

Flood Risk and Uncertainty

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



Rachel Hogan Carr
DRBC
Wednesday, Nov. 6, 2013



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.





2008: Identifying the Need

Science on a Sphere: Realizing the Dream!





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).

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.



“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:

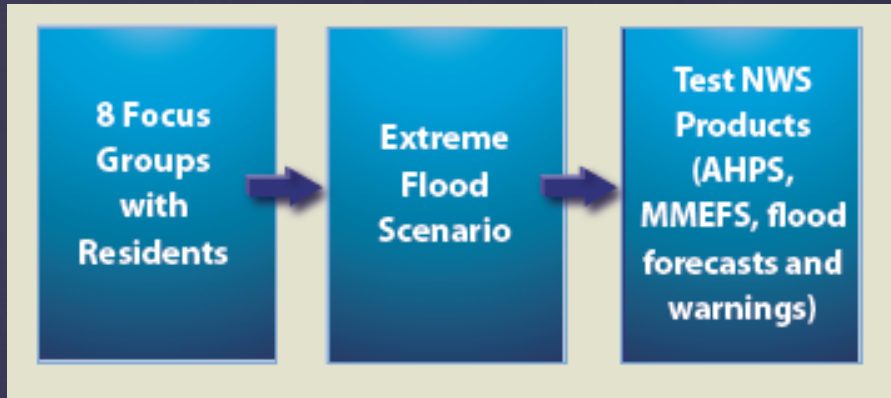
- How do people living in the Delaware River Basin understand and use NWS products and services in understanding flood risk?
- What strategies are important for NWS to consider in preparing/revising its flood forecast and warning products to better motivate flood preparedness and warning response among rural and urban public audiences in the Delaware River Basin?

What Are the Tools?

NWS Flood Forecast and Warning Tools:

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

What Methods Are We Using?

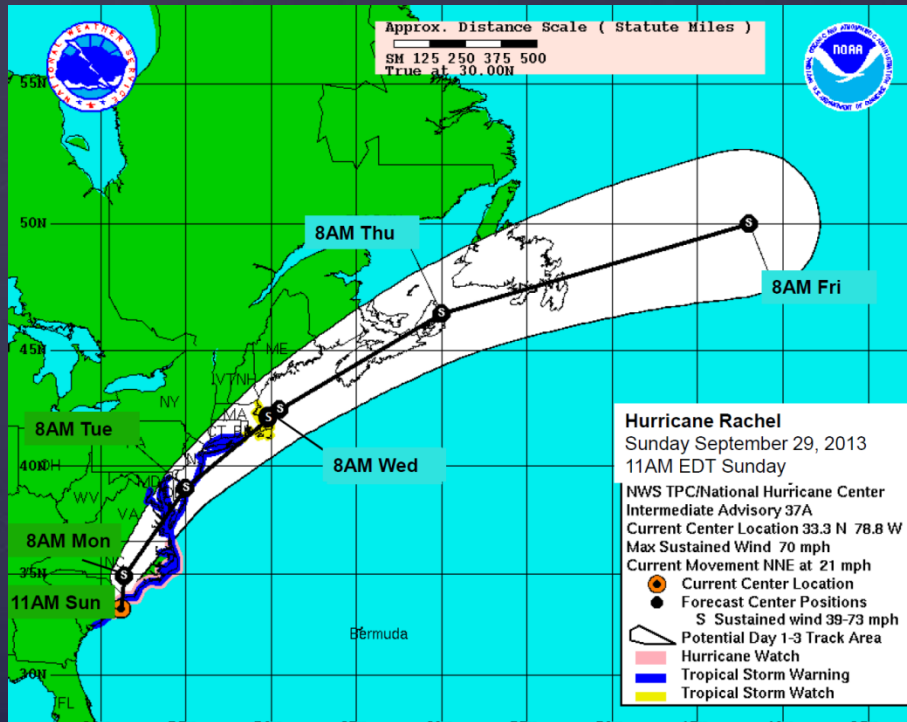


Focus group participants respond to flood tools through an extreme flood scenario that produces rainfall akin to that of the flood of record in the region, the Flood of 1955



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

Flood Scenario: An East Coast Hurricane



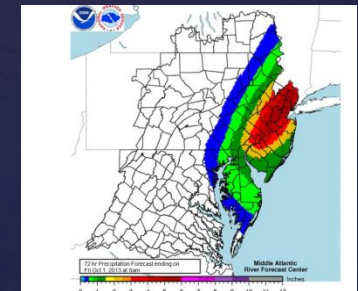
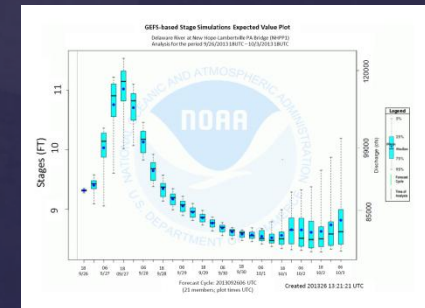
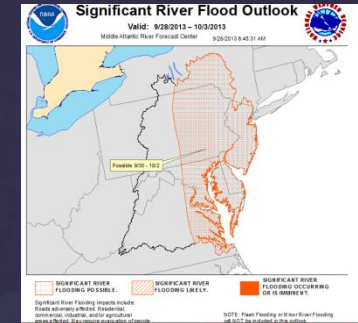
The 7-day scenario includes a series of products issued by the NWS, including:

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

Focus Groups:

A facilitated discussion about the tools

- Four focus groups held in early June 2013; two in Easton, PA and two in Lambertville
- 15 participants per session, average, including a large number of flood-affected individuals
- Participants discussed their understanding of graphics and how they would respond to each one as it was issued



What Kind of Feedback Did Participants Give?

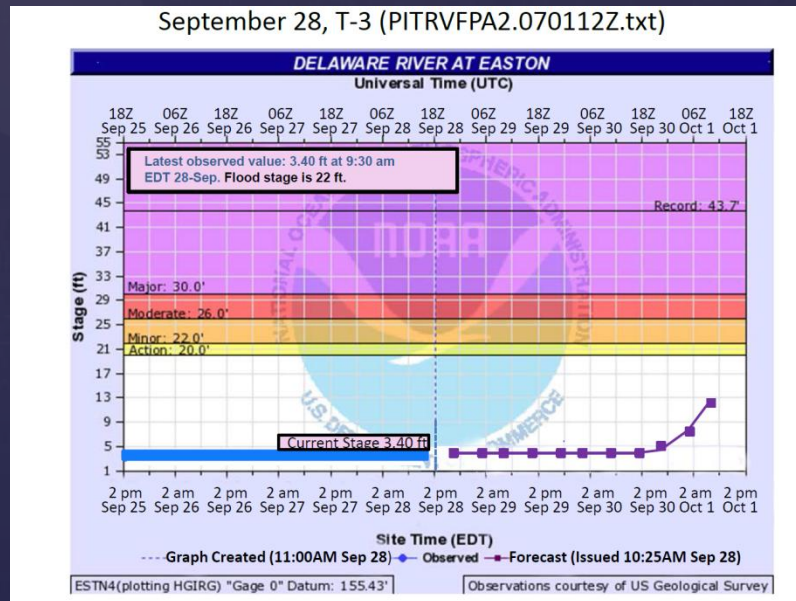
Information about:

- 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:

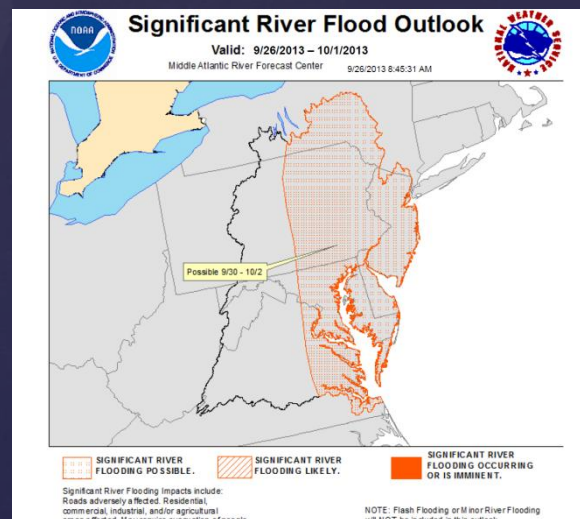
- Participants noted it was “Very clear, easy to read & useful.”
- High results for visual clarity, usefulness and location specificity.



Location Details

GEOGRAPHIC SPECIFICITY helps understanding of risk: people wanted hyper-local info wherever possible

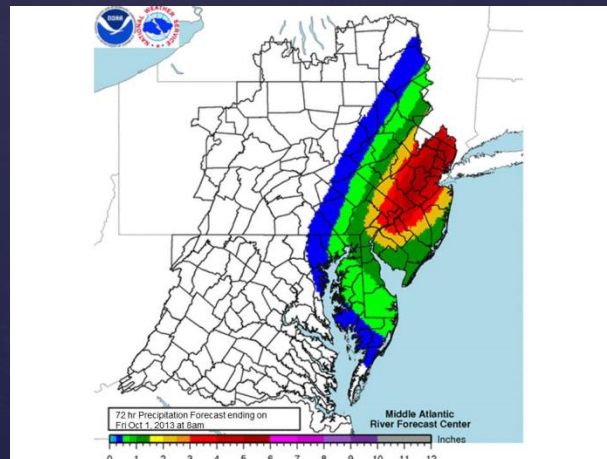
- Participants expressed serious confusion about what this the SRFO product intended to show because of a lack of geographic specificity



Use Color, and Use It Carefully

USE OF COLOR in graphics came up repeatedly and served as an aid or a stumbling block to understanding

- Participants cited the helpful use of color in products including the quantitative precipitation forecast
- Participants complained about confusing use of color and patterning in other products, including the SRFO and flood inundation maps
- Participants complained about the lack of color variations in some products, including Flood Watches and Warnings

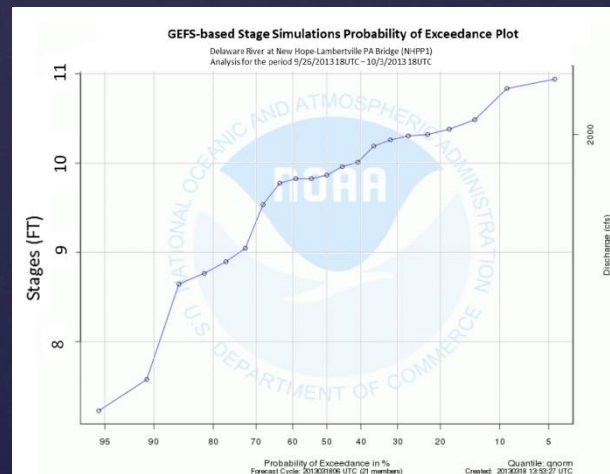
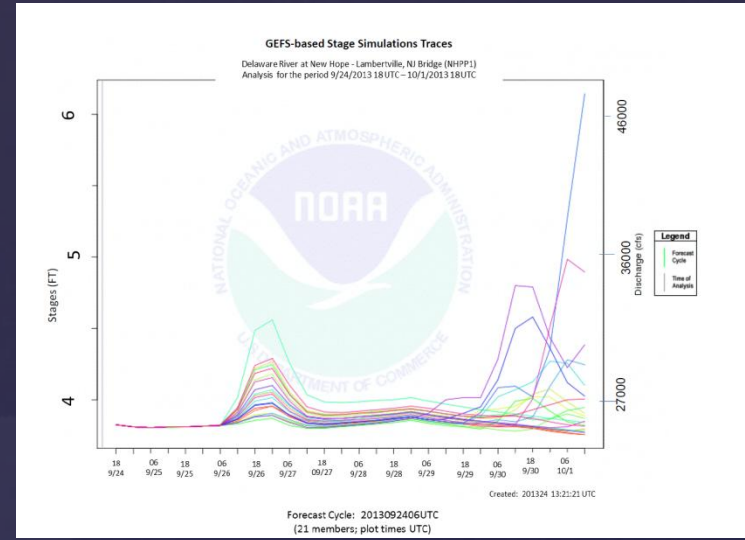
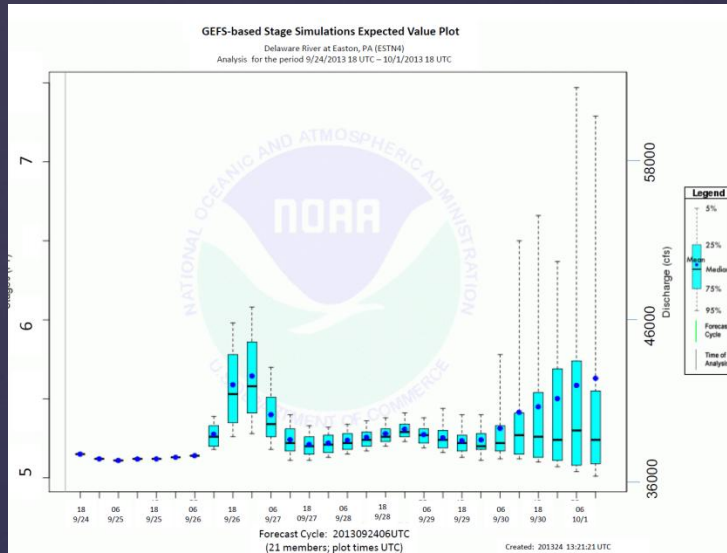


Uncertainty

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



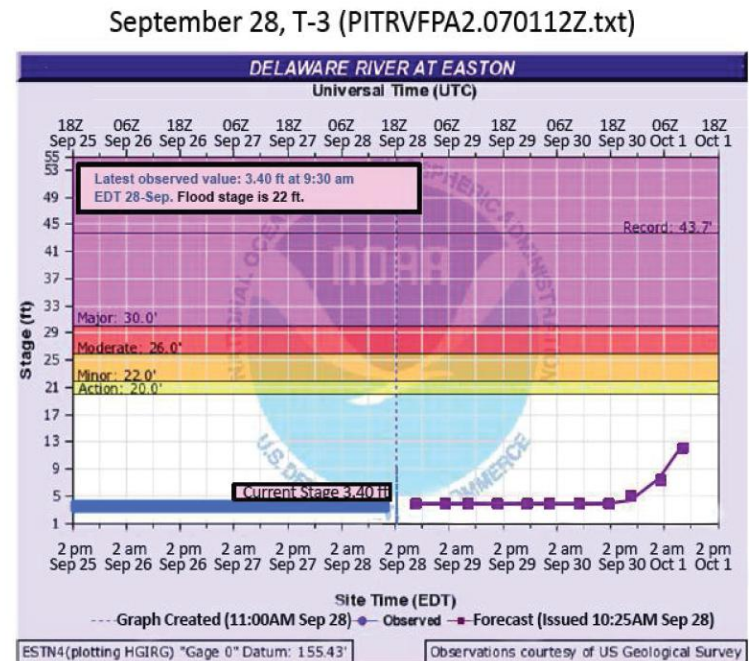
What Are We Doing with the Feedback?

The project team has analyzed all the data from the groups, which includes qualitative data from the sessions as well as quantitative data from pre and post-session surveys.

Based on this feedback, we are making revisions to the tools.

We will re-test these mocked-up tools with a second set of focus group participants in early December 2013.

Example of a Draft Mocked-Up Hydrograph



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

What is Next?

After the next round of focus groups, we will analyze the feedback about the mocked-up graphics. From the complete analysis, we will:

- **Recommend changes to the design and implementation** of the flood forecast and warning tools
- **Write a white paper about extreme flood risk scenarios** and the public response to such an event
- **Author a manuscript** summarizing the findings
- **Create three 5-minute videos** summarizing the findings for NOAA/NWS audiences, emergency managers and the public

Socialscience.Focusonfloods.org

THE NURTURE NATURE CENTER FOCUS ON FLOODS SOCIAL SCIENCE

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Can Social Science Help Improve Public Use of Flood Forecast Tools?

The National Weather Service (NWS) offers many flood forecast and warning tools that individuals can use during a predicted flood event. From tools that allow users to monitor projected river heights to flood inundation maps that show which areas in the community will be underwater during floods, the capability and accuracy of flood forecasting has increased dramatically in recent years. Despite this, many people still fail to understand and respond properly to flood forecasts and warnings issued by NWS.

Beyond technological advances in forecast lead-time and accuracy already achieved, what else can NWS do to improve its flood forecast and warning tools so they better motivate flood preparedness and warning response? In partnership with Nurture Nature Center (nurturenaturecenter.org), NWS is undertaking a social science research study in the four-state Delaware River Basin. The study will ask individuals living in flood-affected communities to participate in focus group interviews to help answer two questions:

- How do people living in the Delaware River Basin use NWS flood forecast and warning tools in understanding their flood risk?
- How can these tools be improved so they better motivate flood preparedness and warning response?

Flood Risk and Uncertainty Project

"Given the frequency and intensity of flooding not only in this region, but across the country, improving how people prepare for flooding is critical to reducing losses," said NNC Director Rachel Hogan Carr. "This project provides an excellent opportunity to help NWS understand how the public uses its flood forecast and warning tools, and what further refinements might improve public preparedness as people respond to news of impending flood events."

Nurture Nature Center, Inc. is a non-profit organization in Easton, Pennsylvania, with a focus on flooding issues. NNC's social science project, "Flood Risk and Uncertainty Assessing the National Weather Service's Forecast and Warning Tools," supports NOAA's new Weather-Ready Nation initiative, designed to help the nation become better equipped to prepare for and respond to weather events.

Includes already:

- research bibliography on social science related to flooding
- project information and focus group registration

In development:

- a series of educational materials, including posters, a traveling display and other tools, to explain flood risk and uncertainty
- final reports and papers

Check back regularly for updates! Visit also www.focusonfloods.org for more on Nurture Nature Center's flood outreach.

FOCUS GROUPS: ROUND 2

FOCUS GROUP STUDY SEEKS PARTICIPANTS



Do you live near a floodplain? Do you rely on flood warnings and alerts to know when to prepare? Do you wish you had more information about your flood risk?

Nurture Nature Center is recruiting participants for two focus groups, as part of a research project with National Oceanic and Atmospheric Administration, about the use of National Weather Service flood forecast and warning tools.

Participants should live in the Lambertville, New Jersey area and be at least 18 years of age. Participants will receive \$30 and will be asked to answer questions and provide input about various flood warning tools and products issued by the National Weather Service. Coffee and light refreshments will be provided.



Register online at www.focusonfloods.org/socialscience or by contacting Rachel Hogan Carr at 610-253-4432 or rhogan@nurturenature.org

Please indicate which session you would like to attend:

Thursday, December 5th in Lambertville, New Jersey:

Session #1: 1:00 p.m. to 3:00 p.m. at Lambertville Justice Center (old ACME Building), 25 S. Union Street, Lambertville

Session #2: 6:00 p.m. to 8:00 p.m. Creekside Room at Inn at Lambertville Station, 11 Bridge Street, Lambertville

Did you participate in Round 1 and want to help? Please refer a friend or relative!



The Nurture Nature Center is a non-profit organization whose focus is on flood education.
518 Northampton Street
Easton, Pa 18042
610-253-4432
www.nurturenaturecenter.org



This was prepared by NNC under award number NA12OAR4590115 from NOAA, U.S. Dept. of Commerce. The statements, findings, conclusions and recommendations are those of the authors and do not necessarily reflect the view of NOAA or the US Dept. of Commerce.

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Friday, December 6th in Easton, Pennsylvania:

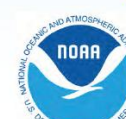
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Thank You!

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Director

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