

# SEVERE AND UNUSUAL WEATHER

## *Basic Meteorological Terminology*

**Adiabatic** - Referring to a process without the addition or removal of heat. A temperature change may come about as a result of a change in the state of a gas.

**Advection** - Horizontal movement of air or atmospheric properties, such as temperature, moisture and vorticity, to indicate the trends of that property; "horizontal convection".

**Aliasing** - In radar, the folding of target returns from outside the normal unambiguous range interval (range folding) into the normal range interval, or the folding of radial velocity measurements outside the unambiguous velocity interval (velocity folding) into the normal velocity interval.

**Alto-** - Prefix used to define mid-level clouds.

**Anticyclonic** - Rotation opposite the earth's rotational sense. In the Northern Hemisphere, clockwise rotation is anticyclonic. Wind in a ridge or around a high; supergeostrophic.

**Backing** - Counterclockwise shifting of the winds with either distance or time.

**Baroclinic** - A state of the atmosphere in which isotherms intersect isobars. The geostrophic wind results in temperature advection, and hence disturbances modify with time. Short waves are baroclinic and therefore modify.

**Barotropic** - A state of the atmosphere where isotherms are parallel to isobars. (This is actually known as equivalent barotropic.) No temperature advection occurs. Long waves are barotropic.

**Bow Echo** - A line or line segment of storms that forms a curved segment similar to that of an archer's bow. Usually indicative of strong to severe surface winds.

**Bright band** - In radar, indicates the melting point of a snowflake. High intensity return is caused by the water surrounding the ice crystal, hence appearing large.

**Buys-Ballot Law** - With the wind at your back, low pressure is to your left in the Northern Hemisphere.

**CAPE** - Convective available potential energy. The amount of energy that is used by thunderstorms to create the updraft; similarly positive buoyant energy (PBE).

**CCL** - Convective condensation level; the lowest level at which condensation will occur as a result of convection due to surface heating.

**CCN** - Cloud condensation nuclei; particles (or aerosols) on which water condenses to form cloud drops.

**Cirro-** - Prefix used to define high-level clouds.

**Cirrus** - A cirriform cloud composed of ice. Appears as fibrous strands.

**CISK** - Conditional Instability of the Second Kind. A cooperative interaction between the cumulus convection and a larger-scale perturbation that leads to unstable growth of the system

**Collision and coalescence** - Process important in precipitation formation; involves the colliding of cloud drops or raindrops and the "sticking-together" of them.

**Condensation** - The change of state from vapor to liquid. The process releases latent heat.

**Conditional instability** - A type of atmospheric instability where the air is stable if it is dry, and unstable if it is saturated.  $\Gamma_W < \Gamma_E < \Gamma_D$

**Conduction** - The transfer of sensible heat from a warm object to a cool object through contact.

**Convection** - A transfer of heat within a fluid by fluid motions. Meteorologists refer to vertical motions as convective. Horizontal motions are advective. Also used to denote the presence of cumulus clouds (also known as convective clouds); most often refers to instability.

**Convective Temperature** - The temperature to which air must be heated to generate convection solely by heating. The air will have a dry adiabatic lapse rate from the surface to the LFC.

**Convective instability** - The state of an unsaturated layer of air whose lapse rates of temperature and moisture are such that when lifted adiabatically to saturation, convection is spontaneous.

**Convergence** - Coming together; "piling up" of mass. Surface convergence occurs in association with rising air whereas upper-level convergence is associated with subsidence.

**Coriolis force** - An apparent force that makes moving objects deflect to the right of motion in the Northern Hemisphere.  $\text{Coriolis Force} = 2\Omega \cdot v \cdot \sin \phi$

**Cyclonic** - Rotation in the same sense that the earth rotates, counter-clockwise in the Northern Hemisphere. Wind around a low; subgeostrophic.

**Dealiasing** - Correcting aliased data.

**Derecho** - Very fast moving line of storms that produce considerable damage, often associated with LEWPS and bows. The word is of Spanish origin meaning "straight ahead."

**Dew point ( $T_d$ )** - The temperature to which air must cool *at constant pressure* in order for air to reach saturation (commonly dew to form); indicates moisture content.

**Divergence** - Going apart. Upper-level divergence is associated with rising air. Surface divergence is associated with subsidence and high surface pressure.

**Doppler radar** - Radar that indicates radial (toward or away from the radar) wind speed as well as precipitation echoes; coherent radar.

**Dry bulb temperature** - The actual air temperature as measured by a sling psychrometer.

**Dry Line** - A boundary between moist air and dry air with little or no temperature difference during mid-day. It often serves as a focus for convective initiation.

**Echo** - The energy received on radar that results from back-scattered energy; indicates the presence of precipitation (targets).

**Entrainment** - The act of air being drawn into a cloud from the non-cloud environment.

**Entropy** - A measure of randomness. A measure of thermal energy not available to do work.

**EL** - Equilibrium level; the level where unstable air becomes stable again.

**Evaporation** - The change of state from liquid water to vapor, requires energy (latent heat is absorbed).

**Freezing rain** - Rain that falls as liquid water but freezes on contact with a cold surface.

**Front** - A narrow transition zone, or boundary, between disparate synoptic scale air masses whose primary discontinuity is density. Fronts are commonly associated with a moisture gradient, a pressure trough, a wind shift and/or various sensible weather phenomena. A front is a convergent boundary. It is synoptic scale along the length of the front, but mesoscale across the front itself.

**Geostrophic wind** - Wind that flows parallel to the isobars in a straight line; a balance between the pressure gradient force and the coriolis force. The pressure gradient force is balanced by the Coriolis force in the geostrophic balance.

**Gradient wind** - Wind that flows parallel to the isobars, but non-linearly. Wind that curves cyclonically is sub-geostrophic, or slower than the geostrophic approximation would predict the wind to be, while wind that curves anticyclonically is faster, or super-geostrophic; results from a balance among the PGF, the coriolis force and the centrifugal force.

**Gravity wave** - A wave disturbance in which buoyancy acts as a restoring force on parcels displaced from hydrostatic equilibrium.

**Hydrostatic** - A vertical balance between gravity and the vertical pressure gradient force. The atmosphere is considered to be in hydrostatic balance except in strong disturbances. *i.e.* thunderstorms.

**Hypsometric Equation** - An equation relating the vertical distance between two isobaric surfaces (constant pressure levels) to the layer's mean (virtual) temperature. The greater the distance between isobaric surfaces, the greater the average temperature of the intervening layer. In other words, the thicker the warmer, the thinner the colder. Also known as the thickness relation.

**Instability** - Possessing the ability to move away from the original position; allows convection and enhances vertical motions.

**Inversion** - Temperatures increasing with increased altitude, or height. A negative lapse rate.

**Isobar** - A line of constant pressure.

**Isoheight** - A line of constant height above a certain reference point such as sea-level. Also called a contour line.

**Isodrosotherm** - A line of constant dew point temperature.

**Isotach** - A line of constant wind speed.

**Isotherm** - A line of constant temperature.

**Jet stream** - An upper-level stream of fast moving air, the result of a strong meridional pressure gradient. The polar jet stream separates cold polar air from warm tropical air.

**Lapse rate ( $\Gamma$ )** - The change of temperature with a change in height. Also a rate of cooling. A positive lapse rate indicates temperatures cooling as height increases while a negative lapse rate indicates an inversion.  $\Gamma \equiv \Delta T / \Delta Z$

**Latent heat** - The heat either released or absorbed as a result of a change of state.

**LCL** - Lifting condensation level. The level at which lifted air will saturate.

**LEWP** - Line echo wave pattern. A feature within a line of storms that resembles a wave with a mesolow at the crest of this feature. Often associated with multiple bowing segments within a larger squall line.

**LFC** - Level of free convection. The level at which lifted air becomes unstable and hence rises on its own.

**Mamma** - Pouch-like clouds, usually found beneath the anvil of a thunderstorm.

**Meridional** - In the north-south direction; along a meridian.

**Macroscale** - A large scale event usually measured in 10,000's of kilometers and weeks of time; a planetary scale event; *e.g.* long waves in the jet stream.

**MCS** - Mesoscale convective system. A grouping of storms, either in a line or a circular cluster that has organization larger than each individual cell.

**Mesoscale** - A middle-sized event that usually is measured in 10's of miles and hours of time; a thunderstorm-sized phenomenon; *e.g.* thunderstorms and sea breeze circulations.

**Microscale** - A small-sized event that is usually measured in meters and seconds to minutes; a cloud-sized phenomenon; *e.g.* turbulence, and dust devils.

**Mixing ratio (w)**- A measurement of the amount of water vapor in the air of a given sized quantity of dry air; grams of vapor per kilogram of dry air.

**Nimbo-** ; **-nimbus** - Indicates a precipitating cloud.

**Perturbation** - A disturbance; often develops into a low-pressure system.

**Potential Temperature** - A measure of heat. It is the temperature air would be if brought dry adiabatically to 1000 mb.

**Radiosonde** - A light-weight instrument package carried aloft by a weather balloon; radios to earth upper atmosphere data.

**Relative humidity** - A ratio of the amount of water vapor that the air *is* holding to the amount of water vapor the air *can* hold, which depends on temperature.

**Ridge** - An area of high pressure. An area of anticyclonically curving winds.

**Saturation** - The point at which the air cannot hold any more water vapor; the point at which condensation occurs. RH=100%. Saturation is where the amount of water condensing is equal to the amount of water evaporating.

**Sleet** - Frozen precipitation that falls as little chunks o' ice.

**Sounding** - A temperature profile of the atmosphere measured by a radiosonde. Also can indicate wind and dew point.

**Stability** - Possessing the ability to return to its original position; suppresses convection.

**Steering** - Directing other motion. The jet stream steers surface storm systems.

**Subsidence** - Sinking air.

**Supercooled water** - Water that is below the freezing temperature but is still in liquid form.

**Synoptic scale** - A large scale event that is usually measured in hundreds to thousands of kilometers and days to weeks; *e.g.* fronts, cyclones, and anticyclones.

**Thickness** - The vertical distance between two levels of constant pressure. The greater the average temperature of the layer, the "thicker" it is.

**Trough** - An area of low pressure. Cyclonically curving winds.

**Upwelling** - A rising-up of colder water.

**Veering** - Clockwise shifting of the winds with time or distance.

**Vorticity** - Spin of the air indicating rotation. Positive vorticity is cyclonic flow, while negative vorticity is anticyclonic.

**Wet bulb temperature ( $T_w$ )** - An easily measurable quantity (using a sling psychrometer) which indicates the effect of evaporative cooling on temperature; used to determine relative humidity.

**Wind shear** - A changing of wind speed or direction with distance; vertical wind shear is changing of wind with respect to height.

**Zonal** - In the west-east direction.