

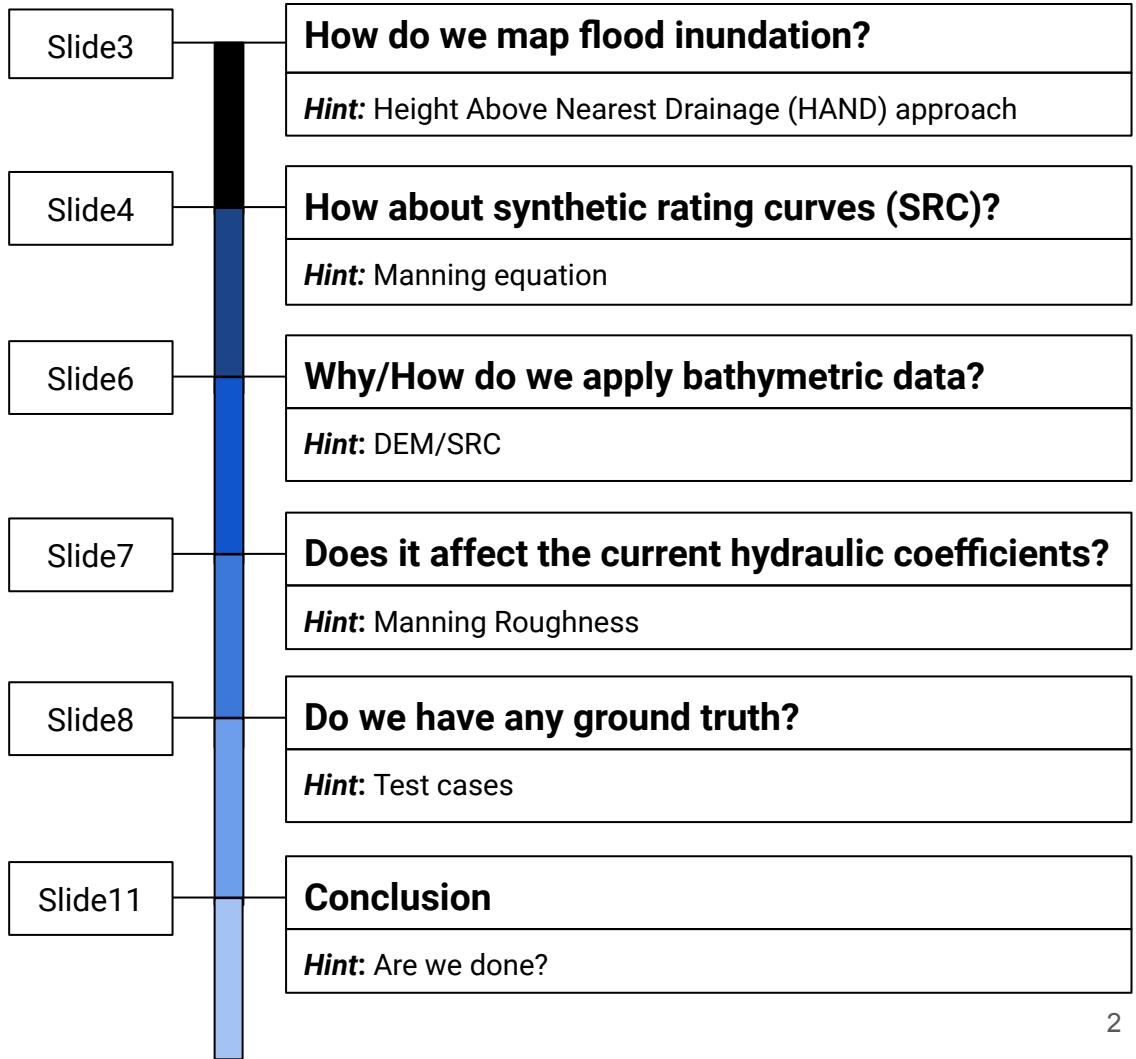
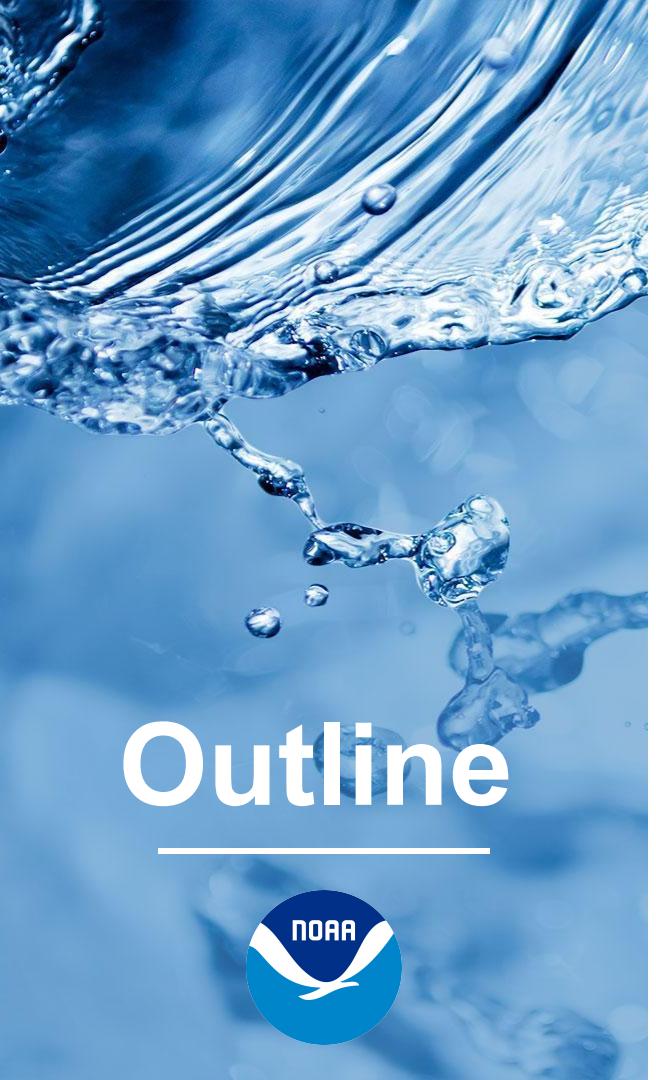
# Enhancing Flood Inundation Predictions: Integrating AI-Driven Bathymetric Data and Manning's Roughness Coefficients

Hamideh H. Safa, Carson Pruitt, Zahra Ghahremani, Robert Hanna, Ryan Spies, Arash Rad,  
Derek Giardino, Matt Luck, James Coll, Emily Deardorf, Ali Forghani, Fernando Salas



# Outline

---

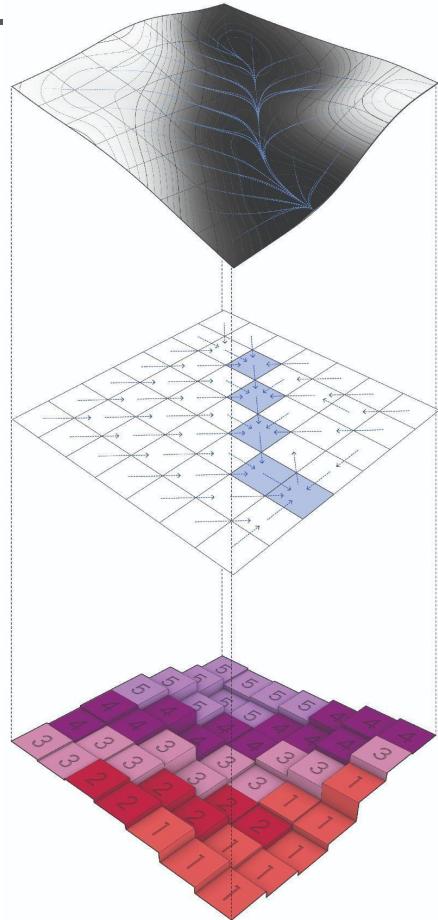


# Flood Inundation Mapping (FIM) Using Height Above Nearest Drainage (HAND)

1) Inputs: Digital Elevation Model (DEM) and stream line network

2) Hydroconditioning

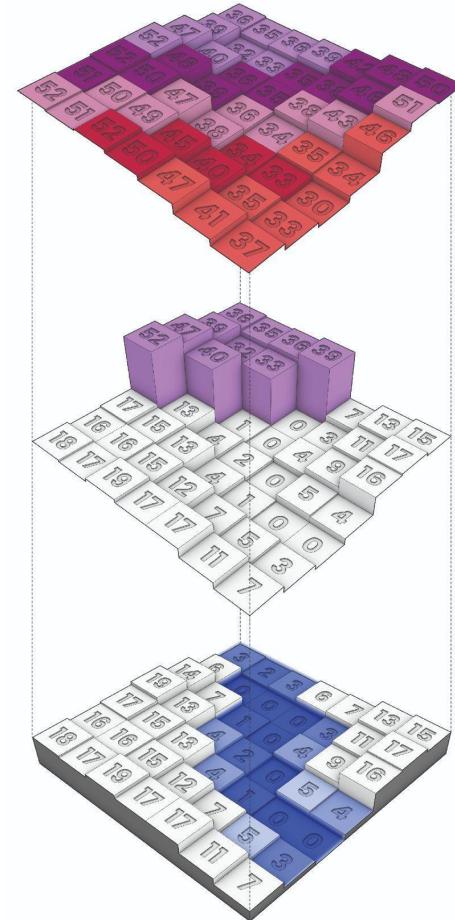
3) Delineate a drainage network and corresponding catchments



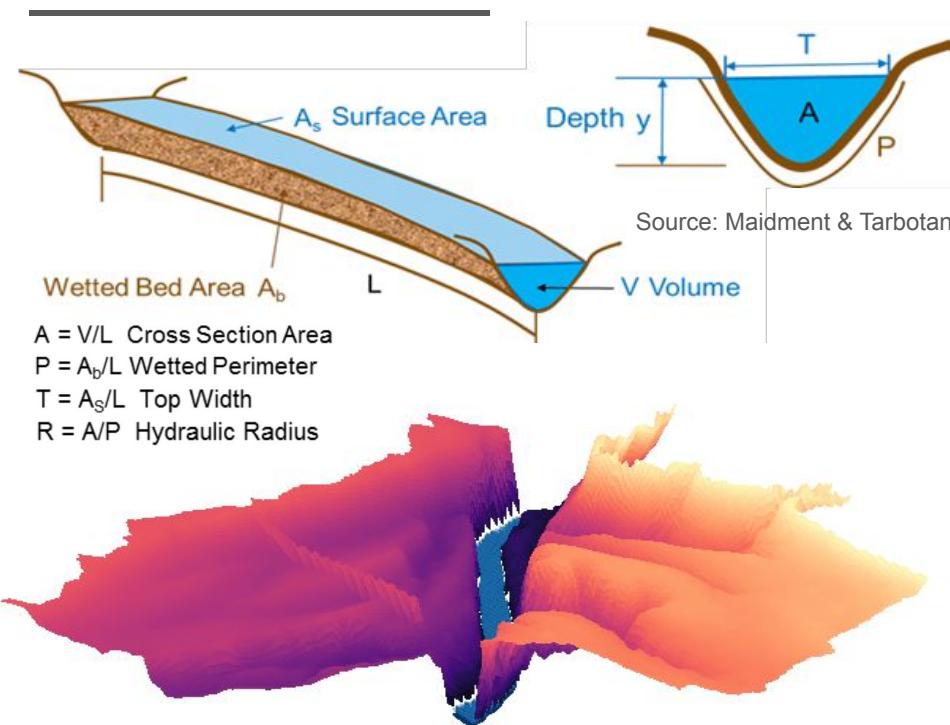
4) Convert channel elevation values to 0 elevation

5) Calculate the height above nearest drainage values for each catchment

6) Compute a relative elevation model

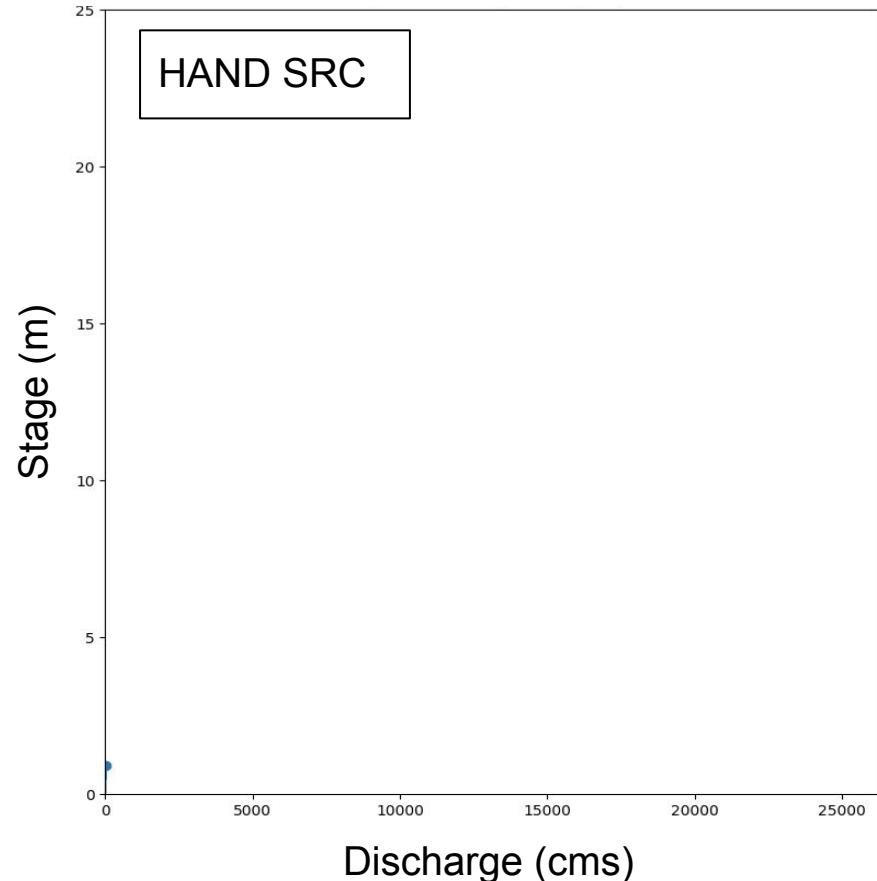


# Synthetic Rating Curve (SRC)



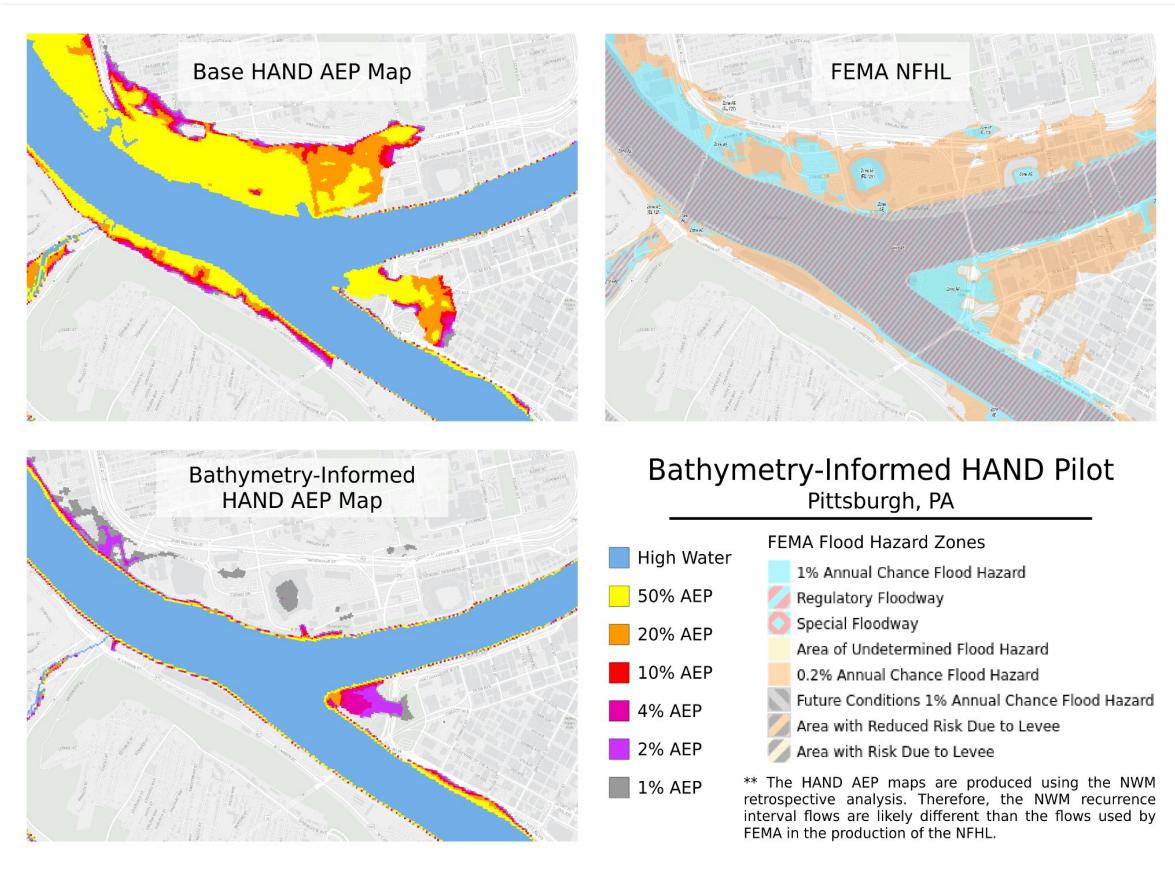
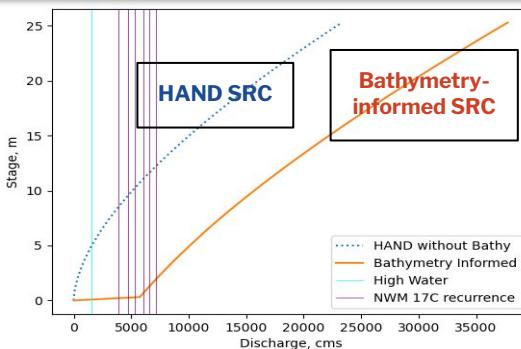
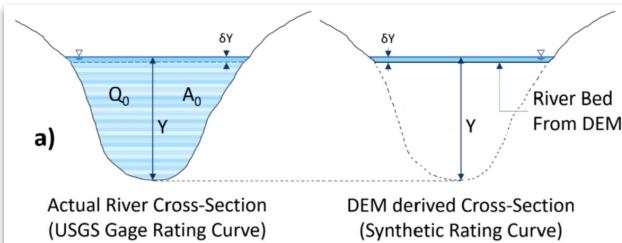
Hand Catchment

$$Q = \frac{1.49}{n} AR^{2/3} S_o^{1/2}$$



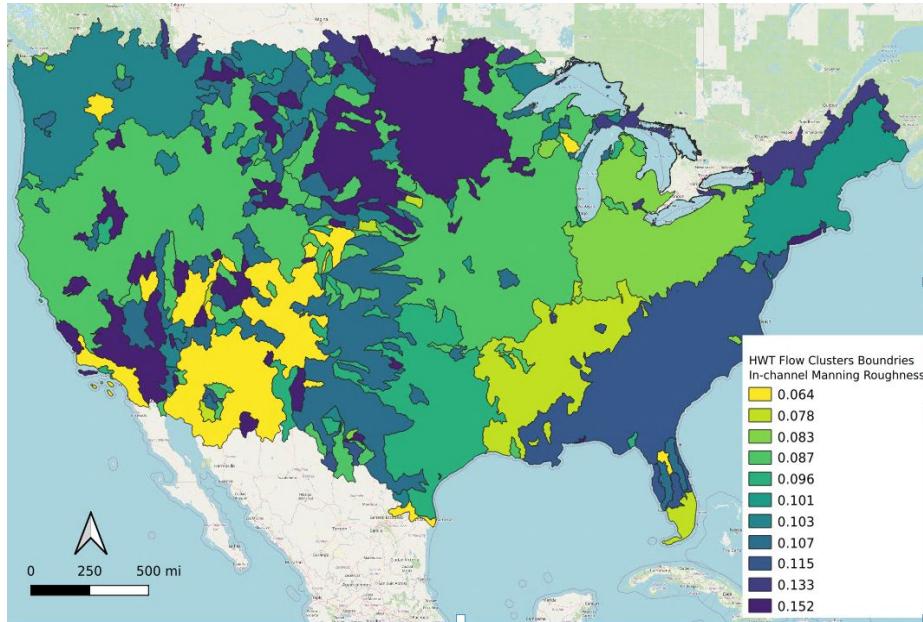
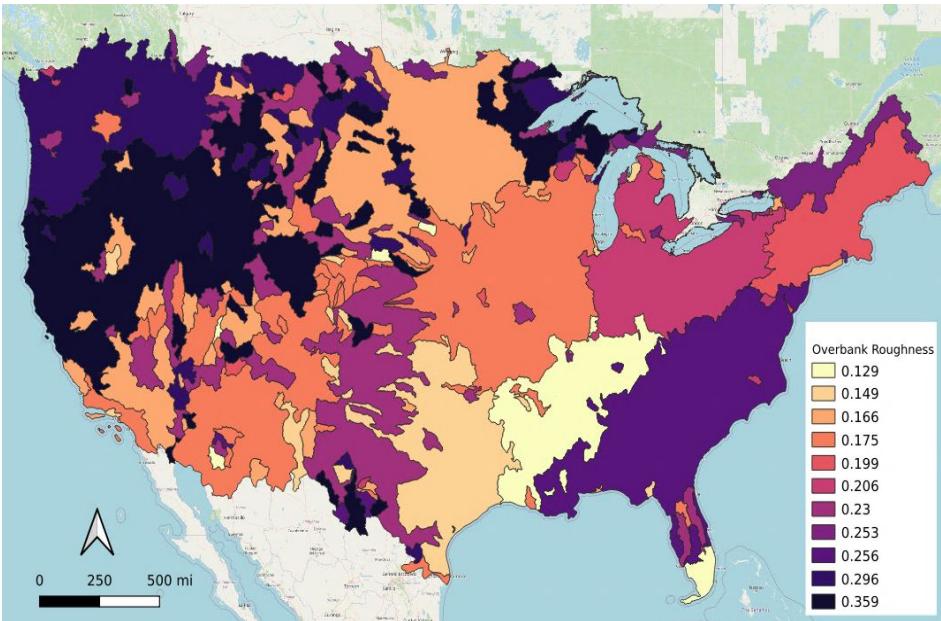
# Bathymetric Adjustment in HAND Synthetic Rating Curve

- ❖ eHydro and AI-driven bathymetric data for each reach
- ❖ Estimating missing volume and cross-sectional area caused by lack of bathymetry in USGS DEMs



# Optimizing Manning Roughness using BLE & AHPS Sites for Runoff Efficiency Clusters

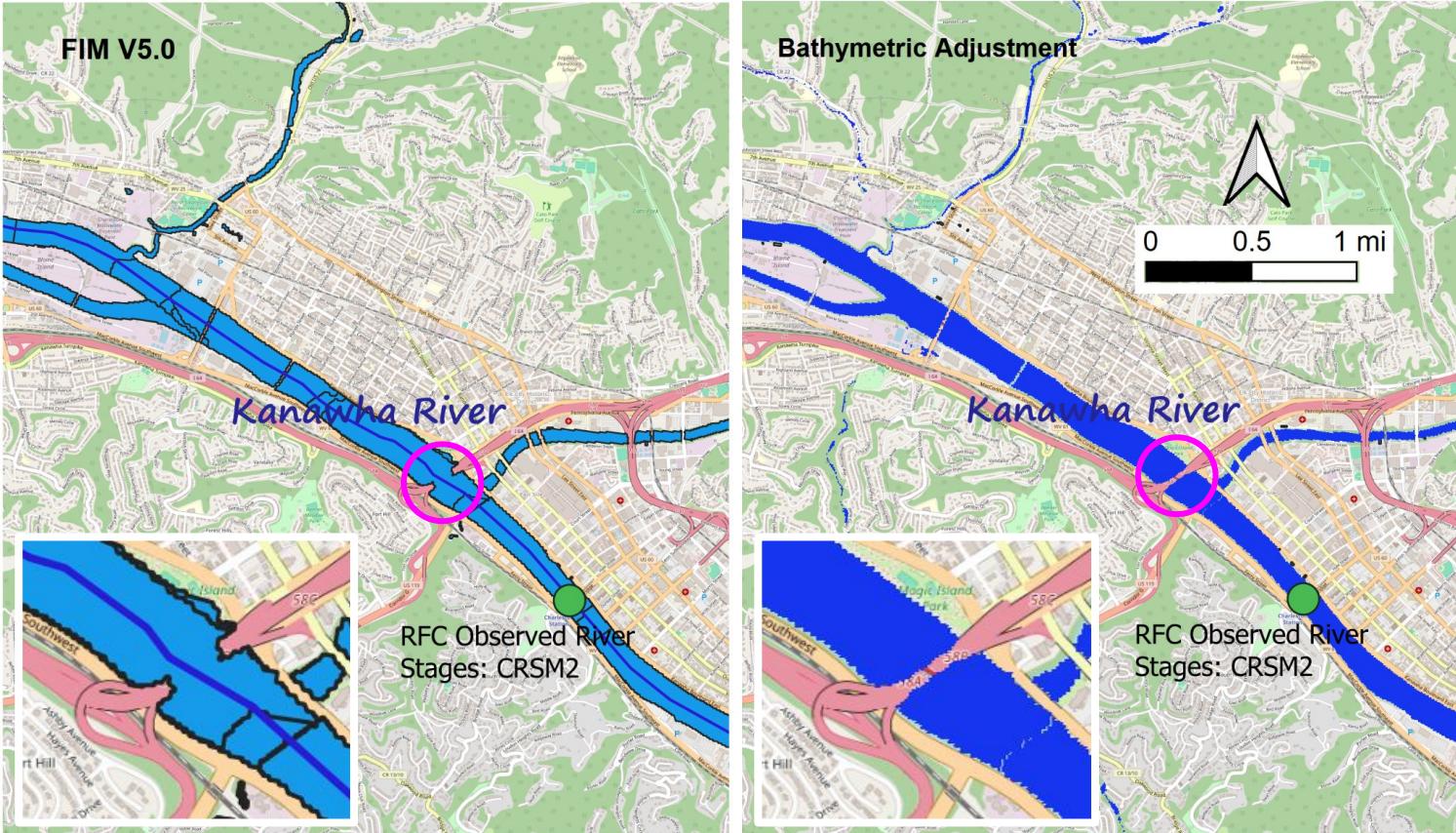
- ❖ Global roughness values 0.06 (inchan) and 0.12 (obank)
- ❖ Optimizing manning roughness using BLE & AHPS sites for runoff efficiency clusters



- ❖ Minimizing the percentage of false negative and false positive inundated Cells using differential\_evolution method

# Bathymetric Adjustment Test Cases

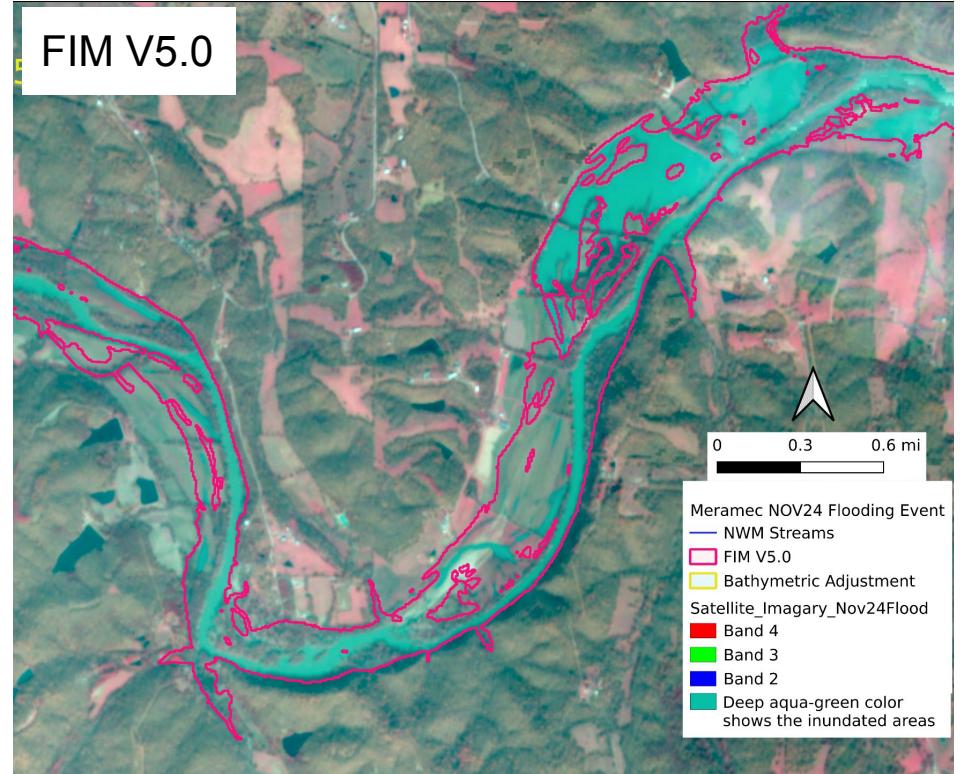
Helene  
Hurricane  
impact on the  
historic bridge  
in Charleston,  
WV



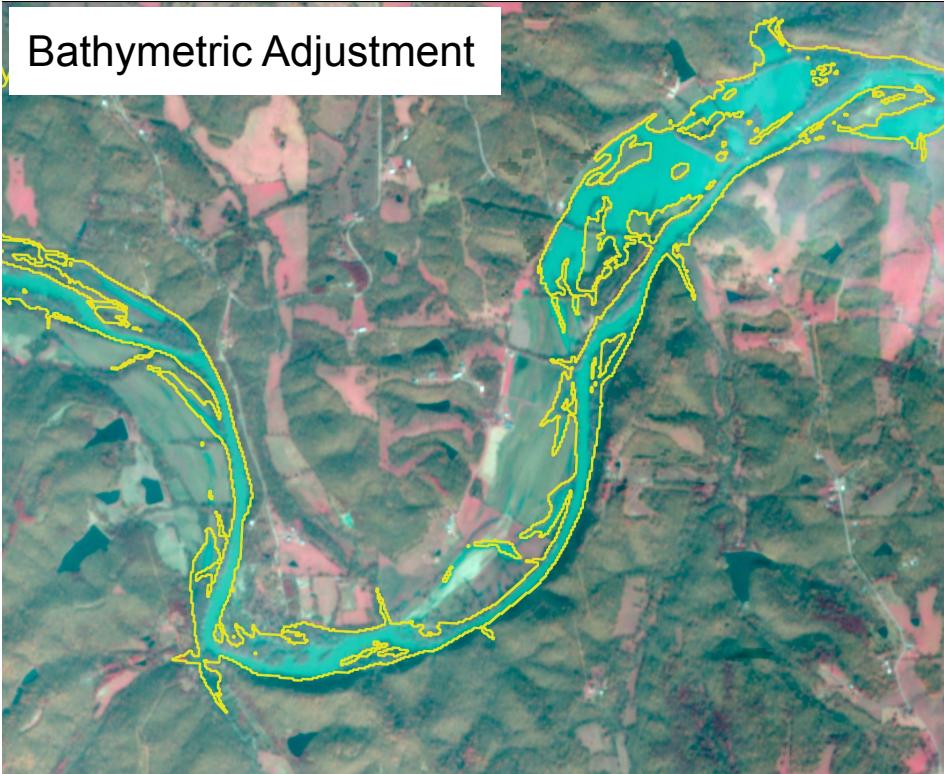
# Bathymetric Adjustment Test Cases

St. Louis flash flood event impact on Meramec River in Central Township, MO (Nov 4-8th)

FIM V5.0

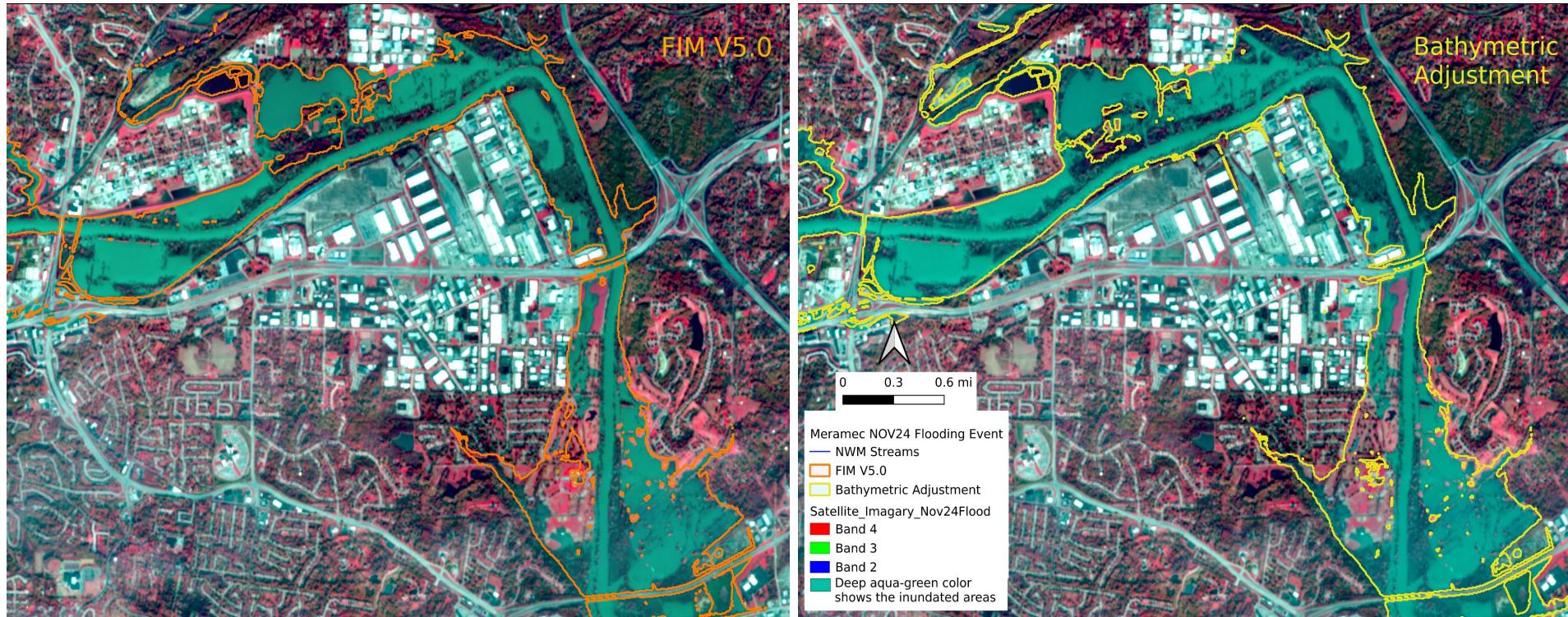


Bathymetric Adjustment



# Bathymetric Adjustment Test Cases

St. Louis flash flood event impact on Meramec River in Valley Park, MO (Nov 4-8th)





# Conclusion

---



- ❖ This presentation discusses the interactions between bathymetry and Manning's roughness, and their impact on flood mapping accuracy.
- ❖ Incorporating missing bathymetric channel geometry improves flood inundation extent, however, it may result in the underprediction of FIM
- ❖ Application of optimized Manning's roughness coefficients will enhance FIM skill.
- ❖ Are we done? AI-driven Manning roughness adjustment for each NWM reach
- ❖ ***Related studies: Session Number and Title: H54D: Machine Learning and Generative AI for Hydrologic and River Modeling IV Oral; Presentation Length: 17:10 - 17:20 EST\*; Session Date and Time: Friday, 13 December 2024; 16:00 - 17:30 EST***



# *Thank You!*

---



Hamideh Heidi Safa, Zahra Ghahremani, et al.



[hamideh.safa@noaa.gov](mailto:hamideh.safa@noaa.gov); [carson.pruitt@noaa.gov](mailto:carson.pruitt@noaa.gov)



<https://water.noaa.gov>

