Connecting the Dots Between NOAA’s Hurricane Social Science Efforts: Early Findings from the Social and Behavioral Science Hurricane Supplemental Projects

Gina Eosco & Castle Williams  
Social Science Program  
Weather Program Office, NOAA/OAR

Jen Sprague-Hilderbrand  
Office of Programming, Planning, and Service Development, National Weather Service

Valerie Were  
Office of Science and Technology Integration, National Weather Service

Jessica Schauer  
AFS Marine, Tropical, & Tsunami Services Branch, National Weather Service

Robbie Berg  
National Hurricane Center

Note: Special thanks to Micki Olson for assisting with project management earlier in the award period, and for assisting with triangulation of research findings.

CREDITS: This presentation template was created by Slidesgo, including icons by Flaticon, and infographics & images by Freepik.
Weather Act & Disaster Supplemental Appropriations

Section 104 of the Weather Research and Forecasting Innovation Act of 2017 ("Weather Act") and the Bipartisan Budget Act, 2018: Division B - Supplemental Appropriations, Tax Relief, and Medicaid Changes Relating to Certain Disasters and Further Extension of Continuing Appropriations ("Disaster Supplemental Appropriations") provide NOAA with a unique and important opportunity to integrate the social, behavioral and economic sciences into NOAA’s tropical products, information and services.

Further, the Strategic Plan for the Next Phase of HFIP articulates a path forward to incorporate risk communication research into the design and communication of its products:

- By 2021 NOAA will complete a baseline understanding of partner and stakeholder needs relating to the TC product suite,
- By 2023, through social and behavioral science research, NOAA intends to improve communicating the forecasted risks by transitioning 2-3 TC hazard guidance products per year and,
- By 2028, modernize all products in the TC product suite.

The following 4 supplemental projects will advance our efforts!
The complementary design behind the projects

**Complement:** Will both provide needed information on Core Partner understanding of products.

**Differ:** Focus on products vs. understanding uncertainty.

---

**Complement:** Both may provide comments on technology & communication.

**Differ:** Focus on core partners vs. public; Focus on TC products more specifically vs. information content on the web more holistically.

---

**Complement:** Will both provide needed information on general publics.

**Differ:** Focus on changes between forecasts versus understanding uncertainty.

---

**Complement:** Will both focus on the publics.

**Differ:** Focus on perceptions versus website dissemination and communication.

---

**There's a chance of what?**
Assessing numeracy skills of forecasters, partners, and publics to improve TC product uncertainty communication, IDSS, and training.

**Wait, the forecast changed?**
Assessing how publics consume and process changing tropical cyclone forecasts over time.

**Minding the gap:**
Modernizing the TC product suite by evaluating NWS core partner information needs.

**Optimizing tropical cyclone information:** An NHC website usability study from a public perspective.
There’s a Chance of What? Assessing Numeracy Skills of Forecasters, Partners, and Publics

Set of 4 studies that mapped comprehension and communication of probabilistic information by surveying weather forecasters, emergency managers, and the public.

Numeracy Findings
EMs are generally more numerate than members of the public, but they look more like the public than forecasters.

Vague Messages
A majority of forecasters/EMs use vague words and phrases vs. precise numbers to explain probability information.

Strong Messages
Strong messages that include numeric information help the public correctly interpret complex probability information.
Minding the Gap: Modernizing the TC product suite by evaluating NWS partner information needs

Used semi-structured interviews and survey methods to understand how broadcast meteorologists and emergency managers currently use the tropical cyclone product suite.

Both broadcast meteorologists and emergency managers find that there is often a mismatch between available TC information and their decision timeline.

There is a need for easily interpretable and localized TC information.

How can the NWS identify gaps in their TC product suite needed to enhance partner decision-making?
Wait, that forecast changed? Assessing how publics consume and process changing tropical cyclone forecasts over time

Developing a methodological approach to deploy longitudinal surveys before, during, and after tropical cyclone events to measure the public’s information-seeking, risk perception, and response in real-time.

Combining Physical & Social
An early concept approach to further integrate both physical science & social science by using TC products to define and categorize TC exposed.

Social Science Observing System
This methodological approach acts similar to a meteorological observing system, but for risk perceptions and responses of people!
Optimizing tropical cyclone information: An NHC web user experience study from a public perspective

Used a variety of usability and user-centered design methodologies (e.g., interviews, heuristic analysis, card sorting, etc.) to identify design opportunities for modernizing the NHC website:

- Increase Investment in Internal Capacity & Site
- Build for Mobile
- Adopt Contemporary Visual Design Standards
- Continue Improving Accessibility for Diverse Audiences

How can NOAA’s hurricane web presence be modernized?
What is Triangulation?

“Triangulation in research is the use of more than one approach to researching a question. The combination of findings from two or more rigorous approaches provides a more comprehensive picture of the results than either approach could do alone.” (Heale and Forbes 2013)
Our Approach to Triangulation

Tiny Triangulation
This was a preliminary analysis to begin understanding the broader themes we would likely see before receiving all of the final reports.

Taller Triangulation
A more detailed analysis with the goal of translating social science findings into actionable recommendations for NOAA research, development, & operations.

(Triangulation is still ongoing, these are very preliminary findings)
What’s Different About Taller Triangulation?
It’s All About Translation!

Map Project Findings on Miro Board
Translate Project Findings to Transition Opportunities
Iterate with the Tropical Roadmap Team
Review Findings to Identify Cross-Cutting Themes
Identify* Relevant NOAA Transition Opportunities

*When identifying NOAA transition opportunities, many different NWS operational partners will be consulted and iterated with to assess operational viability in order to put forward relevant and actionable recommendations.
Generally speaking, broadcast meteorologists, emergency managers, and members of the public find NOAA/NWS’ tropical cyclone products and services **useful and important.**
Big Themes & Takeaways from Tiny Triangulation Efforts

- **Identify ways to localize & personalize TC information**
- **Improve the accessibility of TC products and services.**
- **People search for different types of information during different phases of the lifecycle of a TC threat.**
- **Timing information is critical for decision-making, thus the timing of when forecasts are issued is important too.**
- **Uncertainty information is important to communicate, but it is not always communicated well.**
- **Graphical TC products are important, but some need to improve their depiction of risk and/or uncertainty.**
- **There is a misperception among forecasters & partners that the public does not understand uncertainty info.**
- **There is a misperception that emergency managers are highly numerate like weather forecasters.**
Even when they correctly interpret probabilistic products, a significant majority of forecasters & EMs tend to use vague words and phrases in place of precise numbers to explain probability info. It appears that this tendency to use vague language is partially driven by an underlying perception that members of the public are unable to interpret and use probability information. Vague messages are extremely common but they are not as effective as strong messages. Strong messages included numerical probability information rather than words & phrases.

This likely requires a **culture shift & additional training** among forecasters and partners that end users do benefit from probabilistic information when making decisions, and embedding this into NWS products & external communication.
Recommendation from Ripberger: Forecasters should include a sentence or two explaining how to interpret probability information in graphics when sharing them with end users.
Static CAT for Potential Storm Surge Flooding Map

This map shows a reasonable worst-case scenario of storm surge flooding that several locations along the coast should prepare for. There is approximately a 1-in-10 (10%) chance that storm surge flooding at any location could be higher than the values shown on the map.
Dynamic CAT for Potential Storm Surge Flooding Map

This map shows a reasonable worst-case scenario of storm surge flooding of **greater than 6 feet above ground** that you should prepare for **in Smith Point, TX (77514)**. There is approximately a 1-in-10 (10%) chance that storm surge flooding in **Smith Point, TX** could be higher than the value shown on the map.

**Recommendation from Ripberger & Morss:** Forecasters should include a plain-language sentence or two explaining how to interpret probability information in graphics when sharing them with end users.
Finding from Soden, Ripberger, and Morss: New or reformulated graphical products are more valuable when meteorologists co-produce or co-develop these products alongside partners and relevant end users.

New or Updated Graphical Products Should Be Co-produced with End Users

Taller Triangulation Translation Opportunity

Participated in Co-Development with End Users

Opportunities for Future Co-Development
Social science research is often thought of as a mechanism to improve or change policies, products, and services. However, it can also be used to inspire product development and/or explore potential physical science capabilities.

**What capabilities do we have to provide storm surge information more than 48 hours in advance?**

**How can the modeling suite inform the development of storm scenarios 72 hours before impacts?**

**How do our models/post processing give NOAA the ability to provide both onset and departure time?**
Next Steps - Translating Social Science Findings
Following the Tropical Roadmap Process

Receive One More Final Report & Triangulate Findings

Translating Social Science Research Findings to Applications
2.5 Miles Ahead
Questions?

Office of Oceanic & Atmospheric Research (OAR)
Weather Program Office
Social Science Program
Dr. Gina Eosco
Dr. Castle Williams

National Weather Service (NWS)
Social Science Program
Jennifer Sprague-Hilderbrand
OSTI
Dr. Valerie Were

National Weather Service (NWS)
Tropical Services Program
AFS26
Jessica Schauer
NHC
Robbie Berg

CREDITS: This presentation template was created by Slidesgo, including icons by Flaticon, and infographics & images by Freepik.