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HFIP and Storm Surge Warnings Social Science Research

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Overview

- Benefits of Improved Hurricane Forecasting
- Hurricane Forecast Improvement Project
- Communicating Hurricane Information
- Warning Decisions: Extreme Weather Events
- Storm Surge Warning Information

Benefits of Improved Hurricane Forecasting

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Objective: explore methods for deriving household values for improved hurricane forecasts

- **Evacuation decision making**
- **Non-market valuation approach**
- **Small sample implementation**
- **Benefit estimation**

Papers from this work

- *Weather and Forecasting*
- *Economic Letters* – under revision

Ex: conjoint analysis valuation question

34 **Please indicate which Program, if you had to choose, you would prefer.**

	Accuracy of Current Forecasts	Program C ⮟	Program D ⮟
Time of expected landfall	Now accurate to within 8 hours	4 hours	No change
Maximum wind speed	Now accurate to within 20 miles per hour	No change	15 hours
Projected landfall	Now accurate to within 100 miles	80 miles	65 miles
Expected storm surge	Now accurate to within 8 feet above sea level	4 feet	No change
Increase in Annual Cost to Your Household		$12 per year	$24 per year
I would prefer (please put check mark in box indicating your preferred Program)		**Program C** ☐	**Program D** ☐

35 **Would you prefer to keep forecast quality the way it is now and pay no more in taxes or stay with the Program you indicated above?**

☐		Keep forecast quality the way it is now and pay no more in taxes.
☐		Undertake the Program chosen above and pay the amount indicated.

WTP Calculation: Improve Baseline to Intermediate on All Attributes

Attribute	Baseline (all 48 hours in advance)	Intermediate Improvement	Diff.	Marg. WTP	WTP
Time of expected landfall	± 8 hours	± 6 hours	2	$2.18	$4.36
Maximum wind speed	± 20 mph	± 15 mph	5	$0.26	$1.30
Projected location of landfall	± 100 miles	± 80 miles	20	$0.23	$4.60
Expected storm surge	±8’ of height above sea level	± 6’ of height above sea level	2	$2.04	$4.08
				Total WTP	$14.34

Hurricane Forecast Improvement Project Socio-Economic Impact Assessment (HFIP-SEIA)

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- **10-year program – multiple team research areas**
  - About $20m/yr for 10 years – total ~$200 million
  - Current social science – about $150k

- **HFIP Metrics**

- Reduce average track error by 50% for Days 1 through 5.
- Reduce average intensity error by 50% for Days 1 through 5.
- Increase the probability of detection (POD) for rapid intensity change to 90% at Day 1 decreasing linearly to 60% at Day 5, and decrease the false alarm ratio (FAR) for rapid intensity change to 10% for Day 1 increasing linearly to 30% at Day 5.
- Extend the lead time for hurricane forecasts out to Day 7

HFIP-SEIA

- Socio-Economic Impacts Assessment
  - Assessment of Emergency Managers - Betty Morrow
    - in-depth focused interviews
    - emergency managers
    - stakeholder communities (hospitals / transport / etc)
  - Household valuation – Jeff Lazo
    - non-market stated choice assessment
    - adapted *Benefits of Improved Hurricane Forecasting*
    - attribute set from HFIP
    - 400 sample across the vulnerable region

HFIP-SEIA

- **Outcomes**
  - Better understanding of need for improved hurricane forecast and warning information
  - Estimate of economic value of improved hurricane forecast and warning information
  - Potential for benefit-cost analysis of HFIP program

- **Need to fully integrate social sciences now!**
  - Make project outcomes meaningful and usable
  - How to communicate with broadcasters, emergency managers, stakeholders
  - Understanding uses of forecasts in decision making – e.g., evacuations
  - Continued assessment of value of improvements
    - Other sectors and users

Storm Surge

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Tropical Cyclone Public Advisory

NWS TPC/NATIONAL HURRICANE CENTER MIAMI FL ...HURRICANE WARNINGS ISSUED FOR PORTIONS OF THE TEXAS COAST… AT 1000 AM CDT...1500 UTC...A HURRICANE WARNING HAS BEEN ISSUED FOR THE TEXAS COAST FROM… AT 1000 AM CDT...1500 UTC...THE TROPICAL STORM WARNING HAS BEEN DISCONTINUED... FOR STORM INFORMATION SPECIFIC TO YOUR AREA...INCLUDING POSSIBLE INLAND WATCHES AND WARNINGS...PLEASE MONITOR PRODUCTS ISSUED BY YOUR LOCAL WEATHER OFFICE.
AT 1000 AM CDT...1500 UTC...THE CENTER OF HURRICANE ROBERTO WAS LOCATED NEAR… ROBERTO IS MOVING TOWARD... MAXIMUM SUSTAINED WINDS HAVE INCREASED TO NEAR 120 MPH...195 KM/HR...WITH HIGHER GUSTS. ROBERTO IS A DANGEROUS CATEGORY THREE HURRICANE ON THE SAFFIR-SIMPSON SCALE.
HURRICANE FORCE WINDS EXTEND OUTWARD UP TO 50 MILES…
THE ESTIMATED MINIMUM CENTRAL PRESSURE IS 960 MB...28.35 INCHES.
STORM SURGE WILL RAISE WATER LEVELS 10 TO 15 FEET ABOVE GROUND LEVEL ALONG THE COAST WITH LARGE AND DANGEROUS BATTERING WAVE NEAR AND TO THE RIGHT OF WHERE ROBERTO MAKES LANDFALL. THE SURGE COULD PENETRATE AS MUCH AS 40 MILES INLAND FROM THE SHORE WITH DEPTHS GENERALLY DECREASING AS THE WATER MOVES INLAND. STORM TOTAL RAINFALL ACCUMULATIONS OF 10 TO 15 INCHES ARE POSSIBLE OVER COASTAL TEXAS AND SOUTHWESTERN LOUSIANA TODAY AND TOMORROW.

Some social science-related questions:

- Do people read the storm surge information?
- How do they interpret surge info? What does it mean to them?
- How do people use storm surge information?
- How does it compare to other info – especially the hurricane category level?
- Is the surge information timely?
- What other factors affect the use of surge information? Experience? Credibility? Family?

Storm Surge

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Objectives

- Explore and assess the public's awareness and understanding, or lack thereof, concerning storm surge and currently available storm surge information, regardless of the meteorological cause.

- Assess need for new storm surge informational approaches to improve the communication and decision-making with respect to extratropical and tropical cyclone storm surge risk

Storm Surge – Methods

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Methods

- Literature Review
- Emergency Manager Interviews
- Public Focus Groups
- Public Survey(s)
  - Tropical (with HFIP survey)
  - Extratropical / tropical

Storm Surge – Outcomes

Dissemination of results

- **Reports to sponsors – NOAA**
- **Stakeholder meetings**
- **Peer review publications**
- **Research-to-operations – new warning product?**
- **Conferences / workshops (e.g. NHC 2011)**

Researchers	Advisors / Collaborators
Ann Bostrom – *Risk Communication*	*David Bernard*
Julie Demuth – *Meteorology / Communication*	*Frank Billingsley*
Gina Eosco – *Communication*	*Luis Carrera*
Somer Erickson – *Emergency Management*	*Christopher Davis*
Brandi Gilbert – *Sociology*	*Mark DeMaria*
Hugh Gladwin – *Sociology*	*Kelvin Droegemeier*
Jennifer Hudson – *Public Administration*	*Mary Erikson*
Matthew Jensen – *Mgmt. Information Systems*	*Jesse Feyen*
Jeff Lazo – *Economics*	*Gene Hafele*
Claude Miller – *Communication*	*Tim Heller*
Betty Morrow – *Sociology*	*Greg Holland*
Rebecca Morss – *Meteorology*	*Keelin Kuipers*
Dan O'Hair – *Communication*	*Chuck Lanza*
Kathleen Tierney – *Sociology*	*Max Mayfield*
Jennifer Thacher – *Economics*	*Bryan Norcross*
Don Waldman – *Economics*	*Frank Redding*
	Jamie Rhome
	Jennifer Sprague