

# Glossary

- Absolute Humidity** The mass of water vapor per volume of air (usually expressed as grams of water vapor per cubic meter of air).
- Absolute Instability** The condition of air that has an environmental lapse rate that is greater than the dry adiabatic rate (1°C per 100 meters).
- Absolute Stability** The condition of air that has an environmental lapse rate that is less than the wet adiabatic rate.
- Absolute Zero** The zero point on the Kelvin temperature scale, representing the temperature at which all molecular motion is presumed to cease.
- Acid Precipitation** Rain or snow with a pH value that is less than the value for uncontaminated rain.
- Adiabatic Temperature Change** The cooling or warming of air caused when air is allowed to expand or is compressed, not because heat is added or subtracted.
- Advection** Horizontal convective motion, such as wind.
- Advection Fog** Fog formed when warm moist air is blown over a cool surface and chilled below the dew point.
- Aerosols** Tiny solid and liquid particles suspended in the atmosphere.
- Aerovane** A device that resembles a wind vane with a propeller at one end. Used to indicate wind speed and direction.
- Air** A mixture of many discrete gases, of which nitrogen and oxygen are most abundant, in which varying quantities of tiny solid and liquid particles are suspended.
- Air Mass** A large body of air, usually 1600 kilometers or more across, that is characterized by homogeneous physical properties at any given altitude.
- Air-Mass Thunderstorm** A localized thunderstorm that forms in a warm, moist, unstable air mass. Most frequent in the afternoon in spring and summer.
- Air-Mass Weather** The conditions experienced in an area as an air mass passes over it. Because air masses are large and relatively homogeneous, air-mass weather will be fairly constant and may last for several days.
- Air Pollutants** Airborne particles and gases occurring in concentrations that endanger the health and well-being of organisms or disrupt the orderly functioning of the environment.
- Air Pressure** The force exerted by the weight of a column of air above a given point.
- Albedo** The reflectivity of a substance, usually expressed as a percentage of the incident radiation reflected.
- Aleutian Low** A large cell of low pressure centered over the Aleutian Islands of the North Pacific during the winter.
- Altimeter** An aneroid barometer calibrated to indicate altitude instead of pressure.
- Altitude (of the Sun)** The angle of the Sun above the horizon.
- Analog Method** A statistical approach to weather forecasting in which current conditions are matched with records of similar past weather events with the idea that the succession of events in the past will be paralleled by current conditions.
- Anemometer** An instrument used to determine wind speed.
- Aneroid Barometer** An instrument for measuring air pressure; it consists of evacuated metal chambers that are very sensitive to variations in air pressure.
- Annual Mean Temperature** An average of the 12 monthly means.
- Annual Temperature Range** The difference between the warmest and coldest monthly means.
- Anticyclone** An area of high atmospheric pressure characterized by diverging and rotating winds and subsiding air aloft.
- Anticyclonic Flow** Winds blow out and flow clockwise about an anticyclone (high) in the Northern Hemisphere, and they blow out and flow counterclockwise about an anticyclone in the Southern Hemisphere.
- Apelion** The point in the orbit of a planet that is farthest from the Sun.
- Apparent Temperature** The air temperature perceived by a person.
- Arctic (A) Air Mass** A bitterly cold air mass that forms over the frozen Arctic Ocean.
- Arctic Sea Smoke** A dense and often extensive steam fog occurring over high-latitude ocean areas in winter.
- Arid** See Desert.
- Atmosphere** The gaseous portion of a planet, the planet's envelope of air; one of the traditional subdivisions of Earth's physical environment.
- Atmospheric Window** Refers to the fact that the troposphere is transparent (i.e., does not absorb) to terrestrial radiation between 8 and 11 micrometers in length.
- Aurora** A bright and ever-changing display of light caused by solar radiation interacting with the upper atmosphere in the region of the poles. It is called *aurora borealis* in the Northern Hemisphere and *aurora australis* in the Southern Hemisphere.
- Automated Surface Observing System (ASOS)** A widely used, standardized set of automated weather instruments that provide routine surface observations.
- Autumnal Equinox** See Equinox.
- Azores High** The name given to the subtropical anticyclone when it is situated over the eastern part of the North Atlantic Ocean.
- Backing Wind Shift** A wind shift in a counterclockwise direction, such as a shift from east to north.
- Barograph** A recording barometer.
- Barometric Tendency** See Pressure Tendency.
- Beaufort Scale** A scale that can be used for estimating wind speed when an anemometer is not available.
- Bergeron Process** A theory that relates the formation of precipitation to supercooled clouds, freezing nuclei, and the different saturation levels of ice and liquid water.
- Bermuda High** The name given to the subtropical high in the North Atlantic during the summer when it is centered near the island of Bermuda.
- Bimetal Strip** A thermometer consisting of two thin strips of metal welded together, which have widely different coefficients of thermal expansion. When temperature changes, the two metals expand or contract unequally and cause changes in the curvature of the element. Commonly used in thermographs.
- Biosphere** The totality of life forms on Earth.
- Blackbody** A material that is able to absorb 100 percent of the radiation that strikes it.

- Blizzard** A violent and extremely cold wind laden with dry snow picked up from the ground.
- Bora** In the region of the eastern shore of the Adriatic Sea, a cold, dry northeasterly wind that blows down from the mountains.
- Buys Ballot's Law** With your back to the wind in the Northern Hemisphere, low pressure will be to your left and high pressure to your right. The reverse is true in the Southern Hemisphere.
- Calorie** The amount of heat required to raise the temperature of 1 gram of water 1°C.
- Ceiling** The height ascribed to the lowest layer of clouds or obscuring phenomena when the sky is reported as broken, overcast, or obscured and the clouds are not classified "thin" or "partial." The ceiling is termed *unlimited* when the foregoing conditions are not present.
- Celsius Scale** A temperature scale (at one time called the centigrade scale) devised by Anders Celsius in 1742 and used where the metric system is in use. For water at sea level, 0° is designated the ice point and 100° the steam point.
- Chinook** The name applied to a foehn wind in the Rocky Mountains.
- Circle of Illumination** The line (great circle) separating daylight from darkness on Earth.
- Cirrus** One of three basic cloud forms; also one of the three high cloud types. They are thin, delicate ice-crystal clouds often appearing as veil-like patches or thin, wispy fibers.
- Climate** A description of aggregate weather conditions; the sum of all statistical weather information that helps describe a place or region.
- Climate Change** A study dealing with variations in climate on many different time scales from decades to millions of years, and the possible causes of such variations.
- Climate-Feedback Mechanisms** Because the atmosphere is a complex interactive physical system, several different possible outcomes may result when one of the system's elements is altered. These various possibilities are called *climate-feedback mechanisms*.
- Climate System** The exchanges of energy and moisture occurring among the atmosphere, hydrosphere, lithosphere, biosphere, and cryosphere.
- Closed System** A system that is self contained with regard to matter—that is, no matter enters or leaves.
- Cloud** A form of condensation best described as a dense concentration of suspended water droplets or tiny ice crystals.
- Cloud Condensation Nuclei** Microscopic particles that serve as surfaces on which water vapor condenses.
- Cloud Seeding** The introduction into clouds of particles (most commonly dry ice or silver iodide) for the purpose of altering the cloud's natural development.
- Clouds of Vertical Development** A cloud that has its base in the low height range but extends upward into the middle or high altitudes.
- Cold Front** The discontinuity at the forward edge of an advancing cold air mass that is displacing warmer air in its path.
- Cold-Type Occluded Front** A front that forms when the air behind the cold front is colder than the air underlying the warm front it is overtaking.
- Cold Wave** A rapid and marked fall of temperature. The National Weather Service applies this term to a fall of temperature in 24 hours equaling or exceeding a specified number of degrees and reaching a specified minimum temperature or lower. These specifications vary for different parts of the country and for different periods of the year.
- Collision–Coalescence Process** A theory of raindrop formation in warm clouds (above 0°C) in which large cloud droplets ("giants") collide and join together with smaller droplets to form a raindrop. Opposite electrical charges may bind the cloud droplets together.
- Condensation** The change of state from a gas to a liquid.
- Conditional Instability** The condition of moist air with an environmental lapse rate between the dry and wet adiabatic rates.
- Conduction** The transfer of heat through matter by molecular activity. Energy is transferred during collisions among molecules.
- Constant-Pressure Surface** A surface along which the atmospheric pressure is everywhere equal at any given moment.
- Continental (c) Air Mass** An air mass that forms over land; it is normally relatively dry.
- Continental Climate** A climate lacking marine influence and characterized by more extreme temperatures than in marine climates; therefore, it has a relatively high annual temperature range for its latitude.
- Contrail** A cloudlike streamer frequently observed behind aircraft flying in clear, cold, and humid air and caused by the addition to the atmosphere of water vapor from engine exhaust gases.
- Controls of Temperature** Those factors that cause variations in temperature from place to place, such as latitude and altitude.
- Convection** The transfer of heat by the movement of a mass or substance. It can only take place in fluids.
- Convection Cell** Circulation that results from the uneven heating of a fluid; the warmer parts of the fluid expand and rise because of their buoyancy, and the cooler parts sink.
- Convergence** The condition that exists when the wind distribution within a given region results in a net horizontal inflow of air into the area. Because convergence at lower levels is associated with an upward movement of air, areas of convergent winds are regions favorable to cloud formation and precipitation.
- Cooling Degree-Days** Each degree of temperature of the daily mean above 65°F is counted as one cooling degree-day. The amount of energy required to maintain a certain temperature in a building is proportional to the cooling degree-days total.
- Coriolis Effect** The deflective effect of Earth's rotation on all free-moving objects, including the atmosphere and oceans. Deflection is to the right in the Northern Hemisphere and to the left in the Southern Hemisphere.
- Corona** A bright, whitish disk centered on the Moon or Sun that results from diffraction when the objects are veiled by a thin cloud layer.
- Country Breeze** A circulation pattern characterized by a light wind blowing into a city from the surrounding countryside. It is best developed on clear and otherwise calm nights when the urban heat island is most pronounced.
- Cryosphere** Collective term for the ice and snow that exist on Earth. One of the *spheres* of the climate system.
- Cumulus** One of three basic cloud forms; also the name given one of the clouds of vertical development. Cumulus are billowy, individual cloud masses that often have flat bases.
- Cumulus Stage** The initial stage in thunderstorm development in which the growing cumulonimbus is dominated by strong updrafts.
- Cup Anemometer** See Anemometer.

- Cyclogenesis** The process that creates or develops a new cyclone; also the process that produces an intensification of a preexisting cyclone.
- Cyclone** An area of low atmospheric pressure characterized by rotating and converging winds and ascending air.
- Cyclonic Flow** Winds blow in and counterclockwise about a cyclone (low) in the Northern Hemisphere and in and clockwise about a cyclone in the Southern Hemisphere.
- Daily Mean Temperature** The mean temperature for a day that is determined by averaging the hourly readings or, more commonly, by averaging the maximum and minimum temperatures for a day.
- Daily Temperature Range** The difference between the maximum and minimum temperatures for a day.
- Dart Leader** *See* Leader.
- Deposition** The process whereby water vapor changes directly to ice without going through the liquid state.
- Desert** One of the two types of dry climate—the driest of the dry climates.
- Dew** A form of condensation consisting of small water drops on grass or other objects near the ground that forms when the surface temperature drops below the dew point. Usually associated with radiation cooling on clear, calm nights.
- Dew Point** The temperature to which air has to be cooled in order to reach saturation.
- Diffraction** The slight bending of light as it passes sharp edges.
- Diffused Light** Solar energy is scattered and reflected in the atmosphere and reaches Earth's surface in the form of diffuse blue light from the sky.
- Discontinuity** A zone characterized by a comparatively rapid transition of meteorological elements.
- Dispersion** The separation of colors by refraction.
- Dissipating Stage** The final stage of a thunderstorm that is dominated by downdrafts and entrainment leading to the evaporation of the cloud structure.
- Diurnal** Daily, especially pertaining to actions that are completed within 24 hours and that recur every 24 hours.
- Divergence** The condition that exists when the distribution of winds within a given area results in a net horizontal outflow of air from the region. In divergence at lower levels, the resulting deficit is compensated for by a downward movement of air from aloft; hence, areas of divergent winds are unfavorable to cloud formation and precipitation.
- Doldrums** The equatorial belt of calms or light variable winds lying between the two trade-wind belts.
- Doppler Radar** A type of radar that has the capacity of detecting motion directly.
- Drizzle** Precipitation from stratus clouds consisting of tiny droplets.
- Dry Adiabatic Rate** The rate of adiabatic cooling or warming in unsaturated air. The rate of temperature change is 1°C per 100 meters.
- Dry Climate** A climate in which yearly precipitation is not as great as the potential loss of water by evaporation.
- Dryline** A narrow zone in the atmosphere along which there is an abrupt change in moisture as when dry continental tropical air converges with humid maritime tropical air. The denser cT air acts to lift the less dense mT air producing clouds and storms.
- Dry-Summer Subtropical Climate** A climate located on the west sides of continents between latitudes 30° and 45°. It is the only humid climate with a strong winter precipitation maximum.
- Dynamic Seeding** A type of cloud seeding that uses massive seeding, a process resulting in an increase of the release of latent heat and causing the cloud to grow larger.
- Easterly Wave** A large migratory wavelike disturbance in the trade winds that sometimes triggers the formation of a hurricane.
- Eccentricity** The variation of an ellipse from a circle.
- Electromagnetic Radiation** *See* Radiation.
- Elements (atmospheric)** Those quantities or properties of the atmosphere that are measured regularly and that are used to express the nature of weather and climate.
- El Niño** The name given to the periodic warming of the ocean that occurs in the central and eastern Pacific. A major El Niño episode can cause extreme weather in many parts of the world.
- Entrainment** The infiltration of surrounding air into a vertically-moving air column. For example, the influx of cool, dry air into the downdraft of a cumulonimbus cloud; a process that acts to intensify the downdraft.
- Environmental Lapse Rate** The rate of temperature decrease with height in the troposphere.
- Equatorial Low** A quasi-continuous belt of low pressure lying near the equator and between the subtropical highs.
- Equinox** The point in time when the vertical rays of the Sun are striking the equator. In the Northern Hemisphere, March 20 or 21 is the *vernal* or *spring equinox* and September 22 or 23 is the *autumnal equinox*. Lengths of daylight and darkness are equal at all latitudes at equinox.
- Evaporation** The process by which a liquid is transformed into gas.
- Eye** A roughly circular area of relatively light winds and fair weather at the center of a hurricane.
- Eye Wall** The doughnut-shaped area of intensive cumulonimbus development and very strong winds that surrounds the eye of a hurricane.
- Fahrenheit Scale** A temperature scale devised by Gabriel Daniel Fahrenheit in 1714 and used in the English system. For water at sea level, 32° is designated the ice point and 212° the steam point.
- Fall Wind** *See* Katabatic Wind.
- Fata Morgana** A mirage most frequently observed in coastal areas in which extreme towering occurs.
- Fixed Points** Reference points, such as the steam point and the ice point, used in the construction of temperature scales.
- Flash** The total discharge of lightning, which is usually perceived as a single flash of light but which actually consists of several flashes (*see* Stroke).
- Foehn** A warm, dry wind on the ice side of a mountain range that owes its relatively high temperature largely to adiabatic heating during descent down mountain slopes.
- Fog** A cloud with its base at or very near Earth's surface.
- Forecasting Skill** *See* Skill.
- Freezing** The change of state from a liquid to a solid.
- Freezing Nuclei** Solid particles that have a crystal form resembling that of ice; they serve as cores for the formation of ice crystals.
- Freezing Rain** *See* Glaze.
- Front** A boundary (discontinuity) separating air masses of different densities, one warmer and often higher in moisture content than the other.
- Frontal Fog** Fog formed when rain evaporates as it falls through a layer of cool air.
- Frontal Wedging** The lifting of air resulting when cool air acts as a barrier over which warmer, lighter air will rise.
- Frontogenesis** The beginning or creation of a front.

**Frontolysis** The destruction and dying of a front.

**Frost** Occurs when the temperature falls to 0°C or below (*See* White Frost).

**Fujita Intensity Scale (F-scale)** A scale developed by T. Theodore Fujita for classifying the severity of a tornado, based on the correlation of wind speed with the degree of destruction.

**Geosphere** The solid Earth, the largest of Earth's four major spheres.

**Geostationary Satellite** A satellite that remains over a fixed point because its rate of travel corresponds to Earth's rate of rotation. Because the satellite must orbit at distances of about 35,000 kilometers, images from this type of satellite are not as detailed as those from polar satellites.

**Geostrophic Wind** A wind, usually above a height of 600 meters, that blows parallel to the isobars.

**Glaze** A coating of ice on objects formed when supercooled rain freezes on contact. A storm that produces glaze is termed an "icing storm."

**Global Circulation** The general circulation of the atmosphere; the average flow of air over the entire globe.

**Glorify** A series of rings of colored light most commonly appearing around the shadow of an airplane that is projected on clouds below.

**Gradient Wind** The curved airflow pattern around a pressure center resulting from a balance among pressure-gradient force, Coriolis force, and centrifugal force.

**Greenhouse Effect** The transmission of shortwave solar radiation by the atmosphere coupled with the selective absorption of longer-wavelength terrestrial radiation, especially by water vapor and carbon dioxide, resulting in warming of the atmosphere.

**Growing Degree-Days** A practical application of temperature data for determining the approximate date when crops will be ready for harvest.

**Gust Front** The boundary separating the cold downdraft from a thunderstorm and the relatively warm, moist surface air. Lifting along this boundary may initiate the development of thunderstorms.

**Hadley Cell** The thermally driven circulation system of equatorial and tropical latitudes consisting of two convection cells, one in each hemisphere. The existence of this circulation system was first proposed by George Hadley in 1735 as an explanation for the trade winds.

**Hail** Precipitation in the form of hard, round pellets or irregular lumps of ice that may have concentric shells formed by the successive freezing of layers of water.

**Halo** A narrow whitish ring of large diameter centered around the Sun. The commonly observed 22° *halo* subtends an angle of 22° from the observer.

**Heat** The kinetic energy of random molecular motion.

**Heat Budget** The balance of incoming and outgoing radiation.

**Heating Degree-Day** Each degree of temperature of the daily mean below 65°F is counted as one heating degree-day. The amount of heat required to maintain a certain temperature in a building is proportional to the heating degree-days total.

**Heterosphere** A zone of the atmosphere beyond about 80 kilometers where the gases are arranged into four roughly spherical shells, each with a distinctive composition.

**High Cloud** A cloud that normally has its base above 6000 meters; the base may be lower in winter and at high-latitude locations.

**Highland Climate** Complex pattern of climate conditions associated with mountains. Highland climates are characterized by large differences that occur over short distances.

**Homosphere** A zone of atmosphere extending from Earth's surface to about 80 kilometers that is uniform in terms of the proportions of its component gases.

**Horse Latitudes** A belt of calms or light variable winds and subsiding air located near the center of the subtropical high.

**Humid Continental Climate** A relatively severe climate characteristic of broad continents in the middle latitudes between approximately 40° and 50° north latitude. This climate is not found in the Southern Hemisphere, where the middle latitudes are dominated by the oceans.

**Humidity** A general term referring to water vapor in the air.

**Humid Subtropical Climate** A climate generally located on the eastern side of a continent and characterized by hot, sultry summers and cool winters.

**Hurricane** A tropical cyclonic storm having minimum winds of 119 kilometers per hour; also known as *typhoon* (western Pacific) and *cyclone* (Indian Ocean).

**Hurricane Warning** A warning issued when sustained winds of 119 kilometers per hour or higher are expected within a specified coastal area in 24 hours or less.

**Hurricane Watch** An announcement aimed at specific coastal areas that a hurricane poses a possible threat, generally within 36 hours.

**Hydrologic Cycle** The continuous movement of water from the oceans to the atmosphere (by evaporation), from the atmosphere to the land (by condensation and precipitation), and from the land back to the sea (via stream flow).

**Hydrophobic Nuclei** Particles that are not efficient condensation nuclei. Small droplets will form on them whenever the relative humidity reaches 100 percent.

**Hydrosphere** The water portion of our planet; one of the traditional subdivisions of Earth's physical environment.

**Hydrostatic Equilibrium** The balance maintained between the force of gravity and the vertical pressure gradient that does not allow air to escape to space.

**Hygrometer** An instrument designed to measure relative humidity.

**Hygroscopic Nuclei** Condensation nuclei having a high affinity for water, such as salt particles.

**Hypothesis** A tentative explanation that is tested to determine if it is valid.

**Ice Cap Climate** A climate that has no monthly means above freezing and supports no vegetative cover except in a few scattered high mountain areas. This climate, with its perpetual ice and snow, is confined largely to the ice sheets of Greenland and Antarctica.

**Icelandic Low** A large cell of low pressure centered over Iceland and southern Greenland in the North Atlantic during the winter.

**Ice Point** The temperature at which ice melts.

**Ideal Gas Law** The pressure exerted by a gas is proportional to its density and absolute temperature.

**Inclination of the Axis** The tilt of Earth's axis from the perpendicular to the plane of Earth's orbit (plane of the ecliptic). Currently, the inclination is about 23 1/2° away from the perpendicular.

**Inferior Mirage** A mirage in which the image appears below the true location of the object.

**Infrared Radiation** Radiation with a wavelength from 0.7 to 200 micrometers.

**Interference** Occurs when light rays of different frequencies (i.e., colors) meet. Such interference results in the cancellation or subtraction of some frequencies, which is responsible for the colors associated with coronas.

**Internal Reflection** Occurs when light that is traveling through a transparent material, such as water, reaches the opposite surface and is reflected back into the material. This is an important factor in the formation of such optical phenomena as rainbows.

**Intertropical Convergence Zone (ITCZ)** The zone of general convergence between the Northern and Southern Hemisphere trade winds.

**Ionosphere** A complex atmospheric zone of ionized gases extending between 80 and 400 kilometers, thus coinciding with the lower thermosphere and heterosphere.

**Isobar** A line drawn on a map connecting points of equal barometric pressure, usually corrected to sea level.

**Isohyet** A line connecting places having equal rainfall.

**Isotachs** Lines of equal wind speed.

**Isotherm** A line connecting points of equal air temperature.

**ITCZ** See Intertropical Convergence Zone.

**Jet Streak** Areas of higher-velocity winds found within the jet stream.

**Jet Stream** Swift geostrophic airstreams in the upper troposphere that meander in relatively narrow belts.

**Jungle** An almost impenetrable growth of tangle vines, shrubs, and short trees characterizing areas where the tropical rain forest has been cleared.

**Katabatic Wind** The flow of cold, dense air downslope under the influence of gravity; the direction of flow is controlled largely by topography.

**Kelvin Scale** A temperature scale (also called the *absolute scale*) used primarily for scientific purposes and having intervals equivalent to those on the Celsius scale but beginning at absolute zero.

**Köppen Classification** Devised by Wladimir Köppen, a system for classifying climates that is based on mean monthly and annual values of temperature and precipitation.

**Lake-Effect Snow** Snow showers associated with a *cP* air mass to which moisture and heat are added from below as it traverses a large and relatively warm lake (such as one of the Great Lakes), rendering the air mass humid and unstable.

**Land Breeze** A local wind blowing from the land toward the sea during the night in coastal areas.

**La Niña** An episode of strong trade winds and unusually low sea-surface temperatures in the central and eastern Pacific. The opposite of *El Niño*.

**Lapse Rate** See Environmental Lapse Rate; Normal Lapse Rate.

**Latent Heat** The energy absorbed or released during a change of state.

**Latent Heat of Condensation** The energy released when water vapor changes to the liquid state. The amount of energy released is equivalent to the amount absorbed during evaporation.

**Latent Heat of Vaporization** The energy absorbed by water molecules during evaporation. It varies from about 600 calories per gram for water at 0°C to 540 calories per gram at 100°C.

**Law of Conservation of Angular Momentum** The product of the velocity of an object around a center of rotation (axis) and the distance of the object from the axis is constant.

**Leader** The conductive path of ionized air that forms near a cloud base prior to a lightning stroke. The initial conductive path is referred to as a *step leader* because it extends itself earthward in short, nearly invisible bursts. A *dart leader*, which is continuous and less branched than a step leader, precedes each subsequent stroke along the same path.

**Lifting Condensation Level** The height at which rising air that is cooling at the dry adiabatic rate becomes saturated and condensation begins.

**Lightning** A sudden flash of light generated by the flow of electrons between oppositely charged parts of a cumulonimbus cloud or between the cloud and the ground.

**Liquid-in-Glass Thermometer** A device for measuring temperature that consists of a tube with a liquid-filled bulb at one end. The expansion or contraction of the fluid indicates temperature.

**Long-Range Forecasting** Estimating rainfall and temperatures for a period beyond 3 to 5 days, usually for 30-day periods. Such forecasts are not as detailed or reliable as those for shorter periods.

**Longwave Radiation** A reference to radiation emitted by Earth. Wavelengths are roughly 20 times longer than those emitted by the Sun.

**Looming** A mirage that allows objects that are below the horizon to be seen.

**Low Cloud** A cloud that forms below a height of about 2000 meters.

**Macroscale Winds** Such phenomena as cyclones and anticyclones, which persist for days or weeks and have a horizontal dimension of hundreds to several thousands of kilometers; also, features of the atmospheric circulation that persist for weeks or months and have horizontal dimensions of up to 10,000 kilometers.

**Marine Climate** A climate dominated by the ocean; because of the moderating effect of water, sites having this climate are considered relatively mild.

**Marine West Coast Climate** A climate found on windward coasts from latitudes 40° to 65° and dominated by maritime air masses. Winters are mild and summers are cool.

**Maritime (m) Air Mass** An air mass that originates over the ocean. These air masses are relatively humid.

**Mature Stage** The second of the three stages of a thunderstorm. This stage is characterized by violent weather as downdrafts exist side by side with updrafts.

**Maximum Thermometer** A thermometer that measures the maximum temperature for a given period in time, usually 24 hours. A constriction in the base of the glass tube allows mercury to rise but prevents it from returning to the bulb until the thermometer is shaken or whirled.

**Mediterranean Climate** A common name applied to the dry-summer subtropical climate.

**Melting** The change of state from a solid to a liquid.

**Mercury Barometer** A mercury-filled glass tube in which the height of the column of mercury is a measure of air pressure.

**Mesocyclone** A vertical cylinder of cyclonically rotating air (3 to 10 kilometers in diameter) that develops in the updraft of a severe thunderstorm and that often precedes the development of damaging hail or tornadoes.

**Mesopause** The boundary between the mesosphere and the thermosphere.

**Mesoscale Convective Complex (MCC)** A slow-moving roughly circular cluster of interacting thunderstorm cells covering an area of thousands of square kilometers that may persist for 12 hours or more.

**Mesoscale Winds** Small convective cells that exist for minutes or hours, such as thunderstorms, tornadoes, and land and sea breezes. Typical horizontal dimensions range from 1 to 100 kilometers.

**Meteorology** The scientific study of the atmosphere and atmospheric phenomena; the study of weather and climate.

**Microburst** Small (less than 4 kilometers across), short-lived, straight-line downbursts of wind that occur beneath some thunderstorms.

- Microscale Winds** Phenomena such as turbulence, with life spans of less than a few minutes that affect small areas and are strongly influenced by local conditions of temperature and terrain.
- Middle Cloud** A cloud occupying the height range from 2000 to 6000 meters.
- Middle-Latitude (Midlatitude) Cyclone** Large low-pressure center with diameter often exceeding 1000 kilometers that moves from west to east and may last from a few days to more than a week and usually has a cold front and a warm front extending from the central area of low pressure.
- Midlatitude Jet Stream** A jet stream that migrates between the latitudes of 30° and 70°.
- Milankovitch Cycles** Systematic changes in three elements of Earth's orbit—eccentricity, obliquity, and precession. Named for Yugoslavian astronomer Milutin Milankovitch.
- Millibar** The standard unit of pressure measurement used by the National Weather Service. One millibar (mb) equals 100 newtons per square meter.
- Minimum Thermometer** A thermometer that measures the minimum temperature for a given period of time, usually 24 hours. By checking the small dumbbell-shaped index, the minimum temperature can be read.
- Mirage** An optical effect of the atmosphere caused by refraction in which the image of an object appears displaced from its true position.
- Mistral** A cold northwest wind that blows into the western Mediterranean basin from higher elevations to the north.
- Mixing Depth** The height to which convective movements extend above Earth's surface. The greater the mixing depths, the better the air quality.
- Mixing Ratio** The mass of water vapor in a unit mass of dry air; commonly expressed as grams of water vapor per kilogram of dry air.
- Model** A term often used synonymously with hypothesis but is less precise because it is sometimes used to describe a theory as well.
- Monsoon** The seasonal reversal of wind direction associated with large continents, especially Asia. In winter, the wind blows from land to sea; in summer, it blows from sea to land.
- Monthly Mean Temperature** The mean temperature for a month that is calculated by averaging the daily means.
- Mountain Breeze** The nightly downslope winds commonly encountered in mountain valleys.
- Multiple Vortex Tornado** Tornadoes that contain several smaller intense whirls called suction vortices that orbit the center of the larger tornado circulation.
- National Weather Service (NWS)** The federal agency responsible for gathering and disseminating weather-related information.
- Negative-Feedback Mechanism** As used in climatic change, any effect that is opposite of the initial change and tends to offset it.
- Newton** A unit of force used in physics. One newton is the force necessary to accelerate 1 kilogram of mass 1 meter per second per second.
- Normal Lapse Rate** The average drop in temperature with increasing height in the troposphere; about 6.5°C per kilometer.
- Nor'easter** The term used to describe the weather associated with an incursion of *mP* air into the Northeast from the North Atlantic; strong northeast winds, freezing or near-freezing temperatures, and the possibility of precipitation make this an unwelcome weather event.
- Nowcasting** Short-term weather forecasting techniques that are generally applied to predicting severe weather.
- Numerical Weather Prediction (NWP)** Forecasting the behavior of atmospheric disturbances based upon the solution of the governing fundamental equations of hydrodynamics, subject to the observed initial conditions. Because of the vast number of calculations involved, high-speed computers are always used.
- Obliquity** The angle between the planes of Earth's equator and orbit.
- Occluded Front** A front formed when a cold front overtakes a warm front.
- Occlusion** The overtaking of one front by another.
- Ocean Current** The mass movement of ocean water that is either wind-driven or initiated by temperature and salinity conditions that alter the density of seawater.
- Open System** One in which both matter and energy flow into and out of the system. Most natural systems are of this type.
- Orographic Lifting** Mountains or highlands acting as barriers to the flow of air force the air to ascend. The air cools, adiabatically, and clouds and precipitation may result.
- Outgassing** The release of gases dissolved in molten rock.
- Overrunning** Warm air gliding up a retreating cold air mass.
- Oxygen-Isotope Analysis** A method of deciphering past temperatures based on the precise measurement of the ratio between two isotopes of oxygen, <sup>16</sup>O and <sup>18</sup>O. Analysis is commonly made of seafloor sediments and cores from ice sheets.
- Ozone** A molecule of oxygen containing three oxygen atoms.
- Paleoclimatology** The study of ancient climates; the study of climate and climate change prior to the period of instrumental records using proxy data.
- Paleosol** Old, buried soil that may furnish some evidence of the nature of past climates because climate is the most important factor in soil formation.
- Parcel** An imaginary volume of air enclosed in a thin elastic cover. Typically it is considered to be a few hundred cubic meters in volume and is assumed to act independently of the surrounding air.
- Parhelia** See Sun dogs.
- Perihelion** The point in the orbit of a planet closest to the Sun.
- Permafrost** The permanent freezing of the subsoil in tundra regions.
- Persistence Forecast** A forecast that assumes that the weather occurring upstream will persist and move on and will affect the areas in its path in much the same way. Persistence forecasts do not account for changes that might occur in the weather system.
- pH Scale** A 0 to 14 scale that is used for expressing the exact degree of acidity or alkalinity of a solution. A pH of 7 signifies a neutral solution. Values below 7 signify an acid solution, and values above 7 signify an alkaline solution.
- Photochemical Reaction** A chemical reaction in the atmosphere triggered by sunlight, often yielding a secondary pollutant.
- Photosynthesis** The production of sugars and starches by plants using air, water, sunlight, and chlorophyll. In the process, atmospheric carbon dioxide is changed to organic matter and oxygen is released.
- Photosynthesis** The production of sugars and starches by plants using air, water, sunlight, and chlorophyll. In the process, atmospheric carbon dioxide is changed to organic matter and oxygen is released.
- Plane of the Ecliptic** Plane of Earth's orbit around the Sun.
- Plate Tectonics Theory** A theory that states the outer portion of Earth is made up of several individual pieces, called *plates*,

which move in relation to one another upon a partially molten zone below. As plates move, so do continents, which explains some climatic changes in the geologic past.

**Polar (P) Air Mass** A cold air mass that forms in a high-latitude source region.

**Polar Climates** Climates in which the mean temperature of the warmest month is below 10°C; climates that are too cold to support the growth of trees.

**Polar Easterlies** In the global pattern of prevailing winds, winds that blow from the polar high toward the subpolar low. These winds, however, should not be thought of as persistent winds, such as the trade winds.

**Polar Front** The stormy frontal zone separating air masses of polar origin from air masses of tropical origin.

**Polar Front Theory** A theory developed by J. Bjerknes and other Scandinavian meteorologists in which the polar front, separating polar and tropical air masses, gives rise to cyclonic disturbances that intensify and move along the front and pass through a succession of stages.

**Polar High** Anticyclones that are assumed to occupy the inner polar regions and are believed to be thermally induced, at least in part.

**Polar Satellite** Satellites that orbit the poles at rather low altitudes of a few hundred kilometers and require only 100 minutes per orbit.

**Positive-Feedback Mechanism** As used in climatic change, any effect that acts to reinforce the initial change.

**Potential Energy** Energy that exists by virtue of a body's position with respect to gravitation.

**Precession** The slow migration of Earth's axis that traces out a cone over a period of 26,000 years.

**Precipitation Fog** See Frontal Fog.

**Pressure Gradient** The amount of pressure change occurring over a given distance.

**Pressure Tendency** The nature of the change in atmospheric pressure over the past several hours. It can be a useful aid in short-range weather prediction.

**Prevailing Westerlies** The dominant west-to-east motion of the atmosphere that characterizes the regions on the poleward side of the subtropical highs.

**Prevailing Wind** A wind that consistently blows from one direction more than from any other.

**Primary Pollutant** A pollutant emitted directly from an identifiable source.

**Prognostic Chart** A computer-generated forecast showing the expected pressure pattern at a specified future time. Anticipated positions of fronts are also included. They usually represent the graphical output associated with a numerical weather prediction model.

**Proxy Data** Data gathered from natural recorders of climate variability such as tree rings, ice cores, and ocean-floor sediments.

**Psychrometer** Device consisting of two thermometers (wet bulb and dry bulb) that is rapidly whirled and, with the use of tables, yields the relative humidity and dew point.

**Radiation** The wavelike energy emitted by any substance that possesses heat. This energy travels through space at 300,000 kilometers per second (the speed of light).

**Radiation Fog** Fog resulting from radiation cooling of the ground and adjacent air; primarily a nighttime and early morning phenomenon.

**Radiosonde** A lightweight package of weather instruments fitted with a radio transmitter and carried aloft by a balloon.

**Rainbow** A luminous arc formed by the refraction and reflection of light in drops of water.

**Rain Shadow Desert** A dry area on the lee side of a mountain range.

**Rawinsonde** A radiosonde that is tracked by radio-location devices in order to obtain data on upper-air winds.

**Reflection, Law of** The angle of incidence (incoming ray) is equal to the angle of reflection (outgoing ray).

**Refraction** The bending of light as it passes obliquely from one transparent medium to another.

**Relative Humidity** The ratio of the air's water-vapor content to its water vapor capacity.

**Return Stroke** Term applied to the electric discharge resulting from the downward (earthward) movement of electrons from successively higher levels along the conductive path of lightning.

**Revolution** The motion of one body about another, as Earth about the Sun.

**Ridge** An elongate region of high atmospheric pressure.

**Rime** A delicate accumulation of ice crystals formed when supercooled fog or cloud droplets freeze on contact with objects.

**Rossby Waves** Upper-air waves in the middle and upper troposphere of the middle latitudes with wavelengths of from 4000 to 6000 kilometers; named for C. G. Rossby, the meteorologist who developed the equations for parameters governing the waves.

**Rotation** The spinning of a body, such as Earth, about its axis.

**Saffir-Simpson Scale** A scale, from 1 to 5, used to rank the relative intensities of hurricanes.

**Santa Ana** The local name given a foehn wind in southern California.

**Saturation** The maximum possible quantity of water vapor that the air can hold at any given temperature and pressure.

**Saturation Vapor Pressure** The vapor pressure, at a given temperature, wherein the water vapor is in equilibrium with a surface of pure water or ice.

**Savanna** A tropical grassland, usually with scattered trees and shrubs.

**Sea Breeze** A local wind blowing from the sea during the afternoon in coastal areas.

**Secondary Pollutant** A pollutant that is produced in the atmosphere by chemical reactions occurring among primary pollutants.

**Semiarid** See Steppe.

**Severe Thunderstorm** A thunderstorm that produces frequent lightning, locally damaging wind, or hail that is 2 centimeters or more in diameter. In the middle latitudes, most thunderstorms form along or ahead of cold fronts.

**Shortwave Radiation** Radiation emitted by the Sun.

**Siberian High** The high-pressure center that forms over the Asian interior in January and produces the dry winter monsoon for much of the continent.

**Skill** An index of the degree of accuracy of a set of forecasts as compared to forecasts based on some standard, such as chance or climatic data.

**Sleet** Frozen or semifrozen rain formed when raindrops pass through a subfreezing layer of air.

**Smog** A word currently used as a synonym for general air pollution. It was originally created by combining the words "smoke" and "fog."

**Snow** Precipitation in the form of white or translucent ice crystals, chiefly in complex branched hexagonal form and often clustered into snowflakes.

**Solstice** The point in time when the vertical rays of the Sun are striking either the Tropic of Cancer (summer solstice in the Northern Hemisphere) or the Tropic of Capricorn (winter solstice in the Northern Hemisphere). Solstice repre-

- sents the longest or shortest day (length of daylight) of the year.
- Source Region** The area where an air mass acquires its characteristic properties of temperature and moisture.
- Southern Oscillation** The seesaw pattern of atmospheric pressure change that occurs between the eastern and western Pacific. The interaction of this effect and that of El Niño can cause extreme weather events in many parts of the world.
- Specific Heat** The amount of heat needed to raise 1 gram of a substance 1°C at sea-level atmospheric pressure.
- Specific Humidity** The mass of water vapor per unit mass of air, including the water vapor (usually expressed as grams of water vapor per kilogram of air).
- Speed Divergence** The divergence of air aloft that results from the variations in velocity occurring along the axis of a jet stream. On passing from a zone of lower wind speed to one of faster speed, air accelerates and therefore experiences divergence.
- Squall Line** Any nonfrontal line or narrow band of active thunderstorms.
- Stable Air** Air that resists vertical displacement. If it is lifted, adiabatic cooling will cause its temperature to be lower than the surrounding environment; and if it is allowed, it will sink to its original position.
- Standard Atmosphere** The idealized vertical distribution of atmospheric pressure (as well as temperature and density), which is taken to represent average conditions in the real atmosphere.
- Standard Rain Gauge** Having a diameter of about 20 centimeters, this gauge funnels rain into a cylinder that magnifies precipitation amounts by a factor of 10, allowing for accurate measurement of small amounts.
- Static Seeding** The most commonly used technique of cloud seeding; based on the assumption that cumulus clouds are deficient in freezing nuclei and that the addition of nuclei will spur additional precipitation formation.
- Stationary Front** A situation in which the surface position of a front does not move; the flow on either side of such a boundary is nearly parallel to the position of the front.
- Statistical Methods (in forecasting)** Methods in which tables or graphs are prepared from a long series of observations to show the probability of certain weather events under certain conditions of pressure, temperature, or wind direction.
- Steam Fog** Fog having the appearance of steam: produced by evaporation from a warm water surface into the cool air above.
- Steam Point** The temperature at which water boils.
- Step Leader** *See* Leader.
- Steppe** One of the two types of dry climate; a marginal and more humid variant of the desert that separates it from bordering humid climates. Steppe also refers to the short-grass vegetation associated with this semiarid climate.
- Storm Surge** The abnormal rise of the sea along a shore as a result of strong winds.
- Stratopause** The boundary between the stratosphere and the mesosphere.
- Stratosphere** The zone of the atmosphere above the troposphere characterized at first by isothermal conditions and then a gradual temperature increase. Earth's ozone is concentrated here.
- Stratus** One of three basic cloud forms; also the name given one of the low clouds. Stratus clouds are sheets or layers that cover much or all of the sky.
- Stroke** One of the individual components that make up a flash of lightning. There are usually three to four strokes per flash, roughly 50 milliseconds apart.
- Subarctic Climate** A climate found north of the humid continental climate and south of the polar climate and characterized by bitterly cold winters and short cool summers. Places within this climatic realm experience the highest annual temperature ranges on Earth.
- Sublimation** The process whereby a solid changes directly to a gas without going through the liquid state.
- Subpolar Low** Low pressure located at about the latitudes of the Arctic and Antarctic circles. In the Northern Hemisphere, the low takes the form of individual oceanic cells; in the Southern Hemisphere, there is a deep and continuous trough of low pressure.
- Subsidence** An extensive sinking motion of air, most frequently occurring in anticyclones. The subsiding air is warmed by compression and becomes more stable.
- Subtropical High** Not a continuous belt of high pressure, but rather several semipermanent anticyclonic centers characterized by subsidence and divergence located roughly between latitudes 25° and 35°.
- Summer Solstice** *See* Solstice.
- Sun Dogs** Two bright spots of light, sometimes called “mock suns,” that sit at a distance of 22° on either side of the Sun.
- Sun Pillar** Shafts of light caused by reflection from ice crystals that extend upward or, less commonly, downward from the Sun when the Sun is near the horizon.
- Sunspot** A dark area on the Sun associated with powerful magnetic storms that extend from the Sun's surface deep into the interior.
- Supercell** A type of thunderstorm that consists of a single, persistent, and very powerful cell (updraft and downdraft) and that often produces severe weather, including hail and tornadoes.
- Supercooled** The condition of water droplets that remain in the liquid state at temperatures well below 0°C.
- Superior Mirage** A mirage in which the image appears above the true position of the object.
- Synoptic Weather Forecasting** A system of forecasting based on careful studies of synoptic weather charts over a period of years; from such studies a set of empirical rules is established to aid the forecaster in estimating the rate and direction of weather-system movements.
- Synoptic Weather Map** A weather map describing the state of the atmosphere over a large area at a given moment.
- Taiga** The northern coniferous forest; also a name applied to the subarctic climate.
- Temperature** A measure of the degree of hotness or coldness of a substance.
- Temperature Gradient** The amount of temperature change per unit of distance.
- Temperature Inversion** A layer in the atmosphere of limited depth where the temperature increases rather than decreases with height.
- Theory** A well-tested and widely accepted view that explains certain observable facts.
- Thermal** An example of convection that involves the upward movements of warm, less dense air. In this manner, heat is transported to greater heights.
- Thermal Low** An area of low atmospheric pressure created by abnormal surface heating.
- Thermistor** An electric thermometer consisting of a conductor whose resistance to the flow of current is temperature-dependent; commonly used in radiosondes.
- Thermocouple** An electric thermometer that operates on the principle that differences in temperature between the junction of two unlike metal wires in a circuit will induce a current to flow.



- Thermograph** An instrument that continuously records temperature.
- Thermometer** An instrument for measuring temperature; in meteorology, generally used to measure the temperature of the air.
- Thermosphere** The zone of the atmosphere beyond the mesosphere in which there is a rapid rise in temperature with height.
- Thunder** The sound emitted by rapidly expanding gases along the channel of a lightning discharge.
- Thunderstorm** A storm produced by a cumulonimbus cloud and always accompanied by lightning and thunder. It is of relatively short duration and usually accompanied by strong wind gusts, heavy rain, and sometimes hail.
- Tipping-Bucket Gauge** A recording rain gauge consisting of two compartments ("buckets"), each capable of holding 0.025 centimeter of water. When one compartment fills, it tips and the other compartment takes its place.
- Tornado** A violently rotating column of air attended by a funnel-shaped or tubular cloud extending downward from a cumulonimbus cloud.
- Tornado Warning** A warning issued when a tornado has actually been sighted in an area or is indicated by radar.
- Tornado Watch** A forecast issued for areas of about 65,000 square kilometers, indicating that conditions are such that tornadoes may develop; they are intended to alert people to the possibility of tornadoes.
- Towering** A mirage in which the size of an object is magnified.
- Trace of Precipitation** An amount less than 0.025 centimeter.
- Trade Winds** Two belts of winds that blow almost constantly from easterly directions and are located on the equatorward sides of the subtropical highs.
- Transpiration** The release of water vapor to the atmosphere by plants.
- Trend Forecast** A short-range forecasting technique that assumes that the weather occurring upstream will persist and move on to affect the area in its path.
- Tropic of Cancer** The parallel of latitude, 23 1/2° north latitude, marking the northern limit of the Sun's vertical rays.
- Tropic of Capricorn** The parallel of latitude, 23 1/2° south latitude, marking the southern limit of the Sun's vertical rays.
- Tropical (T) Air Mass** A warm-to-hot air mass that forms in the subtropics.
- Tropical Depression** By international agreement, a tropical cyclone with maximum winds that do not exceed 61 kilometers per hour.
- Tropical Disturbance** A term used by the National Weather Service for a cyclonic wind system in the tropics that is in its formative stages.
- Tropical Rain Forest** A luxuriant broadleaf evergreen forest; also the name given the climate associated with this vegetation.
- Tropical Storm** By international agreement, a tropical cyclone with maximum winds between 61 and 115 kilometers per hour.
- Tropical Wet and Dry** A climate that is transitional between the wet tropics and the subtropical steppes.
- Tropopause** The boundary between the troposphere and the stratosphere.
- Troposphere** The lowermost layer of the atmosphere marked by considerable turbulence and, in general, a decrease in temperature with increasing height.
- Trough** An elongate region of low atmospheric pressure.
- Tundra Climate** Found almost exclusively in the Northern Hemisphere or at high altitudes in many mountainous regions. A treeless climatic realm of sedges, grasses, mosses, and lichens dominated by a long, bitterly cold winter.
- Ultraviolet Radiation** Radiation with a wavelength from 0.2 to 0.4 micrometer.
- Unstable Air** Air that does not resist vertical displacement. If it is lifted, its temperature will not cool as rapidly as the surrounding environment and so it will continue to rise on its own.
- Upslope Fog** Fog created when air moves up a slope and cools adiabatically.
- Upwelling** The process by which deep, cold, nutrient-rich water is brought to the surface, usually by coastal currents that move water away from the coast.
- Urban Heat Island** Refers to the fact that temperatures within a city are generally higher than in surrounding rural areas.
- Valley Breeze** The daily upslope winds commonly encountered in a mountain valley.
- Vapor Pressure** That part of the total atmospheric pressure attributable to its water-vapor content.
- Veering Wind Shift** A wind shift in a clockwise direction, such as a shift from east to south.
- Vernal Equinox** *See* Equinox.
- Virga** Wisps or streaks of water or ice particles falling out of a cloud but evaporating before reaching Earth's surface.
- Visibility** The greatest distance that prominent objects can be seen and identified by unaided, normal eyes.
- Visible Light** Radiation with a wavelength from 0.4 to 0.7 micrometer.
- Warm Front** The discontinuity at the forward edge of an advancing warm air mass that is displacing cooler air in its path.
- Warm-Type Occluded Front** A front that forms when the air behind the cold front is warmer than the air underlying the warm front it is overtaking.
- Water Hemisphere** A term used to refer to the Southern Hemisphere, where the oceans cover 81 percent of the surface (compared to 61 percent in the Northern Hemisphere).
- Wavelength** The horizontal distance separating successive crests or troughs.
- Weather** The state of the atmosphere at any given time.
- Weather Analysis** The stage prior to developing a weather forecast. This stage involves collecting, compiling, and transmitting observational data.
- Weather Forecasting** Predicting the future state of the atmosphere.
- Weather Modification** Deliberate human intervention to influence and improve atmospheric processes.
- Weighting Gauge** A recording precipitation gauge consisting of a cylinder that rests on a spring balance.
- Westerlies** *See* Prevailing Westerlies.
- Wet Adiabatic Rate** The rate of adiabatic temperature change in saturated air. The rate of temperature change is variable, but it is always less than the dry adiabatic rate.
- White Frost** Ice crystals that form on surfaces instead of dew when the dew point is below freezing.
- Wind** Air flowing horizontally with respect to Earth's surface.
- Windchill** A measure of apparent temperature that uses the effects of wind and temperature on the cooling rate of the human body. The windchill chart translates the cooling power of the atmosphere with the wind to a temperature under nearly calm conditions.
- Wind Vane** An instrument used to determine wind direction.
- Winter Solstice** *See* Solstice.
- World Meteorological Organization (WMO)** Established by the United Nations, the WMO consists of more than 130 nations and is responsible for gathering needed observational data and compiling some general prognostic charts.