

Implementing Machine Learning to Support Flood Impact Forecasting for the U.S.



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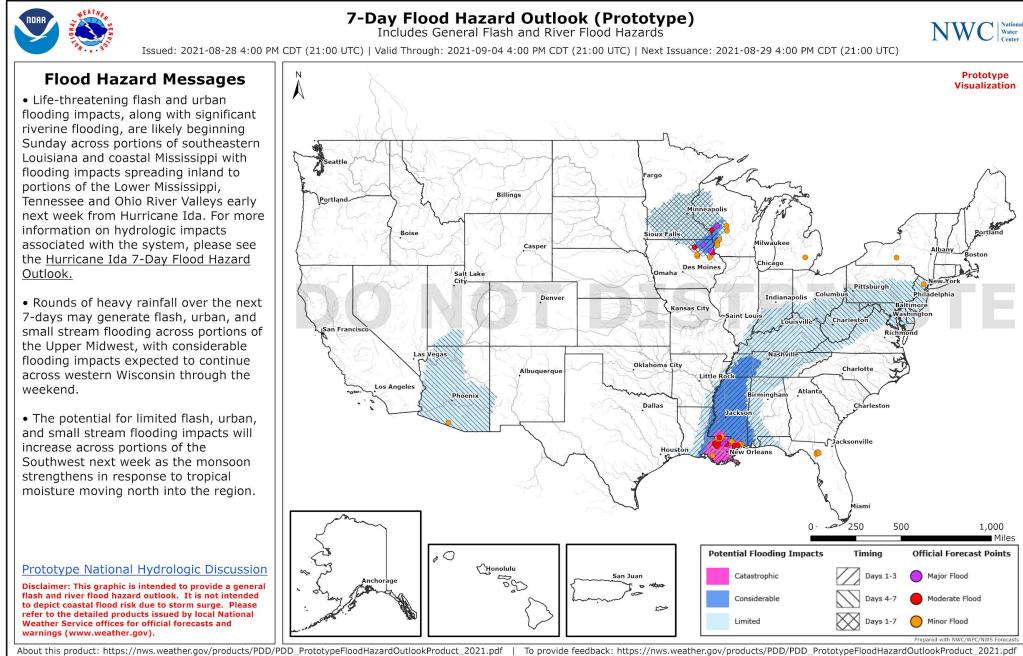
AWRA 2022 Spring Conference
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Outline

1. What is the NWC's Flood Hazard Outlook
2. The Challenge
3. The Solution and Benefits
4. Machine Learning “First Look” Flood Hazard Outlook Explained
5. What is Next?



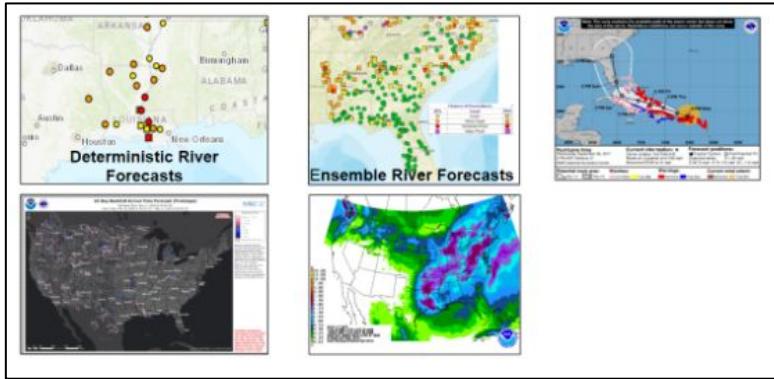
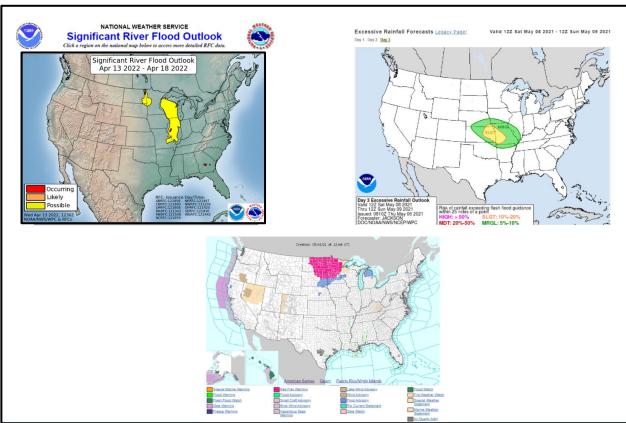
The NWC's Flood Hazard Outlook



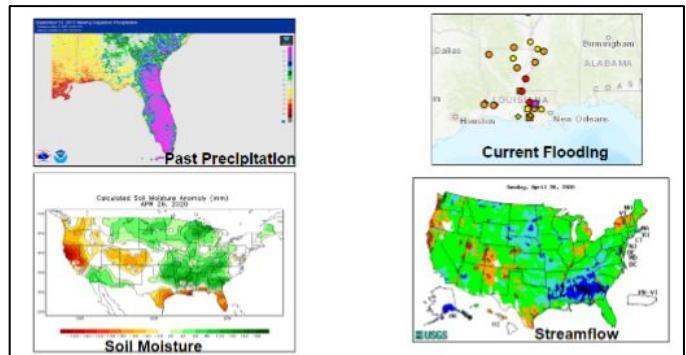
- An infographic highlighting the general flash and river flood hazard over the next 7 days
- National and regional level NWS briefers to: Federal Water Partners (on a National scale)



The NWC's Flood Hazard Outlook



Models & Forecasts



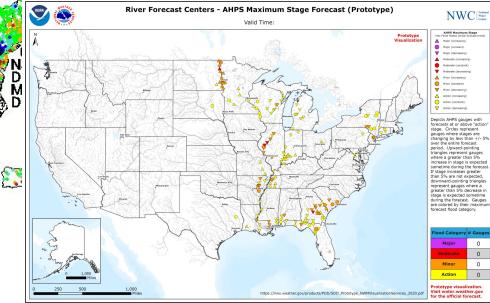
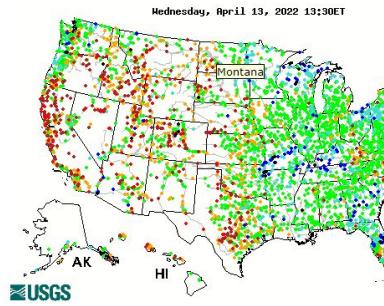
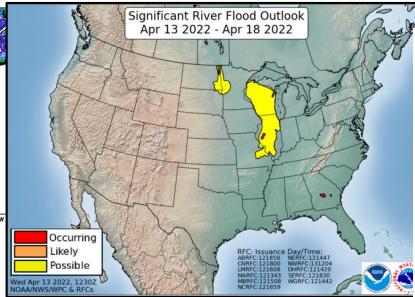
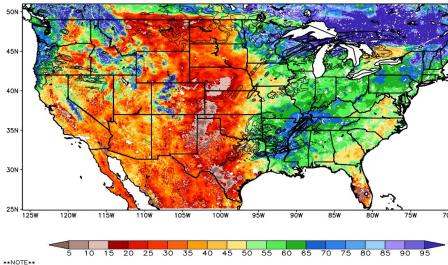
Antecedent Conditions



The Challenge

- Development of FHO currently relies heavily on forecasters' critical assessment of over 30 variables in classifying hydrologic units (HUCS) based on the severity and timing of the flooding impacts. However, this method involves a subjective nature of the selection of HUCs, such as how forecasters weigh different variables, local knowledge, biases, experience, and even forecaster fatigue.

10–40 cm Relative Soil Moisture (available water; %) valid 12z 13 Apr 2022
Precipitation in previous hour (1,2,5,10,15,20,25 mm contours)

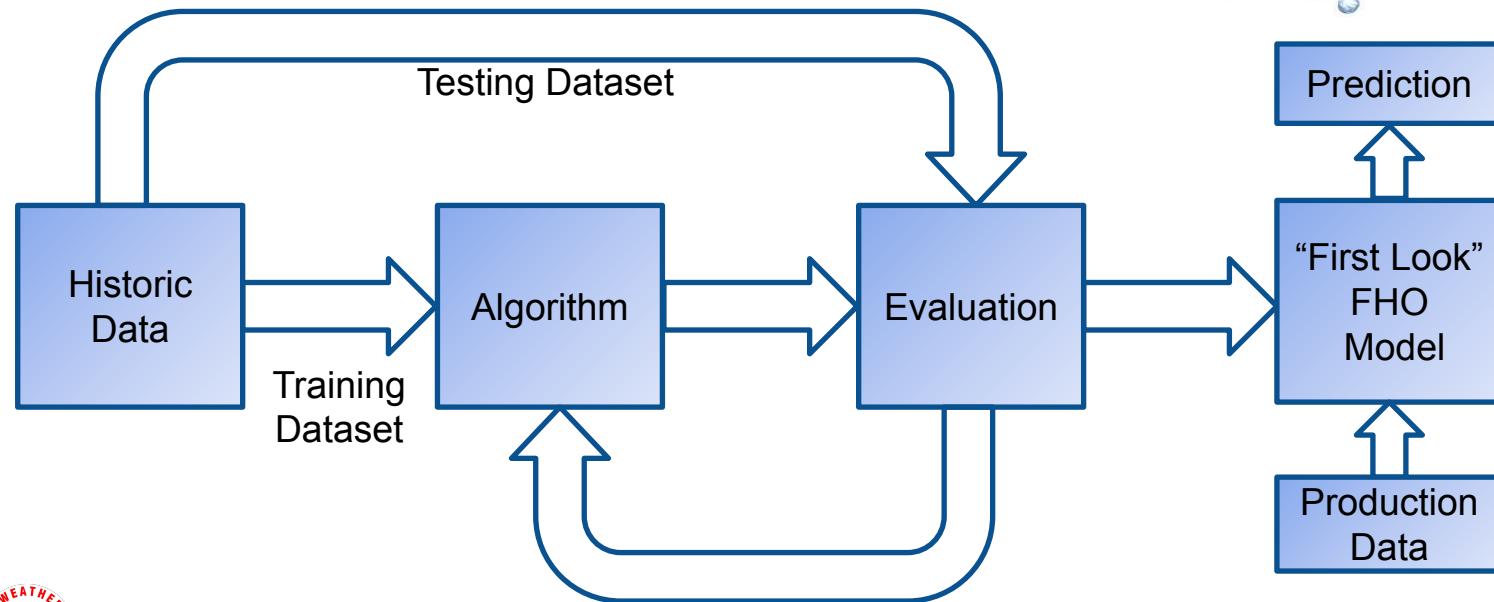


Machine Learning “First Look” Flood Hazard Outlook

- Provide an objective, quantitative, and programmatic approach in defining and characterizing potential flood impacts across the U.S.
- Provide a baseline classification to highlight areas of concern considering key variables, such as population density, land use, terrain, soil type and moisture, quantitative precipitation forecasts (QPF), and many others.
- Increase the efficiency of FHO production by creating a starting point.
- Bring the attention of a forecaster to areas that may be less obvious.



Machine Learning “First Look” Flood Hazard Outlook



Machine Learning “First Look” Flood Hazard Outlook

Historic Data (Training and Testing)

- National Water Model Basins (16,055)
 - USGS Hydrologic Unit (HUC 10)
 - Terrain
 - Land Use
 - Urban Area
 - Basin Shape (HUC 10)
- 5 years of 3- and 4-day time blocks (3,650)
 - NASA SPoRT Relative Soil Moisture 0 - 10 cm
 - RFC Quantitative Precipitation Estimates

- Storm Report Density (Flooding)

ANSWER

Production Data

- National Water Model Basins
 - USGS Hydrologic Unit (HUC 10)
 - Terrain
 - Land Use
 - Urban Area
 - Basin Shape (HUC 10)
- New Data
 - NASA SPoRT Relative Soil Moisture 0 - 10 cm
 - **Quantitative Precipitation Forecasts (WPC, GFS)**

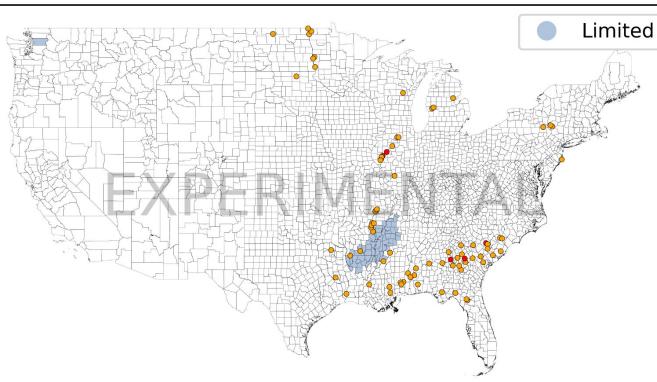
- Storm Report Density (Flooding)

PREDICTION

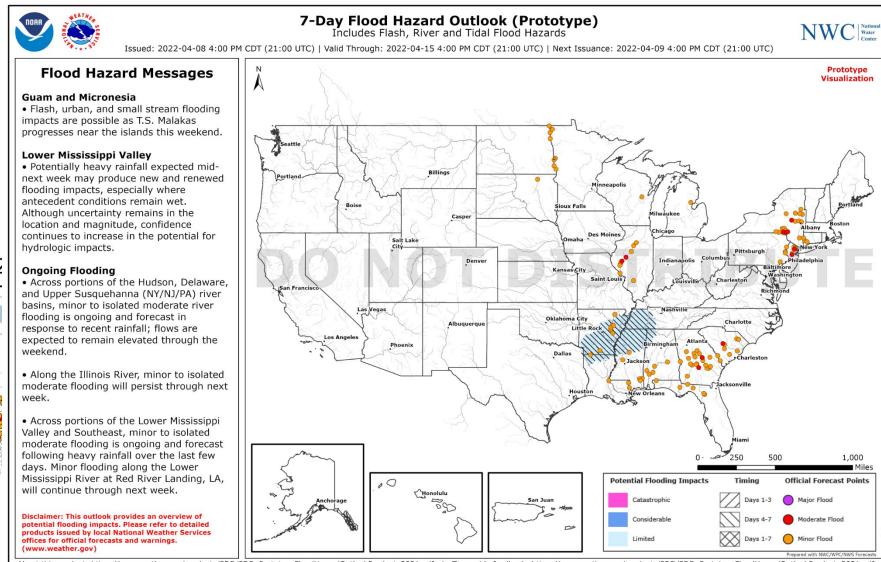
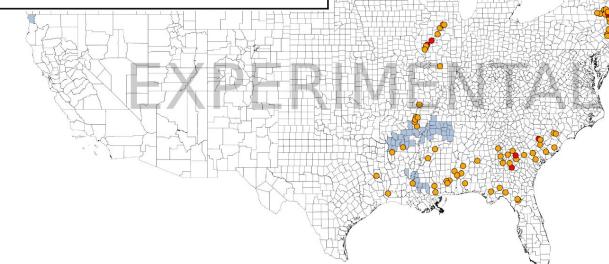


Machine Learning “First Look” Flood Hazard Outlook

Machine Learning First Look Flood Hazard Outlook 20220407

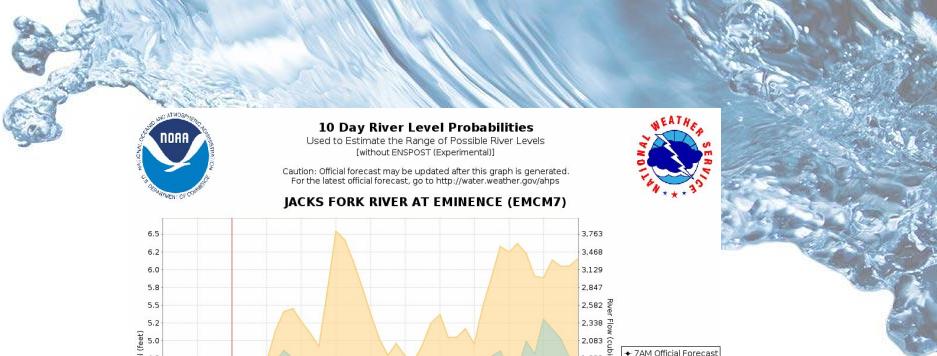


Flood Hazard Outlook 20220407



What is Next?

- Incorporating the Hydrologic Ensemble Forecasting System (HEFS)
- Snow
- Choosing an Algorithm
- Storm Report Density = Flood Threat Category ?



10 Day River Level Probabilities
Used to Estimate the Range of Possible River Levels
[without ENPOST (Experimental)]

Caution: Official forecast may be updated after this graph is generated.
For the latest official forecast, go to <http://water.weather.gov/ahps>

JACKS FORK RIVER AT EMINENCE (EMCM7)

