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Just Talking About the Weather—Social Networks and the Weather Enterprise

by Nate Johnson*

The lexicographers at Oxford University Press recently analyzed 1.5 million posts on one online "social networking" service, distilling out the most frequently used words. Given the impact of the weather on our daily lives—and the subsequent impact on our daily conversations—it should come as no surprise that weather-related terms featured prominently in the top 500: cold, hot, rain, sun, and weather all made the list [1].

In other words, if people are talking, chances are they're talking about the weather. That's regardless of whether they're making small talk at the bus stop or chatting with friends online. The rapid growth of social networking sites such as Facebook, Twitter, and others has enabled conversations about every topic under the sun, including the sun itself, to go beyond the bus stop, the elevator, and perhaps even e-mail. These sites, along with localized communities, such as WRAL-TV's GoLo (out of Raleigh, North Carolina), allow users to share their weather with others from next door to a world away, in text, pictures, and videos—all in near-real time.

Clearly, the weather enterprise has a lot to gain from participating in these conversations, from the real-time exchange of pictures and information during severe weather to using these networks as a societal impacts research tool. Although the potential is great, dozens of questions do arise about how best to engage these growing communities.

Some Basics

It may not have been the first of these new social media sites, but Facebook is one of the fastest growing. It began in 2004 in the dorm room of Mark Zuckerberg, who originally intended it to help fellow students identify classmates at Harvard. It quickly spread to other schools and has since continued to grow into the largest online community in the world [2].

The Facebook experience begins with creating a user profile, including contact information, favorite books and movies, and even a college or work history. Then, users find other friends through the service by looking up e-mail addresses, searching on common interests, or connecting through other friends. Users can then share pictures, video clips, and status updates—brief blurbs about what one is thinking or doing at a given moment—with their Facebook friends. They can also

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Thick ice coats plants along the River-walk in San Antonio, Texas, during the 2007 AMS annual meeting. See p. 2 for research about this unusual winter storm. (Photo courtesy of Kenneth E. Kehoe)

In This Issue

Decision Making and Risk: Traveling to the 2007 AMS Annual Meeting

by Kimberly E. Klockow* and Randy A. Peppler**

Inspired by a Weather and Society*Integrated Studies (WAS*IS) workshop held at the University of Oklahoma in April 2006, we surveyed meteorologists and geographers in Norman, Oklahoma, who had plans to attend the American Meteorological Society (AMS) Annual Meeting held January 14–18, 2007, in San Antonio, Texas. A winter storm producing sleet and freezing rain snarled travel in Oklahoma and Texas in the days leading up to and during the early portions of the meeting, closing airports and making road conditions hazardous and in some cases impassable.

Knowing that most of our colleagues made it to San Antonio for the meeting anyway, we wondered how they, a presumably highly weather-salient sample within society at large, made decisions under uncertainty and weighed or perceived risks in deciding whether and how to travel to San Antonio when the public was repeatedly urged to keep off the roads and stay home.

Jan. 2007 Winter Storm Event

An arctic cold front that moved through the southern plains early on January 12 (Friday) joined with a long-lived weather system that had formed in the Southwest to create several waves of winter precipitation through January 16 (Tuesday). [1] In Oklahoma, the first wave hit late in the morning of the 12th, a second wave on the morning of the 13th (Saturday), and a third intense wave on the morning of the 14th (Sunday). The third wave produced three hours of "thundersleet" as surface temperatures sat in the low to mid-20s. [2]

Central Oklahoma, where our sample resides, received a heavy layer of sleet and ice. Areas to the south, along the travel route in Oklahoma and north Texas, had moderate freezing rain or rain. South of Dallas-Fort Worth, those who left early to "beat the storm" experienced spring-like severe weather, and even saw a tornado. The roads started icing on the 12th; this lasted into the middle of the following week, with black ice a common problem (Figure 1: photo on this page). Oklahoma City's airport cancelled flights beginning late on the morning of the 12th and closed at times until the 17th. Poor weather conditions at connecting airports such as those in the Dallas-Fort Worth area contributed to cancellations. It was icy in San Antonio during the meeting, and attendees were treated to an ice display near and along the Riverwalk on the morning of the 17th (Wednesday; Figure 2: Photos on pages 1 and 14); even the Alamo historical site closed. [3]

Weather Salience

Alan Stewart has used surveys to assess the human dimensions of weather salience, and he described some of his work in the spring 2009 edition of this newsletter. He described weather salience as the "psychological orientation, awareness, and value that individuals place on the weather and its changes." Members of the Norman meteorological community are presumed to be weather salient, but differ from the lay audience Stewart surveyed because their weather salience is formed in part through meteorology education. Although it would be inaccurate for us to speculate that actual driving experiences on icy roads can be replaced by meteorology education when navigating risky travel, the decision about whether to travel may greatly be emboldened by meteorological knowledge.

Icy roads create treacherous driving conditions during a January 2007 ice storm. (Photo courtesy of Kenneth E. Kehoe)

Psychology of Risk

Empirical work on the psychology of risk helped inform our study. Breakwell's (2007) comprehensive

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Using Wind Tunnels for Calibration: Costs and Benefits

by Ildikó Dobi* and Gábor Kis-Kovács**

Background

The World Meteorological Organization (WMO) organized a Workshop on Assessment of Socioeconomic Benefits of Weather, Climate and Water Services, which was held in September 2008, in Sofia. [1] Ildiko Dobi represented Hungary and enjoyed the possibilities of improving her knowledge related to the basic economical issues of national meteorological services (NMSs).

The workshop was similar to a university course: participants attended interesting lectures all day and were asked to prepare materials and preliminary studies. This paper is a summary of a case study based on manuscripts [2] prepared by Gabor Kis-Kovács in 2002.

It is well known that professional weather observation and forecasting is the basic activity of all NMSs. The WMO prepares and upgrades guidelines regularly to recommend best practices to produce unified, accurate data measurement for data exchange from all over the world. [3]

To measure wind speed and direction, a wind vane and cup or propeller anemometers are usually installed at a height of 10 meters. Regular inspections are advisable for anemometers, because changes in sensor characteristics can degrade wind data quality as a result of physical damage, dust, or corrosion. Fully reliable calibration of anemometers is only possible in a wind tunnel.

But uninterrupted measurement is very expensive, not only because of the cost of a good quality instrument, but also because of the expenses of maintaining and running the meteorological network, including telecommunication aspects.
A wind tunnel is an expensive investment, and therefore a cost-benefit study is a practical tool for decision making as most European NMSs are partly financed by the government, and the remaining budget must be earned from commercial activities.

The Hungarian Meteorological Service (HMS) has more than 100 years of experience measuring wind. The surface network is based on nearly 100 automated stations that include a Vaisala WAA 15 A electric cap and propeller anemometer and a WAV 15 A wind vane. In 2002, HMS fulfilled the requirement of the ISO 9001:2000 quality assurance system. Regular calibrations of wind speed and direction tools were critical for receiving the certificate on regular executed audit and thus it was determined to investigate the acquisition of a wind tunnel. The president of the institute instructed an economic analyst to prepare a study on the estimated cost and expected benefits.

Demands for Wind Measurements

First, regular calibration of hundred anemometers running in our network had to be solved according to the medium-term strategic plan of the HMS. Second, at the same time the first grid connected wind generator in Hungary was installed and an increasing demand on preliminary wind measurement for wind energy studies was expected. Another critical application for wind measurements is dispersion modeling of potential nuclear pollution. Hungary has a nuclear power plant in Paks not far from the capital and wind data are essential inputs for its nuclear alarm system.

In the early stages, the plan was to negotiate with the Slovakian Hydrometeorological Institute about the possibility of purchasing their calibration data. It was rejected because of the high estimated cost, potential technical difficulties at customs, and other risk factors.

Costs

The wind tunnel cost about $185,000 including delivery, installation, testing, insurance, and training, in addition to minor costs for remodeling the building to accommodate the size of the equipment. Maintenance costs of the wind tunnel were estimated at $4,000/year requiring 0.2 persons/year. According to the study, one month could be sufficient to calibrate all the anemometers running in the HMS network,

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Perspectives on Communication: A Self-Ethnography on the Importance of Communication Research to the Weather Community

by Gina M. Eosco*

Communication is a word with many meanings. As a result, a one-sentence definition is typically inadequate. To provide some structure, the National Communication Association (NCA) opens its communication description with this statement: "Communication focuses on how people use messages to generate meaning within and across all kinds of contexts, cultures, channels and media."[1] Meaning can be generated on many levels, and communication researchers analyze the different levels, from interpersonal to group to organizational to mass media. In addition, many look at themes that cross all levels of analysis, such as social influence, the role of credibility, and the use of different channels (e.g., television, newspaper, Internet). To study these areas and the many others not listed, researchers use many different qualitative or quantitative research tools, including in-depth interviews, focus groups, observations, ethnography, surveys, and experimental designs.

Just as context is important to the definition of communication, it also plays a vital role in defining an overall concept of the importance of communication research within the weather community. To do this, allow me to share a self-ethnography of my first tornado warning experience in Norman, Oklahoma. Ethnography combines observations of the surrounding environment with interviews of those living in that environment. A self-ethnography, then, is a personal reflection of what I observed in my environment, and my interpretation of my actions. I then analyze how the different levels of analysis and cross-cutting themes can be applied to this situation.

My Self-Ethnography

May 13 was a typical Wednesday evening toward the end of the spring semester. Final papers and projects were due, creating a flurry of stressed students across campus. I was studying on the top floor of the National Weather Center in hopes that a different study environment would spark a newfound motivation for finishing my papers. In tow, I had my laptop with Firefox open with multiple tabs, the most important of which were the Norman radar, Norman velocity, the Norman National Weather Service (NWS) page with warnings, and the best procrastination tool, Facebook. Of course, I had my green turtle, otherwise known as my lime green backpack, nicknamed for its size and shape on my back, full of books, power cords, a camera, and a Blackberry. And last and most important, I had my meatball sub from Subway.

It was a beautiful evening, with thunderstorms to the north and to the west and an amazing sunset between the two storms. Although we were under a severe thunderstorm watch, I quickly succumbed to the "storms don't hit Norman" mentality that was introduced to me upon moving to Norman last summer. Indeed, at that moment in time, no storms were coming our way. The local view must be correct!

As the storms continued to develop, I also continued to update my multiple NWS tabs open in Firefox while also receiving one text and one e-mail message on my Blackberry for every new watch or warning issued for our area. I'm one of those members of the public who loves to be overwarned! With my stuff spread out on a table, my Blackberry once again chirped. I looked at it and saw the word "Torn…." I clicked on the message and read, "Tornado Warning for Cleveland County." The overprepared, overwarned, overly into weather Gina panicked. This was my first tornado warning in Norman, and I did not believe it. I quickly updated the NWS Norman page, but it didn't show any signs of a tornado warning. Was the text from my local TV station true? Was it credible? How did they know this before the NWS? Was the NWS Web site behind?

What was to follow makes me laugh today. In a matter of picoseconds, I tossed all my stuff into the green turtle, squishing my half-eaten meatball sub. I called my mother in Norwood, Massachusetts, hoping to hear her calm voice, but instead causing her to panic. I quickly texted friends to alert them of the warning, urging one to drive to the weather center immediately because it has a storm shelter. And somewhere in all of this, I managed to update my Facebook status to alert my other procrastinating Normanites about the tornado warning. I took the elevator to the first floor, met the friend I had urged to drive to the weather center, and went into the tornado shelter to bunker down. Moments later, my friend and I encountered a group of meteorology graduate students who said that we were entirely safe at the weather center. So what does any logical weather weenie do? I followed the crowd back to the top floor to watch the impending storm. I watched in awe as I saw a funnel cloud float over Norman as we heard the eerie sound of tornado sirens.

The Analysis: How communication research and my weather experience fit together

Why is communication important? Every step of my self-ethnography has a communication component. The laptop, Blackberry, and subsequent sirens all show the importance of both old and new technologies during the warning process. Texting and Facebook show the increased potential of social network sites in disseminating warnings. Receiving the warning via text message before I saw the NWS warning made me question the credibility of the message. Did I do this because of the medium the warning came on or because of the source? Or perhaps I was influenced by the Norman myth that "tornadoes can't happen here." Calling my mother shows a psychological desire to hear a calming voice in a time of increased risk. The green turtle even shows that there are important items to protect before taking action. My friend's arrival shows how my urgent message persuaded her to take action immediately. She trusted me; she took action.

The field of communication generally approaches research topics from different levels of analysis:

- *Intrapersonal* (how the individual thinks)
- *Interpersonal* (one-to-one interaction, often using technology, or as it is commonly known, "face to face")
- *Group* (typically small groups of people)
- *Organizational* (larger groups of people or networks, such as the government or companies), and
- *Mass communication* (mass audiences).

For many, these categories are not a perfect fit, and thus other analysis areas emerge: social influence or persuasion, computer-mediated communication, new technologies, and nonverbal communication (including visuals), among others. Further, other specialty areas also exist, such as risk communication, science communication, and environmental/health communication. Each area has theories and models to help explain, describe, or predict how or why individuals through to societies respond to communication messages. Although they may not fit perfectly, the steps of my self-ethnography can help explain these many areas of communication.

I*ntrapersonal*

How often have you talked to yourself in your mind or even out loud? My process of deliberating the truthfulness of the tornado warning was, in essence, an example of intrapersonal communication. Individuals can selectively expose themselves to weather information through, for example, a NOAA weather radio, warnings via text message, or a TV. Further, individuals can selectively attend to this weather information. Just because the TV is on does not mean an individual has to pay attention.

If an individual falls for the myth of Norman, then a tornado is impossible and, thus, he or she may not pay attention. If an individual does attend to the information, he or she can selectively interpret or create meaning of this weather information, possibly aligning their interpretation with their beliefs to take action or to further their belief in the myth. The messages communicated by the weather community may influence an individual at any of point in their intrapersonal communication process.

Interpersonal

How often have you called someone during a risk event? How often have you consulted someone before

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Social (continued from page 1)

share links from other Web sites on Facebook, as well. According to Web-sharing service AddToAny, sharing items via Facebook is now more popular than sharing via e-mail [3].

Facebook may have been built to answer the question, "Who's sitting behind me in history class?" On the other hand, Twitter is all about "What are you doing?" The "microblogging" service asks its users to answer that question, but with a twist—the answer must fit within 140 characters. At the surface, this short format encourages brevity and pithiness, but it has had an interesting side effect: creativity.

The 140-character limit has inspired a great deal of innovation, with complementary services popping up to allow users to share their exact locations and links to pictures and other Web sites, among other things. The combination of the length limitation, the availability of these related applications, and the proliferation of camera-enabled mobile devices has empowered users to share—in real time—eyewitness accounts of breaking news events worldwide, including severe weather and breaking news events. So important an outlet was Twitter during the turmoil surrounding the recent elections in Iran that the U.S. State Department urged Twitter to delay system maintenance that would have cut off access to the service for Iranians disputing the election results. [4]

Who's Already Here?

Facebook and similar sites such as LinkedIn (focusing on resume sharing and professional users), MySpace (reorganizing itself as an entertainment portal), and others continue to show impressive growth, with Facebook leading the way. The service now claims more than 250 million users worldwide, more than doubling from 100 million in less than 11 months [5,6].

Twitter's growth is even more remarkable. According to Nielsen Online, Twitter posted an astonishing year-to-year growth rate of 1,928% through June of this year. The service that started "as a side project" in the spring of 2006 now boasts 21 million unique users per month [2,7].

These growth rates are more impressive when you consider who comprises those statistics, and at least one recent study suggests a rather large percentage of users are on at least one of these social media sites. In a recent study in the United Kingdom, comScore found that some 80% of British Internet users used a social media Web site, spending an average of 4.6 hours per month each.

Perhaps more telling are usage statistics of various networks during high-impact weather events. During the Inauguration Day snowstorm of 2009, viewers of WRAL-TV in Raleigh and members of their GoLo.com community posted more than 2,350 pictures and 80 videos, far and above the normal number of such submissions [8]. These images were shared online and some were also broadcast during WRAL's continuing coverage of the snowstorm. Usage of Twitter also increases markedly during high-impact weather events, especially those affecting population centers.

Power of Social Media

Much of the power of social media comes from two related sources: the ability to update and share information instantaneously and the interconnectedness of users across the network. This allows information to be put into the network in near-real time and for it to be shared just as quickly from one set of friends, to another, and so on. In other words, an individual can snap a picture, post it to a social network, and watch it spread well beyond his or her own contact networks very quickly.

Naturally, the idea of additional sources of real-time data from within or near severe or extreme weather is very attractive. Where storm spotters use reports to paint a picture of a storm, social media users can post an actual picture, or even video, of the same storm. The true nature of a storm's aftermath can become clear almost immediately, too, allowing emergency managers and first responders to direct resources to the greatest need.

This information continues to have value long after the storm has passed. Pictures and videos can be used to identify damage patterns and classify storm damages. Researchers are also using videos from various sources on the Internet to understand why people make poor decisions during severe weather. Those same images can be used in future public awareness campaigns, showing the

damage storms can cause and the consequences of being unprepared.

Beyond simply "listening", the weather enterprise has a great deal to add to the conversation. Numerous segments already share time-sensitive watch and warning information via social media, often reaching people away from traditional sources like TV and radio. Preparedness campaigns could also make effective use of social networks, sharing "best of" or "worst of" pictures and videos as education tools. Like everything else, once initially shared, content is often shared again and again. For example, the video-taped aftermath of an encounter between a tornado and a freight train in January 2008 was posted on YouTube, has been viewed there more than a million times, and has spread to dozens of other websites. [9, 10].

"Weather" to Jump In

Social networks and the information that passes across them do present some challenges for the enterprise. For starters, cultivating a social network can take some work, and monitoring multiple networks, especially during active weather, can be very time-intensive. In addition, anytime we solicit information from the public, there is the potential for misuse or even intentional abuse, including phony reports. In spite of the issues involved, however, the recent explosion in social media points toward a growing potential for all sides of the weather enterprise to communicate with each other and with the public in a new and exciting way.

With a proper strategy, these networks can serve both as a way to receive quality information and a way to share potentially life-saving information with the public. All involved should thoughtfully determine in which conversations they will participate and have a strategy for doing so. Furthermore, the members of the weather enterprise should share those strategies with each other in an effort to provide coherency and consistency of message. Ferree and coauthors suggest that the National Weather Service could even play a role in encouraging use of social media, as well as proposing standard notation for users to adopt to facilitate the two-way sharing of information [11].

The bottom line: Just like at the bus stop or on the elevator, people will continue to talk about the weather online and through social media, and these conversations will go on whether we participate or not. The weather enterprise has a fantastic opportunity to both learn from and educate by engaging these communities. All we need to do is what seems natural—talk about the weather.

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overview of this work and its theoretical underpinnings offers a general framework for how a person makes decisions about risk activities; Table 1 (Available only online; see http://www.sip.ucar.edu/news/risk_table1) summarizes the overview. Individuals ultimately take action based on decision making informed to various degrees by various psychological elements. Risk perception and decision-making literature highlighting these elements includes studies of the role of personality traits (e.g., Goldberg 1993; Trumbo 1999; Zuckerman 2002; Rosenbloom 2003); group influences (Wallach et al. 1962); previous experience with risk activities (e.g., Richardson et al. 1987; Barnett and Breakwell 2001; Lima et al. 2005); and belonging to expert professions or communities (e.g., Canon-Bowers et al. 1993; Garvin 2001).

Survey of Travelers

To collect data, we developed a survey, obtained approval on it from the University of Oklahoma Institutional Review Board, and e-mailed it to local meeting registrants. Some of the survey's short-answer questions included the following:

- What places have you lived as an adult, and have you previously experienced icy travel conditions like those during this storm?
- What was your original plan of travel and did you have a backup plan? How did you ultimately travel, and how did you decide?
- Were you supporting your own travel, or was your travel covered by your employer?
- Were you attending the meeting for professional or personal reasons?
- What sources of information did you consult prior to and during travel?
- Did you travel in a group? How big was the group? How did your group's dynamics affect final decisions?
- Do you think your status as a 'highly weather salient' person gave you more confidence about making the trip, made you more cautious, or…?
- If you could start over, knowing what you know now, would you have made the same decisions?

Thirty people responded, or almost one-third of those from the Norman community listed in the Author Index of the Annual Meeting's program (ninety-three people).

Composition and travel characteristics of respondents

Table 2 (see page 11) gives the composition of respondents and their plans and actions. The sample was predominantly male, and the average male respondent was considerably older than the average female respondent. Slightly more than half planned to drive, and more than two-thirds ended up driving. Nearly all had previously lived someplace that experiences frequent cold weather, and exactly half planned to travel in a group (group sizes ranged from two to eight). One male who had planned to fly alone had a change of heart and attached to a small group of drivers as weather conditions worsened. Only three respondents cancelled their trips (all males), two of whom had intended to drive alone and one who had plans to fly, but his flight was cancelled. Of the thirteen travelers that departed on their scheduled date, seven drivers and three flyers stuck to original travel modes and three turned to driving (two male, one female) because of cancelled flights. Of the seven travelers that departed one day (five respondents) or two days early (two respondents), all were drivers that had intended to drive. Of the two respondents that delayed travel by one day, each switched from flying to driving. Those delayed by more than one day (one driver and four flyers) stuck to their original travel modes.

Weather conditions imagined and experienced, and apprehension levels

Table 3 (See page 14) shows respondents' thoughts on weather conditions, imagined and experienced, and their apprehension levels before and during the trip. Interestingly, half of the females said they experienced travel conditions worse than imagined and less than a third of the males did. Only four said they experienced conditions better than imagined. Analysis of apprehension levels showed that slightly more than half of the respondents had little to no apprehension about what was to be encountered; one person said, "We knew what to expect"; another said, "What will be will be." Most of

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assuming yearly calibration by six checking, or calibration by six different wind speeds.

Benefits

There were some expected indirect benefits from the wind tunnel investment. The equipment was the first wind tunnel in Hungary that was suitable for calibration. For the first time, the laboratory could provide calibration services for the full range of meteorological instruments beyond those required for wind measurements. It is evident that increasing data reliability produces better products, e.g., more precise weather forecasts. Additional capacity beyond the needs for anemometer calibration also made it possible to undertake commercial activities for partner institutions and enterprises.

Without these calibration tools, incorrect data could have harmful effects on the nation's economy and decrease the perception of the meterological service as a reliable institute. These benefits haven't been quantified. However, around $6000 income is expected from anemometer calibration for other institutions.

Consequences

The wind tunnel, shown in Figure 1, was installed in 2002. Based on the suggestion of the preliminary economic study, the analysis was repeated in a year. Working capacity was somewhat overestimated. The first year and a half year had many more technical problems than expected. But the wind tunnel proved to be ideal for calibrating the HMS anemometers because it was easy, fast, and accurate. Since then, there has been increasing demand on the use of the wind tunnel for calibrations. The benefit cost study concluded that it was worth it to accredit the laboratory, and with better marketing, calibration could be a profitable activity.

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The HMS wind tunnel, installed in 2002 (Photo courtesy of Ildikó Dobi)

Conferences & Opportunities

Call for Papers: Fifth Symposium on Policy and Socio-Economic Research

Conference: 90th American Meteorological Society (AMS) Annual Meeting
Date: January 17-21, 2010
Location: Atlanta, Georgia
Extended Deadline: August 12, 2009
For More Information: Please visit **http://www.ametsoc.org/meet/annual/call.html#research**.

The theme for the 90th AMS Annual Meeting is "Weather, Climate, and Society: New Demands on Science and Services". In support of this, the Fifth Symposium on Policy and Socio-Economic Research will include discussions on the impacts of weather and climate variations and how recent advances in weather and climate research can be better utilized in service to society.

For more information or to submit an abstract, please visit **http://www.ametsoc.org/meet/annual/call.html#research**.

Fifth European Conference on Severe Storms

Date: October 12-16, 2009
Location: Landshut, Germany
Cost and Registration: $246 before September 13; open until filled.
For More Information: Please visit **http://www.essl.org/ECSS/**.

This conference covers all aspects of severe convective weather. Session topics include severe weather climatology and hazards assessment, climate change impacts on severe storms and adaptation concepts, and severe storms forecasting, nowcasting, and warning.

For more information, please visit **http://www.essl.org/.ECSS/**

those who indicated some level of apprehension, however, described it as a "very high" level, and one even used the word "dangerous." One male in this category said, "The only thing that made me go was that the AMS paid for my trip, and I didn't want to not show."

Interestingly, during the trip, apprehension levels of about half of the travelers from both the not apprehensive and apprehensive categories dropped because conditions either were better than expected or improved as travelers headed south. Only one respondent (male) expressed a higher level of apprehension during the trip, and he was one of the few in the sample who had no experience with severe winter conditions.

Group behavior

Among the respondents in this study, about half traveled in one of four groups, three of which we describe here. Each group included at least one person that led group decision making. Group 1 originally intended to depart on Saturday, but decided as a group to drive on Friday before the storm began. Weather salience made this group "highly confident," and one respondent claimed that other groups or individuals "did not listen to them." Group 2 waited to drive until Sunday, one day after anticipated departure. Weather salience made this group more confident, but also more resolved to be cautious. Group 3 drove on Friday as anticipated and departed Norman at the first sign of hazardous weather. One person in this group claimed that weather salience made him more cautious though conditions turned out as he expected; conditions were said to be worse than expected for another person in this group, professed to be not -weather salient. No group traveled on Saturday, a good decision because this would have been the most difficult day to drive.

Weather salience effect on individuals

Twenty-three of the thirty respondents felt confident enough about their weather salience to note it as a factor in their decision making. Eight (seven males, one female) said their weather salience made them more cautious and eight others (six males, two females) said it made them more confident. One respondent stated that weather salience made him more cautious, "but not enough to change plans." Another said that his experience living in a northern climate "trumped salience for him." One respondent said that weather salience-induced caution made him "more aware than average person." Another confident person said weather salience and experience living in wintry conditions, plus a new vehicle, made him "highly confident" to drive. One respondent said weather salience made him "confident that he could avoid the hazard altogether." Another, however, said weather salience made him "overconfident," and the group this individual traveled with (not analyzed here) suffered an unfortunate driving mishap on its way to San Antonio.

The three nontravelers

Only three respondents (all male) ultimately declined to travel, representing a small control group. One recalled attending a past presentation on weather hazards and said it instilled in him an increased appreciation for caution, ultimately resulting in the decision not to travel. Another indicated that "weather salience made me confident that going would make me forever stuck in traffic." For them, weather salience was a factor in the decision not to travel. All three had planned to travel alone and two had planned to drive—these two were entirely or mostly self-funded. These factors affected their decisions to stay home.

Discussion and Summary

Even though our study looked at a very specific event and population, the respondents displayed characteristics of Breakwell's psychological elements that guide decision making about risk. For example, past events such as traveling to other AMS conferences during bad weather and previous experiences with ice and winter storms led to informed evaluations of risk; normative pressure applied by others as the would-be travelers communicated before the event helped convince some to depart on different days or use different travel modes; institutional affordances such as airport closures and closed or poor roads constrained but mostly did not prevent travel; and interpersonal affordances regulated group decision making as people altered plans to accommodate friends.

The general social representation of the event was that it was dangerous to some degree, but navigable,

	Number	Average age	Previously lived in a cold climate	Planned group travel	Traveled for professional reasons	Traveled for enjoyment	Gave talk or poster
Male	22	44.1	20	9	21	9	16
Female	8	29.6	6	6	8	7	4

	Planned to drive	Ultimately drove	Planned to fly	Ultimately flew	Canceled trip	Left on schedule	Left early	Left delayed
Male	11	13	11	6	3	8	5	6
Female	6	7	2	1	0	5	2	1

Table 2. Composition and travel characteristics of respondents

despite media urgings to stay home. Although risk conscious and possessing different levels of anxiety, all but three of our respondents were willing to assume the risks of travel and would make the same decisions again, though a few might have changed their dates of departure. Though females seemed more willing than males to seek the opinions of others, about the same proportion of each (three-fourths) claimed that weather salience played a role in decision making. Males were slightly more cautious than females overall, especially during the trip.

Apprehension levels dropped in all age categories during the trip, though respondents in the age range 30–39 seemed markedly less worried beforehand than others. Those who said they didn't experience conditions as bad as imagined or previously experienced were less anxious to begin with. Those who were more anxious before the trip proportionally planned to travel more as individuals, which could have added to anxiety levels. Respondents in this category generally said that weather salience made them more cautious. In the end, our weather-salient sample experienced a range of anxiety levels and made choices about risk based on their knowledge of, gut feelings about, and experiences with hazardous weather situations.

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(continued on page 14)

Communication (continued from page 5)

issuing a warning? The simple explanation of interpersonal communication is that people influence people, but with different effects, at different times, in different conditions.

In my experience, when I called my friend, she trusted my message and took immediate action. Why? Was it the trust aspect? Or maybe it was my tone of voice? Or could it be that she has known me for a year? Or that I study weather communication and she defers to my judgment in these situations? It could be any or all of these factors. Interpersonal communication through face-to-face interaction, or through text messaging or Facebook, becomes a critical social influence factor during risk events. Factors such as trust between two individuals, as well as tone of voice, type of message sent, and form of the message can all change the effect of the face-to-face interaction. Interpersonal communication may play a large role in influencing an individual to take action during a risk event.

Groups

Have you ever changed the way you communicated because you were in a small group? Have you ever changed your behavior based on what a group of people decided to do? I did. Upon entering the tornado shelter, I met up with a group of graduate students who were confident the tornado was not going to hit our part of town. In this scenario, I deferred to their judgment, and we went back to the top floor of the weather center to watch the event unfold. Why did I suddenly reverse my decision to take action? Why did I trust this group of people? Many communication researchers focus on group interaction effects and how these effects alter not only the communication process but also the subsequent group or individual decisions and actions.

Organizational

This level of analysis can be broken down into two types, large groups, such as the NWS, and a network of people. Focusing on the first, how did the NWS in Norman decide to issue a warning? What institutional mechanisms allow them or the private sector to communicate warnings to the public? Obviously, the NWS has rules and organizational mechanisms that have been in place for a long time. But it's important to ask how an organization implemented those mechanisms, and how these mechanisms influence or affect the communication of other groups or organizations like the private sector weather industry, emergency management, and broadcast meteorology. Focusing on networks, how did my updated Facebook status message help warn or influence others in Norman to take action? Further, how did those people, once warned through my status message, warn others? Communication through networks of people, especially social networks, can be very powerful.

Mass Communication.

An evolving term, mass communication refers to communication to large or "mass" audiences. Traditionally, television, newspaper, and radio have been the main mass communication tools. But, with ever-increasing new technologies, tools such as blogs, cell phones, and the Internet are also becoming forms of mass communication. Remember, I first learned about the tornado warning via a mass text message! Research continues to show that the main medium during high-risk events such as tornadoes is television. In my situation, though, I did not have a television. How did other mass communication tools warn me? How did their message, either verbal or visual, influence my thought process and ultimate action? What forms of mass communication does the public trust? Mass communication is an excellent way to communicate to large groups of people, but it also risks treating everyone the same. The "public" is indeed a large group of people. It is not , however, a homogeneous group of people, and thus one message for many different types of people may not be adequate.

Although only a small portion of communication researchers conduct studies specifically about weather, much of the research I describe pertains to weather communication. It is important not to overlook the findings of communication articles that focus on another context, because they may have important applications to the weather community. For example, much of the risk communication literature focuses on health risks and how people respond to health messages. Though health and weather are different contexts, they share many similarities, namely to

protect an individual's well-being. The weather community has the potential to learn much from the communication literature.

Right now, the weather and climate enterprise is facing some of the most difficult communication questions in its history. How do we communicate the impending threats of future weather events such as major hurricanes to policy makers and decision makers such that mitigation takes place? How do we communicate the difference between short-term and long-term actions such as taking shelter for a tornado or buying flood insurance for future floods or hurricanes? How do we communicate uncertainty about all the hazards our community predicts? In what form should this communication come: verbal, visual, or both? What type of information does the public want or need to make decisions? Does the public want uncertainty information? Do we continue to adopt new technologies while maintaining the old ones? How do meteorologists and social scientists communicate with one another to create effective societal impacts research? This is but a sampling of communication questions; it hardly scratches the surface of communication-related concerns about weather, hazards, and climate. This is a challenging, but exciting time to conduct weather research as part of the field of communication.

The biggest challenge is that weather communication is not simply about broadcasting a daily forecast or issuing a warning; it is also a process of sharing meaningful risk information. For weather communication to become meaningful, we, as a community, must ensure that the public, stakeholders, and decision makers understand the information well enough to make the best personal decisions. This could require formal or informal back and forth discussions to determine how these important audiences interpret or create meaning from our messages. It may even require your own self-ethnography to allow you to reflect as I did about your own weather risk experience. Although the weather community has a wealth of hazard expertise, we are all still members of this thing we call the "public." Even we can make poor decisions in the face of weather risks.

Whether it's meeting a tornado victim during an NWS damage assessment, conducting formal in-depth interviews to understand how individuals interpret hurricane track graphics, or describing our own self-ethnography, it is our responsibility to communicate with our audience, to listen to our audience, and to reflect on how we collectively create meaning. That is the challenge. The opportunity, ironically, is a more *meaningful* weather communication process.

To end, I would like to challenge you to learn more about the field of communication, and luckily, there are many ways you can do this! First, you can read a book or article about a topic of communication that you find relevant to your area of interest or even take a course in that area. Second, you can attend one of the many symposium sessions at the American Meteorological Society (AMS) Annual Meeting that cover communication issues such as the Communication Workshop or sessions in the Policy and Socioeconomic Symposium. Further, you can help plan or attend the 2011 AMS Annual Meeting in Seattle, where one of the meeting themes set by AMS President Elect Margaret A. LeMone is communication! Or you could organize a local weather communication event, inviting experts from a department of communication, school of journalism, or a local newspaper to talk about weather with your meteorology department, your local NWS office, and local private sector companies. Even further, if you are really passionate about communication, you can also consider degrees in communication at the undergraduate or graduate level. I hope that you will accept my challenge to learn more about the field of communication, and that as a community we will continue to find new ways to create meaningful weather communication.

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Risk (continued from page 11)

	Number of respondents	Travel was worse than imagined	Travel was better than imagined	Travel was as imagined	Little or no apprehension before departing	Elevated apprehension before departing	Apprehension dropped during travel
Male	22	5	3	11	10	9	7
Female	8	4	1	3	5	3	6

Table 3. Weather conditions imagined and experienced, and apprehension levels

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Thick ice coats downtown San Antonio, Texas, during a Jan. 2007 ice storm. (Photo courtesy of Kenneth E. Kehoe)

Job Opportunities

Director, Center for Hazards Assessment, Response and Technology (CHART)
New Orleans, Louisiana

CHART seeks a sociologist with specialization in applied research in community, social justice, and hazards to serve as director. Applicants must show a record of successful research funding, established scholarship, and management of multidisciplinary, multi-researcher projects, preferably in an administrative research center role.

Additional qualifications include

- Complementary sociology specialties desired include environmental sociology, organizations, social movements and political economy.
- Experience and success in collaborations with community stakeholders, natural scientists/engineers, and government agency officials in an equitable, collaborative manner.

Salary is commensurate with qualifications and experience. Application closing data is November 1, 2009. For more information, visit http://hrm.uno.edu/employment/docs/CHART1366.doc.

Deputy Director, City of Seattle Office of Emergency Management
Seattle, Washington

This position promotes the Seattle Office of Emergency Management, directs the citywide emergency management program, and assists the director in achieving emergency management goals. A bachelor's degree in emergency management or related field, minimum of five years of emergency management supervisor experience, and leadership experience in presidentially declared disasters are required. Application closing date is August 11, 2009. For more information, visit http://www.seattle.gov/personnel/employment/.

Societal Impacts News & Announcements

Updated Extreme Weather Statistics Database

SIP researchers have updated hurricane, flood, and tornado damage data on the Extreme Weather Sourcebook Web site, as well as composite statistics for all three extreme weather categories to $2007. The Sourcebook is a collection of historical monetary loss data on severe weather events and presents a summary of damage suffered from hurricanes, floods, and tornadoes in the United States and its territories. The goal of the Web site is to educate viewers on the economic impacts of severe weather events and stimulate interest in the societal impacts of weather. Loss totals by state are presented alphabetically and by monetary rank with data adjusted for both inflation and inflation and wealth. The Sourcebook also displays aggregate monetary loss information for hurricanes, floods and tornadoes, as well as information on fatalities, casualties, injuries and damages for severe weather events such as lightning, hail and wind. For more information, please visit http://www.sip.ucar.edu/sourcebook. To see original data sources or to download additional data, please visit the Sourcebook's data and methodology page directly at http://www.sip.ucar.edu/sourcebook/data.jsp.

Weather and Society*Integrated Studies (WAS*IS) Evaluation Report Available Online

During the summer of 2008, Societal Impacts Program (SIP) researchers conducted a formal evaluation of Weather and Society*Integrated Studies (WAS*IS) by surveying all past WAS*IS workshop participants. The two main goals of the evaluation were: (1) to evaluate the WAS*IS program, including efforts to date in achieving the vision and mission of WAS*IS and (2) to get input on the future directions of WAS*IS. Based on these two goals, a survey with open- and close-ended questions was developed, pretested, and revised. The final survey was implemented via the Internet in July-August 2008. Access to the web survey was controlled by an independent survey company; only past workshop participants were invited to respond to the survey, and they could only respond once. A total of 124 of the 171 WAS*IS participants completed the survey, for an overall response rate of 73%.

Key results included respondents' evaluations of the importance and effectiveness of WAS*IS vision, mission and goals; the impacts of WAS*IS workshops on participants work and education; and respondents' suggestions for future directions of WAS*IS workshops and other efforts.

A full summary of the evaluation results, as well as a complete copy of the survey, is now available online at http://www.sip.ucar.edu/wasis/evaluation2008.jsp.

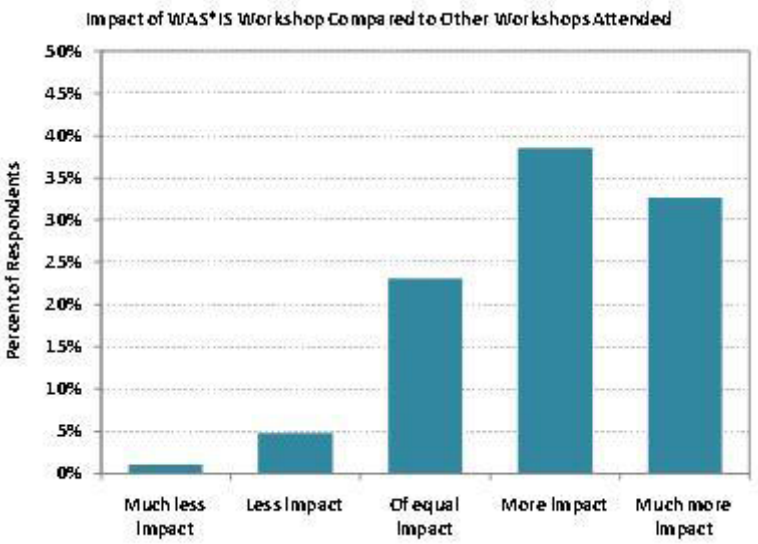

*Figure 1. For the 104 people who have attended other workshops, the overall impact of WAS*IS on them compared to those other professional opportunities (N=104)*

Contribute to WSW

To contribute a research article, program highlight, historial/interest article, editorial, photographs, or a book review, please contact Emily Laidlaw at laidlaw@ucar.edu.

About Weather and Society Watch

Weather and Society Watch is published quarterly by the Societal Impacts Program (SIP) at the National Center for Atmospheric Research (NCAR). The University Corporation for Atmospheric Research (UCAR) operates NCAR with support from the National Science Foundation and other sponsors.

The purpose of *Weather and Society Watch* is to provide a forum for those interested in the societal impacts of weather and weather forecasting to discuss and debate relevant issues, ask questions, and stimulate perspective. The newsletter is intended to serve as a vehicle for building a stronger, more informed societal impacts community.

Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of NSF or other sponsors. Contributions to *Weather and Society Watch* are subject to technical editing at the discretion of SIP staff.

Weather and Society Watch is available on the World Wide Web at: http://www.sip.ucar.edu/news/. Archives of WeatherZine, a previous weather impacts newsletter upon which *Weather and Society Watch* was modeled, are available on the Web at http://sciencepolicy.colorado.edu/zine/archives/.

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About SIP

All aspects of the U.S. public sector, along with the nation's economy, are directly and indirectly affected by weather. Although the economic impacts of weather and weather information on U.S. economic agents have been loosely documented over the years, no definitive assessments have been performed, and information generated from the previous studies is difficult to locate and synthesize.

SIP, initiated in 2004 and funded by NOAA's U.S. Weather Research Program (USWRP) and NCAR, aims to improve the societal gains from weather forecasting. SIP researchers work to infuse social science and economic research, methods and capabilities into the planning, execution and analysis of weather information, applications, and research directions. SIP serves as a focal point for developing and supporting a closer relationship between researchers, operational forecasters, relevant end users, and social scientists concerned with the impacts of weather and weather information on society. Program activities include primary research, outreach and education, and development and support for the weather impacts community.

For more general information on SIP, contact Jeff Lazo at lazo@ucar.edu or http://www.sip.ucar.edu.