

Glossary of Aviation Weather (and Related Terms)

With the use of pilot self-briefing methods, technical meteorological terms and concepts, once the domain of the forecaster, briefer, and dispatcher, must be translated



and interpreted by the pilot. This includes the reintroduction of “coded textual” products available through flight deck data link. New aviation products and services, formerly the realm of the National Weather Service, Federal Aviation Administration, and the scientific community are now directly available to users—in real time. The Glossary of Aviation Weather and Related Terms provides a “quick reference” for this material.

Although some terms are not directly weather related, they’ve been included to supplement weather terminology. Other terms are obsolete and no longer in general use. However, they’ve been included to provide supplemental and background information or provide historical perspective.

A

AO1—A remark on an automated surface observation indicating that the station is not equipped with a precipitation type discriminator. The equipment cannot determine the difference between liquid, freezing, and frozen precipitation. *See also* AO2.

AO2—A remark on an automated surface observation indicating that the station is equipped with a precipitation type discriminator. The equipment can determine the difference between liquid, freezing, and frozen precipitation. *See also* AO1.

abbreviated briefing—A type of FAA Flight Service Station (FSS) briefing, provided when a pilot requests specific data, information to update a previous briefing, or supplement an FAA mass dissemination system. *See also* inflight briefing, outlook briefing, standard briefing.

above ground level (AGL)—The height of a cloud layer or obstacle measured from the surface to the cloud base or obstacle top.

absolute altitude—The actual height or altitude of an aircraft above terrain.

absolute instability—A condition of the atmosphere where a vertically displaced air parcel, whether saturated or unsaturated, continues to accelerate away from its original position due to buoyancy forces; occurs when the environmental lapse rate is greater than the dry adiabatic lapse rate.

absolute stability—A condition of the atmosphere where a vertically displaced air parcel, whether saturated or unsaturated, resists vertical motion due to buoyancy forces acting against the displacement; occurs when the environmental lapse rate is less than the moist adiabatic lapse rate.

absolute vorticity—The sum of the Earth's vorticity plus relative vorticity. *See also* Earth's vorticity, relative vorticity, vorticity.

absolute zero—The complete absence of heat (-273°C).

accretion—The accumulation of ice on aircraft surfaces in flight due to the freezing of supercooled liquid water droplets; occurs because of the tendency of cloud droplets to remain in a liquid state at temperatures below freezing (i.e., supercooling). *See also* aircraft icing.

additive and automated maintenance date—Remarks on METAR reports are divided into automated, manual, and plain language, and additive and automated maintenance date. Automated remarks indicate the type of automated station. Additive data is used by the National Weather Service (NWS) and consist of climatological information, usually in numerical code groups. Automated maintenance data reports sensor outages and maintenance requirements.

adiabatic cooling—An atmospheric process by which a decrease in pressure on an air parcel results in a decrease in air parcel temperature. *See also* adiabatic process, adiabatic warming.

adiabatic process—A thermodynamic change of state where no transfer of heat or mass occurs between an air parcel undergoing the change and its environment, under these conditions compression due to an increase in pressure always results in air parcel warming, expansion due to a decrease pressure always results in air parcel cooling.

adiabatic warming—An atmospheric process by which an increase in pressure on an air parcel results in an increase in air parcel temperature. *See also* adiabatic cooling, adiabatic process.

ADS-B—*See* Automatic Dependent Surveillance-Broadcast.

advanced weather interactive processing (AWIPS)—A computer system used by the National Weather Service to display weather products and prepare and distribute weather forecasts.

advection—The process of moving an atmospheric property from one location to another. Advection usually refers to the horizontal movement of properties (temperature, moisture, vorticity, etc.).

advection fog—Fog resulting from the transport of warm, humid air over a cold surface. The air is cooled from below. When its dew point temperature is reached, fog forms. Advection fog requires a wind of 5 to 15 knots and can form under overcast skies. *See also* fog.

air density—*See* density.

air mass—A widespread body of air, whose homogeneous properties were established while the air was over a particular region of the Earth's surface and undergoes specific modifications while moving away from its source region. Air masses have similar properties through both their horizontal and vertical cross sections. *See also* air mass source region.

air mass classification—A system used to identify and characterize different air masses according to a basic scheme—temperature and moisture. The system most used: tropical (T), polar (P), and arctic (A). They are further classified according to moisture: continental (c) or maritime (m).

air mass modification—When an air mass moves over an area of difference properties, the air mass takes on some or all of the surface characteristics. Horizontal changes in temperature, moisture, and lapse rate gradually occur. Air masses are modified by warming or cooling from below, or by the addition or subtraction of water vapor.

air mass source region—Air masses take on the properties (temperature, moisture, and stability) of the region where they originate. These areas are known as source regions. *See also* air mass classification.

air parcel—*See* parcel.

air mass thunderstorm—*See* limited state thunderstorm.

Air Route Traffic Control Center (ARTCC)—A

facility established to provide air traffic control service to aircraft operating on IFR flight plans within controlled airspace and principally during the enroute phase of flight.

airborne weather radar—Weather radar of limited power designed to detect precipitation size particles and help pilots avoid severe weather.

aircraft—A device that is used or intended to be used for flight in the air. Categories of aircraft include: airplanes, rotorcraft, glider, lighter-than-air, and tilt-rotor.

aircraft icing—The accumulation of frozen water on aircraft surfaces produced by super cooled water droplets. Aircraft icing consists of airframe, induction, and instrument icing. *See also* airframe icing, carburetor icing, frost, ground icing, induction icing, instrument icing.

aircraft report—*See* pilot report.

airframe icing—An ice accumulation on the exterior parts of an aircraft, typically the leading edges and protrusions such as pitot tubes and antenna. *See also* aircraft icing, induction icing, instrument icing.

AIRMET Bulletin—An AIRMET was originally an inflight weather advisory intended to provide advance notice of potentially hazardous weather to small aircraft. Today the AIRMET Bulletin supplements the Area Forecast by providing information on less than 14 CFR Part 91 Basic VFR conditions, mountain obscuration, moderate turbulence and strong low level winds and low-level wind shear, and icing and freezing level.

Conditions must be widespread to be included in the AIRMET Bulletin. *See also* area forecast, VFR.

air to air visibility—The distance aloft that aircraft or an aircraft and an obstacle (i.e. clouds) can be *Seen* by the pilot. *See also* visibility.

air to ground visibility—The visibility as observed by a pilot aloft and objects on the ground. *See also* slant range visibility, visibility.

airport elevation—The highest point of an airport's usable runway measured in feet or meters above mean sea level.

Airport/Facility Directory (A/FD)—*See* Chart Supplement.

albedo—The ratio of the amount of solar radiation reflected by a body to the amount of incoming radiation.

Alberta Clipper—A strong storm system that develops near the Province of Alberta in Canada. These storms occasionally form on the lee side of the Canadian Rockies. The storm moves rapidly east and southeast into the Great Lakes and then into the northeast United States. Severe weather and blizzards may accompany the system. They are colloquially referred to as the “Alberta Clipper”. However, typically the “clipper” brings strong winds and cold air, often not producing much snow. Although, the strong winds can cause lake effect snow south and east of the Great Lakes.

Alberta low—*See* Alberta Clipper.

ALDARS—*See* Automated Lightning Detection and Reporting System.

Aleutian low—Low pressure systems that originate in the northern North Pacific ocean at the latitudes of the Aleutian Islands.

aloft—Aloft usually describes phenomena occurring at some height above the Earth's surface. It is usually used to describe weather occurring at or above 500 mbs (i.e. COLD LOW ALOFT, UPPER LEVEL TROUGH). *See also* upper-level.

altimeter—An instrument that measures the height of the aircraft. (Pronounced “al’tē-mê’tēr” by the British, it wasn’t appealing enough for Americans, so in the United States it’s pronounced “al tim’eter”.) Like an aneroid barometer, the altimeter measures changes in pressure as the aircraft climbs or descends. Without a means of adjustment, the altimeter indicates correct altitude only under standard atmospheric conditions of pressure and temperature. *See also* aneroid barometer, Kollsman window.

altimeter setting—The altimeter setting is a value determined for a point 10 feet above an airport (approximate cockpit height) that will correct an aircraft’s altimeter to read airport elevation. It corrects the altimeter for both nonstandard pressure and temperature at the surface.

altimeter setting window—*See* Kollsman window.

altitude—The height of an object expressed in units of

distance above a reference plane, usually above mean sea level or above ground level. *See also* absolute altitude, corrected altitude, density altitude, indicated altitude, pressure altitude, true altitude.

alto—A cloud prefix meaning “high” and used to indicate mid-level cumulus and stratus clouds (Altostratus AS; Altostratus AS).

altocumulus (AC)—White or gray layers or patches of cloud; cloud elements appear as rounded masses or rolls. Altocumulus indicates vertical motion and instability at mid-levels. Altocumulus may be thin, mostly semitransparent. Some altocumulus are thick, developed, and may be associated with other cloud forms. This cloud may indicate the approach of a cold front. *See also* mountain wave.

altocumulus castellanus (ACC)—Altocumulus castellanus is a mid-level cloud of which at least a fraction of its upper part presents some vertically developed, cumuli-form protuberances and give the cloud a turreted appearance. They indicate moisture and instability at this level. ACC might indicate thunderstorm development. Showers falling from these clouds can evaporate before reaching the surface, known as virga.

altocumulus standing lenticular—*See* standing lenticular altocumulus.

altostratus (AS)—Some altostratus are thin, semitransparent, while others are thick enough to hide the sun or moon. Altostratus indicates a stable atmosphere at mid-levels. Some Altostratus indicate the approach of a

warm front. These clouds can produce precipitation in the form of rain or snow, even heavy snow, at times.

ambient air—Air that surrounds an object.

ambient pressure—The pressure of the air surrounding an object.

ambient temperature—The temperature of the air surrounding an object.

amendment criteria—Specific threshold of ceiling, visibility, and atmospheric phenomena that require the forecaster to issue an amended forecast.

anabatic wind—An upslope wind caused by local surface heating and not part of the larger-scale circulation. The opposite of a katabatic wind. The most common type is a valley wind.

anemometer—An instrument used to measure wind speed.

aneroid barometer—An instrument used to measure atmospheric pressure. As pressure decreases the aneroid wafers within the instrument expand, through mechanical linkage the change in pressure is reflected on the instrument dial. Conversely, when pressure increases the wafers are compressed. *See also* altimeter.

anomalous propagation (AP)—In radar meteorology the greater than normal bending of the radar beam. Under highly stable atmospheric conditions (typically on calm, clear nights), the radar beam can be refracted

almost directly into the ground at some distance from the radar, resulting in an area of intense, but false, echoes beyond the distances of normal ground clutter.

anti-icing—A system used to preclude the formation of ice on aircraft surfaces, induction system, or instruments for a limited period.

anticyclone—An area of high atmospheric pressure which has a closed circulation, this circulation is clockwise about the high center in the northern hemisphere, counterclockwise in the Southern Hemisphere.

anticyclonic relative vorticity—Air spinning or having the tendency to spin in a clockwise direction in the Northern Hemisphere possesses anticyclonic relative vorticity. *See also* relative vorticity, vorticity.

anvil cloud—The colloquial name used to describe the upper flattened portion of a cumulonimbus cloud having an anvil-like form.

arc cloud—*See* arc line.

arc line—An arc-shaped line of convective clouds often observed on satellite imagery moving away from an area of dissipating thunderstorms.

Arctic air—A cold, dry air mass that forms over snow and ice covered surfaces above a latitude of 60° north in the northern hemisphere.

Arctic front—A front whose air mass originated in arctic regions. Arctic fronts, descending out of Canada,

moving southward or westward may result in cold Arctic air pushing across the mountain barriers all the way to the Pacific, Gulf, and Atlantic coasts. This, normally, only occurs a few times over a period of several years. Snow and freezing rain may accompany the front, or skies may be clear if the air masses contain little moisture.

Arctic high—An anticyclone that forms over the Arctic Basin during late spring, summer, and early autumn. Arctic highs occasionally produce pressure above 31.00 in Hg requiring special air traffic procedures because it exceeds the altimeter setting limits of most altimeters.

area forecast (FA)—A text product, the Area Forecast predicts conditions over an area the size of several states. Due to limitations on size, computer storage, and communications equipment the forecast cannot be divided into smaller segments, nor provide the detail available in other forecast products. Widely varying conditions over relatively large areas must be included, therefore small scale events are often described using conditional terms, such as occasional, isolated, and widely scattered. The FA provides a forecast for the enroute portion of flight and destination weather for locations without TAFs. Conditions are forecast from the surface to 70 millibars (approximately 63,000 ft).

area forecast conditional terms—*See* weather advisory, area forecast conditional terms.

arrow echo—Severe storms are tilted though the atmosphere, which allows them to be steady state and often severe. This tilting is sometimes indicated on radar by

an arrow shaped echo. *See also* severe weather echoes, steady state thunderstorms.

ASRS—*See* Aviation Safety Reporting System.

asymmetric echo—Similar to the arrow shape, it indicates a tilted storm, with its associated severe weather. The storm produces echoes shapes and colors that are not even or concentric. *See also* severe weather echoes, steady state thunderstorms.

at the station—Refers to an area within five statute miles of the point of observation (METAR/SPECI).

atmosphere—The envelope of air surrounding the earth.

atmospheric phenomena—As reported on METAR, atmospheric phenomena are weather occurring at the station and any obstructions to vision. Obstructions to vision are only reported when the prevailing visibility is less than seven miles. *See also* obstructions to vision.

atmospheric pressure—The pressure exerted by the atmosphere as a result of gravitational attraction exerted upon the column of air lying directly above the observation point.

atmospheric property—A characteristic trait or peculiarity of the atmosphere such as temperature, pressure, moisture, density, and stability.

attenuation—A decrease in amplitude, density, or energy because of scattering, absorption, or friction. Radar energy is attenuated, a reduction in power density, by

distance from the antenna and scattering or absorption by rain or clouds. *See also* precipitation attenuation, range attenuation.

augmentation—An automated METAR report indicates the observation was derived without human intervention. The terms manual, augmentation, or backup refer to the fact that a person has overall responsibility for the observation; even though some or all of the elements of the report are derived from automated equipment. Augmentation requires the observer to manually add data which the automated equipment is not capable of reporting. Backup involves correcting non-representative, erroneous, or missing data. It does not, however, necessarily mean that an observer is maintaining a continuous weather watch.

aurora—A luminous, radiant emission over middle and high latitudes confined to the thin air of high altitude and centered over the earth's magnetic poles. Called "aurora borealis" (northern lights) or "aurora australis" (southern lights).

AUTO—On METAR reports the modifier AUTO indicates the report comes from an automated weather observation station without augmentation or backup. The absence of AUTO means that the report was produced manually, or that an automated report has manual augmentation or backup. When AUTO appears in the body of the report, the type of precipitation sensor is contained in the remarks. *See also* AO1, AO2.

automated flight service stations (AFSS)—*See* Flight Service Station.

Automated Lightning Detection and Reporting

System (ALDARS)—ALDARS acquires lightning information from the National Lightning Detection Network, this allows automated surface observations to report the occurrence of a thunderstorm.

automated maintenance data—*See* additive and automated maintenance data.

automated observation—An automated report indicates the observation was derived without human intervention. *See also* A01, A02.

automated radar weather reports (RAREP)—The National Weather Service routinely takes radar observations. These observations are coded and transmitted over the FAA's weather distribution system and available on DUAT and the Internet. Aerial coverage is graphically depicted in the Aeronautical Information Manual (AIM) and AC 00-45 Aviation Weather Services. The radar report or SD (storm detection) is automatically generated by NEXRAD radars.

Automated Surface Observing System (ASOS)—A computerized system like AWOS, but developed jointly by the FAA, NWS, and Department of Defense. In addition to standard weather elements the system encodes climatological data at the end of the report. *See also* Automated Weather Observing System (AWOS).

automated visibility—A system used to determine visibility automatically from a scatter meter device. The visibility sensor indirectly derives a value of visibility corresponding to what the human eye would *See*. The

sensor samples the air every 30 seconds. A computer algorithm (mathematical formula) evaluates sensor readings for the past 10 minutes to provide a representative value. Reported visibility is the average one minute value for the past 10 minutes.

Automated Weather Observing System (AWOS)—

AWOS is a commercial computerized system that measures sky condition, visibility, precipitation, temperature, dew point, wind, and altimeter setting. When these systems do not have manual augmentation or backup they are termed “stand-alone” observations. It may be equipped with a voice synthesizer to report minute by minute observations over radio frequencies, telephone lines, or local displays. Some installations may only provide specific elements of a complete observation (e.g. AWOS-AV; AWOS providing only altimeter setting and visibility). *See also* Automated Surface Observing System (ASOS).

Automated Weather System—Any of the automated weather sensor platforms that collect weather data at airports and disseminate the weather information via radio and/or landline.

Automatic Dependent Surveillance-Broadcast

(ADS-B)—A surveillance system in which an aircraft is fitted with equipment in the form of a data link transmitter. The aircraft broadcasts its position and other information such as identity and velocity, which is then received by a ground-based or space-based receiver for processing and display at an air traffic control facility, as well as by suitably equipped aircraft.

Automatic Meteorological Observing Station

(AMOS)—Automated surface observations began with the Automatic Meteorological Observing Station. Unfortunately, this system was only capable of reporting temperature, dew point, wind direction and speed, and pressure. Occasionally, observers manually entered data to augment the report.

Automatic Observing Station (AUTOB)—The

Automatic Observing Station, a refinement of AMOS, added sky condition, visibility, and precipitation reporting. AUTOB, however, was limited to cloud amount and height measurements of 6000 ft above ground level (AGL), and three cloud layers. Visibility values are reported in whole miles, to a maximum of seven.

Automatic Terminal Information Service (ATIS)—A

recorded service at tower controlled airports that provides the pilot with weather, traffic, and non-control takeoff and landing information.

average—A single value (a mean) that represents the middle point of a set of unequal values. In aviation it's often used as a base or standard for calculating aircraft performance—where the “standard value” rarely occurs in nature.

Aviation Safety Reporting System (ASRS)—The

National Aeronautics and Space Administration's Aviation Safety Reporting System collects, analyzes, and responds to voluntarily submitted aviation safety incidents.

B

back side of low—Usually a reference to the north and west side of a low pressure system.

background information—The information required by an FSS pilot weather briefer used to tailor the briefing to the pilot's proposed flight.

backing—Shifting of the wind in a counterclockwise direction; opposite of veering.

backscatter—Pertaining to radar, the energy reflected or scattered by a target, an echo.

backscatter device—An instrument used to measure surface visibility at an automated weather observing station.

backup—*See* augmentation.

balanced field length—The runway required to accelerate the airplane to a **GO-NO GO** point, decide to abort the takeoff, and come to a complete stop.

banner cloud—A banner-like cloud streaming off from a mountain peak.

baroclinic—A state of the atmosphere where temperature and pressure surfaces do not coincide (i.e., isotherms, lines of equal temperature, are visible on a constant pressure chart and, therefore, temperature gradients are evident); vertical wind shear is present in the

form of speed shear, direction shear, or both; temperature advection may also be present; temperature advection associated with a baroclinic atmosphere enhances the formation and intensification of storms; *See also* barotropic, equivalent barotropic.

barometric pressure—*See* atmospheric pressure.

barotropic—A state of the atmosphere where temperature and pressure surfaces coincide (i.e., isotherms, lines of equal temperature, will not be *Seen* on a constant pressure chart and, therefore, temperature gradients are not present on pressure surfaces); vertical wind shear and temperature advection are not present; theoretically, an entirely barotropic atmosphere would yield constant pressure charts with no height or temperature gradients and no vertical motion; *See also* baroclinic, equivalent barotropic.

base reflectivity—A radar image created with the radar's antenna tilted 0.5° above the horizon. It is the lowest radar tilt within the radar's tilt angles. It represents only one elevation within the radars tile range.

beam resolution—Describes the ability of the radar to distinguish between targets at the same range, but different azimuths.

BECMG—*See* forecast change groups.

berm—A raised bank, usually frozen snow, along a taxiway or runway.

Bermuda high—A semi-permanent subtropical high in

the western North Atlantic ocean. In the Midwest and eastern United States, the Bermuda high brings moist, warm air to the region. This results in hot, humid conditions, often resulting in severe weather. *See also* subtropical high.

big picture—A concept in weather evaluation consisting of the synopsis; that is, the position and movement of weather systems—especially those that pose a hazard to flight operations. *See also* complete picture.

Bjerknes, Vilhelm—Norwegian meteorologist who developed the polar front theory at the beginning of the 20th century.

bleed air—Small extraction of hot air from a turbine engine compressor, sometimes used with aircraft anti-icing system.

blizzard—A popular term used to describe a severe weather condition characterized by low temperatures, strong winds, and large amounts of snow fall. The phrase first appeared in an Iowa newspaper in 1870 used by German immigrants: “der strum kommt blitzartig,” shortened to “blizzard.” NWS blizzard warnings are issued when snow restricts visibility to less than 1/4 mile, accompanied by surface winds of 30 knots, and expected to last for three hours.

blocking high—An upper level high pressure area that blocks approaching weather systems. *See also* omega block.

blowing (BL)—The descriptor blowing describes a con-

dition where an airborne obscuration (e.g. snow, sand, dust, or spray) is raised to a height of six feet or more above the surface. Additionally, when applied to sand, dust, or spray, blowing implies that horizontal visibility is reduced to less than seven statute miles; applied to snow, blowing identifies snow lifted by the wind to more than six feet in such quantities that visibility is restricted at and above that level.

blowing dust (BLDU)—Dust particles picked up from the surface. Particles can reduce visibility to near zero and be raised to above 16,000 feet. The fine particles may be blown hundreds or thousands of miles down wind and remain suspended for days and after the wind subsides.

blowing sand (BLSA)—Blowing sand, made up of particles larger than dust, usually remains within a few hundred feet of the surface. It can also reduce visibility to near zero. But, when the wind subsides particles fall back to the surface and visibility improves rapidly.

blowing snow (BLSN)—Snow picked up from the surface by the wind and carried to a height of 6 feet or more. It can reduce visibility to near zero. But when the wind subsides falls back to the surface and visibility improves rapidly.

blowing spray (BLPY)—Water particles picked up by the wind from the surface of a large body of water that reduces visibility to less than 7 statute miles.

blue norther—*See* Texas norter.

boundaries—Zones in the lower atmosphere characterized by sharp gradients or discontinuities of temperature, pressure, or moisture and often accompanied by convergence in the wind field. Examples include surface fronts, dry lines, and outflow boundaries. In the latter case, the boundary is produced by a surge of rain-cooled air flowing outward near the surface from the originating area of convection. In an unstable air mass, thunderstorms tend to develop along these zones and especially at intersections of two or more boundaries.

boundary layer—The layer of the atmosphere adjacent to the earth that is directly influenced by the earth's surface;—these influences include frictional drag on the wind, evaporation and transpiration of water, heat transfer, and terrain induced flow modification; layer can often be turbulent due to heating effects (i.e., convection) and frictional and terrain effects; the depth of the boundary layer varies and is often deeper during the day and shallower at night, on average can be described as the layer within 2000 feet of the surface for land areas and 1000 feet over oceans, this is one reason why winds aloft forecasts are not available below 3000 feet MSL or for reporting levels within 1500 feet of the earth's surface.

bow echo—A radar echo typically associated with fast moving, broken or solid lines of thunderstorms. Severe weather most likely develops along the bulge and at the northern end of the echo pattern. *See also* severe weather echoes.

breaking action—A report of conditions on the airport movement area providing a pilot with the degree or

quality of braking that can be expected. Braking action is reported in terms of good, fair, poor or nil. There are no specific object definitions of reported braking action. FAIR would indicate braking action was not what could be expected on a dry runway. NIL indicates the lack of any braking action. With POOR somewhere in between. *See also* runway condition reading.

bridging—A formation of ice over the deicing boot that is not cracked by boot inflation.

broken (BKN)—In the body weather reports and forecasts broken indicates 5/8 to 7/8 sky cover of clouds. In the remarks of weather reports "...BKN000..." means that between 5/8 and 7/8 of the sky is obscured by a surface based partial obscuration. *See also* ceiling, partial obscuration.

C

calibrated airspeed (CAS)—Calibrated airspeed is indicated airspeed corrected for installation and instrument error. These errors are usually greatest at low airspeeds, with flaps deployed. Normally, the manufacturer provides a table to convert indicated to calibrated airspeed for different speed ranges and flap settings.

calm—The absence of wind (i.e., no apparent motion of the air relative to the earth).

calorie—An energy unit; specifically, the amount of heat energy required to raise the temperature of one gram of water one degree Celsius.

cap cloud—A standing or stationary cap-like cloud topping a mountain summit. When sufficient moisture is present these clouds will form on the peaks and upper windward sides of mountains during mountain wave, foehn, Santa Ana, and Chinook conditions. This cloud formation should alert pilots to strong winds, possible turbulence, and wind shear.

CAPE—*See* convective available potential energy.

CAPE strength— Calculated in Joules/kilogram (J/kg), or simply Joules, Convective Available Potential Energy (CAPE) is a measure of atmospheric energy. It reflects the strength of a thunderstorm updraft and depicts the energy in the atmosphere from the point where clouds form and will be uninhibited. CAPE is an indicator of thunderstorm severity. CAPE values indicators: <1000 J/kg—weak convection, 1000 – 2000 J/kg—isolated thunderstorms, 2000 – 3000 J/kg—thunderstorms probable, >3000 J/kg—severe thunderstorm probable

Catalina Eddy—A low-level wind circulation off the southern California coast typically in the vicinity of Catalina Island; this cyclonic circulation is trapped below an inversion within a low-level layer of cold, moist air, produces southeasterly flow along the coast, and is associated with coastal stratus; this eddying effect of the coastal winds is produced by the interaction of the flow with the coastal islands and terrain; it usually develops when a rather strong current of air flows southeastward over the ocean near the coast with falling pressures inland, coastal stratus increases rapidly—often unforecast, and is carried further inland with bases as well as tops higher than normal, a solid overcast well inland

may persist for several days

categories, weather—*See* weather categories.

carburetor air temperature gauge—An instrument used to measure the temperature in an aircraft carburetor. The yellow arc indicates temperatures at which icing is most likely to occur. When ice is suspected or detected the pilot can apply enough heat to raise the temperature out of the danger zone.

carburetor heat—Carburetor heat preheats air before it reaches the carburetor. Carburetor heat is usually adequate to prevent carburetor icing but may not always clear ice that has already formed.

carburetor icing—Normally aspirated engines can develop ice in the carburetor throat. The vaporization of fuel, along with the adiabatic expansion of air as it passes through the fuel discharge nozzle, venturi, throttle valve, and passages to the engine, causes sudden and significant cooling. If the air temperature drops below the dew point, water vapor in the air condenses into water droplets. Therefore, water can form in the carburetor in cloudless skies. This cooling can reduce the temperature in the carburetor to below freezing and with sufficient moisture present ice forms.

ceiling (CIG)—The lowest cloud layer with a coverage of broken (5/8 to 7/8 coverage) or overcast (8/8 coverage), or a vertical visibility into a total obscuration. *See also* indefinite ceiling, obscuration.

ceilometer—A cloud-height measuring system.

Automated weather observing systems use a laser ceilometer to determine cloud height and sky cover.

celestial dome—That portion of the sky which would be visible provided, due to the absence of human-made structures, there was an unobstructed view of the horizon in all directions.

Celsius (C)—A temperature scale where 0 is the melting point of ice and 100 is the boiling point of water at standard sea level pressure.

Center Weather Advisory (CWA)—An unscheduled weather advisory issued by Center Weather Service Unit meteorologists for ATC use to alert pilot of existing or anticipated adverse weather conditions.

Center Weather Service Unit (CWSU)—A joint FAA/NWS meteorological support unit directly supporting Air Route Traffic Control Centers (ARTCC). CWSU forecasters provide meteorological consultation, forecasts, and advise to ARTCC managers, staff, and other supported FAA facilities. CWSU provides advisories of hazardous weather conditions for airborne aircraft.

change of state—The transformation of water from one form—solid, liquid, or gaseous—to another. *See also* condensation, evaporation, freezing, melting, sublimation, deposition.

Chart Supplement—Formally Airport/Facility Directory (A/FD), an FAA publication containing information on airports, seaplane bases, and heliports open to the public. The Chart Supplement contains communications

data, navigational facilities, and other data to supplement aeronautical charts.

Chinook—A Native American name given to a warm, dry wind that occurs as air flows down the eastern slopes of the Rockies.

chop—Reported with turbulence, chop refers to a slight, rapid, and somewhat rhythmic bumpiness without appreciable changes in altitude or attitude. Since CHOP does not cause appreciable changes in altitude or attitude, it would not be classified as severe.

circular polarization (CP)—An ATC radar circuit that reduces the radar's sensitivity to light and moderate precipitation. Controllers, especially at approach facilities, engage these features during poor weather to accomplish their primary task—separation of aircraft. *See also* dual polarization.

cirriiform—Varieties of high clouds composed mostly or entirely of small ice crystals (i.e., cirrus, cirrocumulus, and cirrostratus clouds); Cirriiform is often used during pilot weather briefings and text forecasts to indicate the presence of one or all of the high cloud types.

cirrocumulus (CC)—High level ice crystal clouds that appear as small, rounded puffs that occur individually or in rows; cloud elements resemble fish scales therefore referred to as “mackerel sky”; their presence may indicate high altitude turbulence. Cirrocumulus standing lenticular (CCSL) often develops in a mountain wave; when associated with the jet stream are organized in transverse lines, these lines are oriented perpendicular

to the jet. Cirrus streaks are also associated with the jet stream. However, cirrus streaks are parallel to jet core.

cirrocumulus standing lenticular—*See* standing lenticular cirrocumulus.

cirrostratus (CS)—A high level ice crystal cloud organized in sheets or layers. Sun or moon halos may occur. When cirrostratus appear within a few hours after cirrus in mid-latitudes, there is a good probability of an approaching front. Thick bands of cirrostratus often mark the location of the jet stream. Jet stream cirrus can be *Seen* on satellite imagery and are often observed in the area of an upper level ridge. The poleward edge of the cirrus shield ends in a line parallel to the jet axis.

cirrus (CI)—A high level ice crystal cloud organized into filaments, commonly known as mares' tails; cirrus also makes up the anvil of cumulonimbus clouds; a thickening cirrus layer may indicate the approach of a front.

civil twilight—*See* twilight.

class II NOTAM—Published Notice to Airmen (NOTAM) are sometimes referred to as Class II. Class II is the international term used to identify NOTAMs that appear in printed form for mail distribution. *See also* notice to airmen.

clear (SKC)—Indicates no clouds on weather reports and forecasts.

clear below 12,000 (CLR)—Indicates no clouds below 12,000 feet AGL on weather reports and forecasts; usu-

ally used with automated weather observations.

clear air mode—This NWS radar mode has the slowest antenna rotation rate which permits the radar to sample a given volume of the atmosphere longer. Longer sampling increases the radar's sensitivity and ability to detect smaller objects than is possible in precipitation mode.

clear air turbulence (CAT)—Turbulence encountered in clear air not associated with cumuliform clouds, usually occurs above 15,000 feet (i.e., at or near the jet stream) and is associated with wind shear. CAT is very patchy and transitory in nature; the dimensions of these turbulent patches are quite variable but generally are on the order of 2000 feet in depth, 20 miles in width, and 50 or more miles in length (patches elongate in the direction of the wind); the dimensions of these areas are typically on the small end of the mesoscale and the exact position of specific areas is difficult, if not impossible, to forecast.

clear ice—A glossy and smooth, clear or translucent ice formed by relatively slow freezing of large supercooled droplets; the large droplets spread out over the airfoil prior to complete freezing, forming a sheet of ice. Clear ice may also result in protrusions (horns). Clear ice is denser, harder, and sometimes more transparent than rime ice. *See also* glaze ice.

closed low—An area of low pressure aloft with associated cyclonic circulation that is surrounded by a contour.

climate—The statistical description of the weather for a

specified location over a specified interval of time.

climatology—The study of climate.

closed cell stratocumulus—*Seen* in satellite imagery as cellular, closely packed stratocumulus clouds; often form over water below an inversion associated with a stagnant high pressure center.

cloud—Visible liquid water droplets, supercooled water droplets, or ice crystals—or any combination—in the atmosphere above the earth's surface. *See also* clouds with vertical development, high clouds, low clouds, middle clouds.

cloud band—*Seen* in satellite imagery as a nearly continuous cloud formation with a distinct long axis, a length-to-width ratio of at least four to one, and a width greater than one degree of latitude (60 nm).

cloud bank—Generally, a fairly well-defined mass of clouds observed at a distance; it covers an appreciable portion of the horizon sky but does not extend overhead.

cloud element—The smallest cloud form that can be resolved on satellite imagery from a given satellite system.

cloud height indicator (CHI)—Automated observations use a laser ceilometer cloud height indicator to determine sky condition (i.e., cloud coverage and base height); the CHI sends out short, intense pulses of infrared radiation which are partially reflected back to the sensor by any cloud elements that may be present; as this information is collected a computer algorithm processes the

last 30 minutes of CHI data to generate values of sky cover and cloud height for the observation (i.e., cloud observations are representative of last 30 minutes of data), however, to be more responsive to the most recent conditions, the algorithm “double-weighs” the last 10 minutes of data; up to three cloud layers are reported

cloud line—*Seen* in satellite imagery as a narrow cloud band in which individual elements are connected and the line is less than one degree of latitude in width indicates strong surface winds, often 30 knots or greater when observed over water.

cloud shield—A broad cloud formation that is not more than four times as long as it is wide can be associated with (1) the warm air advection region of a wave cyclone with the eastern edge of the shield dissipating along the downstream upper level ridge or (2) the jet stream.

cloud streets—A series of aligned cloud elements that are not connected. Several cloud streets usually line up parallel to each other and each street is not more than 10 miles wide.

cloudburst—In popular terminology, any sudden and heavy fall of rain, almost always in the form of showers.

clouds with vertical development—This family of clouds is generally referred to as cumuliform clouds; cloud types with vertical development include cumulus and cumulonimbus; some cumulus with little vertical development occur with fair weather (i.e., no significant weather), the atmosphere is turbulent below the bases but smooth on top; other cumulus contain considerable

vertical development, and sometimes are referred to as towering cumulus; this type of cumulus precedes the development of cumulonimbus clouds (i.e., thunderstorms). *See also* towering cumulus, cumulonimbus.

coalescence—The merging of two water drops into a single larger drop.

coastal waters—Coastal waters are defined as the area from the coastline to the Domestic Flight Information Region (FIR) boundary—typically a distance of 100 nautical miles.

coefficient of friction—The ratio of the tangential force needed to maintain uniform relative motion between two contacting surfaces (aircraft tires to the pavement surface) to the perpendicular force holding them in contact (distributed aircraft weight to the aircraft tire area).—The coefficient may be denoted by the Greek letter MU (μ). It is a simple means used to quantify the relative slipperiness of pavement surfaces. Friction values range from 0 to 100 where zero is the lowest friction value and 100 is the maximum frictional value obtainable.

cold-air advection—Occurs when colder upstream air is transported (i.e., advected) past a location, if advection is the only process affecting temperature change cold-air advection will cause temperatures to drop locally; produces downward vertical motion that generally has a stabilizing effect in the atmosphere; cold-air advection in the upper atmosphere, however, has a destabilizing effect that can lead to convection and severe weather. *See also* advection.

cold-core low—A low pressure area with its associated cyclonic circulation that has the coldest air at the center of the circulation (i.e., temperature increases outward from the circulation center). The low pressure and its circulation intensifies with increasing altitude. When this type of low extends through a deep layer of the atmosphere, its movements tend to be slow and erratic.

cold front—A front which moves in such a way that colder air replaces warmer air (i.e., regions of colder air advance on regions of warmer air).

cold pool—Generally refers to areas aloft in which the air temperature is colder than adjacent areas. Under the right conditions cold pools aloft can destabilize the atmosphere making thunderstorm and rain shower development more likely.

cold soaked—An aircraft descending from an area of cold air; if airframe temperature is below zero, icing may occur with droplets at temperatures slightly greater than 0°C.

comma cloud system—A cloud system that, on satellite imagery, resembles the comma punctuation mark. The shape results from the vorticity advection patterns associated with troughs (i.e., vorticity maxima) in the upper part of the atmosphere. Downwind of a vorticity maximum positive vorticity advection is occurring leading to rising air and cloudiness while upwind of the maximum negative vorticity advection is occurring producing sinking motion and cloud-free skies.

comma head—The rounded portion of the comma cloud

system. This region often produces most of the steady precipitation. *See also* comma cloud system.

comma tail—The portion of the comma cloud that lies to the right of, and often nearly parallel to, the axis of maximum winds. *See also* comma cloud system.

complete picture—A concept that takes in all available information for a flight, including the synopsis. Every report, chart, or product provides insight into the “complete picture.” Each must be decoded, translated, interpreted, and applied—with a knowledge of its scope, purpose, and limitations. Then, with a knowledge of the “complete picture,” strategic planning can be applied to the flight. *See also* big picture.

compliant weather briefing—Elements required for a compliant weather briefing must satisfy the requirements of:

14 CFR §91.103 Preflight Action.

14 CFR §91.9 ...Aircraft Flight Manuals....

14 CFR §91.13 Careless or Reckless Operation.

As a minimum weather products must include weather advisories, enroute forecast products, and terminal aerodrome forecasts. *See also* weather advisories, enroute forecast products, and terminal aerodrome forecasts.

composite image—An overlay of two or more products; most often surface analysis chart, radar mosaics, and satellite pictures.

composite radar display—*See* radar mosaic.

composite reflectivity—This radar image displays maximum echo intensity from any elevation angle at every range from the radar. This product is used to reveal the highest reflectivity in all echoes.

condensation—A physical process where vapor changes to a liquid; the opposite of evaporation.

condensation level—The height at which a rising parcel or layer of air would become saturated if lifted adiabatically.

condensation nuclei—Small particles in the air on which water vapor condenses or sublimates.

condensation trail—*See* contrail.

conditionally unstable—A condition of the atmosphere where a vertically displaced air parcel will resist vertical motion if unsaturated (i.e., a stable situation) and will accelerate away from its original position if saturated (i.e., an unstable situation); occurs when the environmental lapse rate is greater than the moist adiabatic lapse rate ($\sim +6^{\circ}\text{C}/\text{km}$) and less than the dry adiabatic lapse rate ($+10^{\circ}\text{C}/\text{km}$).

cone of silence—When used with radar, is the area directly over the antenna where radar echoes are not detected.

conduction—The process of transferring energy by means of physical contact; transfer is always from warmer to colder temperature.

confluence—A region where streamlines converge. The opposite of diffluence. It may cause convergence.

continental polar air—*See* polar air.

continental tropical air—*See* tropical air.

contour—Lines of equal height on constant pressure charts.

constant pressure chart—A chart that represents meteorological data on a constant pressure surface (e.g., 500 mb); may contain analyses of the height of the surface and wind, temperature, humidity, or other meteorological elements at that level above the surface.

constant pressure surface—A surface of equal atmospheric pressure; the height of the constant pressure surface can be related to pressure (i.e., where the pressure surface has high heights the pressure is high, where the pressure surface has low heights the pressure is low).

contiguous United States—*See* CONUS.

contrail—A contrail, or condensation trail, is a cloud-like streamer frequently observed behind aircraft flying in clear, cold, moist air. Contrails typically form in the upper troposphere. Contrails can form from the addition of water vapor produced by engine combustion. Or, in air that is almost fully saturated, aerodynamic forces around the propeller tips or wings can cool the air and induce condensation.

CONUS—The contiguous (lower 48) United States.

convection—The vertical transport of an atmospheric property.

convective available potential energy (CAPE)—Measured in Joules/kilogram (J/kg), or simply Joules, CAPE is a measure of buoyant energy available to accelerate an air parcel upward. Therefore, it indicates the potential strength of a thunderstorm updraft and, consequently, the severity of the thunderstorm itself.

convective condensation level (CCL)—The lowest level at which condensation will occur as a result of convection due to surface heating.

convective instability—The state of an initially unsaturated layer of air where the lapse rates of temperature and moisture within the layer are such that if the layer is lifted adiabatically until it becomes saturated, convection is spontaneous.

convective LLWS—Low-level wind shear produced by thunderstorms. *See also* non-convective LLWS and low-level wind shear.

convective outlook (AC)—The convective outlook is prepared by the Storm Prediction Center (SPC). It consists of two forecasts: day 1, the first 24 hours, and day 2, the next 24 hours. Times of issuance for day 1 are 0600Z, 1300Z, 1630Z, 2000Z, and 0100Z daily. The initial day 2 issuance is at 0830Z and updated at 1730Z. The AC describes the potential for thunderstorm activity and describes areas where thunderstorms

might approach severe limits. Risk categories are defined: slight risk, moderate risk, or high risk for severe thunderstorms. The AC also forecasts areas of general thunderstorms—non-severe.

convective turbulence—*See* thermal turbulence.

convergence—Air flowing together near the surface is forced upward due to convergence. It is a vertical motion producer that tends to destabilize the atmosphere near the surface. *See also* divergence.

convergence zone—An area where convergence is occurring, often is referring to surface convergence associated with such things as shorelines (differences in surface friction between land and water leads to convergence) and surface fronts (surface fronts form within convergence zones) as well as other low-level phenomenon.

Coordinated Universal Time (UTC)—The same as Greenwich Mean Time (i.e., the local time along the meridian that runs through Greenwich, England), also known as “Z” or ZULU time. UTC is the international time standard and is used in all FAA and NWS aviation time references.

Coriolis force—An apparent force, resulting from the earth’s rotation, that causes objects (including air) moving relative to the earth to be deflected to the right of motion in the northern hemisphere and to the left of motion in the southern hemisphere.—The effect of this force, when interacting with the pressure gradient force, leads to the situation where air tends to move generally parallel to isobars rather than moving directly across

the isobars from high to low pressure. *See also* geostrophic balance, geostrophic wind, and pressure gradient force.

Coriolis, Gaspard de—A French mathematician, in 1835 he developed the theory of an apparent deflection force produced by angular rotation.

Coriolis vorticity—*See* Earth’s vorticity.

corona—Colored circles or arcs of a circle with the sun or moon at its center. They result from the diffraction (i.e., bending) of light around liquid water droplets in clouds. Typically, are smaller in radius when compared to halos. *See also* halos.

corrected altitude—Indicated altitude of an aircraft altimeter corrected for temperature, an approximation of true altitude.

correction (COR)—In a METAR/SPECI reports indicates that the original was transmitted with an error, that has now been corrected.

crepuscular rays— Alternating lighter and darker bands, light and shadow, that diverge in a fanlike array from the sun’s position around twilight-twilight rays. Towering cumulus produces this effect, especially with haze in the lower atmosphere.

crosswind component—That component of the wind that acts at a right angle (i.e., 90o) to the aircraft’s flight path. On takeoffs and landings, the component of the surface wind acts at a right angle to the runway. *See*

also tailwind component.

cumulogranite—Colloquial term used to describe clouds containing rocks.

cumuliform—The category of clouds that are characterized by vertical development in the form of rising mounds, domes, or towers. These clouds tend to form under less stable atmospheric conditions and include cumulus cloud types: cumulonimbus, altocumulus, and cirrocumulus.

cumulonimbus (CB)—This cloud type exhibits great vertical development (cumulo-) and is precipitating (nimbus). Cumulonimbus clouds imply thunderstorms, with all its potential hazards (lightning, hail, strong turbulence, significant icing, strong winds including downbursts and tornadoes). Cumulonimbus often has a cirrus shield (i.e., cirrus cloud near the upper portion of the cumulonimbus cloud that is smooth, fibrous, and almost flattened, often extending outward in the form of an anvil or plume). Precipitation is showery, and often heavy.

cumulonimbus mammatus (CBMAM)—From the Latin word meaning udder or breast, Cumulonimbus mammatus result from severe updrafts and downdrafts. They are characterized by lobes that protrude from the bottom of the cloud. They indicate probable severe or greater turbulence, and often appear just before or at the beginning of a squall. A greenish tint to the sky often indicates hail.

cumulus (CU)—Meaning heaped up; cumulus clouds

display vertical development. Some cumulus describes fair weather, *Seemingly* flattened, with little vertical development: no significant weather, turbulent below the bases and smooth on top. Other cumulus contains considerable vertical development, generally towering. This type precedes the development of cumulonimbus and thunderstorms. With cumulus clouds expect usually good ceilings and visibilities, except in the vicinity of precipitation. These clouds imply turbulent flying conditions. Precipitation is showery. *See also* enhanced cumulus, pyrocumulus.

cumulus fractus—*See* fractus.

cut-off low—*See* closed low.

cyclongenesis—The development or strengthening of a cyclone.

cyclone—An area of low pressure which has a closed, cyclonic circulation.

cyclonic—Having a counterclockwise rotation in the northern hemisphere, associated with the circulation around a cyclone or low pressure area.

cyclonic relative vorticity—Air spinning or having the tendency to spin in a counterclockwise direction in the Northern Hemisphere possesses cyclonic relative vorticity.

D

data link—For our purposes data link refers to any

cockpit display of digital weather information (textual or graphical) provided by an outside source.

decibel (dBZ)—A unit of electric signal power. NEXRAD (Doppler) weather radars use this unit to display radar return intensity levels.

deepening—A decrease in the central pressure of a pressure system; usually applied to a low.

deformation zone—An area within the atmospheric circulation where air parcels contract in one direction and elongate in the perpendicular direction. The narrow zone along the axis of elongation is called the deformation zone. Deformation is a primary factor in frontogenesis and frontolysis.

deiced (deicing)—1) Applied to an aircraft a chemical used to remove/prevent the accumulation of ice and snow. 2) Ice, snow, or slush on a runway that has been coated with chemicals. 3) A procedure that removes the formation of frost or ice for a limited period.

dendritic pattern— On visual satellite imagery this branchy, saw tooth, pattern identifies areas of snow cover. Mountain ridges above the tree line are essentially barren and snow is visible; in the tree filled valleys, most of the snow is hidden beneath the trees.

density—The weight of air per unit volume. Air density is affected by altitude, pressure, temperature, and moisture.

density altitude—The altitude in the standard atmo-

sphere that has the same density as the location of the aircraft. Aircraft and engines perform at the calculated density altitude level in the standard atmosphere. Density altitude is affected by altitude, pressure, temperature, and moisture, and can be calculated by correcting pressure altitude for nonstandard temperature.

deposition—The process by which water changes directly from a vapor into a solid (e.g. frost). The opposite of sublimation. *See also* sublimation.

depression—An area of low pressure, a low or trough. Depression is usually applied to a certain stage in the development of a tropical cyclone, to migratory lows and troughs, and to upper level lows and troughs that are only weakly developed.

descriptor—In aviation weather reports and forecasts the descriptor adds additional detail to certain types of precipitation and obstructions to vision.

dew—Water condensation onto objects near the ground, the temperatures of which have fallen below the initial dewpoint temperature of the surface air but remain above freezing. *See also* frost.

dewpoint (dewpoint temperature)—The temperature to which air must be cooled, water vapor remains constant, to become saturated.

dewpoint front—*See* dryline.

diabatic—A process that involves the exchange of heat with an external source, or non-adiabatic; the loss may

occur through radiation resulting in fog or low clouds, or conduction through contact with a cold surface.

dig (digging)—Indicates a trough with a strong southerly component of motion. These troughs contain considerable strength and are difficult to forecast with accuracy.

diffluence—The spreading apart of adjacent streamlines. The speed of horizontal flow often decreases with a diffluent zone. The horizontal spreading apart of wind flow resulting in divergence. The opposite of confluence. It may cause divergence and can activate or perpetuate thunderstorm development.

Direct User Access Terminal (DUAT)—A computer terminal where pilots can directly access meteorological and aeronautical information, and file and close flight plans without the assistance of a Flight Service Station (FSS).

dirty ridge—Moisture and clouds sometimes spill over the top or move through a ridge. When this occurs, weather types sometimes refer to it as a dirty ridge. I'm not sure if a "dirty ridge" refers to the unsettled character of the weather or the fact that forecasting these conditions is difficult. *See also* flat ridge.

discontinuity—A zone with comparatively rapid transition of one or more meteorological elements.

distant (DSNT)—When used in remarks of a METAR report: phenomena that occurs beyond 10 miles, but less than 30 miles from the reporting station.

disturbance—1) Any low pressure or cyclone, but usually one that is relatively small. 2) An area where weather, wind, pressure, etc., show signs of cyclonic development. 3) Any deviation in flow or pressure that is associated with a disturbed state of the weather (i.e. cloudiness and precipitation). 4) Any individual circulatory system within the primary circulation of the atmosphere.

diurnal—Daily, especially pertaining to a cycle completed with a 24-hour period, and which recurs every 24 hours.

diurnal temperature range—The Earth's daily range in temperature. The earth receives its greatest amount of solar radiation at noon (sun time) and the least heating at sunset and sunrise. Surface air temperature is also affected by the amount of reflected radiation. At noon, the earth is receiving its greatest heat, but it is still not warm enough to radiate as much energy as it is receiving. Therefore, surface air temperature continues to get warmer. Shortly after noon the earth gets still warmer but begins to receive less solar radiation. Finally, incoming solar radiation exactly balances outgoing terrestrial radiation, and that is the time of maximum temperature. Maximum temperature, typically, occurs just before midafternoon.

divergence—Subsiding air diverges, or spreads, at the surface. Divergence is a downward motion producer that tends to stabilize the atmosphere near the surface.

Doppler radar system (NEXRAD)—The Doppler radar system is the next generation (NEXRAD) weather radar

(WSR-88D). NEXRAD is a Doppler radar system which, with a few minor exceptions, provides weather radar coverage from coast to coast in the contiguous United States, Hawaii, Alaska, and the Caribbean.

doubtful—Open to question. Circumstances where a safe outcome is not assured. *See also* uncertain.

downdraft—A relatively small scale downward current of air; often observed on the lee side of large objects restricting the smooth flow of the air or in precipitation areas in or near cumuliform clouds.

drainage wind—A wind directed down the slope of an incline and caused by greater air density near the slope than at the same levels some distance horizontally from the slope. *See also* mountain breeze.

drifting (DR)—Low drifting (DR) describes snow, sand, or dust raised to a height of less than six ft above the surface.

drizzle (DZ)—Drizzle is very small, numerous, and uniformly dispersed water drops that may appear to float. Unlike fog droplets, drizzle falls to the ground. Drizzle usually falls from stratus clouds and indicates a relatively shallow cloud layer. Drizzle restricts visibility to a greater degree than rain because it falls in stable air often accompanied by fog, haze, and smoke.

dry adiabatic lapse rate—The rate at which unsaturated air cools or warms when forced upward or downward (3°C per 1000 feet).

dry environment—Most often associated with thunderstorms/microbursts. A characteristic of semi-arid regions, where rain evaporates before reaching the surface. It refers to high based clouds producing a rain shaft or VIRGA, which can result in downdrafts/microburst absence of visible moisture. *See also* wet environment.

dry snow—Snow which has insufficient free water to cause cohesion between individual particles; generally, occurs at temperatures well below 0° C. Dry snow does not constitute an aircraft icing hazard in flight. *See also* wet snow.

dry slot—A satellite meteorology term used to describe a cloud feature associated with an upper level short wave trough. The cloud system is shaped like a large comma. As the system develops, sinking air beneath the jet stream causes an intrusion of dry, relatively cloud-free air on the upwind side of the comma cloud. The air of the intrusion is the dry slot. It is commonly the location where lines of thunderstorms subsequently develop. *See also* comma cloud system.

dryline—The boundary between the dry and moist air produces a lifting mechanism. Although not a true front, it has the potential to produce hazardous weather. It is also known as a dewpoint front.

dual polarization—National Weather Service radars are being upgraded with dual polarization. This will improve the radar's ability to evaluate the shape and composition of precipitation particles.

dust (DU)—Dust and blowing dust describe a combination of fine dust or sand particles suspended in the air, that can be raised to above 16,000 feet by the wind.

Dust Bowl—The colloquial name given to the south-central United States in the 1930s affected by severe drought and duststorms.

dust devil (PO)—Dust devils, or dust/sand whirls as they are known in the international METAR code, form in continental Tropical air masses. This microscale whirlwind forms over hot, dry land in fair weather and light winds as the result of intense local daytime convection and surface friction. They have diameters of 10 to 50 feet and extend from the surface to several thousand feet. Wind speed within the rotation varies from 25 to more than 75 knots. Dust devils are capable of substantial damage, but the majority are small.

duststorm (DS)—A duststorm is an unusual condition characterized by strong winds and covering extensive areas. In METAR duststorms are reported when visibilities are equal to or greater than 5/16SM and equal to or less than 5/8SM. When visibility is less than 5/16SM it is reported as heavy or well developed duststorm (+DS).

dust/sand whirls (PO)—*See* dust devil.

E

Earth's vorticity—Also known as Coriolis vorticity, is zero at the equator, increases with wind flow toward the pole and decreases with wind flow toward the equator.

echo—The radar energy reflected or scattered by a target, the radar presentation of the return from a target.

echo configuration—Weather radar echo configuration falls into three categories: cell, area, and line. A single isolated area of precipitation, clearly distinguishable from surrounding echoes, constitutes a cell. An area consists of a group of echoes of similar type that appear to be associated. A line (LN) defines an area of precipitation in a line—straight, curved, or irregular—at least 30 miles long, five times as long as it is wide, with at least 30 percent coverage. Echo coverage is reported in tenths.

eddy—A local irregularity of wind in a large scale wind flow. Small scale eddies produce turbulent conditions.

Eddy Dissipation Rate (EDR)—EDR is an automated turbulence forecast. Intensities are based on the state of the atmosphere, rather than a subjective pilot evaluation of the effects on an aircraft. *See also* Graphical Turbulence Guidance.

EDR—*See* Eddy Dissipation Rate.

element—A weather element consists of most items described in chapter 9, Surface Observations. Specifically, Table 9-1 Present Weather, Descriptor and Weather Phenomena. Various elements contain subsets (e.g. Wind—direction, speed, character).

embedded thunderstorm—A thunderstorm that occurs within non-convective precipitation. A thunderstorm that is hidden in stratiform clouds.

enhancement curve—*See* enhanced infrared imagery.

enhanced infrared (IR) imagery—A process by which infrared imagery is enhanced to provide increased contrast between features to simplify interpretation. This is done by assigning specific shades of gray to specific temperature ranges.

enhanced cumulus—Towering cumulus as *Seen* on satellite imagery; cumulus with vertical development without cirroform tops indicated by texturing and shadowing.

enhanced V—A cloud top signature sometimes *Seen* in enhanced infrared imagery in which the coldest cloud top temperatures form a “V” shape. Storms that show this cloud top feature are often associated with severe weather.

Enroute Flight Advisory Service (EFAS)—A service provided by selected FAA Flight Service Stations. The objective and purpose of Flight Watch is to enhance aviation safety by providing enroute aircraft with timely and meaningful weather advisories. EFAS was commissioned in 1972 and decommissioned in 2015.

enroute forecast products—For our purposes, enroute forecasts consist of text Area Forecasts, Graphical Surface and Graphical Clouds Forecasts, and the Graphical Forecasts for Aviation suite. These products address the enroute phase of flight and cover locations without terminal forecasts.

equivalent barotropic—A state of the atmosphere that

is—baroclinic but the isotherms *Seen* on a constant pressure surface are oriented exactly parallel to the lines of constant geopotential height (i.e. height contours); vertical speed shear of the wind is present but not direction shear; temperature advection is also not present; dynamically behaves much like a barotropic atmosphere. *See also* baroclinic, barotropic.

Eutectic Temperature/Composition—A deicing chemical that melts ice by lowering the freezing point.

evaporation—A physical process where a liquid is transformed into a gas, the opposite of condensation.

evaporative cooling turbulence—This type of wind shear occurs in a vertical plane rather than horizontal like inversion-induced. Evaporative cooling turbulence develops in areas of precipitation. This usually occurs in a dry environment with convective activity. Precipitation evaporates and cools the air, causing downdrafts. A pilot penetrating these areas will encounter wind shear turbulence, which can be severe.

extratropical cyclone—*See* extratropical low.

extratropical low—Sometimes called extratropical cyclone or extratropical storm, any cyclone that is not a tropical cyclone, usually referring to the migratory frontal cyclones of middle and high latitudes.

eye—An area of clear skies that develops in the center of a tropical storm.

eye wall—The area of thunderstorms that surrounds the

eye of a tropical storm.

F

Fahrenheit—A temperature scale where 32° is the melting point of ice and 212° the boiling point of water.

fall streaks—Fall streaks are ice crystals or snowflakes falling from high clouds into dry air where they sublimates directly from a solid to a gas. *See also* virga.

Fall wind—A cold wind blowing downslope. Fall wind differs from foehn in that the air is initially cold enough to remain relatively cold despite compressional heating during descent.

FDC NOTAM—FDC NOTAMs contain regulatory information, such as interim IFR flight procedures and temporary flight restrictions. *See also* Notice to Airmen.

few (FEW)—In weather reports and forecasts few indicate less than 1/8 to 2/8 sky cover of clouds or obscuring phenomena.

FICON—FICON (Field Condition) NOTAMs report surface contaminants on runways, taxiways, and aprons/ramps.

filling—An increase in the central pressure of a pressure system; opposite of deepening; more commonly applied to a low rather than a high.

fine line/thin line—At times weather radar picks up dust or debris that appear as a fine or thin line caused

by a dry front or gust front. It indicates the presence of low-level wind shear.

finger echo—Like a hook echo, a finger echo represents a strong probability of severe thunderstorms and tornadoes. *See also* severe weather echoes.

first gust—The leading edge of the spreading downdraft from an approaching thunderstorm.

FIS-B—*See* Flight Information Services–Broadcast.

flat ridge—Forecasters occasionally use the term “flat ridge.” Flat ridge—sounds sort of contradictory, doesn’t it? Forecasters usually use the term when a trough is crossing over the top of a ridge, reducing the amplitude of the ridge and consequently reducing the “ridge effects” such as subsidence or downward vertical motion. It’s a means of transitioning from high amplitude or meridional flow to zonal flow patterns. *See also* dirty ridge.

Flight Information Services–Broadcast (FIS-B)—FIS-B automatically transmits a wide range of weather products. Refer to the Aeronautical Information Manual for details.

Flight Service Station (FSS)—Air traffic facilities which provide pilot briefings, enroute communications, search and rescue services, assist lost aircraft and aircraft in emergency situations, relay ATC clearances, originate Notices to Airmen, process flight plans, and monitor navigational aids.

flight watch—*See* Enroute Flight Advisory Service.

flight level—Pressure altitude read off an altimeter set to standard pressure of 29.92; altitude used in the US above 17,999 feet. When pressure altitude is being flown, altitudes are referred to as “Flight Level” (FL). For example, “Flight Level One Eight Zero” (FL180 or a pressure altitude of 18,000 feet).

FM—*See* forecast change groups.

foehn—*See* foehn wind.

foehn wall—The steep leeward boundary of flat, cumuliiform clouds formed on the peaks and upper windward sides of mountains during foehn conditions—such as the Santa Ana and Chinook. This cloud formation should alert pilots to strong winds, possible turbulence, and wind shear. When sufficient moisture is present the cloud forms on the windward side and evaporates on the leeward side of the range.

foehn wind—A warm, dry, downslope wind.

fog (FG)—Visible liquid water droplets, supercooled water droplets, or ice crystals—or any combination—in the atmosphere with bases at or near the Earth’s surface.

forecast amendment criteria—*See* amendment criteria.

forecast change groups—Change groups consist of from (FM) followed by a time group (TTTT) FMTTTT and becoming (BECMG) followed by a time group (TTTt) BECMG TTTt. The FMTTTT group is used when a rapid change is expected, usually within less than one hour.

The BECMG TTTt group indicates a more gradual change in conditions over a longer period. The BECMG group indicates a change in conditions that are expected to occur at either a regular or irregular rate at an unspecified time, but within the period.

Four Corners—The adjoining boarders of the states of Utah, Colorado, Arizona, and New Mexico.

fractus—Clouds in the form of irregular shreds, appearing as if torn; have a clearly ragged appearance; applies only to stratus and cumulus (i.e. cumulus fractus and stratus fractus).

fractocumulus—Fractocumulus are shreds of small, detached clouds moving rapidly below a solid deck or higher clouds, normally associated with bad weather. Pilots who fly low, in poor weather conditions associated with these clouds, are known as “scud runners”. *See* fractostratus, scud.

fractostratus—Fractostratus are shreds of small, detached clouds moving rapidly below a solid deck or higher clouds, normally associated with bad weather. Pilots who fly low, in poor weather conditions associated with these clouds, are known as “scud runners”. *See* fractocumulus, scud.

freezing—The change of state of liquid water to ice.

freezing (FZ)—Freezing precipitation (FZ) in the form of rain (FZRA) or drizzle (FZDZ) is caused by liquid precipitation falling from warmer air into air that is at or below freezing. Droplets freeze upon impact producing

structural icing. *See also* freezing fog.

freezing drizzle (FZDZ)—Freezing drizzle is caused by liquid precipitation falling from warmer air into air that is at or below freezing. Droplets freeze upon impact. Structural icing can be expected while flying through freezing precipitation. Freezing precipitation is probably the most dangerous of all icing conditions. It can build hazardous amounts of ice in a few minutes and is extremely difficult to remove. Freezing drizzle can flow back along the aircraft, covering the static ports with the resultant loss of accurate pitot-static instruments—airspeed, altimeter, and vertical speed.

freezing fog (FZFG)—A fog composed of supercooled water droplets which freeze upon contact with exposed cold objects causing rime or glaze. When fog is occurring, and the temperature is below 0°C freezing fog is reported in METAR.

freezing level—As used in aviation forecasts the level at which ice melts (0° Celsius; 32° Fahrenheit).

freezing level data (RADAT)—Freezing level data is derived from the 00Z and 12Z radiosonde (upper air) observation sites. The RADAT has been removed from surface observations in the contiguous United States.

freezing point depressant—A fluid that combines with supercooled water droplets forming a mixture with a freezing temperature below the ambient air temperature.

freezing rain (FZRA)—Freezing rain is caused by

liquid precipitation falling from warmer air into air that is at or below freezing. Droplets freeze upon impact.

frictional force—Wind is directed by three forces: pressure gradient force, Coriolis force, and frictional force. Frictional force always acts opposite to wind direction.

friction layer—*See* boundary layer.

front—A boundary between air masses of different temperatures, moisture, and wind. *See also* cold front, frontogenesis, frontolysis, occluded front, stationary front, warm front.

frontal fog—*See* precipitation-induced fog.

frontal passage—*See* FROPA.

frontal turbulence—Frontal turbulence is caused by surface temperature differences exceeding five degrees Celsius within 50 miles of the front and usually occurs below 15,000 ft MSL. Since temperature is the determining factor, speed or type of front is not involved in the extent of frontal turbulence. Other types of turbulence, however, such as mechanical or wind shear, may also accompany a front.

frontal zone—*See* front.

frontogenesis—The process by which frontal systems are formed.

frontolysis—The process of frontal system dissipation.

FROPA—Frontal passage. At one time this contraction appeared on surface observations and terminal forecast; it is no longer used on METAR and TAF.

frost—Ice crystal deposits formed by sublimation when temperature and dew point are below freezing. *See also* aircraft icing.

frost heaves—Ruptured pavement caused by the expansion of freezing water immediately under the surface—receive NOTAM distribution.

Fujita scale—Tornado intensity is described using the Fujita/Pearson “F” scale. The scale was updated in 2007. Enhanced F-Scale (EF) winds, and associated damage, are contained in Table 5-1, pg97.

funnel cloud (FC)—A tornado cloud or vortex cloud extending downward from the parent cloud but not reaching the ground. *See also* tornado, waterspout.

G

general aviation—Used to describe the segment of aviation consisting of non-military and non-commercial operations. For our purposes general aviation includes light single and multi-engine aircraft (less than 12,500 lbs gross takeoff weight) used primarily for personal sport or pleasure, flight schools and clubs, and may include some business (corporate or executive) flying. Operations are conducted in accordance with 14 CFR Part 91 General Operating and Flight Rules.

general circulation—*See* planetary scale.

geostrophic wind—A hypothetical model describing an unaccelerated horizontal wind that blows in a straight path parallel to isobars or contours above the friction layer. It results from a balance between pressure gradient and Coriolis force.

glaciation—The transformation of liquid cloud particles to ice crystals.

glaze ice—A coating of ice, generally clear and smooth, formed by freezing of supercooled water on a surface. The terms “glaze” and “clear” have been used for essentially the same type of ice accretion; some use “clear” for thinner accretions which lack horns and conform to the airfoil. *See also* clear ice.

global circulation—*See* planetary scale.

Global Positioning System (GPS)—A network of earth satellites that provides high accuracy position, velocity, and time information to ground based or airborne receivers.

Geostationary Operational Environmental Satellite (GOES)—Geostationary Operational Environmental Satellites, are normally located about 22,000 nm above the equator at 75° W and 135° W. The satellites provide half-hourly visible and infrared imagery.

gradient—A horizontal decrease in value per unit distance of an atmospheric property in the direction of maximum decrease; most used with pressure, temperature, and moisture.

Graphical Turbulence Guidance (GTG)—Derived from model data and airborne turbulence observations, the GTG provides an automated turbulence forecast product. *See also* Eddy Dissipation Rate.

graupel—Snow pellets (GS) are also known as soft hail. Small, soft, fragile pellets formed when supercooled water droplets freeze onto snow crystals, a process called riming. If particularly intense, the crystal grows to an appreciable size. *See also* snow pellets.

gravity wind—*See* drainage wind, mountain breeze.

Great Basin—The area between the Sierra Nevada and Rocky mountains, consisting of southeastern Oregon, southern Idaho, western Utah, and Nevada.

grid—Depicts computer generated point forecasts of weather elements (e.g. weather symbols, and clouds and winds point forecasts.

ground clutter—Interference of the radar beam due to objects on the ground, usually within proximity to the radar antenna.

ground communication outlet (GCO)—A remotely controlled, ground to ground communications facility. Pilots at uncontrolled airports may contact an air traffic control facility via VHF radio to a telephone. The GCO system is intended to be used only on the ground. Available location are advertised in the Chart Supplement.

ground effect—Additional lift caused by the interaction

of the ground and downwash from the wing or rotor; ground effect ceases when the aircraft is about a half wing or rotor span above the surface.

ground icing—Structural icing that occurs on an aircraft on the ground, usually produced by snow or frost. *See also* aircraft icing.

GTG—*See* Graphical Turbulence Guidance.

Gulf of Alaska—The inlet of the Pacific Ocean off the southern coast of Alaska between the Alaska Peninsula on the west and the Alexander Archipelago on the east.

gust—Gusts refer to rapid fluctuations in wind speed. Gusts are reported when the variation in wind speed between peaks and lulls is at least 10 knots. Gustiness is a measure of turbulence. The greater the difference between sustained wind speed and gusts, the greater the turbulence.

gust front—A low-level wind shift line created by the downdrafts associated with thunderstorms and other convective clouds. Acting like a front, these features might produce strong gustiness, pressure rises, and low-level wind shear.

gustiness—*See* gust.

gustnado—A glorified dust devil. A local term used to describe a funnel cloud that develops along the gust front of a thunderstorm, not a tornado. It is believed that the gustnado receives its initial rotation from the shift in wind directions across the gust front. Cold, dense air

behind the gust front lifting the warm air ahead imparts a rotating motion in the wind shear zone.

H

Hadley cell—A closed circulation theory describing how low pressure at the equator causes rising air which moves pole ward at higher altitudes and sinks in high pressure areas at about 30 degrees, then near the surface moves toward the equator.

Hadley, George—In 1735, George Hadley was the first to propose a direct thermally-driven and zonally symmetric circulation as an explanation for the trade winds. *See also* Hadley cell.

hail (GR)—Hail is precipitation in the form of balls or irregular lumps of ice, always produced by convective clouds, nearly always cumulonimbus. An individual ball is called a hailstone. Thunderstorms characterized by strong updrafts, large liquid water content, large cloud-drop size, and great vertical height are favorable to hail formation. The violent updrafts keep hailstones suspended for several up and down cycles. Each cycle adds a layer to the hailstone until it can no longer be suspended in the cloud. *See also* hailstone size.

hailstone size—Hailstone size appears in remarks of METAR (...GR...RMK GR 1/2...; hailstones 1/2 inch in diameter) when hailstones are one-quarter inch or greater. Hailstones less than one-quarter inch are reported in the body of METAR reports as Small Hail (GS), with no remarks indicating size.

hail shaft—A shaft of hail detected on weather radar.

halo—A prismatically colored or whitish circle or arcs of a circle with the sun or moon at its center produced by clouds composed of ice crystals.

heat—The total energy of the motion of molecules with the ability to do work.

haze (HZ)—Haze is caused by the suspension of extremely small, dry particles invisible to the eye, but sufficiently numerous to reduce visibility. Haze, combined with smoke, often describes conditions in metropolitan areas. Large anticyclones—high pressure cells—can dominate the southeast United States trapping haze and pollutants, especially in industrial areas.

heat burst—A rapid, but brief, temperature jump associated with compressional heating produced by the downdraft of a thunderstorm.

heat capacity—The amount of heat required to raise the temperature of air, or the amount of heat lost when air is cooled.

heavy icing—Certain pilots will report icing intensity as heavy. This is a misnomer—all ice is heavy! It seems that the maximum intensity reported for icing was “heavy” until 1968. On the Current Icing Product/Forecast Icing Product suite the term heavy refers to the severity of the meteorological icing environment. *See also* icing, meteorological icing environment.

hectopascal—The international unit of atmospheric

pressure (hPa), equivalent to the millibar (mb).

high—An area of high pressure surrounded by lower pressure, also known as an anticyclone or high pressure area.

high aloft—*See* upper-level high.

high altitude prognostic chart (PROG)—The high altitude significant weather prognostic chart provides a graphic depiction of forecast weather from 400 mbs—to about 70 mbs, approximately 24,000 through 60,000 ft. All heights are pressure altitudes (flight levels).

high clouds—High clouds are those with bases at or above 20,000 feet. High clouds include cirrus, cirrostratus, and cirrocumulus. Cirriform is a term that describes the entire family of high clouds.

hook echo—A bona fide hook echo indicates the existence of a mesolow associated with a large thunderstorm cell. Such mesolows are often associated with severe thunderstorms and tornadoes. Hook echoes are not *Seen* on ATC radars.

humidity—Water vapor content of the air. *See also* relative humidity.

hurricane—A large, severe tropical storm with sustained surface winds greater than 64 knots. Hurricanes produce just about every kind of nasty weather extending over thousands of square miles. **See also** Saffir-Simpson scale, tropical depression, tropical storm, typhoon.

hydroplaning—A condition where a thin layer of water between the wheel and runway causes the tires to lose contact with the surface.

I

ice—The solid form of water consisting of a characteristic hexagonal symmetry of water molecules.

ice crystals (IC)—Ice crystals might appear suspended and fall from a cloud or clear air. They frequently occur in polar regions in stable air and only at very low temperatures. Ice crystals are not assigned intensity. *See also* cumulonimbus, fall streaks, mother of pearl, snow, snow pellets.

ice pellets (PL)—Ice pellets, formerly sleet, are grains of ice consisting of frozen raindrops, or largely melted and refrozen snowflakes. They occur when there is a shallow layer aloft with above-freezing temperatures and with a deep layer of below-freezing air based at the surface. As snow falls into the shallow warm layer, the snowflakes partially melt. As the precipitation reenters air that is below freezing, it freezes into ice pellets. Ice pellets do not bring about the formation of structural ice, except when mixed with supercooled water above.

ice protection equipment—For our purposes, and in the icing intensity definitions, the term refers to aircraft and equipment certified for flight into known icing. Although many aircraft have limited deice/anti-ice devices (pitot heat, prop anti-ice, alternate static source, etc.), it should never be construed as allowable for flight in icing; their purpose is for emergency use only, should

icing be inadvertently encountered.

icephobic liquid—A spray that reduces the adhesion of ice to the deicing boot surface improving deicing.

icing—The formation of ice on aircraft leading edges due to impact of the aircraft surfaces with supercooled water droplets. *See also* heavy icing, meteorological icing environment.

improper technique—Contrary to the FAA's or manufacturer's recommendation for the task or procedure.

impulse—A weak, mid to upper level and fast moving short wave feature, that can kick off thunderstorms.

inches of mercury—For aviation purposes we commonly relate atmospheric pressure to inches of mercury (in. Hg). *See also* altimeter setting.

indefinite ceiling (VV)—On METARs when the sky is completely hidden by a surface based obscuring phenomena an indefinite ceiling (VV) is reported. An indefinite ceiling is the vertical visibility upward into a surface-based obscuring phenomena that completely conceals the sky; the distance at which a pilot can expect ground contact when looking straight down on descent, or the point at which the ground disappears on climb out. This condition is most often caused by fog, but snow, smoke, or even heavy rain can cause this condition. *See also* ceiling.

indicated airspeed (IAS)—The airspeed read directly from the instrument uncorrected for installation and

instrument error, or variations in atmospheric density.

indicated altitude—The altitude read off an altimeter when set to the current altimeter setting. Indicated altitude is equal to true altitude when the aircraft is on the ground. Aloft indicated altitude equals true altitude only when the temperature lapse rate is standard. *See also* altimeter setting.

induction icing—The induction system includes the air filter, ducting, and fuel metering device. Induction system icing consists of any ice accumulation that blocks any component of the system. Air filter icing occurs when flying in areas of visible moisture with temperatures at or below freezing. For VFR pilots air filter icing should only occur in areas of freezing precipitation or wet snow. Induction system icing takes place anytime structural icing occurs. *See also* aircraft icing, airframe icing.

inflight briefing—Although discouraged, unless unavoidable, briefings once airborne will be conducted in accordance with a standard, abbreviated, or outlook briefing as requested by the pilot. As with any briefing sufficient background information must be made available. *See also* abbreviated briefing, outlook briefing, standard briefing.

inflight visibility—*See* air to air visibility.

infrared—Satellite imagery that measures the relative temperature of clouds or the Earth's surface.

instrument flight rules (IFR)—Federal regulations

that govern flight in instrument meteorological conditions—flight by reference to aircraft instruments.

instrument icing—Instrument icing affects aircraft flight and engine instruments. Iced over pitot-static instruments can cause false readings or render the instruments useless. Clogging of the pitot tube by ice affects the airspeed indicator only. Instrument icing has caused jet air carriers as well as general aviation accidents.

instrument meteorological conditions (IMC)—Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling less than the minimum specified for visual meteorological conditions.

intensity—Intensity in METAR describes the rate of precipitation, including that associated with thunderstorms or showers. Intensity is entered for all types of precipitation, except ice crystals and hail. Intensity levels may also be shown with obstructions such as blowing dust, sand, or snow.

intensity level—Used to describe radar precipitation intensity on RAREPs (SD) and the Radar Summary Chart.

intercycle ice—Ice which accumulates on a protected surface between actuation cycles of a deicing system.

intermountain region—The area of the western United States, west of the Rocky Mountains and east of the Sierra Nevada and Cascade Mountains, which includes Idaho and Arizona.

international standard atmosphere (ISA)—A hypothetical vertical distribution of atmospheric properties (temperature, pressure, and density). At the surface, the ISA has a temperature of 15° C (59° F), pressure of 1013.2 mb (29.92 in.), and a lapse rate of approximately 2° C in the troposphere.

interpolation—To estimate values between known values (e.g. Winds and Temperatures Aloft Forecasts and aircraft performance tables.)

intertropical convergence zone (ITCZ)—The dividing line between the southeast trade winds and the northeast trade winds of the southern and northern hemispheres respectively.

inversion—A lapse rate where temperature increases with altitude.

inversion-induced turbulence—This type of turbulence develops along the boundary between cool air trapped near the surface and warm air aloft. The turbulence tends to be strongest in valleys during morning hours when temperature differences are greatest. Moderate or greater turbulence may be encountered penetrating the layer.

inverted trough—An inverted trough is an atmospheric trough which is oriented opposite to most troughs of the mid-latitudes; that is the trough extends from a low pressure center toward the north. Most, but not all, are associated with tropical waves—also commonly called easterly waves.

inverted V profile—Environmental temperature and moisture profiles characterized by steep lapse rates and decreasing dew point depression with height in the lower troposphere, capped by a moist layer in the mid troposphere. They are typical of severe weather.

IR—*See* infrared imagery.

isobars—Lines connecting equal values of surface pressure.

isohumes—Lines of equal relative humidity.

isopleths—Lines of equal number or quantity.

isotachs—Used on charts and graphs, lines of equal wind speed.

isothermal—A constant lapse rate; typically, a layer in the atmosphere where temperature remains constant with an increase in height.

isotherms—Used on charts and graphs, lines of equal temperature.

J

jet streaks—*See* jet stream.

jet stream—The jet stream is a narrow, shallow, meandering band of strong winds embedded in breaks in the tropopause. To be classified as a jet stream, winds must be 50 knots or greater; although, jet stream winds generally range between 100 and 150 knots. Wind speed can

reach 200 knots along the east coast of North America and Asia in the cool season when temperature contrasts are greatest.

jetlets—*See* jet stream.

K

K index—The K index evaluates moisture and temperature. The higher the K Index the greater potential for an unstable lapse rate and the availability of moisture. Values range from -20 to +40, with some higher values associated with precipitation. The K Index must be used with caution; it is not a true stability index. Large K indices indicate favorable conditions for air mass thunderstorms during the thunderstorm season. K values can change significantly over short periods due to temperature and moisture advection.

katabatic wind—Any wind blowing down an incline.

Kelvin-Helmholtz (K-H) wind turbulence—H-K turbulence is caused by wind shear. It develops when there is a proper balance of wind shear and stability. Stability is important, if the atmosphere is too unstable, mixing occurs and the waves do not develop. With large wind speed changes over a short distance in a stable atmosphere are right for H-K turbulence. Under proper conditions an undulating wave forms. If the shear is strong enough the crests overrun the troughs. With sufficient moisture a herring bone shaped cloud develops. Wavelengths are much shorter than in a mountain wave, usually less than two miles. The implications are severe wind shear and, like the mountain wave, strong

updrafts on the windward side of the wave and strong downdrafts on the leeward side.

KMH—Kilometers per hour.

known icing—Atmospheric conditions in which the formation of ice is observed or detected in flight; where a reasonable pilot would expect a substantial likelihood of ice formation on the aircraft based upon all available information—reports and forecasts.

Kollsman, Paul—A German-born aeronautical engineer, invented the method to correct the altimeter for nonstandard pressure in 1928. This was a major step in allowing pilots to fly solely by instruments.

Kollsman window—Since atmospheric conditions vary continuously, the altimeter must be adjustable for a nonstandard environment. Most altimeters are equipped with an altimeter setting window, sometimes known as the “Kollsman window” The altimeter setting window allows the pilot to adjust the instrument for nonstandard pressure using the altimeter set knob. Typically, altimeters can be adjusted for pressures from 28.10 to 31.00 in. Hg.

L

lake effect—Often in winter, cold air moves over relatively warm lakes. The warm water adds both heat and water vapor to the air. The added heat makes the air unstable resulting in showers to the lee of the lakes. This phenomena is known as lake effect. Since it's winter, snow showers develop downwind. These snow show-

ers can be heavy and produce severe aircraft icing. This often occurs in the Great Salt Lake area of Utah, and the Great Lakes.

lake effect snow—*See* lake effect.

laminar flow—A smooth fluid flow that moves in parallel layers, a non-turbulent flow.

land breeze—At night, as the land cools more rapidly than the sea, wind blows from the cool land toward the warmer water, creating a land breeze. If moisture, lift, and instability are right, thunderstorms and rain showers develop. The opposite of a sea breeze.

lapse rate—The decrease of an atmospheric variable with height, usually temperature.

latency—The time between the actual occurrence of a phenomena (observation) and when it becomes available to the user. It includes data collection, processing, transmission, and display. Often used to describe the time lag of NEXRAD radar images.

latent heat—The amount of heat exchanged (absorbed or released) during the processes of condensation, fusion, vaporization or sublimation.

learning by experience—People learn through training or experience. Learning by experience can be defined as where: “The test comes before the lesson.”

lee—*See* leeward.

lee-side low—Low pressure areas that develop east of mountain barriers. Vorticity explains the development of low pressure areas east of mountain barriers, particularly in eastern Colorado. These lows are most predominant east of the Rockies because of the high mountain elevations.

leeward—The direction or side away from the prevailing wind (e.g. island, mountain, or region).

legacy radar summary chart—See radar summary chart.

lenticular clouds—Lenticular clouds appear smooth and remain stationary to the observer; they might develop as horizontal bands produced by long ridges, or circular and stacked from isolated peaks. Specific names are given to mountain wave clouds. SCSL (Standing Lenticular Stratocumulus)—a low cloud, ACSL (Standing Lenticular Altocumulus)—a middle cloud, and CCSL (Standing Lenticular Cirrocumulus)—a high cloud—indicate mountain wave activity. Although these clouds imply turbulence, turbulence will not always be present.

level of free convection (LFC)—The level at which a parcel of air lifted adiabatically until saturation would become warmer than its surrounding air and become unstable.

lifted condensation level (LCL)—The level at which a parcel of air lifted adiabatically would cool and become saturated. The level at which clouds would form.

lifted index—The lifted index provides an indication

of atmospheric moisture and stability—thunderstorm potential at the time of observation. The lifted index compares the temperature a parcel of air near the surface would have if lifted to the 500 mb level and cooled adiabatically, with the observed temperature at 500 mbs. The index indicates stability at the 500 mb level. The index can range from +20 to -20 but generally remains between +10 and -10 (The figures are strictly an index, not a representation of temperature). A positive index indicates a stable condition, high positive values, very stable air. A zero index indicates neutral stability. Values from zero to minus four indicate areas of potential convection. Values of +2 to -2 indicate the potential for general thunderstorms that will likely not be severe. Large negative values from minus five to minus eight represent very unstable air, which could result in severe thunderstorms—should convection develop.

lightning—A meteorological condition in thunderstorms caused by differences in electrical charge that produce a visible electrical discharge. When lightning (LTG) is *Seen*, it will appear in remarks of METAR reports.

lightning detection equipment—Lightning detection equipment was invented in the mid 1970s by Paul A. Ryan as a low-cost alternative to radar. Lightning detectors sense and display electrical discharges in approximate range and azimuth to the aircraft. The system has limitations. One misconception proclaims that in the absence of dots or lighted bands there are no thunderstorms. However, NASA's tests differed. Precipitation intensity levels of three and occasionally four would be indicated on radar without activating the lightning detection system. A clear display only indicates the

absence of electrical discharges. This does not necessarily mean convective activity and associated thunderstorm hazards are not present. Even tornadic storms have been found that produced very little lightning.

limited state thunderstorm—Generally referred to as air mass thunderstorms, cells progress rapidly through the mature stage. The mature stage is self-destructive. When the updraft is too weak to support the rain drops, precipitation falls through the updraft. Falling precipitation induces frictional drag retarding the updraft, finally reversing it to a downdraft. The downdraft and precipitation cool the lower portion of the storm cloud and the surface below. This cuts off the inflow of water vapor and dissipates the storm. This self-destructive cell usually lasts from 20 minutes to about one and one-half hours and rarely produces extreme turbulence or large hail. However, even a limited state thunderstorm can produce severe icing and turbulence, and hail which can cause structural damage.

line echo wave pattern (LEWP)—A weather radar signature indicating strong thunderstorms and the development of severe weather.

linier—Equal or proportional over a lateral distance.

liquid water content (LWC)—The total mass of water contained in all the liquid cloud droplets within a unit volume of cloud. Units of LWC are usually grams of water per cubic meter of air (g/m³).

location identifier (LOCID)—LOCIDs consist of three to five alphanumeric characters are contractions used to

identify geographical locations, navigational aids, and intersections.

LOCID—*See* location identifier.

loop—A series of satellite or radar images, displayed in sequence, to obtain a trend of weather conditions.

long wave—*See* Rossby wave.

low—An area of low pressure surrounded by higher pressure.

low altitude PROG chart—The 12-24 hour low-level significant weather prognostic (prog) chart is issued four times a day, valid at 0000Z, 0600Z, 1200Z, and 1800Z depending on issuance time. Because it takes approximately six hours to prepare and distribute the chart, by the time it becomes available valid times are only up to 18 hours. If a pilot calls just prior to the next issuance, only a 12-hour forecast would be available. The 12-24 hour prog consists of four panels. The two upper panels forecast significant weather from the surface to 400 mb (24,000 ft). These panels are produced by AWC forecasters responsible for the domestic FAs. The lower panels depict the location and coverage of precipitation, and the location of surface features—fronts and pressure systems. Forecast weather categories (VFR, MVFR, and IFR) have the same definitions and limitations as the weather depiction chart and area forecast outlook categories.

low clouds—Low clouds are those with bases near the surface to about 6,500 feet. This family consists of

stratus, stratocumulus, nimbostratus, fractostratus and fractocumulus.

low drifting (DR)—*See* drifting.

low-level—As used on aviation weather products low-level (also referred to as Surface) describes weather phenomena occurring between the surface and 500 millibars (mbs)—about 18,000 ft.

low-level jet (LLJ)—*See* low-level jet stream.

low-level jet stream—A band of strong winds in the lower portion of the troposphere. For example, a strong air current produced by terrain effects, such as a cold air mass surging against a mountain range; a nighttime layer of strong wind within 2000 ft of the surface, produced by strong radiational cooling. Low-level jet streams are sometime described in the discussion portion of the Convective Outlook.

low-level wind shear (LLWS)—Wind shear that occurs within 2000 ft of the surface. *See also* convective LLWS, non-convective LLWS, and wind shear.

M

macroburst—A downburst that affects a path longer than two nm and may persist for up to 30 minutes.

magnetic variation—The angular difference between true north and magnetic north, for a given location.

magnetic wind direction—The direction from which

the wind is blowing in relation to magnetic north. The only time pilots can expect to receive “official” wind direction in relation to magnetic north is from a control tower, an FSS providing Local Airport Advisory (LAA), ATIS recording, or AWOS/ASOS radio broadcast.

mamma—*See* cumulonimbus mammatus.

mammatus—*See* cumulonimbus mammatus.

maneuvering speed—The maximum speed at which full, abrupt control movements can be made without exceeding the structural limits of the airplane. Vertical gusts and wind shear put additional loads on the aircraft. Turbulent air penetration speed prevents structural damage as a result of gust loads. In turbulent flight maintain an airspeed well above indicated stall speed and below maneuvering speed.

manual observation—The term manual refers to the fact that a human has overall responsibility for the observation. *See also* augmentation.

mayday—The international radio distress signal. Repeated three times indicates imminent danger and assistance required. (From the French word *maides*.) *See also* pan.

mean sea level (MSL)—A cloud layer or altitude measured from average sea level to the cloud base, or altitude or elevation.

mean storm motion vector—The mean wind vector is the direction and magnitude of the mean winds from

5000 ft AGL to the tropopause. It can be used to estimate cell movement.

mean wind vector—*See* mean storm motion vector.

mechanical turbulence—An object placed in any moving air current impedes the flow causing abrupt changes in wind direction. As the current closes in behind the object, eddy currents develop leeward of the obstruction. This turbulence is caused by the obstruction and not by any meteorological phenomena inherent in the air itself.

melting—A change of state from solid ice to liquid water.

melting level—The temperature at which ice melts, often referred to as the freezing level; although ice does not necessarily freeze at 0°C. *See* also supercooled.

mesocyclone—A stage in the development of a tornado ranging from 1.5 to 4.5 nm in diameter.

mesolow—Also known as mesocyclone, a mesolow is a small area of low pressure within a severe thunderstorm. Tornadoes can develop within the vortex.

mesoscale—Small-scale meteorological phenomena that can range in size from that of a single thunderstorm to an area the size of the state of Oklahoma.

mesoscale convective complex (MCC)—A large homogeneous convective weather system on the order of 100,000 square miles. They tend to form during the morning hours.

mesoscale convective system (MCS)—An organized cluster of thunderstorms, larger than individual thunderstorms, but smaller than synoptic scale systems, that can last for hours. MCSs include tropical cyclones, squall lines, and mesoscale convective complexes.

METAR—Meteorological Aviation Routine surface weather report.

meteorological icing environment—An atmospheric set of conditions where the rate of ice accumulation is objectively defined and can be measured using a suitable icing rate meter; as opposed to a subjective observation (e.g. pilot) of the rate of ice accumulation and its effects on an aircraft.

microburst—A microburst consists of a small-scale, severe, storm downburst less than two-and-a-half miles across. This flow can be 180° from the prevailing wind, with an average peak intensity of about 45 knots. Microburst winds intensify for about five minutes after ground contact and typically dissipate about 10 to 20 minutes later. Microburst wind speed differences of almost 100 knots have been measured. Some microburst events are beyond the capability of any aircraft and pilot to recover. Although normally midafternoon, mid-summer events, microbursts can occur any time, in any season.

micron (μm)—One millionth of a meter.

microscale—*See* sub-synoptic scale.

middle clouds—Middle clouds are those with bases from

6500 ft to 20,000 ft. Middle clouds fall into two general types: altostratus and altocumulus.

midlatitude cyclone—A synoptic scale low pressure system found in middle latitudes.

midlatitude westerlies—The prevailing westerly winds in the middle latitudes blowing out of high pressure towards the poles.

millibar (mb)—A unit of pressure equal to 100 newtons per square meter or 1 hectopascal. For aviation purposes we commonly relate atmospheric pressure to inches of mercury or millibars.

mist (BR)—In METAR mist refers to an obstruction to vision, not precipitation—its generic definition. Fog is only reported when the visibility is less than five-eighths of a mile. With visibility five-eighths of a mile or greater, mist (BR) designates this phenomenon. (BR is a contraction derived from the French word *brume*.)

mixed ice—Rime ice and clear ice (mixed ice) is a hard, rough, irregular, whitish conglomerate formed when supercooled water droplets vary in size or are mixed with snow, ice pellets, or small hail. Since the clarity, color, and shape of the ice will be a mixture of rime and clear characteristics, accurate identification of mixed ice may be difficult.

mixed icing conditions—An atmospheric environment where supercooled liquid water and ice crystals coexist.

mixing layer—The layer of the atmosphere, usually

within several thousand feet of the surface, where wind speed and direction are affected by friction with the Earth's surface; in which the air is thoroughly mixed by convection.

mixing ratio—The ratio of water vapor to dry air, expressed in grams of water vapor per kilogram of dry air.

MLCAPE—*See* convective available potential energy.

moist adiabatic lapse rate—*See* saturated adiabatic lapse rate.

moisture—A term used to describe the water vapor content of the atmosphere, whether gaseous, liquid, or solid.

moisture channel imagery—Weather satellite imagery of atmospheric moisture content.

moisture convergence—An objective analysis field combining wind flow convergence and moisture advection. Under certain circumstances, this field is useful for forecasting areas of thunderstorm development.

monsoon—Any seasonal change in the general atmospheric wind circulation is termed a monsoon. It is generally caused by differential heating between land and water areas. Examples are the Indian monsoon of south Asia. Monsoon and monsoonal moisture are also used to describe the summer influx of moisture, originating as far away as the Gulf of Mexico, into the southwest U.S. in the warm season, resulting in mid- and high-level clouds, rain showers, and thunderstorms.

mosaic—*See* radar mosaic.

mother of pearl—In a very rare occurrence, an aggregate of ice crystals will form in the stratosphere. These clouds are known as mother of pearl.

mountain breeze—At night, the layer of air near the mountain slope cools more rapidly than air over the valley. There is greater air density near the slope than at the same levels some distance horizontally from the slope. The cool air flows down the slope as a mountain wind. The mountain wind—sometimes called a gravity wind—often continues to flow down the gentler slopes of canyons or valleys, and in such cases, it takes on the name “drainage wind”. It can become quite strong over some terrain when atmospheric conditions are favorable, and in extreme cases become hazardous when flowing through canyons. The opposite of a valley breeze.

mountain obscuration—AIRMET SIERRA addressing mountain obscuration. Advisories for mountain obscuration apply to the mountains—coastal mountains, Cascades, Sierra Nevada, Rockies, Appalachian, and so on. This forecast outlines areas where extensive or widespread obscuration is expected.

mountain wave—When winds aloft blow more than about 40 knots, approximately perpendicular to a mountain range, and speed increases with height in a stable atmosphere a mountain wave or standing wave can develop. Turbulence can become severe to extreme. Updrafts and downdrafts occasionally reach 3000 ft per minute and can exist to the tropopause or slightly higher. Downdrafts may dip to the surface on the

leeward side of the mountains. Large waves may form to the lee of mountains and may extend hundreds of miles downstream. Complete overturning may occur under the wave crests at lower levels. Altimeter errors might exceed 1000 ft. Mountain wave activity typically can be *Seen* on visible, and sometimes infrared satellite imagery. With lack of adequate moisture, waves occasionally occur in clear air.

moving target indicator (MTI)—As used on ATC radars, MTI only displays moving targets; unless precipitation droplets have a rapid horizontal movement, they remain undetected; even rapidly moving precipitation will not be observed when advancing perpendicular (tangentially) to the radar beam.

MPS—Meters per Second

mu—The Greek letter mu (μ) designates a friction value representing runway surface conditions. The lower the mu value, the less effective braking performance becomes, and more difficult direction control becomes. Pilots can expect to receive mu values from ATC or Notice to Airmen (NOTAM). Also recall that no correlation has been established between mu values and the descriptive terms “good”, “fair”, “poor”, and “nil” used in braking action reports.

N

NAVAID—*See* navigational aid.

navigational aid—An electronic, ground or space based, device used in aerial navigation.

negative tilt—Refers to troughs with an axis in the horizontal plane tilting from northwest to southeast. These systems tend to cause more weather in California because they bring in warm, moist air.

negative vorticity advection (NVA)—Area of low values of vorticity producing downward vertical motion.

neutral stability—An atmospheric condition that after a parcel is displaced it remains at rest—even when the displacing force ceases.

NEXRAD—The next generation Doppler weather radar system.

NIL—METAR or TAF not filed or missing, element not available.

nimbo—A cloud type prefix or suffix meaning “rain;” for example, nimbostratus and cumulonimbus.

nimbostratus (NS)—Nimbostratus are low clouds, usually uniform, and dark gray in color. Nimbostratus usually evolves from altostratus that has thickened and lowered, sometimes with a ragged appearance. This is the ordinary rain cloud that produces light to moderate, steady precipitation. Flight in, and in the vicinity of, nimbostratus is usually smooth. The presence of nimbostratus indicates a stable air mass.

non-convective LLWS—Wind shear produced by phenomena other than thunderstorms, such as fronts, low-level jet streams, terrain, valley effect, sea breezes, lee side effect, inversions, or Santa Ana or similar foehn-

like winds. *See also* convective LLWS and low-level wind shear.

normally aspirated engine—A reciprocating engine that uses ambient atmospheric pressure to force the fuel/air mixture into the cylinders—NOT supercharged/turbocharged. Also called naturally aspirated engine.

NOTAM—*See* Notice to Air Missions.

NOTAM (D)—NOTAM (D)s contain information that might influence a pilot’s decision to make a flight, or require alternate routes, approaches, or airports. They are considered “need-to-know” and issued for certain landing area restrictions, lighting aids, special data, and air navigation aids that are part of the National Airspace System (NAS). NOTAM (D)s are issued for all public use airports listed in the *Chart Supplement*.

Notice to Air Missions (NOTAM)—The Federal Aviation Administration advertises the status of components or hazards in the National Airspace System (NAS) through aeronautical charts, the Flight Supplement, other publications, and the National Notice to Airmen System. Changes are normally published on charts, in the Directory, or appear in the Notices to Airmen publication. Unpublished NOTAMs are divided into three groups:—NOTAM (D), FDC NOTAM. *See also* NOTAM (D), FDC NOTAM.

nor’easter—A “nor’easter” usually develops in the lower midlatitudes (30° to 40° north), within 100 miles east or west of the Atlantic coast. Systems set up pressure gradients that produce a strong easterly flow to the north

of the storm. An intense low pressure system progresses generally north- to northeastward along the east coast of the United States and typically attains maximum intensity near New England and the Maritime Provinces of eastern Canada.

northeaster—*See* nor'easter.

nucleation—In meteorology, the initiation of either of the phase changes from water vapor to liquid water, or from liquid water to ice.

O

OASIS—*See* Operation and Supportable Implementation System.

obscuration—Precipitation or obstruction to vision that hides part or all the sky. *See also* partial obscuration, indefinite ceiling.

obstruction to vision—A phenomenon in the atmosphere, other than precipitation, that reduces horizontal visibility.

occluded front—The combination of two fronts. An occlusion results from a cold front catching up with and overrunning a warm front.

octas—Meaning eight. Sometimes used to describe the amount of sky cover which is reported in eighths or octas.

one-minute observations (OMO)—In addition to long-

line transmission of routine hourly METAR, and SPECI reports, many automated facilities provide one-minute observations (OMO), usually through discrete low-power radio frequencies and by telephone. They may differ from long-line transmissions and are not “instant weather.” Sky condition and visibility employ time averaging algorithms to be more representative and buffer rapidly changing conditions. They’re designed to report deteriorating weather faster than improving conditions.

omega block—A specific pattern associated with upper level highs are called an “omega block.” Upper level flow resembles the Greek letter omega (Ω), with an upper level high in the center of the pattern. This is a strong blocking high that can remain stationary for days or weeks. Short waves, and their associated weather ride up over the high.

OMO—*See* one-minute observations.

Operation and Supportable Implementation System (OASIS)—Equipment designed to replace FSS Model 1 computer and graphics system. Equipment was never completed or fielded with the contracting of Flight Services to Lockheed-Martin.

open cell—On satellite imagery a pattern of clear air surrounding individual convective cells.

orographic—A term used to describe the effects caused by terrain, especially mountains, on the weather.

outflow boundary—The boundary produced by a surge of rain-cooled air flowing outward near the surface from

the originating area of convection. In an unstable air mass, thunderstorms tend to develop along these zones and especially at intersections of two or more boundaries. The boundary is often the lifting mechanism needed to generate new thunderstorms.

outlook briefing—When the pilot's proposed departure time is beyond six hours, the FSS will normally provide an outlook briefing. The briefing will contain available information applicable to the proposed flight. The details will depend on the proposed time of departure. The farther in the future, the less specific. As a minimum the outlook will consist of a synopsis and route/destination forecast. *See also* abbreviated briefing, inflight briefing, standard briefing.

overcast (OVC)—In weather reports and forecasts overcast indicates 8/8 sky cover of clouds or obscuring phenomena. Ceiling is not designated. For aviation purposes, the ceiling is the lowest broken (BKN) or overcast (OVC) layer, or vertical visibility (VV) into a complete obscuration.

overlay—Consists of computer generated aerial coverage of a weather element (e.g. ceilings, visibilities, precipitation, clouds, turbulence, icing, or winds).

overrunning—A condition in which air flow from one air mass is moving over another air mass of greater density. The term usually applies to warmer air flowing over cooler air as in a warm frontal situation. It implies a lifting mechanism that can trigger convection in unstable air.

overshooting tops—On satellite imagery it refers to the tops of severe thunderstorms, which often develop above the normal cloud tops due to the severe updrafts of the storm. *See also* supercell.

P

p-static—*See* precipitation static.

pan—The international radio call to indicate uncertainty or alert. Repeated three times followed by the nature of the urgency. (From the French word *panne*.) *See also* mayday.

parhelion—Colloquially known as a Sun Dog, a rainbow like phenomena caused by refraction of sunlight by ice crystals of cirrostratus clouds.

partial (PR)—Describes fog (PRFG) that covers a substantial part of the airport, while the remainder is fog free. *See also* patches.

parcel—A parcel is a small volume of air arbitrarily selected for study; it retains its composition and does not mix with the surrounding air.

partial obscuration—A partial obscuration indicates that between one-eighth and seven-eighths of the sky is hidden by a surface-based obscuring phenomena. Precipitation—including snow, haze, smoke, and fog usually cause this condition. Automated systems will, normally, not report these conditions. *See also* obscuration.

Pascal, Blaise—Blaise Pascal (1623—1662) was a French philosopher and mathematician for whom the international unit of atmospheric pressure, the hectopascal (hPa), is named.

patches (BC)—Indicates that fog (BCFG) randomly covers parts of the airport. *See also* partial (PR).

patchy—When used with field condition (FICON) NOTAMs indicates that 20% or less of the surface is covered by snow, ice, etc.

patchy conditions—Areas of bare pavement showing through snow and/or ice covered pavements. Patches normally show up first along the centerline in the central portion of the runway in the touchdown areas.

peak wind—Peak wind appears in the remarks of METARs when speed exceeds 25 knots. The direction, speed, and time of occurrence is reported ...PK WND 3560/40..., peak wind from 350° at 60 knots occurred at 40 minutes past the hour. Peak wind might substantially exceed the value in the body of the observation.

pendant echo—A pendant represents one of the most severe storms. *See also* supercell.

pitot-static system—Three flight instruments operate from air density: the altimeter, airspeed indicator, and the vertical speed indicator. Ram air pressure is connected to the airspeed indicator. The airspeed indicator measures the differential pressure between the ram air and static air pressure from the static ports. The altimeter and vertical speed indicators are also vented to

ambient, or static, air pressure through the static ports, usually located on the side of the aircraft. The three flight instruments, connecting tubing, and static ports make up the pitot-static system.

planetary boundary layer—*See* boundary layer.

planetary scale—Planetary scale, also called global or general circulation, consists of the jet stream, polar high, polar front, subtropical high, and intertropical convergence zone.

planetary waves—*See* Rossby waves.

point of observation—The location where observations (METRA/SPECI) are normally taken. Certain elements may be made at other sites (i.e. Tower visibility from the tower cab; sky condition elements from a location at the instrument runway.) At automated sites from the ASOS installation—which may or may not be at the instrument runway.

polar air—An air mass that originates in polar regions.

polar easterlies—Anticyclonic circulation, in the northern hemisphere, produces easterly wind around the polar high. This is the area of the polar easterlies at about 60° latitude.

polar front—A semi-permanent, semi-continuous front separating air masses of tropical and polar origin.

polar high—At the poles is an area of subsidence. This is the region of the polar high—some of the highest

atmospheric pressures ever recorded have occurred in these areas.

polar jet—The jet stream located at the break between the polar tropopause and subtropical tropopause.

polar orbiters—Meteorological satellites that orbit along a north-south axis crossing the Earth's poles at an altitude from about 400 to 600 nm.

positive tilt—Refers to troughs with an axis in the horizontal plane tilting from northeast to southwest.

positive vorticity advection (PVA)—Positive vorticity advection, usually applies to the 500 mb level and refers to areas where the wind flow implies advection from higher values of absolute vorticity to lower ones. These areas are presumed to mark zones where upward vertical motion will be supported or enhanced. A vertical motion producer.

precipitation—Any or all of the forms of water particles, whether liquid or solid, that fall from the atmosphere and reach the ground.

precipitation attenuation—The reduction of power density of a radar beam due to the absorption or reflection of energy by precipitation.

precipitation discriminator—An automated weather observation sensor, or sensor array, that differentiates between types of precipitation—liquid, freezing, frozen.

precipitation-induced fog—Rain-induced fog, also

known as frontal fog, occurs when warm rain falls through cooler air, evaporates, and condenses forming fog; it can be dense and will persist as long as the rain continues. Winds must generally be light. This condition is usually associated with stationary, warm, or shallow, weak cold fronts. Satellite imagery is of no use in determining the extent of the fog because of presents of higher cloud layers. See also fog.

precipitation mode—This NWS radar mode is designed specifically to detect precipitation size returns.

precipitation static—Low frequency radio communications and navigation interference caused by corona discharge from radio antennas or other protuberances on aircraft.

present weather—Present weather includes precipitation, obscurations, well-developed dust/sand whirls, squalls, tornadic activity, sandstorms and duststorms.

pressure—Pressure is force per unit area.

pressure altitude—The altitude in the standard atmosphere—above the mean sea level constant pressure surface—that has the same altitude as the location of the aircraft. Pressure altitude can be read off an altimeter when set to 29.92 in Hg—standard sea level pressure. Indicated altitude and pressure altitude are equal only when the altimeter setting is 29.92. Pressure altitude is used to eliminate station barometer errors, some altimeter instrument errors and relieve air traffic controllers and pilots from having to issue and reset the altimeter at frequent intervals due to the high speeds typically

flown at higher altitudes. Pressure altitude is also used, along with temperature, to calculate aircraft take off, climb, and landing performance.

pressure gradient force—Wind is directed by three forces: pressure gradient force, Coriolis force, and frictional force. Differences in pressure cause pressure gradient force. At least initially, the wind wants to blow from areas of high pressure to low pressure. If pressure gradient were the only force acting on the wind, wind would always blow perpendicular to isobars—directly from areas of high pressure to low pressure.

prevailing visibility—Visibility reported in manual observations. The greatest distance that can be seen throughout at least half the horizon circle, which need not be continuous.

PROB 30—A 30 to less than 40 percent probability.

PROB 40—A 40 to less than 50 percent probability.

probability—The ratio of the chances favoring an event to the total number of chances for and against it.

probable cause(s)—NTSB probable cause is NOT a legal determination and may NOT be used in any suit or action. Only a Court can determine cause and assign liability.

proximity—Proximity in METAR modifies the location of a weather event in relation to the airport. Proximity applies only to weather phenomena occurring in the vicinity of the airport. *See also* vicinity.

pyrocumulus—A cloud that results from the rising hot air of a wildfire or volcanic eruption. Water vapor condenses on the ash forming cloud drops. Under the right conditions thunderstorms can form.

Q

QFE—Altimeter setting used so that the altimeter will read zero when the aircraft is on the ground.

QNE—Altimeter setting used to obtain pressure altitude.

QNH—Altimeter setting used to obtain indicated altitude.

R

radar—*See* weather radar.

radar altitude—The altitude of an aircraft, above the surface, determined by radar-type radio altimeter.

radar mosaic—An image consisting of multiple single-site radars combined to produce a regional or national scale display.

radar summary chart—The “Legacy” Radar Summary Chart graphically displayed a computer-generated summation of RAREP digital data. The date and time of the observation—time is important because the transmission system might make the report several hours old—appeared on the chart. Similar to the RAREP, the chart contained information on precipitation type, intensity, configuration, coverage, tops and bases, and movement.

The “Legacy” Radar Summary Chart evolved in the 1970s as a graphical summation of radar observations. Computer graphics and electronic transmission of data have replaced this product. The National Weather Service ceased producing the Chart in June 2013.

radiation—The process of transferring energy through space without the aid of a material medium.

radiation fog—Radiation fog forms when air cools from contact with the ground and becomes saturated. This occurs at night and tends to be most dense, with lowest visibilities, around sunrise. Clear skies, light winds (less than five knots), high relative humidity, and stable air are favorable conditions for the formation of radiation fog. On calm, cool nights high pressure traps low level moisture. Dry air aloft enhances the formation of radiation fog. Radiation fog shows up well on visual satellite imagery. Overcast skies, strong winds, low relative humidity, and unstable air prevent or retard the formation of radiation fog. *See also* fog.

radiational cooling—The cooling of the Earth’s surface and the adjacent atmosphere through the radiation of heat energy into space.

radiosonde—A balloon launched instrument package used to measure meteorological data through the vertical extent of the atmosphere—approximately 100,000 ft during the day and 80,000 ft at night. Pressure, temperature, and humidity are typically recorded. Wind direction and speed can be measured by tracking the balloon.

rain (RA)—Rain is precipitation in the form of liquid water drops. Rain drops have diameters greater than 0.5 millimeters (mm), which distinguishes them from drizzle drops that have a diameter less than 0.5 mm. Rain reduces forward visibility, but visibility to the side and downward remains good. In moderate rain forward visibility can be reduced to less than VFR. If the rain is heavy, it can obscure terrain.

rain-induced fog—*See* precipitation-induced fog.

rain line—At latitudes of the United States, as a rule, weather systems will tend to produce precipitation in the form of rain north of the 564 contour line on the 500 mb chart.

rain shadow—One effect of terrain is “rain shadows.” This predominately occurs in the west. Pacific storms shed most of their moisture over the Cascades of Washington and Oregon, and Sierra Nevada of California. This results in semiarid climates east of these mountain ranges.

range attenuation—The loss of radar power density due to distance from the antenna.

rapid update cycle (RUC)—A high speed computer model that updates every three hours, designed for short-term forecasting. The RUC20 model was developed at NOAA’s Forecast Systems Laboratory in Boulder, Colorado. Called the RUC20 because of its 20-km resolution, it improves forecasts widely used for aviation, severe-weather forecasting, and general weather forecasting.

RAREP (SD)—Automated, textual radar weather report.

RAREP digital data—RAREP digital data appears at the bottom of the RAREP report. A grid centers on the reporting station. Each block, 22 nm on a side, is assigned the maximum intensity level observed. When 20 percent of a block contains light intensity, that level is assigned. Therefore, from digital data alone, all that can be concluded from intensity level one is that at least 20 percent of that grid contains light precipitation. Letters represent coordinates; numbers indicate the maximum intensity level for that and succeeding coordinates to the right. These numbers are a prime ingredient in Convective SIGMETs.

rawinsonde—Upper air observation of wind direction and speed, pressure, temperature, and relative humidity using a balloon launch radiosonde. Basically, a radiosonde tracked by radar to determine wind direction and speed.

rawinsonde observation (RAOB)—*See* rawinsonde.

relative humidity—The ratio, expressed as a percentage, of water vapor present in the air compared to the maximum amount the air could hold at its present temperature.

relative vorticity—*See* absolute vorticity, anticyclonic relative vorticity, earth's vorticity, vorticity.

residual ice—Ice which remains on a protected surface immediately after the actuation of a deicing system.

ridge—An elongated area of high pressure. *See also* dirty ridge; flat ridge.

rime—A white or milky and opaque granular deposit of ice.

rime ice—A rough, milky, opaque ice formed by the instantaneous freezing of small, supercooled droplets as they strike the aircraft. Rime ice typically accretes along the stagnation line of an airfoil and is more regular in shape and conformal to the airfoil than clear ice. It is the ice shape, rather than the clarity or color of the ice, which is most likely to be accurately assessed by the pilot.

roll cloud—Associated with convective activity, a roll cloud appears as a detached, dense, horizontal cloud at the lower front part of the main cloud. It indicates thunderstorms and potential for severe weather.

rote—The ability to repeat something back but not understanding or being able to apply what has been learned (e.g. The contraction BKN decodes “broken.”).

Rossby waves—Also known as major waves, planetary waves, or long waves, they are characterized by their large length and significant amplitude. They tend to be slow moving.

RUC—*See* rapid update cycle.

runback ice—Ice which forms from the freezing or re-freezing of water leaving protected surfaces and running back to unprotected surfaces.

runway braking action—*See* breaking action.

runway condition reading—*See* mu.

runway visual range (RVR)—Runway Visual Range measures the horizontal distance a pilot can see high intensity runway lights while looking down the runway—not slant range. A transmissometer transmitter projects a beam of light toward the receiver. A photoelectric cell measures the amount of light reaching the receiver. This value is electronically converted into visibility and displayed at appropriate locations (tower, FSS, weather office, or a combination of locations). RVR applies to instrument approach minimums found on IFR approach and landing, and departure procedure charts.

S

safe—Risk free; however, for practical (operational) purposes it can be interpreted as “acceptable risk.”

Saffir-Simpson scale—The Saffir-Simpson scale of hurricane intensity is based on central pressure, storm surge, and mean wind speed.

St. Elmo’s fire—An electrical phenomena associated with thunderstorms causing a corona discharge.

sand (SA)—Sand particles raised by the wind to a height sufficient to reduce horizontal visibility.

sandstorm (SS)—In contrast to a duststorm, a sandstorm causes grains of sand to be blown into the air. In METAR sandstorms are reported with visibilities equal

to or greater than 5/16SM and equal to or less than 5/8SM. When visibility is less than 5/16SM the phenomenon it is report as heavy or well developed (+SS).

satellite loop—The capability to view several satellite images in succession—a satellite loop—can often provide a sense of weather movement, development, and dissipation. Viewing a loop will also help distinguish between terrain and surface features, and cloud cover.

saturated adiabatic lapse rate—The rate at which saturated air cools or warms when forced upward or downward.

Santa Ana—The local name given to a foehn wind that occurs in late fall, winter, and early summer in Southern California.

saturation—When a parcel of air can no longer hold any additional water vapor as a gas, it is said to be saturated; its temperature and dew point are the same, relative humidity 100%.

scalloped echo—Scalloped shaped echoes indicate turbulent motion within the cloud. There is a good probability of hail associated with these echoes.

scattered (SCT)—In weather reports and forecasts scattered indicates 3/8 to 4/8 sky cover of clouds or obscuring phenomena.

scud—Shreds of small, detached clouds moving rapidly below a solid deck or higher clouds, normally associated with bad weather. Pilots who fly low, in poor weather

conditions associated with these clouds, are known as “scud runners”. This practice has given rise to aviation axiom: “There are old pilots and there are bold pilots, but there are no old, bold pilots.” The life expectancy of scud runners is rather poor. See also fractocumulus, fractostratus.

SD—*See* RAREP.

sea breeze—During the day the land heats more rapidly than ocean or lake surfaces. This creates low pressure over the land and an onshore flow. With enough moisture and lift, clouds develop at the lifted condensation level (LCL) over the land. This is particularly true in the southeast United States with its abundant moisture and unstable air. Activity tends to be widespread, with some areas receiving torrential downpours and adjacent areas remaining dry. Sea breezes, since they occur during the day, can often be seen on visual satellite imagery once clouds develop. The opposite of a land breeze.

sea level pressure (SLP)—Atmospheric pressure converted to its sea level equivalent. Remarks of METAR may contain SLP in millibars.

sector visibility—Visibility reported in the remarks of METAR when different from that contained in the body of the report.

sensitive time control (STC)—A radar circuit used to compensate for range attenuation of echoes, which is loss of power density due to distance from echoes. STC-displayed intensity remains independent of range, therefore, targets with the same intensity, at different

ranges, appear the same on the display.

service standards for surface observations—To alleviate some of the concerns with automated observations a government and industry team developed service standards for surface observations. Service standards consist of four levels, D through A. Service Level D is a completely automated site in which the ASOS observation constitutes the entire observation; there is no augmentation or backup.

severe thunderstorm—For aviation purposes a severe thunderstorm produces any or all the following: tornadoes, winds of 50 knots or greater, hail 3/4 inch or greater. (In 2010 severe thunderstorm hail criteria increased from 3/4 in. to 1 in. However, aviation criteria remain 3/4 in.)

severe weather warning—*See* warning, severe weather.

severe weather watch—*See* watch, severe weather.

severe weather echoes—A radar echo typically associated with severe weather. *See* also arrow echo, asymmetric echo, bow echo, finger echo, level 1 dot, hook echo, line echo wave pattern, pendant echo, scallop echo, V-notch.

severe wind shear—*See* wind shear.

shallow (MI)—Refers to radiation fog (MIFG) that extends to less than six feet above the surface.

shear axis—An axis indicating maximum lateral change in wind direction, as in an elongated circulation. This lateral change or shear might be either cyclonic or anticyclonic.

short wave—With wave lengths shorter than long waves, they tend to move rapidly through the long wave circulation. They can intensify or dampen weather systems.

showers (SH)— Produced by vertical motion, showers are precipitation characterized by the suddenness with which they start and stop, and rapid changes of intensity and in the appearance of the sky. They may or may not indicate thunderstorms, which in addition to vertical motion require an unstable air mass.

SIGMET—A significant meteorological advisory that warns of phenomena that affects all aircraft.

significant icing layer—A region of moderate or greater icing intensity where the aircraft's ice protection equipment must be used to prevent or control ice accumulation. Aircraft without ice protection equipment may be unable to continue flight even when out of the significant icing layer.

significant weather prognostic chart—*See* low altitude PROG chart and high altitude PROG chart.

sky condition—METAR sky condition consist of the amount of sky cover, height in feet, and under certain conditions cloud type.

sky condition at second site—Reported in the remarks of an automated site to indicate sky condition at a location other than normal point of observation.

sky cover—Sky cover refers to clouds or obscuring phenomena as seen by an observer on the ground from horizon to horizon; the summation of layers based on specific criteria.

slant range visibility—The visibility between an aircraft in the air and objects on the ground.

sleet—Also known as ice pellets are frozen raindrops that bounce on impact with the ground or other objects. Sleet and freezing rain occur by a similar process but are different forms of precipitation. Sleet occurs when snowflakes melt into a raindrop in warm air above the ground and refreeze in a layer of freezing air just above the surface resulting in frozen raindrops or small ice pellets. *See* also ice pellets.

slush—A soft, watery mixture of snow or ice that has been reduced by rain, above freezing temperatures, or chemical treatment. Snow which has a water content exceeding its freely drained condition such that it takes on fluid properties (e.g., flowing and splashing).

smog—Technically a mixture of industrial pollutants (smoke) with fog; also, a combination of pollutants with haze and smoke. (Sometimes colloquially translated as “hack and kough.”)

smoke (FU)—Small particles produced by combustion suspended in the air. (FU is a contraction derived from

the French word *fumée*.)

snow (SN)—A porous, permeable aggregate of ice grains which can be predominately single crystals or close groupings of several crystals. Snow is composed of white or translucent ice crystals, chiefly in complex branched hexagonal form and often integrated into snowflakes. See also lake effect.

snow grains (SG)—Snow grains are small, white, opaque grains of ice, the solid equivalent of drizzle. Since snow grains are already frozen, they typically do not present an icing hazard.

snow flurry—Snow flurry is a popular term for snow showers, particularly of a very light and brief nature.

snow line—At latitudes of the United States, as a general rule, weather systems will tend to produce precipitation in the form of snow north of the 540 contour line on the 500 mb chart.

snow pellets (GS)—Small, white, opaque grains of ice—form when ice crystals fall through supercooled droplets and the surface temperature is at or slightly below freezing. Falling from cumuliform clouds, snow pellets are more prone to cause structural icing than snow grains. Snow pellets are also known as soft hail or graupel.

solar radiation—Electromagnetic energy radiated by the sun.

Sonora storm—Occasionally, eastern Pacific hurricanes reach southern California and Arizona. The moist,

unstable remnants of these storms can be carried north and inland to affect central California and the southern part of the intermountain region. Analysis of these southerly disturbances was first studied in the 1930s. Because they sometimes approached from the southeast, they were called “Sonora” storms, after the Mexican state of that name.

spatial—A particular area of the surface. Used to describe forecast coverage. See also temporal.

SPECI—A special surface aviation weather report.

special VFR—Aircraft can be safely flown visually in less than basic VFR conditions required for controlled airspace. Special VFR allows pilots to operate in weather with a visual horizon or contact with the ground, and enough visibility to avoid terrain and obstructions. Under such conditions Air Traffic Control (ATC) must ensure separation from other aircraft. Although ATC provides separation from other aircraft, it is still the pilot’s responsibility to maintain terrain and obstruction clearance. Special VFR applies only to operations within low density surface based Class B, and class C, D, and E airspace. Special VFR is prohibited within high density Class B airspace. Weather minimums for an airplane operating under special VFR are clear of clouds and one statute mile visibility.

spray (PY)—An collection of water droplets torn by the wind from the surface of an extensive body of water and carried up a short distance into the air.

squall (SQ)—When a sudden wind increase of at least

15 knots, sustained at 20 knots or more for at least one minute occurs, a squall is reported. Usually associated with thunderstorm activity, squall implies severe low-level wind shear as well as severe turbulence. See also gusts.

squall line—An organized line of thunderstorms.

stabilized approach—A concept where the pilot maintains a constant approach speed, descent rate, vertical flightpath, and configuration from inside the Final Approach Fix (FAF) or descent from pattern altitude to touchdown. For VFR a stabilized configuration should be established by 500 ft AGL, but no lower than 300 ft AGL. Should a pilot fail to establish a stabilized approach or lose the stabilized configuration below about 300 ft AGL a missed approach or go-around should be considered.

stability—The property of an air mass to remain in equilibrium; its ability to resist displacement from its initial position. See also, absolute stability, absolute instability, conditional instability, neutral stability.

stagnation point—The point on a surface where the local free stream velocity is zero; the point of maximum collection efficiency for a symmetric body at zero degrees angle of attack.

stand-alone—An automated weather observation system that does not have manual augmentation or backup.

standard atmosphere—See International Standard Atmosphere.

standard briefing—An FSS standard briefing is designed for a pilot's initial weather rundown prior to departure. Standard briefings are not normally provided when the departure time is beyond six hours, nor current weather beyond two hours. See also abbreviated briefing, inflight briefing, outlook briefing.

standing wave—See mountain wave.

standing lenticular altocumulus (ACSL)—See mountain wave.

standing lenticular cirrocumulus (CCSL)—See mountain wave.

standing lenticular stratocumulus (SCSL)—See mountain wave.

station pressure—The atmospheric pressure for the level of the station elevation—uncorrected for sea level.

stationary front—The transition between air masses of difference properties that does not move or is almost stationary.

steady state thunderstorms—Supercell and squall line thunderstorms are the main types of severe, steady state thunderstorms. When both updrafts and downdrafts coexist in the mature stage and are about equally balanced—not significantly affecting the other—steady state thunderstorms result. The most obvious consequence is that the mature stage continues in this “steady state” and intensifies becoming severe with extreme turbulence and large hail. The life of an

individual cell may be considerably longer than that of a limited state cell. The severe storm complex, often consisting of many dissipating and developing cells, may last as long as twenty-four hours and move as far as 1000 miles. The thunderstorm continues in this steady state until affected by some outside influence or until the mechanics of the thunderstorm cell itself change and it becomes self-destructive.

steam fog—Steam fog develops as cold air moves over warm water. Evaporation from the water takes place and saturation occurs. Low-level turbulence develops as the warm water heats lower levels creating a shallow layer of instability. Also known as evaporation fog, steam fog occurs in cold climates over lakes, such as the Great Salt Lake in Utah and Great Lakes, in the autumn. *See also* fog.

storm detection (SD)—*See* automated radar weather reports.

storm detection equipment—This term refers to airborne access to real-time weather radar or lightning detection equipment.

stovepipe icing algorithm—This experimental product has been developed by the National Center for Atmospheric Research (NCAR), Research Applications Program, Boulder, Colorado. The Stovepipe icing algorithm uses information available from surface observations and three dimensional grided fields of temperature, relative humidity, and geopotential height—a measure of atmospheric energy—to create a three dimensional diagnostic of icing conditions. Since new

surface observations are available every hour, the algorithm is run hourly.

strategic weather planning—An evaluation of the “complete picture.” The initial part of planning—strategic planning—consists of an evaluation of terrain, altitudes, and the environment. Although typically a preflight assessment, strategic planning and evaluation may be required enroute, especially if there is a change in the “complete picture.” *See also* tactical weather planning.

stratiform—Stratiform describes clouds of extensive horizontal development, and a stable air mass.

stratosphere—The atmospheric layer above the tropopause. It is characterized by a slight increase in temperature with height and the near absence of water vapor. Occasionally severe thunderstorms will break through the tropopause into the stratosphere.

stratiform—Stratiform clouds consist of small water droplets. The following cloud types are classified as stratiform: stratus, stratocumulus, nimbostratus, altostratus, and cirrostratus.

stratocumulus (SC)—Stratocumulus represent a moist layer with some convection. Stratocumulus may form from the spreading out of cumulus, which indicates decreasing convection. Stratocumulus can develop from stratus with winds of moderate to strong intensity. Updrafts and turbulence develop below and within the layer.

stratocumulus standing lenticular—See standing lenticular stratocumulus.

stratus (ST)—Stratus indicates a stable air mass. Stratus may lower, becoming fog, after sunset due to the absence of surface heating and decreased winds. During the morning, fog may lift, due to surface heating, to become a stratus layers. Ceilings and visibilities are typically poor. Flight through stratus clouds is smooth. Precipitation, when it occurs, is usually light, often in the form of drizzle.

streamlines—A line that represents the wind flow pattern, and is parallel to the instantaneous velocity. Streamlines indicate the trajectory of the flow.

sub-synoptic scale—Small, microscale events, that often are not within the detection system currently available—tornadoes and microbursts.

sublimation—The process by which ice (a solid) changes directly to water vapor (a gas). The opposite of deposition. See also deposition.

subsidence—Downward vertical motion of the air.

subtropical high—A semipermanent anticyclones of the subtropical high pressure region (e.g. Bermuda high, Pacific high).

subtropical jet—The jet around 20°-30° north latitude at approximately 39,000 ft, located in the break between the midlatitude and tropical tropopause.

sun dog—See parhelion.

supercell—A thunderstorm where updrafts and downdraft coexist prolonging the life of the cell. The supercell thunderstorm can maintain itself as a single entity for hours. This type of storm produces tornadoes and large hail and can grow to over 60,000 ft. They may produce overshooting tops on satellite imagery.

supercooled—Liquid water (precipitation or cloud) that exists at temperatures below freezing. Supercooled water drops produce airframe icing—visible, liquid water with temperatures at or below 0°C.

supercooled large droplet (SLD) icing—SLDs are freezing drizzle or freezing rain size (>50 micrometers in diameter) supercooled water droplets, as opposed to cloud droplets which are much smaller. A forecast for SLDs implies rapid accumulation of mixed or clear ice, possibly forming aft of aircraft ice protected areas.

surface—See low-level.

surface boundary layer—See boundary layer.

surface visibility—Surface visibility represents horizontal visibility occurring at the surface—prevailing visibility or its automated equivalent. Reported surface visibility comes into play when a pilot plans to takeoff or land or enter the traffic pattern VFR. When tower visibility differs from surface visibility, a complicated formula determines which is prevailing and entered in the body of the METAR. In such cases the other value (TWR; SFC) is included in the remarks of the report.

synopsis—The synopsis describes the location and movement of pressure systems and fronts, and weather patterns, usually as a brief, generalized statement.

synoptic scale—Large-scale weather patterns the size of the migratory high and low pressure systems of the lower troposphere with wave lengths on the order of 1000 miles.

T

TAA—*See* Technically Advanced Airplane.

TAF conditional terms—Domestic TAF conditional terms consist of TEMPO: A 50 percent or greater probability of occurrence, expected to last for generally less than an hour at a time, and to cover less than half of the forecast period and PROB 30: A 30 percent probability.

tactical weather planning—Actions carried out with a limited or immediate goal. For example, weather does not improve or deteriorates more rapidly than forecast. (Tactical evaluation includes fuel, aircraft equipment, and the pilot's physical and psychological status.) Tactical evaluation is a continuous process from the beginning to the end of the flight—no matter how simple or complex. *See also* strategic weather planning.

tailplane icing—As well as wing and fuselage icing, another hazard of structural icing is tailplane or empennage stall. A tailplane stall occurs, like the wing, when the critical angle of attack is exceeded. Since the horizontal stabilizer counters the natural nose down tendency caused by the center of lift of the main wing, the

airplane will react by pitching down, sometimes uncontrollably, when the tailplane stalls.

tailwind component—The vector component of surface wind that affects the aircraft on takeoffs and landings; that component of the wind at a 180° angle to the aircraft's flight path. *See also* crosswind component.

TCAS—*See* Traffic Alert and Collision Avoidance System.

Technically Advanced Airplane (TAA)—The FAA defines a TAA (14 CFR 61.1) as “an airplane equipped with an electronically advanced avionics system.” Its generic definition is meant to accommodate future technologies. As provided in 14 CFR 61.129(j) TAA must provide an electronic primary flight display (PFD), an electronic multi-function display (MFD) with a GPS moving map, and a two-axis autopilot with navigation and heading systems.

temperature—A measurement of the average speed of molecules. The higher the temperature the farther apart the air molecules, resulting in lower density.

temperature-dewpoint spread—The arithmetic difference between the temperature of a parcel of air and its dew point temperature.

TEMPO—TEMPO indicates that temporary conditions are expected to occur during the forecast period. TEMPO describes any condition with a 50 percent or greater probability of occurrence, expected to last for generally less than an hour at a time, and to cover less than half of the forecast period. The time during which the

condition is expected to occur is indicated with a four digit group giving beginning and ending times UTC.

terminal aerodrome forecast (TAF)—In the United States TAFs cover a five statute mile radius of the center of an airport's runway complex. Vicinity (VC) is defined as an area from beyond five miles to 10 statute miles from the center of the runway complex. Prepared by forecasters at local Weather Forecast Offices, terminal forecasts provide a scheduled forecast for individual airports. Terminal forecasts are not stand-alone products. They must be used with other forecasts (weather advisories; enroute forecast products). *See also* compliant briefing.

terminator—The sunset line seen on visible satellite imagery.

temporal—Relating to time. Used to describe a time interval within a forecast period. *See also* areal.

terrain obscuration—*See* mountain obscuration.

terrestrial radiation—The long wave radiation emitted by the Earth's surface.

texture—On satellite imagery, texture refers to the lumpy, rounded, billowy, and puffy appearance of clouds.

thermal high—An area of high atmospheric pressure caused by the cooling of air by a cold surface. They tend to remain relatively stationary over the cold ground.

thermal low—An area of low atmospheric pressure caused by intense surface heating. They are common to the continental subtropics in summer, remain stationary, and cyclonic circulation is generally weak and diffuse.

thermal turbulence—Daytime heating causes rising air currents that produce thermal turbulence—also called convective turbulence. Thermal turbulence usually occurs within 7000 ft of the surface in stable or conditionally unstable air. This means that vertical movement requires an initiating force, in this case surface heating. In stable or extremely dry air, skies remain clear. Should air parcels reach the lifted condensation level, saturation occurs, and stratocumulus, or fair weather cumulus, clouds will form. These clouds are most often scattered and rarely become overcast. Should the air be conditionally unstable cumuliform clouds form, which can develop into air mass thunderstorms. There are rising air currents in the clouds and descending currents in the clear air. Flight below the clouds will be turbulent and above the clouds smooth.

thin line—*See* fine line/thin line.

thunderstorm (TS)—A local storm produced by a cumulonimbus cloud and always accompanied by lightning and thunder; and, usually with strong gusty winds, heavy rain, and sometimes hail. *See also* embedded thunderstorm, gust front, limited state thunderstorm, steady state thunderstorm.

thunderstorm hazards—Thunderstorm hazards consist of turbulence, icing, precipitation—including hail,

lightning, tornadoes, gusty surface winds—including low-level wind shear, effects on the altimeter, and low ceilings and visibilities. Under certain conditions they can produce high density altitude—heat bursts.

time of observation—The actual date and time of a METAR/SPECI. The time the last element of a METAR was observed; the time the criteria for the SPECI was met. Individual elements entered in an observation reflect conditions existing at the time of observation. Recency of elements at manual stations are those observed within 15 minutes of the time of the observation; at automated stations time averaging of sensor data—most elements within 10 minutes of the time of the observation.

tornado—A small mass of air produced by a severe thunderstorm that spins rapidly about a vertical axis and forms a funnel cloud.

tornado intensity—See Fujita scale of tornado intensity.

tornado vortex signature (TVS)—A radar derived location for the possible development of tornadoes.

Torricelli, Evangelista—The Italian inventor of the mercurial barometer in 1643.

total air temperature (TAT)—The result of ambient air temperature and aerodynamic heating.

total observation concept—In the U.S. forecasts need not have complete surface observations to issue a forecast. They may employ the total observation concept,

which includes nearby observations, radar, satellite, radiosonde, forecast model data, and other sources, to prepare and issue the product.

tower visibility—See surface visibility.

towering cumulus (TCU)—A rapidly growing cumulus in which height exceeds width that resembles a cauliflower, but with tops that have not yet reached the cirrus level. Towering cumulus is often the first stage of a thunderstorm and implies significant turbulence and icing.

trade winds—A tropical wind system that blows outward from subtropical highs toward the equatorial trough.

Traffic Alert and Collision Avoidance System (TCAS)—An airborne collision avoidance system based on radar beacon signals which operate independent of ground-based equipment.

transverse cirrus banding—Irregularly spaced band-like cirrus clouds that form nearly perpendicular to a jet stream axis. They indicate turbulence associated with the jet.

tropical air—A warm, usually unstable air mass that originates over tropical and subtropical seas, or over hot, dry tropical and subtropical land masses.

tropical cyclone—A general term applied to any low pressure area that originates over tropical oceans.

tropical disturbance—An organized area of nonfrontal convection; a basic generic designation that may intensify into a tropical depression, tropical storm, or hurricane.

tropical wave—The migratory wavelike disturbance embedded in the tropical easterlies. They often signal the development of more significant tropical weather, such as tropical depressions, tropical storms, and hurricanes.

tropopause—The boundary between the troposphere and the stratosphere is called the tropopause. It consists of several discrete overlapping layers, rather than a single continuous surface, and acts as a lid trapping almost all water vapor in the troposphere. It is marked by a decrease in wind speed, and constant temperature with an increase in height.

troposphere—The lower layer of the atmosphere, extending from the surface to an average of seven miles. Temperature normally decreases with height, and winds increase with height. It is the layer of the atmosphere where almost all weather occurs.

trough—An elongated area of low pressure

true altitude—True altitude is the actual altitude of an aircraft above mean sea level. Pressure altitude and true altitude are the same when pressure equals 29.92 in Hg and temperature is 15°C.

true airspeed (TAS)—Calibrated airspeed corrected for atmospheric density—pressure and temperature.

true wind direction—The direction from which the wind is blowing in relation to true north. See also magnetic wind direction.

Tule Fog—Tule” [tôô’lê] is a Spanish word for bulrushes, a marsh plant that grows during the winter season in California’s Central valley; it describes an extensive area of radiation fog that develops in this area.

turbulence—A condition of the atmosphere in which air currents vary greatly over short distances.

turbulent air penetration speed—See maneuvering speed.

TVS—See tornado vortex signature.

U

uncertain—Not confident to occur. The situation may not end with a safe result. *See also* doubtful.

upper air observations—Upper air observations consist of twice daily balloon observations, supplemented by PIREPS, and air carrier data link wind and temperature information; additionally, United Parcel Service aircraft and Southwest Airlines provide moisture data.

upper-level—As used on aviation weather products upper-level (also referred to as aloft) describes phenomena occurring at or above the 500 mb level—about 18,000 ft.

upper-level weather system—Highs and lows, troughs and ridges, reflected at and above the 500 mb level

(approximately 18,000 ft), which includes the jet stream.

UNICOM—A nongovernment communication facility which may provide airport information at certain airports. Locations and frequencies are shown on aeronautical charts and publications.

unknown precipitation (UP)—Automated METARs may use “UP” (unknown precipitation) to report precipitation when the precipitation discriminator cannot identify the type of (liquid, freezing, frozen) precipitation.

upslope—The orographic effect of air moving up a slope, which tends to cool adiabatically.

upslope fog—Upslope fog forms as air is forced upward, expands, and cools adiabatically. Moist air must be forced upslope, which requires a wind of five to 15 knots. This condition occurs during winter and spring in the Midwest where terrain rises steadily from the Gulf of Mexico to the Rockies. Upslope fog can be widespread and will persist as long as favorable conditions continue.

Understanding—To comprehend the meaning of something (e.g. “BKN” constitutes a ceiling).

unsaturated—A parcel of air that has not yet reached saturation. It can hold additional water in the form of water vapor, its dew point temperature is less than air temperature, and humidity has not yet reached 100%.

UTC—*See* coordinated universal time.

V

V-notch—A large, isolated echo which sometimes has the configuration of a V or U shape. A V-notch often accompanies severe thunderstorms and tornadoes.

valid time—Most forecasts provide static “snapshot” images of expected conditions valid at one specific time. They do NOT represent an average. Changes occur at a regular or irregular rate at an unspecified time between forecast periods—avoid interpolation between valid times.

valley breeze—In the daytime, mountain slopes become warm, heating the adjacent layer of air. This layer is warmer than air at the same altitude farther from the slope. The resulting density difference creates a convective current in which the air over the valley sinks, forcing the warmer air up the mountains as a valley wind—so named because the wind blows from the valley toward, or up, the mountain. See also mountain breeze.

valley effect—*See* valley breeze.

variable ceiling—Variable ceiling, in the remarks of METAR, describes a situation where cloud height changes during the period of observation, normally the 15 minute period preceding the time of observation.

variable sky cover—Variable sky cover, in the remarks of METAR, describes a situation where the amount of sky cover changes during the period of observation, normally the 15 minute period preceding time of

observation.

veering—A clockwise change in wind direction. The opposite of a backing wind.

venturi effect—The venturi effect of mountains and mountain passes accelerates winds over ridges and through passes. On the windward side the winds are accelerated due to the compressional effect of the mountain range. On the leeward side wind speed decreases. Stronger than forecast winds should be expected in these areas, especially within 5000 ft of terrain.

vertical motion—Upward or downward motion in the atmosphere.

vertical shear—Wind shear that occurs in the vertical, rather than horizontal plane. An example would be evaporative cooling turbulence (shear).

vertical visibility—*See* indefinite ceiling.

VFR—*See* visual flight rules.

VFR flight is not recommended (VNR)—Undoubtedly the VNR statement is the most controversial element of the FSS weather briefing, nevertheless, the FAA requires the briefer to: “Include this recommendation when VFR flight is proposed and sky conditions or visibilities are present or forecast, surface or aloft, that in (the judgment of the specialist), would make flight under visual flight rules doubtful.” This leaves considerable leeway for the briefer. Notice that VNR applies to sky condition and visibility only. Such phenomena as

turbulence, icing, winds, and thunderstorms, of themselves, do not warrant the issuance of this statement.

VFR Tower—An Air Traffic Control facility responsible for operations within Class D airspace. The only place separation, including wake turbulence, standards are applied is on the runway. Another facility, Approach Control or Center, provides IFR separation.

video integrator and processor (VIP)—Prior to the commissioning of the WSR-88D, radar intensity levels were commonly referred to as VIP levels. This was because precipitation intensity, and therefore the digits, were derived using a video integrator processor. The WSR-88D does not use a video integrator processor to determine precipitation intensity. Therefore, VIP level is no longer a valid term when describing precipitation intensity.

VIP—*See* video integrator and processor.

vicinity (VC)—Vicinity, when used in METAR, is defined as precipitation not occurring at the point of observation, but within 10 statute miles or an obstruction to vision between five and 10 statute miles from the point of observation. When used in a TAF, an area from beyond five miles to 10 statute miles from the center of the runway complex.

VIRGA—Variable intensity rain gradient aloft (VIRGA) is rain that evaporates before reaching the surface. Evaporative cooling turbulence develops in the vicinity of virga. Precipitation evaporates and cools the air, causing downdrafts and wind shear. A pilot penetrating

these areas will encounter wind shear turbulence, which can be severe. Turbulence can be avoided by circumnavigation of these areas. *See also* fall streaks.

visible moisture—Moisture in the form of clouds or precipitation as opposed to water vapor.

visibility—Visibility is a measure of the transparency of the atmosphere. During the day visibility represents the distance at which predominant objects can be seen; at night, visibility is the distance that unfocused lights of moderate intensity are visible. *See also* air to air visibility, air to ground visibility, automated visibility, prevailing visibility, slant range visibility.

visibility at second site—Reported in the remarks of an automated site to indicate visibility at a location other than normal point of observation.

visual flight rules (VFR)—Federal regulations that govern flight in visual meteorological conditions (flight by reference to the natural horizon and/or the ground.

visual meteorological conditions (VMC)—Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling equal to or better than specified minima.

volcanic ash (VA)—Volcanic ash consists of fine particles of rock powder, blown out from the volcano. The particles remain suspended in the atmosphere for long periods, extend well into the Flight Levels, and may drift thousands of miles. Ash power, up to one-eighth inch in diameter can be very abrasive. Volcanic ash

can be extremely destructive to aircraft leading edges, windscreens, and engines. Turbojet aircraft engines are especially susceptible.

volcanic ash forecast transport and dispersion

chart (VAFTED)—The National Weather Service produces an experimental Volcanic Ash Forecast Transport and Dispersion chart. Each complete chart consists of 8 panels. The 4 panels in any column are for a single valid time after eruption. Individual panels are for layers applicable to aviation operations and are identified at the side of a panel with upper and lower flight levels (FL) in hundreds of ft. The bottom panel is a composite from the surface to FL550. Volcano eruption information is at the lower left. A description of the input meteorology is at the lower right with a message to SEE CURRENT SIGMET FOR WARNING AREA. The visual ash cloud symbol and run description are at the lower center.

volume—The amount of space occupied by a three-dimensional object as measured in cubic units.

vort lobe—A contraction for vorticity lobe. It usually applies to the 500 mb level and identifies an area of relatively higher values of vorticity. It is synonymous with short wave trough or upper level impulse. Generally speaking, there is rising air ahead of the vort lobe and sinking air behind.

vort max—A contraction for vorticity maximum. It usually applies to the 500 mb level and refers to a point along a vorticity lobe where the absolute vorticity reaches a maximum value.

vortex—In the most general use, any flow possessing vorticity. More often the term refers to a flow with closed streamlines.

vorticity—Indicates a circulation or rotation within the atmosphere. *See also* absolute vorticity, anticyclonic relative vorticity, cyclonic relative vorticity.

W

wake turbulence—A wing producing lift generates a disturbance or wake caused by a pair of counter rotating vortices trailing the wing tips. Vortices occur because of the pressure differential above and below the wing at the tips. After completion of the roll up, the wake consists of two counter rotating cylindrical vortices. The strength of the vortex depends on the weight, speed, and shape of the wing. Although wake turbulence from large aircraft is a factor enroute, it is a more serious concern during takeoffs and landing.

wall cloud—Associated with convective activity, a wall cloud, usually on the southwest edge of the thunderstorm, has a lowered base, and indicates the storm might be severe. *See also* eye wall.

warm front—A non-occluded frontal boundary where warm air overrides and replaces colder air.

warm-air advection—A condition in the atmosphere characterized by air flowing from a relatively warmer area to a cooler area. It is often accompanied by upward vertical motion that in the presence of sufficient instability leads to thunderstorm development. *See also*

advection.

warm-core low—An area of low pressure that is warmer at its center than at its periphery. Thermal lows and tropical cyclones are examples.

warm nose—A prominent northward bulge of relatively warm air.

WARP—*See* weather and radar processor.

warning, severe weather—A Public forecasts issued for severe convective activity. Indicating severe weather is imminent or occurring, take immediate action. They cover small areas, the size of cities or counties, usually valid for an hour or less.

watch, severe weather—A Public forecast issued for severe convective activity. Indicates conditions are favorable for the development of severe events. A watch serves as a “heads-up,” be prepared and monitor the situation. They cover large areas, the size of states, usually valid for 8 to 12 hours.

water vapor—The invisible water molecules suspended in the air.

wave—A pattern of ridges and troughs in the horizontal flow as depicted on upper level charts. At the surface, a wave is characterized by a break along a frontal boundary. A center of low pressure is frequently located at the apex of the wave.

weak echo region (WER)—A weather radar term used

to indicate strong thunderstorms and the development of severe weather.

weather advisory—Weather advisories inform users—during preflight briefings and enroute operations—to the occurrence or expected occurrence of potentially hazardous weather. Advisories are disseminated through AIRMET Bulletins (WA), SIGMETs (WS), Convective SIGMETs (WST), and Center Weather Advisories.

weather briefing—*See* abbreviated briefing, inflight briefing, outlook briefing, standard briefing, direct user access terminal.

weather categories—Ceiling and visibility thresholds that generally correspond to VFR and IFR weather minimums. They are used on weather graphics to depict general weather conditions over large areas and to define criteria for weather forecast amendments.

weather grid—*See* grid.

weather element—*See* element.

weather overlay—*See* overlay.

weather radar—*See* airborne weather radar, automated radar weather reports, Doppler radar systems, radar precipitation intensity levels, radar summary chart, RAREP digital data.

weather and radar processor (WARP)—WARP generates a NEXRAD mosaic overlay on ATC controller's displays.

weathervane—The tendency of an aircraft to align with the wind. This tendency is greater with increased wind speed and on slick surfaces.

wet ice—An ice surface covered with a thin film of moisture caused by melting, insufficient to cause hydroplaning.

wet environment—Most often associated with thunderstorms/microbursts. It refers to low based clouds producing heavy rain, which can result in downdrafts/ microbursts. *See* also dry environment.

wet snow—Snow which has grains coated with liquid water which bonds the mass together but has no excess water in the pore spaces.

whiteout—An atmospheric optical phenomenon in which the pilot appears to be engulfed in a uniformly white glow. Neither shadow, horizon, or clouds are discernible; sense of depth and orientation is lost. Whiteout occurs over an unbroken snow cover and beneath a uniformly overcast sky, when light from the sky is about equal to that from the snow surface. Blowing snow may be an additional cause.

widespread—An area of at least 3000 sq ml.

wind chill factor—The apparent cooling effect of wind on temperature.

wind cone—A wind direction indicator where the large end points into the wind. Colloquially called a “wind sock.”

wind direction—The direction from which the wind is blowing. See also magnetic wind direction, true wind direction.

wind field—Winds plotted at a specified level in the atmosphere are referred to as a wind field (surface, 5,000 feet, 300 mb, etc.). Wind fields show areas of convergence, divergence, and advection, which provide meteorologists with a valuable forecast tool.

wind profiler—Observational equipment that uses radar or sound waves to detect wind direction and speed at various altitude above the ground.

wind shear—Any rapid change in wind direction or speed. Low-level wind shear (LLWS) is generally shear that occurs within about 2000 ft of the surface. LLWS is classified severe when a rapid change in wind direction or velocity causes an airspeed change greater than 15 knots or vertical speed change greater than 500 feet per minute.

wind shear-induced turbulence—Wind shear-induced turbulence can be caused by those phenomena associated with non-convective LLWS or associated with clear air turbulence and thunderstorms. *See also* non-convective LLWS.

wind sock—*See* wind cone.

wind shift—Wind shift in METAR describes a change in direction of 45° or more that takes place in less than 15 minutes, with sustained speeds of 10 knots or more.

winds and temperatures aloft forecast (FB)—Textual or graphical products that provide forecast wind direction, speed, and temperature at various altitudes and times.

windward—The direction or side of an object, such as an island or mountain, that faces the prevailing wind. Opposite of leeward.

W0X0F—In the pre-1996 weather code ceiling zero, visibility zero (zero-zero) was coded “W0X0F” indefinite ceiling zero, sky obscured, visibility zero—colloquially pronounced “wox’off.”

wrap around—An atmospheric property (usually moisture) advected by cyclonic circulation to the north and west of a low.

Z

zero-zero—*See* W0X0F.

zonal flow—A wind flow that is generally in a west to east direction.

ZULU (Z)—*See* Coordinated Universal Time.