FLOOD RISK AND UNCERTAINTY

Assessing the National Weather Service's Flood Forecast and Warning Tools

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Delaware River Basin Commission
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THE NURTURE NATURE CENTER

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Nurture Nature Center is a non-profit organization in Easton, PA, that has been working to educate the public about flooding. NNC has undertaken several projects with NOAA and NWS, including its “Focus on Floods” education campaign, to understand and share information about how the public perceives and acts upon flood risk.

Social Science:
A Key Step in Building a Weather-Ready Nation

- One of four social science projects awarded in 2012 to look at decision-making during extreme weather events.
- These projects support NOAA's Weather-Ready Nation Initiative.
- Projects are managed through the Office of Weather and Air Quality in the NOAA Office of Oceanic and Atmospheric Research with funding from the U.S. Weather Research Program and the NOAA National Weather Service (NWS).

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Partners:

- East Carolina University
- National Weather Service (NWS) Mid-Atlantic River Forecast Center
- (NWS) Mt. Holly, NJ Weather Forecast Office
- (NWS) Binghamton, NY Weather Forecast Office
- RMC Research Corporation (evaluators)

What Is the Issue?

NWS flood forecast and warning tools offer tremendous amounts of timely, accurate data.

But: People often don't respond the way they should to protect life and property.

FLOOD RISK AND UNCERTAINTY PROJECT

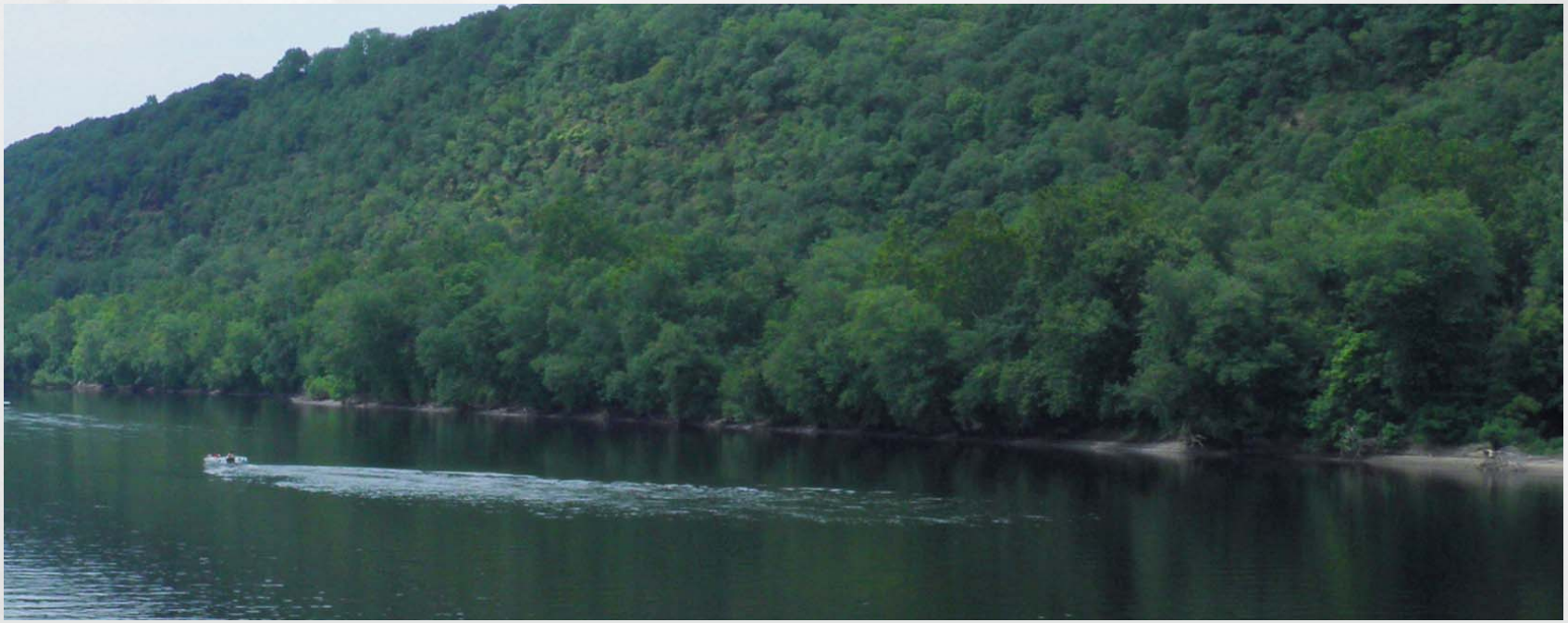
"What we need now is to package and communicate weather warning information so that people understand it and take the right action with the time they are given."

Gary Szatkowski, Meteorologist in Charge of the NWS Philadelphia, PA/Mt. Holly NJ WFO

Research Questions:

- How do people living in the Delaware River Basin understand and use NWS products and services in understanding flood risk?

- What improvements to NWS flood forecast products would better motivate people to take flood preparedness and response actions?



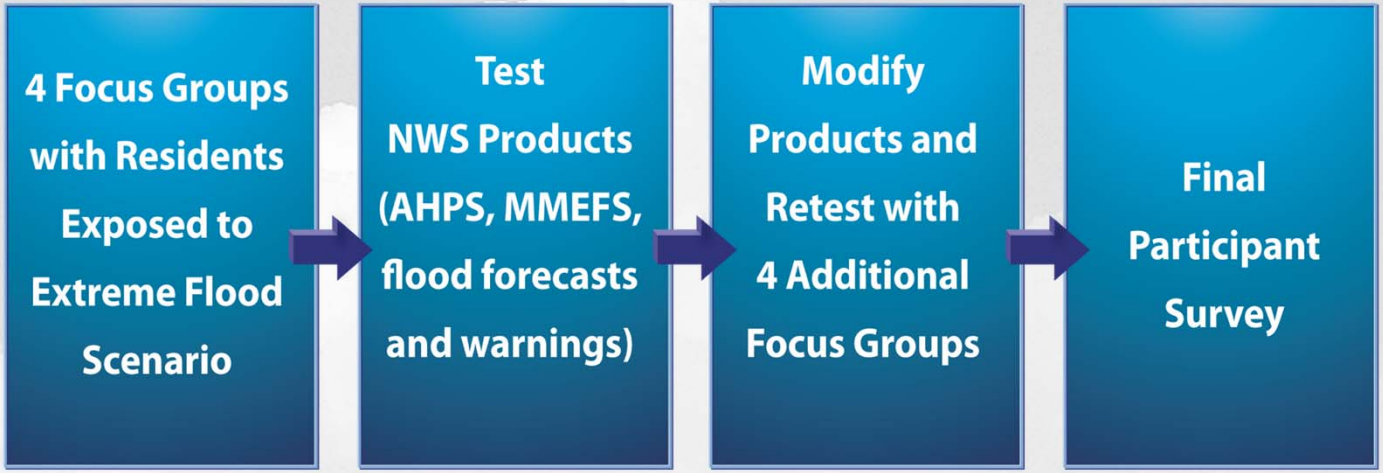
What Are the Tools?

NWS Flood Forecast and Warning Tools:

- Advanced Hydrologic Prediction Service (including hydrograph and flood inundation mapping)
- Flood Forecast Watches and Warnings (including flash flooding)
- Meteorological Model-Based Ensemble Forecasting System (demonstrate uncertainty in forecasts)

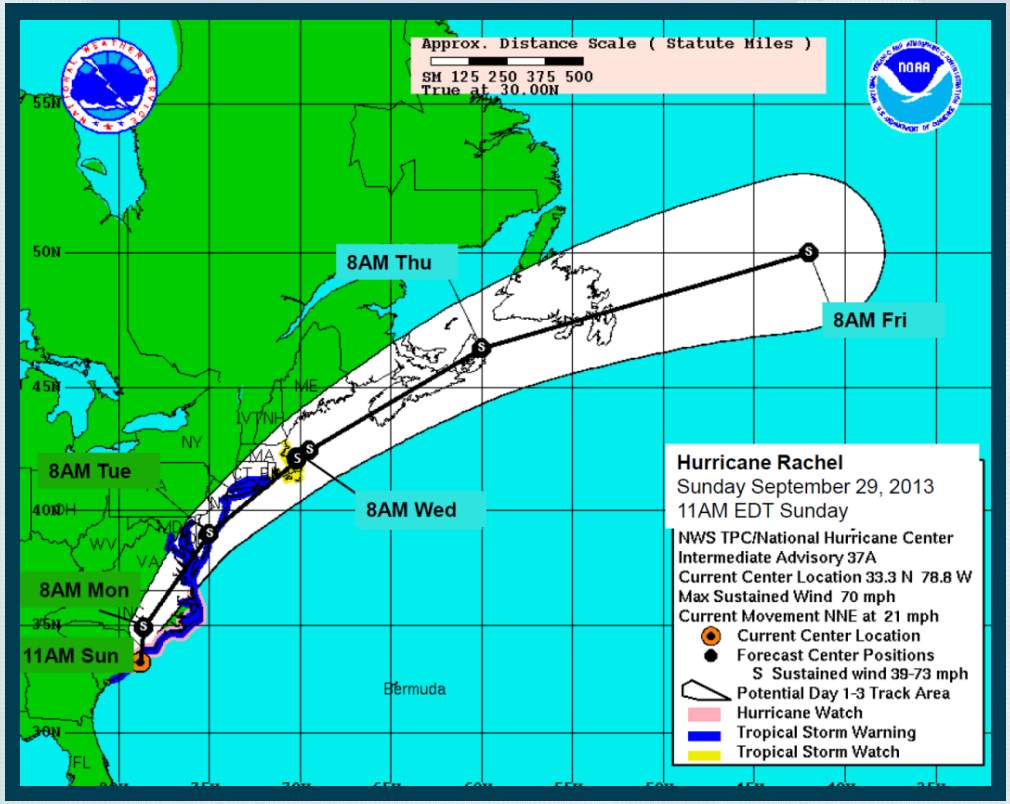
What Methods Are We Using?

Focus group participants respond to flood tools through an extreme flood scenario akin to that of the flood of record in the region, the Flood of 1955.



- Total of eight focus groups
- Four in urban Easton, PA area
- Four in less dense Lambertville, NJ
- Both are flood-prone communities with heavy residential impacts

Flood Scenario: A Simulated East Coast Hurricane



The 7-day scenario includes a series of products issued by the NWS, including:

- Hurricane cones
- Hydrographs
- Significant River Flood Outlooks
- Quantitative Precipitation Forecasts
- Flood Watches and Warnings
- Ensemble forecasts showing uncertainty

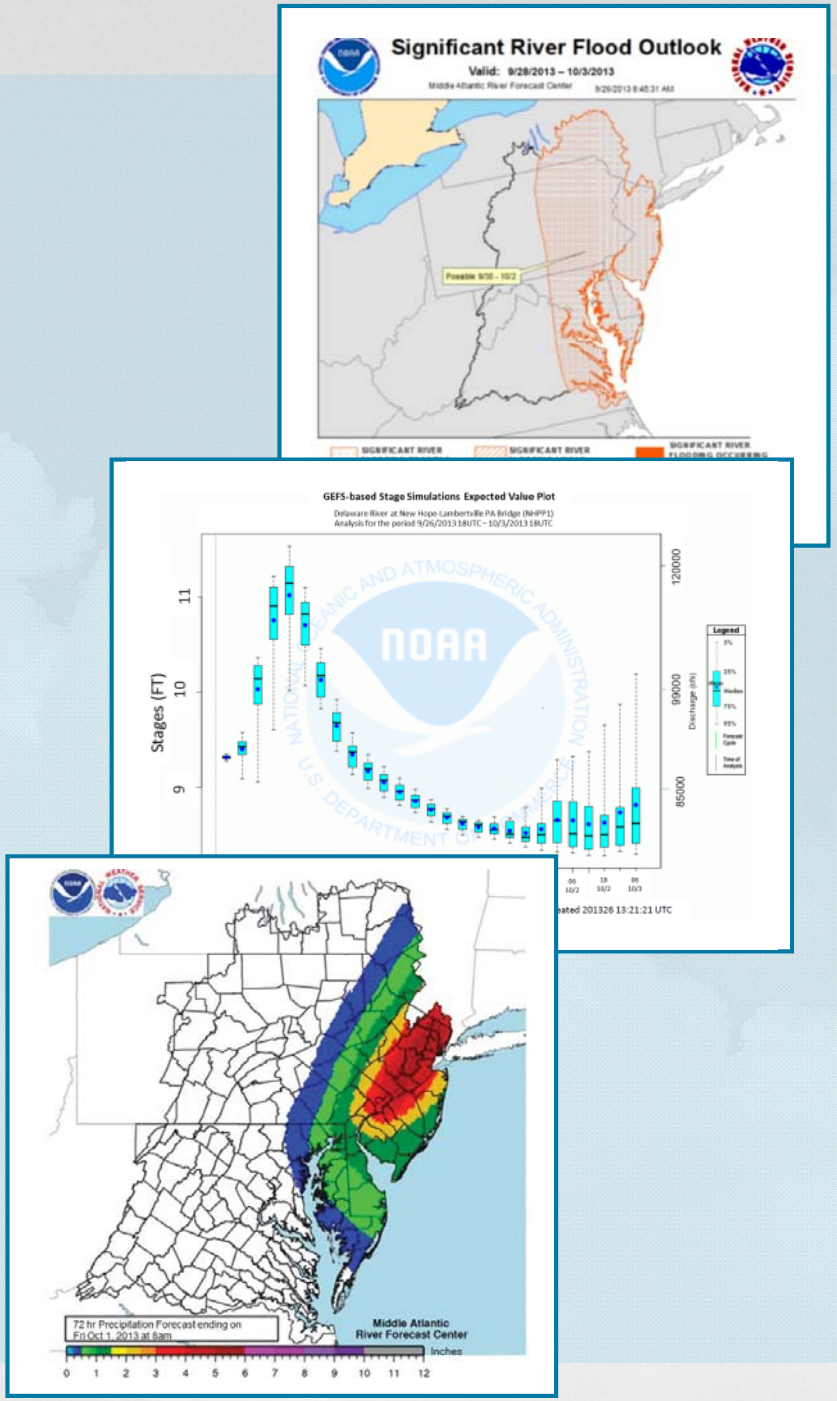
Focus Groups:

A facilitated discussion about the tools

- 15 participants per session, average, flood-affected individuals

Participants gave feedback about:

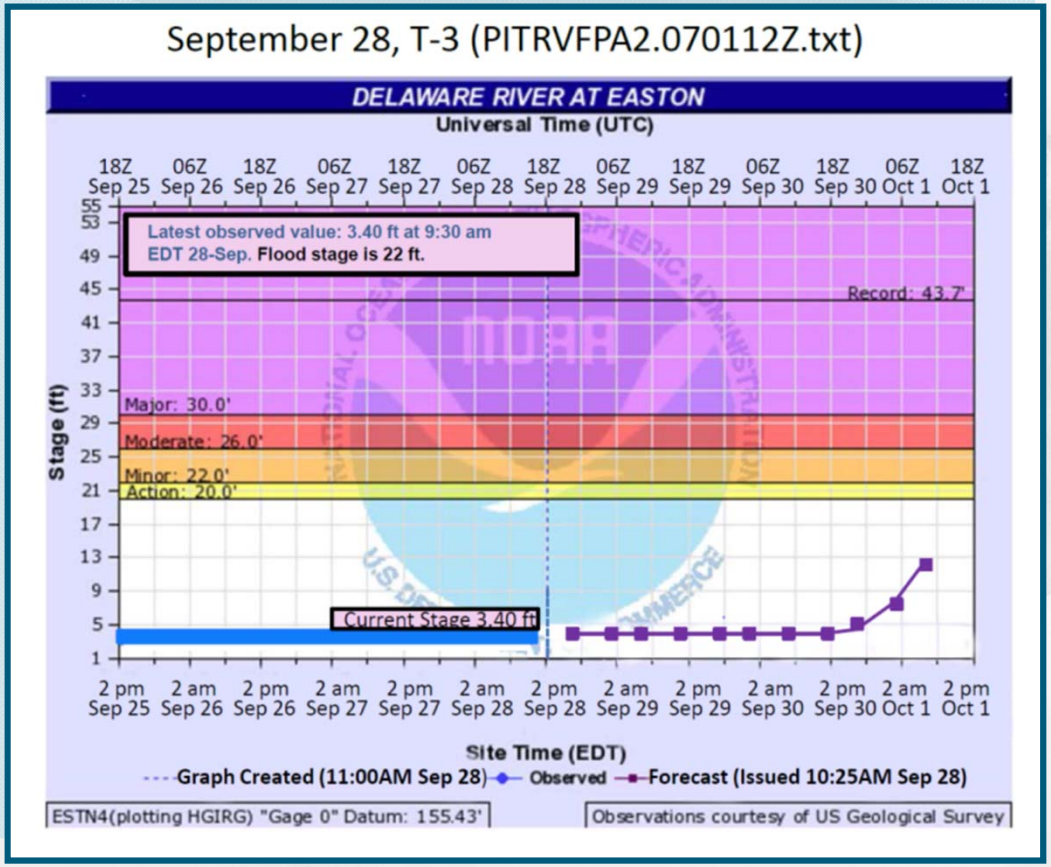
- Timing of products
- Graphic design and visual clarity
- Ways the products motivated action
- How they share the information with others



River Levels Matter

HYDROGRAPH was the highest-ranked product:

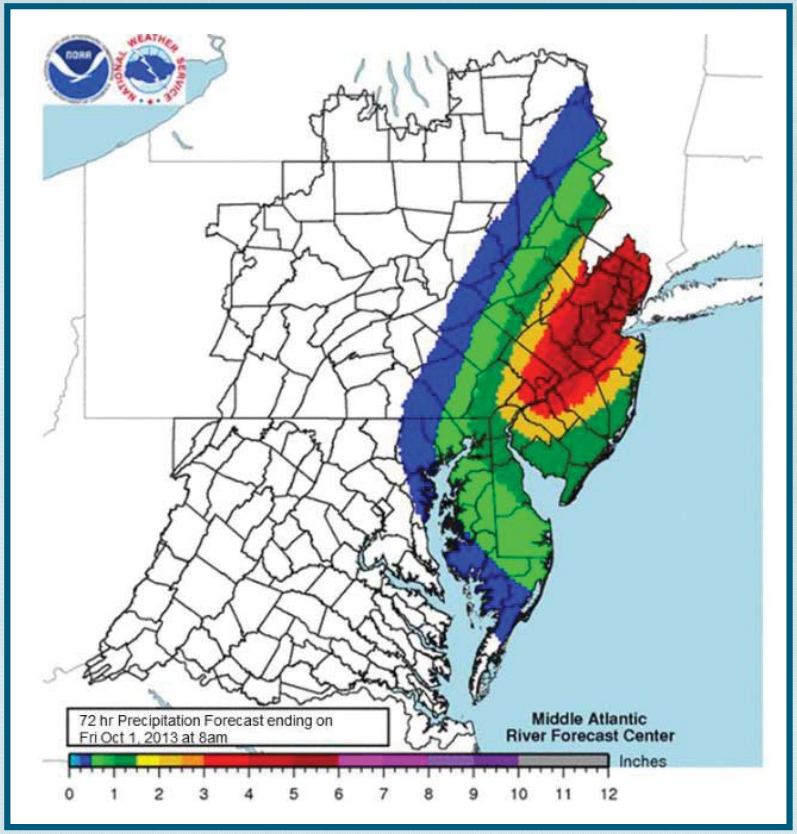
- “Very clear, easy to read & useful.”
- High results for visual clarity, usefulness and location specificity.
- Suggestion: link every flood product to hydrograph



Use Color, and Use It Carefully

COLOR in graphics can help or hurt people's understanding of risk. Participants discussed:

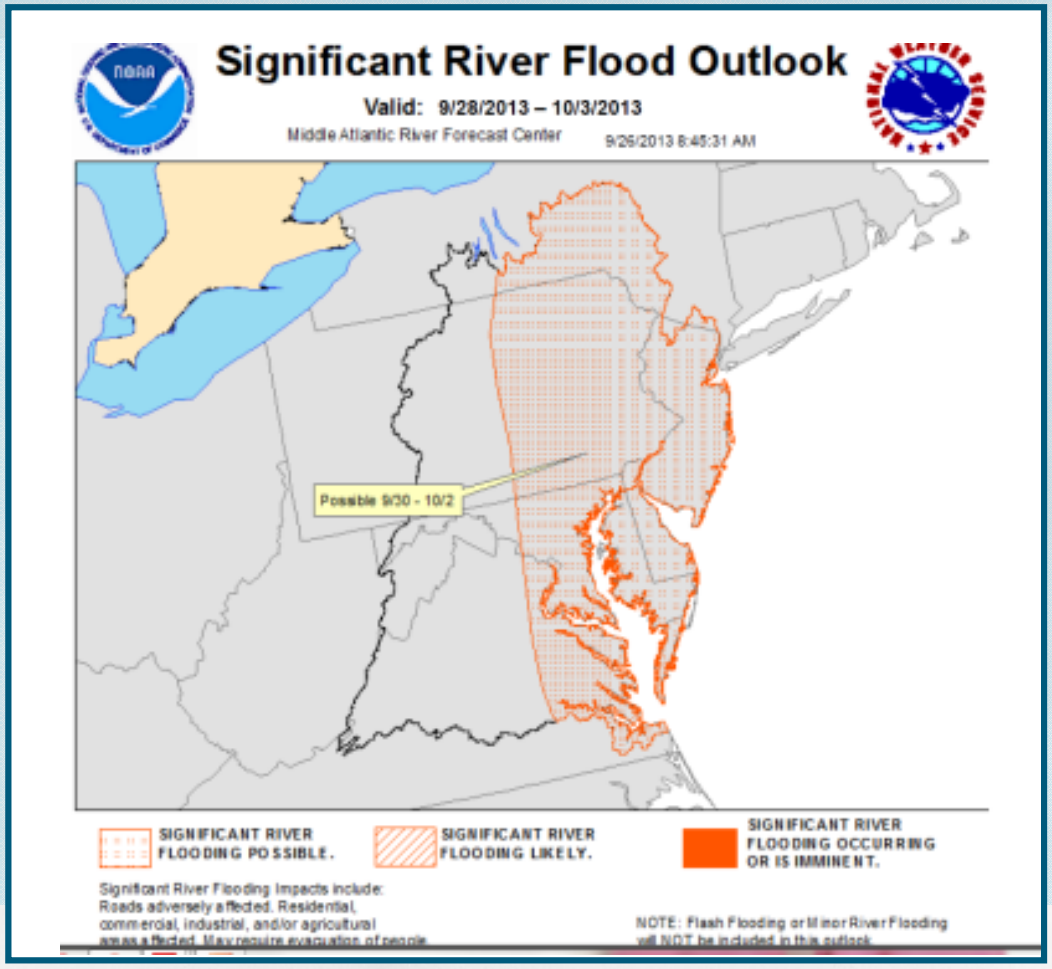
- Positive use of color (Quantitative Precipitation Forecast)
- Confusing use of color (inundation maps and flood outlooks)
- Lack of color/font variations (Flood Watches and Warnings)



Location Details

GEOGRAPHIC SPECIFICITY
helps understanding of risk:
Use hyper-local info when possible

- Poor ratings for this product due to lack of location detail
- Product unhelpful; did not prompt action

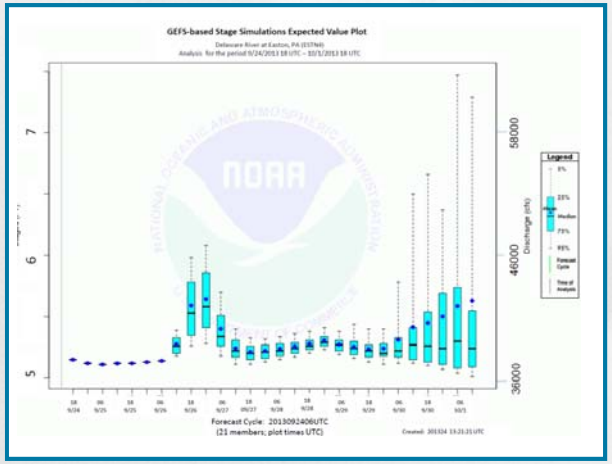


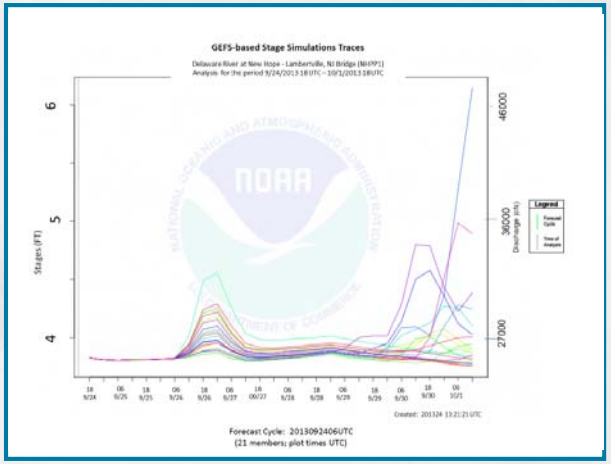
Uncertainty

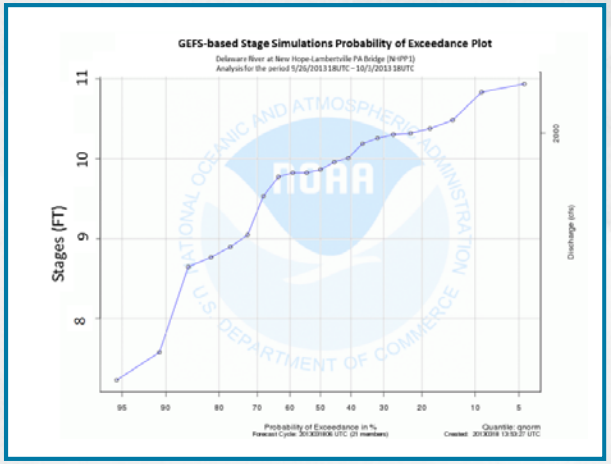
UNCERTAINTY MESSAGES need to be carefully considered.

- Current ensemble forecast graphics were very confusing
- Some participants did want to receive uncertainty information
- Almost no participants could properly interpret the information from the current suite of Meteorological Model Ensemble River Forecasts (MMEFS) graphics

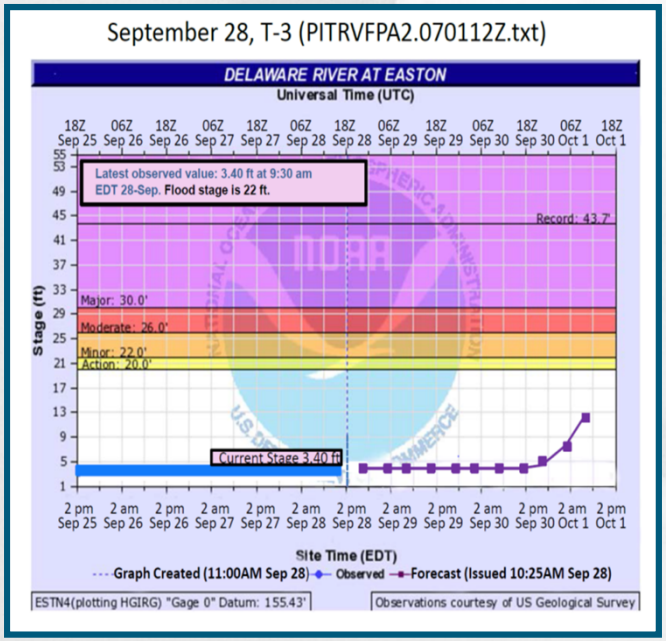
MMEFS Graphics:

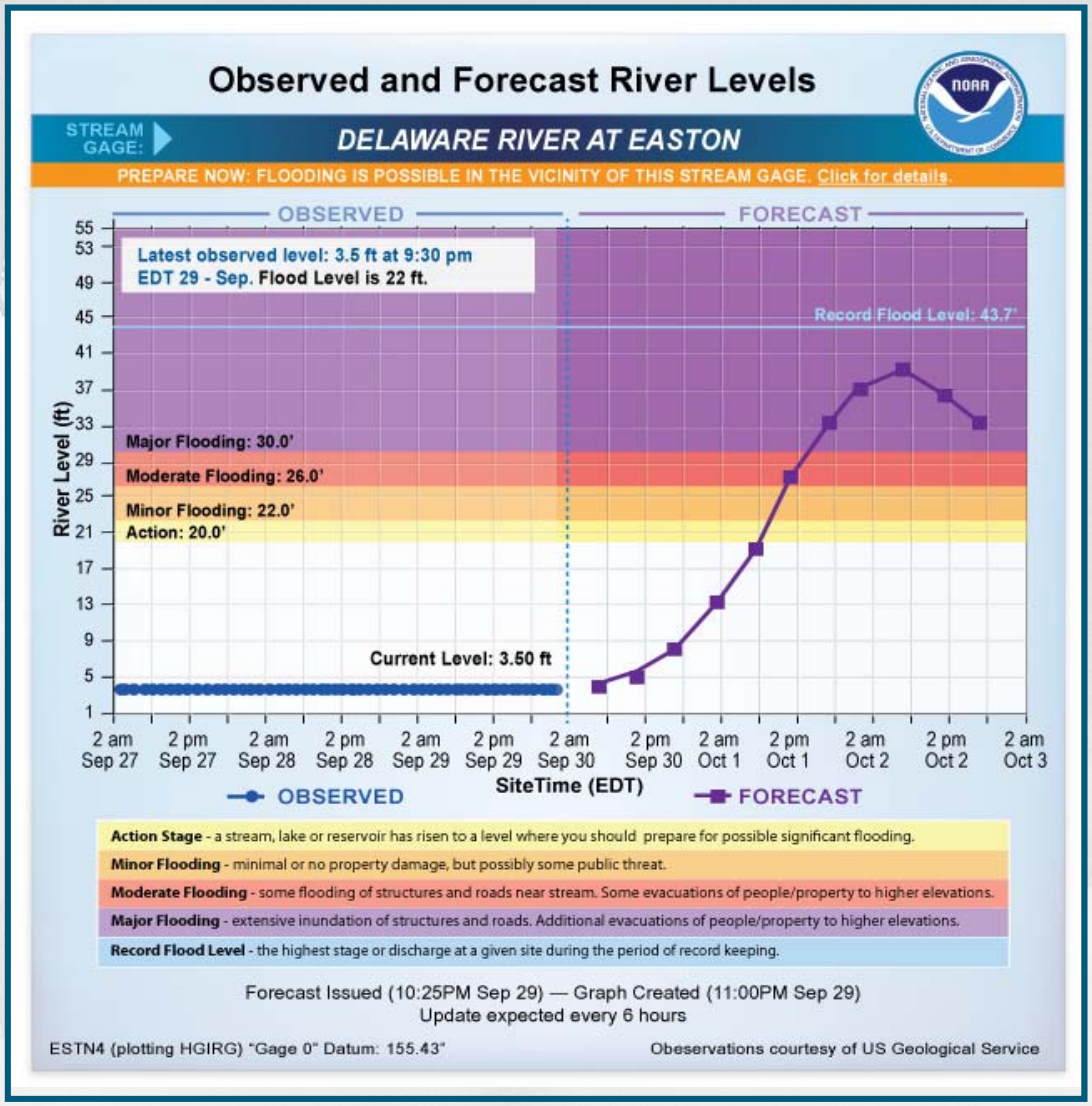






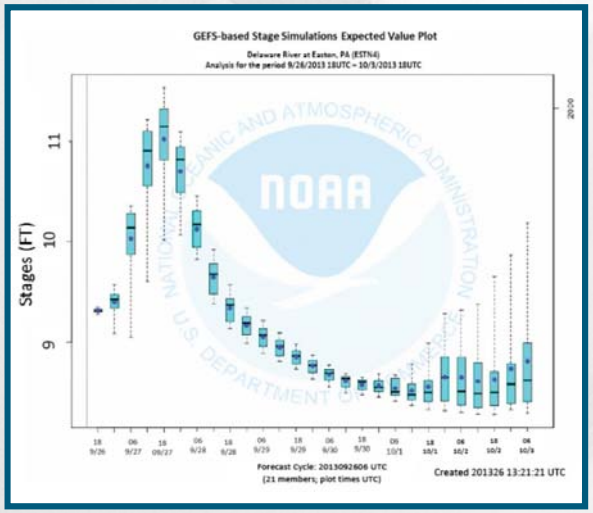
Example of a Draft Mocked-up Hydrograph

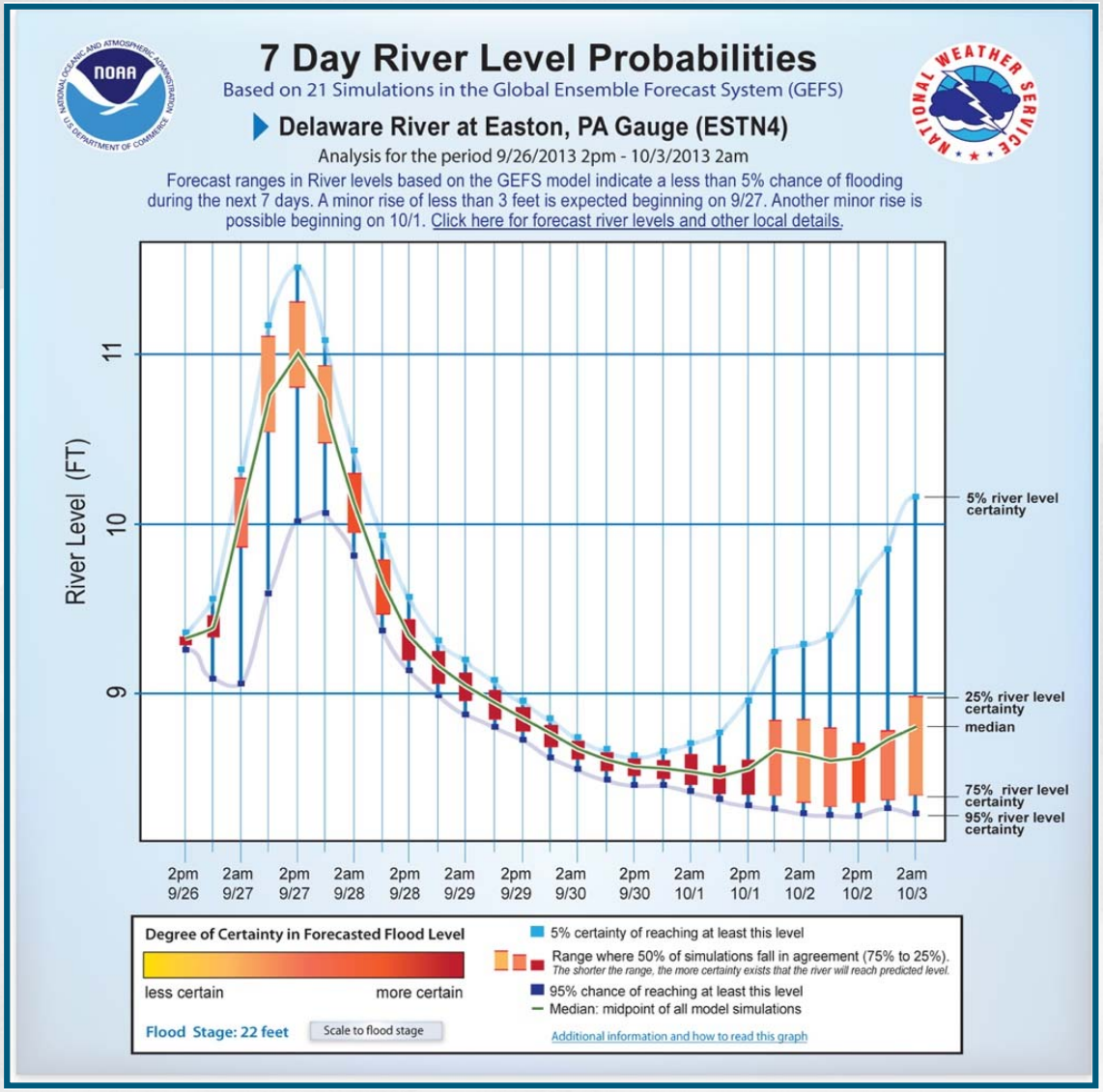




Incorporates various focus groups recommendations, including the careful use of text, and color variation

Example of a Draft Mocked-up Uncertainty Graphic





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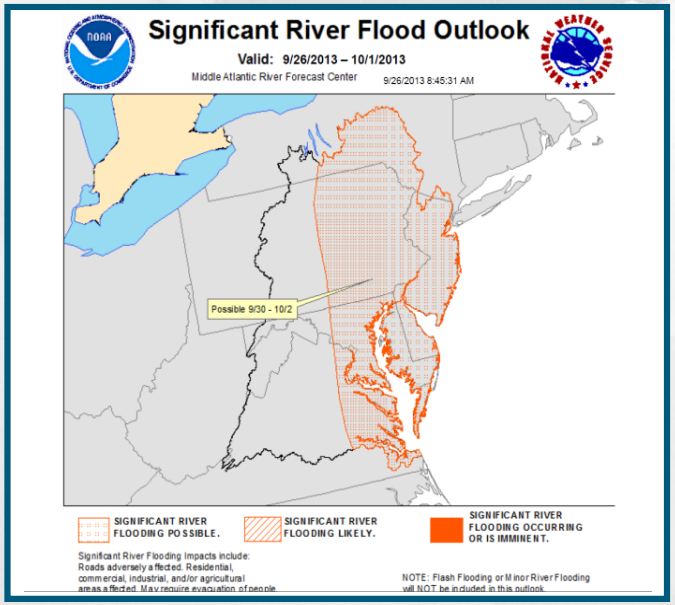
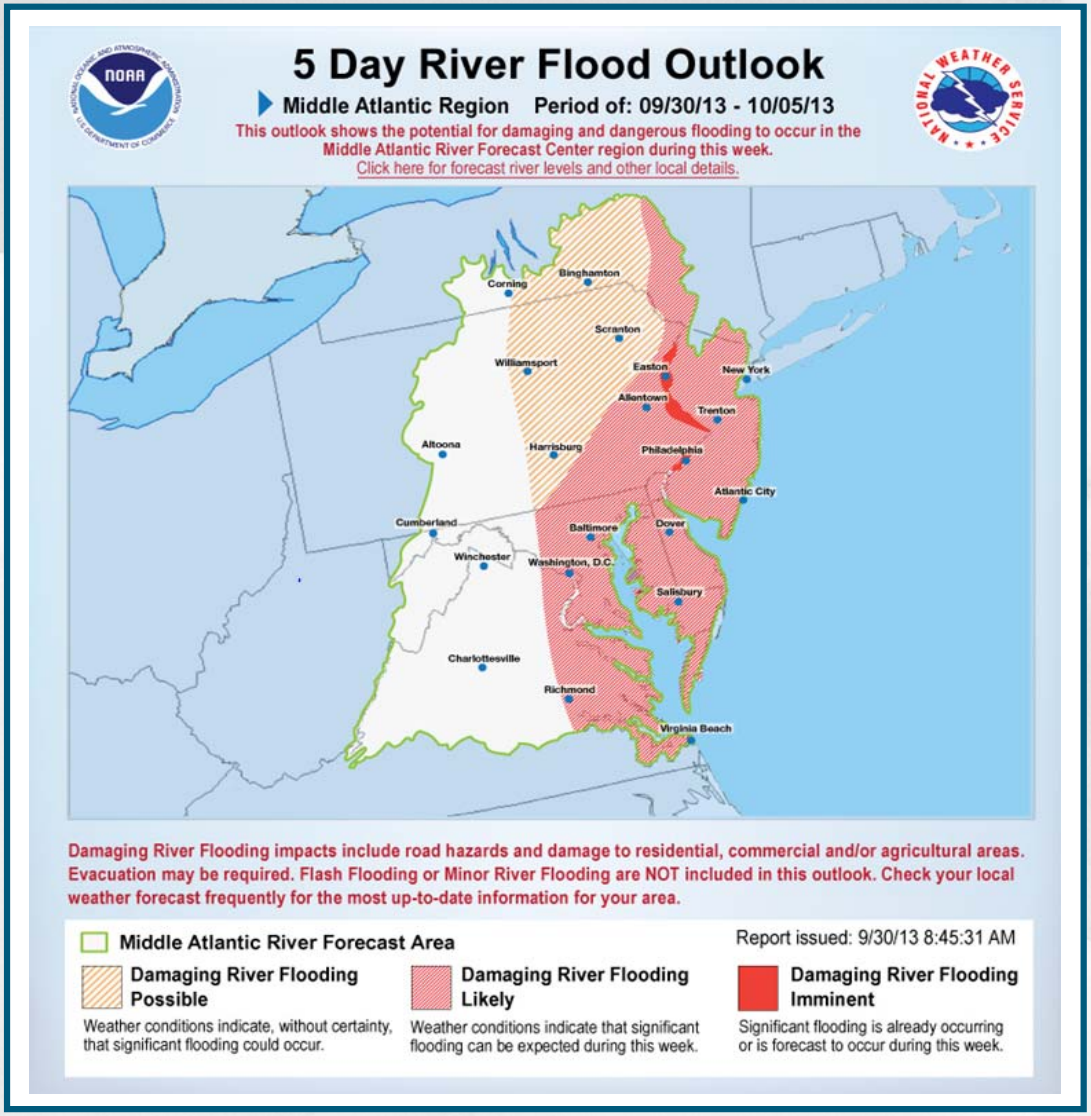
Example of a Draft Significant River Flood Outlook





Adds geographic specificity, demarcates service area boundaries, differentiates between levels of risk and provides more specific legend.

What is Next?

From the complete analysis, we will:

- **Recommend changes to the design and implementation** of the flood forecast and warning tools
- **Author a manuscript** summarizing the findings
- Create **three 5-minute videos** summarizing the findings for NOAA/NWS audiences, emergency managers and the public
- Share findings through series of **webinars and speaking presentations**

Socialscience.Focusonfloods.org

Includes already:

- research bibliography on social science related to flooding
- project information

In development:

- educational materials
- final reports and papers

Going forward:

- Second Social Science Study about Coastal Flooding tools (Coastal.Focusonfloods.org)

Thank you!

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