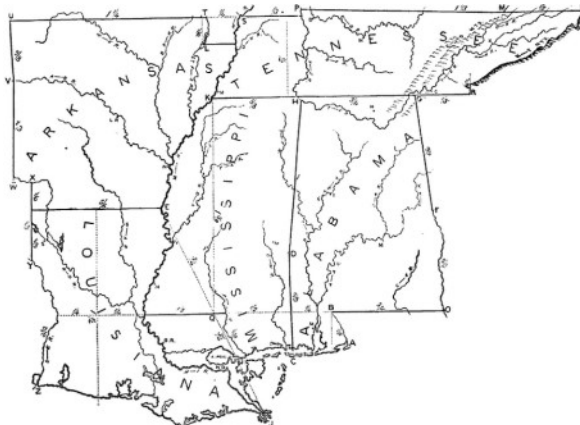




**Near Realtime Data
Collection, Storing, Distribution
USGS Lower Mississippi–Gulf Water Science Center**

Shannon Williams
Associate Director



U.S. Department of the Interior
U.S. Geological Survey

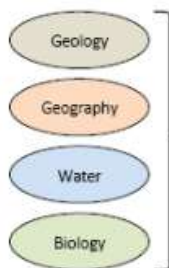
1

USGS History and Mission Areas

US Geological Survey Formed in 1879
Department of Interior
First Stream Gage in 1889



Former Disciplines
(Pre-2010)



Mission Areas



2

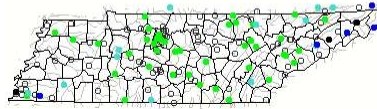
What types of near real-time data collected

1146 Near Real-time sites in Lower Mississippi Gulf WSC

- **Streamflow**
- Gage Height
- Groundwater levels
- **Irrigation water use**
- Precipitation
- Windspeed and Direction
- **Water Quality**
 - Water Temperature
 - Dissolved Oxygen
 - pH
 - Specific Conductance/Salinity
 - Nitrate, Chlorophyll, etc.

Daily Streamflow Conditions

Select a site to retrieve data and station information.
Wednesday, June 12, 2019 11:30ET



3

Realtime Network Partners

- Only 29% of our LMGWSC network is funded by USGS
 - Federal Government Partners
 - Local and State Government Partners
 - Private Sector



United States Army
Corps of Engineers
Federal agency



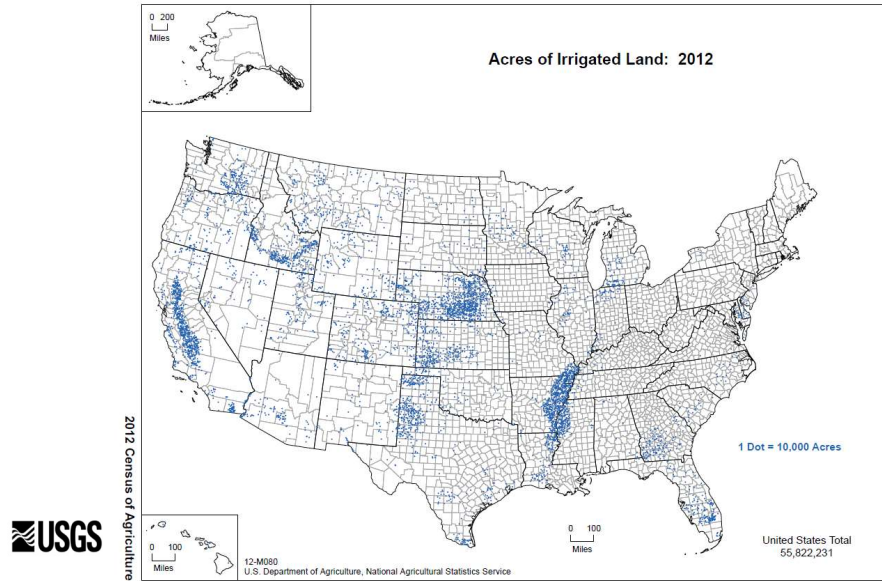
Tennessee Valley
Authority
Corporation



4

Data Collection – Irrigation Water Use

- Arkansas 3rd largest area of irrigated cropland in US



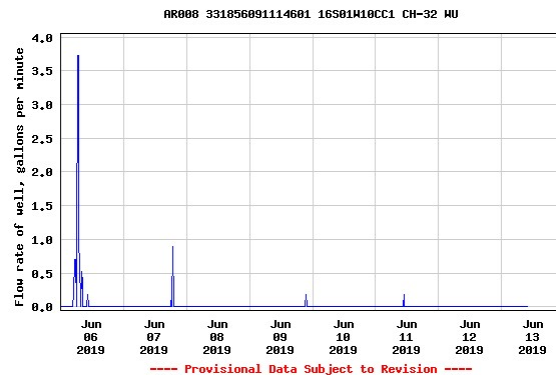
5

Data Collection – Irrigation Water Use

- Near real-time flow meters on irrigation wells

Flow rate of well, gallons per minute

Most recent instantaneous value: 0.00 06-13-2019 10:00 CDT



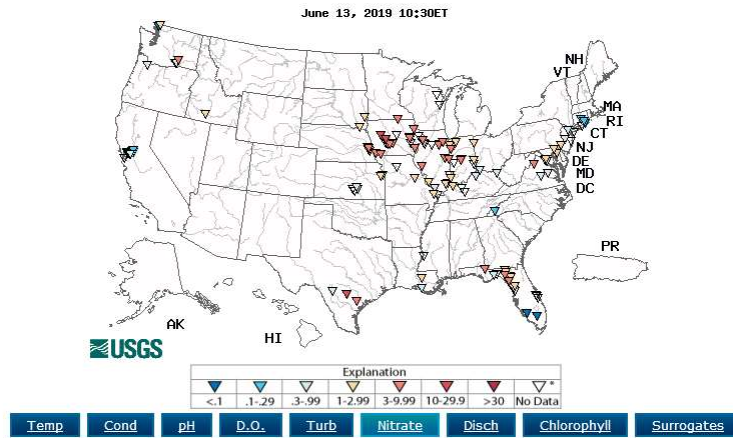
USGS

6

Data Collection – Water Quality – newer continuous monitoring

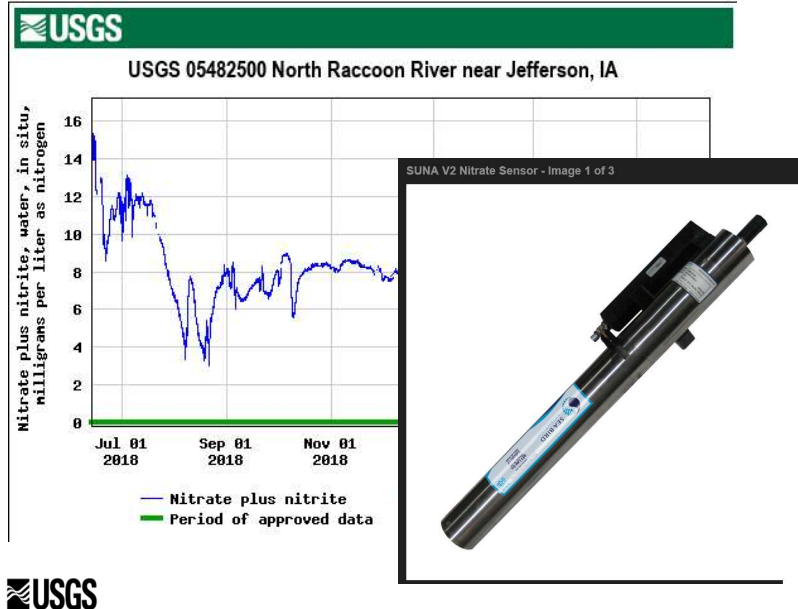
- Nitrate, Chlorophyll, Estimated Suspended Sediment

Real-Time Nitrate, in mg/L as N



7

Data Collection – Water Quality – newer continuous monitoring



8

Data Collection – Water levels

- Similar to instruments used in Lower Mekong



"MRC Hydro-meteorological Network" Hydro-meteorological data collection and transmission system

Network of 49 stations for efficient, reliable and timely measurement of water level (OTT CBS Bubble Sensor, OTT RLS Radar Level Sensor, OTT SE200 Shaft Encoder) with remote data transmission systems by GPRS



Background

The Mekong River Commission Secretariat (MRCs) is a Basin Management Organization formed through the joint cooperation by the National Governments of Cambodia, Lao PDR, Thailand and Vietnam. Besides, China and Myanmar are dialogue partners for cooperation with the MRCs.



The organization aims at sustainable development on managing water resources, sharing information among the Mekong member countries.

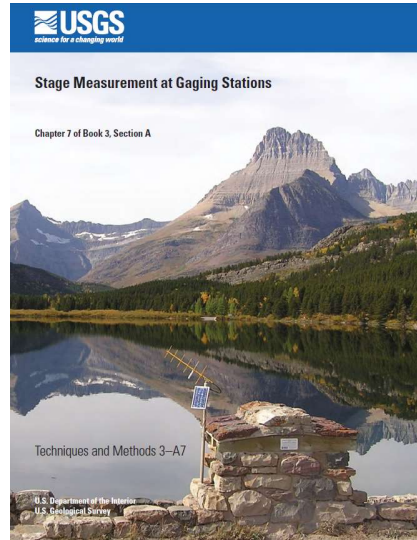
In cooperation with the World Meteorological Organization (WMO), MRC established a near-real time Hydro-meteorological network, funded by the French Development Agency AFD.

The MRC hydro-meteorological network is a basin wide hydro-meteorological monitoring system, spatially covering both mainstream and main tributaries of the Mekong River.

The system is integrated into the existing MRCs monitoring system and will also improve the national hydrological networks and river monitoring / forecasting capacities.

The project is managed under the Information and Knowledge Management Programme (IKMP) in the Technical Support Division (TSD) of the MRC Secretariat.

It shall be ensured that all data collected basin wide are made available in a timely manner to the Regional Flood Management and Mitigation Center (RFMMC) in Phnom



9

Data Collection – Water levels

- Any Questions on Water level methods?

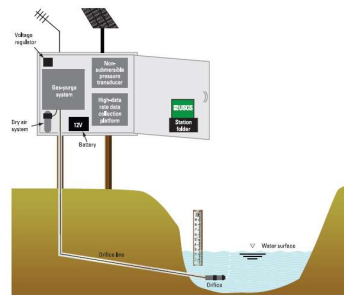


Figure 51. Schematic of bubble gage, nonsubmersible pressure transducer, DGL, and IRT DGP

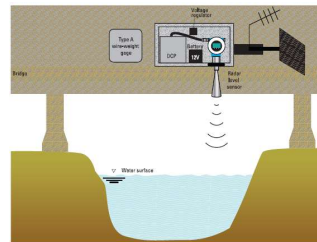


Figure 53. Schematic of a radar level sensor used to measure stage with EEL and IRT DGP



10

Data Collection – Water levels

- Peak water level verification

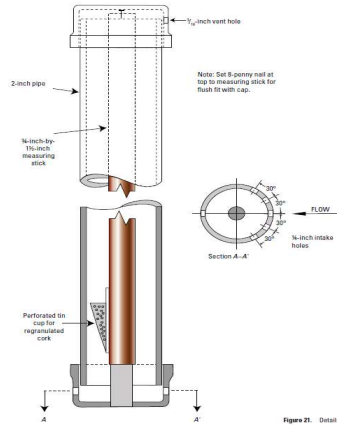


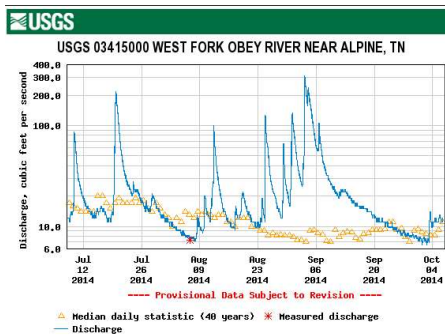
Figure 21. Details of a crest-stage gage.



11

Data Collection – Streamflow

- Major focus of USGS



12



Discharge Measurements at Gaging Stations

Chapter 8 of Book 3, Section A

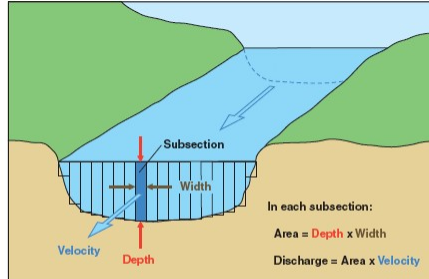


Techniques and Methods 3–A8

U.S. Department of the Interior
U.S. Geological Survey

Data Collection – Streamflow

- Section by Section measurements



Current-meter discharge measurements are made by determining the discharge in each subsection of a channel cross section and summing the subsection discharges to obtain a total discharge.

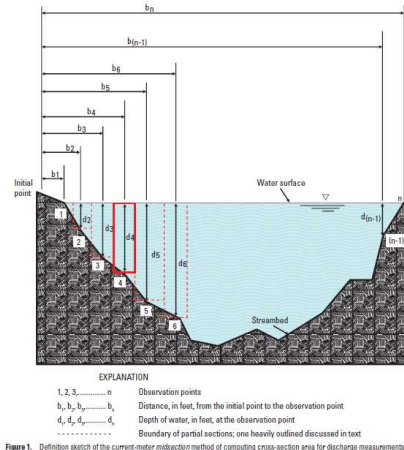


Figure 1. Definition sketch of the current-meter subsection method of computing cross-section area for discharge measurements.



13

Data Collection – Streamflow

- Wading, Bridges, Cableways



Figure 17. Wading measurement using a top-setting rod.



Figure 66. Measuring from a bridge with a bridge board.



Figure 70. Vehicle-mounted, power-driven crane.



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Data Collection – Streamflow

- Standard method for almost 100 years

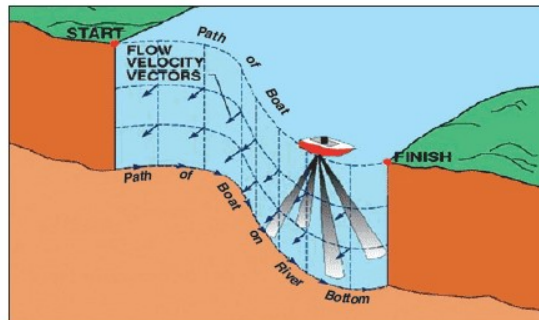


Truck mounted current meter and sounding weight, on bridge over...
Truck mounted current meter and sounding weight, on bridge over Mississippi River at Memphis, Shelby County, Tennessee, 1938. Upper right photograph on page 31. Images of the U.S. Geological Survey, 1879-1979. - ID. Water Supply Paper, 103 - h2op0103 - U.S. Geological Survey - Public domain image

15

Data Collection – Streamflow

- Now use Acoustic Doppler Current Profiler (ADCP)



Acoustic Doppler Current Profiler (ADCP) mounted in a small watercraft, is used for measuring the discharge of a river. The ADCP acoustic beams are directed down into the water as it is guided across a river channel.



16

Data Collection – Streamflow

- Examples of field techniques



Figure 64. Remotely operated hydrographic survey vessel (RHV) with ADCP and sonar equipment used by the USGS.



Figure 73. ADCP equipment mounted and operated on A, a moving boat and B, a tethered platform.



17

Data Collection – Streamflow

- Example of Data from ADCP measurement

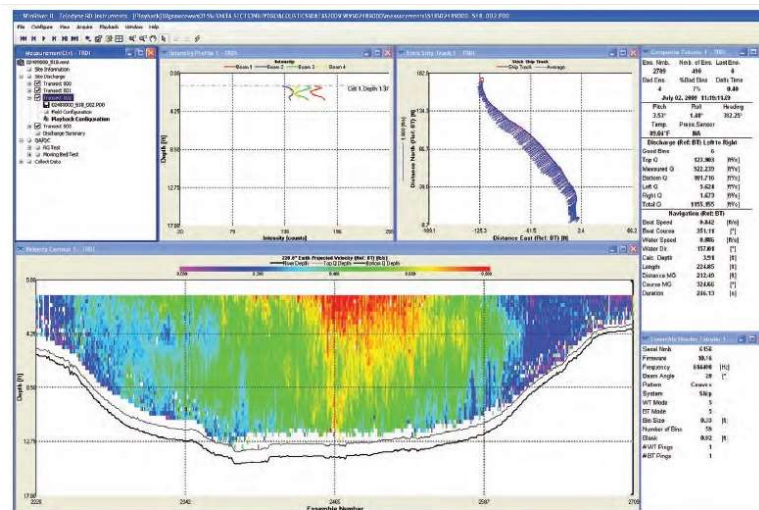


Figure 42. Screen capture of an ADCP measurement of discharge for the Pearl River near Columbia, MS (02489000).

18

Data Collection – Streamflow

- Index Velocity Method

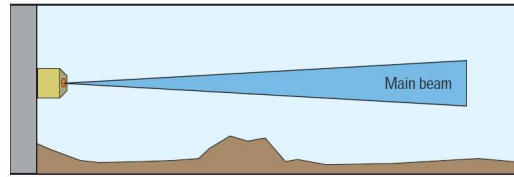
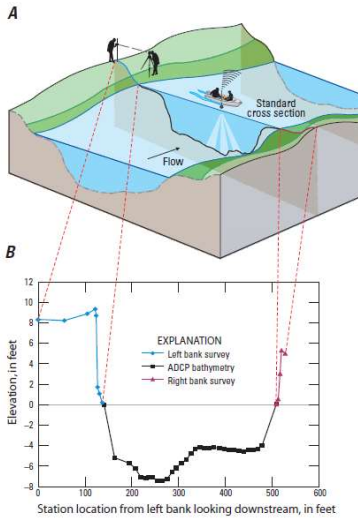


Figure 4. Diagram of sideloader ADV measurement volume and main acoustic beam.

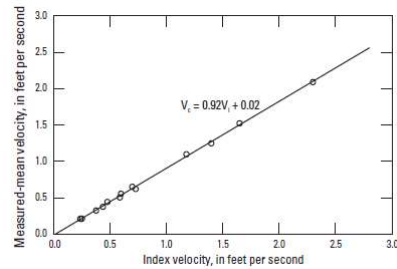


Figure 22. Example of an index rating.

19

Data Collection – Data Transmission

- Geostationary Operational Environmental Satellite (GOES)
- Cellular Data Service
- Iridium Satellite System

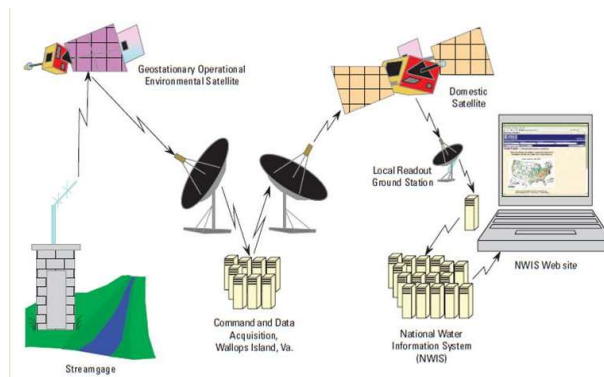


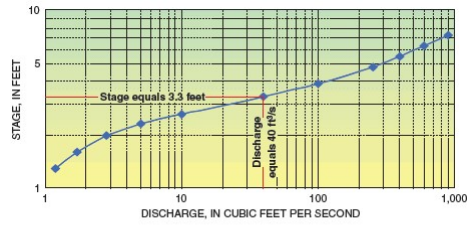
Figure 4. Schematic showing flow of hydrological data for a DCP transmission from a gaging station to the Internet.



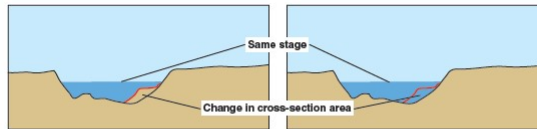
20

Data Processing – Stage Discharge Rating Curves

- Example of Data from ADCP measurement



Example of a typical stage-discharge relation; here, the discharge of the river is 40 cubic feet per second (ft³/s) when the stage is 3.30 feet (ft). The dots on the curve represent concurrent measurement of stage and discharge.



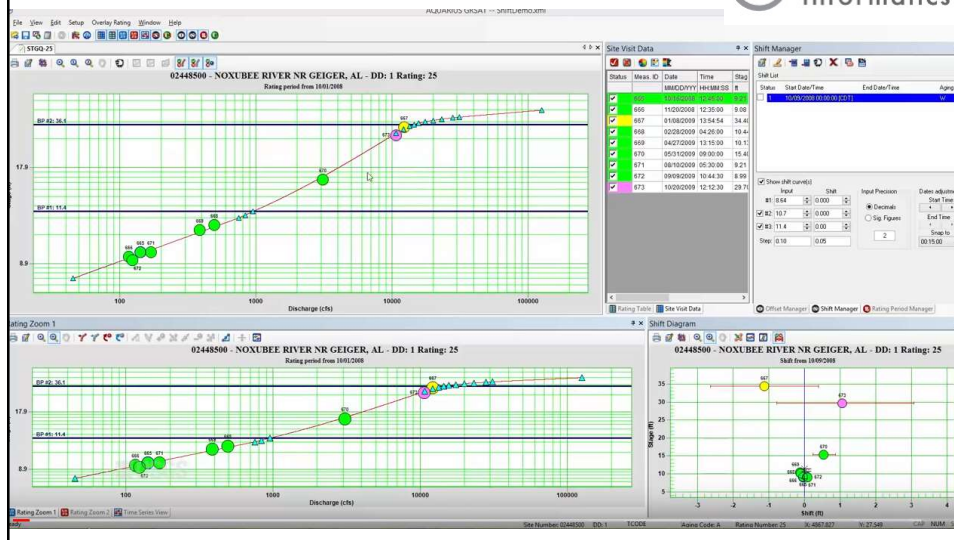
Erosion of part of a channel results in an increased cross-sectional area in the diagram on the right and the potential for conveying a larger quantity of water at the same stage.



21

Data Processing – Aquarius Software

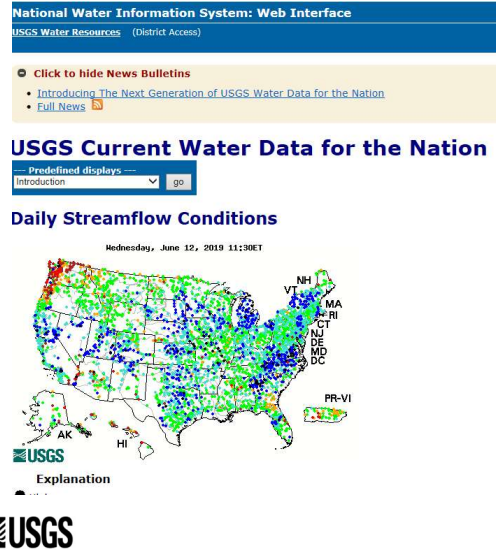
- Several USGS Demonstration Videos available on YouTube



22

Data Distribution – NWISweb

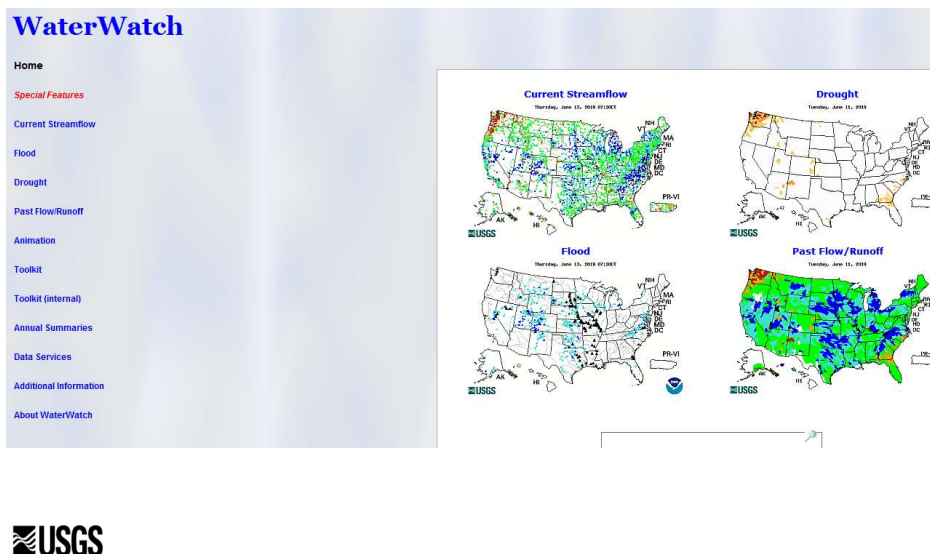
- Needs some updates – drop down menus, etc.



23

Data Distribution – USGS WaterWatch

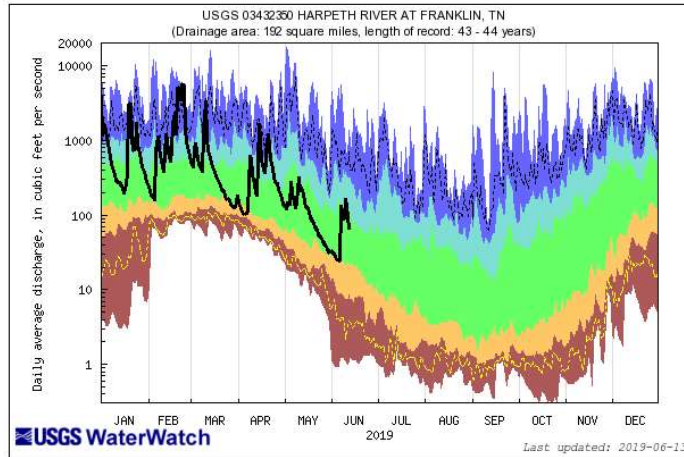
- Flood, Droughts, etc.



24

Data Distribution – USGS WaterWatch

- Site Duration Hydrograph

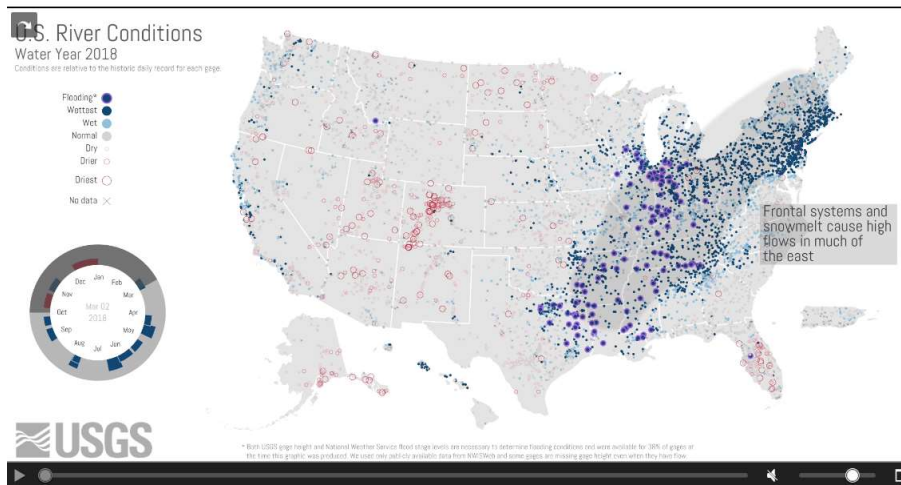


Explanation - Percentile classes					
lowest-10th percentile	5	10-24	25-75	76-90	90th percentile-highest
Much below Normal	Below normal	Normal	Above normal	Much above normal	Flow

25

Data Distribution – US River Conditions Water Year 2018

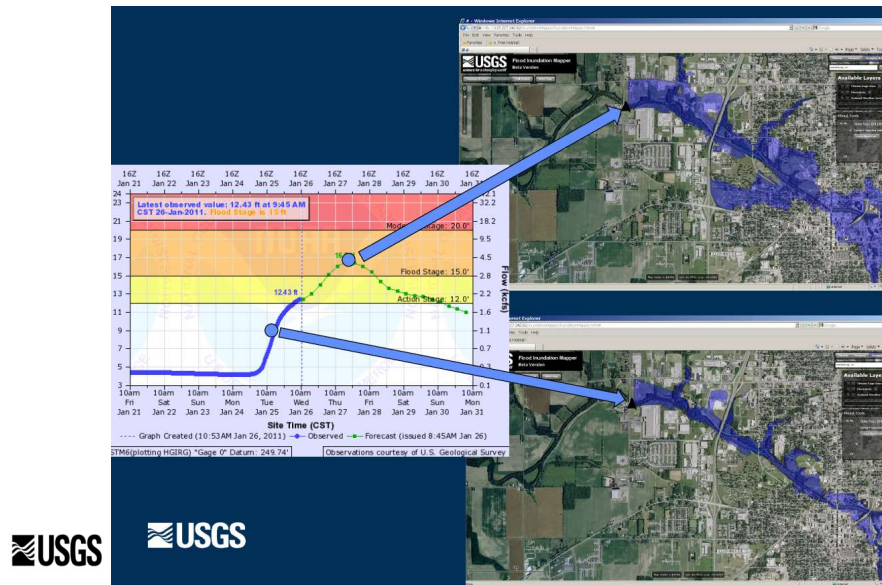
- New ways of showing data
- <https://www.usgs.gov/media/videos/us-river-conditions-water-year-2018>



26

Data Distribution – Flood Inundation Maps

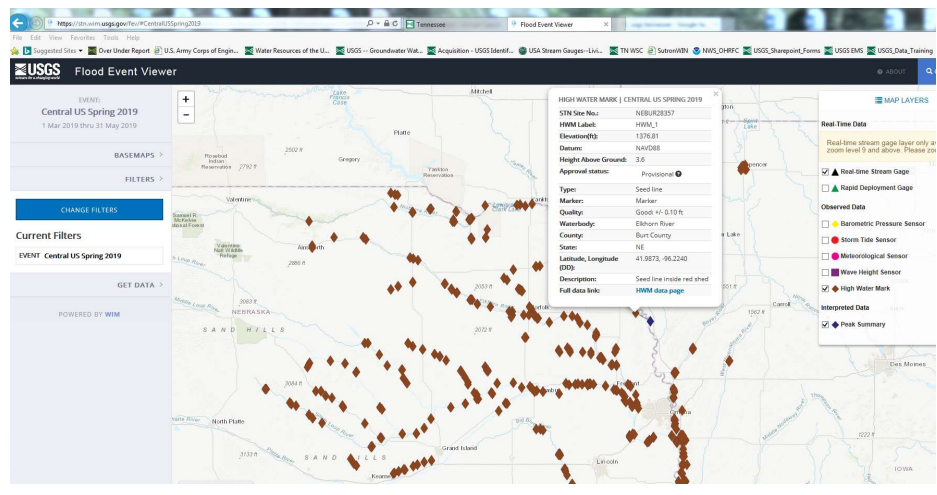
- USGS, USACE, and NWS working together on these



27

Data Distribution – Short-Term Network (STN)

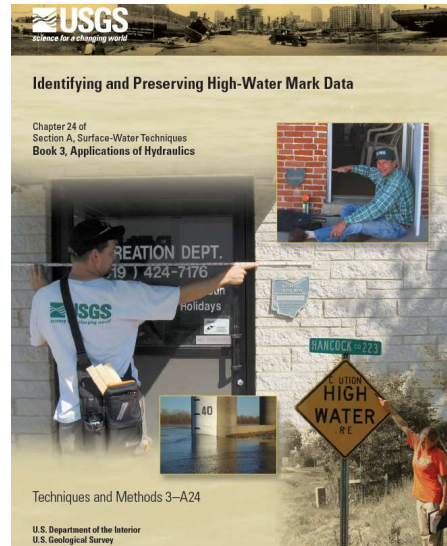
- Event Based Sensor deployments (coastal storm surge)
- High Water Mark (HWM) data collection



28

Data Distribution – Short-Term Network (STN)

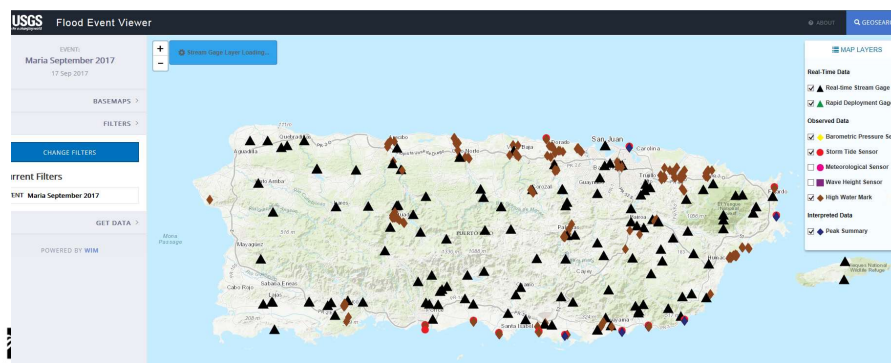
- Event Based Sensor deployments (coastal storm surge)
- High Water Mark (HWM) data collection



29

Data Distribution – Short-Term Network (STN)

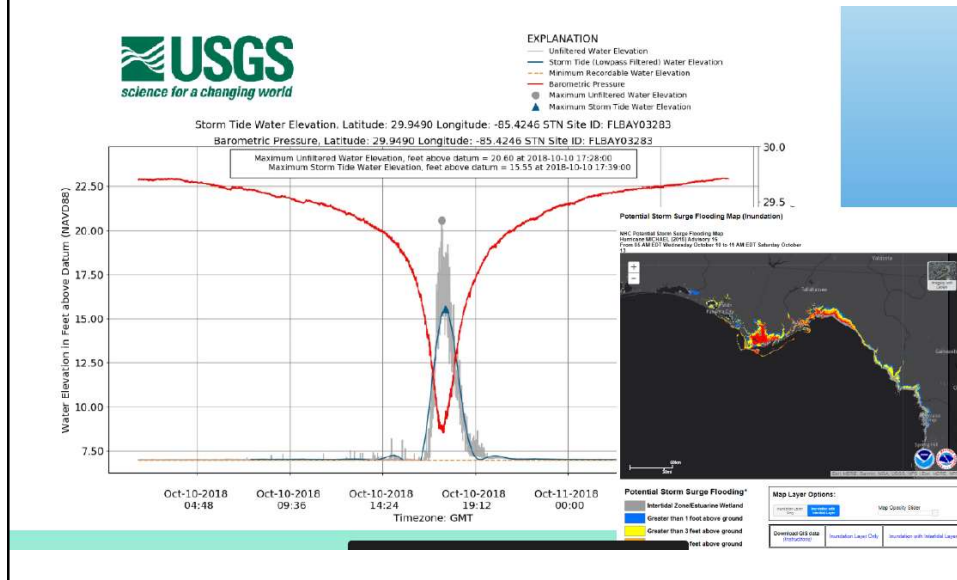
- Storm Tide Sensors
- Hurricane Maria Sept. 2017



30

Data Distribution – Short-Term Network (STN)

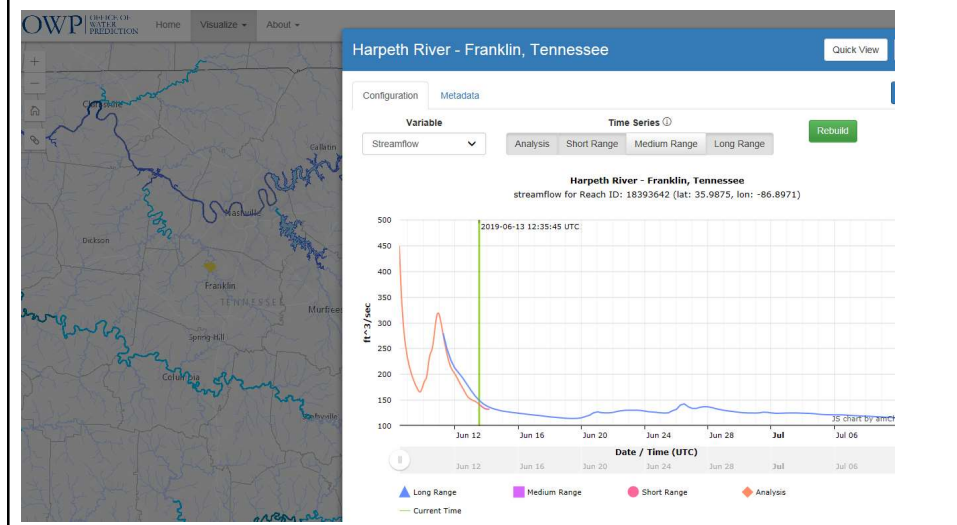
- Storm Tide Sensors



31

USGS Water Mission Area Priorities

- Next Generation Water Observing Systems
- Water Prediction Work Program
- Assist NWS in improving National Water Model



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Questions

- Shannon Williams
- swilliam@usgs.gov

Lower Mississippi Gulf Water Science Center

