7.4: THE USE OF INNOVATIVE COMMUNICATIONS TO ENHANCE WEATHER INFORMATION FOR A RARE WINTER STORM IN SOUTH TEXAS

Barry S. Goldsmith*
NOAA/National Weather Service Forecast Office
Brownsville, Texas, USA
And
Mike Buchanan, Scott Cordero, and John Metz
NOAA/National Weather Service Forecast Office
Corpus Christi, Texas, USA

1. INTRODUCTION

From late on 1 February to 4 February, 2011, significant winter weather impacted nearly 2 million people from the Coastal Bend to the Rio Grande Valley of South Texas (*Figure 1*), a region known for warm winters. Prolonged very cold temperatures culminated with a period of freezing rain, which covered exposed surfaces with up to 3.8 cm (1.5 in.) of ice. The widespread icing was the first such event for South Texas since February 1989, and required a much higher level of decision support due to increased population and impacted infrastructure, such as roads, businesses, schools, and health facilities. The National Weather Service (NWS) offices in Corpus Christi and Brownsville used innovative methods and trusted relationships with decision makers to communicate the threat to partners in emergency management, public health, public safety, transportation, education, and the media several days in advance. Early warning resulted in decisions that likely saved lives and mitigated significant economic loss.

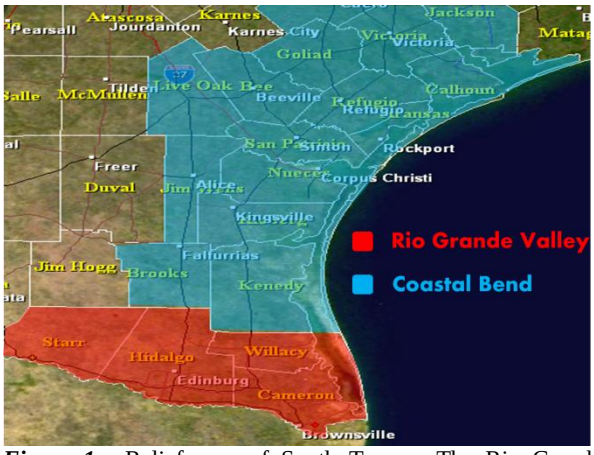

Figure 1. Relief map of South Texas. The Rio Grande Valley and Coastal Bend regions are shaded in red and cyan, respectively.

* *Corresponding author address: Barry S. Goldsmith, NOAA/National Weather Service, 20 S. Vermillion Rd, Brownsville, TX 78521; e-mail: barry.goldsmith@noaa.gov .*

2. WINTER STORM OF 3-4 FEBRUARY 2011

A strong cold front swept across South Texas on 1 February, followed by a sprawling arctic high pressure ridge (*Figure 2*), which spread from western Nebraska and eastern Wyoming southward through Texas. By daybreak on 2 February, temperatures ranged from -5°C(23°F) at Beeville to 1°C(34°F) at McAllen. Temperatures would remain near freezing (0°C) through the daylight hours of 2 February under a steel-gray overcast, dropping below 0°C(32°F) in all areas by 06 UTC (midnight CST) on 3 February.

The approach of an upper level disturbance lifted a limited amount of low level moisture into light precipitation, starting around 1330 UTC (730 AM CST) 3 February near the Lower Rio Grande Valley coast and spread north and west through the day and overnight, eventually covering all of South Texas with a coating of ice. The freezing drizzle continued for up to 24 hours in some locations. Temperatures remained at or below 0°C for at least 30 hours in South Texas and up to 60 hours in some locations between 1 February and 4 February. Ice accretion ranged from 1 cm (0.375 in.) across the Coastal Bend near Corpus Christi, to 3.8 cm (1.5 in.) in Brownsville (*Figure 3*). Most of the ice accumulated on exposed surfaces, including elevated roadways, bridges, power lines, trees, and grasses.

The long duration freeze and icing caused an estimated $11 million to insured crops across the Rio Grande Valley, particularly to sugar cane. Ornamental, unprotected tropical plants were heavily damaged. Rolling blackouts across the state of Texas were implemented through the arctic outbreak and frozen precipitation to prevent long term suffering. Power outages peaked at 65,000 residences across the Rio Grande Valley. There were nearly 200 reported vehicle accidents on state and federal highways in the Rio Grande Valley, another 200 reported around Corpus Christi, and dozens more near Kingsville and Laredo. Across the region, dozens of persons were admitted to local hospitals with injuries from the accidents; there were two fatalities from vehicle rollovers. Dozens more persons suffered minor injuries from slips and falls on the ice.

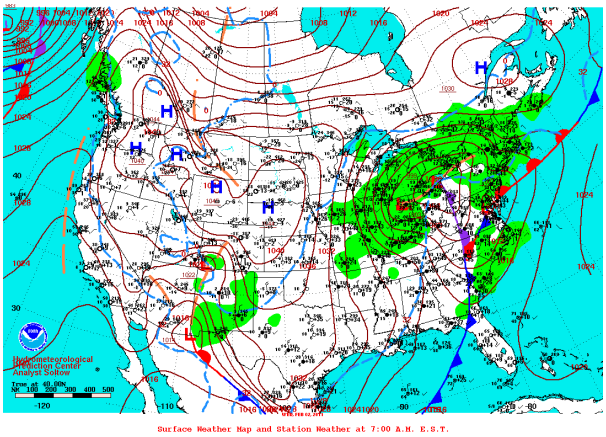

Figure 2. Surface weather map of pressure systems, fronts, precipitation, and conditions at 7 AM 2 February 2011.

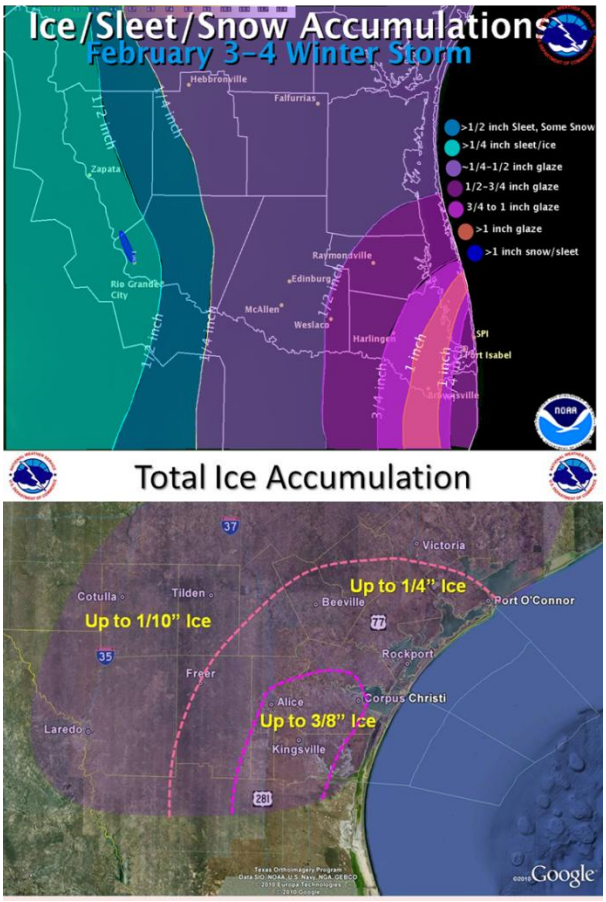

Figure 3. Measured and estimated ice accretion across the Rio Grande Valley (top) and Coastal Bend (bottom) from 3 February to 4 February 2011.

3. INNOVATIVE COMMUNICATION

Decision support prior to life threatening weather is nothing new. Significant events, such as the 1944 Florida Peninsula Hurricane (Simpson, et. al., 2003), Hurricane Beulah in 1967, and the Superstorm of March 12-14, 1993 (U.S. Department of Commerce, 1994) were accurately predicted with sufficient advance notice, amplified by trusted local officials through newspaper, radio, and television. Consistent messages targeted to local populations likely reduced impacts to people, property, and the economy. Recent decades have seen exponential growth and mobility of the American population (Hobbs and Stoops, 2002), and the number of information sources available to this population (Bohn and Short, 2009). Common wisdom suggests more sources would enhance community preparedness. The opposite may be true: A mobile, growing society with thousands of choices for information on numerous platforms may be less prepared; it's easy to avoid local information – including emergencies – by simply tuning out.

To ensure South Texas communities would be prepared well ahead of the ice storm, NWS offices in Corpus Christi and Brownsville used an array of Internet-based communication tools available to staff and decision makers in public safety, public health, education, transportation, and the media to provide a continuous stream of weather information, from the planning stages through the entire event. Decision makers were notified up to a week prior to the event with "heads-up" email messages describing the expectation for a long duration freeze, dangerous and potentially life-threatening wind chill, and increasing confidence for wintry precipitation beginning on 3 February. The email notices were supplemented by the following communications at each office:

- Created daily webinars, starting on 31 January and continuing through 4 February
- Provided winter weather safety tips and weather graphics of current conditions and forecast hazards on front page of each website (*Figure 4*)
- Updated a Web log (blog). Information highlighted breaking news: Traffic accident and road closure reports, power outages, ice accretion reports, rapid forecast updates, safety alerts, special graphics, and photographs (*Figure 5*).

NWS Corpus Christi added the following innovations:

- Created voice, text, and graphic "multi-media" briefings in English and Spanish (*Figure 6*), recorded and uploaded to YouTube™ and linked from the home page for wide distribution
- Sent hourly email updates to key emergency management partners
- Monitored social media in English and Spanish using HootSuite™. This included transmissions from Nuevo Laredo, Mexico.
- Participated as a subject matter expert in the *Victoria Advocate* (newspaper) chat room

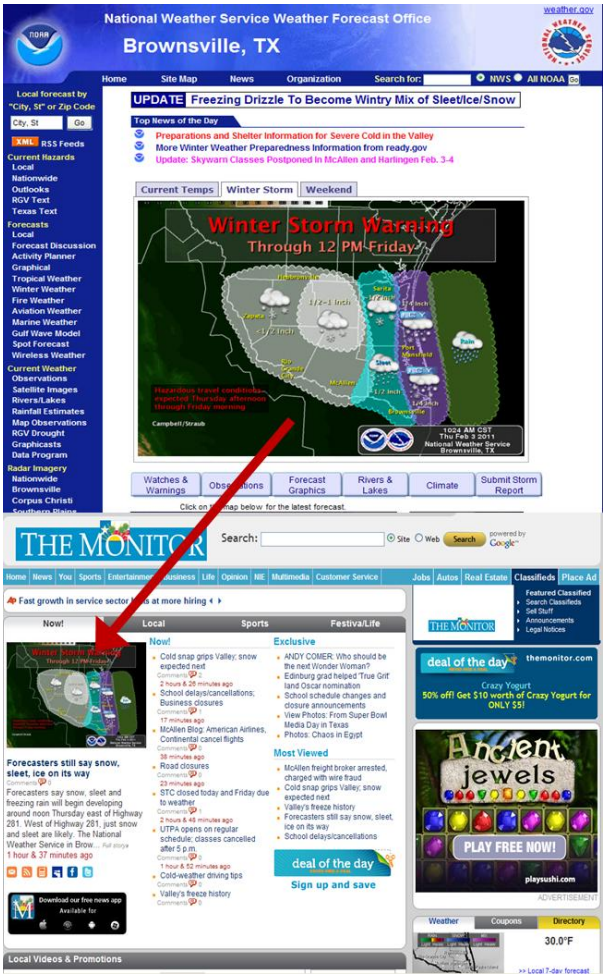

Figure 4. Winter Storm weather story graphic from the NWS Brownsville/Rio Grande Office (top). The same graphic (bottom, at arrow head) was used by the *McAllen Monitor*, along with information provided via NWS e-mail, to reach a large online audience.

NWS Brownsville/Rio Grande Valley added the following innovations:

- Local television and newspaper web sites shared NWS graphics, and snippets from email correspondence (*Figure 4*)
- Received hourly updates of road closures from Texas Department of Transportation and included the reports in the winter weather blog.

Traditional communications were also used by each office for the event and included official outlook, watch, warning, and advisory text products. Public Information Statements began on 30 January, followed by Freeze Watches/Warnings, and Winter Weather Watches, Warnings, and Advisories as the event approached. A *Local Area Emergency* (National Weather Service, 2010) was issued by the City of Corpus Christi Department of Emergency Management to heighten awareness for life threatening road conditions during the peak of the storm. NWS Corpus Christi relayed the message (*Figure 7*) through the Emergency Alert System, ensuring wide distribution to the general public. Dozens of telephone, radio, and television interviews were conducted. Local Storm Reports (LSRs) were issued in near real-time to update primary media partners on icing conditions, in case innovative communications failed or were not available.

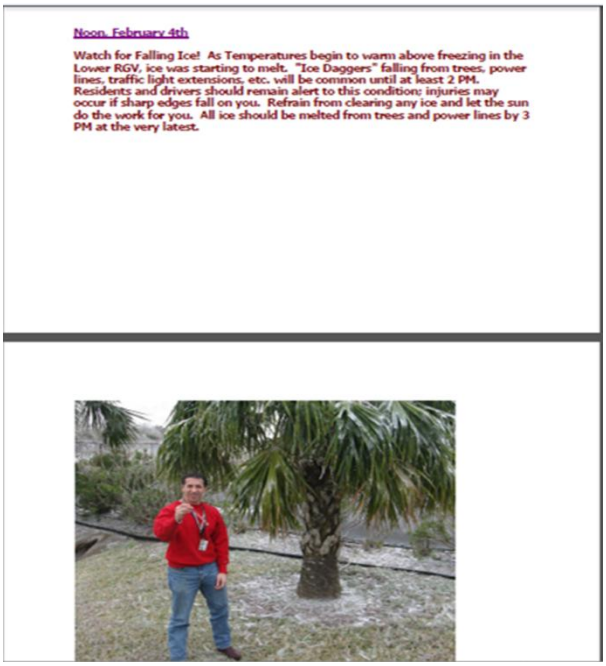

Figure 5. Winter weather blog entry from NWS Brownsville, 1800 UGC (12 noon), 4 February 2011. Top: Safety instructions were provided for falling ice "daggers". Bottom: The author holds an ice "dagger" outside of the office.

Figure 6. Spanish language graphic indicating potential ice accretion and snow accumulation, used to brief Spanish language media partners and posted as part of a multimedia briefing (voice, images, text) to YouTube™.

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BULLETIN - EAS ACTIVATION REQUESTED
LOCAL AREA EMERGENCY
TEXAS EMERGENCY MANAGEMENT AGENCY CORPUS CHRISTI TEXAS
RELAYED BY NATIONAL WEATHER SERVICE CORPUS CHRISTI TX
843 PM CST THU FEB 3 2011

THE FOLLOWING MESSAGE IS TRANSMITTED AT THE REQUEST OF THE CITY OF
CORPUS CHRISTI EMERGENCY MANAGEMENT.

DUE TO ICING AND NUMEROUS MULTI-VEHICLE ACCIDENTS ALL MAJOR
FREEWAY SYSTEMS IN THE CITY OF CORPUS CHRISTI ARE BEING CLOSED.
THIS INCLUDES INTERSTATE 37...STATE HIGHWAY 286 (CROSSTOWN
EXPRESSWAY)...AND STATE HIGHWAY 358 (SOUTH PADRE ISLAND DRIVE)...
STATE HIGHWAY 181...THE HARBOR BRIDGE...AND THE JFK CAUSEWAY.

THIS IS A DANGEROUS SITUATION. ALL CITIZENS ARE ENCOURAGED TO STAY
OFF THE STREETS IF AT ALL POSSIBLE.
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Figure 7. Local Area Emergency text information, issued by the City of Corpus Christi, TX, Emergency Management Office and relayed by NWS Corpus Christi.

4. IMPACT REDUCTION

Prior to the recent emphasis on weather decision support services, the process for meeting the NWS stated mission of "providing…weather warnings…for the protection of life and property and the enhancement of the national economy" at the local level was predominantly a one-way street driven by government meteorologists issuing ALL CAPS text products in a fairly technical language, often assuming that decision makers and other listeners and readers would be able to comprehend the message to carry out their missions in ample time to protect life and property in their communities. Metrics used to define the effectiveness of warning texts included lead time, calculated solely on the time the text was issued to the time the first verifying data were observed by trained weather spotters or other trusted observers.

A meteorologist may consider a lead time of 12 to 18 hours for a significant winter weather event to be sufficient. To the community, that same lead time may be perceived as insufficient. The time required to bring in additional staff and equipment to prepare roads for ice and snow, prepare public utilities for potential power outages, and cancel early morning school bus runs can be longer than 12 hours. Infrastructure preparation, public comprehension and preparedness actions, and overall awareness of the threat are critical to a successful outcome for society.

New tools, techniques, and trusted relationships are being implemented throughout the NWS to improve real-world communication well before the first snowflake falls, the first tidal surge arrives, or the explosive growth wildfire is sparked. Objective data and anecdotal evidence from South Texas decision makers involved with the 1-4 February 2011 winter weather suggested the NWS focus on advance communication of potential weather hazards, well beyond the traditional watch/warning "lead time", paid dividends and saved life, property, and money.

Independent school district officials used webinar and email information from NWS Brownsville/Rio Grande Valley to close school the night before the arrival of glaze ice in the Cameron and Willacy County on 3 February. Officials in Hidalgo County elected to hold classes during the morning of 3 February, with plans ready for staggered early dismissal based on the forecast arrival of icing later in the day and through continuous contact with staff early in the morning. Public safety and public works personnel were able to treat and close roads a day before glazing began. Hospitals were staffed in advance to handle additional patients injured in vehicle accidents or from slipping. Airports and sea ports from the Rio Grande Valley to the Coastal Bend prepared for rare de-icing, and moved aircraft and other ice sensitive equipment indoors prior to the onset of freezing rain.

There were nearly 200 vehicle accidents, dozens of accident related injuries, and at least one driving fatality on 3 February across the Rio Grande Valley. Objective data and anecdotal evidence suggests those numbers would have been substantially higher had the Rio Grande Valley not been effectively shut down for commerce and education – in part from advance notification through NWS decision support services.

Early February traffic volume across the Rio Grande Valley is among the highest of any time during the year. Local travelers, seasonal residents, and trans-migrants combine for more than 100,000 vehicles on elevated highways and interchanges per day. The Annual Average Daily Traffic (U.S. Department of Transportation, 2001) count for Hidalgo County between Weslaco and the Highway 281/Highway 83 interchange (McAllen/Pharr) exceeds 100,000 vehicles, with 131,000 vehicles at the interchange itself (Texas Department of Transportation, 2010) (*Figure 8*). The potential for *thousands* of accidents was very high on these elevated roads in a region where driving in frozen or freezing precipitation is seldom required.

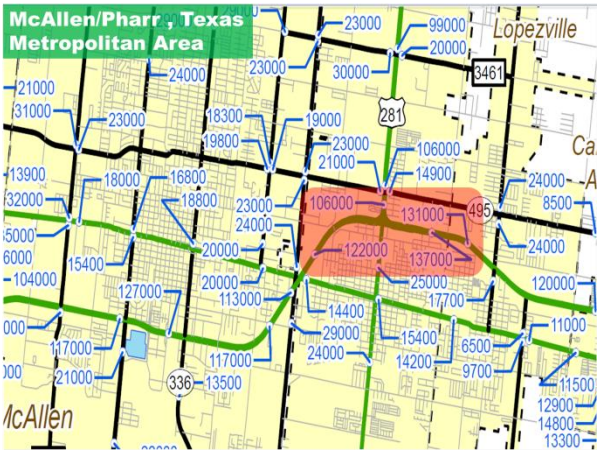

Figure 8. Annual Average Daily Traffic values for McAllen/Pharr area. Red shaded area shows volume at the US 83/US 281 interchange, a system of elevated highway and entrance/exit ramps.

Coordinated preparedness actions by jurisdictions from the Rio Grande Valley to the Coastal Bend, triggered by NWS decision support services, reduced the number of travelers on and February 3 and 4 to a small fraction of average. Such reductions may have saved lives, as well as millions of dollars in repair or recovery costs to vehicles and highway infrastructure. Millions more in medical expenses may have been saved by reducing the potential number of critical human casualties in vehicle accidents.

5. TESTIMONIALS

More than a dozen public and private sector partners tasked with life and property protection provided testimonials to the NWS offices in Brownsville and Corpus Christi. Several credited innovative decision support communications; their quotes are listed below:

"*The webinar was good and I was really impressed, since it was easier for us to…actually see what you were talking about. Your explanations were excellent."*

"The webinar allowed us to see a better picture plus allow us to see what our neighboring counties were undergoing at the same time. EMS utilizes hospitals in our neighboring counties, which puts our EMS services on their public roads."

- Diana D. DeLeon
Communication Supervisor
Brooks County Sheriff's Office

"…its very helpful to have the local, detailed outlook for our planning and response purposes. I also appreciate your willingness to consider and take into account the emergency management aspect of meteorology, this makes our job a lot easier."

- Justen R. Noakes
Director of Emergency Preparedness
H-E-B Stores

"The National Weather Service (NWS) webinars… provided stakeholders with… impact information on the adverse weather conditions that directly affected the Rio Grande Valley. Continuous updates from the online weather briefings were vital to understanding the complex weather environment and maintaining an open line of communication with emergency management personnel… Your services provided us real-time, actionable weather information necessary to ensure CBP preparedness mechanisms were coordinated among Office of Border Patrol, Office of Field Operations, Office of Information Technology, and Office of Air and Marine resources in our mitigation against a significant impact to operations to our area of responsibility."

"RGV/OIM was able to utilize the National Weather Service webinars, teleconferences and web pages to notify local CBP stakeholders of the nature and exact degree of impact to our geographic area of responsibility. As a result, the RGV sector command staff was able to effectively mitigate impact to CBP personnel, their families and facilities."

-Esequiel "Zeke" Treviño
Office of Incident Management
CBP Region VI / RGV-HQ, Edinburg, TX

"CG [Coast Guard] really took advantage of the forecasts prior to and during the ice event. We used the timing of the icing forecasted to determine our closure posture and as a result, were open much of the ice storm day… I'm pleased with the picture we had of the timing of the weather to make decisions. The GoToMeeting webinars and Facebook updates were terrific!"

-Kathy Moore, CAPT
Deputy Sector Commander
CG Sector Corpus Christi

"… we got into the Webinars later in the week, but finding the previous presentations online were really helpful... The detailed e-mail messages before the Webinars were extremely helpful also as we tried to consistently update our websites.

-Edwina P. Garza
Assistant Editor, *Progress Times*
Mission, Texas

6. SUMMARY AND CONCLUSIONS

This event, and catastrophic events that followed across the United States through spring and summer of 2011, showed the importance of hazardous weather communication to an increasing number of decision makers. The shift toward shared, synergistic weather information among stakeholders who inform and protect persons in harm's way has been aided by the 21st century communication technology revolution.

Innovative approaches to providing this information, from plain language confidence forecasts by trusted NWS employees to the technological tools that allow an increasingly diverse universe of decision makers to better comprehend the information in order to act efficiently, is making a difference to communities across America. As Crowe (2011) states: "Social media systems thrive in emergencies and must be considered in all phases of emergency management including preparedness, response, recovery, and mitigation."

The National Weather Service has developed the Weather Ready Nation Strategic Plan (National Weather Service, 2011), which aims to combine new technology and scientific research with a social science component to provide real world weather information to a rapidly growing and ever diversifying population that uses more infrastructure, and is becoming more economically independent.

The future looks bright for partnerships dedicated to the well-being of Americans subject to weather hazards that threaten life and livelihood. Seeds are being sown to improve how these threats are communicated. Technological innovation, improved messaging techniques, and shared data platforms are critical. Trusted relationships among the National Weather Service and partners beyond the traditional emergency management and media model are vital to collective success in saving life, property, and money.

Objective and anecdotal evidence from the South Texas winter weather events of 1-4 February offered a glimpse into this future. Plain language messages, graphics, and photographs were provided in English and Spanish by NWS offices in Corpus Christi and Brownsville to a diverse group of partners across the public and private spectrum by e-mails, webinar, social media, video briefings, and breaking news blogs.

Partners included health and safety officials, school superintendents, transportation departments, news media, agricultural centers, airports and seaports, mail delivery systems, private businesses, and more. Positive feedback from these partners made the case for continued and expanded decision support services in South Texas and beyond to achieve the vision of a Weather Ready Nation.

Photo: Icicles hanging from road sign in Brownsville. Credit: Jim Campbell, National Weather Service.

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