

RiverMorph: A Web Platform for Enabling River Morphology Research

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NSF Collaborative Research Project

River Morphology Data and Analysis Tools (RiverMorph):
A Web Platform for Enabling River Morphology Research

Awards: #1948938 - #1948944 - #1948972 - #1948940



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RiverMorph Vision

DATA INTEGRATION

MODERN CYBERINFRASTRUCTURE

COMMUNITY SUPPORT

The RiverMorph platform is a user-friendly, scalable, data and information system for river morphology research, equipped with tools for discovery, retrieval, analysis, integration, and knowledge generation. Given its community focus, RiverMorph provides visualization and collaboration tools that enable transparency and reproducible research outcomes.

RiverMorph – from vision to implementation

CATALYTIC ACTIVITIES

- Identify existing resources
- Engage community through workshops to inform the RiverMorph design
- Assess the available data, cyber tools and resources
- Specify RiverMorph design features
- Assemble workflows and design new cyber tools
- Develop user-friendly interfaces for cross-disciplinary research

OUTCOMES & DELIVERABLES

- Easy access to data sources of interdisciplinary research
- Improved handling of big data & data-driven information exploration
- Support scientific studies with NSF FAIR* science practices
- Cyber training of instructors
- Tools for data uploading and online processing
- RiverMorph workflows for data handling & information and knowledge production

LONG-TERM PROGRESSION

- Support Earth Science community with integrated data and cyber resources
- Advance cross-scalar research on river morphology exposed to human-natural impacts
- Synergy & democratization of geomorphology research
- Curricular innovation in geomorphology education
- Connect science with practice
- Self-sustained, long-term research resource

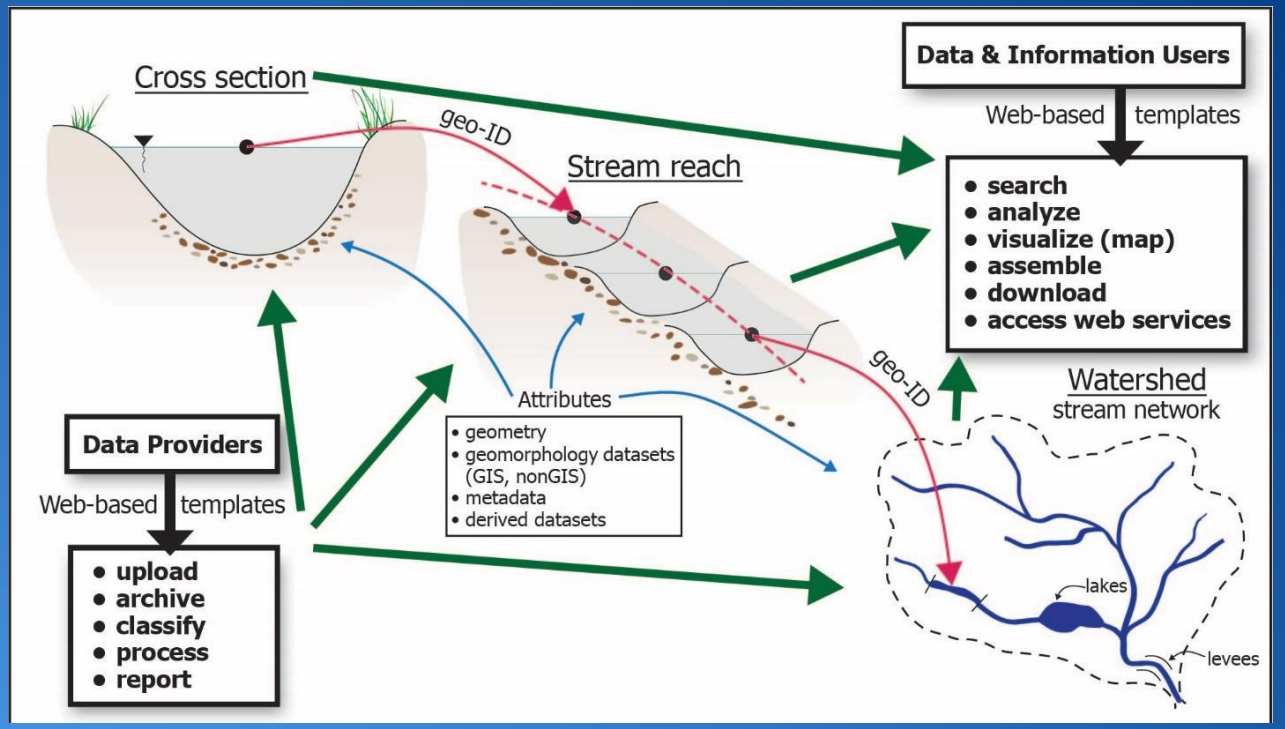
BROADER IMPACTS

- Increase reproducibility through FAIR science
- Innovative workflow generation
- Scalable and sustainable methods for cross-disciplinary collaborative research & education

* FAIR – NSF's acronym for Findable Accessible Interoperable and Reusable principle

RiverMorph: Functions

- Host hydro and geomorphology data from multiple sources in a centralized hub that links existing and newly added datasets
- Allow users to upload data, access the stored data using basic query tools, and visualize the data for basic content (metadata level)
- Enable seamless integration across datasets irrespective of their location
- Enable building of customized applications utilizing the data for routine management operations or exploratory scientific investigations



RiverMorph: Features

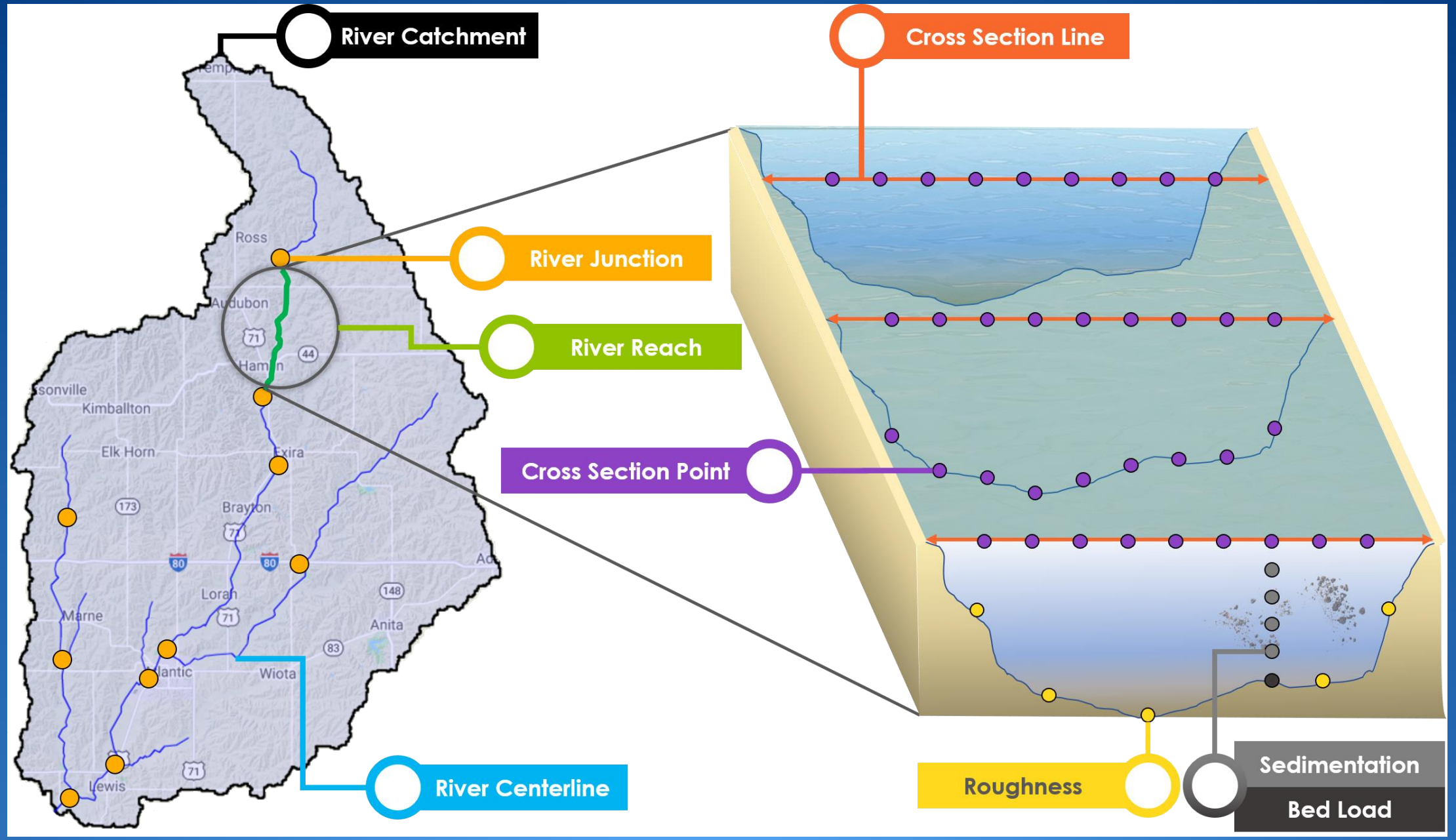
Complement existing hydrological data models (Arc Hydro, Arc Hydro Ground Water) to provide:

(i) river hydro-geomorphological data in channel-oriented coordinates

(ii) multidimensional river features represented as points, lines, polygons, and volumes in order to facilitate visualization of the stored data and interaction with numerical models

(iii) observe data in a framework that allow identification and visualization of dynamic river objects and their spatio-temporal evolution using Eulerian or Lagrangian observational frameworks

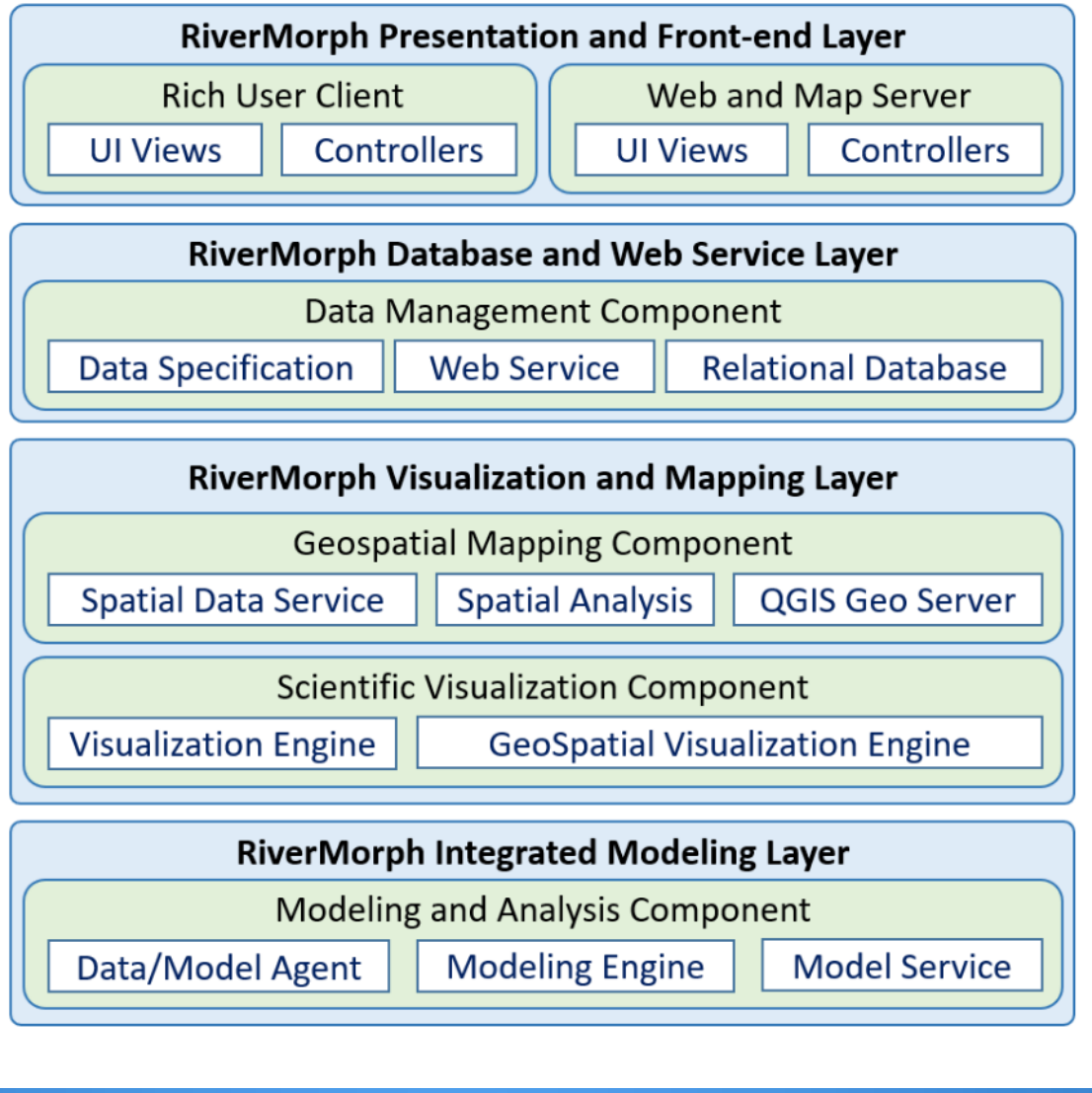
RiverMorph: Features



RiverMorph: Data Model



RiverMorph: Architecture



RiverMorph: Data & Tool Resources

Critical datasets

Datasets	River, reservoir, and lake **bathymetry** collected with echosounders
	Topography of river corridors and associated floodplains (channel centerlines, bank positions, anthropogenic features, and surface mapping)
	Water surface **elevations** and reach **slopes**
	Sediment properties – deposited, eroded, and transported (quantity, grair size, cohesiveness)
	Channel roughness (e.g., Manning's n) and its spatial (in reach) and temporal variation (seasonal)
	Water-velocity profiles and vectors collected by Acoustic Doppler Current Profilers and other instrumentation
	Soil-erodibility metrics
	Historical stream evolution using aerial imagery, historical maps, and site photographs acquired over long time intervals

RiverMorph: Data & Tool Resources

Potential sources

Datasets	USGS National Hydrography Dataset (**NHD**)
	USACE Reservoir Sediment Information (**RSI**)
	USACE Hydrographic Surveys (**eHydro**)
	USGS National Water Information System (**NWIS**)
	USGS 3-D Elevation Program (**3DEP**)
	USGS **StreamStats**
	USGS **Vigil Network**
	NRCS **Regional Curves** Datasets
	Surface Water Oceanographic Topography (SWORD)
Tools	**USGS** Stream Channel and Floodplain Metric Toolbox
	Geomorphic Change Detection (**GCD**) Software
	USACE Sediment Analysis & Geo-App (**SAGA**) Database
	USGS DEM **Geomorphology Toolbox**
	USACE **Cross Section** Viewer

RiverMorph: Use Case Areas

- **Natural Disaster Response** (quick updates of the input data for readily available models)
- **Planning Studies** (making data from multiple sources accessible with possibilities of continuous update inputs)
- **River Restoration and Geomorphic Change Research** (enabling the tracking of river features over time)
- **Dam Removal Analysis** (facilitating decision making across management agencies**)**
- **Sediment Budgeting and Sustainable River** Management (enabling data sharing and integration across multiple data producers)

Wood & Boyd (2020)

RiverMorph: Community Building Workshop

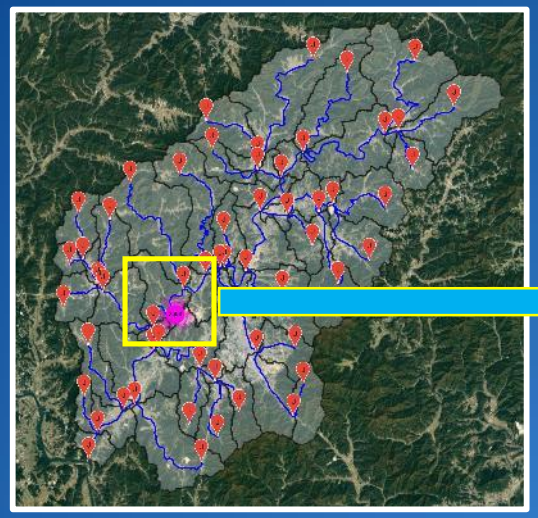
- Community building and partnership workshop
- Spring 2021
- Federal and state agencies and organization, industry and academia
- Check RiverMorph website for workshop announcement and details

  https://river-morph.org

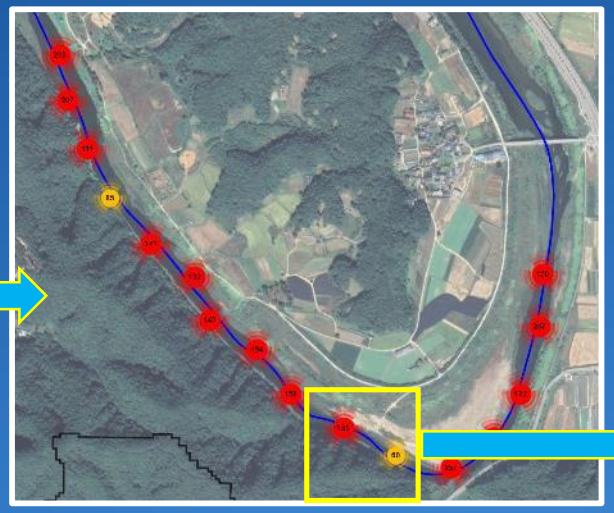
Wood & Boyd (2020)

RiverMorph: Use Case #1

Find the hydro-morphologic measurements available in a specific stream reach



Search for reach in the watershed



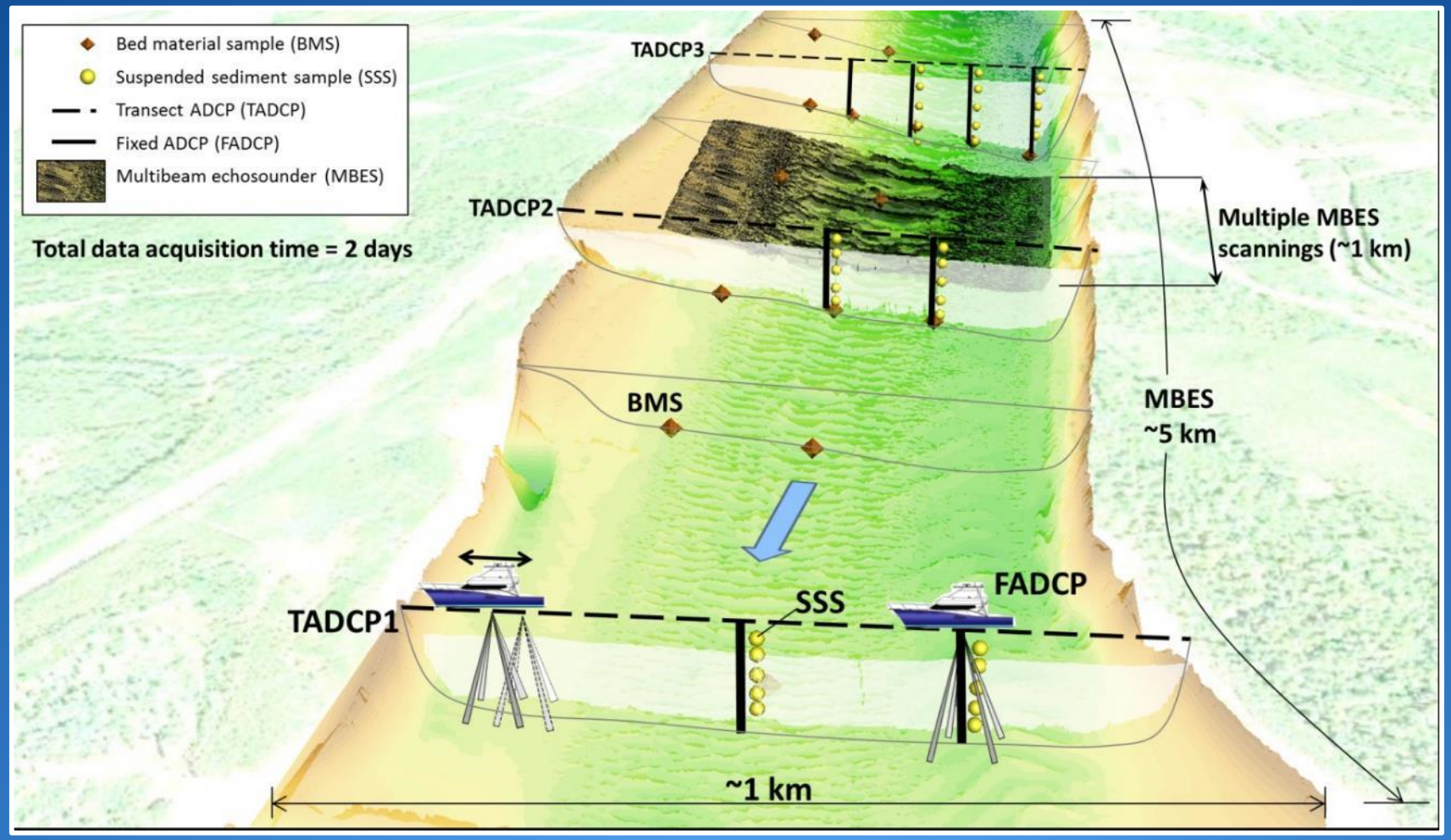
Search for measurements in the stream reach



Show measurement locations and download the ADCP files (raw format)

RiverMorph: Use Case #2

Reach scale analysis: assembly & visualization of multi-instrument data acquisition



Courtesy of T. Pratt (USACE)

Conclusion

- **Easy to update data/info & upgrade computational tools by the resource owners themselves** (data and components can be quickly changed as soon as new data occur)
- **Centralized control over data** (lower costs for hardware, software, distribution, maintenance, and training; greater efficiency in real-time modeling and data update)
- **Easily accessibility** (no need for modeling, GIS, or other software knowledge)
- **Platform independence** (encourage stakeholders to engage in the use and upgrading)
- **Scalable and transferable** (adaptable to various-size watersheds irrespective of their location)
- **Improved communication and coordination across data producers irrespective of their mission**

Thank You!

Contact RiverMorph

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