

## Relationships Are Built on Sunny Days: Uncovering Quiet Weather Communication Strategies

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**ABSTRACT:** This study proposes the concept of quiet weather communication and offers the first framework of quiet weather communication strategies tied to specific public outcomes (e.g., build and maintain organization–public relationships). Most of the risk communication literature focuses on severe weather communication. We posit that through defining and examining quiet weather strategic communication we can better understand how the weather enterprise can prepare communities for future severe weather. Through four virtual focus groups with 28 NWS and broadcast meteorologists, we operationalize quiet weather communication strategies (humanize the organization, provide weather education, share the love of blue skies, and showcase quiet weather trends). We then report meteorologists' perceptions of the strengths and weaknesses of each strategy and propose future directions for research on quiet weather communication.

**KEYWORDS:** Social Science; Tornadoes; Communications/decision making

### 1. Introduction

Risk and crisis communication should deliver accurate information in a timely manner to at-risk communities (Reynolds and Seeger 2005). Beyond crafting messages, organizations must develop positive relationships with community members because people turn to trusted sources for disaster information (Heath 2004; Seeger 2006). In turn, strong relationships with trusted organizations are a driving force in publics' protective action taking (Chon and Park 2021; Sherman-Morris 2005).

In the United States, the organization primarily responsible for weather communication is the National Weather Service (NWS; Olson et al. 2019; Sutton et al. 2019). The NWS works with their core partners, including broadcast meteorologists, to disseminate information to communities so that community members are prepared for threats. The NWS has begun stressing the importance of risk communication, including the importance of maintaining strong relationships among core partners and with members of the public (Uccellini and Ten Hoeve 2019). However, only recently have researchers established the connection between strong organization–public relationships and successful risk communication (Chon and Park 2021; Liu and Atwell Seate 2021). Likewise, only recently has the research community distinguished between strategic communication during threat and nonthreat conditions (B. F. Liu et al. 2020; Olson et al. 2019; Sutton et al. 2019).

Our study builds on this nascent research through proposing the concept of *quiet weather communication*. We define quiet weather communication as communicative efforts that aim to build strong organizational–public relationships when there is not high-impact weather on the horizon (i.e., within the next 3–5 days). High-impact weather communication aims

to capitalize on the strong relationships built during quiet weather to inform at-risk publics about specific threats and recommended protective actions. To test and expand the new quiet weather communication concept, we conducted four virtual focus groups with 28 NWS and broadcast meteorologists. These focus groups uncovered the quiet weather communication strategies that NWS and broadcast meteorologists employ. The research also revealed for what purposes these meteorologists employ quiet weather strategies and how they assess the effectiveness of their quiet weather communication.

In the next section, we define risk and crisis communication and provide an overview of relevant literature. We then synthesize the limited research related to quiet weather communication and offer our first research question. We conclude with the limited research on risk communication outcomes and evaluation along with our second and third research questions.

### 2. Literature review

#### a. Risk and crisis communication overview

Risk communication is “an iterative exchange of information among individuals, groups, and institutions related to the assessment, characterization, and management of risk” (McComas 2006, p. 76), whereas crisis communication is “nonroutine” persuasive communication that is “bound to the specific conditions of a particular crisis” (Reynolds and Seeger 2005, 48–49). In other words, risk communication focuses on dialog about long-term threats, whereas crisis communication focuses on recommended actions to take in response to a specific threat (Reynolds and Seeger 2005). Communication scholars have called for more risk and crisis message research that focuses on prosocial outcomes like building relationships with community members and providing protective action guidance (e.g., Coombs 2016; B. F. Liu et al. 2020).

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For high-impact weather, risk and crisis communication is essential to protect communities. Over the past 40 years, scholars have built substantial knowledge on communication messengers, message attributes, and audience characteristics (Balog-Way et al. 2020). In the weather context, research on the source of risk information finds that messengers affect whether individuals take recommended protective actions. There is a preference for messengers with whom communities have long-term sustained relationships (Heath et al. 2019; Longstaff and Yang 2008), which includes family, friends, and neighbors along with authoritative sources such as NWS and local broadcast meteorologists (Liu et al. 2019a; Ploran et al. 2018; Sherman-Morris 2005).

In terms of message attributes, research has identified what features make disaster messages more likely to be shared and engaged with via social media such as the use of rich media like photographs or videos and the use of language that invites dialog (e.g., Fan et al. 2021; Sutton et al. 2015, 2019). Another large body of scholarship examines essential message contents such as information that must be included in warnings and other emergency messages to motivate appropriate actions (Sutton et al. 2018, 2019). In the area of audience characteristics, growing attention has been dedicated to how to tailor messages for diverse populations including racial/ethnic groups, cultural groups, and other populations with special needs (e.g., Heath et al. 2009; Messias et al. 2011; Senkbeil et al. 2021).

In sum, scholars have built substantial knowledge on communication messengers, message attributes, and audience characteristics, but not on message strategies. Reviewing the extensive body of communication research in the weather context is outside the scope of this study. The brief overview provided above contextualizes the primary impetus for this paper: The robust risk and crisis communication scholarship has largely ignored strategic communication strategies. As Sutton et al. (2015) noted in their study of flood tweets, public communicators have “little knowledge of strategies that may increase efficacy or compliance among those under threat” (p. 136). Strategic communication is “the purposeful use of communication by an organization to fulfill its mission” (Hallahan et al. 2007, p. 3). Goals of strategic communication include building strong organization–public relationships, providing education, building consensus on important issues, and reducing risky behaviors (Hallahan et al. 2007). One challenge of strategic communication research is establishing how these goals translate into messages, which in turn generate meaningful behavioral outcomes that promote societal well-being (Holtzhausen and Zerfass 2015). Researchers are just beginning to meet this challenge when it comes to strategic communication during quiet weather, as we review below. Prior work has exclusively examined the NWS, despite that other research points to broadcast meteorologists as many community members’ preferred sources for weather information (Kleier et al. 2018; Liu et al. 2019a; Morss and Hayden 2010; Sherman-Morris 2005). Accordingly, our study extends prior research by examining NWS and broadcast meteorologists’ quiet weather communication.

#### *b. Quiet weather communication strategies*

Olson et al. (2019) were the first to examine how the NWS communicates differently during threat (i.e., the possibility of high-impact weather) and nonthreat periods (i.e., quiet weather). They examined how 12 NWS offices used Twitter during a 3-month period. During nonthreat periods, NWS offices primarily used messages to build community, promote action, and provide weather facts. During threat periods, NWS offices primarily used messages to provide weather information as well as to build community. The researchers concluded that “when fair weather changes and storms approach, the offices shift to the communication of risk” (p. 359).

Findings from the same dataset show that message characteristics and weather period predict audience message engagement. Sutton et al. (2019) found that messages with weather facts or protective actions were most likely to be retweeted during threat and nonthreat time periods. Messages that included forecasts and nowcasts were least likely to be retweeted during threat and nonthreat conditions. Community building messages were more likely to be retweeted during nonthreat conditions than threat conditions.

Other scholars have likewise encouraged the NWS and other U.S. federal government science agencies to increase engagement with their publics by using platforms such as Facebook and Twitter to initiate dialog, signal and detect disasters, correct misinformation, encourage appropriate behavior change, and improve trust in climate science (Houston et al. 2014; Lee and VanDyke 2015; Lee et al. 2018; W. Liu et al. 2020). Social media engagement is defined as publics’ consumption, contribution, and creation behaviors (Men and Tsai 2014). This engagement is a proxy measure for publics’ disaster involvement, supportive behaviors such as information sharing, and motivation to take appropriate behavioral responses (Zhang and Shay 2019). In limited research, publics’ social media engagement has a positive relationship with their self-reported protective behaviors such as following NOAA-recommended actions in the tornado context (Liu et al. 2019b). Other work has found that social media can be used as “valid indicators of real-time attention to severe weather communication” to answer questions about the relationship among communication, public attention, and public responsiveness to high-impact weather (Ripberger et al. 2014, p. 529). The same may be true for quiet weather communication.

Following up on research conducted by Olson et al. (2019), Sutton et al. (2019), and B. F. Liu et al. (2020) examined NWS message strategies through a multisited rapid ethnography at three NWS offices. While the researchers did not operationalize quiet weather, they identified the following strategies that meteorologists employ on and offline: build threat awareness, translate science, humanize the organization, and foster *communitas* (i.e., community). See Table 1 for a summary of these strategies. In identifying these quiet weather strategies, B. F. Liu et al. (2020) called for additional research to contextualize and nuance these strategies, including the strategic communication goals for each approach.

Given the nascent theorizing on quiet weather communication, we extend the prior research by examining NWS and

TABLE 1. NWS quiet and high-impact weather communication strategies. This table summarizes the quiet and high-impact weather communication strategies B. F. Liu et al. (2020) identified in their interviews with NWS meteorologists and content analysis of NWS social media.

Strategy	Definition	Phase
Build threat awareness	Through building threat awareness, meteorologists assist their publics in preparing for risks well before issuing a warning	Quiet weather: Employ when transitioning to a potential storm
Visualize the risk	Meteorologists employ a variety of infographics quickly and accurately to convey threats; meteorologists similarly use words to help publics visualize risk (e.g., communicating hail size)	High-impact weather: Employ when high-impact weather is forecast or is occurring
Translate science	Make meteorological science accessible to publics through explaining weather phenomena	Quiet and high-impact weather
Motivate action	Educate publics about appropriate protective actions to take during high-impact weather	High-impact weather
Humanize the organization	Build relationships with publics through showcasing meteorologists' personalities, having fun during quiet weather, admitting errors, and expressing compassion for disaster survivor.	Quiet weather: Showcase personalities and having fun through humorous posts, connecting weather to special events or popular culture, and employing weather throwback posts; high-impact weather: Admit errors and express compassion
Foster <i>communitas</i>	<i>Communitas</i> is a shared sense of community; to foster <i>communitas</i> , forecasters ask for help from community members to build relationships with them, engage in two-way communication with publics, improve forecasting, and responsibly share power (i.e., responsibility for building a weather-ready nation)	Quiet weather: Build relationships with publics, engage in two-way communication with publics, and share power; high-impact weather: Improve forecasting through soliciting reports from trained spotters, which also shares power

broadcast meteorologists' quiet weather communication. Specifically, we pose the following research question (RQ): RQ1: *What quiet weather communication strategies do NWS meteorologists and broadcast meteorologists employ?*

In sum, RQ1 builds on the limited prior research on NWS quiet weather strategic communication on and offline (Olson et al. 2019; B. F. Liu et al. 2020), extending this work to the broadcast media context. Given that the NWS is a government agency and broadcast media are for-profit organizations, meteorologists in these two contexts may have different risk communication goals and practices, as prior research has alluded to (B. F. Liu et al. 2020).

c. *Quiet weather communication goals*

1) BUILD RELATIONSHIPS TO PROTECT COMMUNITIES

As noted in the prior section, research has found that one of the primary goals of NWS quiet weather communication is to build community or, in other words, relationships with key publics, often online through engaging with followers (B. F. Liu et al. 2020; Olson et al. 2019; Sutton et al. 2019). Community members are likely to comply with organizations' protective guidance when organizations have established strong positive relationships with these community members (Chon and Park 2021; Sherman-Morris 2005). In addition to building strong positive relationships with community members, the NWS also builds strong positive relationships with its core organizational partners including broadcast meteorologists to achieve a weather-ready nation (Liu and Atwell Seate 2021), in part to

help achieve the ambitious goal of message consistency (Williams and Eosco 2021).

2) CONTRIBUTE TO DISASTER PREPAREDNESS

A second goal of quiet weather communication identified in the literature is to contribute to disaster preparedness. As B. F. Liu et al. (2020) theorized, messages on and offline that build threat awareness and translate science help community members understand appropriate protective actions to take before high-impact weather occurs. Similarly, social media messages with weather facts (e.g., historical weather data, fun weather facts, hazard statistics) can help prepare online community members for threats and increase online engagement with the NWS (Olson et al. 2019; Sutton et al. 2019).

Examining the broader risk communication literature provides additional insights into how quiet weather communication can contribute to disaster preparedness. Research finds that exposure to disaster news coverage, pressure from peers, and feeling connected to one's community all can affect whether individuals prepare for disasters (Kim and Kang 2010; Paek et al. 2010). Perceived self-efficacy, susceptibility, disaster immediacy, and disaster certainty also are important predictors of individual disaster preparedness (Adame and Miller 2015; Paek et al. 2010). Likewise, personal experience with past high-impact weather can lead to higher perceived credibility of warning messages for ongoing threats (Sharma and Patt 2012), but it does not necessarily lead to taking recommended protective actions (Demuth et al. 2016; Silver and Andrey 2014). Translating these findings to message design,

quiet weather messages may motivate at-risk publics to prepare for future hazards when these messages share news about past high-impact weather events, come from peers (e.g., family, friends, and neighbors), provide actionable steps that individuals have the resources to take, and/or communicate the relevance of preparing for disasters. In this study, we examine how, if at all, experts (i.e., NWS and broadcast meteorologists) employ quiet weather communication to motivate disaster preparedness.

### 3) PROVIDE WEATHER EDUCATION

A third goal of quiet weather communication is to provide education. As previously noted, messages that educate about protective actions in the absence of a weather threat can build online community and stimulate engagement among the NWS and its publics (Olson et al. 2019; Sutton et al. 2019). Furthermore, during disasters governments' messages with behavioral recommendations can be difficult to find given the large volume of social media messages during the lead up to high-impact weather (Spence et al. 2015). For this reason, it may be especially important to provide education about appropriate protective actions during quiet weather.

Related research finds that campaigns and other interventions on and offline that focus on educational messages can raise awareness of natural disasters (Fraustino and Ma 2015; Kim and Kang 2010; Shaw et al. 2004), especially if message recipients positively evaluate the messengers (Anderson et al. 2013). However, disaster awareness does not necessarily lead to preparedness (Shaw et al. 2004) or appropriate action taking during disasters (Demuth et al. 2016; Silver and Andrey 2014). How experts (e.g., NWS and broadcast meteorologists) perceive the potential benefits and drawbacks of weather education during quiet weather is an open empirical question, along with to what extent these messages prepare community members for future disasters. This study begins to fill these important research gaps (see the research questions below).

### 4) RESEARCH QUESTIONS: QUIET WEATHER COMMUNICATION GOALS

In sum, past research indicates that there are three primary goals of strategic quiet weather communication: build relationships to protect communities, contribute to individual preparedness, and provide weather education. Given the scant prior research, there may be additional goals. Furthermore, prior research does not indicate how NWS and broadcast meteorologists assess the effectiveness of quiet weather communication strategies. This may be because meteorologists have identified risk communication, including message evaluation, as a primary knowledge gap for which they need future training (B. F. Liu et al. 2020; Sherman-Morris et al. 2018). Therefore, we ask the following questions:

- RQ2: For what purposes do NWS meteorologists and broadcast meteorologists employ quiet weather strategies?
- RQ3: How do NWS meteorologists and broadcast meteorologists assess the effectiveness of their quiet weather communication strategies?

## 3. Method

To answer our research questions, this study took a qualitative approach. After receiving Institutional Review Board (IRB) approval, we conducted four virtual 90-min focus groups via the online Zoom meeting platform in November 2020. Focus groups are ideal for simulating free-flowing discussions about topics for which there is inadequate prior research (Tracy 2013).

### a. Participants and recruitment

Twenty-eight participants were recruited from five NWS Weather Forecast Offices (WFOs) in the southeastern United States along with media partners in the same region. On average, seven meteorologists participated in each focus group. The five WFOs were selected because they are geographically proximate to each other, which means they often issue warnings for the same storms. The media partners were selected because their markets correspond with the five WFOs.

Before inviting participants to the focus groups, we conducted four virtual briefings via Zoom in September and October 2020. These briefings explained the purpose of the focus groups and allowed for an opportunity to answer any questions from potential participants. We also created a recorded briefing of this information for WFOs to share with their media partners who were unable to attend the briefings. Subsequently, we invited all of the meteorologists from our five partner WFOs and their media partners to the focus groups. Following our IRB protocol, we assigned gender-neutral pseudonyms to protect the identities of our participants when reporting findings (see Table 2). In the findings, we include whether participants represented broadcast media or the NWS after their pseudonyms to further contextualize the data.

### b. Data collection procedures

Prior to the focus groups, participants were invited to submit what they perceived to be their offices' best social media messages via a shared Google slide deck. Because this project is funded by NOAA's VORTEX-Southeast (VORTEX-SE) Program, the primary context for our study was tornadoes in the southeastern United States. Accordingly, we invited participants to submit social media messages about tornadoes as well as messages about other hazards such as severe thunderstorms and floods that could work well in a tornado context.

The NWS has increasingly encouraged meteorologists to adopt social media, in part because these channels allow for direct-to-the-public communication and flexibility in selecting risk communication strategies and tactics (B. F. Liu et al. 2020). For some NWS meteorologists, broadcast media have served as a valuable resource to help them master social media (B. F. Liu et al. 2020).

Despite the growing support for social media in the disaster context, social media are not without limitations. For example, these channels do not necessarily reach everyone, given disaster communication inequalities (Taylor-Clark et al. 2010) such as access to reliable internet and mobile devices. Another primary limitation is that social media support terse

TABLE 2. Summary of focus-group participants and their roles (NWS or media).

Pseudonym	NWS	Media
1. Alex	X	
2. Blake	X	
3. Kyle	X	
4. Drew	X	
5. Taylor	X	
6. Kennedy	X	
7. Jordan	X	
8. Parker		X
9. Avery		X
10. Ryan		X
11. Brooklyn		X
12. Cameron		X
13. Emerson	X	
14. Frankie		X
15. Austin	X	
16. Blake	X	
17. Charlie	X	
18. Finley		X
19. Skyler		X
20. Oakley	X	
21. Landry		X
22. Addison		X
23. Blair	X	
24. Adrian	X	
25. Dylan		X
26. Lane		X
27. Reese		X
28. Tanner		X

or short messages, which means they deliver limited content; this limited content could negatively affect stakeholders' message processing (Sutton et al. 2015), especially for messages that do not include rich message features such as videos and photographs (W. Liu et al. 2020). Despite these limitations, we focused on social media messages for this study given the primary role social media play in today's information society.

More specifically, in the shared Google slide deck we invited participants to submit messages organized by strategies identified in prior research (B. F. Liu et al. 2020; Olson et al. 2019; Sutton et al. 2019). In the shared Google slide deck, we created a cover slide for each strategy. The cover slides briefly explained each strategy. After each cover slide, we asked participants to add slides with message examples if their office employed that strategy. We also included an "other" category to capture strategies that were not identified in the prior literature. None of the participants identified strategies that were not already captured in the cover slides, but the submitted messages and focus-group discussion revealed approaches to implementing these strategies that were not captured in the prior research. In total, we received 39 quiet weather messages to discuss during the focus groups.

With participants' unanimous consent, each focus group was video recorded. After welcoming remarks and a summary of logistics, each participant briefly introduced themselves. We then conducted an ice-breaker activity to build rapport,

asking each participant how to define effective risk communication. Subsequently, we led a discussion of quiet weather communication that lasted 50 min for each focus group. To facilitate free-flowing conversations, research team members as moderators employed an open-ended discussion guide that employed the following prompt for each category of submitted messages in the shared slide deck: "What aspects of the submitted messages do you think are effective and why?" We also asked participants to reflect on "whether any of the message strategies could be effectively combined and, if so, under what circumstances?" Our third open-ended question was which risk communication strategies are most effective to use when transitioning from quiet to high-impact weather. While most participants actively engaged in the discussion, occasionally, the moderators prompted some participants by directly asking for their opinions about specific messages when those participants were quiet, following best practices in moderation of focus groups (Tracy 2013). We concluded the focus groups with each group sharing a 3–5-min summary of the highlights from their discussion.

c. Data analysis

During the focus groups, research team members took notes to record their initial observations. Each focus group also had a volunteer notetaker from the participants to record the highlights of the discussion from the participants' perspectives, following best practices in participatory action research (Whyte 1991). Video-recorded focus groups were professionally transcribed by the firm Rev, which requires that transcribers sign a nondisclosure agreement to protect the confidentiality of research participants. To analyze the data, researchers employed codes from the notes and from the extant literature. Additional codes emerged inductively during data analysis, as recommended by best practices in qualitative data analysis (Kvale and Brinkmann 2009; Lindlof and Taylor 2011).

When coding the data, the research team employed the qualitative software NVivo. NVivo facilitates human coding of open-ended data, including the capacity to merge themes and visually display data. First, we created nodes in NVivo, which are tags researchers use to code data thematically. Nodes allow researchers to view all data related to a single theme. Nodes for this project included the quiet weather strategies identified in the prior research, participants' quiet weather communication goals, and participants' perceptions of risk communication strategy effectiveness. As the data were coded, additional subnodes were added (e.g., the different communication goals identified by participants). While using NVivo, we employed analytical strategies from Corbin and Strauss (2015) to iteratively code the data, which include constantly reflecting on the data, looking for negative-case examples, and using the participants' own words to code data.

4. Findings

In this section we report the findings, organized by research questions.

TABLE 3. Quiet weather communication strategies. This table presents meteorologists' perceptions of strategic communication options for quiet weather. The table includes meteorologists' perceptions of the drawbacks of each strategy. Future research is needed to determine how community members respond to each strategy.

Strategies	Goals	Example messages	Meteorologists' perceptions of strategies' drawbacks
Humanize: Community care	Foster relationships with community members by showing that an organization cares about their community	<ol style="list-style-type: none"> <li>1. Expression of concern for communities experiencing devastating flooding</li> <li>2. An explanation that broadcast meteorologists break into television programming to protect people during high-impact weather</li> <li>3. A congratulatory note on making it halfway through 2020 [the first year of the coronavirus disease 2019 (COVID-19) pandemic]</li> </ol>	None identified
Humanize: Cute littles	Establish and sustain relationships with community members by posting pictures of babies, children, pets, and/or animals	<ol style="list-style-type: none"> <li>1. A snapshot of a broadcast meteorologist conducting a Facebook live science experiment with her niece and nephew</li> <li>2. A picture of a meteorologist's dog alongside an NWS forecast for cold weather</li> <li>3. A picture of a squirrel with a tagline "that's nuts" to describe a chilly winter forecast</li> </ol>	Typically does not translate to better understanding high-impact weather risks or taking protective actions
Humanize: Fun communicative connections	Post playful messages to engage with community members and sustain organization-public relationships over time	<ol style="list-style-type: none"> <li>1. A comparison of the expected snow accumulation to the powder on a donut</li> <li>2. Connecting a forecast to the popular 1980s band New Kids on the Block</li> <li>3. Invite questions about weather, life, or fashion</li> </ol>	Humor can fall flat and potentially alienate some community members
Humanize: Inside the weather enterprise	Help community members understand what experts within the weather enterprise do	<ol style="list-style-type: none"> <li>1. A picture of hurricane hunters employed by NOAA</li> <li>2. A picture of NWS or broadcast meteorologists at work inside or outside of their offices</li> </ol>	Not linked to any specific outcomes such as building relationships, increasing trust, or motivating appropriate protective action taking
Humanize: Weather throwbacks	Remind community members of a past significant event to grab attention, facilitate dialog, and provide weather education	<ol style="list-style-type: none"> <li>1. Post a picture of a past storm on the storm's anniversary</li> <li>2. Ask trivia questions about past weather events</li> </ol>	Can invite climate debates, which detracts from providing weather education and building positive relationships
Humanize: weatherlore	Debunk myths and/or build relationships with community members	<ol style="list-style-type: none"> <li>1. A picture of spoons in persimmon seeds and discussed the upcoming winter forecast in a video</li> <li>2. Discuss how reliable woolly worms are for predicting winter weather</li> </ol>	May promote unscientific knowledge, which does not help increase community members' accurate weather knowledge
Provide weather education	Build awareness of weather risks and knowledge about what actions to take	<ol style="list-style-type: none"> <li>1. Graphics explaining what actions to take when there are floods, rising waters, or tornados</li> <li>2. Graphic explaining the difference between a watch and a warning</li> <li>3. Graphic advocating for community members to "get your safety kit ready" or "know where you are on a map"</li> </ol>	Can be boring; use sparingly and only when a potential threat is on the horizon
Share the love of blue skies	Post images of quiet weather to connect with community members when there is nothing else to post; may increase trust in the message source	<ol style="list-style-type: none"> <li>1. Photographs of country roads, sunsets, and sunny skies</li> </ol>	Does not increase high-impact weather knowledge or protective action knowledge
Showcase quiet weather trends	No clear purpose identified	<ol style="list-style-type: none"> <li>1. Forecast graphic that shows calm weather trends</li> </ol>	No clear purpose for this strategy; experts assessed it as less engaging than the other "filler" strategies like providing weather education and sharing the love of blue skies

### a. *Quiet weather communication strategies (RQ1)*

Our first research question investigated what quiet weather communication strategies NWS and broadcast meteorologists employ. As displayed in [Table 3](#), participants implement a wide variety of strategies. These strategies are grouped into four categories: humanize the organization, provide weather education, share the love of blue skies, and showcase quiet weather trends. Next, we explain each strategy.

#### 1) HUMANIZE THE ORGANIZATION

Participants identified humanizing the organization as their primary quiet weather communication strategy. This strategy aims to build relationships with community members through showcasing meteorologists' personalities by having fun during quiet weather. All of the participants had a favorable view of humanizing. As Ryan (media) explained, "Sometimes I think we're not conversational enough in our messaging. And by putting those words together and phrases like that, it allows us to not just talk like robots sometimes." Participants discussed that there may be some reticence to employ the humanizing strategy as it involves more than sharing science, but overcoming that reticence is essential "to get our name out there" (Tanner; media) and "to build relationships and have effective messaging" (Emerson; NWS).

Participants identified six different approaches to humanizing their offices during quiet weather: community care, cute littles, fun communicative connections, weather throwbacks, and weatherlore (see [Table 3](#)). The results for RQ2, presented later, further detail these approaches in terms of their goals and limitations.

#### 2) PROVIDE WEATHER EDUCATION

The second quiet weather communication strategy identified by participants is providing weather education. This strategy aims to build community members' awareness of weather risks along with knowledge about what actions to take in response to those risks. Most participants advised against employing this strategy in the absence of a potential threat. From Oakley's (NWS) perspective, "I would say weather education only works when the hazard isn't imminent, but it's in your forecast . . . Because people do not like to be lectured to, unless they feel like they have a personal stake in what's happening to them."

Even when there is a potential weather threat, NWS participants in particular recommended using the weather education strategy sparingly because they believe that it can be perceived as "filler" with no purpose (Oakley and Adrian; NWS) and produce messages that often are "boring" for community members who are not actively engaged with the weather [Jordan (NWS) and Ryan (media)].

Participants further noted that they believe that the weather education strategy may be best received by audiences who are highly interested in the weather. For those who are interested in learning about the weather, forecasters believe that education can build trust. As Ryan (media) noted:

I think it really builds trust because we get a lot of feedback from people saying, "We love when you teach us stuff, we actually now understand it." And I've always thought that if people understand weather better, they will not be as scared of it when it actually moves in. Instead of that scary black cloud coming at you, like, "Oh, that's a shelf cloud, I learned about that from [meteorologist's name removed]'s post."

#### 3) SHARE THE LOVE OF BLUE SKIES

The third communication strategy identified by participants is sharing the love of blue skies. Participants employ this strategy to connect with their community members by posting quiet weather images. Similar to providing weather education, most participants characterized sharing the love of blue skies as a "filler" strategy. As Jordan (NWS) noted, "Well, sometimes you've got to stay engaged, and that's all that you've got at that time. And hey, everybody loves it, so why not?" Overall, participants recommended using this strategy sparingly, in large part because it is not connected with a specific communication goal. However, as Skyler (media) explained, they believe that sharing "blue skies" posts can help meteorologists "remain relevant" and "stay in their [community members'] newsfeed."

#### 4) SHOWCASE QUIET WEATHER TRENDS

The fourth communication strategy identified by participants is showcasing quiet weather trends such as forecast graphics. Participants were not enthusiastic about this strategy because they did not see a clear purpose for this type of communication. They also noted that from their past experiences they are unlikely to get a lot of engagement (e.g., likes, shares, and comments) for this strategy. As Emerson (NWS) explained, "I'd say that this is probably really similar to the blue skies post, but we're not going to get as many responses to this." However, there still could be a time and a place for this strategy. Brooklyn (media) suggested that this approach could potentially be used when transitioning away from a quiet weather period, but Brooklyn agreed with the other participants that it is not the most engaging approach from their experiences. Brooklyn shared, "During quiet weather, I hope it's showing some sort of change coming like 'we've been in a drought, and here's how much of a drought we've been in,' or something like that. Otherwise, I do not know if there's really an effective way or method to use it."

### b. *Quiet weather communication goals (RQ2)*

Our second research question inquired about the goals meteorologists have when employing quiet weather communication strategies. Overall, participants' primary goal across strategies is relationship building. Other quiet weather communication goals are providing weather education and motivating future protective actions. Below we elaborate on these goals.

### 1) BUILD RELATIONSHIPS WITH COMMUNITY MEMBERS

Participants recommend humanizing as the optimal quiet weather communication strategy for building relationships with community members. Participants noted that they believe that the humanizing strategy “invites participation” (Kyle; NWS), helps “people feel like they know you when they need you most” (Oakley; NWS), and facilitates “establishing credibility” for the messenger (Tanner; media).

In terms of the different humanizing approaches, participants agreed that they believe that messages of community care are essential for establishing strong relationships before high-impact weather. Participants recommended using the other humanizing strategies carefully and sparingly, as further discussed below.

#### (i) Community care

Messages of community care seek to build relationships by communicating that meteorologists understand their publics’ interests and needs. Participants shared their perspectives that these messages are particularly effective in building relationships during quiet weather because they are “a way to connect and to have that one-on-one sort of interaction” (Blake; NWS). Avery (media) noted, “If the message does not have that personal connection, then it is a lot more disconnected from the audience.” Meteorologists underscored the importance of building these connections during quiet weather days because having relationships in place are thought to pay dividends during high-impact weather. Emerson (NWS) shared, “I think the more we can show that we’re real people and not some boring federal government agency, the better off we can make that relationship and have effective messaging.” Participants believed this is important because “There’s a lot more sense of urgency going on during an event” and less time to build relationships than during quiet weather (Avery; media).

#### (ii) Weather throwbacks

Participants agreed that weather throwbacks can facilitate online dialog, which can contribute to building relationships. Speaking about dialog, Adrian (NWS) shared the following:

This past April 27th 2011 anniversary we actually had someone that said, “Hey, I was affected by this track. And then someone followed up and he said, “I was a paramedic that saved you from your house.” And so then that got a conversation going and just seeing the connection sometimes that you are able to form unintentionally with people, or, either like, “I was a kid when this happened.” And so, then people are telling additional details, I never knew that. And so it pulls back memories. And it shows that you’re not forgetting those big events that have happened.

To facilitate dialog, participants noted that from their experiences, throwbacks must include images to grab attention and to provide weather education. For instance, Reese (media) recommended, “A graphic that has a fuzzy-looking tornado that says 258 lives lost or something basic that will evoke emotion and then let the person stay there a little longer and read what you’re really trying to tell them.”

#### (iii) Fun communicative connections

“Fun communicative connections” is a message strategy that uses various forms of humor, typically word play or puns, to connect with community members and/or share weather information. Participants favorably viewed fun communicative connections as a humanizing approach to engage with community members. However, they offered a few caveats. On the positive side, Tanner (media) summarized, “People appreciate levity and you being a real person . . . And by establishing a relationship with people and showing that, that’s a darn good thing.” Participants also believed that this approach helps posts circulate more widely on social media. Taylor (NWS) noted, “As far as our engagement in posts, this strategy during quiet weather is the most effective . . . Just with the algorithms on social media to stay relevant, where our posts are popping up on people’s feeds. I think as far as quiet weather messaging, this is probably one of the most effective ways for us.”

Participants discussed that a post does not have to be funny to build connections. Landry (media) recommended, “You’re not a comedian, you’re a communicator. So, let people know who you are. And I think if you do that, you’re doing well.”

At the same time, participants agreed that you have to know when to shut humor off, especially when potential high-impact weather is approaching. Additionally, participants agreed that there are topics that should always be avoided, which are religion, politics, and sometimes sports. Charlie (NWS) explained by stating, “It’s a fine line. It’s important to be human on these quiet weather days and show that we’re not just weather nerds, there’s a fun side of us too. But it seems like you have to be real selective when the country is just very divided.”

#### (iv) Cute littles

Participants recommended sparingly sharing pictures of pets, other animals, and babies/young family members to build connections with community members. Jordan (NWS) explained, “There are some people who have their daily dog picture. Okay, I love your dog, but not every day. It needs to be with discretion.”

Participants differed as to whether it is better to post about animals or pets versus children when employing the cute little approach to build relationships. Most NWS meteorologists agreed that they do not post pictures of their kids for privacy concerns, but that animal posts “seem to be the one thing that gets the most engagement on social media” (Blake; NWS) in terms of likes, comments, and shares. As Lane explained, the cute littles approach, especially with children, may work best for broadcast meteorologists. Lane shared, “They [members of the community] do not have a relationship with me, but if it was, someone on TV, [broadcast meteorologist name removed] and her five kids . . . Those things, they seem to take off on social media, but I’m behind the scenes with the National Weather Service and it kind of flopped for me.”

Most broadcast meteorologists felt comfortable posting pictures of kids and animals, in part because broadcast media is very visually driven.



(v) *Inside the weather enterprise*

For the “inside the weather enterprise” message strategy, meteorologists provide behind-the-scenes information about how they make the forecast. For example, participants post photographs of balloon launches, working together in the office, or of meteorologists in the field (e.g., conducting storm damage assessment surveys). Participants expressed that they rarely employ this approach to build relationships, but they believe there could be opportunities to do so in the future. For example, Avery (media) shared, “During quiet weather getting people to look at the enterprise itself, it will help humanize us . . . I think that one of the ways I have seen it is doing a day in the life type of story . . . That usually seems to track pretty well. But you can’t do a day in the life every day.”

Participants also believed that the inside the weather enterprise can be an appropriate strategy for helping community members understand who the NWS is. Taylor (NWS) elaborated, “I think it’s a good way for us in the Weather Service to humanize ourself because we’re not in front of the camera. Whenever someone asks us, ‘What do you do?, I work for the Weather Service.’ They’re, ‘Oh, what station is that?’ It kind of gives people a better idea of what we do and personalizes us.”

However, not all participants agreed that this is a valuable approach because some believed that this approach tends to only reach weather enthusiasts. Participants reported that inside the weather enterprise posts tend to only generate engagement (e.g., likes, comments, and shares) with weather enthusiasts, as judged by the weather expertise displayed in comments.

## 2) PROVIDE WEATHER EDUCATION

A second potential goal of quiet weather communication is to provide weather education. As previously discussed, participants identified providing weather education as a communication strategy that helps community members understand weather threats and mitigation actions. However, participants believed that this strategy can be perceived as “filler” [Avery (media), Oakley (NWS) and Adrian (NWS)] and “boring” (Jordan; NWS) to nonweather enthusiasts. Participants advised against frequently deploying the weather education strategy on social media, but they saw great value in this strategy for training. As Taylor (NWS) explained, “We do a lot of online classes . . . And that gives us an opportunity to interact. Now we usually see the people that are very interested in the weather. You aren’t going to get the common person, but it does help us educate during the quiet periods.”

Participants more favorably viewed employing two humanizing approaches to provide weather education: weather throwbacks and weatherlore. From their experiences, participants explained that weather throwbacks can be used for big events in order to educate people about high-impact weather risks in their community. Charlie (NWS) explained, “So if you can show, ‘Hey one came close to you 20 years ago.’ I think that reinforces your message and the legitimacy that bad things can happen.”

Similarly, some participants expressed that weatherlore messages are appropriate for making fun communicative connections with community members while simultaneously providing weather education. Parker (media) explained weatherlore as

follows: “You’re having fun with it, but you can also go back to the actual science, ‘so we’re going to have the actual science coming up. So, stick with us.’ And so you’re kind of building on that playfulness, but also realize it’s not for real.”

In contrast, a few participants explained that they never use weatherlore because it is not scientific. From their perspective, this approach also does not appear to help educate community members (i.e., debunk misinformation) about weather threats even if it can be a fun way to build connections with community members. Oakley (NWS) summarized this perspective as follows: “I’m always worried that if I’m supporting in any fashion an ‘old wives tale’ then I’m also inadvertently reinforcing someone’s belief that I live on this side of the hill therefore the tornado can’t get me . . . I worry about, in the information age, somehow promoting something that might get somebody hurt.”

In the end, participants agreed that it comes down to knowing your audience and whether weatherlore coupled with science will resonate positively rather than inadvertently cause harm.

## 3) MOTIVATING PROTECTIVE ACTIONS

A third potential goal of quiet weather communication is motivating protective actions. Participants noted that motivating appropriate protective actions is typically a goal for high-impact weather education. However, at times, quiet weather communication may also aim to motivate protective actions for future events. In particular, participants recommended employing the cute littles approach to humanizing to move beyond engagement (likes, comments, and shares) to future action taking. For example, posting a picture of animals and then reminding community members to move animals inside during freezing temperatures was perceived as effective. Avery (media) explained, “I’ll frequently get posts from people who want me to make sure that I remind the audience to get their pets inside.”

### c. *Quiet weather communication effectiveness (RQ3)*

Our third research question examined how NWS and broadcast meteorologists assess the effectiveness of their quiet weather communication. As can be seen in our RQ2 results, participants frequently connected message effectiveness to engagement. This included whether community members responded to messages posted online with comments or reaction buttons such as “like” on Facebook. This also included message reach and other metrics provided by Facebook to business accounts.

When asked specifically about what makes for effective communication, participants focused on high-impact weather communication rather than quiet weather communication. They noted that high-impact weather communication must be “clear, concise, actionable, and updated during an event” (Oakley; NWS) as well as “calm . . . and involve very direct calls to action” (Reese; media). Messages that are “short, simple, and sweet” (Dylan; media) are imperative. Tanner (media) explained, “Part of tornado risk communication is establishing a relationship with people before the tornado day happens . . . You just can’t be some stranger that comes in during a tornado event.”

Broadcast meteorologists focused on the emotional valence of their messages as an important metric of success. They emphasized the importance of remaining calm for risk communication to be effective. As Austin (media) shared, “I think effective, good communication is, in terms of television, you’ve got to keep the viewer calm, don’t get hyped up.” NWS meteorologists commented on the effectiveness of their office’s risk communication depending upon “who is working” (Blake; NWS). While some participants saw divergence in risk communication by shift as problematic and offered templates to increase consistency, others viewed divergence as beneficial so that meteorologists could “focus on their strengths” (Taylor; NWS).

Ultimately, participants measured effective communication by whether their messages protect lives and property. For instance, Blair (NWS) shared, “After having been thoroughly involved in the 27 April 2011 tornadoes my main thing is what you’re putting out, people are going to react to it. I’ve found that that has been key. And when folks aren’t doing what we want them to do, aren’t taking shelter, we’re not getting out effective communication.”

## 5. Discussion

The former editor of *Weather, Climate and Society* wrote, “compared to other foci of risk communication, the Weather Enterprise is woefully behind in understanding and researching communication processes” (Lazo 2012, p. 234). Significant progress has been made on understanding communication messengers, message attributes, and audience characteristics (Balog-Way et al. 2020), especially in the context of high-impact weather. Yet, much less is known about the role of communication during quiet weather. The focus on high-impact weather communication is sensible, as it is critical for protecting lives and property. Equally important is developing trust and establishing credibility before high-impact weather occurs (Balog-Way et al. 2020; Olson et al. 2019; Seeger 2006). This paper is the first to conceptualize and study quiet weather communication strategies in order help forecasters build relationships with community members before high-impact weather occurs.

### a. RQ1: Quiet weather communication strategies

To understand quiet weather communication, we conducted four focus groups with 28 NWS and broadcast meteorologists. Gaining insights from practitioners is an important contribution of this study, as researchers rarely gain insider perspectives when making recommendations for practice (Eriksson 2018; Ha and Riffe 2015).

Building from previous work (B. F. Liu et al. 2020; Olson et al. 2019; Sutton et al. 2019), our study found that NWS and broadcast meteorologists employ four types of quiet weather message strategies: humanizing their organization, providing weather education, sharing the love of the blue skies, and showcasing quiet weather trends. As indicated in Table 3, messages that humanize the organization were the most prevalent and nuanced of the message strategies meteorologists discussed.

### b. RQ2: Goals and drawbacks of quiet weather message strategies

The literature suggests three potential goals for quiet weather communication: building relationships (B. F. Liu et al. 2020; Olson et al. 2019), contributing to disaster preparedness (Paek et al. 2010; Kim and Kang 2010), and providing weather education (B. F. Liu et al. 2020; Sutton et al. 2019). Our findings indicate that meteorologists prioritize relationship building as a key goal of their quiet weather communication, which serves as a foundation for the other two goals to occur. We unpack these ideas in more detail below.

#### 1) BUILDING RELATIONSHIPS THROUGH HUMANIZING MESSAGES

Participants emphasized the importance of humanizing messages during quiet weather because they believe that these messages build relationships with their publics. Past research found that community identification has a positive relationship with perceived community resilience and social media action taking during disasters (e.g., sharing information) among hurricane survivors (Zhang and Shay 2019). Related scholarship showed that strong organizational relationships predict public protective action taking (Chon and Park 2021; Sherman-Morris 2005). It is an open empirical question whether humanizing strategies increase community identification and online engagement with forecasters in ways that build community resilience. Our research reveals meteorologists’ perceptions of effective humanizing messages, which future research can test with community members.

Six subtypes of humanizing strategies emerged from the focus groups: community care, cute littles, fun communicative connections, inside the weather enterprise, weather throwbacks, and weatherlore. Participants believed that publics seeing their organizations as composed of real people is essential for successful communication. Participants did not identify any potential drawbacks of the community care message strategy.

A second message strategy that was seen as important in building relationships is fun communicative connections. Participants believed that these messages allow publics to see a playful side of the communicator that, in turn humanizes them to their publics. While some participants indicated that several of their most successful social media post in terms of engagement metrics have used this message strategy, other participants warned that using humor can potentially fall flat and alienate some community members. This hesitancy is not unfounded. Previous research suggests that humor can increase topic awareness, but this increased awareness may not translate to publics’ protective action taking (e.g., Fraustino and Ma 2015). Additional research suggests that humor may be best for engaging with weather enthusiasts online (Lambert 2020).

The three other humanizing message strategies (i.e., cute littles, weather throwbacks, and weatherlore) were seen as potentially important in building relationships, but some participants indicated that these strategies may detract from the other two goals of quiet weather communication: providing weather education and contributing to disaster preparedness. Meteorologists perceived the cute littles message strategy as a

way to connect to publics in a humanizing way. There was a difference between NWS and broadcast meteorologists in implementing this message strategy. NWS meteorologists discussed that they do not have an individualized relationship with their publics because they are not “on air” like their broadcast counterparts. Both NWS and broadcast meteorologists indicated that they believe that a cute little message does not typically translate to a better understanding of high-impact weather risk or protective action taking.

Weather throwbacks are perceived as important to gain attention, facilitate dialogue, and provide weather education. Communication research has long recognized that dialogue is essential for building relationships (e.g., [Kent and Taylor 2002](#); [Sommerfeldt and Yang 2018](#)). [Kent and Taylor \(2002\)](#) underscored the importance empathy and commitment to the dialogue process, which means that message strategies should be designed with these goals in mind. However, some meteorologists shared that dialogue in response to weather throwback messages could get sidetracked by members of the public in ways that detract from providing weather education (e.g., climate change deniers), which in turn may negatively impact relationship building efforts.

Weatherlore is another message strategy that may allow for engagement with publics (i.e., likes, comments, and shares), but can come with the drawback of not providing weather education. Meteorologists feared that using these messages may inadvertently give credence to inaccurate weather knowledge because weatherlore is unscientific. However, scholars have urged the hazards community to not “relegate local knowledge about tornadoes to simply myths that need to be dispelled” ([Klockow et al. 2014](#), p. 803) because doing so damages potential relationships with community members. It is an open empirical question as to whether weatherlore both builds relationships and helps community members safely prepare for high-impact weather, which future research can explore.

A final humanizing message, inside the weather enterprise, was infrequently used by participants. However, participants indicated that there are potential benefits to using this approach. This was particularly the case for NWS participants, who perceived a lack of a relationship between their organization and community members because they are not on camera like broadcast meteorologists. One word of caution was provided: Most participants believed that inside the weather enterprise messages are best suited for weather enthusiasts. As others have noted, future research is needed to identify how social media message strategies can be best tailored to meet different stakeholders’ weather information needs ([Liu and Xu 2019](#)) and to determine to what extent online engagement with disaster messages transfers to offline behaviors among different stakeholders ([Liu et al. 2019b](#); [Ripberger et al. 2014](#)).

Participants also noted the importance of certain strategies for relationship maintenance. Most of the humanizing strategies discussed above were seen as helpful in building and maintaining relationships with publics. Sharing the love of the blue skies was an additional strategy meteorologists believe helps them maintain relationships. The potential drawback of this message strategy is that it likely does not increase publics’

knowledge about the weather or appropriate protective actions. However, participants indicated that these messages are important because they can help meteorologists stay on people’s newsfeeds, which prior crisis research supports ([Fowler 2017](#)). It is also important to note that this message strategy might facilitate relationship initiation as well. [Sutton et al. \(2019\)](#) found that social media posts with images were more likely to be shared during quiet and high-impact weather.

## 2) DISASTER PREPAREDNESS

A second potential goal of quiet weather communication is disaster preparedness (e.g., [Kim and Kang 2010](#); [B. F. Liu et al. 2020](#); [Paek et al. 2010](#)). Participants discussed motivating protective action as the primary goal for high-impact weather communication. However, participants indicated that they see the benefit of using humanizing strategies during the transition from quiet to high-impact weather to remind publics of important protective actions. Weather education messages also address disaster preparedness, as further discussed below.

## 3) PROVIDING WEATHER EDUCATION

A third goal of quiet weather communication is to provide weather education ([B. F. Liu et al. 2020](#); [Olson et al. 2019](#); [Sutton et al. 2019](#)). Educational campaigns can increase awareness (e.g., [Fraustino and Ma 2015](#)), but that increase in awareness does not always lead to preparedness ([Shaw et al. 2004](#)) or appropriate protective action taking ([Demuth et al. 2016](#)). Participants believed that weather education messages are important but come with the drawback of potentially being perceived as boring by the general public. Additionally, participants believed that these messages should only be used when a potential threat is on the horizon because the time proximity helps make the message more salient to publics. While not tested in the disaster context, this idea is supported by construal theory, which states that events and objects that are perceived as closer to the self in terms of time and space are processed differently than events and objects that are perceived as far from the self (e.g., [Trope and Liberman 2010](#)).

In addition, our findings show that meteorologists rely on their publics’ collective memory about a prior event when employing weather throwbacks to educate. Collective memories are shared by a group of people and can be formed by a community experiencing a disaster (e.g., [le Blanc 2012](#); [Monteil et al. 2020](#)). Weather throwbacks appear to activate collective memory in order to reduce optimism bias—a cognitive bias in which people believe that they are less at risk for a negative event or outcome in comparison with others (e.g., [Shepperd et al. 2013](#)). Whether weather throwbacks are effective at reducing optimism bias is an open empirical question for future research.

The final type of quiet weather strategy, showcasing quiet weather trends, was not perceived as linked to achieving the goals of quiet weather communication. Participants indicated that, like sharing the love of the blue skies, this is a filler strategy. Unlike “blue skies” messages, showcasing quiet weather trends does not receive much engagement. While many participants did not see the benefit of showcasing quiet weather

trends, others indicated that this strategy could potentially be helpful when transitioning away from quiet weather, which future research could examine.

*c. RQ3: Assessing effectiveness of quiet weather communication*

Our third research question inquired about how meteorologists assessed the effectiveness of their quiet weather communication. Participants overwhelmingly rely on engagement metrics (e.g., like, shares, comments) to determine message effectiveness rather than measuring other outcomes that are important in determining publics' on and offline behaviors (e.g., trust, credibility; Balog-Way et al. 2020). It is also important to note that achieving engagement is not the same as building a relationship (Liu and Atwell Seate 2021).

Furthermore, research indicates that not all online engagement is positive (e.g., Kochigina 2020), as demonstrated by our weather throwback findings. Scholars have called for research to distinguish among the multiple ways that publics engage online (Johnston and Taylor 2018; W. Liu et al. 2020). For example, online behaviors such as "likes" may be a proxy measure for publics' emotional engagement with a message whereas online behaviors such as comments may be a proxy measure for a deeper and more sustained reaction (W. Liu et al. 2020). Whether these deeper reactions are related to relational building efforts is an open empirical question. Additionally, it is an open empirical question whether different social media engagement behaviors lead to different offline actions during quiet and high-impact weather, which future research should explore. Overall, our findings indicate that meteorologists need help measuring their communication effectiveness during quiet weather—a problem that has been noted in prior research for high-impact weather (e.g., Sherman-Morris et al. 2018).

While participants overwhelmingly pointed to engagement metrics to determine their communication effectiveness, there are some interesting differences that emerged between NWS and broadcast meteorologists. NWS meteorologists stated that their office's communication effectiveness was inconsistent across shifts. Some NWS meteorologists believed that this was a problem needed to be reconciled through message templates, while others suggested that offices should let meteorologists play to their communication strengths. Additionally, our results suggest that broadcast meteorologists believed that for communication to be effective it should be calm. NWS participants did not speak to emotional valence of their messages, but previous research found that NWS meteorologists believe it is important to not arouse fear in their risk messaging (B. F. Liu et al. 2020).

## 6. Limitations and directions for future research

This study has limitations. First, our sample consisted of five NWS offices in the southeastern United States and their broadcast meteorologist partners. Hence, the findings may not transfer to other contexts. Second, this study focused on the perceptions of meteorologists and not their publics. Future research is needed to test publics' perspectives on the quiet

weather strategies identified here. Third, we captured meteorologists' self-identified quiet weather communication strategies, building on the strategies identified in the prior content analysis and interview literature (B. F. Liu et al. 2020; Olson et al. 2019; Sutton et al. 2019). However, the research team did not independently code the strategies that meteorologists identified. Also, we focused on meteorologists' use of quiet weather strategies on social media. Future research can examine other communication vehicles such as meteorologists' live TV broadcasts.

## 7. Conclusions

Fortunately, meteorologists typically spend most of their time forecasting quiet rather than high-impact weather. While prior research has established the importance of building relationships with publics before storms, our study presents the first theoretical typology of four message strategies that meteorologists use during quiet weather: humanizing the organization, providing weather education, sharing the love of blue skies, and showcasing quiet weather trends. Descriptive theories, like this typology, can guide future research by challenging how people understand a concept (Reinard 2008). In this regard, our study is also the first to operationalize the quiet weather communication concept from an inside-out perspective through direct interactions with meteorologists. Future research should test these message strategies to determine their effectiveness in building relationships with key publics, providing weather education, and motivating appropriate protective actions during high-impact weather. Through a better understanding of quiet weather communication, meteorologists can help communities become more resilient.

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*Data availability statement.* This study received approval from the University of Maryland Institutional Review Board (IRB) to collect human subjects' data. In line with that approval, only researchers identified in the IRB package have access to the focus-group data collected.

## REFERENCES

- Adame, B. J., and C. H. Miller, 2015: Vested interest, disaster preparedness, and strategic campaign message design. *Health Commun.*, **30**, 271–281, <https://doi.org/10.1080/10410236.2013.842527>.
- Anderson, A. A., T. Myers, E. W. Maibach, E. Cullen, J. Gandy, J. White, N. Stenhouse, and A. Leiserowitz, 2013: If they like you, they learn from you: How a brief weathercaster-delivered climate education segment is moderated by viewer evaluations of the weathercaster. *Wea. Climate Soc.*, **5**, 367–377, <https://doi.org/10.1175/WCAS-D-12-00051.1>.

- Balog-Way, D., K. McComas, and J. Besley, 2020: The evolving field of risk communication. *Risk Anal.*, **40**, 2240–2262, <https://doi.org/10.1111/risa.13615>.
- Chon, M.-G., and H. Park, 2021: Predicting public support for government actions in a public health crisis: Testing fear, organization-public relationship, and behavioral intention in the framework of the situational theory of problem solving. *Health Commun.*, **36**, 476–486, <https://doi.org/10.1080/10410236.2019.1700439>.
- Coombs, W. T., 2016: Reflections on a meta-analysis: Crystallizing thinking about SCCT. *J. Public Relat. Res.*, **28**, 120–122, <https://doi.org/10.1080/1062726X.2016.1167479>.
- Corbin, J., and A. Strauss, 2015: *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*. Sage, 456 pp.
- Demuth, J. L., R. E. Morss, J. K. Lazo, and C. Trumbo, 2016: The effects of past hurricane experiences on evacuation intentions through risk perception and efficacy beliefs: A mediation analysis. *Wea. Climate Soc.*, **8**, 327–344, <https://doi.org/10.1175/WCAS-D-15-0074.1>.
- Eriksson, M., 2018: Lessons for crisis communication on social media: A systematic review of what research tells the practice. *Int. J. Strategic Commun.*, **12**, 526–551, <https://doi.org/10.1080/1553118X.2018.1510405>.
- Fan, C., C. Zhang, A. Yahja, and A. Mostafavi, 2021: Disaster city digital twin: A vision for integrating artificial and human intelligence for disaster management. *J. Int. Manage.*, **56**, 102049, <https://doi.org/10.1016/j.ijinfomgt.2019.102049>.
- Fowler, B. M., 2017: Stealing thunder and filling the silence: Twitter as a primary channel of police crisis communication. *Public Relat. Rev.*, **43**, 718–728, <https://doi.org/10.1016/j.pubrev.2017.04.007>.
- Fraustino, J. D., and L. Ma, 2015: CDC's use of social media and humor in a risk campaign—"Preparedness 101: Zombie Apocalypse." *J. Appl. Commun. Res.*, **43**, 222–241, <https://doi.org/10.1080/00909882.2015.1019544>.
- Ha, J. H., and D. Riffe, 2015: Crisis-related research in communication and business journals: An interdisciplinary review from 1992 to 2011. *Public Relat. Rev.*, **41**, 569–578, <https://doi.org/10.1016/j.pubrev.2015.06.019>.
- Hallahan, K., D. Holtzhausen, B. van Ruler, D. Vercic, and K. Srimamesh, 2007: Defining strategic communication. *Int. J. Strategic Commun.*, **1**, 3–35, <https://doi.org/10.1080/15531180701285244>.
- Heath, R. L., 2004: *Handbook of Public Relations*. Sage, 816 pp.
- , J. Lee, and L. Ni, 2009: Crisis and risk approaches to emergency management planning and communication: The role of similarity and sensitivity. *J. Public Relat. Res.*, **21**, 123–141, <https://doi.org/10.1080/10627260802557415>.
- , —, and L. L. Lemon, 2019: Narratives of risk communication: Nudging community residents to shelter-in-place. *Public Relat. Rev.*, **45**, 128–137, <https://doi.org/10.1016/j.pubrev.2018.12.004>.
- Holtzhausen, D., and A. Zerfass, 2015: Strategic communication: Opportunities and challenges in the research area. *The Routledge Handbook of Strategic Communication*, D. Holtzhausen, and A. Zerfass, Eds., Routledge, 27–41.
- Houston, J. B., and Coauthors, 2014: Social media and disasters: A functional framework for social media use in disaster planning, response, and research. *Disasters*, **39**, 1–22, <https://doi.org/10.1111/disa.12092>.
- Johnston, K. A., and M. Taylor, 2018: *The Handbook of Communication Engagement*. John Wiley and Sons, 600 pp.
- Kent, M. L., and M. Taylor, 2002: Toward a dialogic theory of public relations. *Public Relat. Rev.*, **28**, 21–37, [https://doi.org/10.1016/S0363-8111\(02\)00108-X](https://doi.org/10.1016/S0363-8111(02)00108-X).
- Kim, Y.-C., and J. Kang, 2010: Communication, neighborhood belonging and household hurricane preparedness. *Disasters*, **34**, 470–488, <https://doi.org/10.1111/j.1467-7717.2009.01138.x>.
- Kleier, J. A., D. Krause, and T. Ogilby, 2018: Hurricane preparedness among elderly residents in south Florida. *Public Health Nurs.*, **35**, 3–9, <https://doi.org/10.1111/phn.12344>.
- Klockow, K. E., R. A. Peppler, and R. A. McPherson, 2014: Tornado folk science in Alabama and Mississippi in the 27 April 2011 tornado outbreak. *GeoJournal*, **79**, 791–804, <https://doi.org/10.1007/s10708-013-9518-6>.
- Kochigina, A., 2020: The parallel power in organizations' defense: Exploring faith-holders and their crisis communication. *Public Relat. Rev.*, **46**, 101950, <https://doi.org/10.1016/j.pubrev.2020.101950>.
- Kvale, S., and S. Brinkmann, 2009: *InterViews: Learning the Craft of Qualitative Research Interviewing*. Sage, 354 pp.
- Lambert, C. E., 2020: Earthquake country: A qualitative analysis of risk communication via Facebook. *Environ. Commun.*, **14**, 744–757, <https://doi.org/10.1080/17524032.2020.1719176>.
- Lazo, J. K., 2012: One economist's entreaty for increased research on weather risk communication. *Wea. Climate Soc.*, **4**, 233–235, <https://doi.org/10.1175/WCAS-D-12-00057.1>.
- le Blanc, A., 2012: Remembering disasters: The resilience approach. *J. Art Theory Pract.*, **14**, 217–245, <http://db.koreascholar.com/article.aspx?code=278805>.
- Lee, N. M., and M. S. VanDyke, 2015: Set it and forget it: The one-way use of social media by government agencies communicating science. *Sci. Commun.*, **37**, 533–541, <https://doi.org/10.1177/1075547015588600>.
- , —, and R. G. Cummins, 2018: A missed opportunity? NOAA's use of social media to communicate climate science. *Environ. Commun.*, **12**, 274–283, <https://doi.org/10.1080/17524032.2016.1269825>.
- Lindlof, T. R., and B. C. Taylor, 2011: *Qualitative Communication Research Methods*. Sage, 520 pp.
- Liu, B. F., and A. Atwell Seate, 2021: The evolving Weather Service: Forecasters' perceptions of their relationships with core partners. *Wea. Climate Soc.*, **13**, 437–448, <https://doi.org/10.1175/WCAS-D-20-0097.1>.
- , M. Egnoto, and J. R. Lim, 2019a: How mobile home residents understand and respond to tornado warnings. *Wea. Climate Soc.*, **11**, 521–534, <https://doi.org/10.1175/WCAS-D-17-0080.1>.
- , S. Xu, J. K. R. Lim, and M. Egnoto, 2019b: How publics' active and passive communicative behaviors affect their tornado responses: An integration of STOPS and SMCC. *Public Relat. Rev.*, **45**, 101831, <https://doi.org/10.1016/j.pubrev.2019.101831>.
- , A. Atwell Seate, I. Iles, and E. Herovic, 2020: Tornado warning: Understanding the National Weather Service's communication strategies. *Public Relat. Rev.*, **46**, 101879, <https://doi.org/10.1016/j.pubrev.2019.101879>.
- Liu, W., and W. W. Xu, 2019: Tweeting to (selectively) engage: How government agencies target stakeholders on Twitter during Hurricane Harvey. *Int. J. Commun.*, **13**, 4917–4939.
- , —, and J.-J. J. Tsai, 2020: Developing a multi-level organization-public dialogic communication framework to assess social media-mediated disaster communication and engagement outcomes. *Public Relat. Rev.*, **46**, 101949, <https://doi.org/10.1016/j.pubrev.2020.101949>.

- Longstaff, P. H., and S. Yang, 2008: Communication management and trust: Their role in building resilience in “surprises” such as natural disasters, pandemic flu, and terrorism. *Ecol. Soc.*, **13**, 3, <https://doi.org/10.5751/ES-02232-130103>.
- McComas, K. A., 2006: Defining moments in risk communication research: 1996–2005. *J. Health Commun.*, **11**, 75–91, <https://doi.org/10.1080/10810730500461091>.
- Men, L. R., and W. S. Tsai, 2014: Perceptual, attitudinal, and behavioral outcomes of organization–public engagement on corporate networking sites. *J. Public Relat. Res.*, **26**, 417–435, <https://doi.org/10.1080/1062726X.2014.951047>.
- Messias, D. K., H. C. Barrington, and E. Lacy, 2011: Latino social network dynamics and the Hurricane Katrina disaster. *Disasters*, **36**, 101–121, <https://doi.org/10.1111/j.1467-7717.2011.01243.x>.
- Monteil, C., J. Barclay, and A. Hicks, 2020: Remembering, forgetting, and absencing disasters in the post-disaster recovery process. *Int. J. Disaster Risk Sci.*, **11**, 287–299, <https://doi.org/10.1007/s13753-020-00277-8>.
- Morss, R. E., and M. H. Hayden, 2010: Storm surge and “certain death”: Interviews with Texas coastal residents following Hurricane Ike. *Wea. Climate Soc.*, **2**, 174–189, <https://doi.org/10.1175/2010WCAS1041.1>.
- Olson, M. K., J. Sutton, S. C. Vos, R. Prestley, S. L. Renshaw, and C. T. Butts, 2019: Build community before the storm: The National Weather Service’s social media engagement. *J. Cont. Crisis Manage.*, **27**, 359–373, <https://doi.org/10.1111/1468-5973.12267>.
- Paek, H.-J., K. Hilyard, V. Freimuth, J. K. Barge, and M. Mindlin, 2010: Theory-based approaches to understanding public emergency preparedness: Implications for effective health and risk communication. *J. Health Commun.*, **15**, 428–444, <https://doi.org/10.1080/10810731003753083>.
- Ploran, E. J., M. A. Trasciatti, and E. C. Farmer, 2018: Efficacy and authority of the message sender during emergency evacuations: A mixed methods study. *J. Appl. Commun. Res.*, **46**, 291–322, <https://doi.org/10.1080/00909882.2018.1464659>.
- Reinard, J. C., 2008: *Introduction to Communication Research*. McGraw Hill, 768 pp.
- Reynolds, B., and M. W. Seeger, 2005: Crisis and emergency risk communication as an integrative model. *J. Health Commun.*, **10**, 43–55, <https://doi.org/10.1080/10810730509094571>.
- Ripberger, J. T., H. C. Jenkins-Smith, C. L. Silva, D. E. Carlson, and M. Henderson, 2014: Social media and severe weather: Do tweets provide a valid indicator of public attention to severe weather risk communication? *Wea. Climate Soc.*, **6**, 520–530, <https://doi.org/10.1175/WCAS-D-13-00028.1>.
- Seeger, M. W., 2006: Best practices in crisis communication: An expert panel process. *J. Appl. Commun. Res.*, **34**, 232–244, <https://doi.org/10.1080/00909880600769944>.
- Senkbeil, J. C., D. J. Griffin, K. Sherman-Morris, J. Saari, and K. Brothers, 2021: Improving tornado warning communication for deaf and hard of hearing audiences. *J. Oper. Meteor.*, **9**, 18–35, <https://doi.org/10.15191/nwajom.2021.0902>.
- Sharma, U., and A. Patt, 2012: Disaster warning response: The effects of different types of personal experience. *Nat. Hazards*, **60**, 409–423, <https://doi.org/10.1007/s11069-011-0023-2>.
- Shaw, R., K. Shiwaku, H. Kobayashi, and M. Kobayashi, 2004: Linking experience, education, perception, and earthquake preparedness. *Disaster Prev. Manage.*, **13**, 39–49, <https://doi.org/10.1108/09653560410521689>.
- Shepperd, J. A., W. M. P. Klein, E. A. Waters, and N. D. Weinstein, 2013: Taking stock of unrealistic optimism. *Perspect. Psychol. Sci.*, **8**, 395–411, <https://doi.org/10.1177/1745691613485247>.
- Sherman-Morris, K., 2005: Tornadoes, television and trust—A closer look at the influence of the local weathercaster during severe weather. *Global Environ. Change*, **6B**, 201–210, <https://doi.org/10.1016/j.hazards.2006.10.002>.
- , H. Lussenden, A. Kent, and C. MacDonald, 2018: Perceptions about social science among NWS warning coordination meteorologists. *Wea. Climate Soc.*, **10**, 597–612, <https://doi.org/10.1175/WCAS-D-17-0079.1>.
- Silver, A., and J. Andrey, 2014: The influence of previous disaster experience and sociodemographic on protective behaviors during two successive tornado events. *Wea. Climate Soc.*, **6**, 91–103, <https://doi.org/10.1175/WCAS-D-13-00026.1>.
- Sommerfeldt, E. J., and A. Yang, 2018: Notes on dialogue: Twenty years of digital dialogic communication research in public relations. *J. Public Relat. Res.*, **30**, 59–64, <https://doi.org/10.1080/1062726X.2018.1498248>.
- Spence, P. R., K. A. Lachlan, X. Lin, and M. del Greco, 2015: Variability in Twitter content across the stages of a natural disaster: Implications for crisis communication. *Commun. Quart.*, **63**, 171–186, <https://doi.org/10.1080/01463373.2015.1012219>.
- Sutton, J., C. League, T. L. Sellnow, and D. D. Sellnow, 2015: Terse messaging and public health in the midst of natural disasters: The case of the Boulder floods. *Health Commun.*, **30**, 135–143, <https://doi.org/10.1080/10410236.2014.974124>.
- , S. C. Vos, M. M. Wood, and M. Turner, 2018: Designing effective tsunami messages: Examining the role of short messages and fear in warning response. *Wea. Climate Soc.*, **10**, 75–87, <https://doi.org/10.1175/WCAS-D-17-0032.1>.
- , S. L. Renshaw, S. C. Vos, M. K. Olson, R. Prestley, C. B. Gibson, and C. T. Butts, 2019: Getting the word out, rain or shine: The impact of message features and hazard context on message passing online. *Wea. Climate Soc.*, **11**, 763–776, <https://doi.org/10.1175/WCAS-D-19-0021.1>.
- Taylor-Clark, K., K. Viswanath, and R. J. Blendon, 2010: Communication inequalities during public health disasters: Katrina’s wake. *Health Commun.*, **25**, 221–229, <https://doi.org/10.1080/10410231003698895>.
- Tracy, S. J., 2013: *Qualitative Research Methods: Collecting Evidence, Crafting Analysis, Communicating Impact*. Wiley-Blackwell, 350 pp.
- Trope, Y., and N. Liberman, 2010: Construal-level theory of psychological distance. *Psychol. Rev.*, **117**, 440–463, <https://doi.org/10.1037/a0018963>.
- Uccellini, L. W., and J. E. Ten Hoeve, 2019: Evolving the National Weather Service to build a weather-ready nation: Connecting observations, forecasts, and warnings to decision-makers through impact-based decision support services. *Bull. Amer. Meteor. Soc.*, **100**, 1923–1942, <https://doi.org/10.1175/BAMS-D-18-0159.1>.
- Whyte, W. F., 1991: *Participatory Action Research*. Sage, 247 pp.
- Williams, C. A., and G. M. Eosco, 2021: Is a consistent message achievable? Defining “message consistency” for weather enterprise researchers and practitioners. *Bull. Amer. Meteor. Soc.*, **102**, E279–E295, <https://doi.org/10.1175/BAMS-D-18-0250.1>.
- Zhang, Z. A., and R. Shay, 2019: An examination of antecedents to perceived community resilience in disaster postcrisis communication. *J. Mass Commun. Quart.*, **96**, 264–287, <https://doi.org/10.1177/1077699018793612>.