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Topic: Storm-Based Warning Fundamentals

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Drawing the Warning, Part 1: Fundamentals

Title Slide
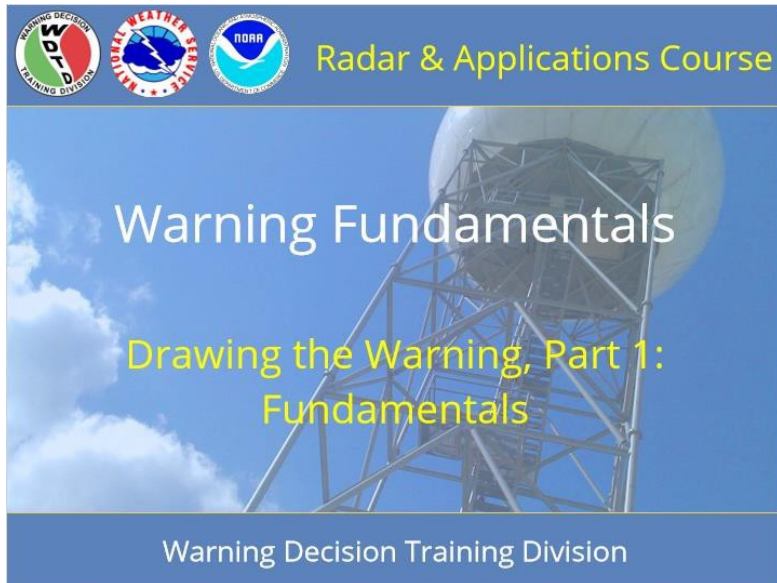
Notes:

Welcome to RAC Warning Fundamentals. This is Drawing the Warning, Part One, and we will discuss the fundamentals of drawing warning polygons. I am Barb Mayes Boustead.

Learning Objectives

Learning Objectives

- Identify factors to consider when drawing a warning polygon, including storm shape and type, threats, anticipated evolution, and conceptual models.

- Draw or select warning polygons that follow best practices for:
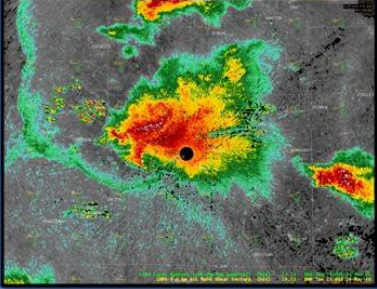 - Supercells
  - Pulse storms
  - Multicells

Notes:

The learning objectives for this module are to identify factors to consider when drawing a warning polygon, including storm shape and type, anticipated threats and storm evolution, and conceptual models. Then, draw or select warning polygons that follow best practices for supercells, pulse severe thunderstorms, and multicells (including line segments, bow echoes, and QLCSs).

Homepage: Drawing the Warning: Fundamentals and Philosophy

Notes:

Welcome to the homepage for this first lesson on drawing warning polygons, focusing on the fundamentals. From here, you can click on these three buttons to learn more about the layers of information to consider when drawing a polygon. Then, once you feel comfortable with these materials, take the quiz by clicking the button at the bottom right of the screen.

Basic Considerations

Notes:

FUNDAMENTALS: When issuing a warning on a single cell for a tornado, set the "drag me to a storm" dot on the center of the mesocyclonic circulation, and track that circulation for storm motion. Flare the polygon out at the end to cover the inherent increase in uncertainty with time. For a single cell hail or wind threat, set the dot at the updraft-downdraftinterface. Let the motion follow the parent storm, and again, flare out the polygon toward its end. With a line of storms, using the line feature, align 2 or 3 vertices with the leading edge of the wind to track the storm.

Goals - III (Slide Layer)

Notes:

BASIC GOALS:

I. Would it make sense for the goal of a warning to be to maximize or to minimize lead time?
II. Our goal is to maximize the reasonable lead time in a warning. Would it make sense for the goal a warning to be to maximize or to minimize false alarms?

III. It makes more sense to minimize the false alarm area in our warnings! Put more broadly, our goal is to cover the hazard fully in order to alert the public in a timely fashion about an impending threat

12-County Limit (Slide Layer)

Notes:

12 COUNTY LIMIT:

Do you know the maximum number of counties or parishes that can be included in a severe thunderstorm or tornado warning? The answer, provided in the NWS directives, is 12! Be sure that the maximum number of counties in your warnings is 12, at the most.

Corrections (Slide Layer)

Notes:

CAN'T CORRECT SHAPE OF BOX:

Any warning or statement can be corrected for its wording and grammar, format, and dissemination code. Can you correct the shape of the polygon with a correction: The answer is no! It is important to get that right when the warning is first sent.

Storm Mode and Threats

Notes:

STORM MODE AND THREATS:

Storm mode plays a role in the current and future shape of a thunderstorm, as well as the most likely hazards. Understanding conceptual models of storm modes can help a warning meteorologist anticipate where in the storm the hazards are likely to occur and, when combined with knowledge about the storm environment, how those hazards may persist, intensify, or decline over the next 30 to 60 minutes. For each storm mode, click on the buttonsto view the most likely locations for tornadoes, hail, and damaging winds, along with how those threats would be contained in an example warning polygon.

Supercells (Slide Layer)

Notes:

SUPERCELLS

Supercells can contain all hazards: tornadoes, hail, and winds. For most isolated supercells, if a tornado warning is issued, the threats of damaging winds and hail are in close enough proximity that one warning can cover all of the hazards.

Multicells (Slide Layer)

Notes:

MULTICELLS (LINEAR)

Multicell thunderstorms often are in the shape of a line or line segment. The main risk tends to be damaging winds, with tornadoes as a secondary risk. Though the risk of hail is not zero, it is usually more limited in nature. With a more widespread risk of winds than tornadoes, a larger severe thunderstorm warning would be needed to cover the risk of winds, with smaller embedded tornado warnings when spin-ups are possible. We will get into more details of tornadoes embedded in lines in another module.

Pulse Storms (Slide Layer)

Notes:

PULSE STORMS

Pulse thunderstorms can contain a risk of hail, especially as they reach mature phase, with the threat of wind increasing as storms pass maturity and in the early dissipation phase. Though the risk of tornadoes is not zero, it is rare for tornadoes to occur in pulse convectio
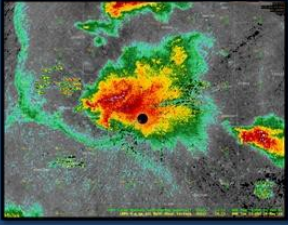
Storm Motion and Evolution

Notes:

STORM MOTION AND EVOLUTION:

We take the motion and expected evolution of a storm into account when we draw a warning polygon. Doing so will help us better anticipate how far to extend a warning downstream and whether we need to account for deviant motion. Many factors influence a storm's motion, including wind shear profiles, boundary interactions, topography, and storm mergers. The uncertainty of future motion is why polygons are drawn larger at the end than the beginning.

Extrapolation (Slide Layer)
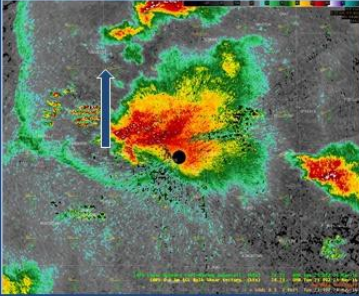
Notes:

EXTRAPOLATION

Extrapolation is the assumption that the recent motion of a storm will continue into the future. It is how the speed and direction of a storm are anticipated using WarnGen's distance/speed tracking and is a good first guess in anticipating the location of a storm through the duration of a warning.

Right / Left Motion (Slide Layer)

Notes:

RIGHT AND LEFT MOTION:

Right/Left 1: Supercells can take on motion that is either right or left of the mean wind, as you have learned earlier. Aright-moving storm often will slow down in addition to propagating right of the mean wind. You can overlay Bunkersright-moving storm vectors as a first guess to help anticipate and account for the right turn, then stretch your polygon on its right side to account for the area of threat.

Right/Left 2: A left-moving supercell often occurs after a storm has split. Left movers are notorious for their hail threats. Overlay Bunkers left-moving vectors to anticipate the direction of a left-mover, and turn your distance-speed indicator to match it.

Stationary Storms (Slide Layer)

Notes:

STATIONARY STORMS:

Stationary 1: Stationary storms can occur for a couple of reasons. One common type of stationary storm is a pulse thunderstorm in a low-shear environment, in which the mean steering flow is weak. In the case of a nearly stationary pulse storm, downburst winds can spread in all directions, and the resulting polygon is square or symmetrical to capture the threat.

Stationary 2: Given a certain balance of mean winds and right-moving propagation, supercells also can become stationary, with nearly stationary tornadoes possible. The threat for a tornado in a stationary supercell is often confined to a very small area that, once established, can be warned with a small polygon that still captures the threat fully. Tornadoes can still wobble, retrograde, and anticyclonically wrap around the mesocyclone in an stationary storm, so while the polygon can be drawn tight to the threat, use care to not be overly aggressive in trimming its size.

Acceleration (Slide Layer)
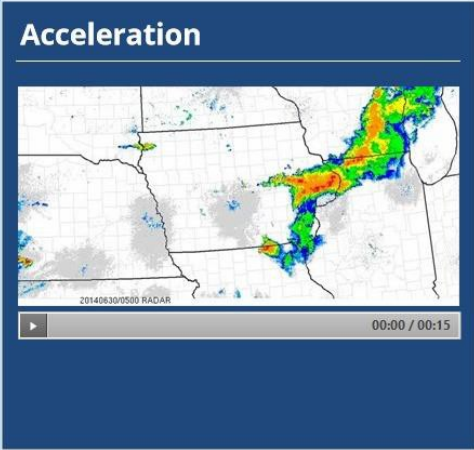
Notes:

ACCELERATION:

Especially in the case of multicells, as in linear convection or bowing segments, storms can accelerate with the development of a cold pool. Follow the apex of the bow to anticipate the direction in which storms are accelerating, and be mindful of the mesoscale environment to anticipate cold pool development. In these cases, take care to draw your polygons far enough downstream, and leave yourself enough time to issue the next warning downstream before the wind threat accelerates out of the polygon.

For Additional Help

Notes:

For additional help, check with your facilitator (typically your SOO) or send your questions to the listserv e-mail address here.

Radar & Applications Course (RAC)

Warning Fundamentals

Lesson: Drawing the Warning, Part 2: Additional Considerations

Warning Decision Training Division (WDTD)

Welcome to this RAC Warning Fundamentals lesson, the second of three parts on drawing the warning. In this section, we will discuss additional considerations to the shape of your warnings.

Learning Objective

- Identify warning polygons that follow NWSI 10-511 and best practices while incorporating additional factors such as:
  - County boundaries and other geographical entities
  - Overlapping warnings
  - Large areal coverage

The learning objective for this lesson is to select warning polygons while considering additional factors such as county boundaries and other geographical entities, overlapping warnings, and large areal coverage.
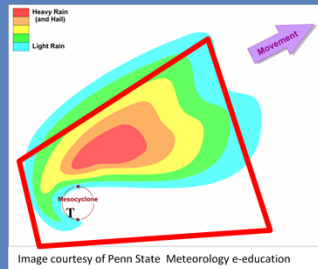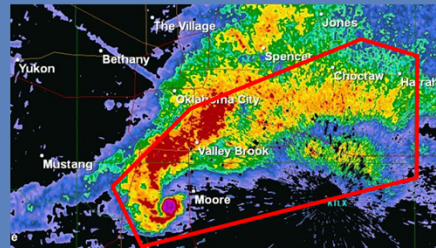
In an idealized world, we would draw purely storm-based warning polygons as a practice. In reality, we realize that we don't operate in a bubble, and neither do our warnings. Many of our interactions are with officials at the county and city levels, and these boundaries are important for both our partners and the public. We also may be weighing decisions of whether or not to include decision support points, bodies of water, or other point locations of interest in a warning that we are drawing. Our warnings are more of a hybrid of considerations that range from meteorological to geopolitical and societal. As we balance these considerations, it is important to be aware of the impact of our warnings and make intentional decisions about what to include and what to leave out.

Image link: https://www.e-education.psu.edu/meteo3/sites/www.e-education.psu.edu.meteo3/files/images/lesson8/idealizedreflectivity_supercell.PNG

County Boundaries:
Small Chunks and Slivers
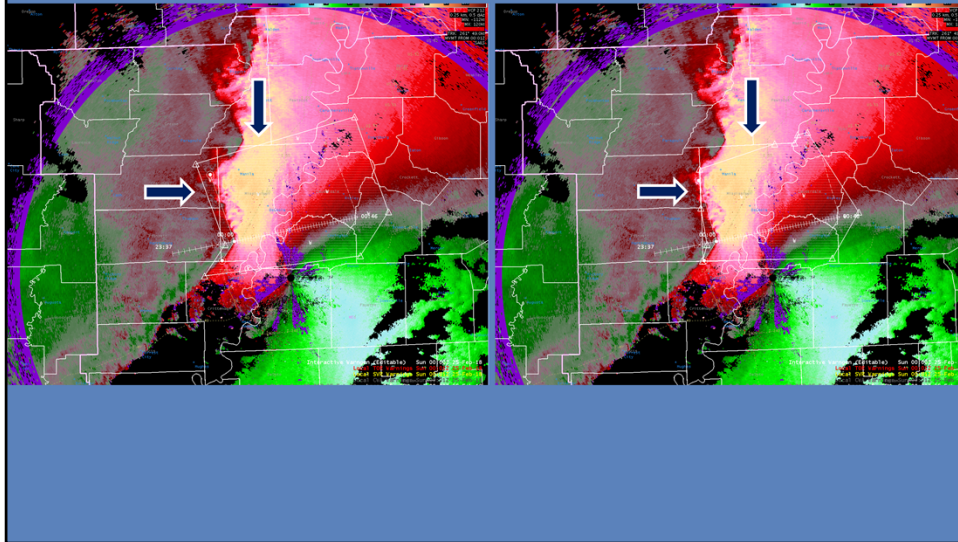
As you draw your warning to be initially storm-based, you may find that the polygon just barely clips the edges of counties into the warning. Be cognizant of those edge pieces, and be sure that the decision of whether that segment is in or out of the warning is intentional. If that sliver will be threatened by severe hail, damaging winds, or a tornado, it should be included. If the sliver is far enough removed from the core of the storm, you can leave it out. A quick time-saving tip is to right-click on a county as you are drawing the warning to leave it out. When you hit the button to redraw based on warned/hatched area, the vectors will adjust to keep that county out. Also, keep in mind that a designated percentage of a county must be included in the polygon, by default, in order for that county to be included in the warning. That percentage is set locally via the Localization perspective. If you are intentionally drawing a small area of a county into the warning and WarnGen snaps it back out again, redraw your line to include a slightly larger portion of the county.
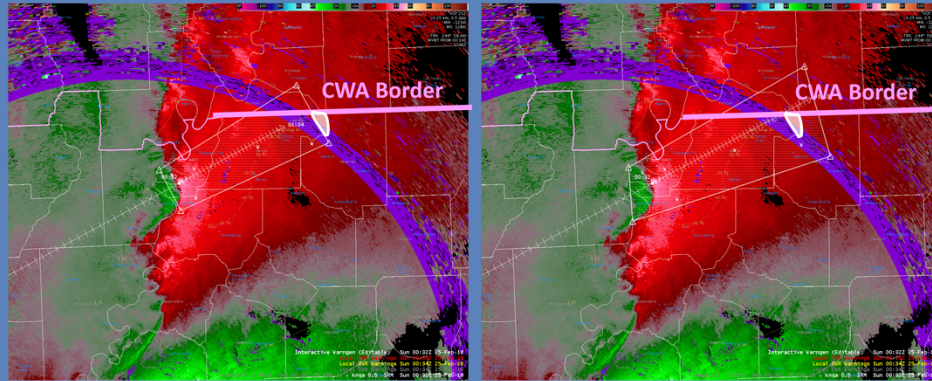
When a warning polygon is close to the edge of a county, a city, or a decision support point, but not quite all the way there, you may want to pull the warning to the edge of the county or to include that point. This is especially true at the edge of a county warning area, where the next office downstream may wish to draw a polygon without leaving a gap between the warnings. In this example, a small sliver of a county, shown in white, was left out of the default polygon near the edge of the county warning area border, in pink. To extend the polygon in this case, I extended the length of the warning from 30 to 45 minutes, though I could have simply drawn the polygon out farther, as well.

Warning polygons for storms close together should have enough overlap, but not too much. With adjacent polygons, small overlap is good, especially if the storm prompting the warnings is continuous. If the storms are both isolated and not merging, and the threat areas are far enough apart, there may not be a need to overlap at all.

**Warning Overlap:
Next Warning**
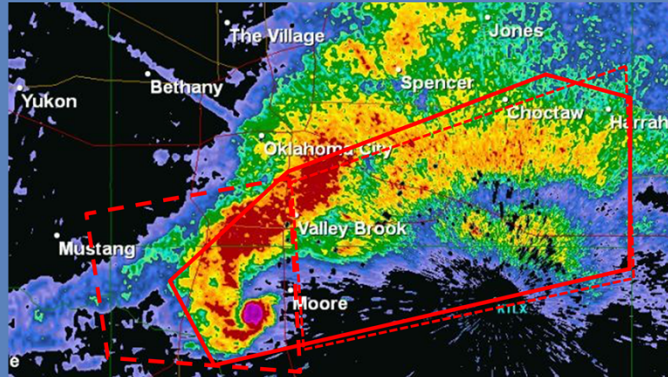
Some overlap is desired as an active storm exits its previous warning and enters the new polygon. You do not want to match the edge of the old polygon to the edge of the new polygon. First, the odds of the storm crossing the line between polygons at exactly the time when the first warning expires and the second takes effect are very low. Second, storms cover an area even if the center of it did land perfectly on that line at expiration time. Keep a reasonable overlap to cover the time that both warnings are in effect, and concentrate on issuing the new warning for where the storm is now and will be for the duration of the warning. Keep in mind that faster-moving storms probably will need a little less overlap than slower storms, and also be sure to adjust your polygons if you find that your warnings have a large area left at the end of the valid warning time as you work through the event.
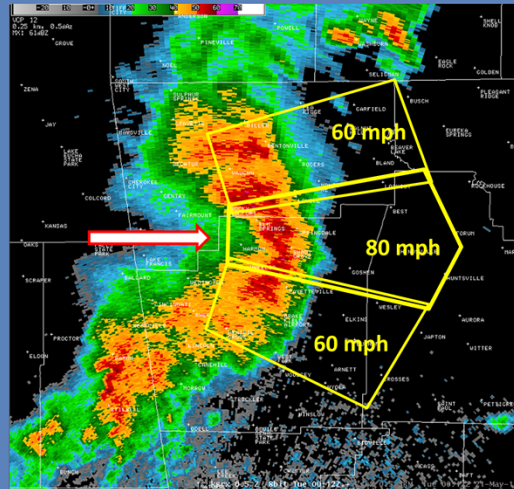
When the threat is a multicell line, particularly a long linear storm, you may want to break the line into segments for warnings, balancing workload with manageable warning sizes. Keep in mind that 12-county limit to warning size, and also keep in mind grouping like threats together. For example, if this was a line that spanned the length of numerous counties and its center is capable of producing 80-mph winds, while the threat of 60-mph winds extends up and down the line, you might want to issue a warning for the higher-end threat in the bowing segment, with two additional warnings on either side of it to capture the lower-end severe threat. Note the slight overlap in these polygons, as well. You can keep the workload manageable by keeping like threats grouped together, staggering end times, and limiting to a few warnings per line – in other words, by not going to an extreme of segmenting, such as issuing single-county warnings.

In summary, our warning polygons include meteorological, geographical, and even societal factors in their shapes. Be intentional about the decision to include or not include small fragments of counties, cities, decision support points, bodies of water, or other geographical entities in the warning. Maintain a small amount of overlap between polygons on continuous storms and between an old warning and its replacement. For more isolated convection, the decision to overlap or not depends on the size and proximity of those thunderstorms. For long lines of convection, consider breaking them into segments. Keep like threats grouped, and use some segments but not so many that your workload becomes unmanageable.

For Additional Help

1. Check with your facilitator (typically your SOO)
2. Send your questions to:
   nws.wdtd.rachelp@noaa.gov

For additional help, check with your facilitator (typically your SOO) or send your questions to the listserv e-mail address here.

Drawing the Warning, Part 3: Complex Scenarios

Title Slide
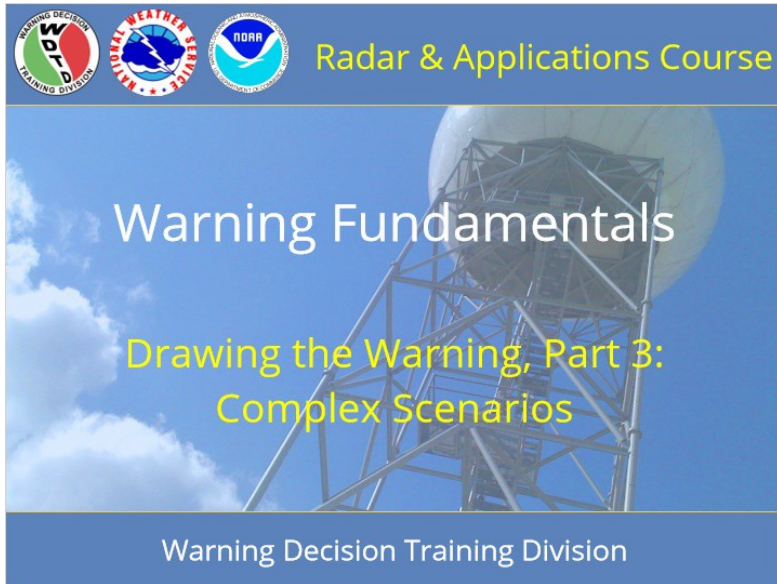
Notes:

Welcome to RAC Warning Fundamentals. This is Drawing the Warning, Part Three, and we will go over some of the more complex scenarios you may see when drawing warnings polygons.

Learning Objectives

Learning Objective

- Identify warning polygons that follow NWSI 10-511and best practices during complicated scenarios such as:
  — Splitting supercells
  — Training storms
  — Tornadoes embedded in larger thunderstorm complexes
    • Tornado in larger supercell
    • Tornado in QLCS

Notes:
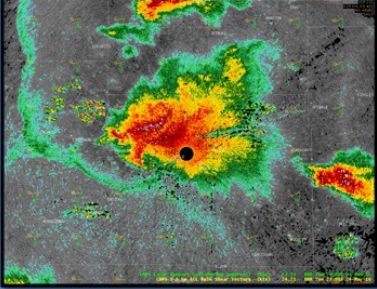
The learning objective for this module is to be able to identify warning polygons for complex scenarios such as splitting supercells, training storms, and tornadoes embedded in larger thunderstorm complexes.

Homepage
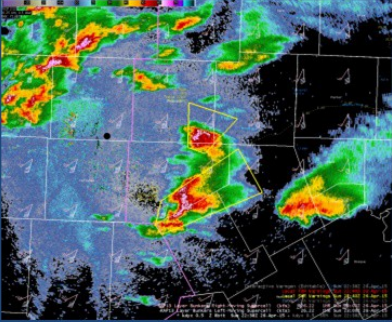
Notes:

Welcome to the homepage for this third lesson on drawing warning polygons, focusing on additional layers of complexity from storm structures and evolutions. From here, you can click on these three buttons to learn more about some of these complex scenarios. At the lower left, we'll leave you with one last thought about drawing warning polygons. Then, once you feel comfortable with these materials, take the quiz by clicking the button at the bottom right of the screen.

Splitting Supercells

Notes:

As discussed in previous lessons, supercells can and do split into right- and left-movers. Keep in mind that you can diagnose left and right movement using near-storm environmental analysis and with overlays of motion barbs from numerical model output. A single warning doesn't typically split with them, of course, so what is the best strategy when you find yourself warning on a storm that you know is beginning the process of splitting? In most cases, you'll warn the right- and left-movers separately. The starting edges of your polygons are likely to overlap, but that overlap will decrease as the storms move apart. As you click through the steps, note the different speeds and directions of motion of each component of the split. As the warnings are updated to remove the back edges from the threat, the polygons separate.

Training Storms

Notes:
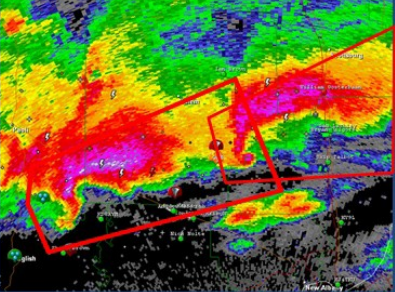
Warning polygons get a little more complicated for training storms. In an example of training supercells, warn on each storm individually. Initially, the polygons will have a little overlap. Be sensitive about erasing the back edge of the polygon on the leading storm. If the second storm is going to move into that location, let that warning stay in place to prevent the mixed message of being in a warning, then out, then in again. You can trim the back edge of the second storm, though, as well as any part of the polygon for the leading storm that the second storm is not expected to move into.

Embedded Tornadoes

Notes:

Tornadoes can be embedded in areas of more widespread severe weather threat. In those cases, it can make sense to issue severe thunderstorm warnings for the larger threat, with smaller tornado warnings for those more limited areas of tornado threat.

Embedded Supercell (Slide Layer)
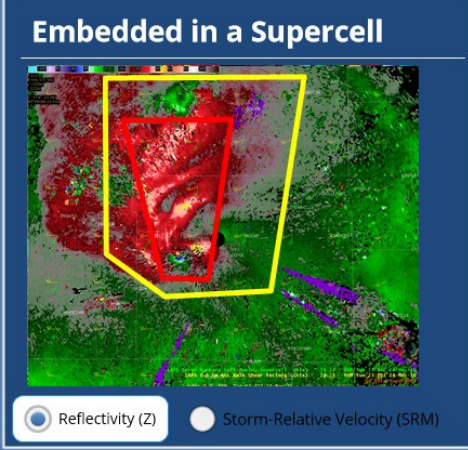
Notes:

EMBEDDED TORNADOES: SUPERCELL

In a few cases, the area of threat from a tornado is small relative to the threat of hail and damaging winds from the entire supercell. In that case, you might want to issue a severe thunderstorm warning for the supercell to cover the broader hail and wind threats, with a smaller tornado warning in place to cover the more compact tornado threat. If you choose to go this route, here is an example of how to address it. Let's envision a scenario where you issue a severe thunderstorm warning first, perhaps even with a tornado-possible tag. (We'll discuss those tags in a later lesson.) The severe thunderstorm warning should encompass the hail and wind threats of the supercell, as we learned in a previous lesson. When you draw the tornado warning, the threat is much smaller, and the warning may be entirely embedded within the severe thunderstorm warning. The tornado warning also will be a shorter duration, typically.

Embedded Line (Slide Layer)
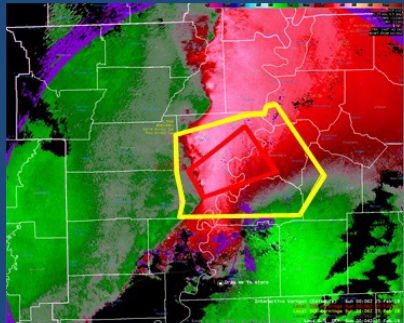
Notes:

EMBEDDED TORNADOES: LINE

Identifying and warning for QLCS tornadoes is a complicated and tricky issue that is tackled more in-depth in the WOC Severe training series, as well as in a set of modules produced by NWS Central Region and available in the learning center. We will just touch on one warning polygon possibility here, noting that you will want to complete further training to round out your competence with QLCS tornadoes. When a tornado is embedded in a line of convection, there often is a broader severe thunderstorm warning in effect - likely before the tornado threat materializes. One or more tornado warnings can be embedded in that severe thunderstorm warning to highlight the small areas of threat for a tornado.

Put It Together
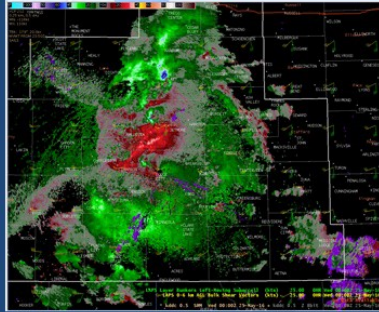
Notes:

You'll see things in your career that are not textbook storms. In fact, that will be the case more often than not. Use best practices to make the best warning polygons and construct the best messages for whatever scenario you encounter. The foundations will remain the same: Be intentional about what areas are and are not included in the warning. Keep your workload manageable. Match the warning shape to areas at risk of hail, damaging winds, or tornadoes.

For Additional Help

For Additional Help

- Check with your facilitator (typically your SOO)

- Send your questions to

  nws.wdtd.rachelp@noaa.gov

Notes:

For additional help, check with your facilitator (typically your SOO) or send your questions to the listserv e-mail address here.

Impact-Based Warning Content

Impact-Based Warning Content

Notes:

Welcome to RAC Warning Fundamentals. This is Impact-Based Warning Content, and I am Barb Mayes Boustead.

Learning Objectives

Learning Objectives

- Given lists of severe thunderstorm warning impact-based warning tags, match each tag with the hail size and wind speeds that will trigger it.

- Using radar-based indicators, as well as observational and environmental factors, identify situations that warrant a "considerable" or "catastrophic/tornado emergency" tag.

Notes:

After completing this module, you will be able to match severe thunderstorm and tornado warning tags with the hail, wind, and tornado intensity thresholds that trigger them, based on definitions in the NWS directives. We also will learn how to identify "considerable" and the rare "tornado emergency" situations.

Homepage: Warning Content (IBW)

Homepage: Impact-Based Warning Content

Click each button for more information about impact-based warnings:

Severe Thunderstorm (SVR)

Tornado (TOR)

Summary

Quiz

Notes:

Welcome to the homepage for this lesson on impact-based warning content. From this page, you can click on the severe thunderstorm and tornado warning buttons to learn how tags are applied for each type of warning. Then, view the summary. Click on the homepage button at the end of each section to return to this page. Once you feel comfortable with these materials, take the quiz by clicking the button at the bottom of the screen.

Severe Thunderstorm Warnings (SVR)

Notes:

Severe thunderstorm warnings now contain impact-based tags, called thunderstorm damage threat tags, that categorize the hail and/or wind severity. The categories, or levels of severity, are base, considerable, and destructive. The hail size and wind speed that you choose in a severe thunderstorm warning will determine the tags that are automatically applied to your warning. This is an important distinction from tornado impact tags. Unlike tornado tags, you won't be deliberately selecting the categories. You will continue to focus on analyzing the storm and its environment to determine the maximum hail size and wind speed possible and then choose those in the warning or update, allowing the tag to come from your decisions. Of course, awareness of the category that will result from your decisions is important, too. Calls-to-action are now labeled with a (B) for base and an (E) for excessive, which covers the considerable and destructive categories. Select the calls-to-action that apply to the category you've warned and the characteristics of the storm.

So, what do you do if you receive a report of a 65-mph wind gust? Keeping in mind that 65 rounds up to 70 mph, and also that it is very rare that we actually sample the largest hail size or highest wind speed with the reports that we receive, you'll want to consider rounding up in your warning to capture the maximum possible threat. Research by Blair et al. in 2017 also supports that we rarely receive reports for the actual largest hail size in a storm and that NWS warnings routinely underestimate maximum hail size, giving us more encouragement to put the largest hail size that we think the storm could produce into the warning instead of "playing it safe" and using more conservative estimates - that is, of course, assuming that you have a supportive environment and storm structure.

The block of tags at the bottom of an impact-based severe thunderstorm warning can have at least four and up to six tags, depending on if a considerable or destructive tag is warranted and if a "tornado possible" tag is selected.

SVR: Radar-Indicated or Observed

Notes:

One important change in your process of issuing the warning is that in addition to noting the source at the top of the WarnGen interface, you will need to select "observed" tags for both hail and wind. Severe thunderstorm warnings will be tagged for whether both the hail and the wind threats were radar-indicated or observed, requiring attention from the warning meteorologist to ensure the correct source is noted for each. Any of the impact categories can be either radar-indicated or observed - just make sure you are consistent with the source throughout the warning. The source you have selected will be included in the tags at the bottom of the warning separately for each hazard. If you select a reported warning basis, you must also manually select that either the hail or wind is observed in order for the warning to be consistent.

As with tornado warnings, you may change the tags anytime for a warning by using SVS updates as well as by issuing new warnings. No warning is a "set it and forget it" product - they require continued monitoring and updating to provide the best and most recent information about the storm's intensity and hazards, as well as its location and track.

SVR: Base Warning

Notes:

Base severe thunderstorm warnings include hail sizes of 1 to 1.5 inches, or quarter to ping pong ball sized, or if you select a wind speed of 60 mph. When you select a call-to-action, use those that are marked with a (B) or, if needed, special calls-to-action that are not marked. There is no impact tag at the bottom of a base warning. Click on the images to see larger versions of them.

SVR: Considerable Tag

Notes:

Severe thunderstorm warnings will be assigned a considerable tag automatically if you select a hail size from 1.75 to 2.5 inches, or golf ball to tennis ball size, or if you select a wind speed of 70 mph. Select a call to action marked with an (E), or if needed, special calls-to-action that are not marked. Text in the some of the calls to action that you can select with the excessive (E) label will populate with the language, "This is an extremely dangerous situation," and will prompt you to specify the location with framing text. Note at the bottom of the warning, in the tag block, that the considerable impact tag now appears.

SVR: Destructive Tag

Notes:

Severe thunderstorm warnings will be assigned a destructive tag if you select a hail size of 2.75 inches (baseball size) or greater, or if you choose a wind speed of 80 mph or greater. As with the considerable impact level, choose a call to action with an (E), or if needed, special calls-to-action that are not marked. Text in the warning will populate with a leading headline that reads "This is a destructive storm for" (if the warning is drawn with a point) or "These are destructive storms for" (if the warning is drawn with a line) and prompts you to fill in the location. This is similar to a tornado emergency, where you should include the location or locations that you are most confident will be impacted by the destructive conditions. In some cases, such as a lone supercell producing large hail in remote areas, that might be a small town or tiny part of a county; in others, such as a high-end derecho, it could be most or all of a county or several counties. Again, text in the some of the calls to action that you can select with the excessive (E) label can contain increasingly elevated wording, such as the example for wind here, or may need editing to replace framed text. At the bottom of the warning, in the tag block, the destructive impact tag now appears. Additionally, the destructive tag on a severe thunderstorm warning now will activate the Wireless Emergency Alert (or WEA) system each time it is issued - that is, each new warning and each SVS update with the tag. Because of the WEA activation, we encourage you to be especially careful to keep the polygon drawn close to the hazards and include as little false alarm area as possible. Segment your severe thunderstorm warnings, as we have learned in other training modules, to group together similar hazards.

SVR: Tornado Possible Tag

Notes:

The "tornado possible" tag is used in severe thunderstorm warnings for situations in which a severe thunderstorm has some potential for producing a tornado, but forecaster confidence is not high enough in having an imminent tornado risk to issue a tornado warning. It would make sense to apply the "tornado possible" tag, for example, when you are issuing a severe thunderstorm warning for a QLCS with smaller, embedded tornado warnings. You also could apply this tag with severe thunderstorms in an environment that you believe will be conducive to tornado development, such as initial supercell development within tornado watches before storms are mature enough to produce tornadoes. It is not a tag that is appropriate to apply to every severe thunderstorm warning, of course; many severe thunderstorms do occur in environments that are not conducive to tornadogenesis. There are only two places in the warning where a tornado will be mentioned with the "tornado possible" tag: in the call-to-action and in the tags. When a "tornado possible" tag is applied, you should also make sure you manually select the "tornado possible" call-to-action statement. Often, these warnings require especially careful monitoring and updating to be ready to issue a tornado warning if needed.

SVR: Observed vs Radar-Indicated

Notes:

It is often the case that you have received a report on a severe thunderstorm, but your storm and environmental analysis suggest that the actual intensity is higher than the reported intensity. When this happens, you can and should communicate both in the text of a warning or statement. First, select the source of the report as the source of the warning, such as a trained spotter or law enforcement. Then, in the hazards, select the maximum hail size and wind speed you believe the storm is capable of producing. For example, if you received a report of golf ball size hail but believe the storm is capable of producing baseballs, then select baseball size among the hazards. If you have a report of a tree down and think the storm could produce 80mph winds, select the 80 mph threshold. Just below the hazards, you must select "Observed hail" or "Observed wind" to relay through the warning's tags that these are reported. Below that is an option, "Include Additional Reports," that allows you to add text about the report; select this so that you can provide the specific report time, location, and observation.

When you select "Include Additional Reports," WarnGen creates framed text in the warning in the location specified by the directives (NWSI 10-511), and you can edit the framed text in the report statement to indicate the source, time, location, and hazard reported. Note selecting both "observed wind or hail" and "include additional reports" must be done manually after you've selected an observed source for the warning. WarnGen does not do these automatically, which means that it's possible that you could accidentally select "radar indicated" in the warning and provide observations. These would be contradictory and confusing, so be sure to take the time to work through these steps accurately.

Tornado Warnings (TOR)

Tornado Warnings (TOR)

	Radar-Indicated	Observed (Radar or Visual)
Base	x	x
Considerable	?	x
Catastrophic		x

```
TORNADO...RADAR INDICATED
MAX HAIL SIZE...<.75 IN
```

```
TORNADO...OBSERVED
TORNADO DAMAGE THREAT...CONSIDERABLE
MAX HAIL SIZE...<.75 IN
```

```
TORNADO...OBSERVED
TORNADO DAMAGE THREAT...CATASTROPHIC
MAX HAIL SIZE...<.75 IN
```

Notes:

Let's move on to the tags that can be applied to tornado warnings. These are the tornado impact tags for tornado warnings and severe weather statements (or SVSs), as delineated in the NWS directives (NWSI 10-511).

There are three accepted tornado damage threat categories that provide information to partners and the public on the type of potential tornado damage and magnitude: base, considerable, and catastrophic.

Base-tagged warnings can be either observed or radar-indicated, and observed can be either radar-confirmed or visually observed. Considerable tags should be used when there is radar or visual observational evidence of a tornado capable of producing considerable damage - in other words, confidence should be high that a tornado is occurring. For a catastrophic tag, NWS directives specify it must be used only when there is direct observational evidence of a tornado - again, that can be a highly confident radar confirmation or a visual observation. You can issue either warnings or statements with any of the three tags, and you have the flexibility to change the tag (either up or down) by using updated SVSs, during a warning as well as by issuing a new warning.

TOR: Base Warning

Notes:

Base tornado warnings are used in the majority of tornado warning situations. The warning can be radar-indicated, radar-confirmed, or observed. Part of the reason base tornado warnings are more common is that they are intended to be issued before the tornado has formed - unlike considerable and catastrophic tags, which are issued with confidence of a tornado already on the ground. Remember, you can upgrade the tag with an SVS update or a new warning after a tornado develops and intensifies, if its conditions warrant an upgrade.

As with a base severe thunderstorm warning, the impact tag is not included at the base level. The tornado threat will be tagged as radar-indicated or observed, depending on what you select as a source. Note that a radar-confirmed tornado will be tagged as observed.

TOR Considerable Tag

Notes:

The next level of impact tag for tornado warnings is the considerable tag. The intent of impact-based warning tags is to give forecasters a way to distinguish the potential for a high-impact event in warnings and follow-up statements. The target range for the "Considerable" tag is strong to violent tornadoes, but don't try to pinpoint or forecast EF-scale ratings. The headline that "This is a particularly dangerous situation," along with enhanced impact statement, provide high-intensity cues for partners and the public. There should be a preponderance of evidence that the tornado is on the ground. That confirmation can be visual, such as a report from a reliable source like trained spotters, trusted storm chasers, or live cameras. It also can be radar-based, with confidence in the presence of a tornado debris signature along with the higher rotational velocities that support the existence of a strong or violent tornado. The considerable tag should be selected only for those tornado warnings where the storm signatures and reports provide high confidence in the presence of a tornado, with the possibility of a strong or violent tornado. The messaging in a tornado warning with a considerable tag is nearly as elevated as that of a tornado emergency. It is appropriate to use the considerable tag if you believe the storm strength and continuity justifies it but are unsure about the widespread population impact.

TOR Catastrophic Tag

Notes:

In exceptional circumstances, the conditions might warrant issuing a catastrophic tag, which is also a tornado emergency. The label should be reserved for the most extreme of circumstances, the kind that rarely, if ever, happen in any one meteorologist's career, and it should be an office-wide decision to issue it. Before issuing a tornado emergency, all of the following criteria must be met, beyond a reasonable doubt. First, there must be an imminent or ongoing severe threat to human life. That is, the tornado is approaching a population center. Second, catastrophic damage must be imminent or ongoing. Third, there must be confirmation of a tornado on the ground. As with a considerable tag, that confirmation can be either visual or radar-based, with the confident presence of a tornado debris signature combined with high-end rotational velocities in the tornado vortex signature. Essentially, you would issue a tornado emergency with high confidence of a strong or violent tornado approaching a populated area, in an environment that supports its persistence. What constitutes a "populated area" is a local decision. You can apply the tornado emergency tag in both new warnings and in SVS updates. With a tornado emergency, you will use the catastrophic damage tag in addition to manually selecting tornado emergency from the options within the WarnGen interface. It is important to include both steps if you are issuing a tornado emergency. The wording within the warning elevates another step, with a headline at the top of the warning that reads "Tornado Emergency For" and requires you to specify a location. If you are on the fence, keep in mind that a considerable tag contains elevated wording and will provide a highly visible cue that you have confidence in a high-impact tornado. Think of the tornado emergency as a municipal warning, compared to base and considerable tornado warnings that are public warnings.

TOR IBW Guidance
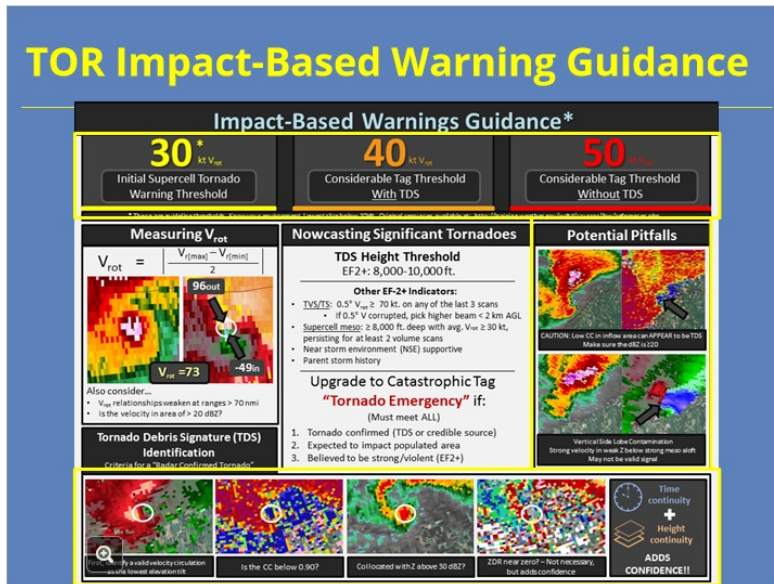
Notes:

A copy of this handy one-pager of guidance is available in the "Resources" tab and also will be handed out during the RAC workshop. At the top, notice the guidelines for rotational velocity thresholds: at 30 kt, a tornado warning may be needed. If rotational velocity reaches 40 kt with a TDS, or 50 kt without one, then an upgrade to a considerable tag may be needed. Keep in mind that the thresholds have fuzzy boundaries. Persistence of the features matters, as do storm history and the near-storm environment. Beware of pitfalls and look-alike signatures, including side-lobe contamination and low-CC signatures in the inflow notch. True tornado debris signature components include a velocity couplet, low CC (usually embedded within higher values), high spectrum width, and near-zero ZDR in the presence of reflectivity above 30 dBZ. Check the height of the tornado debris signature as a proxy for intensity, and also keep in mind that a TDS may not be evident in places where a relative lack of trees or structures means that little debris is being lofted by the tornado.

Rotational Velocity and Intensity
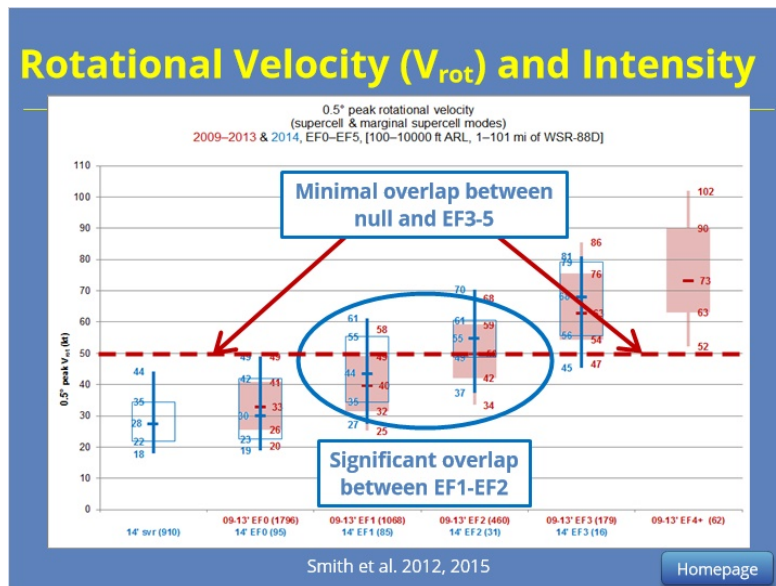
Notes:

We have talked about what the tags are and how to use them, so now let's talk about the "why" and the background a bit more. The resources shown here are linked in the "Resources" tab.

This SPC relational climatology by Smith et al. in 2012 and 2015 shows a relationship between increasing maximum 0.5-degree rotational velocity and increasing maximum EF scale of occurring tornadoes. The box and whiskers chart shown is for maximum low-level rotational velocity below 10,000 feet, looking at supercell and marginal supercell convective modes. The light red shaded boxes are data from 2009-2013, while the blue outlines are data from 2014 and include rotational velocities from non-tornadic severe supercells - in other words, null events. The box and whiskers have standard configurations, with the box encompassing the 2nd and 3rd quartiles and the tips of the whiskers representing the 10th and 90th percentiles. The dash in the middle of each box is the median, or the top of the 2nd quartile. For each event in the study, the authors recorded rotational velocities from the scan prior to tornado touchdown until the scan prior to tornado dissipation.

Again, we are not trying to pinpoint tornado intensity by EF scale. (For one thing, we can't forecast damage indicators in the path!) We are just trying to "ring the bell" a little louder for higher-impact tornado events. This chart shows why. You'll notice that there is plenty of overlap in maximum low-level rotational velocity associated with EF1 and EF2 tornadoes - but you can also see there is little overlap between null events or EF0s and EF3s to EF5s. The graphic hints at some capacity for distinguishing between weak and strong tornadoes and provides guidance for rotational velocities that are more likely to be associated with strong or violent tornadoes than with weak or no tornadoes.

There is no cookbook answer to the question of when to use a "considerable" tag or a "tornado emergency," but that is rarely the case for anything in operational meteorology. Keep in mind that the value of your role in the warning decision process is in staying situationally aware and considering a wide variety of factors to stay one step ahead of the tornado threat and to communicate the possible impacts.

Learning Objectives

Summary: Impact-Based Warnings

Tags	Base	Considerable	Destructive
Hail Size	1.0" - 1.5"	1.75" - 2.5"	2.75" +
Wind Speed	58 - 60 mph	70 mph	80 mph +
Calls-to-Action	Base (B)	Excessive (E)	

	Radar-Indicated	Observed (Radar or Visual)
Base	x	x
Considerable	?	x
Catastrophic		x

30 kt V_rot
Initial Supercell Tornado Warning Threshold

40 kt V_rot
Considerable Tag Threshold With TDS

50 kt V_rot
Considerable Tag Threshold Without TDS

* These are guideline thresholds. Know your environment. Lowest slice below 10kft. Original resources available at: http://training.weather.gov/wdtd/courses/ibw/references.php

Homepage

Notes:

To summarize, both severe thunderstorm and tornado warnings now use impact-based tags to categorize the potential impacts of severe thunderstorms and tornadoes. Severe thunderstorm warnings are tagged as base, considerable, or destructive and are triggered by the hail size or wind speed selected in the warning, using whichever has a higher impact. These can be either radar-indicated or observed, which must be selected manually while creating the warning text.

Tornado warnings are tagged as base, considerable, or catastrophic and are selected manually by the warning meteorologist. Considerable-tagged tornado warnings should have rotational velocities of 40 kt or greater with a TDS, or 50 kt or greater without one, with high confidence that a tornado is on the ground, either with radar confirmation or visual observation. Catastrophic-tagged tornado warnings, with tornado emergency wording, must pose an imminent danger to human lives and property - that is, approaching a population center. They must be either radar-confirmed or visually observed, and they also should have the rotational velocity indicators that you would apply to a considerable-tagged warning.

For Additional Help

For Additional Help

- Check with your facilitator (typically your SOO)

- Send your questions to

  nws.wdtd.rachelp@noaa.gov

Notes:

For additional help, check with your facilitator (typically your SOO) or send your questions to the listserv e-mail address here.

Radar & Applications Course (RAC)

Warning Fundamentals

Lesson: After the Warning Is Issued

Warning Decision Training Division (WDTD)

Welcome to this RAC Warning Fundamentals lesson on what to do after the warning is issued. We will go through the many ways to use severe weather statements, or SVSs, to follow up initial warning issuance. I am Barb Mayes Boustead.

Learning Objectives

- List the steps to issue a Severe Weather Statement (SVS)
- Identify best practices for SVS frequency
- Differentiate among situations in which a warning continuation, cancellation, and/or expiration statement are appropriate

The learning objectives for this lesson are to be able to list the steps to issue a Severe Weather Statement (or SVS), to identify best practices for frequency of issuing SVSs, and to differentiate among situations that would require an SVS to continue, cancel, or expire the warning.
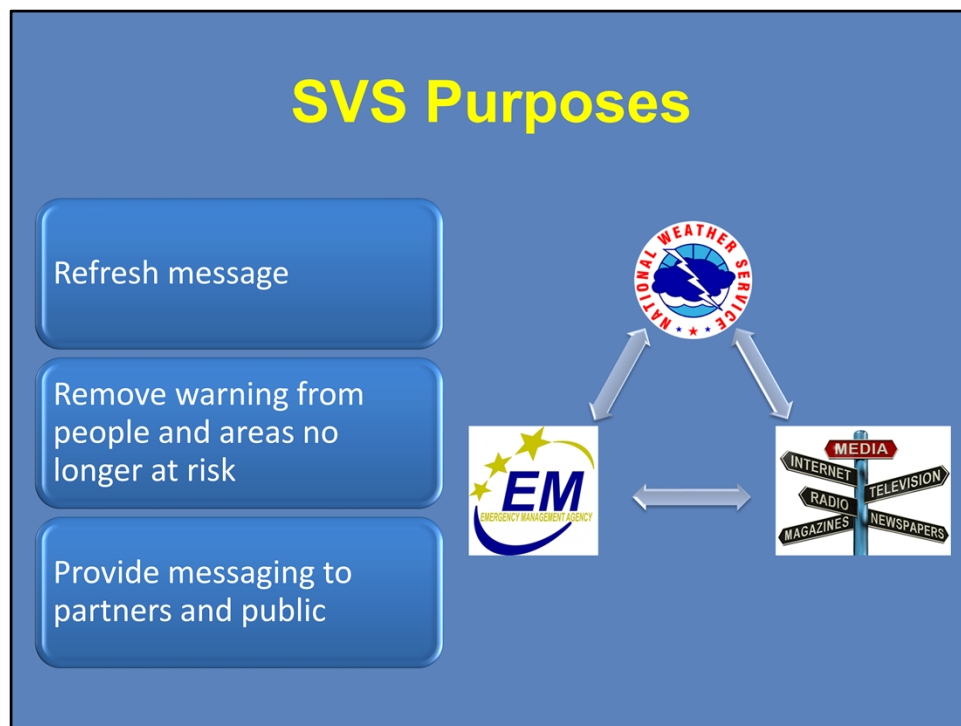
SVSs are an integral part of the communication chain to our partners and the public. An SVS refreshes the message about the severe thunderstorm or tornado, which allows the media to update their messaging. Emergency managers and first responders can shift from shelter to response more quickly with updated messaging from their local NWS office. SVSs also refresh the message of the warning on NOAA weather radio and on our webpages, as well as to private sector vendors who are relaying the warnings. Additionally, issuing an SVS allows the office to remove areas no longer at risk from the warning, by taking areas out of the polygon where the threat has passed. SVSs should be viewed as a decision support and communication tool, allowing the warning meteorologist to reach partners and the public directly and communicate clearly the changes in threat during a severe thunderstorm or tornado warning.
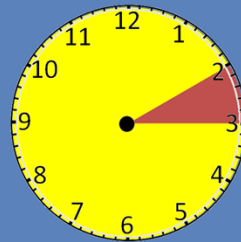
SVS Frequency

Tornado warnings
- Every 5-10 min
- Consider every 3-5 min if catastrophic or considerable tags applied

Severe thunderstorm warnings
- Every 10-15 min
- When threat type or severity changes

Directives provide a lower limit on the number of SVSs required during a warning, but there are some best practices to ensure the flow of information to our partners and public. NWS Instruction 10-511 stipulates that WFOs should issue an SVS at least once during a warning, with more frequent updates to help keep the public informed. For tornado warnings, a good rule of thumb is to issue an SVS every 5 to 10 minutes during the warning. Consider more frequent updates, as much as every 3 to 5 minutes, in high-impact situations, such as when a considerable or catastrophic tag is applied. For severe thunderstorm warnings, aim for issuing an SVS at least every 10 to 15 minutes. Reports of severe weather often can trigger an SVS, and warnings and statements should include recent reports in their text. It's also important to issue an SVS when the threat type or intensity changes, such as when radar signatures or reports indicate a bigger hail size than the initial warning or when a tornado goes from being radar-indicated to reported.
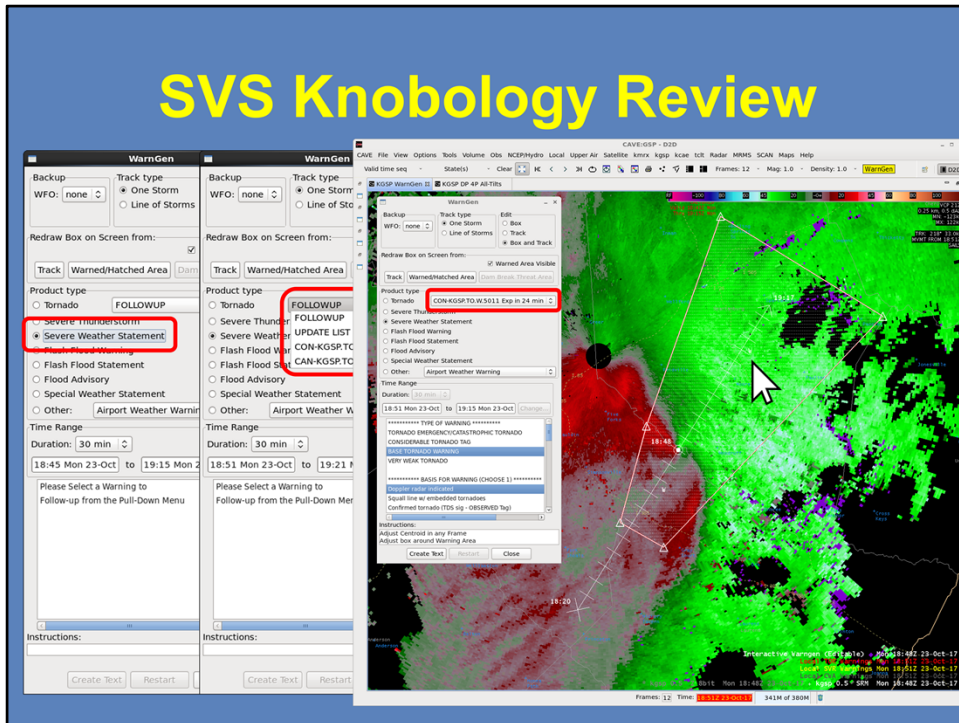
When you are ready to issue an SVS, select "Severe Weather Statement" in the WarnGen product list. There are two ways you can select which warning you are SVSing. The first way is to use the drop-down menu and select using the warning number. The second way, which has the benefits of being faster and removing a possible source of human error, is to right-click in the polygon of the warning you wish to update. The correct warning will be selected automatically in the list in the WarnGen window. From there, possible options will include continuing the warning, canceling it, or expiring it, depending on how much time is left until the warning expires.

Issue an SVS to continue a warning anytime from as soon as it is issued through up to 5 minutes before expiration. In the process of issuing the continuation, remember to update four components: First, update the location of the storm, then update its motion. Tweak the shape of the polygon, and then check and, if needed, update the basis and hazards. It typically makes the most sense for your workflow to progress in that order: use the distance/speed indicator to be sure the point is aligned to the threat area, check the motion to ensure it is still representative, tighten the polygon and remove areas no longer in a threat, and then update the basis of the warning, as well as the hazards for which you are warning, if those have changed. As you update the warning, the change in polygon shape may remove some counties from the threat; these will appear in the text of the SVS as a cancellation for just those counties, with a continuation for the remaining counties in the polygon.

You should proactively cancel a warning when it no longer poses the risk indicated by the type of warning. For a severe thunderstorm warning, use an SVS to cancel when the storm has weakened below severe limits, such as a pulse storm that has dropped its core already. Cancel a tornado warning when a storm is no longer capable of producing a tornado, such as when a storm is overtaken by a line and rapidly loses its rotation in the low and mid levels. Finally, cancel a warning if the storm that prompted it has moved fully out of the polygon. You can issue a cancellation up to 5 minutes before the expiration time of the warning, using the option labeled "CAN" in the drop-down menu.
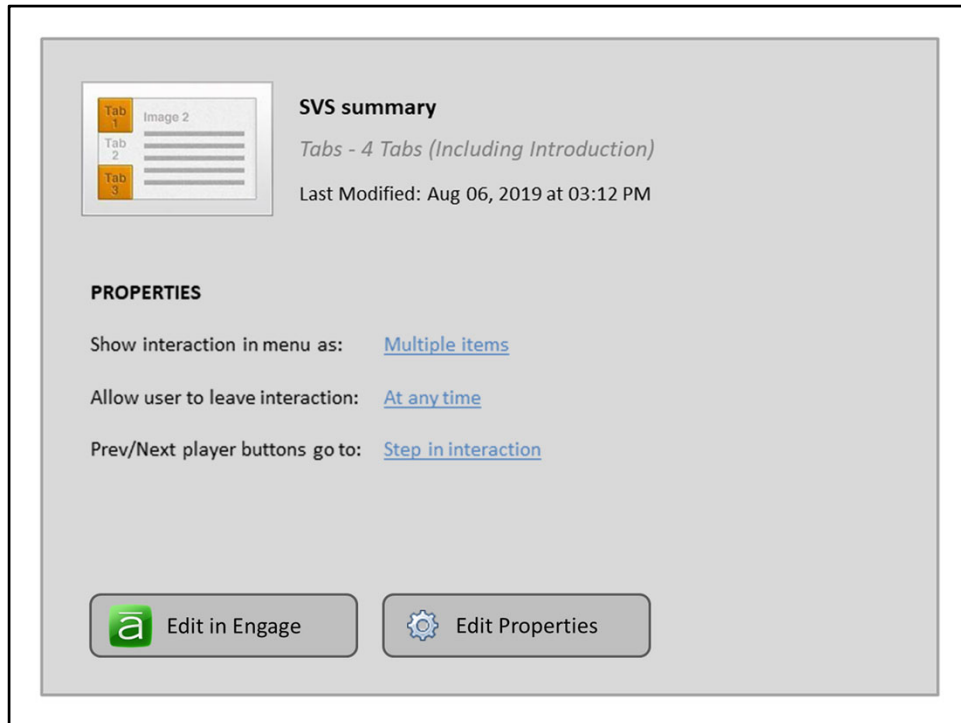
Expiration statements are issued near the end time of a warning. They may be issued within 10 minutes of expiration, and they *must* be used within 5 minutes of expiration. They also can be issued up to 10 minutes after the expiration time of the warning. Expirations should be used when a storm has moved out of a polygon or has weakened. They may be used even when another warning is being issued, and the templates allow for text input that a warning remains in effect for an area that you can describe by county portions. It's not recommended to use an expiration if the overlap between the expiring warning and its replacement, or a different warning in effect, is significant. This is to avoid confusing the message to partners and the public about whether or not a warning is in effect. So, how much is "significant"? It's a judgment call. The text options in the SVS templates can help clarify the message, by cueing text that another warning remains in effect or has been issued. Those text prompts can help you convey the right message – even with overlap.

In summary, SVSs are an important part of the information flow from the warning decision-maker to our full suite of partners and the public, allowing the media to adjust their messaging and responders a chance to issue "all clear" messages and begin their response efforts. The workflow of issuing an SVS includes updating the location of the storm and its track, then updating the polygon to remove areas that are no longer in the threat, and finally, updating the severity information and basis of the warning in the text. We issue SVSs to continue the warning, with updated messaging; to cancel a warning before its expiration time window; and to expire a warning at its scheduled time.

For Additional Help

1. Check with your facilitator (typically your SOO)
2. Send your questions to:
   nws.wdtd.rachelp@noaa.gov

For additional help, check with your facilitator (typically your SOO) or send your questions to the listserv e-mail address here.

10 Steps to Issue a Warning or Statement

Steps to Issue a Warning or Statement
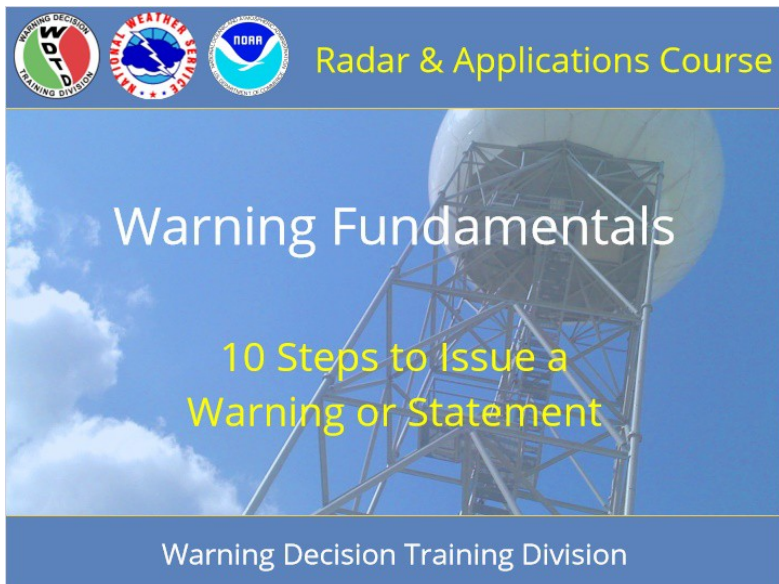
Notes:

Welcome to RAC Warning Fundamentals. This is the 10 Steps to Issue a Warning or Statement. I am Barb Mayes Boustead.

Learning Objectives

Learning Objectives

- Given a list, place in order the 10 steps to issue a severe thunderstorm or tornado warning or statement (SVR, TOR, or SVS).
- Identify when to proceed through the 10 steps, relative to the Screen-Rank-Analyze-Decide (SRAD) process.
- Identify the WDTD best practice for how long it should take to move through the 10 steps.

Notes:

The learning objectives for this module are to list, in correct order, the steps to issue a severe thunderstorm or tornado warning or statement, to identify when to proceed through the 10 steps relative to the SRAD process, and to note the goal for how long it should take to move through the 10 steps.

Before You Warn

Notes:

Before you even begin the process of drawing a warning or update, your storm analysis should be complete. You should know what kind of warning you want to issue, what size hail you are including, and if it is a severe thunderstorm warning, what wind speeds to include. You should know if it's radar-indicated or reported, and that should only change if a report comes in while you are drawing up the warning. You should know what tags you intend to apply (with tornado warnings, for example, base, considerable, or catastrophic). Having all of this information together before you start to draw the warning will help the process flow seamlessly, and it will help you achieve a goal of doing the entire process is less than 2 minutes, which is our goal for you by the end of RAC workshops.

Homepage: 10 Steps to Issue a Warning or Statement

Notes:

Welcome to the homepage for this lesson on the ten steps to issue a severe thunderstorm or tornado warning or statement. In warning operations, you will go through these ten steps with every warning and statement that you issue. From this page, you can click on these ten buttons to see more information about each step in the process of creating a warning or statement. Watch the summary video to see the process come together. Then, once you feel comfortable with these materials, take the quiz by clicking the button at the bottom right of the screen.

Select Product Type

Notes:

Remember, before you begin the process of producing your warning, you should have completed the screen, rank, and analyze steps in the warning decision process, and you should have made the decision what kind of warning or statement you want to issue and where. The first step you should take in the process of creating the warning is to select the warning product type - tornado, severe thunderstorm, or severe weather statement.
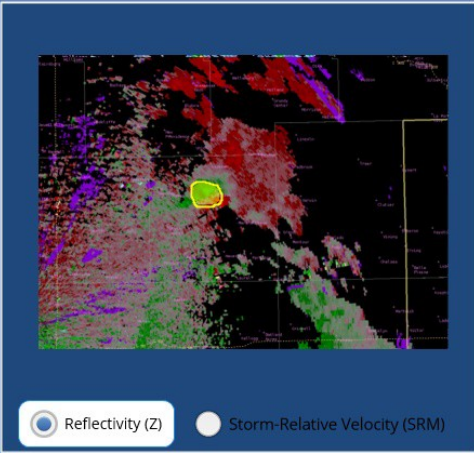
Check Duration

Notes:

Next, check the duration of the warning. Tornado warnings default to 30 minutes and severe thunderstorm warnings to 45 minutes. If you wish to move away from these defaults, have an intentional reason to do so, such as lengthening a tornado warning for a cyclical tornado-producing supercell in a favorable environment, or shortening a severe thunderstorm warning for a storm that is close to exiting your CWA. SVSs will continue for the remainder of the initial warning, unless you are issuing a cancellation. Being aware of how much time is left in a warning you are updating will let you be sure about what SVS options will be available to you - continuation, cancellation, and/or expiration.

Place Point or Line

Notes:

Use a point to track supercells and pulse storms and a line to track some multicellular storm modes, including QLCSs and bow echoes. For a supercell, place the point on the inflow notch area of the storm or on the center of mesocyclonic rotation. Take care if you place it on a tornadic couplet; we will talk about that a little more on the next step. For a storm that does not have a mesocyclone or inflow notch, such as a pulse storm, place the point on the leading edge of the high reflectivity area or wind signature, whichever is farther ahead relative to storm motion. For linear convection, use a line with three vertex points and align with the leading edge of winds associated with the storm. We will cover issuing for wind events like lines more in depth in the WOC Severe module on advanced warning polygonology for winds.

You can toggle between reflectivity and storm-relative velocity. On either image, click where you would place the "drag me to a storm" point to begin tracking the storm. When you've selected the correct area, you'll see a confirmation screen.
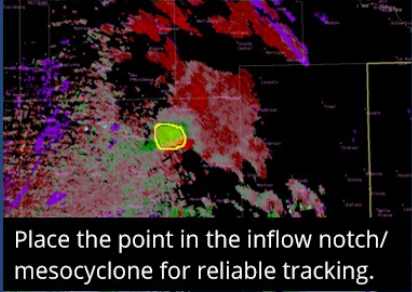
Yes Point (Slide Layer)
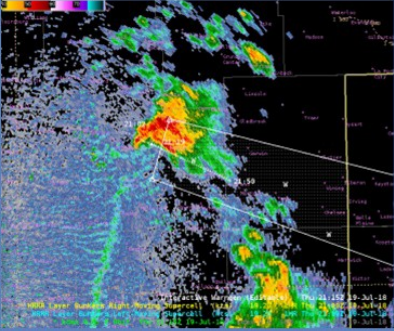
Track Storm Motion

Notes:

For supercells with a defined inflow notch area and mesocyclone, you can track the storm with these. Take care with tracking a tornadic circulation. Sometimes that works well, but sometimes, the circulation makes irregular motions, such as occluding back into the mesocyclone as the tornado cycles, which will make the overall track of the tornado-producing area of the storm less accurate if you follow it. When you track with velocity or storm-relative velocity, flip back to reflectivity to make sure the track makes sense. For linear convection, use velocity to track the leading edge of the gust front. In most cases, you'll want to track the motion for just the last few frames. WarnGen only allows linear motion extrapolation, while most storms have some kind of nonlinear motion. If you track backwards too far, you may get unrepresentative motion. As with all steps, be intentional about the motion you set and aware of the direction and speed.

Adjust Polygon

Notes:

From here, you'll click on "Warning from Track" to get a first-guess polygon. Inevitably, this will need at least minor adjustment. That said, often the biggest time sink for creating a warning, especially with newer warning meteorologists, is tweaking and adjusting the polygon. Your goal is to intentionally adjust it to trim away excess counties or areas that will not be impacted by the hazards, expand it to account for such things as nonlinear motion or unusual size, and maybe add an extra vertex at the end to shape the flare. Ensure that all hazards are covered by the polygon, as we learned in part 1 of RAC Warning Fundamentals, but limit the coverage to only those areas that are at risk for a tornado or severe hail or winds. It is not worth the time spent to add multiple extra vertices. Be aware, as you adjust the polygon, that counties may automatically add in or drop out of the warning if you move past the thresholds set locally for percent of county allowed to be included in a polygon. Pay attention to where counties are or are not hatched or marked with a "W" to know what will or will not be included. To see the final polygon shape that will result from your warning, click on "Warned/Hatched Area" - the polygon will snap to what it will actually include. This is one way to check that it is shaped as you intended it. If you don't like the outcome, click to draw from "Track" and adjust again.

Select Source and Tag

Notes:

As we work through the text interface of Warngen, we'll move through deliberately, from top to bottom. If it is a tornado warning, start by selecting the tag for the warning: base, considerable, or catastrophic. You will have made this decision before you start the warning process as you analyzed the storm. Next, in both tornado and severe thunderstorm warnings, select the basis of the warning - is it radar-indicated or spotter-reported, or in a tornado warning, radar-observed? If you select that the basis comes from any non-radar source, you must also select "Select to include additional information" - click on the "Next" button here to see that in the interface. We are showing an example of a tornado warning here, but it applies to severe thunderstorm warnings, too.

Scroll down (Slide Layer)

Select Hazards/Intensity and CTA

Notes:

Continue to work your way down the list of selections for the text of the warning, deliberately, from top to bottom. Choose the hail size to include in the warning or statement, whether it is tornado or severe thunderstorm. Remember, you should have the hail size in mind that you'd like to include before you begin creating the warning. This is often overlooked when analyzing a storm for a tornado warning. If you are issuing a severe thunderstorm warning or an SVS for a SVR, also choose the wind speed. Similarly, you should analyze and decide this before you begin to create the warning. Click "next" here to see the view as we scroll down through the options. Finally, choose 1 or 2 calls to action to fit the situation. If you have chosen a catastrophic tag for a tornado warning, this includes choosing the tornado emergency call to action.

Scroll down (Slide Layer)

7. Select Hazards/Intensity and CTAs

Create, QC, Send Text

Notes:

Click on the button in the WarnGen interface to create the text. Then, look at it, top to bottom, section by section. Be sure to fill in any framing text, including the area framed to include reports in any warnings, as well as the text that is often framed in SVSs that include cancellation and expiration statements. Check to make sure that the source selected matches the report - for example, if there is a report, it should not be a radar-indicated warning, and if a spotter reported it, then "spotter" should be your source. Check the number of counties to ensure it is 12 or less and that all the counties included need to be included. Check that the locations included are what you intended, and that there aren't any locations missing from the list that you intended to include. Check the storm motion, both speed and direction, to make sure it makes sense. While very fast storm motions sometimes are justified, anything over about 50 kt should probably flag you to ensure it is what you intended. These are some of the most common spots for errors that often result from going too quickly and not quality-controlling your warning. After you have reviewed your text, replace the framing text at the bottom with your name, initials, number, or blank sign-off, and send it. But the task doesn't end here.

Clear Outline
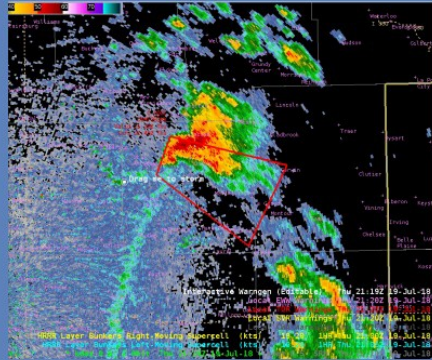
Notes:

Our next step could save you some accidental errors later in your warning process. We recommend that you next hit "Restart" in the WarnGen interface. If you have just issued an SVS, you'll need to switch to tornado or severe thunderstorm warning and then hit "Restart." When you do that, it will clear away the hatched outline of the polygon you just issued, preventing you from accidentally reissuing the same polygon later.

Write on Warning Tracking Sheet

Notes:

Finally, the warning meteorologist - or the warning assistant, if your office has set up a 2-person warning team - should write down the warning on a warning tracking sheet. We have this template linked in the resources, but your office may have its own version, too. We strongly recommend each warning meteorologist has their own tracking sheet that they keep updated with their own warnings. This will allow you to see at a glance what warnings are in effect and when they expire, so that you can anticipate your workload. By putting a check in the SVS column each time you issue an SVS for a warning, you'll also have a better handle on what warnings need updated. The notes section can help cue you to see warnings that are impacting significant locations, have elevated tags, or otherwise need attention. We will cover using the warning tracking sheet more at the RAC Workshop.

Putting the Steps Together
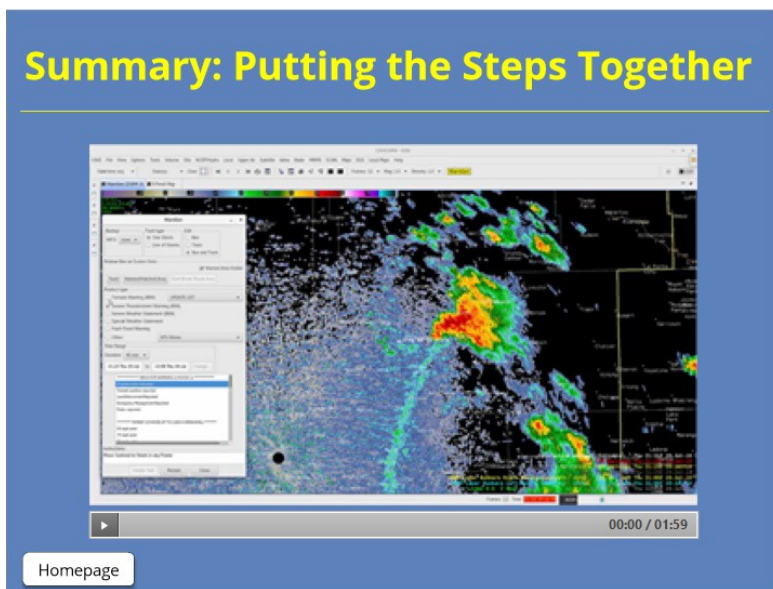
Notes:

In this video, watch all ten steps of the warning process come together as we issue a tornado warning. Note that the entire process takes under two minutes, which is a goal every warning meteorologist should have as you become more fluent in the warning process.

SPS for Near-Severe Storms

SPS for Near-Severe Storms

Notes:

Welcome to RAC Warning Fundamentals. This is a module on the Special Weather Statement (or SPS) for Near-Severe Storms. I am Barb Mayes Boustead.

Learning Objectives

Learning Objectives

- List the directives-based guidelines for issuing and formatting convective SPSs.
- Identify purposes for issuing convective SPSs.
- List the steps and best practices for issuing convective SPSs.

Notes:

After completing this module, you will be able to list the guidelines from the directives for issuing and formatting convective SPSs using WarnGen, identify reasons to issue convective SPSs, and list the steps and best practices for issuing convective SPSs.

Homepage: SPS for Near-Severe Storms

SPS for Near-Severe Storms

Click each button for more information about SPS:

- What is an SPS?
- Why issue an SPS?
- How do I issue an SPS?
- Summary
- Quiz

Notes:

Welcome to the homepage for SPS for near-severe-storms. Click on the what, why, and how buttons to learn more about the SPS product, its purposes, and the steps to issue the product. Then, click on the summary to put it all together. Finally, click to take the quiz for credit after you have viewed the other sections.

What Is an SPS?

What Is an SPS?

- NWSI 10-517
- Ongoing or imminent weather hazard
- Developing hazardous convective weather
- Sub-severe thunderstorm hazards
  - Winds/gusts 40-57 mph
  - Hail <1 in
  - Frequent to continuous lightning
  - Non-destructive rotating things (i.e. landspouts, non-marine-zone waterspouts, funnel clouds)

Notes:

The guidelines for the Special Weather Statement, or SPS, are outlined by NWS Instruction 10-517, section 3 - the directive is linked in the resources, as is the product description document (PDD). The directive specifies that an SPS should be issued to "provide the public with information concerning ongoing or imminent weather hazards, which require a heightened level of awareness or action." For convective weather, this includes developing hazardous convective weather and sub-severe thunderstorms. In a 2021 update to the directive, it also includes what we would call "non-destructive rotating things" - landspouts and non-marine-zone waterspouts, for instance. We'll talk more about this newer component of SPSs in the "why" section.

More about SPS
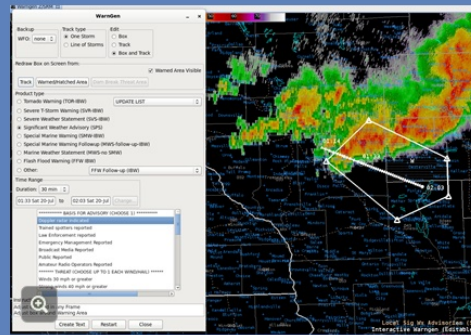
Notes:

We use WarnGen to issue convective SPSs, drawing them just like we would a tornado or severe thunderstorm warning. We will go through that process in the "How to issue an SPS" section. Unlike warnings, though, we cannot update an SPS once we issue it. For that reason, we recommend keeping SPS polygons small - tight to the hazard and short in duration.

SPS Format

Notes:

The SPS templates are being updated in 2021. The text is reformatted to look more like the IBW formats of severe thunderstorm and tornado warnings. This includes hazard, source, and impact bullets that are triggered by selections you make in WarnGen that should not be edited. Just as in severe thunderstorm warnings, SPSs will now include hail size and wind speed tags. If you select a landspout or waterspout, those will be tagged, as well.

The updated SPS also requires a descriptive headline of a strong thunderstorm, with the location and time of expiration - for example, "A strong thunderstorm will impact a portion of Wood County until 900 PM," or "A line of strong thunderstorms…" if you use the line tool. Most importantly, the phrase "Significant Weather Advisory" is no longer allowed as a headline.

You can click on the buttons to see formats for SPSs with hail and wind only, with a landspout in addition to hail and wind, and with a waterspout. Click to enlarge any of the images.

SPS Dissemination
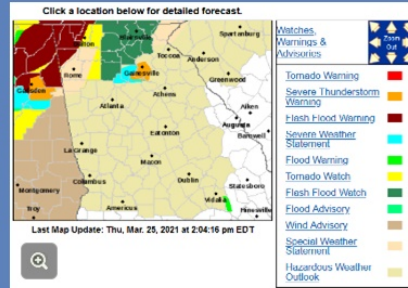
Notes:

SPSs do not have the visibility that severe thunderstorm and tornado warnings do. This is by design - they are intended to be a heads-up product that heightens awareness and not an alert-level product. Though they are played on NOAA weather radio, they do not have as much reach on the web and in applications. They are not often on commonly used radar apps and software products. They do, however, show up on the NWS website and on many TV media displays. Broadcast media partners, in particular, appreciate the SPS products, as it gives them information that they can relay on air.

Why Issue an SPS?

Notes:

Some of you, or some of your offices, may not prioritize using the SPS, since it is not a warning product. Why do we have a product to tell people that a storm is not severe? Let's go through some key reasons that support using SPSs.

Storms that fall below severe limits can still be impactful. Small hail is disruptive, even if it is not destructive - it can cover roadways, damage gardens, and cause cars to pull over while driving. Non-severe-level gusty winds can blow over bounce houses or tents. Frequent lightning can endanger people who are using outdoor recreational areas. Also, the non-destructive rotating things like landspouts and waterspouts can garner media or public attention, even if they are not causing damage.

Also, keep in mind that NWSI 10-517 uses the strong language "should," as in, "WFOs should use an SPS for strong thunderstorms that approach, or are expected to approach, severe convective criteria." Directives set up an expectation of consistent services across all NWS forecast offices.

Pic.1: https://www.nssl.noaa.gov/education/svrwx101/hail/;
https://www.nssl.noaa.gov/education/svrwx101/hail/img/PIC-0056.jpg

Pic. 2: Fort Lauderdale, FL, bounce house launched by waterspout. https://www.today.com/news/bounce-house-flies-away-injuring-teens-what-you-need-know-t153358; https://media2.s-nbcnews.com/i/MSNBC/Components/Video/150526/tdy_rossen_house3_150526.jpg

Non-Destructive Rotating Things

Non-Destructive Rotating Things

• Landspouts
• Waterspouts over inland lakes
• Funnel clouds unlikely to reach the ground

Homepage

Notes:

Let's go deeper into the guidance for non-destructive rotating things. The SPS allows you to fill that middle ground or gray area when you have a non-destructive rotating thing, like a landspout, a waterspout over non-marine zones, or a funnel cloud that is unlikely to reach the ground - the situations in which a tornado warning didn't quite apply, because the event wasn't destructive. These features may have captured some public attention, but if there is no destructive potential, then a warning might not be the best product. The SPS allows you to give a heads up about the feature.

There is no black-and-white decision tree that is going to delineate when to issue an SPS or a tornado warning in these situations. Apply your best meteorological and impact-based judgment. The SPS for these rotating things becomes a tool in your toolbox to use when you know you don't want to issue a tornado warning but also don't want to give the appearance that you are ignoring or unaware of the situation. It can provide a solution when you know that a tornado warning is not the best product for the situation. Knowing your area will help you know when it makes sense to use an SPS - for instance, knowing if you have locations that are prone to landspouts or inland lake waterspouts.

Pic 1: Weld Co., CO. https://www.9news.com/article/weather/weather-colorado/landspout-tornadoes-weld-county/73-ffdeb320-0488-4f6a-a1d9-41a375b6b666, https://media.9news.com/assets/KUSA/images/6fdfe414-899b-4c4d-b1d9-2c5a1fd21fef/6fdfe414-899b-4c4d-b1d9-2c5a1fd21fef_1140x641.jpg

Pic 2: Williamsburg, KS, (C) Jared Leighton (WFO EAX), 2011. https://kwwl.com/2019/07/07/gustnado-vs-tornado/; https://s3-ca-central-1.amazonaws.com/quincy-network/wp-content/uploads/sites/6/2019/07/JLgustnado.jpg

Pic 3: Lake Manawa, IA, . https://www.wowt.com/content/news/Rope-tornado-spotted-near-metro.html; https://gray-wowt-prod.cdn.arcpublishing.com/resizer/r_c9tM5_dYfMUbqXIRJxzPrdKyM=/1200x675/smart/cloudfront-us-east-1.images.arcpublishing.com/gray/YC77JJWW3ZMU5MS3A5ECYP5XOQ.jpg

How to Issue an SPS
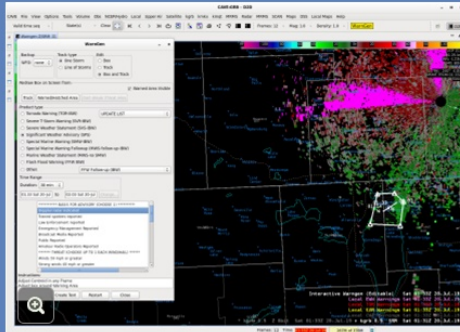
Notes:

There are two ways to issue an SPS. For longer-fuse, county-scale, grid-based events, on the scale of 2 to 6 hours, you should use the Graphical Forecast Editor (or GFE) to issue an SPS. For shorter-fused events on the scale of 15 to 60 minutes - including convective SPSs - you will use WarnGen to issue the product.

We want to emphasize keeping the polygon for a WarnGen-based SPS tight to the hazard, since you have no ability to trim or update the polygon after it is issued. This is especially true of the non-destructive rotating things. Waterspouts and landspouts that warrant an SPS are unlikely to be moving much and only impact a very small area. The polygons for these should be very tiny, limited to just the waterway being impacted by a waterspout or the very small convective area producing a landspout.
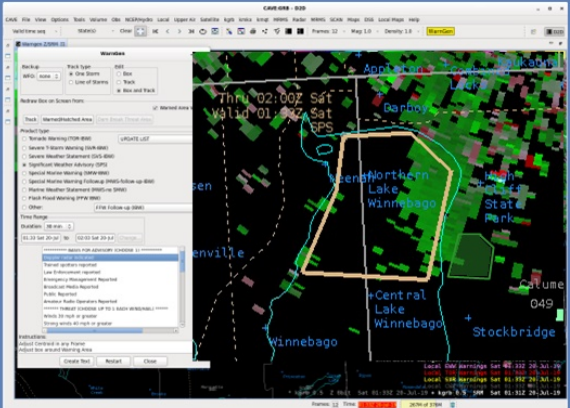
SPS in WarnGen

Notes:

When issuing an SPS for convective hazards, you will use WarnGen very similarly to how you use it to draw severe thunderstorm or tornado warnings. Complete your storm diagnosis before beginning the process of creating the SPS product. Then, follow the 10 steps protocol introduced in an earlier module (and linked in the resources) to create and send the SPS.

As a reminder, after you select the product type - Special Weather Statement - you will choose a duration. We recommend keeping this short, as in 30 minutes or less - again, because you cannot update the SPS. Place your "drag me to a storm" dot or line on the feature, and then track it, keeping in mind that many features you would track in an SPS are stationary or nearly stationary. Adjust your polygon next, keeping it very tight to the impacted area, especially for landspouts and waterspouts.

In the WarnGen interface, choose the source, then choose the hazards, including hail size, wind speed, and if there is a landspout or waterspout, either reported or possible. Work through the calls-to-action, choosing one or two for the situation. Create your text, quality-control the product from top to bottom, fill in any framing text, and then send it. You do still want to keep the habit of clicking "restart" to clear the hatched area. Be sure you have a way to keep track of SPSs you have issued, as these should alert you to pay closer attention to those storms - that could be a warning tracking sheet or a visual reminder with polygons on a screen.

SPS Example

Notes:

For example, if you have a waterspout over a lake or a wide river, you would draw an SPS with a very small and tight polygon snapped right around the body of water, taking care to include as little land around it as possible. That way, your messaging that it is a waterspout is accurate for the polygon you draw. The calls-to-action in an SPS for a waterspout are specific toward boaters who will need to reach shore or safety. If the waterspout may move on land, then it likely warrants a tornado warning.

Click on the polygon in the WarnGen image to see a closer view of the area included. Click on the zoomed picture to go back to the WarnGen view. Note that this WFO has included lake names and even portions of lake names as point locations, a best practice that we encourage.

After Issuing an SPS

Notes:

After you issue an SPS, it will go onto NOAA weather radio, where you can manually remove it from the feed if there are a lot of products on higher-impact storms and you want to reduce clutter on the broadcast. It will appear on the NWS website, and it often appears in crawls on local TV stations.

Once the SPS is issued, use the screen-rank-analyze-and-decide (SRAD) process to continue to monitor the storm of interest closely. By definition, the storm is close to severe limits or is producing a rotating thing, both of which warrant continued analysis. If the storm intensifies to severe weather thresholds, or if you lose confidence that the rotating thing will not cause a threat to life or property, move quickly to issue a severe thunderstorm or tornado warning. The SPS should be a visual cue to you to pay closer attention to that storm, rather than a note that you've "dealt with it" and can leave it alone.

Summary

Summary

- Issue for near-severe hail and wind and non-destructive rotating things
  - Hail < 1"
  - Thunderstorm wind gusts 40-57 mph
  - Landspouts, waterspouts over non-marine zones, funnel clouds
- Use WarnGen
  - Follow "10 Steps" methodology
  - Keep polygons small, tight to the hazard
- Monitor storm after SPS issuance

Homepage

Notes:

In summary, SPSs are a tool in our toolbox to raise awareness about storms that are approaching severe limits or may garner media attention. These include storms with less than 1 inch size hail and/or gusty winds of 40 to 57 mph. It also includes non-destructive rotating things like landspouts and waterspouts over non-marine zones, as long as the warning forecaster is confident that the rotating thing will not threaten lives or property. Use WarnGen to issue convective SPSs, following the 10 steps methodology we've learned in other training modules, and keep polygon sizes tight to the hazard. After you issue the SPS, continue to monitor the storm of interest closely in case it intensifies and warrants an upgrade to a severe thunderstorm or tornado warning.

For Additional Help

Notes:

For additional help, check with your facilitator (typically your SOO) or send your questions to the listserv e-mail address here.