National Weather Service Hazard Simplification Project Social Science Research for Phase I: Focus Groups

Final Report

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National Weather Service Hazard Simplification Project Final Report of Social Science Research for Phase I: Focus Groups

I don't know the difference between watch, warning, and advisory. Maybe at one point, I knew, but I have forgotten.
   - *Focus Group Participant, Public Group, Silver Spring, Maryland*

These words have been around 60-70 years. We hear them all the time. As kids, we learned these words in elementary school. They have been around since day one.
   - *Focus Group Participant, Public Group, Galveston, Texas*

Executive Summary

The National Weather Service (NWS) is interested in enhancing its weather warning, watch, and advisory (WWA) products, as it has found that many members of the public don't understand the distinctions among these terms or their intent. In addition, these terms may not always effectively convey the true impact of individual hazardous weather events.

Social scientists from Eastern Research Group (ERG), the NWS, and the National Oceanic and Atmospheric Administration's (NOAA's) Coastal Services Center conducted 20 focus groups from May to July 2014, to gather stakeholder perspectives from across the United States on the current WWA system and request suggestions for a possible future system. The focus groups were conducted in Minneapolis, Minnesota; Houston and Galveston, Texas; Silver Spring, Maryland/Sterling, Virginia; and Anchorage, Alaska. They were held with members of the public (two groups each location), emergency managers (EMs), broadcast meteorologists (BMs) and other media professionals, and NWS Weather Forecast Offices (WFOs). The focus group discussions touched upon many different hazard types and WWA products of concern to the participants (e.g., convective, winter weather, tropical, non-precipitation, coastal flood, hydrology).

Focus Group Goals

The main goals of the focus groups were to:

1. Explore **understanding, attitudes, and utility** of the current WWA system.
2. Identify **strengths and limitations** of the current WWA system.
3. Identify possible **enhancements or changes** to the current system to better communicate hazardous weather and water threats and prompt appropriate protective action.

4. Explore one ***possible prototype of an alternative system*** called Meteoalarm[1] as a way to compare/contrast the current WWA and weather.gov features.

It should be noted that focus groups are useful in exploring issues and offering creative suggestions, especially with the help of "group thinking." While focus groups can help social scientists gain an initial understanding of an issue to guide further inquiry, the findings are not conclusive and cannot be used to make generalizations about the population(s) of interest.

Key Findings

Among the public focus groups, there was a ***spectrum of comprehension*** of the current WWA system, ranging from ignorance to misunderstanding to understanding. Very few participants understood the term "advisory," and partners didn't uniformly see a need for it. There also was a general opinion among NWS staff and partners that the current system consists of too many individual WWAs for a variety of hazards (these individual WWA are also called "products") and lacks flexibility due to policy limitations (e.g., criteria restrictions and product limitations).

There was general support among the focus groups for a ***hierarchical scheme*** that could enhance or replace the current system involving color (most likely along the red/orange/yellow spectrum), numbers, and/or symbols. Many suggested the NWS consider a system where colors would denote threat levels and symbols would depict hazards. Opinions differed on whether a number scale was useful, how many levels or tiers a system should have, and whether to show areas where there are no threats on a map.

There was general support for an ***additional tier***, used sparingly for an extreme event, above the standard warning system. If a color scale was used, this tier could be magenta or black and be accompanied by language such as "emergency."

There was also general agreement that any warning system needs ***simple, action-oriented language.*** Various participants voiced that they would like to see a system that also presented not only the threats, but timing information, impacts, and confidence.

Many participants were cautious about creating a new system that might not alleviate current confusion—or make it even worse. They also noted that the present WWA system is a known entity for some important sectors (e.g., military, oil plants) and ***institutionalized*** into certain kinds of decision-making (e.g., evacuation, insurance decisions), so any change would need to be deliberate, extremely well-coordinated, and extensively marketed.

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[1] The focus group facilitators did not suggest that the NWS was considering replacing the current WWA system with Meteoalarm (or any other system), but rather used the Meteoalarm system as a way to gather input on possible features for a potential new or enhanced system.

Some participants advocated for simply providing **public education** on the current system. Others suggested modifying the system, by eliminating advisories or by adding colors and/or simple action statements (but not changing the terms). Still, others liked the [Meteoalarm](#) prototype presented and favored more extensive changes to the current system. (Meteoalarm is a color-coded and icon-based system used in Europe that alerts people to the possible occurrence of hazardous weather.)

There was a strong consensus that if the NWS makes any changes to the present system, it will require *time, training,* and a *massive, national outreach campaign* to ensure success. Many believed that even if the NWS makes no changes to the current system, the present system still warrants more public education.

Conclusion

This work indicated that there is a spectrum of understanding of the current WWA system and a difference of opinion on how much change is needed or desired to enhance the present system. There was considerable support among all stakeholder types and locations for enhancing the current WWA system with *simple explanatory language* that could convey threats, impacts, and/or desired actions, although there was no agreement on what terms or phrases should be used. There was also considerable support for the use of a *color scale* to convey threat levels, with most participants favoring the red/orange/yellow spectrum. Opinions differed on whether a number scale or icons would be useful. Participants agreed that the system must work across *multiple mediums*, including websites, radio, television, and print. They also agreed that any change to the current system needs to *happen gradually*, over time, and be accompanied by *training, coordination, and massive public outreach.*

Recommendations and Next Steps

Given the diversity of focus group opinion and understanding of the current WWA system, the team recommends that the NWS develop prototypes based on the focus group feedback for ***testing with key stakeholder groups*** (EMs, BMs, media, and the public). In particular, the team recommends:

1. ***Clarify overall purpose and objectives.*** What does the NWS want from the present WWA system (or an alternative system)? Is the objective to ensure the public understands the difference in terms used? Is it to demonstrate an order of increasing risk? Is it to ensure people take appropriate action?

2. ***Develop several system prototypes for testing*** that include a variety of features, such as risk/threat levels, meteorological hazards, symbols/icons, color scales, confidence options, call-to-action statements, societal impact statements, and timing options.

3. ***Consider pre-testing prototypes/variables*** in different combinations to narrow the choices to test more extensively. Pre-testing might be accomplished through a limited number of one-on-one webinars or small discussion groups, for example.

4. ***Test refined prototypes with stakeholders at national conferences,*** which would enable the team to test with a larger sample than focus groups, to gather some quantitative data on preferences, and to test across all applicable mediums (radio, television, print, Web).

5. ***Establish an internal NWS working group*** to serve as a "brain trust" to help guide and support the work. The group will assist in developing prototypes and guiding the next steps in research and data collection.

6. ***Consider a research study,*** to be conducted in parallel to the prototype testing, to better understand how WWA terms are institutionalized in policies and decision-making at federal, state, and local levels (e.g., evacuation decisions, insurance policies).

I.   Background

The NWS issues a variety of weather warnings, watches, advisories, and statements. These can be issued for a single forecast zone (usually one county or a part of a county) or for many forecast zones. The NWS is interested in enhancing the clarifty of its warning, watch, and advisory (WWA) products to depict hazardous weather and water events, as it has found that many members of the public don't understand the distinctions among the terms used in the different WWA products or their intent. In addition, these terms may not always effectively convey the true impact of individual hazardous weather events.

Hazardous weather events are indicated on a map (See Figure 1) of the United States by different colors (www.weather.gov). Since only one event per forecast zone can be shown at a time, a forecast zone may have several warnings and watches in effect, but only the most significant threat to life or property will be displayed on the map. By clicking on the map, a person can access forecast pages and read the text of all warnings, watches, and advisories in effect for the forecast zone.
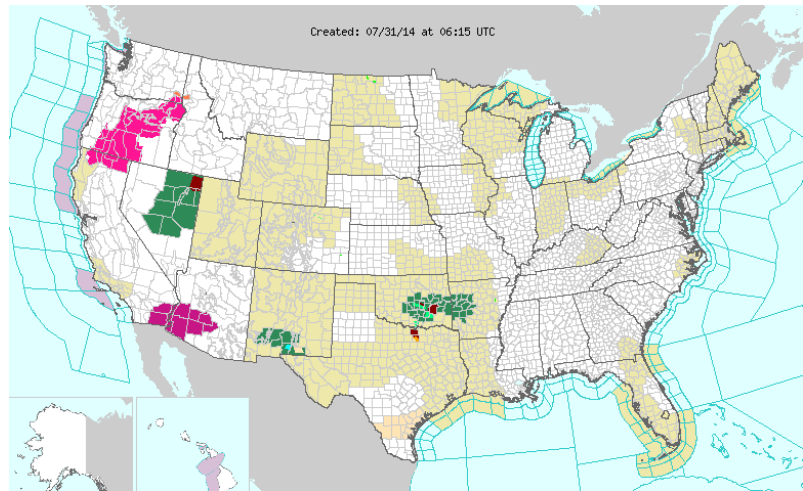

Figure 1. NWS map of watches, warnings, and advisories for the United States, as found at www.weather.gov.

In the winter of 2013, NWS conducted a "Hazard Simplification Demonstration" data gathering effort to propose alternative language to communicate certain weather hazard messages, collect public and partner comments on the proposed alternatives, and consider next steps. This work focused on winter weather. NWS set up a nonoperational, experimental website to propose alternative messages in real time for its official winter-based WWA products ("Winter Storm Warning", "Winter Storm Watch" and "Winter Weather Advisory"). Two-thirds of the respondents supported a change of some kind in the WWA language used. They were about evenly split on the proposed alternatives, while nearly one-third of the respondents opposed any change to the current system. The demonstration also recorded recurring feedback and comments, which showed that people were interested in a **shorter message** and a **color scale**. In addition to the website, the demonstration collected comments via email, which showed slightly more support for the proposed changes and also recommended a color scale, number scale, and bolded text, among other findings. While the demonstration provided useful input, respondents were self-selecting and limited to Internet users. As such, the study was not generalizable to the general public. Additionally, the demonstration was narrow in scope, focusing only on winter weather hazards, and not necessarily transferable to other kinds of weather hazards.

II.   Methodology and Objectives

To build on 2013 NWS demonstration project and expand it to address all key NWS customer groups and all types of weather hazards, social scientists from ERG, NWS, and NOAA's Coastal Services Center conducted 20 focus groups from May to July 2014. The focus groups were used to gather stakeholder perspectives from across the United States on the current WWA system and to request suggestions for a possible future system.[2] The focus groups were conducted in Minneapolis, Minnesota; Houston and Galveston, Texas; Silver Spring, Maryland and Sterling, Virginia; and Anchorage, Alaska. They were held with members of the public (two groups each location), EMs, BMs and other media professionals, and NWS WFOs.

Sample

Table 1 lists the number of participants by location and stakeholder group. WFOs in each location were responsible for identifying and recruiting EMs, BMs, and WFO staff. In Alaska and Houston, some WFO staff from neighboring WFOs also attended. Participants for the public groups were recruited through market research firms based in each location, and only these public group participants were paid a monetary incentive for their participation. With input from NOAA, ERG developed a focus group screener (see Appendix A) to recruit the public group participants and developed focus group facilitator scripts (see Appendix B) tailored to the different stakeholder groups.

Table 1. Sample by Location and Stakeholder Group					
Location	**EMs**	**BMs**	**WFO**	**Public #1**	**Public #2**
Minneapolis, MN	11	8	18	13	14
Anchorage, AK	9	10	14	13	14
Houston, TX	14	5	16	14 (Galveston)	12
Silver Spring, MD	6	5	10 (Sterling, VA)	11	7
Subtotals	40	28	58	51	47
Totals	**40**	**28**	**58**	**98**	

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[2] The focus groups were conducted with Office of Management and Budget (OMB) approval (approval date 3/14/14), and the data were collected under NOAA's Generic Clearance for the Collection of Qualitative Feedback on Agency Service Delivery, OMB Control Number 0690-0030.

Goals

The main goals of the focus groups were to:

1. Explore **understanding, attitudes, and utility** of the current WWA system.
2. Identify **strengths and limitations** of the current WWA system.
3. Identify **potential enhancements or changes** to the current system to better communicate hazardous weather and water threats and prompt appropriate protective action.
4. Explore one **possible prototype of an alternative system** called Meteoalarm as a way to compare/contrast the current WWA and weather.gov features.

The focus group discussions touched upon many different hazard types and WWA products of concern to the participants (e.g., convective, winter weather, tropical, non-precipitation, coastal flood, hydrology).

It should be noted that focus groups are useful in exploring issues and offering creative suggestions, especially with the help of "group thinking." While focus groups can help social scientists gain an initial understanding of an issue to guide further inquiry, the findings are not conclusive and cannot be used to make generalizations about the population(s) of interest.

III.   Key Findings

The focus groups provided important insights into stakeholders' understanding of the current WWA system, along with some of the strengths and limitations of the system. They also provided many ideas and suggestions for enhancements or modifications to the current system.

Understanding of the WWA System

Across all locations, the focus group EMs, BMs, and WFOs largely believed the public does not understand the WWA system; yet, many of these individuals also believed the words "watch" and "warning" are entrenched in our society. BMs and some EMs make a conscious effort to try to educate people about the terms when they have time.

Among the public groups, there was a spectrum of understanding of the terms. In some areas, (e.g., Alaska, Galveston, Minneapolis), many participants had a good understanding of the "watch" and "warning" terms. In many of the groups, there were also participants who *thought* that they understood the terms, but did not or confused the terms (especially when other members of the group questioned the terms and their meanings, casting doubt on what people thought they knew). Some people recalled hearing the terms, but didn't think they were meaningful to them. Some participants stated that they grew up learning the terms; others said they never received any education on them. In the Silver Spring focus group, participants also commented that there were a lot of people in the area who were not born there, so the terms are likely to get lost in translation. Many people commented that the terms "watch" and "warning" are phonetically similar (both beginning with "wa"), making it easy to mix them up.

Some WFO staff also explained that there are misunderstandings among their partners. For example, EMs can be on a county boundary or have different WFOs in their area where there could be different criteria in place for the same kind of hazard. They also noted that there can be substantial turnover in the EM community, so there is a need for continual education on the WWA system.

> **Definitions of Watch, Warning and Advisory**
>
> These definitions of watch, warning, and advisory from the NWS were shown and read aloud to the focus group participants.
> - A watch means hazardous weather is possible, anywhere from three days in advance to the next few hours.
> - A warning means that hazardous weather has been observed, or is expected soon.
> - An advisory highlights special weather conditions that are less serious than a warning. An advisory is issued for hazards that have been observed or are expected soon that may cause significant inconvenience, and if caution is not exercised, could lead to situations that may threaten life and/or property.

"Advisory" was the most problematic term for the focus group participants. Many members of the public, as well as some EMs, did not know the definition of an advisory and perceived advisories to be less of a concern than either a watch or warning. Some thought advisories were directed at changing behavior or telling people to exercise caution (e.g., excessive heat advisory). Some EMs and BMs commented that they didn't pay much attention to advisories.

Even when shown a definition of the three terms (watch, warning, and advisory), many focus group participants struggled to grasp the differences among them. Many wanted to see a clear hierarchy among the three terms. EMs and BMs stated that they didn't always use the WWA terms, but would try to explain a particular WWA product at a level that the public could understand.

BMs also commented that advisories can have different meanings, depending on the hazard (e.g., heat, winter weather, flooding), and noted that they spend a lot of time explaining the term. One BM in Houston gave the example of flood advisory: "I have to explain it; I have to caveat it that it is not a flood warning. I lose people in that time I have to explain it."

Many participants across the different groups (even the WFO groups) thought the NWS could switch to a binary system and eliminate advisories altogether. Several WFO staff and BMs also commented that there were just too many NWS products and suggested consolidating the list of current hazards as part of any system change.

Limitations of the Current System

EMs, BMs, and WFOs described several limitations of the current system, including flexibility, efficiency, verification metrics, thresholds/criteria, and clarity.

Flexibility

Many EMs, BMs, and WFOs said the current system is not flexible enough. One BM in the Silver Spring focus group cited the Washington, D.C., area derecho as an example. During the 2012 Summer Olympics, he had a hard time convincing his station manager to interrupt the broadcast with a warning about the storm, in part, because the NWS product issued was for a severe thunderstorm. The station manager would only interrupt programming for a tornado warning. Although the NWS had also issued a special weather statement, the BM said that statement was meaningless to the station manager. The Sterling WFO also pointed out that the NWS lacked a mechanism for warning of these kinds of significant events, noting that the derecho was a perfect example of not "having the right tools in the toolbox."

WFO participants noted that special weather statements do build some flexibility into the system. However, these statements can be issued many times, which can desensitize some individuals or make them feel overwarned. Another factor that contributes to people feeling overwarned or becoming desensitized is that some WFOs can issue the same products repeatedly (such as severe thunderstorm warnings on a daily basis in the summer).

Efficiency

Some WFOs saw the amount of internal discussion that was often needed before issuing a watch or warning as a limitation of the current system. They noted there were too many people involved in making decisions, making the entire process inefficient.

Verification/Metrics

A few staff indicated that forecast verification metrics (e.g., false alarms, forecast tracks) can sometimes be a limitation. While such metrics can hold offices accountable, they can also influence how an individual forecasts an event. WFOs also mentioned the lack of societal or communication metrics within the enterprise as another limitation. One individual pointed out that the mission of the NWS is to save lives and property; yet, it is difficult to really verify how NWS forecasts or its communications are accomplishing this mission. "We are the most important unknown entity in the nation," he said. "Social media, newspapers, and many followers will post our information, but we don't measure our actual reach. We need new ways to verify our communication."

Thresholds/Criteria

All of the WFOs stated that their thresholds can be limiting in some circumstances. They did not think people understood that NWS products are based on criteria. Some individuals felt the WWA system was too black and white because of the thresholds; others liked and felt comfortable with their criteria.

Some WFOs suggested eliminating criteria and messaging just for impact. Others questioned how they would determine impact, noting that impacts are different for different user groups. Many forecasters said they already consider societal impacts in addition to the meteorological criteria when issuing WWA products. They convey impacts through advisories, call-to-action statements, and discussions, but are not sure people drill down and read this information. Several WFOs said that they are now adding graphics to help convey impacts. These can be particularly useful on social media, as they can include timing and be easily shared. Additionally, WFO forecasters from Fort Worth, Baton Rouge, Houston, and Anchorage said they either have changed their criteria to better reflect true societal impacts or are currently considering doing so, but that it takes a good deal of coordination to affect change.

Clarity

Clarity is another current challenge. WFOs stated that "people interpret our warnings differently," and some "just grab our headlines." They noted that people focus too much on the WWA words instead of the details. Yet, people need those details to make informed decisions.

Some also mentioned the "flip flop" nature of the WWA system as another limitation, noting that forecasts can go back and forth from advisory to watch, which can be confusing and cause perception changes.

Variables to Consider Changing in the WWA System

In all locations, there was general support among all stakeholders for a *hierarchical* scheme involving color, numbers, and/or symbols. Individuals had many different suggestions and preferences.

Tiers
Opinions differed on how many tiers a system should have. A number of partners advocated for a two-level system (akin to the current watch and warning) that would take into account both timing and threat severity. Some stated that there shouldn't be too many tiers (citing the Homeland Security threat scale as an example), as the differences between tiers can be too subtle. There was general support for an additional tier, above any two-, three-, or four-tiered system, which would be used sparingly for an extreme event.

Color Scale
Many individuals in every group and location advocated for a color scale. Some BMs pointed out that their stations already use colors; Alaska also already uses a three-color system. Many liked the idea of a stoplight approach, which would range from low to high as green, yellow, and red. Others preferred a color spectrum ranging from low to high as yellow, orange, and red. Many participants in every group stated that they liked using red for danger. Some suggested a spectrum similar to the beach warning flag system already in place, which people understood. If a tier was designated for an extreme event, purple and black were the preferred colors. Some participants also suggested color-coding terms used (e.g. put the word "warning" in red).

One BM suggested using solid colors to convey areas where there was the most potential for hazardous weather, as well as cross-hatching for where the conditions for such weather were possible, similar to the forecast cone used for tropical cyclones. Another suggestion was to use shading or cross-hatching to indicate short- or long- term impact.

However, participants did express concerns for people who are color blind and for messaging color over radio. BMs in Houston and Sterling also indicated that every station wants to use its own colors and graphics. At the same time, however, several stated that if NWS were to establish a color scale, they thought their station would follow suit, noting the "more consistency we have the better." Every group also mentioned the issues arising from inevitable comparisons with the Homeland Security colors and wondered if this would pose a problem for the NWS.

Pictograms/Icons
Many participants suggested the NWS use pictograms or icons in its system. Suggestions included using a combination of colors and icons. For example, different colored circles (to represent different threat levels) could be paired with icons inside the circles depicting the hazard (snow, rain, etc). Participants thought that pictures would be helpful in bridging low literacy and other language barriers. They would also be useful for mobile apps. Some expressed concerns about the number of icons the NWS would need to develop, particularly on the national map. Participants suggested that the NWS develop

standardized icons that everyone else could use if it takes this route. Many EMs, in particular, liked the idea of using icons.

Number Scale

Opinions differed on whether numbers could be useful. Concerns included potential confusion with hurricane categories and with people understanding the direction of the scale (e.g., is ace high or low?). Some suggested pairing colors and numbers.

Timing

Participants in all groups stressed the importance of including timing information. They noted that people need to know when hazardous weather is coming and how long it will last. They didn't think the public understood the current WWA system's timing element and suggested including a calendar or a bar chart with a timeline.

Probability

EMs indicated that they want the NWS to provide both "best guess" and worst case information. Some members of the public stated that they understand percentages and want to know the probability of any event occurring. BMs suggested that any new system have a confidence scale.

Impacts

The focus groups discussed the importance of localized, impact-based information. Many EMs explained that they already try to hyper-localize their communication. Members of the public stated that they do want this information, but recognized that impacts can be different for people in different places and standardizing a system could be difficult. WFOs also noted the difficulty in developing usable impacts catalogues.

Language

Participants in all focus groups were divided on whether to change the current WWA terms. However, there was strong support among participants for simpler, more memorable language and more consistency in the use of terms among the NWS and its partners. EMs noted that they wanted strong language, with one stating, "I need to scare people. I need to convey a sense of urgency."

There was no consensus on alternative words or phrases to the current system (see Table 2). There was considerable support among all the groups for eliminating "advisory," but maintaining "warning" or both "watch" and "warning." Many people across the different stakeholder groups also suggested gradually transitioning from the current WWA words to any new terms.

One forecaster observed that, "Anything you have to explain, you have failed. You have already lost people. [Whatever language is used] needs to be inherently understandable. It is one of the flaws of the current system. I have to explain watch and warning." BMs echoed this sentiment stating that in the time it takes for them to explain the terms, people are already in danger.

	Public	EMs	BMs	WFOs
Table 2. Suggestions for Alternative WWA Terms				
Watch	• Look Out • Anticipate • Possibility • Potential • Threat • Caution • Likely • Alert • Be Observant • Pay Attention • Pre-Warning	• Potential • Caution • Possible • Something Might Happen • Be Alert • Pay Attention • Monitor • Be Aware	• Risk • Threat • Possibly • Likely • Heads Up	• Watch Out • Pay Attention • Monitor • Keep Watching • Take Action • Possible
Warning	• Imminent • Emergency • Take Cover • Alert • Danger • Hazard • Hazardous Weather • Severe • WARNING (in caps) • Warning! (with exclamation mark) • Warning (in red) •	• Look Out • Severe Threat • Emergency • Imminent • Warning (in red)	• Imminent • Imminent Threat • Life-Threatening • Emergency • Happening • Warning (in red)	• Take Shelter • Imminent Danger • Protect Yourselves • Take Immediate Action • Happening
Advisory	• Be Prepared • Take Caution • Alert • Hazardous • Severe Conditions	• Pre-Warning • Courtesy Message • If You Take Action, You Can Prevent It	• Keep An Eye Out • Pay Attention	• Expected

Feedback on weather.gov and Meteoalarm

The second part of the focus groups involved looking at the current WWA system and the European system, Meteoalarm. Meteoalarm is a color-coded and icon-based system that alerts people to the possible occurrence of severe weather (see Figure 2). The colors used on the Meteoalarm website maps indicate the severity of the danger and its possible impact. On the

Figure 2. Meteoalarm map showing color scale and icon system.

European map, each participating country is colored consistent with the highest color assigned to a current warning. Clicking on a country will link a person to national and regional warnings.
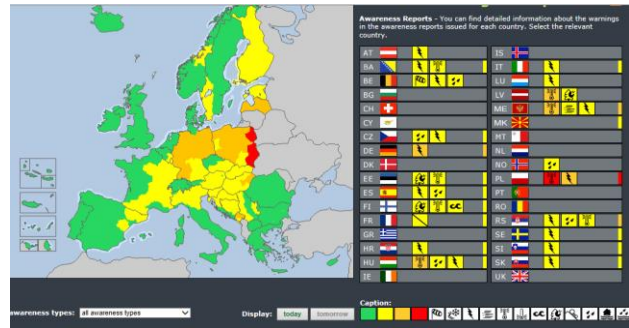
Participants were shown sample pages from the current NWS weather.gov site (at national, regional, and local levels) and then shown how that system might look after applying the Meteoalarm approach.
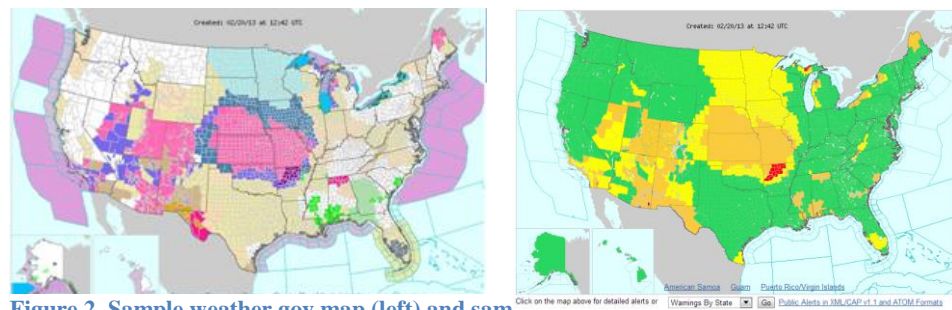

Figure 2. Sample weather.gov map (left) and same map as it would appear in the Meteoalarm system (right).

Most members of the public were overwhelmed by the current weather.gov map (See Figure 3, map on left) and its multiple colors. A few called it "awful." Others said they were intrigued by the map. One stated, "It makes you curious. The different color schemes draw me in." Some BMs stated they like the current map and understand all the colors. Many WFOs and NWS partners did note that a problem with the current weather.gov national map is that it only shows one hazard in an area and can mask other hazards.

When shown how the current national map would look with a Meteoalarm approach (see Figure 3), some were concerned that the map was vague, overly broad, and would not serve them at all. One BM commented, "It looks like a map drawn by a kid. It doesn't make me feel like the weather is urgent." Another stated, "I am worried people will say the weather is the same in different places." Others had the opposite reaction, with one participant expressing, "This is really good. I love it." Another added, "It has good potential to satisfy all the generations."

There were suggestions to:

- Have *one national map*, but searchable for anything: area, time, hazard, and threat.
- Have *two national maps* (a hazard map and a "take action" map).

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- Have ***three national maps*** (a hazard map like the current weather.gov map, a map with just watches and warnings, and a map like Meteoalarm showing colored threat levels).
- Use the Meteoalarm approach (threat levels limited to four categories/colors) on the national map, but add ***hazard-specific colors or icons on local/regional maps***.
- Add ***toggle capability*** so a user could see the national/regional/local maps by hazard or threat.
- Use a ***series of maps over time***, or use a slider similar to the Storm Prediction Center. The slider could be in hours or days.
- Add a ***time dimension***.
- Have it possible to search by ***zip codes,***[3] so a user does not have to click down.
- Consider how to show threats to ***marine*** versus land. Consider a paler color of the same shade for marine, or click on/off for marine.

Additional comments on the regional/local pages included:

- Put impacts at the top of page.
- Add time stamp and confidence scale.
- Add links to more information, such as what to do to prepare.
- Add links to radar.

Figure 3. United Kingdom version of Meteoalarm color scale showing impacts, actions, use, and thresholds.

Color and Language

Each color level in the Meteoalarm system corresponds to short action statements. Focus group participants discussed how the NWS might apply these elements to a U.S. system. Some people suggested that if the NWS were to use a system similar to Meteoalarm (see Figure 4) in the United States, they would start with yellow ("Be Aware") rather than green (for usual phenomena). Others suggested using blue instead of green for the lowest level. Some mentioned the new NWS "Potential Storm Surge Flooding Map" for tropical cyclones, and said the NWS should be consistent with those colors. Others wanted the green level, stating that green provides some information and is a quick reference. Those advocating for the green level said there could be a possible or nominal threat, and that they want people to be aware. One BM stated that his station did a survey to see if people care "if nothing is going on," and found that people do care. He explained, "It reassures people to depict no threat." Another BM commented that in weather, it is hard to say "no" with certainty.

In all of the groups, most of the participants responded well to the Meteoalarm approach's action statements, simple language, and conciseness. Participants in every group, however, took issue with the "be prepared" language.[4] Some noted it begs too many questions (e.g., be prepared for what and

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[3] The focus groups only viewed certain weather.gov pages, so they did not see that there already is a zip code search function on the site.

[4] While the four-color scale shown is used throughout the Meteoalarm as a whole, the "Be Aware, "Be Prepared" Take Action" text is specific to the United Kingdom version of the system.

when?). Others noted that preparation is what they do in advance of the hurricane season. Still others noted that people should always be prepared. Some participants suggested using the colored levels of the Meteoalarm approach, but using the current WWA words instead of action statements. Many EMs advocated for action statements, stating they want the NWS to tell people what to do. Several participants also pondered if there was enough distinction between "be prepared" and "be aware." One BM noted that you always have to "be aware."

Several WFOs, BMs, and EMs had operational questions that would need to be addressed if the NWS were to use a similar approach in the United States, such as:

- What happens when you have orange or yellow on top of one another?
- What happens if you have multiple hazards going on? If one is red, does it take precedence?
- Is it possible for one WFO to have orange and another to have yellow for the same kind of event?
- How will WFOs ensure consistent messaging?
- How do we educate people that different areas can have different impacts?

III. Implementation

Individuals in all groups and locations expressed concern about changing the current system or adopting a new system that isn't any better or that introduces new inconsistencies or problems. Comments included:

- "These words have been around 60-70 years. We hear them all the time. As kids, we learned these words in elementary school. They have been around since day one."
- "There is a lot of information overload; these words help to focus attention. "
- "If it isn't broke, don't change it."
- "I am concerned we are just rearranging the deck chairs on the Titanic."

Participants also noted that WWA is a known entity for some important sectors (e.g., military, oil plants) and institutionalized into certain kinds of decision-making (e.g., evacuation, insurance decisions). They were concerned about broader implications of a system change.

Some felt that public education on the current system was all that was needed while others believed strongly in change, especially given the way people now get weather information (e.g., apps, smart phones). Comments included:

- "Without change, the NWS will be obsolete."
- "It will serve future generations well to change the system now."

Some believed that people become desensitized to any system over time, noting that the NWS will have to consider continual modernization and change, particularly to keep pace with technology. Many liked the idea of giving the current system "a facelift" and gradually changing it more substantially over time.

Numerous people stated that **massive** public education will be needed for any new system. One WFO stated, "We should consider that even if we do nothing, we should implement some education on our life-saving products. We should have some weather service product lessons that go out to all schools."

IV.   Conclusion

This work indicated that there is a spectrum of understanding of the current WWA system, ranging from comprehension to confusion to complete lack of understanding. There is also a range of support for completely changing the current system to not changing it at all. There was a good deal of support for enhancing the system with simple explanatory language that could convey threats, impacts, and/or desired actions, although there was no agreement on what terms or phrases should be used. There was also considerable support for using a color scale to convey threat levels, with most participants favoring the red/orange/yellow spectrum. Opinions differed on whether a number scale would be useful, with some participants supporting the idea (possibly in combination with a color, such as "threat level one: yellow") and others believing numbers would be confusing ("is ace high or low"), particularly with other NWS number scales already in use (e.g., Saffir-Simpson Hurricane Wind Scale). Support for icons/symbols was also mixed, with some participants enthusiastic about the universality of symbols, their adaptability for mobile devices, and their ability to communicate information to people with language barriers. Others were concerned about the number of icons/symbols that might be needed and how and where the symbols would be used. Participants agreed that the system must work across multiple mediums, including websites, radio, television, and print. There was also agreement that any change to the current system needs to happen slowly, over time, and be accompanied by training, coordination, and massive public outreach.

V.   Recommendations and Next Steps

The team recommends that, as a next step in the data collection process, the NWS develop prototypes (based on the feedback from the focus groups) for testing with key stakeholder groups (EMs, BMs, media, the public). Given the diversity of opinion and understanding of the current WWA system displayed by the focus groups, the development and testing of prototypes would provide NWS with an opportunity to further define and narrow the options for a new or modified system. In particular, the team recommends:

1. ***Clarify overall purpose and objectives.*** What does the NWS want from the present WWA system (or an alternative system)? Is the objective to ensure the public understands the difference in terms used? Is it to demonstrate an order of increasing risk? Is it to ensure people take appropriate action?

2. ***Develop several system prototypes for testing***, which could include 1) the current WWA (to serve as a control) with the possible omission of advisories, 2) the "Meteoalarm" example with possible adjustments (i.e., let participants experience it for themselves instead of a facilitator walking them through all the details), 3) a three-tier system, and 4) a four-tier system (including extreme event category). For prototypes three and four, we would vary the variables to test, which could include a variety of options determined in consultation with a working group (see #4 below), such as:

a. Threat levels (e.g., severe, moderate, minimal): various color scales, numeric scale, text.
b. Meteorological hazards (e.g., wind, snow, flash floods): symbols/icons, colors, text.
c. Location: county, polygon.
d. Probability (likelihood or confidence): symbols, percents, words.
e. Call to action: symbols, phrases, words.
f. Societal impacts (e.g., road closings, building damage, power outages): bulleted lists, statements, symbols.
g. Timing: timeline, dashboard, clock, calendar days.

3. ***Consider pre-testing prototypes/variables in different combinations*** to narrow the choices to test more extensively. Pre-testing could be conducted through a limited number of one-on-one webinars or small discussion groups, for example.

4. ***Test refined prototypes with stakeholders at national conferences,*** which would enable the team to test with a larger sample than focus groups, to gather some quantitative data on preferences, and to test across all applicable mediums (radio, television, print, Web). The team recommends we have refined prototypes ready for the American Meteorological Society (AMS) conference in January, which also has a public component (Weatherfest). Since the conference is scheduled in the Western Region (Phoenix)—a region not targeted in the focus group testing—we may want to consider additional public/EM testing in Phoenix (beyond the conference venue) as well. We recommend the team investigate additional testing opportunities beyond AMS, as well.

5. ***Establish a small, internal NWS working group to serve as a "brain trust"*** to help guide and support the work. The working group would likely consist of NWS staff from headquarters and WFOs across all of the regions. The size of the group should be limited to ensure optimal efficiency and decision-making. The group will assist in developing prototypes and guiding the next steps in the research and data collection.

6. ***Consider a research study***, to be conducted in parallel to the prototype testing, to better understand how WWA terms are ***institutionalized in policies and decision-making*** at federal, state, and local levels (e.g., evacuation decisions, insurance policies).

Appendix A – Focus Group Screener for the Public

Screening Questions for Recruiting ERG/National Weather Service Focus Groups

We are looking for a general mix of people (by age/gender/education/ethnicity/location).

How often do you get your weather information from a website (not a smartphone or tablet app) such as weather.gov, the Weather Channel, Accuweather, or another site?
- o Very often
- o Sometimes
- o Rarely
- o Never

If "rarely" or "never," terminate call. If "very often" or "sometimes," proceed with the following questions.

Gender – Should be clear on the phone.
- o Male
- o Female

Age

What's your age? _____

Education

What is the highest degree you've earned?
- o High school or less (incl GED)
- o College degree
- o Graduate degree

Race/Ethnicity

How would you describe your ethnicity or race?
- o American Indian or Alaska Native
- o Asian
- o Black or African American
- o Hispanic or Latino
- o Native Hawaiian or Other Pacific Islander
- o White

Location

How would you describe where you live?
- o Urban
- o Suburban
- o Rural

Appendix B: Focus Group Scripts

Weather Forecast Offices

Part I: Overview
As you know, the NWS is always trying to assess its products and services. We are here today to talk about the language of "Watch, Warning, and Advisory." In addition to this focus group, we are talking to emergency managers, broadcast meteorologists, and the public here in X [fill in name of location]. We are also doing focus groups in X, X, and X [add other locations]. We're trying to get input from you all today to get your perspective on how WWA works for you in your forecasting and also how it works for communicating with the public.

Part I: Watch/Warning/Advisory Language: How does the current system work from a WFO perspective?
1. Let's talk about the current WWA system from a forecast perspective. How well does WWA function for you?
2. Does the system give you enough flexibility?
3. Is there a way to change this?
4. What if we could build in more flexibility? How can you verify?
5. How much do metrics influence your forecast?

Part II: Communicating With Stakeholders
1. Do people make decisions on the WWA language or by the meteorological information in the actual forecast?
2. What kind of communication is most helpful? [Probe for language and also visual design.]
3. If we didn't have the WWA terms and you could invent a new system, what would you use? [Probe for language and also visual design.]
4. Consider we need to convey not just physical parameters in the system, but also social parameters like when, where, and who. How would you accomplish this?
5. Now we need to think about how you would communicate this new system. How would you push this out? What are you asking people to do?

Part III: Weather.gov
1. Keep in mind this is not a focus group on a redesign of weather.gov. But, relative to WWA, what are your sentiments on this map? Do you like having this national view?
2. [Click on local page.] What are your thoughts on this page relative to WWA?

Part VI: Introduction of New Prototype
<<Give some background on Meteoalarm as the initial idea, etc.>> Now we would like to show you a potential new prototype of weather.gov and its associated local pages and warnings.
1. Here's a possible weather.gov page in the Meteoalarm system. What are some of your initial reactions? Let's start with the positive. What do you like about this design and why? What do you dislike about this design and why? What would you change?
2. This page works similarly to the previous weather.gov. You can click on your area to enter your local page information. <<click on their local page>> What are your thoughts about this local page? What do you like about this design? Why? What do you dislike about this design? Why? What would you change?
3. Just like before, when there are warnings they will be posted on your local page. You can click on the warning to gather more information. <<click on the warning>> What are your thoughts about this new warning page? What do you like about this design? Why? What do you dislike about this design? Why? What would you change?
4. Implementing a new system like this will require significant training and coordination within NWS. How do you feel about this?

Broadcast Meteorologists

Opening Remarks [Feel free to use this as a guide]: Welcome everyone! As you know, the National Weather Service often assesses the value of their services and products. Today is for one of those assessments. But to ensure we don't bias you, we will provide a bit more background to you after the first half of the focus group. I would, however, like to introduce some of our partners that will help us facilitate today's focus group ….

Part I: Overview

As you know, the National Weather Service often assesses the value of their products and services. Today, the focus is on the language of "Watch, Warning, and Advisory." To begin, we would like to start by talking about your use of these terms.

1. *Before* we discuss thoughts on changing language, we would like to know if you use the phrases **watch**, **warning**, and **advisory** to convey weather risks on air [in print, online, etc.]?
   - IF no, why? And what do you use?
   - Does your use of the phrase ever **vary by hazard**? If so, how?
2. What are some of the techniques you use to explain the **differences** between a watch, warning, or advisory?
3. What type of **audience feedback** do you receive on using such phrases?

Part II: Watch/Warning/Advisory Language

1. What do you think about the term "watch"? What do you think this means to your audiences?
2. What do you think about the term "warning"? What do you think it means to your audiences?
3. What do you think about the term "advisory"? What do you think it means to your audiences?
4. Based on our discussion, are there other words or phrases that would better describe these definitions? Let's take watch first.
   - Now warning.
   - Now advisory.
5. Should these alternative terms be used in addition to or instead of the current terms (e.g. watch, warning, advisory)?

Part III. Conveying Hazard Information without WWA

Thinking about the concepts of WWA, let's try to break down the general meaning without using the words watch, warning, and advisory.

1. In the days to a week before an event, such as a flooding risk, you have some weather information available to you, although very uncertain that many days out. How would you convey this type of information to your audience?
2. For a predicted flood event, for example, how would you describe this pending risk 48 to 72 hours beforehand to your audience?
3. For a predicted flood event, for example, how would you describe the imminent nature of a significant flooding event?

Part IV. Probing for visual designs …

[If they have pointed this out…] **We know that the words watch vs warning are similar in spelling, and can also have similar definitions outside of the weather context, [as you have pointed out]. The NWS is considering keeping the language, but perhaps incorporating a visual design, such as a color scheme, numeric scale, or icons to help increase understanding.**

1. What are your thoughts on this?
2. Specifically, how do you feel about colors associated with a watch? Recall that it means […fill in blank]. What colors do you associate it with it?
3. How do you feel about colors associated with a warning. Recall that it means […fill in blank]. What colors do you associate with it?

EXERCISE

- Are there are other scales or color schemes that you encounter in your work or local environment? How could you apply that to this?
- Do you have any ideas about how to combine color, numbers and icons?

Part V: Weather.gov

One of the ways that the NWS communicates their watches and warnings is through their weather.gov site.

1. <<Place weather.gov on a projector screen>> **This is weather.gov.** In reference to watches, warnings, and advisories, what are your initial thoughts on the design of this page?
   o From a media perspective, is there anything you find useful? Not useful? Why?
2. **This is a local page.** What are your thoughts on this page?
   o From a media perspective, is there anything you find useful? Not useful? Why?
   o Is there anything missing from this page that you would find useful?
3. **This is a warning page.** What are your thoughts on this page?
   o From a media perspective, is there anything you find useful? Not useful? Why?
   o Is there anything missing from this page that you would find useful?
   <<if we have time>>
4. Are there any features to this entire website–the homepage, local pages and warnings–that you would like to see changed? Why?

Part VI: Introduction of New Prototype

<<Give some background on Meteoalarm as the initial idea, etc.>> Now we would like to show you a potential new prototype of weather.gov and its associated local pages and warnings.

1. Here's a possible weather.gov page.
   - What are some of your initial reactions?
   - Let's start with the positive. What do you like about this design and why?
   - What do you dislike about this design and why? What would you change?
2. This page works similarly to the previous weather.gov. You can click on your area to enter your local page information. <<click on their local page>>
   - What are your thoughts about this local page?
   - What do you like about this design? Why?
   - What do you dislike about this design? Why?
   - What would you change?
3. Just like before, when there are warnings they will be posted on your local page. You can click on the warning to gather more information. <<click on the warning>>
   - What are your thoughts about this new warning page?
   - What do you like about this design? Why?
   - What do you dislike about this design? Why?
   - What would you change?

Emergency Managers

Opening Remarks [Feel free to use this as a guide]: Welcome everyone! As you know, the National Weather Service often assesses the value of their services and products. Today is for one of those assessments. But to ensure we don't bias you, we will provide a bit more background to you after the first half of the focus group. I would, however, like to introduce some of our partners that will help us facilitate today's focus group ….

Part I: Overview
As you know, the National Weather Service often assesses the value of their services and products. This is why you are here today. But, before we discuss the specific products of interest, we would like to gather some preliminary information on weather sources that are important for you to do your jobs as emergency managers.
1. Where do you prefer to access your weather information and why?
   a. Probe for channels (TV, website, preferred broadcaster, etc.)
2. Do you seek out other or additional sources for a significant weather event?
   a. Probe for channels (TV, website, preferred broadcaster, etc.)?
3. When you are communicating to your stakeholders (the public and decision-makers), how do you communicate a significant weather event? Are there special terms you use? What kinds of terms would prompt you to take action?
4. In the days to a week before an event, forecasters have some information available, although very uncertain. How soon do you want to know that an event may occur? How would you explain the uncertainty of that event occurring to your stakeholders (the public and decision-makers)?

Part II: Introduction of Watch/Warning
1. Do you think your stakeholders understand the terms watch, warning, and advisory? According to the National Weather Service, a **watch** means hazardous weather is possible, anywhere from three days in advance to the next few hours, while a **warning** means that hazardous weather has been observed, or is expected soon. An **advisory** highlights special weather conditions that are less serious than a warning. An advisory is issued for hazards that have been observed or are expected soon that may cause significant inconvenience, and if caution is not exercised, could lead to situations that may threaten life and/or property.
2. Based on our discussion, are there other words or phrases that would better describe these definitions? Let's take watch first. Now warning. Now advisory.
3. Should these alternative terms be used in addition to or instead of the current terms (e.g. watch, warning, advisory)?

Part III: Probing for visual designs …
We know that the words watch vs. warning are similar in spelling, and can also have similar definitions outside of the weather context, [as you have pointed out]. The NWS is considering keeping the language, but perhaps incorporating a visual design, such as a color scheme, numeric scale, or icons to help increase understanding.
1. What are your thoughts on this?
2. Do you have any visual suggestions? There are pieces of paper and colored pencils, if, as a group or individually, you would like to sketch some of your ideas. We'd like to document some of the ideas to give to our colleagues at the NWS.
   - Are there are other scales or color schemes that you encounter in your work or local environment? How could you apply that to this?
   - Do you have any ideas about how to combine color, numbers, and icons?
3. Specifically, how do you feel about colors associated with a watch? Recall that it means […fill in blank]. What colors do you associate it with it?
4. How do you feel about colors associated with a warning? Recall that it means […fill in blank]. What colors do you associate with it?

Part IV: Weather.gov

Now we would like to shift our attention to Weather.gov for a moment.
1. How many of you use weather.gov to gather your local weather information?
2. What are your thoughts on the design of weather.gov?
   - Is there anything you find useful? Not useful? Why?
3. This is a local page. What are your thoughts on this page?
   - Is there anything you find useful? Not useful? Why?
   - Is there anything missing from this page that you would find useful?
4. This is a warning page. What are your thoughts on this page?
   - Is there anything you find useful? Not useful? Why?
   - Is there anything missing from this page that you would find useful?
      <<if we have time>>
5. Are there any features to this entire website–the homepage, local pages and warnings–that you would like to see changed? Why?

Part V: Introduction of New Prototype
<<Give some background on Meteoalarm as the initial idea, etc.>> Now we would like to show you a potential new prototype of weather.gov and its associated local pages and warnings.
1. Here's a possible weather.gov page.
   - What are some of your initial reactions?
   - Let's start with the positive. What do you like about this design and why?
   - What do you dislike about this design and why? What would you change?
2. This page works similarly to the previous weather.gov. You can click on your area to enter your local page information. <<click on their local page>>
   - What are your thoughts about this local page?
   - What do you like about this design? Why?
   - What do you dislike about this design? Why?
   - What would you change?
3. Just like before, when there are warnings they will be posted on your local page. You can click on the warning to gather more information. <<click on the warning>>
   - What are your thoughts about this new warning page?
   - What do you like about this design? Why?
   - What do you dislike about this design? Why?
   - What would you change?

PUBLIC FOCUS GROUPS

Opening Remarks: Welcome everyone! The National Weather Service often assesses the value of its services and products to improve people's understanding of weather forecasts and to help them prepare. You are here today to help inform one of these assessments. To ensure we don't bias you, we will provide a bit more background to you after the first half of the focus group. But let's start with introductions… go around the table … name, where you are from, and what kind of weather you are most concerned about and why.

Part I: Overview
1. Where do you prefer to access your weather information and why? Probe for channels (TV, website, preferred broadcaster, etc.)?
2. Do you seek out other or additional sources for a significant weather event? Probe for channels (TV, website, preferred broadcaster, etc.)?
3. When you are accessing your preferred weather source, how do you learn about or differentiate between a daily forecast and a significant weather event? Are there ways that your preferred source expresses (or describes) a significant weather event? [Probing for hazardous weather type warnings or watches to see if they are familiar with these terms]

4. What about for a significant weather event that will start two or three days ahead? What kinds of words have you heard to describe these kinds of events?
   - Can you think of any other terms that would explain that hazardous weather may occur in the next 48 hours?
   - What word or phrase would spark you to begin preparing?
5. In the days to a week before an event, forecasters have some information available, although very uncertain. How would you prefer forecasters convey this information to you? How would you explain the uncertainty of that event occurring?
6. What about for a significant weather event that is imminent? What term(s) are used to describe this? Can you think of any other terms that would prompt you to take action?

Part II: Introduction of Watch/Warning
1. What do you think about the term "watch"? What does it mean to you?
   - Placing this in context, what does a [fill in relevant hazard] watch mean to you?
2. What do you think about the term "warning"? What does it mean to you?
   - Placing this in context, what does a [Fill in relevant hazard] warning mean to you?
3. What do you think about the term "advisory"? What does it mean to you?
4. PUT ON SCREEN, ALSO COULD HAND OUT According to the National Weather Service, a watch means hazardous weather is possible, anywhere from three days in advance to the next few hours, while a warning means that hazardous weather has been observed, or is expected soon. An advisory highlights special weather conditions that are less serious than a warning. An advisory is issued for hazards that have been observed or are expected soon that may cause significant inconvenience, and if caution is not exercised, could lead to situations that may threaten life and/or property.
   - Based on our discussion, are there other words or phrases that would better describe these definitions? Let's take **watch** first. Again, a watch means hazardous weather is possible during the next few hours. Now **warning.** Remember that a warning means that hazardous weather has been observed, or is expected soon. Now **advisory.** An advisory is issued for hazards that have been observed or are expected soon that may cause significant inconvenience, and if caution is not exercised, could lead to situations that may threaten life and/or property.
5. Should these alternative terms be used in addition to or instead of the current terms (e.g. watch, warning, advisory)?

Probing for visual designs …

6. [If they have pointed this out…] We know that the words watch vs. warning are similar in spelling, and can also have similar definitions outside of the weather context, [as you have pointed out]. The NWS is considering incorporating a visual design, such as a color scheme, numeric scale, or icons to help increase understanding. What are your thoughts on this?
7. How do you feel about colors associated with a watch? Recall that it means […fill in blank]. What colors do you associate it with it?
8. How do you feel about colors associated with a warning? Recall that it means […fill in blank]. What colors do you associate with it?

Part III: Weather.gov
1. How many of you have heard of weather.gov, the official website for the National Weather Service? (For facilitators…. Explore whether or not the participants are confused about the nature of weather.gov and what institution is behind it [confusion with private sector partners, etc.])
2. How many of you use weather.gov to gather your local weather information?
3. <<Place weather.gov on a projector screen>> This is weather.gov. Explain the information on this page.
   - Is there anything you find useful? Not useful? Why?
4. This is a local page. Explain the information on the page. What are your thoughts on this page?
   - Is there anything you find useful? Not useful? Why?

- Is there anything missing from this page that you would find useful?
5. This is a warning page. Explain the information on the page. What are your thoughts on this page?
    - Is there anything you find useful? Not useful? Why?
    - Is there anything missing from this page that you would find useful?

Part IV: Introduction of New Prototype

<<Give some background on Meteoalarm as the initial idea, etc.>> Now we would like to show you a potential new prototype of weather.gov and its associated local pages and warnings.

1. Here's a possible weather.gov page. What are some of your initial reactions? Let's start with the positive. What do you like about this design and why? What do you dislike about this design and why? What would you change?
2. This page works similarly to the previous weather.gov. You can click on your area to enter your local page information. <<click on their local page>. What are your thoughts about this local page? What do you like about this design? Why? What do you dislike about this design? Why? What would you change?
3. Just like before, when there are warnings they will be posted on your local page. You can click on the warning to gather more information. <<click on the warning>>. What are your thoughts about this new warning page? What do you like about this design? Why? What do you dislike about this design? Why? What would you change?