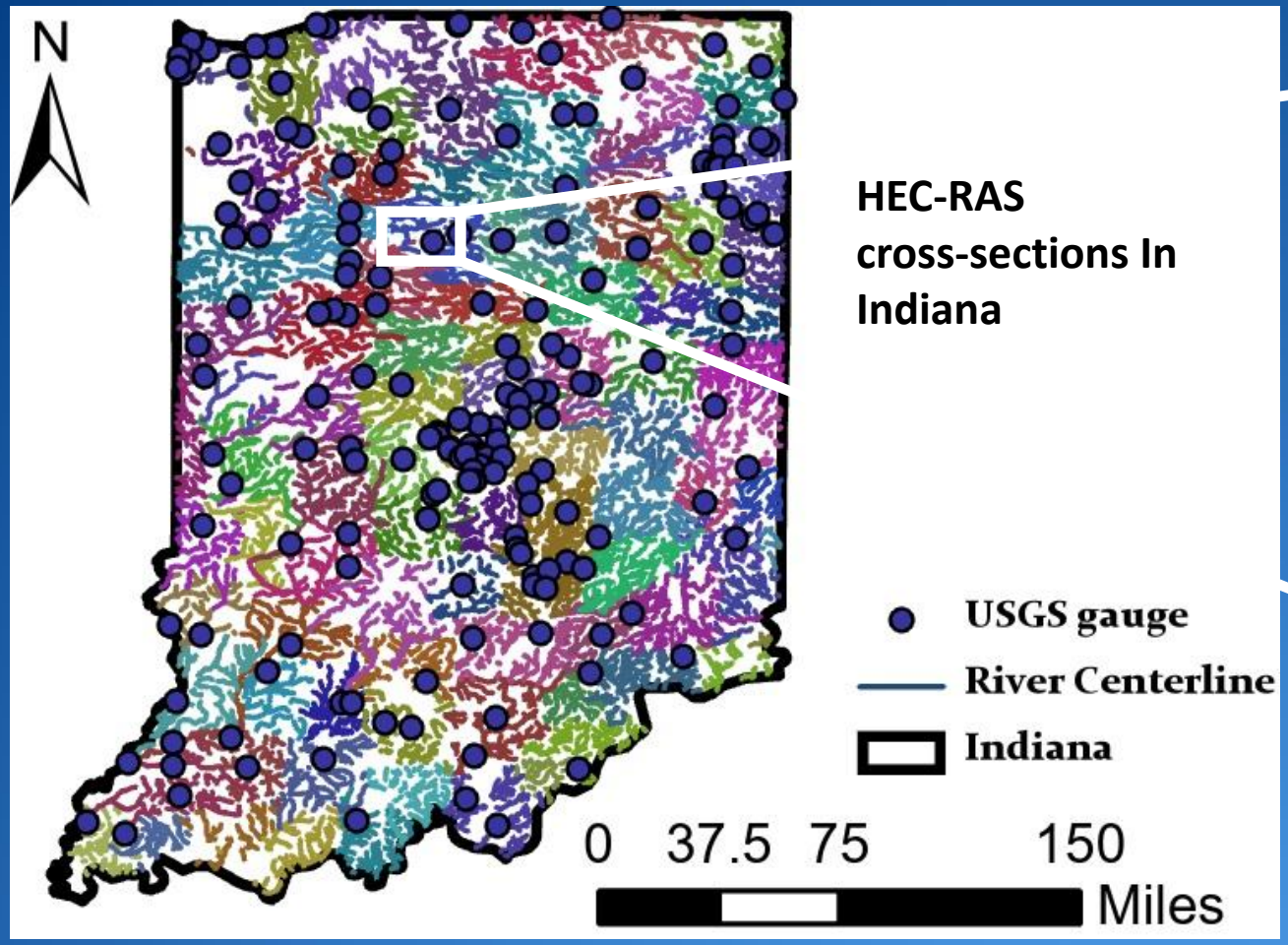
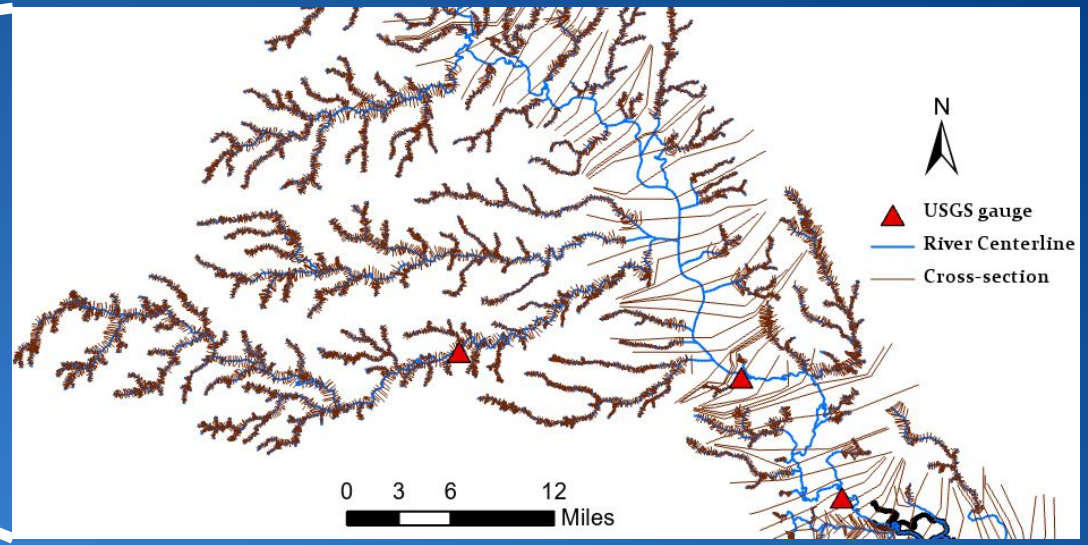
RIMORPHIS Tools – Present and Future

RIMORPHIS Tools

- Bathymetry Tools
  - Processing bathymetry data in space and time
  - Visualization
- Satellite Imagery Tools
  - Finding inundation extent based on a hydrologic variable
  - Quantifying changes in river planform
- Sonar Data Tools
  - Visualization
  - Quantifying changes in river bed or sediment dynamics

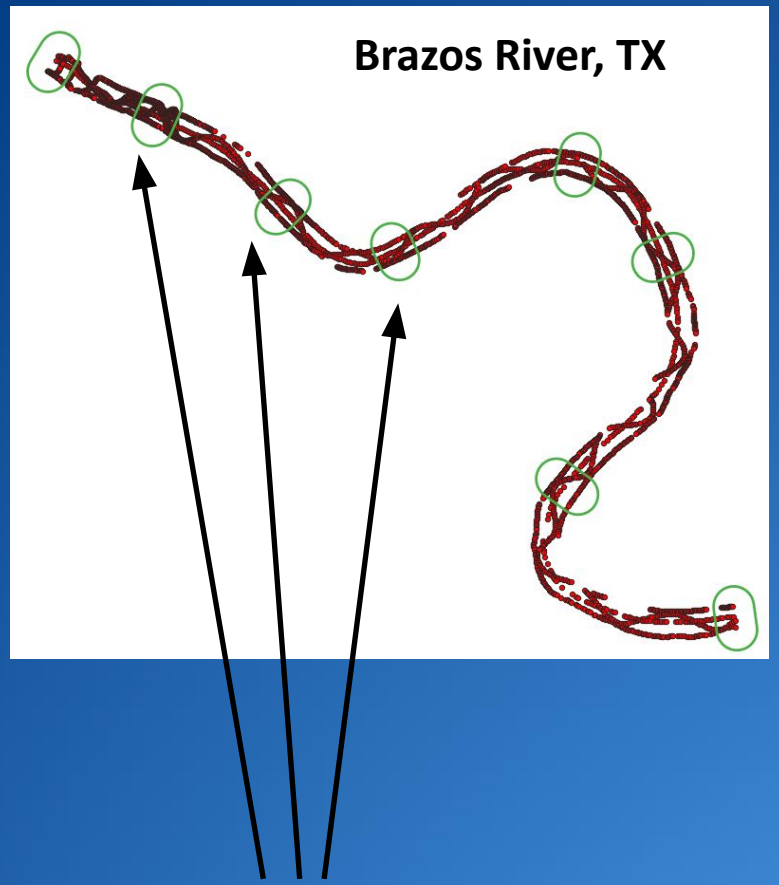
Need for Cross-section/Bathymetry Tools

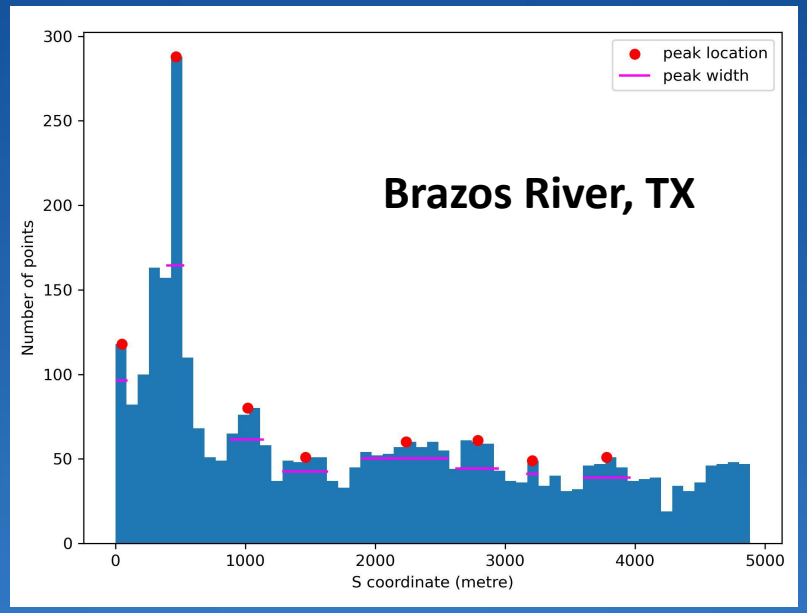




Augment /process existing data to estimate bathymetry at any location in a form needed by the user

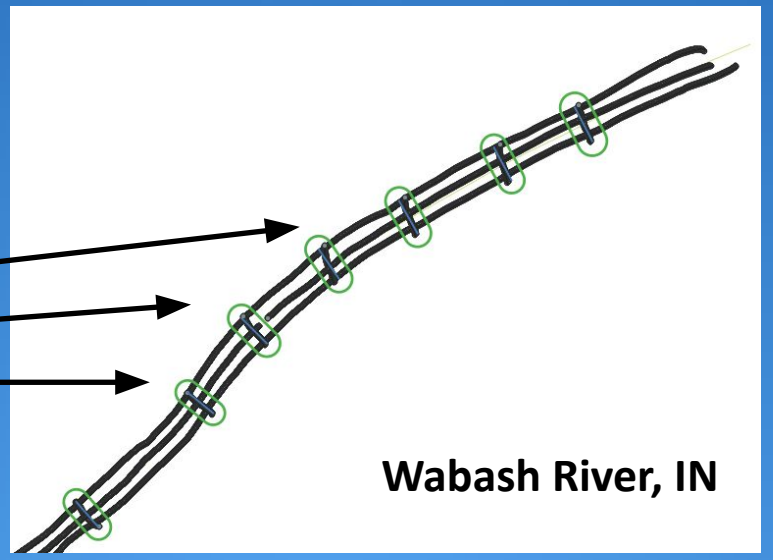
Point □Cross-sections □Mesh

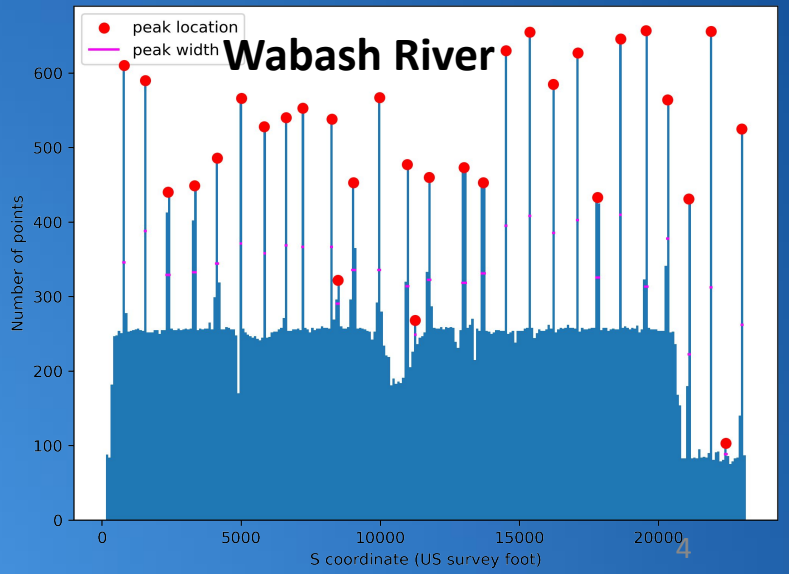




<u>Use case</u>: Need cross-sections (for 1D modeling) or mesh (2D modeling) from points

Get the histogram of s-coordinates to locate cross-section. <u>Already implemented.</u>





Cross-section Prediction Tool using Deep Learning (Under Development)

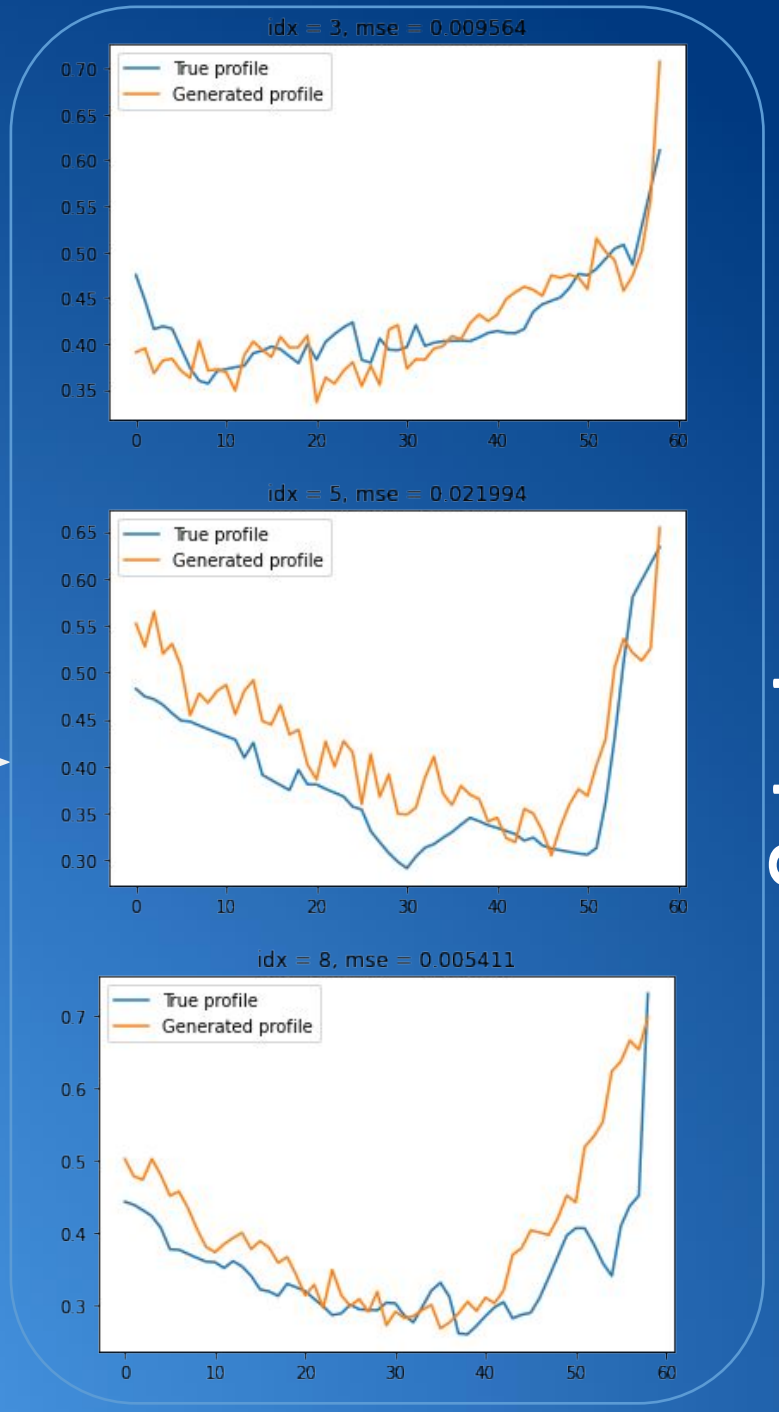
Input

River channel features related to planform, slope, etc.

Generator

DL Model

1) Pre-trained model
2) Periodically update when getting new datasets

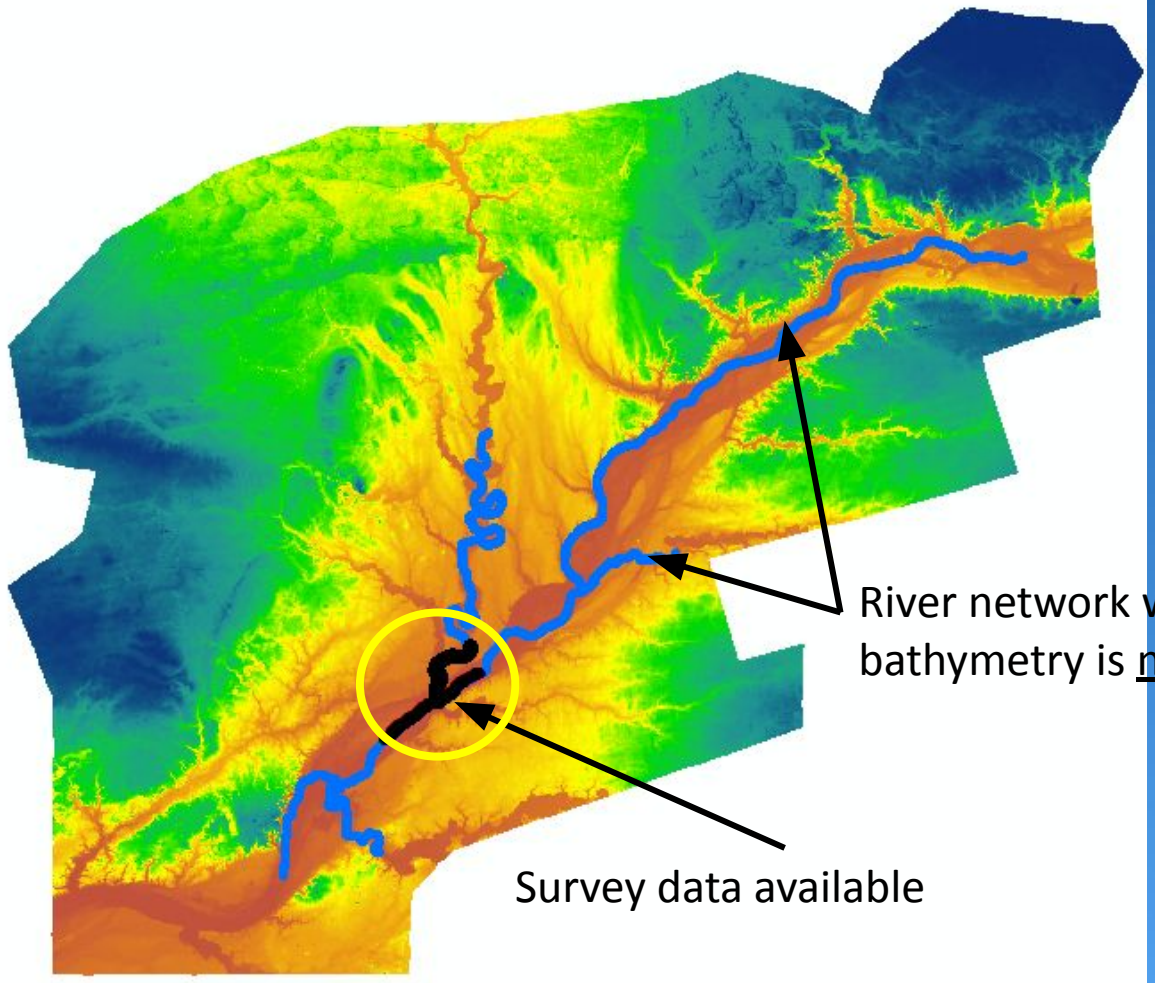


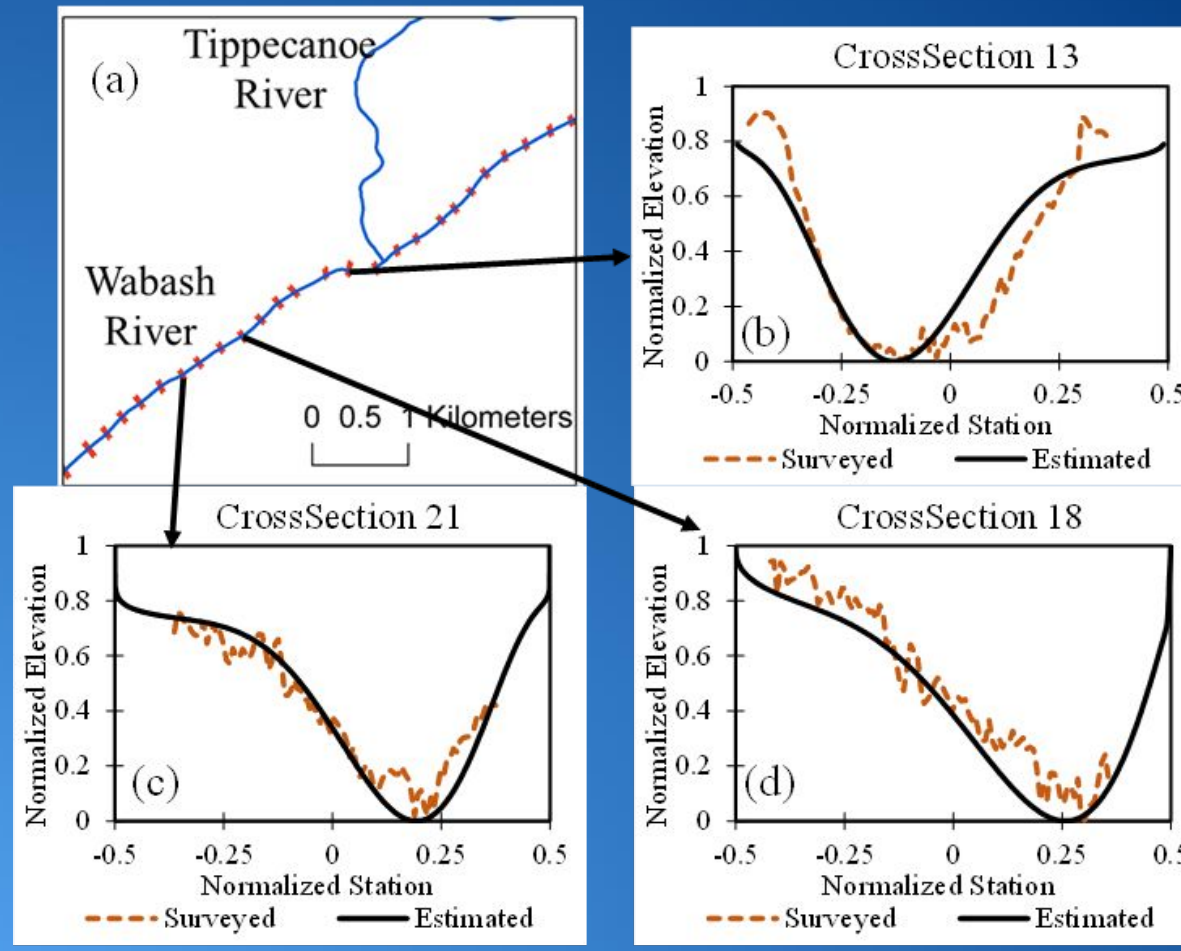
Output

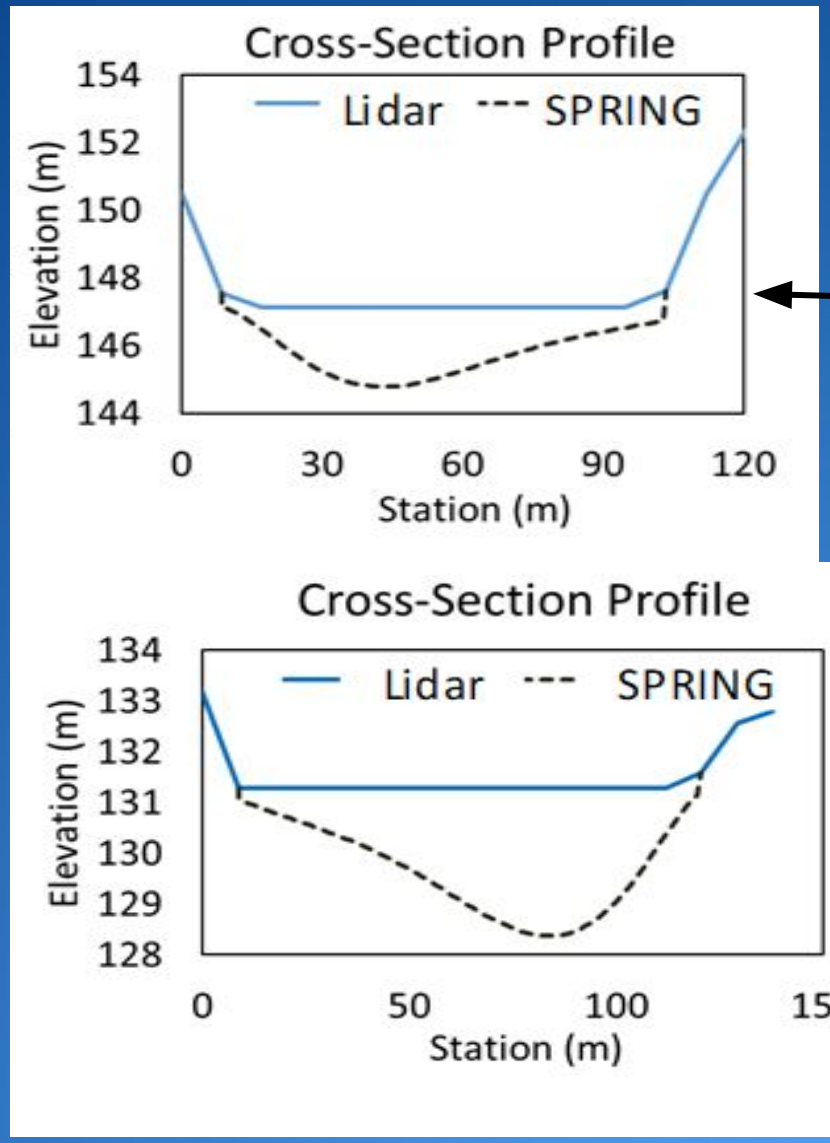
<u>Use case</u>: Estimate bathymetry where data gap exists or extrapolate information beyond survey region

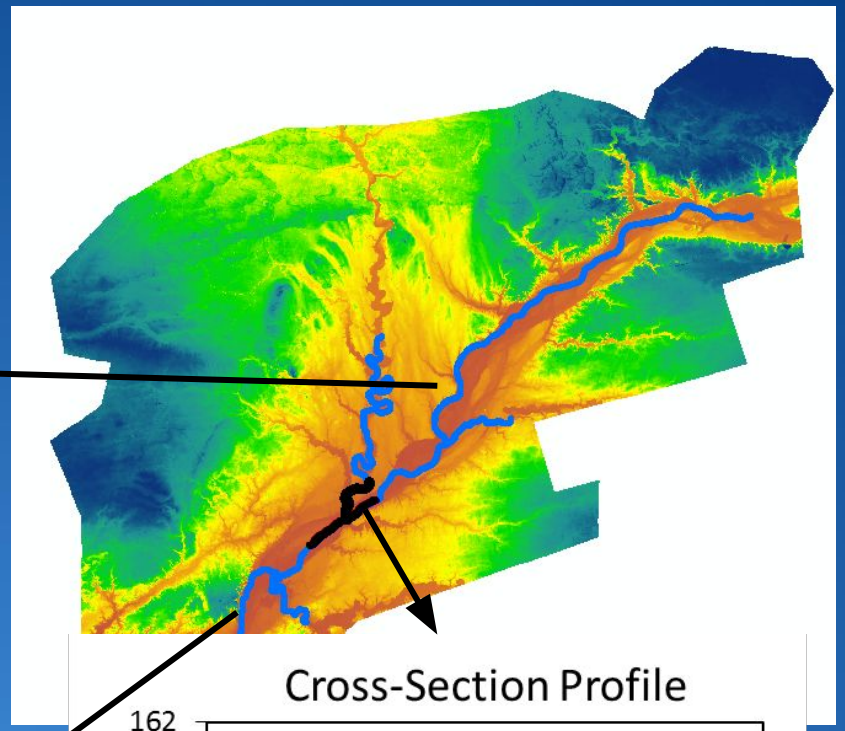
Bathymetry Estimation at Watershed Scale(Under Development)

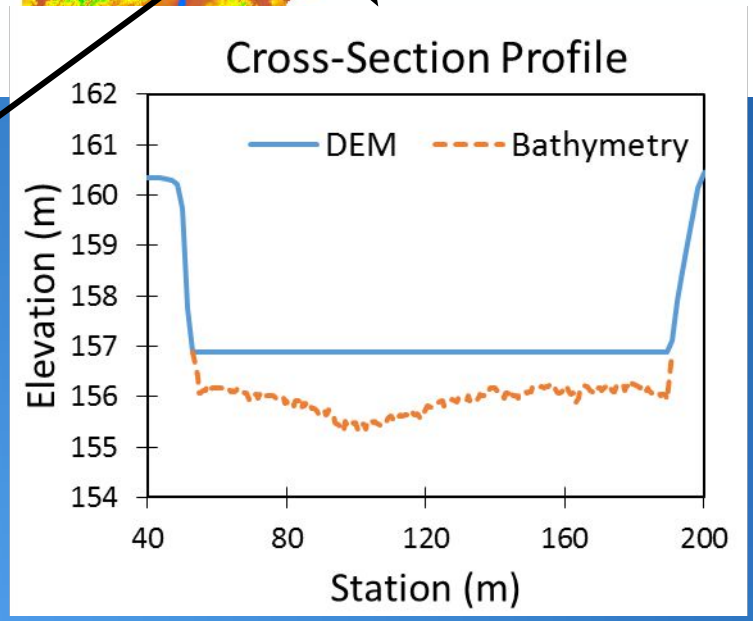
<u>Use case</u>: Estimate continuous bathymetry by using existing information and/by creating new information for large areas



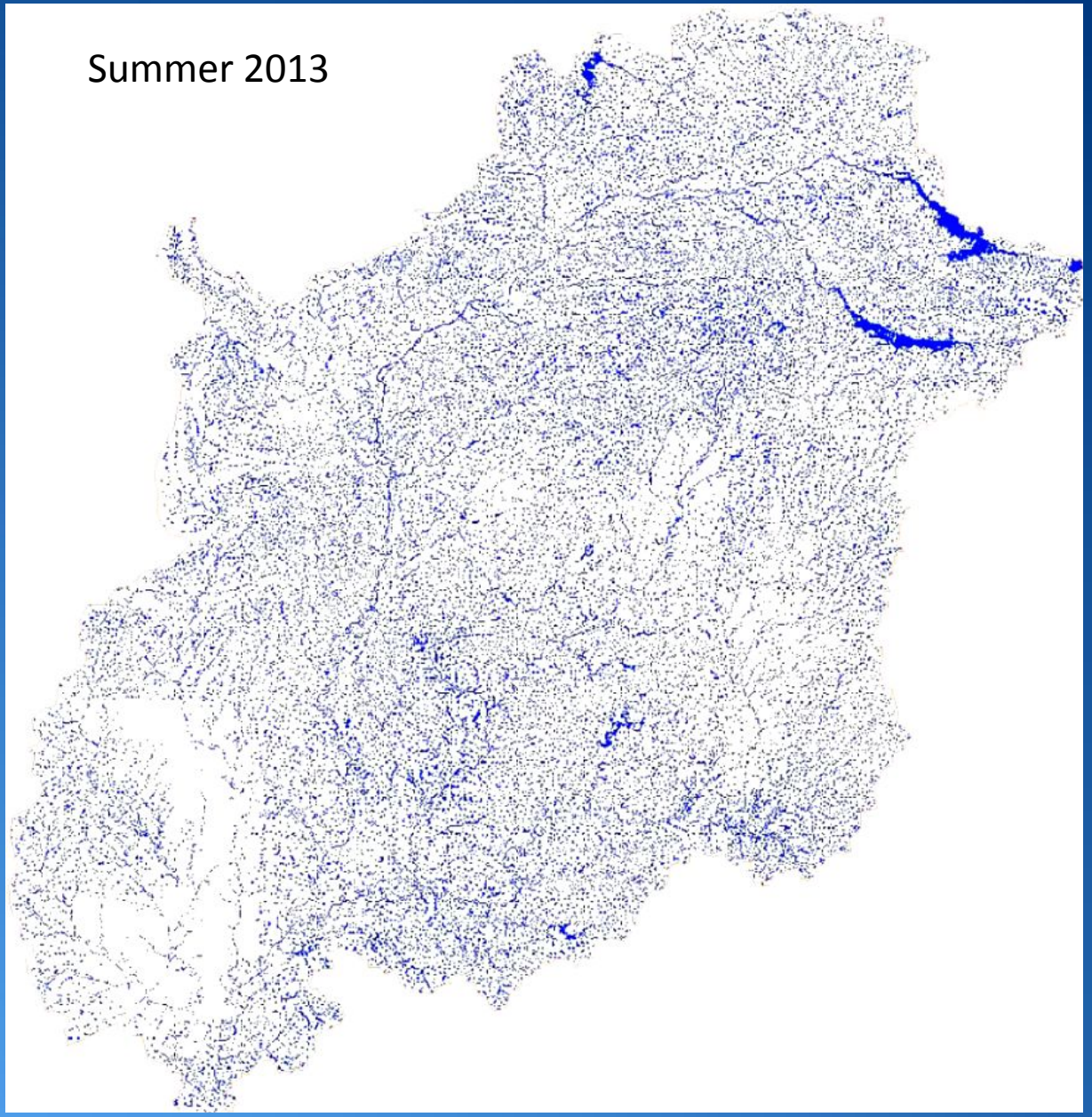



Cross-Section Profile
Lidar
SPRING
Elevation (m)
154
152
150
148
146
144
0
30
60
90
120
Station (m)
Cross-Section Profile
Lidar
SPRING
Elevation (m)
134
133
132
131
130
129
128
0
50
100
150
Station (m)

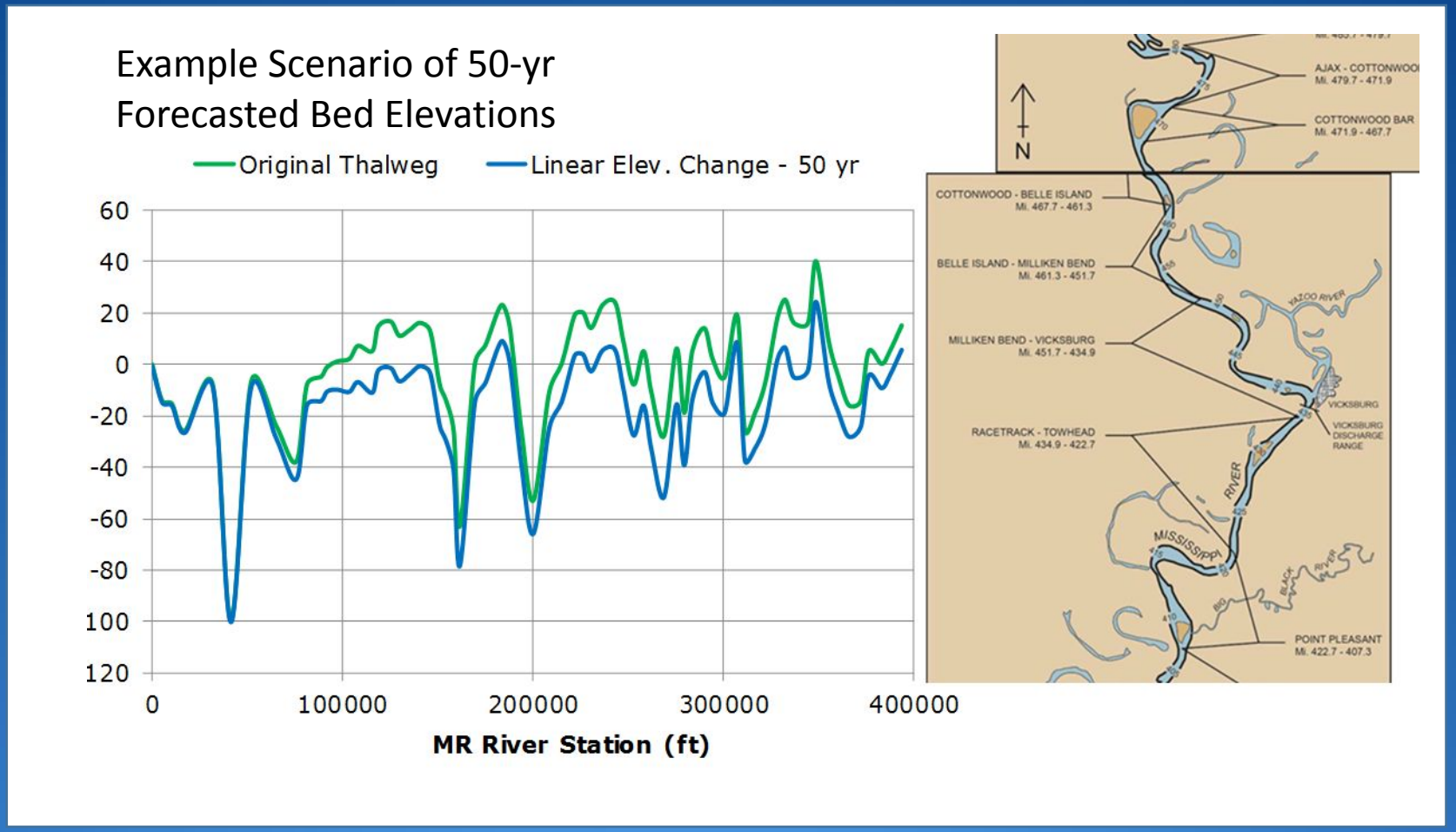



Cross-Section Profile
DEM
Bathymetry
Elevation (m)
162
161
160
159
158
157
156
155
154
40
80
120
160
200
Station (m)

With continuous bathymetry provided by RIMORPHIS more accurate flood models and inundation maps are possible



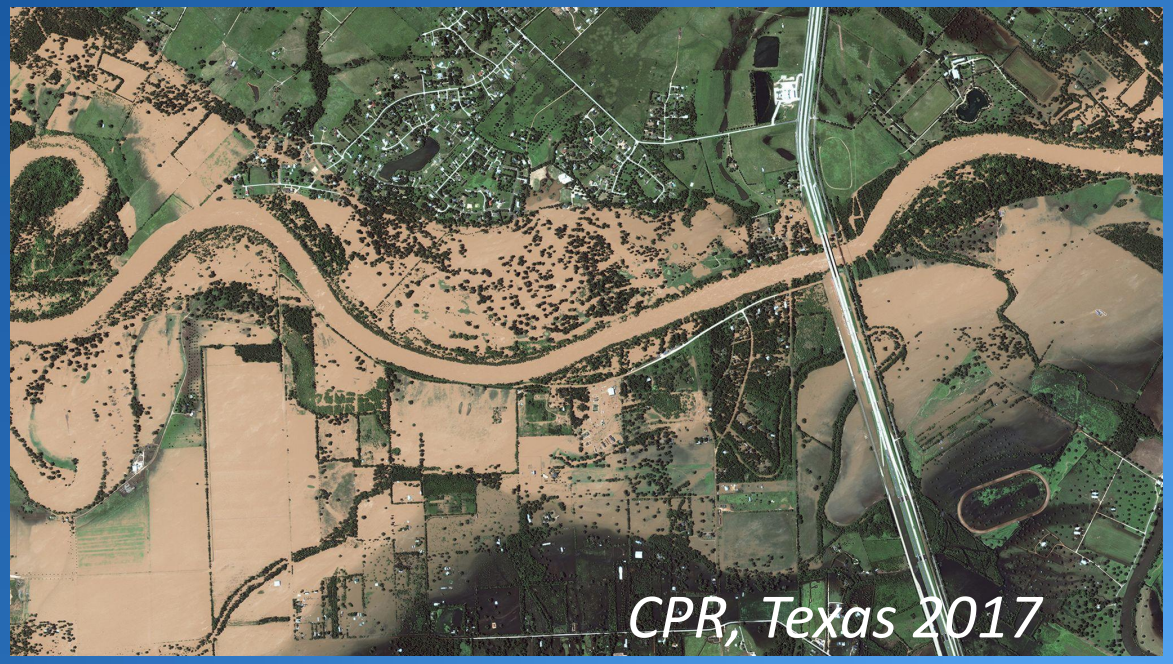
Long-term Channel Morphology Forecasting



Use Case: How has the river has changed or will change over a given duration? Time series analysis of river cross-sections/profiles (Planned)

Satellite Imagery Search and Processing Tool (being integrated)

- Hydrologic events (e.g. floods) are irregular in time
- Difficult to search image archives for hydrologic events

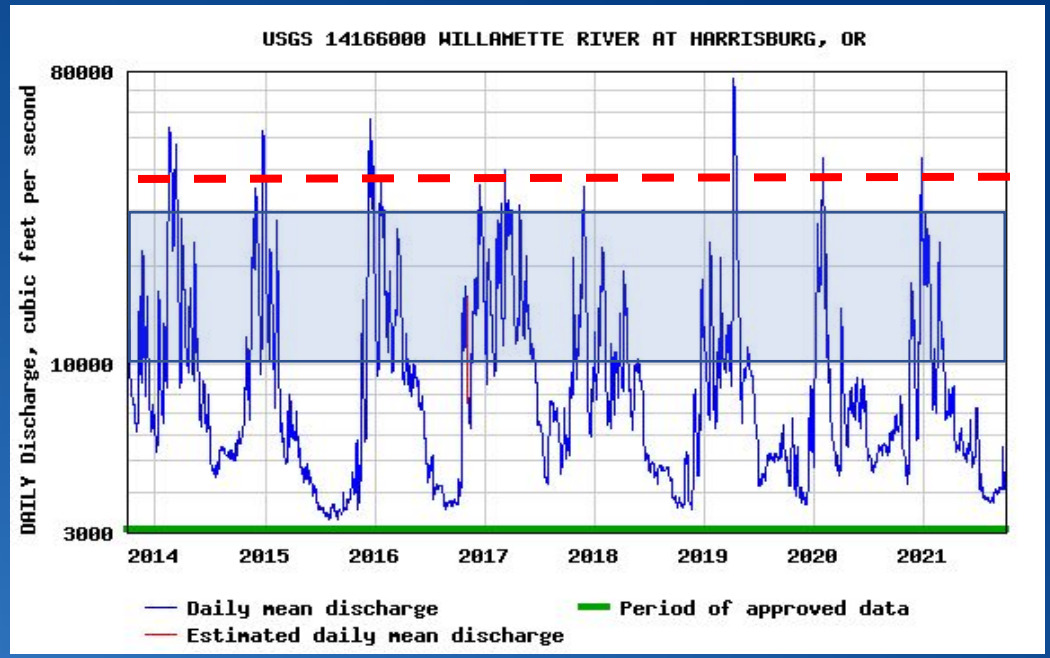




Satellite Imagery Search and Processing Tool (being integrated)

1

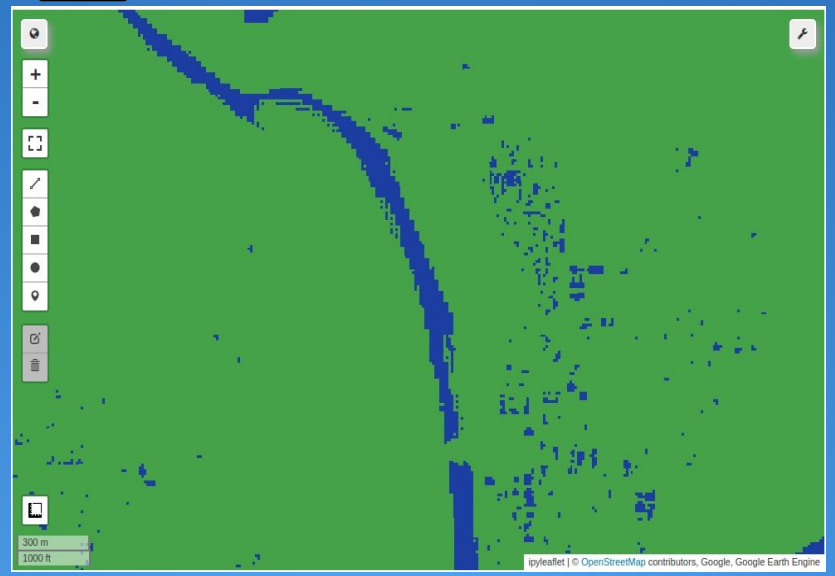
1. Filter for days with target discharges
2. Find cloud-free images on those days
3. Process images for NDWI/MNDWI, water mask
4. Find instantaneous discharge, inundated area



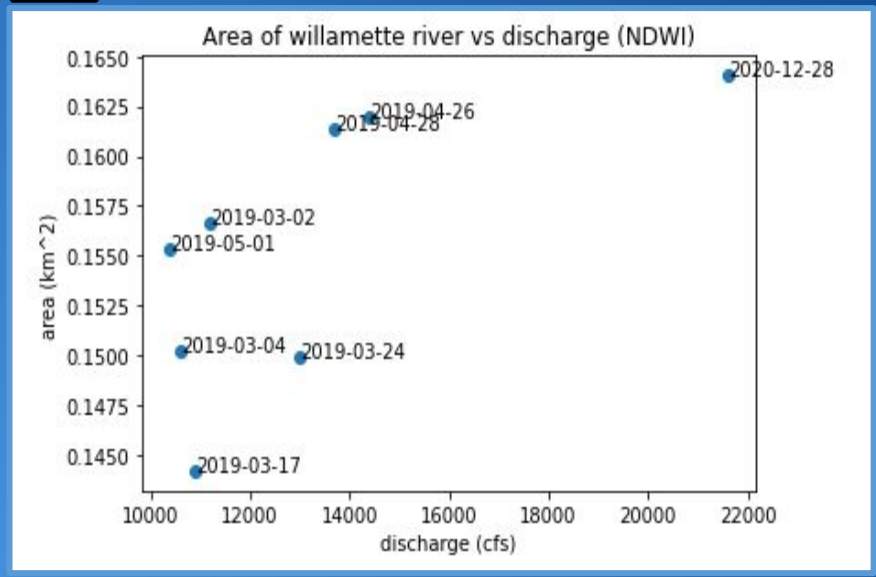
2



3

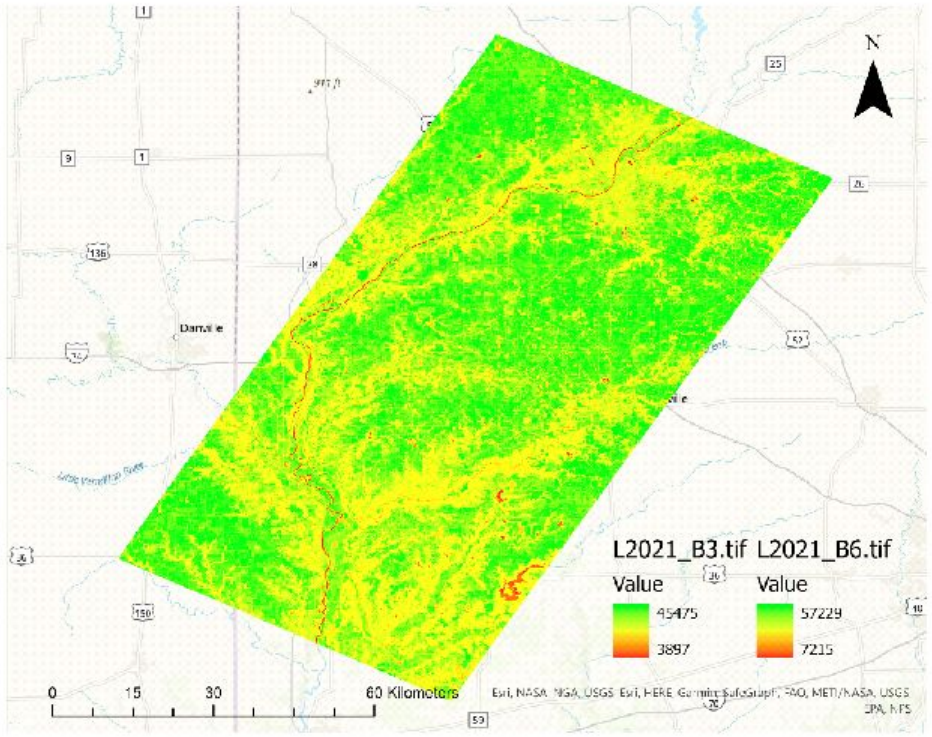


4

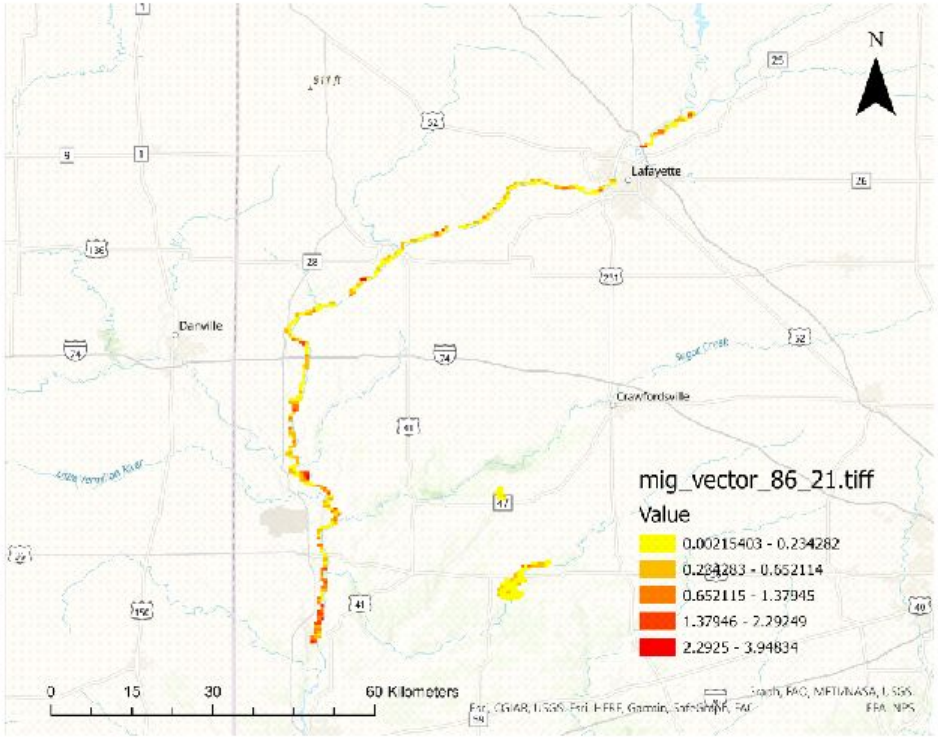


Computing River Migration using Landsat

Computation of River Migration using Satellite Data



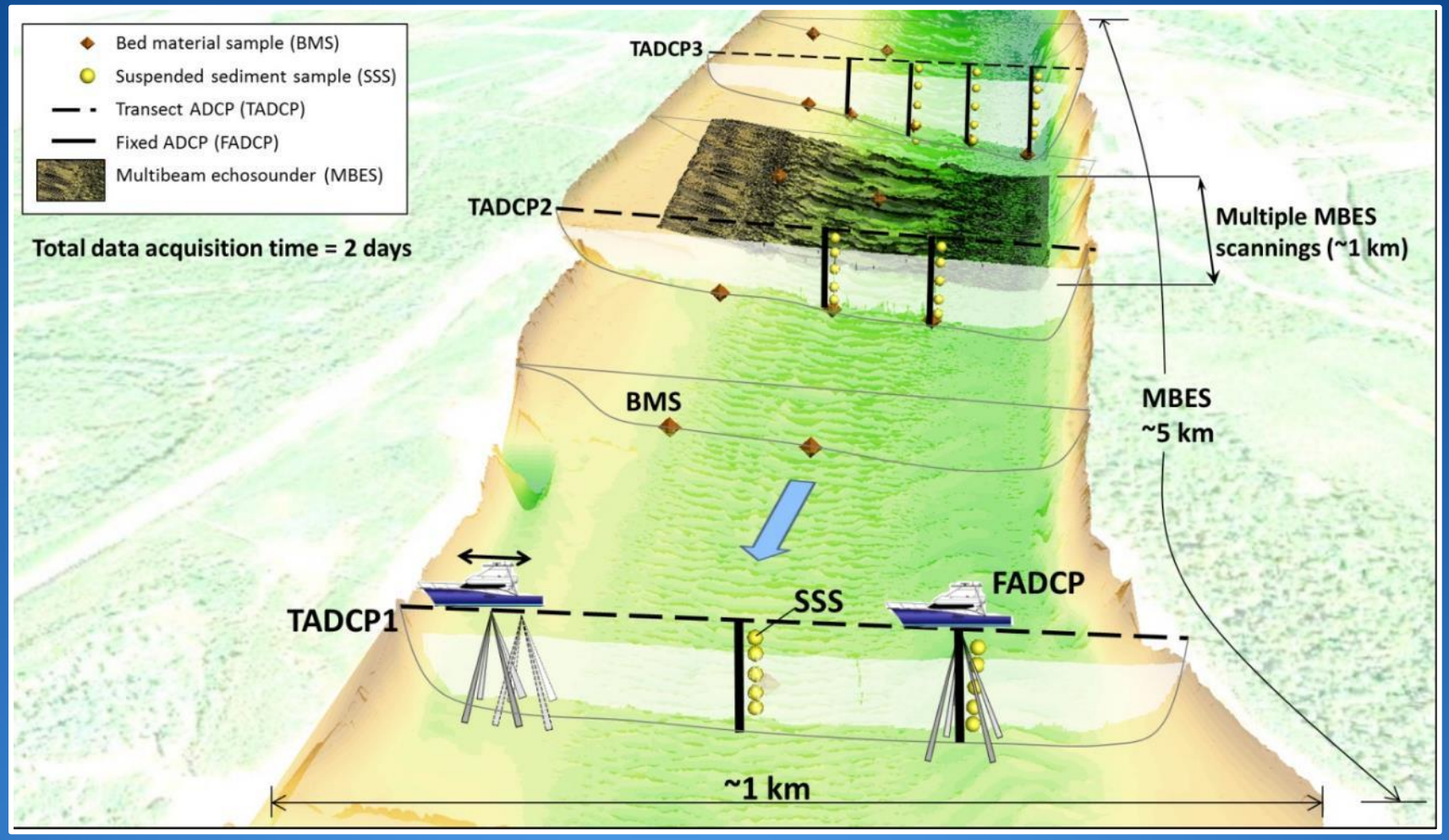
The input is green and short wave infrared bands of Landsat data



The output is the raster of river migration rate per year

Use Case: How is river planform has changed or changing over a given duration? (Under development)

Utilizing Sonar Data (ADCP, MBES)

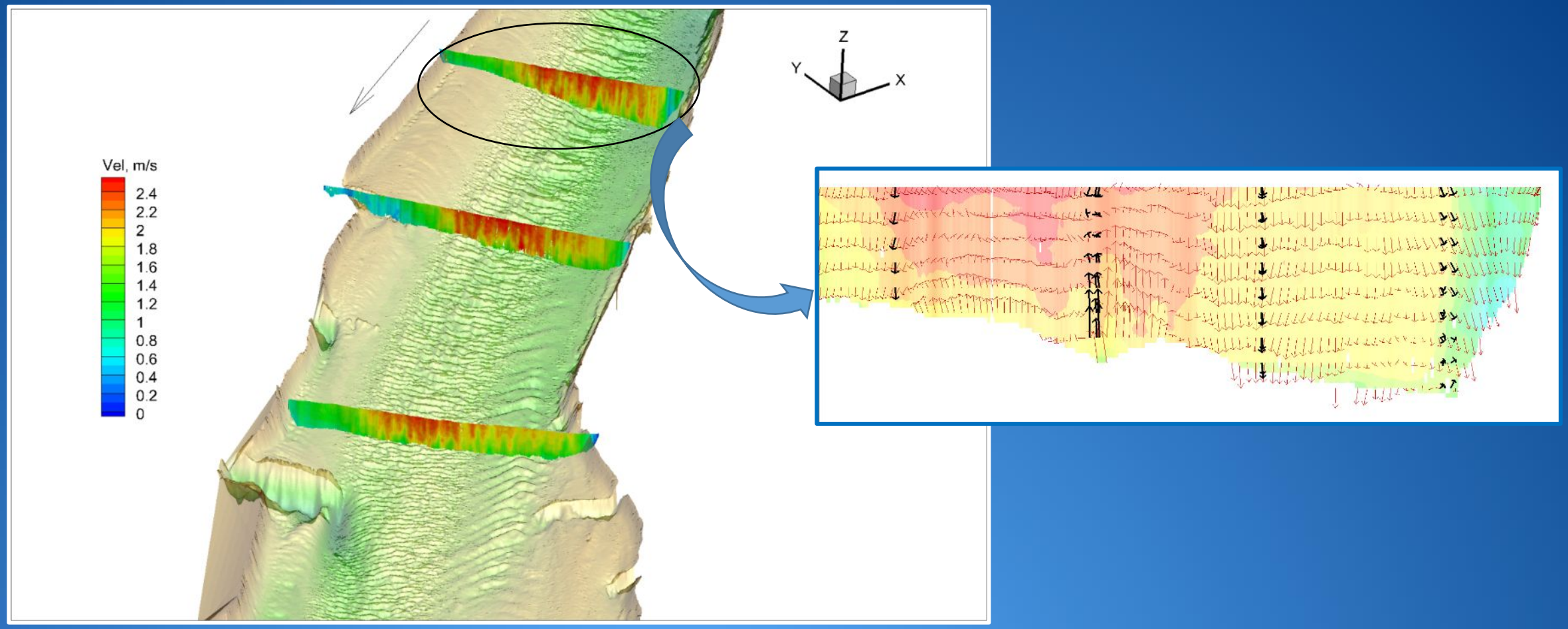


Use case: How to assemble and visualize multi-instrument data for reach scale analysis (Planned)

Courtesy of T. Pratt (USACE)

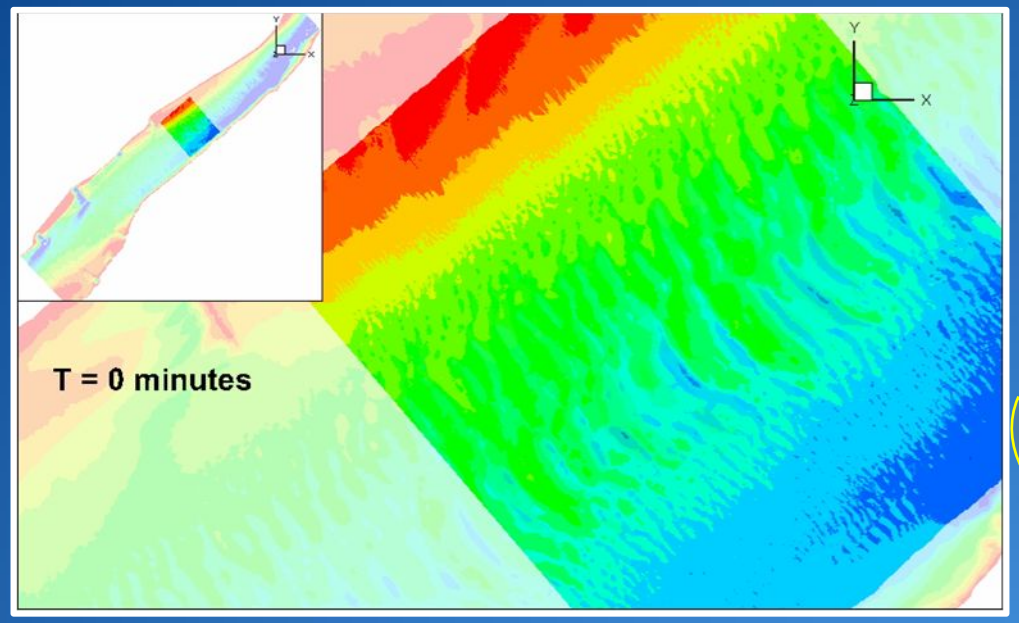
ADCP data

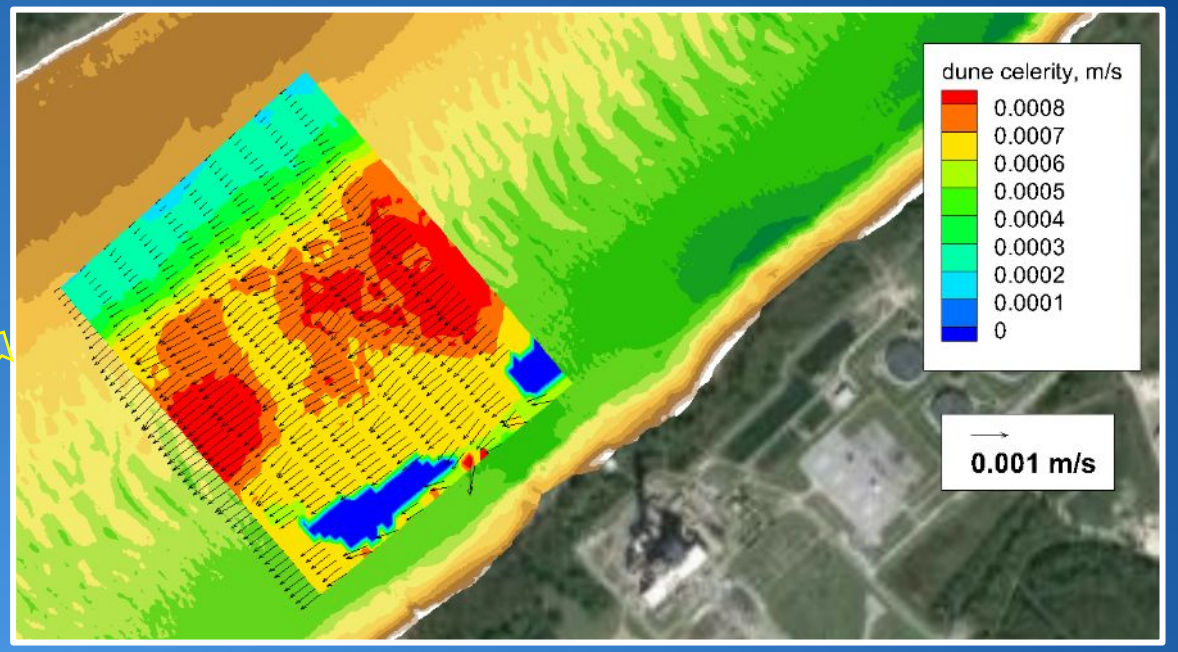
Multi-beam echosounder (MBES) and Acoustic Doppler Current Profiler (ADCP)



Utilizing Sonar Data (ADCP, MBES)

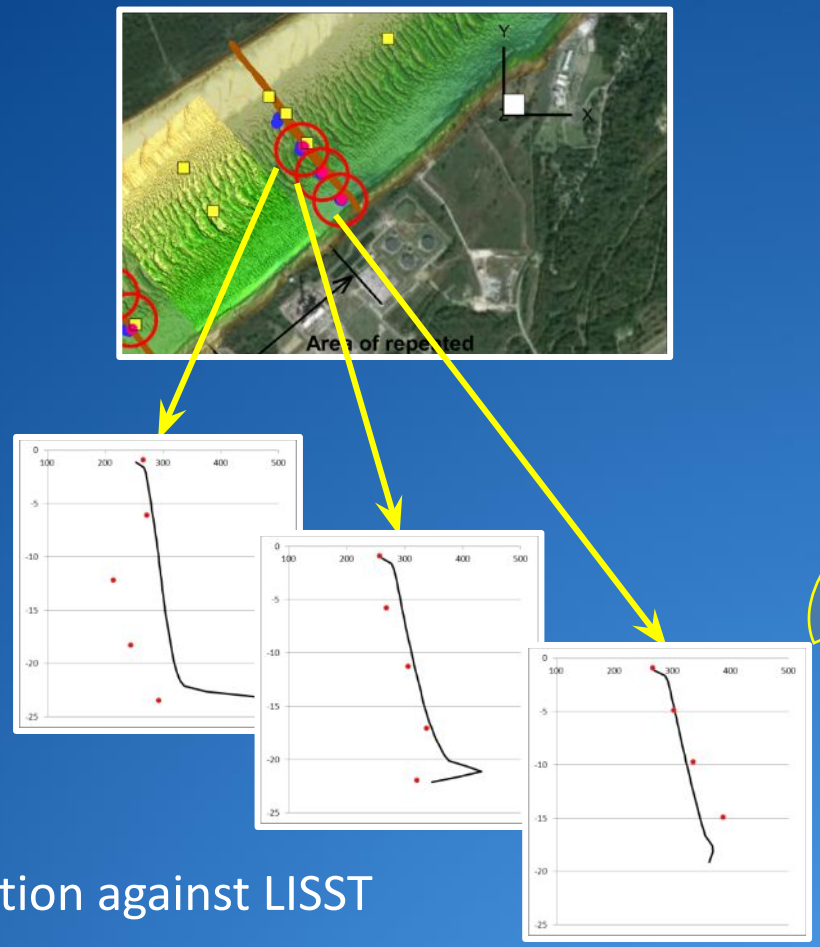
Bedform movement (Acoustic Mapping Velocimetry applied to MBES data)





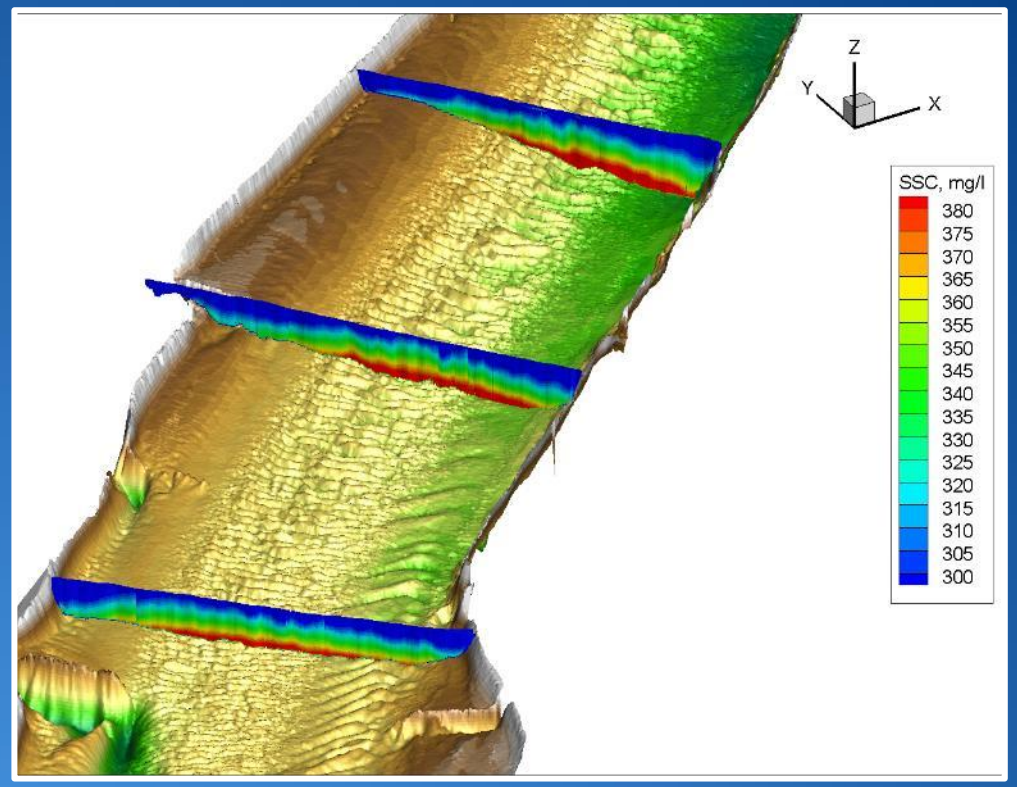
Use case: How to assemble and visualize multi-instrument data for reach scale analysis (Planned)

Utilizing Sonar Data (ADCP, MBES)



Calibration against LISST

Suspended sediment concentration (ADCP data)



Suspended sediment concentration mapping

Use case: How to assemble and visualize multi-instrument data for reach scale analysis (Planned)

More Ideas for Future Tools

- Incorporating NWIS data (annual exceedance probabilities, shear stress calculations)
- Accessing 3DEP topo data for floodplains, overlaying MNDWI/NDWI on top of topography
- Estimating suspended sediment concentration distributions using Landsat imagery and regression equations (EX: in the Mississippi and Missouri River region).
- Evaluating temporal trends in bed elevation changes using bathymetric rasters generated from multiple survey datasets.

Today's Agenda

- 12:00 - 12:15: Project Introduction (Venkatesh Merwade)
- 12:15 - 12:35: Overview of RIMORPHIS Platform - Year 2 (Iowa team)
- 12:35 - 12:50: Tools in Development (Purdue team)
- **12:50 - 12:55: Q & A**
- **12:55 - 01:00: Break**
- 01:00 - 01:05: Ground Rules (Toby Minear)
- 01:05 - 01:15: Polling Questions (Toby Minear)
- 01:15 - 01:40: Breakout Groups
- 01:40 - 01:55: Open Forum/Discussion
- 01:55 - 02:00: Concluding Remarks (Venkatesh Merwade)