4.1A IMPROVING WEATHER COMMUNICATION IN AREAS OF HIGH SOCIOECONOMIC VULNERABILITY: SPANISH LANGUAGE INFORMATION FOR THE LOWER RIO GRANDE VALLEY OF TEXAS

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1. INTRODUCTION

The Lower Rio Grande Valley of Deep South Texas, comprised of Cameron, Hidalgo, Starr and Willacy counties is home to two of the most impoverished metropolitan areas in the United States (U.S. Census Bureau, 2015). This exceptional poverty is juxtaposed with regular threats from hurricanes, severe thunderstorms producing damaging winds, very large hail and tornadoes, flash floods, and occasional main stem river flooding of the Rio Grande River.

The poverty of the region makes it particularly challenging for the National Weather Service (NWS) and the remainder of the weather enterprise to be effective in encouraging weather preparedness and to obtain a high rate of compliance with protective action recommendations in weather emergencies.

As a result, substantial efforts have been undertaken by the NWS in Brownsville to positively impact weather preparedness and response in the community. These efforts include wide reaching bi-lingual outreach campaigns, bi-lingual warning products, and a bi-lingual presence on traditional and social media. Preliminary results suggest the campaign has been successful in increasing the weather preparedness and response of the region.

2. SOCIOECONOMIC AND METEOROLOGICAL MAKEUP OF THE REGION

Out of over 1.3 million residents in the Lower Rio Grande Valley, 37% live in poverty. 48% of all children live in homes with income below the poverty line. The median per capita income of $14,500 is roughly half of the U.S. average. Only 64% of residents speak English "very well" and 37% lack a high school diploma. Around 85% of the region's population speaks Spanish. Roughly 91% of the area's population is of Hispanic or Latino origin (U.S. Census 2014).

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Storm surveys in the area regularly encounter substandard construction practices, with total structural failure occurring in winds as low as 50 to 70 mph (National Weather Service 2015). These structures are most frequently found in *colonias* - settlements of tightly clustered homes that sometimes lack basic services. Homes in these colonias often are aging travel trailers or single-wide mobile homes. These homes are normally not tied down and their owners have little to no means to better prepare their home or family for a weather emergency, or evacuate in the event of a hurricane (Rivera 2014).

This exceptional poverty is juxtaposed with numerous weather-related threats to the region. Since 1800, the area has experienced a hurricane landfall recurrence interval of one storm every 14.2 years (Goldsmith, 2015). Severe thunderstorms also produce damaging winds, flash flooding, destructive hail and tornadoes in the area several times each year. The poor construction practices in the poorest neighborhoods often exacerbate the damage of otherwise marginally severe storms (National Weather Service 2015). Thunderstorms are most frequent in summer months when deep tropical moisture and weak steering currents often lead to slow moving, efficient rainfall producing thunderstorms which promote flash flooding (Gibbs and Butts 2015).

3. SOCIAL SCIENCE PERSPECTIVE

Individuals of lower social and economic statuses experience a differential vulnerability in disasters. They often live in structures and areas that are more directly exposed to threats, and less able to withstand them. Once impacted, they are also less able to recover and return to their pre-event quality of life (Fothergill and Peek 2003). Financially disadvantaged individuals also lose more, on average, in disasters, both in terms of death and injury, and damage to the property they own. This increased loss is normally due to their inability to adequately prepare or evacuate (McCoy and Dash, 2013).

The rate and depth of poverty in the Lower Rio Grande Valley makes it more likely that area children will not finish high school, and when they do attend

school, many are significantly underfunded and understaffed (Shanahan et al. 1998). Societal and engineering efforts to mitigate community vulnerability, such as flood walls, or drainage improvements are often geared to help the most powerful, rather than the most at risk (Freudenberg et al 2009). This puts a large socioeconomic weight on those attempting to not only better themselves financially, but also find resources and means to better protect themselves and their family from, and respond to, weather emergencies.

The vulnerability of the poorest communities often leads to very intertwined individual families and strong relationships within the immediate community but increasing resentment towards much of the rest of society (Hilhorst and Bankoff 2004). This can make it particularly difficult for outsiders to influence disempowered populations (Boyce 2000). For example, firefighters and police officers going door to door has long been considered the most effective method for encouraging citizens to evacuate (Dash and Gladwin 2007), but disenfranchised groups may not see firefighters or police officers, or other authority figures as credible or trustworthy (Donner and Rodriguez 2008).

Traditionally, the Hispanic culture will make decisions within close-knit family and social circles. Official information sources are often not taken into account, in many cases due to language barriers (Ruin et al 2009). A text warning, distributed only in English is unlikely to be well-understood by a Spanish speaking recipient, making them much more likely to either ignore the warning or interpret it incorrectly (Aguirre 1998).

4. EFFORTS OF THE NATIONAL WEATHER SERVICE

The NWS office in Brownsville, Texas has engaged in comprehensive efforts to reduce the overall weather-related vulnerability of the Lower Rio Grande Valley. These efforts are designed to increase community engagement and trust, empower citizens to take cost-effective mitigation and preparedness action, and respond more effectively once a weather emergency becomes imminent.

4.1 *Engaging the Community*

NWS Brownsville conducts or participates in over 100 outreach events each year, dating back to 2012 and continuing through the present. Some of these events target the general community, such as the bi-annual Weather Festival, which draws between 500 and 1,000 visitors to the office each year to learn about the NWS, weather forecasting, and weather safety. The office also conducts numerous hurricane preparedness and safety talks, and has increased the number of interviews it conducts with Spanish-language TV, radio stations and newspapers in the region.

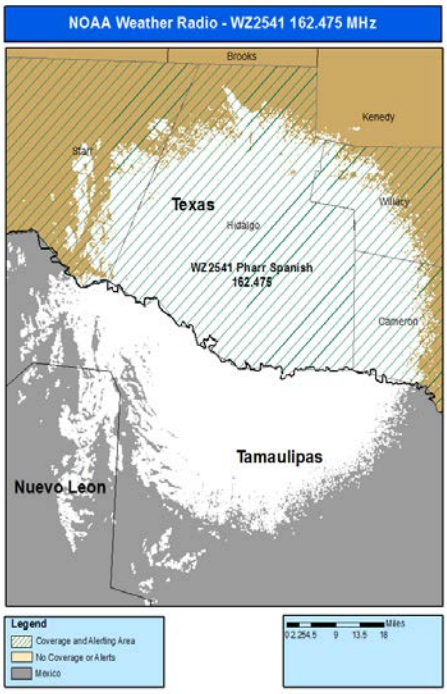
Many of the events specifically target the highest vulnerability populations. These include talks, town-halls and Q&A sessions at *colonia* community centers, the focal points of some of the poorest neighborhoods in the Lower Rio Grande Valley. Spanish-speaking team members also co-host a monthly radio show on weather safety on a highly-rated Spanish language radio network in the region. The office attends numerous school talks, often in impoverished neighborhoods that highlight weather safety, as well as career prospects in Science, Technology, Engineering, and Mathematics fields that encourage and empower students to not only be weather-ready, but highlight the importance of staying in school which increases the prospects of well-paying jobs that can result from furthering their education. The availability of public transport to aid evacuation during a storm, and how to register for that assistance is highlighted, as well as educating potential evacuees that immigration status will not be considered before public transportation is provided in an emergency evacuation.

NWS Brownsville forecaster Maria Torres co-hosts a Spanish language radio show in Edinburg, TX.

The office has also significantly increased its bi-lingual presence on social media, most frequently Facebook and Twitter. Posts of critical warning information are now written almost exclusively in both English and Spanish. Recorded video briefings, particularly prior to significant events, are also presented in English and Spanish. Questions written to the office in Spanish are answered in Spanish. The offices tropical cyclone emergency plan includes 24/7 Spanish-language coverage for decision support services and media interviews.

4.2 *Speaking the Language*

As part of the community engagement strategy, representatives from NWS Brownsville regularly attend meetings of the the Lower Rio Grande Valley Development Council. This budding partnership led to the council obtaining grant funding for two new Spanish-language NOAA All-Hazards Weather Radio Stations. These stations went on the air in 2015 and their signals cover virtually all of the area's population.



Signal map for NOAA Weather Radio Station WZS-541, with a transmitter located in Pharr, Texas

The stations also came equipped with translation software (SYSTRAN). This software takes English-language text-products generated by NWS forecasters and converts them to Spanish, prior to their broadcast on NOAA Weather Radio. The software allows for quality control and adjustment of the translations by Spanish-speaking team members. This capability allows for changes specific to local and regional dialects as well as ensuring words commonly used in weather forecasts and warnings translate appropriately.

The final translation is also available to the office in real time. This allows forecasters to not only quality-control the translation, but non-Spanish speakers can take the output of the translator and transmit the content via social media. This ensures that warning information is always available to be distributed via social media, or other channels, even if the forecast team on shift is not bi-lingual. Nearly all of the staff can provide at least rudimentary answers to weather-related questions that develop on social media, where translating an entire warning or forecast would be quite difficult for those not proficient in the language.

The Hurricane Local Statement product, used by the NWS to transmit tropical storm and hurricane watches and warnings as well as critical threat and impact information, cannot be run through this software. Manually translating this product would be time and resource prohibitive. To solve this problem, the office modified the existing code that runs through the NWS Graphical Forecast Editor text formatter, to produce a Spanish language version of the Hurricane Local Statement. Output was developed by existing local and national Spanish-language NWS employees with quality-control contributions from local Spanish-language media and academic partners. The product is not a translation, but runs directly from the gridded forecast information, just as English language products do. This allows the office to develop and transmit both English and Spanish language products at exactly the same time (Goldsmith et al. 2013).

5. RESULTS AND FUTURE WORK

The office has experienced a significant increase in engagement through its social media channels since the deliberate effort to increase Spanish-language communication began. Spanish-language or-bi-lingual posts frequently receive around an order of magnitude more engagement and reach than English-only posts. An example, on August 27, 2014 the office produced virtually identical briefings highlighting an upcoming heavy rainfall event. After a few hours the English post had reached around 3,000 users, with 295 likes, and 27 shares, while the Spanish post had reached 32,000 users, with 6,000 likes and 852 shares. This post alone provided a significant platform to not only inform of an upcoming weather hazard, but increase trust and credibility with the Spanish-speaking population, and engender an increase in the rate at which official sources are trusted and used for warning information.

The number of requests for community talks and outreach events continues to go up, as does the attendance and participation in those events. Local media and academic partners and emergency managers have engaged in an effort to raise awareness about the availability and affordability of Spanish-language NOAA Weather Radio receivers and broadcasts.

These efforts position the NWS to embed themselves within the close-knit circle in which decisions are made amongst its poorest population. This will allow the organization to comprehensively educate and empower the community to mitigate against threat, and effectively prepare and respond to weather emergencies.

Moving forward, there is a significant need to expand a national and regional NWS effort to increase the availability of Spanish-language forecasts and warnings. Vulnerability assessments using our evolving understanding of sociology and its role in increasing natural hazard vulnerability should be performed and engagement efforts should be directed at the nation's most vulnerable populations to truly build a Weather Ready Nation (National Weather Service, 2013)

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