

Adaptation of Archived Precipitation Data for Geospatial Analysis



NGI
NORTHERN GULF INSTITUTE



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The Intern: Tom Nguyen



Education Background

University of South Alabama

Major: Civil Engineering (Senior)

Mississippi Gulf Coast Community College

Major: Drafting and Design Technology

Prior Experiences

Environmental Engineering Research (1 Year)

Fractionated natural organic matter of lake water
used for a municipal drinking water facility

Drafting (2 Years)

The Mentor:

Suzanne Van Cooten, Ph.D.
Hydrologist In Charge
NWS Lower Mississippi River Forecast Center



Education Background

- **Undergrad: B.S. Meteorology** - University of Oklahoma (1991)
- **Masters: M.S. Engineering** - University of New Orleans-LSU (2000)
- **Doctoral: Ph.D. Engineering and Applied Sciences** - University of New Orleans-LSU (2004)

NOAA Experience

- **Operational weather and water forecaster** at Weather Forecast Offices in Fort Worth, TX and Slidell, LA and Lower Mississippi River Forecast Center.
- **Chief Scientist** at National Data Buoy Center
- **Deputy Division Chief of Warning Research and Development Division** at National Severe Storms Laboratory prior to accepting Hydrologist in Charge position at Lower Mississippi River Forecast Center

National Weather Service:

Lower Mississippi River Forecast Center

Daily River Forecast Center Operations

Forecast river water level (stage) to save lives and reduce property damages

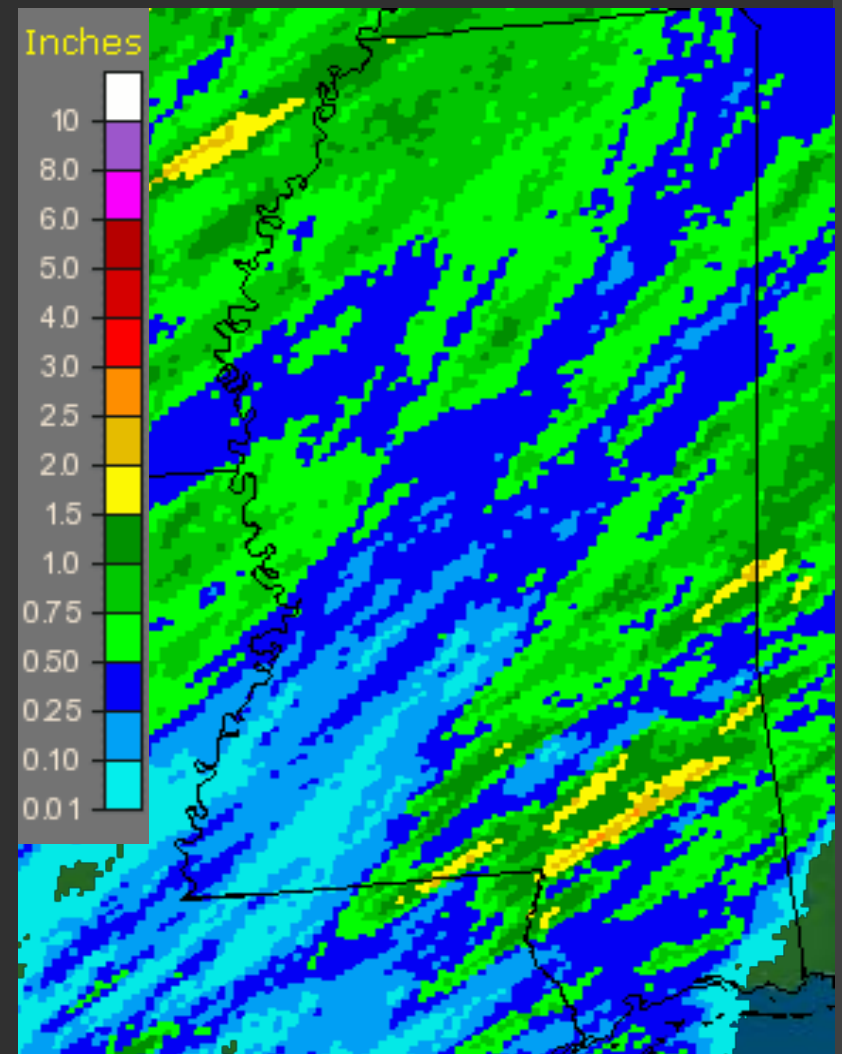
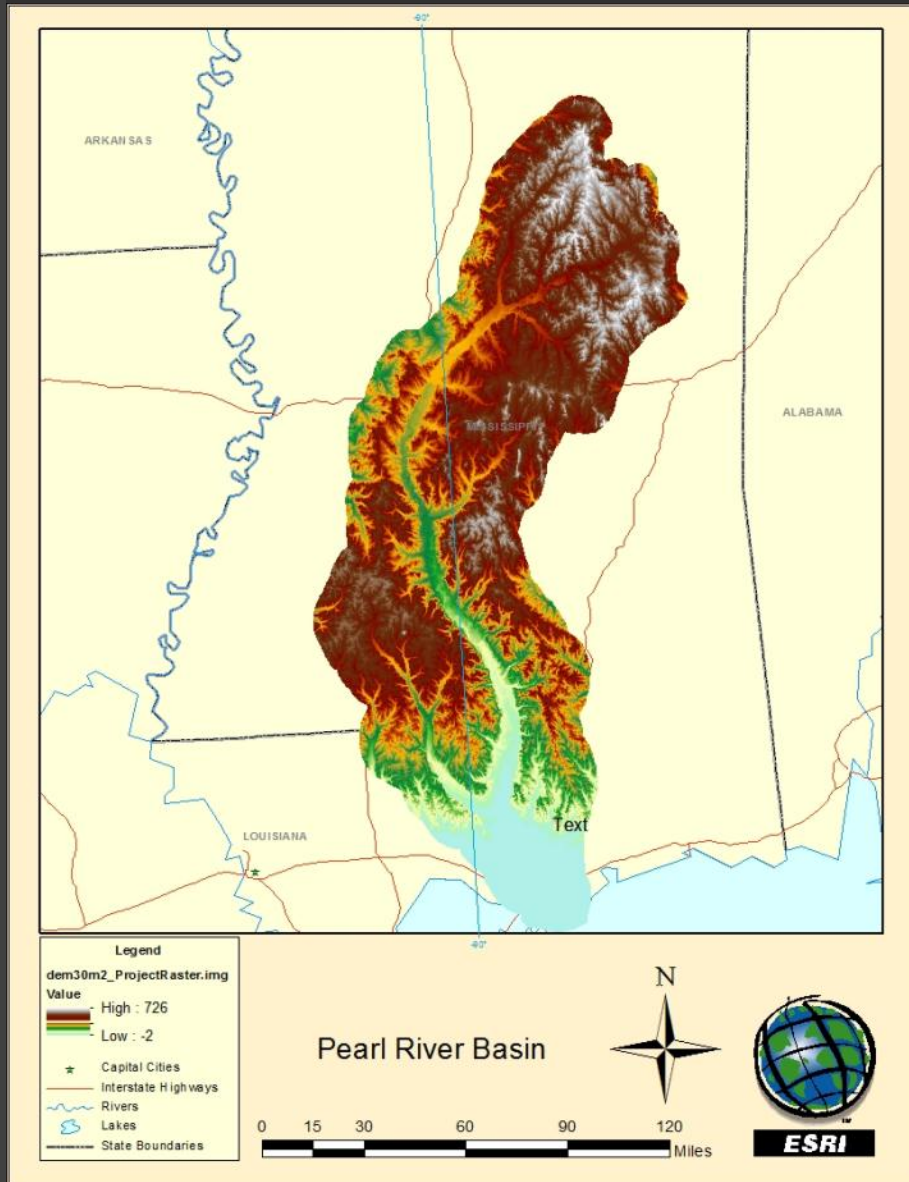
What affects river stage?

- Precipitation (Duration, Intensity, & Location)
- Watershed or Basin Shape
- Soil Moisture Content
- Soil type
- Slope of the area
- Timing of accumulated water at the forecast point



<http://www.kidsgeo.com>

Pearl River Basin & Precipitation

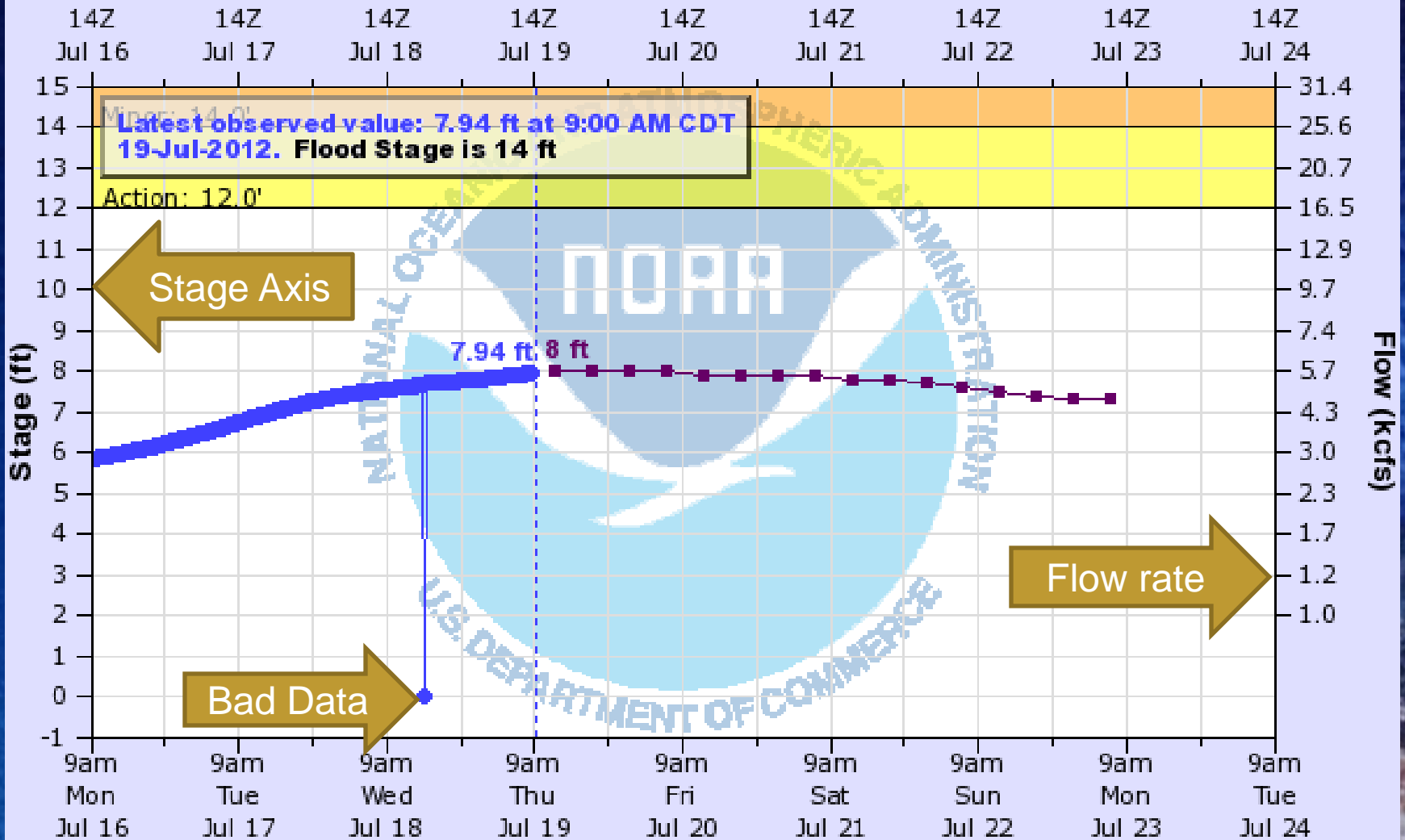


4/8/2010 1-Day Observed Precipitation
<http://water.weather.gov/precip/>

Hydrograph

PEARL RIVER NEAR PEARL RIVER

Universal Time (UTC)



----- Graph Created (9:44AM Jul 19, 2012) ● Observed ■ Forecast (issued 11:00AM Jul 18)

PERL1(plotting HGIRG) "Gage 0" Datum: n/a

Observations courtesy of US Geological Survey

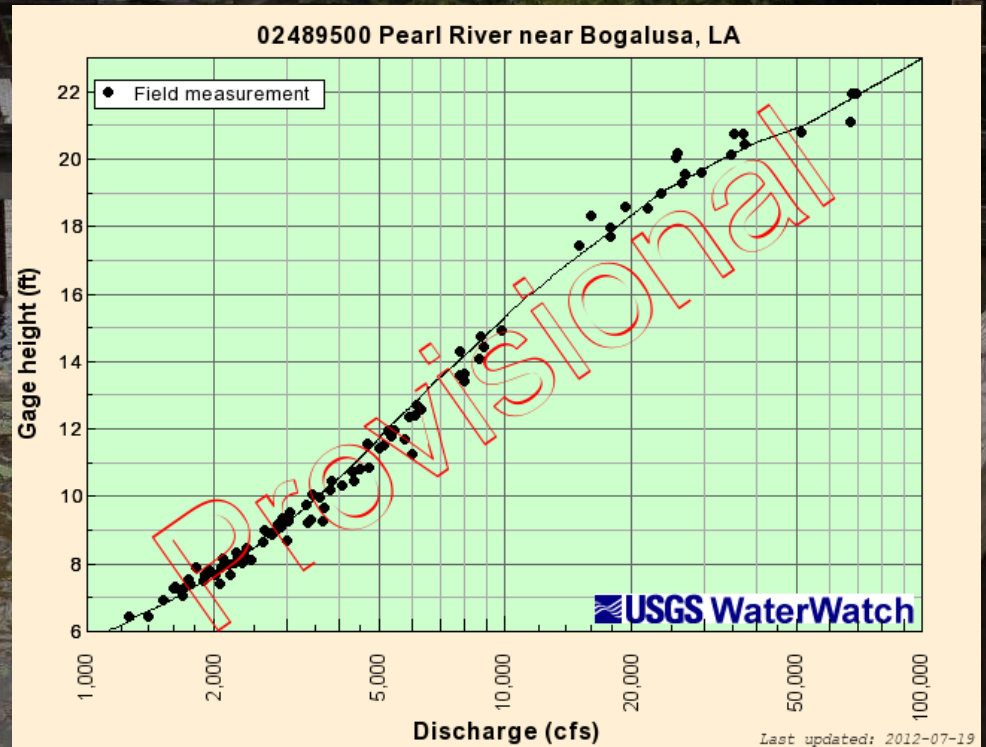
water.weather.gov/ahps2/hydrograph.php?wfo=lix&gage=perl1

Hydrographs & Rating Curves

Hydrographs shows
Flow Rate and/or
River Stage with
respect to time

Rating Curves are...

- Used to correlate
Flow Rate and
River Stage
- Usually Created
from historical
survey data



<http://waterwatch.usgs.gov/index.php>

The Project: Adaptation of Archived Precipitation Data for Geospatial Analysis

NOAA Hydrologic Data Systems Group (HDSG) has a wealth of rainfall data from 1948 to 2011, which came from manual observations from co-op observers.

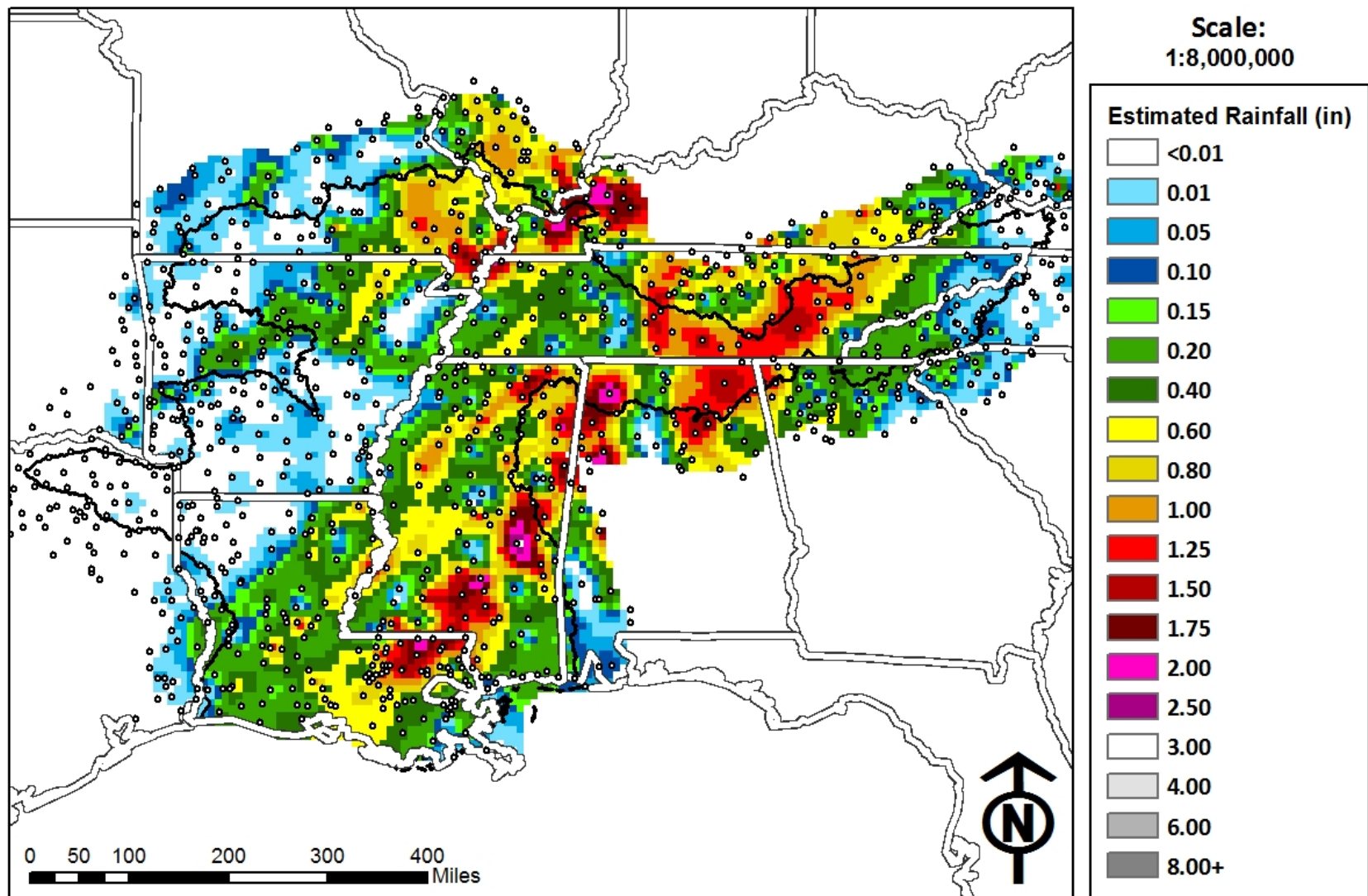
The precipitation data can be paired with the rainfall gauge's coordinates for use in a Geographic Information System (GIS)

Once the data in a GIS, the precipitation areas in between the rain gauges can be interpolated to show a continuous gridded dataset of the rain event of the historic day of interest

The Image: Preliminary

Estimated Daily Rainfall for January 4th, 2000

Interpolated from manual gauge readings taken between 6-9AM local time daily by the Kriging method.



The Application:

Guidance for the Forecaster

- **Help create an archive to see an estimation of spatial distribution of past rainfall events**
 - If paired with historical stage gauge data, past rain events can be recreated which can provide insight on the behavior of the location
- **Better quality control rainfall data**
 - With a spatial image of rainfall magnitudes, discrepancies can be found that otherwise may be overlooked
- **Help find record highs and other anomalies**
 - A GIS function that compares data sets consecutively to identify desired information and estimate record high anomalous values for areas away from observation sites

The Process: Key Steps

- Gather the data
- Process the data
 - Rearrange the data to a GIS friendly format
 - Convert from **.XLS** to **.CSV** & add coordinates from a table
 - Convert from a **Site File** format to a **Date File** Format
 - A **Site File** has all data for a particular site
 - A **Date File** has add data for a particular date
 - Create a companion file which indicates time of reading
- Program the GIS process
 - Import the data within a range of times between 6am to 9am, which was subjectively chosen to balance...
 - Having as much data as possible
 - Keeping the data consistent
 - Implement interpolation
 - Generate a gridded data set

The Metadata Status: Pending

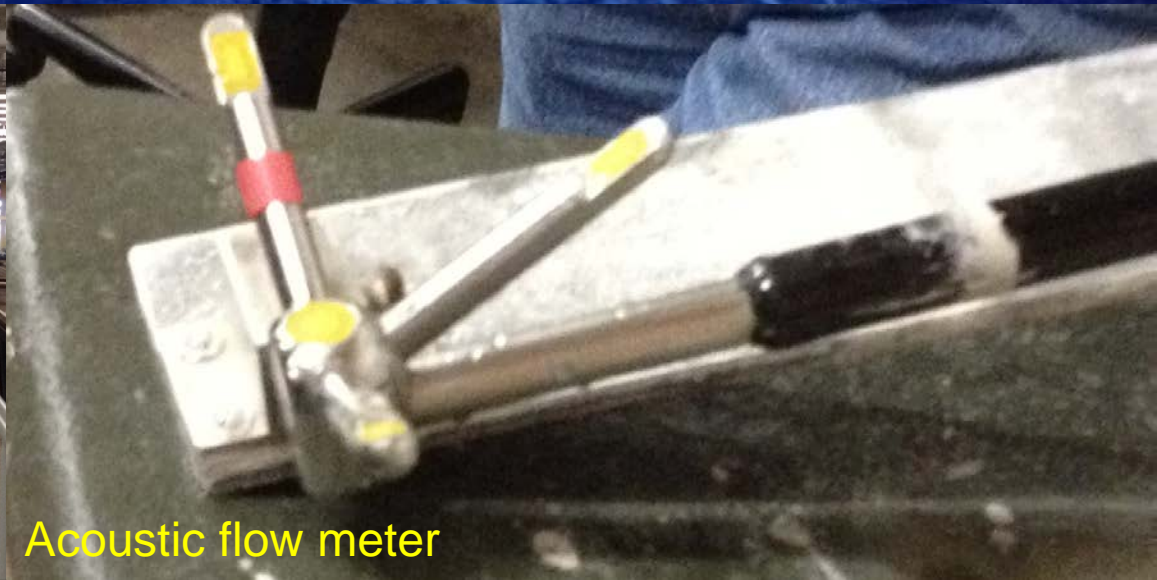
Metadata will consist of...

- Data source
- Clean up
 - Why some data was excluded
 - Why was it necessary to reorganize the data set
- Assumptions
- Uncertainties
- Background on interpolation choice
 - Tension Spline
 - Inverse distance weighting (IDW)
 - Kriging & different Kriging options

The Field Trip: USGS Hydrologic Instrumentation Facility (HIF)



Towing vehicle moving along the rails of the towing tank



Acoustic flow meter



David Sutley in awe of 12 x 12 x 450 ft towing tank



Rapid Deployment Gage Version III (RDG III)

<http://water.usgs.gov/hif/>

The New Skills:

- Refined Excel skills
 - Learned new functions to help QC and rearrange data
 - Learned to use, record, and write macros
- Introduced to ArcGIS and the use of Python to automate tasks for ArcGIS
- Forecasted river stage on a daily basis
- Developed a better understanding of the NOAA & USGS tools and data available online

The Reflection:

NOAA-NGI Internship Experience

- The experience from the NOAA-NGI internship program will always be a major influence on my future because...
 - It allowed me to see and appreciate the water resource side of civil engineering
 - It gave me a preview and opportunity to develop skills that are useful in the workforce, but are not emphasized in a school setting
- The collaboration, like NGI, can also be seen between the federal agencies
- NOAA is a great agency to work for in the science and engineering fields. I would be excited to work for NOAA in the future.

The Acknowledgments:

- **NOAA** - National Oceanic and Atmospheric Administration
- **NGI** – Northern Gulf Institute
- **DISL** – Dauphin Island Sea Lab
- **NWS** – National Weather Service
- **LMRFC** – Lower Mississippi River Forecast Center
- **Hydrologist in Charge** – Dr. Suzanne Van Cooten
- **The Project Team**
 - Scott Lincoln
 - David Schlotzhauer
 - Gina Tillis-Nash