Skywarn Nets and Local Weather Nets

Skywarn is made up of trained volunteer spotters for the National Weather Service (**NWS**). Skywarn spotters are essential information sources for all types of weather hazards. The largest responsibility for a Skywarn spotter is to identify and describe severe local storms.

A **Skywarn Net** or a local **Weather Net** are Amateur Radio Service ***Formal Directed*** nets, declared with a Net Control Station (**NCS**) and possibly backup NCS and/or logging stations. An NWS ***Skywarn Net*** is usually triggered throughout a coverage area by NWS announcement of a watch or warning. The progression to net status could include, as spotters become aware of potential situations:

- Individual contacts and reports analyzing the situation
- A declared *Open Net* such as **Wet Net** (which is normally to gather NWS precipitation data) with the repeater or frequency in normal operation
- A declared *Informal Directed* **Weather** *Net* with the frequency or repeater in "net mode" or A *Formal Directed* **Standby** or **Resource** *Weather Net* in anticipation of
- A *Formal Directed* **Skywarn** *Emergency Net* with liaison to, and requested by, NWS

NCS will regularly announce the authority for, and status (*Open, Informal Directed, Formal Directed*) of, during the course of the nets.

Once **Skywarn** or **Weather** net is declared, and as with all *Informal* and *Formal Directed* nets,

1. NCS has absolute control of the frequency until the net is closed. All communications must pass through NCS – *i.e.,* members must request permission before making a direct contact, and all communication should be important and relevant to the net with no personal transmissions.

2. NCS will give check-in instructions and observation requests at the beginning of a net and repeat them as often as possible. Stations should check into the net as instructed and **report only** those things that NCS has requested. These requests may change during the course of the net operation. Record *what to report*, as well as the *information* you gather, so that you are prepared to report.

3. Keep all your transmissions short and to the point. Always be ready to record messages transmitted to you or to be transmitted to NCS. ***Rule***: Think it, Write it down, Say it, Get off the key.

4. NCS may establish ***sub-nets*** to organize operations. If assigned to check-in to a sub-net, stay on that frequency and communicate through the Sub-net NCS.

5. Unless in immediate danger or at the direction of the NCS, never leave your post or your transmitter/receiver. Stay put. NCS must know exactly where observers are located. Do not switch back and forth between net and sub-nets. If assigned to a sub-net, contact main NCS only through sub-net NCS. Pay attention to your power source and be prepared with backup.

6. Listen, listen, listen. Do not check-in in the middle of fast moving net activity, except for ***Emergency*** (death or serious injury if not heard) or ***Priority*** (an immediate safety issue regarding *Human* life or injury, or impending property damage*)* traffic.

Field Spotting Guide

Definitions and Terminology Used by NWS:

Advisory – Conditions are favorable for the severe weather event in or near the advisory area. Advisories are issued for dangerous snow and/or wind chill conditions.

Watch -- Conditions are favorable for the severe weather event in or near the watch area. Watches are issued for tornadoes, severe thunderstorms, and flash floods.

Warning -- The severe weather event is imminent or occurring in the warned area. Warnings are issued for tornadoes, severe thunderstorms, flash floods, and river flooding.

Blizzard – Sustained winds or frequent gusts to 35 mph for at least 3 hours and considerable falling and/or blowing snow, reducing visibility to less than ¼ mile.

Blowing and/or drifting snow advisory – Visibility intermittently at or below ¼ mile due to blowing snow.

Downburst -- A strong downdraft from a cumulonimbus cloud with an outrush of damaging wind on or near the ground.

Flash Flood – A rapid rise in water, within a few hours, that follows heavy rainfall, dam/levee failure or other sudden release of water.

Freezing Rain Warning – Significant ice accumulation on all surfaces.

Funnel Cloud -- A rotating, funnel-shaped cloud extending downward from a thunderstorm base.

Heavy Snow Warning [Central and Southern Indiana] – 4" or more in 12 hours or less; 6" or more in 24 hours or less.

High Winds – Sustained winds of 40 mph or greater or winds gusting to 58 mph or greater.

Ice Storm Warning – Ice accumulation of ¼" or more on all surfaces; breaks wires.

Macroburst – Large downpour with outflow diameter 2 ½ miles or larger and damaging winds lasting 15-20 minutes; intense macrobursts can cause tornado-force damage.

Microburst – Small downburst with outflow diameter less than 2 ½ miles and peak winds lasting only 2-5 minutes; may induce dangerous wind and downflow wind shears which can affect aircraft.

Severe Thunderstorm -- A storm that produces hail 3/4 inch in diameter or larger and/or wind gusts of 58 mph or more, and/or tornadoes.

Snow Advisory [Central and Southern Indiana] – 2-4" in 12 hours. [Southwest and South Central, Indiana] – 1-3" in 12 hours.

Squall Line – A line of thunderstorms that may extend over several hundred miles.

Tornado -- A violently rotating column of air attached to a thunderstorm and in contact with the ground.

Waterspout – A rotating column of air, usually from a cumulus or cumulonimbus cloud, that forms over water and circulation reaches the water.

Wind Chill Advisory – Wind chill -20 to -34.

Wind Chill Warning – Wind chill -35 or less.

What to report: all reports *must* contain ***Time, Effect, Location*** information. Report *what you are seeing*, not necessarily what happened earlier or what was reported to you.

NWS Urgent Priority

1. **Tornado on the Ground** -- A lot of associated debris will be present in the formation. Definite and concentrated rotation is present. If the condensation cloud does not reach the ground, spotters should look for a rotating dust/debris cloud on the ground below the funnel.

2. **Funnel Cloud** - Virtually no debris, if any at all. Formation will usually be sucking in and/or giving off smaller rotating clouds.

3. **Rotating Wall Cloud** -- Wall clouds are attached to the cloud base and exhibit major rotation and formation. It won't extend all the way to the ground, and the "tail" (if present) will be trailing the storm and often pointing downward**.**

   Make sure it's not *a* ***rain column*** *which extends all the way to the ground but lacks a debris cloud near the ground and is not rotating;* not *a* ***Shelf Cloud*** *which will have a "tail" that is fairly level and pointing in the direction storm is moving;* not *a* ***Scud Cloud*** *which is wind-torn and changes shape rapidly; and/or* not *a* ***Roll Cloud*** *which forms along the gust front as the cool outflow lifts warm, moist air in the shape of horizontal tubes, and in some cases, has a visible horizontal rolling motion. Shelf and Scud clouds do not.*

   Localized, small rotations of short duration are common and not reportable. Rotation of a major nature and/or formation is reported if it is sustained and can be confirmed. Tornado-producing wall clouds may change shape but will exhibit persistent rotation for 10-20 minutes before tornado appears.

Radar cannot truly **see** ***a Wall Cloud or a Tornado***, only the potential. Only a spotter can actually verify the presence of a Wall Cloud or Tornado. After dark, during heavy rainfall, when vision is restricted, or at any time you are unsure, always report location of a suspect formation so that others may confirm.

4. **Flash Flooding** – A rapid rise in water, within a few hours, that follows heavy rainfall, dam/levee failure or other sudden release of water.

NWS High Priority

1. **Hail** ¾ -inch diameter or larger (nickel, quarter, golfball, baseball, softball)

2. **Wind speed** greater than **58 mph** [Beaufort Chart Descriptions]
   47 - 54 -- 3 inch or larger green branches break. Chimneys and shingles begin to tear off. TV antenna masts bend and antennas are destroyed.
   55 - 63 -- Trees begin to uproot. Structural damage starts getting serious. Large sections of roofs and roofing tear off and fly. Patio roofs and awnings destroyed. Some Mobile homes begin to suffer damage. Walking nearly impossible.
   64 - 72 -- Structural damage widespread and major. Mobile homes skins peel. Entire roofs blow off and windows blow in. Mobile homes displaced. Cement block parapets begin to collapse.

3. **Persistent non-rotating Wall Cloud** -- Wall cloud "tail" (if present) will be trailing the storm and often pointing downward and are attached to the cloud base. No rotation.

4. **Rainfall** 1 inch or more per hour

NWS Lower Priority

1. **Hail** ½-inch diameter or larger (do not use the term "marble" since marbles can come in a variety of sizes. “Dime” is closer to the “coin” analogy used for ¾” and 1” hail).

2. Wind speed greater than **40 mph** [Beaufort Chart Descriptions]
   39 - 46 Green twigs begin to break off. You have to lean into the wind to walk. Shingles flap violently.

3. **Cloud features**, such as anvil formations flanking lines, and a rain foot, suggesting storm organization

4. **Other** locally-defined criteria

Other Observations *to be or not to be* Reported

1. **Waterspout** -- Moving towards land or moving away from land.

2. **Thunder --** *Never* reportable.

3. **Lightning --** Reportable *only* if it has started a fire, hit electrical service components, knocked a tree or pole into a roadway, or hit a building, vehicle or person(s). If lightning is coming from a cloud that is very close to the ground, showing signs of rotation, sucking up debris and smaller clouds, and moving toward you, call NCS and move or take cover.

4. **Drastic Sustained Wind Speed Changes** - especially if rotation is present in cloud structures.

How To Estimate Wind Speed: Beaufort Chart

mph	Observations / **Reportable** (as High/Lower Priority)
0	Smoke will rise vertically
1-3	Smoke will show slight direction but there is not enough wind to move a wind vane.
4-7	You will feel a breeze on your face, smoke has definite direction, leaves move a bit and a wind vane will move**.**
8-12	Leaves will be in constant motion, small twig branches move, flags extend.
13-18	Dust puffs blow, loose paper flies, 1/2 to 1 inch branches move.
19-24	Small leafy trees sway and small waves will form on ponds & lakes, flags whip
25-31	4 inch & larger branches moving, telephone, power wires & chain link fences whistle.
32-38	Large, whole trees in motion, becomes hard to walk totally upright against the wind. Shingles begin to lift.
39-46	**Green twigs begin to break off. You have to lean into the wind to walk. Shingles flap violently.**
47-54	**3 inch or larger green branches break. Chimneys and shingles begin to tear off. TV antenna masts bend and antennas are destroyed.**
55-63	**Trees begin to uproot. Structural damage starts getting serious. Large sections of roofs and roofing tear off and fly. Patio roofs and awnings destroyed. Some Mobile homes begin to suffer damage. Walking nearly impossible.**
64-72	**Structural damage widespread and major. Mobile homes skins peel. Entire roofs blow off and windows blow in. Mobile homes displaced. Cement block parapets begin to collapse.**

5. **Wind Related Reportable Observations**: These are only things which you *are actually seeing happen*. Do not report what happened a short time ago unless injuries are involved.

- *Multiple* trees being blown down or uprooted
- Breakage of tree limbs *4 inches* in diameter or larger
- Downed power lines
- Commercial broadcast tower damage
- Large permanent sign damage
- Windows broken by wind (not debris)
- *Multiple* home TV antennas being blown over/down
- Roofing being blown from buildings/homes
- Wind-caused vehicle accidents
- Injuries to people.
- *Severe* mobile home damage
- *Major* structural damage to buildings

The Warning Signs

Several visual clues will help the spotter determine if a storm has severe weather potential. These clues are evident in the upper, middle, and lower levels of the storm. The spotter should pay particular attention to these clues, especially when watching more than one storm at a time.

1. **Upper-Level Storm Clues** -- Best seen 30-40 miles from the storm, so difficult to see in poor visibility conditions: A large overshooting top that persists for more than 10 minutes and an anvil with sharp and well-defined edges. Storms with weaker updrafts will usually have an anvil that is thin, wispy, and fuzzy.

2. **Mid-Level Storm Clues** -- Best seen 10-20 miles from the storm, also difficult to see in poor visibility conditions: Concentrated in the main storm tower area, the clues are the following.
   - A ***solid appearing updraft tower*** with a sharp, cauliflower definition in the storm tower. Some storms have a soft or "mushy" appearance indicative of a weaker updraft and therefore are a poor candidate for producing severe weather.
   - A ***flanking line*** -- a row of small cloud towers that build up (stair-step) into the main storm tower from the south or southwest. The flanking line does not suggest updraft strength, but it does indicate storm-scale organization necessary for persistent severe weather.

3. **Low-Level Storm Clues** -- Best seen within 10 miles of the storm and are the easiest to detect in lower visibility conditions. Low-level storm features can be the most critical in determining a storm's severe potential but can result in the most confusion.
   - **The rain-free base** -- a low, flat cloud base from which little visible precipitation is falling. However, the precipitation in this area is often in the form of large hail. The rain-free base defines the primary inflow and updraft area in the storm. The preferred area for severe weather formation is near and just north/east of the rain-free base.
   - **The wall cloud** -- an isolated lowering of the rain-free base. It is always attached to the cloud base. It indicates the storm's strongest updraft area, and it is the primary location for severe weather development. Wall clouds with persistent rotation (10 minutes or more) are especially significant since they denote a very dangerous storm that may produce large hail, strong downbursts, or a tornado.

Characteristics of a Supercell: A supercell thunderstorm is a long-lived storm containing a ***mesocyclone*** -- an area of intense, storm-scale rotation extending through much of the depth of the storm. Supercell storms are usually separated from other thunderstorms or may even be isolated. This separation allows them to feed upon warm, moist air from miles around.

Strong winds aloft are blowing from the southwest to northeast. Air in the upper portion of the updraft eventually becomes colder than the surrounding air and upward motion decelerates. The cloud spreads rapidly, forming an "anvil."

The "front flank" downdraft sinks to the ground in the area where precipitation is falling in the forward position of the storm (usually north or northeast of the updraft). A second downdraft forms just southwest of the updraft. This area, near the intersection of the updraft and this "rear-flank" downdraft, is where a tornado is most likely to occur. Large hail is likely to fall just outside the updraft core, mainly northeast of the updraft. Tornadoes also may form along the gust front and flanking line; however, these are usually weak and short-lived.

Large hail is a common occurrence in strong thunderstorms, especially supercells, and size is determined by the updraft strength, *i.e.*, the stronger the updraft, the larger the hailstones. Single cell storms can produce hail up to about nickel size, multicell storms to about golfball size, and supercells up to about softball size.

In addition to a ***rain-free base*** and a **wall cloud**, supercells often exhibit **downbursts** -- a strong downdraft from a thunderstorm with an out rush of damaging wind on or near the ground. Damaging downbursts, although relatively rare, are much more common than tornadoes. Because of their small size and short lifespan, *it is difficult to detect and warn for downbursts.* Downbursts are divided into two categories.

Macroburst -- Swath of damaging wind is 2.5 miles or more wide.
Microburst -- Swath of damaging wind is less than 2.5 miles wide.

The initial stage of a downburst begins as the wind surges from the cloud base. The second stage, called the "impact" stage, occurs when the downburst makes contact with the ground and begins to spread outward. Expect the strongest wind speed shortly after the downburst hits the ground. The impact stage is also the most dangerous stage for aviation as aircraft caught in the strong winds may see wing lift decreased, possibly causing the plane to stall and crash. "Dissipation," the final stage, occurs when the downburst spreads out and weakens. Beware, other downbursts may form later.

A **rain foot** or a **dust foot** are downburst indicators. The rain foot is a pronounced outward deflection of the precipitation area near the ground, marking an area of strong outflow winds. Over plowed fields (or in the western states), look for a dust foot -- a plume of dust raised as the downburst reaches the ground and moves away from the impact point.

Characteristics of a Tornado: The typical tornado goes through a three-stage life cycle:

Developing:. A rotating wall cloud is evident, with tighter rotation evident in the base of the wall cloud. As the tornadic circulation continues to develop, the condensation funnel appears. It may not yet be a tornado, since the visible cloud is less than half way to the ground; however, in some cases you will see a dust whirl on the ground indicating a tornado before the condensation funnel touches down.

Mature tornadoes form in storms which continue to get a good inflow of warm, moist air, and the circulation is near the maximum size and intensity. The inflow becomes disrupted a short time later, which starts the dissipating stage.

The ***dissipating*** tornado stage is sometimes called the "rope stage." The condensation funnel becomes tilted and shrinks into a contorted, rope-like configuration. The tornado is still dangerous even at this late stage in its life. Some tornadoes, especially larger ones, dissipate as the funnel lifts into a bowl-shaped lowering of the cloud base.

Tornado intensities are classified by the **Fujita Damage Scale**. The scale ranges from F0-F5, with F5 storms creating incredible damage. The NWS also uses a broader, three-level classification scale, consisting of "weak" (F0-F1), "strong" (F2-F3), and “violent” (F4-F5).

Weak tornadoes (F0 & F1) may not be associated with mesocyclones are difficult to detect and forecast; thus, there is a *heavy reliance on spotters* to identify and report these storms. Wind speed: 60-115 mph; 80% of all tornadoes, 5% of tornado-related deaths; life: 1-10 minutes; path: 3 miles long.

Strong tornadoes (F2 & F3) are typically associated with mesocyclones. They are easier to infer from radar, but spotter reports of these storms are still a very important part of the warning process. Wind speed: 110-205 mph; 19% of all tornadoes, 30% of tornado-related deaths; life: 20+ minutes; path 15+ miles long.

Violent tornadoes (F4 & F5) are virtually always associated with a powerful mesocyclone. Their signatures are often easily detectable on radar, but spotter reports provide vital ground truth of actual storm conditions.

Many strong and violent tornadoes develop as multiple vortex tornadoes. They consist of one large circulation (vortex) with several smaller circulations rotating around it. The smaller vortices usually are responsible for the extreme winds and damage associated with violent tornadoes.

Storm spotters should not wait for a condensation cloud to reach the ground before reporting a tornado. Instead, spotters should look for a rotating dust/debris cloud on the ground below the funnel. This rule is especially true in western states, where storm cloud bases are relatively high and the air below the cloud base can be quite dry.

Spotters should not attempt to judge tornado intensity based only on size. Cases have been documented of small, violent tornadoes and weak tornadoes with large condensation funnels.

Tornado Lookalikes:

Rainshafts sometimes may be located where a tornado normally would be found, but lack a debris cloud near the ground and organized rotation about a vertical axis. ***Smoke columns*** are among the most convincing look-alikes. Watch for a minute or so to look for rotation, both in the cloud and in the debris near the ground. Check with other spotters who may have a better viewing angle. ***Scud clouds*** are small, detached, wind-torn clouds that often form near thunderstorms. Scud clouds can change shape rapidly and sometimes take on the appearance of a wall cloud or funnel cloud. Remember, though, that wall clouds are attached to the cloud base and funnel clouds always rotate. ***Roll clouds*** form along the gust front as the cool outflow lifts warm, moist air, take the shape of horizontal tubes, and in some cases, you can actually see a horizontal rolling motion.

Shelf clouds form in a process similar to roll clouds, but shelf clouds but take more of a wedge shape. The motion in the shelf cloud's base will be turbulent but without the persistent, organized rotation seen in true wall clouds. Shelf clouds are more common than roll clouds and can define areas of strong downburst winds but usually are not favorable locations for tornado development. They are associated with cool outflow (downward vertical motion) while wall cloud is associated with a warm updraft (upward vertical motion).

Field Safety

Most spotting should be done from a spotter's home or very close to it. Stationary observers with an open and clear view are *preferred* by the NWS. Stay put. NCS must know exactly where observers are located. Skywarn training does not qualify anyone as a chaser. Do not chase any storm without special training and being assigned to do so. Chasing can be extremely dangerous for even highly trained observers and *deadly* for the untrained. Cars are pretty safe places to be in the presence of lightning and very unsafe places to be in a tornado or a flash flood. Don't drive across fast moving water. Always have a safe place picked out to protect yourself from large hail and high winds. Don't wait for the wind to get so strong that you can't get to cover.

Flash Floods -- Flash flooding is a major killer. Many flash floods occur at night, which makes them more difficult to see. Do not attempt to drive or walk across a flooded roadway or low water crossing. Moving water 2 feet deep will carry away most cars. If caught and stalled, and if you can do so safely, seek higher ground. Be especially careful at night when flash floods are harder to recognize.

Lightning -- Lightning tends to strike the tallest object in an area -- make sure it is not you. Remain in your vehicle or an indoor location whenever possible. If you must go outside, crouch down to make yourself a poor lightning target. Do not lie flat on the ground since you will be more likely to be severely shocked if lightning strikes close to you.

Hail -- If the storm you are observing produces a tornado, it will likely form very near the shaft of large hail. Substantial structures and highway overpasses (out of traffic lanes) offer the best hail protection. Hardtop vehicles offer fair protection from hail up to about golf ball sized, but significant windshield and auto body damage can result with hail larger than golf balls.

Downbursts and outflow winds -- Winds may exceed 100 mph in very strong downbursts. Keep a firm grip on your vehicle's steering wheel to maintain control. Wind speed and direction can change rapidly in a downburst. Blowing dust or heavy rain may accompany downbursts. Be prepared for sudden changes in visibility that may create hazardous spotting conditions. Spotters observing from a substantial building should move away from windows as the downburst approaches.

Tornadoes -- Mobile spotters in high visibility areas, such as rural areas, may be able to drive away from an approaching tornado. This does not apply to spotters in urban areas, inexperienced spotters, spotters in low visibility locations such as in heavily wooded areas, or members of the general public. Spotters should be familiar with their area and have planned escape route. If an oncoming tornado can’t be avoided, take shelter in a substantial building, ditch, ravine, or other low spot (but be cautious of flash flooding and lightening).

Safe Viewing Tips -- Mobile spotters should try to view a storm from its right flank. This will usually provide the best viewing angle, the best contrast, and it will generally keep spotters out of the storm's path. For storms moving to the northeast, the best viewing location is from the south or southeast. With east or southeast moving storms, a viewing angle from the south or southwest (respectively) is preferred, although spotters will need to be more conscious of the storm's movement and have an escape route available.