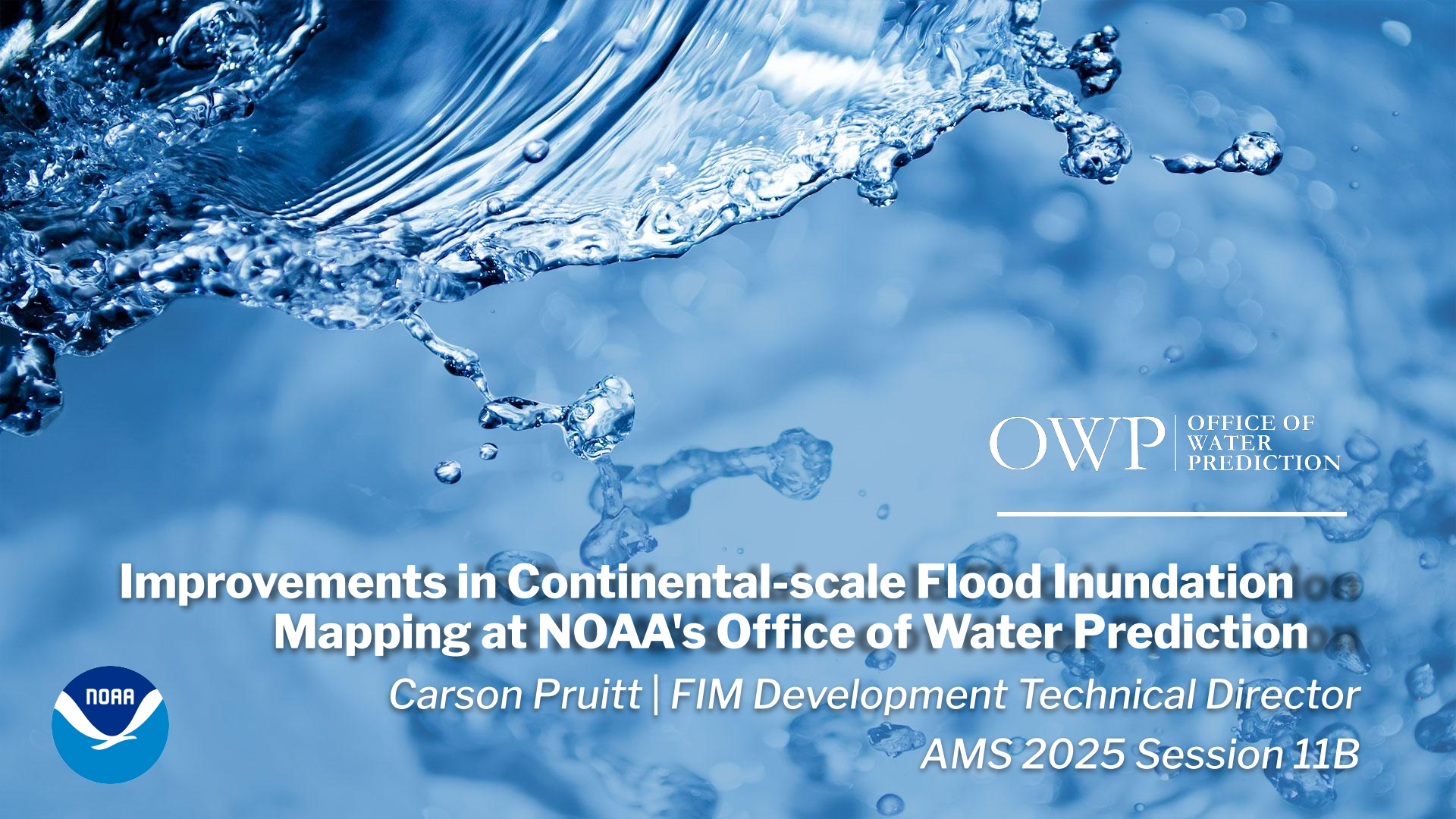
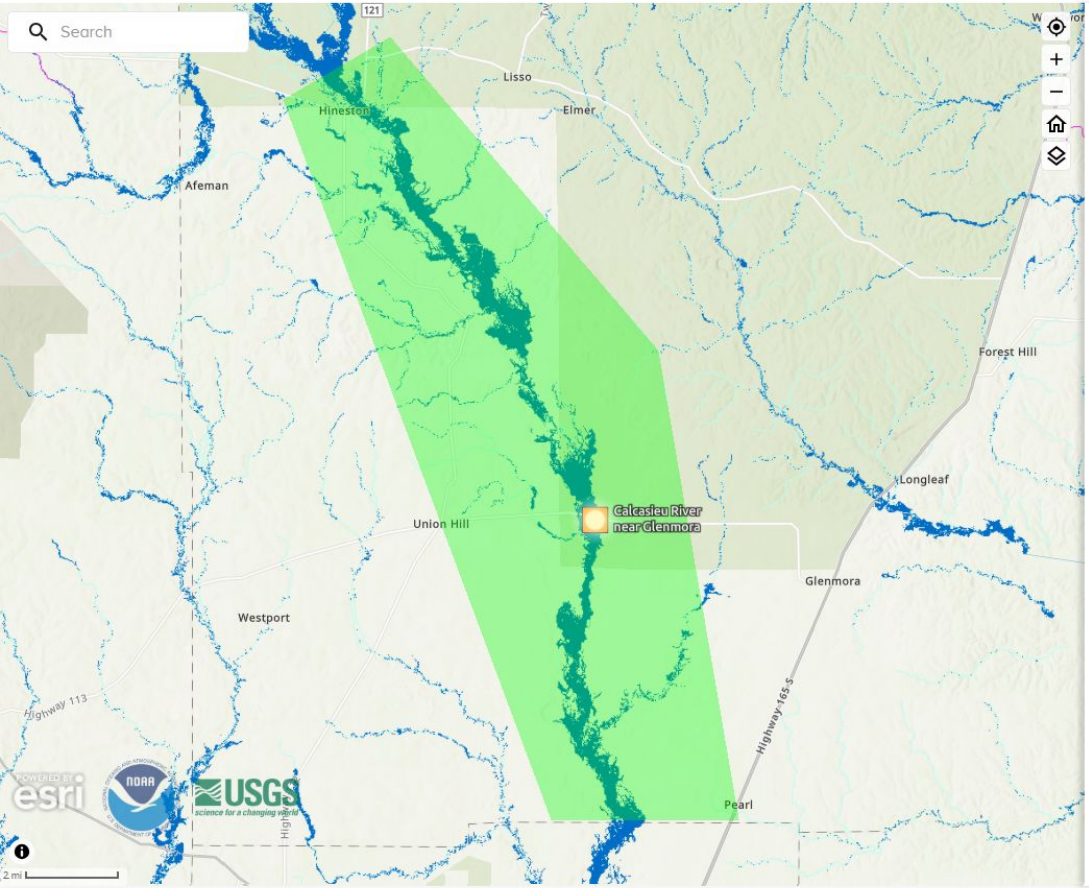


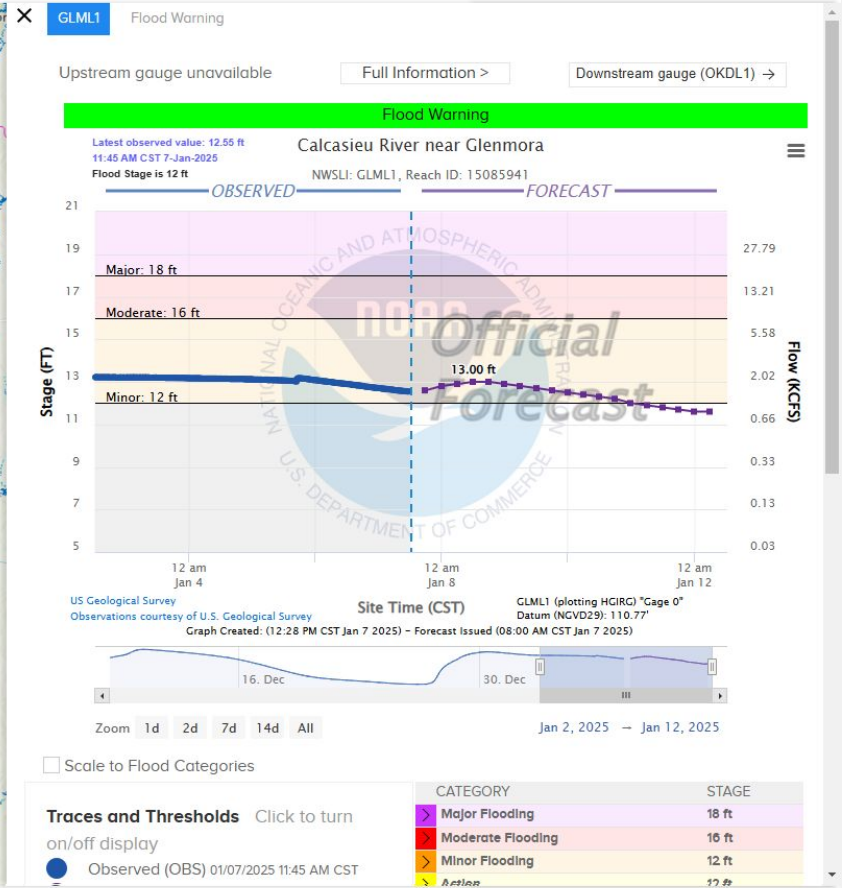
OWP | OFFICE OF WATER PREDICTION

Improvements in Continental-scale Flood Inundation Mapping at NOAA's Office of Water Prediction

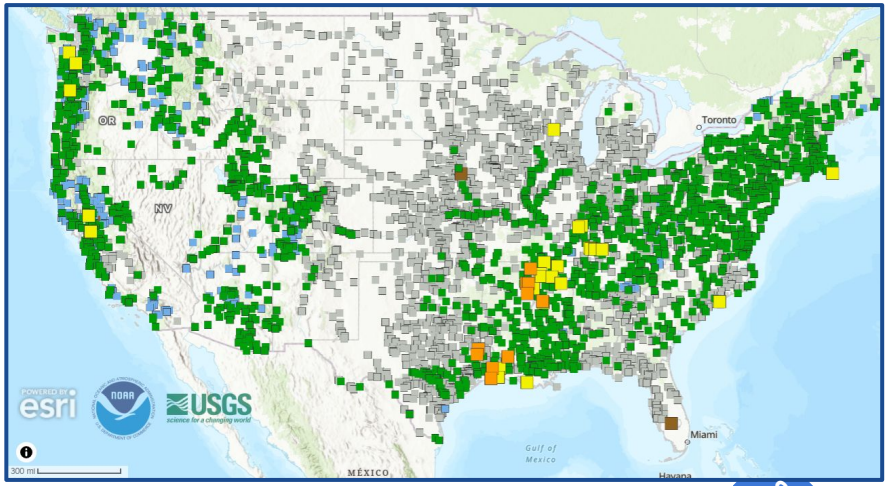
Carson Pruitt | FIM Development Technical Director

AMS 2025 Session 11B


Search
Lisso
Elmer
Hineston
Afeman
Forest Hill
Longleaf
Union Hill
Calcasieu River near Glenmora
Glenmora
Westport
Pearl
Highway 113
Highway 165 S
esri
USGS


GLML1
Flood Warning
Upstream gauge unavailable
Full Information >
Downstream gauge (OKDL1) →
Flood Warning
Latest observed value: 12.55 ft
11:45 AM CST 7-Jan-2025
Flood Stage is 12 ft
Calcasieu River near Glenmora
NWSLI: GLML1, Reach ID: 15085941
OBSERVED
FORECAST
Major: 18 ft
Moderate: 16 ft
Minor: 12 ft
13.00 ft
Stage (FT)
Flow (KCFS)
Official Forecast
12 am Jan 4
12 am Jan 8
12 am Jan 12
US Geological Survey
Observations courtesy of U.S. Geological Survey
Site Time (CST)
GLML1 (plotting HGIRG) "Gage 0"
Datum (NGVD29): 110.77'
Graph Created: (12:28 PM CST Jan 7 2025) - Forecast Issued (08:00 AM CST Jan 7 2025)
16. Dec
30. Dec
Zoom 1d 2d 7d 14d All
Jan 2, 2025 → Jan 12, 2025
Scale to Flood Categories
Traces and Thresholds Click to turn on/off display
Observed (OBS) 01/07/2025 11:45 AM CST
CATEGORY
STAGE
Major Flooding 18 ft
Moderate Flooding 16 ft
Minor Flooding 12 ft

Evolving Water Prediction Capabilities



~3,600 NWPS Forecast Points

RFC CHPS Forecast Models

Supplement RFC Forecasts

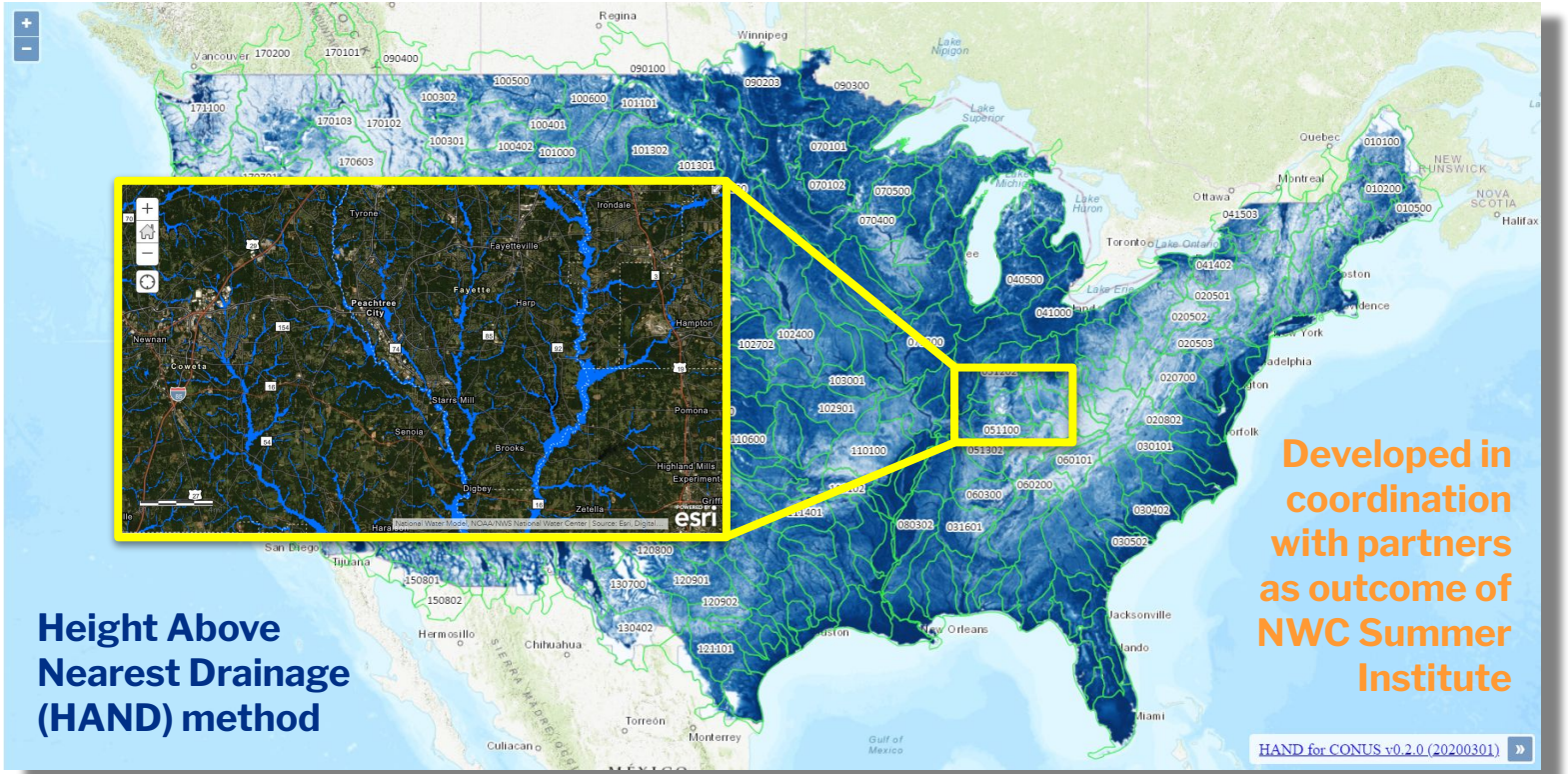
~2.7M NWM Forecast Points

National Water Model (NWM)

1 forecast point for every 1,000 river miles

(3.4M river miles in U.S.)

Continental Scale Flood Inundation Mapping System

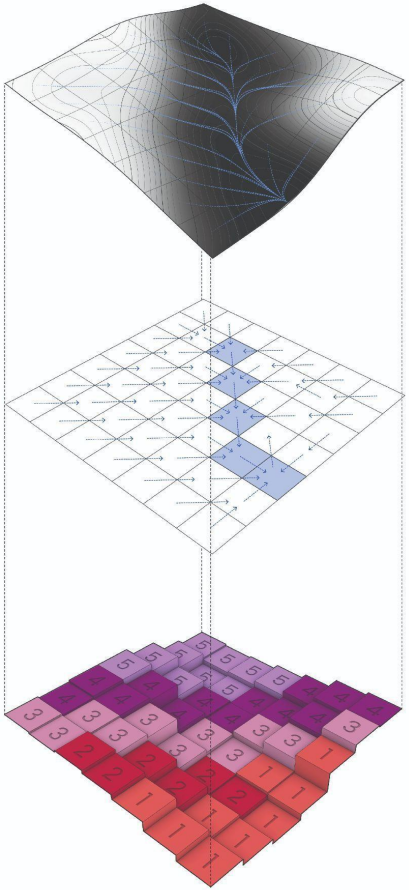


Height Above Nearest Drainage (HAND)

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

2) Hydroconditioning

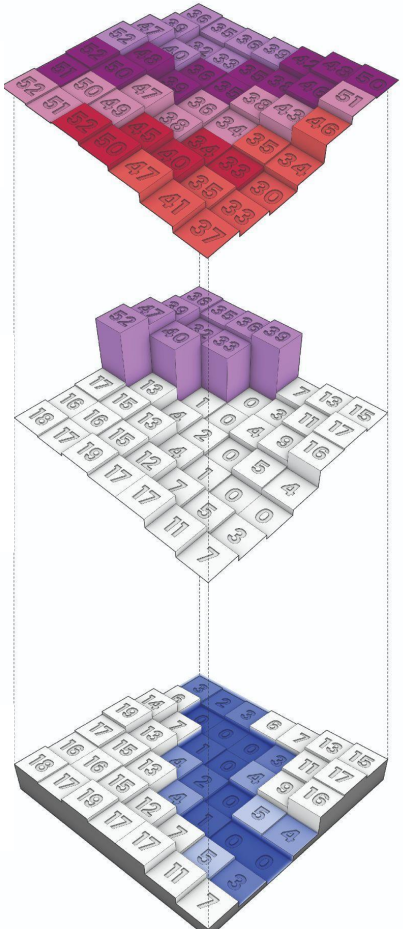
3) Delineate a drainage network and corresponding catchments



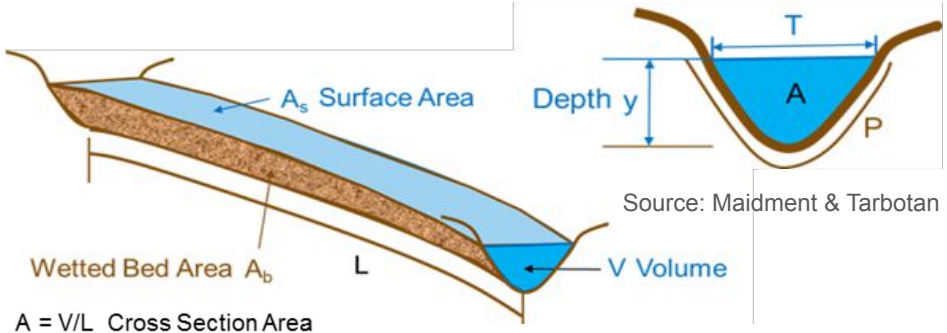
4) Convert channel elevation values to 0 elevation

5) Calculate the elevation of every upland cell relative to the stream pixel to which it drains

6) Produce inundation map from forecasted stage



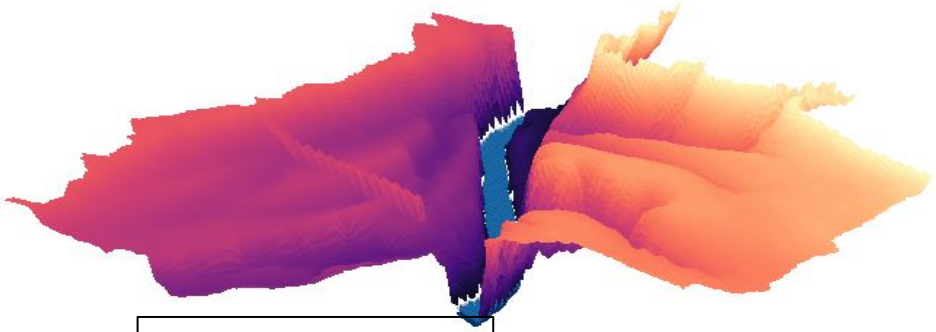
Synthetic Rating Curves (SRC)



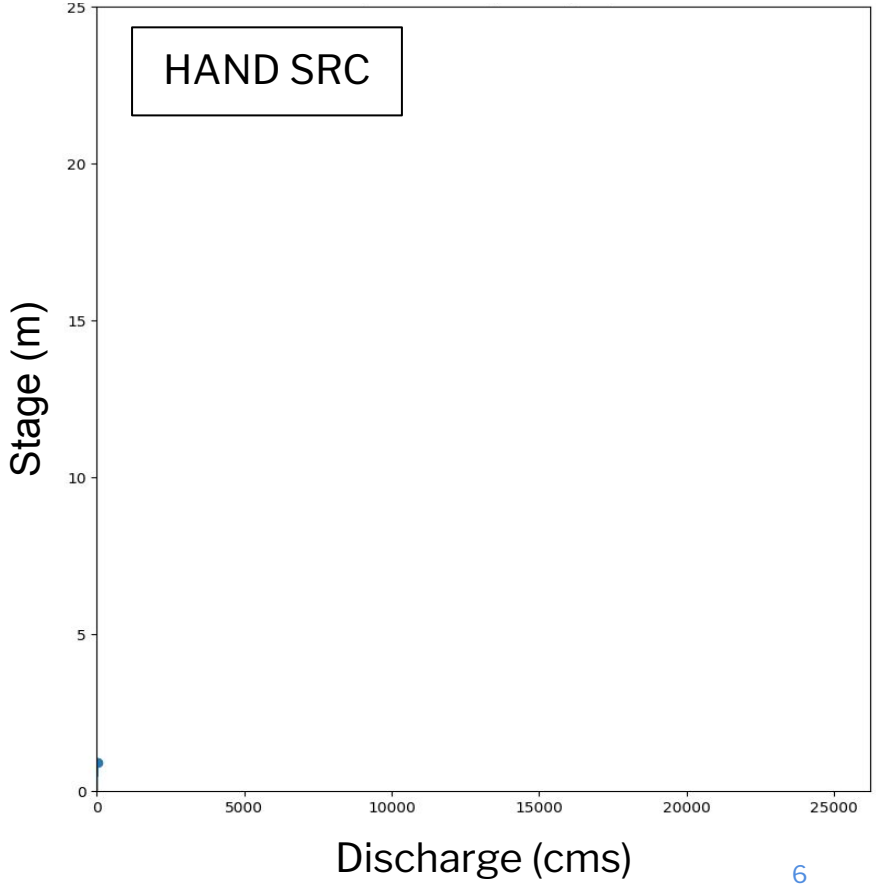
Source: Maidment & Tarbotan

A = V/L Cross Section Area
P = A_b/L Wetted Perimeter
T = A_S/L Top Width
R = A/P Hydraulic Radius

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

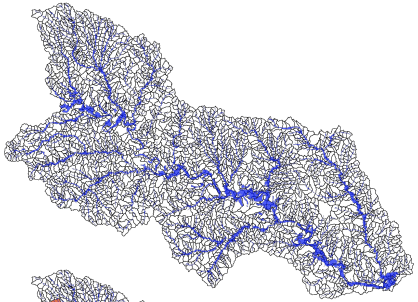


Hand Catchment

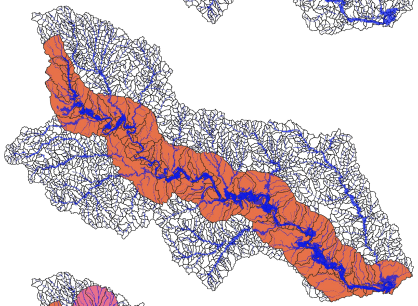


Enhancements to HAND-based FIM Capabilities

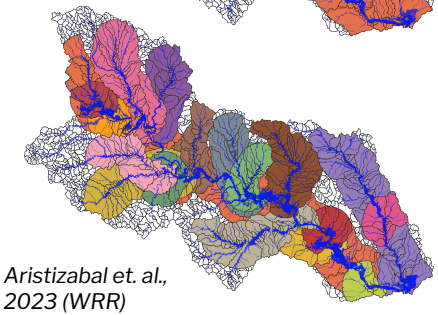
FIM v1.0
Full Resolution



FIM v2.X
FIM v3.X
Main Stems



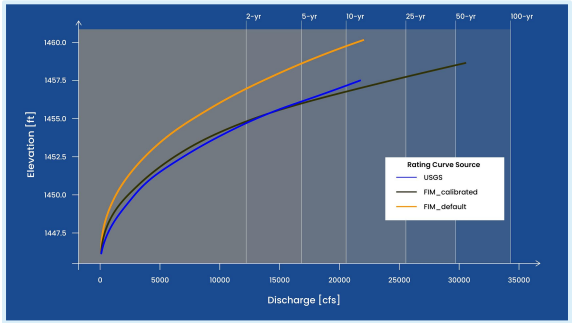
FIM v4.X
Generalized Main Stems



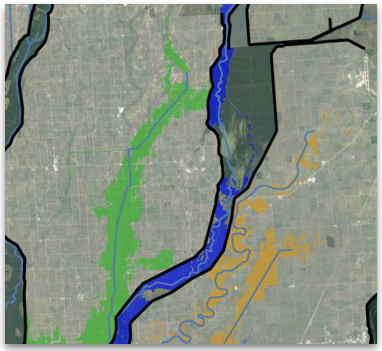
Aristizabal et. al., 2023 (WRR)

Software: https://github.com/noaa-owp/inundation-mapping

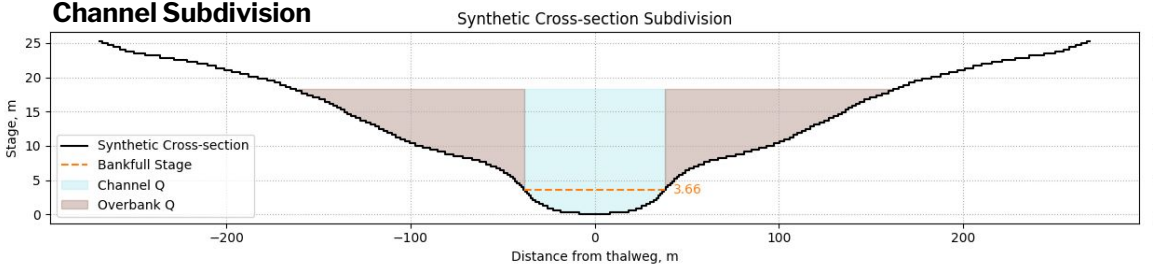
Synthetic Rating Curve Calibration



FIM Masking around Levees

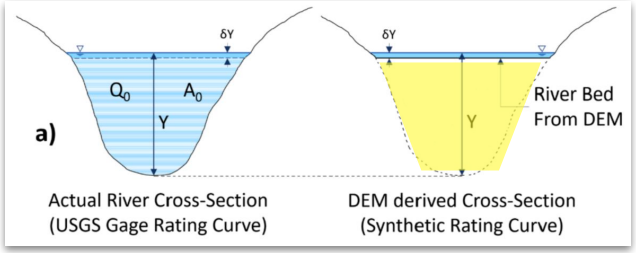


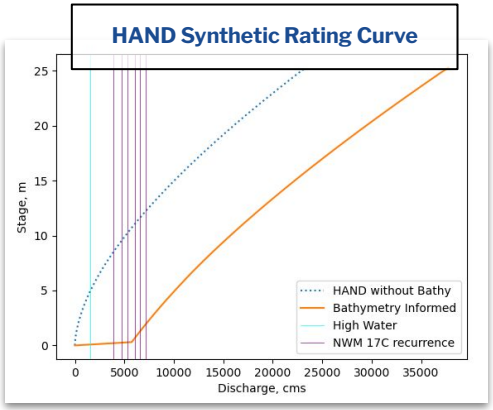
Channel Subdivision

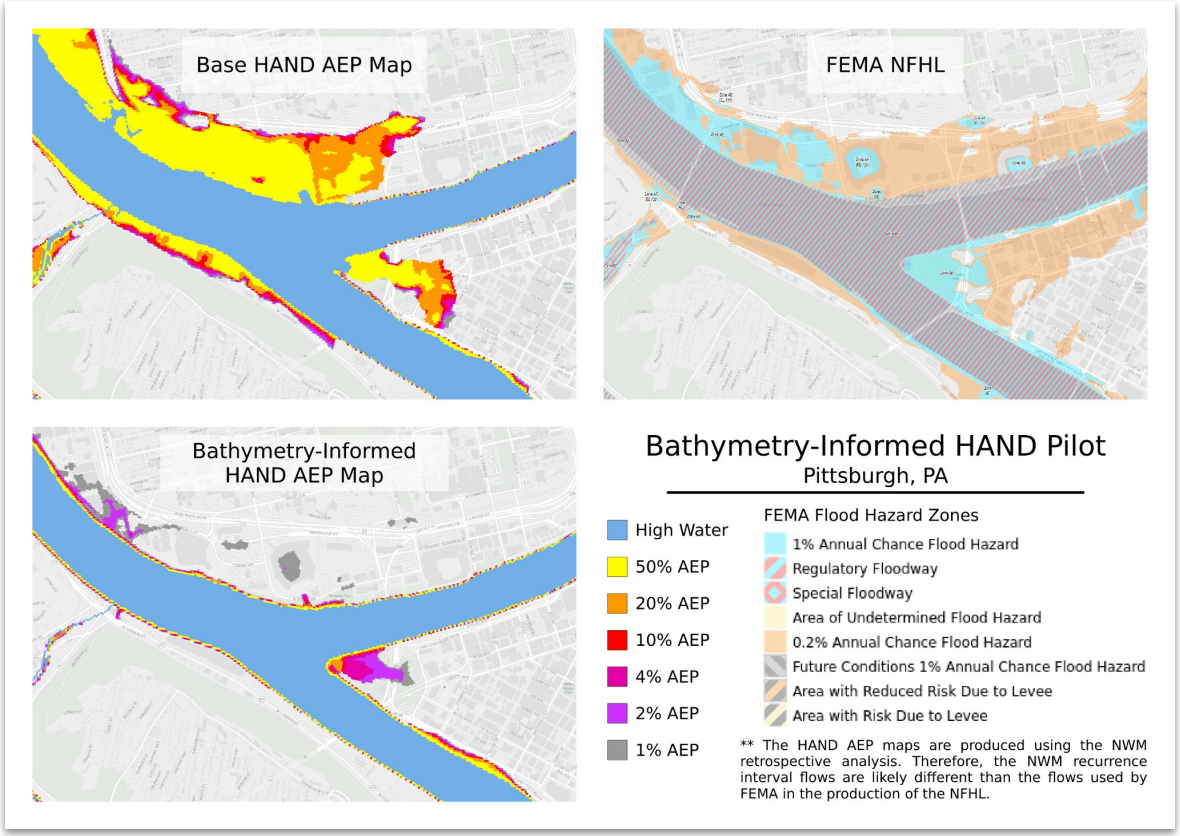


Bathymetric Adjustment

Estimating missing flow volume caused by lack of bathymetry in USGS DEMs







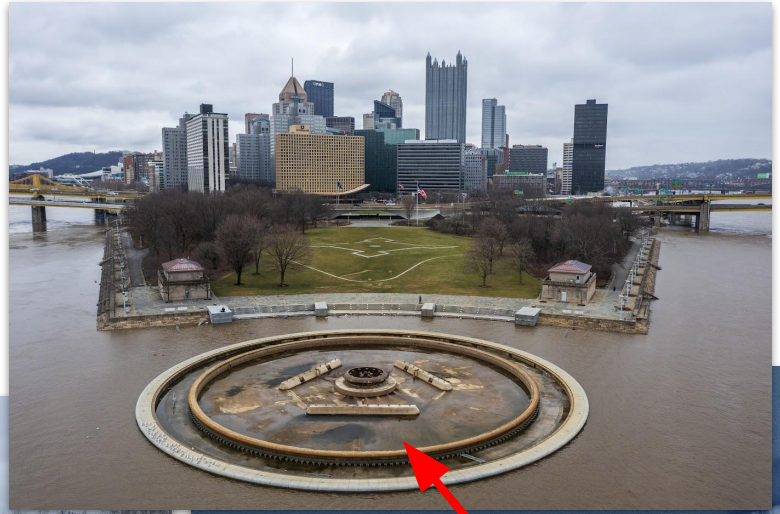
Bathymetry Correction Realized in Real World Example

January 29, 2024

Credit: Alicia Miller, PBZ

January 29, 2024

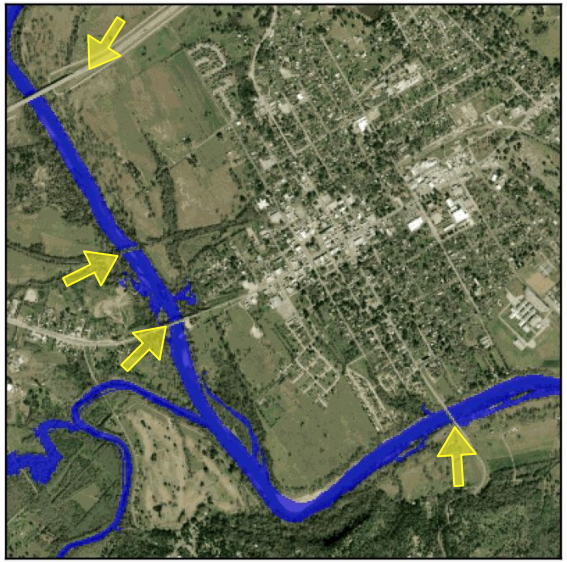
Credit: Alicia Miller, PBZ



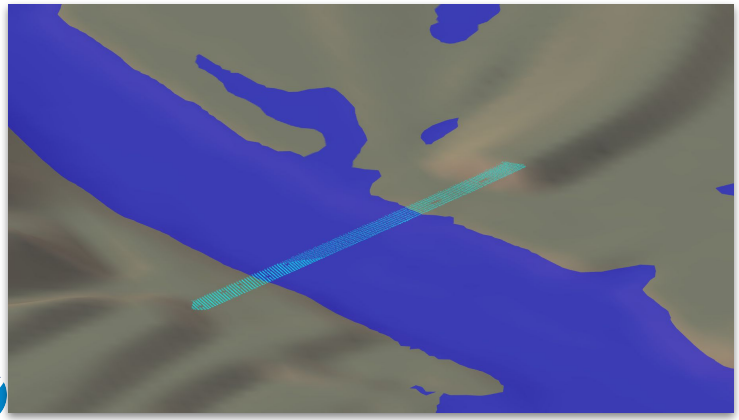
Bridge Representation in FIM

- Bridge locations crowdsourced from OpenStreetMaps
- Elevation estimated from the DEM
- *Under development:* LiDAR-derived elevations & bridge status layers

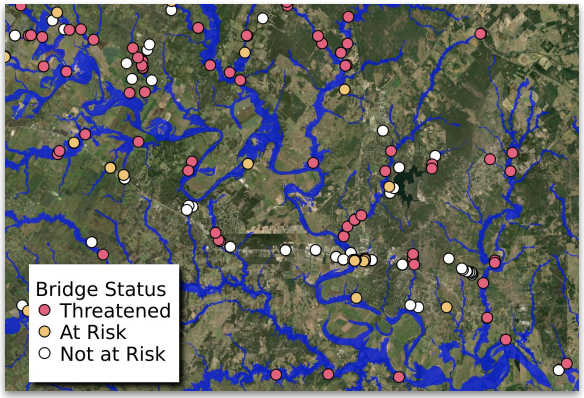
Bridge FIM simulation



Extracting Bridge LiDAR Elevation

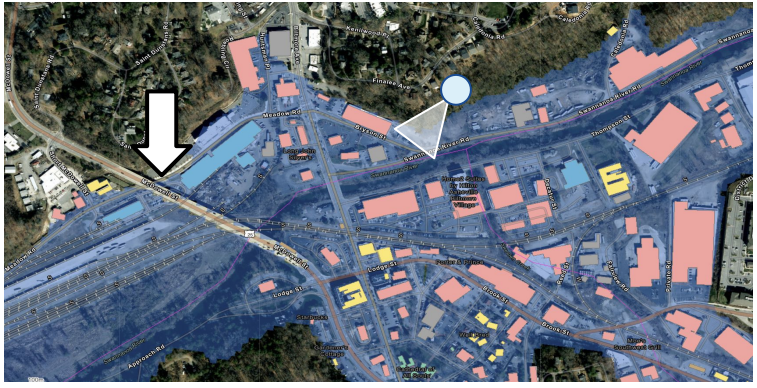


Bridge Status Indicators



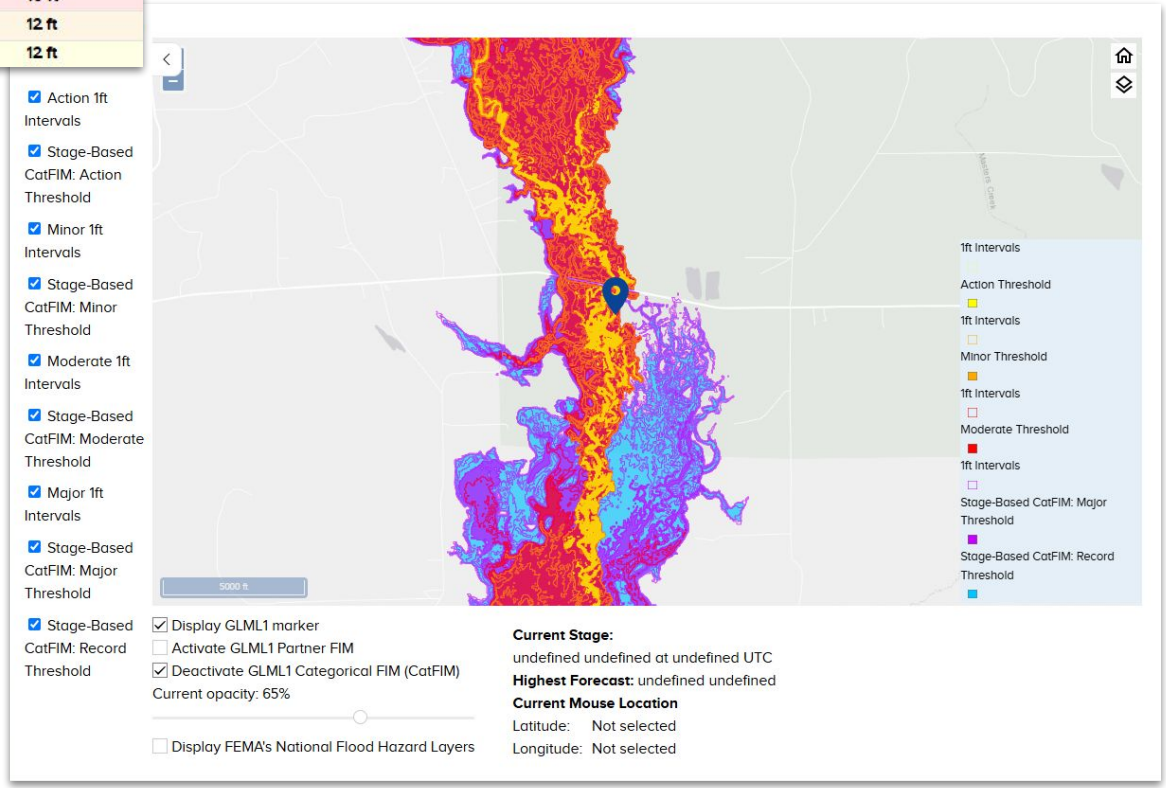
Bridge Representation in FIM

Addition of bridges in FIM Version 5 provided new capability in estimating impact to bridges from the flooding in North Carolina



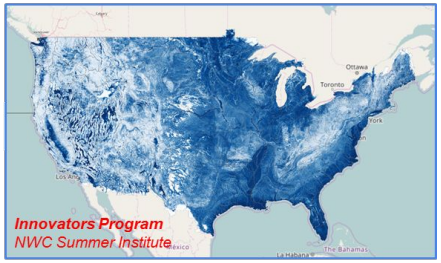
Additional Intelligence: Categorical FIM

CATEGORY	STAGE
Major Flooding	18 ft
Moderate Flooding	16 ft
Minor Flooding	12 ft
Action	12 ft

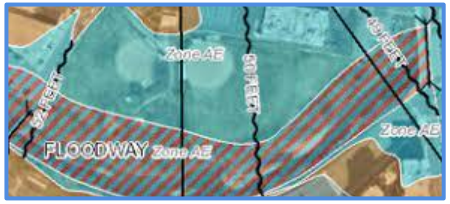


Integrated Mapping Capabilities and Services

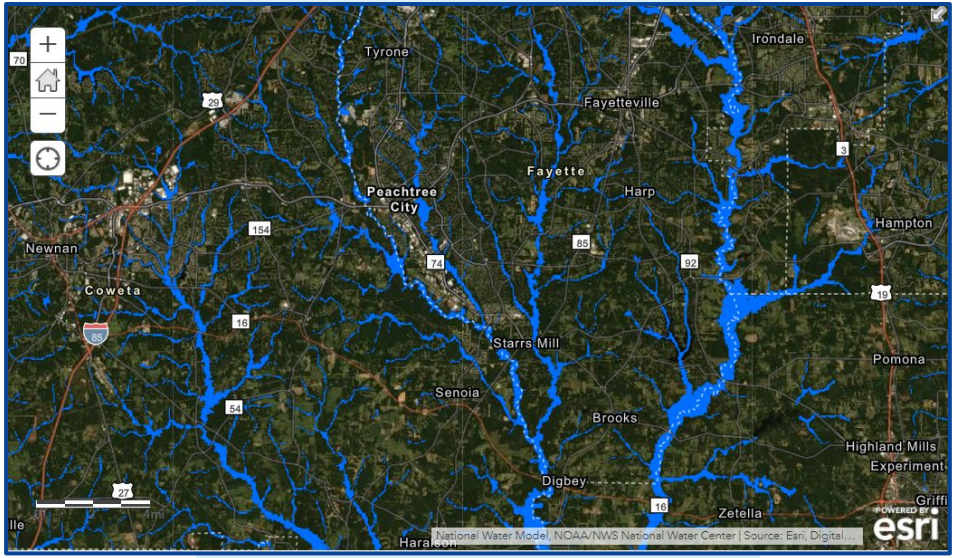
Height Above Nearest Drainage (HAND) Derived FIM



Indexed Static FIM Libraries



NWM (Total Water Level) Derived FIM



Use Highest Fidelity Model Where Available

Move Towards Probabilistic Forecasts

Related Presentations Today

Poster Session 3 - Model Dev & Applications

3:00-4:30 pm | Hall C

- **Sudhir Shrestha (#658)** | *Harnessing the Power of Scalable Cloud Infrastructure for Hydrologic Data and Service Dissemination Through NWPS*
- **Dina Sang (#755)** | *Enhancing Total Water Level Forecasting for the Great Lakes and Lake Champlain using the Next Generation Water Resources Modeling Framework (NextGen)*
- **Tadd Bindas (#801)** | *Improving Near Real-Time Operational Flood Inundation Mapping Capabilities through the use of Replace and Route*
- **John Kirk (#802)** | *NWS Flood Inundation Mapping: Roles and Experiences at River Forecast Centers*
- **Emily Stephan (#803)**| *Ensemble River Forecasts and Flood Inundation Mapping - Maximizing Available IDSS Tools*
- **Mike Jurewicz (#804)** | *Examples of Flood Inundation Mapping (FIM) Related Impact-Based Decision Support Services (IDSS), Collaboration, and Training Initiatives*
- **D. Charlie Smith (#806)** | *Evaluating Flood Inundation Maps Using Innovative Tools*

Session 12B - Flood Inundation Mapping: Part II

4:45pm-6:00pm | Room 341

- **Nicole Rockwell (SERFC) |** *National Weather Service Southeast River Forecast Center and Office of Water Prediction's Support of the Implementation of Flood Inundation Mapping in Puerto Rico*
- **Katie Landry-Guyton (WFO Houston) |** *Flood Inundation Mapping: A New Paradigm of Hydrologic Impact-Based Decision Support Services*
- **Alicia Miller (WFO Pittsburgh) |** *From Floods to FIM: How NWS Flood Inundation Mapping (FIM) Performed During the April 2024 Ohio Valley Floods*
- **Amanda Schroeder (WFO Fort Worth/Dallas) |** *Application of National Weather Service Flood Inundation Maps: Case Study Examples from North Central Texas*
- **Bill Saunders (NERFC) |** *Assessment of National Weather Service Categorical Flood Inundation Mapping (CatFIMs) in Preparation for their Public Release*

OWP | OFFICE OF WATER PREDICTION

Thank You!

Carson Pruitt

carson.pruitt@noaa.gov

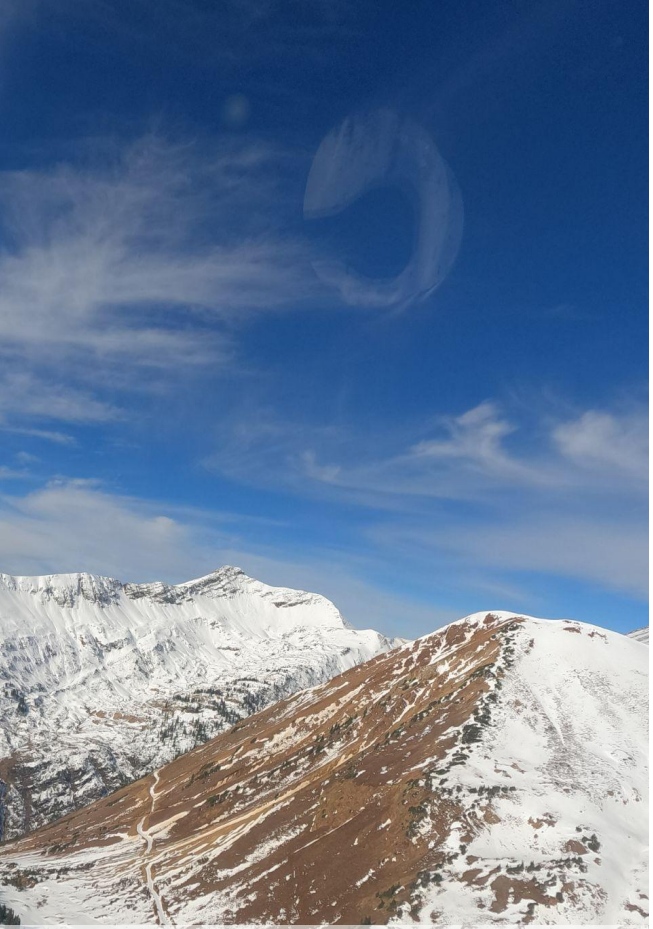
https://water.noaa.gov

Vision

A “water-ready” nation, capable of addressing the nation’s challenges relating to water extremes, water scarcity, and water quality through improved water prediction and related decision support services.

Mission

Collaboratively research, develop and deliver timely and consistent, state-of-the-science national hydrologic analyses, forecast information, data, guidance, and decision-support services to inform essential emergency management and water resources decisions across all time scales.



Colorado SPLASH Soil Moisture Survey, October 2021

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Stakeholder Priorities

Need integrated understanding of near- and long-term outlooks and risks

- Provide consistent, high resolution (“street level”) analyses, predictions and data to address critical unmet information and service gaps
- Transform information into actionable intelligence by linking hydrologic, infrastructure, economic, demographic, environmental, and political data


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OWP
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PREDICTION