CHAPTER A7 ATMOSPHERIC PHENOMENA

Page

TABLES

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ATMOSPHERIC PHENOMENA

1. Content. This chapter contains instructions on identifying, recording, and reporting atmospheric phenomena. Definitions of phenomena are in accordance with the WMO International Cloud Atlas.

2. Definitions.

2.1 Meteors. A meteor is a phenomena observed in the atmosphere or on the surface, consisting of precipitation, a suspension or a deposit of liquid water, frozen water, or other particulate matter, or an optical or electrical manifestation. Meteors are classified into four groups, namely, hydrometeors, lithometeors, photometeors, and electrometeors.

2.2 Hydrometeors. A hydrometeor is a meteor consisting of liquid or solid water particles that are falling through or suspended in the atmosphere, blown from the surface by wind, or deposited on exposed surfaces. The most common hydrometeors are defined below.

2.2.1 Rain. Precipitation of liquid water particles, either in the form of drops larger than 0.02 inch (0.5 mm), or smaller drops

which, in contrast to drizzle, are widely separated.

2.2.2 Freezing Rain. Rain which freezes upon impact with the ground, or with objects in flight, or on the ground.

2.2.3 Drizzle. Fairly uniform precipitation composed exclusively of fine drops (diameter less than 0.02 inch or 0.5 mm) very close together. Drizzle appears to float while following air cur-rents, although unlike fog droplets, it falls to the ground. Drizzle drops are too small to disturb, appreciably, still water puddles.

2.2.4 Freezing Drizzle. Drizzle which freezes upon impact with the ground, or with objects in flight, or on the ground.

2.2.5 Snow. Precipitation of snow crystals, mostly branched in the form of six-pointed stars. -- At temperatures higher than about 23 degrees Fahrenheit (-5 degrees Celsius), the crystals are generally clustered to form snowflakes.

2.2.6 Snow Pellets. Precipitation of white, opaque grains of ice. The grains are round or sometimes conical. Diameters range from about 0.08 to 0.2 inch (2 to 5 mm). -- Snow pellets are brittle and easily crushed; when they fall on hard ground, they bounce and often break up.

2.2.7 Snow Grains. Precipitation of very small, white, opaque grains of ice similar in structure to snow crystals. -- When the grains hit hard ground, they do not bounce or shatter. They usually fall in small quantities, mostly from stratus, and never as showers.

2.2.8 Ice Pellets. Precipitation of transparent or translucent pellets of ice, which are round or irregular, rarely conical, and which have a diameter of 0.2 inch (5 mm), or less. -- The pellets usually rebound when striking hard ground, and make a sound on impact. There are two main types:

a. Hard grains of ice consisting of frozen raindrops, or largely melted and refrozen snowflakes (formerly sleet). -- This type falls as continuous or intermittent precipitation.

b. Pellets of snow encased in a thin layer of ice which has formed from the freezing, either of droplets intercepted by the pellets, or of water resulting from the partial melting of the pellets. -- This type falls as showers.

2.2.9 Hail. Precipitation of small balls or other pieces of ice (hail stones) falling separately or frozen together in irregular lumps. -- Hailstones consist of alternate opaque and clear layers of ice in most cases. Hail is normally associated with thunderstorms and surface temperatures above freezing.

2.2.10 Ice Prisms (Ice Crystals). A fall of unbranched (snow crystals are branched) ice crystals in the form of needles, columns, or plates. These are often so tiny that they seem to be suspended in the air. They may fall from a cloud or from clear air. -- In Aviation observations, ice prisms are called Ice Crystals. The crystals are visible mainly when they glitter in

the sunshine or other bright light (diamond dust); they may then produce a luminous pillar or other optical phenomena. This hydrometeor (rarely more than the slightest precipitation) which is frequent in polar regions, occurs only at very low temperatures in stable air masses.

2.2.11 Fog and Ground Fog. A visible aggregate of minute water particles (droplets) which are based at the Earth's surface.

a. Fog reduces horizontal and vertical visibility, and may extend over a sizable area. In Aviation observations, Fog is reported when the depth of the phenomena is greater than approximately 20 feet.

b. Ground Fog has little vertical extent (normally less than 20 feet), and reduces visibility horizontally, but to a lesser extent vertically. The stars may often be seen by night and the sun by day. This is a local phenomena usually formed by radiational cooling of the air. It is often patchy, forming first in low lying areas.

c. When fog is present and the occurrence does not clearly fit the definition of Ground Fog, the phenomena will be reported as Fog.

2.2.12 Ice Fog. A suspension of numerous minute ice - crystals in the air, based at the Earth's surface, which reduces horizontal visibility. -- Unlike Fog, Ice Fog does not produce rime or glaze on cold exposed objects. Temperatures are usually at or below -20 degrees Fahrenheit (approximately -30 degrees Celsius) when Ice Fog forms. However, a mixture of liquid and Ice Fog occasionally forms at temperatures below freezing. This condition may persist for a few hours as the Fog changes to Ice Fog and dissipates due to a drying of the air, even though temperatures continue to fall. Optical effects similar to those associated with ice prisms are observed in Ice Fog (diamond dust, etc.). Temperature-dew point differences may approach 8 degrees Fahrenheit (4 degrees Celsius) or more.

2.2.13 Drifting Snow and Blowing Snow. Snow particles raised from the ground by a strong, turbulent wind.

a. DRIFTING SNOW. Snow particles raised by the wind to small heights above the ground. -- Visibility is not reduced below 7 miles at eye level although obstructions below this level may be veiled or hidden by the particles moving nearly horizontal to the ground.

b. BLOWING SNOW. Snow particles raised and stirred violently by the wind to moderate or great heights. -- Visibility is poor (6 miles or less), and the sky may become obscured when the particles are raised to great heights.

2.2.14 Spray and Blowing Spray.

a. SPRAY. Water droplets torn by the wind from a substantial body of water, generally from the crests of waves, and carried up a short distance into the air.

b. BLOWING SPRAY. Spray raised in such quantities as to reduce

the visibility at eye level (6 feet on shore, 33 feet at sea) to 6 miles or less.

2.2.15 Dew. A deposit of water drops on objects at or near the ground produced by condensation of water vapor from the surrounding clear air.

2.2.16 White Dew. A deposit of white, frozen dew drops. -- White Dew forms as liquid dew, then freezes.

2.2.17 Hoar Frost. A deposit of ice having a crystalline appearance, generally assuming the form of scales, needles, or fans. -- Hoar frost is formed when water vapor is deposited on surfaces whose temperatures are at or below freezing.

2.2.18 Rime. A deposit of ice, produced by fog at temperatures below freezing. It is composed of grains separated by air, sometimes adorned with crystalline branches.

2.2.19 Glaze (Clear Ice). A coating of ice, generally clear and smooth, but with some air pockets. -- It is formed on exposed objects at temperatures below or slightly above the freezing temperature by the freezing of super-cool drizzle or rain drops. Glaze is denser, harder, and more transparent than either rime or hoar frost.

2.2.20 Tornado. A violent, rotating column of air, forming a pendant, usually from a cumulonimbus cloud touching the ground. -- It nearly always starts as a funnel cloud, and is accompanied by a loud roaring noise.

2.2.21 Funnel Cloud. A violent, rotating column of air which does not touch the ground, usually a pendant from a cumulonimbus cloud.

2.2.22 Waterspout. If a funnel cloud forms over a large body of water, such as a bay, gulf, or lake, and touches the water surface, it is called a waterspout.

2.3 Lithometeors. A lithometeor is a meteor consisting of a visible concentration of mostly solid, dry particles. The particles are more or less suspended in the air or lifted from the ground by wind. The more common lithometeors are defined below.

2.3.1 Haze. A suspension in the air of extremely small, dry particles invisible to the naked eye and sufficiently numerous to give the air an opalescent appearance. -- This phenomenon resembles a uniform veil over the landscape that subdues all colors. Dark objects viewed through this veil tend to have a bluish tinge while bright objects, such as the sun or distant lights, tend to have a dirty yellow or reddish hue.

When haze is present and the sun is well above the horizon, its light may have a peculiar silvery tinge. Haze particles may be composed of a variety of substances; e.g., dust, salt, residue from distant fires or volcanoes, pollen. The particles, generally, are well diffused through the atmosphere.

2.3.2 Dust. Fine particles of dust or sand suspended in the air

by a duststorm or sandstorm that may have occurred at or far away from the station. Dust gives a tan or gray tinge to distant objects. The sun's disk is pale and colorless, or has a yellow tinge through dust.

2.3.3 Smoke. A suspension in the air of small particles produced by combustion. This phenomenon may be present either near the Earth's surface or in the free atmosphere. When viewed through smoke, the disk of the sun at sunrise and sunset appears very red. The disk may have an orange tinge when the sun is above the horizon. Evenly distributed smoke from distant sources generally has a light grayish or bluish appearance. A transition to haze may occur when smoke particles have traveled great distances; for example, 25 to 100 miles or more, and when the larger particles have settled out and the remaining particles have become widely scattered through the atmosphere.

* 2.3.4 Volcanic Ash-Dust. Fine particles of rock powder that are blown out from a volcano and that may remain suspended in the atmosphere for long periods producing red sunsets and climatic modifications thousands of miles away.

2.3.5 Dust Devil. A small, vigorous whirlwind, usually of short duration, made visible by dust picked up from the surface.

2.3.6 Blowing Dust. Dust raised by the wind to moderate heights above the ground and restricting horizontal visibility to less than 7 miles. -- In aviation observations, the following are also reported as blowing dust:

a. DUSTSTORM. Same as blowing dust, except visibility is reduced to less than 5/8 mile, but not less than 5/16 mile.

b. SEVERE DUSTSTORM. Same as blowing dust, except visibility is reduced to less than 5/16 mile.

2.3.7 Blowing Sand. Sand raised by the wind to moderate heights above the ground, reducing horizontal visibility to less than 7 miles. -- In Aviation observations, the following are also reported as blowing sand:

a. SANDSTORM. Same as blowing sand, except horizontal visibility is reduced to less than 5/8 mile, but not less than 5/16 mile.

b. SEVERE SANDSTORM. Same as blowing sand, except horizontal visibility is reduced to less than 5/16 mile.

2.4 Photometeors. A photometeor is a luminous phenomenon produced by the reflection, refraction, diffraction, or interference of light from the sun or moon. The most common photometeors are defined below:

2.4.1 Halo Phenomena. A group of phenomena in the form of rings, arcs, pillars, or bright spots produced by the reflection or refraction of sunlight or moonlight by ice crystals suspended in the atmosphere (cirriform clouds, ice fog, etc.). -- Halo phenomena include the following:

a. SMALL HALO. A luminous ring, with the luminary at its center, of 22 degrees radius -- the angle between the lines of sight from the observation point to the luminary and to the ring.

b. LARGE HALO. A luminous ring of 46 degrees radius. -- It is less bright and less common than the small halo.

2.4.2 Corona. One or more sequences of small colored rings centered on the sun or moon. -- A corona is usually smaller than a halo. All the spectral colors may be visible with red on the outside, although the inner colors may not be present. Sometimes the colors are repeated irregularly causing iridescence.

2.4.3 Rainbow. A group of concentric arcs produced on a screen" of falling precipitation by light from the sun or moon. -- The primary bow usually includes violet on the inside and red on the outside. The secondary bow is not as bright, with red on the inside and violet on the outside.

2.4.4 Fog Bow. A primary rainbow consisting of a white band which appears on a screen of fog. -- It is usually fringed with red on the outside and blue on the inside.

2.5 Electrometeors. An electrometeor is a visible or audible manifestation of the atmospheric electricity. The more important electrometeors are defined below.

2.5.1 Thunderstorm. A local storm produced by a cumulonimbus cloud. It is always accompanied by lightning and thunder, usually with strong gusts of wind, heavy rain, and, sometimes, with hail.

2.5.2 Lightning. A flash of light from a sudden electrical discharge which takes place from or inside a cloud, or from high structures on the ground, or from mountains. -- Four main types of lightning can be distinguished:

a. CLOUD TO GROUND LIGHTNING (CG). Lightning occurring between cloud- and ground.

b. CLOUD DISCHARGES (IC). Lightning which takes place within the thunder cloud.

c. CLOUD TO CLOUD DISCHARGES (CC). Streaks of lightning reaching from one cloud to another.

d. AIR DISCHARGES (CA). Streaks of lightning which pass from a cloud to the air, but do not strike the ground.

2.5.3 Aurora. A luminous phenomenon which appears in the - high atmosphere in the form of arcs, bands, draperies, or curtains. This phenomena is usually white, but may have other colors. The lower edges of the arcs or curtains are usually well defined,

while the upper edges are not. Polar aurorae are due to electrically charged particles, ejected from the sun, acting on the rarified gases of the higher atmosphere. The particles are channeled by the Earth's magnetic field, so that aurorae are mainly observed near the magnetic poles.

2.6 Character of Precipitation.

2.6.1 Continuous. Intensity changes gradually, if at all.

2.6.2 Intermittent. Intensity changes gradually, if at all, but precipitation stops and starts at least once within the hour preceding the observation.

2.6.3 Showery. Precipitation changes intensity, or starts and stops abruptly. Showers fall from cumuliform clouds.

2.7 Precipitation Intensity. Intensity of precipitation is an indication of the amount of precipitation falling at the time of observation. It is expressed as light, moderate, or heavy. Each intensity is defined with respect to the type of precipitation occurring; based either on rate-of-fall for rain and ice pellets or visibility for snow and drizzle. The rate-of-fall criteria are based on time, and do not accurately describe the intensity at the time of observation. For this reason, tables A7-1, A7-2, and A7-4 should only be used as a guide to estimate the intensity at the time of observation. Tables A7- 3A and B, on the other hand, are based on the visibility at the time of observation, and must be used to determine intensity of drizzle or snow. If either is occurring alone, use table A7-3A. If snow or drizzle is present with other obscuring phenomena, use table A7-3B as directed in A7-3.6.5.2.

2.8 Miscellaneous Terms.

2.8.1 Core Sample. A core sample is a section cut from the snow cover at a station to determine the amount of water present in the solid state (see 2.8.4).

2.8.2 (WS) Maximum Precipitation. The greatest amount of precipitation measured during the month for specific periods of time. Maximum precipitation is determined at NWS offices having a recording rain gauge.

2.8.3 Snowboard. An aid for measuring new snowfall. The snowboard is made of a piece of thin, light-colored, wooden board, at least 2 feet square, or an equivalent, light-weight, poor conductor of heat.

2.8.4 Water Equivalent. This is the amount of liquid produced by melting frozen precipitation.

2.8.5 Weather Modification. Any attempt at changing or dispersing one or more of the natural meteorological phenomena occurring in the atmosphere.

2.8.6 Freeze. The condition of the lower atmosphere when the

temperature of surface objects is 32 degrees Fahrenheit (0 degrees Celsius) or lower. A freeze may occur with or without frost.

3. Observing and Recording Procedures.

(N, AF) Reporting of beginning and ending times as specified in this section is not required, except as directed in A3-2.13c(3). (Also, see A2-2.2.)

3.1 Tornado, Waterspout. or Funnel Cloud. Report these phenomena in an urgent Special observation when they are observed by station personnel to begin and/or disappear. The report may be a single-element Special. A Special will also be filed if a tornado, waterspout, or funnel cloud is reported by the public within 1 hour of its occurrence, and was not observed by station personnel. Insofar as known, the following should be reported.

a. Source of report, if other than station personnel.

b. Type of phenomenon, spelled out.

c. Time of beginning, ending, or disappearance, or both, to the nearest minute.

d. Location with respect to station, or with reference to a well-known point (show distance in nautical miles).

e. Direction toward which the phenomenon is moving. If this is unknown, enter MOVMT UNKN.

(WS, FAA) Except at A-type stations, the above elements should also appear in the Remarks of the next Record observation if not previously reported in a Record observation.

3.2 Thunderstorm.

3.2.1 Beginning of a Thunderstorm. A thunderstorm is considered to begin at the station when:

a. thunder is heard, or

b. overhead lightning or hail is observed, and the local noise level is such as might prevent hearing thunder.

3.2.2 Ending of a Thunderstorm. A thunderstorm is considered to have ended 15 minutes after the last occurrence of any of the criteria in A7-3.2.l.

3.2.3 Intensity of Thunderstorms. The intensity of a thunderstorm is based on the following characteristics observed within the previous 15 minutes:

a. Thunderstorm (T) - wind gusts less than 50 knots, and hail, if any, less than 3/4 inch (19 mm) in diameter.

b. Severe Thunderstorm (T+) - wind gusts of 50 knots or greater, or hail 3/4 inch or greater in diameter.

3.2.4 Reporting a Thunderstorm. Reports concerning thunderstorms will be made whenever a thunderstorm begins, ends, or increases in intensity. The report will include the following:

a. Type (T or T+).

b. Time of beginning, ending, or both, to the nearest minute.

c. Location (and distance, if known) of each storm center with respect to the station. (Show distance in nautical miles and direction to 8 points of the compass.)

d. Direction toward which the storm is moving. Omit, if unknown.

e. Type and frequency of lightning.

(WS, FAA) Except at A-type stations, update the above remarks and include them with the time of beginning, ending, or both on the next transmitted Record observation if not previously reported in a Record observation.

3.2.5 (WS. FAA) Time of Beginning and or Ending of a Thunderstorm. When the time of beginning or ending of a thunderstorm is reported in a Special, it need not be recorded again until the next transmitted Record observation if not previously reported in a Record observation.

3.3 Reporting Hail. Report hail in a SP or RS observation whenever it begins or ends, and in all observations taken while it is occurring. Times of beginnings and endings will be included either in Remarks at civil stations or by the actual time of observation at military stations. All observations concerning hail shall report the diameter of the largest hailstones (in units and fractions of inches).

3.3.1 (WS. FAA) Time of Beginning and/or Ending of Hail. When the time of beginning or ending of hail is reported in a Special, it need not be recorded again until the next transmitted Record observation if not previously reported in a Record observation.

3.3.2 Intensity of Hail. All occurrences of hail are reported as moderate in Aviation observations.

3.4 Reporting Freezing Precipitation. Take a Special observation whenever freezing precipitation begins, ends, or changes intensity.

3.4.1 (WS. FAA) Time of Beginning and/or Ending of Freezing Precipitation. Except at A-type stations, include the time freezing precipitation began and/or ended in the first observation after the event is first observed. Repeat the time only in the next Record observation if not previously reported in a Record observation.

3.4.2 Intensity of Freezing Precipitation.

3.4.2.1 Freezing Drizzle. When freezing drizzle is occurring alone, determine the intensity by use of Table A7-3A, Visibility as Criteria. Use table A7-3B if drizzle is occurring with other

phenomena. Note that moderate drizzle reduces the visibility to less than 5/8 mile. Only if visibility meets this criteria, can moderate drizzle be reported. Likewise, heavy drizzle can only be reported if the visibility is less than 5/16 of a mile.

3.4.2.2 Freezing Rain. Determine the intensity of freezing rain by using Table A7-1, Rate-of-Fall, as a guide if a recording or totalizing gauge is available; otherwise, use Table A7-2, Estimating Intensity of Rain.

3.5 Reporting Ice Pellets. Take a Special observation whenever ice pellets begin, end, or change intensity.

3.5.1 (WS. FAA) Time of Beginning and/or Ending of Ice Pellets. Include the time ice pellets began and/or ended in the first observation after the event occurs. The times are repeated again only in the next transmitted Record observation if not previously reported in a Record observation.

3.5.2 Intensity of Ice Pellets. The intensity of ice pellets may be estimated by using Table A7-1, Rate-of-Fall Criteria, if recording or totalizing gauges are available; otherwise, estimate the intensity in accordance with Table A7-4, Estimating The Intensity of Ice Pellets.

3.6 Reporting Precipitation. Precipitation of any form is reported in the body of the weather report whenever it is observed to occur at the station. Precipitation observed at a distance from the station is reported in Remarks.

3.6.1 Observing Precipitation. To adequately report and document precipitation, determine:

a. Time of beginning, ending, and changes in intensity.

b. Type, character, and intensity.

c. Data for miscellaneous remarks.

d. Amount.

3.6.2 (WS FAA) Time of Beginning and/or Ending of Precipitation. Except at A-type stations, note to the nearest minute the time that precipitation of any type begins and ends. Report these times in the next Record observation. Report times for separate periods only if the intervening time of no precipitation exceeds 15 minutes. Report the data by identifying the type, using the appropriate symbol, followed by B for began or E for ended, as appropriate, and the time in minutes past the hour; e.g., RB04SBl9RSE43, meaning rain began at 04, snow began at 19, and both types ended at 43 minutes past the hour.

3.6.3 Determining and Reporting Type of Precipitation. Determine the type by using the definitions in section 2 of this chapter. Use the order (liquid, freezing, frozen) and letter symbols from table A3-3 to report precipitation.

3.6.4 Determining the Character of Precipitation. Use the

definitions in A7-2.6 to determine the character of precipitation.

3.6.5 Determining the Intensity of Precipitation.

3.6.5.1 Intensity of Rain. Use table A7-1 as a guide to estimate the intensity of rain on the rate-of-fall basis if a recording or totalizing gauge is available. Estimate that portion of the rate-of-fall associated with the rain if other precipitation is also occurring. If a recording or totalizing gauge is not available, use table A7-2 to estimate the intensity.

* 3.6.5.2 Intensity of Drizzle. Freezing Drizzle. Snow. Snow Pellets. and Snow Grains. If any of these phenomena are occurring alone, use table A7-3A to determine intensity on the basis of visibility. If occurring with other precipitation or obstruction to vision, estimate intensity and then use table A7-3B to determine if your estimate is valid. You cannot use table A7-3B to estimate visibility. Use some other means to estimate intensity before using A7-3B; e.g., size of flakes, accumulation. The intensity assigned will be no greater than that determined using visibility criteria if any of the above were occurring alone. With or without other obscuring phenomena, S+ cannot be reported if the visibility is 5/16 or more and S cannot be reported if the visibility is 5/8 or more.

3.6.6 Reporting Intensity. Report the intensity of precipitation using the symbols in table A3-4.

3.7 Determining the Amount of Precipitation. Amounts of precipitation are expressed in terms of vertical depth. The standard unit of measurement is the inch. The following paragraphs describe the different procedures used in measuring the amount of precipitation.

3.7.1 Priority of Gauges. If more than one type of gauge is available, use the one appearing highest on the following list:

a. Weighing gauge.
b. Stick measurement of tipping-bucket gauge.
c. Eight-inch gauge.
d. Four-inch gauge.
e. All others.

3.7.2 Stick Measurement of Liquid Precipitation. Insert a dry measuring stick into the measuring tube. Permit the stick to rest on the bottom for 2 or 3 seconds. Withdraw the stick and read the depth of precipitation at the upper limit of the wet portion. After measuring the liquid in the measuring tube empty it and pour the liquid (if any) from the overflow container into the measuring tube and measure it. Add the two amounts to get the total precipitation. When the measurements are completed, empty the tube and reassemble the gauge.

3.7.3 Stick Measurement of Solid Precipitation. When solid or freezing precipitation is anticipated, remove the funnel and measuring tube from the gauge. To measure the precipitation, melt the contents of the overflow container, pour the liquid into the measuring tube and measure it as with liquid precipitation. If, because of strong winds, the amount of precipitation is considered

to be unrepresentative, disregard the catch and obtain a measurement by a vertical core sampling (see A7-3.7.6). As an aid in obtaining the measurement of new snowfall, snowboards may be placed on top of the snow after each measurement. Each measurement can then be taken from the top of the snow to the snowboard.

3.7.4 (WS. FAA) Determining Water Equivalent of Solid Precipitation. Selected stations are provided with spring scales for the determination of the water equivalent of solid precipitation. The scales are used in conjunction with the overflow container of an 8-inch non-recording gauge. Determine water equivalent of a snow sample as follows:

a. Attach the empty overflow container to the hook on the spring scale, and read the position of the pointer to the nearest 0.01 inch.

b. Obtain a snow sample in the overflow container.

c. Attach the overflow container with the sample to the scale, and read the position of the pointer to the nearest 0.01 inch.

d. Determine the water equivalent by subtracting the reading found in a. from the reading found in c.

3.7.5 Core Sampling and Depth Measurements. Select, for core sampling and depth measurements, an area that is smooth, level, preferably grass covered, and as free from drifting as possible. Paved areas and low spots where water tends to collect should be avoided. The size and utilization of the area should permit samples and measurements to be taken in undisturbed snow. The deeper the snow and the greater the drifting, the greater the distance between samples will have to be in order to prevent intersection of the holes, nonrepresentative melting, erosion, or piling up of snow in the holes. The observer should start his measurements along the edge of the area nearest the office to avoid unnecessary tracking of the snow. Unless the snow is very deep, and drifting is pronounced, a sample cut 2 feet from previous samples should be adequate.

3.7.6 Water Equivalent of Core Samples. Irregularities caused by uneven terrain, drifting, footsteps, prior sampling, etc., usually introduce some unavoidable errors in this type of water-equivalent measurement. Some of these errors can be materially reduced by the following procedure:

a. Measure the snow depth, to tenths of an inch, at the spot where the core sample has been taken.

b. Measure the snow depth at the most representative location available, to tenths of an inch, as accurately as practicable.

c. Using the snow depth found in a. and its water equivalent, determine the density of the snowpack by dividing the water equivalent by the depth.

d. Multiply the snow depth from b. by the density of the core

sample in step c. to obtain the adjusted water
-- equivalent of the snowpack.

3.7.7 Estimation of Water Equivalent of Snow. When the water equivalent of snow cannot be accurately measured by melting, weighing, or core sampling; estimate the water equivalent to the nearest 0.01 inch. (See A3-2.44.l.)

3.7.8 (WS. N) Determination of Three-hour Accumulation of Precipitation. Insofar as possible, determine the amount of precipitation to be reported in the 3-Hourly observation using a method that will not affect the measurement of the 6-Hourly observation. If a weighing gauge is not available, use the uncorrected reading of the tipping-bucket gauge or a stick measurement of the 8-inch gauge. Do not empty the gauge unless it is necessary to obtain a complete measurement of the accumulation (if the precipitation exceeded 2 inches). In the case of solid precipitation, estimate the water equivalent by using the ratio of water to snow considered most representative if a weighing rain gauge is not available.

3.8 Depth Measurement of Solid Forms. For the purpose of depth measurements, the term snow also includes ice pellets, glaze, hail, any combination of these, and sheet ice formed directly or indirectly from precipitation. Therefore, if snow falls, melts, and refreezes, the depth of ice formed will be included in depth measurements of snow. Depth is determined to the nearest 0.1 inch.

3.8.1 Measurement of Total Depth. Measurement of the total depth will be made in accordance with the following instructions:

3.8.1.1 Undrifted Snow. Thrust the measuring stick vertically into the snow so that the end rests on the ground surface. Repeat at several spots and take the average of the readings as the snow depth. If the ground is covered with ice, cut through the ice with some suitable implement, and measure the thickness. Add the thickness of the ice to the depth of snow above the ice.

3.8.1.2 Drifted Snow. When the snow has drifted, a reasonably accurate depth measurement may be made by taking the average of several measurements over representative areas. These should include the greatest and least depths. For example, if spots with no snow are visible, one of the values should be zero.

3.8.1.3 Snow Stakes. Snow stakes should be used as a last resort to obtain depth measurements of a snowpack. They should be placed in the most representative area available, for use when it is likely that routine core sampling may disturb an otherwise representative area for subsequent use. Depth measurements used in adjusting water equivalent of core samples should be made to tenths of an inch, as far as practicable, without disturbing the snow within a few feet of the stake.

3.8.2 Snowfall within Specified Periods. If practicable, make these measurements on a surface that has been cleared of previous snowfall. If such a spot is not available, and snow boards are not in place, measure the total depth of snow and subtract the depth previously measured. When it is likely that melting and settling of the snow makes such measurements of questionable value, they should be considered as estimated. If the previous snowfall has crusted, the new fall may be measured by permitting the end of the measuring stick to rest on the crust. If different falls of snow are mixed by drifting, measure the total depth of snow and subtract the previously measured depth. The remainder is the approximate depth of the new fall, which will -be adjusted, if necessary, to correct for suspected melting, evaporation, and runoff. For example, if several snow showers occur between observations, and each melts before the following one occurs, the total snowfall for the period will be the sum of the maximum depth (measured or estimated) for each occurrence. Estimate the depth only when the maximum is considered to have occurred between scheduled observations at a time impracticable for measuring depth.

3.9 Obstructions to Vision.

3.9.1 Reporting Obstructions to Vision. Include obstructions to vision in the body of a report if prevailing visibility is reduced to 6 miles or less, and the obstruction is present at the station. If the visibility is reduced to less than 7 miles by an obstruction at a distance from the station, the phenomenon is described in Remarks.

a. If more than one type of obstruction to vision is occurring at the same time, report them in order of decreasing predominance if discernible.

b. (WS) Note the times during which an obstruction to vision at the station reduces the prevailing visibility to 6 miles or less. Record the beginning and ending times in columns 83 and 84 only if the obstruction was present at the station.

3.9.2 Operationally Significant Remarks for Obstructions to Vision. Any occurrence of an obstruction to vision which, in the opinion of the observer, is operationally significant and not reported elsewhere in the observation, should be reported clearly in Remarks. Some examples of desirable items to be entered in Remarks are: fog dissipating or increasing, smoke drifting over field, shallow ground fog, drifting snow, obstructions to vision at a distance from but, not at the station.

3.10 Aurorae and Photometeors. When these phenomena are observed, record pertinent data such as time of beginning and ending, and the elevation and azimuth angles of the display with respect to true north in block 90. Navy and Air Force units located north of 45 degrees latitude will enter these data in

Remarks and transmit as part of the Record observation in accordance with table A3-8B(5).

* 3.11 (WS. FAA) Volcanic Eruption. When observed, volcanic eruptions will be reported and disseminated by a single element, urgent Special (USP) observation. The report will be plain language and contain the following if known:

a. Name of volcano.

b. Latitude and longitude or direction and approximate distance from station.

c. Date/Time (UTC) of eruption.

d. Size description, approximate height, and direction of movement of ash cloud.

e. Any other pertinent data about eruption.

EXAMPLE

HOM USP 1510 MT. AUGUSTINE VOLCANO 70 MILES SW ERUPTED 230005 LARGE ASH CLOUD EXTENDING TO APPROX 30000 FEET MOVING NE

NOTE: Pre-eruption volcanic activity will not be reported. This means unusual and/or increasing volcanic activity which could presage a volcanic eruption.

TABLE A7-1.
ESTIMATING INTENSITY OF RAIN OR ICE PELLETS ON A RATE-OF-FALL BASIS

Light Scattered drops or pellets that do not completely wet or cover an exposed surface, regardless of duration to 0.10 inch per hour; maximum 0.01 inch in 6 minutes.

Moderate 0.11 inch to 0.30 inch per hour; more than 0.01 inch to 0.03 inch in 6 minutes.

Heavy More than 0.30 inch per hour; more than 0.03 inch in 6 minutes.

TABLE A7-2. ESTIMATING THE INTENSITY OF RAIN

Light Scattered drops that do not completely wet an exposed surface, regardless of duration to a condition where individual drops are easily seen; slight spray is observed over pavements; puddles form slowly; sound on roofs ranges from slow pattering to gentle swishing; steady small streams may flow in gutters and downspouts.

Moderate Individual drops are not clearly identifiable; spray is observable just above pavements and other hard surfaces, puddles form rapidly; downspouts on buildings seen 1/4 to 1/2 full; sound on roofs ranges from swishing to gentle roar.

Heavy Rain seemingly falls in sheets; individual drops are not identifiable; heavy spray to height of several inches is observed over hard surfaces; downspouts run more than 1/2 full; visibility is greatly reduced; sound on roofs resembles roll of drums or distant roar.

TABLE A7-3A. INTENSITY OF DRIZZLE OR SNOW, OCCURRING ALONE, WITH VISIBILITY

Light Visibility 5/8 statute mile or more.

Moderate Visibility less than 5/8 statute mile, but not less than 5/16 statute mile.

Heavy Visibility less than 5/16 statute mile.

* TABLE A7-3B. DETERMINING THE VALIDITY OF AN ESTIMATED INTENSITY OF DRIZZLE OR SNOW, OCCURRING WITH OTHER OBSCURING PHENOMENA, BY COMPARING IT WITH THE VISIBILITY

TO REPORT INTENSITY AS:	VISIBILITY MUST BE:
Light	Any reportable value.
Moderate	Less than 5/8 mile.
Heavy	Less than 5/16 mile.

Estimate intensity first. The estimate is valid only if it meets the visibility criteria in this table.

TABLE A7-4. ESTIMATING THE INTENSITY OF ICE PELLETS

Light	Few pellets falling with little accumulation.
Moderate	Slow accumulation.
Heavy	Rapid accumulation.

Excerpts from other Sections - Weather Symbols

ENTRIES ON METEOROLOGICAL FORM 1-10 A3-79
* TABLE A3-12. CLOUD TYPES AND OBSCURING PHENOMENA

CLOUD TYPES	CONTRACTIONS
Altocumulus	AC
Altocumulus castellanus	ACCAS
Altocumulus (standing lenticular)	ACSL
Altostratus	AS

Cirrocumulus	CC
Cirrocumulus (standing lenticular)	CCSL
Cirrostratus	CS
Cirrus	CI
Cumulonimbus	CB
Cumulonimbus mamma (Mammatocumulus)	CBMAM
Cumulus	CU
Cumulus Fractus	CUFRA
Towering Cumulus	TCU
Stratus Fractus	STFRA
Nimbostratus	NS
Stratocumulus	SC
Stratocumulus (standing lenticular)	SCSL
Stratus	ST

SYMBOLS USED IN COLUMN 13 WITH THE AMOUNT OF SKY OBSCURED WHEN -X REPORTED IN COLUMN 3

PRECIPITATION

Drizzle (any form and intensity including ZL)	L
Ice Crystals	IC
Rain (any form and intensity including RW and ZR)	R
Snow (any form and intensity including SW, SP, and SG)	S
Ice Pellets	IP

HYDROMETEORS OTHER THAN PRECIPITATION

Blowing Snow	BS
Blowing Spray	BY
Fog (any form including GF and IF)	F

LITHOMETEORS

Volcanic Ash	Volcanic Ash
Dust (including BD)	D
Haze	H
Sand (including BN)	N
Smoke	K

A3-54 ENTRIES ON METEOROLOGICAL FORM 1-10

TABLE A3-3. SYMBOLS FOR WEATHER AND OBSTRUCTIONS TO VISION

WEATHER

TORNADO	always	Freezing Rain	ZR
WATERSPOUT	written out	Freezing Drizzle	ZL
FUNNEL CLOUD	in full	Ice Pellets	IP
Severe Thunder-storm	T+	Ice Pellet Showers	IPW
		Snow	S
Thunderstorm	T	Snow Showers	SW
Rain	R	Snow Pellets	SP
Rain Showers	RW	Snow Grains	SG
Drizzle	L	Ice Crystals	IC
Hail	A		

OBSTRUCTIONS TO VISION

VOLCANIC ASH	always written out in full	Blowing Dust	BD
		Ice Fog	IF
		Haze	H
Fog	F	Smoke	K
Ground Fog	GF	Dust	D
Blowing Snow	BS	Blowing Spray	BY
Blowing Sand	BN		

I1. Combinations of these symbols are entered in the following order:

a. TORNADO, FUNNEL CLOUD, or WATERSPOUT

b. Thunderstorm

c. Liguid precipitation, in order of decreasing intensity.

d. Freezing precipitation, in order of decreasing intensity.

e. Frozen precipitation, in order of decreasing intensity.

f. Obstructions to vision, in order of decreasing predominance, if discernible.

2. Obstructions to vision are reported in column 5 only when the prevailing visibility is 6 miles or less and the obstruction to vision is occurring at the station. If the stationps visibility is reduced to 6 miles or less by obscuring phenopena not at the station, report the phenomena in Remarks. DO NOT assign precipitation intensity symbols to obstructions to vision.