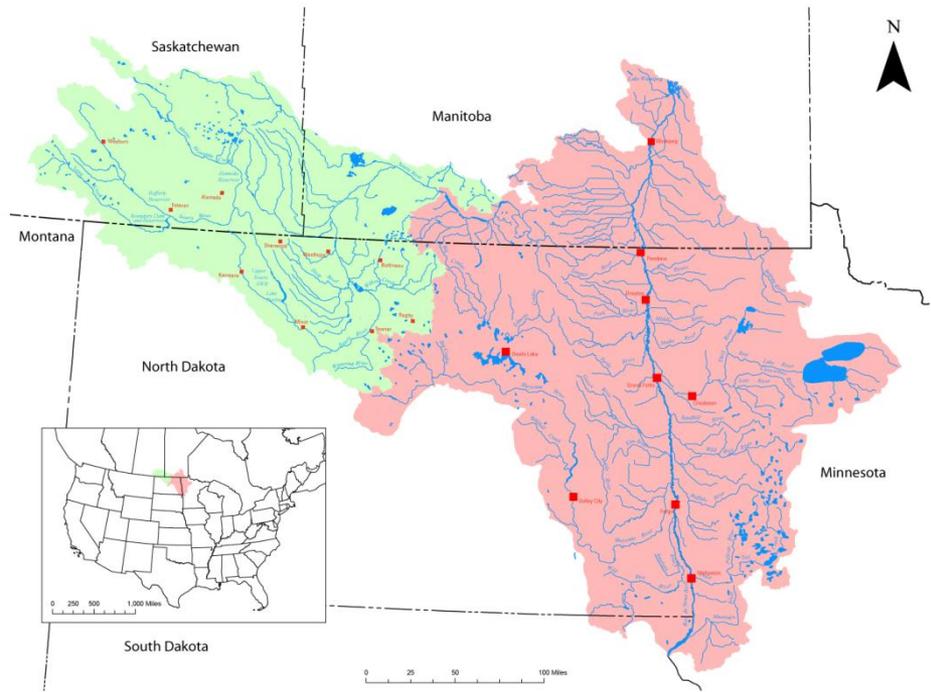


Floods of 2011: U.S. Geological Survey Response and Activities in the Mississippi and Red/Souris River basins

Robert R. Holmes, Jr., PhD, P.E., D.WRE
National Flood Coordinator
U.S. Geological Survey

Red/Souris System



Mississippi River Basin



This map is not to scale.

Outline

- Flooding Overview
- USGS Streamgauge Activities
 - Network Operations
 - Flood Measurements
 - Rating Extensions
 - Rapid Deployment Gages
- Special Measurements/Investigations
 - Hydraulic Investigations and Modeling
 - Sedimentation/Geomorphology
 - Inundation Mapping

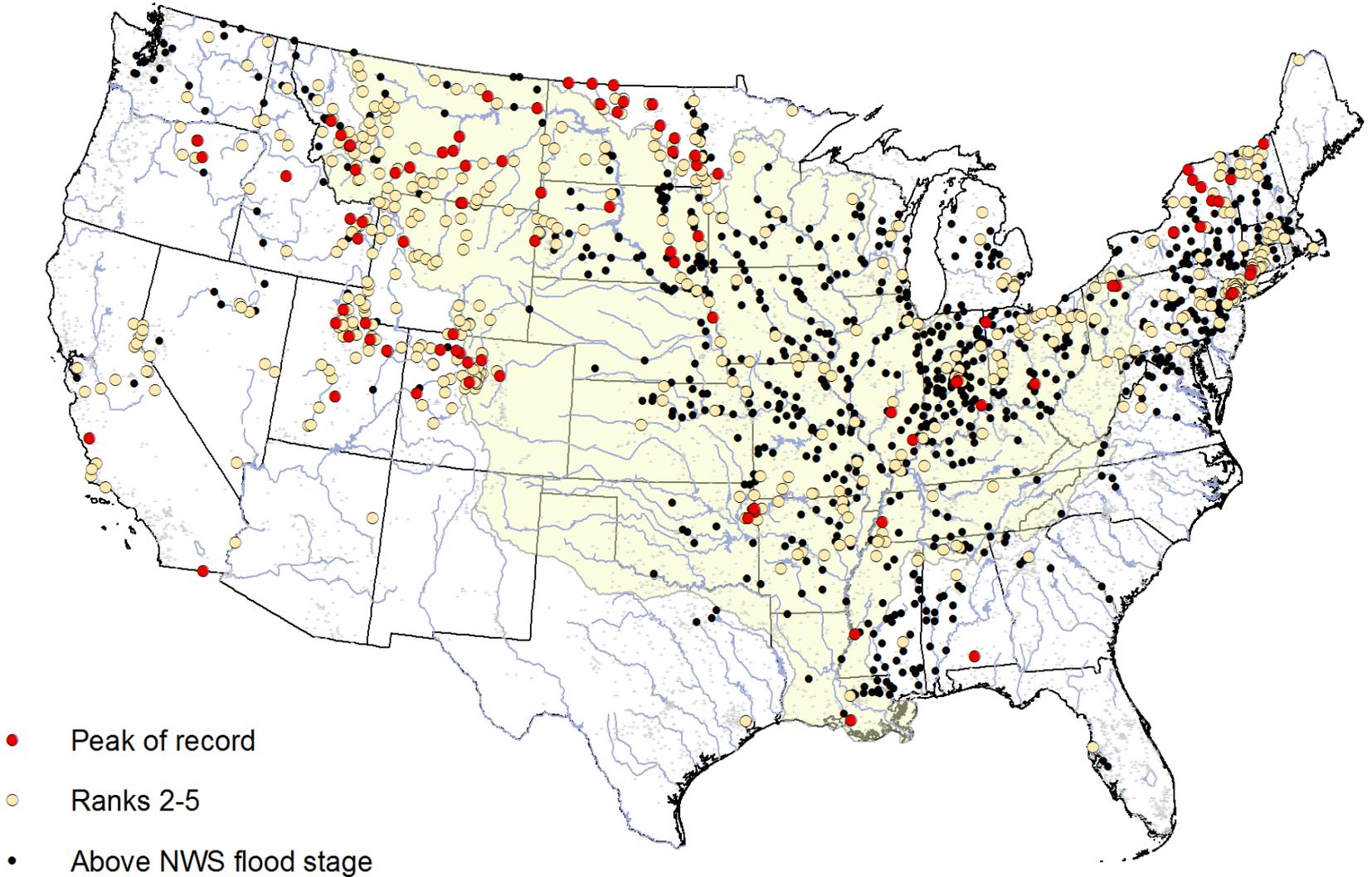
Flooding Timeline

- Jan 28—3 Rapid Deployment Gages (RDG) sent to ND for installation
- February 28 –Indiana and Ohio report the beginning of flooding
- February—RDG’s being installed in ND, MN
- March 9-10—Tributaries in state of Mississippi flooding
- March 18—Snowmelt flooding starts in SD. Installation of RDGs and rating extensions along with many special measurements.
- March 23—Snowmelt (with some rainfall) flooding begins in MN
- April 6—Spring flood begins in earnest in ND on the Red River. MT reports the beginning of snowmelt flooding
- **March-April -- Spring Floods in Red River of North, upper Mississippi River, and upper Missouri basins (ND, SD, MN, MT, WY)—peak effort in ND on April 8 when ND WSC made 46 measurements in the Red basin**
- April 19-20—heavy rains in Indiana induce more flooding; Red River cresting at Drayton
- April 23—lots of concerns raised by NWS over major flooding in the Ohio and Mississippi River basins

Flooding Timeline (contd)

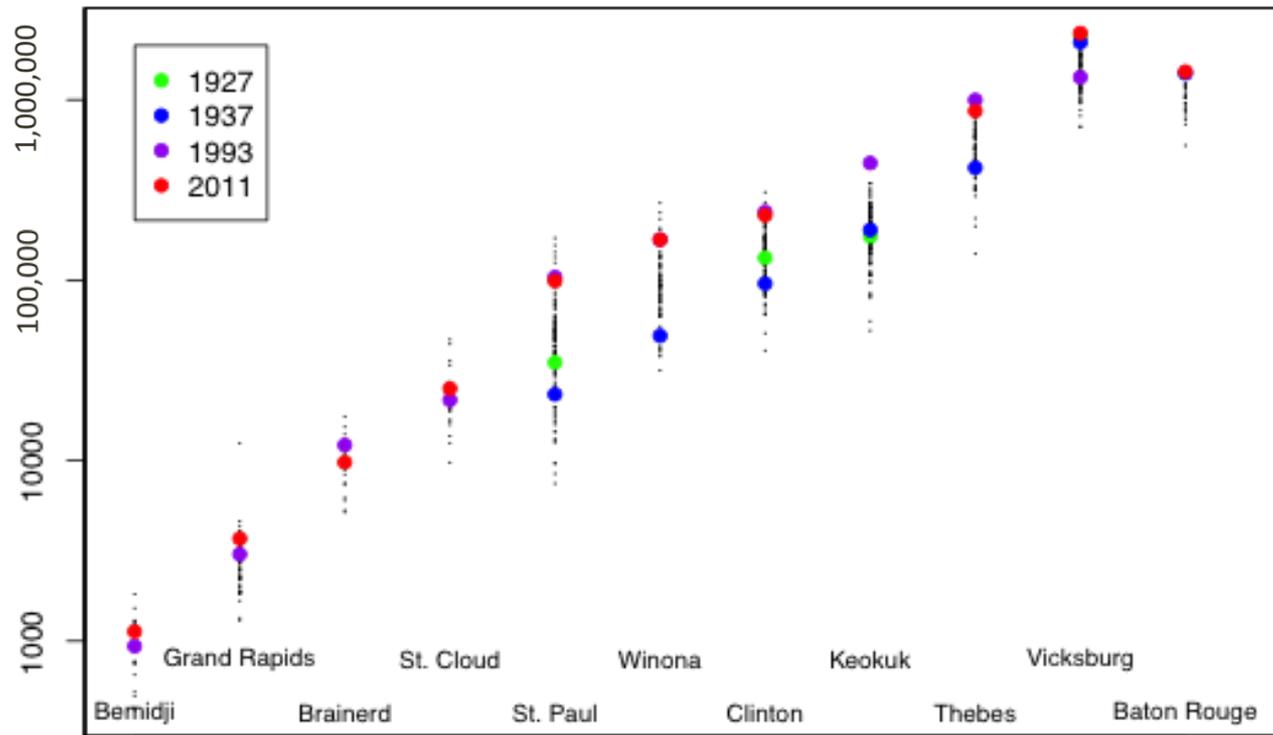
- April 19-29—Several days of widespread rain events hit OK, AR, MO, IL, KY, and IN push tributary streams higher. MO had over 12 inches in the week.
- April 25--Red River of North crest passes into Canada
- April 28—additional heavy rains in IL and IN
- April 29—USGS begins effort to install 38 water level sensors in the New Madrid floodway for potential activation
- May 1-2—several more inches of rain in AR, MO, IL, IN, KY
- May 2—Activation of Birds Point-New Madrid Floodway
- May 9—Activation of Bonnet Carre' Floodway
- May 14—Activation of Morganza Floodway
- **April – June—Major flooding on the lower Ohio and lower Mississippi Rivers**
- May 19-23—MT, ND, and SD experiences 3 to 6 inches of rain, begins deploying RDGs
- May 28-29—Souris River basin experiences 4 to 5 inches of rainfall, pushing the Souris to record levels.
- **May – July –Major flooding on the Souris River**
- June 23—Souris River overtops levees in Minot
- **May –August –Major flooding on the Missouri River**

2011 Major Flood Peaks



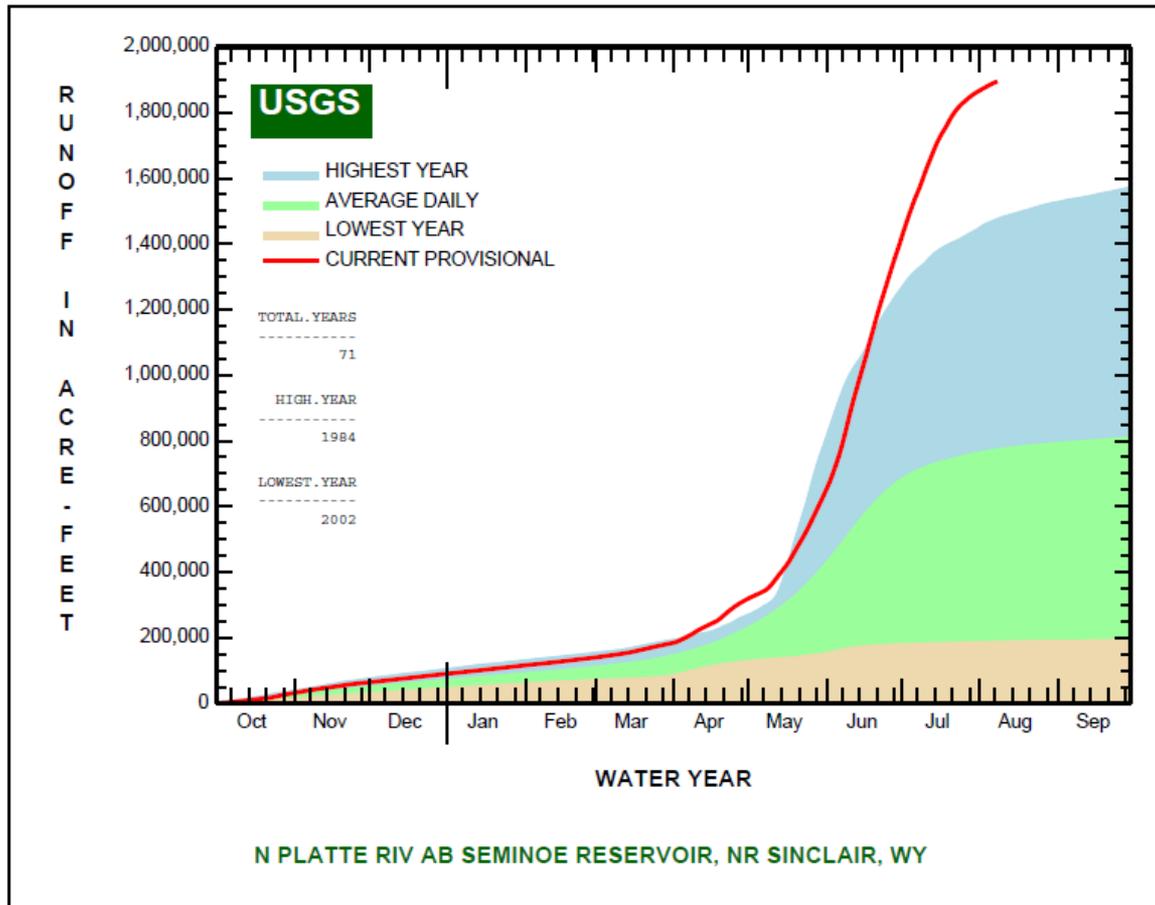
2011 Peaks on the Mississippi River

Specific Years Identified by Colored Circles
Mississippi River Gaging Stations



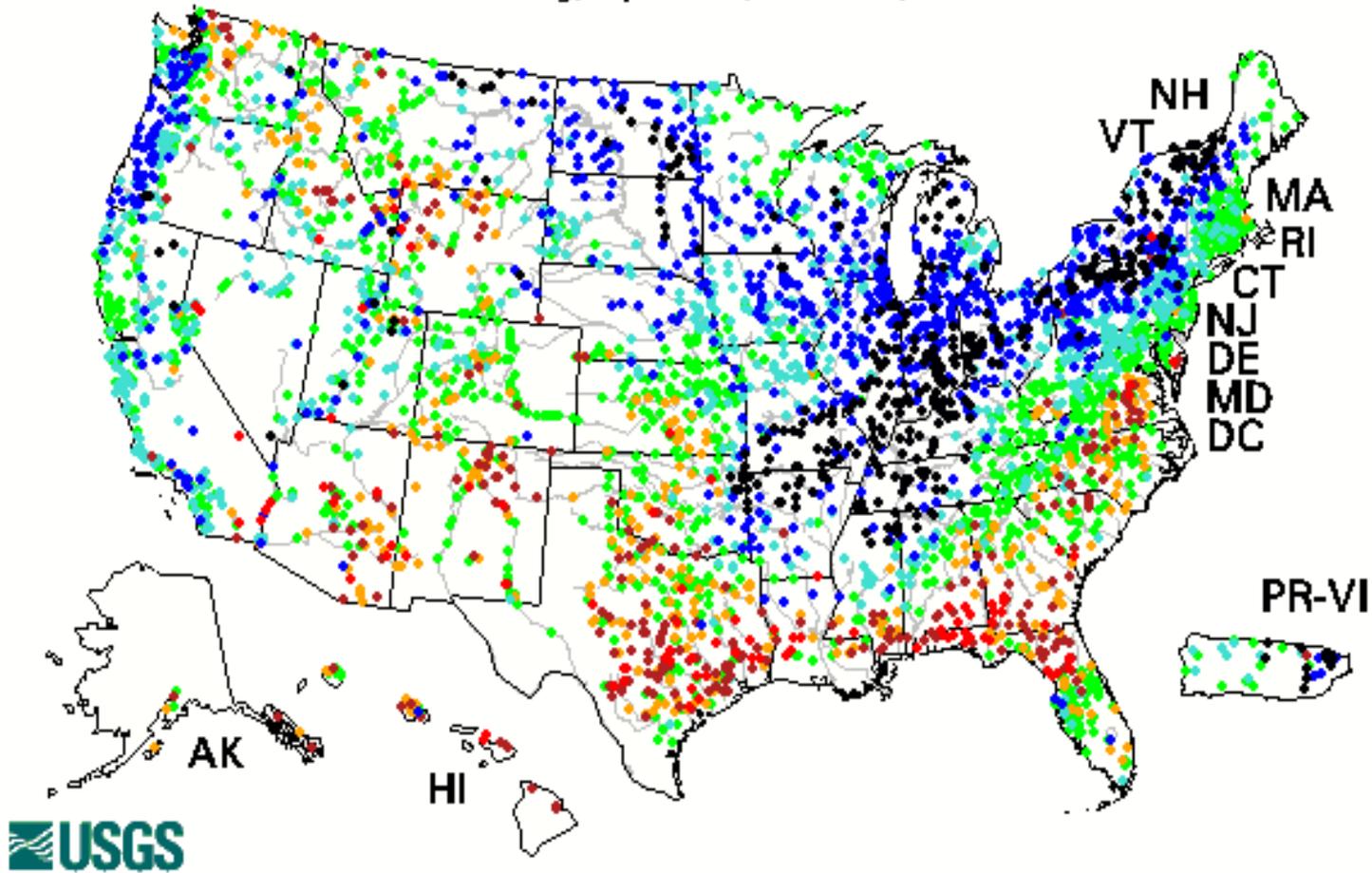
River Miles (Not to Scale)

Flood Volumes



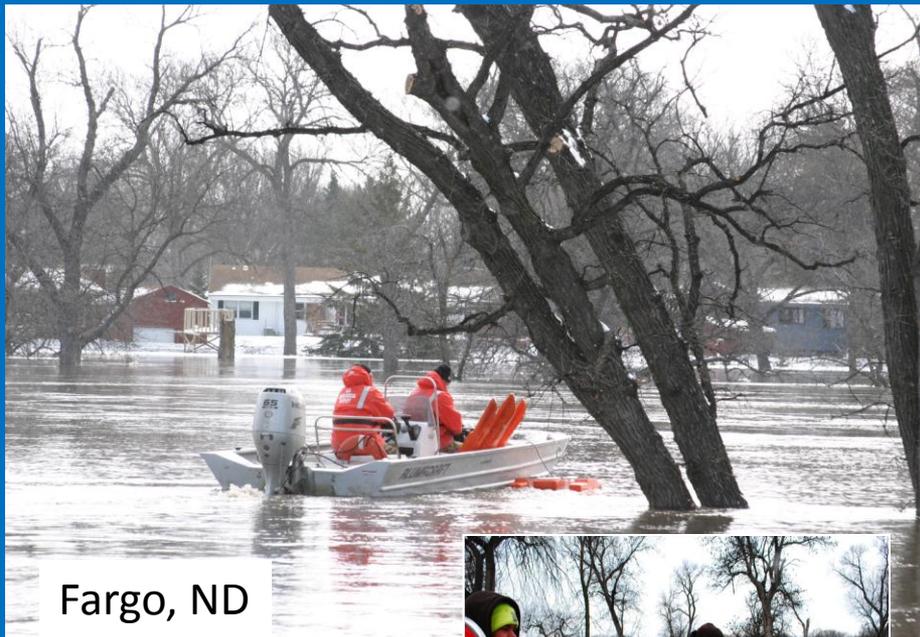
USGS Streamgaging Activities

Wednesday, April 27, 2011 19:30ET





Natchez, MS

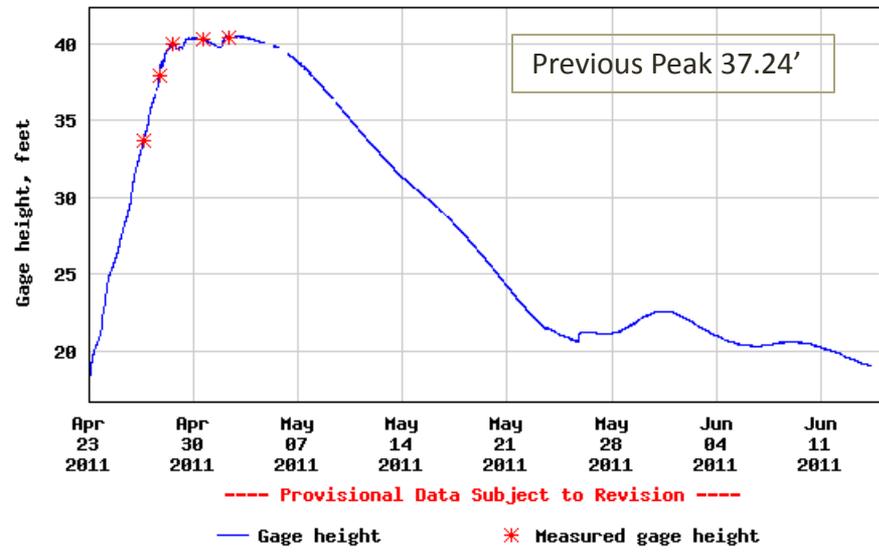


Fargo, ND

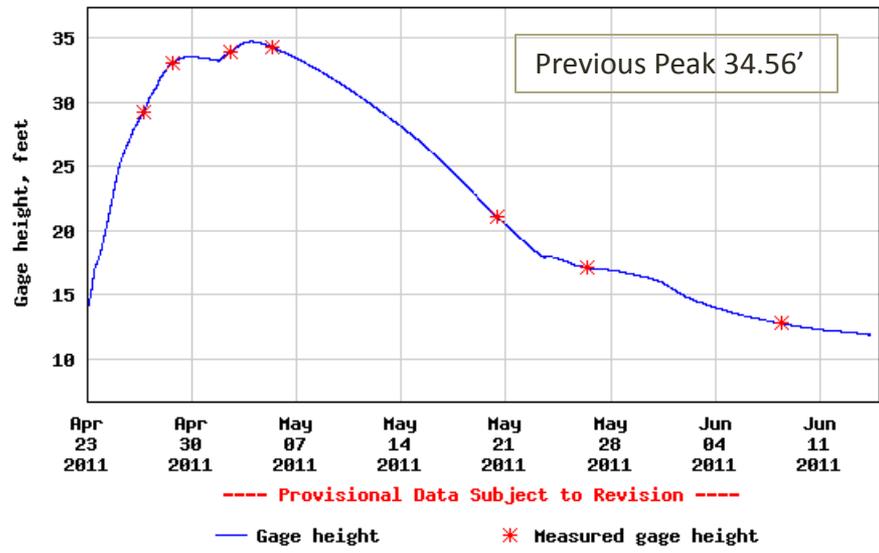


- **2,263 special streamflow measurements in 15 states from February through August, 2011**
- **Installation of 51 Rapid Deployment Gages (RDG)**
- **Rating extensions for at least 74 streamgages**

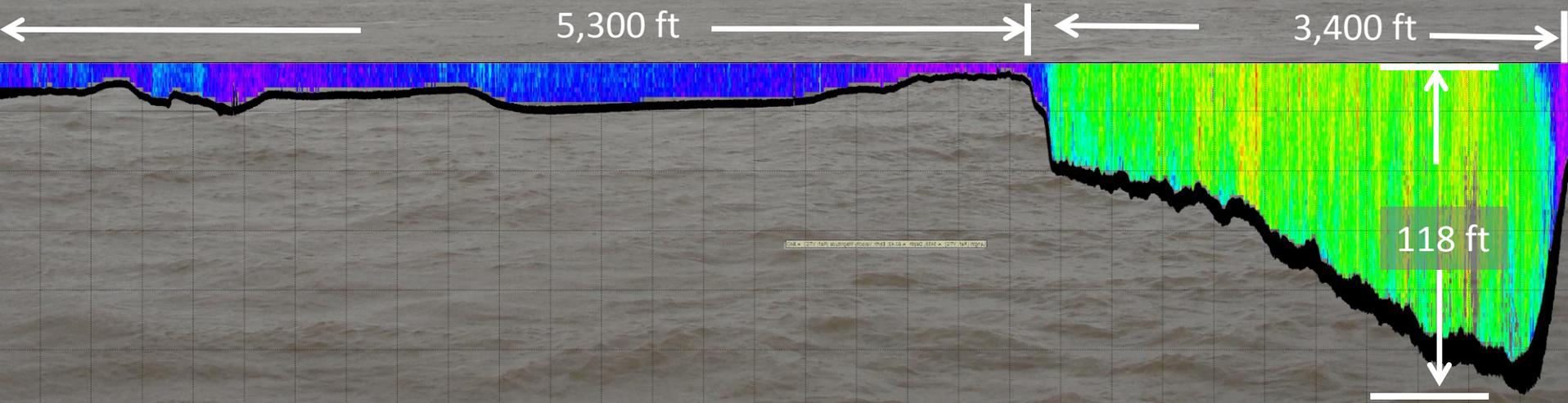
USGS 05599490 BIG MUDDY RIVER AT RTE 127 AT MURPHYSBORO, IL



USGS 05597000 BIG MUDDY RIVER AT PLUMFIELD, IL



Mississippi River Looking Upstream Just Below Confluence of Ohio and Mississippi at Wycliffe, KY



Data Dissemination

Methods

- Phone calls
- Emails
- NWS Chat



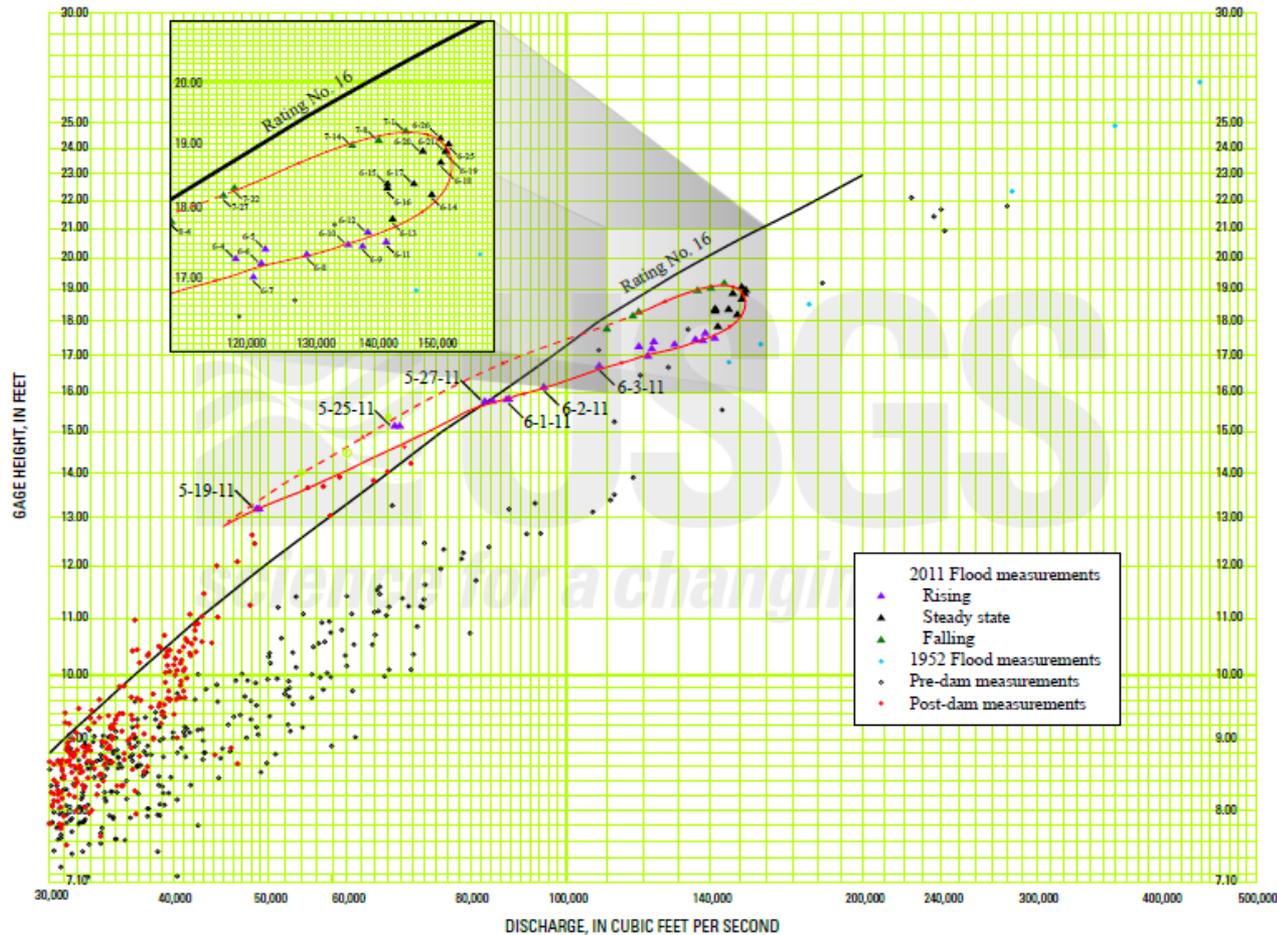
The screenshot shows a web-based chat interface for 'mbrfcagencieschat'. The window title is 'mbrfcagencieschat' and the subtitle is 'Missouri Basin RFC Agencies Chatroom'. The chat history includes several messages from 'nwsbot' and 'usgs-paul.h.rydlund'. The messages discuss river forecasts for various rivers and provide detailed discharge data for the Missouri River at Hermann, MO, and Brownville, NE. The data includes discharge (Q), width, mean velocity, and maximum velocity for both the main channel and overflow.

Jun River, Marais River, Grinnow River, Madison River, Beaverhead River
(7/21/2011 10:05:02 AM) nwsbot: KRF issues [River Forecast \(RVFSPL\)](#) for Big Thompson River
(7/21/2011 10:05:42 AM) nwsbot: KRF issues [River Forecast \(RVFUMO\)](#) for Unknown River
(7/21/2011 10:09:35 AM) nwsbot: KRF issues [River Forecast \(RVFMIL\)](#) for Unknown River, Missouri River
(7/21/2011 2:26:45 PM) nwsbot: KRF issues [River Forecast \(RVFUDT\)](#) for Missouri River
(7/21/2011 3:01:45 PM) usgs-paul.h.rydlund: Missouri River at Hermann, MO, 1120 CDT, GH=22.93, Discharge 217,000 cfs, Mean Velocity = 5.07 fps, Max Velocity = 9.75 fps, Max Depth 41.2 ft.
(7/21/2011 4:03:05 PM) USGS-IA Kris Lund: Missouri River at Brownville, NE: 11:15 CDT, GH=38.77 ft, Q=232,300 cfs, width=19,272 ft, max depth=39.0 ft, mean vel=2.81 ft/s.
Main channel: Q=116,400 cfs, width=872 ft, mean vel=4.54 ft/s, max vel=9.57 ft/s.
Overflow: Q=115,900 cfs, width=18,400 ft, mean vel=1.07 ft/s, max vel=8.72 ft/s.
(7/21/2011 4:55:52 PM) nwsbot: NESDIS issues [Satellite Precipitation Estimates](#)
(7/21/2011 7:00:00 PM) nwsbot: ----- Jul 22, 2011 [GMT] -----
(7/21/2011 7:16:37 PM) nwsbot: KRF issues [River Forecast \(RVFJAM\)](#) for Pipestem Creek
(7/21/2011 7:23:17 PM) nwsbot: NESDIS issues [Satellite Precipitation Estimates](#)

Font + Insert Smile!

Notable Stage-Q Rating Work

06342500 Missouri River at Bismarck, ND



Rapid Deployment Gages



Minnesota River at Granite Falls, MN.



Post Creek Cutoff near Karnak, IL



Mississippi River at Memphis, TN

Special Investigations

Mississippi River

Ohio River

Scott

Ballard

McCrac

57

Birds Point-New Madrid Floodway

55

Carlisle

Grav

Hickman

Pre-existing drainage outlet - 1500 ft gap

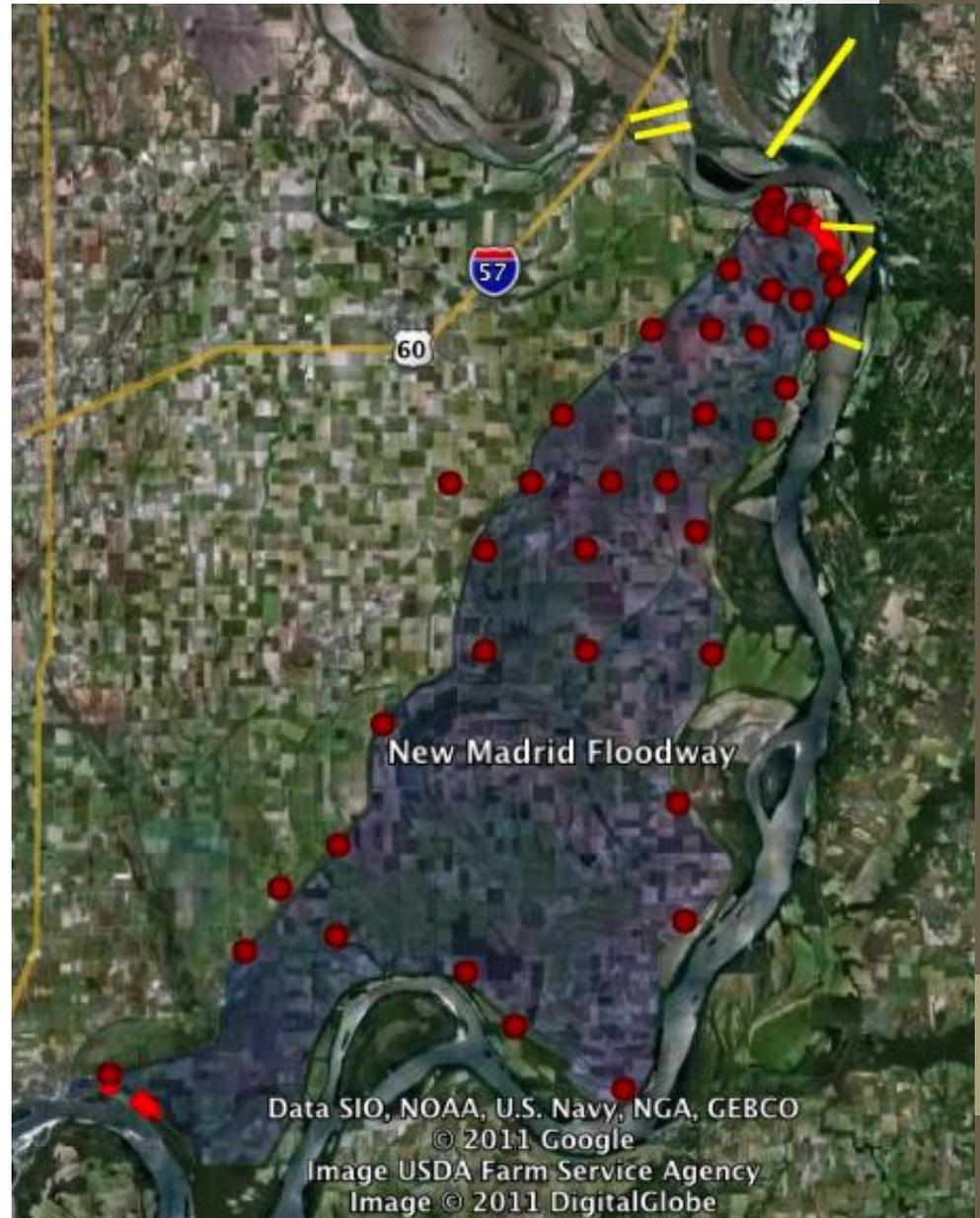
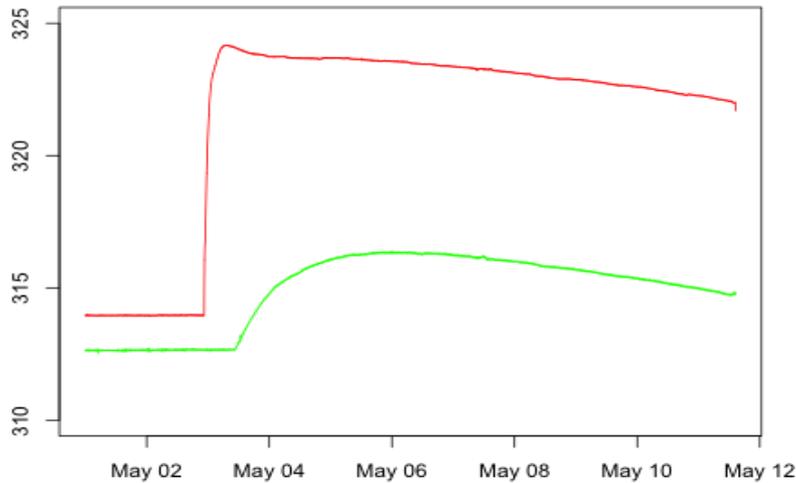


Fulton

New Madrid

51

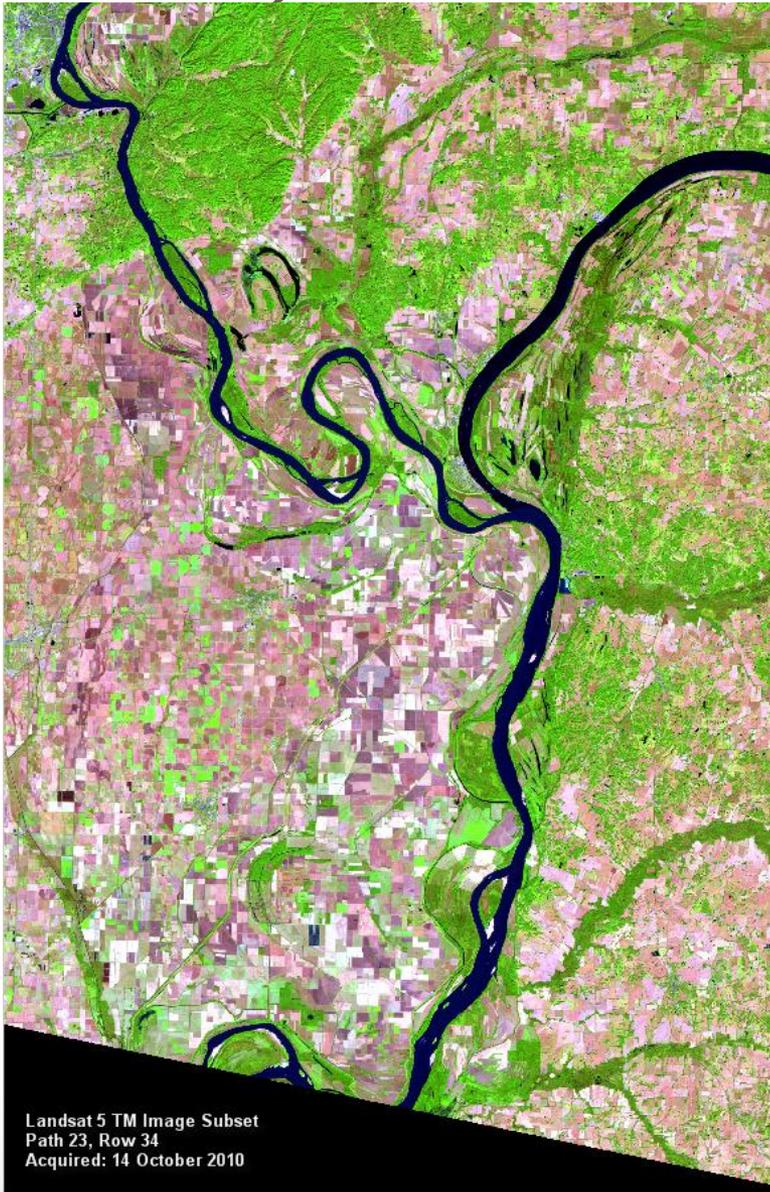
Birds Point-New Madrid Floodway



Mississippi River – New Madrid Floodway



Cairo, IL and BPNM Floodway



Flood Velocities: Navigational Impacts



Mississippi River – New Madrid Floodway



Activation May 2, 2011 10:00 PM

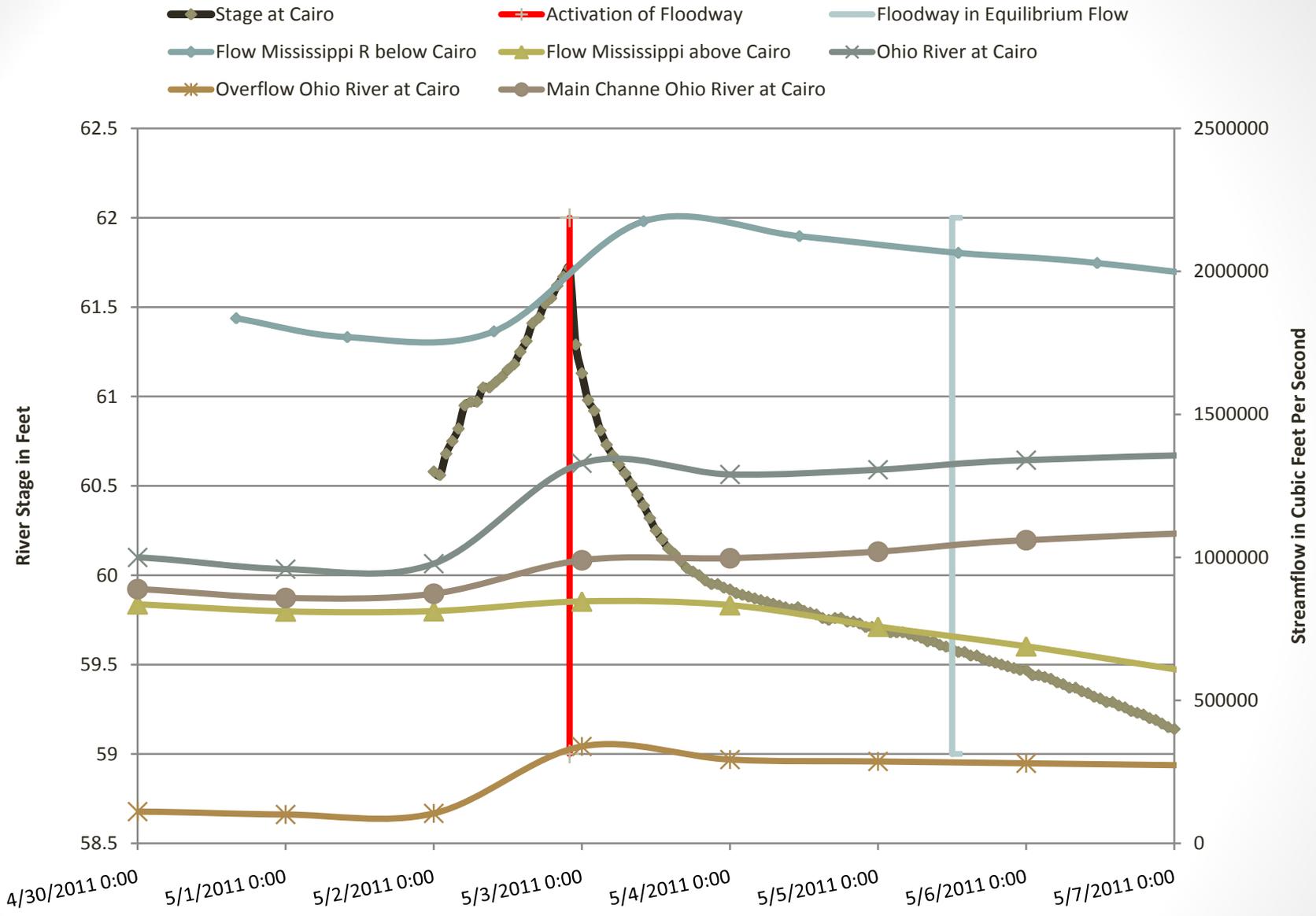


way



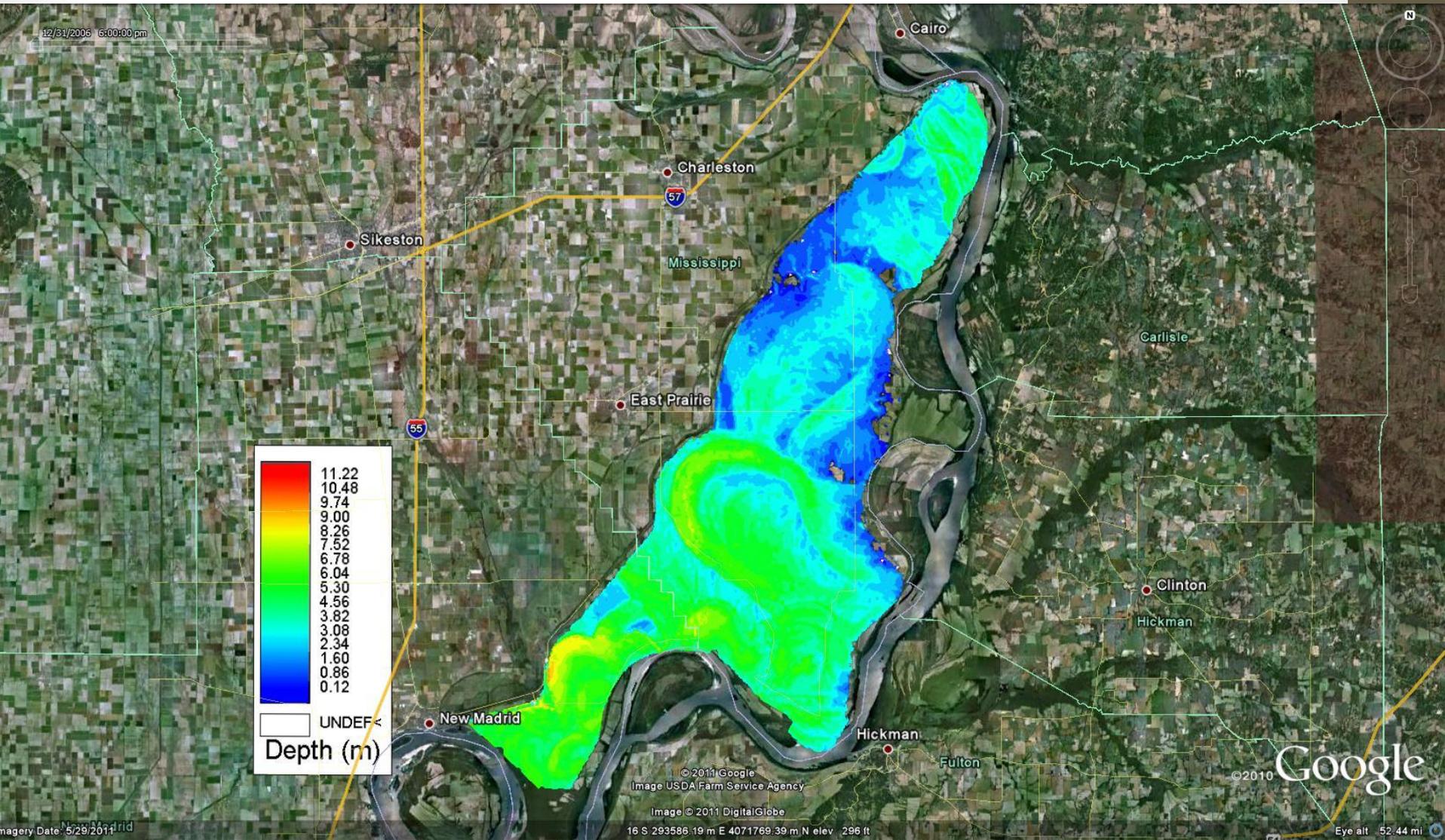
Inflow/Outflow #1





Mississippi and Ohio River Confluence

2-D Modeling of the New Madrid Floodway

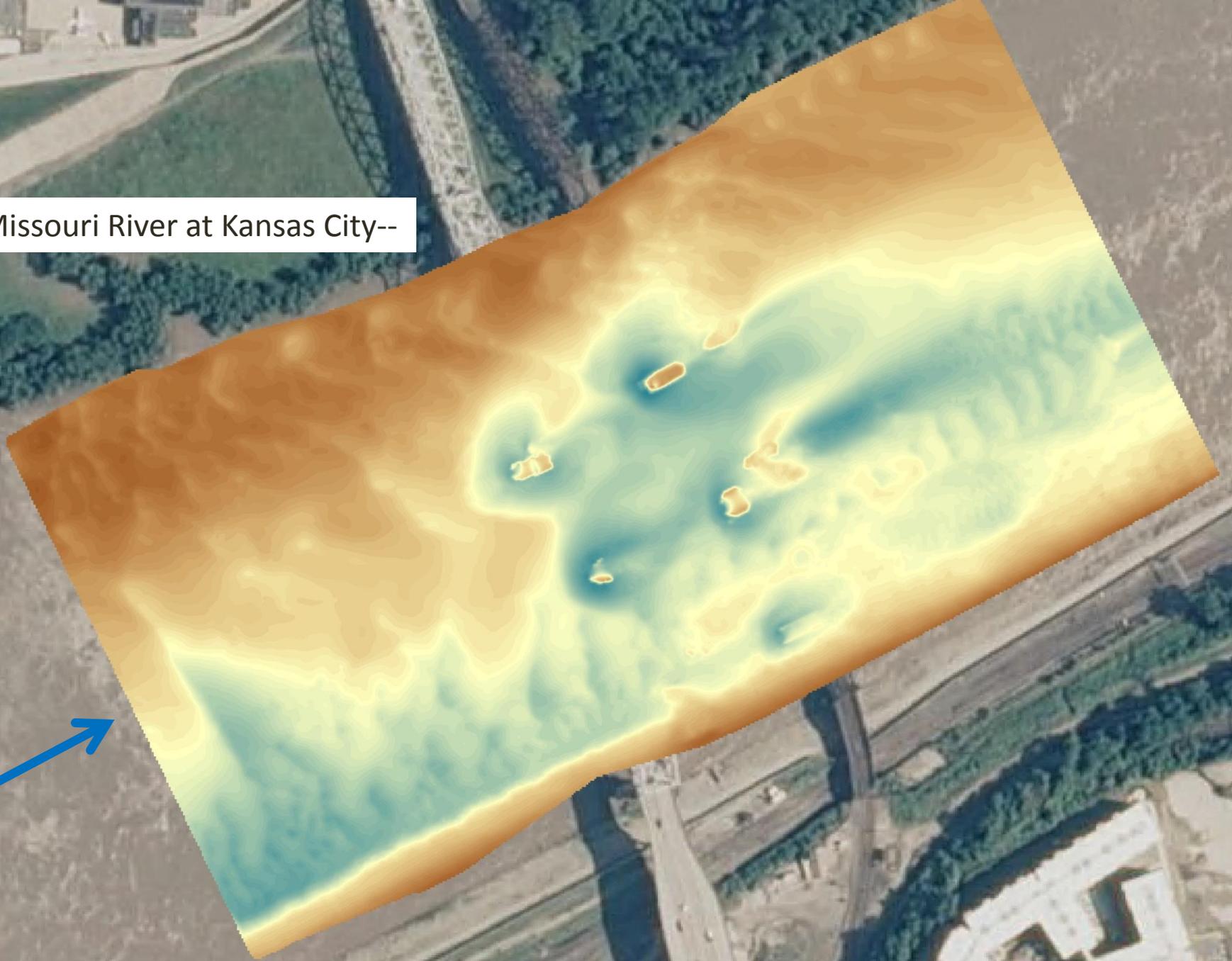


Model—USGS IRIC Platform using FastMech and Storm

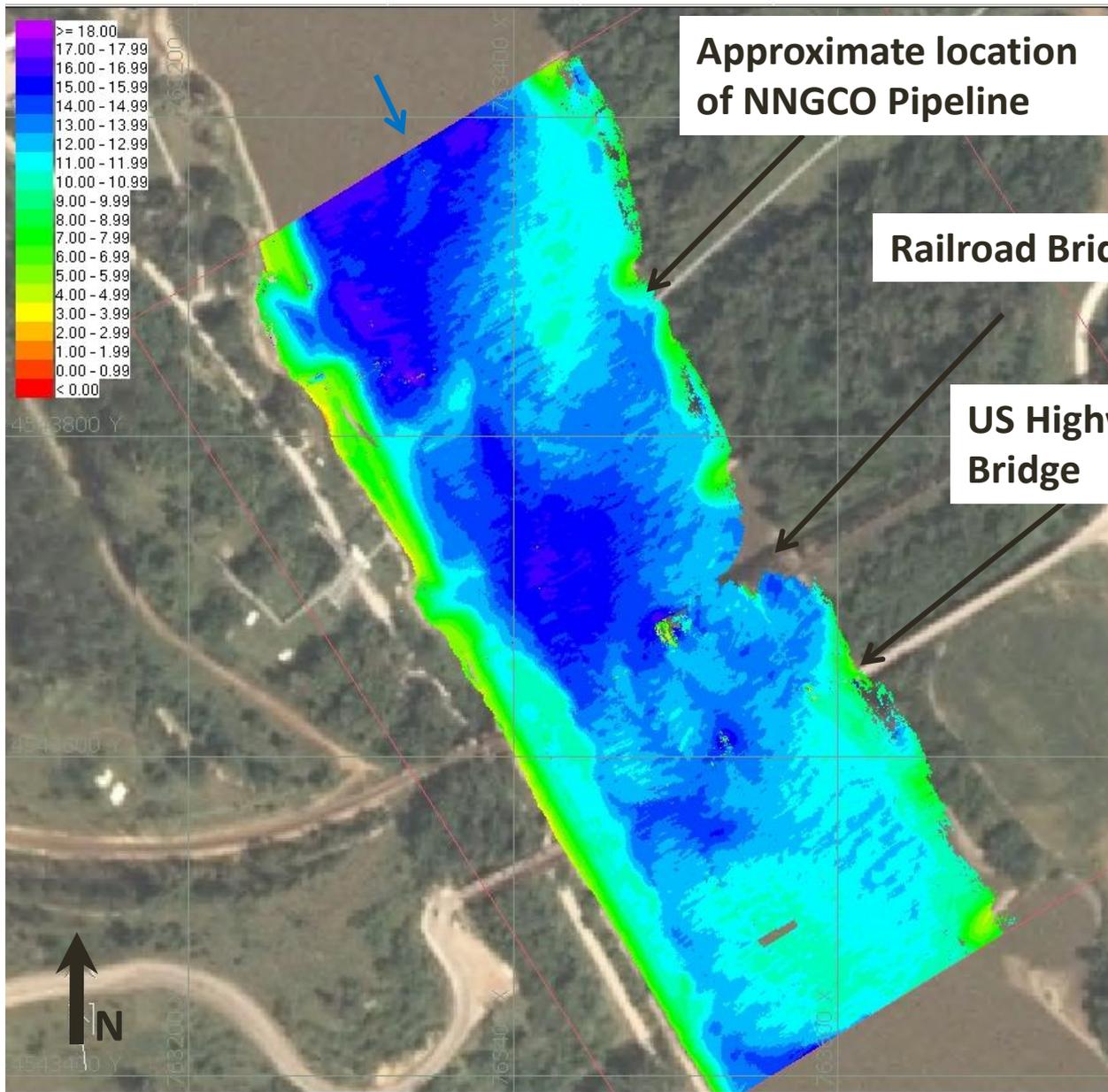
Multibeam Bathymetric Surveys

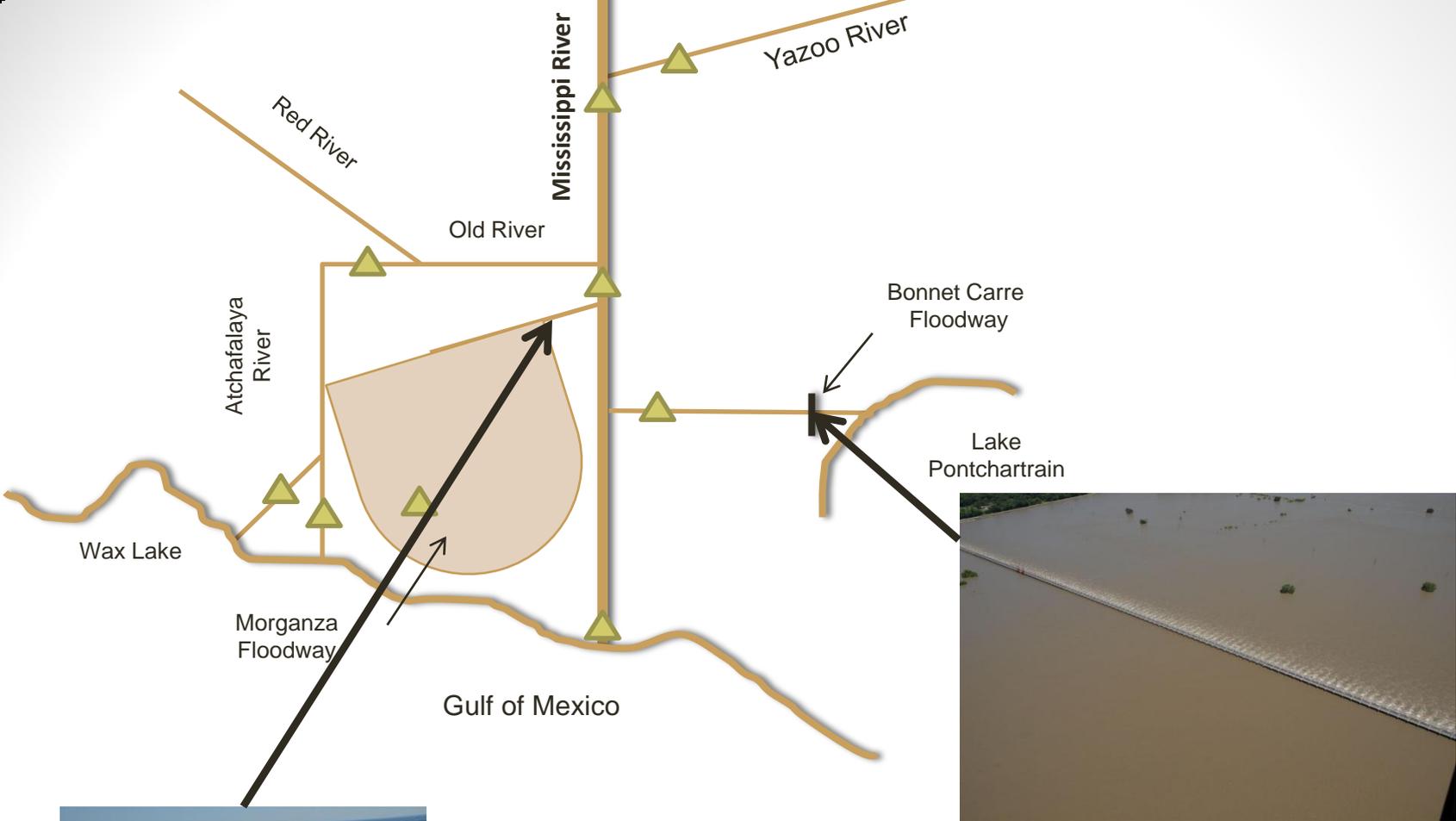


Missouri River at Kansas City--



Plattsmouth, Nebraska Missouri River Pipeline Crossings





Lower Mississippi River

Morganza Floodway

- Water Level Sensors Deployed
- Special Measurements of Flow
- Note disagreement in ADCP vs AA-Price Measurements at Tarbert Landing



● USGS Realtime gages
● COE operated gages

📷 USGS Realtime cameras

● Non realtime

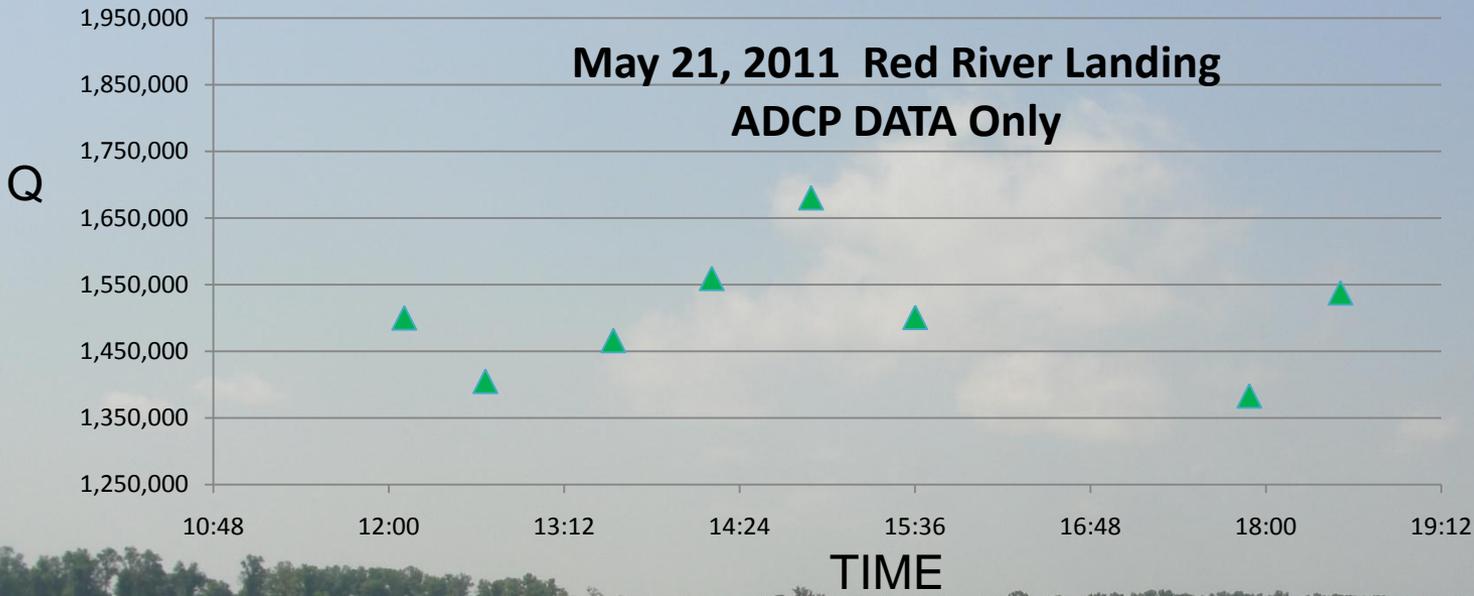


C-200

SEA ARK SOUTHERN COMFORT USGS

HONDA

US

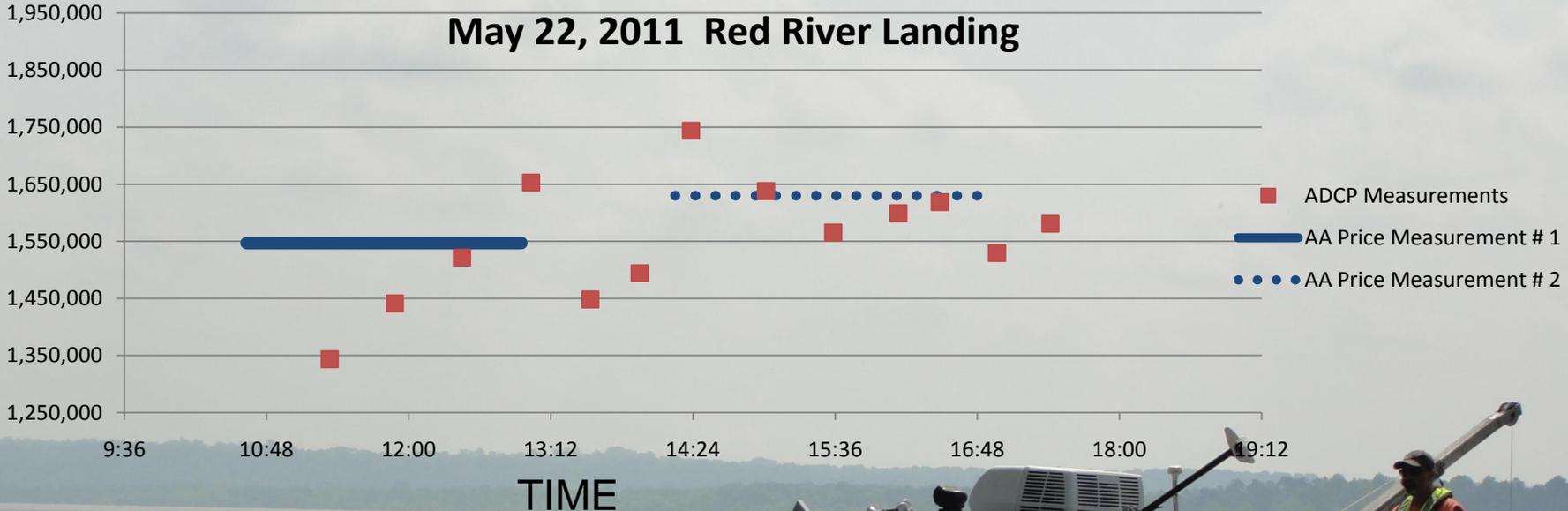


Red River Landing Flow Measurements 5/21/2011



May 22, 2011 Red River Landing

Q



Red River Landing Flow Measurements 5/22/2011

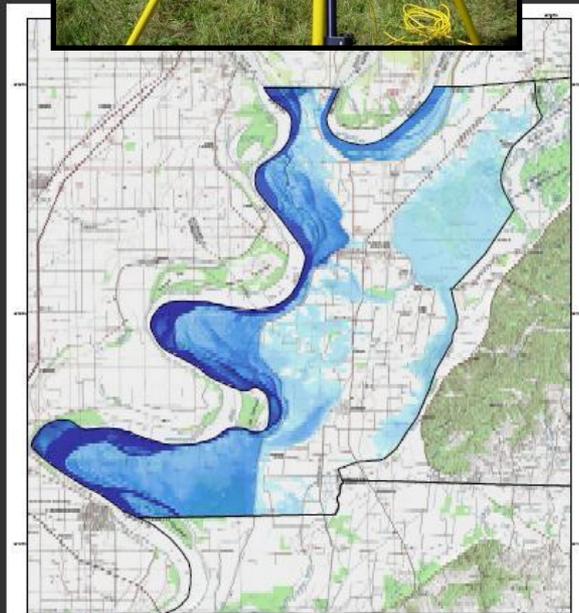
Flood Inundation Mapping



Peak Flood Inundation - preliminary map
Shelby Co., TN, 5/10/11

This map represents peak flood inundation in Shelby County along the Mississippi River as of 5/10/11. It is based on preliminary field data and may not represent actual conditions in the area. This should be considered a draft product.

David Ladd, USGS TN Water Science Center



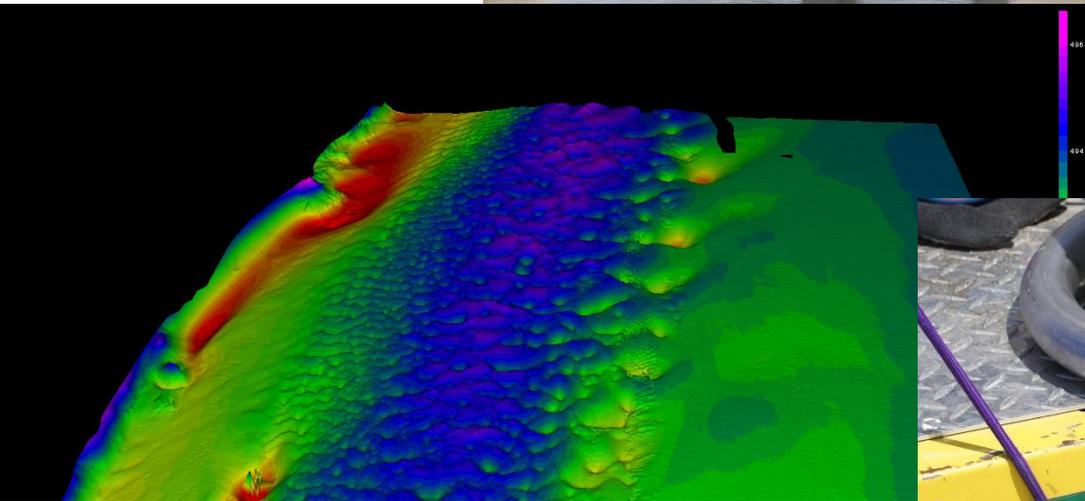
Peak Flood Inundation - preliminary map
Lake Co., TN
map created on 5/20/11

This map represents peak flood inundation in Lake County, Tennessee due to flooding early May 2011. It is based on preliminary field data and may not represent actual conditions in the area. This should be considered a draft product.

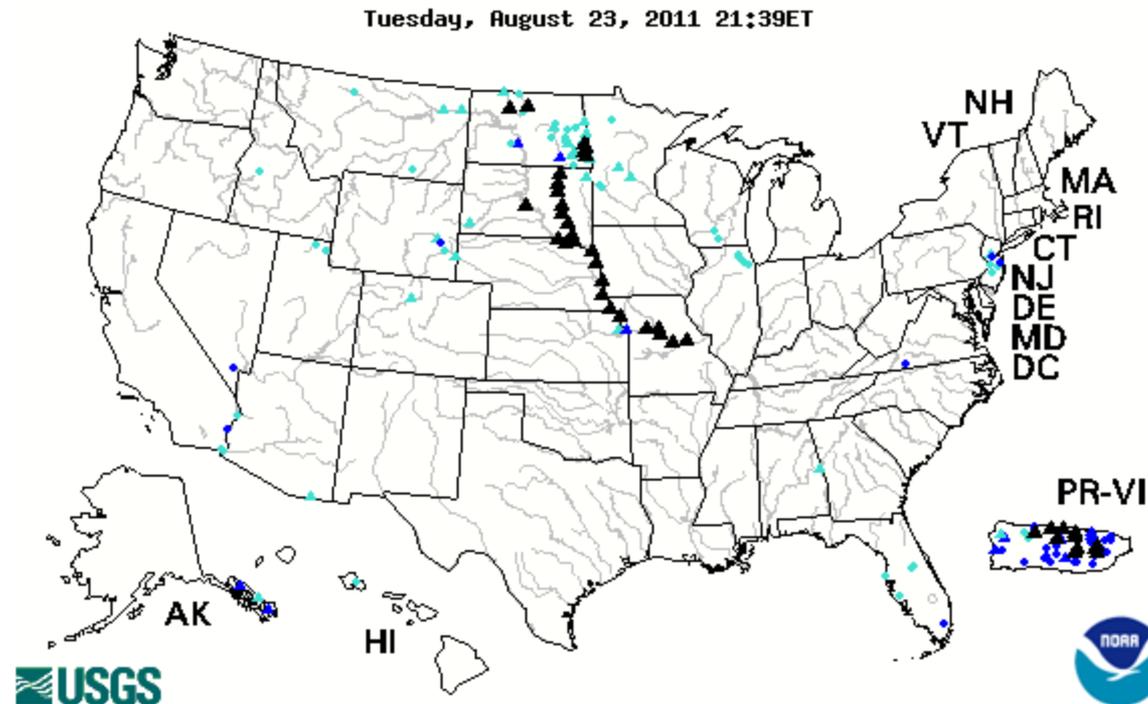
David Ladd, USGS TN Water Science Center

Sediment Transport

Missouri River at
Nebraska City, Neb.



Current



- RDG just installed on James River (ND) in support of Corps flood control at Jamestown and Pipestem Reservoirs
- 11 other RDGs remain in place in ND, with 4 in Souris basin
- Weekly measurements on Missouri River at selected locations
- Misc. measurements on James River (ND) as needed at request of Corps.
- Various interpretive and flood inundation efforts underway

Future



- Central U.S. Flood Report Series to (potentially) include:
 - Flood peaks
 - Flood frequency assessments
 - Water Quality Studies
 - Sediment/Geomorph
 - Hydraulic impacts of levee breaches
 - Hydrology Assessments
 - Flood volumes
 - Trends
 - Biologic Impacts