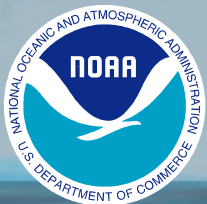


The Historic Iowa Floods of 2008– It Can't be Worse than 1993, Can It?

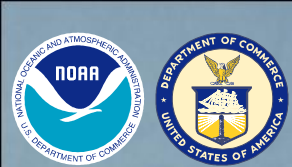
Jeffrey Zogg
Senior Hydrologist

NWS Des Moines, IA / La Crosse, WI

March 6, 2009



“America’s Weather Enterprise: Protecting Lives, Livelihoods, and Your Way of Life”



Topics

- Overview & perspective
- Cedar Rapids flash flood
- Phenomena of interest
- Communications



*Cedar River—Interstate 80 in eastern IA,
6/13/2008 (looking east)*



Acknowledgments

- **NWS national service assessment team**
- **University of Iowa/IHR Hydroscience & Engineering**
- **WFO staffs**
 - *Quad Cities, IA/IL*
 - *Des Moines, IA*
 - *La Crosse, WI*



Floods, 1993 vs. 2008

- **Summary**
 - *Flooding in 1993 affected more area, was more severe and lasted longer*
 - *BUT—some places were hit much harder in 2008 vs. 1993*
- **Antecedent conditions: moist soils & elevated river levels both years**
- **Damages: \$25B (inflation adjusted) vs. \$5-10B**



Farm near Oakville, IA



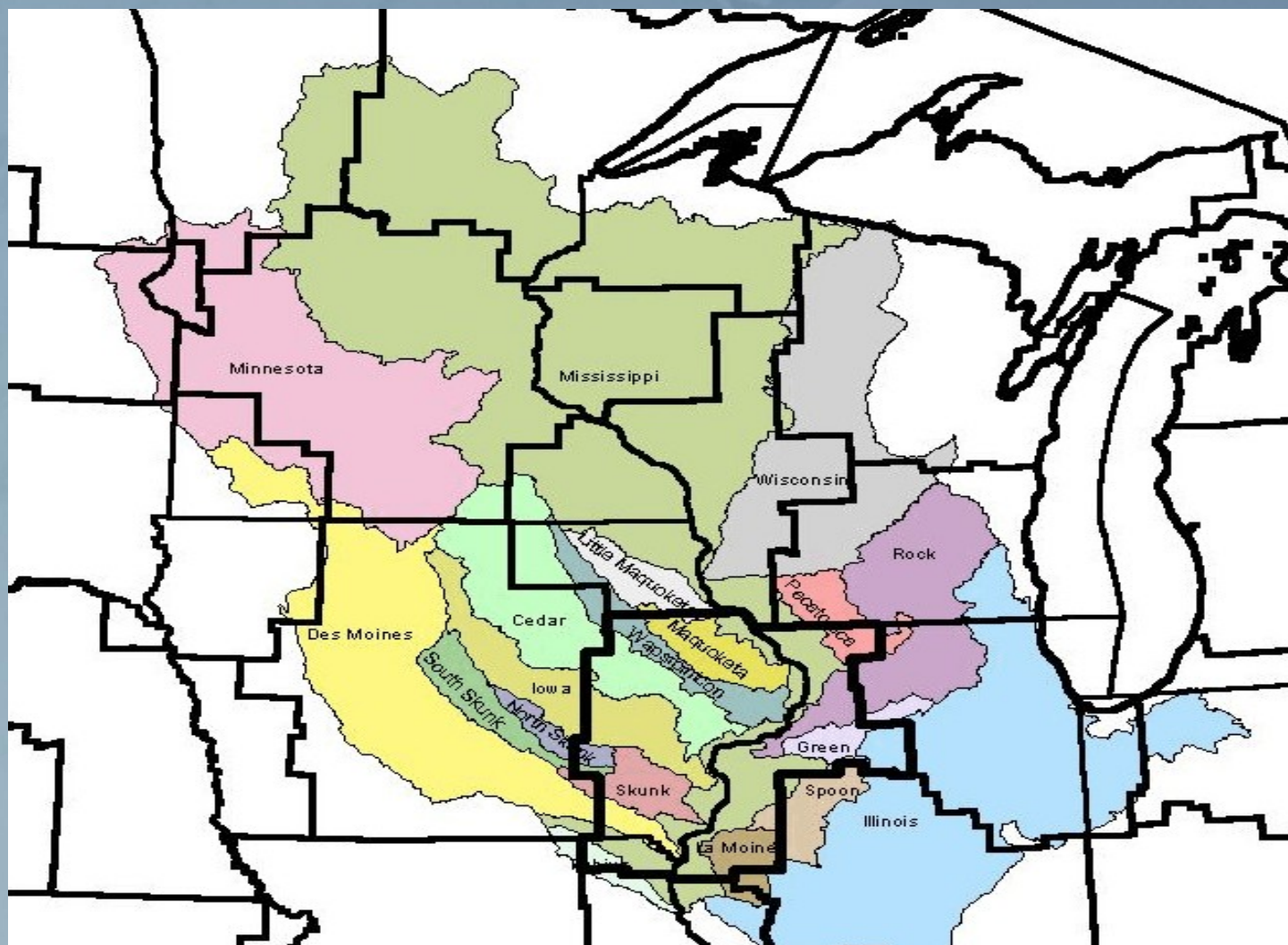
Floods, 1993 vs. 2008

- **Precipitation**
 - *Significant rain: 6 weeks vs. 2 weeks*
 - *Rainfall amounts: 24-36 in (200-350%) vs. 12-20 in (150-250%)*
- **Flooding**
 - *Records at forecast points: 118 vs. 71*
 - *Flood stage: ~750 vs. ~250 locs*
 - *Duration: 4-6 mo vs. 4-6 wk*
- **Compromised levees:**
~1,000 vs. <100



Locator map

- Extended period of heavy snow then heavy rain from November through June





The combination of factors

Heavy rainfall in summer 2007

+ Heavy winter snow

+ Flooding in April (high river levels)

+ Extremely moist soils

+ Heavy June rains



= Historic flooding

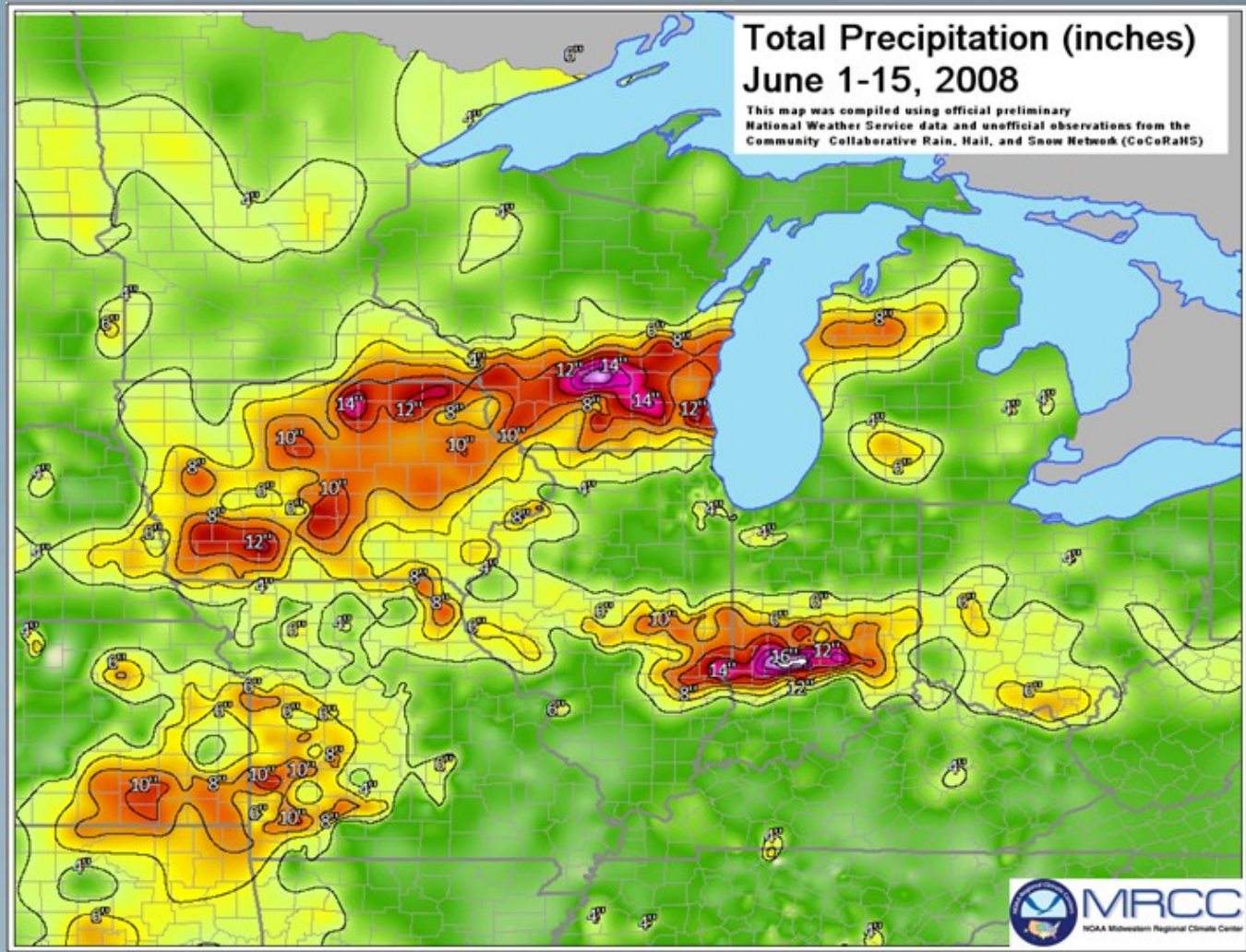


Coralville Reservoir—Iowa River



Heavy rainfall, early-mid June

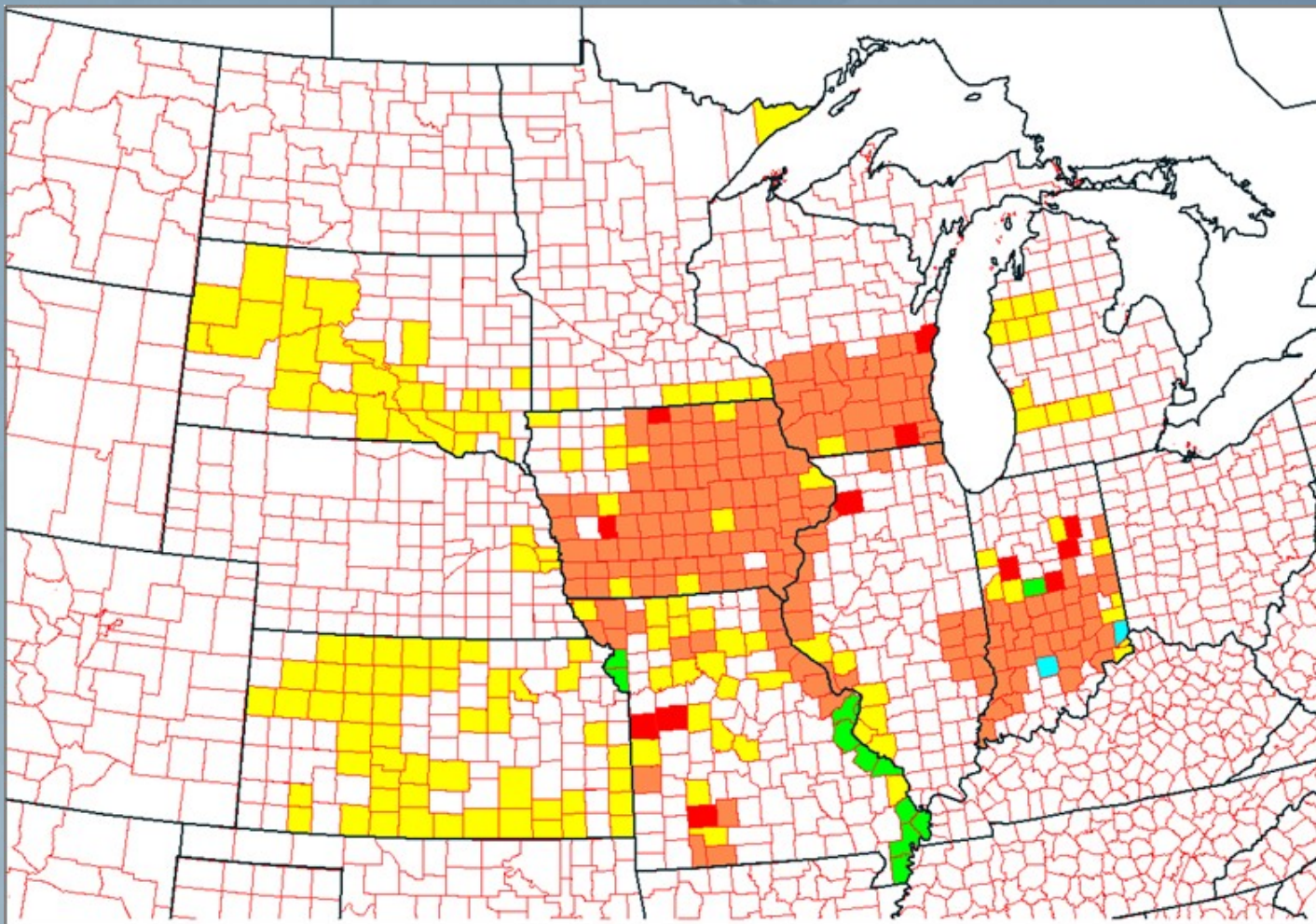
- Axis from southwest IA into southeast WI





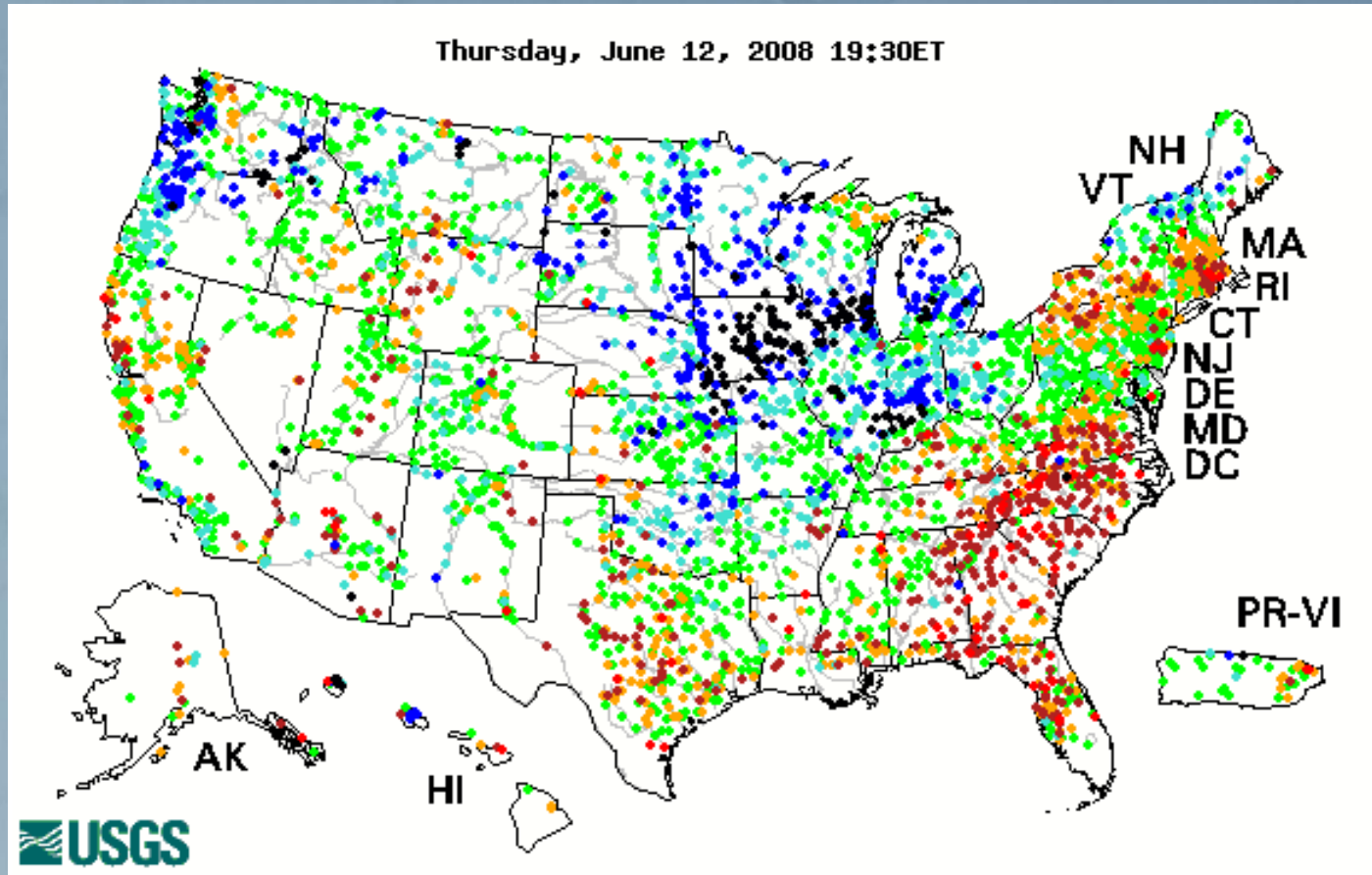
FEMA disaster declarations







- Individual & public assistance

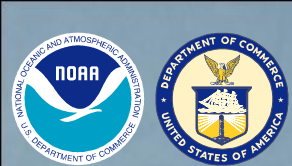


Stream flow, June 2008

- Much above normal to record in IA



Explanation - Percentile classes						
						
Low	<10	10-24	25-75	76-90	>90	High
	Much below normal	Below normal	Normal	Above normal	Much above normal	



June 2008

Cedar Rapids Coralville Saylorville Red Rock

	Cedar Rapids	Coralville	Saylorville	Red Rock
Actual volume (M ft³)	120,407	55,412	61,201	146,552
Actual volume vs. flood storage	-	3.36	2.48	2.34
Normal volume (M ft³)	18,656	9,940	16,392	41,657
Actual volume vs. normal	6.45	5.57	3.73	3.52
Actual volume vs. annual normal	0.98	0.97	0.68	0.70
Depth in Norman (ft)	24.4	11.2	12.4	29.7

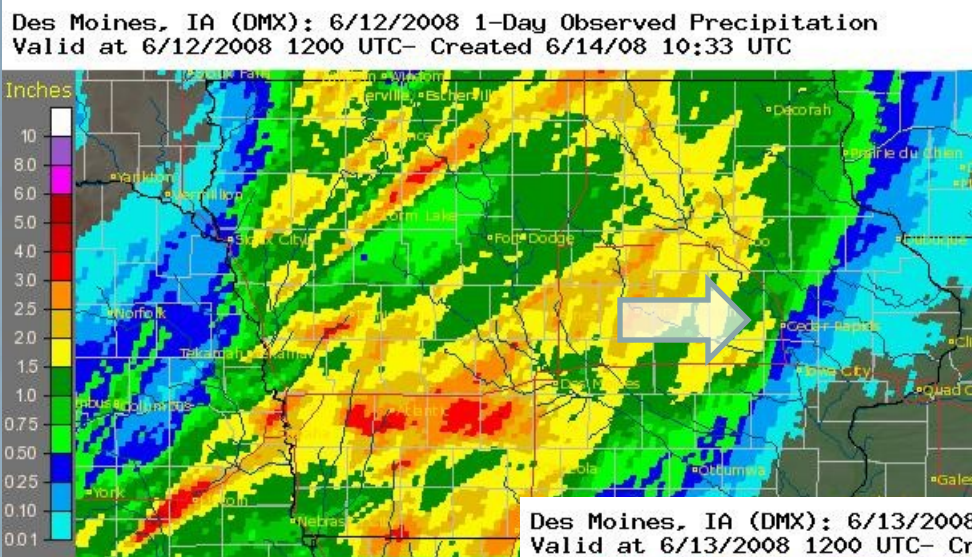


Mar/Apr through June 2008

	Cedar Rapids	Coralville	Saylorville	Red Rock
Actual volume (M ft³)	239,588	112,494	92,147	203,227
Actual volume vs. flood storage	-	6.82	3.73	3.25
Normal volume (M ft³)	64,625	30,234	39,379	92,589
Actual volume vs. normal	3.71	3.72	2.34	2.19
Actual volume vs. annual normal	1.95	1.98	1.02	0.97
Depth in Norman (ft)	48.6	22.8	18.7	41.2

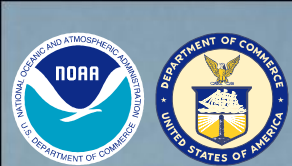
Cedar Rapids flooding

- Heavy rainfall on top of crest
- Near 100% runoff



NWS multi-sensor QPE





Cedar Rapids flooding

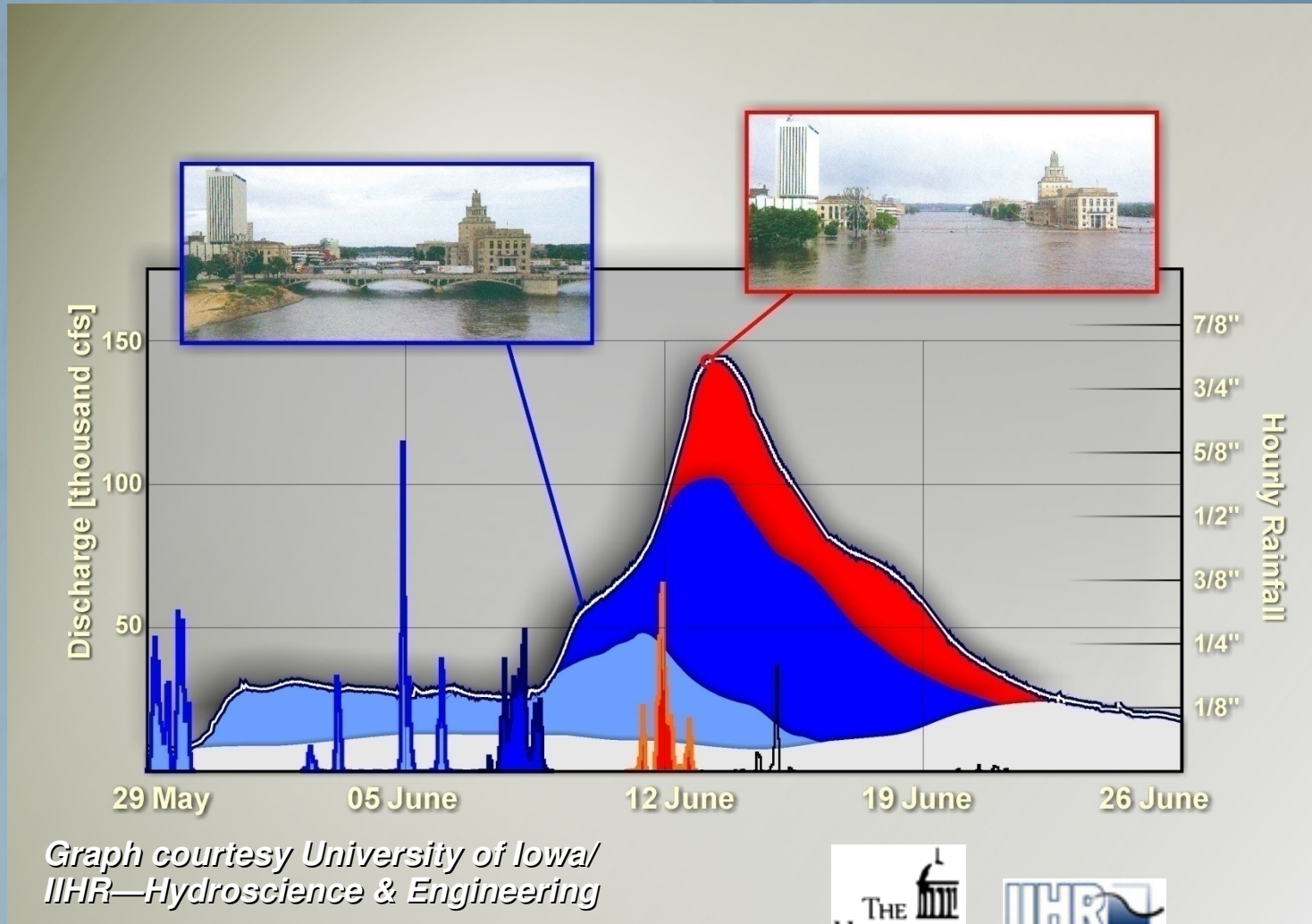
- Crest: 31.1 ft on 6/13
- Flood stage: 12 ft
- Previous record: 20.0 ft (1851 & 1929)



Cedar River—downtown Cedar Rapids, IA

Cedar Rapids flooding

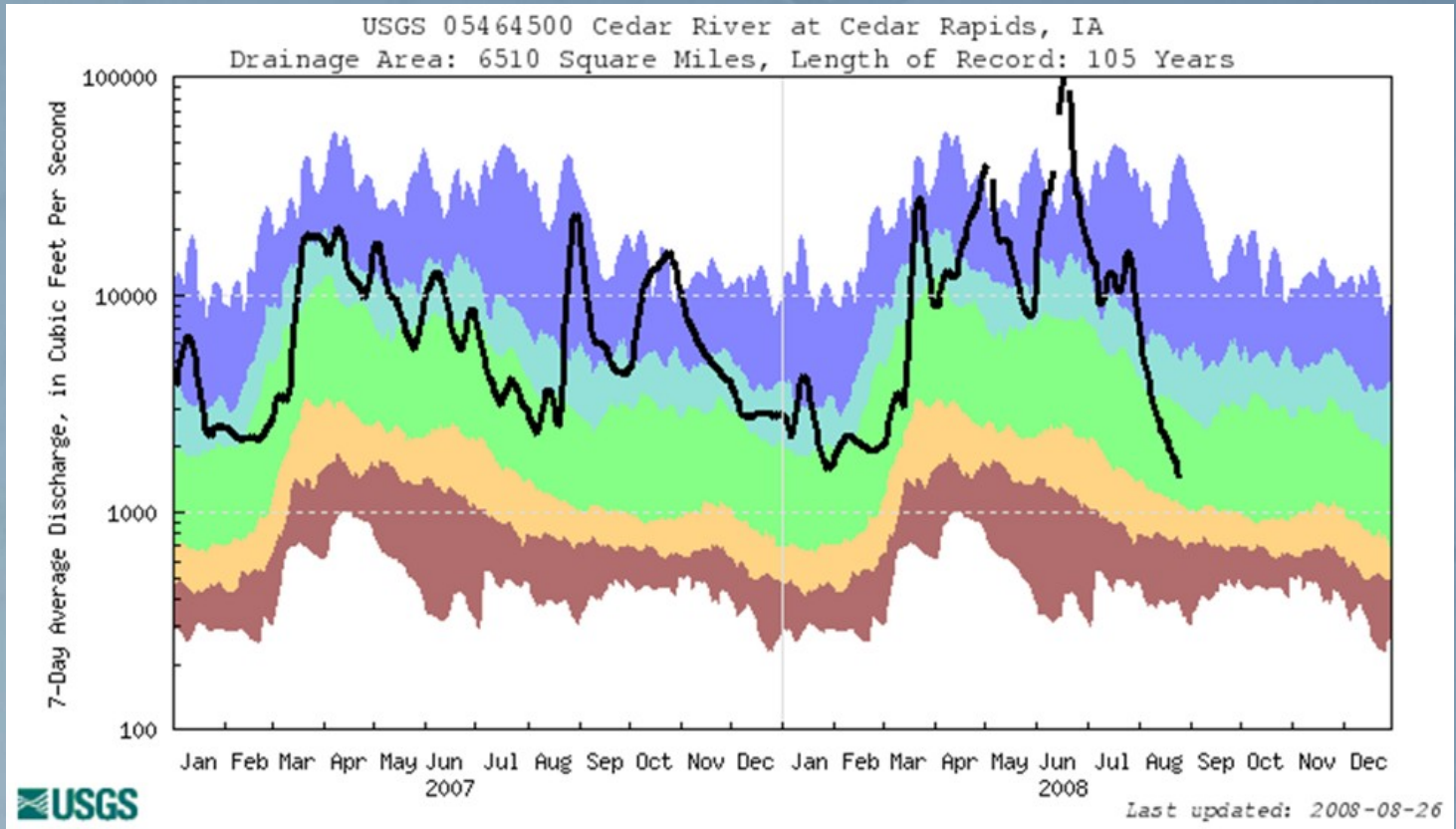
- Heavy rain added ~40%
- ~ 6 ft difference
- Crest ~25 ft (estimated) vs. 31.1 ft (actual)
- Flood stage: 12 ft





Cedar Rapids flooding

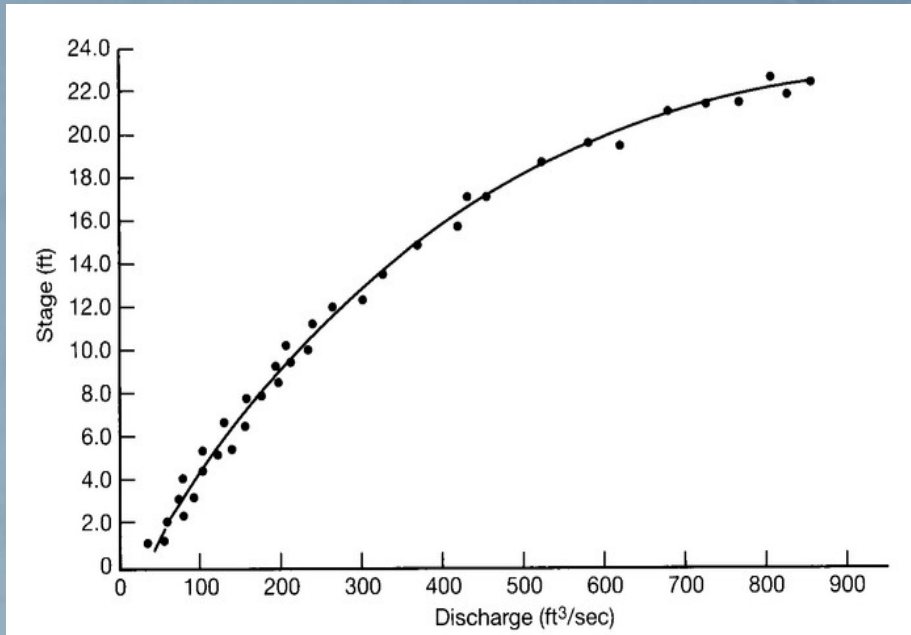
- Several days of record high flows
- Extended period of above or much above normal flows



Explanation - Percentile classes					
lowest-10th percentile	10-24	25-75	76-90	90th percentile-highest	Flow
Much below normal	Below normal	Normal	Above normal	Much above normal	

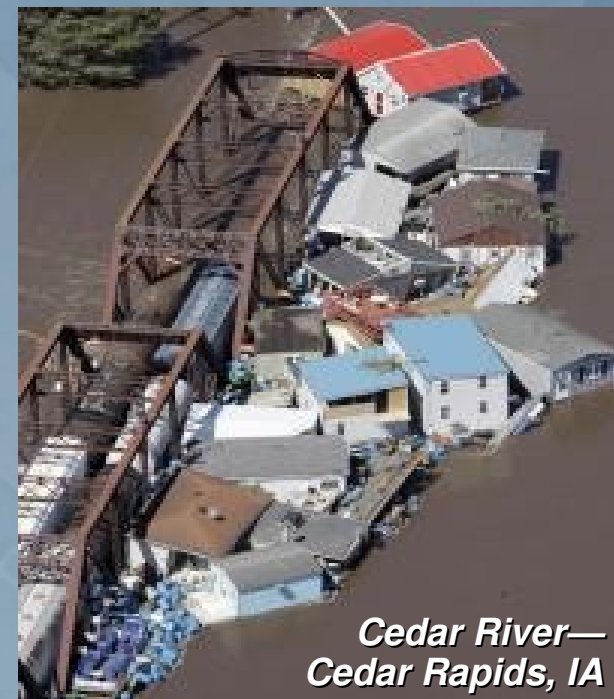
Beyond rating curves

- Relate stage and flow
- Where does it go?
- Uncharted territory
- Quicker measures
- Difficulty reaching locations



Frequency of occurrence

- 1 in a 100 year = 1% chance each year
- 1 in a 500 year = 0.2% chance each year
- Confusion
- NWS national service assessment



*Cedar River—
Cedar Rapids, IA*



WFO communications

- Dedicated operational hydro positions
- State of Iowa EOC on-site support 24x7
- Public Information Officer (PIO)

COOP	HYDRO	NWR																																																																																																												
<p>RE-SURVEY GALVA</p> <p>F/P IS MOVE LURAY</p> <p>LOWDEN MISSED PUNCHES</p> <p>MT Pleasant LTG hit MMTS OTS</p> <p>F/P LEVELS</p> <p>PUT ILL CITY BACK</p> <p>MUSCATINE LOW? OB TIMES?</p> <p>ELIZABETH MMTS BROKE</p>	<p>FLW</p> <table border="1"> <tr><td>DLDI4</td><td>MOD</td><td>MROI4</td><td>REC</td></tr> <tr><td>DBQI4</td><td>MOD</td><td>IOWI4</td><td>REC</td></tr> <tr><td>BLVI4</td><td>MOD</td><td>CJT14</td><td>REC</td></tr> <tr><td>FLTI2</td><td>MOD</td><td>LNTI4</td><td>MAJ</td></tr> <tr><td>CMMI4</td><td>MAJ</td><td>WAPI4</td><td>REC</td></tr> <tr><td>LECI4</td><td>MAJ</td><td></td><td></td></tr> <tr><td>ROKI2</td><td>MAJ</td><td>SIGI4</td><td>MAJ</td></tr> <tr><td>ILNI2</td><td>MAJ</td><td>AGSI4</td><td>MAJ</td></tr> <tr><td>MUSI4</td><td>MAJ</td><td>KEQI4</td><td>MAJ</td></tr> <tr><td>NBOI2</td><td>MAJ</td><td>SFLM7</td><td>MAJ</td></tr> <tr><td>KHBI2</td><td>MAJ</td><td></td><td></td></tr> <tr><td>GLDI2</td><td>REC</td><td>KALI4</td><td>MOD</td></tr> <tr><td>BRLI4</td><td>REC</td><td></td><td></td></tr> <tr><td>EOKI4</td><td>MAJ</td><td></td><td></td></tr> <tr><td>GGYM7</td><td>MAJ</td><td></td><td></td></tr> <tr><td></td><td></td><td>MAQI4</td><td>MAJ</td></tr> <tr><td>IDPI4</td><td>MAJ</td><td></td><td></td></tr> <tr><td>ANSI4</td><td>REC</td><td></td><td></td></tr> <tr><td>DEWI4</td><td>MAJ</td><td></td><td></td></tr> <tr><td>VINI4</td><td>REC</td><td></td><td></td></tr> <tr><td>CIDI4</td><td>REC</td><td></td><td></td></tr> <tr><td>GNRI4</td><td>REC</td><td></td><td></td></tr> <tr><td>FEI2</td><td>MOD</td><td></td><td></td></tr> <tr><td>CMOI2</td><td>MOD</td><td></td><td></td></tr> <tr><td>JOI2</td><td>MAJ</td><td></td><td></td></tr> <tr><td>MLI2</td><td>MAJ</td><td></td><td></td></tr> <tr><td>GENI</td><td>MIN</td><td></td><td></td></tr> </table> <p>ATTENTION</p> <p>BKN Gages</p>	DLDI4	MOD	MROI4	REC	DBQI4	MOD	IOWI4	REC	BLVI4	MOD	CJT14	REC	FLTI2	MOD	LNTI4	MAJ	CMMI4	MAJ	WAPI4	REC	LECI4	MAJ			ROKI2	MAJ	SIGI4	MAJ	ILNI2	MAJ	AGSI4	MAJ	MUSI4	MAJ	KEQI4	MAJ	NBOI2	MAJ	SFLM7	MAJ	KHBI2	MAJ			GLDI2	REC	KALI4	MOD	BRLI4	REC			EOKI4	MAJ			GGYM7	MAJ					MAQI4	MAJ	IDPI4	MAJ			ANSI4	REC			DEWI4	MAJ			VINI4	REC			CIDI4	REC			GNRI4	REC			FEI2	MOD			CMOI2	MOD			JOI2	MAJ			MLI2	MAJ			GENI	MIN			<p>DBG TW "M"</p> <p>Phone Li</p> <p>LNT very near Record</p> <p>Transmitter</p>
DLDI4	MOD	MROI4	REC																																																																																																											
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06/14/2008

WFO Quad Cities operational status board



WFO Quad Cities, IA/IL



WFO Des Moines, IA



WFO La Crosse, WI



Communications

- EM & media conference calls
- IEM Chat (NWS Chat)

dmxchat@conference.nwschat.weather.gov

Conversation Options Send To

dmxchat@conference.nwschat.weather.gov hydrology-chat@conference.collaborate... arxchat@conference.nwschat.weather.g... ncrfcchat@conference.nwschat.weather...

dmxchat@conference.nwschat.weather.gov
Welcome to the DMX chatroom.

12 people in room

(3/1/2009 6:00:02 PM) nwsbot: ----- Mar 02, 2009 [GMT] -----
(3/2/2009 6:33:04 AM) woity-Kelley: DMX, what's the highest snow total that you've heard from this Nor'Easter so far?
(3/2/2009 7:37:55 AM) DMX - Moyer: koity - Sorry for the belated response. We haven't really dug around to see yet, but you could go to www.weather.gov and click on any location from southern TN through the East Coast states and see what reports may be on their respective websites.
(3/2/2009 7:39:49 AM) DMX - Moyer: I see a 12.3 in Saluda, NC - (southern foothills of the state)
(3/2/2009 7:42:03 AM) media-mark.schnackenberg: 12" of snow in Rice, VA
(3/2/2009 7:42:08 AM) NWS DMX - Podrazik: http://www.erh.noaa.gov/mk/mk_displayprod.php?product=WBCPNSR&version=0&versions=5&type=snow
(3/2/2009 7:42:22 AM) NWS DMX - Podrazik: <http://forecast.weather.gov/product.php?site=NWS&issuedby=GSP&product=PNS&format=C&version=1&glossary=0>
(3/2/2009 7:43:12 AM) NWS DMX - Podrazik: <http://forecast.weather.gov/product.php?site=NWS&issuedby=PHI&product=PNS&format=C&version=1&glossary=0>
(3/2/2009 7:43:23 AM) media-mark.schnackenberg: Here is a photo of that 12" in VA <http://www.reportstoms.com/?eventID=3295>
(3/2/2009 7:44:14 AM) NWS DMX - Podrazik: 12.9" Vineland, NJ
(9:27:42 AM) NWSEAX - Forecaster left the room.
(9:30:21 AM) NWSEAX - Forecaster [nws-matthew.dux@nwschat.weather.gov/Home] entered the room.

Font Insert Smiley

Buddy List

Buddies Accounts Tools Help

Des Moines Chat Group (17/90)

- LaCrosse Chat Group (1/16)
- Davenport Chat Group (4/23)
- Sioux Falls Chat Group (1/24)
- Omaha Chat Group (3/28)
- NWSChat Admin Team (6/7)
- NCRFC Chat Group (0/7)

Chats

- arxchat
- dmxchat
- dmxemachat
- dymchat
- fsdchat
- hydrology-chat
- iaseocchat
- mbrfcchat
- ncrfcagencieschat
- ncrfcchat
- nws-it-chat
- oakchat

Buddies (0/2)

Available



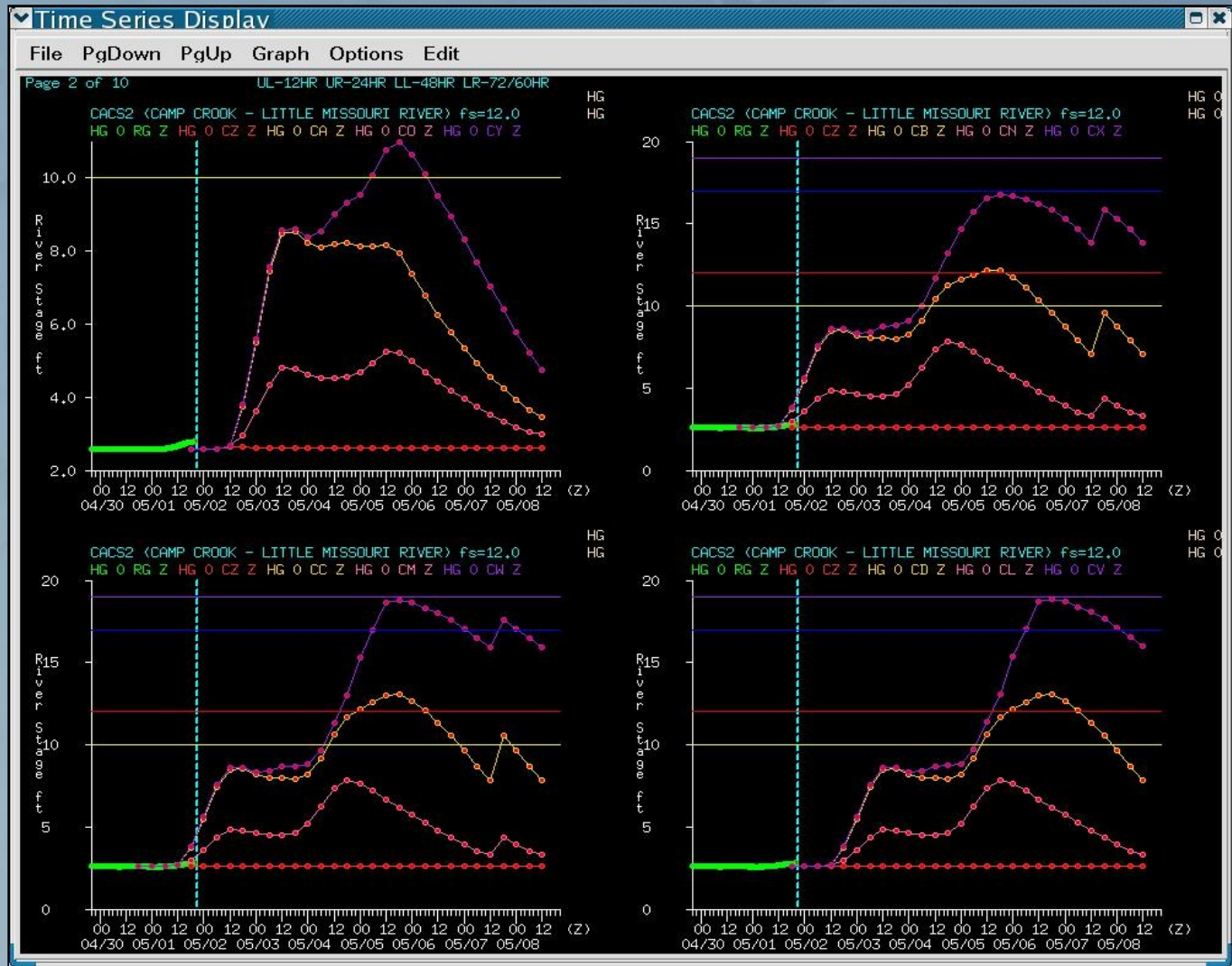
Communicating possibilities

- NCRFC QPF ensembles

- Sensitivity analysis

- Possible stream response

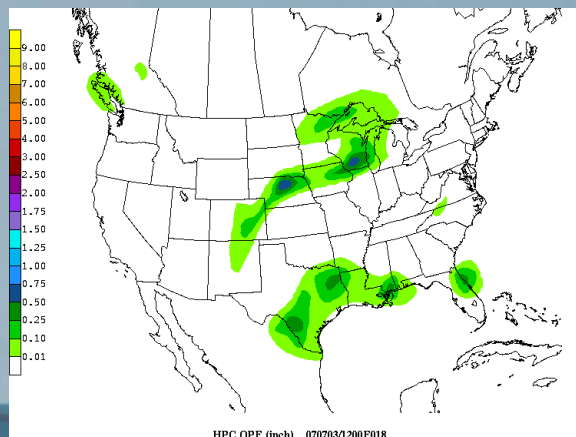
- USACE used to manage water resource projects



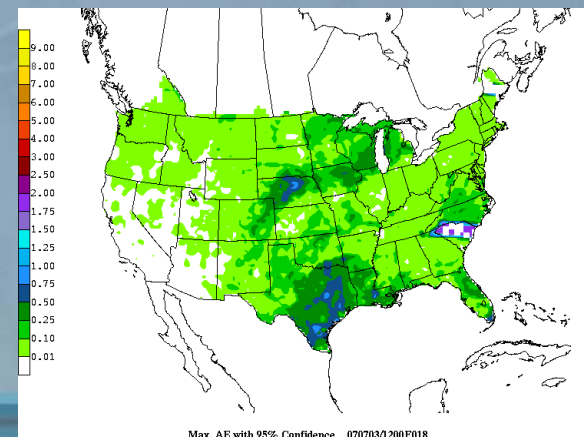
NCRFC QPF ensembles

- Good correlation between error of 6-hr QPF and the spread in QPF from HPC Short-Range Ensemble Forecast (SREF)
- Use the spread in SREF QPF to estimate error in corresponding HPC QPF

HPC QPF

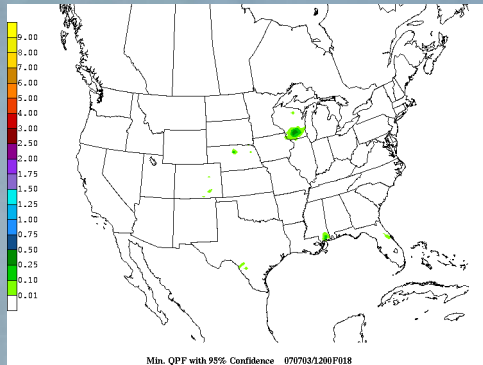


Maximum Absolute Error with 95% Confidence

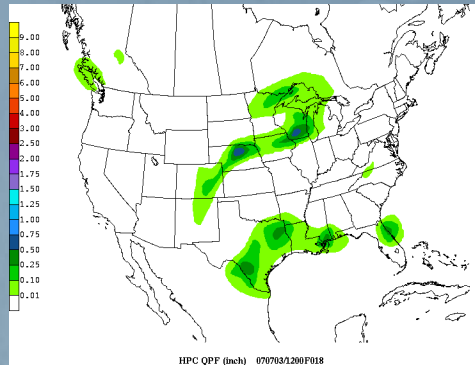


NCRFC QPF ensembles

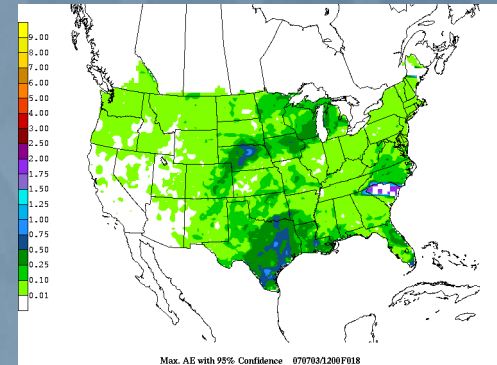
Min QPF with 95% Confidence



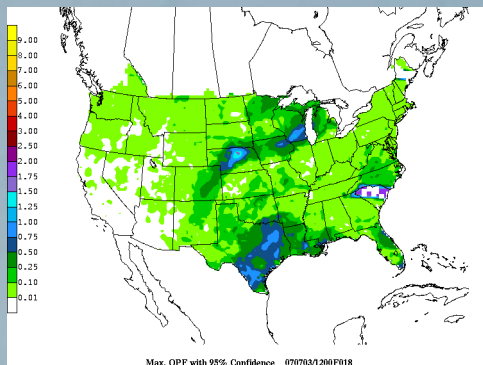
HPC QPF



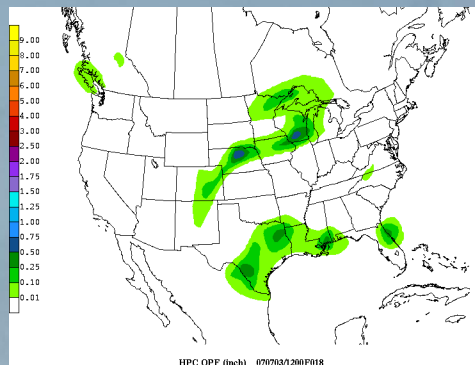
Max Absolute Error with 95% Confidence



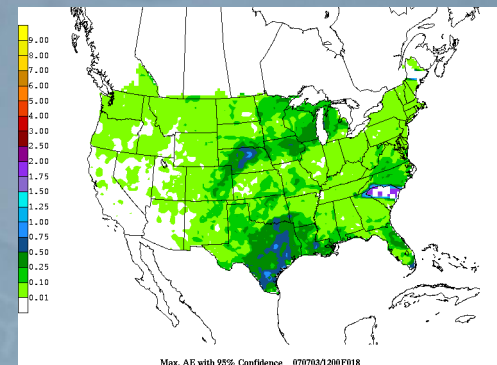
Max QPF with 95% Confidence



HPC QPF



Max Absolute Error with 95% Confidence



==

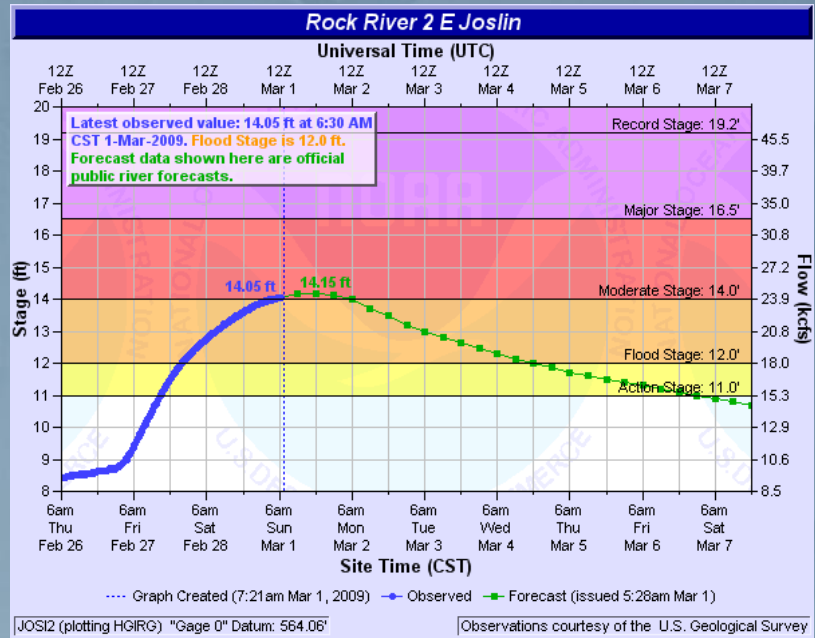
-

==

+

BLESSing river forecasts

- WHFS HydroGen
- Available, but not default
- Implemented before flooding began
- Review & modify before going public
- Consistent message



Oakville, IA

Communications needs

- Inundation mapping
- Levee breaches & failures





Thank you

<http://www.weather.gov/>

The screenshot shows the NOAA National Weather Service website. The browser window title is "NOAA's National Weather Service - Mozilla Firefox". The address bar shows "http://www.weather.gov/". The page header includes the NOAA logo and the text "National Oceanic and Atmospheric Administration's National Weather Service". Below the header is a navigation bar with links for "Site Map", "News", "Organization", "Search", and "NWS All NOAA".

The main content area features a news article titled "...Major Late Season Winter Storm along the U.S. East Coast...". Below the article is a map of the United States showing weather conditions. The map is titled "Created: 03/12/99 at 15:45 UTC" and shows various weather warnings and advisories across the country. A legend below the map lists various weather warnings and advisories, including:

- Flash Flood Warning
- Blizzard Warning
- Winter Storm Warning
- Aviation Warning
- Flood Warning
- Lake Effect Snow Warning
- Flash Flood Watch
- Dale Warning
- Flood Statement
- Freeze Warning
- Red Flag Warning
- Winter Weather Advisory
- Lake Effect Snow Advisory
- Wind Chill Advisory
- Road Advisory
- High Surf Advisory
- Heavy Freezing Spray Warning
- Small Craft Advisory
- Brisk Wind Advisory
- Lake Wind Advisory
- Wind Advisory
- Winter Storm Watch
- Road Watch
- High Wind Watch
- Dale Watch
- Hard Freeze Watch
- Freeze Watch
- Fire Weather Watch
- Special Weather Statement
- Marine Weather Statement
- Hazardous Seas Warning
- Hazardous Weather Outlook
- Short Term Forecast

At the bottom of the page, there are links for "High Res", "Map FAQ", "Map Comments", and "What is UTC?".



The end





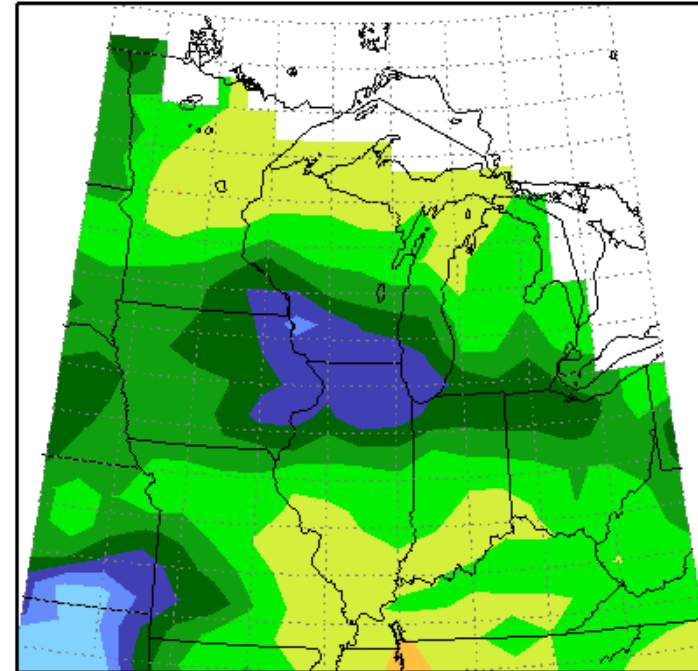
Extra slides



Antecedent conditions

- Began in summer 2007
- Heavy rains and flooding in the upper Mississippi River basin
- Significant flooding in eastern IA, southeastern MN, southern WI and northern IL

Total Precipitation Percent of Mean
June 1, 2007 to August 31, 2007

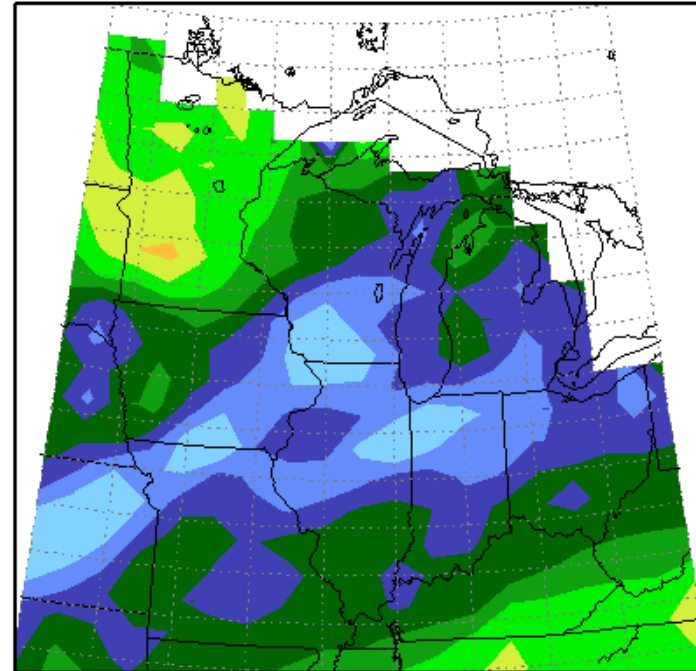


Midwestern Regional Climate Center
Illinois State Water Survey
Champaign, Illinois

Antecedent conditions

- Above normal soil and precipitation persisted into fall and winter
- Record snowfall in southern WI
- Spring flood threat mitigated by gradual snow melt

Total Precipitation Percent of Mean
December 1, 2007 to February 29, 2008

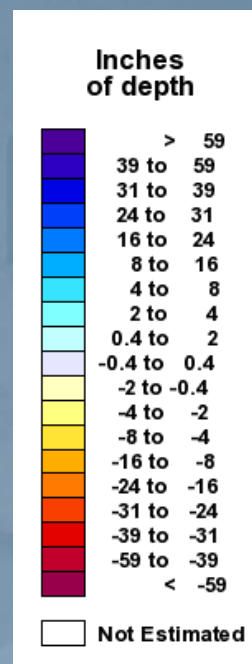
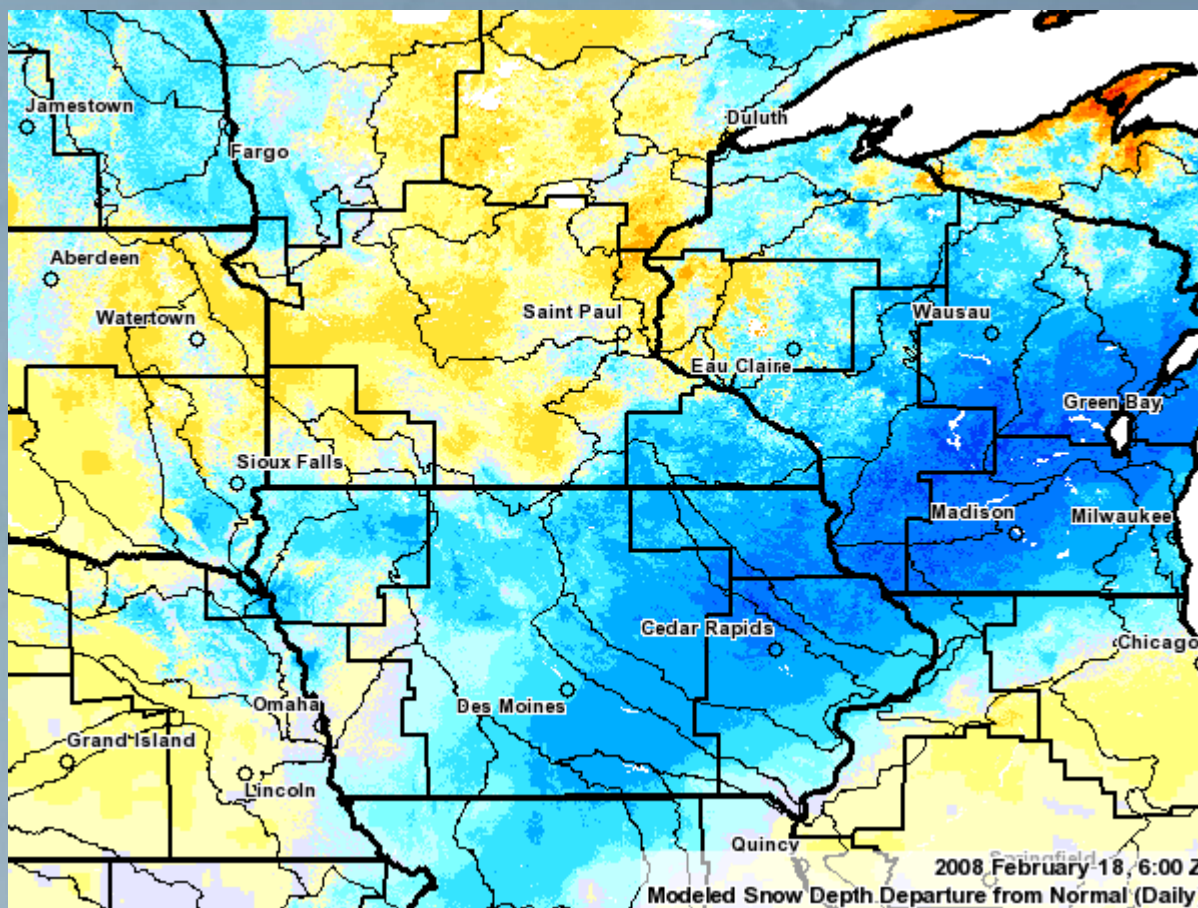


Midwestern Regional Climate Center
Illinois State Water Survey
Champaign, Illinois



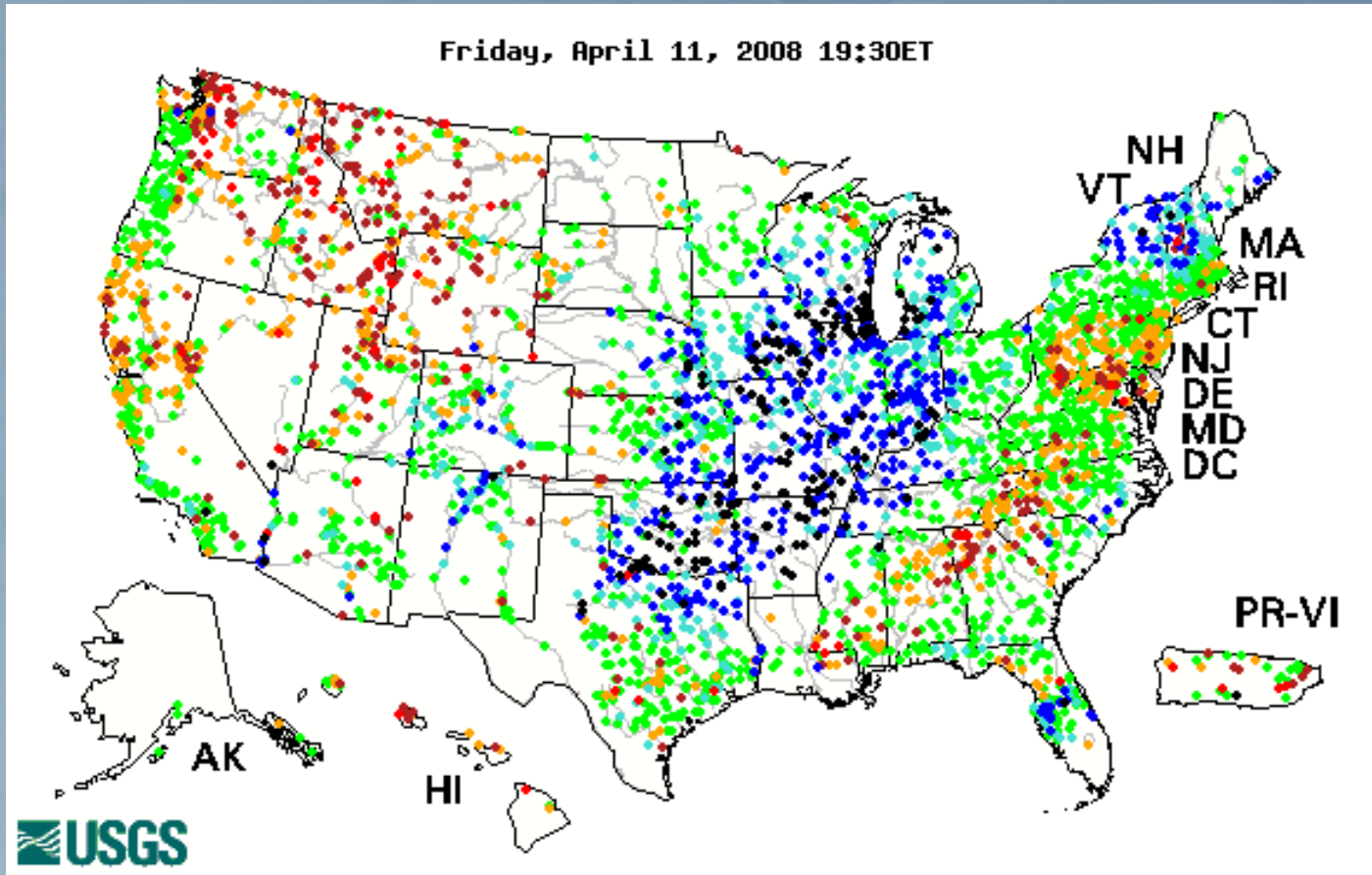
Winter snow, mid-February 2008

- Depth vs. normal
- Record depth in some places
- High water equivalents










April 2008 stream flow

- Much above normal and record values

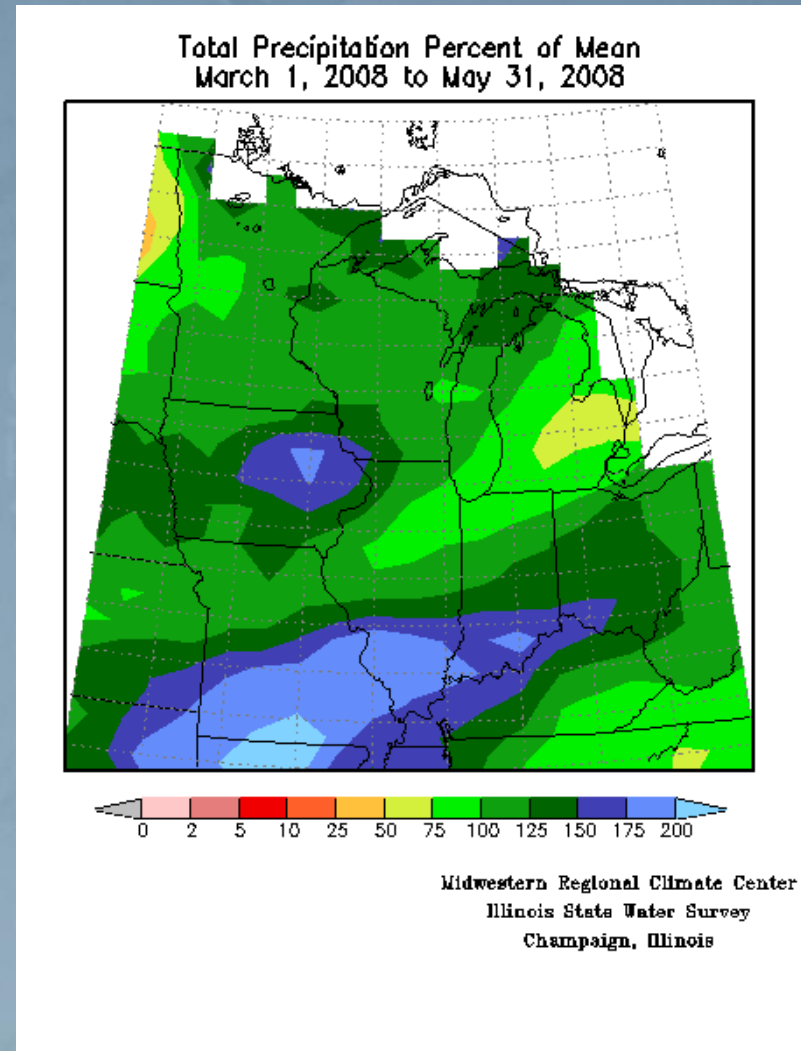


Explanation - Percentile classes

							
Low	<10	10-24	25-75	76-90	>90	High	
	Much below normal	Below normal	Normal	Above normal	Much above normal		

Antecedent conditions

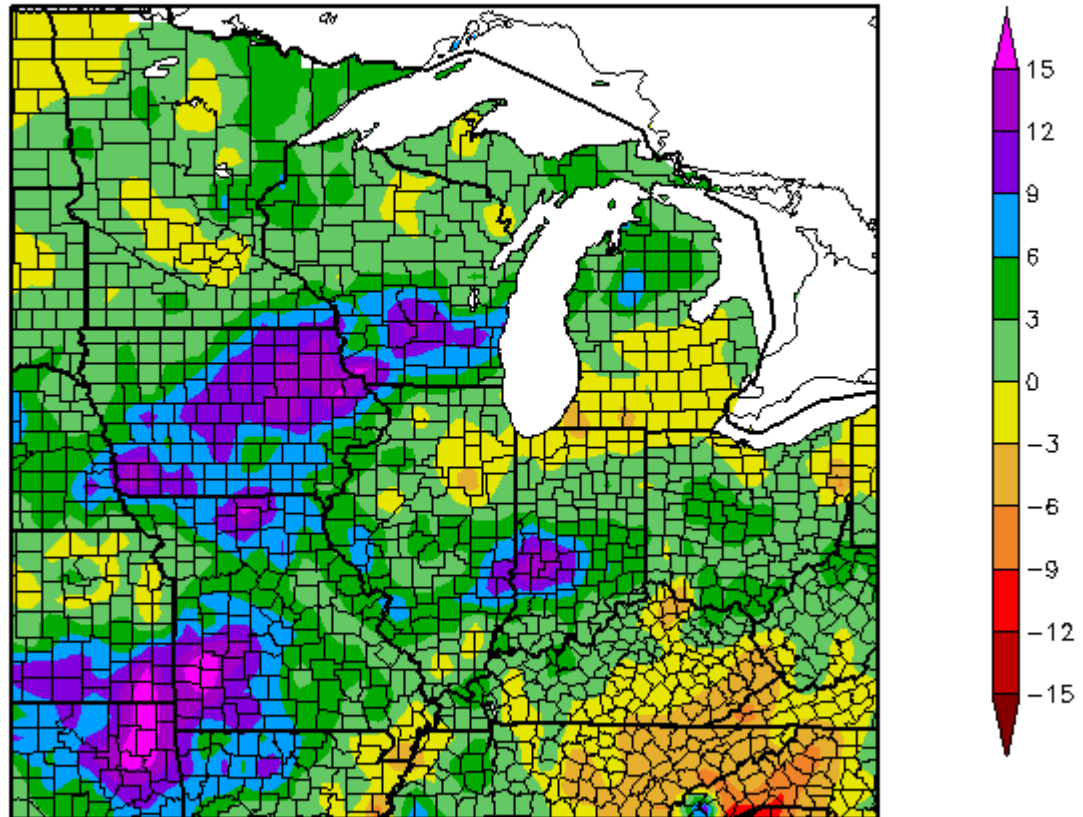
- Above normal spring precipitation in eastern IA



Heavy rainfall, April-June

- Record depth in some places

Departure from Normal Precipitation (in)
4/1/2008 – 6/30/2008

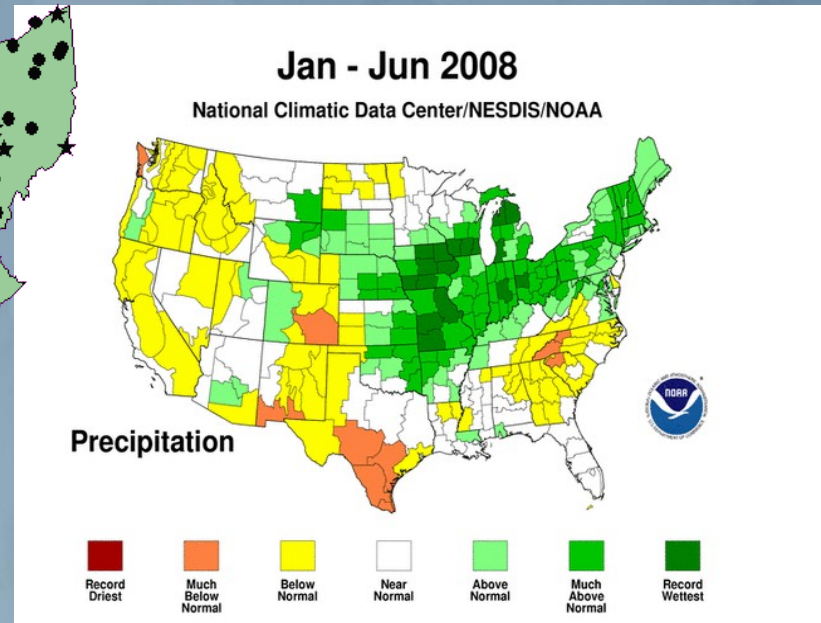
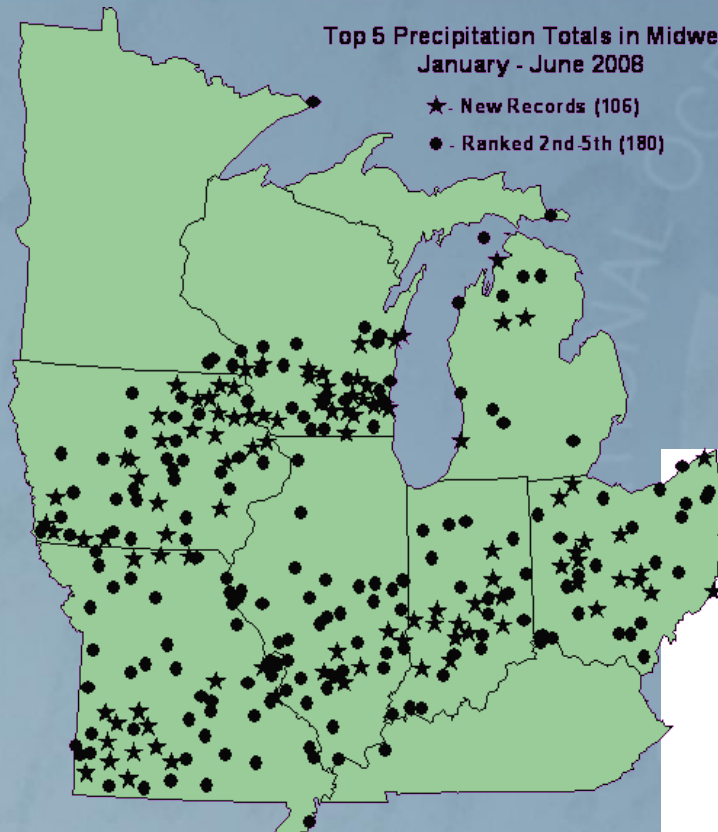


Generated 7/11/2008 at HPRCC using provisional data.

NOAA Regional Climate Centers

Perspective

- Many all-time records





Stage jumps

- **Obstructions**
- **Conservation of energy**
- **Backwater**

