WPO SOCIAL SCIENCE PROGRAM

Our Challenge
Recent societal impacts from hurricanes, floods, wildfires, and other weather hazards shows a great need to understand the intersection of people and meteorology.

Our Mission
The Social Science Program funds research that plays a critical role in connecting the improvements of NOAA's weather forecast information to the publics' growing forecast needs.

Our Focus Areas
- Social Science Data & Research
- Research to Applications (R2X)
- Portfolio Analysis & Evaluation

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MEET THE WPO SOCIAL SCIENCE PROGRAM TEAM

Dr. Gina Eosco

SSP Program Manager

Dr. Cassandra Shivers-Williams

SSP Deputy Program Manager

Dr. Alison Agather

SSP Competition Lead

Dr. Stephanie Hoekstra

SSP VORTEX Lead

Dr. Jonathon Mote

SSP Data Engagement Lead

Dr. Castle Williamsberg

SSP R2X Lead

POLL EVERYWHERE QUESTION #1

Poll Everywhere

If you were asked to evaluate the quality of social science research right now, how comfortable would you feel doing so?

Si le pidieran que evaluara la calidad de la investigación en ciencias sociales en este momento, ¿qué tan cómodo se sentiría al hacerlo?

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SOCIAL SCIENCE: THE BASICS

WHAT IS SOCIAL SCIENCE?

"Social science is the process of describing, explaining and predicting human behavior and institutional structures in interaction with their environments…"

-NOAA Science Advisory Board

| Psychology | Communication | Economics |
| Geography | Anthropology | Sociology |

And many others!

Sociology

The study of how humans function in groups, organizations, and societies as social beings

Anthropology

The study of humans, past and present, focusing on behavior & understanding culture

Psychology

The study of the human mind and how people experience the world

Social Science
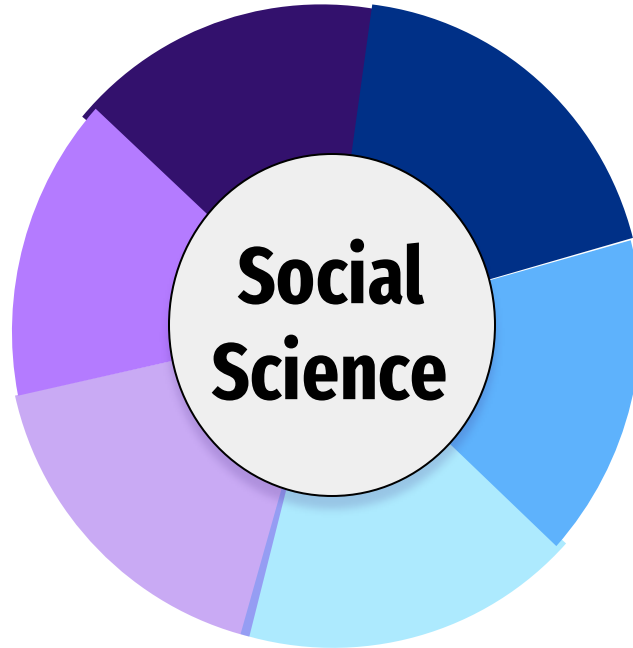
...and many more!

Geography

The study of places and the relationships between people and their environments.

Economics

The study of how individuals & societies make choices about using or allocating resources, with or without money

Communication

The study of the human process of communication, including the creation, delivery, and receiving of both verbal and non-verbal messages

GOALS OF SOCIAL SCIENCE RESEARCH

To better understand human processes and behavior.

To find explanations for unexplained phenomena by looking for patterns and finding connections among those patterns.
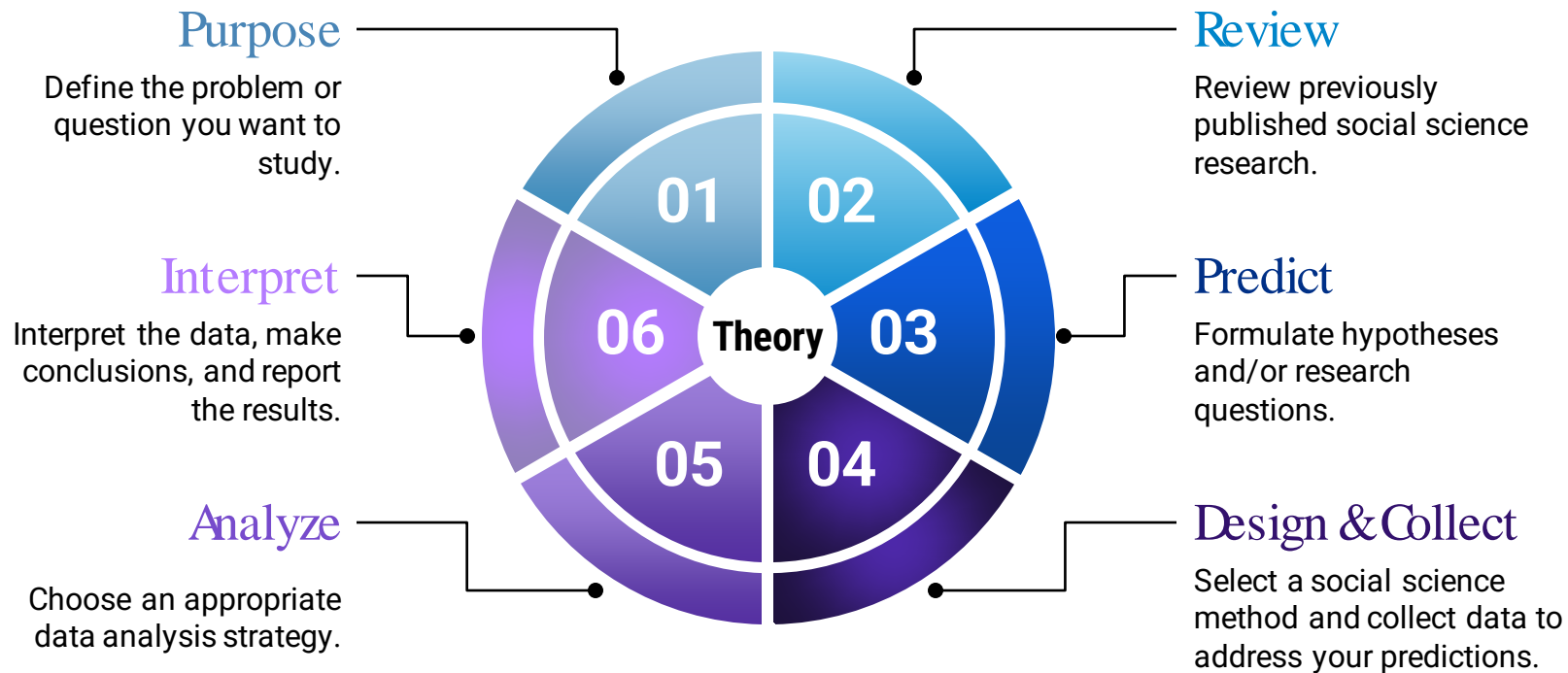
To predict behavior and derive causal explanations.

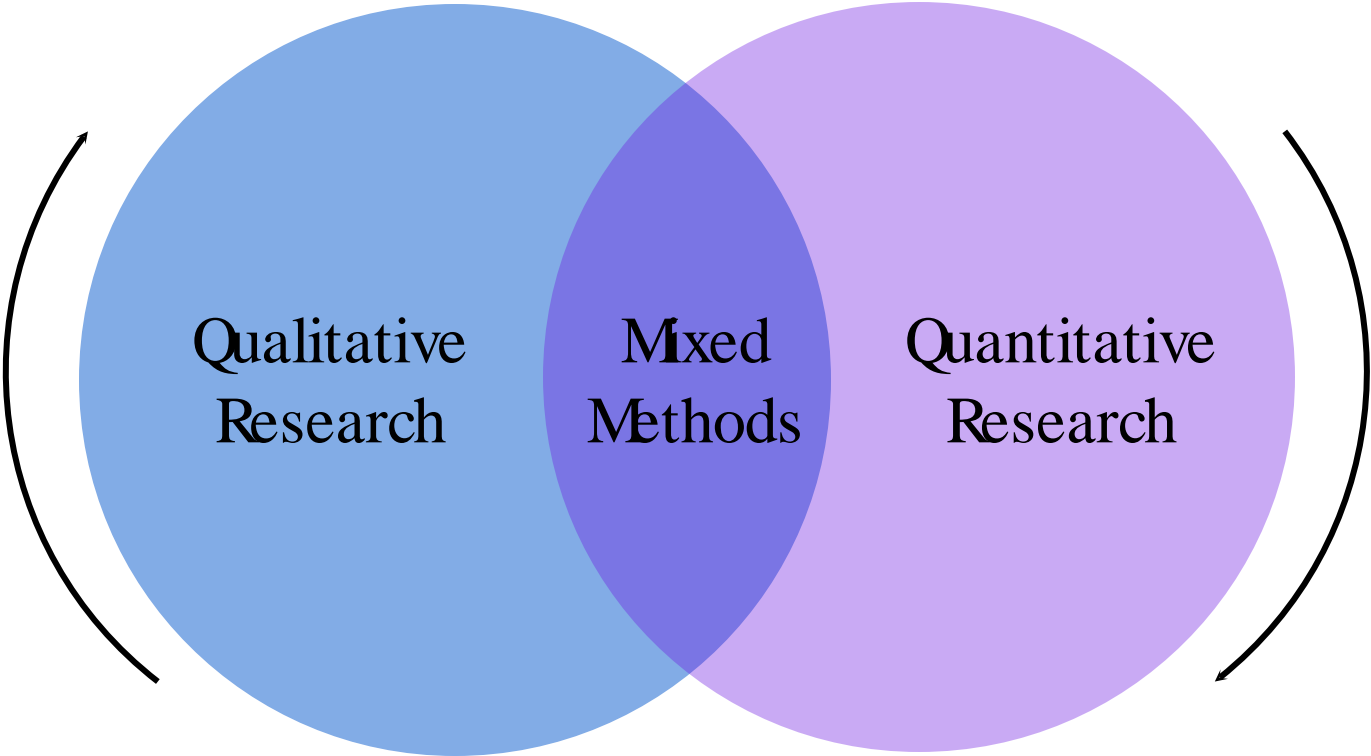To build, test, and/or refine theories that explain human behavior.

THE SOCIAL SCIENCE RESEARCH PROCESS

Purpose
Define the problem or question you want to study.

Review
Review previously published social science research.

Interpret
Interpret the data, make conclusions, and report the results.

Predict
Formulate hypotheses and/or research questions.

Analyze
Choose an appropriate data analysis strategy.

Design & Collect
Select a social science method and collect data to address your predictions.

01 02 03 04 05 06

Theory

SOCIAL SCIENCE RESEARCH METHODS

CHOOSE AN APPROPRIATE METHOD

	Qualitative	Quantitative
Objective	To gain a rich understanding of underlying of the phenomena from the participant(s) perspective	To quantify and generalize results from a sample to the population of interest via precise measurement
Approach	Observe and interpret	Measure and test
Sample	Usually a small number of non-representative population	Usually a large number of cases representing a population of interest
Data Analysis	Non-statistical; data cannot be expressed as an number	Numerical comparisons & statistical inferences; data can be represented as a number

DIFFERENT TYPES OF METHODS

Determining the most appropriate social science method depends on your research problem, research questions, and/or hypotheses. An example of a few qualitative and quantitative methods are:

Qualitative Research Methods

Goal: Gain a richer understanding of a topic

Case Studies	Focus Groups
Ethnography	**Interviews**

Quantitative Research Methods

Goal: To quantify or generalize results

Meta-Analysis	Content Analysis
Surveys	**Experiments**
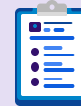
CRITERIA FOR JUDGING SOCIAL SCIENCE RESEARCH

In addition to evaluating whether a study identified an appropriate research question and methodological approach, the quality of social science research is often judged using validity, reliability, & generalizability.

Qualitative Research	***Transferability:*** Degree to which the results can be transferred to other contexts or settings.	***Credibility:*** Results are credible or believable from the perspective of the participant in the research.	***Dependability:*** Results are consistent in relation to the contexts in which they were generated.
Quantitative Research	***Generalizability:*** Extent to which the results can be generalized from the sample to the population.	***Internal Validity:*** There are few alternative explanations for the research findings.	***Reliability:*** Results would be consistent if the study would be replicated.

(Frambach et al. 2013)

THE ROAD TO GENERALIZABILITY

Does the sample represent the population of interest?	Is there a large enough sample to draw broader conclusions?	Will these findings apply to different and/or new situations?	Will these findings apply to other people or populations?	Are there other studies that have similar findings?

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STOP

POLL EVERYWHERE QUESTION #2

Poll Everywhere

If my research question is about gaining a richer understanding of a topic (vs. creating generalizable results), which method would be most appropriate?

A. Experiment
B. One-on-one interviews
C. Meta-analysis
D. Short survey

Si mi pregunta de investigación trata de obtener un entendimiento más detallado de un tema (en lugar de generar resultados genéricos), ¿qué método sería el más apropiado?

A. Experimento
B. Entrevistas individuales
C. Meta análisis
D. Encuesta breve

Generalizability is the extent to which…

A. The sample is like the population
B. Conclusions developed from the data collected from a sample can be extended to the population
C. Error exists in the population
D. Participants in the sample are biased.

Generalizabilidad es el grado en que…

A. La muestra se parece a la población.
B. Las conclusiones desarrolladas a partir de los datos recopilados de una muestra pueden extenderse a la población.
C. Existen errores en la población.
D. Los participantes en la muestra están predispuestos.

Respond at PollEv.com/castlewillia326

Poll Everywhere

Now, after learning about the basics of social science research, how comfortable would you feel evaluating the quality of social science research?

Ahora, después de conocer los fundamentos de la investigación en ciencias sociales, ¿qué tan cómodo se sentiría usted evaluando la calidad de las investigaciones en ciencias sociales?

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BACKGROUND ON THE HURRICANE SUPPLEMENTAL PROCESS

In collaboration with our NWS colleagues: Ji Sun Lee, Valerie Were, Jessica Schauer, & Robbie Berg

WEATHER ACT & DISASTER SUPPLEMENTAL APPROPRIATIONS

NOAA provided $1.5M of Bipartisan Budget Act of 2018 (Disaster Supplemental) funding to implement the Hurricane Forecast Improvement Program's SBES research needs.

Four projects were developed with a complimentary design, but still produced lengthy, individual reports that needed to be synthesized and translated.

As we discuss our approach and findings, think about how to scale it (either up or down) for your geographic area or particular meteorological service.

There's a Chance for What? Assessing numeracy skills of forecasters, partners, and publics

Dr. Joe Ripberger (PI)

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

Complement: Both provide information on publics.

Differ: Focus on changes between forecasts vs. understanding uncertainty
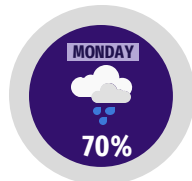
Minding the Gap: Modernizing the TC product suite by evaluating NWS partner info. needs

Drs. Rebecca Morss & Ann Bostrom (PIs)

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

Complement: Both provide information on Core Partner understanding of products.

Differ: Focus on products vs. understanding uncertainty.

Complement: Both provide comments on technology & communication.

Differ: Focus on TC products more specifically vs. web content more holistically; Core partners vs. publics

Wait, the forecast changed? Assessing how publics consume/process changing TC forecasts

Drs. Julie Demuth, Rebecca Morss, Leysia Palen, & Gabrielle Wong-Parodi (PIs)

Deployed a longitudinal survey before, during, and after Hurricanes Laura and Marco (2020), Henri (2021), and Ian (2022) and analyzed Twitter data during Hurricane Harvey.

Complement: Both focus on the publics.

Differ: Focus on perceptions versus website dissemination and communication.

Optimizing TC information: An NHC web user experience study from a public perspective
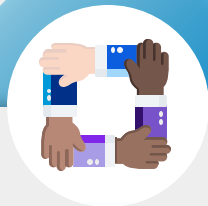
Dr. Scott Miles & Dr. Robert Soden (PIs)

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

PILOTING A COHORT APPROACH

A cohort approach created **an opportunity to build a collective body of research** whereby the cross-cutting findings build on one another to provide more generalizable findings.
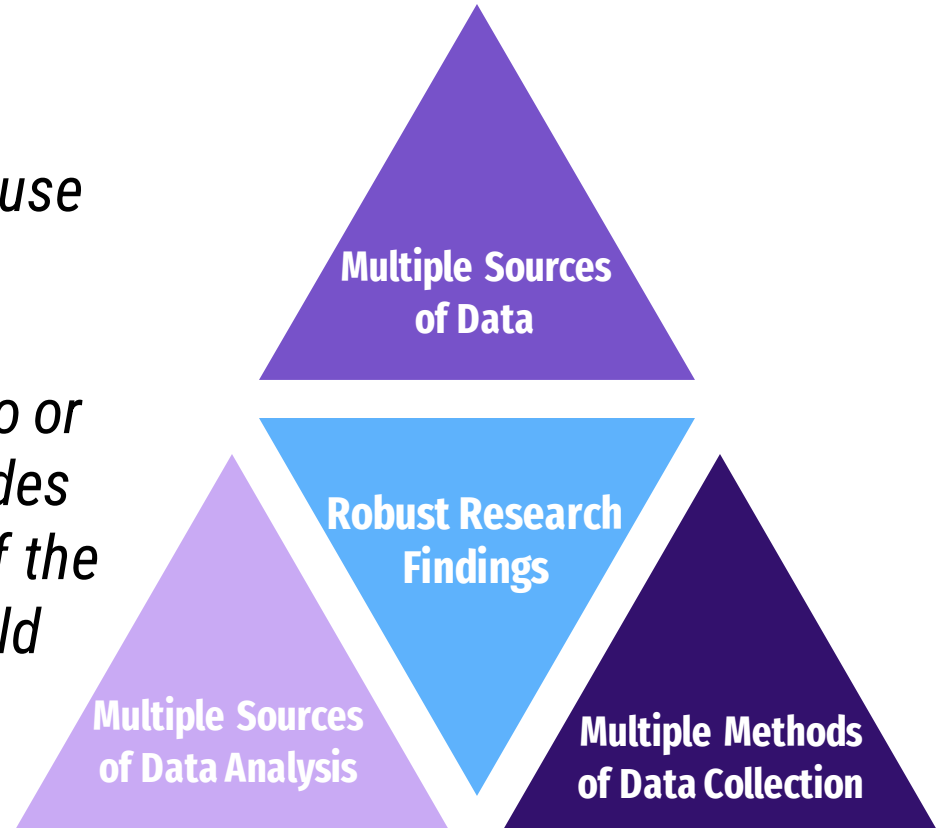
We have found that transitioning research to practice rarely occurs on a one project-to-one transition basis. **Instead, it takes a suite of research to influence a transition.**
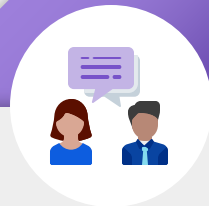
Unexpectedly, the principal investigators started **sharing data collection instruments, reaching out to one another with research questions, and confiding in one another.**

COLLABORATING WITH THE TROPICAL ROADMAP TEAM

Tropical Roadmap Team

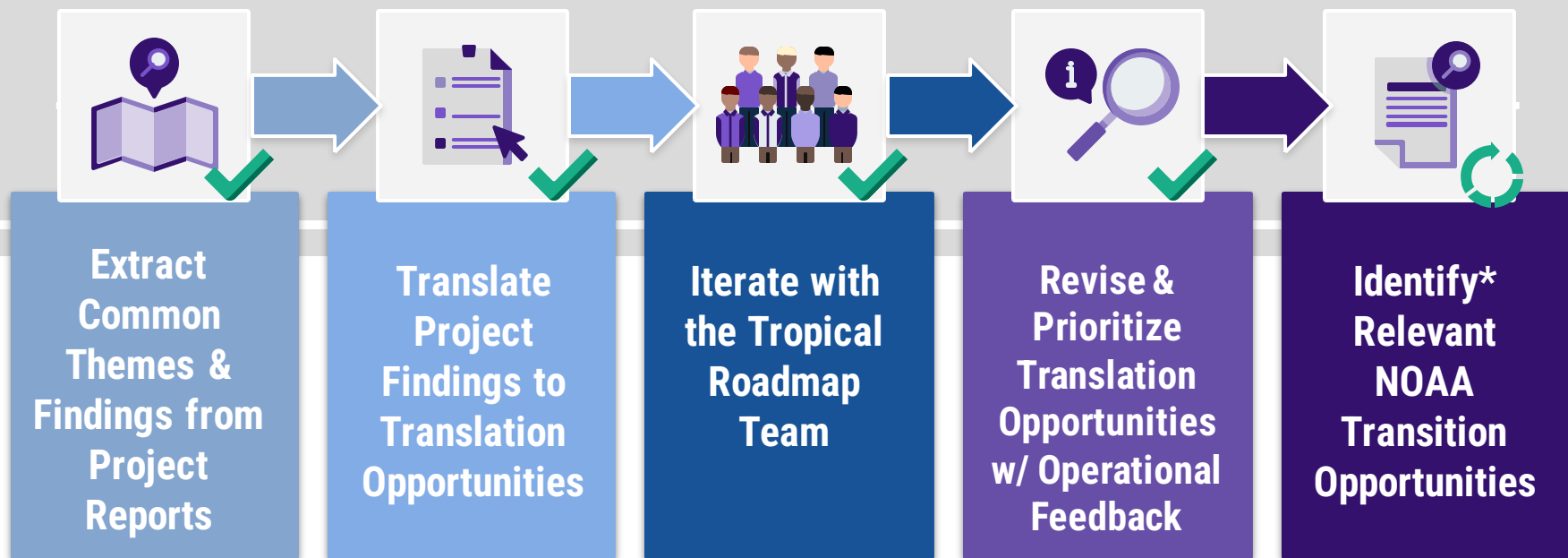|	
About The Team	The NWS Tropical Roadmap Team is made up of both policy-level meteorologists and operational meteorologists at the local and national scales and was created to **evaluate upcoming possible changes to NWS tropical products and services, as well as NWS policy.**
Why Partner?	Collaborating alongside the Tropical Roadmap Team has created several unique opportunities to share and iterate on social science project findings with operational and policy-level meteorologists **to accelerate the R2X process.**
The Tropical Roadmap	The Tropical Roadmap was developed to direct the strategic vision of the NWS Tropical Program over the next 10 years. The expected outcome is to produce a suite of **highly accurate, scientifically validated tropical products and services that are relevant to partners and publics.**

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)

Multiple Sources of Data

Robust Research Findings

Multiple Sources of Data Analysis

Multiple Methods of Data Collection

THE SOCIAL SCIENCE TRIANGULATION & TRANSLATION PROCESS

| Extract Common Themes & Findings from Project Reports | Translate Project Findings to Translation Opportunities | Iterate with the Tropical Roadmap Team | Revise & Prioritize Translation Opportunities w/ Operational Feedback | Identify* Relevant NOAA Transition Opportunities |

*When identifying NOAA transition opportunities, many different NOAA stakeholders are being consulted and iterated with to assess operational viability in order to put forward relevant and actionable recommendations.

Respond at PollEv.com/castlewillia326

 Poll Everywhere

What is Triangulation in research?

A. Using three different methods for one project.
B. The combination of findings from two or more rigorous approaches to provide a more comprehensive picture of the results.
C. Drawing a triangular diagram to represent the relations between three concepts.

¿Qué es la triangulación en la investigación?

A. Utilizar tres métodos diferentes para un mismo proyecto.
B. La combinación de las conclusiones de dos o más métodos rigurosos para ofrecer una perspectiva completa de los resultados.
C. Dibujar un diagrama triangular para representar las relaciones entre los tres conceptos.

FINDINGS & TRANSLATION OPPORTUNITIES ACROSS THE FOUR PROJECTS

*Generally speaking, broadcast meteorologists, emergency managers, and members of the public find NOAA/NWS' tropical cyclone products and services **useful and important.***

BIG THEMES FROM TRIANGULATION EFFORTS

Think about which themes & findings (if any) might be transferable to your geographic area or met service.

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 a TC threat.

Timing information is critical for decision-making, thus the _timing_ of when products 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 and partners that the public does not understand probabilities.

There is a misperception that emergency managers are highly numerate like weather forecasters.

01

70%

People use and benefit from probabilistic information when making decisions. **Providing short explanations** that describe how to interpret probability information with a graphic or product can **significantly improve their understanding.**

PROBABILISTIC INFORMATION & NUMERACY TAKEAWAYS
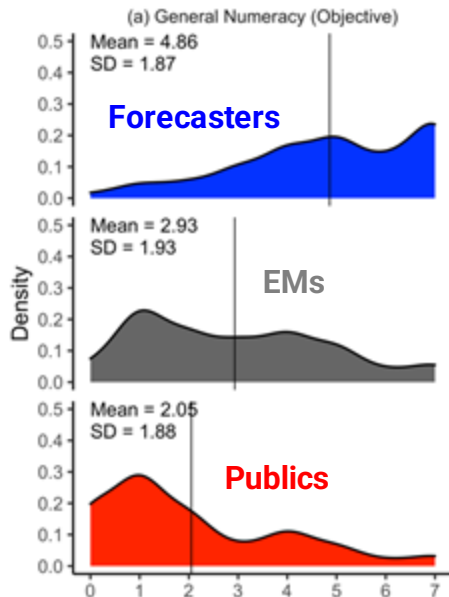
(a) General Numeracy (Objective)

Forecasters — Mean = 4.86, SD = 1.87

EMs — Mean = 2.93, SD = 1.93

Publics — Mean = 2.05, SD = 1.88

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.

ADD COMMUNICATION ASSIST TEXT (CAT) TO PROBABILISTIC PRODUCTS

Translation Opportunity

Recommendation from Ripberger and Morss: *Forecasters should include a plain-language 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.

Morss Finding
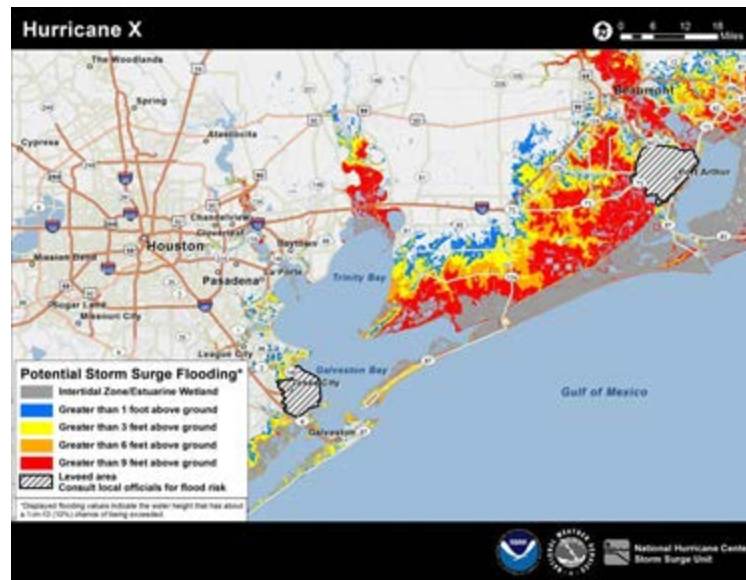
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ADD COMMUNICATION ASSIST TEXT (CAT) TO PROBABILISTIC PRODUCTS

Translation Opportunity

Recommendation from Ripberger and Morss: *Forecasters should include a plain-language, <u>locally-tailored</u> sentence or two explaining how to interpret probability information <u>for a specific location.</u>*

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.
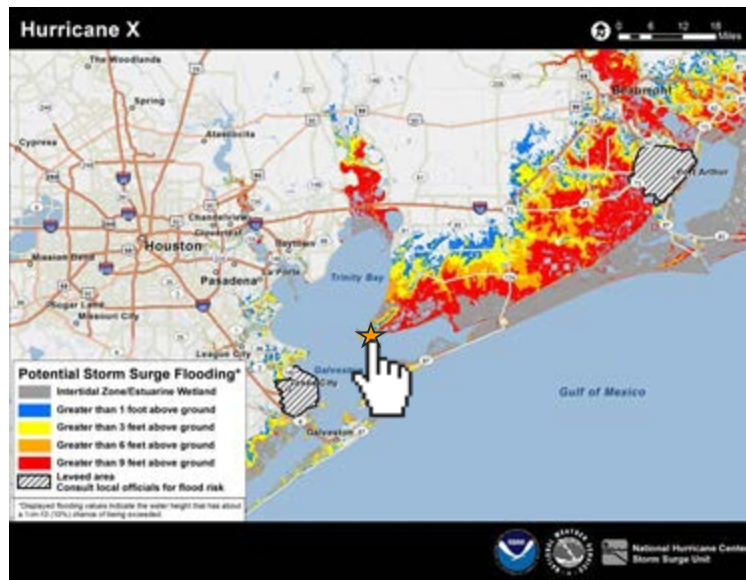
02

NOAA/NWS' tropical products and services **need to provide more localized and personalized information**, such that partners are able to make better decisions for their local area.
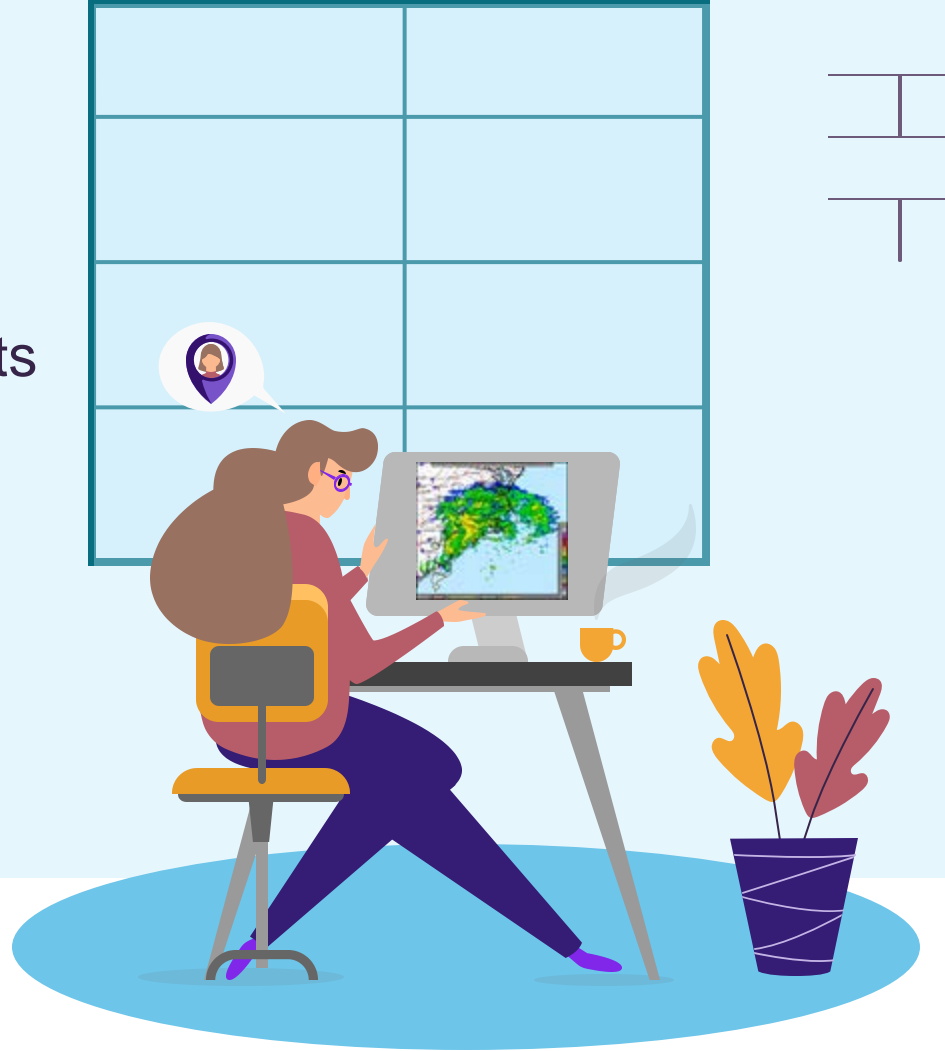
THE TC PRODUCT SUITE NEEDS TO PROVIDE MORE SPECIFIC & LOCAL INFO

Finding from Morss: *Many decisions that partners make during tropical cyclones depend on the anticipated impact to their local area. Therefore, partners asked for geographically specific information whenever and wherever possible—even when local forecast information is highly uncertain.*

Stakeholder Engagement Opportunity

What does "specific" or "local" mean to emergency managers and other partners?

How Can We Make TC Products More Specific and Local to Meet Partner Decision Making Needs?

|	
Increased Spatial and/or Model Resolution?	Dynamic Graphical Products with Zoom Capabilities?
Increased Deployments to EOCs to Support EM Decision-Making?	Improve Flow of Information from NHC to Local WFO websites?

03

Different types of timing information (e.g., onset, cessation, and duration) are critical for decision making, and as a result, the timing of when forecasts, products, and data are released to partners is important too.

TIMING INFORMATION IS VERY IMPORTANT FOR DECISION-MAKING

Finding from Morss: *Many partners expressed interest in additional information about anticipated hazard timing information. Before expanding the Arrival Time product suite, some feedback was given:*
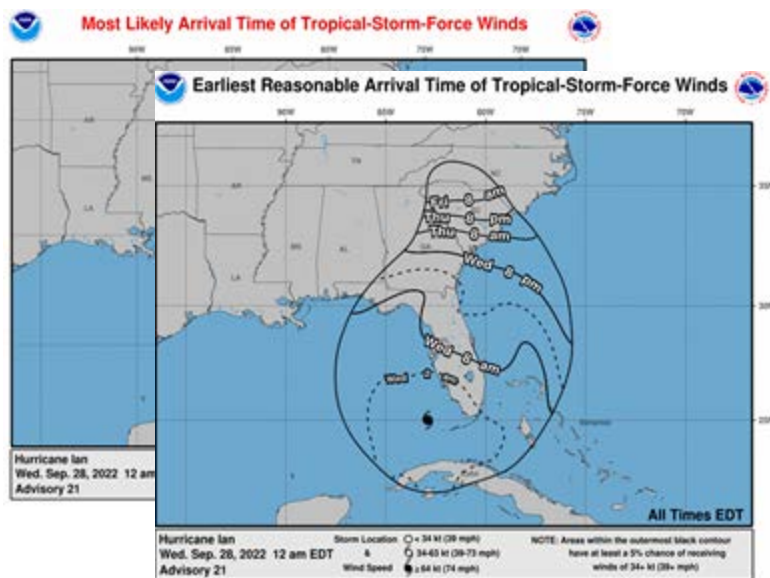
Broadcaster Feedback
The product is hard to edit on their devices they use or the data layer is not available. Some said the product provides too much information or is too difficult to understand.

Emergency Manager Feedback
The product does not provide information specific enough to their area or takes up too much time to understand. Some said the product is commonly misunderstood or is difficult to explain to the public.

MORE ONSET, CESSATION, & DURATION TIMING INFO IS WANTED BY PARTNERS

Translation Opportunity

Onset

Arrival Time Graphic Suite
Currently supports evacuation decision making; need more partner feedback to consider expanding these products.
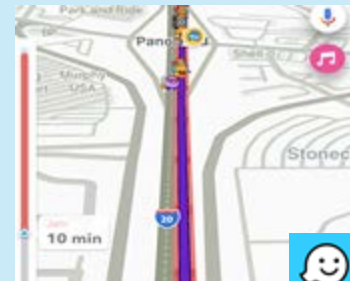
Cessation

Most Likely End Time Graphic?
Partners asked for more end time information to decide when to halt and resume preparation and emergency services. End time graphic?

Duration

Duration Product Like Waze?
Can we use probabilistic information in a different way to provide duration information? Similar to the Waze traffic jam duration feature?

QUESTIONS TO CONSIDER ABOUT PRODUCT ISSUANCE & TIMING

Translation Opportunity

What forecast tool information "starts the clock" for forecast development and subsequent issuance?

If it's tied to model releases, how will future changes impact this, and can we factor in tropical users timing needs?

How does the timing of NHC and WFO forecast product issuance currently work? Why is it this way?

If NOAA could change the timing of product issuance, how might we go about changing it? What impediment(s) exist?

STOP

04

At greater than five days of lead time, partners asked for more information about **tropical cyclone tracks and scenarios, forecast models, and forecast confidence or uncertainty.**
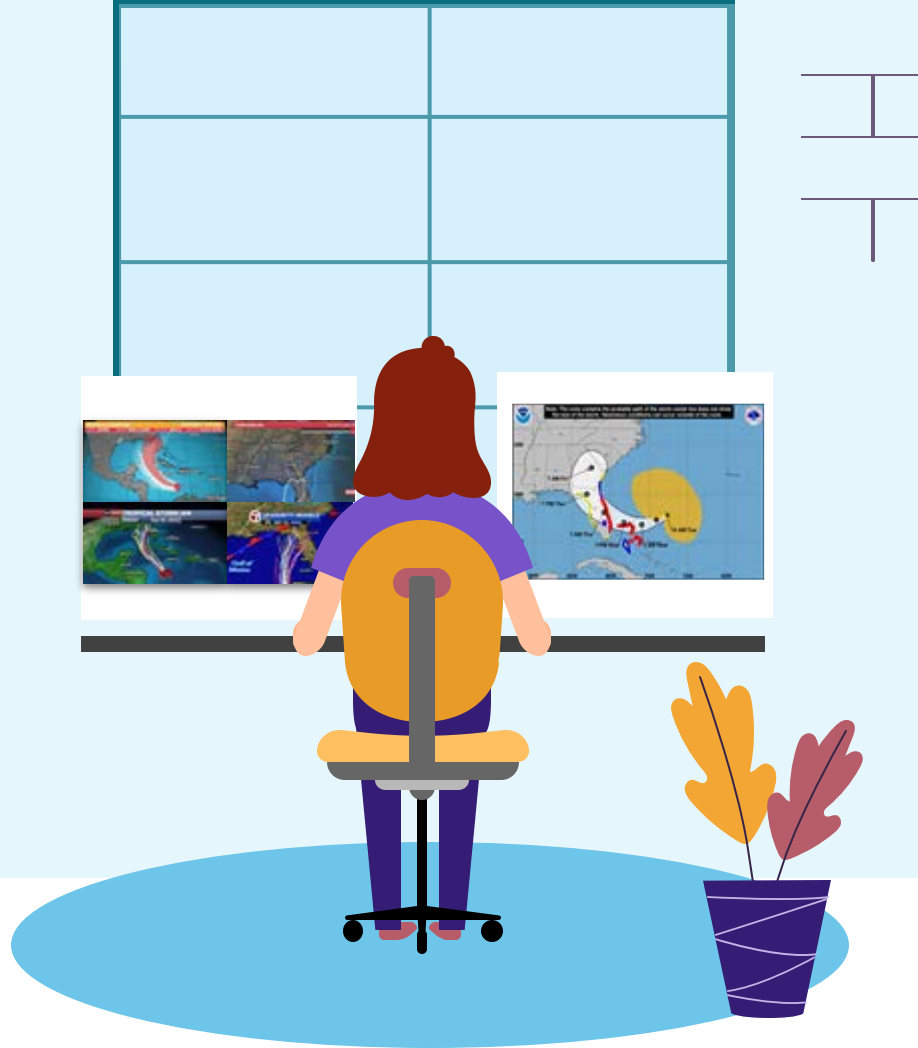
PARTNERS LOOK TO OTHER SOURCES FOR TC TRACKS & SCENARIOS

Finding from Morss: *In the absence of an official NWS forecast product, partners seek information about potential TC tracks at longer lead times from other sources such as looking at numerical model output.*

Finding from Morss: *The fact that NWS partners are seeking out unofficial TC track information at more than five days of lead time suggests that this is an important gap in the TC product suite.*
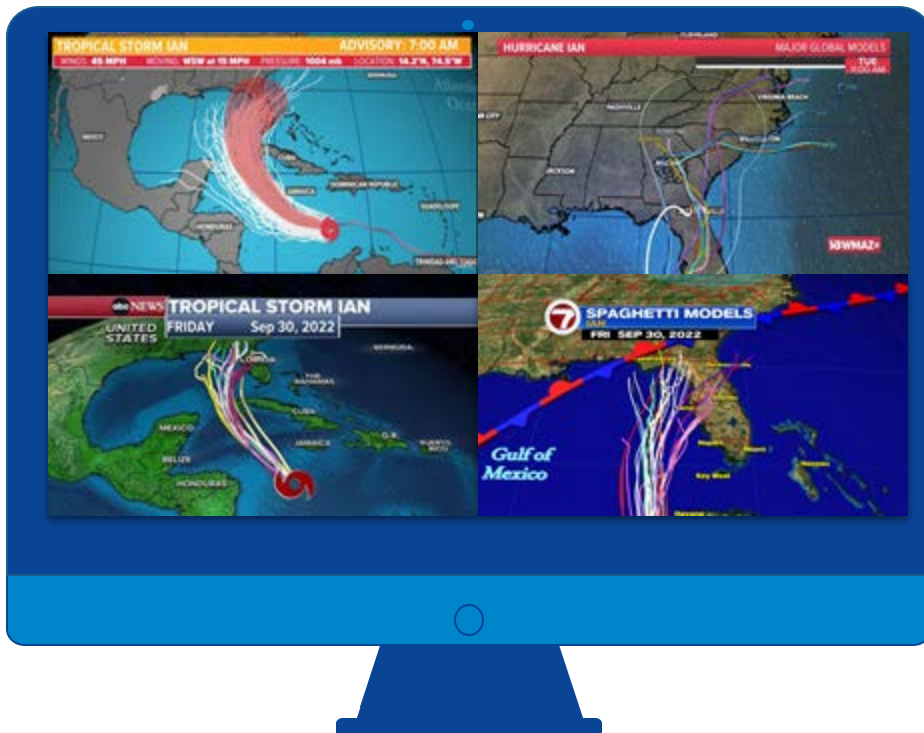
ADDING INFO ABOUT TRACKS & SCENARIOS SHOULD BE PRIORITIZED

Translation Opportunity

Recommendation from Morss: *Develop a new graphical product or interactive service that complements the already-popular NHC Tropical Weather Outlook and Track Forecast Cone that leverages ensemble numerical output to provide additional information about TC tracks and threat scenarios.*
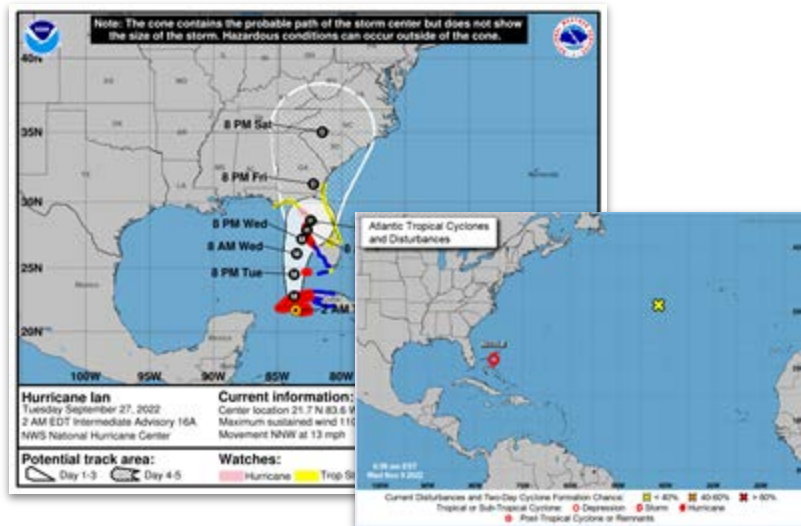
What Could This New Graphical Product Do?

Depict multiple potential TC evolutions using curated model output, accompanied by forecaster annotation or interpretations.

Make the Cone graphic interactive or dynamic with pop up windows that provide explanations about what to expect at a local scale.

Dynamic CATs!

Local & Specific Info

05

Develop an operational center that could analyze longitudinal SBES data and provide **real-time societal insights to guide IDSS messaging** to partners and publics.

Hurricane Survey

USING SBES LONGITUDINAL DATA TO GUIDE REAL-TIME IDSS MESSAGING

Just as meteorological observational data helps NOAA improve weather forecasts, social science data are similarly needed to continue improving forecast communication.

Possible Short-term Applications

These event-based longitudinal social science data will enhance NOAA/NWS' understanding of how evolving tropical cyclone information shape's people's perceptions and behaviors, as well as aid in identifying and prioritizing TC product improvements.

Long-term Vision

*Develop a mechanism to analyze event-based longitudinal social science data in real-time. One proposal is a **Center for Real-Time Societal Insights (CRTSI)** with staff social scientists that could deliver societal insights to inform NWS operations & IDSS.*

International Center?

Poll Everywhere

Which translation opportunity are you most excited about?

A. Adding communication assist text to products.
B. Learning from users how to make products more specific and local.
C. Providing more onset, cessation, and duration timing information.
D. Developing a product that provides scenarios and track information.
E. Being able to analyze social science data in real-time to guide messaging.

¿Cuál es la oportunidad de traducción que más le emociona?

A. Añadir textos de comunicación asistida a los productos.
B. Aprender de los usuarios cómo hacer que los productos sean más específicos y locales.
C. Proveer más información sobre los tiempos de inicio, cese y duración.
D. Desarrollar un producto que proporcione información de escenarios y trayectorias.
E. Ser capaz de analizar datos sobre ciencias sociales en tiempo real para mejorar los mensajes

SCALING THIS APPROACH FOR FUTURE EFFORTS

HOW MIGHT THIS WORK FOR YOUR MET SERVICE? REVISITING GENERALIZABILITY & TRANSFERABILITY

Generalizability: The extent to which the results can be generalized from the research sample to the broader target population. Research results are considered generalizable when the findings can be applied to other contexts & people.

Does the sample represent the population of interest?

Is there a large enough sample to draw broader conclusions?

Will these findings apply to different and/or new situations?

Will these findings apply to other people or populations?

Are there other studies that have similar findings?

WAYS TO SCALE THIS APPROACH

Funding	Population	Location	Team
More projects that maintain a complimentary design.	Larger population; might include larger samples or more representative.	Project elements might cover a different or larger geographic extent.	Implementation teams might be larger; more focus on translation.

Scaling (up arrow / down arrow)

Funding	Population	Location	Team
Less projects that maintain a complimentary design.	Smaller population; might include smaller samples or more representative.	Project elements might cover a different or smaller geographic extent.	Smaller team; should include researchers, practitioners, and translators.

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BEST PRACTICES IF PLANNING TO SCALE OR REPLICATE THIS APPROACH

After seeing the benefits of this approach, our team is actively looking for ways to adapt this process for new supplemental projects on extreme precipitation and fire weather efforts over the coming years.

Start with Operational Challenges

When developing social science research projects, start by understanding critical operational challenges and develop research questions that address those challenges.

Develop Projects with Intentional Overlap

After identifying research questions, build in both complementary and unique elements to each project. This will allow you to build a collective body of research.
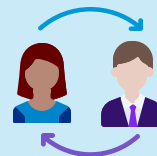
Iterate with Meteorologists

The success of this approach is largely driven by our frequent and purposeful iterations with operational meteorologists. Build in several engagement points to gather feedback.
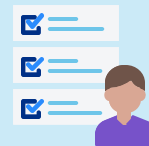
Build SBES Capacity for Translating Findings

Build social science capacity on your team to synthesize and translate findings across all projects to identify cross-cutting themes & develop actionable recommendations.

LINKS TO INDIVIDUAL REPORTS

- There's a Chance of What? Assessing Numeracy Skills of Forecasters, Partners, and Publics to Improve Tropical Cyclone Product Uncertainty, IDSS, and Training

- Minding the Gap: Modernizing the Tropical Cyclone Product Suite by Evaluating NWS Partner Information Needs

    - Part 1: Interviews with Broadcast Meteorologists and Emergency Managers

    - Part 2: Surveys with Broadcast Meteorologists and Emergency Managers

    - Cross-Method Synthesis of Key Findings and Recommendations

- Wait, that Forecast Changed? Assessing How Publics Consume and Process Changing Tropical Cyclone Forecasts Over Time

- Optimizing Tropical Cyclone Information: An National Hurricane Center Web User Experience Study from a Public Perspective