

USGS OBSERVATIONAL CAPABILITIES TO SUPPORT SURFACE WATER MODELING

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What is the USGS Role in Water?

- **Observations**
 - Over 8,100 streamgages in operation across the U.S.
 - 24,000 sites w/historic annual peaks (some back to 1800)
 - Deployment of temporary gages and sensors
 - Indirect measurements and paleoflood reconstructions
- **Situational Awareness**
 - WaterWatch
 - WaterAlert
 - Flood Inundation Mapping (FIM)
 - Contributions to other missions of other agencies
- **Fundamental Understanding**
 - Flood-Frequency and Low Flow Analysis
 - Regional Studies
 - Trends Analysis
- **Assessment Products and Services**
 - Regional and State Studies
 - Numerical Modeling

Outline

- Gage network
- Temporary gages and sensors
- New technologies

GAGE NETWORK

Active Surface Water Sites

The screenshot displays the USGS National Water Information System: Mapper web application. The browser address bar shows the URL maps.waterdata.usgs.gov/mapper/index.html. The page features a USGS banner at the top with the tagline "science for a changing world" and navigation links for "USGS Home", "Contact USGS", and "Search USGS". Below the banner is the title "National Water Information System: Mapper" with "Help" and "Info" links.

The main interface includes a sidebar on the left with a "Search" field and a "Surface-Water Sites" filter. Under "Active Sites", several data types are listed with radio buttons: "Any data" (selected), "Instantaneous data", "Daily data", "Water-quality data", "Peak data", "Wetland events", and "Annual Report". Under "Inactive Sites", the same list is present but "Any data" is not selected. Other site categories include "Groundwater Sites", "Springs", "Atmospheric Sites", and "Other Sites".

The central map shows the United States and parts of Canada and Mexico, densely populated with black dots representing active surface water sites. A scale bar at the bottom left indicates 0, 300, and 600 miles, with coordinates -110, 846, 53, 124. An inset world map at the bottom right shows the current view area in blue. The map is powered by Esri, HERE, and other providers.

The Windows taskbar at the bottom shows the system clock at 4:13 PM and various application icons.

<http://maps.waterdata.usgs.gov/mapper/index.html>

Active and Inactive Surface Water Sites

The screenshot displays the USGS National Water Information System: Mapper web application. The browser address bar shows the URL maps.waterdata.usgs.gov/mapper/index.html. The page features a navigation bar with the USGS logo and the text "National Water Information System: Mapper".

The main content area is a map of the United States and parts of Canada and Mexico, densely populated with small black dots representing surface water sites. A search panel on the left side of the map is open, showing the following options:

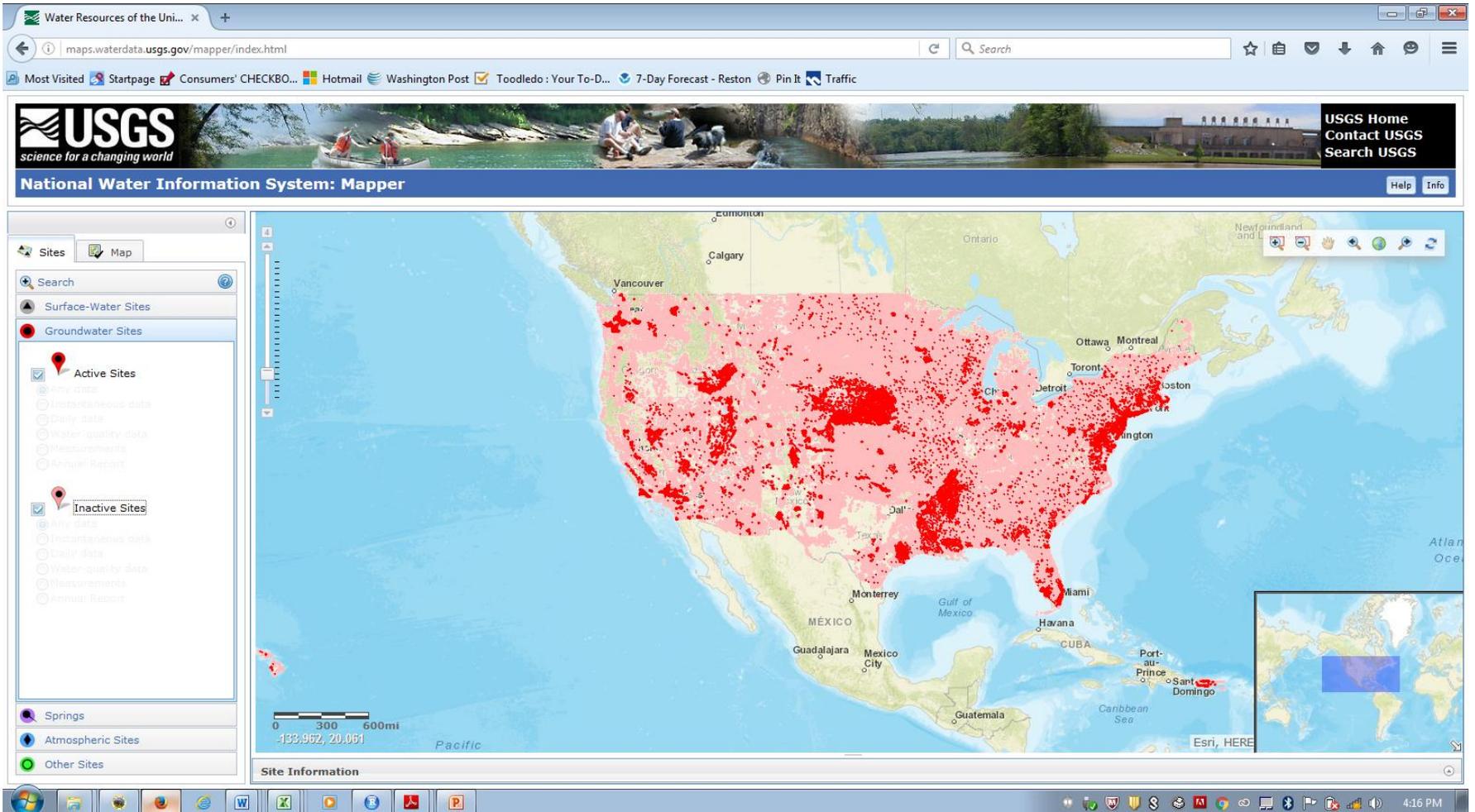
- Surface-Water Sites
 - Active Sites
 - Any
 - Instantaneous data
 - Daily data
 - Water-quality data
 - Peak data
 - Measurements
 - Annual Report
 - Inactive Sites
 - Any
 - Instantaneous data
 - Daily data
 - Water-quality data
 - Peak data
 - Measurements
 - Annual Report
- Groundwater Sites
- Springs
- Atmospheric Sites
- Other Sites

The map includes a scale bar (0 to 600 miles), a coordinate display (-148.112, 53.018), and a small inset map of the world showing the current view area. The bottom of the browser window shows the Windows taskbar with various application icons and the system clock displaying 4:14 PM.

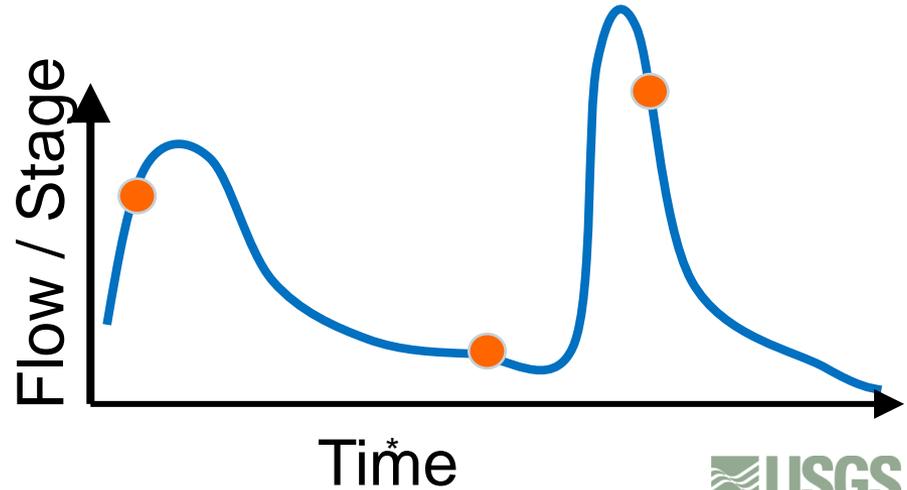
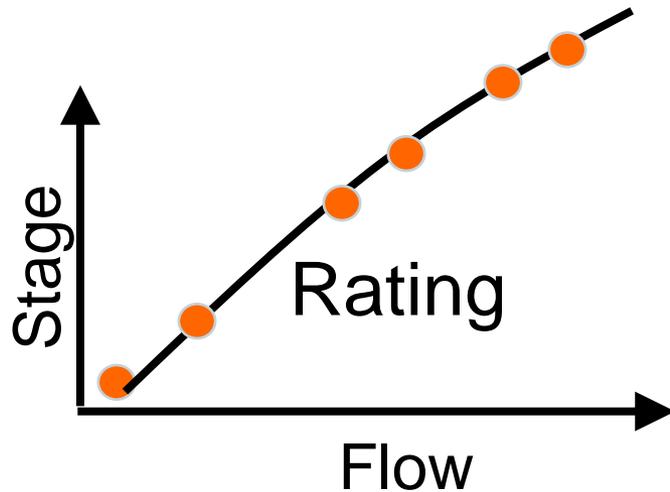
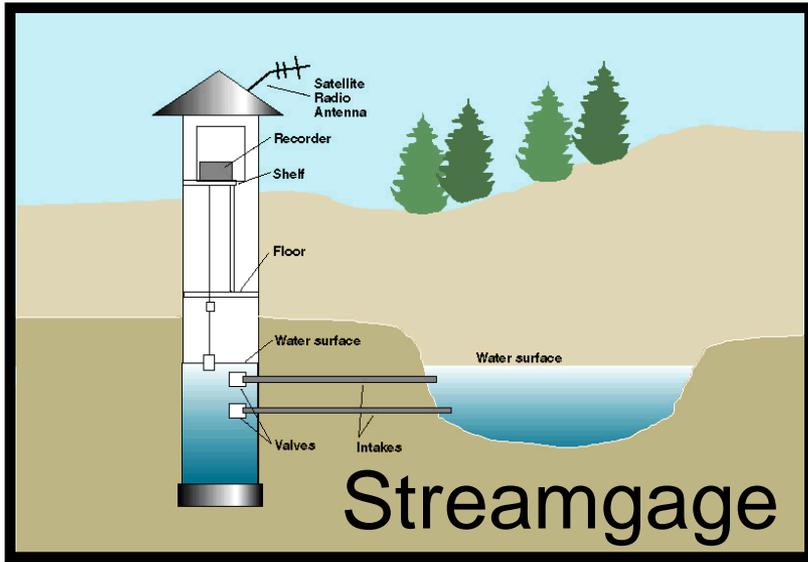
Active Groundwater Sites

The screenshot displays the USGS National Water Information System: Mapper web application. The browser window shows the URL `maps.waterdata.usgs.gov/mapper/index.html`. The page header features the USGS logo and navigation links for Home, Contact, and Search. The main content area is a map of the United States and parts of Canada, densely populated with red dots representing active groundwater sites. A sidebar on the left provides search and filter options, including a search bar and checkboxes for 'Active Sites' and 'Inactive Sites', with sub-options for data types like 'Any data', 'Instantaneous data', 'Daily data', 'Water-quality data', 'Measurements', and 'Annual Report'. A 'Site Information' panel is visible at the bottom of the map area. The browser's taskbar at the bottom shows various application icons and the system clock indicating 4:15 PM.

Active and Inactive Groundwater Sites

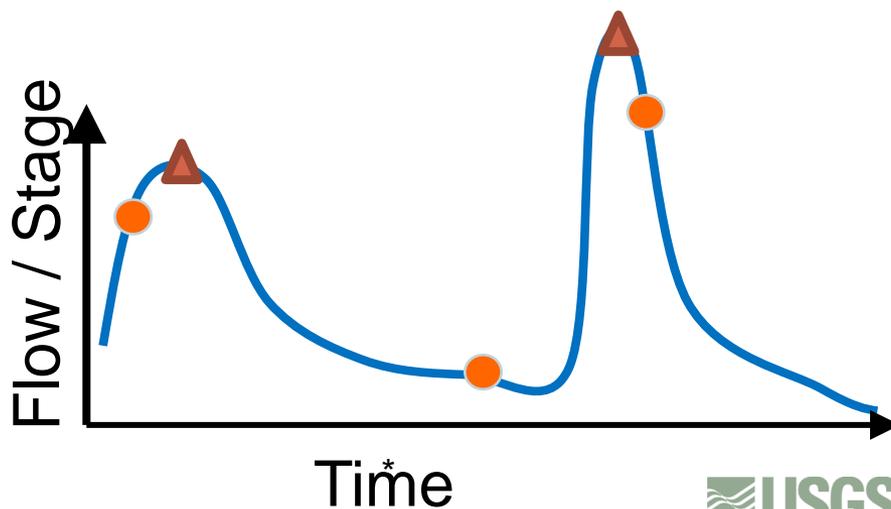
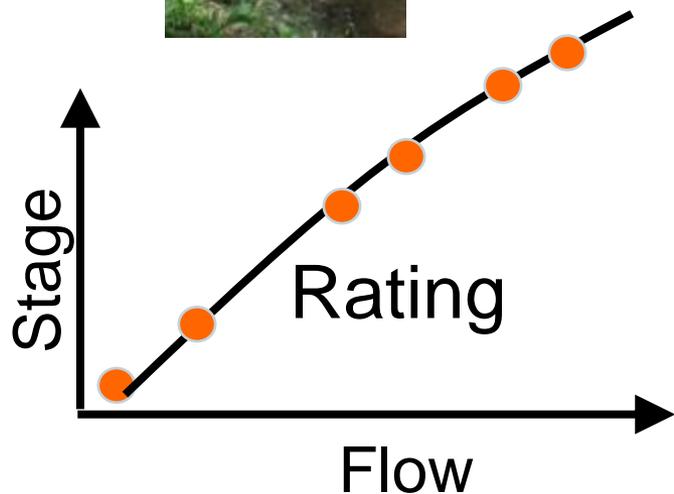
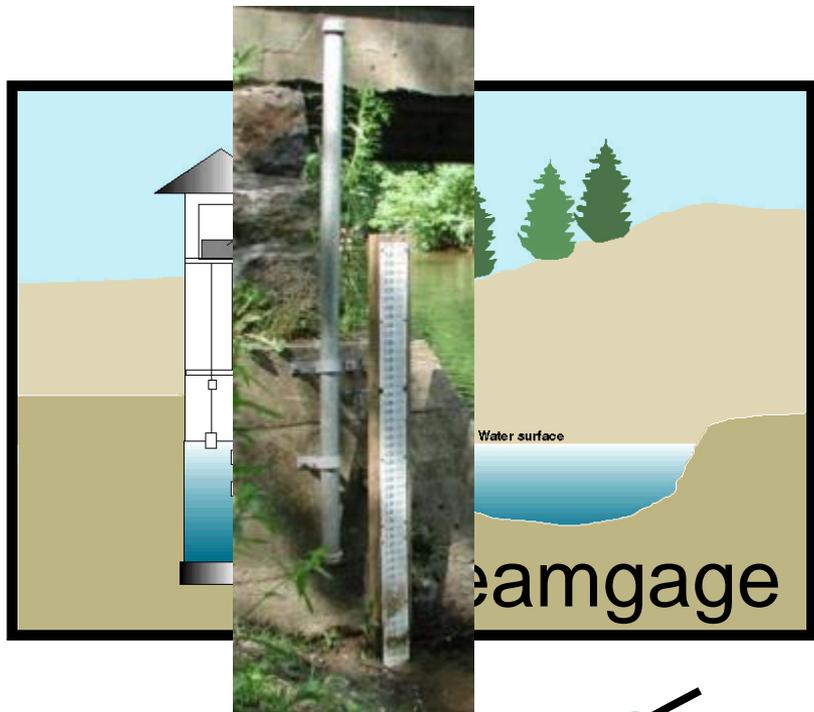


The Streamgaging Process



Crest Stage Gages

24,000 sites with historical records



Types of streamgages

- Continuous Record (the flagship)
 - ~8100 active gages
- Crest-stage (peak stage and discharge only)
 - 24,000+ sites in database
- Low flow measurement sites (limited number of measurements)
- Stage-only
 - ~2,500 active gages
 - Seibert and Vis (*in press*) How informative are stream level observations in different geographic regions?

TEMPORARY GAGES

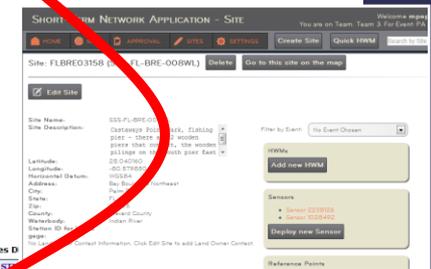
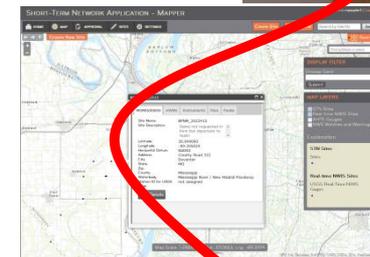
Short Term Networks

Focuses on opportunistic networks to document large events

Fills gaps between streamgages for large events

National high water mark (HWM) database

Supports perishable data collection



USGS STN Short-Term Network

Home > services > STN

2025 | SOAP

Folder: STN

Current Version: 10.11

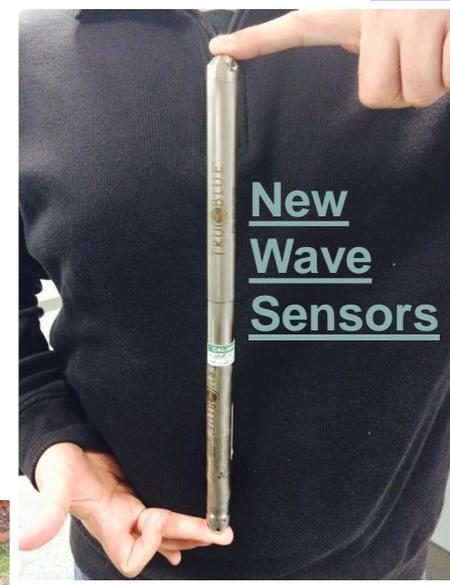
View Footprints In: [ArcGIS.com Map](#)

Services:

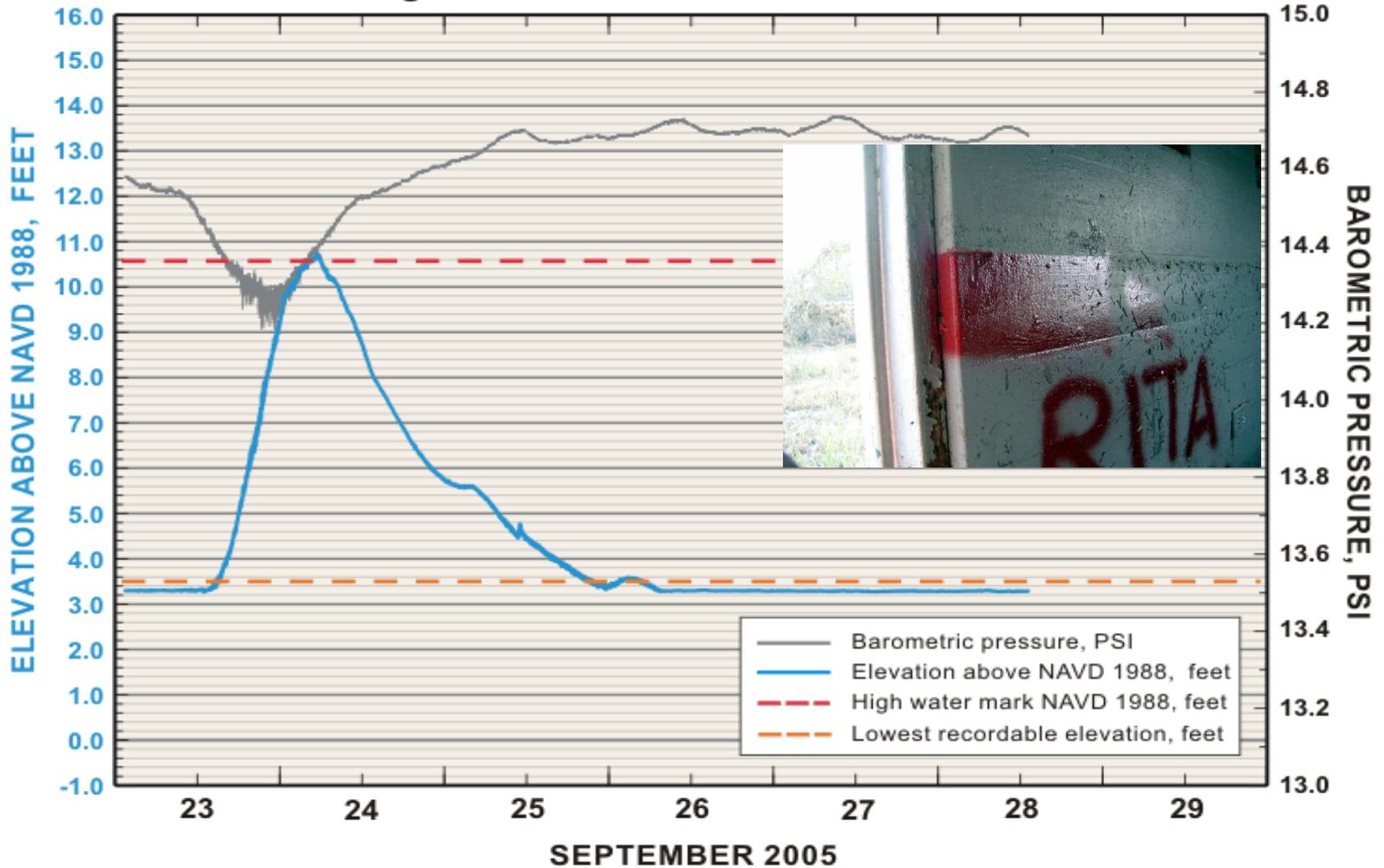
- [STN/AddHWM](#) (GPService)
- [STN/AddSite](#) (GPService)
- [STN/andrea_track](#) (MapServer)
- [STN/HWMs](#) (MapServer)
- [STN/instruments](#) (MapServer)
- [STN/peaks](#) (MapServer)
- [STN/STN_news_11](#) (MapServer)
- [STN/STN](#) (MapServer)

Supported Interfaces: [REST](#) [SOAP](#) [Sitemap](#) [Geo.Sitemap](#)

New SW Monitoring Approaches

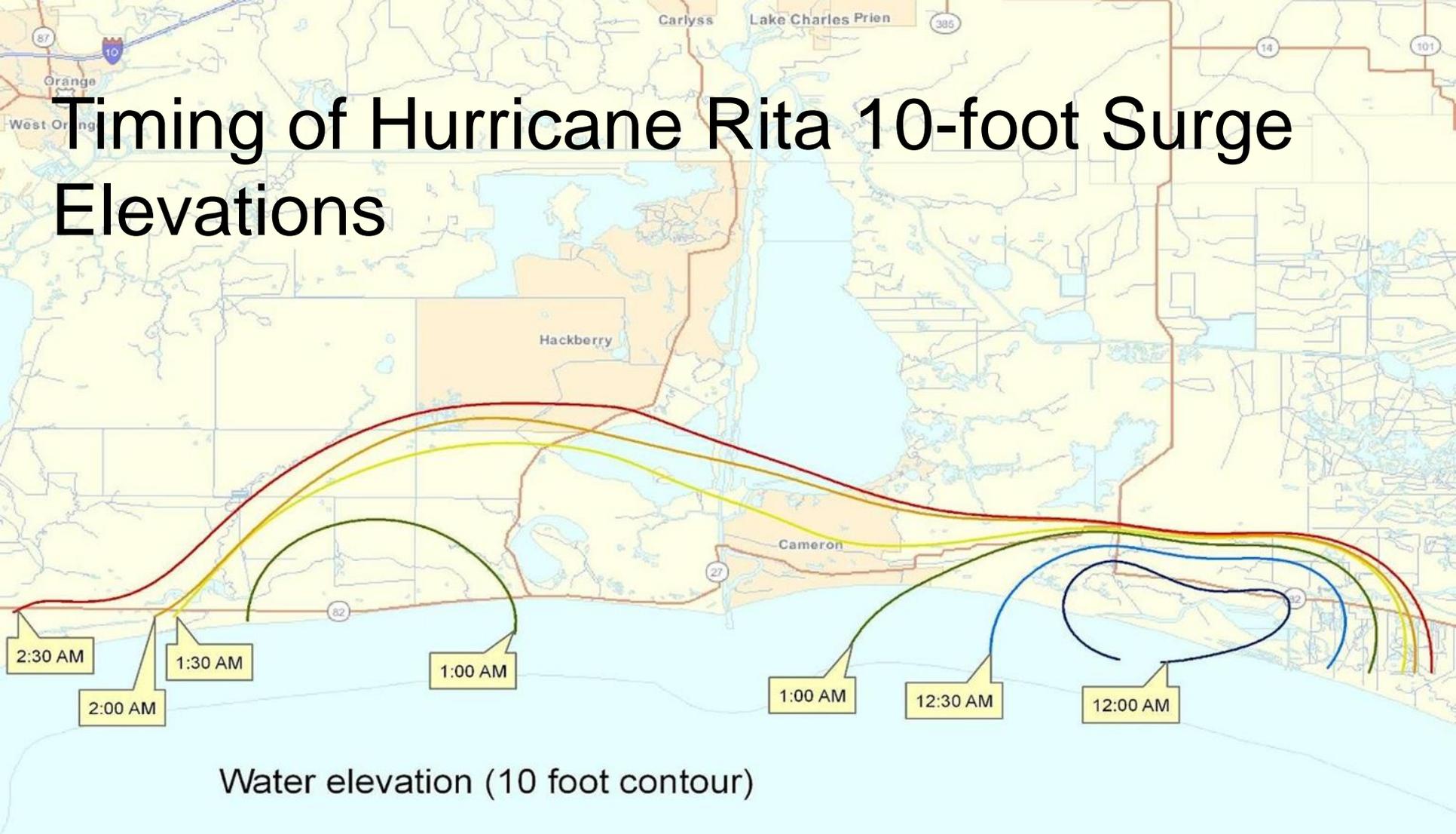


Storm Surge Data from Hurricane Rita - - Site: La9b



<http://pubs.water.usgs.gov/ds220/>

Timing of Hurricane Rita 10-foot Surge Elevations





Appalachian Floods and Hurricane Joaquin Data Viewer

ABOUT

GEOSEARCH

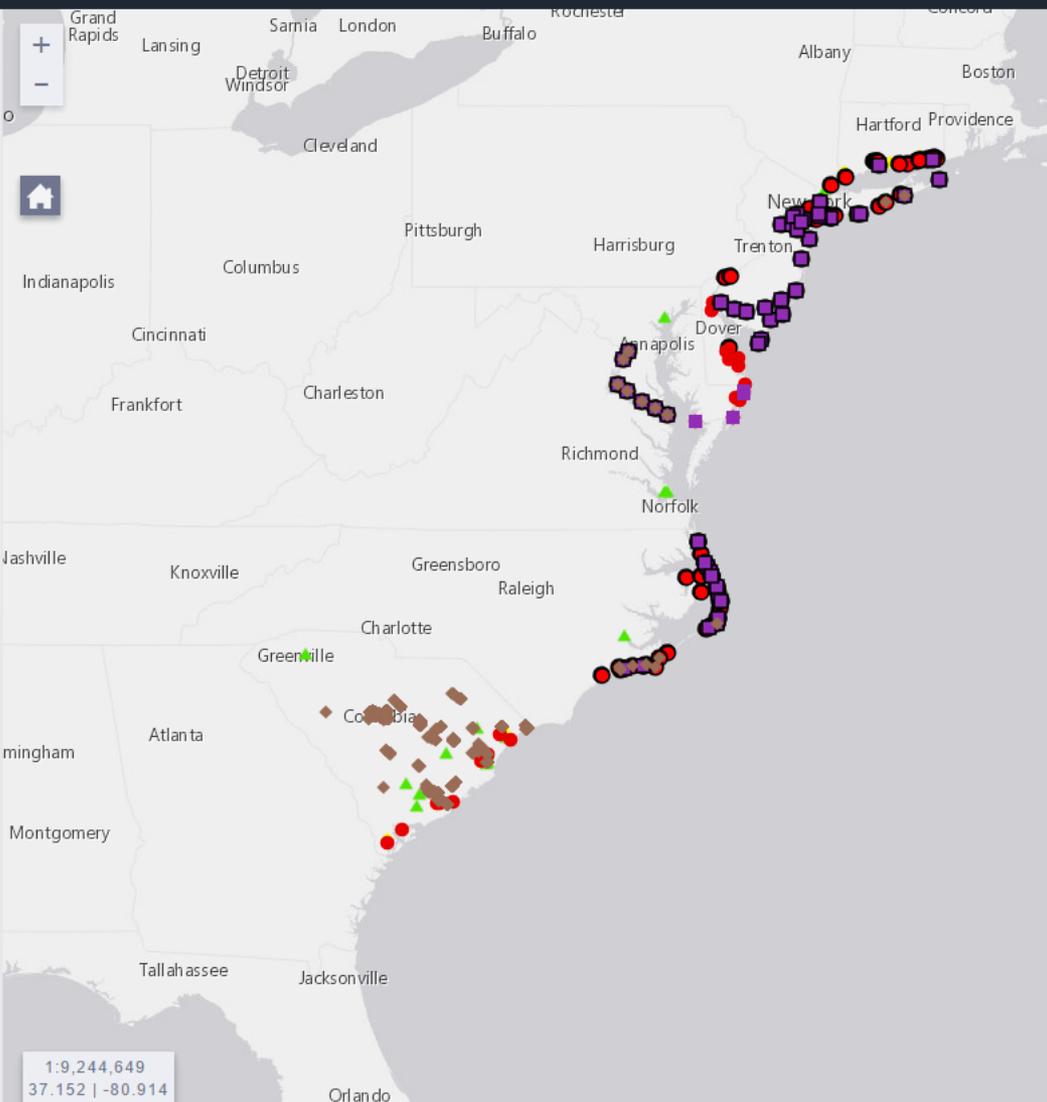
BASEMAPS >

MAP LAYERS >

Event Data

- NOAA Tropical Cyclone Track
- Barometric
- Meteorological
- Rapid Deploy Gage
- Storm Tide
- Wave Height
- High-water Marks
- Peaks
- USGS real-time NWS gages
- NWS Doppler Radar

POWERED BY WIM



LEGEND

High-water Marks

- ◆ Unapproved High-water Mark
- ◆ Approved High-water Mark

Wave Height

- Deployed
- Retrieved

Storm Tide

- Deployed
- Retrieved

Rapid Deploy Gage

- ▲ Rapid Deployment
- ▲ Streamgage

Meteorological

- Meteorological Sensor

Barometric

- ◆ Barometric Pressure Sensor

BERMUDA

1:9,244,649
37.152 | -80.914



NEW METHODS: NON-CONTACT STREAMGAGING

Terrestrial Laser Scanning (TLS)



The instrument head turns, sending laser beams out in all directions to measure surface features.

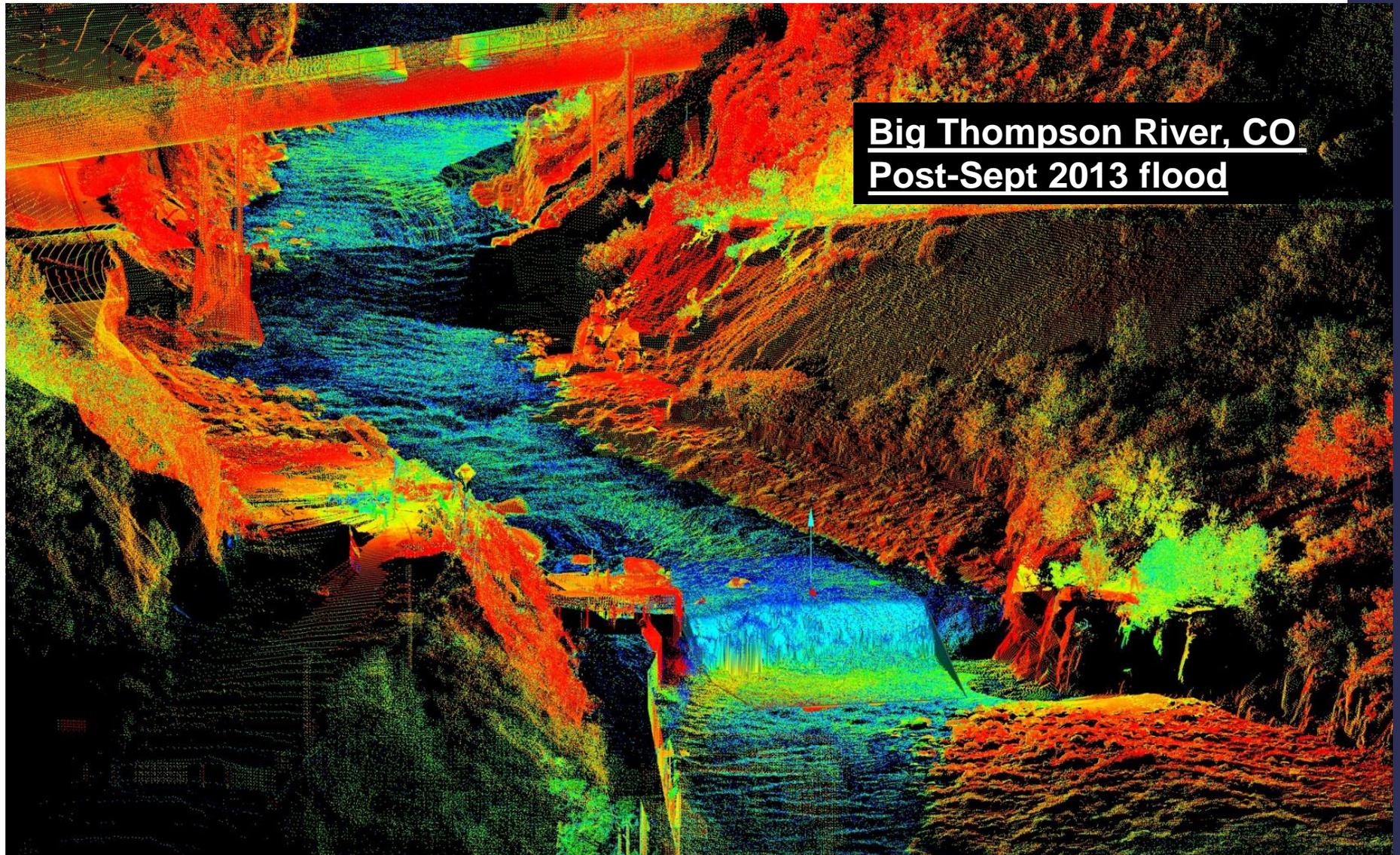
Big Thompson River, Colorado



(oblique view looking
upstream)

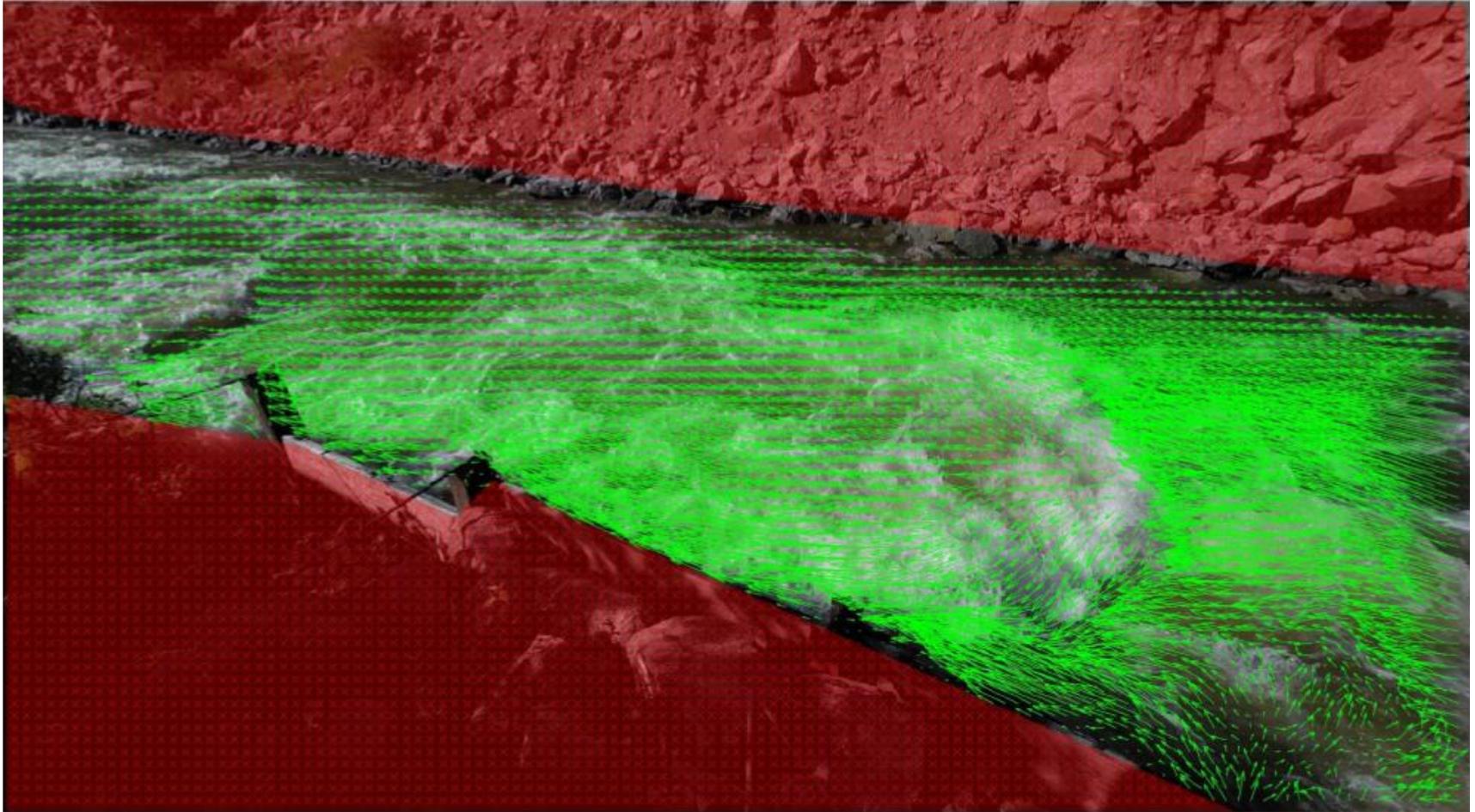
Big Thompson River at Canyon Mouth, Colorado
post-September 2013 floods

TLS water-surface measurements

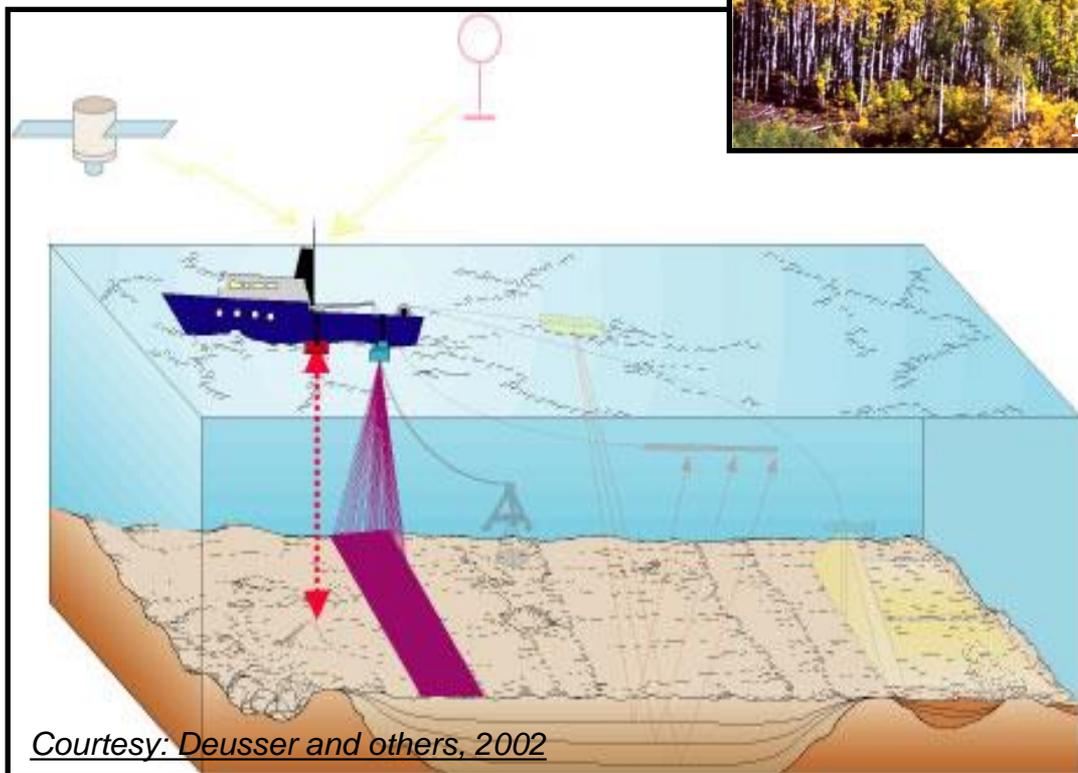
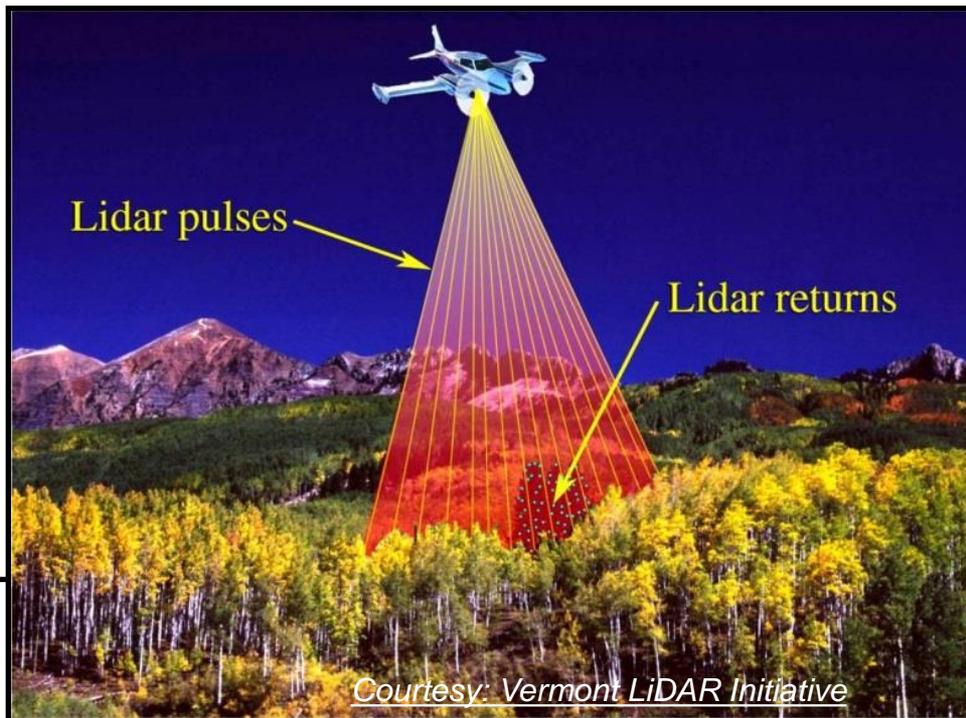


$$Q = \text{velocity} * \text{area}$$

Particle Image Velocimetry (PIV)



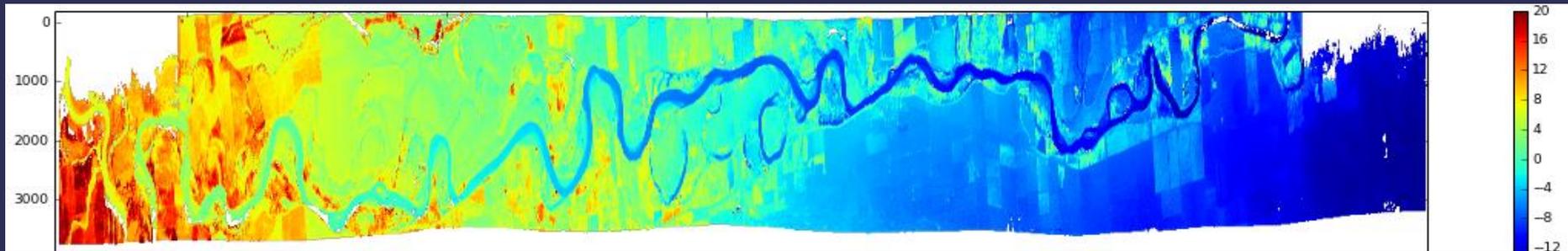
Boulder Creek, Colorado. Video station li08.



**Also testing PIV
with airborne
sensors.**

Multibeam echosounder (underwater)

NASA SURFACE WATER AND OCEAN TOPOGRAPHY (SWOT) MISSION



AirSWOT data from Sacramento River, March 2015

Water-surface elevations to within 2 cm of measured water elevation

VALUE-ADDED INFO: STREAMFLOW UNCERTAINTY

PARTNERSHIPS

IWRSS

Integrated Water Resources Science and Services

Partnership of federal water agencies.

Founding agencies

- NOAA
- USACE
- USGS

Recently added

- FEMA

Early steps - chartered workgroups on operational concerns.

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QUESTIONS? (jkiang@usgs.gov)