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SITUATION SPECIFIC CALL-TO-ACTION STATEMENTS

Timothy W. Troutman and Richard Smith
Climate, Water and Weather Division, SRH
Fort Worth, Texas

and

Mark A. Rose
WFO Nashville
Old Hickory, Tennessee

Scientific Services Division
Southern Region
Fort Worth, Texas

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NITED STATES
EPARTMENT OF COMMERCE
Donald L. Evans, Secretary

National Oceanic and Atmospheric Administration
Conrad C. Lautenbacher, Jr.
Under Secretary and Administrator

National Weather Service
John J. Kelly, Jr.
Assistant Administrator
for Weather Services

1. Introduction

The National Weather Service is mandated the responsibility of issuing warnings for the protection of life and property. This is our most important job and requires effective communication of hazardous weather information to the media, emergency managers and the general public. What we say and how we say it are critical in conveying our expectations and communicating the necessary protective actions to be taken.

For many years it has been standard National Weather Service policy to include in warnings a "call-to-action" statement which is intended to do just what the term says. The NWS Southern Region Headquarters initiated the emphasis on call-to-action as part of the warning process in the early 1970s when Dr. B.F. McLuckie from Delaware University was asked to study how to improve the effectiveness of written warnings. McLuckie (1974) developed a workbook and self-study course titled *"Warning–A Call to Action"* which became an important tool for use by forecasters to improve the effectiveness of their warnings.

Increased demand and the ability to place more detailed information in severe weather warnings have led to the need to more specifically tailor call-to-action (CTA) statements to the specific situation. This paper will attempt to improve upon previous publications addressing this topic. The goal of the warning meteorologist is to convey specific information as concisely as possible. Individual weather offices are therefore encouraged to develop a set of CTA statements which are specific to their local regimes.

The importance of the CTA statement is often overlooked, but it serves a very important purpose in the warning message. It is the part of the warning message which prompts the public to respond, in effect saying, *-we have told you where the storm is and where it is going, now here is what you need to think about as it approaches.* The CTA statement should prompt listeners to put their severe weather plans into action.

Too often in the past CTA statements have been used simply to provide generic safety rules. In the age of automated crawls on television, CRS and EAS, warning messages have by necessity become shorter, while, at the same time the amount of information forecasters are able to convey to the customers has increased. Text within a warning which may have been devoted to rehashing a list of safety rules can better be used to provide specific, detailed information related to the threat at hand. Basic tornado and severe thunderstorm safety rules are vitally important, but are better suited for public information statements issued *before* the warnings begin.

Several papers have been published recently on tailored National Weather Service warning CTAs (Smith 1999, Sharp *et al.* 2000, Smith 2000). With increased demand to place more detailed information in warnings, generic (or "canned") CTAs have proven less effective. With the advent of the Automated Weather Interactive Processing System (AWIPS) and the use of interactive Warning Generation (WarnGen) software to produce warnings, the insertion of CTAs specific to the current meteorological environment has become feasible and can be done very quickly by the warning meteorologist.

This paper will attempt to augment the useful information cited above by categorizing environment-specific CTAs for tornado, severe thunderstorm, and flood/flash flood warnings. The determination of the environment for severe thunderstorm warning CTAs lies largely in mesoscale features such as the wind profile and the WSR-88D reflectivity imagery. For flood/flash flood-producing

environments, the meteorologist must understand the atmospheric mechanisms that are creating heavy precipitation, as described by Troutman and Rose (1999).

2. Choosing the Most Effective CTA

Choosing the most effective CTA statement requires knowledge of what is expected to be the main threat with the storm. Given the spectrum of possibilities that may arise when dealing with severe convective storms, it is impossible to foresee every possible scenario.

Call-to-action statements should provide specific, localized information on what actions to take in response to what is to be expected in the warned area. For example, if a storm is about to cross an interstate highway, CTAs might focus on quick actions to be taken by motorists in the path. If a tornado is developing over hilly or mountainous terrain, the CTA could be used to remind people that they will likely not see the tornado coming, so they shouldn't wait for its appearance. The same concept applies when highlighting the storm's main hazards. If you're dealing with the bow echo, you would want to focus on the damaging wind potential. A potential tornadic supercell might warrant a CTA that highlights not only the tornado threat, but also the attendant hail and wind hazards. In order for the CTA to be most effective, only one (or perhaps two) CTAs should be used in each warning or statement - using more leads to a longer warning message and defeats the purpose of the concise format of the bullet warning.

Thunderstorms cover a wide spectrum and present a wide variety of hazards. The same thunderstorm warning may be used to inform the public about a marginal storm producing dime-sized hail and 58 mph winds, but a product with the same name must also make people respond when a violent storm with baseball size hail and 80 mph winds is bearing down on a location. One of the ways to differentiate between the different levels of threat associated with severe storms is by using the call to action portion of the warning. Including specific information about what is anticipated with the storm can be extremely effective.

While all severe thunderstorms are by definition dangerous in that they produce lightning, gusty winds and likely heavy rains, individual storms might not warrant over-emphasis by calling the storm "dangerous." The level of dangerous is relative, in other words. If every warning says "This is a dangerous storm...," there will be no way to highlight *the more* dangerous events when they occur. Offices might consider developing "emergency" CTA statements to be used *only* in dire circumstances when the warning or statement deserves extra special attention.

3. Environment Specific CTAs

The following sections contain CTAs which are environment-specific, but the lists are by no means exhaustive. They are intended only to provide examples. Individual offices are encouraged to develop CTAs which are specific to their local regimes (meteorological, geographical, topographical, etc.). Remember, the goals of the warning meteorologist are to convey as much useful information as possible, and be as specific as possible, while also being as brief as possible. The call-to-action statement must also reflect the degree of danger posed by the particular event. Users should know what the danger (threat) is and *what to do.*

4. Tornado Warning Call-To-Action Statements

a. Tornado indicated by radar:

- A tornado may form at any time. Take cover now! Abandon mobile homes and vehicles for more substantial shelter. Avoid windows.

- Radar shows strong signs that a tornado is developing. Take cover now!

- This storm shows strong rotation and may produce a tornado at any time. Do not wait. Go to a safe place now! Put as many walls between you and the outside as possible.

- Doppler radar indicates a tornado may form at any time. Take cover now! Abandon mobile homes and vehicles. Move to an interior room or hallway on the lowest floor away from windows.

b. Tornado is difficult to see:

- Take cover now! This tornado is wrapped in rain. If you wait until you see or hear it coming, it may be too late to get to a safe place.

- Take cover now! Tornadoes at night are extremely dangerous. Do not wait until you see or hear the tornado. It may be too late.

- Go to a safe place now! Tornadoes in hilly or mountainous terrain are hard to see. Do not wait to see or hear the tornado.

- Very heavy rain may make this tornado invisible. Take cover now! If you wait until you see or hear it coming, it may be too late to get to a safe place.

- This tornado is likely obscured by rain and may not be visible. Take cover now!

c. Confirmed tornado:

- This is an extremely dangerous and life threatening situation. If you are near the path of this large and destructive tornado, take cover now!

- A tornado has been confirmed! Take cover in a sturdy building now. Mobile homes and vehicles are not safe.

- If you are near the path of this tornado, take cover in an interior room on the lowest floor. Protect your head and body from flying debris.

- If no underground shelter is available, go to an interior room on the lowest floor. Mobile homes and vehicles are not safe.

- Do not run outside to find the tornado. Take cover now! IF you cannot get underground, go to an interior room on the lowest floor. Avoid windows!

d. Waterspout:

- A waterspout is a tornado over water that can be dangerous, and even deadly. Small craft can be swamped or overturned by a waterspout. Stay away from them at all times!

- Waterspouts that move onshore become tornadoes. Shoreline residents should be alert and seek shelter if threatening weather approaches.

e. Multiple threats:

- In addition to the threat of a tornado, damaging hail and strong winds can be expected. Go to a safe place now!

- Large hail and strong straight line winds are also expected.

f. For Motorists:

- Motorists should look for shelter in a substantial building. As a last resort, take cover in a ditch or low spot. Overpasses are not safe!

- Do not stop under bridges or highway overpasses. They offer no protection from violent winds. Blocking the road will prevent others from reaching safe shelter.

g. Blowing dust:

- Blowing dust or debris and sudden wind changes may mean a tornado is approaching. Take cover inside a sturdy building and stay away from windows.

5. Severe Thunderstorm Warning Call-To-Action Statements for Supercell Environments.

a. For a severe thunderstorm warning with a tornado watch in effect:

- Go inside a sturdy building and stay away from windows! A tornado watch is in effect. Severe thunderstorms can produce tornadoes.

- A tornado watch is in effect for the warned area. Severe thunderstorms can produce tornadoes with little or no warning. Go to a safe place if severe thunderstorms approach your area, especially if you live in a mobile home.

- A tornado watch is in effect for the warned area. Severe thunderstorms can produce tornadoes suddenly. Be alert for rapidly changing weather conditions and be prepared to act quickly.

- A tornado watch is in effect for the warned area. Severe thunderstorms produce damaging winds in excess of 58 miles an hour, destructive hail, deadly lightning, very heavy rain, and possibly tornadoes. If this storm approaches you, move to an interior room on the lowest floor.

- Severe thunderstorms can produce tornadoes suddenly. Be alert for rapidly changing weather conditions and be ready to act quickly

- Radar indicated some rotation with this storm. People near the path should go to a safe place now!

- This is a very dangerous storm. If you are near its path, you should be ready for destructive hail, violent winds and possibly a tornado. Move to a safe place now!

- Very large hail and damaging winds are expected with this dangerous storm. A tornado could also form with little warning. Seek shelter now!

b. For a hail storm:

- This storm will produce damaging hail, capable of causing extensive property damage and serious injury. Take cover now! Avoid windows.

- Doppler radar indicated this storm may contain destructive hail the size of ? or larger.

- This thunderstorm is capable of producing extremely large hail, which may cause injury and damage property. Take shelter in a sturdy building. Avoid windows.

- In addition to destructive hail, damaging winds can also be expected.

- Motorists on ? will encounter damaging hail, strong winds and blinding rain. Find substantial shelter now. Bridges and overpasses are not safe!

- Large hail blown by violent winds will cause extensive damage. Take cover now! Find a substantial shelter. Avoid windows, vehicles and mobile homes!

- Destructive hail can be expected with this storm. Take cover now. Go to the lowest floor of a sturdy building and avoid windows!

- Destructive hail and damaging winds in excess of 58 miles an hour can be expected with this storm. Take cover now! Go to the lowest floor of a sturdy building and stay away from outside walls and windows.

- This thunderstorm is capable of producing extremely large hail, which may cause injury and property damage. Take shelter in a sturdy building and avoid windows.

- Very large hail is possible with these severe storms. If you are in their path, put your car in a garage and move to a sturdy building and away from windows.

6. Severe Thunderstorm Warning CTAs for Bow Echoes or Squall Line Damage:

- These storms will likely produce damaging winds. Mobile homes and vehicles are especially susceptible to high winds and may be overturned.

- Severe thunderstorms can produce tornadoes suddenly. Be alert for rapidly changing weather conditions and be ready to act quickly.

- High winds and large hail can spread quickly across open areas. Move to protected areas when blowing dust, sudden wind changes or lightning approach.

- Damaging winds may occur up to ? miles ahead of the rain. Go to a safe place until the storms have passed. Stay away from windows.

- These storms will produce extensive property damage. Take cover now! If you cannot get underground, go to an interior room on the lowest floor. Vehicles and mobile homes are not safe.

- Damaging winds in excess of 58 miles an hour may occur a few miles ahead of this line of severe thunderstorms. Move quickly to an interior room and stay away from outside walls and windows.

- Weak, short lived tornadoes may occur along the leading edge of this line of severe thunderstorms. However, the main threat is damaging winds. Seek shelter inside a sturdy building and stay away from outside walls and windows.

- This is a very dangerous storm. Take cover now. Violent straight line winds and large hail can be expected.

- Destructive winds can be expected. If you cannot get underground, go to an interior room on the lowest floor of a sturdy building. Avoid windows!

- This thunderstorm may produce weak, short lived tornadoes along its leading edge. Seek shelter inside a sturdy building and avoid windows and outside walls.

- Destructive winds can be expected. Take cover now! Vehicles and mobile homes are not safe.

- Widespread wind damage is expected with these storms. Damaging winds may knock down trees and power lines, and damage buildings and homes. Take cover now.

- These storms will produce extensive property damage. Move to an interior room with four sturdy walls such as a closet, hallway, or bathroom away from outside walls. Vehicles and mobile homes are not safe.

- Very small, brief, but dangerous tornadoes are possible with these storms. Stay indoors away from windows until the storm has passed.

7. Severe Thunderstorm Warning Call-To-Action Statements for Weak Shear Environments

a. Downburst:

- In addition to damaging winds, large hail can also be expected.

- Damaging winds can be expected. Go to a safe place now and remain protected until the storm has passed.

- Severe thunderstorm winds can be as destructive as a tornado. For your safety, go to a safe place immediately.

- Damaging winds, very heavy rain, and large hail are likely. Move indoors to a sturdy building and stay away from windows and outside walls.

- Hail the size of ? and wind gusts up to ? mph can be expected.

- Damaging winds may occur up to ? miles ahead of the rain. Go to a safe place until the storms have passed. Stay away from windows.

b. For a dry microburst:

- Strong and damaging winds are likely with this storm, but there will be little rain. Take cover in a sturdy building until the storm passes.

c. For excessive lightning:

- This is a dangerous storm. Prepare for deadly, excessive lightning, damaging winds in excess of 58 miles an hour, and large hail. Move indoors to a sturdy building and away from windows and outside walls.

- Excessive lightning is occurring with this storm. Move indoors if possible. Stay away from windows and doors, and avoid using the telephone unless it is an emergency.

- Large hail, excessive lightning, and damaging winds are likely. Take cover in a sturdy building until the storm passes.

8. Flood/Flash Flood Warning Call-To-Action Statements.

a. For synoptic events- Heavy rainfall produced by synoptic weather system with a strong 500 millibar jet stream (50 knots or greater), primarily from the southwest (Troutman and Rose, 1999). An El Niño winter pattern would be conducive to this situation.

- A flood warning means that flooding is imminent or occurring. Move to higher ground immediately. Residents living along streams and creeks should take immediate precautions to protect life and property.

- A flood warning means that flooding is imminent or occurring. Do not attempt to cross swiftly flowing waters, or waters of unknown depth by foot or by automobile. If your vehicle stalls, abandon it immediately and seek higher ground.

- Most flooding deaths are automobile related. Do not attempt to drive across bridges, dips, or low spots if water covers the road. Never try to cross a flowing stream, even a small one, on foot.

- This is a dangerous, life threatening situation and every precaution should be taken to avoid loss of life and property. Extensive flooding is expected. Motorists should avoid water covered roads and find alternate routes.

- This is a very dangerous and life threatening situation. You should not attempt to travel. Stay home unless you are forced to evacuate to higher ground.

b. For frontal events- Heavy rainfall produced by a quasi-stationary front moving south or southeast (Troutman and Rose, 1999). Another example is a "backdoor" frontal boundary moving slowly southward along the east coast.

- A flood warning means that flooding is occurring or is imminent. Most flood deaths occur in automobiles. Do not attempt to cross bridges, dips, or other low spots if water covers the road. Never try to cross a flowing stream, even a small one, on foot. To escape rising water, move to higher ground.

- A flood warning means that flooding is imminent. It is important to know where you are relative to streams, rivers, or creeks, which can become killers during heavy rains. Campers should avoid camping along streams or creeks during threatening rains.

- Be especially cautious at night when it is harder to recognize the dangers of floods and flash floods. If flooding is observed, move to higher ground to escape the flood waters. Do not stay in areas subject to flooding when water begins rising.

- This is a very dangerous and life threatening flooding situation. You should not attempt to travel. Stay home unless you are forced to evacuate to higher ground.

- Extremely dangerous flooding is occurring. Numerous roads, streets, and highways are closed due to high water. Travel is discouraged. Do not attempt to drive until weather and travel conditions improve later. Conditions are life threatening.

c. For mesoscale events- Heavy rainfall occurring primarily during the warm season. Heavy rainfall is produced by the slow movement and training of thunderstorms (Troutman and Rose, 1999).

- A flood warning means that flooding is occurring or is imminent. Most flood deaths occur in automobiles. Do not attempt to cross bridges, dips, or other low spots if water covers the road. Never try to cross a flowing stream, even a small one, on foot. To escape rising water, move to higher ground.

- Do not drive your vehicle into areas where the water covers the roads. The water depth may be too great to allow your car to cross safely. Vehicles caught in rising water should be abandoned quickly. Move to higher ground.

- Excessive rainfall from this storm will cause flooding along creeks and streams, urban areas, highways, streets, and underpasses, as well as drainage areas and low lying spots.

- This is a dangerous situation. Very heavy rainfall from these slow moving lightning storms will produce in low lying areas and long streets. Many roads will be closed due to high water and driving is not recommended across the warned area during the next few hours.

- An excessive amount of rainfall will occur with this storm. You should move to higher ground immediately to escape the imminent flood waters.

d. For tropical events- Heavy rainfall typically influenced by a tropical system (Troutman and Rose, 1999).

- This is a dangerous, life threatening situation and every precaution should be taken to avoid loss of life and property. Extensive flooding is expected. Motorists should avoid water covered roads and find alternative routes.

- This is a very dangerous and life threatening flooding situation. You should not attempt to travel. Stay home unless you are forced to evacuate to higher ground.

- Extremely dangerous flooding is occurring. Numerous roads, streets, and highways are closed due to high water. Travel is discouraged. Do not attempt to drive until weather and travel conditions improve after the rainbands move out of the area. Conditions are life threatening.

- This is a dangerous situation. Rainfall from persistent rainbands will produce flooding in low lying areas and along streets. Many roads will be closed due to high water and driving is not recommended during the next several hours.

- Flooding is the main killer during tropical weather events. This is a dangerous flooding situation. You should immediately move to a higher location to escape the flood waters.

- If you live in a low lying or flood prone area, you should move to a safe, higher location to protect your life and property.

- Extensive flooding will occur overnight as (tropical system) produces excessive rainfall. Since flooding is imminent, you should quickly move to higher ground to escape the expected flood waters.

9. Discussion

The preceding lists of call-to-action statements are not exhaustive. Some offices will not require each example provided here; some will have use of categories that have not been mentioned. The goal of this paper is to simply outline a methodology to allow each office to tailor its own database of CTAs. Therefore, the warning meteorologist can quickly choose the call-to-action which best represents the severe weather potential.

For a storm expected to produce marginally severe weather, the statement "Take cover now! Hail the size of dimes and wind gusts up to 60 mph can be expected" would be much better suited than, say "This is a very dangerous storm. Take cover now. Violent straight line winds and large hail can be expected." The second example exhibits a more generic and less specific use of a call-to-action in relation to the level of threat being faced. The constant abuse of such statements, where the warning far outweighs the threat, may very well decrease the effectiveness of the warning content.

Conversely, a spotter report indicating a large tornado might warrant the more urgent statement "A tornado has been confirmed! Take cover in a sturdy building now. Mobile homes and vehicles are not safe," which is much more effective than "Radar shows strong signs that a tornado is developing. Take cover now!" The difference in the two statements is obvious. The call-to-action must reflect the specific threat and urgency of the situation.

If all National Weather Service offices adopt a situation specific philosophy regarding warning composition, the benefits would far outweigh those from using generic statements, when inserting the call-to-action was almost an afterthought. Situation specific CTAs could mean the difference between an overused statement that is ignored by the media and public and a tailored and specific call-to-action which catches the attention of the listener.

10. Conclusions

With the improved technology enjoyed by National Weather Service meteorologists using the AWIPS system, we now have the ability to apply technological advances to the products we issue, from warnings to forecasts. The warning meteorologist is now able to view radar imagery and other data and compose warnings using the same workstation. This allows the meteorologist to make the decision to warn, plot the warning, and generate the warning text in less than two minutes. Recent automation has allowed the inclusion of specific location and pathcast warning information, which has greatly improved the value of the severe weather warnings we issue (Fig. 1). It only follows that our CTA statements reflect the same detail and precision as the remainder of the warning. Meteorologists are strongly encouraged to transfer their increased abilities to such applications. Situation specific call-to-action statements, when used appropriately and carefully, may prove invaluable to the public and can be included in a warning message in just a few seconds. It is well worth the effort.

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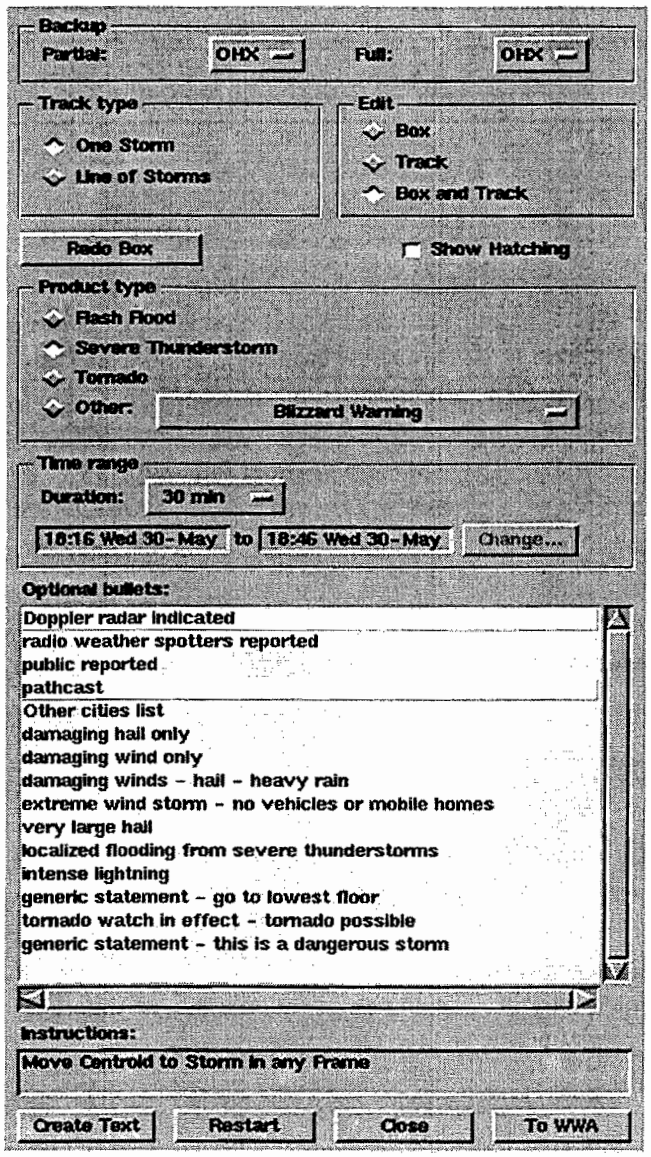

Figure 1. AWIPS WarnGen template showing how Call-To-Action statements can be organized for quick selection during the warning composition process.