What Defines a Severe Thunderstorm?

Perceptions from a Cross Section of Residents of the Lower Rio Grande Valley of South Texas

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The Lower Rio Grande Valley of Texas

- Population (US): 1,357,910
- Hispanic: 91%
- Gender: Male – 48.7%; Female – 51.3%
- Spanish Spoken at Home: 80.4%
- English “Not Spoken Well”: 31.4%

Source: US Census, American Community Survey 2016 Update
Survey “Drivers”

- Informal surveys of multiple publics, including hundreds of prospective Skywarn® spotters, indicated minimal knowledge of NWS severe thunderstorm definition in the Rio Grande Valley.
- The vast majority of responses when asked “what defines a severe thunderstorm” were heavy rain/flooding and lightning.
- This formal survey aimed to prove/disprove the hypothesis that heavy rain/flooding and lightning define a severe thunderstorm.
Survey Development/Methodology

- Semi-structured interview (questionnaire) created by authors (October 2017)
- Specifically designed to be “open to interpretation” with few prompts/probes
- “Person on the Street” interviews conducted during peak of the holiday shopping season (December 2017)
- Permission granted to conduct brief, 5 to 7 minute interviews, by selected locations including two Storm Ready Communities
- Interviewer attempted to reach a fair cross-section of Rio Grande Valley residents to minimize bias
Interview Locations

Rio Grande Valley Survey Locations
December 21 to 30, 2017

n=33
Survey Demographic Baseline

- Completed Interviews: 33
  - Declined Interviews: About 20
  - Out of Area/Mexican Nationals: About 25
- Gender: 18 male (55%), 15 female (45%)
- Ethnicity: 29 Hispanic (88%), 4 White (12%)
- Primary Language Spoken:
  - English – 21 (64%)
  - Spanish – 10 (30%)
  - Both Equally – 2 (6%)
- Age (n=32)
  - Range: 16 to 61 years
  - Mean: 44 years
Warning Reception/Frequency Concept

Question was asked of home location, not interview location.

Open ended: These were the only answers provided. List included 15 total options.
The Meaning of a Severe Thunderstorm

n=33
Elements of a Severe Thunderstorm

Weather Condition - # of Responses

- Wind: 21 responses
- Hail: 11 responses
- Lightning: 23 responses
- Heavy Rain: 32 responses
- Tornado: 1 response
Highest Ranked Elements of a Severe Thunderstorm

- Heavy Rain: 20
- Lightning: 7
- Wind: 7
- Hail: 4
- Tornado: 0

Legend:
- First
- Second
- Third
- Fourth
Note:

- Quoted Rainfall Amounts Ranged from 2 to 10 inches
- Water Depth ranged from 6 inches to 2+ feet
Sense of Lightning in a Severe Thunderstorm

frequent, continuous, moderate, close, lot
people, tons, within, strong
live, lines, strikes, stay, outages
miles, c-g, poles, power, damaged

n=20
(3 not probed)
Sense of Wind in a Severe Thunderstorm

Wind Response (n=20; one unprobed)

- 30 mph
- 35 mph
- 40 mph
- 45 mph
- 50 mph
- 60 mph
- 70-80 mph
- 90 mph
- Trees/Structural Damage

- 30 mph has the highest response with a value of 7.
- Other wind speeds have lower responses, with trees/structural damage having the next highest values.
Sense of Hail in a Severe Thunderstorm

Hail Response (n=10; one unprobed)

- Dime
- Quarter
- Golfball
Danger Perception and Affect on Daily Routine (1-10 Rating Scale)

n=33

- Heavy Rain
- Pea Hail
- 50 mph
- Lightning
- Tornado
- Quarter Hail
- 60 mph
- Golfball Hail

Danger Routine
Would They Liked to Be Warned For...

- Heavy Rain: 97% (n=32)
- Tornado: 100% (n=32)
- Pea Sized Hail: 68% (n=31)
- Quarter Sized Hail: 100% (n=32)
- 50 mph Wind: 97% (n=31)
- 60 mph Wind: 97% (n=31)
- Frequent Lightning: 87% (n=31)
- Golfball sized Hail: 100% (n=32)

“Warned” was defined as an alert message on television, smart phone, radio, etc.
Frequency of NWS-Defined Severe Thunderstorms

- Frequency of 2 per year, 5 per year, and 3 per year of NWS criteria-defined severe thunderstorms closely matched the perceived frequency of warning issuances.
- At 23.2 events/year for entire Rio Grande Valley (1996-2016), 2 to 5 events/year for individual communities may be reasonable perception.
Survey Conclusions and Next Steps

• Survey revealed what hypothesis suspected: Rio Grande Valley residents perceive a “Severe” Thunderstorm to contain heavy rain and frequent lightning

• Sense of “Severe” wind was below actual NWS criteria; sense of “Severe” hail was above NWS criteria

• While there was little difference between “danger” and “routine” perception, the highest averages were more in line with NWS defined wind and hail criteria

• With sole exception of pea sized hail, nearly all respondents desired warning messages for conditions below NWS severe or flood criteria

• Next steps: Conduct simple statistical tests (Student’s-t, etc) on some of these data
Questions to Ponder

• Are results related to event frequency? In past twenty years, number of NWS-defined severe weather events in the Rio Grande Valley is less than 3% of those in North Texas; one third of those in North Texas when normalized for population.

• Would matching the message to the hazard reduce confusion on defining a severe thunderstorm (i.e. “golfball sized hail” warning)?

• If local perception of a severe thunderstorm includes conditions that are very likely under a warning (blinding rain), are warnings actually more effective despite NWS not officially verifying on sub-severe criteria?

• Would additional “person on the street” interviews across the nation provide a stronger baseline of how wide cross-sections of residents understand NWS warning messaging?
Questions?

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