Radar & Applications Course (RAC): Glossary

Term	Definition
Above Radar Level (ARL)	The altitude measured with respect to the radar.
Advanced Weather Interactive Processing System (AWIPS)	A processing, display, and telecommunications system that is the cornerstone of the United States National Weather Service's (NWS) operations.
Anafront	A front at which the warm air is ascending the frontal surface up to high altitudes. With anafronts, precipitation may occur to the rear of the front and is sometimes associated with cyclogenesis. *Compare* katafront. American Meteorological Society cited 2013: "term." Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/anafront]
Anvil Cloud	The anvil-shaped cloud that comprises the upper portion of mature cumulonimbus clouds; the popular name given to a cumulonimbus capillatus cloud, particularly if it embodies the supplementary feature incus (from the Latin for anvil). American Meteorological Society, cited 2013: Anvil Cloud. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Anvil_cloud]
Atmospheric Boundary Layer	(Abbreviated ABL; *also called* boundary layer, planetary boundary layer.) The bottom layer of the troposphere that is in contact with the surface of the earth. It is often turbulent and is capped by a statically stable layer of air or temperature inversion. The ABL depth (i.e., the inversion height) is variable in time and space, ranging from tens of meters in strongly statically stable situations, to several kilometers in convective conditions over deserts. During fair weather over land, the ABL has a marked diurnal cycle. During daytime, a mixed layer of vigorous turbulence grows in depth, capped by a statically stable entrainment zone of intermittent turbulence. Near sunset, turbulence decays, leaving a residual layer in place of the mixed layer. During nighttime, the bottom of the residual layer is transformed into a statically stable boundary layer by contact with the radiatively cooled surface. Cumulus and stratocumulus clouds can form within the top portion of a humid ABL, while fog can form at the bottom of a stable boundary layer. The bottom 10% of the ABL is called the surface layer. *Compare* Ekman layer. American Meteorological Society, cited 2025: Atmospheric Boundary Layer. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Atmospheric_boundary_layer]
Backing Winds	In the Northern Hemisphere, a wind that rotates in the counterclockwise direction with increasing height. Opposite of veering wind.

	American Meteorological Society, cited 2013: Backing Winds. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Backing_wind]
Baroclinic Zone	A region in which a temperature gradient exists on a constant pressure surface. Baroclinic zones are favored regions for the development of extratropical cyclones. Also, wind shear is characteristic of a baroclinic zone. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Baroclinic+Zone
Beaver('s) Tail	[Slang] A particular type of inflow band with a relatively broad, flat appearance suggestive of a beaver's tail. It is attached to a supercell's general updraft and is oriented roughly parallel to the pseudo-warm front (forward-flank downdraft gust front). As with any inflow band, cloud elements move toward the updraft. Its size and shape change as the strength of the inflow changes. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Beaver('s)+Tail
Book-end Vortices	Mesoscale vortices observed at the ends of a line segment of convective cells, usually cyclonic on the northern end of the system and anticyclonic on the southern end, for an environment of westerly vertical wind shear (in the Northern Hemisphere). The vortices are generally strongest between 2 and 4 km above ground level, but may extend from near the surface to about 8 km above ground level. They have been observed at scales between 10 and 200 km, and often have lifetimes of several hours. In extreme cases, the larger cyclonic vortices may become balanced with the Coriolis force and last for several days. *See also* bow echo. American Meteorological Society, cited 2025: Book-end Vortices. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Book-end_vortices]
Bounded Weak Echo Region (BWER)	(Abbreviated BWER.) A nearly vertical channel of weak radar echo, surrounded on the sides and top by significantly stronger echo. The BWER, sometimes called a vault, is related to the strong updraft in a severe convective storm that carries newly formed hydrometeors to high levels before they can grow to radar-detectable sizes. BWERs are typically found at midlevels of convective storms, 3–10 km above the ground, and are a few kilometers in horizontal diameter. *See also* weak echo region.

	American Meteorological Society, cited 2025: Bounded Weak Echo Region (BWER). Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Bounded_weak_echo_region]
Bow Echo	A bow-shaped line of convective cells that is often associated with swaths of damaging straight-line winds and small tornadoes. Key structural features include an intense rear-inflow jet impinging on the core of the bow, with book-end or line-end vortices on both sides of the rear-inflow jet, behind the ends of the bowed convective segment. Bow echoes have been observed with scales between 20 and 200 km, and often have lifetimes between 3 and 6 h. At early stages in their evolution, both cyclonic and anticyclonic book-end vortices tend to be of similar strength, but later in the evolution, the northern cyclonic vortex often dominates, giving the convective system a comma-shaped appearance. American Meteorological Society, cited 2025: Bow Echo. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Bow_echo]
Buoyancy	The tendency of a body to float or to rise when submerged in a fluid; the power of a fluid to exert an upward force on a body placed in it. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Buoyancy
Burn Scar	The mark left on a landscape by fire.
C Band Radar	A radar which operates in the 4-8 GHz frequency and 3.75-7.5 cm wavelength ranges. Because of these characteristics, the antenna size does not need to be as large as an S Band radar to achieve a smaller beam width. This makes C band radars more affordable. The signal is more easily attenuated, so this type of radar is best used for short range weather observation. The Terminal Doppler Weather Radar (TDWR) is a C band radar. *See also* S band radar, X band radar.
Cap	(*Also called* lid.) A region of negative buoyancy below an existing level of free convection (LFC) where energy must be supplied to the parcel to maintain its ascent. This tends to inhibit the development of convection until some physical mechanism can lift a parcel to its LFC. The intensity of the cap is measured by its convective inhibition. The term capping inversion is sometimes used, but an inversion is not necessary for the conditions producing convective inhibition to exist. American Meteorological Society, cited 2025: Cap. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Cap]

Cell	In radar usage, a local maximum in radar reflectivity that undergoes a life cycle of growth and decay. The rising portion of the reflectivity maximum is indicative of updraft, and the later descending portion is indicative of a precipitation downdraft. Cells in ordinary convective storms last from 20 to 30 min, but often form longer-lasting multicell convective storms. Cells in supercell storms are more steady and last considerably longer. *See also* thunderstorm cell. American Meteorological Society, cited 2025: Cell. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Cell]
Classic Supercell	A sub-category of supercell, falling in between Low Precipitation (LP) and High Precipitation (HP) supercells, which exhibits moderate precipitation production. While there may be some precipitation with a classic supercell's rear flank downdraft (RFD) (and hook echo), its radar reflectivities are lower than its forward flank downdraft (FFD) precipitation core.
Cloud Microphysics	Cloud processes (growth, evaporation, etc.) taking place on the scale of the individual aerosol or precipitation particle as opposed to the scale of the visual cloud. *See* cloud physics. American Meteorological Society, cited 2025: Cloud Microphysics. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Cloud_microphysics]
Cloud Seeding	The addition of agents (aerosol, small ice particles) that will alter the phase and size distribution of cloud particles, with the intent of influencing precipitation. The most frequently used agents are granulated solid carbon dioxide (dry ice), silver iodide aerosol for initiation of the ice phase, and salt (sodium chloride) for initiation of larger cloud droplets. Many other agents (e.g., organic materials, bacteria) have been tested and proposed for use. The intent of cloud seeding is to modify or alter the natural development of the cloud so as to enhance or redistribute precipitation, suppress hail formation, dissipate fog or stratus cloud, or suppress lightning. Cloud seeding may involve different techniques. Particles may be released from the ground, from aircraft, or from rockets. The goal of ice phase cloud seeding is to induce the phase transition from a supercooled water cloud to one composed partially or entirely of ice. The goal of dynamic cloud seeding is to stimulate or enhance vertical air motions in the cloud through increased buoyancy derived from the release of latent heat of freezing. Hygroscopic seeding utilizes hygroscopic salt aerosols that readily condense water and may grow large enough to become centers for coalescence growth of precipitation.

	American Meteorological Society, cited 2025: Cloud Seeding. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Cloud_seeding]
Cold Pool	1. (*Also called* cold drop, cold-air drop.) A region, or "pool," of relatively cold air surrounded by warmer air; the opposite of a warm pool. This is usually applied to cold air of appreciable vertical extent that has been isolated in lower latitudes as part of the formation of a cut-off low. Cold pools are best identified as thickness minima on thickness charts. They are cyclonic-scale phenomena. 1. Any large-scale mass of cold air; a cold air mass or cold dome. American Meteorological Society, cited 2025: Cold Pool. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Cold_pool]
Cold Rain Process	In cloud physics, precipitation generation which is dominated by deposition and the Bergeron Process. *Compare* warm rain process.
Convection	Generally, transport of heat and moisture by the movement of a fluid. In meteorology, the term is used specifically to describe vertical transport of heat and moisture in the atmosphere, especially by updrafts and downdrafts in an unstable atmosphere. The terms "convection" and "thunderstorms" often are used interchangeably, although thunderstorms are only one form of convection. Cbs, towering cumulus clouds, and ACCAS clouds all are visible forms of convection. However, convection is not always made visible by clouds. Convection which occurs without cloud formation is called dry convection, while the visible convection processes referred to above are forms of moist convection. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Convection
Coordinated Universal Time (UT)	By international agreement, the local time at the prime meridian, which passes through Greenwich, England. Prior to 1972, this time was called Greenwich Mean Time (GMT) but is now referred to as Coordinated Universal Time or Universal Time Coordinated (UTC). It is a coordinated time scale, maintained by the Bureau International des Poids et Mesures (BIPM). It is also known a "Z time" or "Zulu Time". More about UTC, and a table to convert UTC to your local time is posted at: http://www.srh.noaa.gov/srh/jetstream/doppler/radarfaq.htm#utc

	National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Coordinated+Universal+Time
County Warning Area (CWA)	The group of counties for which a National Weather Service (NWS) Weather Forecast Office (WFO) is responsible for issuing warnings. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=County+Warning+Area
Crosswise Vorticity	The component of the vorticity vector that is perpendicular to the flow velocity vector. *See also* streamwise vorticity, helicity. American Meteorological Society, cited 2025: Crosswise Vorticity. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Crosswise_vorticity]
Debris Cloud	A rotating "cloud" of dust or debris, near or on the ground, often appearing beneath a condensation funnel and surrounding the base of a tornado. This term is similar to dust whirl, although the latter typically refers to a circulation which contains dust but not necessarily any debris. A dust plume, on the other hand, does not rotate. Note that a debris cloud appearing beneath a thunderstorm will confirm the presence of a tornado, even in the absence of a condensation funnel. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Debris+Cloud
Deep Convergence Zone (DCZ)	A narrow interface of high shear and turbulence found along the leading edge of both the rear and forward flank gust fronts of a high precipitation (HP) supercell that extends vertically though midlevels of the storm (~10 km/ 33 kft). The DCZ behaves like a “fluid wall” separating the major storm drafts; dry, potentially cold mid-level inflow feeding downdraft on one side and very warm, moist, low-level inflow feeding the updraft on the other side. Air stream mixing is effectively confined to this narrow zone which shields the supercell updraft from destructive mixing effects and allows the undiluted updraft to approach parcel theory values supportive of significant and often giant hail. This feature is also known as an Updraft/Downdraft Convergence Zone (UDCZ)
Deep Moist Convection (DMC)	A subset of convection in which air parcels rise above their level of free convection (LFC) to release convective instability through a substantial fraction of the depth of the troposphere in the form of a cumulonimbus cloud.
Deep-Layer Vertical Shear	The vertical wind shear through the lowest half of a deep, moist convective storm. It is best determined using the effective bulk vertical shear, but often the 0-6 km bulk shear is used for simplicity.

Derecho	A widespread convectively induced straight-line windstorm. Specifically, the term is defined as any family of particularly damaging downburst clusters produced by a mesoscale convective system. Such systems have sustained bow echoes with book-end vortices and/or rear-inflow jets and can generate considerable damage from straight-line winds. Damage must be incurred either continuously or intermittently over a swath of at least 650 km (~400 mi) and a width of approximately 100 km (~60 mi) or more. The term derecho derives from a Spanish word that can be interpreted as "straight ahead" or "direct" and was chosen to discriminate between wind damage caused by tornadoes, which have rotating flow, from straight-line winds. More specific guidelines for identifying derechos are suggested in the references below. These guidelines are subject to change with improvements in observing systems, particularly with severe wind measuring and reporting capabilities. Corfidi, S. F., M. C. Coniglio, A. E. Cohen, and C. M. Meade, 2016: A proposed revision to the definition of “derecho.” *Bull. Amer. Meteror. Soc.*, **97**, 935–949, doi:10.1175/BAMS-D-14-00254.1. Johns, R. H., and W. D. Hirt, 1987: Derechos: Widespread convectively induced windstorms. *Wea. Forecasting*, **2**, 32–49, doi:10.1175/1520-0434(1987)002<0032:DWCIW>2.0.CO;2. American Meteorological Society, cited 2025: Derecho. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Derecho]
Differential Reflectivity (ZDR)	The ratio of radar reflectivity measured by means of two signals that differ in one attribute, for example, polarization or wavelength. As applied to polarimetric radar observations, the differential reflectivity is the ratio of the reflectivity observed with transmitted and received signals of horizontal polarization to that observed with signals of vertical polarization. It is commonly represented by the symbol Z_{DR}. The ratio of radar reflectivity measured with two signals of different wavelength is more commonly described as the dual-wavelength ratio. American Meteorological Society, cited 2025: Differential Reflectivity (ZDR). Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Differential_reflectivity]
Downburst	An area of strong, often damaging, winds produced by one or more convective downdrafts. Downbursts over horizontal spatial scales ≤ 4 km are referred to as microbursts, whereas larger events with horizontal spatial scales > 4 km are termed macrobursts.

	American Meteorological Society, cited 2025: Downburst. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Downburst]
Downdraft	Small-scale downward moving air current in a cumulonimbus cloud. *See also* draft. American Meteorological Society, cited 2025: Downdraft. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Downdraft]
Downshear	In the same direction as the shear vector within a specified layer. *Compare* upshear.
Downwind	The direction toward which the wind is blowing; with the wind. *See also* upwind. American Meteorological Society, cited 2025: Downwind. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Downwind]
Dual-Polarization Radar	A radar capable of transmitting and receiving two orthogonal polarizations. The transmitted polarization must be switchable at a rate that is fast compared with the timescale of changes in the scattering properties of the target and the propagation medium. *Compare* dual-channel radar, polarimetric radar, polarization-diversity radar. American Meteorological Society, cited 2025: Dual-Polarization Radar. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Dual-polarization_radar]
Dust Devil	A well-developed dust whirl; a small but vigorous whirlwind, usually of short duration, rendered visible by dust, sand, and debris picked up from the ground. Dust devils are occasionally strong enough to cause minor damage (up to EF0 on the Enhanced Fujita scale). Diameters range from about 3 m to greater than 30 m; their average height is about 200 m, but a few have been observed as high as 1 km or more. They have been observed to rotate anticyclonically as well as cyclonically. Although the vertical velocity is predominantly upward, the flow along the axis of large dust devils may be downward. Large dust devils may also contain secondary vortices. Dust devils are best developed on a hot, calm afternoon with clear skies, in a dry region when intense surface heating causes a very steep lapse rate of temperature in the lowest 100 m of the atmosphere.

	American Meteorological Society, cited 2025: Dust Devil. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Dust_devil]
Dust Plume	A non-rotating "cloud" of dust raised by straight-line winds. Often seen in a microburst or behind a gust front. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Dust+Plume
Dust Whirl	(*Also called* dancing dervish, dancing devil, devil, satan, shaitan; and, over desert areas, desert devil, sand auger, sand devil.) A rapidly rotating column of air (whirlwind) over a dry and dusty or shady area, carrying dust, leaves, and other light material picked up from the ground. When well developed it is known as a dust devil. Dust whirls typically form as the result of strong convection during sunny, hot, calm summer afternoons. This type is generally several meters in diameter at the base, narrowing for a short distance upward and then expanding again, like two cones apex to apex. Their height varies; normally it is only 30–100 m, but in hot desert country it may be as high as 1 km. Rotation may be either clockwise or counterclockwise. Dust whirls move erratically, from one patch of heated air to another, and generally slowly. In desert country it is not unusual for three or more desert devils to be visible at the same time. Another type of vigorous dust whirl occurs under the bases of cumulonimbus or cumulus clouds, almost always on or near a wind-shift line. These vortices often inflict little or no damage and are short- lived, but occasionally represent the first visible sign of a developing tornado. Another form of dust whirl, often seen at street corners, is merely an eddy caused by the meeting of winds blowing along two intersecting streets. Such whirls are small and very short-lived. *Compare* duststorm. American Meteorological Society, cited 2025: Dust Whirl. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Dust_whirl]
Echo	In radar, a general term for the appearance, on a radar display, of the radio signal scattered or reflected from a target. The characteristics of a radar echo are determined by 1) the waveform, frequency, and power of the incident wave; 2) the range and velocity of the target with respect to the radar; and 3) the size, shape, and composition of the target. *See also* target signal, blip. American Meteorological Society, cited 2025: Echo. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Echo]

Echo Overhang	In the radar echo associated with a severe thunderstorm, the portion of the echo that is located above the weak-echo region on the low-altitude inflow side of the storm. The overhang consists of precipitation particles diverging from the storm's summit that descend as they are carried downwind. If the storm echo develops a bounded weak-echo region, it is found within the echo overhang. American Meteorological Society, cited 2025: Echo Overhang. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Echo_overhang]
Echo Top	The height above ground of the center of the radar beam using the tilt, or scan, that contains the highest elevation where reflectivities greater than 18 dBZ can be detected. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Echo+Top
Elevated Convection	Convection that originates from an atmospheric layer above the boundary layer. American Meteorological Society, cited 2025: Elevated Convection. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Elevated_convection]
Enhanced Fujita (EF) Scale	(Also known as the EF scale.) A six-level numerical, damage-based classification of estimated wind speeds. Following suspected high-wind events, affected areas are surveyed to provide an EF-scale rating. These high-wind events are typically tornadoes. However, the EF scale has also been applied to downbursts and tropical cyclones. Investigators determine an EF-scale rating using its primary methodology whereby wind speeds are estimated by assigning degrees of damage (DoD; DoDs typically range from first visible damage up to complete destruction, with higher specified wind speeds linked with increasing incremental amounts of observed damage) for various damage indicators (DI; there are 26 anthropogenic DIs, such as residences, strip malls, and motels, along with hardwood and softwood trees). For tornadoes, these maximum wind speed estimates are used to determine the operational EF-scale rating, as shown in Table 1. Traditionally, an EF-scale rating depends on damage to an established DI and may not be representative of true maximum wind speeds, especially in areas lacking DIs. Table 1: EF-scale wind speed ranges as a function of rating. The wind speeds correspond to an estimated 3-s gust at 10 m AGL. Wind speed ranges are given in meters per second, with the equivalent ranges in miles per hour in parentheses.

EF-scale classes	Wind speed
EF0	29-38 (65–85)
EF1	38-49 (86–110)
EF2	50-60 (111–135)
EF3	61-74 (136–165)
EF4	74-89 (166–200)
EF5	>89 (200)

Gradations of damage ranging from EF0 (in upper-left corner) to EF5 (in lower-right corner). EF-scale ratings have been assigned to select one- and two-family houses.
Image courtesy of T. Marshall.

The correspondence of wind speed to damage was determined using linear regression of the data points relating wind speeds, the Fujita scale (F scale) categories, and damage obtained via an "expert elicitation" process. The EF scale was created to improve the wind speed–to-damage relationship, increase the number of DIs (28), maintain continuity with tornadoes rated with the F scale, and allow future modifications. In 2007, the U.S. National Weather Service adopted the EF scale, supplanting the F scale. Other countries (e.g., Canada and France) have also adopted the EF scale, but with minor modifications.

Reference: Edwards, R., J. G. LaDue, J. T. Ferree, K. Scharfenberg, C. Maier, and W. L. Coulbourne, 2013: Tornado intensity estimation: Past, present, and future. *Bull. Amer. Meteor. Soc.*, **94**, 641–653.

	American Meteorological Society, cited 2025: Enhanced Fujita Scale. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Enhanced_Fujita_Scale]
Enhanced "V"	A signature on infrared satellite imagery that depicts a warm, wedge-shaped region stretching from the upshear edge of a thunderstorm anvil, downshear along its long axis. This so-called warm wake is surrounded by long, narrow regions of colder pixels along either side, forming an apparent V shape. The warmer pixels may be stratospheric cirrus "blow-off" from overshooting tops, meaning that they are higher than the mean anvil height, even though they are warmer. American Meteorological Society, cited 2025: Enhanced "V". Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Enhanced_%22v%22]
Enhanced Wording	1. An option used by the SPC in tornado and severe thunderstorm watches when the potential for strong/violent tornadoes, or unusually widespread damaging straight-line winds, is high. The text that accompanies a watch of this type will include the line "THIS IS A PARTICULARLY DANGEROUS SITUATION." 2. Strong wording or emphasis used in a zone forecast issued by a National Weather Service Forecast Office highlighting a potential condition (e.g., "some thunderstorms may be severe"). National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Enhanced+Wording
Entrainment	1. In meteorology, the mixing of environmental air into a preexisting organized air current so that the environmental air becomes part of the current; the opposite of detrainment. Entrainment of air into clouds, especially cumulus, is said to be inhomogeneous when the timescale for mixing of environmental air is very much greater than the timescale for drop evaporation. Under these conditions, which are often found when environmental air is first entrained into cumulus, regions of cloud and entrained air are intertwined, with evaporation occurring only on the edges of the interface between the cloudy and entrained environmental air. 2. The process by which turbulent fluid within a mixed layer incorporates adjacent fluid that is nonturbulent, or much less turbulent; thus entrainment always proceeds toward the nonturbulent layer. In the absence of advection effects, this tends to deepen the mixed layer.

	American Meteorological Society, cited 2025: Entrainment. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Entrainment]
Entrainment Zone	(*Also called* entrainment layer.) A layer of intermittent turbulence and overshooting thermals at the top of the convective mixed layer where the free atmosphere is entrained into the top of the boundary layer. The entrainment zone is thinner when a stronger temperature inversion caps the boundary layer and thicker when turbulence and thermals are more vigorous. American Meteorological Society, cited 2025: Entrainment Zone. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Entrainment_zone]
Family of Tornadoes	A sequence of long-lived tornadoes produced by a "cyclic" supercell storm. Tornadoes touch down at quasi-regular intervals (typically 45 min). Usually a new tornado develops in a new mesocyclone just after an old tornado has decayed in an old, occluded neighboring mesocyclone. Sometimes, two successive tornadoes may overlap in time for a few minutes. The two mesocyclones may rotate partially around each other. If the damage tracks of the tornadoes appear to form a wavy broken line, the family is classified as a series mode. In the more common parallel-mode family, the damage tracks are parallel arcs with each new tornado forming on the right side of its predecessor. The parallel mode is subcategorized into left turn and right turn, according to the direction in which the paths curve. Davies–Jones, R. 1986. Tornado dynamics. Thunderstorm Morphology and Dynamics. E. Kessler, Ed., Univ. of Okla. Press, p. 223. American Meteorological Society, cited 2025: Family of Tornadoes. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Family_of_tornadoes]
Flanking Line	An organized lifting zone of cumulus and towering cumulus clouds, connected to and extending outward from the mature updraft tower of a supercell or strong multicell convective storm. The flanking line often has a stair-step appearance, with the tallest clouds adjacent to the mature updraft tower. American Meteorological Society, cited 2025: Flanking Line. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Flanking_line]
Flash Flood	Flooding caused by rapidly rising water level in streams, creeks, rivers, or other waterways, normally dry stream beds, or in urban

	areas, usually as a result of intense rainfall over a relatively small area or for moderate to intense rainfall over highly saturated or impervious land surfaces, and generally occurring within minutes to several hours of the rainfall event. Steep terrain tends to concentrate runoff into streams very quickly and is often a contributing factor. Changes in soil properties (e.g., burn areas from wildfires), hydrophobic or impervious soils, removal of surface vegetation, and excess runoff from warm rainfall on significant snowpack can also be important contributors. Additional causes of flash floods include ice jams and levee and dam failures. American Meteorological Society, cited 2025: Flash Flood. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Flash_flood]
Flash Flood Guidance (FFG)	Forecast guidance produced by the National Weather Service (NWS) River Forecast Centers (RFCs), often model output, specific to the potential for flash flooding (e.g., how much rainfall over a given area will be required to produce flash flooding). National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Flash+Flood+Guidance
Flash Flood Statement (FFS)	In hydrologic terms, a statement by a National Weather Service (NWS) Weather Forecast Office (WFO) which provides follow-up information on flash flood watches and warnings. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Flash+Flood+Statement
Flash Flood Warning	Issued to inform the public, emergency management, and other cooperating agencies that flash flooding is in progress, imminent, or highly likely. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Flash+Flood+Warning
Flash Flood Watch	Issued to indicate current or developing hydrologic conditions that are favorable for flash flooding in and close to the watch area, but the occurrence is neither certain or imminent. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Flash+Flood+Watch
Forward Flank Downdraft (FFD)	The main region of downdraft in the forward, or leading, part of a supercell, where most of the heavy precipitation is. *See also* rear flank downdraft (RFD).

	National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Forward+Flank+Downdraft
Frontogenesis	1. The initial formation of a front or frontal zone. 2. In general, an increase in the horizontal gradient of an airmass property, principally density, and the development of the accompanying features of the wind field that typify a front. American Meteorological Society, cited 2025: Frontogenesis. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Frontogenesis]
Frontolysis	1. The dissipation of a front or frontal zone. 2. In general, a decrease in the horizontal gradient of an air mass property, principally density, and the dissipation of the accompanying features of the wind field. American Meteorological Society, cited 2025: Frontolysis. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Frontolysis]
Funnel Cloud	A condensation cloud, typically funnel-shaped and extending outward from a cumuliform cloud, associated with a rotating column of air (a vortex) that may or may not be in contact with the surface. If the rotation is violent and in contact with the surface, the vortex is a tornado. Funnel clouds can occur through a variety of processes in association with convection. For example, small funnel clouds are infrequently seen extending from small, dissipating cumulus clouds in environments with significant vertical wind shear in the cloud-bearing layer. Bluestein, H. 1994. High-based funnel clouds in the Southern Plains. Mon. Wea. Rev.. 122. 2631–2638. American Meteorological Society, cited 2025: Funnel Cloud. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Funnel_cloud]
Graupel	Precipitation in the form of white, opaque ice particles that are easily crushed and typically have a diameter of 2 mm or more. They often fall in shower form, rebounding when they impact a hard surface and commonly breaking apart. Graupel forms from the accretion of supercooled droplets collected on what is initially a falling ice crystal, freezing on impact and leading to the formation of rime on the surface of the ice crystal. Its shape can vary and largely depends on how it forms and falls, e.g., lump or round graupel usually develops from frozen drops and/or tumbling during the growth process, while conical graupel typically forms from snow and the accretion of rime on the bottom of the falling particle.

	Also referred to as snow pellets in operations. American Meteorological Society, cited 2025: Graupel. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Graupel]
Gust Front	The leading edge of a mesoscale pressure dome separating the outflow air in a convective storm from the environmental air. This boundary, which is marked by upward motion along it and downward motion behind it, is followed by a surge of gusty winds on or near the ground. A gust front is often associated with a pressure jump, wind shift, temperature drop, and sometimes with heavy precipitation. Gust fronts are often marked by arcus clouds. American Meteorological Society, cited 2025: Gust Front. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Gust_front]
Gustnado	Colloquial expression for a short-lived, shallow, generally weak, vertically oriented vortex found along a gust front. Gustnadoes are usually visualized by a rotating dust or debris cloud. American Meteorological Society, cited 2025: Gustnado. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Gustnado]
Hail	Precipitation in the form of balls or irregular lumps of ice, always produced by convective clouds, nearly always cumulonimbus. An individual unit of hail is called a hailstone. By convention, hail has a diameter of 5 mm or more, while smaller particles of similar origin, formerly called small hail, may be classed as either ice pellets or snow pellets. Thunderstorms that are characterized by strong updrafts, large liquid water contents, large cloud-drop sizes, and great vertical height are favorable to hail formation. The destructive effects of hailstorms upon plant and animal life, buildings and property, and aircraft in flight render them a prime object of weather modification studies. In aviation weather observations, hail is encoded A. American Meteorological Society, cited 2025: Hail. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Hail]
Hail Growth Zone	The region of supercooled water within a deep, moist, convective storm where hailstone growth is maximized, approximately the -10°C to -30°C layer. The growth rate is maximized near -13°C and rapidly diminishes at temperatures approaching -30°C as supercooled water droplets become rare at these colder temperatures.
Helicity	One-half the scalar product of the velocity and vorticity vectors.

	It is a conserved quantity if the flow is inviscid and homogeneous in density, but is not conserved in more general viscous flows with buoyancy effects. The concept is useful in understanding severe convective storms and tornadoes, since in strong updrafts the velocity and vorticity vectors tend to be aligned, yielding high helicity. Three-dimensional turbulence containing a nonzero mean value of helicity may develop an inertial decay range, but the development is slowed by helicity. The reluctance of helical turbulence to cascade into an inertial range means that small-scale atmospheric flows with high helicity are less unstable and more predictable than small-scale flows with low helicity. *See also* storm-relative environmental helicity, streamwise vorticity. American Meteorological Society, cited 2025: Helicity. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Helicity]
High Precipitation (HP) Supercell	A sub-category of supercell (also called an HP storm) is a highly efficient precipitation producer that develops and maintains precipitation-filled rear flank downdrafts (RFDs) that often envelop the mesocyclones. This makes visual identification of any embedded tornadoes difficult and very dangerous. HP supercells often produce large damaging hail, extreme and prolonged downbursts, and flash flooding.
Hodograph	In general (mathematics), the locus of one end of a variable vector as the other end remains fixed. A common hodograph (or hodogram) in meteorology represents the vertical distribution of the horizontal wind. American Meteorological Society, cited 2025: Hodograph. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Hodograph]
Hook Echo	A pendant, curve-shaped region of reflectivity caused when precipitation is drawn into the cyclonic spiral of a mesocyclone. The hook echo is a fairly shallow feature, typically extending only up to 3–4 km in height before becoming part of a bounded weak echo region (BWER). Fujita, T. 1958. Mesoanalysis of the Illinois tornadoes of 9 April 1953. J. Meteor.. 15. 288–296. American Meteorological Society, cited 2025: Hook Echo. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Hook_echo]
Hydrometeor	Any product of condensation or deposition of atmospheric water vapor, whether formed in the free atmosphere or at the earth's surface; also, any water particle blown by the wind from the earth's surface.

	Hydrometeors may be classified in a number of different ways, of which the following is one example: 1) liquid or solid water particles formed and remaining suspended in the air, for example, damp (high relative humidity) haze, cloud, fog, ice fog, and mist; 2) liquid precipitation, for example, drizzle and rain; 3) freezing precipitation, for example, freezing drizzle and freezing rain; 4) solid (frozen) precipitation, for example, snow, hail, ice pellets, snow pellets (soft hail, graupel), snow grains, and ice crystals; 5) falling particles that evaporate before reaching the ground, for example, virga; 6) liquid or solid water particles lifted by the wind from the earth's surface, for example, drifting snow, blowing snow, and blowing spray. American Meteorological Society, cited 2025: Hydrometeor. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Hydrometeor]
Infiltration	The passage of water through the soil surface into the soil. American Meteorological Society, cited 2025: Infiltration. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Infiltration]
Infiltration Capacity	Maximum volumetric rate at which water can be absorbed by a porous material, per unit area, under given conditions. American Meteorological Society, cited 2025: Infiltration Capacity. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Infiltration_capacity]
Infiltration Index	Rate of infiltration calculated from records of rainfall and runoff. There are alternative values depending on the method of calculation. American Meteorological Society, cited 2025: Infiltration Index. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Infiltration_index]
Infiltration Rate	The rate at which a liquid enters a porous material, expressed as volumetric rate per unit area. American Meteorological Society, cited 2025: Infiltration Rate. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Infiltration_rate]
Inflow Bands	Bands of low clouds, arranged parallel to the low-level winds and moving into or toward a thunderstorm. They may indicate the strength of the inflow of moist air into the storm, and, hence, its potential severity. Spotters should be especially wary of inflow bands that are curved in a manner suggesting cyclonic rotation; this pattern may indicate the presence of a mesocyclone. National Weather Service Glossary, cited 2025.

	https://forecast.weather.gov/glossary.php?word=Inflow+Bands
Inflow Jet	Local jets of air near the surface flowing inward toward the base of a tornado. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Inflow+Jet
Inflow Notch	A radar signature characterized by an indentation in the reflectivity pattern on the inflow side of the storm. The indentation often is V-shaped, but this term should not be confused with V-notch. Supercell thunderstorms often exhibit inflow notches, usually in the right quadrant of a classic supercell, but sometimes in the eastern part of an HP storm or in the rear part of a storm (rear inflow notch). National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Inflow+Notch
Intercell Seeding	A method of feeding hydrometeors to the main updraft(s) of a deep, moist, convective storm by flanking lines or recycling. It improves precipitation efficiency because cells share hydrometeors while the environmental humidity increases. Multicell storms whose updrafts recycle hydrometeors are more efficient than more discrete cells.
Internal Dynamics (ID) Method	(*Also called* Bunker's Method, Bunker's Motion). A method for estimating supercell motion which uses the mechanisms by which updraft and shear interact. It can be used to calculate storm motion for both the cyclonically and anticyclonically rotating supercells resulting from a storm split. Supercell motion is approximately 7.5 m/s right and left of the deep-layer shear vector along a line that passes through the point describing the mean convective steering layer flow.
Katafront	A front (usually a cold front) at which the warm air descends the frontal surface (except, presumably, in the lowest layers). *Compare* anafront. American Meteorological Society, cited 2025: Katafront. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Katafront]
KDP Column	A dual-polarimetric radar signature of specific differential phase (KDP) values > 2-3°/km caused by high concentrations of liquid water in a convective cell.*See also* ZDR column, KDP column.
Kinematics	The branch of dynamics that describes the properties of pure motion without regard to force, momentum, or energy. Translation, advection, vorticity, and deformation are examples of kinematic variables. American Meteorological Society, cited 2025: Kinematics. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Kinematics]

Lag	1) The measure of the time between the center of mass of precipitation to the center of mass of runoff (on the hydrograph); basin lag is a function of not only basin characteristics, but also of storm intensity and movement. Some hydrologic texts define lag from the center of mass of rainfall to the hydrograph peak. 2) The time it takes a flood wave to move downstream. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Lag
Landspout	1. (Rare.) A tornado. 2. Colloquial expression describing tornadoes occurring with a parent cloud in its growth stage and with its vorticity originating in the boundary layer. The parent cloud does not contain a preexisting midlevel mesocyclone. The landspout was so named because it looks like a weak, Florida Keys waterspout over land. *See* nonsupercell tornado. Bluestein, H. B. 1985. The formation of a "landspout" in a "broken-line" squall line in Oklahoma. Preprints, 14th Conf. on Severe Local Storms. Indianapolis, . 267–270. American Meteorological Society, cited 2025: Landspout. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Landspout]
Left Mover	A thunderstorm which moves to the left relative to the steering winds, and to other nearby thunderstorms; often the northern part of a splitting storm. *Compare* right mover. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Left+Mover
Level of Free Convection (LFC)	(Abbreviated LFC.) The level at which a parcel of air lifted dry-adiabatically until saturated and saturation-adiabatically thereafter would first become warmer than its surroundings in a conditionally unstable atmosphere. On a thermodynamic diagram the level of free convection is given by the point of intersection of the process curve, representing the process followed by the ascending parcel, and the sounding curve, representing the lapse rate of temperature in the environment. From the level of free convection to the point where the ascending parcel again becomes colder than its surroundings the atmosphere is characterized by latent instability. Throughout this region the parcel will gain kinetic energy as it rises. *See* conditional instability, convective condensation level;

	compare level of free sink. American Meteorological Society, cited 2025: Level of Free Convection. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Level_of_free_convection]
Level of Neutral Buoyancy	(*Also called* equilibrium level.) The level at which an air parcel, rising or descending adiabatically, attains the same density as its environment. American Meteorological Society, cited 2025: Level of Neutral Buoyancy. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Level_of_neutral_buoyancy]
Lifting Condensation Level (LCL)	(Abbreviated LCL; *also called* isentropic condensation level.) The level at which a parcel of moist air lifted dry-adiabatically would become saturated. On a thermodynamic diagram it is located at the point of intersection of the dry adiabat through the point representing the parcel's original pressure and temperature with the saturation mixing ratio line having the same value of the mixing ratio as the parcel. The pressure and temperature at the lifting condensation level are usually called the condensation pressure and condensation temperature, respectively, and the corresponding point on a thermodynamic diagram is called either the characteristic point, adiabatic saturation point, or adiabatic condensation point. *See* convective condensation level, conditional instability, saturation level. American Meteorological Society, cited 2025: Lifting Condensation Level. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Lifting_condensation_level]
Line Echo Wave Pattern (LEWP)	(Abbreviated LEWP.) A special configuration in a line of convective storms that indicates the presence of a low pressure area and the possibility of damaging winds and tornadoes. In response to very strong outflow winds behind it, a portion of the line may bulge outward forming a bow echo. Nolen, R. H. 1959. A radar pattern associated with tornadoes. Bull. Amer. Meteor. Soc.. 40. 277–279. American Meteorological Society, cited 2025: Line Echo Wave Pattern. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Line_echo_wave_pattern]
Liquid Water Loading	The amount of liquid water present within an air parcel as cloud droplets, rain, or ice, usually expressed in percent or fraction by weight (e.g., as a liquid water mixing ratio r_L) or volume.

	The higher the liquid water loading, the greater the average density and colder the virtual temperature of the parcel. American Meteorological Society, cited 2025: Liquid Water Loading. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Liquid_water_loading]
Loaded Gun (Sounding)	[Slang], a sounding characterized by extreme instability but containing a cap, such that explosive thunderstorm development can be expected if the cap can be weakened or the air below it heated sufficiently to overcome it. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Loaded+Gun+(Sounding)
Low CC column	A dual-pol radar signature used to identify a deep, moist, convective updraft. It appears as an upward extension of the low (< 0.8) Correlation Coefficient (CC) clear air boundary layer echoes into the updraft. The echo is associated with scattering from flying insects, light vegetative debris, and other non-meteorological scatterers. *See also* ZDR column, KDP column.
Low CC Inflow	A dual-pol radar signature of low (< 0.8) Correlation Coefficient (CC) clear air boundary layer echoes that help demarcate the inflow into a deep, moist, convective updraft. The echo is associated with scattering from flying insects, light vegetative debris, and other non-meteorological scatterers.
Low CC Ring	A dual-polarimetric radar signature of low (< 0.8) Correlation Coefficient (CC) echoes located at the periphery of a persistent updraft in a sheared environment, just above the freezing level, caused by mixed-phase precipitation which forms as a result of melting between the environment and the updraft. *See also* ZDR ring.
Low-Echo Centroid (LEC) Signature	A radar signature in which the greatest reflectivity of a mature cell is below the freezing (0°C) level.
Low-Level	The lower portion of the troposphere. No distinct limit is set, but the term can generally be applied to the levels 850 mb and below. *Compare* midlevel. *See also* upper air.
Low-Level Jet (LLJ)	(Abbreviated LLJ; also called low-level jet stream.) A jet stream that is typically found in the lower 2–3 km of the troposphere. At night, sometimes called a nocturnal jet. Examples are the African jet and the Somali jet. American Meteorological Society, cited 2025: Low Level Jet. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Low-level_jet]

Low-Level Rotational Velocity (LLDV)	The velocity difference (DV) measured in the lowest radar elevation slice calculated by adding the absolute magnitudes of the lowest and highest radial velocities found within a storm-scale vortex signature (typically a mesocyclone, tornado vortex signature, or tornado signature).
Low Precipitation (LP) Supercell	(Also called a dryline storm) A sub-category of supercell which is dominated by updraft with little precipitation reaching the ground. It is visualized by an exposed updraft and a translucent to nearly transparent precipitation core. Low-level mesocyclones and tornadoes are rare owing to the lack of a well-defined rear flank downdraft (RFD). Most of the precipitation is carried well downstream of the updraft by strong (>30 m/s or 58 kt) anvil-layer winds.
Macroburst	A downburst on the mesoscale. Bow echoes are often associated with macrobursts. *See also* microburst. American Meteorological Society, cited 2025: Macroburst. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Macroburst]
Macroscale	Meteorological expression referring to synoptic events occurring on a scale of thousands of kilometers, such as warm and cold fronts. *Compare* mesoscale, microscale. American Meteorological Society, cited 2025: Macroscale. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Macroscale]
Maximum Delta V (MDV)	The maximum velocity difference (DV) for all Doppler radar elevation slices containing a TS/TVS.
Melting Layer	The altitude interval throughout which ice-phase precipitation melts as it descends. The top of the melting layer is the melting level. The melting layer may be several hundred meters deep, reflecting the time it takes for all the hydrometeors to undergo the transition from solid to liquid phase. The temperature of the melting layer is typically 0°C or slightly warmer. *See* bright band. American Meteorological Society, cited 2025: Melting Layer. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Melting_layer]
Meltwater	The water released by the melting of snow or ice, including hail.
Mesocyclogenesis	Any development or strengthening of a mesocyclone.
Mesocyclone	A cyclonically rotating vortex, around 2–10 km in diameter, in a convective storm.

	The vorticity associated with a mesocyclone is often on the order of 10^{-2} s^{-1} or greater. (It should be noted that a mesocyclone is not just any cyclone on the mesoscale; it refers specifically to cyclones within convective storms.) Mesocyclones are frequently found in conjunction with updrafts in supercells. Tornadoes sometimes form in mesocyclones. Persistent mesocyclones that have significant vertical extent are detected by Doppler radar as mesocyclone signatures. Tornado warnings may be issued when a mesocyclone signature is detected. American Meteorological Society, cited 2025: Mesocyclone. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Mesocyclone]
Mesocyclone Signature	The Doppler velocity pattern of a mesocyclone within a severe thunderstorm. In a storm-relative reference frame, the idealized signature is symmetric about the radar viewing direction with marked azimuthal shear across the core region between peak Doppler velocity values of opposite sign. Typical signatures consist of Doppler velocity differences of 25– 75 m s^{-1} across core diameters of 2–8 km, with resulting azimuthal shear values of 5×10^{-3} s^{-1} to 2×10^{-2} s^{-1}. American Meteorological Society, cited 2025: Mesocyclone Signature. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Mesocyclone_signature]
Mesocyclonic Tornado	A tornado that is associated with a mesocyclone. Also called a "supercell tornado." *Compare* non-mesocyclonic tornado.
Mesohigh	A mesoscale area of high atmospheric pressure that typically forms beneath a multicell thunderstorm. It is usually associated with a mesoscale convective system (MCS) or its remnants.*Compare* mesolow.
Mesolow	A low pressure area on the mesoscale. It has been used to refer both to features observed within convective storms and features even larger in scale. American Meteorological Society, cited 2025: Mesolow. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Mesolow]
Mesoscale	Pertaining to atmospheric phenomena having horizontal scales ranging from a few to several hundred kilometers, including thunderstorms, squall lines, fronts, precipitation bands in tropical and extratropical cyclones, and topographically generated weather systems such as mountain waves and sea and land breezes.

	From a dynamical perspective, this term pertains to processes with timescales ranging from the inverse of the Brunt–Väisälä frequency to a pendulum day, encompassing deep moist convection and the full spectrum of inertio-gravity waves but stopping short of synoptic-scale phenomena, which have Rossby numbers less than 1. American Meteorological Society, cited 2025: Mesoscale. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Mesoscale]
Mesoscale Beta Elements (MBE) Technique	A procedure used to forecast the short-term (3-6 hour) motion of Mesoscale Convective System (MCS) centroids which builds on the long-established observation that MCS motion is a function of both the advection of existing cells by the mean wind and the propagation of new cells relative to existing storms. MCS centroid forecast motion is calculated to be the vector sum of the mean cloud-layer wind (typically assumed to be the 850-300 mb layer) and the mesoscale beta element (MBE) propagation component. The MBE propagation vector is dictated by the location of the maximum cold-pool gust front convergence in the presence of conditional instability. For an upwind (downwind) propagating MCS, the magnitude and direction is assumed to be equal and opposite (identical) to that of the low-level jet (typically assumed to be the 850 mb wind). Corfidi, Stephen F., 2003: Cold Pools and MCS Propagation: Forecasting the Motion of Downwind-Developing MCSs. Wea. Forecasting, 18, 997–1017.
Mesoscale Convective Complex (MCC)	(Abbreviated MCC.) A subset of mesoscale convective systems (MCS) that exhibit a large, circular (as observed by satellite), long-lived, cold cloud shield. The cold cloud shield must exhibit the following physical characteristics. Size: A - Cloud shield with continuously low infrared (IR) temperature ≤ -32°C must have an area ≥ 10^5 km^2; and B - Interior cold cloud region with temperature ≤ -52°C must have an area ≥ 0.5 X 10^5 km^2. Initiate: Size definitions A and B are first satisfied Duration: Size definitions A and B must be met for a period ≥ 6 h. Maximum extent: Contiguous cold cloud shield (IR temperature ≤ -33°C) reaches maximum size. Shape: Eccentricity (minor axis/major axis) ≥ 0.7 at time of maximum extent.

	Terminate: Size definitions A and B no longer satisfied. Alternatively, a dynamical definition of an MCC requires that the system have a Rossby number of order 1 and exhibit a horizontal scale comparable to the Rossby radius of deformation. In midlatitude MCS environments, the Rossby radius of deformation is about 300 km. American Meteorological Society, cited 2025: Mesoscale Convective Complex (MCC). Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Mesoscale_convective_complex]
Mesoscale Convective System (MCS)	(Abbreviated MCS.) A cloud system that occurs in connection with an ensemble of thunderstorms and produces a contiguous precipitation area on the order of 100 km or more in horizontal scale in at least one direction. An MCS exhibits deep, moist convective overturning contiguous with or embedded within a mesoscale vertical circulation that is at least partially driven by the convective overturning. American Meteorological Society, cited 2025: Mesoscale Convective System (MCS). Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Mesoscale_convective_system]
Mesoscale Convective Vortex (MCV)	(Abbreviated MCV) A midlevel, warm-core low pressure center that develops within the stratiform region of a mesoscale convective system (MCS) as a result of latent heat release over a multihour time period. The cyclonic vortex has a diameter ranging from 50 to 200 km (31 to 124 mi) and a depth from 2.5 to 5 km (1.5 to 3.1 mi). An MCV can persist for 12 hours or more after its parent MCS has dissipated. A residual MCV may help initiate a subsequent episode of convection. An MCV that moves into tropical waters can serve as a nucleus for a tropical cyclone. Bartels, D. L., and R. A. Maddox, 1991: Midlevel cyclonic vortices generated by mesoscale convective systems. *Mon. Wea. Rev.*, **119**, 104–118, https://doi.org/10.1175/1520-0493(1991)119%3C0104:MCVGBM%3E2.0.CO;2. Davis, C. A., and M. L. Weisman, 1994: Balanced dynamics of mesoscale vortices produced in simulated convective systems. *J. Atmos. Sci.*, **51**, 2005–2030, https://doi.org/10.1175/1520-0469(1994)051%3C2005:BDOMVP%3E2.0.CO;2. —, and Coauthors, 2004: The Bow Echo and MCV Experiment: Observations and opportunities. *Bull. Amer. Meteor. Soc.*, **85**, 1075–1093, https://doi.org/10.1175/BAMS-85-8-1075.

	American Meteorological Society, cited 2025: Mesoscale Convective Vortex (MCV). Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Mesoscale_convective_vortex]
Microburst	A convective downdraft (downburst) that covers an area less than 4 km along a side with peak winds that last 2–5 minutes. Differential velocity across the divergence center is greater than 10 m s^{-1}. The strong wind shears associated with a microburst can result in aircraft accidents. Microbursts can be wet (contain rain) or dry. Atkins, N. T., and R. M. Wakimoto, 1991: Wet microburst activity over the southeastern United States: Implications for forecasting. *Wea. Forecasting*, **6**, 470–482, https://doi.org/10.1175/1520-0434(1991)006<0470:WMAOTS>2.0.CO;2. American Meteorological Society, cited 2025: Microburst. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Microburst]
Microscale	Atmospheric motions with Lagrangian Rossby numbers greater than 200 or spatial scales 2 km or less. Emanuel, K. A. 1986. Overview and definition of mesoscale meteorology. Mesoscale Meteorology and Forecasting. P. Ray, Ed., Amer. Meteor. Soc., P. 13. Orlanski, I. 1975. A rational subdivision of scales for atmospheric processes. Bull. Amer. Meteor. Soc. 56. 527–530. American Meteorological Society, cited 2025: Microscale. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Microscale]
Mid-Altitude Radial Convergence (MARC) Velocity Signature	A Doppler radar-velocity signature that serves as a precursor to the initial onset of damaging straight-line winds in a deep, moist, convective cell; Quasi-Linear Convective System (QLCS); or bowing convective system. It may also represent the upper portions of a gust front associated with a deep, convergence zone (DCZ).
Mid-level	The middle portion of the troposphere. No distinct limits are set, but the term can generally be applied to levels between 700 mb to 500 mb.*Compare* low-level. *See* also upper air.
Mie Scattering	Any scattering produced by spherical particles whose diameters are greater than 1/10 the wavelength of the scattered radiation. This type of scattering causes the clouds to appear white in the sky. Often, hail exhibits in this type of scattering. American Meteorological Society, cited 2025: Mie Scattering. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Mie_scattering]

Misocyclone	A vertically oriented vortex with a width perpendicular to the axis of rotation of between 40 m and 4 km. It is often used to refer to a small, vertically oriented closed cyclonic circulation that is either 1) embedded within a convective storm, or 2) a near-surface vortex along a horizontal convergence line. Fujita, T. T., 1981. Tornadoes and Downbursts in the Context of Generalized Planetary Scales. *J. Atmos. Sci.*, **38**. 1511–1534, doi:10.1175/1520-0469(1981)038<1511:TADITC>2.0.CO;2. American Meteorological Society, cited 2025: Misocyclone. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Misocyclone]
Mixed Layer (ML)	1. (Abbreviated ML; sometimes called convective mixed layer, convective boundary layer, or mixing layer in air-pollution meteorology.) A type of atmospheric boundary layer characterized by vigorous turbulence tending to stir and uniformly mix, primarily in the vertical, quantities such as conservative tracer concentrations, potential temperature, and momentum or wind speed. Moisture is often not so well mixed, showing a slight decrease with height. The vigorous turbulence can be caused by either strong winds or wind shears that generate mechanical turbulence (called forced convection), or by buoyant turbulence (called free convection) associated with large thermals. The buoyantly generated mixed layers are usually statically unstable, caused by heating at the bottom boundary such as the earth's surface or radiative cooling at the tops of cloud or fog layers within the mixed layer. The terms mixed layer, convective mixed layer, and convective boundary layer commonly imply only the buoyantly stirred layer. During fair weather over land, mixed layers are usually daytime phenomena generated buoyantly, with growth caused by entrainment of free-atmosphere air into the mixed-layer top. *See* mixed-layer depth, entrainment zone, radix layer, uniform layer. American Meteorological Society, cited 2025: Mixed Layer. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Mixed_layer]
Multi-Radar/Multi-Sensor (MRMS)	MRMS is a system with automated algorithms that quickly and intelligently integrate data streams from multiple radars, surface and upper air observations, lightning detection systems, and satellite and forecast models. Numerous two-dimensional multiple-sensor products offer assistance for hail, wind, tornado, quantitative precipitation estimation forecasts, convection, icing, and turbulence diagnosis.

	National Severe Storms Laboratory, cited 2025: Multi-Radar/Multi-Sensor System (MRMS) [https://www.nssl.noaa.gov/projects/mrms/]
Multicell Convective Storm	A convective storm system usually composed of a cluster of ordinary convective cells at various stages of their life cycle. New cells within the convective system are generated primarily by either low-level convergence along a preexisting boundary, or by lifting at the leading edge of the system-scale cold pool that was produced by the previous cells. A Multicell storm may have a lifetime of several hours, and may also have supercells incorporated as a part of the system as well. *See also* cell, ordinary cell, supercell, thunderstorm. American Meteorological Society, cited 2025: Multicell Convective Storm. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Multicell_convective_storm]
Multiple Vortex Tornado	A tornado in which two or more vortices are present at the same time, often rotating about a common center or about each other. Multiple-vortex tornadoes can be especially damaging. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Multiple+Vortex+Tornado
National Hurricane Center (NHC)	One of three branches of the Tropical Prediction Center (TPC). This center maintains a continuous watch on tropical cyclones over the Atlantic, Caribbean, Gulf, and the Eastern Pacific. The Center prepares and distributes hurricane watches and warnings for the general public, and also prepares and distributes marine and military advisories for other users. During the "off-season" NHC provides training for U.S. emergency managers and representatives from many other countries that are affected by tropical cyclones. NHC also conducts applied research to evaluate and improve hurricane forecasting techniques, and is involved in public awareness programs. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=National+Hurricane+Center
National Severe Storms Laboratory (NSSL)	This is one of NOAA's internationally known Environmental Research Laboratories, leading the way in investigations of all aspects of severe weather. Headquartered in Norman OK with staff in Colorado, Nevada, Washington, Utah, and Wisconsin, the people of NSSL, in partnership with the National Weather Service, are dedicated to improving severe weather warnings and forecasts in order to save lives and reduce property damage. National Weather Service Glossary, cited 2025.

	https://forecast.weather.gov/glossary.php?word=National+Severe+Storms+Laboratory
NEXRAD	NEXt Generation RADar. A NWS network of about 140 Doppler radars operating nationwide. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=NEXRAD
Non-Mesocyclonic Tornado	(*Also called* non-supercell tornado). A tornado which is not associated with a mesocyclone. *Compare* mesocyclonic tornado. *See also* landspout, waterspout.
Ordinary Cell	The most basic component of a convective storm, consisting of a single main updraft that is usually quickly replaced by a downdraft once precipitation begins. Ordinary cells are especially observed in environments with weak vertical wind shear, and typically have lifetimes of 30–50 minutes. Ordinary cells are the primary component of multicell storms. *See also* convective cell, multicell convective storm, thunderstorm. American Meteorological Society, cited 2025: Ordinary Cell. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Ordinary_Cell]
Outflow Boundary	A surface boundary formed by the horizontal spreading of thunderstorm-cooled air. Outflow boundaries may intersect with each other or with other features (fronts, low-level jets) and act to focus new convection. Outflow boundaries may be short-lived, or last for longer than a day. *See* gust front. American Meteorological Society, cited 2025: Outflow Boundary. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Outflow_boundary]
Overshooting Top	(*Or* anvil dome, penetrating top.) A domelike protrusion above a cumulonimbus anvil, representing the intrusion of an updraft through its equilibrium level (level of neutral buoyancy). It is usually a transient feature because the rising parcel's momentum acquired during its buoyant ascent carries it past the point where it is in equilibrium; the air within it rapidly becomes negatively buoyant and descends. Tall and persistent overshooting tops are frequently observed with strong or severe thunderstorms in which there is a nearly continuous stream of buoyant updrafts.

	American Meteorological Society, cited 2025: Overshooting Top. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Overshooting_top]
Parameter	In general, any quantity of a problem that is not an independent variable. More specifically, the term is often used to distinguish, from dependent variables, quantities that may be more or less arbitrarily assigned values for purposes of the problem at hand. American Meteorological Society, cited 2025: Parameter. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Parameter]
Parcel	An imaginary volume of fluid to which may be assigned various thermodynamic and kinematic quantities. The size of a parcel is arbitrary but is generally much smaller than the characteristic scale of variability of its environment. American Meteorological Society, cited 2025: Parcel. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Parcel]
Partial Beam Filling	A limitation of the rainfall estimation techniques used by weather radar. At far ranges from the radar, a storm may occupy only a portion of the radar beam (which may be several miles across). However, the radiation received by the radar antenna consists of the average reflectivity across the entire beam, so the reflectivity and associated rainfall rates are underestimated. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Partial+Beam+Filling
Pendant Echo	Radar signature generally similar to a hook echo, except that the hook shape is not as well defined. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Pendant+Echo
Percolation	The gravity flow of water within soil. American Meteorological Society, cited 2025: Percolation. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Percolation]
Precipitation Efficiency	The percentage of the total volume of moisture transported upward to the volume of precipitation received at ground-level over the lifetime of a precipitating system.
Propagation	1. The movement of an atmospheric phenomenon. This term is frequently applied to the motion of thunderstorms into regions favorable for their continued development (into a maritime tropical airmass).

	2. The transmission of electromagnetic energy as waves through or along a medium. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Propagation
Proximity Sounding	Atmospheric properties (i.e. temperature, dew point, and wind) plotted on a thermodynamic diagram (usually a SKEW-T diagram) that represent the atmospheric environment associated with a particular meteorological event such as a tornadic supercell.
Pulse Storm	A thunderstorm within which a brief period (pulse) of strong updraft occurs, during and immediately after which the storm produces a short episode of severe weather. These storms generally are not tornado producers, but often produce large hail and/or damaging winds. See also overshooting top. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Pulse+Storm
Quasi-Linear Convective System (QLCS)	A type of Mesoscale Convective System (MCS) that features a convective line or line segments that are much longer than they are wide.
Radar	(Coined word for radio detection and ranging.) An electronic instrument used for the detection and ranging of distant objects of such composition that they scatter or reflect radio energy. A radar consists of a transmitter, receiver, antenna, display, and associated equipment for control and signal processing. The most common radars are monostatic radars, which use the same antenna for both transmission and reception. These radars depend on backscattering to produce a detectable echo from a target. Bistatic radars have the transmitter and its antenna at one location and the receiver and its antenna at a remote location. These radars depend upon forward scattering to produce a detectable signal. Radio energy emitted by the transmitter and focused by the antenna of a monostatic radar propagates outward through the atmosphere in a narrow beam. Objects lying in the path of the beam reflect, scatter, and absorb the energy. A small portion of the reflected and scattered energy, called the target signal, travels back along the same path through the atmosphere and is intercepted by the receiving antenna. The time delay between the transmitted signal and the target signal is used to determine the distance or slant range of the target from the radar. The direction in which the focused beam is pointing at the instant the target signal is received (i.e., the azimuth and elevation angles of the antenna) determine the direction and height of the target. This information is presented visually as echoes on different types of radar displays. Because hydrometeors scatter radio energy, weather radars, operating in certain radar frequency bands, can detect the presence of precipitation and other weather phenomena at distances up to several hundred kilometers from

<table>
<tr><td></td><td>the radar, depending upon meteorological conditions and the type of radar.MST radars and wind profilers, which operate at longer wavelengths than weather radars, are able to detect echoes from optically clear air that are caused by spatial fluctuations of refractivity. Additional information provided by a radar about a target may include the radial velocity or rate of change of range, as measured by a Doppler radar, or the depolarizing characteristics of the target, as measured by a polarimetric radar.

American Meteorological Society, cited 2025: Radar. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Radar]</td></tr>
<tr><td>Radar Beam</td><td>The focused electromagnetic emissions from a radar antenna.

The beam is defined by the main lobe of the antenna pattern.

American Meteorological Society, cited 2025: Radar beam. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Radar_beam]</td></tr>
<tr><td>Radar Frequency Band</td><td>A frequency band of microwave radiation within which radars operate. The radar frequency bands were first designated by code letters for secrecy during World War II; these letters are still in common use, although the exact frequency intervals to which they apply have undergone some redefinition.
They all fall within the UHF, SHF, and EHF radio frequency bands. The bands normally used for radar detection of precipitation and clouds are the following.

<table>
<tr><th>Frequency band</th><th>Frequency range (GHz)</th><th>Wavelength range (cm)</th></tr>
<tr><td>L band</td><td>1–2</td><td>15–30</td></tr>
<tr><td>S band</td><td>2–4</td><td>7.5–15</td></tr>
<tr><td>C band</td><td>4–8</td><td>3.75–7.5</td></tr>
<tr><td>X band</td><td>8–12</td><td>2.5–3.75</td></tr>
<tr><td>Ku band</td><td>12–18</td><td>1.67–2.5</td></tr>
<tr><td>K band</td><td>18–27</td><td>1.11–1.67</td></tr>
<tr><td>Ka band</td><td>27–40</td><td>0.75–1.11</td></tr>
<tr><td>V band</td><td>40–75</td><td>0.4–0.75</td></tr>
<tr><td>W band</td><td>75–110</td><td>0.27–0.4</td></tr>
</table>

Radars operating in the S, C, and X bands are the ones mainly used for precipitation measurements. Attenuation of the transmitted radio frequency energy by atmospheric gases, precipitation, and cloud particles is severe for all frequency bands higher than X band, and even X band can suffer severe attenuation in heavy rain. Nevertheless, because radars operating in the K, Ka, and W bands are able to detect clouds, they are used for cloud observations even though they are not able to penetrate far through precipitation. Radar wind profilers and MST radars operate at lower frequencies than those included in this table, namely, in the UHF and VHF bands.
Compare radio frequency band.</td></tr>
</table>

	American Meteorological Society, cited 2025: Radar Frequency Band. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Radar_frequency_band]
Radar Mosaic	A radar product that combines information from multiple radars to give a regional or national view of reflectivity or precipitation. An individual NEXRAD radar is limited to a range of about 200 miles. Typically, a mosaic product is produced for regions spanning several hundreds to several thousands of miles. Mosaic products are produced by vendors external to the NEXRAD system. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Radar+Mosaic
Rain Foot	Slang for a horizontal bulging near the surface in a precipitation shaft, forming a foot-shaped prominence. It is a visual indication of a wet microburst. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Rain+Foot
Rain-free Base	A dark, horizontal cloud base with no visible precipitation beneath it. It typically marks the location of the thunderstorm updraft. Tornadoes may develop from wall clouds attached to the rain-free base, or from the rain-free base itself - especially when the rain-free base is on the south or southwest side of the main precipitation area. Note that the rain-free base may not actually be rain free; hail or large rain drops may be falling. For this reason, updraft base is more accurate. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Rain-free+Base
Range Aliasing	(*Also called* range folding.) In radar meteorology, a sampling problem that arises when echoes located beyond the maximum unambiguous range (r_{max}) are received as if they were within this range of the radar. A radar ordinarily computes range to targets by measuring the time interval between the transmission of a pulse and the receipt of the returned signal, assuming that the signal was associated with the pulse just transmitted. However, depending on the pulse repetition frequency, the returned signal may be associated with one of several pulses transmitted prior to the latest one. Therefore, a returned signal, indicated as originating at range r, could have originated at $r + r_{max}$ (second-trip echo), or $r + 2r_{max}$ (third-trip echo), etc. A range-aliased echo from a weather target is sometimes recognizable by a distorted shape. It may appear elongated radially or shrunk in azimuth extent because the radial length is unaffected by aliasing and is a correct measure of the target size while the azimuthal width decreases with increasing range from the radar.

	American Meteorological Society, cited 2025: Range aliasing. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Range_aliasing]
Range Gate	A selectable interval of range (or of time delay from transmission) within which returning radar signals are measured. Gating is used to isolate the echoes from different regions of distributed targets. Contiguous range gates of narrow width, separated by a distance equal to half the transmitted pulse length, are often used in lidar and weather radar systems. Some systems employ as many as a thousand range gates to measure the signals returned along each pointing direction. *See* gating. American Meteorological Society, cited 2025: Range aliasing. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Range_aliasing]
Range Resolution	The least radial separation between two targets in the same direction from a radar that allows them to be distinguished. This separation equals one-half the transmitted pulse length. Targets closer together than this distance are not resolved and appear as a single target on the display. *See* radar resolution. American Meteorological Society, cited 2025: Range Resolution. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Range_resolution]
Range Unfolding	Process of removing range ambiguity in apparent range of a multitrip target on the radar. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Range+Unfolding
Rayleigh Scattering	Changes in directions of electromagnetic energy by particles whose diameters are 1/16 wavelength or less. This type of scattering is responsible for the sky being blue. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Rayleigh+Scattering
Rear Flank Downdraft (RFD)	A region of dry air subsiding on the back side of, and wrapping around, a mesocyclone. It often is visible as a clear slot wrapping around the wall cloud. Scattered large precipitation particles (rain and hail) at the interface between the clear slot and wall cloud may show up on radar as a hook or pendant; thus the presence of a hook or pendant may indicate the presence of an RFD. *See also* forward flank downdraft (FFD).

	National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Rear+Flank+Downdraft
Rear Flank Downdraft Gust Front (RFDGF)	A gust front associated with a rear flank downdraft (RFD).
Rear Flank Downdraft Internal Surge (RFDIS)	A secondary rear flank downdraft (RFD) embedded within a pre-existing RFD. RFDIS events appear to influence tornado development, intensity, and demise by altering the thermodynamic and kinematic character of the RFD region bounding the pretornadic and tornadic circulations.
Rear Flank Downdraft Internal Surge Boundary (RFDISB)	A gust front associated with a rear flank downdraft internal surge (RFDIS).
Rear Inflow Jet (RIJ)	A mesoscale circulation feature in which a system-relative current of air enters and flows through the stratiform precipitation region of mesoscale convective systems from the rear. The rear-inflow jet forms in response to the upshear-tilting of the convective circulation, as the horizontal buoyancy gradients along the back edge of the system create a circulation that draws midlevel air in from the rear. The rear-inflow jet supplies potentially cold and dry midlevel air that aids in the production of convective and system-scale downdrafts. American Meteorological Society, cited 2025: Rear-Inflow Jet. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Rear-inflow_jet]
Rear-Inflow Notch	(*Also called* weak echo channel). A radar signature of a rear inflow jet (RIJ) characterized by an indentation or channel in the reflectivity pattern that originates in the trailing stratiform rainfall region of a squall line near the top of the cold pool and is directed toward the leading edge. *See also* inflow notch.
Right Mover	A thunderstorm that moves appreciably to the right relative to the main steering winds and to other nearby thunderstorms. Right movers typically are associated with a high potential for severe weather. (Supercells often are right movers). *Compare* left mover. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Right+Mover
River Forecast Center (RFC)	Centers that serve groups of Weather Service Forecast offices and Weather Forecast offices, in providing hydrologic guidance and is the first echelon office for the preparation of river and flood forecasts and warnings. National Weather Service Glossary, cited 2025.

	https://forecast.weather.gov/glossary.php?word=River+Forecast+Center
Roll Cloud	1. The popular term for arcus. 2. A low-level, horizontal, tube-shaped arcus cloud associated with a gust front of a convective storm (or occasionally a cold front). Roll clouds are relatively rare; they are completely detached from the convective storm's cloud base, thus differentiating them from the more familiar shelf clouds. Roll clouds appear to be rolling about a horizontal axis because of the shearing effects and horizontal vorticity provided by the differing air masses. *See also* rotor cloud, morning glory. American Meteorological Society, cited 2025: Roll Cloud. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Roll_cloud]
Rope	(Also "Rope Funnel") - a narrow, often contorted condensation funnel usually associated with the decaying stage of a tornado. See rope stage. *See also* rope stage. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Rope
Rope Stage	The dissipating stage of a tornado, characterized by thinning and shrinking of the condensation funnel into a rope (or rope funnel). Damage still is possible during this stage. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Rope+Stage
Rotational Velocity (Vr)	The single site Doppler radar intensity of an atmospheric circulation (i.e., mesocyclone, TVS, or TS) as quantified by the sum of the absolute value of the minimum radial velocity (Vmin) and the absolute value of the maximum radial velocity (Vmax) divided by two. *Compare* velocity difference (DV). *See also* rotational velocity (Vr) shear.
Rotational Velocity (Vr) Shear	The single site Doppler radar intensity of an atmospheric circulation (i.e., mesocyclone, TVS, or TS) as quantified by the sum of the absolute value of the minimum radial velocity (Vmin) and the absolute value of the maximum radial velocity (Vmax) divided by the distance between velocity peaks. Values are on the order of 10-2 s-1 for mesocyclones.

S-Band Radar	A radar which operates in the 2-4 GHz wavelength and 7.5-15 cm wavelength ranges. Because of these characteristics, S band radars are not easily attenuated. This makes them useful for both near and far range weather observation. The National Weather Service (NWS) WSR-88D is an S band radar which operates on a wavelength of just over 10 cm. The drawback to this band of radar is that it requires a large antenna dish and a large motor to power it. *See also* C band radar, X band radar.
Severe Local Storm	A convective storm that usually covers a relatively small geographic area, or moves in a narrow path, and is sufficiently intense to threaten life and/or property. Examples include severe thunderstorms with large hail, damaging wind, or tornadoes. Although cloud-to-ground lightning is not a criteria for severe local storms, it is acknowledged to be highly dangerous and a leading cause of deaths, injuries, and damage from thunderstorms. A thunderstorm need not be severe to generate frequent cloud-to-ground lightning. Additionally, excessive localized convective rains are not classified as severe storms but often are the product of severe local storms. Such rainfall may result in related phenomena (flash floods) that threaten life and property. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Severe+Local+Storm
Severe Thunderstorm	A thunderstorm that produces a tornado, winds of at least 58 mph (50knots), and/or hail at least 1" in diameter. Structural wind damage may imply the occurrence of a severe thunderstorm. A thunderstorm wind equal to or greater than 40 mph (35 knots) and/or hail of at least 1" is defined as approaching severe. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Severe+Thunderstorm
Severe Thunderstorm Warning	This is issued when either a severe thunderstorm is indicated by the WSR-88D radar or a spotter reports a thunderstorm producing hail one inch or larger in diameter and/or winds equal or exceed 58 miles an hour; therefore, people in the affected area should seek safe shelter immediately. Severe thunderstorms can produce tornadoes with little or no advance warning. Lightning frequency is not a criteria for issuing a severe thunderstorm warning. They are usually issued for a duration of one hour. They can be issued without a Severe Thunderstorm Watch being already in effect. Like a Tornado Warning, the Severe Thunderstorm Warning is issued by your National Weather Service Forecast Office (NWFO). Severe Thunderstorm Warnings will include where the storm was located, what towns will be affected by the severe thunderstorm, and the primary threat associated with the severe thunderstorm warning. If the severe thunderstorm will affect the nearshore or coastal waters, it will be issued as the combined

	product--Severe Thunderstorm Warning and Special Marine Warning. If the severe thunderstorm is also causing torrential rains, this warning may also be combined with a Flash Flood Warning. If there is an ampersand (&) symbol at the bottom of the warning, it indicates that the warning was issued as a result of a severe weather report. After it has been issued, the affected NWFO will follow it up periodically with Severe Weather Statements. These statements will contain updated information on the severe thunderstorm and they will also let the public know when the warning is no longer in effect. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Severe+Thunderstorm+Warning
Severe Thunderstorm Watch	This is issued by the National Weather Service when conditions are favorable for the development of severe thunderstorms in and close to the watch area. A severe thunderstorm by definition is a thunderstorm that produces one inch hail or larger in diameter and/or winds equal or exceed 58 miles an hour. The size of the watch can vary depending on the weather situation. They are usually issued for a duration of 4 to 8 hours. They are normally issued well in advance of the actual occurrence of severe weather. During the watch, people should review severe thunderstorm safety rules and be prepared to move a place of safety if threatening weather approaches. A Severe Thunderstorm Watch is issued by the Storm Prediction Center in Norman, Oklahoma. Prior to the issuance of a Severe Thunderstorm Watch, SPC will usually contact the affected local National Weather Service Forecast Office (NWFO) and they will discuss what their current thinking is on the weather situation. Afterwards, SPC will issue a preliminary Severe Thunderstorm Watch and then the affected NWFO will then adjust the watch (adding or eliminating counties/parishes) and then issue it to the public by way of a Watch Redefining Statement. During the watch, the NWFO will keep the public informed on what is happening in the watch area and also let the public know when the watch has expired or been cancelled. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Severe+Thunderstorm+Watch
Severe Weather Statement	A National Weather Service product which provides follow up information on severe weather conditions (severe thunderstorm or tornadoes) which have occurred or are currently occurring. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Severe+Weather+Statement

Shear	Variation in wind speed (speed shear) and/or direction (directional shear) over a short distance within the atmosphere. Shear usually refers to vertical wind shear, i.e., the change in wind with height, but the term also is used in Doppler radar to describe changes in radial velocity over short horizontal distances. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Shear
Shelf Cloud	A low, horizontal wedge-shaped arcus cloud, associated with a thunderstorm gust front (or occasionally with a cold front, even in the absence of thunderstorms). Unlike the roll cloud, the shelf cloud is attached to the base of the parent cloud above it (usually a thunderstorm). Rising cloud motion often can be seen in the leading (outer) part of the shelf cloud, while the underside often appears turbulent, boiling, and wind-torn. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Shelf+Cloud
Squall Line	A line of active deep moist convection frequently associated with thunder, either continuous or with breaks, including contiguous precipitation areas. The squall line is a type of mesoscale convective system distinguished from other types by a larger length-to-width ratio. American Meteorological Society, cited 2025: Squall line. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Squall_line]
Steering Winds	Same as Steering Currents; A prevailing synoptic scale flow which governs the movement of smaller features embedded within it. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Steering+Winds
Storm Motion	The speed and direction at which a thunderstorm travels. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=storm+motion
Storm Prediction Center (SPC)	A National Weather Service (NWS) National Center for Environmental Prediction (NCEP) in Norman, Oklahoma, which is responsible for providing short-term forecast guidance for severe convection, excessive rainfall (flash flooding), fire weather, and severe winter weather over the contiguous United States.
Storm Scale	Referring to weather systems with sizes on the order of individual thunderstorms. See synoptic scale and mesoscale. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=storm+motion
Storm-Relative	Measured relative to a moving thunderstorm, usually referring to winds, wind shear, or helicity.

	National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Storm+Relative
Streamwise Vorticity	The component of vorticity that is parallel to the ambient velocity vector. *See also* helicity. American Meteorological Society, cited 2025: Streamwise Vorticity. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Streamwise_vorticity]
Striations	Grooves or channels in cloud formations, arranged parallel to the flow of air and therefore depicting the airflow relative to the parent cloud. Striations often reveal the presence of rotation, as in the barber pole or "corkscrew" effect often observed with the rotating updraft of a Low Precipitation (LP) supercell. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Striations
Suction Vortices	Smaller-scale secondary vortices within a tornado core that orbit around a central axis. The transition of a one-celled vortex into secondary vortices in laboratory and numerical simulations occurs at high swirl ratios. The vortices produce cycloidal swaths within tornado damage tracks and are often used to explain the gradation of wind damage caused by a tornado. Structures in the path of a suction vortex are damaged while others are spared. American Meteorological Society, cited 2025: Suction Vortices. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Suction_vortices]
Supercell	An often dangerous convective storm that consists primarily of a single, quasi-steady rotating updraft, which persists for a period of time much longer than it takes an air parcel to rise from the base of the updraft to its summit (often much longer than 10–20 min). Most rotating updrafts are characterized by cyclonic vorticity (*see* mesocyclone). The supercell typically has a very organized internal structure that enables it to propagate continuously. It may exist for several hours and usually forms in an environment with strong vertical wind shear. Supercells often propagate in a direction and with a speed other than indicated by the mean wind in the environment. Such storms sometimes evolve through a splitting process, which produces a cyclonic, right-moving (with respect to the mean wind), and anticyclonic, left-moving, pair of supercells. Severe weather often accompanies supercells, which are capable of producing high winds, large hail, and strong, long-lived tornadoes.

	See also: classic supercell, low precipitation (LP) supercell, high precipitation (HP) supercell, convective storm, thunderstorm, splitting convective storm, cell, bulk Richardson number. American Meteorological Society, cited 2025: Supercell. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Supercell]
Supercooled Water	Liquid water at temperatures below the nominal freezing point of pure water [~0°C (32°F) for atmospheric-relevant pressure]. This usually refers to cloud droplets, which often remain liquid for a long time at temperatures below 0°C (32°F). The actual freezing temperature of a supercooled cloud droplet depends on its size and composition and may be as low as several tens of degrees below 0°C (32°F). American Meteorological Society, cited 2025: Supercooled Water. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Supercooled_water]
Surface-based Convection	Convection occurring within a surface-based layer, i.e., a layer in which the lowest portion is based at or very near the earth's surface. Compare with elevated convection. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Surface-based+Convection
Synoptic Scale	Used with respect to weather systems ranging in size from several hundred kilometers to several thousand kilometers, the scale of migratory high and low pressure systems (frontal cyclones) of the lower troposphere. *See* cyclonic scale. American Meteorological Society, cited 2025: Synoptic scale. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Synoptic_scale]
Tail Cloud	A horizontal, tail-shaped cloud (not a funnel cloud) at low levels extending from the precipitation cascade region of a supercell toward the wall cloud (i.e., it usually is observed extending from the wall cloud toward the north or northeast). The base of the tail cloud is about the same as that of the wall cloud. Cloud motion in the tail cloud is away from the precipitation and toward the wall cloud, with rapid upward motion often observed near the junction of the tail and wall clouds. Compare with beaver tail, which is a form of inflow band that normally attaches to the storm's main updraft (not to the wall cloud) and has a base at about the same level as the updraft base (not the wall cloud). National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Tail+Cloud

Tail-End Charlie	Slang for the thunderstorm at the southernmost end of a squall line or other line or band of thunderstorms. Since low-level southerly inflow of warm, moist air into this storm is relatively unimpeded, such a storm often has a higher probability of strengthening to severe levels than the other storms in the line. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Tail-End+Charlie
Thermodynamics	In general, the relationships between heat and other properties (such as temperature, pressure, density, etc.) In forecast discussions, thermodynamics usually refers to the distribution of temperature and moisture (both vertical and horizontal) as related to the diagnosis of atmospheric instability. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Thermodynamics
Three-Body Scatter Spike (TBSS)	(*Also called* hail spike.) A radar artifact caused by radar microwave scattering associated with large hydrometeors, typically severe hail. The TBSS is strictly an artifact of the electromagnetic radar beam being subject to “Mie scattering” instead of the usual “Rayleigh scattering” process. A TBSS forms as incident energy from the radar is reflected off the hail, down to the ground, then back up to the hail and back to the radar. Because of the delay in reception of the pulses, the radar circuitry displays the TBSS as downrange from the hail core. The TBSS is characterized by a 10-30 km (5-16 nm) long, low reflectivity (< 25 dBZ), echo “spike” aligned radially downrange from a high reflectivity (usually > 63 dBZ) core. The TBSS signature also produces low radial velocities (V), high spectrum widths (SW), extremely low correlation coefficients (CC), and extremely positive Differential Reflectivity (ZDR) transitioning into lower positive or even negative values farther down-radial. The presence of a TBSS with reflectivities greater than 5 dBZ on a S-band (10 cm) radar (such as the WSR-88D) suggests that the thunderstorm possesses severe hail.
Thunderstorm	(Sometimes called electrical storm.) In general, a local storm, invariably produced by a cumulonimbus cloud and always accompanied by lightning and thunder, usually with strong gusts of wind, heavy rain, and sometimes with hail. It is usually of short duration, seldom over two hours for any one storm. A thunderstorm is a consequence of atmospheric instability and constitutes, loosely, an overturning of air layers in order to achieve a more stable density stratification. A strong convective updraft is a distinguishing feature of this storm in its early phases. A strong downdraft in a column of precipitation marks its dissipating stages. Thunderstorms often build to altitudes of 40 000–50 000 ft in midlatitudes and to even greater heights in the

	Tropics; only the great stability of the lower stratosphere limits their upward growth. A unique quality of thunderstorms is their striking electrical activity. The study of thunderstorm electricity includes not only lightning phenomena per se but all of the complexities of thunderstorm charge separation and all charge distribution within the realm of thunderstorm influence. In U.S. weather observing procedure, a thunderstorm is reported whenever thunder is heard at the station; it is reported on regularly scheduled observations if thunder is heard within 15 minutes preceding the observation. Thunderstorms are reported as light, medium, or heavy according to 1) the nature of the lightning and thunder; 2) the type and intensity of the precipitation, if any; 3) the speed and gustiness of the wind; 4) the appearance of the clouds; and 5) the effect upon surface temperature. From the viewpoint of the synoptic meteorologist, thunderstorms may be classified by the nature of the overall weather situation, such as airmass thunderstorm, frontal thunderstorm, and squall-line thunderstorm. Byers, H. R., and R. R. Braham Jr. 1949. The Thunderstorm. U.S. Government Printing Office, . 287 pp. Byers, H. R. 1951. Compendium of Meteorology. p. 681. American Meteorological Society, cited 2025: Thunderstorm. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Thunderstorm]
Thunderstorm Cell	The convective cell of a cumulonimbus cloud having lightning and thunder. American Meteorological Society, cited 2025: Thunderstorm Cell. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Thunderstorm_cell]
Tornadic Vortex Signature (TVS)	(Abbreviated TVS.) The Doppler velocity signature of a tornado or of an incipient tornado-like circulation aloft. As the signature occurs when the radar beam is wider than the vortex, the measured Doppler velocities are weaker than the rotational velocities within the vortex and the apparent core diameter is larger than that of the vortex. The signature, which may extend throughout a considerable vertical depth, is ideally characterized by extreme Doppler velocity values of opposite sign separated in azimuth by the equivalent of one beamwidth. However, since most radars display and record Doppler velocity values at discrete azimuthal intervals, the extreme Doppler velocity values are usually at azimuthally adjacent positions that are roughly one beamwidth apart. If the centers of the radar beam and the vortex coincide, the signature includes a zero Doppler velocity value that separates the extreme values.

	American Meteorological Society, cited 2025: Tornadic Vortex Signature (TVS). Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Tornadic_vortex_signature
Tornado	A rapidly rotating column of air extending vertically from the surface to the base of a cumuliform cloud, often with near-surface circulating debris/dust when over land or spray when over water. Although its presence is not required, a funnel cloud is often visible and may partly or fully extend from the cloud base to the ground. Characteristics of typical tornadoes include a diameter of 2 km or less, with maximum wind velocity differences across the circulation exceeding 40 m s^{-1} within 200 m of the surface. Tornadoes typically last on the order of 100–1000 s. Some may be comprised of multiple subvortices with spatial scales as small as tens of meters, rotating around a central axis. Tornadoes rated by the enhanced Fujita (EF) scale have wind gusts at 10 m above the surface equaling or exceeding 29 m s^{-1} (65 mph; the lower bound of EF-0). Tornadoes that occur over water are classified as waterspouts. Landspouts are a subset of tornadoes that occur independent of a parent mesocyclone. Gustnadoes are not considered tornadoes since they are shallow and short-lived vortices that are usually weak. Dust devils are not considered tornadoes since they are not associated with cumuliform clouds. American Meteorological Society, cited 2025: Tornado. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Tornado
Tornado Debris Signature (TDS)	Often referred to as a TDS. A dual-polarization radar-based feature indicative of nonmeteorological tornadic debris present in the radar sample volume. It is typically associated with a significantly reduced copular correlation coefficient, a low differential reflectivity, and sometimes an enhanced reflectivity factor, which are centered or nearly centered on a tornadic vortex signature. Ryzhkov, A. V., T. J. Schurr, D. W. Burgess, and D. S. Zrnic, 2005: Polarimetric tornado detection. *J. Appl. Meteor.*, **44**, 557–570, doi:10.1175/JAM2235.1. |Explanation= Kumjian, M. R., and A. J. Ryzhkov, 2008: Polarimetric signatures in supercell thunderstorms. *J. Appl. Meteor. Climatol.*, **47**, 1940–1961, doi:10.1175/2007JAMC1874.1. American Meteorological Society, cited 2025: Thunderstorm Cell. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Tornadic_debris_signature]
Tornado Emergency	An exceedingly rare tornado warning issued when there is a severe threat to human life and catastrophic damage from an imminent or ongoing tornado. This tornado warning is reserved for

	situations when a reliable source confirms a tornado, or there is clear radar evidence of the existence of a damaging tornado, such as the observation of debris. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Tornado+Emergency
Tornado Signature (TS)	A Doppler velocity identified tornado-scale vortex which is larger than or equal to the effective beam width. *See also* tornado vortex signature.
Tornado Warning	This is issued when a tornado is indicated by the WSR-88D radar or sighted by spotters; therefore, people in the affected area should seek safe shelter immediately. They can be issued without a Tornado Watch being already in effect. They are usually issued for a duration of around 30 minutes. A Tornado Warning is issued by your local National Weather Service office (NWFO). It will include where the tornado was located and what towns will be in its path. If the tornado will affect the nearshore or coastal waters, it will be issued as the combined product--Tornado Warning and Special Marine Warning. If the thunderstorm which is causing the tornado is also producing torrential rains, this warning may also be combined with a Flash Flood Warning. If there is an ampersand (&) symbol at the bottom of the warning, it indicates that the warning was issued as a result of a severe weather report. After it has been issued, the affected NWFO will followed it up periodically with Severe Weather Statements. These statements will contain updated information on the tornado and they will also let the public know when warning is no longer in effect. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Tornado+Warning
Tornado Watch	This is issued by the National Weather Service when conditions are favorable for the development of tornadoes in and close to the watch area. Their size can vary depending on the weather situation. They are usually issued for a duration of 4 to 8 hours. They normally are issued well in advance of the actual occurrence of severe weather. During the watch, people should review tornado safety rules and be prepared to move a place of safety if threatening weather approaches. A Tornado Watch is issued by the Storm Prediction Center (SPC) in Norman, Oklahoma. Prior to the issuance of a Tornado Watch, SPC will usually contact the affected local National Weather Forecast Office (NWFO) and they will discuss what their current thinking is on the weather situation. Afterwards, SPC will issue a preliminary Tornado Watch and then the affected NWFO will then

	adjust the watch (adding or eliminating counties/parishes) and then issue it to the public. After adjusting the watch, the NWFO will let the public know which counties are included by way of a Watch Redefining Statement. During the watch, the NWFO will keep the public informed on what is happening in the watch area and also let the public know when the watch has expired or been cancelled. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Tornado+Watch
Tornadogenesis	The process by which a tornado forms.
Torus	A doughnut-shaped surface generated by a circle rotated about an axis in its plane that does not intersect the circle. For a hailstone, a torus is the meltwater which forms a band around the equator of the hailstone due to drag as it falls through the atmosphere.
Training	Repeated areas of rain, typically associated with thunderstorms, that move over the same region in a relatively short period of time and are capable of producing excessive rainfall totals. Train(ing) echoes can frequently be a source of flash flooding. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Training
Transverse Bands	Bands of clouds oriented perpendicular to the flow in which they are embedded. They often are seen best on satellite photographs. When observed at high levels (i.e., in cirrus formations), they may indicate severe or extreme turbulence. Transverse bands observed at low levels (called transverse rolls or T rolls) often indicate the presence of a temperature inversion (or cap) as well as directional shear in the low- to mid-level winds. These conditions often favor the development of strong to severe thunderstorms. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Transverse+Bands
Transverse Rolls	Elongated low-level clouds, arranged in parallel bands and aligned parallel to the low-level winds but perpendicular to the mid-level flow. Transverse rolls are one type of transverse band, and often indicate an environment favorable for the subsequent development of supercells. Since they are aligned parallel to the low-level inflow, they may point toward the region most likely for later storm development. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Transverse+Rolls
Triple Point	The intersection point between two boundaries (dry line, outflow boundary, cold front, etc.), often a focus for thunderstorm development. Triple point also may refer to a point on the gust front of a supercell, where the warm moist inflow, the rain-cooled

	outflow from the forward flank downdraft, and the rear flank downdraft all intersect; this point is a favored location for tornado development (or redevelopment). National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Triple+Point
Universal Time (UT)	By international agreement, the local time at the prime meridian, which passes through Greenwich, England. Prior to 1972, this time was called Greenwich Mean Time (GMT) but is now referred to as Coordinated Universal Time or Universal Time Coordinated (UTC). It is a coordinated time scale, maintained by the Bureau International des Poids et Mesures (BIPM). It is also known a "Z time" or "Zulu Time". More about UTC, and a table to convert UTC to your local time is posted at: http://www.srh.noaa.gov/srh/jetstream/doppler/radarfaq.htm#utc National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Universal+Time
Updraft	A small-scale current of rising air. If the air is sufficiently moist, then the moisture condenses to become a cumulus cloud or an individual tower of a towering cumulus or Cb. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Updraft
Upper Air	(Also aerological.) Having to do with the free atmosphere, including the troposphere and stratosphere. Upper-air observations are distinguished from surface observations, even though an upper-air observation may include data from the surface. American Meteorological Society, cited 2025: Upper Air. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Upper Air]
Upshear	In the opposite direction as shear vector within a specified layer. *Compare* downshear.
Upwind	In the direction from which the wind is blowing. American Meteorological Society, cited 2025: Upper Air. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Upwind]
V Notch	A radar reflectivity signature seen as a V-shaped notch in the downwind part of a thunderstorm echo. The V-notch often is seen on supercells, and is thought to be a sign of diverging flow around the main storm updraft (and hence a very strong updraft). This term should not be confused with inflow notch or with enhanced V, although the latter is believed to form by a similar process.

	National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=V+Notch
Veering Wind	In the Northern Hemisphere, a wind that rotates in a clockwise direction with increasing height; the opposite of backing wind. American Meteorological Society, cited 2025: Veering Wind. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Veering_wind]
Velocity Difference (DV)	(*Also called* delta V). The single site Doppler radar intensity of a convergent velocity signature, divergent velocity signature, or atmospheric circulation as quantified by the product of the absolute value of the minimum radial velocity and the absolute value of the maximum radial velocity. *See also* low-level rotational velocity (LLDV).
Vertical Wind Shear	The change in the wind's direction and speed with height. This is a critical factor in determining whether severe thunderstorms will develop. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Vertical+Wind+Shear
Vortex	A compact flow that circulates around an axis, characterized by a local extremum in vorticity. *See also* eddy, coherent structures, vorticity. American Meteorological Society, cited 2025: Vortex. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Vortex]
Vorticity	A measure of the rotation of air in a horizontal plane. Positive (counter-clockwise or cyclonic) vorticity can be correlated with surface low development and upward vertical motion (in areas of positive vorticity advection). National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Vorticity
Wall Cloud	(Sometimes referred to as pedestal cloud.) A local, often abrupt lowering from a cumulonimbus cloud base into a low-hanging accessory cloud, normally a kilometer or more in diameter. A wall cloud marks the lower portion of a very strong updraft, usually associated with a supercell or severe multicell storm. It typically develops near the precipitation region of the cumulonimbus. Wall clouds that exhibit significant rotation and vertical motions often precede tornado formation by a few minutes to an hour.

	Fujita, T. 1959. A detailed analysis of the Fargo tornadoes of June 20, 1957. U.S. Wea. Bur. Res. Paper 42. p.15. American Meteorological Society, cited 2025: Wall Cloud. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Wall_cloud]
Warm Cloud	Cloud that is only in the liquid phase; levels are not present with temperature below 0°C (32°F); no ice is present. Any precipitation will originate from droplet coalescence. It is not to be confused with clouds extending to levels with temperature below 0°C; here, precipitation may form from the ice phase but could form by the warm cloud coalescence process. American Meteorological Society, cited 2025: Warm Cloud. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Warm_cloud]
Warm Rain Process	In cloud physics, the process producing precipitation through collision between liquid particles (cloud droplets, drizzle drops, and raindrops). The warm rain process includes growth by collision–coalescence and limitations to growth by drop breakup. Precipitation produced by the warm rain process occurs in clouds having sufficient liquid water, updraft, and lifetime to sustain collision–coalescence growth to drizzle drop or raindrop sizes. Since warm base (>10°C) convective clouds of about 2-km depth typically have these features, the warm rain process is found to be active in both shallow and deep convection in the Tropics and midlatitudes. The major role of the warm rain process in thunderstorms is to transfer condensed water, in the form of cloud droplets, to precipitable water, in the the form of drizzle droplets and raindrops, by the collision–coalescence process. The warm rain process can also produce supercooled raindrops that freeze and become graupel, necessary for the rapid glaciation of convective tops by production of secondary ice crystals. This has been called the coalescence freezing mechanism. *See* Hallett–Mossop process. American Meteorological Society, cited 2025: Warm Rain Process. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Warm_rain_process]
Waterspout	1. In general, any tornado over a body of water. 2. In its most common form, a nonsupercell tornado over water. Such events consist of an intense columnar vortex (usually containing a funnel cloud) that occurs over a body of water and is connected to a cumuliform cloud. Waterspouts exhibit a five- stage, discrete life cycle observable from aircraft: 1) dark-

	spot stage; 2) spiral pattern stage; 3) spray-ring stage; 4) mature or spray-vortex stage; and 5) decay stage. Waterspouts occur most frequently in the subtropics during the warm season; more are reported in the lower Florida Keys than in any other place in the world. Funnel diameters range from a few up to 100 m or more; lifetimes average 5–10 minutes, but large waterspouts can persist for up to one hour. American Meteorological Society, cited 2025: Waterspout. Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Waterspout]
Weak Echo Region (WER)	(Abbreviated WER.) A region of weak radar echo that is bounded on one side and above by strong echo. It is located on the low-altitude inflow side of the storm. The WER is produced by strong updraft that carries precipitation particles to midlevels in a convective storm before they grow to radar-detectable sizes. In identifying a WER with radar, care must be taken to ensure that the strong midlevel echo is related to an updraft and not to horizontal motion of precipitation particles (e.g., the spreading anvil). *See also* bounded weak echo region (BWER). American Meteorological Society, cited 2025: Weak Echo Region (WER). Glossary of Meteorology. [Available online at https://glossary.ametsoc.org/wiki/Waterspout]
Weather Forecast Office (WFO)	(Abbrev. WFO) - this type of National Weather Service office is responsible for issuing advisories, warnings, statements, and short term forecasts for its county warning area National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Weather+Forecast+Office
Wedge Tornado	Slang for a large tornado with a condensation funnel that is at least as wide (horizontally) at the ground as it is tall (vertically) from the ground to cloud base. The term "wedge" often is used somewhat loosely to describe any large tornado. However, not every large tornado is a wedge. A true wedge tornado, with a funnel at least as wide at the ground as it is tall, is very rare. Wedges often appear with violent tornadoes (F4 or F5 on the Fujita Scale), but many documented wedges have been rated lower. And some violent tornadoes may not appear as wedges (e.g., Xenia, OH on 3 April 1974, which was rated F5 but appeared only as a series of suction vortices without a central condensation funnel). Whether or not a tornado achieves "wedge" status depends on several factors other than intensity - in particular, the height of the environmental cloud base and the availability of moisture below cloud base. Therefore, spotters should not estimate wind speeds or F-scale ratings based on

	visual appearance alone. However, it generally is safe to assume that most (if not all) wedges have the potential to produce strong (F2/F3) or violent (F4/F5) damage. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Wedge+Tornado
Whirlwind	General term for a small-scale, rotating column of air. More specific terms are dust whirl, dust devil, waterspout, and tornado. American Meteorological Society, cited 2025: Wind Shear. Glossary of Meteorology. [Available online at http://glossary.ametsoc.org/wiki/Whirlwind]
Wind Shear	The rate at which wind velocity changes from point to point in a given direction (as, vertically). The shear can be speed shear (where speed changes between the two points, but not direction), direction shear (where direction changes between the two points, but not speed) or a combination of the two. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Wind+Shear
WSR-88D	Weather Surveillance Radar - 1988 Doppler; NEXRAD unit. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=WSR-88D
X Band Radar	A radar which operates in the 8-12 GHz and 2.5-3.75 cm wavelength ranges. Because of the smaller wavelength, the X band radar is more sensitive and can detect smaller particles. These radars are used for studies on cloud development because they can detect the tiny water particles and also used to detect light precipitation such as snow. X band radars also attenuate very easily, so they are used for only very short range weather observation. Also, due to the small size of the radar, it can therefore be portable. Most major airplanes are equipped with an X band radar to pick up turbulence and other weather phenomenon. This band is also shared with some police speed radars and some space radars. *See also* C band radar, S band radar.
ZDR Arc	A region of high differential reflectivity (ZDR) precipitation echoes that lie along the sharp low-level reflectivity gradient facing the storm-relative inflow. Some of these hydrometeors are from the sloping echo overhang and others are from the edge of the precipitation cascade region. Research has theorized that the ZDR arc originates as the precipitation falling from aloft, is sorted by the vertical wind shear present in the environment, and enhanced along the forward flank outflow.
ZDR Column	A dual-polarimetric radar signature of differential reflectivity (ZDR) values above 1-2 dB caused by large liquid drops associated with the updraft of a convective cell+B134

ZDR Ring	A dual-polarimetric radar signature of differential reflectivity (ZDR) values above 1-2 dB horizontally surrounding a bounded weak echo region (BWER) caused by large liquid drops which have been transported around the exterior of a supercell thunderstorm updraft. The ZDR ring is often small and ephemeral making radar detection difficult due to sampling limitations. *See also* low CC ring.
Zulu (Z) Time	For practical purposes, the same as Coordinated Universal Time (UTC). The notation formerly used to identify time Greenwich MeanTime. The word "Zulu" is notation in the phonetic alphabet corresponding to the letter "Z" assigned to the time zone on the Greenwich Prime Meridian. National Weather Service Glossary, cited 2025. https://forecast.weather.gov/glossary.php?word=Zulu+%28Z%29+Time