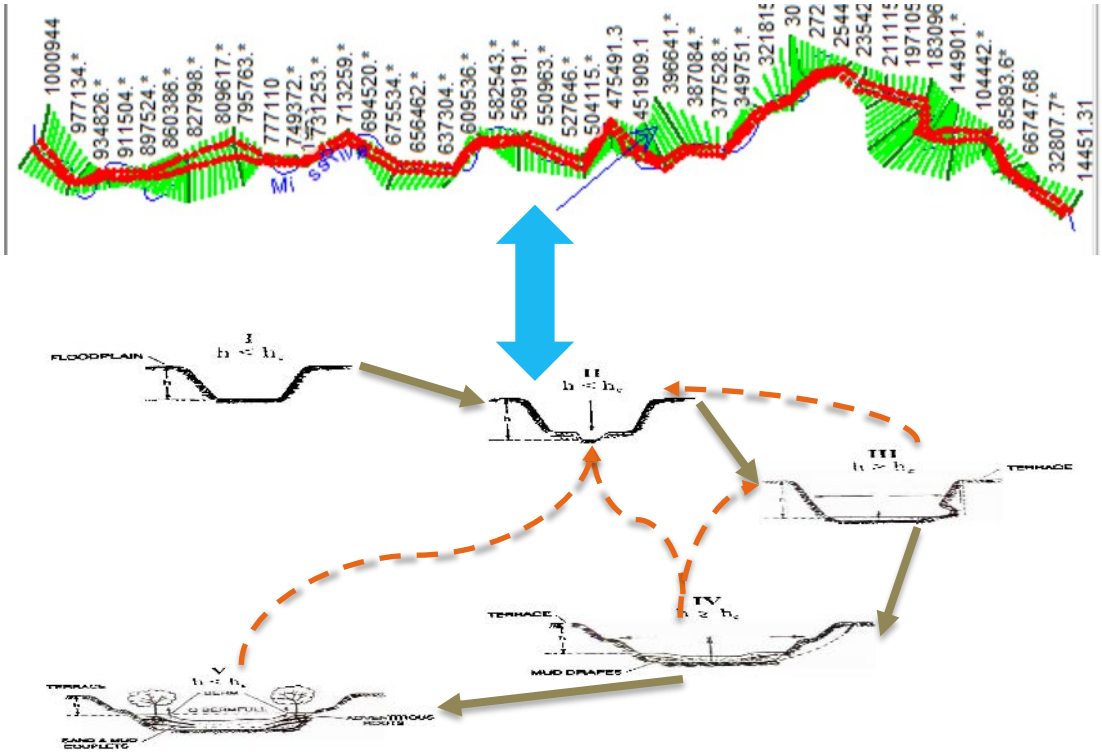
FY21 RSM IPR
ERDC, FRAME Tool, David Biedenharn & Travis Dahl

BLUF: The Future River Analysis & Management Evaluation (FRAME) Tool will provide river managers and planners exploratory insights into plausible river futures and the impact of interventions. The FRAME Tool will be a hybrid model that combines hydraulic and sediment transport model with morphologic rules for river evolution.

Objectives

- **Morphological Rules for Geometry Adjustment**
- **Incorporate Uncertainty**
- **Run Fast**
- **Provide Insight Into River Response**



FY21 RSM IPR
ERDC, FRAME Tool

Core Team Members

David Biedenharn and Travis Dahl
- ERDC-CHL

Phil Soar and Pete Downs
- University of Portsmouth (UK)

Amanda Cox
- St. Louis University

Colin Thorne
- Nottingham University (UK)

Charlie Little
- Mendrop Engineering

With Input From

Jim Lewis, MVD

Joe Dunbar, ERDC-GSL

Casey Mayne, Keaton Jones, Chris Haring, ERDC-CHL

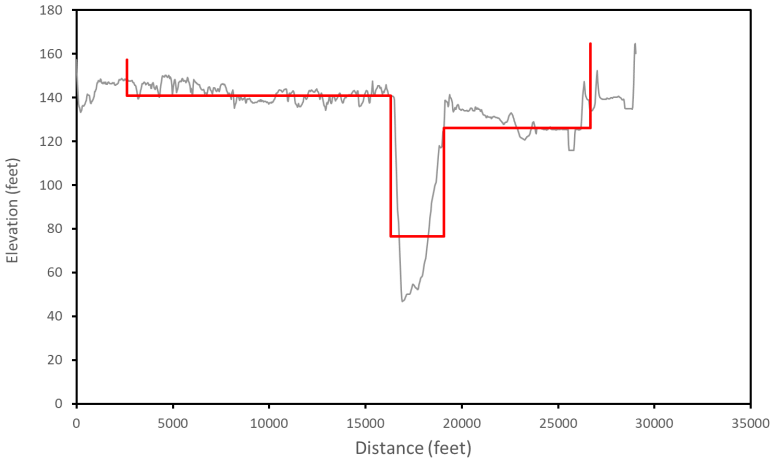
Leveraging/Collaborative Opportunities

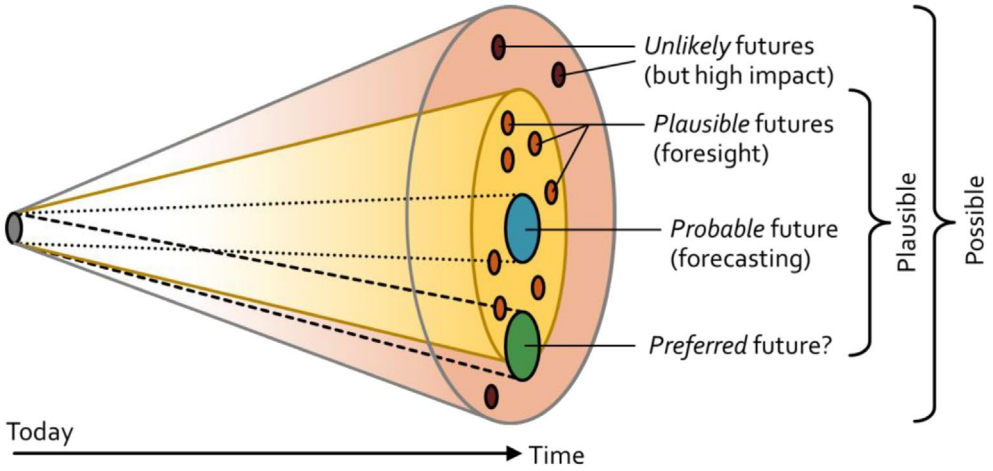
- Mississippi River Geomorphology & Potamology (MVD)
- Flood & Coastal Systems

FY21 RSM Mid-Year IPR
ERDC, FRAME Tool

Approach

- Develop a fast, simplified hydraulic and sediment transport model
  - Hybrid 1D-sediment transport model
  - Simplified Cross-Sections (Avatars)
  - Geomorphic Rules
- Built with uncertainty in mind

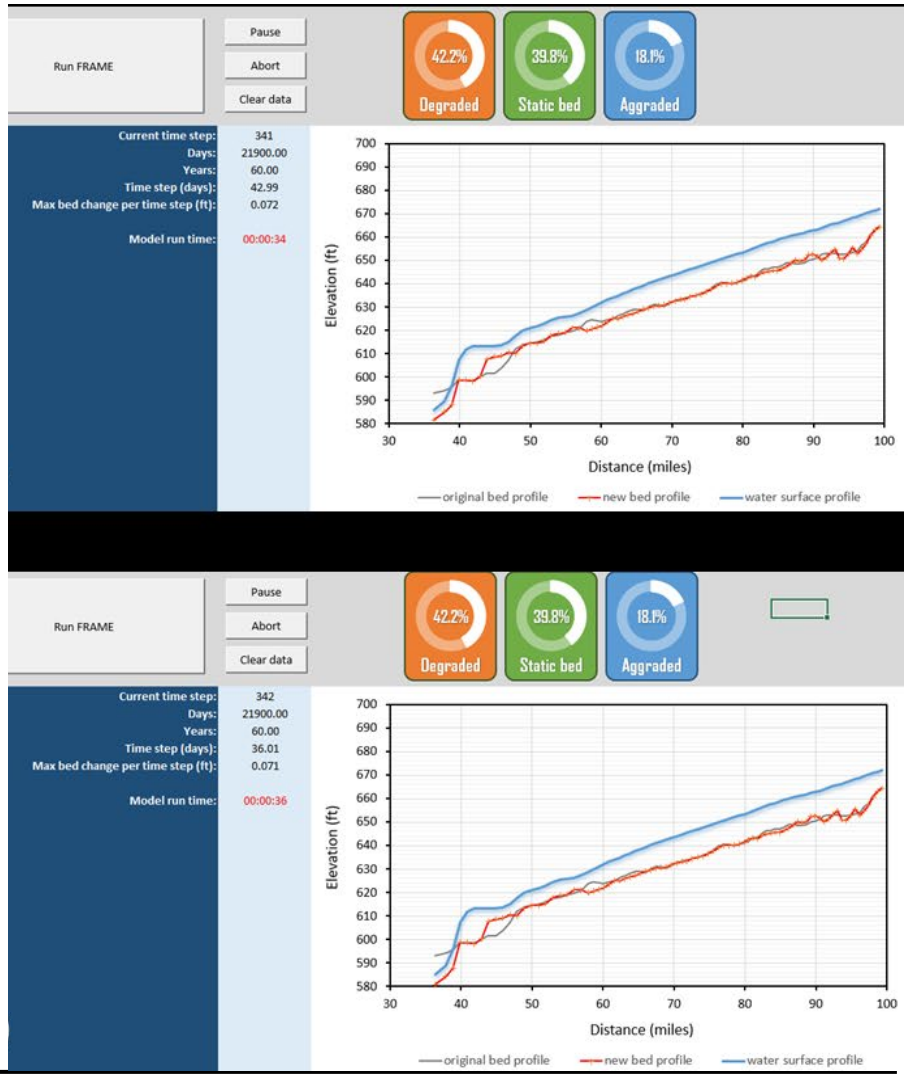




FY21 RSM IPR
ERDC, FRAME Tool

Accomplishments

- Working Hydraulic and Sediment Transport Engine
- FRAME set up on Mississippi and Kaskaskia Rivers
- Presentation at the World's Large Rivers Conference (Online, August 2021)
- Developed set of guiding principles for the morphological response rules
- Draft RUBRIC design
- Explored the potential application of Alluvial Phase Space Diagrams

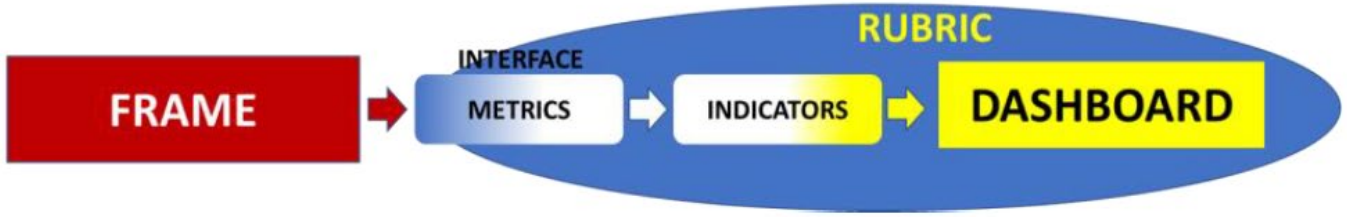


FY21 RSM IPR
ERDC, FRAME Tool

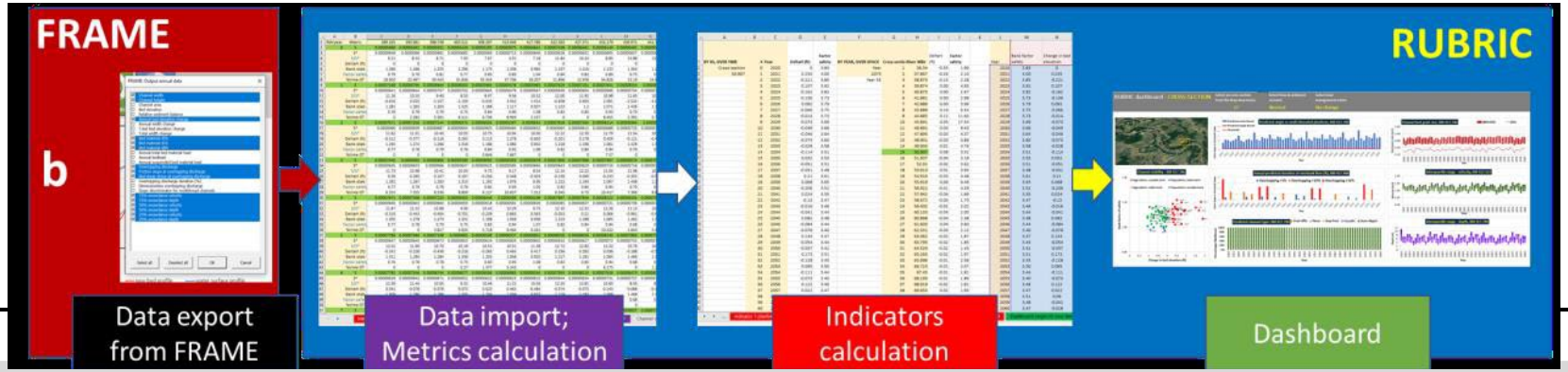
RUles-**B**ased morphological **R**esponse **I**n river **C**hannels (**RUBRIC**)

- Goal is to bridge the gap between *forecasting* of potential futures and *planning* projects
  - This step is called *Visioning*

Scanning ----------→ **Forecasting** ——————→ **Visioning** ----------→ **Planning**



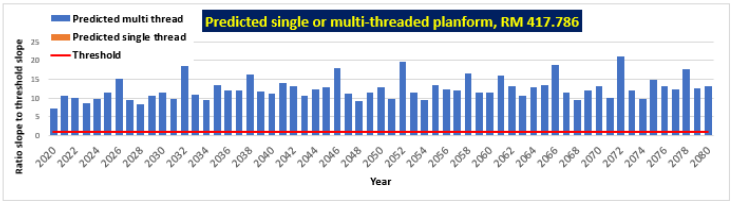
- RUBRIC includes state-transition *metrics* and threshold-based risk *indicators* calculated based on FRAME outputs and presented in a *dashboard*

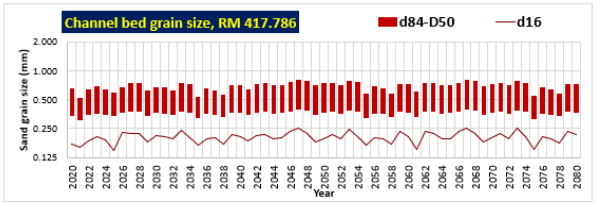


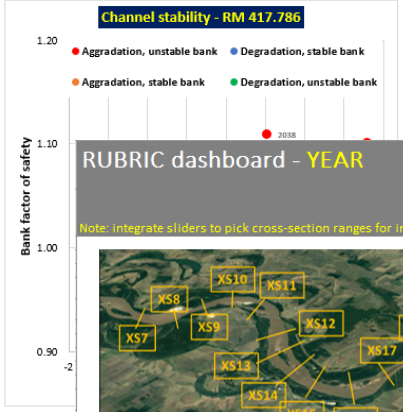
FY21 RSM IPR
ERDC, FRAME Tool

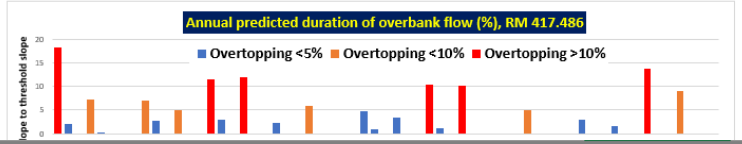
RUBRIC dashboard - CROSS-SECTION

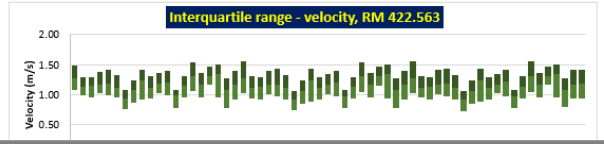
Select an cross-section from the drop drop menu	Select flow & sediment scenario	Select local management action
17	Normal	No change







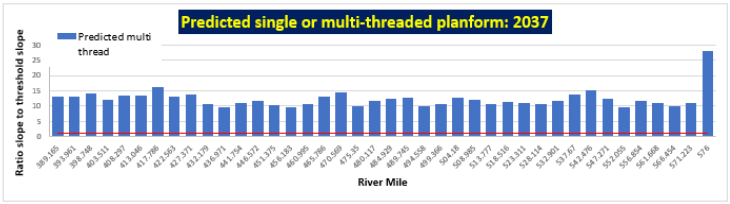


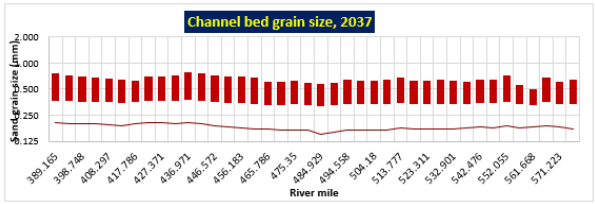


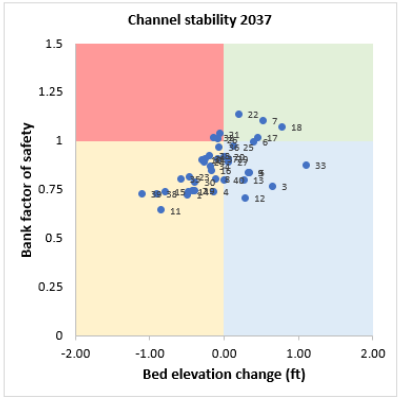
RUBRIC dashboard - YEAR

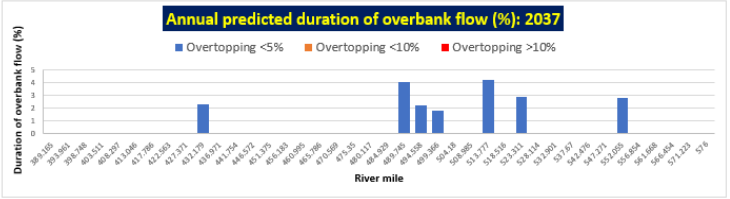
Select an year from the drop drop menu	Select flow & sediment scenario	Select local management action
2037	Normal	No change

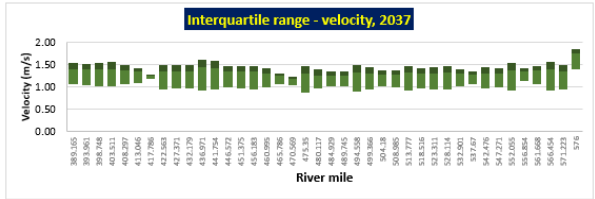
Note: integrate sliders to pick cross-section ranges for indicators

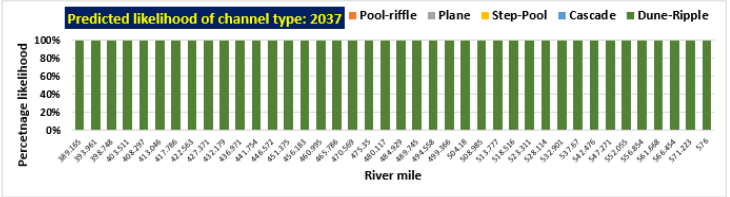


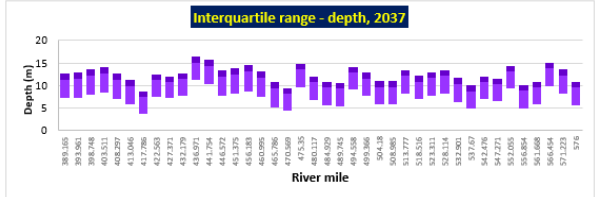








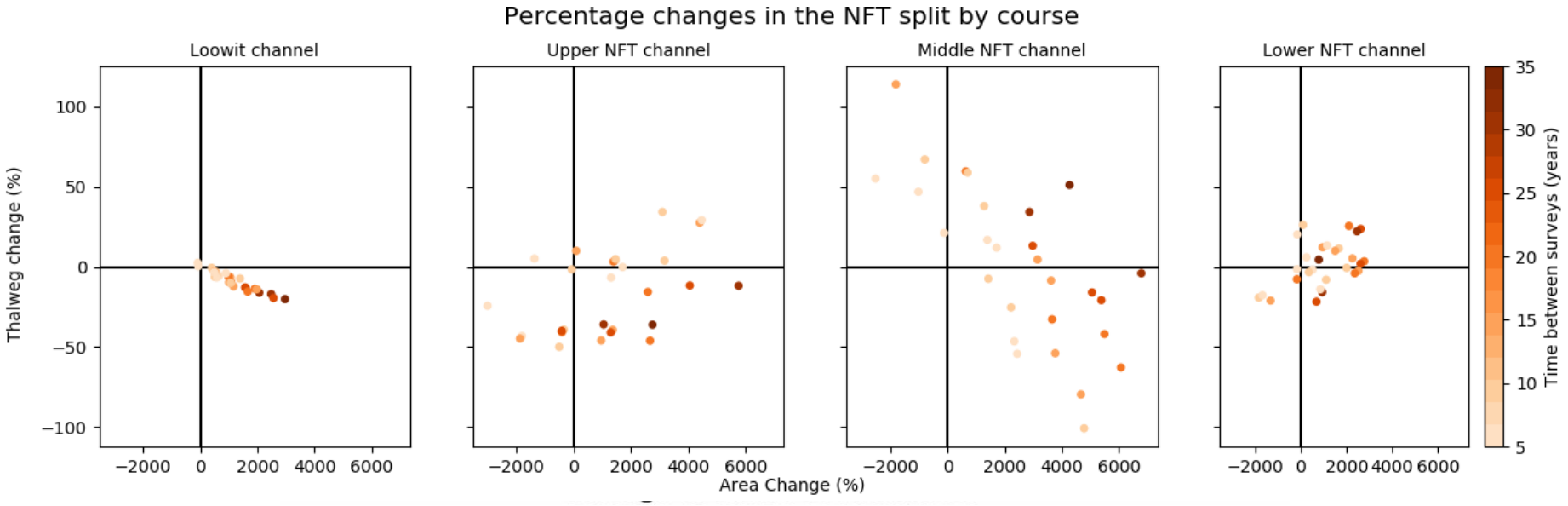




FY21 RSM IPR
ERDC, FRAME Tool

Alluvial Phase Space (**APS**) investigations

- Explored relationships between changes in thalweg elevation and channel area
- Looked at the North Fork Toutle (Mt. St. Helens) and the Mississippi River
- Provided insight for these systems
  - But very data intensive



FY21 RSM IPR
ERDC, FRAME Tool

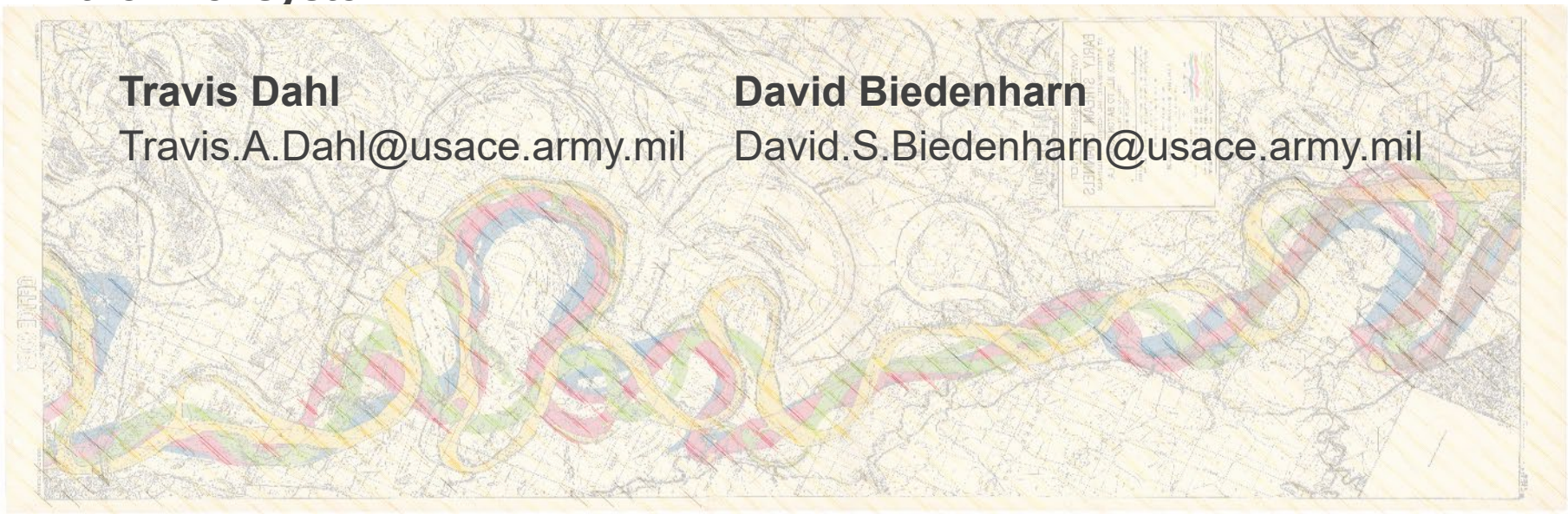
Challenges

- COVID eliminated valuable, in-person meetings
  - Continued our successful webmeetings, but progress was slowed on complex, conceptual issues
  - Also prevented workshops with potential users
- This RSM effort was an incremental step forward, but we need to identify future funding to continue development.

FY21 RSM IPR
ERDC, FRAME Tool

BENEFITS

When complete, the FRAME tool will allow planners and engineers to rapidly gain insights into how a river system will respond to potential interventions and provide a realistic range of uncertainty. This information will improve confidence in selected plans and potentially save millions of dollars pursuing designs that will cause unanticipated problems elsewhere in the river system.



Travis Dahl
Travis.A.Dahl@usace.army.mil

David Biedenharn
David.S.Biedenharn@usace.army.mil