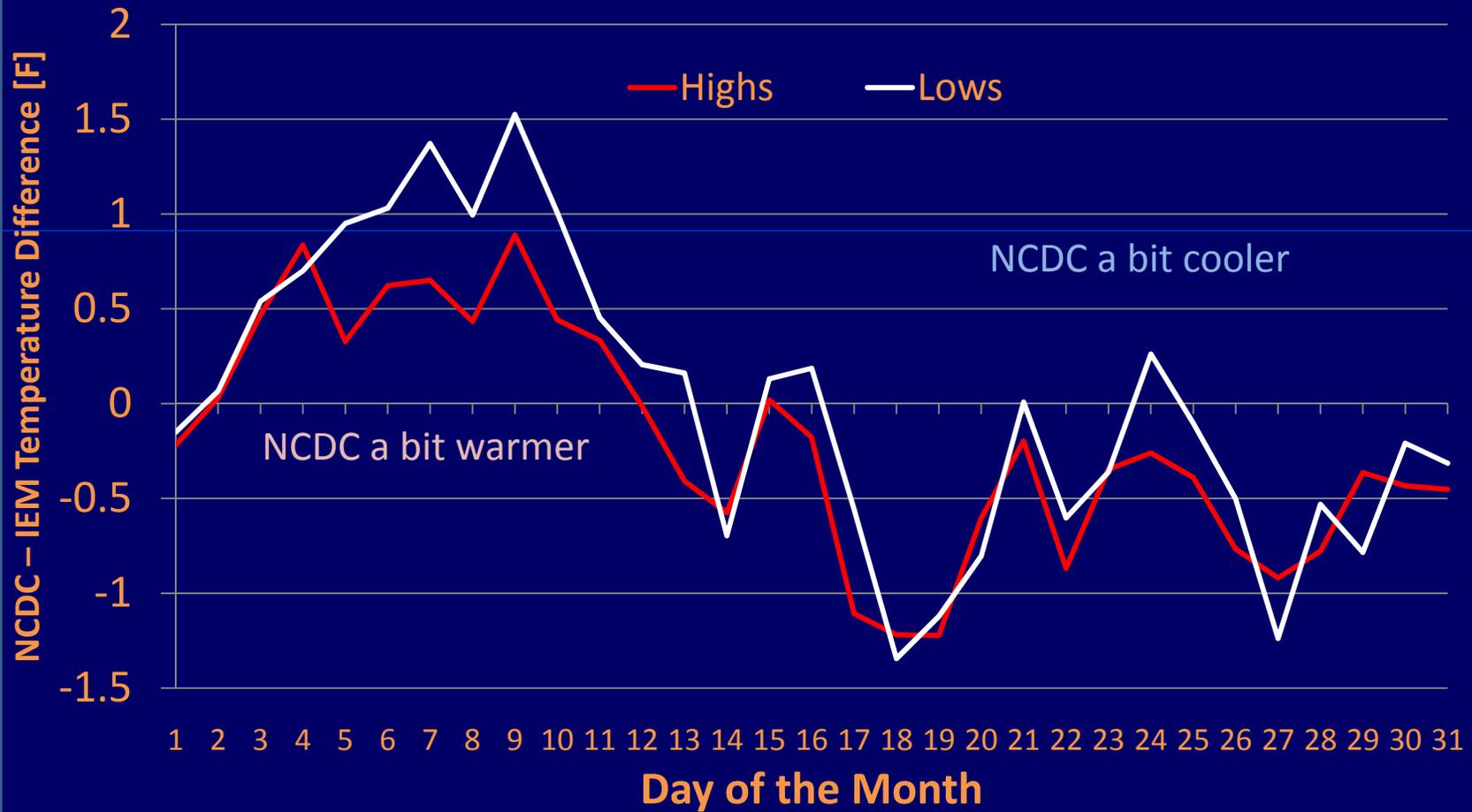


NCDC – “The daily normals are derived by statistically fitting smooth curves through monthly values; daily data were **not** used to compute daily normals.”

Daily NCDC Departure



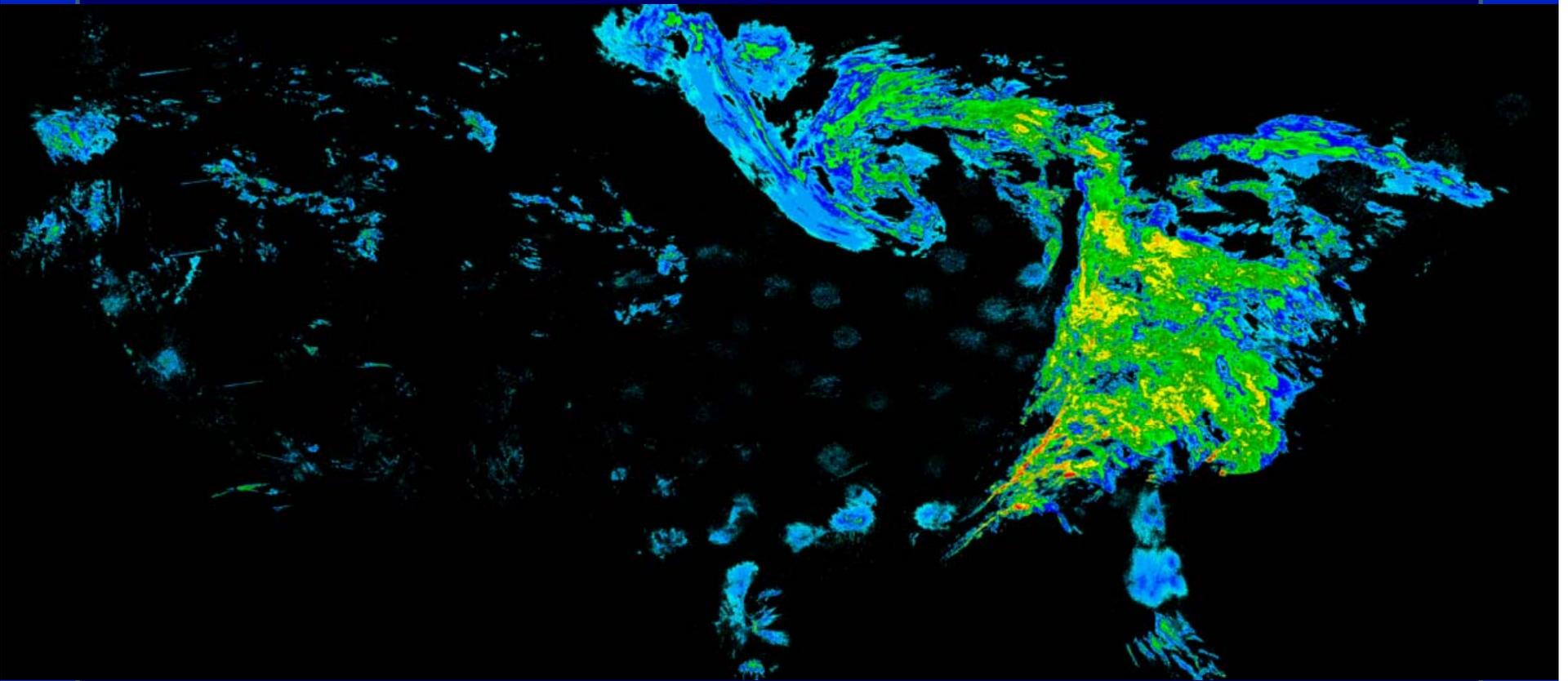
NCDC Mean Bias per Day of Month



Authorities on the Subject

- **NCDC's July Report**
 - For the contiguous United States the average temperature of 73.5°F was 0.8°F below the 20th century average...
- **Iowa's State Climatologist / IEM News Item for March**
 - The statewide average temperature was 36.7 °F or 0.7 °F above normal.
- **Wikipedia**
 - People who are not experts in metrology or statistics can overestimate the usefulness of significant figures. The topic receives much more emphasis in high-school and undergraduate chemistry texts than it does in real-world research laboratories.
- **Mark Twain: "There are three kinds of lies: lies, damned lies, and statistics."**
- **Moral: While it is debatable if ASOS can sense a 0.7 °F change, it certainly **can not report it.****

1995-Present NEXRAD Composites



1 March 2007 7:35 PM

Processing Steps

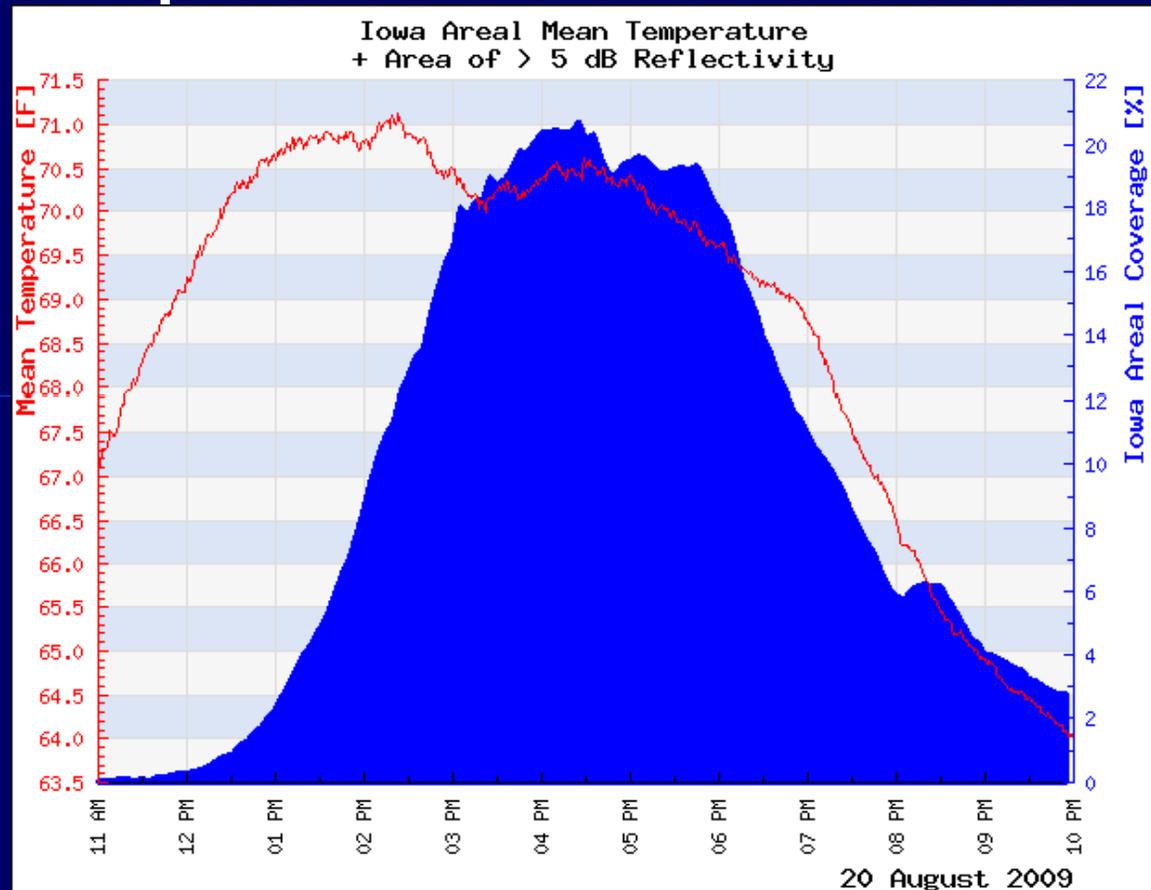
- Combine base reflectivity of individual WSR-88Ds onto a common grid (0.01° Lat/Lon)
- Compare this product against a gridded analysis of RUC surface temperatures (stop clutter suppression in the winter)
- Where above freezing, compare against the “Net Echo Tops” composite to filter out clutter
- Convert to a number of different formats for further web and local processing

Backfilling the archive

- National Climatic Data Center kindly provided their entire NIDS archive (1.4 TB) to run my scripts against to backfill to 1995.
- Took around 6-8 months for a handful of machines to process.
- Clutter suppression was done for APR-SEP for years after 2003 (when NET product was available), no RUC temperature filter.

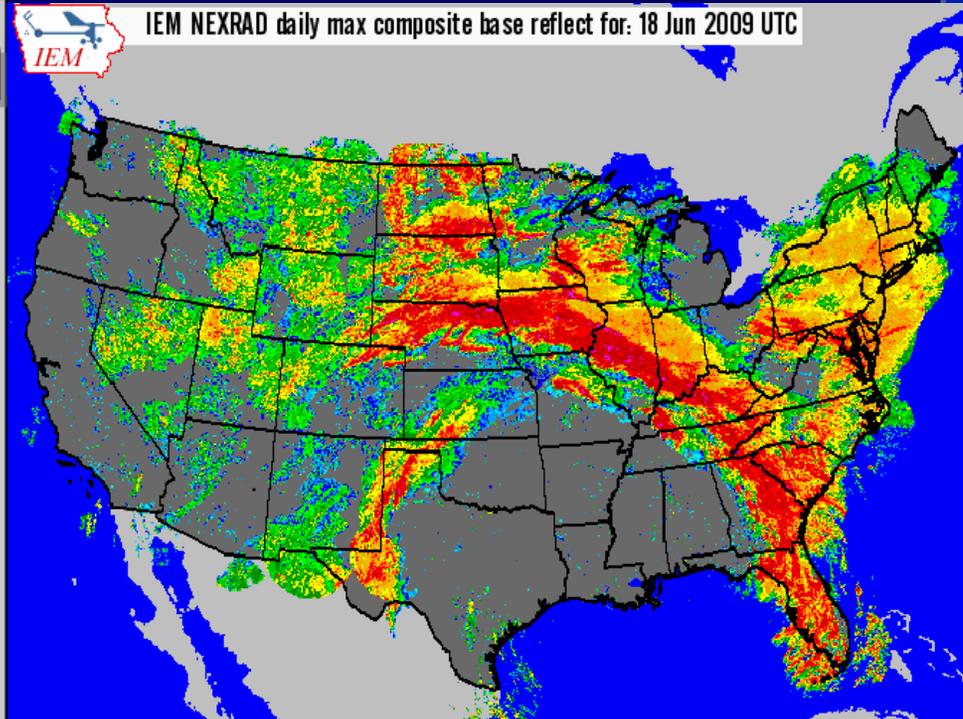
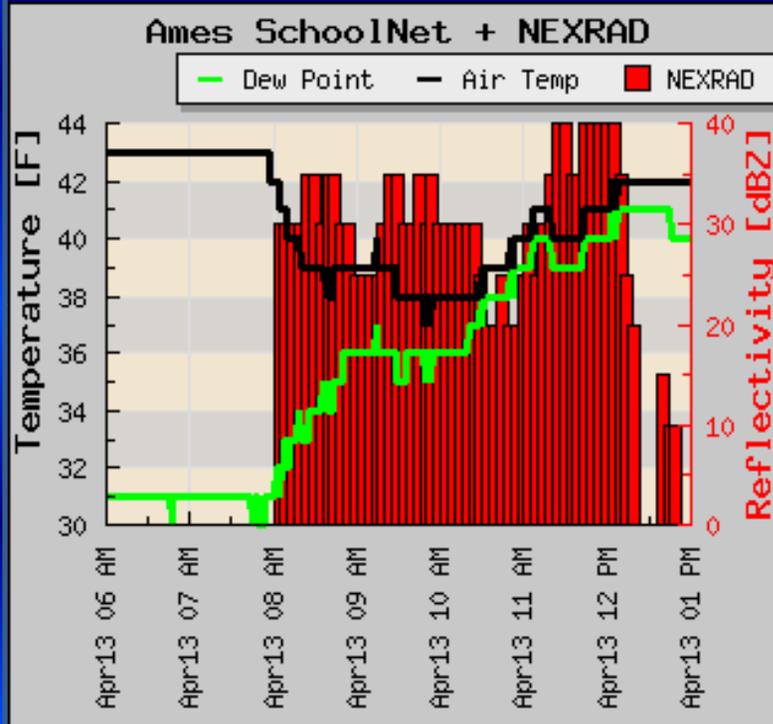
NEXRAD Composite Archive Stats

- ~ 1x1 km composite for the CONUS
- 1995 - Now
- Valid every 5 minutes
- 1.5 million images
- 500 GB total size
- Updated in real-time with a 're-analysis' done each hour.



Example analysis showing the Iowa areal coverage of NEXRAD reflectivity on a day marked by summertime afternoon showers.

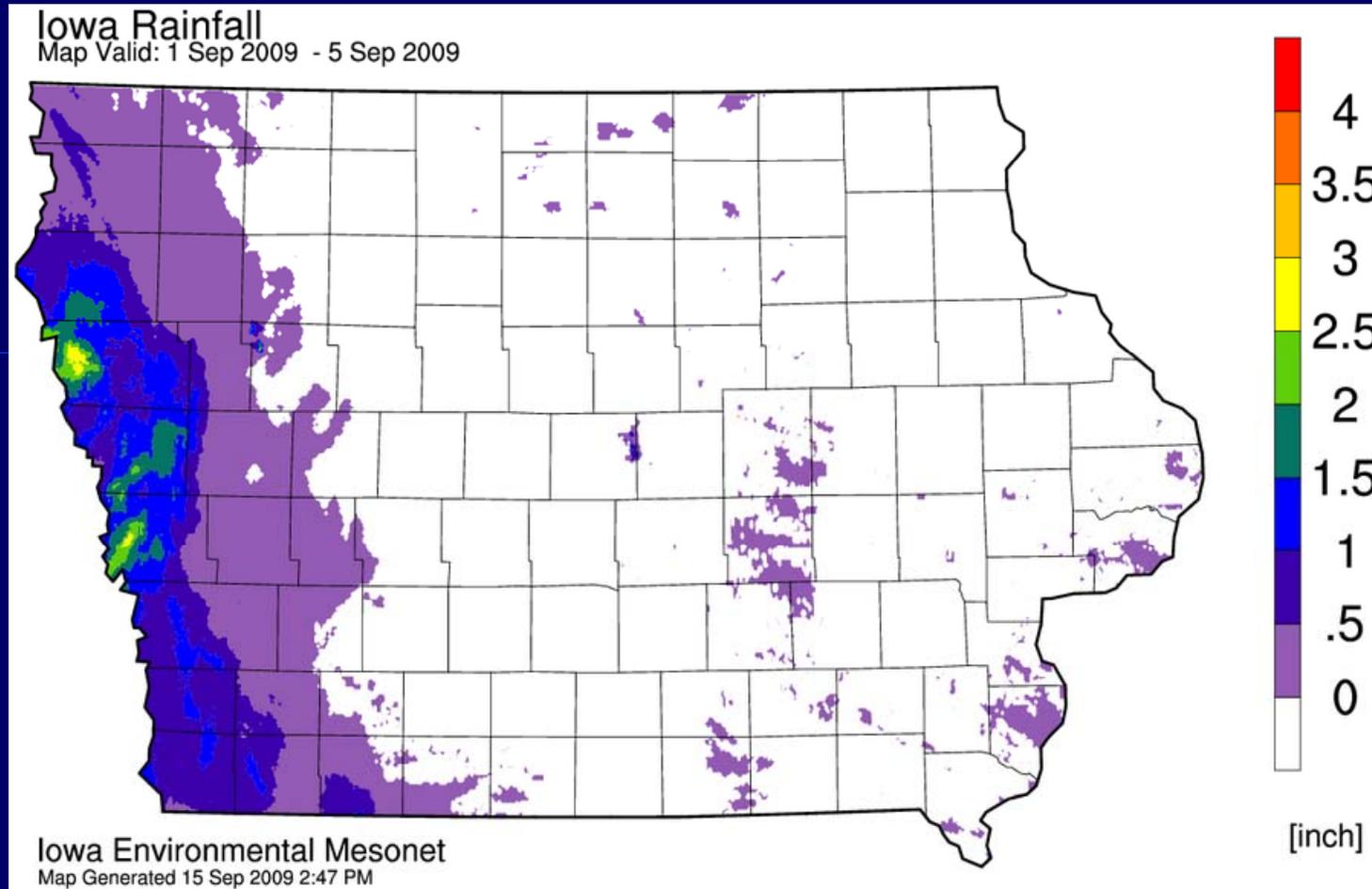
Makes a great data source for the “Daily Feature”



Combine NEXRAD with 1 minute observations to show a wet bulb illustration.

“Ring of Fire” illustrated by computing the daily maximum reflectivity.

Apply a Z-R and have fun!



Come on Darly, why don't you gauge correct this product?

Gauge Correction is not easy!

“Real time” METARs from Cedar Rapids on 27 August 2009

METAR KCID 272052Z 06017KT 1SM +RA BR BKN009 OVC036 17/17
A3000 RMK AO2 SLP158 **P0075** 60091 T01720172 55000

METAR KCID 272152Z 07010KT 1SM +RA BR BKN007 OVC036 17/17
A3000 RMK AO2 SLP157 **P0058** T01720172

“Delayed” Daily Summary Message arrives later that evening (period to 6 UTC!)

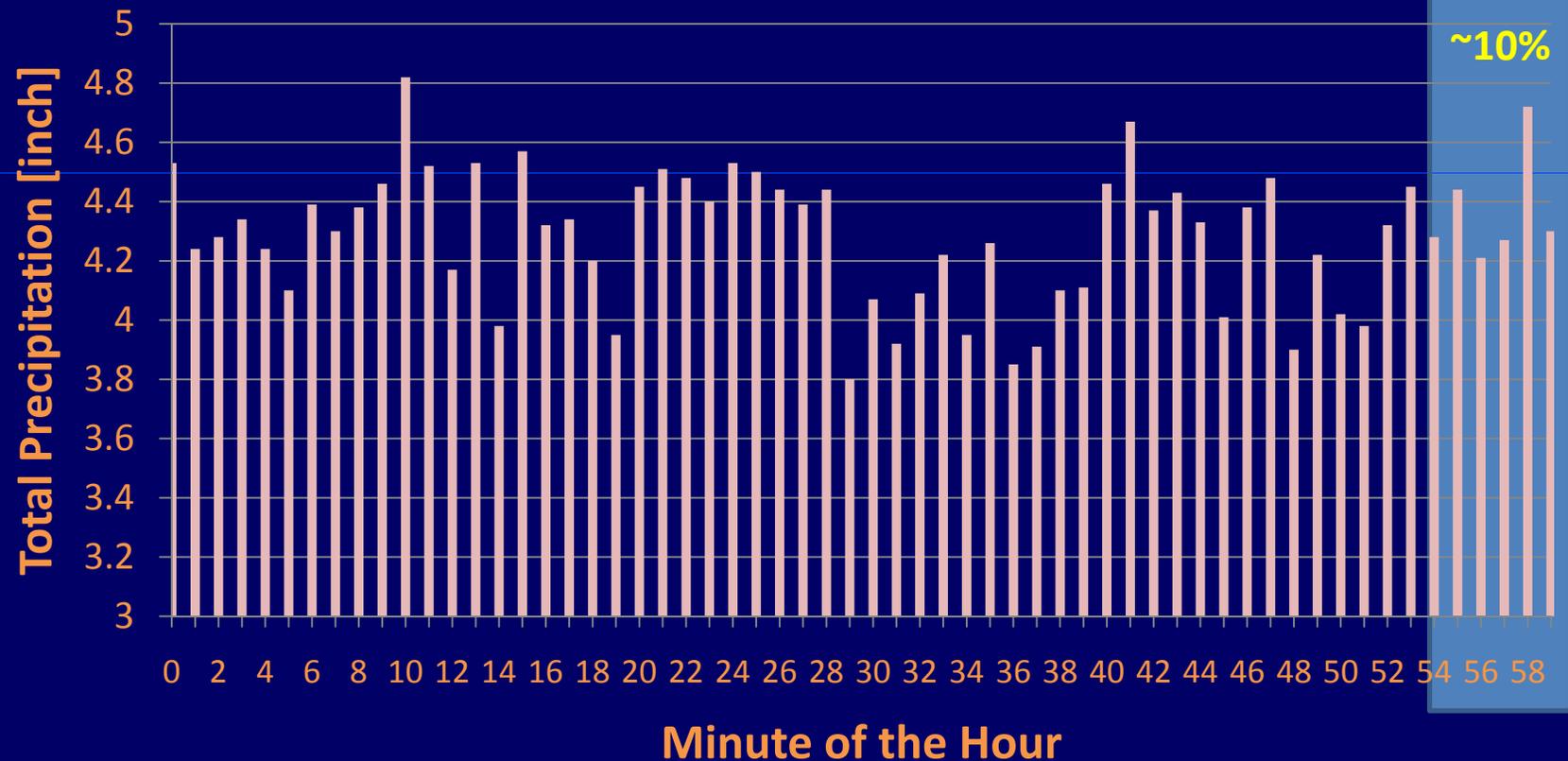
KCID DS 27/08 641527/ 602359// 64/ 60//9981724/535/45/81/33/27/03/06/
28/14/19/68/17/01/01/17/**80/60**/34/01/00/00/00/00/00/00/131/06221336/
07261507/1=

The numbers do not match as they represent different hourly windows:

METAR: :52 to :52 Daily Summary Message: :00 to :00

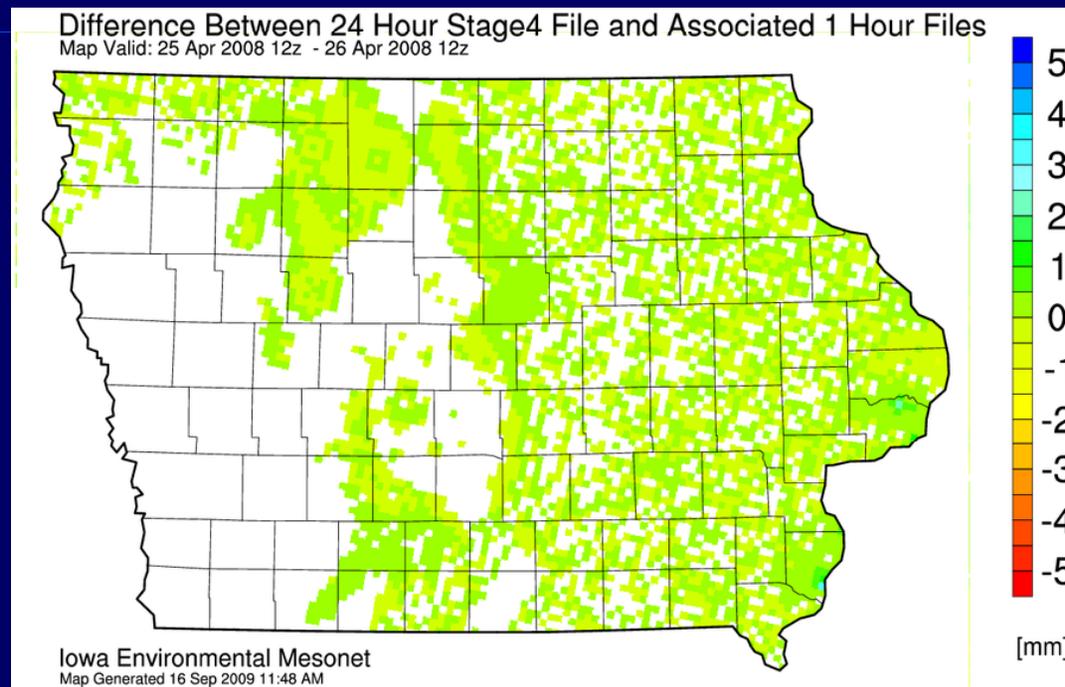
How much precipitation per minute?

2000-2008 Des Moines Minute of the Hour Precipitation Total



Why not use NCEP's stage4 precip?

- *The Stage IV 6-hourlies are not simple summations of the hourly... Some of the hourly we receive are only the automated runs (no QC), while for the 6-hourlies we almost always receive the QC'd version. - source: NCEP Stage4 FAQ*



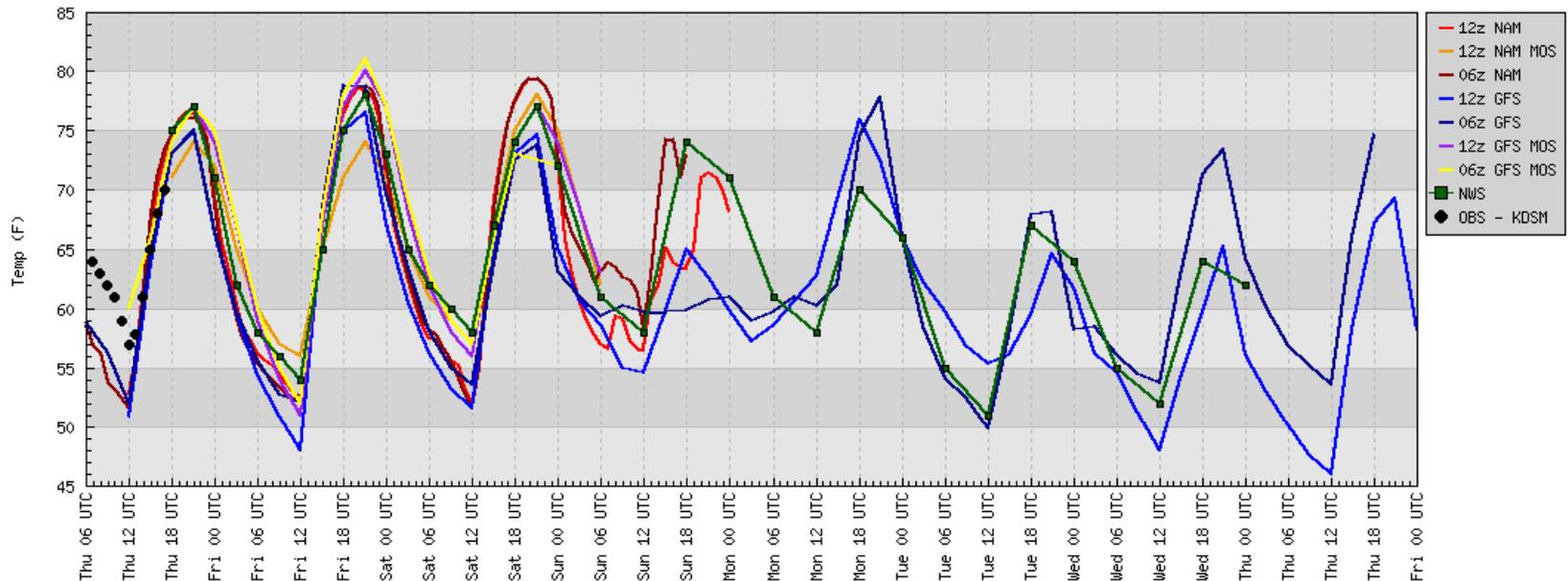
Model Output Statistics Archive

```

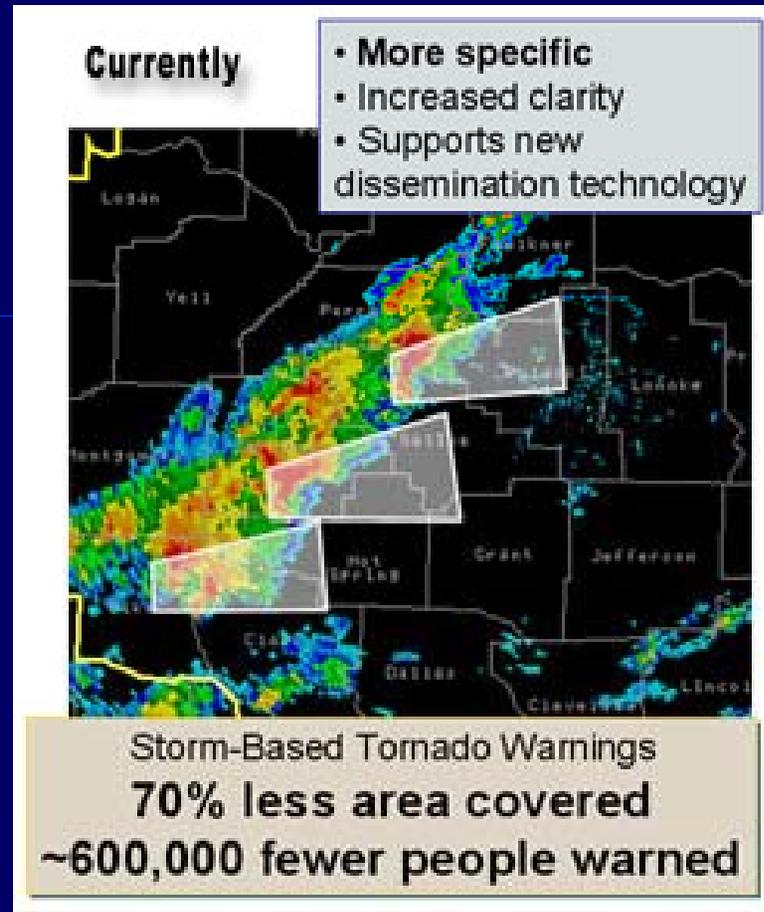
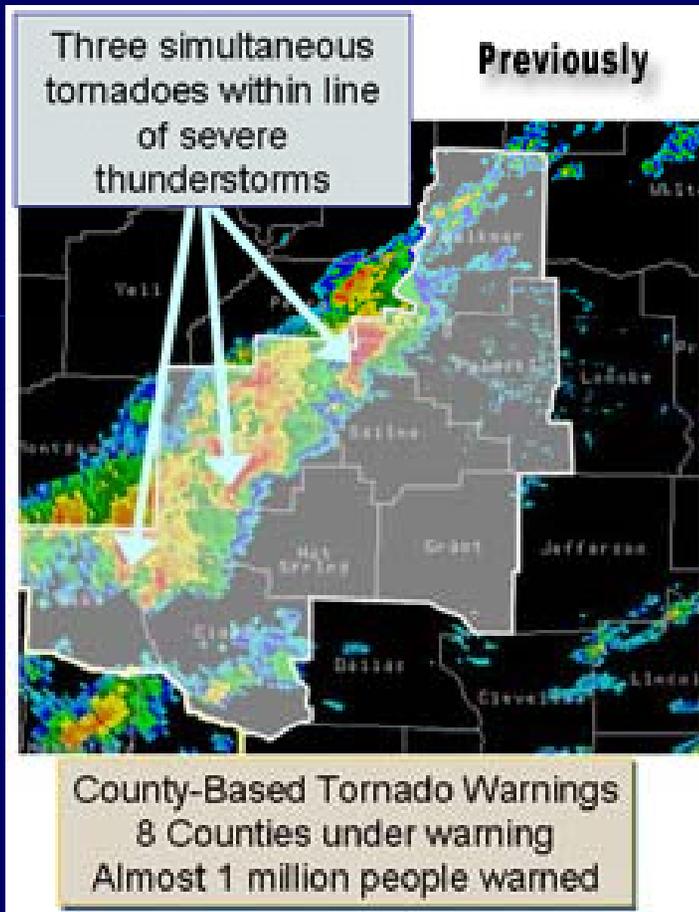
145
FOUS23 KWNO 170600
MAVNC1
KDSM   GFS MOS GUIDANCE   9/17/2009 0600 UTC
DT /SEPT 17   /SEPT 18   /SEPT 19   /
HR  12 15 18 21 00 03 06 09 12 15 18 21 00 03 06 09 12 15 18 00 06
X/N          78          51          82          56          77
TMP  60 66 74 77 75 67 60 55 52 68 78 81 77 69 63 59 57 66 73 72 63
DPT  55 55 54 54 54 54 50 49 48 55 56 55 56 56 54 53 52 55 55 56 56
CLD  FW FW FW FW CL CL CL CL CL CL CL FW CL CL CL CL CL CL CL BK OV
WDR  10 07 05 05 08 12 14 15 19 08 08 09 11 11 12 11 10 12 11 11 11
WSP  02 03 05 05 05 04 03 02 01 03 05 06 06 06 05 04 05 07 08 06 05
P06          1          1          0          3          3          2          3          3          8 11 27
P12          3          3          3          3          3          3          3          14
Q06          0          0          0          0          0          0          0          0          0 0 0
Q12          0          0          0          0          0          0          0          0
T06          0/ 0  0/ 0  0/ 0  0/ 0  0/ 0  0/ 0  1/ 0  0/ 0  0/ 0  6/ 0
T12          0/ 0  0/ 0  0/ 0  0/ 0  1/ 0  0/ 0  0/ 0  6/ 0
    
```

- Database the NAM/GFS MOS data for all locations.
- Mostly complete back to early 2007

KDSM - Hourly Temperature Forecast



NWS Storm Based Warning Verification



Images from: <http://www.weather.gov/sbwarnings/>

Components of a NWS Warning

UGC (County/Zones Impacted) P-VTEC String Storm Based warning Polygon

210

WFUS53 KDMX 252145

TORDMX

IAC023-075-252230-

/O.NEW.KDMX.TO.W.0013.080525T2146Z-080525T2230Z/

BULLETIN - EAS ACTIVATION REQUESTED

TORNADO WARNING

NATIONAL WEATHER SERVICE DES MOINES IA

446 PM CDT SUN MAY 25 2008

THE NATIONAL WEATHER SERVICE IN DES MOINES HAS
ISSUED A

* TORNADO WARNING FOR...
NORTHERN GRUNDY COUNTY IN CENTRAL IOWA...
SOUTHEASTERN BUTLER COUNTY IN NORTH CENTRAL
IOWA...

* UNTIL 530 PM CDT.

* AT 441 PM CDT...NATIONAL WEATHER SERVICE DOPPLER
RADAR INDICATED A
SEVERE THUNDERSTORM CAPABLE OF PRODUCING A TORNADO
7 MILES
SOUTHWEST OF APLINGTON...OR 33 MILES WEST OF
WATERLOO...MOVING
NORTHEAST AT 36 MPH.

* THE TORNADO WILL BE NEAR...
APLINGTON BY 455 PM CDT...
PARKERSBURG BY 500 PM CDT...
ALLISON BY 510 PM CDT...
SHELL ROCK AND CLARKSVILLE BY 520 PM
CDT...

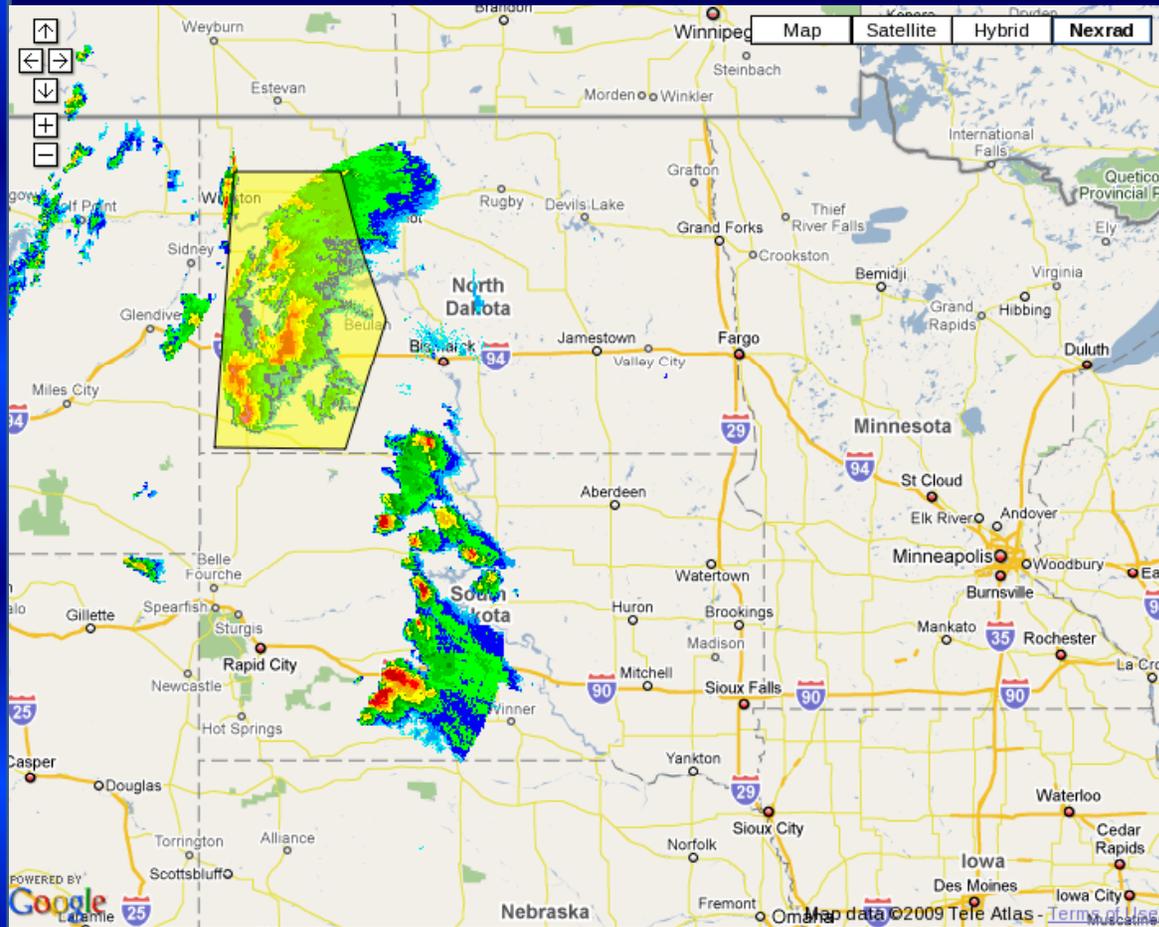
THIS IS A HAZARDOUS SITUATION. SEEK
SHELTER IN A BASEMENT...OR IN AN
INTERIOR ROOM. STAY AWAY FROM WINDOWS.
IF YOU ARE OUTSIDE OR IN A
CAR...SEEK SHELTER IN A REINFORCED
BUILDING.

A TORNADO WATCH REMAINS IN EFFECT UNTIL
900 PM CDT SUNDAY EVENING FOR
NORTHWESTERN IOWA.

LAT...LON 4249 9256 4247 9302 4267 9303
4287 9256

TIME...MOT...LOC 2146Z 238DEG 31KT 4256
9295

Polygon Size FAIL



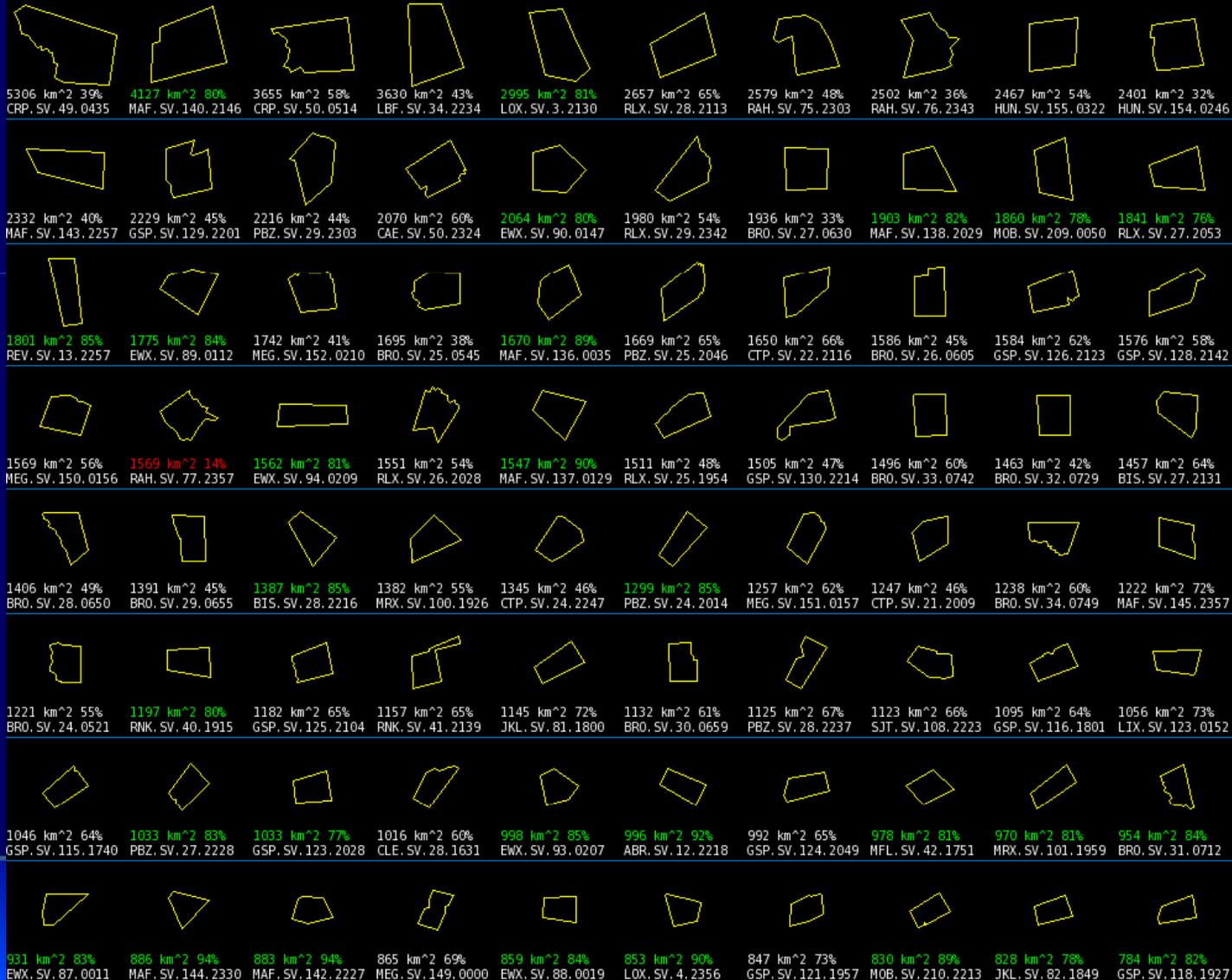
- ~40,000 sq km Severe Thunderstorm Warning issued in July 2009
- Covering portions of 16 counties

Polygon Shape FAIL



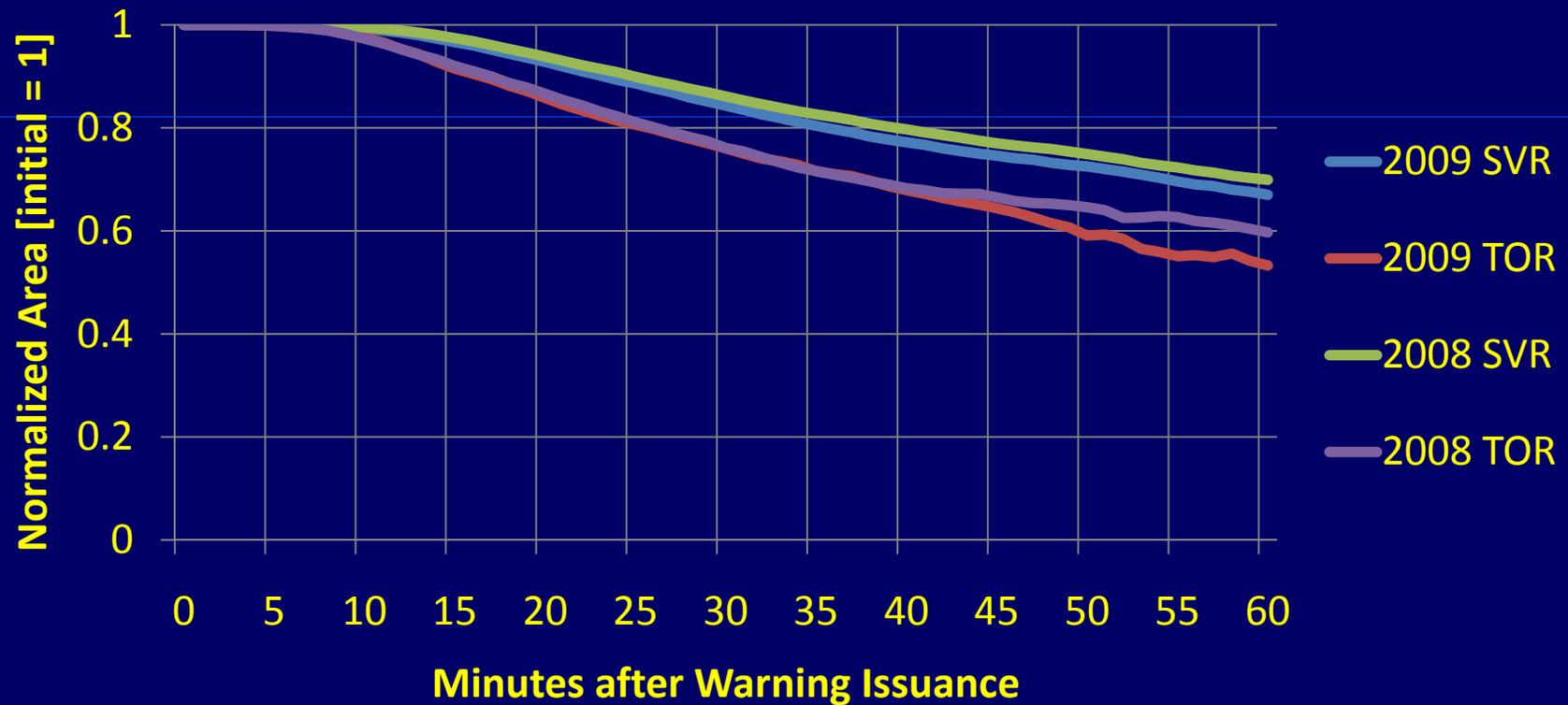
IEM Summary of NWS Storm Based Warnings issued 28 May 2009 UTC
 Generated: 29 May 2009 00:12:02 UTC

122 SVR: Avg Size 1227 km² CAR: 77%
 4 TOR: Avg Size 365 km² CAR: 87%



Polygon Time FAIL

Storm Based Warning
Normalized Size Change with SVS update
[all 2008, 2009 thru 13 Aug]



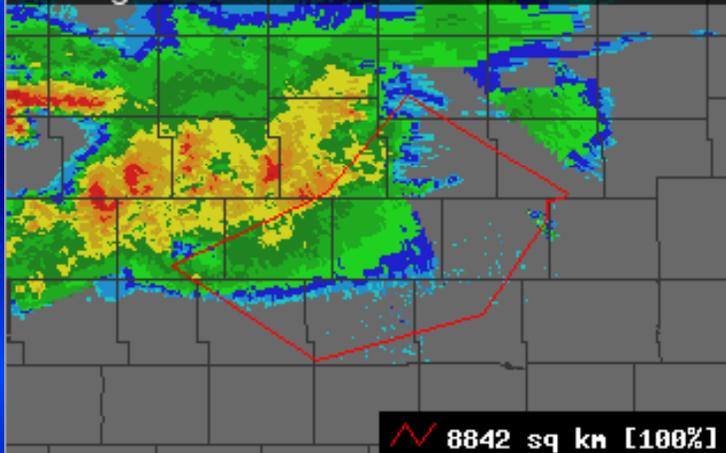


Storm Based Warning History

DMX Severe Thunderstorm Warning #160 till 03 August 2009 2:15 AM CDT

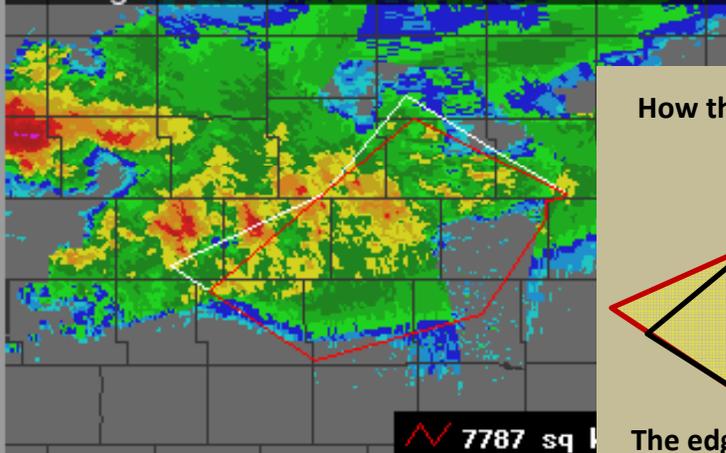
issues

03 Aug 2009 1:23 AM CDT



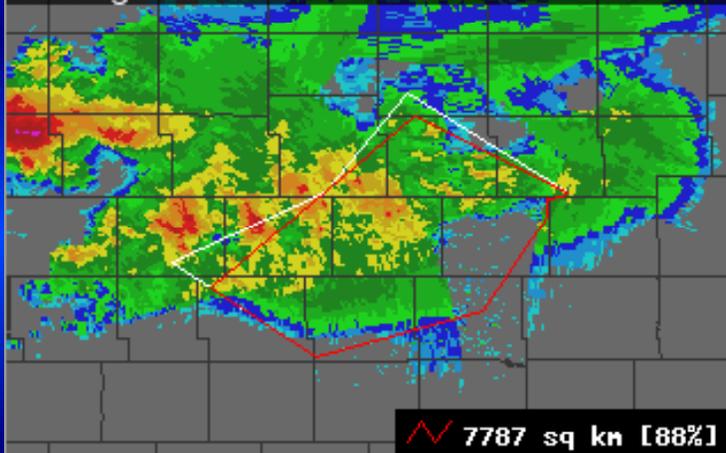
Cancels

03 Aug 2009 1:49 AM CDT



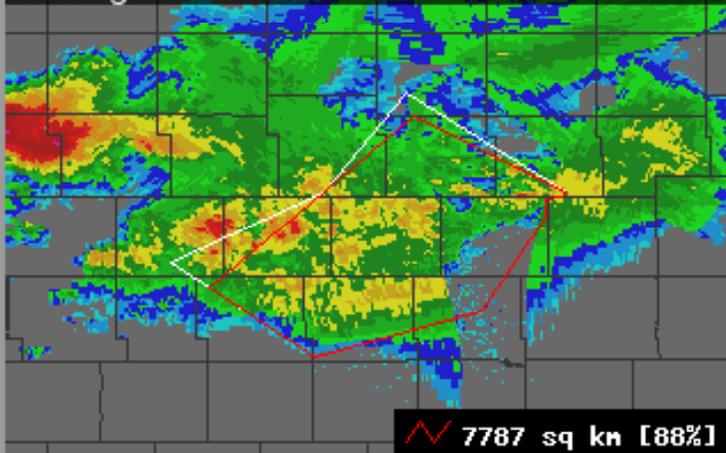
continues

03 Aug 2009 1:49 AM CDT

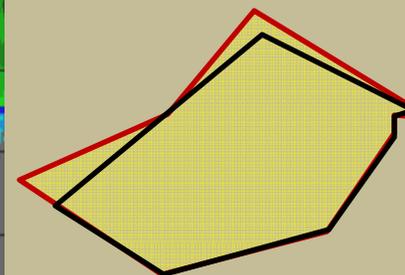


Cancels

03 Aug 2009 1:58 AM CDT



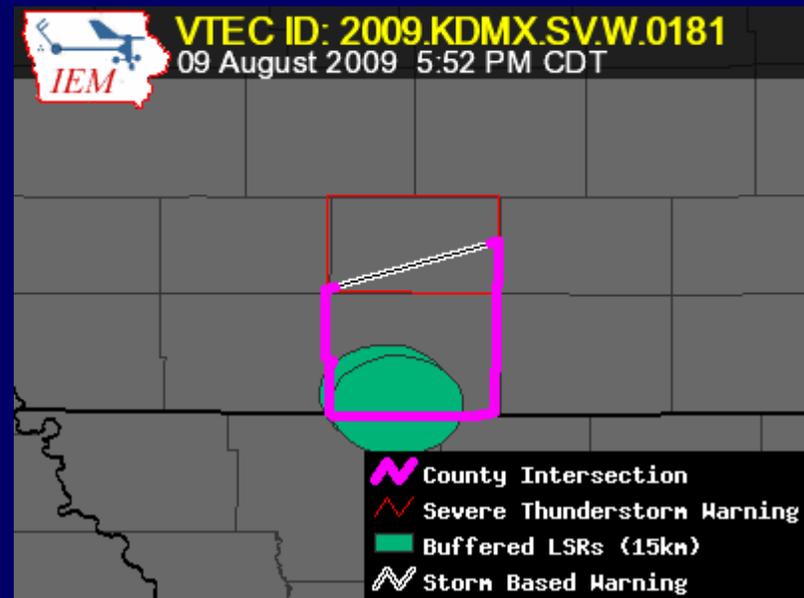
How the Polygon Changed



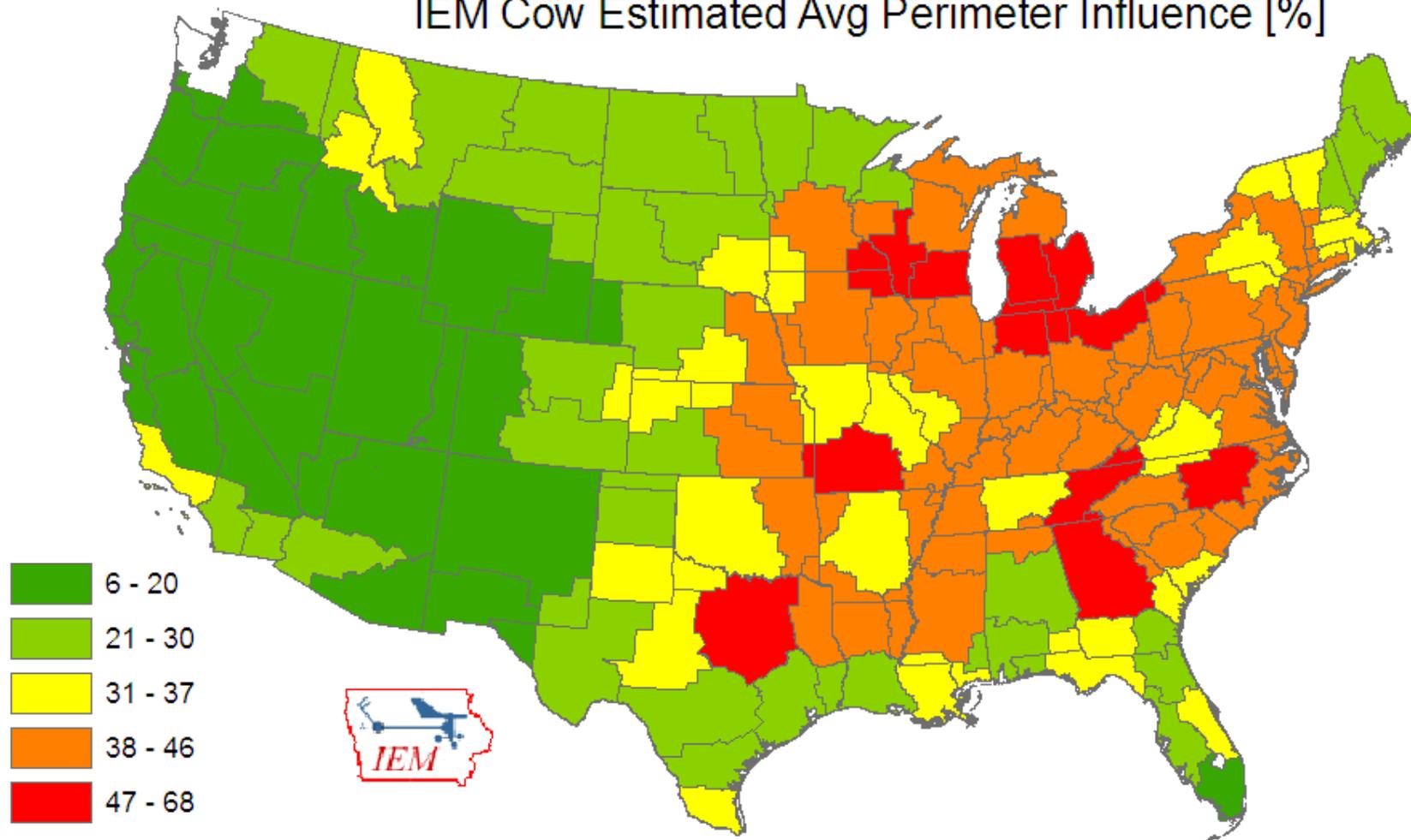
The edges were clipped to remove Carroll and Wright County from the warning.

Introduce some metrics “IEM Cow”

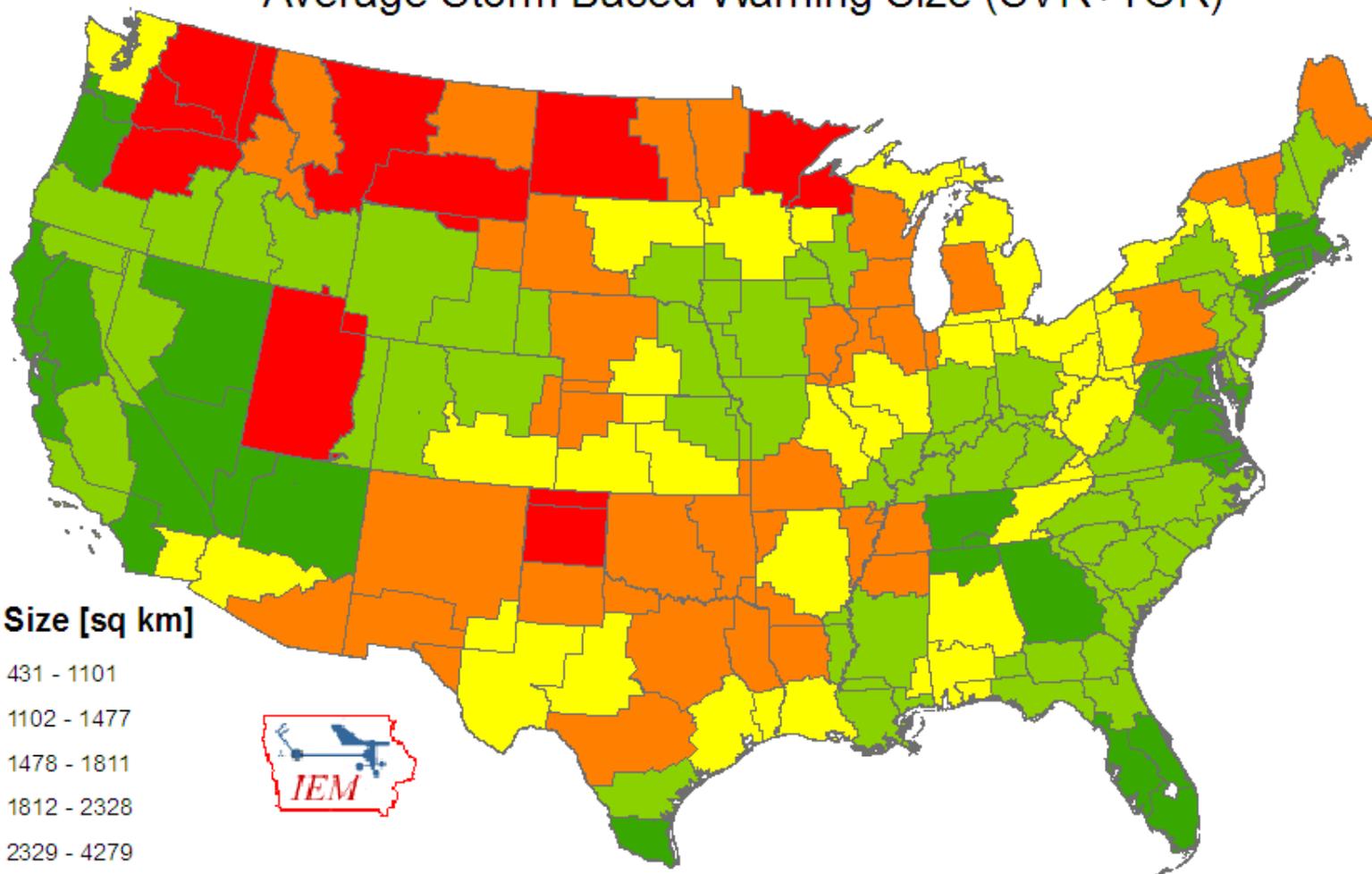
- Perimeter Ratio
 - The coincident SBW border with county border
- Size Reduction
 - The decreased amount of warned area
- Area Verified
 - Storm reports are buffered and then composited. The composite area is compared to the SBW size.



1 Oct 2007 - 22 Jul 2009
IEM Cow Estimated Avg Perimeter Influence [%]



1 Oct 2007 - 22 Jul 2009
Average Storm Based Warning Size (SVR+TOR)



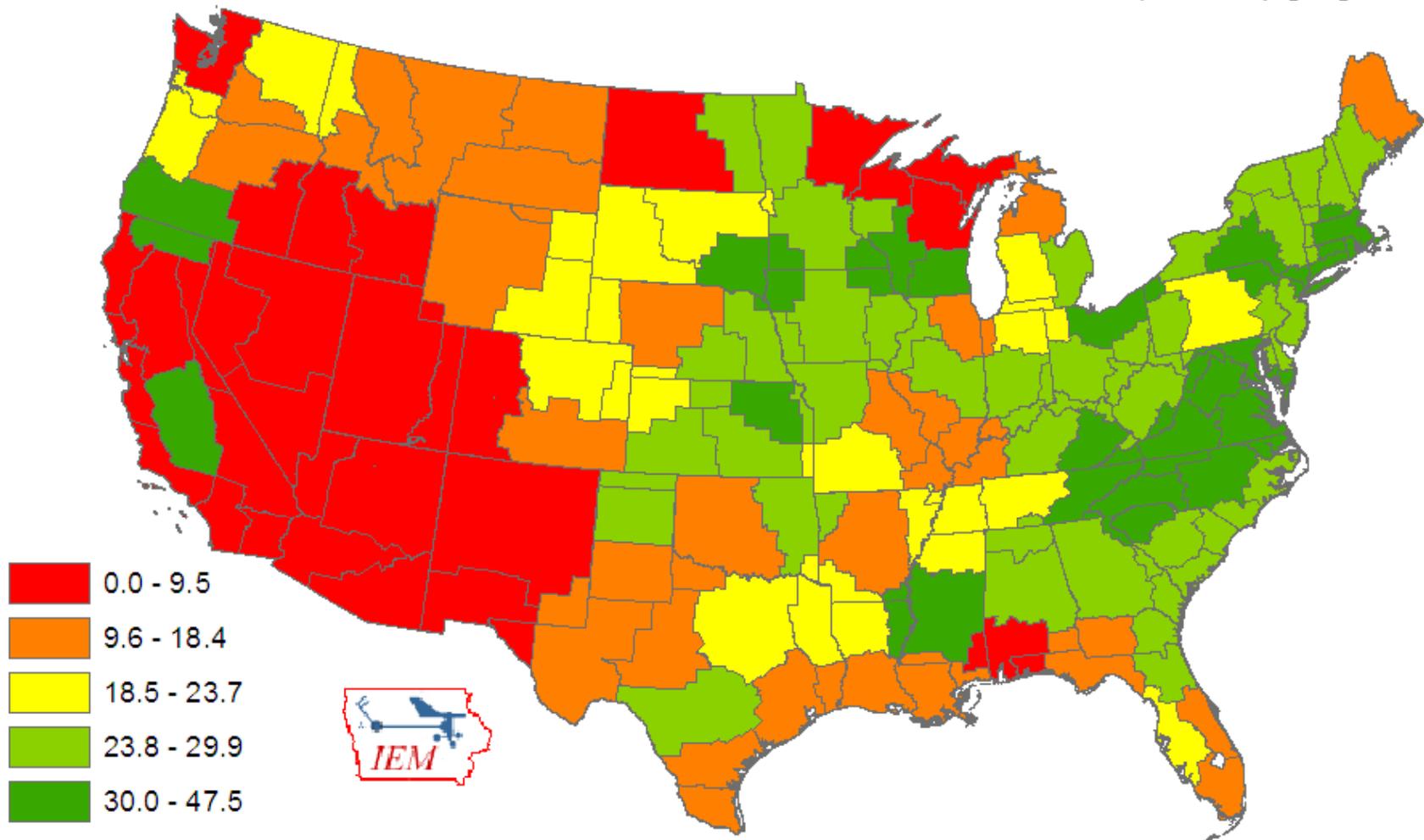
Average Size [sq km]

- 431 - 1101
- 1102 - 1477
- 1478 - 1811
- 1812 - 2328
- 2329 - 4279



1 Apr 2008 - 10 Aug 2009

IEM Cow Estimated SVR+TOR Areal Verification (15 km) [%]



Storm Based Warning Summary Stats

	*2007 TOR+SVR	2008 TOR+SVR	2009 TOR+SVR
Total Warnings	22399	31262	22908
Polygon Size versus County Based	72%	72%	73%
Areal Verification (15km buffer)	23%	23%	23%
Perimeter Ratio	35%	33%	32%
Average Size	1229 sq km	1615 sq km	1650 sq km
Critical Success Index [CSI]	0.39	0.44	0.44
Probability of Detection [POD]	0.70	0.80	0.80
False Alarm Ratio [FAR]	0.54	0.50	0.51

* Unofficial data computed by the IEM, 2009 data thru 21 Sep

* 2007 Data prior to 1 Oct 2007 using issued polygons, when Storm Based Warnings started

Enough Complaining, Solutions?

1. Remove UGC requirement in warnings. This would free the warnings to resemble actual storm tracks.
2. Generating software should limit the number of vertices of polygon to prevent confusing shapes. (Maybe 6, currently around 20)
3. Remove odd policies preventing TOR/SVR warnings from being issued over marine zones.
4. Allow offices to issue warnings for areas outside of their CWA. Completely eliminate political boundaries from warnings.

Data Archives Summary

- SPC Convective Watches [1997-]
- NEXRAD Composite Reflectivity [1995 -]
- 1 minute interval obs
 - ASOS [2000-]
 - AWOS [1995-]
 - SchoolNet [2002-]
- Raw MOS Output [2007-]
- Stage4 Precipitation [1997-]
- NWS Warnings, back to 1996 coming soon!

That's all folks.... Questions?

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