

## APPENDIX B

### GLOSSARY

**Adaptation Data:** Adaptable parameter settings for WSR-88D hardware and software that change their operating characteristics. These changes enable system optimization based on meteorological, climatological, and regional variations, as well as user preferences.

**Adiabatic Process:** A process in which a system does not interact with its surroundings by virtue of a temperature difference between them. In an adiabatic process any change in internal energy (for a system of fixed mass) is solely a consequence of work. For an ideal gas and for most atmospheric systems, compression results in warming, expansion results in cooling.

**Alert:** An operational condition or message created when a user-selected product value or algorithm output is detected during an elevation or volume scan. Usually requested by a user in order to be notified of a condition related to a meteorological event.

**Aliasing:** The process by which frequencies too high to be analyzed with the given sampling interval appear at a frequency less than the Nyquist frequency.

**Algorithm:** A fixed step-by-step procedure, usually within system software, designed to accomplish a given result; usually a simplified procedure for solving a complex problem; also a full statement of a finite number of steps. Meteorological algorithms are designed to recognize data patterns related to weather phenomena or threats.

**Anomalous Propagation:** A propagation path of electromagnetic radiation that deviates from the path expected from refractive conditions in a standard atmosphere.

**Antenna:** (Also called aerial; sometimes the more general term **radiator** is used.) A conductor or system of conductors for radiating and/or receiving radio energy. As used in radar, the antenna is usually "directional," that is, it has the property of radiating or receiving radio waves in larger proportion in a given direction.

**AP Editor:** (See **Clutter Editor**)

**Archive Level I:** The analog, time-domain output from the receiver. These data are useful for detailed engineering studies. The data recording interface is located at the RDA.

**Archive Level II:** The digital base data output from the signal processor. The output also includes status information required to properly interpret the data (e.g., information on synchronization, calibration, date, time, antenna position, clutter and notchwidth maps, and operational mode).

**Archive Level III:** The base products and derived products/algorithm output produced by the RPG. The Level III products are defined in Part A of this handbook.

**Archive Level IV:** The base products and derived products/algorithm output produced by the RPG. Data recorded are selected by at the user display system operator.

**Aspect Ratio:** The ratio of height-to-length scales ( $D/L$ ) characteristic of a fluid flow or for radar, the ratio of the actual physical size of the reflectivity or flow-field entity (e.g., hook echo, mesocyclone, TVS) and the size of the radar illuminated volume.

**Associated Users:** Users with a dedicated communications link to a WSR-88D.

**Atmospheric Boundary Layer:** (Also called boundary layer, planetary boundary layer.) The bottom layer of the troposphere that is in contact with the surface of the earth.

**Azimuth:** A direction in terms of the 360° compass.

**Base Data:** Those digital fields of reflectivity, mean radial velocity, and spectrum width data in spherical coordinates provided at the finest resolution available from the radar. (Also known as Archive Level II.)

**Batch Waveform:** Contains both Surveillance and Doppler pulse trains alternating low and high PRFs within each radial at each low elevation angle scanned to allow resolution of range ambiguities. It is used where a high degree of clutter suppression is required, but where contiguous waveforms are not needed.

**Beam Filling:** The measure of variation of hydrometer density throughout the radar sampling volume. If there is no variation in density, the beam is considered to be filled.

**Beam Width:** Angular width of the antenna pattern. Usually the width where the power density is one-half that of the axis of the beam.

**Bias:** A systematic difference between an estimate of and the true value of the parameter.

**Bin:** Radar sample volume.

**Biological Target:** Airborne living particulates such as insects and birds that backscatter incident radar signals.

**Book-End Vortices:** (Also line-end vortices.) With time, MCSs tend to develop vortex pairs with opposite sense rotation at the ends of the convective line. Primarily created when the system updraft tilts the easterly shear generated at the system's cold pool/updraft interface.

**Boundary Layer:** The layer of a fluid adjacent to a physical boundary in which the fluid motion is affected by the boundary and has a mean velocity less than the free-stream value.

**Bounded Weak Echo Region (BWER):** A nearly vertical channel of weak radar echo, surrounded on the sides and top by significantly stronger echoes. The BWER, sometimes called a vault, is related to the strong updraft in a severe convective storm. The BWER has long been found to be associated with the supercell thunderstorm.

**Bow Echo:** A bow-shaped line of convective cells that is often associated with swaths of damaging straight-line winds and small tornadoes. Key structural features include an intense rear-inflow jet impinging on the core of the bow, with book-end or line-end vortices on both sides of the rear-inflow jet, behind the ends of the bowed convective segment. Bow echoes have been observed with scales between 20 and 200 km, and often have lifetimes between 3 and 6 hours.

**Bypass Map:** In the absence of any operator-defined Clutter Suppression Regions, this map (built by the RDA System Operability Test (RDASOT) software) specifies where to apply clutter suppression.

**Bright Band:** The enhanced radar echo caused by the difference in radar reflectivity of ice and water particles. This echo is interpreted as the delineation on a radar display between frozen and liquid precipitation.

**Calibration Constant:** One of several known test signals injected into the radar system for the purpose of adjusting radar systems such as signal processor and receiver to conform to the output predicted by the radar equation.

**Cell:** A compact region of relatively strong vertical air motion (at least  $10 \text{ ms}^{-1}$ ; 19 kts). In radar, sometimes applied to individual radar echoes or radar echo cores of higher reflectivity.

**Centroid:** The center of mass of a storm echo or storm echo component.

**Channel:** In radar, often pertaining to an elongated or linear weak echo feature.

**Chinook:** The name given to the foehn in western North America, especially on the plains to the lee or eastern side of the Rocky Mountains in the United States and Canada.

**Clear Air Mode:** System scanning in order to gather data which will facilitate the detection of precursors to precipitation development and non-meteorological echoes. This mode uses slower scan rates than are used in the precipitation mode to provide increased sensitivity.

**Cloud Street:** Linear cloud organization occurring atop the updraft branches of horizontal convective rolls when sufficient moisture is present.

**Clutter (or Ground Clutter):** The pattern of radar echoes from fixed ground targets.

**Clutter Editor:** Also known as AP Editor; a software routine or algorithm designed to detect in radar data those range gates that are contaminated or characterized by ground clutter and anomalous propagation echo and, once identified, processed and flagged or removed.

**Clutter Filter Bypass Map:** See **Bypass Map**.

**Clutter Filter Notchwidth Map:** See **Default Notchwidth Map**.

**Clutter Suppression Region:** An area defined by the user or by adaptation data where clutter suppression is to be applied.

**Comma Head:** (Sometimes referred to as rotating comma head.) 1. The rounded portion of a comma cloud system. This occurs to the left of the maximum wind speed axis and contains the most rotation when viewed in motion. 2. The northern, rounded portion of a convective line of storms called a bow echo and often associated with a mesocyclone.

**Combined Attribute Table:** A table affixed to the Composite Reflectivity product composed of the outputs of other products and meteorological algorithms pertaining to severe convective storms.

**Combined Rankine Vortex:** An idealized circular vortex of purely tangential flow in the core which is in what is known as solid body rotation, where the rotational velocity increases directly with radius. Outside the core is a flow which has zero vorticity because the shear profile exactly cancels the curvature contribution. This is known as a potential vortex.

**Complex Signal:** In radar, a representation of the time-varying amplitude and phase of the received signal as the real and imaginary parts of a time-varying complex number. These parts are called the in-phase and quadrature components and are measured by coherent detection of the received signal.

**Conditional Instability:** The state of a layer of unsaturated air when its lapse rate of temperature is less than the dry-adiabatic lapse rate but greater than the moist-adiabatic lapse rate.

**Cone of Silence:** A conical shaped region directly above the radar left un-scanned when the rotating radar antenna has a fixed upper limit to its elevation. A typical value is  $20^\circ$ , leaving the  $70^\circ$  region above un-scanned.

**Contiguous Waveform:** Immediately adjacent waves of the same character.

**Contiguous Surveillance (CS) Scan:** A constant low PRF (long  $R_{max}$  and low  $V_{max}$ ) scan employed for the entire  $360^\circ$  sweep at low elevation angles to determine proper target location, returned power, and to permit optimum clutter filtering.

**Contiguous Doppler (CD) Scan:** A constant high PRF (short  $R_{max}$  and high  $V_{max}$ ) employed for the entire  $360^\circ$  sweep at low elevation angles where range ambiguity resolution is required to accurately determine "1st guess" velocity and spectrum width array estimates.

**Contour Base Value:** The lowest magnitude of a specific entity upon which contours are based.

**Contour Interval:** Value between contours.

**Convergence:** A measure of the contraction of a vector field.

**Correlated Shear:** An output of the Mesocyclone Detection Algorithm indicating a 3-dimensional shear region (i.e., vertically correlated) that is not symmetrical.

**Covariance:** A measure of the degree of association between two variables. In Doppler radars, the argument (or angle) of the covariance of the complex signal is a measure of the Doppler frequency.

**Data Acquisition Unit (DAU):** Monitors, within the WSR-88D, the state of all safety interlocks, power supply voltages, and environmental conditions and regularly reports to the RDASC using an asynchronous serial line.

**Data Level:** The specific range of data values represented by a single pixel when the data are presented in a pixel image format; the specific value a datum may assume.

**Data Level Code:** A code representing a specific data level; used to assign color values when such are assigned.

**Data Resolution:** The resolution of the base data as produced by the signal processor, nominally 1 km (0.54 nm) x 1°(AZ) x 1°(ELEV) for the reflectivity values and 0.25 km (0.13 nm) x 1°(AZ) x 1°(ELEV) for radial velocity and spectrum width values. Averaging and additional processing may reduce these resolutions. A measure of the degree of association between two variables. In Doppler radars, the argument (or angle) of the covariance of the complex signal is a measure of the thing.

**Data Resolution Bit:** A binary digit is the basis for all digital resolution expressions. Bit resolution can be represented by 2<sup>b</sup>, where "b" equals the number of bits, Thus, 2<sup>4</sup> = 16 data levels and 2<sup>8</sup> = 256 levels. Thus, for digital velocity values, a 4-bit product contains 16 data levels and an 8-bit product contains 256 data levels.

**Dealiasing:** Process of correcting for aliases in the velocity field.

**Decibel (dB):** A logarithmic expression for ratio of two quantities. DBm is a decibel with respect to 1 milliwatt.

Mathematically:      dB = 10 Log (P<sub>1</sub>/P<sub>2</sub>)

$$\text{dBa} = 10 \text{ Log } [(\text{accumulation})/1 \text{ mm}]$$

$$\text{dBm} = 10 \text{ Log } (P/10^{-3})$$

$$\text{dBR} = 10 \text{ Log } [(\text{precipitation rate})/(1 \text{ mm/hr})]$$

$$\text{dBZ}_e = 10 \text{ Log } (Z_e)$$

**Deep Convergence Zone:** A narrow and deep velocity signature characterized by strong convergence along a nearly vertical interface extending from the radar horizon upward to altitudes as high as 50,000 ft. Often associated with very damaging surface winds and related to the Mid Altitude Radial Convergence.

**Default Notch Width Map:** In the absence of operator-defined Clutter Suppression Regions, the WSR-88D uses the Default Notch Width Map notch width definitions (stored RDA adaptation data) to determine the amount of suppression to be applied in regions defined by the Bypass Map.

**Delta System Calibration (SYSCAL):** This RDA status factor, often output at the user display system, contains all the quantities of the radar equation but in terms of  $Z_e$  plus a constant converting receiver output power (the digital quantization factor,  $a^2$ , in digits squared per mW) to receiver power in dBm and the receiver gain, relating input to output power.

**Dendritic crystal - (Or Dendrite.)** A crystal, particularly a planar ice crystal, with its macroscopic form (crystal habit) characterized by intricate branching structures of a treelike nature.

**Derecho:** A widespread convectively induced straight-line windstorm event. Specifically, the term is defined as any family of downburst event clusters produced by an extratropical mesoscale convective system. Derechos may or may not be accompanied by tornadoes.

**Digital Data Resolution:** Establishes the number of unique values that can be associated with a parameter of interest. The data resolution is set by the number of binary bits contained within the digital words that represent the values. The number of unique values is equal to  $2^n$ , where  $n$  is the number of bits. For example if 4 bits are used, then  $2^4 = 16$ , thus 16 unique values, or levels, data can be represented. In the case of the base WSR-88D moment data, 4 bits are used to establish the 16 data levels. An 8 bit product would have  $2^8 = 256$  unique levels.

**Display Resolution:** The area or two-dimensional product of the X and Y coordinates represented by one picture element (pixel) of a raster scan display.

**Divergence:** A measure of the expansion or spreading out in a vector field.

**Doppler Radar:** A radar that detects and interprets the Doppler effect in terms of the radial velocity of a target. The signal received by radar from a moving target differs in frequency from the transmitted frequency by an amount that is proportional to the radial component of the velocity relative to the radar.

**Doppler Frequency Shift:** Also called Doppler effect. In general, the change in frequency of a signal reaching a receiver when the receiver and the transmitting source are in motion relative to one another.

**Downburst:** A strong downdraft that induces an outburst of damaging winds on or near the ground.

**Downdraft:** Small-scale downward moving air current in a cumulonimbus cloud.

**Dry-adiabatic Lapse Rate:** A process of temperature, the rate of decrease of temperature with height of a parcel of dry air lifted by a reversible adiabatic process through an atmosphere in hydrostatic equilibrium.

**Dry-adiabatic Process:** An adiabatic process in which no condensation of its water vapor occurs and no liquid water is present.

**Dryline:** A low-level mesoscale boundary or transition zone hundreds of kilometers in length and up to tens of kilometers in width separating dry air from moist air.

**Echo:** Energy backscattered from a target as seen on the radar display.

**Echo Tops:** The height of the greatest (in altitude) non-zero reflectivity value (greater than the minimum significant reflectivity set in adaptation data, 18.5 dBZ is the default) for each 4 x 4 km (2.2 x 2.2. nm) grid box above the surface of the Earth.

**Echo Training:** Thunderstorm (or shower) cells following one after another over the same location.

**Elevation Scan:** The process of the radar completing a full 360° rotation in azimuth for a specific elevation angle.

**Elevation Slice:** The full 360° rotation in azimuth for a specific elevation angle.

**Equivalent Radar Reflectivity ( $Z_e$ ):** When all the assumptions (e.g., uniformly distributed liquid water particles whose diameters meet the Rayleigh approximation) do not apply, the radar reflectivity,  $Z$ , is expressed as  $Z_e$ , the equivalent radar reflectivity. Typically expressed as: dBZ = 10 Log  $Z_e$ .

**Estimate:** A statement of the value of a quantity or function based on a finite number of samples.

**Extratropical Cyclone:** (Sometimes called extratropical low, extratropical storm.) Any cyclonic-scale storm that is not a tropical cyclone, usually referring only to the migratory frontal cyclones of middle and high latitudes.

**Eye:** In meteorology, usually the “eye of the storm” (hurricane, typhoon), that is, the roughly circular area of comparatively light winds found at the center of a severe tropical cyclone and surrounded by the eyewall.

**Eyewall:** A ring of cumulonimbus that encircles the eye of a tropical cyclone. In radar depictions, the clouds must occupy at least 180° of arc to be called an eyewall.

**Feature:** A set of pattern vectors in close proximity.

**Flash Flood:** A flood that rises and falls quite rapidly, usually as the result of intense rainfall over a relatively small area.

**Frequency:** The number of recurrences of a periodic phenomenon per unit time. Electromagnetic energy is usually specified in Hertz (Hz), which is a unit of frequency equal to one cycle per second.

**Fuzzy Logic:** A system of logic dealing with the concept of partial truth with values ranging between “completely true” and “completely false.”

**Gage Data Support System:** A system external to the WSR-88D whose purpose is to collect and transfer precipitation data from several rain gage sites to the WSR-88D.

**Gravity Wave:** (Also called gravitational wave.) A wave disturbance in which buoyancy (or reduced gravity) acts as the restoring force on parcels displaced from hydrostatic equilibrium.

**Gust Front:** The boundary between the horizontally propagating cold air outflow from a thunderstorm and the surrounding environmental air.

**Helicity:** One-half the scalar product of the velocity and vorticity vectors. It is a conserved quantity if the flow is inviscid and homogeneous in density, but is not conserved in more general viscous flows with buoyancy effects. The concept is useful in understanding severe convective storms and tornadoes, since in strong updrafts the velocity and vorticity vectors tend to be aligned, yielding high helicity.

**Hook Echo:** A pendant, curve-shaped region of reflectivity caused when precipitation is drawn into the cyclonic spiral of a mesocyclone. The hook echo is a fairly shallow feature, typically extending only up to 3–4 km in height within a supercell storm before becoming part of a bounded weak echo region.

**Horizontal Convective Rolls:** (Also known as horizontal roll vortices, boundary layer rolls.) Counter-rotating horizontal vortices that commonly occur within the convective boundary layer; their major axes are aligned with the mean boundary layer wind-shear vector.

**Hybrid Scan:** An approach in which different elevation angles (normally the lowest four) are used to minimize the effects of ground clutter and data voids on radar based observations such as precipitation estimates.

**Hydrometeor:** Any product of condensation or deposition of atmospheric water vapor, whether formed in the free atmosphere or at the earth's surface; also, any water particle blown by the wind from the earth's surface.

**In-phase (signal):** The signal obtained by demodulating the received signal with a local oscillator having the same phase and frequency as the transmitted signal.

**Isolated Storm:** An individual cell or group of cells that are identifiable and separate from other cells in a given geographic area.

**Kalman Filter:** A linear system in which the mean squared error between the desired output and the actual output is minimized when the input is a random signal generated by white noise.

**Klystron:** A power amplifier tube used to amplify weak microwave energy (provided by a radar-frequency exciter) to a high power level for a radar transmitter.

**Lifting Condensation Level:** (also called isentropic condensation level.) The level at which a parcel of moist air lifted dry-adiabatically would become saturated.

**Low-topped Supercells:** Convective storm that contains similar radar characteristics to those of a supercell (e.g., mesocyclone, hook echo, WER, BWER), but is significantly smaller in height.

**Lake-effect Snow:** Localized, convective snow bands that occur in the lee of lakes when relatively cold airflows over warm water. In the United States this phenomenon is most noted along the south and east shores of the Great Lakes during arctic cold-air outbreaks.

**Lapse Rate:** The decrease of an atmospheric variable with height, the variable being temperature, unless otherwise specified.

**Limited-Area Fine Mesh (LFM):** A rectangular grid based on a polar stereographic projection. The grid mesh length of the LFM, 1/4 LFM and 1/40 LFM at 60° N (standard latitude) and 105° W (standard longitude) are 190.5, 47.625, and 4.7625 km (102.9, 25.7 and 2.6 nmi), respectively.

**Line Echo Wave Pattern (LEWP):** A special configuration in a line of convective storms configured like a wave and that may indicate the presence of a low pressure area and the possibility of damaging winds and tornadoes. In response to very strong outflow winds behind it, a portion of the line may bulge outward forming a bow echo.

**Low-Level Jet (LLJ):** (Also called low-level jet stream.) A jet stream that is typically found in the lower 2–3 km of the troposphere. At night, sometimes called a nocturnal jet. Examples are the Great Plains Low-level jet, extratropical cyclone low-level jet, African jet and the Somali jet.

**Master System Control Function (MSCF):** The computer-user interface at the WSR-88D system RPG.

**Master Request List:** A list produced in the RPG at the start of each volume scan composed of all algorithm outputs (data types or products) which must be generated in order to satisfy default product requests, external user product requests, unsatisfied one-time product requests, and the Alerting function.

**Mesoscale Convective Complex (MCC):** A subset of mesoscale convective systems (MCS) that exhibit a large, circular (as observed by satellite), long-lived, cold cloud shield.

**Mesoscale Convective System (MCS):** A cloud system that occurs in connection with an ensemble of thunderstorms and produces a contiguous precipitation area on the order of 100 km or more in horizontal scale in at least one direction. An MCS exhibits deep, moist convective overturning contiguous with or embedded within a mesoscale vertical circulation that is at least partially driven by the convective overturning.

**Mesoscale Convective Vortex:** A warm core mid altitude mesoscale vortex often produced as an MCC or MCS decays and often associated with reoccurrence of convection.

**Mean Radial Velocity:** The component of motion of the target toward or away from the radar.

**Mesocyclone:** A 3-dimensional region in a storm that contains strong cyclonic vertical vorticity (rotates cyclonically) and is closely correlated with severe weather.

**Mesocyclone Strength Rank:** A non-dimensional number based on the following strength parameters: rotational velocity, shear, and gate-to-gate velocity difference.

**Mesocyclone Strength Index:** A non-dimensional value based on the vertical integration of the three strength parameters incorporated into Rank calculations. The vertical integration is divided by the depth of the circulation and is weighted by density.

**Mesoscale:** On a scale of 4 km to 400 km (2.2 nm to 215 nm).

**Misoscale:** On a scale of 40 m to 4 km (130 ft to 2.2 nm).

**Microburst:** Small downburst, 1 to 4 km (0.54 to 2.2 nm) in outflow size, with peak winds lasting 2 to 15 minutes.

**Mid Altitude Radial Convergence:** A deep, mid-level, convergent, velocity signature related to the Deep Convergence Zone, but confined to mid-levels, and found to be a Doppler radar-based precursor of damaging straight-line winds in a linear MCS or bowing convective system.

**Mie Scattering:** Scattering of electromagnetic waves by homogeneous spheres of arbitrary size, named after Gustav Mie (1868–1957), whose theory of 1908 explains the process. Often used in reference to radar waves scattered by particles with small diameters as compared to radar wavelength.

**Mini-Supercell:** Convective storm that contains similar radar characteristics to those of a supercell (e.g., mesocyclone, hook echo, WER, BWER), but is significantly smaller in height and width.

**Misoscale:** On a scale of 40 m to 4 km (130 ft to 2.2 nm).

**Mixing Ratio:** The ratio of the mass of a variable atmospheric constituent to the mass of dry air. If not otherwise indicated, the term normally refers to water vapor.

**Moist-adiabatic Process:** (Also known as saturation-adiabatic process.) An adiabatic process for which the air is saturated and may contain liquid water.

**Nyquist interval:** (Also Nyquist velocity). The maximum time interval between equally spaced samples of a signal that will enable the signal waveform to be completely determined. Also known as the (absolute value) of the maximum unambiguous velocity that can be measured by a Doppler radar, e.g., 50 kts.

**Nyquist Co-Interval:** The full range of the Nyquist interval, e.g., +/- 50 kts.

**Operational Mode:** A combination of one or more volume coverage patterns and products mixes tailored to one or more meteorological situations.

**One-Time Request (OTR):** Requests of products made on a one-time basis via Associated Users.

**Overhang:** A storm has overhang if the edge of the storm component at a given height range (mid-levels) extends outward beyond the edge of the storm component at the lowest elevation by a specified distance.

**Pattern Vector:** A pattern vector is formed by a series of azimuthally adjacent sample volumes of increasing or decreasing Doppler velocity.

**Particulate Matter:** (Also called Particulates.) The term for solid or liquid matter in the form of particles found in the air.

**Pedestal:** In radar, a device for supporting and positioning the antenna. Typically, the pedestal allows the azimuth and elevation angles of the antenna to be controlled separately or in a coordinated way to permit different methods of scanning.

**Planetary Boundary Layer:** The bottom layer of the troposphere that is in contact with the surface of the earth.

**Point Clutter Rejection:** The rejection or removal of echoes having the characteristics of point targets.

**Polarization:** With respect to a transverse electromagnetic wave, the correlation between two orthogonal components of its electric (or, equivalently, magnetic) field.

**Polar Coordinates:** A system of coordinates in which a point is isolated by its distance (range) and angular direction (azimuth) from a fixed reference point. For radars, this reference point is usually the location of the antenna.

**Product Resolution:** The smallest spatial increment of a data element that is distinguishable in a product.

**Precipitation Mode:** System scanning at variable rates to accommodate the greatest number of elevation angles, thus sampling to full radar volume in order to detect precipitation in all its forms.

**Precipitable Water:** (Or precipitable water vapor): The total atmospheric water vapor contained in a vertical column of unit cross-sectional area extending between any two specified levels, commonly expressed in terms of the height to which that water substance would stand if completely condensed and collected in a vessel of the same unit cross section.

**Product:** Output of the WSR-88D receiver in the form of the three base moments (reflectivity, mean radial velocity, and velocity spectrum width) formatted by the RPG as base, derived, or algorithm processed alphanumeric messages, graphic images, or graphic overlays for presentation on a user display system.

**Product Distribution Function:** This RPG function is the distribution of all products requested via RPS lists and One-Time Requests.

**Product Generation Function:** (Sometimes called the Product Generation and Control List). Each volume scan the RPG combines the products requested via the RPS list, One-Time requests, alert generated products, and the default list for the weather mode into one list and these products are then generated.

**Product Generation Table:** A table created in the RPG each volume scan composed of products that are to be generated independent of user requests at the RPG. Separate tables for Precipitation, Clear Air, and Maintenance modes exist.

**Product Storage Loadshedding:** Refers to the removal of a product from the RPG product database prior to the product's expiration time. This is required when the number of products in the RPG database exceeds a specified number (~7000 products). In order to experience loadshedding, many products need to be generated with long storage times (the maximum storage time is 360 minutes).

**Product Resolution:** The smallest spatial increment of data element that is distinguishable in a product.

**Propagation:** Transmission of electromagnetic energy as waves through or along a medium.

**Pulse:** A single short duration transmission of electromagnetic energy.

**Pulse Severe Storm:** A convective storm characterized by a single, strong, updraft pulse producing a short-lived period of large hail or damaging winds at the surface.

**Pulse Width:** The linear distance in range occupied by an individual broadcast from a radar.

**Quadrature (signal):** In radar systems, an orthogonal relationship between two coherent signals in which the phase of one signal is offset by  $90^\circ$  from the phase of the other. Two signals in quadrature may be regarded as a single complex signal. In Doppler radar, the signal is composed of the in-phase and quadrature components.

**Radar:** (Coined word for radio detection and ranging.) An electronic instrument used for the detection and ranging of distant objects of such composition that they scatter or reflect microwave radio energy. A radar consists of a transmitter, receiver, antenna, display, and associated equipment for control and signal processing.

**Radar Data Acquisition System Operability Test (RDASOT):** An off-line program designed to determine the status of the hardware and to enhance its maintainability. RDASOT, executed from the system console, consists of diagnostic tests, calibration tests, and maintainability aids.

**Radar Horizon:** The locus of points at which direct rays from a radar transmitter/antenna become tangential to the earth's surface. The radar horizon extends beyond the geometric and visible horizons in conditions of normal atmospheric refraction. It may be decreased or increased in particular cases as standard propagation is replaced by substandard or superstandard propagation respectively. Beyond the radar horizon, surface targets cannot be detected under normal atmospheric conditions although significant radar power is sometimes detected in the diffraction zone below the horizon.

**Radome:** A dome used to cover the antenna assembly of a radar to protect it from the effects of weather.

**Range Aliasing:** (Also called range folding.) In radar meteorology, a sampling problem that arises when echoes located beyond the maximum unambiguous range ( $R_{\max}$ ) are received as if they were within this radar range. A radar ordinarily computes range to targets by measuring the time interval between the transmission of a pulse and the receipt of the returned signal, assuming that the signal was associated with the pulse just transmitted. However, depending on the pulse, the returned signal may be associated with one of several pulses transmitted prior to the latest one. Therefore, a returned signal, indicated as originating at range  $r$ , could have originated at  $r + R_{\max}$  (second-trip echo), or  $r + 2R_{\max}$  (third-trip echo), etc.

**Range Dealiasing:** (Also known as range unfolding.) The process or processes of removing range ambiguity in apparent range of a multitrip target; that is to assign the correct target range.

**Rayleigh Scattering:** Approximate theory for electromagnetic scattering by small particles named for Lord Rayleigh (John William Strutt, 1842–1919). Commonly used in radar theory referring to particles small as compared to radar wavelength.

**Rear Flank Downdraft:** A downdraft almost exclusively associated with supercell storms found along the rear portion (facing in the direction of storm motion) of the storm and associated with the mesocyclone and often, tornadoes. Sometimes responsible for damaging surface winds.

**Rear Inflow Jet:** A mesoscale circulation feature in which a system-relative current of air enters and flows through the stratiform precipitation region of mesoscale convective systems from the rear. The rear-inflow jet forms in response to the upshear-tilting of the convective circulation, as the horizontal buoyancy gradients along the back edge of the system create a circulation that draws midlevel air in from the rear. The rear-inflow jet supplies potentially cold and dry midlevel air that aids in the production of convective and system-scale downdrafts.

**Rear Inflow Notch:** A channel of weak echo extending from the rear into a convective storm line. Often associated with the rear inflow jet.

**Receiver:** An instrument used to detect the presence of and to determine the information carried by electromagnetic radiation. A receiver includes circuits designed to detect, amplify, rectify, and shape the incoming radio-frequency signals received at the antenna.

**Reflectivity:** A measure of the fraction of radiation reflected by a given surface; defined as a ratio of the radiant energy reflected to the total that is incident upon that surface.

**Refraction:** Changes in the direction of energy propagation (due to changes in speed) as a result of density changes within the propagating medium.

**Refractive Index:** A measure of the amount of refraction. Numerically equal to the ratio of wave velocity in a vacuum to wave speed in the medium.

**Routine Product Scheduler:** Within the RPG, this function publishes the Master Request List for all algorithms to use in processing and generation of each algorithms output. See **Master Request List**.

**Routine Product Set (RPS):** A product list requested on a routine basis from user display systems and external users.

**Scatterer:** Any object capable of reflecting the radar signal.

**Sectorized Hybrid Scan:** A single reflectivity scan composed of data from the lowest four elevation scans. Close to the radar, higher tilts are used to reduce clutter. At further ranges, either the maximum values from the lowest two scans are used or the second scan values are used alone.

**Segment:** As applied in the Storm Segments algorithm, segments are defined as runs of contiguous radar sample volumes greater than or equal to the minimum reflectivity threshold and having a combined length greater than or equal to the segment length threshold.

**Severe Storm:** A storm with a tornado, surface hail  $\geq 3/4$  inch, or wind gusts  $\geq 50$  knots, or a combination of them.

**Shear:** The rate of change of the vector wind in a specified direction normal to the wind direction. Vertical shear is the variation of the horizontal wind in the vertical direction.

**Sidelobe:** Secondary radiated energy maximum other than the radar main beam. Typically contains a small percentage of energy compared to the mainlobe.

**Signal Processor:** A computer processor used to apply a series of algorithms to the output of the receiver in order to estimate the spectral moments contained in the received backscattered signal.

**Signal to Noise Ratio:** A ratio that measures the comprehensibility of data, usually expressed as the signal power divided by the noise power.

**Spectrum Width:** A measure of dispersion of velocities within the radar sample volume. Standard deviation of the mean radial velocity spectrum.

**Split Cut (CS/CD) Scan:** While staying at a particular elevation angle, there is one full rotation using the CS waveform, followed by one full rotation using the CD waveform.

**Spot Blanking:** The ability of the RDA to selectively stop radiation of energy along specific azimuths so as not to cause interference with another facility.

**Stratiform:** Descriptive of clouds or precipitation of extensive horizontal development, as contrasted to the vertically developed convective clouds or precipitation types.

**Storm:** Any disturbed state of the atmosphere, especially as affecting the Earth's surface, and strongly implying destructive and otherwise unpleasant weather. Storms range in scale from tornadoes and thunderstorms, through tropical cyclones, to widespread extra-tropical cyclones.

**Supercell:** An often dangerous convective storm that contains radar characteristics such as the hook echo, WER, BWER but that also contains a deep, persistent mesocyclone characterized most often by cyclonic vorticity and closely associated with the dominant storm updraft and Rear Flank Downdraft. Variations include the "Low Precipitation" (LP), "Classic" (C), and "Heavy Precipitation" (HP) supercells. These storms are often long-lived, often move somewhat differently than other non-severe storms in their environment, and commonly produce severe weather.

**Subrefraction:** The propagation of radar energy under conditions of substandard refraction in the atmosphere; that is, refraction by an atmosphere or section of the atmosphere in which the refractive Index decreases with height. Substandard propagation produces less than normal downward bending, or even upward bending, of the radar beam as it travels through the atmosphere.

**Superrefraction:** The propagation of radar energy under conditions of superstandard refraction (superrefraction) in the atmosphere; that is, refraction by an atmosphere or section of the atmosphere in which the refractive index decreases with height and range. Superstandard propagation produces greater than normal downward bending of radar beams as they travel through the atmosphere, giving extended radar horizons and increased radar coverage. It is caused primarily by propagation through layers near the earth's surface in which the dewpoint temperature is rapidly decreasing or the temperature increases with height.

**Surveillance Waveform:** A constant low PRF (long  $R_{max}$  and low  $V_{max}$ ) scan employed for the entire  $360^\circ$  sweep to determine proper target location and returned power. This PRF is unambiguous over the observing domain (range). Generally used as part of a split cut consisting of a surveillance waveform followed immediately by a range-ambiguous Doppler scan. (See also Contiguous Surveillance (CS) Scan).

**Target:** Precipitation or other phenomena that produce echoes.

**Three-body Scattering:** Radiation from a radar is scattered toward the ground is scattered back to hydrometeors, which then scatter some of the radiation back to the radar.

**Three-body Scatter Spike:** (Also called a "flare echo.") A long, narrow, weak reflectivity, echo artifact sometimes found extending down radial from highly reflective echo cores. Indicative of large hail and caused by forward Mie scattering or radar signals, reflecting from the hail core, to the ground, back to the hail core, and back to the radar.

**Tilt:** A storm is said to have tilt if a line connecting the centroid of a midlevel storm component to the centroid of the lowest storm component is to the right or rear of the direction of movement of the storm.

**Tornado Vortex Signature (TVS):** The Doppler velocity signature of a tornado or incipient tornado-like circulation within any scanned elevation angle. As the signature occurs when the radar beam is wider than the vortex, the measured Doppler velocities are weaker than the rotational velocities within the vortex and the apparent core diameter is larger than that of the vortex. The signature, which may extend throughout a considerable vertical depth, is ideally characterized by extreme Doppler velocity values of opposite sign separated in azimuth by the equivalent of one beamwidth.

**TOVER:** An adaptable parameter (power difference) used in the radar range dealiasing algorithm. The parameter is applied in comparing power returned from a range gate and those separated by the unambiguous range or multiples of that range from the range gate in question.

**Transmitter:** A device used for the generation of signals of any type and form that are to be transmitted. In radio and radar, it is that portion of the equipment that includes electronic circuits designed to generate, amplify, and shape the radio frequency energy that is delivered to the antenna where it is radiated out into space.

**Tropical Cyclone:** The general term for a cyclone that originates over the tropical oceans. This term encompasses tropical depressions, tropical storms, hurricanes, and typhoons.

**Turbulence:** Random and continuously changing air motions that are superposed on the mean motion of the air.

**Unambiguous Range:** The range to which a transmitted pulse wave can travel and return to the radar before the next pulse is transmitted.

**Uncorrelated Shear:** An output of the Mesocyclone Detection Algorithm indicating a region of shear that is large and symmetrical but not vertically correlated.

**Unit Radar Committee:** A committee formed at WSR-88D sites where there is more than one Associated Principal User.

**Updraft:** A small- scale current of air with marked vertical motion that is upward moving.

**Updraft Propagation:** Growth or regeneration of new updraft on the flank of an updraft in a given direction.

**Velocity Aliasing:** (Also called velocity folding.) A basic sampling problem arises when the unambiguous velocity sampling interval is less than the full range of naturally occurring velocities, causing the erroneous appearance of higher velocities within the sampling interval. This phenomenon occurs in Doppler velocity measurements when the maximum unambiguous velocity interval ( $\pm V_{\max}$ ) is less than the full range of velocities being measured. Any true velocity,  $V$ , appears within the interval from  $-V_{\max}$  to  $+V_{\max}$ , with the value  $V^f$ , which is related to the true velocity by  $V = V^f \pm 2nV_{\max}$  where  $n$  is an integer.

**Velocity Dealiasing:** (Also called velocity unfolding.) A process or processes by which ambiguous velocities are assigned their correct unambiguous value.

**Vertically Integrated Liquid (VIL):** Vertical integral of liquid water content obtained from radar observations at different elevation angles within a precipitation volume; has dimensions of mass per unit area. Liquid water content  $M$  is computed from the equivalent reflectivity factor  $Z_e$  using the Marshall-Palmer drop-size distribution

**VIL Density:** VIL divided by the echo top (m) and multiplied by 1000, units are  $\text{g m}^{-3}$ .

**VIL of the Day:** A threshold VIL value associated with hail of  $\frac{3}{4}$  inch diameter or larger on a given day. This value will change from day to day, or even during the same day.

**Volume Coverage Pattern:** A volumetric sampling procedure designed for the surveillance of one or more particular meteorological phenomena.

**Volume Scan:** The process of completing a series of specified scans in a specific sequence.

**Vortex:** In its most general use, any flow possessing vorticity. More often the term refers to a flow with closed streamlines.

**Warning:** A message or condition created when an adverse situation is detected by the system in the WSR-88D hardware or software.

**Waveform:** The pictorial representation of the shape of a wave showing the amplitude variations as a function of time. Often used to also represent other wave properties.

**Waveguide:** A type of conductor used to carry VHF or microwave energy from one point to another. Most waveguides are hollow (rectangular or circular) and carefully dimensioned according to the frequency and energy to be conducted. In radar it provides a path for the microwave energy between the antenna and the transmitting and receiving systems.

**Weak Echo Region (WER):** Within a convective echo a localized region of weak radar echo that is bounded on one side and above by strong echo and associated with the strong updraft region. It is located on the low-altitude inflow or updraft side of the storm.

**Wind Shear:** The local variation of the wind vector or any of its components in a given direction.

**WSR-88D System:** The summation of all hardware, software, facilities, communications, logistics, staffing, training, operations, and procedures specifically associated with the collection, processing, analysis, dissemination, and application of data from the WSR-88D unit.

**WSR-88D Unit:** The combination of one RDA, one RPG, and all associated OPUPs and interconnecting communications.

**$Z_e$ :** See **Equivalent Radar Reflectivity**.

