Emergency Manager Feedback on National Weather Service Forecasts Through In-Depth, Hazard Based Interviews

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1. Abstract

Over the past decade, the National Weather Service (NWS) has increased emphasis on Impact-Based Decision Support Services (IDSS). IDSS helps ensure that NWS forecast information is relevant, understandable, and actionable through two-way communication with core partners, notably Emergency Managers (EMs). EMs are crucial as they serve as intermediaries between weather information and community response, influencing decisions that can save lives and protect property. Despite the availability of advanced weather data and forecasting tools, relatively little is known about how weather information from the NWS is utilized and disseminated by EMs or how information from the NWS could enhance EM workflows. This project seeks to bridge this knowledge gap by further evaluating EM workflows through in-depth, semi-structured interviews with EMs from multiple regions of the US. In addition to information about their workflows, EMs also provided feedback on the services provided by the NWS, both prompted and unprompted. The findings presented here consolidate the feedback from these EMs and provide actionable recommendations that could enhance NWS IDSS strategies and forecast products. These EM-driven recommendations aim to improve NWS support to EMs and boost community resilience to hazardous weather events.

2. Introduction

Hazardous weather remains among the most persistent threats to life and property in the United States, and the decisions that translate a forecast into protective actions are rarely made by forecasters themselves, rather they are often made by emergency managers (EMs) and other local officials who interpret weather information, balance various jurisdictional constraints, and decide whether and when to act (Baumgart et al. 2008; League et al. 2010; Hogg et al. 2026). EMs therefore occupy a pivotal position in the warning to response system, as they serve as intermediaries between the meteorological information produced by organizations, specifically the National Weather Service (NWS) and the communities whose safety depends on how that information is understood and acted upon. Understanding how EMs use NWS forecasts to make these community-level decisions is central to reducing weather-related impacts to life and property.

Over the past decade, the NWS has increasingly focused its mission around this relationship through Impact-Based Decision Support Services (IDSS) and the broader Weather-Ready Nation (WRN) strategy (Uccellini and Ten Hoeve 2019, NOAA 2024). IDSS reflects a deliberate shift from one-way issuance of forecasts and warnings towards sustained two-way engagement with core partners, including EMs. The premise is that

forecast information needs to be relevant, understandable, timely, and actionable to the partners who make decisions with it. This is achieved through ongoing dialogue rather than one directional dissemination of forecast information. This shift raises a question: *How well is the NWS meeting the decision-support needs of its EM partners, and where do those partners see room for improvement?*

A body of research has examined pieces of this question. Early work established descriptive models of how EMs make decisions during severe weather and highlighted the role of contact with local NWS offices and spotters in that process (Baumgart et al. 2008), and subsequent studies connected EM decision making to the communication and dissemination of warnings (e.g., League et al. 2010). More recent work has turned to the specifics of forecast information itself, examining what uncertainty and probabilistic information EMs understand and need in severe-weather contexts (Ernst et al. 2018), and characterizing the nuanced, experience-based trust that develops between EMs and forecasters as they navigate forecast uncertainty together (Weaver et al. 2014, Ernst et al. 2018, Cross and LaDue 2021). In parallel, a large-scale survey effort, the Extreme Weather and Emergency Management (WxEM) Survey, has built a nationwide panel of EMs (Wanless et al. 2023, Hogg et al. 2026) and begun to analyze how the effectiveness of IDSS might be quantitatively measured. These studies establish the importance of the EM-NWS relationship and highlight the importance of trust and interpersonal contact, especially in cases of forecast uncertainty.

Yet, important gaps remain. Much of the existing qualitative work is concentrated on a single hazard, most often focused on severe weather or tornadoes, or a single region of the United States, which makes it difficult to distinguish concerns that are hazard specific or across multiple hazards. Survey-based approaches achieve more national representation, but by design constrain responses to predetermined questions and may offer limited insight into the reasoning behind responses. While individual studies document specific improvements, direct EM feedback on NWS products and services are seldom gathered systematically across hazards and organizational contexts to inform operational priorities. Therefore, it is not well understood which strengths and improvements of NWS services and products are broadly shared, or how they vary across hazards or types of EM offices.

This study addresses these gaps through in-depth, semi-structured interviews with 57 EMs across 24 jurisdictions, representing various organizational contexts. For this analysis, we focus on the feedback participants offered about the NWS itself: what EMs

find useful, what can be improved, specific relationships that have been built, and how they respond to specific graphics. This addresses three research questions:

1) How do emergency managers evaluate the usefulness of NWS products and services in their operations, and what specific strengths do they identify?
2) What gaps, frictions, or unmet needs do emergency managers identify in NWS products, services, and communication, and how might these be addressed?
3) How do these perceptions vary across hazard types and across emergency management office contexts (resource level and organizational type)?

3. Research Design & Data Collection

For this study, 24 interviews with 57 emergency managers were conducted in six hazard specific regions of the United States. The interviews took place from January to March 2025 with EMs from 24 different jurisdictions. These semi-structured interviews were primarily conducted in-person at different locations based on hazard types (see Figure 1 and Table 1 below for hazards and locations).



Figure 1: *The estimated geographic locations of EM workflow interviewees based on region-specific hazards. Locations are approximate to protect participant identity.*

Hazard	Number of Participating Jurisdictions	Number of Participating Emergency Managers
Tropical	4	6
Fire	4	4
Severe	4	12
Heat	4	19
Winter	4	5
Flood	4	11
Total	***24***	***57***

Table 1: *Participant breakdown by number of participating jurisdictions and number of emergency managers for each hazard area.*

Specifically, EMs that were considered *high resource local, low resource local, state, or other type* were interviewed for each hazard type. EMs categorized as "high resource" were typically in urban areas and featured robust EM teams and/or offices. "Low resource" EMs were typically in more rural areas and generally had one or two people working in EM roles. For the state perspective, interviewees were selected from a state emergency management agency in the hazard-prone area. EMs categorized as "other type" represented various public and private entities (universities, hospitals, utilities, etc.). Potential participants were identified by a mix of existing relationships, previous research efforts, locations, and interests. Participants were then recruited via email or phone call. The average length of interviews was 1 hour 22 minutes (range 44 – 124 minutes). The study was approved by the Institutional Review Board of the University of Oklahoma (protocol code 18036).

In the first portion of the interview, participants were asked general open-ended questions about their operations related to the specific weather hazard associated with their region. For example, researchers asked questions such as, "how many people work in your emergency management department" and "in general, what are the main decisions/actions, if any, you take when you get forecasts for [a hazard] in your area", among other general questions.

In the second portion of the interview, participants were walked through a hypothetical timeline where they were shown a series of NWS forecast information graphics from a real event for the specific weather hazard of interest. Interviewees were asked to walk the interviewer(s) through their workflows in conjunction with the series graphics. For example, interviewees were asked to identify actions they would take based on the information provided, who they would share graphics with, and specify any additional information that they would need for decision making, among other workflows-based feedback. See Appendix 1 for the full interview guide used.

4. Qualitative Analysis

Following the interviews, the recordings were uploaded to Otter.ai for transcription. Researchers quality checked each transcription to correct any errors. After transcription and quality control, the research team then qualitatively analyzed each transcript using an inductive approach, identifying recurring ideas. These quotes and ideas were collated into larger, more comprehensive themes and associated codes (Braun & Clarke 2006; Thomas 2006). During the individual coding process, the team would regularly meet to discuss the thematic codes for each interview, making sure everyone agreed on the codes. This gave external validity to the initial codes and further ensured coding was consistent across interviews. In these meetings, the team iterated on the assigned themes and created sub-codes within the themes. The codes were not mutually exclusive, meaning that some quotes fit into multiple codes. The main themes identified in the interviews were: decision making and timing, information sources and channels, information sharing and dissemination, jurisdictional context, and NWS specific feedback (see Figure 2). This report focuses on the quotes assigned to the NWS specific feedback theme.

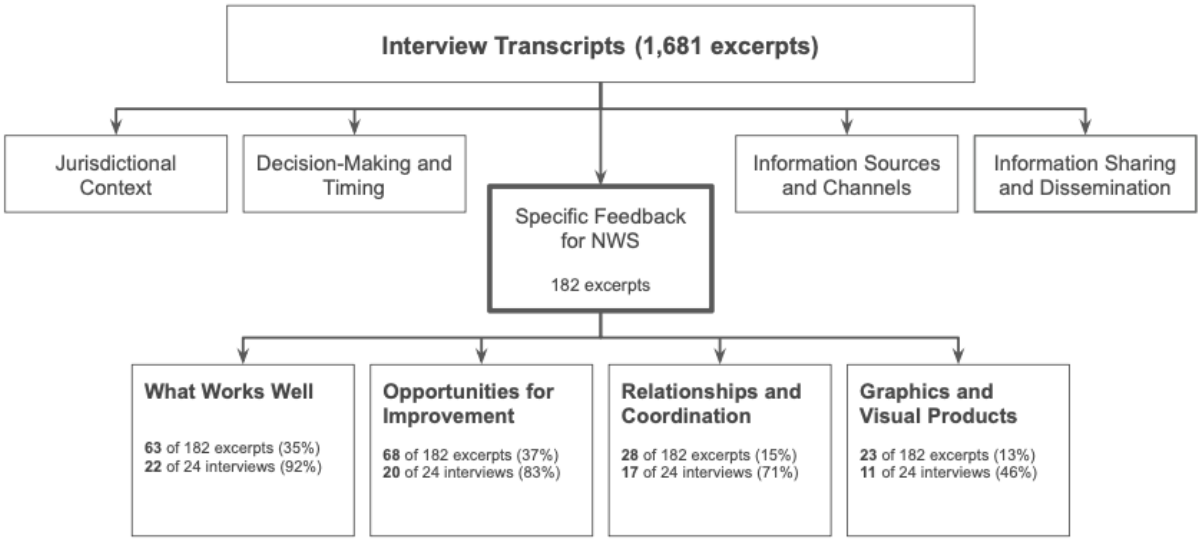


Figure 2: *Workflow for qualitative thematic coding.*

5. Findings

Throughout the interviews, participants provided feedback on the products and services they receive from the NWS. In total, 182 of the 1681 quotes (11%) were categorized as NWS Specific Feedback. This feedback was overwhelmingly positive, with every EM stating how important the information from the NWS is to their operations and how valued those partnerships are. Along with the positive feedback, there were several areas for improvement that came up. This section will introduce these findings, accompanied with the summary of the feedback that led to the findings and supporting quotes. The quotes are attributed to each participant's identifier in accordance with IRB protocols to protect their identity. The identifier indicates the hazard the participant was interviewed about, the type of jurisdiction they represent (H for high resource, L for low resource, S for state, and O for other), and their participant number if there were multiple representatives from a jurisdiction. For example, Severe_H4 was speaker #4 from a high resource jurisdiction in an interview about severe weather.

Primary Codes	**Number of excerpts (n=182)**	**Percentage of excerpts**	**Number of Interviews (n=24)**	**Percentage of interviews**
What Works Well	63	35%	22	92%
Opportunities for Improvement	68	37%	20	83%

Relationships and Coordination	28	15%	17	71%
Graphics and Visual Products	23	13%	11	46%

Table 2: *Primary codes by number and percentage of excerpts and interviews*

5.1 What Works Well

Under the primary code of "What Works Well," researchers identified five sub-codes to provide greater context to the general theme. These sub-codes highlight what specific pieces of the forecasting process or communication flow are particularly useful for their EM partners.

Code: What Works Well (92% of interviews)	
Tailored Forecasts	EMs value forecasts tailored to their specific locations and decision contexts
Multi-Channel Communication	EMs value timely, clear, and actionable communication delivered by the NWS across multiple channels
Planning Support	EMs value collaboration with local NWS offices to inform planning, preparedness, and decision thresholds
Responsiveness to Feedback	EMs value NWS willingness to incorporate partner feedback and research to improve products and services
Forecaster Availability and Support	EMs value reliable and responsive support from NWS forecasters, including direct engagement and embedded support when needed

Table 3: *Subcodes under the primary code "What works well"*

Tailored Forecasts - The most frequent sub-code that emerged provides evidence that the NWS goal of providing useful and actionable forecast information to core partners is being met. Several EMs talked about the ability to request specific forecast information for areas of concern through Spot Forecasts or web pages for specific sites:

> "*For the [State] Fair, this page is specific to the fairs lat/long and shows what the weather is. And we're trying to really push this… so fair goers can use this to really see what it's going to be like at the fair.*" -Fire_L1.

EMs also mentioned the utility of probabilistic forecasts:

> "*Working with the local office, National Weather Service, they created a probabilities page for us, and that's super good. When we're looking at what we anticipate coming, we're not just now looking at the amount of rain. It's not that anymore. If we look at percentages…probabilities make better estimations, better predictions*" -Flood_H2.

Others highlighted products and tools that included impact information:

> "*It's a graphic representation of the impacts from whatever weather event. I feel like it's extremely helpful because I can take that. I know my community, I know what areas are going to be impacted.*"
> -Heat_L1.

Multi-Channel Communication - Almost as important as the relevance of the forecast is the delivery. EMs routinely mentioned the importance of forecaster efforts to not only create valuable forecasts but also deliver them in ways that they can understand and pass on to their own partners. EMs especially highlighted the briefings they receive from their local WFOs, both in the forms of graphic packages and webinars:

> "*webinars, the DSS packages for sure. Yeah, those are really helpful.*"
> -Winter_H1.

EMs also spoke highly of using NWSChat on Slack:

> "*I am grateful that they transitioned the NWSChat to Slack. I'm a big Slack fan, so it makes it easier to at least see what communication is happening.*" -Heat_L1.

Some EMs also talked about getting real-time heads-up information from forecasters:

> "*We've got a text group with the Weather Service in [CITY], that's just sort of our text group. 'Hey late change to the forecast, something's coming in.' They'll text and give a heads up.*" -Fire_H1.

EMs also highlighted that the information the NWS gives to them is often the exact information they communicate to their own partners, highlighting the importance of clear and actionable information:

> "*We do not attempt to do anything with the Weather Service graphics. As far as any kind of changes, we will take those and incorporate them directly into our products. There is nothing that our level of expertise could bring to it that doesn't already exist. If we get a packet of information, whatever it may be, if it has graphics that help paint the*

> *picture, we will simply pull and paste those into our products and pass them along.*" -Fire_S1.

Planning Support - EMs also brought up cases where local NWS offices have assisted in planning, preparedness, or mitigation activities. This theme was particularly prevalent in areas where weather data could be integrated into plans to inform key thresholds or decision points in response to an unfolding incident:

> "*But yeah, that was (a) cool story we did last year with the weather service and really utilizing data and a tool that we could put together to help us communicate to the policy group of what the needs are, the costs and then thresholds for activation.*" -Fire_H1.

Responsiveness to Feedback - Multiple EMs also brought up an appreciation for the willingness by both local NWS offices and the organization as a whole to take into account partner feedback to continue improving services and information delivery:

> "*I know, like the National Weather Service as a whole has been using a lot of social science studies and research to improve and it's been working". - Tropical_H3.*

EMs also highlighted positive changes to forecast graphics and products based on feedback EMs had given to their NWS partners:

> *"I know they're putting out new products. They've upgraded their dot colors on the river forecast, which I think will be helpful - what's flood versus what's actually dangerous, what's going to start potentially impacting homes and stuff - they can be two different things. It helps them get relaxed about the red dots that they see."* -Flood_S1

Forecaster Availability and Support – EMs also shared the importance of the availability of forecasters to support EM operations and decision making. The excerpt below highlights the importance of their partnership with the NWS:

> "*It's an amazing partnership. They're always there to support us as an agency, watch command as a unit, especially in the absence of us having an in-house meteorologist. They're responsive.*" -Heat_H3.

Others praised the ability to have a meteorologist embedded in their Emergency Operations Center:

> "*Sometimes we'll have the Weather Service in here [in the EOC]. They are very open to coming in and being at our side and giving the briefing.*" -Fire_H1.

5.2 Opportunities for Improvement

Under the primary code “Opportunities for Improvement,” researchers identified six sub-codes to better understand and communicate the nuance of areas where EMs see room for improvement in the types of services provided by NWS forecasts and forecasters. While certainly not exhaustive, many of these themes cut across both hazard types and EM office type, thus providing more confidence in the potential need for improvement across scales and not an isolated challenge faced by one particular EM office.

Code: Opportunities for Improvement (83% of interviews)	
More Detailed and Transparent Forecasts	Many EMs want greater specificity, including probabilities and potential impacts, rather than forecasters holding back information due to uncertainty
Deep Collaboration	Some EMs perceive existing products and thresholds as outdated or misaligned and want them better aligned with current risks and impacts (e.g., Red Flag Warning)
More Consistency Across Offices and Regions	Some EMs find it challenging to navigate differences in communication, formats, and forecasting approaches across NWS offices and regions
Improve Geographic Continuity in Graphics	Some EMs want graphics that extend beyond CWA boundaries and better reflect how hazards evolve across regions
More Training and Education on Forecast Products	EMs want more training and advance notice to better understand and use NWS products, especially when tools are updated or introduced
Centralize and Simplify Access	Some EMs report challenges navigating multiple platforms and want a more streamlined, user-friendly way to access NWS information

Table 4: *Subcodes under the primary code "Opportunities for improvement”*

More Detailed and Transparent Forecasts - EMs frequently mentioned a desire for more detailed forecasts from the NWS (including probabilistic information). Many EMs communicated a feeling that forecasters were perhaps holding back information or were hesitant to discuss differing scenarios due to a lack of confidence in the forecast panning out a certain way.

> "*I think my first thing would be, don't let confidence get in the way of sharing information. Just be transparent with a confidence level…if there's potential for that, I don't necessarily want the National Weather Service to take on the burden of deciding what's impactful for us, provide the information and let us determine what's impactful for our communities".* - Heat_L1.

In addition, EMs noted that more impact information would be extremely beneficial to their workflow, aiding in their overall decision making for hazardous weather:

> "*Feel free to chime in, but I always say heat is probably the most clear cut [referring to triggers for action] where it definitely really aligns with the NWS products and their forecasting. But I think for other hazards, there's additional conversations where NWS would have to provide a little bit more information to let us know what is the actual risk and potential impact. So then that will help with the decision making".*
> -Heat_H2

Deep Collaboration - Across multiple hazard types, numerous EMs called out products that are regularly issued by local or national NWS offices that they felt were either unhelpful to their jurisdiction…

> "*But, we look at the traditional wildfire messaging that may come up, you know, Red Flag Warning right, NWS based upon archaic criteria. I'll just get on my soapbox for a second and say that needs to be updated, sure, because there's more to it than that now, but we're better than that, right".* - Fire_O1

…or needs to be updated to reflect more relevant impactful criteria for the communities that they serve:

> "*I still have a problem, even though I do have to consider the people with mobile homes. But this [referring to severe thunderstorm warning] quarters and 60 mile per hour wind warnings, here in the plains, it's just fatiguing. And the alarm, the false alarm rate is horrendous on them. They warn for 60 mile per hour winds all the time with nothing like that ever happens. That's my rant".* -Severe_H2

More Consistency Across Offices and Regions - EMs communicated a variety of challenges related to practices, communication standards, and general forecasting philosophies that may differ between NWS offices and regions:

> "*When they do say, like, one [WFO] says going to be this bad, and then right at the coverage line it changes over does add a lot of confusion, because I'm thinking of wildfires at [local WFO1] office, southwestern portion one time said that there's a risk there, but not the*

northern portion. But then [local WFO2], up in the northwestern portion of their coverage, said there is a wildfire risk because they're considering drought conditions as well, and this [local WFO3] side of the border is not showing". -Severe_S5.

These concerns were most commonly voiced by state emergency management officials who often have to collate forecast information from multiple local NWS offices covering their state, or EM offices that sit on the border between two different NWS county warning areas:

> "*It can be challenging because [WFO1] will do an attachment, which is easier to put into WebEOC. And then [other WFOs] don't put the attachment, so you do a cut and paste, and I don't know if you've ever looked at WebEOC, but some stuff gets caught in the mess, whatever we put in first gets bumped and rolled back. So that's probably a challenge. We try to use the same naming conventions as a subject line, but that's probably our biggest challenge".* -Winter_S1.

There was also some inconsistency noted between forecasts coming from a national center versus those from a local WFO.

Improve Geographic Continuity in Graphics - Several comments were made about general graphical improvements, for example:

> "*Every time I get something from the National Weather Service, I forward on. I always chuckle a little bit. I wish they wouldn't just do the county line stuff, because we know that's not how weather works"* - Winter_L1.

The most common type of feedback received about general graphical challenges was the artificial nature of boundaries created by graphics that abruptly stop at a CWA boundary, which impacts interpretation. There were also many comments that noted the desire for statewide graphics, especially for a state EM office:

> "*Well, because you have to look at [local WFO] to see it, ideally from the state perspective. Yes, I would love to see the entire state at that point, instead of trying to piecemeal alone."* -Winter_S1.

More Training and Education on Forecast Products - Numerous EMs brought up a desire for more opportunities for training and education, to better understand and utilize NWS forecast products:

> "*I might have (seen heat risk graphic) just because we had an in house meteorologist like right before he left…So pretty much at this time (if) there were a heat emergency, or if they had to do forecasting for heat events, it will be what they have always done. I don't think any, any of*

> *us internally here, the agency or our aid partners, have been kind of familiar with using this to inform their decisions and their situational awareness".* -Heat_H2.

This was particularly noted in areas where an existing product or tool might be changed or updated, as well as when the NWS rolls out a new forecast tool such as Heat Risk or the Winter Storm Severity Index:

> "*If there's any updates to the tool that I said that we used earlier. If there's any updates to it in between hurricane seasons, Knowing that ahead of time would be very beneficial before the season starts, or by the end of June at the latest…along with any changes to classification of storms or changes in wind (speed), categories or things like that, because it takes a long time for us to educate an organization".*
> -Tropical_O1

Centralize and Simplify Access - Though not an overwhelmingly common problem, a few EMs noted technological challenges that made accessing information from NWS forecasters difficult, especially in the midst of active hazardous weather. These comments generally fell into two categories - a desire for a one-stop solution for all forecast information:

> "*And the whole reason I keep going back to that is because of what [Severe_H2] just said, have it to us as fast as so that we know where to get it as well. We know we can contact the National Weather Service for it. But in the heat of battle, if there's a one stop shop for all those things, that's easier."* -Severe_H3

and challenges with limited access to online portals or inconsistent use of tools:

> "*We have all had accounts. One of our team members is pretty technologically savvy, and he is a big proponent of like, following along with all the stuff they release. And so we all signed up for NWSChat, I think probably a year or two years, whatever, there was a large push for our team to have it. I will say, looking at that chat, I've signed in probably three times, just to be perfectly honest, and one of them was last week, and it was actually really hard to get on because there's some broken links about how to get there, and they don't work, so that was a little bit problematic. It also is- there's like, seven steps to get there if you log in from Slack, but it was helpful. But like, looking at the chat, I don't know if you have access to this area, for [local WFO], but there's, I think I was the first message in three months that wasn't from the NWS".* -Heat_O3

5.3 Relationships and Coordination

This theme captures aspects of the relationship between EMs and NWS offices - and in many cases specific forecasters - and how those relationships enhance EM understanding of the forecast and potential impacts. Upon further analysis, the "Relationships and Coordination" primary code was divided into two sub-codes to provide further nuance.

Code: Relationships and Coordination (71% of interviews)	
Personal Relationships	EMs value strong personal relationships with NWS forecasters, noting that familiarity and trust improve communication and decision-making
Local Knowledge and Operational Support	EMs value WFO understanding of local conditions and decision thresholds, along with direct support during exercises and incidents

Table 5: *Subcodes under the primary code "Relationships and coordination"*

Personal Relationships - Many EMs mentioned specific NWS forecasters by name, referring to both the experiences they have had with that individual:

> "*If something is really out of the ordinary, I know I could count on [NWS Forecaster] out of the [local WFO] office to give a personal call and say this is weird. I don't know exactly what it means, because we've never seen this before either, but you all should probably be paying attention"* - Fire_S1

As well as to the specific value that individual forecasters bring to their EM office:

> "*I absolutely adore the National Weather Service's probabilities. I had to relearn statistics, and thank God, [local WCM] taught me that once that concept is there. You can't ever look at data without having that available. It just doesn't make sense without those statistics available anymore"* - Flood_H1.

In some cases, EMs mentioned the gap that exists when a long-time or influential forecaster leaves a local WFO to move into another position, speaking to the value of multiple years of experience when working with an individual through numerous hazardous weather events:

> "*You know, I've dealt with [NWS forecaster] for a number of years, and I understand his terminologies, what he's explaining, how he explains things. I can watch his level of excitement, because I know him"*

- Severe_L1.

This feedback was generally consistent across all hazard types.

Local Knowledge and Operational Support - Several EMs mentioned that local knowledge of conditions and concerns, including jurisdictional decision thresholds, was important to the relationship that they have with their WFO:

> "*[The local WFO does] a great job when it reaches a threshold in their mind, which everyone's threshold is different, absolutely. So when I say threshold, I'm not saying good or bad, but they choose at certain times…okay, it's hitting this we're gonna send out a DSS, a support packet right. Hit a certain level, we're going to start having daily calls. We're going to have one call, whatever it may be. [NWS Forecaster] and the team over there are just phenomenal with that. So that is great when it hits their threshold, right?"* - Fire_O1.

Similarly, the availability of local forecasters to participate in either exercises or real-world incident support cases was possible because of locally based relationships:

> *"Yep, we invite them all the time. They can't always attend all of them. But yeah, they're definitely getting invitations to our exercises for sure. We have just such a cool relationship with them…So like, the [major sporting event 1], we can rotate who's being the meteorologist for the [major sporting event 1] and stuff like that. What else the [major sporting event 2] that happened, like, again, we were both at those meetings and taking part in like, weather information that was provided to all of the decision makers for that. Yeah, we're just, like, very close communication with them. Or even like events that happen"* - Winter_H1

5.4 Graphics and Visual Products

Though not the primary purpose of the interviews that were conducted, while walking EMs through the hazard specific scenarios, a number of comments were made relating to specific graphics that were produced by NWS sources. These comments were not necessarily relevant to the larger timeline or workflow discussion but rather could be considered explicit feedback to NWS output. Among the comments, three primary sub-codes could be identified, with almost all comments being positive, even when suggestions for improvements were made. See Appendix 2 for specific graphics tied to quotes below.

Code: Graphics and Visual Products (46% of interviews)

Graphics That Are Easy to Use and Share	EMs value graphics that are clear, useful, and easy to incorporate into their communication and decision-making
Clear Timing Information	EMs value graphics that highlight the timing or impacts because they inform staffing, operations, and response decisions
Improve Clarity and Accessibility of Graphics	Some EMs want clearer, less complex graphics, more thoughtful use of color, and additional impact information to support interpretation

Table 6: *Subcodes under the primary code "Graphics and visual products"*

Graphics That Are Easy to Use and Share - The most frequent sub-code identified were simply comments related to the usefulness of the graphics being created and shared to EMs by their NWS partners:

> "*And I think something like this [referring to hurricane cone], we do actually use this map because, in particular, we'll explain where the current track is"* -Tropical_H1.

Frequently, these comments were broad without additional detail to further discern what particular portions of the graphics were helpful, but at a minimum suggest application by the EM office:

> "*I'll use those exact graphics, and even the spiel that [forecaster1] or [forecaster2] or somebody, puts out, I'll share that as well"* - Severe_L1

Clear Timing Information - Among the specific graphic feedback that did have more detailed feedback, far and away the most important feature mentioned by EMs was the visualization of timing information:

> "*It seemed very reasonable, and the painting of the five days with the color component made sense for me. It drew my attention to the days with the risk and caused me to immediately think about staffing and availability response capabilities and so forth"* -Fire_S1

This timing information directly impacts many of the decisions EMs make leading up to hazardous weather:

> "*[Staff Member Meteorologist] likes this map because [staff member/PIO] was constantly wanting to know when we can expect the first impacts to it. That's big. And that's what I am saying from my perspective, also. In our roles. I like this one (wind timing) also, not only does it help me personally with my family, but I like it because it also gives us an idea of when we get people in, all these different agencies*

> *are not going to operate past what, 40 miles per hour, or some of them maybe 50 miles per hour, but most of them, by 40 or so, they're pulling their people in. And then also when anybody sheltering in place needs to really hunker down, or when we have to have our shelters, if we do open any shelter for people that are in trailers or indigent or homeless or because they live, unfortunately, one of the things about this part of the country is we've got a lot of old homes"* -Tropical_H2.

In addition, uncertainty information, as well as end time, was stressed as important information for hazardous weather:

> "*Whoever came up with this is a genius because you're dealing with uncertainty, right? But I think they've done a really good job of figuring that out. The most likely ending by type of thing, and it seems to be fairly accurate. So I'm glad to see this as a routine thing"* -Severe_H4.

Improve Clarity and Accessibility of Graphics – Finally, there were a few comments speaking to potential areas of improvement for graphics. These comments were generally in one of three categories - either considerations of the use of color, overly complex graphics, or missing information. With regards to color use, some EMs mentioned considerations for individuals with color vision deficiency:

> "*Pictures are good. Color coding is good, especially, and I think the weather service does this really well, where the worse it's going to be, the darker the color gets. And also, I think the pink is a really good example of using colors that work with people with vision impairments, or color blindness".* - Winter_O1

Other EMs mentioned concerns about public interpretation of graphics:

> "*I don't know that I promote this…the interpretation matters, and so somebody that doesn't see this very often could really, like, freak out over this. But if we're seeing this a lot throughout the season in prior years, we know when to react and when not...we're not quite three full days out yet. It's maybe just too much information to put out"* -Flood_L1.

Finally, some EMs expressed a desire for more information, especially about impacts, to be included when possible:

> "*But to me, the real risks are power failures, and then heat related illness. And so you don't have any signals about illness here and I, and that's not a criticism. I just think it's at some point, I think maybe that*

could be developed, and we could even do that where it's just like, 'okay, we could expect that, patient presentations to Emergency Department (ED), these are going to increase by 5%' or something like that, especially if we're in a purple region or something like that. But that's something that our EDs should be aware of." - Heat_O1.

5.5 Hazard Specific Findings

After analysis of primary and secondary themes, researchers compared codes across hazard types to identify any important patterns. Overall, there is a general consistency across hazards for most of the primary codes, with one exception. Among the interview data coded as "Opportunities for Improvement," heat stood out as an outlier, with many more comments made by EMs identifying areas for improved forecast support. While this may be a reflection of a small sample size and particularly outspoken interview subjects, it is also worth considering that forecasting and messaging around heat, particularly to EMs as core partners, may be inherently more challenging due to it being a slow-moving public health threat that does not result in visibly obvious damages like the other five hazard types covered.

Hazard	What Works Well	Improvements	Relationships and Coordination	Graphic Feedback	Total Percentage by Hazard
Fire	7.7%	4.4%	3.3%	1.1%	16.5%
Flood	6.6%	4.4%	1.1%	0.5%	12.6%
Heat	6.0%	14.3%	1.1%	2.7%	24.2%
Severe	6.6%	8.2%	4.4%	1.1%	20.3%
Tropical	3.3%	3.3%	1.6%	3.8%	12.1%
Winter	4.4%	2.7%	3.8%	3.3%	14.3%

Table 7: *Hazard specific breakdown of percentage of excerpts (or the percentage of individual quotes assigned to each hazard and category).*

5.6 EM Office Type Findings

Like section 5.5, additional analysis was also completed to identify any patterns when viewing the interview feedback sorted by the different emergency management office

types. As a reminder, for each of the six hazards identified, four different EM office types were targeted for interviews - an EM office representing a high-resourced jurisdiction with multiple staff, an office representing a low-resourced jurisdiction with no more than two full-time staff, an office representing a state-level government (typically the state emergency operations center), and an office representing a non-traditional EM office (i.e. not a local or state government but performing the functions of an emergency manager).

EM Type	What Works Well	Improvements	Relationships and Coordination	Graphic Feedback	Total Percentage by EM type
High Resource	14.3%	7.7%	6.6%	4.9%	33.5%
Low Resource	7.7%	8.2%	4.4%	1.6%	22.0%
State Office	7.1%	9.3%	2.7%	2.2%	21.4%
Other	5.5%	12.1%	1.6%	3.8%	23.1%

Table 8: *EM office specific breakdown of percentage of excerpts (or the percentage of individual quotes assigned to each office type and category).*

When viewing the data through this lens, there are a few interesting patterns that emerge. Again, as mentioned above, the sample size makes generalization difficult, but there is at least room for potential identification of some trends. First, the “High Resource” EMs made significantly more comments coded as “What Works Well” than their counterparts, as well as having the highest number of comments coded as “Relationships and Coordination”, while being largely inline with other groups on the other topics. It is important to note that of the six “High Resource” offices that were interviewed, three had an in-house meteorologist or weather-related subject matter expert, while a fourth office had recently lost their in-house meteorologist to another agency. While somewhat speculative, it would be perhaps worth investigating whether there is a correlation between having the resources to employ a meteorologist as part of a dedicated EM office and an improved perception of the work and relationship with the NWS.

On the other end of the spectrum, an interesting pattern also emerges among EMs representing state offices and “others.” Here, there is a drop in the comments coded for “Relationships” while also an increase in comments coded as “Opportunities for Improvement” relative to the EM offices representing local jurisdictions. This could point to organizational barriers that make it harder for local NWS forecasters to regularly

interact with these EMs that represent somewhat non-traditional organizations - either due to the possible size of the organization (i.e. state EM offices) or due to nature of EM offices that were categorized as “Other.” For the “Other” EM offices in particular, an especially challenging barrier may arise if the EM serves an organization that is not recognized as a “core partner” of the NWS or represents a private entity, such as in the healthcare or infrastructure sectors, even if that entity is serving the public good.

6. Recommendations

Given the thorough review of the specific NWS related feedback from interview subjects and the findings presented in the above sections, we provide some suggestions for clear and actionable next steps to continue to refine and improve the delivery of forecasts and services to emergency managers. This list of recommendations is not intended to address every individual theme or sub-code identified in the analysis and should not be seen as a replacement for the findings section. Furthermore, we highlight that these interviews should not be considered representative of the entire EM population in the US, and are instead deep, thoughtful input from the 57 individuals we interviewed. Caution should be taken to apply these recommendations to all situations, and NWS forecasters should keep in mind that each partner and situation is unique.

Recommendations for improving support to emergency management partners:

Continue to tailor forecast information to local decision needs. EMs value forecasts that reflect their specific locations, potential impacts, and decision contexts. NWS offices should continue working with partners to understand local concerns and decision thresholds and use that knowledge to tailor IDSS to partner needs.

Provide detailed and transparent information, even when the forecast is uncertain. EMs want probabilities, potential impacts, and information about plausible scenarios that can help them make their own decisions. Forecasters should communicate what is known, what remains uncertain, and their level of confidence rather than withholding potentially useful information because confidence is low.

Prioritize timing and potential impacts in graphics and briefings. EMs repeatedly described timing information as important for staffing, resource allocation, sheltering, and other operational decisions. Forecast information should clearly communicate when

impacts could begin, when they are most likely, when they are expected to end, and what those impacts could mean for partners.

Design graphics and messages to be easy to understand and share. EMs often pass NWS graphics and language directly to their own partners. Graphics should therefore be clear, concise, accessible, and easy to interpret outside the NWS, with careful attention to complexity, color, and the inclusion of relevant impact information.

Continue communicating through multiple channels and providing direct access to forecasters. EMs value webinars, DSS packages, NWSChat, direct messages, calls, and other forms of communication, as well as the ability to reach a forecaster when additional interpretation or support is needed. WFOs should maintain multiple communication pathways rather than relying on a single product or platform.

Invest in relationships and operational understanding before hazardous weather occurs. EMs described familiarity and trust with individual forecasters as important to effective communication and valued WFO knowledge of local conditions and decision thresholds. Routine engagement, planning, and exercises should be used to build these relationships and learn how partners make decisions before an event.

Continue using partner feedback to improve products, services, and decision thresholds. EMs value the NWS's responsiveness to feedback, but some also identified products and thresholds they believe no longer align well with current risks or operational needs. NWS should continue involving partners in the evaluation and co-development of products, graphics, and thresholds, particularly where existing approaches may no longer support partner decisions effectively.

Improve consistency and coordination across WFOs and regions. EMs who work across multiple CWAs described challenges created by differences in communication practices, formats, and forecasting approaches. Neighboring offices should coordinate messaging, graphics, and delivery practices when possible, particularly during events that affect partners across office boundaries.

Provide geographically continuous information when hazards cross CWA boundaries. EMs noted that graphics that stop at CWA boundaries can make it difficult to understand the full threat, particularly for state-level partners. NWS should develop or coordinate graphics that show hazards across relevant geographic areas rather than requiring partners to piece together information from multiple offices.

Provide training and advance notice when products and tools are introduced or changed. EMs need time to understand new forecast products and incorporate them into established organizational workflows. NWS should provide training, examples, and advance notice of substantial changes whenever possible.

Make partner information easier to find and access during hazardous weather. Some EMs described difficulty navigating multiple platforms or accessing tools during active events. NWS should streamline access to partner-relevant information and make the location and means of accessing key products as predictable and consistent as possible.

Expand relationship-building efforts to partners who may be less connected to local WFOs. State and non-traditional EMs reported fewer relationship-oriented experiences and more opportunities for improvement than local high-resource offices. WFOs should look beyond their most established partners and, where possible, create additional opportunities to engage state-level and non-traditional organizations that rely on NWS information.

Overall, Emergency Managers noted that they truly cannot do their jobs without the support they receive from the NWS.

> *"Our job's a whole lot easier because of the National Weather Service [...] the fact that they provide that weather forecasting without any kind of hype. They're just providing facts to me. They're providing them in a way that a non-meteorological person like me can understand. It's obvious that the [local WFO] office puts in a tremendous amount of thought into providing clear, concise graphics. They really make it a lot easier for us just the fact that they're so in tune with assisting their partnership, you know, us, the media, public safety." – Severe_H4*

7. Acknowledgements

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conclusions, and recommendations are those of the authors and do not necessarily reflect the views of NOAA or the U.S. Department of Commerce.

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9. Appendix 1: Interview Guide

To begin, we are curious to know about your operations related to [hurricanes/fire weather/severe weather/winter weather/flooding].

1. Tell us about your jurisdiction…
    a. How many people work in your emergency management department?
    b. How is emergency management organized within your jurisdiction? Is it part of the city/county office, fire/police department, etc.?
    c. Who do you report to?

2. In general, what are the main decisions/actions, if any, you take when you get forecasts for [a hurricane/fire weather/severe weather/winter weather/flooding] in your area?
    a. Are those actions guided by official plans or policies, or are they more built on experience and intuition?
    b. Are there actions that your office can take unilaterally, or do they have to be approved by higher authorities?
    c. Are there any trigger points where you would take action (activate the EOC, call partners, etc.) based on a forecast or product being issued by the NWS?

3. Are there any common questions you usually have after getting [hurricane/fire weather/severe weather/winter weather/flooding] forecasts?
    a. How do you usually get those questions answered?

4. Who (if anyone) do you generally share [hurricane/fire weather/severe weather/winter weather/flooding] forecast information with?
    a. What channels would you use to share this information?
    b. Would you expect to alter or add to the forecast information before distributing it?
        i. Or do you pass information on pretty much as is?
    c. Do you usually get questions from the people you share forecast information with?
        i. If so, what are those questions?

5. Generally speaking, do you go to multiple sources of information, or rely on a select few?
    a. If a select few, which ones?

6. How far in advance do you usually first hear about [hurricane/fire weather/severe weather/winter weather/flooding] forecasts from the NWS?
    a. After that, how often do you get information from the NWS?

Thank you for walking us through your practices for [hurricane/fire weather/severe weather/winter weather/flooding] events.

Next, we want to walk through some forecast information for a recent [hurricane/fire weather/severe weather/winter weather/flooding] event. You may have seen this information during the event. If you haven't, please think about what you might do if you were to get this information in the future.

[SHOW time period 1 graphics]

7. What actions, if any, would this forecast information prompt for your office?
    a. How might those actions be impacted by things like the time of day, day of the week (weekday vs. weekend), holidays, or special events
    b. Would there be any changes to your daily schedule? Additional staffing?

8. What kind of questions would you have based on this forecast information?
    a. How would you go about answering those questions?

9. Would you share this information with anyone?
    a. If so, who?
    b. How would you share it?

c. Would you expect to alter or add to this information any before distributing it?
    i. Or share pretty much as is?

10. When or how would you be expecting additional forecast information to be coming from your local NWS Forecast Office?
    a. Would you make plans, decisions, or actions based on when additional forecast information might be forthcoming?

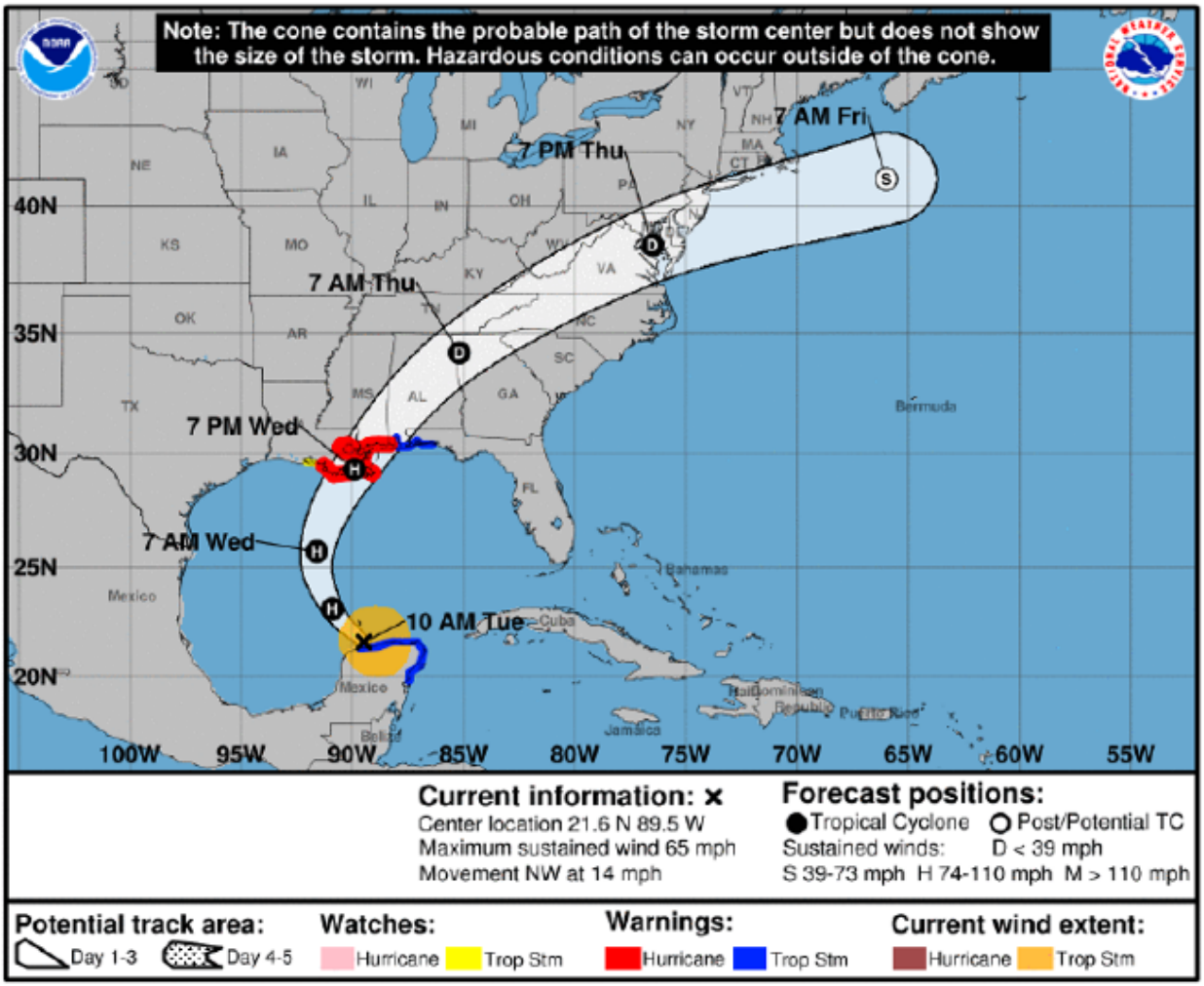
11. Are there pieces of information that you feel are missing or would be especially useful?
    a. In your opinion, how could the NWS provide better partner support at this time period?

[Repeat questions 6 - 10 for time periods 2 & 3]

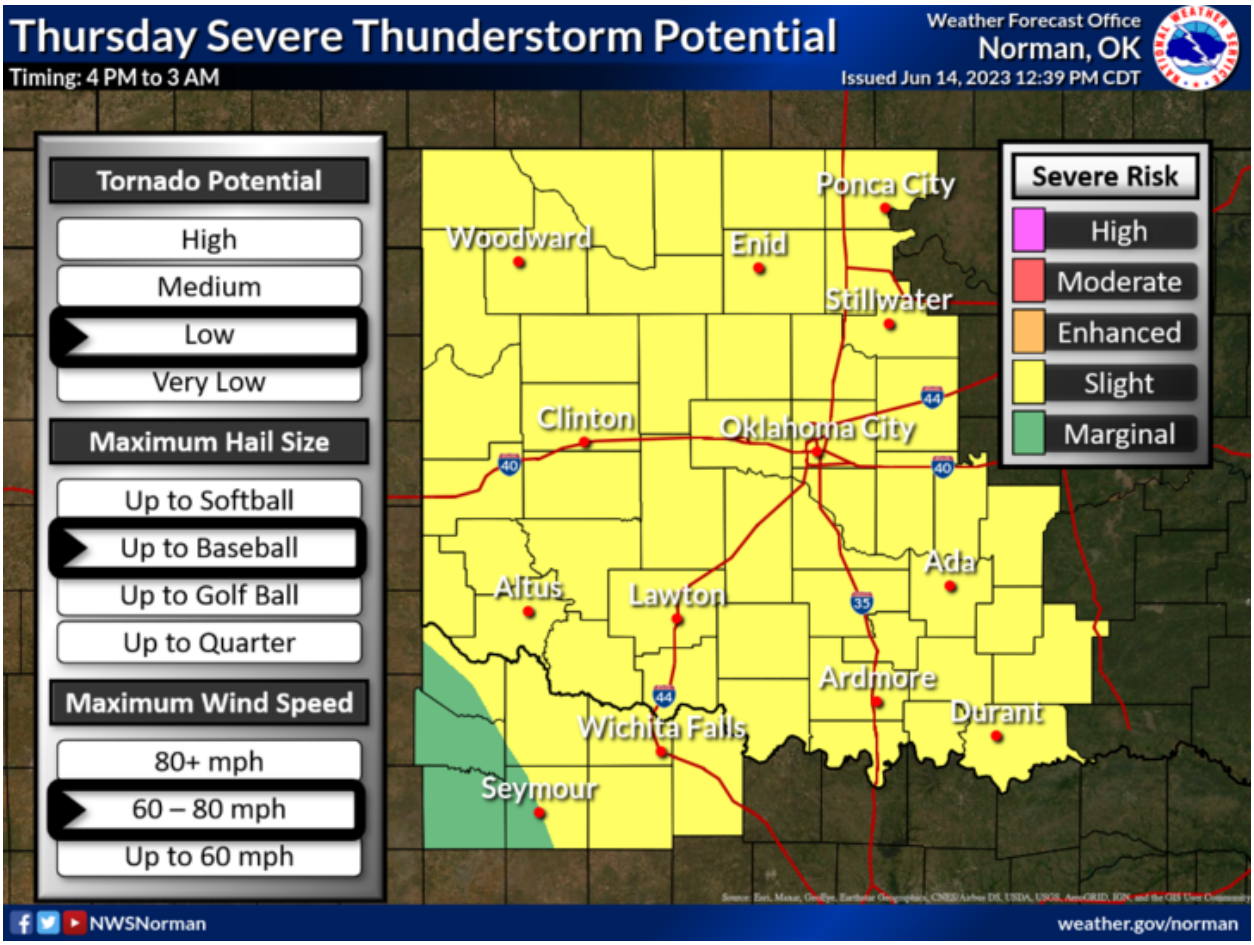
12. Is there any information you would look for from the NWS following an event impacting your jurisdiction?
    a. What kind of information?

10. Appendix 2: Specific Graphic Feedback Examples

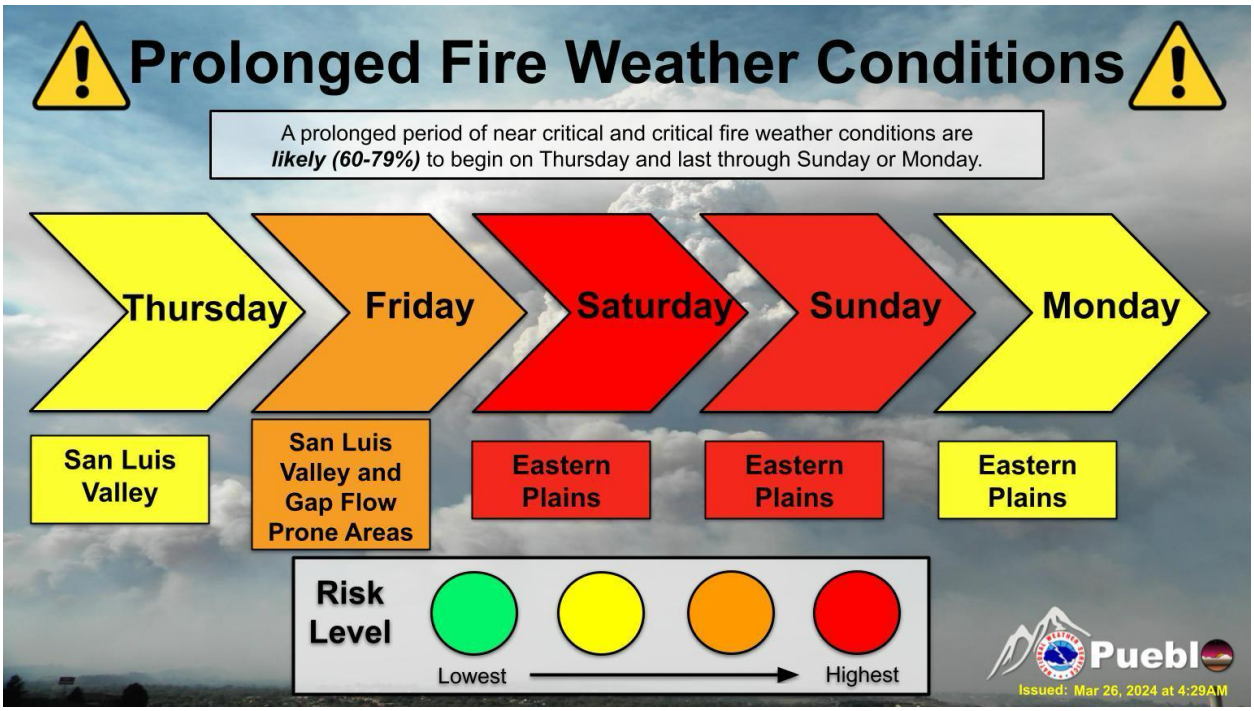
And I think something like this, we do actually use this map because particularly we'll explain where the current track is. - Tropical_H1



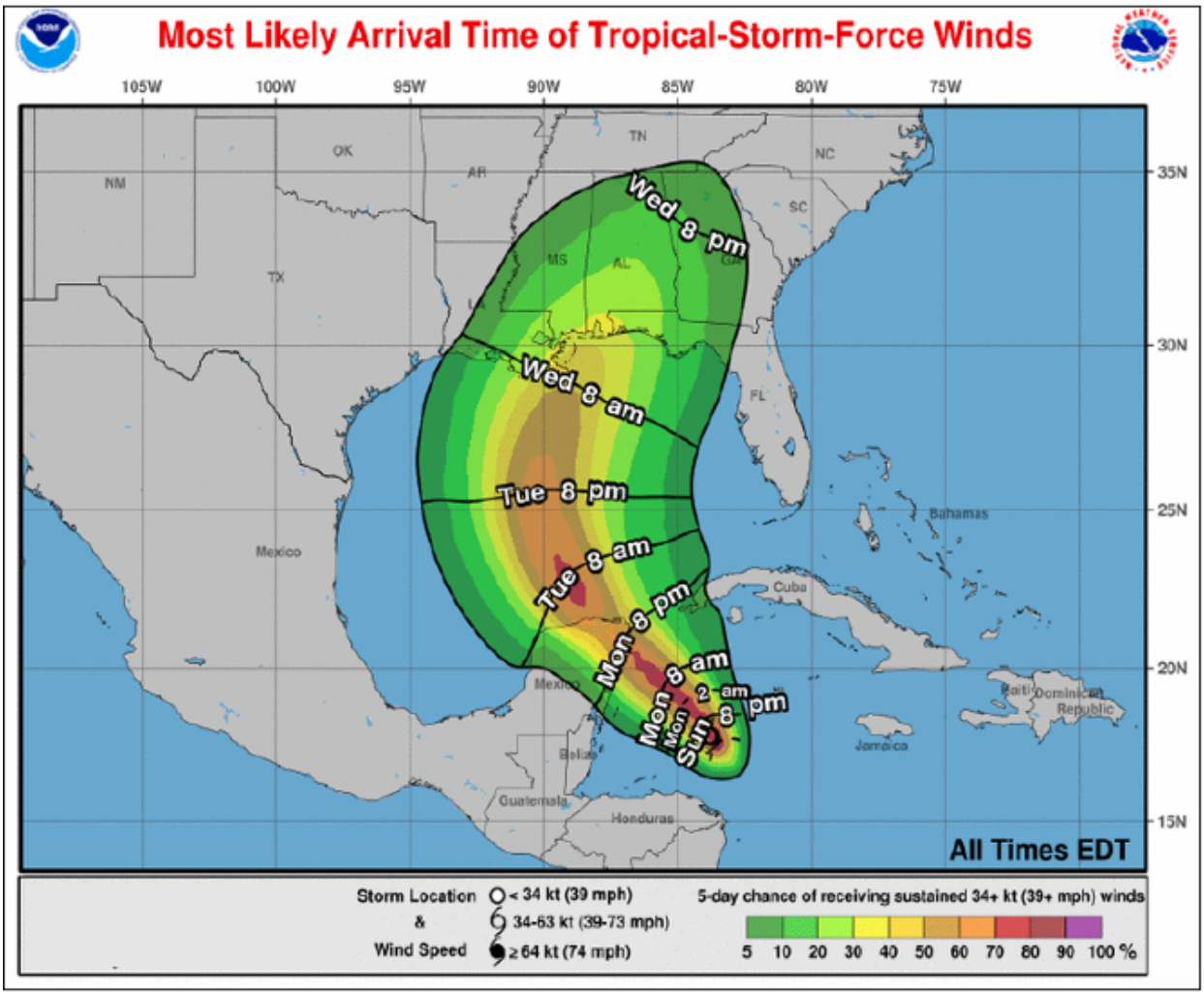
So that's what I use those, you know? And I'll use those exact graphics, and even the spiel that [forecaster] or [forecaster] or somebody, puts out, I'll share that as well. - Severe_L1



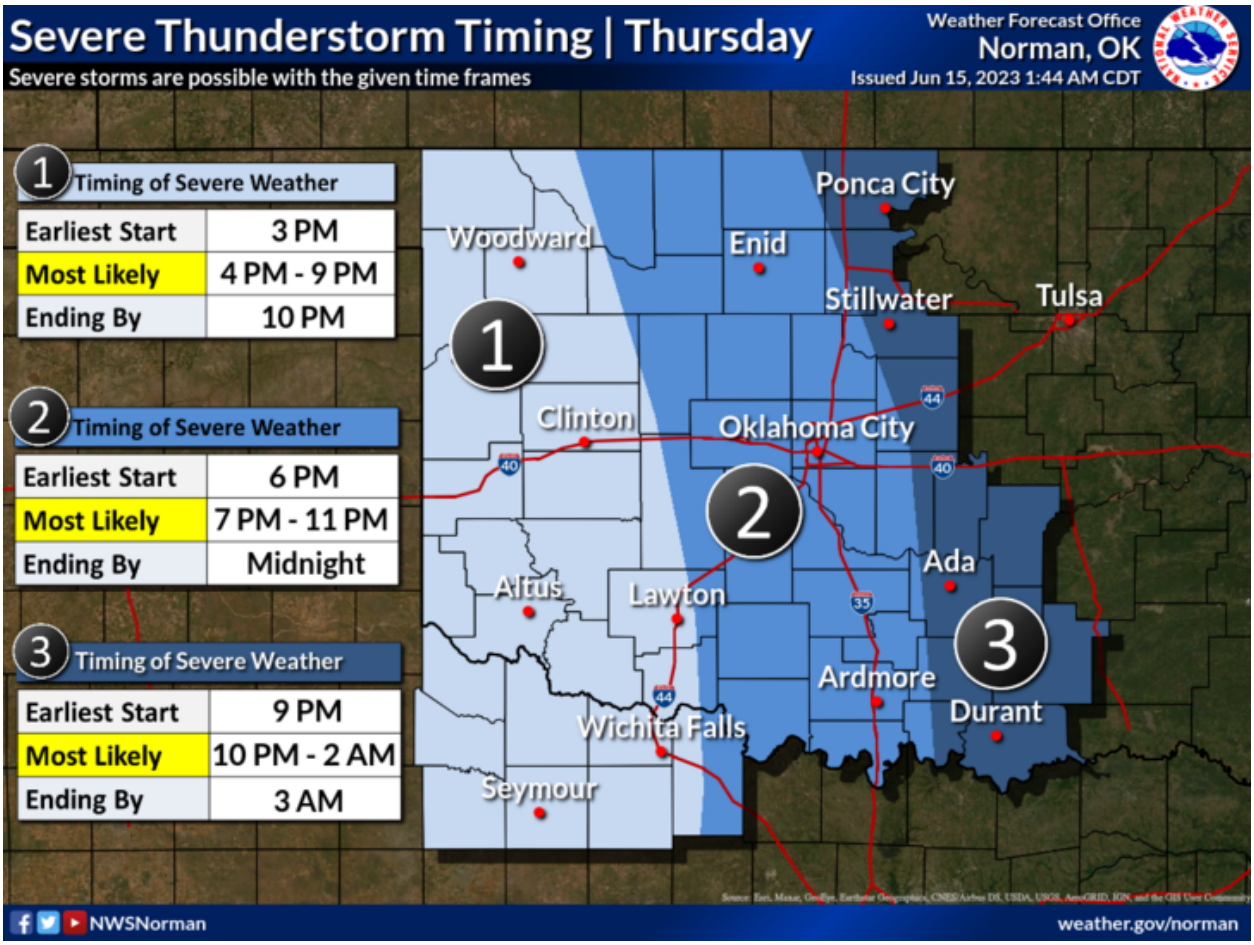
It seemed very reasonable, and the painting of the five days with the color component made sense for me. It drew my attention to the days and the risk and caused me to immediately think about staffing and availability response capabilities and so forth. -Fire_S1



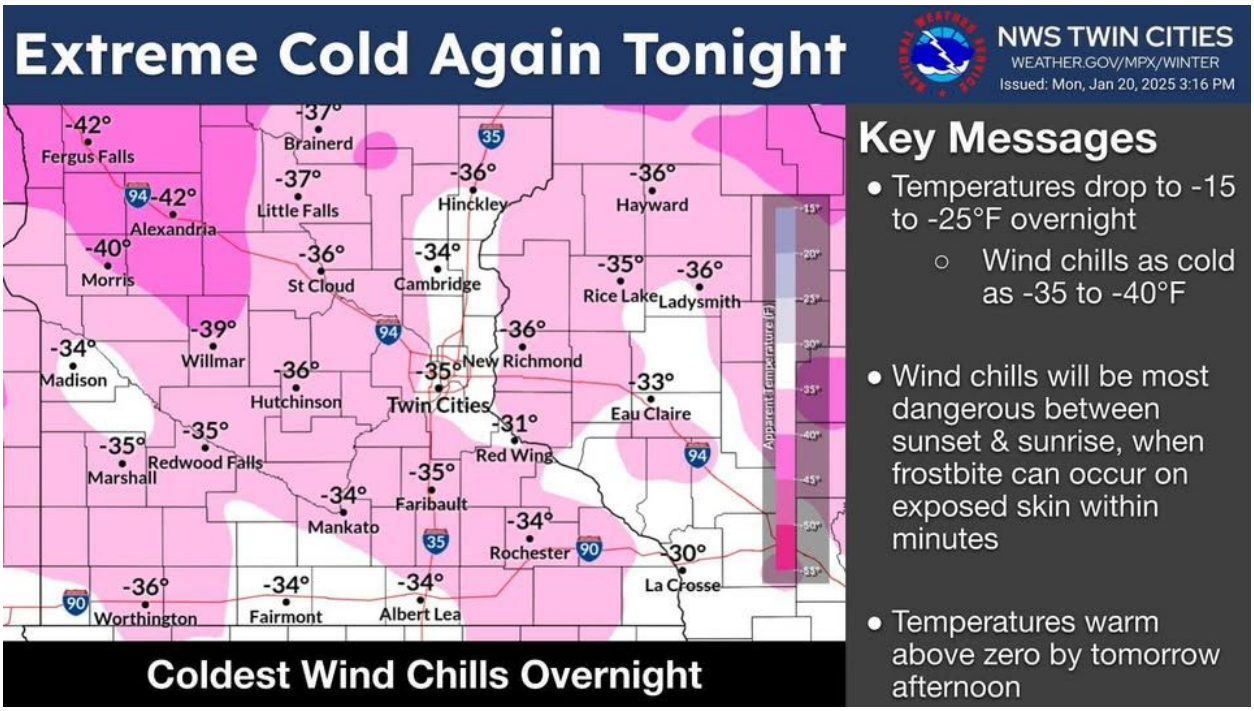
We like (Staff Member - Meteorologist) likes this map because [staff member/PIO] was constantly wanting to know when we can expect the first impacts to it. That's big. And that's what I saying from my perspective, also. In our roles. I like this one (wind timing) also, not only does it help me personally with my family, but I like it because it also gives us an idea of when we get people in, all these different agencies are not going to operate past what, 40 miles per hour, or some of them maybe 50 miles per hour, but most of them, by 40 or so, they're pulling their people in. And then also when anybody sheltering in place needs to really hunker down, or when we have to have our shelters, if we do open any shelter for people that are in trailers or indigent or homeless or because they live, unfortunately, one of the things about this part of the country is we've got a lot of old homes. - Tropical_H2



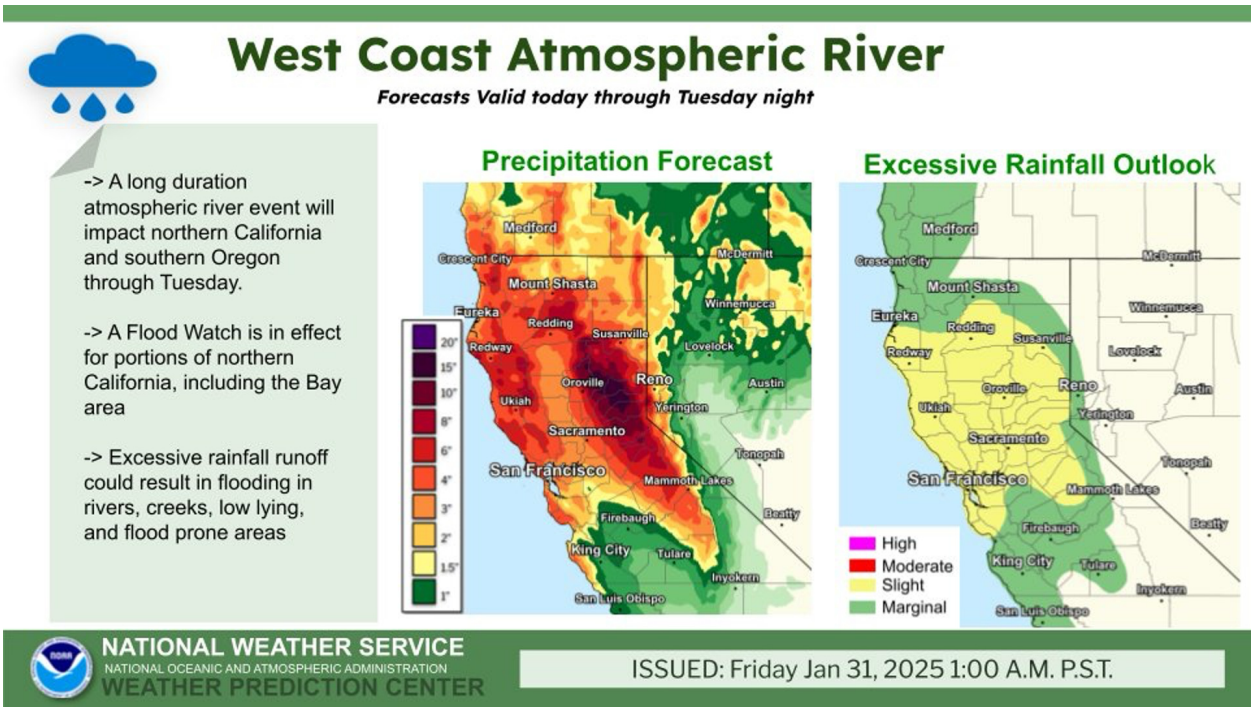
Whoever came up with this is a genius because you're dealing with uncertainty, right? But I think they've done a really good job of figuring that out. The most likely ending by type of thing, and it seems to be fairly accurate. So I'm glad to see this as a routine thing. -Severe_H4



Pictures are good. Color coding is good, especially, and I think the weather service does this really well, where the worse it's going to be, the darker the color gets. And also, I think the pink is a really good example of using colors that work with people with vision impairments, or color blindness. - Winter_O1



I don't know that I promote this (period 1 graphic). It's. Certainly you're welcome to sign in, but we keep this kind of stuff because, like Flood_H1 said, the interpretation matters, and so somebody that doesn't see this very often could really, like, freak out over this. But if we're seeing this a lot throughout the season in prior years, we know when to react and when not to but and then one thing I wanted to get back to on one of your questions about the public and what kind of questions we get. Because we send things out through social media, we don't get a lot of questions anymore. We get criticism, and so all we're getting is criticism everybody on social media these days is an expert, and they know way more than we know. And they tell people that. And so sometimes this kind of information, putting it out, leaning forward, when maybe something might not happen or the storm is going to fizzle out. We're still too... Wednesday to Saturday, we're still, we're not quite three full days out yet. It's maybe just too much information to put out. - Flood_L1



But to me, the real risks are power failures, and then heat related illness. And so you don't have any signals about illness here and I, and that's not a criticism. I just think it's at some point, I think maybe that could be developed, and we could even do that where it's just like, 'okay, we could expect that, patient presentations to ED, these are going to increase by 5%' or something like that, especially if we're in a purple region or something like that. But that's something that our EDs should be aware of. Could happen, that's the main thing. Just giving them a heads up that you could start to see these the more and more you know, seniors and people with underlying medical conditions can start to stream in, right? - Heat_O1

Oppressive Heat and Humidity Through Saturday

New York, NY
WEATHER FORECAST OFFICE

OVERVIEW

- Oppressive heat and humidity will build into the area through Saturday. Excessive Heat Warnings remain effect for the NYC metro and portions of NE NJ through Friday evening. Elsewhere, heat advisories are in effect through Saturday evening.
- Scattered strong to severe thunderstorms are possible this afternoon and evening.

Excessive Heat



HAZARDS & IMPACTS

- **Max Heat Index** –
  - **Today and Friday** – Widespread 103 to 106F expected across most of NE NJ and NYC. Upper 90s to Low 100s, locally 105F elsewhere.
  - **Saturday** – Widespread 95 to 100F likely with locally around 105F possible across NE NJ.
  - Low temperatures will range mostly from 75 to 80, with lower 70s in the far outlying suburbs. Coupled with elevated humidity this will make for uncomfortable conditions at night, especially in NYC/NE NJ.
- **Timing** – Max heat index between 12 noon and 8 PM each day.
- **Heat Impacts** – Extreme heat and humidity will significantly increase the potential for heat related illnesses, particularly for those working or participating in outdoor activities. Elevated ozone levels.

NWS ALERTS

- **Excessive Heat Warning Through Friday evening for NYC and most of NE NJ. Portions of the Excessive Heat Warning may need to be extended into Saturday.** Otherwise, heat advisories will be needed for Saturday for areas currently in the warning.
- Heat Advisory elsewhere through Saturday Evening.

POST-EVENT OUTLOOK

- A cold frontal passage late Saturday will bring relief for Sunday into next week.

NEXT BRIEFING

- By 6pm this evening.

ISSUED: 7/27/2023 5:15 AM

www.weather.gov/nyc