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A COMPREHENSIVE GLOSSARY OF WEATHER TERMS

FOR STORM SPOTTERS

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PREFACE

This glossary contains weather-related terms that may be either heard or used by severe local storm spotters or spotter groups. Its purposes are (1) to achieve some level of standardization in the definitions of the terms that are used, and (2) provide a reference from which the meanings of any terms, especially the lesser-used ones, can be found. The idea is to allow smooth and effective communication between storm spotters and forecasters, and vice versa. This is an important necessity within the severe weather warning program. Despite advances in warning and forecasting techniques (e.g., Doppler radar), the human eye will always be a vital part of any effective warning system. Storm spotters are, and always will be, an indispensable part of the severe local storm warning program.

A complete list of terms probably is impossible to arrive at, but this list is as comprehensive as possible. Certainly it is not necessary for every spotter to know the meaning of every term contained herein. In this sense, the glossary serves as a reference. In fact, many of the terms may never be heard at all; they are included here just in case, someday, they are. (By the way, inclusion of a term in this glossary does not give license to use it freely in radio or phone communication. Use of technical terms should be kept to a minimum.) But there are some terms for which the meanings are both important and specific. The important ones are preceded by asterisks; all spotters should be familiar with the definitions of these terms before taking an active role in any spotter group.

I have written the definitions in what hopefully passes as "layman's terms." They are written to be easily understood by the storm spotter, regardless of his or her meteorological background. At times I have sacrificed technical purity for simplicity, and the result may prompt a few moans from the technical purists. So be it; this glossary wasn't written for them. Many of the terms are so closely interrelated, though, that it becomes necessary to "cross-reference" — that is, to use one or more terms in the definition of another. In this glossary, all terms in **boldface** within a definition are terms that are defined themselves elsewhere.

The glossary is a culmination of an effort which began in the spring of 1991. Many individuals with considerable experience in severe storm research and storm spotting (or chasing) contributed to the glossary. Because of the many comments offered by these individuals, there was disagreement on the descriptions of some terms. Those terms that were identified as such as being somewhat more controversial are handled in the text by inclusion of a second paragraph in the description, which discusses any cautions or controversy regarding the use of the term.

One last word. Storm spotting is vital, but also can be very dangerous. No one should attempt storm spotting without first obtaining the proper training! This glossary in itself is not to be considered sufficient training material to qualify oneself as a spotter. Further training, usually provided by the National Weather Service, must be obtained through local agencies (e.g., Civil Defense) before one can be certified as a storm spotter. There is also something to be said for the so-called storm chasers, who chase storms mainly for the thrill of it (and as such are not spotters). Chasers of all levels of background and experience will no doubt find this glossary useful or at least interesting. But while I commend their enthusiasm, I must emphasize that the glossary does not condone storm chasing as a leisure activity — especially for the unprepared. Proper training and foreknowledge of the dangers are required of everyone who meets face to face with severe thunderstorms — regardless of the reason for the encounter.

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AC - Convective outlook issued by **SELS.** Abbreviation for Anticipated Convection; the term originates from the header coding [ACUS1] of the transmitted product.

ACCAS (pronounced ACK-kas) - AltoCumulus CAStellanus; mid-level clouds (bases generally 8 to 15 thousand feet), of which at least a fraction of their upper parts show **cumulus**-type development. These clouds often are taller than they are wide, giving them a turret-shaped appearance. ACCAS clouds are a sign of **instability** aloft, and may precede the rapid development of thunderstorms.

Accessory cloud - A cloud which is dependent on a larger cloud system for development and continuance. **Roll clouds, shelf clouds,** and **wall clouds** are examples of accessory clouds.

Advection - Transport of an atmospheric property by the wind. See **cold advection, moisture advection, warm advection.**

Air mass thunderstorm - Generally, a thunderstorm not associated with a front or other type of **synoptic-scale** forcing mechanism. Air mass thunderstorms typically are associated with warm, tropical air in the summer months; they develop during the afternoon in response to **insolation,** and dissipate rather quickly after sunset. They generally are less likely to be severe than other types of thunderstorms, but they still are capable of producing **downbursts,** brief heavy rain, and (in extreme cases) hail over 3/4 inch in diameter.

Since all thunderstorms are associated with some type of forcing mechanism, synoptic-scale or otherwise, the existence of true air-mass thunderstorms is debatable. Therefore the term is somewhat controversial and should be used with discretion.

Algorithm - A computer program (or set of programs) which is designed to systematically solve a certain kind of problem. **WSR-88D** radars **(NEXRAD)** employ algorithms to analyze radar data and automatically determine storm motion, probability of hail, **VIL,** accumulated rainfall, and several other parameters.

Anticyclonic rotation - Rotation in the opposite sense as the Earth's rotation, i.e. clockwise in the Northern Hemisphere as would be seen from above. The opposite of **cyclonic rotation.**

Anvil - The flat, spreading top of a **Cb** (cumulonimbus), often shaped like an anvil. Thunderstorm anvils may spread hundreds of miles downwind from the thunderstorm itself, and sometimes may spread upwind (see **back-sheared anvil; overshooting top**).

Anvil dome - Same as **overshooting top** or **penetrating top.**

Anvil rollover - [Slang], a circular or semi-circular lip of clouds along the underside of the upwind part of a **back-sheared anvil,** indicating rapid expansion of the anvil. See **cumuliform anvil, knuckles, mushroom.**

AP - Anomalous Propagation. Radar term for false (non-precipitation) echoes resulting from non-standard propagation of the radar beam under certain atmospheric conditions.

Approaching (severe levels) - A thunderstorm which contains winds of 35 to 49 knots (40 to 57 mph), or hail 1/2 inch or larger but less than 3/4 inch in diameter. See **severe thunderstorm.**

Arcus - A low, horizontal cloud formation associated with the leading edge of thunderstorm outflow (i.e., the **gust front**). **Roll clouds** and **shelf clouds** both are types of arcus clouds.

AVN - AViatioN model; one of the operational forecast models run at **NMC.** The AVN is run twice daily, with forecast output out to 72 hours.

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Back-building thunderstorm - A thunderstorm in which new development takes place on the upwind side (usually the west or southwest side), such that the storm seems to remain stationary or propagate in a backward direction.

Backing winds - Winds which shift in a counterclockwise direction with time at a given location (e.g. from southerly to southeasterly), or change direction in a counterclockwise sense with height (e.g. westerly at the surface but becoming more southerly aloft). The opposite of **veering winds.**

In storm spotting, a backing wind usually refers to the turning of a south or southwest surface wind with time to a more east or southeasterly direction. Backing of the surface wind can increase the potential for **tornado** development by increasing the **directional shear** at low levels.

Back-sheared anvil - [Slang], a thunderstorm **anvil** which spreads upwind, against the flow aloft. A back-sheared anvil often implies a very strong **updraft** and a high severe weather potential. (See Fig. 7, **supercell.**)

Barber pole - [Slang], a thunderstorm **updraft** with a visual appearance including cloud **striations** that are curved in a manner similar to the stripes of a barber pole. The structure typically is most pronounced on the leading edge of the updraft; drier air from the **rear flank downdraft** often erodes the clouds on the trailing side of the updraft.

Bear's cage - [Slang], a region of **storm-scale** rotation, in a thunderstorm, which is wrapped in heavy precipitation. This area often coincides with a radar **hook echo** and/or **mesocyclone**, especially one associated with an **HP storm.**

The term reflects the danger involved in observing such an area visually, which must be done at close range in low visibility.

Beaver tail (or sometimes **inflow stinger**) - [Slang], a low, flat cloud, often shaped like a beaver tail, located in the inflow region of a thunderstorm (the east or southeast side); a particular form of **feeder band.** Its size and shape change as the strength of the inflow changes.

A beaver tail is <u>not</u> a **tail cloud;** the latter typically forms in the moist but cooler air on the north or northeast side of a **wall cloud.**

Blue watch (or **blue box**) - [Slang], a severe thunderstorm watch.

Bow echo - A radar echo which is linear but bent outward in a bow shape (Fig. 1). Damaging **straight-line winds** often occur near the "crest" or center of a bow echo. Areas of circulation also can develop at either end of a bow echo, which sometimes can lead to **tornado** formation - especially in the left (usually northern) end, where the circulation exhibits **cyclonic rotation.**

Boundary layer - In general, a layer of air adjacent to a bounding surface. Specifically, the term most often refers to the <u>planetary</u> boundary layer, which is the layer within which the effects of friction are significant. For the Earth, this layer is considered to be roughly the lowest one or two kilometers of the atmosphere. It is within this layer that temperatures are most strongly affected by daytime **insolation** and nighttime radiational cooling, and winds are affected by friction with the Earth's surface. The effects of friction die out gradually with height, so the "top" of this layer cannot be defined exactly.

There is a thin layer immediately above the Earth's surface known as the <u>surface</u> boundary layer (or simply the surface layer). This layer is only a part of the planetary boundary layer, and represents the layer within which friction effects are more or less constant throughout (as opposed to decreasing with height, as they do above it). The surface boundary layer is roughly 10 meters thick, but again the exact depth is indeterminate. Like friction, the effects of insolation and radiational cooling are strongest within this layer.

Box (or **watch box**) - [Slang], a severe thunderstorm or tornado watch. See **blue box, red box.**

Bust - [Slang], an inaccurate forecast or an unsuccessful storm chase; usually a situation in which thunderstorms or severe weather are expected, but do not occur.

BWER - Bounded Weak Echo Region. (Also known as a **vault.**) Radar signature characterized by an area of weak radar **reflectivity** at low levels which extends upward into, and is surrounded by, higher reflectivities aloft (Fig. 2). This feature is associated with a strong updraft and is almost always found in the inflow region of a thunderstorm. It cannot be seen visually. See **WER.**

CA - Cloud-to-Air lightning.

Cap (or lid) - A layer of warm air, several thousand feet above the surface, which suppresses or delays the development of thunderstorms. Air parcels rising into this layer become cooler than the surrounding air, which inhibits their ability to rise further. As such, the cap often prevents or delays thunderstorm development even in the presence of extreme **instability.** However if the cap is removed or weakened, then explosive thunderstorm development can occur. See Fig. 6, **sounding.**

CAPE - Convective Available Potential Energy. A measure of the amount of energy available for **convection.** CAPE is directly related to the maximum potential vertical speed within an **updraft;** thus higher values indicate greater potential for severe weather. However, as with other indices or indicators, there are no threshold values above which severe weather becomes imminent. CAPE is represented on a **sounding** by the area enclosed between the environmental temperature profile and the path of a rising air parcel, over the layer within which the latter is warmer than the former. (This area often is called **positive area.**) See Fig. 6, **sounding.**

***Cb** - Cumulonimbus cloud, characterized by strong vertical development in the form of mountains or huge towers topped at least partially by a smooth, flat, often fibrous **anvil.** Also known colloquially as a "thunderhead".

CC - Cloud-to-Cloud lightning.

Cell - **Convection** in the form of a single **updraft, downdraft,** or updraft/downdraft couplet, typically seen as a vertical dome or tower as in a **cumulus** or **towering cumulus** cloud. A typical thunderstorm consists of several cells (see **multi-cellular thunderstorm**).

The term "cell" also is used to describe the radar echo returned by an individual shower or thunderstorm. Such usage, although common, is technically incorrect.

***CG** - Cloud-to-Ground lightning flash.

Chaff - Small strips of metal foil, usually dropped in large quantities from aircraft or balloons in order to confuse enemy radar. Chaff typically produces a radar echo which closely resembles precipitation. Chaff drops are conducted by some military installations for testing and calibration purposes.

Cirrus - High-level clouds (16,000 feet or more), composed of ice crystals and appearing in the form of white, delicate filaments or white or mostly white patches or narrow bands. Cirrus clouds typically have a fibrous or hair-like appearance, and often are semi-transparent. Thunderstorm **anvils** are a form of cirrus cloud, but most cirrus clouds are not associated with thunderstorms.

Classic supercell - See **supercell.**

Clear slot - A local region of clearing skies (or reduced cloud cover) indicating an intrusion of drier air; often seen as a bright area with higher cloud bases on the west or southwest side of a **wall cloud.** See **rear flank downdraft.**

Closed low - A low pressure area with a distinct center of **cyclonic circulation** which can be completely encircled by one or more **isobars** or other contour lines. The term usually is used to describe a low pressure area aloft, distinguishing such an area from a low-pressure **trough.** Closed lows aloft typically move slowly since they are detached from the main westerly current (see **cutoff low**).

Cloud streets - Rows of **cumulus** or cumulus-type clouds aligned parallel to the low-level flow. Cloud streets sometimes can be seen from the ground, but are seen best on satellite photographs.

Cloud tags - Ragged, detached cloud fragments; **fractus** or **scud**.

Cold advection - Transport of cold air into a region by horizontal winds.

Cold air funnel - A **funnel cloud** or (rarely) a small, relatively weak **tornado** that can develop from a small shower or thunderstorm when the air aloft is unusually cold (hence the name). They are much less violent than other types of tornadoes.

Collar cloud - A generally circular ring of cloud surrounding the upper part of a **wall cloud**. See Fig. 7, **supercell**. This term sometimes is used (incorrectly) as a synonym for wall cloud.

Comma cloud - A **synoptic-scale** cloud pattern with a characteristic comma-like shape, often seen on satellite photographs associated with large and intense low-pressure systems.

Comma echo - A thunderstorm radar echo which has a comma-like shape. It often appears during latter stages in the life cycle of a **bow echo** (see Fig. 1).

Condensation funnel - A funnel-shaped cloud associated with rotation and consisting of condensed water droplets (as opposed to smoke, dust, debris, etc.). Compare with **debris cloud**.

Confluence - A pattern of wind flow in which winds converge along an axis oriented parallel to the flow along the axis; a form of **convergence**. Compare with **difluence**.

Congestus (or **cumulus congestus**) - same as **towering cumulus**.

Convection - The transport of heat (and moisture) by the movement of a fluid. In meteorology, the term is used most often to describe the vertical transport of heat and moisture, 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** formations also are 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.

Convective Outlook (sometimes called the **AC**) - A forecast containing the area(s) of expected thunderstorm occurrence and expected severity over the Continental U. S., issued several times daily by **SELS**. The terms **approaching**, **slight risk**, **moderate risk**, and **high risk** are used to describe severe thunderstorm potential. Local versions sometimes are prepared by local **NWS** offices (see, e.g., **OTO**).

Convective temperature - The approximate temperature that the air near the ground must warm to in order for **convection** to develop. Calculation of the convective temperature involves many assumptions, such that thunderstorms sometimes develop well before or well after the convective temperature is reached (or may not develop at all). However in some cases the convective temperature is a useful parameter for forecasting the onset of convection. See Fig. 6, **sounding**.

Convergence - A contraction of a vector field, usually said of winds; the opposite of **divergence**. Convergence in a low-level wind field results in upward forcing, thus increasing the potential for thunderstorm development (when other factors, such as **instability**, are favorable). See also **confluence**.

Core punch (or **core plunge**) - [Slang], a penetration by a vehicle into the heavy precipitation core of a thunderstorm.

Core punching is not a recommended procedure for storm spotting.

Cumuliform anvil - A thunderstorm **anvil** with visual characteristics resembling **cumulus**-type clouds (rather than the more typical fibrous appearance associated with **cirrus**). A cumuliform anvil arises from rapid spreading of a thunderstorm **updraft**, and thus implies a very strong updraft. See **anvil rollover, knuckles, mushroom.**

Cumulus - Detached clouds, generally dense and with sharp outlines, showing vertical development in the form of domes, mounds, or towers. Tops normally are rounded while bases are more horizontal. See **CB, towering cumulus.**

Cumulus congestus (or **congestus**) - Same as **towering cumulus.**

Cutoff low - A **closed low** which has become completely displaced (cut off) from basic westerly current, and moves independently of that current. Cutoff lows may remain nearly stationary for days, or on occasion may move westward opposite to the prevailing flow aloft (i.e. **retrogression**).

"Cutoff low" and "closed low" often are used interchangeably to describe low pressure centers aloft. However, not all closed lows are completely removed from the influence of the basic westerlies. Therefore, the recommended usage of the terms is to reserve the use of "cutoff low" only to those closed lows which clearly are detached completely from the westerlies.

Cyclic storm - A thunderstorm that undergoes cycles of intensification and weakening (pulses) while maintaining its individuality. Cyclic storms are capable of producing multiple tornadoes and/or several bursts of severe weather.

A storm which undergoes only one cycle (pulse), and then dissipates, is known as a **pulse storm.**

***Cyclonic circulation** (or **cyclonic rotation**) - Circulation (or rotation) which is in the same sense as the Earth's rotation, i.e. counterclockwise (in the Northern Hemisphere) as would be seen from above. Nearly all **mesocyclones** and strong or violent **tornadoes** exhibit cyclonic rotation, but some smaller vortices such as **gustnadoes** occasionally rotate anticyclonically (clockwise). Compare with **anticyclonic rotation.**

***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.

Derecho - (Pronounced day-RAY-cho), a widespread and usually fast-moving windstorm associated with **convection.** Derechos include any family of **downburst** clusters produced by an extratropical **MCS**, and can produce damaging **straight-line winds** over areas hundreds of miles long and more than 100 miles across.

Dew point - A measure of atmospheric moisture. It is the temperature to which air must be cooled in order to reach saturation (assuming air pressure and moisture content are constant).

Difluence (or **diffluence**) - A pattern of wind flow in which the air spreads laterally in a fan-out pattern from a central axis oriented parallel to the flow along the axis. Difluence in the upper level winds is considered a favorable condition for severe thunderstorm development. See **confluence, divergence.**

Directional shear - The component of **wind shear** which is due to a change in wind direction with height, e.g. southeasterly winds at the surface and southwesterly winds aloft. A **veering wind** with height in the lower part of the atmosphere is a type of directional shear often considered important for **tornado** development.

Divergence - The expansion or spreading out of a vector field; usually said of winds. It is the opposite of **convergence**. Divergence at upper levels of the atmosphere enhances upward motion, and hence the potential for thunderstorm development (if other factors also are favorable).

Doppler radar - Radar that can measure **radial velocity**, the instantaneous component of motion parallel to the radar beam (i.e. toward or away from the radar).

***Downburst** - A strong **downdraft** resulting in an outward burst of damaging winds on or near the ground. Downburst winds can produce damage similar to a strong tornado. Although usually associated with thunderstorms, downbursts can occur with showers too weak to produce thunder. See **dry** and **wet microburst**.

Downdraft - A small-scale column of air that rapidly sinks toward the ground, usually accompanied by precipitation as in a shower or thunderstorm. A **downburst** is the result of a strong downdraft.

Dry line - A boundary separating moist and dry air masses, and an important factor in severe weather frequency in the Great Plains. It typically lies north-south across the central and southern High Plains states during the spring and early summer, where it separates moist air from the Gulf of Mexico and dry desert air from the southwestern states. The dry line typically advances eastward during the afternoon and retreats westward at night. However, a strong storm system can sweep the dry line eastward into the Mississippi Valley, or even further east, regardless of the time of day. A typical dry line passage results in a sharp drop in humidity (hence the name), clearing skies, and a wind shift from south or southeasterly to west or southwesterly. (Blowing dust and rising temperatures may follow if the dry line passes during the daytime; see **dry punch**). These changes occur in reverse order when the dry line retreats westward. Severe and sometimes tornadic thunderstorms often develop along or just east of the dry line, especially when it begins moving eastward. See **LP storm**.

Dry line bulge - A bulge in the **dry line**, representing the area where dry air is advancing most strongly at lower levels (i.e., a surface **dry punch**). Severe weather potential is increased near and ahead of a dry line bulge.

Dry line storm - Generally, any thunderstorm that develops on or near a **dry line**. The term often is used synonymously with **LP storm**, since the latter almost always occurs near the dry line.

Dry microburst - A **microburst** with little or no precipitation reaching the ground; most common in semi-arid regions. They may or may not produce lightning. Dry microbursts may develop in an otherwise fair-weather pattern; visible signs may include a **cumulus** cloud or small **Cb** with a high base and high-level **virga**, or perhaps only an **orphan anvil** from a dying rain shower. At the ground, the only visible sign might be a **dust plume** or a ring of blowing dust beneath a local area of virga. See **wet microburst**.

Dry punch - [Slang], a surge of drier air; normally a **synoptic-scale** or **mesoscale** process. A dry punch at the surface results in a **dry line bulge**. A dry punch aloft above an area of moist air at low levels often increases the potential for severe weather.

Dry slot - A zone of dry (and relatively cloud-free) air which wraps east- or northeastward into the southern and eastern parts of a **synoptic-scale** or **mesoscale** low pressure system. A dry slot generally is seen best on satellite photographs.

Dry slot should not be confused with **clear slot**, which is a **storm-scale** phenomenon.

Dust devil - A small but intense vortex made visible by dust or debris (**dust whirl**), which forms in response to surface heating during fair, hot weather. Dust devils are most frequent in arid or semi-arid regions.

***Dust plume** - A non-rotating "cloud" of dust raised by **straight-line winds**. Often seen in a **microburst** or behind a **gust front**.

If rotation is observed, then **dust whirl** or **debris cloud** should be used.

***Dust whirl** - A rotating column of air rendered visible by dust. Similar to **debris cloud**; see also **dust devil, gustnado, tornado.**

Enhanced V - A pattern seen on satellite infrared photographs of thunderstorms, in which a thunderstorm **anvil** exhibits a V-shaped region of colder cloud tops extending downwind from the thunderstorm core. The enhanced V indicates a very strong **updraft**, and therefore a higher potential for severe weather.

Enhanced V should not be confused with **V notch.**

Enhanced wording - An option used by **SELS** in some tornado and severe thunderstorm watches when the potential for strong to violent tornadoes, or unusually widespread damaging **straight-line winds**, is considered high. The statement "THIS IS A PARTICULARLY DANGEROUS SITUATION WITH THE POSSIBILITY OF VERY DAMAGING TORNADOES" is included in tornado watches with enhanced wording. Severe thunderstorm watches may include the statement "THIS IS A PARTICULARLY DANGEROUS SITUATION WITH THE POSSIBILITY OF EXTREMELY DAMAGING WINDS", usually when a **derecho** event is occurring or forecast to occur. See **PDS watch.**

F scale - See **Fujita scale.**

Feeder bands - Lines or bands of low-level clouds that move (feed) into the updraft region of a thunderstorm, usually from the east through south (i.e. parallel to the inflow). Same as **inflow bands.**

***Flanking line** - A line of **cumulus** or **towering cumulus** clouds connected to and extending outward from the most active part of a **supercell**, normally on the southwest side. The line normally has a stair-step appearance, with the tallest clouds closest to the main storm. See Fig. 5, **HP storm**, and Fig. 7, **supercell.**

Forward flank downdraft - The main region of **downdraft** in the downwind part of a **supercell**; where most of the heavy precipitation is. Compare with **rear flank downdraft**; see Fig. 7, **supercell.**

Front - An interface or transition zone between two air masses of different density, and therefore (usually) of different temperature. A moving front is named according to the advancing air mass, e.g. cold front if colder air is advancing.

Fractus - Ragged, detached cloud fragments; same as **scud.**

Fujita scale - A scale of wind damage intensity in which wind speeds are inferred from an analysis of wind damage:

F0 (weak): 40-72 mph, light damage.
F1 (weak): 73-112 mph, moderate damage.
F2 (strong): 113-157 mph, considerable damage.
F3 (strong): 158-206 mph, severe damage.
F4 (violent): 207-260 mph, devastating damage.
F5 (violent): 261-318 mph, (rare) incredible damage.

All tornadoes, and most other severe local windstorms, are assigned a single number from this scale according to the most intense damage caused by the storm.

***Funnel cloud** - A **condensation funnel** extending from the base of a **towering cumulus** or **Cb**, associated with a rotating column of air that is not in contact with the ground (and hence different from a **tornado**). A condensation funnel is a tornado, not a funnel cloud, if either a) it is in contact with the ground or b) a **debris cloud** or **dust whirl** is visible beneath it.

Ground clutter - A pattern of radar echoes from fixed ground targets (buildings, hills, etc.) near the radar. Ground clutter may hide or confuse nearby precipitation echoes.

Gunge - [Slang], anything in the atmosphere that restricts visibility for storm spotting, such as fog, haze, precipitation (steady rain or drizzle), widespread low clouds (**stratus**), etc.

Gust Front - The leading edge of gusty surface winds from thunderstorm downdrafts; sometimes associated with a **shelf cloud** or **roll cloud**. See also **downburst, gustnado, outflow boundary.**

Gustnado (gustinado) - [Slang], gust front **tornado**. A small tornado, usually weak and short-lived, that occurs along the **gust front** of a thunderstorm. Often it is visible only as a **debris cloud** or **dust whirl** near the ground. Gustnadoes are not associated with **storm-scale** rotation (i.e. **mesocyclones**); they are more likely to be associated visually with a **shelf cloud** than with a **wall cloud.**

Helicity - A property of a moving fluid which represents the potential for helical flow (i.e. flow which follows the pattern of a corkscrew) to evolve. Helicity is proportional to the strength of the flow, the amount of vertical **wind shear**, and the amount of turning in the flow (i.e. **vorticity**). Atmospheric helicity is computed from the vertical wind profile in the lower part of the atmosphere, and is measured relative to storm motion. Higher values of helicity favor the formation of rotation at low levels (i.e. **mesocyclones**).

High risk (of severe thunderstorms) - Severe weather is expected to affect more than 10 percent of the area. A high risk is rare, and implies an unusually dangerous situation with the possibility of a major severe weather outbreak. (See **slight risk, moderate risk, convective outlook.**)

Hodograph - A plot representing the vertical distribution of horizontal winds, using polar coordinates. A hodograph is obtained by plotting the end points of the wind vectors at various altitudes, and connecting these points in order of increasing height. Interpretation of a hodograph can help in forecasting the subsequent evolution of thunderstorms (e.g. **squall line** vs. **supercells**, splitting vs. non-splitting storms, tornadic vs. nontornadic storms, etc.).

Hook (or **hook echo**) - A radar **reflectivity** pattern characterized by a hook-shaped extension of a thunderstorm echo, usually in the southwest part of the storm. A hook often is associated with a **mesocyclone**, and indicates favorable conditions for tornado development. See Fig. 2, **BWER**, and Fig. 7, **supercell.**

HP storm or **HP supercell** - High-Precipitation storm (or High-Precipitation supercell). A **supercell** thunderstorm in which heavy precipitation (often including hail) falls on the trailing side of the **mesocyclone** (Fig. 3). Precipitation often totally envelops the region of rotation, making visual identification of any embedded tornadoes very difficult and very dangerous. Unlike most **classic supercells**, the region of rotation in many HP storms develops in the front-flank region of the storm (i.e. usually in the eastern portion). HP storms often produce extreme and prolonged **downburst** events, serious flash flooding, and very large damaging hail events.

Mobile storm spotters are strongly advised to maintain a safe distance from any storm that has been identified as an HP storm; close observations (e.g. **core punching**) can be extremely dangerous. See **bear's cage.**

Inflow bands (or **feeder 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.**

Inflow jets - Local jets of air near the ground flowing inward toward the base of a **tornado.**

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 southwest quadrant of a **classic supercell** but sometimes in the eastern part of an **HP storm.**

Inflow stinger - A **beaver tail cloud** with a stinger-like shape.

Insolation - Incoming solar radiation. Solar heating; sunshine.

Instability - The tendency for air parcels to accelerate when they are displaced from their original position; especially, the tendency to accelerate upward after being lifted. Instability is a prerequisite for severe weather - the greater the instability, the greater the potential for severe thunderstorms. See **lifted index**, and Fig. 6, **sounding.**

Inversion - Generally, a departure from the usual increase or decrease in an atmospheric property with altitude. Specifically it almost always refers to a temperature inversion, i.e. an increase in temperature with height, or to the layer within which such an increase occurs. An inversion is present in the lower part of a **cap**. See Fig. 6, **sounding.**

Isobar - A line connecting points of equal pressure.

Jet streak - A local wind speed maximum within a **jet stream.**

Jet stream - Relatively strong winds concentrated in a narrow stream in the atmosphere; normally referring to horizontal, high-altitude winds. The position and orientation of jet streams vary from day to day and week to week. General weather patterns (hot/cold, wet/dry) are related closely to the position, strength and orientation of the jet stream (or jet streams).

Knuckles - [Slang], lumpy protrusions on the edges, and sometimes the underside, of a thunderstorm **anvil.** They usually appear on the upwind side of a **back-sheared anvil,** and indicate rapid expansion of the anvil due to the presence of a very strong **updraft.** They are not **mammatus** clouds. See also **cumuliform anvil, anvil rollover.**

Laminar - Smooth, non-turbulent. Often used to describe cloud formations which appear to be shaped by a smooth flow of air travelling in parallel layers or sheets.

Landspout - [Slang], a small, weak **tornado**; generally, one that does not arise from organized **storm-scale** rotation and therefore is not associated with a **wall cloud** (visually) or a **mesocyclone** (on radar). Landspouts typically are observed beneath **Cbs** or **towering cumulus** clouds (often as no more than a **dust whirl**), and essentially are the land-based equivalent of **waterspouts.**

Lapse rate - The rate of change of an atmospheric variable, usually temperature, with height. A steep lapse rate implies a rapid decrease in temperature with height, a sign of **instability.**
See Fig. 6, **sounding.**

Large scale - See **synoptic scale.**

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.** See also **right mover.**

LEWP - Line Echo Wave Pattern. A bulge in a thunderstorm line producing a wave-shaped "kink" in the line (Fig. 4). The potential for strong outflow and damaging **straight-line winds** is increased near the bulge, which often resembles a **bow echo.** Severe weather potential also is increased with storms near the crest of an LEWP.

Lifted Index (or **LI**) - A common measure of atmospheric **instability.** Its value is obtained by computing the temperature that air near the ground would have if it were lifted to some higher level (around 18,000 feet, usually) and comparing that temperature to the actual temperature at that level. Negative values indicate instability - the more negative, the more unstable the air is, and the stronger the updrafts are likely to be with any developing thunderstorms. However there are no "magic numbers" or threshold LI values below which severe weather becomes imminent. See Fig. 6, **sounding.**

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. See Fig. 6, **sounding**.

Longwave trough - A **trough** in the prevailing westerly flow aloft which is characterized by large length and (usually) long duration. Generally, there are no more than about five longwave troughs around the Northern Hemisphere at any given time. Their position and intensity govern general weather patterns (e.g. hot, cold, dry, stormy) over periods ranging from days to months. Smaller disturbances (e.g. **shortwave troughs**) typically move more rapidly through the broader flow of a longwave trough, producing weather changes over shorter time periods (a day or less).

Low-level jet (abbrev. LLJ) - A region of relatively strong winds in the lower part of the atmosphere. Specifically, it often refers to a southerly wind maximum in the **boundary layer**, common over the Plains states at night during the warm season (spring and summer).

The term also may be used to describe a narrow zone of strong winds above the boundary layer, but in this sense the more proper term would be low-level jet stream.

LP storm (or **LP supercell**) - Low-Precipitation storm (or Low-Precipitation supercell). A **supercell** thunderstorm characterized by a relative lack of visible precipitation. Visually similar to a classic **supercell**, except without the heavy precipitation core (Fig. 5). LP storms often exhibit a striking visual appearance; the main tower often is bell-shaped, with a corkscrew appearance suggesting rotation. They are capable of producing tornadoes and very large hail. Radar identification often is difficult, so visual reports are very important. LP storms almost always occur on or near the **dry line**, and therefore are sometimes referred to as **dry line storms**.

Mammatus clouds - Rounded, sack-like protrusions hanging from the underside of a cloud (usually a thunderstorm **anvil**). Mammatus clouds do not produce severe weather; they often accompany **severe thunderstorms**, but may accompany non-severe storms as well. See Figs. 3 (**HP storm**), 5 (**LP storm**), and 7 (**supercell**).

MCC - Mesoscale Convective Complex. A large **MCS**, generally round or oval-shaped, which normally reaches peak intensity at night. The formal definition includes specific minimum criteria for size, duration, and eccentricity (i.e. "roundness"), based on the cloud shield as seen on infrared satellite photographs:

Size: Area of cloud top -32 degrees C or less: 100,000 square kilometers or more (slightly smaller than the state of Ohio), and area of cloud top -52 degrees C or less: 50,000 square kilometers or more.

Duration: Size criteria must be met for at least 6 hours.

Eccentricity: Minor/major axis at least 0.7.

MCCs typically form during the afternoon and evening in the form of several isolated thunderstorms, during which time the potential for severe weather is greatest. During peak intensity, the primary threat shifts toward heavy rain and flooding.

MCS - Mesoscale Convective System. A complex of thunderstorms which becomes organized on a scale larger than the individual thunderstorms, and normally persists for several hours or more. MCSs may be round or linear in shape, and include systems such as tropical cyclones, **squall lines**, and **MCCs** (among others). MCS often is used to describe a cluster of thunderstorms that does not satisfy the size, shape, or duration criteria of an MCC.

***Mesocyclone** - A **storm-scale** region of rotation, typically around 2-6 miles in diameter and often found on the southwest part of a **supercell** (or often on the eastern, or front, flank of an **HP storm**). The circulation of a mesocyclone covers an area much larger than the **tornado** that may develop within it.

Properly used, mesocyclone is a radar term; it is defined as a rotation signature appearing on **Doppler radar** that meets specific criteria for magnitude, vertical depth, and duration. Therefore, a mesocyclone should not be considered a visually-observable phenomenon (although visual evidence of rotation, such as curved **inflow bands**, may imply the presence of a mesocyclone).

Mesolow - A small (**mesoscale**) low-pressure center; not to be confused with **mesocyclone**, which is a **storm-scale** phenomenon. Severe weather potential often increases in the area near and just ahead of a mesolow. (Also called **sub-synoptic low.**)

Mesoscale - Size scale referring to weather systems smaller than **synoptic-scale** systems but larger than **storm-scale** systems. Horizontal dimensions generally range from around 50 miles to several hundred miles. **Squall lines, MCCs,** and **MCSs** are examples of mesoscale weather systems.

***Microburst** - A small, concentrated **downburst** affecting an area less than 4 kilometers (about 2.5 miles) across. Most microbursts are rather short-lived (5 minutes or so), but on rare occasions they have been known to last up to 6 times that long.

Moderate risk (of severe thunderstorms) - Severe thunderstorms are expected to affect between 5 and 10 percent of the area. A moderate risk indicates the possibility of a significant severe weather episode. See **high risk, slight risk, convective outlook.**

Moisture advection - Transport of moisture by horizontal winds.

Moisture convergence - A measure of the degree to which moist air is converging into a given area, taking into account the effect of converging winds and **moisture advection.** Areas of persistent moisture convergence are favored regions for thunderstorm development, if other factors (e.g. **instability**) are favorable.

MRF - Medium-Range Forecast model; one of the operational forecast models run at **NMC.** The MRF is run once daily, with forecast output out to 240 hours (10 days).

Multi-cell(ular) thunderstorm - A thunderstorm consisting of two or more **cells,** of which most or all are often visible at a given time as distinct domes or **towers** in various stages of development.

Nearly all thunderstorms (including **supercells**) are multi-cellular, but the term often is used to differentiate them from a supercell.

***Multiple-vortex** or **multi-vortex tornado** - a **tornado** in which two or more **condensation funnels** or **debris clouds** are present at the same time, often rotating about a common center. Multiple-vortex tornadoes can be especially damaging. See **suction vortex.**

Mushroom - [Slang], a thunderstorm with a well-defined **anvil rollover,** and thus having a visual appearance resembling a mushroom.

NEXRAD - NEXt-Generation Weather RADar. Technologically-advanced weather radar being developed to replace the current **WSR-57** and **WSR-74** units. NEXRAD is a high-resolution **Doppler radar** with increased emphasis on automation, including use of **algorithms** and automated **volume scans.** NEXRAD units are known as **WSR-88D.**

NGM - Nested Grid Model; one of the operational forecast models run at **NMC.** The NGM is run twice daily, with forecast output out to 48 hours.

NMC - National Meteorological Center, Near Washington D.C.

NOAA - National Oceanographic and Atmospheric Administration.

NSSFC - National Severe Storms Forecast Center, in Kansas City MO. The **SELS** unit is a part of NSSFC.

NSSL - National Severe Storms Laboratory, in Norman OK. (Sometimes pronounced NES-sel.)

NWP - Numerical Weather Prediction.

NWS - National Weather Service.

Occluded mesocyclone - A **mesocyclone** in which air from the **rear-flank downdraft** has completely enveloped the circulation at low levels, cutting off the inflow of warm unstable low-level air.

Orphan anvil - [Slang], an **anvil** from a dissipated thunderstorm, below which no other clouds remain.

OTO - Oklahoma Thunderstorm Outlook. A **convective outlook** issued for much of Oklahoma by the **WSFO** in Norman, Oklahoma daily between mid-March and mid-June. (Often pronounced OWE-toe.)

Outflow boundary - A **storm-scale** or **mesoscale** boundary separating thunderstorm-cooled air (outflow) from the surrounding air; similar in effect to a cold front, with passage marked by a wind shift and usually a drop in temperature. Outflow boundaries may persist for 24 hours or more after the thunderstorms that generated them dissipate, and may travel hundreds of miles from their area of origin. New thunderstorms often develop along outflow boundaries, especially near the point of intersection with another boundary (cold front, **dry line**, another outflow boundary, etc.; see **triple point**).

Overhang - Radar term indicating a region of high **reflectivity** at middle and upper levels above an area of weak reflectivity at low levels. (The latter area is known as a weak-echo region, or **WER**.) The overhang is found on the inflow side of a thunderstorm (normally the south or southeast side). See Fig. 2, **BWER**.

Overrunning - A weather pattern in which a relatively warm air mass is in motion above another air mass of greater density at the surface. Embedded thunderstorms sometimes develop in such a pattern; severe thunderstorms (mainly with large hail) can occur, but tornadoes are unlikely.

Overrunning often is applied to the case of warm air riding up over a retreating layer of colder air, as along the sloping surface of a warm front. Such use of the term technically is incorrect, but in general it refers to a pattern characterized by widespread clouds and steady precipitation on the cool side of a front or other boundary.

***Overshooting top** (or **anvil dome, penetrating top**) - A dome-like protrusion above a thunderstorm **anvil**, representing a very strong **updraft** and hence a higher potential for severe weather with that storm. Persistent overshooting tops often are observed with **supercells**. A short-lived overshooting top, or one that forms and dissipates in cycles, may indicate the presence of a **pulse storm** or a **cyclic storm**. See Figs. 3 (**HP storm**), 5 (**LP storm**), and 7 (**supercell**).

PDS watch - [Slang], a tornado watch with **enhanced wording** (particularly dangerous situation).

Pendant echo - Radar signature generally similar to a **hook echo**, except that the hook shape is not as well defined.

Penetrating top - Same as **overshooting top** or **anvil dome**.

Positive area - The area on a **sounding** representing the layer in which a lifted parcel would be warmer than the environment; thus, the area between the environmental temperature profile and the path of the lifted parcel. See Fig. 6, sounding. Positive area is a measure of the energy available for **convection**; see **CAPE**.

Positive CG - A **CG** flash that delivers positive charge to the ground, as opposed to the more common negative charge. Positive CGs have been found to occur more frequently in some severe thunderstorms. Their occurrence is detectable by most lightning detection networks, but visually it is not considered possible to distinguish between a positive CG and a negative CG. (Some claim to have observed a relationship between **staccato lightning** and positive CGs, but this relationship is as yet unproven.)

PPINE - Plan Position Indicates No Echoes, referring to the fact that a radar is not detecting any precipitation within its range.

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 **overshooting top, cyclic storm.**

PVA - Positive Vorticity Advection. **Advection** of higher values of **vorticity** into an area, which often is associated with upward motion (lifting) of the air. PVA typically is found in advance of disturbances aloft (i.e. **shortwaves**), and is a property which often enhances the potential for thunderstorm development.

RADAP II - RAdar DAta Processor II, attached to some **WSR-57** and **WSR-74** radar units. It automatically controls the **tilt sequence** and computes several radar-derived quantities at regular intervals, including **VIL**, storm tops, accumulated rainfall, etc.

Radial velocity - Component of motion toward or away from a given location. As "seen" by **Doppler radar**, it is the component of motion parallel to the radar beam. (The component of motion perpendicular to the beam cannot be seen by the radar. Therefore, strong winds blowing strictly from left to right or from right to left, relative to the radar, cannot be detected.)

Rain foot - [Slang], a horizontal bulging near the surface in a precipitation shaft, forming a foot-shaped prominence. It is a visual indication of a **wet microburst.**

***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. See Figs. 3 (**HP storm**), 5 (**LP storm**), and 7 (**supercell**).

Rear flank downdraft (or **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 Fig. 7, **supercell.**

Red watch or **red box** - [Slang], a tornado watch.

Reflectivity - Radar term referring to the ability of a radar target to return energy; used to derive echo intensity, and to estimate precipitation intensity and rainfall rates. See **VIP.**

Retrogression (or **retrograde motion**) - Movement of a weather system in a direction opposite to that of the basic flow in which it is embedded; usually referring to a **closed low** or a **longwave trough** which moves westward.

Return flow - South winds on the back (west) side of an eastward-moving surface high pressure system. Return flow over the central and eastern United States typically results in a return of moist air from the Gulf of Mexico (or the Atlantic Ocean).

Ridge - An elongated area of relatively high atmospheric pressure; the opposite of **trough.**

***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.) See **left mover, splitting storm.**

***Roll cloud** - A low, horizontal tube-shaped **arcus** cloud associated with a thunderstorm **gust front** (or sometimes with a cold front). Roll clouds are relatively rare; they are completely detached from the thunderstorm base or other cloud features, thus differentiating them from the more familiar **shelf clouds**. Roll clouds usually appear to be "rolling" about a horizontal axis, but should not be confused with **funnel clouds**.

***Rope** (or **rope funnel**) - A narrow, often contorted **condensation funnel** usually associated with the decaying stage of a **tornado**. See **rope stage**.

Rope cloud - In satellite meteorology, a narrow, rope-like band of clouds sometimes seen on satellite images along a **front** or other boundary.

The term sometimes is used synonymously with **rope** or **rope funnel**.

Rope stage - The dissipating stage of a **tornado**, characterized by thinning and shrinking of the **condensation funnel** into a **rope funnel**. Damage still is possible during this stage.

***Scud** (or **fractus**) - Small, ragged, low cloud fragments that are unattached to a larger cloud base and often seen with and behind cold fronts and thunderstorm gust fronts. Such clouds are associated with cool moist air, such as thunderstorm outflow.

SELS - SEvere Local Storms Unit of the National Severe Storms Forecast Center (**NSSFC**) in Kansas City, MO. SELS issues **convective outlooks** several times daily, and is responsible for issuing all tornado and severe thunderstorm watches for the Continental United States.

***Severe thunderstorm** - A thunderstorm which produces tornadoes, hail three-quarters of an inch or more in diameter, or winds of 50 knots (58 mph) or more. Structural wind damage may imply the occurrence of a severe thunderstorm. See **approaching (severe)**.

Shear - Variation in wind speed (**speed shear**) and/or direction (**directional shear**) over a short distance.

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.

***Shelf cloud** - A low, horizontal wedge-shaped **arcus cloud**, associated with a thunderstorm **gust front**. Unlike the **roll cloud**, the shelf cloud is attached to the thunderstorm cloud base. 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.

Shortwave (or **shortwave trough**) - A disturbance in the mid or upper part of the atmosphere which induces upward motion ahead of it. If other conditions are favorable, the upward motion can contribute to thunderstorm development ahead of a shortwave.

Slight risk (of severe thunderstorms) - Severe thunderstorms are expected to affect between 2 and 5 percent of the area. A slight risk generally implies that severe weather events are expected to be isolated. See **high risk, moderate risk, convective outlook.**

Sounding - A plot of the vertical profile of temperature and **dew point** (and often winds) above a fixed location (Fig. 6). Soundings are used extensively in severe weather forecasting, e.g. to determine **instability**, locate temperature **inversions**, measure the strength of the **cap**, obtain the **convective temperature**, etc.

Speed shear - The component of **wind shear** which is due to a change in wind speed with height, e.g. southwesterly winds at 20 mph at 10,000 feet increasing to 50 mph at 20,000 feet. Speed shear is an important factor in severe weather development, especially in the middle and upper levels of the atmosphere.

Spin-up - [Slang], a small-scale vortex initiation, such as what may be seen when a **gustnado, landspout**, or **suction vortex** forms.

Splitting storm - A thunderstorm which splits into two storms which follow diverging paths (a **left mover** and a **right mover**). The left mover typically moves faster than the original storm; the right mover, slower. Of the two, the left mover is most likely to weaken and dissipate (but on rare occasions can become a very severe **anticyclonic-rotating** storm), while the right mover is the one most likely to reach **supercell** status.

***Squall line** - A solid or nearly solid line or band of active thunderstorms.

Staccato lightning - Cloud-to-ground lightning flashes (**CGs**) which appear as very bright, short-duration strokes, often with considerable branching.

Steering winds (or **steering currents**) - A prevailing **synoptic-scale** flow which governs the movement of smaller features embedded within it.

Storm-relative - Measured relative to a moving thunderstorm, usually referring to winds, wind **shear**, or **helicity**.

Storm-scale - Size scale referring to weather systems with sizes on the order of individual thunderstorms. See **synoptic scale**, **mesoscale**.

***Straight-line winds** - Generally, any wind that is not associated with rotation; used mainly to differentiate them from tornadic winds.

Stratiform - Having extensive horizontal development, as opposed to the more vertical development characteristic of **convection**. Stratiform clouds cover large areas but show relatively little vertical development. Stratiform precipitation, in general, is relatively continuous and uniform in intensity (i.e. steady rain versus rain showers).

Stratocumulus - Low-level clouds, existing in a relatively flat layer but having individual elements. Elements often are arranged in rows, bands, or waves. Stratocumulus often reveals the depth of the moist air at low levels, while the speed of the cloud elements can reveal the strength of the **low-level jet**.

Stratus - A low, generally gray cloud layer with a fairly uniform base. Stratus may appear in the form of ragged patches, but otherwise does not exhibit individual cloud elements as do **cumulus** and **stratocumulus** clouds. Fog usually is a surface-based form of stratus.

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 an **LP storm**.

Sub-synoptic low - Essentially the same as **mesolow**.

Suction vortex (sometimes **suction spot**) - A small but very intense vortex within a **tornado** circulation. Several suction vortices typically are present in a **multiple-vortex** tornado. Much of the extreme damage associated with violent tornadoes (F4 and F5 on the **Fujita scale**) is attributed to suction vortices.

***Supercell** - A relatively long-lived thunderstorm with a persistent rotating updraft. Supercells are rare, but are responsible for a remarkably high percentage of severe weather events - especially **tornadoes**, extremely large hail and damaging **straight-line winds**. They frequently travel to the right of the main environmental winds (i.e. they are **right movers**). Radar characteristics often (but not always) include a **hook** or **pendant**, bounded weak echo region (**BWER**), **V-notch**, **mesocyclone**, and sometimes a **TVS**. Visual characteristics often include a **rain-free base** (with or without a **wall cloud**), **tail cloud**, **flanking line**, **overshooting top**, and **back-sheared anvil**, all of which normally are observed in or near the right rear or southwest part of the storm (Fig. 7). Storms exhibiting these characteristics often are called **classic supercells**; however **HP storms** (Fig. 3) and **LP storms** (Fig. 5) also are supercell varieties.

Synoptic scale (or **large scale**) - Size scale referring generally to weather systems with horizontal dimensions of several hundred miles or more. Most high and low pressure areas seen on weather maps are synoptic-scale systems. Compare with **mesoscale, storm-scale.**

***Tail cloud** - A horizontal, tail-shaped cloud (not a **funnel cloud**) at low levels extending north or northeastward from a **wall cloud** toward the precipitation area. 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. See Fig. 7, **supercell.**

Tail-end Charlie - [Slang], the thunderstorm at the southernmost end of a **squall line** or other line or band of thunderstorms. Since low-level southerly inflow into this storm is relatively unimpeded, such a storm often has a higher probability of producing severe weather than the other storms in the line.

Tilt sequence - Radar term indicating that the radar antenna is scanning through a series of antenna elevations in order to obtain a **volume scan.** The radar is said to be "in a tilt" when a tilt sequence is in progress.

Tilted storm or **tilted updraft** - A thunderstorm or cloud **tower** which is not purely vertical but instead exhibits a slanted or tilted character. It is a sign of vertical wind **shear**, a favorable condition for severe storm development.

***Tornado** - A violently rotating column of air in contact with the ground. A **condensation funnel** does not need to reach to the ground for a tornado to be present; a **debris cloud** beneath a thunderstorm is all that is needed to confirm the presence of a tornado, even in the total absence of a condensation funnel.

Tower - (Often short for **towering cumulus**), a cloud element showing appreciable upward vertical development.

Towering cumulus - (Same as **congestus.**) A large **cumulus** cloud with great vertical development, usually with a cauliflower-like appearance, but lacking the characteristic **anvil** of a **Cb.** (Often shortened to "towering cu", and abbreviated TCU.)

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 can indicate severe or greater 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.

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 often point toward the region most likely for later storm development.

T rolls - [Slang], same as **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).

Trough - An elongated area of relatively low atmospheric pressure; usually not associated with a closed circulation, and thus used to distinguish from a **closed low.** The opposite of **ridge.**

Turkey tower - [Slang], a narrow, individual cloud **tower** that develops and falls apart rapidly. The sudden development of turkey towers from small **cumulus** clouds may signify the breaking of a **cap.**

TVS - Tornadic Vortex Signature. **Doppler radar** signature in the **radial velocity** field indicating intense, concentrated rotation - more so than a **mesocyclone**. Like the mesocyclone, specific criteria involving strength, vertical depth, and time continuity must be met in order for a signature to become a TVS. Existence of a TVS strongly increases the probability of **tornado** occurrence, but does not guarantee it. A TVS is not a visually observable feature.

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**.

Updraft base - Alternate term for a **rain-free base**.

Upslope flow - Air that flows toward higher terrain, and hence is forced to rise. The added lift often results in widespread low cloudiness and **stratiform** precipitation if the air is stable, or an increased chance of thunderstorm development if the air is unstable.

Vault - See **BWER** (bounded weak echo region).

Veering winds - Winds which shift in a clockwise direction with time at a given location (e.g. from southerly to westerly), or which change direction in a clockwise sense with height (e.g. southeasterly at the surface turning to southwesterly aloft). The latter example is a form of **directional shear** which is important for **tornado** formation. Compare with **backing winds**.

VIL - Vertically-Integrated Liquid water. A property computed by **RADAP II** and **WSR-88D** units that takes into account the three-dimensional **reflectivity** of an echo. The maximum VIL of a storm is useful in determining its potential severity, especially in terms of maximum hail size.

VIP - Video Integrator and Processor, which contours radar **reflectivity** into six VIP levels:
VIP 1 (Level 1) - Light precipitation
VIP 2 (Level 2) - Light to moderate rain.
VIP 3 (Level 3) - Moderate to heavy rain.
VIP 4 (Level 4) - Heavy rain
VIP 5 (Level 5) - Very heavy rain; hail possible.
VIP 6 (Level 6) - Very heavy rain and hail; large hail possible.

***Virga** - Streaks or wisps of precipitation falling from a cloud but evaporating before reaching the ground. In certain cases, shafts of virga may precede a **microburst**; see **dry microburst**.

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. See Fig. 7, **supercell**.

Volume scan - A radar scanning strategy in which sweeps are made at successive antenna elevations (i.e. a **tilt sequence**), and then combined to obtain the three-dimensional structure of the echoes. Volume scans are necessary to determine thunderstorm type, and to detect features such as **WERs**, **BWERs**, and **overhang**.

Vorticity - A measure of the local rotation in a fluid flow. In weather analysis and forecasting, it usually refers to the vertical component of rotation (i.e. rotation about a vertical axis) and is used most often in reference to **synoptic-scale** or **mesoscale** weather systems. By convention, positive values indicate **cyclonic rotation**.

Vort max - (Slang; short for vorticity maximum), a center, or maximum, in the **vorticity** field of a fluid.

***Wall cloud** - A local, often abrupt lowering from a **rain-free base**. Wall clouds can range from a fraction of a mile up to nearly five miles in diameter, and normally are found on the south or southwest (inflow) side of the thunderstorm. When seen from within several miles, many wall clouds exhibit rapid upward motion and **cyclonic rotation**. Rotating wall clouds usually develop before strong or violent tornadoes, by anywhere from a few minutes up to nearly an hour. Wall clouds should be monitored visually for signs of persistent, sustained rotation. See Fig. 7, **supercell**.

Wall cloud sometimes is used in tropical meteorology to describe the inner cloud wall surrounding the eye of a tropical cyclone, but the proper term for this feature is eyewall.

Warm advection - Transport of warm air into an area by horizontal winds.

Low-level warm advection sometimes is referred to as **overrunning**; although the two terms are not properly interchangeable, both imply the presence of lifting in the lower levels.

Watch box (or **box**) - [Slang], a severe thunderstorm or tornado watch.

Waterspout - In general, a **tornado** occurring over water. Specifically, it normally refers to a small, relatively weak rotating column of air over water beneath a **Cb** or **towering cumulus** cloud. Waterspouts are most common over tropical or subtropical waters.

The exact definition of waterspout is debatable. In most cases the term is reserved for small vortices over water that are not associated with **storm-scale** rotation (i.e. they are the water-based equivalent of **landspouts**). But there is sufficient justification for calling virtually any rotating column of air, in contact with a water surface, a waterspout.

Wedge - [Slang], a large **tornado** with a wedge-like shape.

WER - Weak Echo Region. Radar term for a region of relatively weak **reflectivity** at low levels on the inflow side of a thunderstorm echo, topped by stronger reflectivity in the form of an echo **overhang** directly above it (see Fig. 2). The WER is a sign of a strong **updraft** on the inflow side of a storm, within which precipitation is held aloft. When the area of low reflectivity extends upward into, and is surrounded by, the higher reflectivity aloft, it becomes a **BWER**.

Wet microburst - A **microburst** accompanied by heavy precipitation at the surface. A **rain foot** may be a visible sign of a wet microburst. See **dry microburst**.

Wind shear - See **shear**.

Wrapping gust front - A **gust front** which wraps around a **mesocyclone**, cutting off the inflow of warm moist air to the mesocyclone circulation and resulting in an **occluded mesocyclone**.

WSR-57, WSR-74 - NWS Weather Surveillance Radar units; to be replaced by **WSR-88D** units.

WSR-88D - Weather Surveillance Radar - 1988 Doppler; **NEXRAD** unit.

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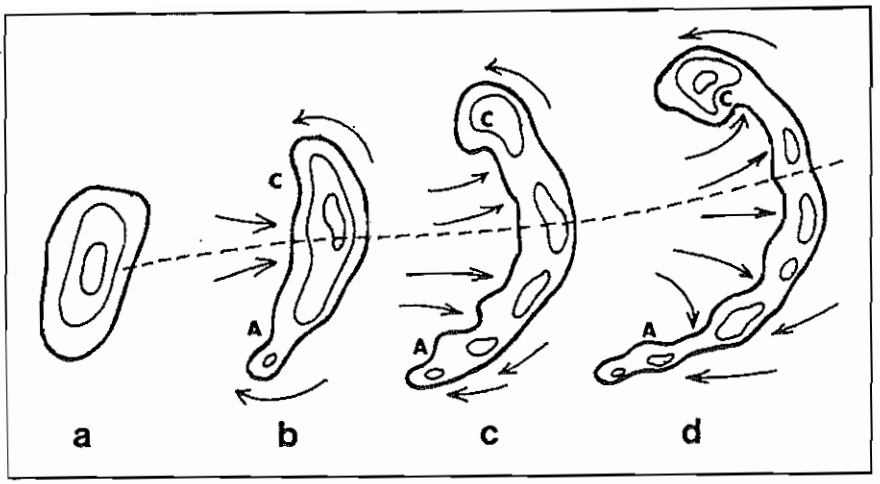

Fig. 1. **Bow echo.** Typical evolution of a thunderstorm radar echo (a) into a bow echo (b, c) and into a **comma echo** (d). Dashed line indicates axis of greatest potential for **downbursts.** Arrows indicate wind flow relative to the storm. Note regions of **cyclonic rotation** (C) and **anticyclonic rotation** (a); both regions, especially C, are capable of supporting **tornado** development in some cases.

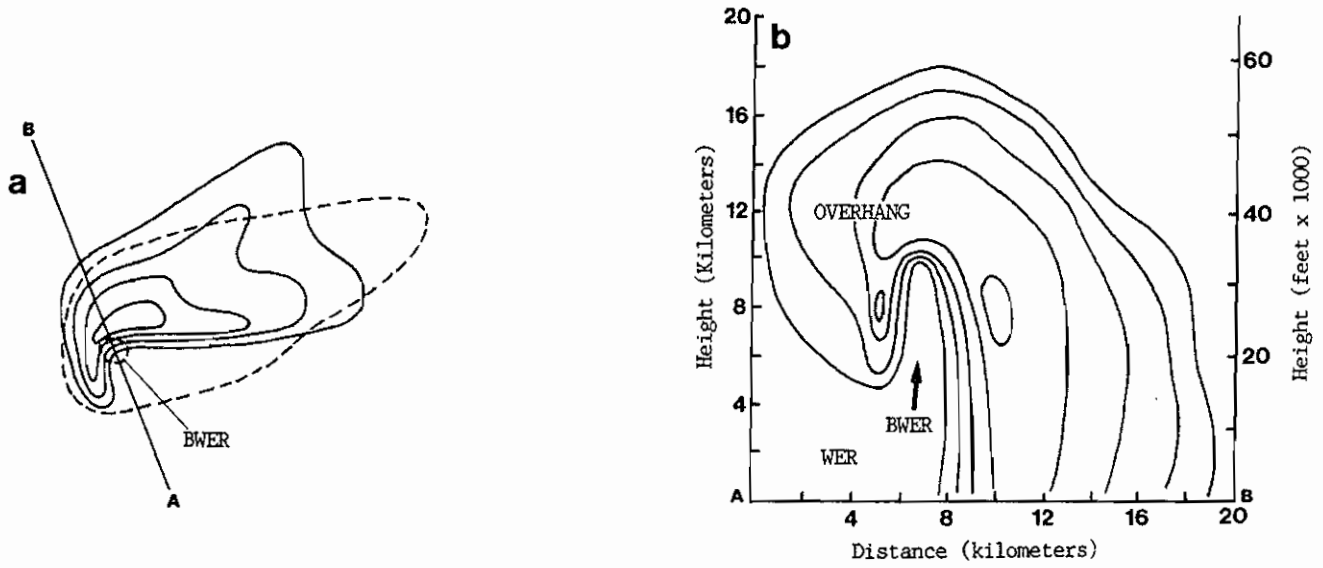

Fig. 2. **BWER, WER.** (a) Schematic showing relative positions of low-level radar **reflectivity** contours (solid) and mid-level echo (around 8 km or 26,000 feet, dashed). (b) Vertical cross-section through AB showing echo **overhang** above weak-echo region (**WER**), and a **BWER** where the area of weak reflectivity extends upward into the region of higher reflectivity aloft. (In (a), note the **hook echo** at lower left and the **V-notch** at upper right; compare with Fig. 7.)

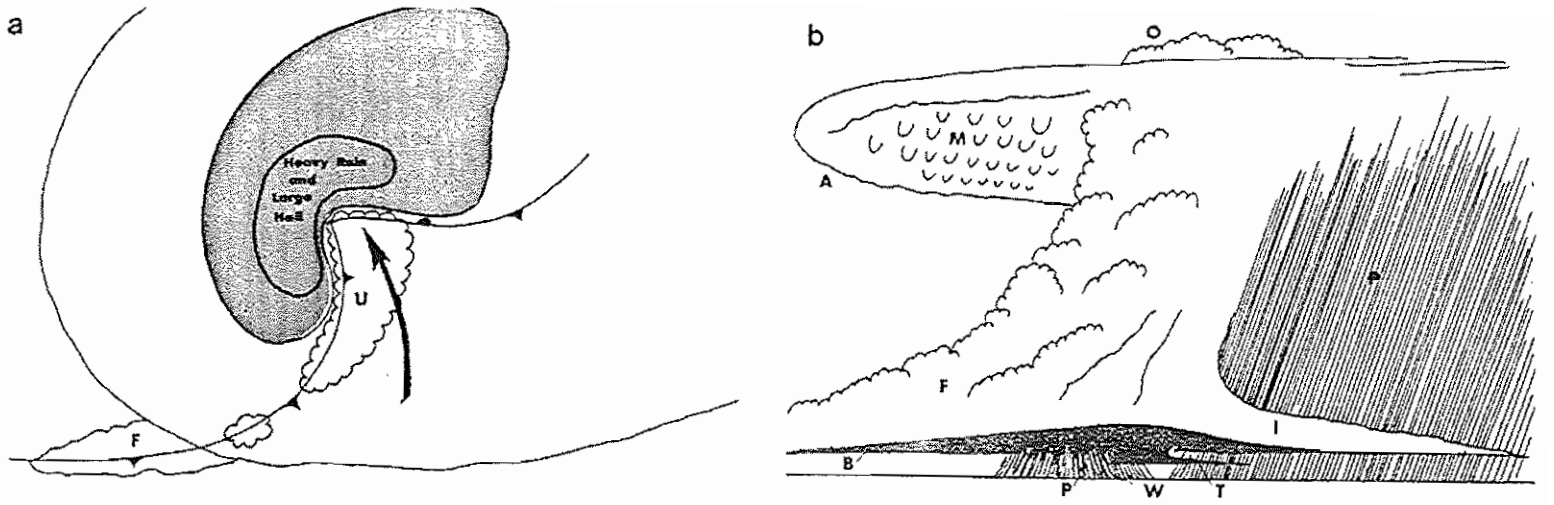

Fig. 3. **HP storm (HP supercell).** Schematic view from above of an HP storm (a), and visual features of the same storm as might be seen from the east or southeast (b). In (a), region of radar **reflectivity** is shaded. Scalloped line encloses region of main updraft (U). Surface inflow is indicated by arrow. Frontal symbols indicate location of **gust front.** Features in (b) include **overshooting top** (O), **back-sheared anvil** (B), **wall cloud** (W; often obscured by precipitation), **tail cloud** (T), **inflow band** (I), and regions of heavy precipitation (P). Compare with Figs. 5 and 7.

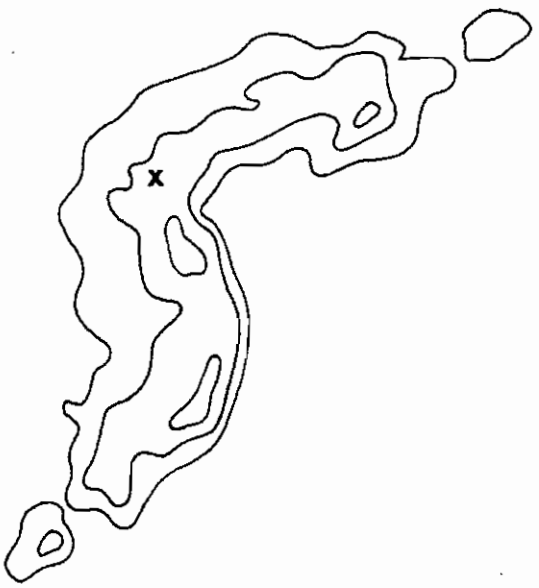

Fig. 4. **LEWP** (line-echo wave pattern). Typical radar **reflectivity** contours associated with a LEWP. The crest of the wave pattern is at X. Note similarity of the echo below X to the **bow echo** in Fig. 1.

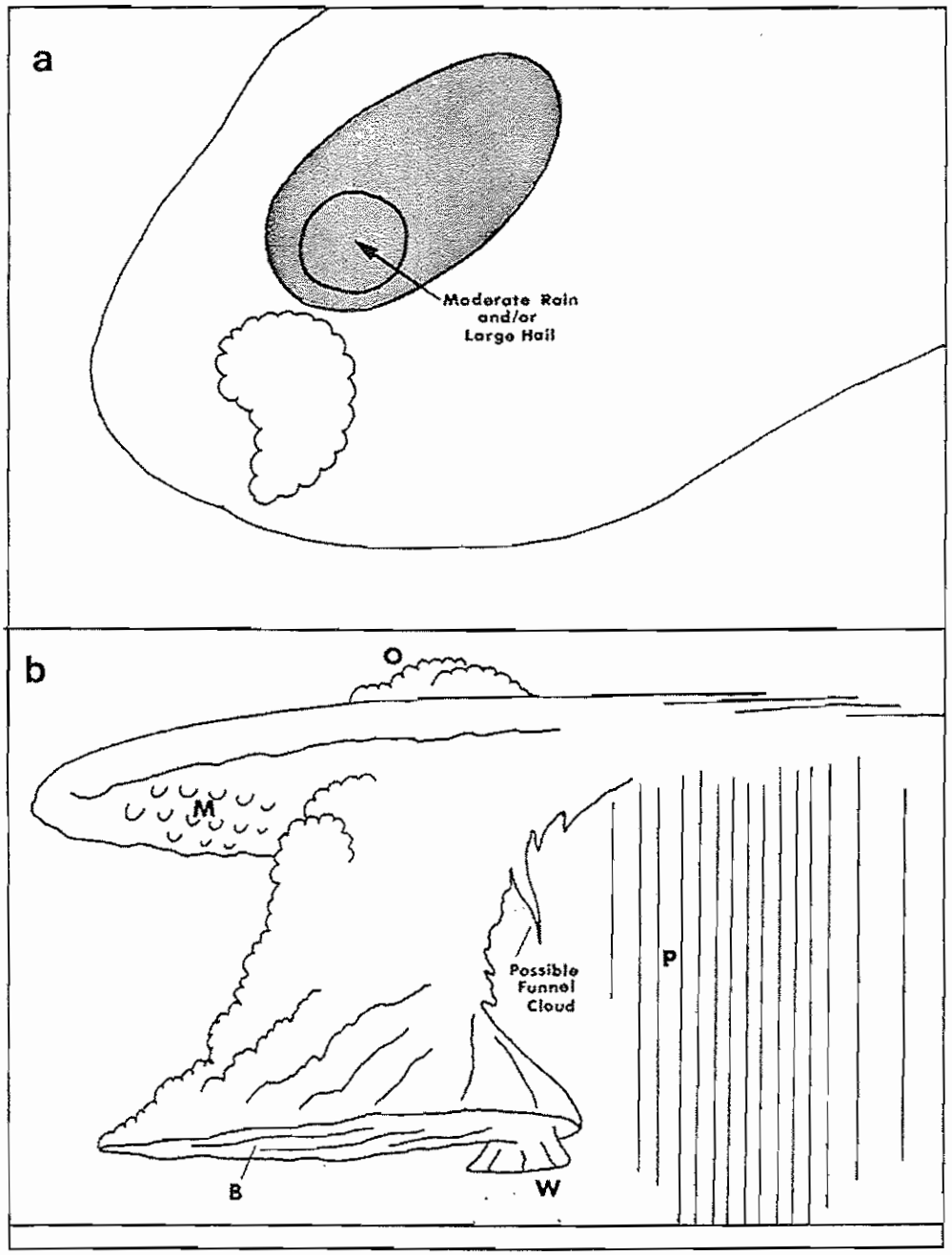

Fig. 5. **LP storm (LP supercell).** Schematic view from above of an LP storm (a), and visual features of the same storm as might be seen from the east or southeast (b). In (a), region of radar **reflectivity** is shaded. Scalloped line encloses region of main updraft (U). (Note the absence of a dominant downdraft.) Features in (b) include **overshooting top** (O), **mammatus** (M), **rain-free base** (B), **wall cloud** (W), and area of mostly light precipitation (P). Compare with Figs. 3 and 7.

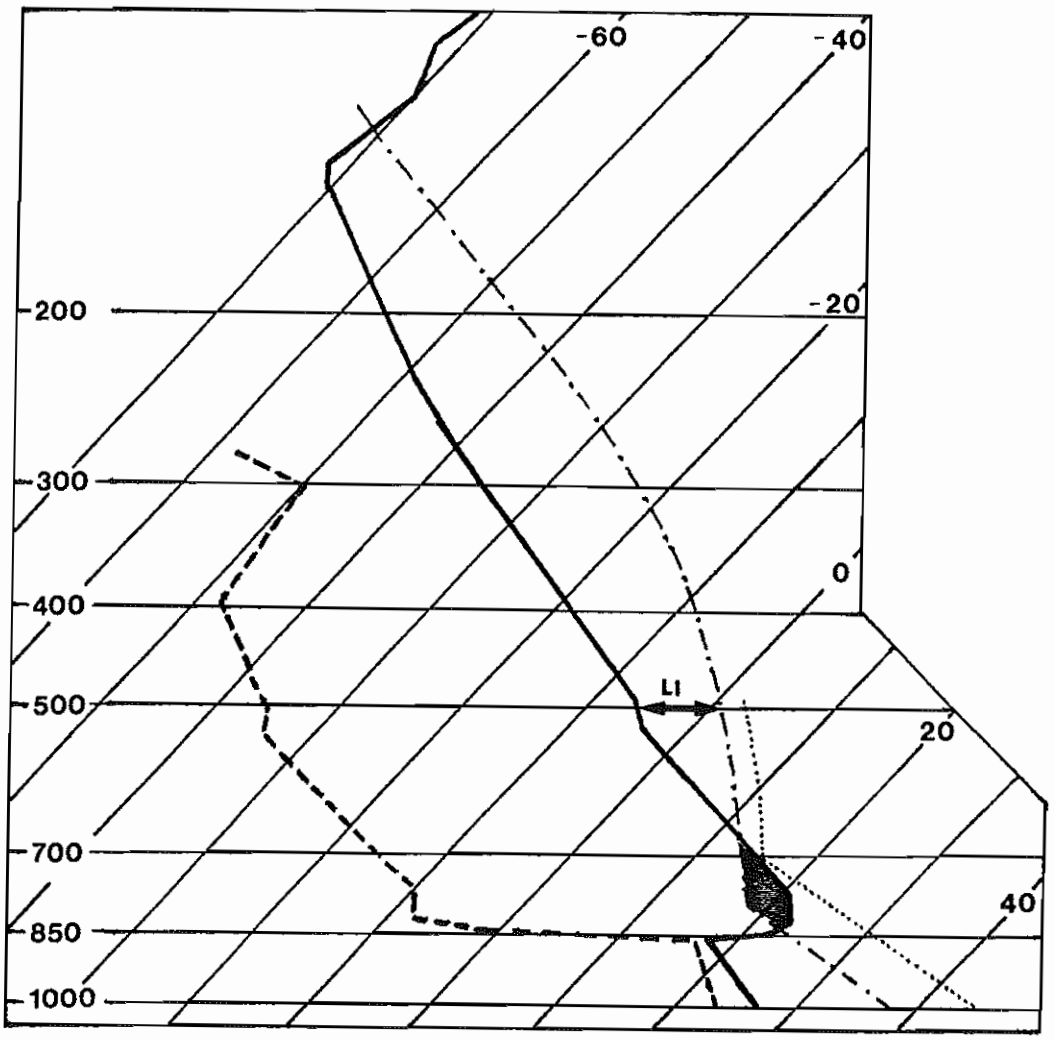

Fig. 6. **Sounding,** Plotted sounding from Oklahoma City, OK, at 7 AM CDT, 8 June 1974. Horizontal lines represent height in pressure coordinates (millibars, or mb); diagonal lines represent temperature. Heavy solid and dashed lines show the vertical profile of observed temperature and **dew point**, respectively. Dash-dot line shows the temperature that a parcel of surface air would have if it were heated to about 38 C (100 F, the forecast high that day), and then lifted.

This is a typical **loaded gun sounding.** A temperature **inversion** exists near 850 mb; the **cap** is represented by the warm layer above it, wherein the lifted parcel would be cooler than the surrounding air (shaded area). Above the cap, the parcel would be warmer than the surrounding air and thus would accelerate upward (i.e., **instability**). At these levels, (above about 690 mb), **positive area** is seen as the area between the solid and dash-dot lines. This area is related directly to the convective available potential energy or **CAPE.** The **lifted index (LI)** is shown by the temperature difference at 500 mb; in this case, it would be about minus 6. The **convective temperature** is found using the dotted lines; surface air would have to heat to about 43 C (109 F) to rise beyond the cap. This value assumes no subsequent changes in the sounding — a bad assumption on this day, since a tornado touched down at the location of the sounding later that afternoon, despite surface temperatures in the 90s.

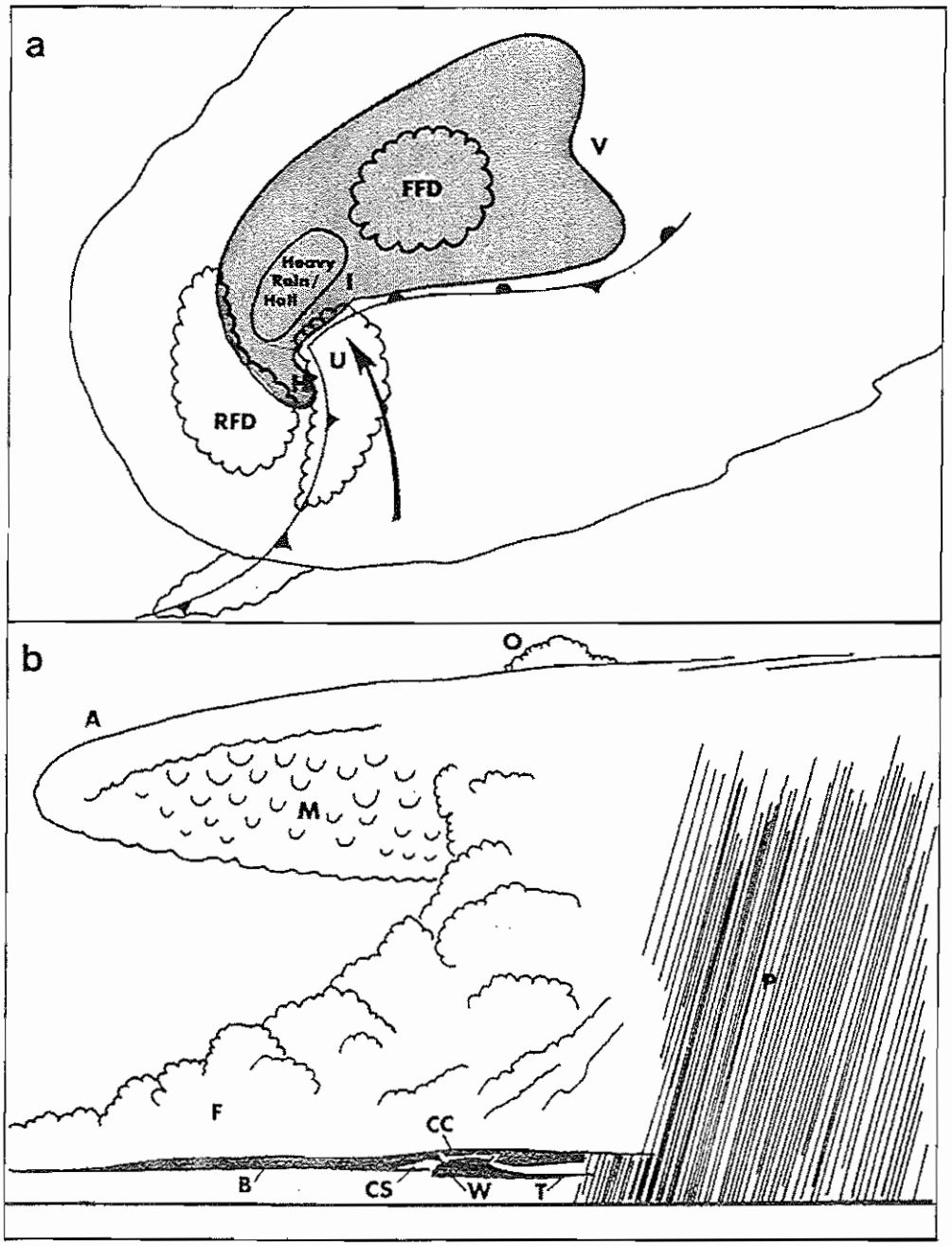

Fig. 7. **Supercell.** Schematic view from above of a **classic supercell** (a), and visual characteristics of the same storm as might be seen from the east or southeast (b). In (a), region of radar **reflectivity** is shaded; note **V-notch** (V), **inflow notch** (I), and **hook echo** (H). Scalloped lines enclose region of main updraft (U), **forward flank downdraft** (FFD) and **rear flank downdraft** (RFD). Surface inflow is indicated by arrow. Frontal symbols indicate location of **gust front.** Features in (b) include **overshooting top** (O), **backsheared anvil** (A), **mammatus** (M), **flanking line** (F), **rain-free base** (B), **clear slot** (CS), **collar cloud** (CC), **wall cloud** (W), **tail cloud** (T), and region of heavy precipitation (P). Compare with Fig. 3 and Fig. 5.