METAR Product Description

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National Oceanic and Atmospheric Administration

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Table of Contents

1 Introduction

This document is intended to serve as a reference for the description of the METAR data product format for the NetxGen Network Enabled Weather (NNEW) program.

The METAR product description information in this document is from the Aviation Weather Services Advisory Circular 00-45F.

> *"Aviation Weather Services, Advisory Circular 00-45F, is published jointly by the National Weather Service (NWS) and the Federal Aviation Administration (FAA). This publication supplements its companion manual Aviation Weather, Advisory Circular 00-6A, which documents weather theory and its application to the aviation community.*
>
> *This advisory circular, AC 00-45F, explains U.S. aviation weather products and services. It details the interpretation and application of advisories, coded weather reports, forecasts, observed and prognostic weather charts, and radar and satellite imagery. Product examples and explanations are taken primarily from the Aviation Weather Center's Aviation Digital Data Service website (http://adds.aviationweather.noaa.gov/).*
>
> *The AC 00-45F was written primarily by Robert A. Prentice and Douglas D. Streu, and edited by Cynthia Abelman. Additional contributors include Raymond Tanabe, Larry Burch, Duane Carpenter, Kathleen Schlachter, Lisa Glikbarg, Celia Miner, Jon Osterberg, Ronald Olson and Richard Akers.*
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> *An on-line version of this document, which includes links to additional information, can be found at: http://www.srh.noaa.gov/faa/*
>
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[1] Prentice, Robert A. and Streu, Douglas D. and ed.(Oct., 2007), "Aviation Weather Services, Advisory Circular 00-45F", [Web URL: http://www.srh.noaa.gov/faa/pubs.html]

2 METAR Production Description

2.1 Aviation Routine Weather Reports (METAR) and Selected Special Weather Reports (SPECI)[2]

Surface weather observations are fundamental to all meteorological services. Observations are the basic information upon which forecasts and warnings are made in support of a wide range of weather sensitive activities within the public and private sectors, including aviation.

Although the METAR/SPECI code is used worldwide, each country is allowed to make modifications or exceptions to the code for use in their particular country. This section will focus on the U.S. modifications and exceptions. METAR/SPECIs are available online at: http://adds.aviationweather.gov/metars/

2.1.1 Aviation Routine Weather Report (METAR)

Aviation Routine Weather Report (METAR) is the primary observation code used in the U. S. to satisfy World Meteorological Organization (WMO) and International Civil Aviation Organization (ICAO) requirements for reporting surface meteorological data. A METAR report includes the airport identifier, time of observation, wind, visibility, runway visual range, present weather phenomena, sky conditions, temperature, dew point, and altimeter setting. Excluding the airport identifier and the time of observation, this information is collectively referred to as "the body of the report." As an addition, coded and/or plain language information elaborating on data in "the body of the report" may be appended to the end of the METAR in a section coded as "Remarks." The contents of the "Remarks" section vary with the type of reporting station. The METAR may be abridged at some designated stations only including a few of the mentioned elements.

2.1.2 Selected Special Weather Report (SPECI)

A Selected Special Weather Report (SPECI) is an unscheduled report taken when any of the criteria given in Table 2-1 are observed during the interim period between the hourly reports. SPECI contains all data elements found in a METAR plus additional plain language information which elaborates on data in the body of the report. All SPECIs are made as soon as possible after the relevant criteria are observed.

Whenever SPECI criteria are met at the time of the routine METAR, a METAR is issued.

Table 2-1 SPECI Criteria

1	**Wind Shift**	Wind direction changes by 45 degrees or more in less than 15 minutes and the wind speed is 10 knots or more throughout the wind shift.

[2] Prentice, Robert A. and Streu, Douglas D. and ed.(Oct., 2007), "Aviation Weather Services, Advisory Circular 00-45F", [Web URL: http://www.srh.noaa.gov/faa/pubs.html]

2	**Visibility**	Surface visibility as reported in the body of the report decreases to less than, or if below, increases to equal or exceed: a. 3 miles b. 2 miles c. 1 mile d. The lowest standard instrument approach procedure minimum as published in the National Ocean Service (NOS) *U.S Instrument Procedures*. If none published use ½ mile.
3	**Runway Visual Range (RVR)**	The highest value from the designated RVR runway decreases to less than, or if below, increases to equal or exceed 2,400 feet during the preceding 10 minutes. U.S. military stations may not report a SPECI based on RVR.
4	**Tornado, Funnel Cloud, or Waterspout**	a. is observed. b. disappears from sight, or ends.
5	**Thunderstorm**	a. begins (a SPECI is not required to report the beginning of a new thunderstorm if one is currently reported). b. ends.
6	**Precipitation**	a. hail begins or ends. b. freezing precipitation begins, ends, or changes intensity. c. ice pellets begin, end, or change intensity
7	**Squalls**	When they occur
8	**Ceiling**	The ceiling (rounded off to reportable values) forms or dissipates below, decreases to less than, or if below, increases to equal or exceed: a. 3,000 feet. b. 1,500 feet c. 1,000 feet d. 500 feet e. The lowest standard instrument approach procedure minimum as published in the National Ocean Service (NOS) *U.S Instrument Procedures.* If none published, use 200 feet.
9	**Sky Condition**	A layer of clouds or obscurations aloft is present below 1,000 feet and no layer aloft was reported below 1,000 feet in the preceding METAR or SPECI.
10	**Volcanic Eruption**	When an eruption is first noted
11	**Aircraft Mishap**	Upon notification of an aircraft mishap, unless there has been an intervening observation
12	**Miscellaneous**	Any other meteorological situation designated by the responsible agency of which , in the opinion of the observer, is critical.

2.1.3 Format

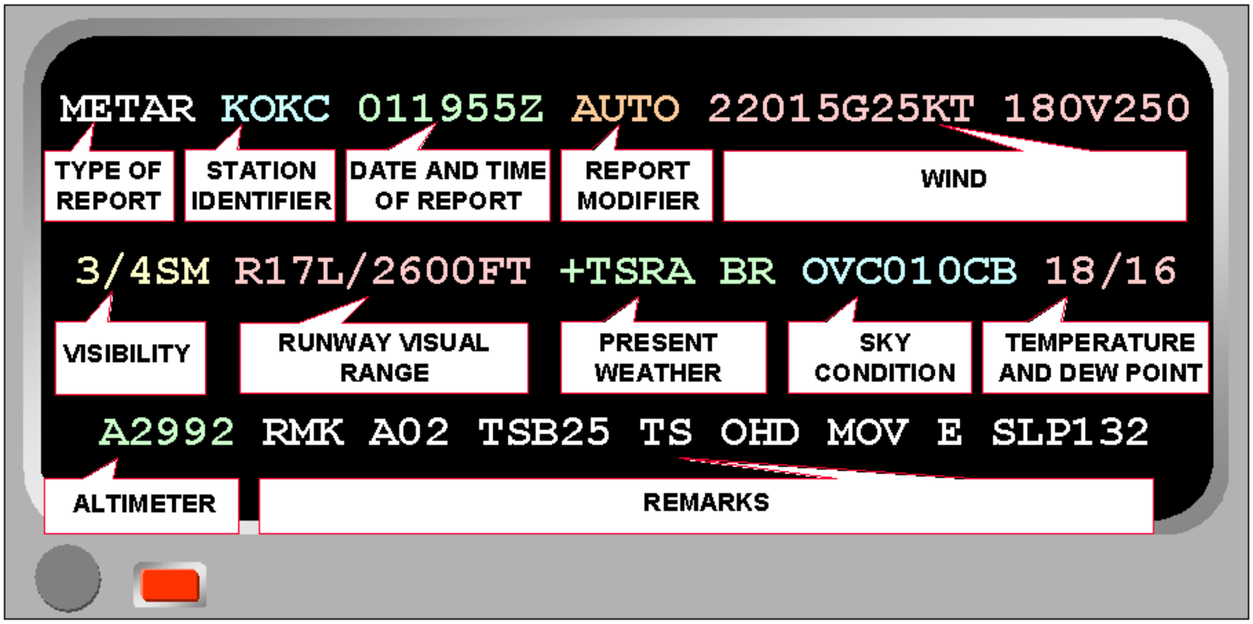

Figure 2-1 METAR/SPECI Coding Format

A METAR/SPECI (Figure 2-1) has two major sections: the Body (consisting of a maximum of 11 groups) and the Remarks (consisting of 2 categories). Together, the body and remarks make up the complete METAR/SPECI. When an element does not occur, or cannot be observed, the corresponding group is omitted from that particular report.

2.1.3.1 Type of Report

METAR KOKC 011955Z AUTO 22015G25KT 180V250 3/4SM R17L/2600FT +TSRA BR OVC010CB 18/16 A2992 RMK AO2 TSB25 TS OHD MOV E SLP132

The type of report, **METAR** or **SPECI** precedes the body of all reports.

2.1.3.2 Station Identifier

METAR **KOKC** 011955Z AUTO 22015G25KT 180V250 3/4SM R17L/2600FT +TSRA BR OVC010CB 18/16 A2992 RMK AO2 TSB25 TS OHD MOV E SLP132

The station identifier, in ICAO format, is included in all reports to identify the station to which the coded report applies.

The ICAO airport code is a four-letter alphanumeric code designating each airport around the world. The ICAO codes are used for flight planning by air traffic controllers and airline operation departments. These codes are not the same as the International Air Transport Association (IATA) codes encountered by the general public used for reservations, baggage handling and in airline timetables. ICAO codes are also used to identify weather stations located on- or off-airport.

Unlike the IATA codes, the ICAO codes have a regional structure. For example, the first letter is allocated by continent (**Figure 2-2**), the second is a country within the continent; the remaining two are used to identify each airport.

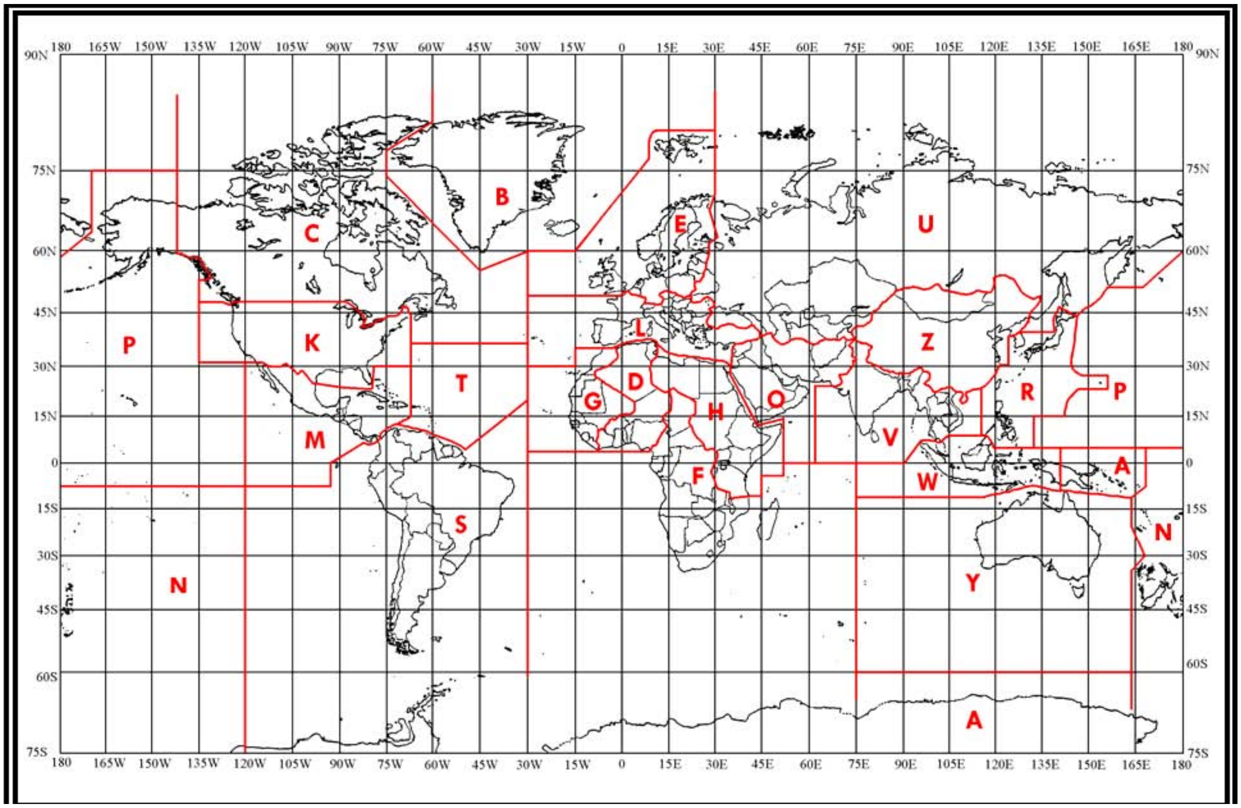

Figure 2-2 ICAO Continent codes

In the contiguous U. S., ICAO station identifiers are coded K followed by the three-letter IATA identifier. For example, the Seattle, Washington (IATA identifier SEA) becomes the ICAO identifier KSEA.

ICAO station identifiers in Alaska, Hawaii, and Guam begin with the continent code P, followed by the proper country code (A, H, and G respectively), and the two-letter airport identifier.

Examples:

PANC	Anchorage, AK
PAOM	Nome, AK
PHNL	Honolulu, HI
PHKO	Keahole Point, HI
PGUM	Agana, Guam
PGUA	Anderson AFB, Guam

Canadian station identifiers begin with C, followed by the country code, and the two-letter airport identifier.

Examples:

CYYZ	Toronto, Canada
CYYC	Calgary Canada
CYQB	Quebec, Canada
CYXU	London, Canada
CZUM	Churchill Falls, Canada

Mexican and western Caribbean station identifiers begin with M, followed by the proper country code and two-letter airport identifier.

Examples:

MMMX	Mexico City, Mexico
MUGM	Guantanamo Bay, Cuba
MDSD	Santo Domingo, Dominican Republic
MYNN	Nassau, Bahamas

Eastern Caribbean station identifiers begin with T, followed by the proper country code, and airport identifier.

Examples:

TJSJ	San Juan, Puerto Rico
TIST	Saint Thomas, Virgin Islands

For a list of Alaskan, Hawaiian, Canadian, Mexican, Pacific, and Caribbean ICAO identifiers see FAA Order 7350.7. For a complete worldwide listing, see ICAO Document 7910, "Location Indicators." Both are available on-line.

2.1.3.3 Date and Time of Report

METAR KOKC **011955Z** AUTO 22015G25KT 180V250 3/4SM R17L/2600FT +TSRA BR OVC010CB 18/16 A2992 RMK AO2 TSB25 TS OHD MOV E SLP132

The date and time is coded in all reports as follows: the day of the month is the first two digits (**01**) followed by the hour (**19**), and the minutes (**55**). The coded time of observations is the actual time of the report or when the criteria for a SPECI is met or noted. If the report is a correction to a previously disseminated report, the time of the corrected report is the same time used in the report being corrected. The date and time group always ends with a **Z** indicating Zulu time (or UTC). For example, METAR KOKC 011955Z would be disseminated as the 2000 hour scheduled report for station KOKC taken on the 1st of the month at 1955 UTC.

2.1.3.4 Report Modifier (As Required)

METAR KOKC 011955Z **AUTO** 22015G25KT 180V250 3/4SM R17L/2600FT +TSRA BR OVC010CB 18/16 A2992 RMK AO2 TSB25 TS OHD MOV E SLP132

The report modifier, **AUTO**, identifies the METAR/SPECI as a fully automated report with no human intervention or oversight. In the event of a corrected METAR or SPECI, the report modifier, **COR**, is substituted for AUTO.

2.1.3.5 Wind Group

```
METAR KOKC 011955Z AUTO 22015G25KT 180V250 3/4SM R17L/2600FT +TSRA BR
OVC010CB 18/16 A2992 RMK AO2 TSB25 TS OHD MOV E SLP132
```

Wind is the horizontal motion of air past a given point. It is measured in terms of velocity, which is a vector that includes direction and speed. It indicates the direction the wind is coming FROM.

In the wind group, the wind direction is coded as the first three digits (220) and is determined by averaging the recorded wind direction over a 2-minute period. It is coded in tens of degrees relative to true north using three figures. Directions less than 100 degrees are preceded with a 0. For example, a wind direction of 900 is coded as 090.

Immediately following the wind direction is the wind speed coded in two or three digits (15). Wind speed is determined by averaging the speed over a 2-minute period and is coded in whole knots using the units, tens digits and, when required, the hundreds digit. When wind speeds are less than 10 knots, a leading zero is used to maintain at least a two digit wind code. For example, a wind speed of 8 knots will be coded 08KT. The wind group is always coded with a KT to indicate wind speeds are reported in knots. Other countries may use kilometers per hour (KPH) or meters per second (MPS) instead of knots.

Examples:

05008KT	Wind 50 degrees at 8 knots
15014KT	Wind 150 degrees at 14 knots
340112KT	Wind 340 degrees at 112 knots

2.1.3.5.1 Wind Gust

Wind speed data for the most recent 10 minutes is examined to evaluate the occurrence of gusts. Gusts are defined as rapid fluctuations in wind speed with a variation of 10 knots or more between peaks and lulls. The coded speed of the gust is the maximum instantaneous wind speed.

Wind gusts are coded in two or three digits immediately following the wind speed. Wind gusts are coded in whole knots using the units, tens, and, if required, the hundreds digit. For example, a wind out of the west at 20 knots with gusts to 35 knots would be coded **27020G35KT**.

2.1.3.5.2 Variable Wind Direction (speed 6 knots or less)

Wind direction may be considered variable when, during the previous 2-minute evaluation period, the wind speed was 6 knots or less. In this case, the wind may be coded as VRB in place of the 3-digit wind direction. For example, if the wind speed was recorded as 3 knots, it would be coded **VRB03KT**.

2.1.3.5.3 Variable Wind Direction (speed greater than 6 knots)

Wind direction may also be considered variable when, during the 2-minute evaluation period, it varies by 60 degrees or more and the speed is greater than 6 knots. In this case a variable wind direction group immediately follows the wind group. The directional variability is coded in a clockwise direction and consists of the extremes of the wind directions separated by a **V**. For example, if the wind is variable from 180º to 240º at 10 knots, it would be coded **21010KT 180V240**.

2.1.3.5.4 Calm Wind

When no motion of air is detected, the wind is reported as calm. A calm wind is coded as **00000KT**.

2.1.3.6 Visibility Group

METAR KOKC 011955Z AUTO 22015G25KT 180V250 **3/4SM** R17L/2600FT +TSRA BR OVC010CB 18/16 A2992 RMK AO2 TSB25 TS OHD MOV E SLP132

Visibility is a measure of the opacity of the atmosphere.

Prevailing visibility is the reported visibility considered representative of recorded visibility conditions at the station during the time of observation. It is the greatest distance that can be seen throughout at least half of the horizon circle, not necessarily continuous.

Surface visibility is the prevailing visibility from the surface at manual stations or the visibility derived from sensors at automated stations.

The visibility group is coded as the surface visibility in statute miles. A space is coded between whole numbers and fractions of reportable visibility values. The visibility group ends with **SM** to indicate that the visibility is in statute miles. For example, a visibility of one and a half statute miles is coded **1 1/2SM**. Other countries may use meters (no code).

Automated stations use an **M** to indicate “less than.” For example, **M1/4SM** means a visibility of less than one-quarter statute mile.

2.1.3.7 Runway Visual Range (RVR) Group

METAR KOKC 011955Z AUTO 22015G25KT 180V250 3/4SM **R17L/2600FT** +TSRA BR OVC010CB 18/16 A2992 RMK AO2 TSB25 TS OHD MOV E SLP132

The runway visual range (RVR) is an instrument-derived value representing the horizontal distance a pilot may see down the runway.

RVR is reported whenever the station has RVR equipment and prevailing visibility is 1 statute mile or less and/or the RVR for the designated instrument runway is 6,000 feet or less. Otherwise the RVR group is omitted.

Runway visual range is coded in the following format: the initial **R** is code for runway and is followed by the runway number. When more than one runway is defined with the same runway number a directional letter is coded on the end of the runway number. Next is a solidus /; followed by the visual range in feet and then **FT** completes the RVR report. For example, an RVR value for Runway 01L of 800 feet would be coded **R01L/0800FT**. Other countries may use meters.

RVR values are coded in increments of 100 feet up to 1,000 feet, increments of 200 feet from 1,000 feet to 3,000 feet, and increments of 500 feet from 3,000 feet to 6,000 feet. Manual RVR is not reported below 600 feet. At automated stations, RVR may be reported for up to four designated runways.

When the RVR varies by more than one reportable value, the lowest and highest values will be shown with **V** between them indicating variable conditions. For example, the 10-minute RVR for runway 01L varying between 600 and 1,000 feet would be coded **R01L/0600V1000FT**.

If RVR is less than its lowest reportable value, the visual range group is preceded by **M**. For example, an RVR for runway 01L of less than 600 feet is coded **R01L/M0600FT**.

If RVR is greater than its highest reportable value, the visual range group is preceded by a **P**. For example, an RVR for runway 27 of greater than 6,000 feet will be coded **R27/P6000FT**.

2.1.3.8 Present Weather Group

```
METAR KOKC 011955Z AUTO 22015G25KT 180V250 3/4SM R17L/2600FT +TSRA BR
OVC010CB 18/16 A2992 RMK AO2 TSB25 TS OHD MOV E SLP132
```

Present weather includes precipitation, obscurations, and other weather phenomena. The appropriate notations found in Table 2-2 are used to code present weather.

Table 2-2 METAR/SPECI Notations for Reporting Present Weather[1]

QUALIFIER		WEATHER PHENOMENA		
INTENSITY OR PROXIMITY 1	**DESCRIPTOR** 2	**PRECIPITATION** 3	**OBSCURATION** 4	**OTHER** 5
- Light	**MI** Shallow	**DZ** Drizzle	**BR** Mist	**PO** Dust/Sand whirls
Moderate[2]	**PR** Partial	**RA** Rain	**FG** Fog	**SQ** Squalls
+ Heavy	**BC** Patches	**SN** Snow	**FU** Smoke	**FC** Funnel Cloud, Tornado, or Waterspout[4]
VC In the Vicinity[3]	**DR** Low Drifting	**SG** Snow Grains	**VA** Volcanic Ash	**SS** Sandstorm

	BL Blowing	**IC** Ice Crystals (Diamond Dust)	**DU** Widespread Dust	**DS** Duststorm
	SH Shower(s)	**PL** Ice Pellets	**SA** Sand	
	TS Thunderstorms	**GR** Hail	**HZ** Haze	
	FZ Freezing	**GS** Small Hail and/or Snow Pellets **UP** Unknown Precipitation	**PY** Spray	

1. The weather groups are constructed by considering columns 1 to 5 in the table above in sequence, i.e., intensity followed by description, followed by weather phenomena, e.g., heavy rain shower(s) is coded as +SHRA.
2. To denote moderate intensity no entry or symbol is used.
3. See text for vicinity definitions.
4. Tornadoes and waterspouts are coded as +FC.

Separate groups are used for each type of present weather. Each group is separated from the other by a space. METAR/SPECI reports contain no more than three present weather groups.

When more than one type of present weather is reported at the same time, present weather is reported in the following order:

- Tornadic activity – Tornado, Funnel Cloud, or Waterspout.
- Thunderstorm(s) with and without associated precipitation.
- Present weather in order of decreasing dominance, i.e., the most dominant type is reported first.
- Left-to-right in Table 2-2 (Columns 1 through 5).

Qualifiers may be used in various combinations to describe weather phenomena. Present weather qualifiers fall into two categories: intensity (Section 2.1.3.8.1) or proximity (Section 2.1.3.8.2) and descriptors (Section 2.1.3.8.3).

2.1.3.8.1 Intensity Qualifier

The intensity qualifiers are light, moderate, and heavy. They are coded with precipitation types except ice crystals (**IC**) and hail (**GR or GS**) including those associated with a thunderstorm (**TS**) and those of a showery nature (**SH**). Tornadoes and waterspouts are coded as heavy (**+FC**). No intensity is ascribed to the obscurations of blowing dust (**BLDU**), blowing sand (**BLSA**), and blowing snow (**BLSN**). Only moderate or heavy intensity is ascribed to sandstorm (**SS**) and duststorm (**DS**).

When more than one form of precipitation is occurring at a time or precipitation is occurring with an obscuration, the reported intensities are not cumulative. The reported intensity will not be greater than the intensity for each form of precipitation.

2.1.3.8.2 Proximity Qualifier

Weather phenomena occurring beyond the point of observation (between 5 and 10 statute miles) are coded as in the vicinity (**VC**). VC can be coded in combination with thunderstorm (**TS**), fog (**FG**), shower(s) (**SH**), well-developed dust/sand whirls (**PO**), blowing dust (**BLDU**), blowing sand (**BLSA**), blowing snow (**BLSN**), sandstorm (**SS**), and duststorm (**DS**). Intensity qualifiers are not coded in conjunction with **VC**.

For example, **VCFG** can be decoded as meaning some form of fog is between 5 and 10 statute miles of the point of observation. If **VCSH** is coded, showers are occurring between 5 and 10 statute miles of the point of observation.

Weather phenomena occurring at the point of observation (at the station) or in the vicinity of the point of observation are coded in the body of the report. Weather phenomena observed beyond 10SM from the point of observation (at the station) is not coded in the body but may be coded in the remarks section (Section 2.1.3.12).

2.1.3.8.3 Descriptor Qualifier

Descriptors are qualifiers which further amplify weather phenomena and are used in conjunction with some types of precipitation and obscurations. The descriptor qualifiers are: shallow (**MI**), partial (**PR**), patches (**BC**), low drifting (**DR**), blowing (**BL**), shower(s) (**SH**), thunderstorm (**TS**), and freezing (**FZ**). Only one descriptor is coded for each weather phenomena group, e.g., **FZDZ**.

The descriptors shallow (**MI**), partial (**PR**), and patches (**BC**) are only coded with **FG**, e.g., **MIFG**. Mist (**BR**) is not coded with any descriptor.

The descriptors low drifting (**DR**) and blowing (**BL**) will only be coded with dust (**DU**), sand (**SA**), and snow (**SN**), e.g., **BLSN** or **DRSN**. **DR** is coded with **DU**, **SA**, or **SN** for raised particles drifting less than six feet above the ground.

When blowing snow is observed with snow falling from clouds, both phenomena are reported, e.g., **SN BLSN**. If blowing snow is occurring and the observer cannot determine whether or not snow is also falling, then **BLSN** is reported. Spray (**PY**) is coded only with blowing (**BL**).

The descriptor for showery-type precipitation (**SH**) is coded only with one or more of the precipitation qualifiers for rain (**RA**), snow (**SN**), ice pellets (**PL**), small hail (**GS**), or large hail (**GR**). The **SH** descriptor indicates showery-type precipitation. When any type of precipitation is coded with **VC**, the intensity and type of precipitation is not coded.

The descriptor for thunderstorm (**TS**) may be coded by itself when the thunderstorm is without associated precipitation. A thunderstorm may also be coded with the precipitation types of rain (**RA**), snow (**SN**), ice pellets (**PL**), small hail and/or snow pellets (**GS**), or hail (**GR**). For example, a thunderstorm with snow and small hail and/or snow pellets would be coded as **TSSNGS**. **TS** are not coded with **SH**.
The descriptor freezing (**FZ**) is only coded in combination with fog (**FG**), drizzle (**DZ**), or rain (**RA**), e.g., **FZRA**. **FZ** is not coded with **SH**.

2.1.3.8.4 Precipitation

Precipitation is any of the forms of water particles, whether liquid or solid, that falls from the atmosphere and reaches the ground. The precipitation types are: drizzle (**DZ**), rain (**RA**), snow (**SN**), snow grains (**SG**), ice crystals (**IC**), ice pellets (**IP**), hail (**GR**), small hail and/or snow pellets (**GS**), and unknown precipitation (**UP**). **UP** is reported if an automated station detects the occurrence of precipitation but the precipitation sensor cannot recognize the type.

Up to three types of precipitation may be coded in a single present weather group. They are coded in order of decreasing dominance based on intensity.

2.1.3.8.5 Obscuration

Obscurations are any phenomenon in the atmosphere, other than precipitation, reducing the horizontal visibility. The obscuration types are: mist (**BR**), fog (**FG**), smoke (**FU**), volcanic ash (**VC**), widespread dust (**DU**), sand (**SA**), haze (**HZ**), and spray (**PY**). Spray (**PY**) is coded only as **BLPY**.
With the exception of volcanic ash, low drifting dust, low drifting sand, low drifting snow, shallow fog, partial fog, and patches (of) fog, an obscuration is coded in the body of the report if the surface visibility is less than 7 miles or considered operationally significant. Volcanic ash is always reported when observed.

2.1.3.8.6 Other Weather Phenomena

Other weather phenomena types include: well-developed dust/sand whirls (**PO**), sand storms (**SS**), dust storms (**DS**), squalls (**SQ**), funnel clouds (**FC**), and tornados and waterspouts (**+FC**).

Examples:

-DZ	Light drizzle
-RASN	Light rain and snow
SN BR	(Moderate) snow, mist
-FZRA FG	Light freezing rain, fog
SHRA	(Moderate) rain shower

VCBLSA	Blowing sand in the vicinity
-RASN FG HZ	Light rain and snow, fog, haze
TS	Thunderstorm (without precipitation)
+TSRA	Thunderstorm, heavy rain
+FC TSRAGR BR	Tornado, thunderstorm, (moderate) rain, hail, mist

2.1.3.9 Sky Condition Group

`METAR KOKC 011955Z AUTO 22015G25KT 180V250 3/4SM R17L/2600FT +TSRA BR` **`OVC010CB`** `18/16 A2992 RMK AO2 TSB25 TS OHD MOV E SLP132`

Sky condition is a description of the appearance of the sky. It is coded as: sky condition, vertical visibility, or clear skies.

The sky condition group is based on the amount of sky cover (the first three letters) followed by the height of the base of the sky cover (final three digits). No space is between the amount of sky cover and the height of the layer. The height of the layer is recorded in feet Above Ground Level (AGL).
Sky condition is coded in ascending order and ends at the first overcast layer. At mountain stations, if the layer is below station level, the height of the layer will be coded as ***///***.

Vertical visibility is coded as **VV** followed by the vertical visibility into the indefinite ceiling. No space is between the group identifier and the vertical visibility. Figure 2-3 illustrates the effect of an obscuration on the vision from a descending aircraft.

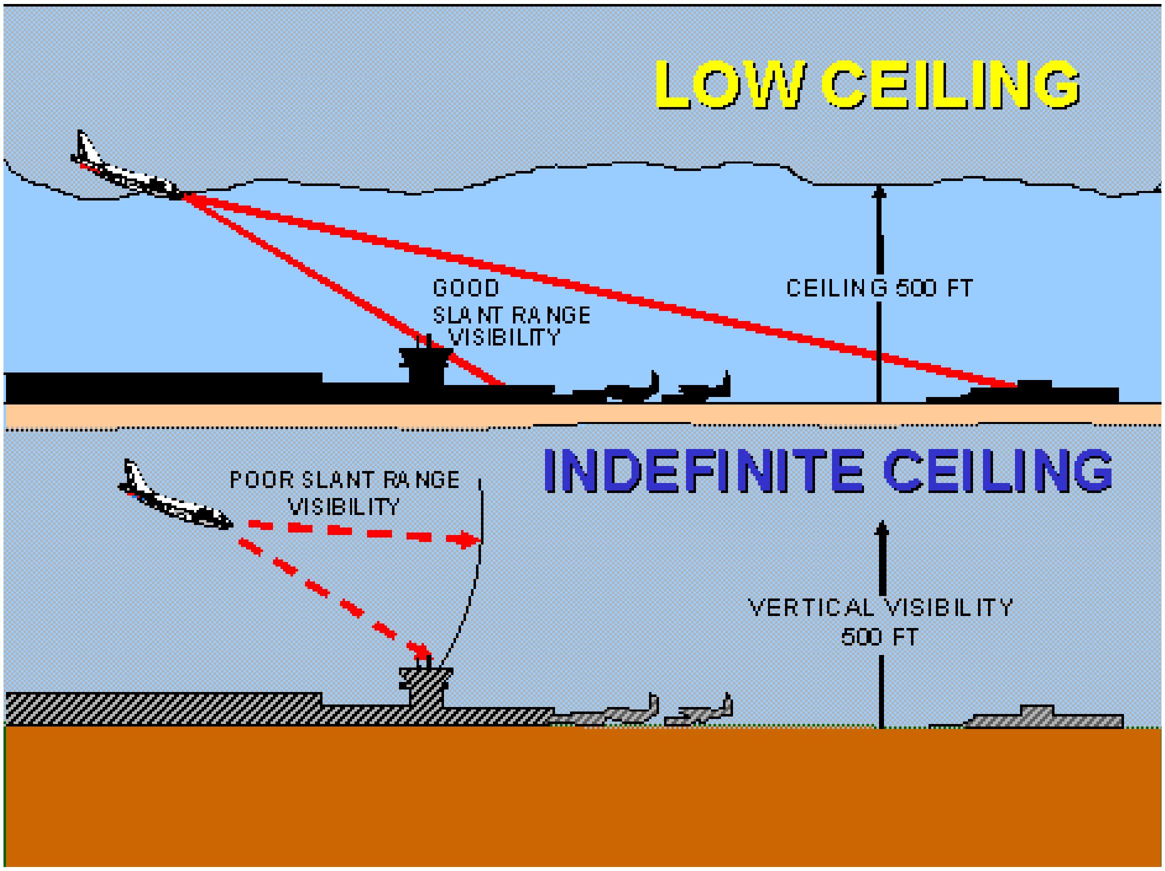

Figure 2-3 Obscuration Effects on Slant Range Visibility

The ceiling is 500 feet in both examples, but the indefinite ceiling example (bottom) produces a more adverse impact to landing aircraft. This is because an obscuration (e.g., fog, blowing dust, snow, etc.) limits runway acquisition due to reduced slant range visibility. This pilot would be able to see the ground but not the runway. If the pilot was at approach minimums, the approach could not be continued and a missed approach must be executed.

Clear skies are coded in the format, **SKC** or **CLR**. When **SKC** is used, an observer indicates no layers are present; and **CLR** is used by automated stations to indicate no layers are detected at or below 12,000 feet.

Each coded layer is separated from the others by a space. Each layer reported is coded by using the appropriate reportable contraction seen in **Error! Reference source not found.**. A report of clear skies (**SKC** or **CLR**) is a complete layer report within itself. The abbreviations **FEW**, **SCT**, **BKN**, and **OVC** will be followed, without a space, by the height of the layer.

Table 2-3 METAR/SPECI Contractions for Sky Cover

Reportable Contraction	Meaning	Summation Amount of Layer
VV	Vertical Visibility	8/8

SKC or CLR[1]	Clear	0
FEW[2]	Few	1/8 – 2/8
SCT	Scattered	3/8 – 4/8
BKN	Broken	5/8 – 7/8
OVC	Overcast	8/8
1. The abbreviation **CLR** will be used at automated stations when no layers at or below 12,000 feet are reported; the abbreviation **SKC** will be used at manual stations when no layers are reported. 2. Any layer amount less than 1/8 is reported as FEW.		

The height is coded in hundreds of feet above the surface using three digits in accordance with Table 2-4.

Table 2-4 METAR/SPECI Increments of Reportable Values of Sky Cover Height

Range of Height Values (feet)	Reportable Increment (feet)
Less than or equal to 5,000	To nearest 100
5,001 to 10,000	To nearest 500
Greater than 10,000	To nearest 1,000

The ceiling is the lowest layer aloft reported as broken or overcast. If the sky is totally obscured with ground based clouds, the vertical visibility is the ceiling.

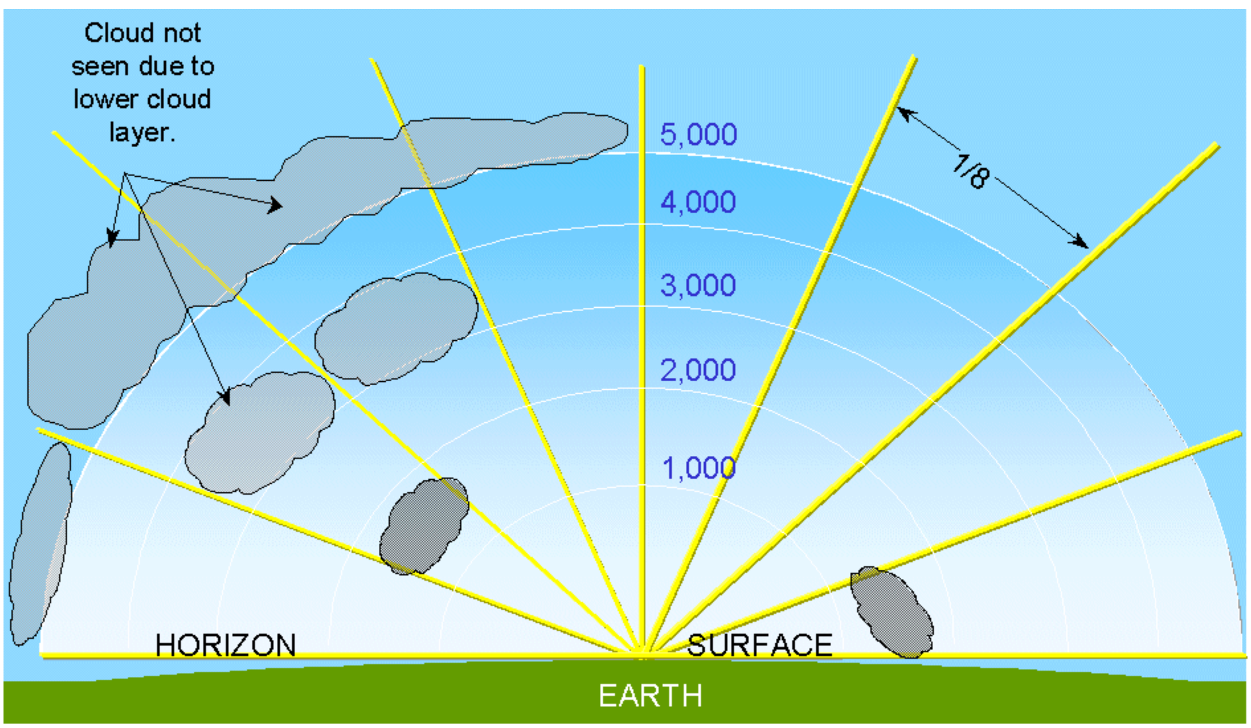

Figure 2-4 METAR/SPECI Sky Condition Coding

Clouds at 1,200 feet obscure 2/8ths of the sky (FEW). Higher clouds at 3,000 feet obscure an additional 1/8th of the sky, and because the observer cannot see above the 1,200-foot layer, he is to assume that the higher 3,000-foot layer also exists above the lower layer (SCT). The highest clouds at 5,000 feet obscure 2/8ths of the sky, and again since the observer cannot see past the 1,200 and 3,000-foot layers, he is to assume the higher 5,000-foot layer also exists above the lower layers (BKN). The sky condition group would be coded as: FEW012 SCT030 BKN050.

At manual stations, cumulonimbus (**CB**) or towering cumulus (**TCU**) is appended to the associated layer. For example, a scattered layer of towering cumulus at 1,500 feet would be coded **SCT015TCU** and would be followed by a space if there were additional higher layers to code.

Examples:

SKC	No layers are present
CLR	No layers are detected at or below 12,000 feet AGL
FEW004	Few at 400 feet AGL
SCT023TCU	Scattered layer of towering cumulus at 2,300 feet
BKN105	Broken layer (ceiling) at 10,500 feet
OVC250	Overcast layer (ceiling) at 25,000 feet
VV001	Indefinite ceiling with a vertical visibility of 100 feet
FEW012 SCT046	Few clouds at 1,200 feet, scattered layer at 4,600 feet
SCT033 BKN085	Scattered layer at 3,300 feet, broken layer (ceiling) at 8,500 feet
SCT018 OVC032CB	Scattered layer at 1,800 feet, overcast layer (ceiling) of cumulonimbus at 7,500 feet
SCT009 SCT024 BKN048	Scattered layer at 900 feet, scattered layer at 2,400 feet, broken layer (ceiling) at 4,800 feet)

2.1.3.10 Temperature/Dew Point Group

```
METAR KOKC 011955Z AUTO 22015G25KT 180V250 3/4SM R17L/2600FT +TSRA BR
OVC010CB 18/16 A2992 RMK AO2 TSB25 TS OHD MOV E SLP132
```

Temperature is the degree of hotness or coldness of the ambient air seems as measured by a suitable instrument. Dew point is the temperature to which a given parcel of air must be cooled at constant pressure and constant water vapor content for the air to become fully saturated.

Temperature and dew point are coded as two digits rounded to the nearest whole degree Celsius. For example, a temperature of 0.3ºC would be coded at **00**. Sub-zero temperatures and dew points are prefixed with an **M**. For example, a temperature of 4ºC with a dew point of –2ºC would be coded as **04/M02**; a temperature of –2ºC would be coded as **M02**.

If temperature is not available, the entire temperature/dew point group is not coded. If dew point is not available, temperature is coded followed by a solidus, **/,** and no entry made for dew point. For example, a temperature of 1.5ºC and a missing dew point would be coded as **02/.**

2.1.3.11 Altimeter

```
METAR KOKC 011955Z AUTO 22015G25KT 180V250 3/4SM R17L/2600FT +TSRA BR
OVC010CB 18/16 A2992 RMK AO2 TSB25 TS OHD MOV E SLP132
```

The altimeter setting group codes the current pressure at elevation. This setting is then used by aircraft altimeters to determine the true altitude above a fixed plane of mean sea level.

The altimeter group always starts with an **A** (the international indicator for altimeter in inches of mercury) and is followed by the four digit group representing the pressure in tens, units, tenths, and hundredths of inches of mercury. The decimal point is not coded. For example, an altimeter setting of 29.92 inches of Mercury would be coded as **A2992**.

2.1.3.12 Remarks (RMK)

```
METAR KOKC 011955Z AUTO 22015G25KT 180V250 3/4SM R17L/2600FT +TSRA BR
OVC010CB 18/16 A2992 RMK AO2 TSB25 TS OHD MOV E SLP132
```

Remarks are included in all METAR and SPECI, when appropriate.

Remarks are separated from the body of the report by the contraction **RMK**. When no remarks are necessary, the contraction **RMK** is not required.

METAR/SPECI remarks fall into two categories: (1) Automated, Manual, and Plain Language, and (2) Additive Maintenance Data.

Table 2-5 METAR/SPECI Order of Remarks

Automated, Manual, and Plain Language				Additive and Automated Maintenance Data	
1.	Volcanic Eruptions	14.	Hailstone Size	27.	Precipitation*
2.	Funnel Cloud	15.	Virga	28.	Cloud Types*
3.	Type of Automated Station	16.	Variable Ceiling Height	29.	Duration of Sunshine*
4.	Peak Wind	17.	Obscurations	30.	Hourly Temperature and Dew Point
5.	Wind Shift	18.	Variable Sky Condition	31.	6-Hourly Maximum Temperature*
6.	Tower or Surface Visibility	19.	Significant Cloud Types	32.	6-Hourly Minimum Temperature*
7.	Variable Prevailing Visibility	20.	Ceiling Height at Second Location	33.	24-Hour Maximum and Minimum Temperature*
8.	Sector Visibility	21.	Pressure Rising or Falling Rapidly	34.	3-Hourly Pressure Tendency*

9.	Visibility at Second Location	22.	Sea-Level Pressure	35.	Sensor Status Indicators
10.	Lightning	23.	Aircraft Mishap	36.	Maintenance Indicator
11.	Beginning and Ending of Precipitation	24.	No SPECI Reports Taken	Note: Additive data is primarily used by the National Weather Service for climatological purposes. * These groups should have no direct impact on the aviation community and will not be discussed in this document.	
12.	Beginning and Ending of Thunderstorms	25.	Snow Increasing Rapidly		
13.	Thunderstorm Location	26.	Other Significant Information		

Remarks are made in accordance with the following:

- Time entries are made in minutes past the hour if the time reported occurs during the same hour the observation is taken. Hours and minutes are used if the hour is different;
- Present weather coded in the body of the report as **VC** may be further described, i.e., direction from the station, if known. Weather phenomena beyond 10 statute miles of the point(s) of observation are coded as distant (**DSNT**) followed by the direction from the station. For example, precipitation of unknown intensity within 10 statute miles east of the station would be coded as **VCSH E**; lightning 25 statute miles west of the station would be coded as **LTG DSNT W**;
- Distance remarks are in statute miles except for automated lightning remarks which are in nautical miles;
- Movement of clouds or weather, when known, is coded with respect to the direction toward which the phenomena are moving. For example, a thunderstorm moving toward the northeast would be coded as **TS MOV NE**;
- Directions use the eight points of the compass coded in a clockwise order; and
- Insofar as possible, remarks are entered in the order they are presented in the following paragraphs (and Table 2-5).

2.1.3.13 Automated, Manual, and Plain Language Remarks

These remarks generally elaborate on parameters reported in the body of the report. Automated and manual remarks may be generated either by an automated station or observer. Plain language remarks are only provided from an observer.

2.1.3.13.1 Volcanic Eruptions (Plain Language)

Volcanic eruptions are coded in plain language and contain the following, when known:

- **Name** of volcano
- **Latitude and longitude** or the direction and approximate distance from the station
- **Date/Time** (UTC) of the eruption
- Size **description**, approximate height, and direction of movement **of the ash cloud**
- Any **other pertinent data** about the eruption

For example, a remark on a volcanic eruption would look like the following:

```
MT. AUGUSTINE VOLCANO 70 MILES SW ERUPTED AT 231505 LARGE ASH CLOUD
EXTENDING TO APRX 30000 FEET MOVING NE.
```

Pre-eruption volcanic activity is not coded. Pre-eruption refers to unusual and/or increasing volcanic activity which could presage a volcanic eruption.

2.1.3.13.2 Funnel Cloud

At manual stations, tornadoes, funnel clouds, and waterspouts are coded in the following format: Tornadic activity, **TORNADO**, **FUNNEL CLOUD**, or **WATERSPOUT,** followed by the beginning and/or ending time, followed by the location and/or direction of the phenomena from the station, and/or movement, when known. For example, **TORNADO B13 6 NE** would indicate that a tornado began at 13 minutes past the hour and was 6 statute miles northeast of the station.

2.1.3.13.3 Type of Automated Station

AO1 or **AO2** are coded in all METAR/SPECI from automated stations. Automated stations without a precipitation discriminator are identified as **AO1**; automated stations with a precipitation discriminator are identified as **AO2**.

2.1.3.13.4 Peak Wind

Peak wind is coded in the following format: the remark identifier **PK WND**, followed by the direction of the wind (first three digits), peak wind speed (next two or three digits) since the last METAR, and the time of occurrence. A space is between the two elements of the remark identifier and the wind direction/speed group; a solidus, **/**, (without spaces) separates the wind direction/speed group and the time. For example, a peak wind of 45 knots from 280 degrees which occurred at 15 minutes past the hour is coded **PK WND 28045/15**.

2.1.3.13.5 Wind Shift

Wind shift is coded in the format: the remark identifier **WSHFT**, followed by the time the wind shift began. The contraction **FROPA** is entered following the time if there is reasonable data to consider the wind shift was the result of a frontal passage. A space is between the remark identifier and the time and, if applicable, between the time and the frontal passage contraction. For example, a remark reporting a wind shift accompanied by a frontal passage that began at 30 minutes after the hour would be coded as **WSHFT 30 FROPA**.

2.1.3.13.6 Tower or Surface Visibility

Tower or surface visibility is coded in the following format: tower **TWR VIS** or surface **SFC**, followed by the observed tower/surface visibility value. A space is coded between each of the remark elements. For example, the control tower visibility of 1 ½ statute miles would be coded **TWR VIS 1 1/2**.

2.1.3.13.7 Variable Prevailing Visibility

Variable prevailing visibility is coded in the following format: the remark identifier **VIS**, followed the lowest and highest visibilities evaluated separated by the letter **V**. A space follows the remark identifier and no spaces are between the letter **V** and the lowest/highest values. For example, a visibility that was varying between 1/2 and 2 statute miles would be coded **VIS 1/2V2**.

2.1.3.13.8 Sector Visibility (Plain Language)

Sector visibility is coded in the following format: the remark identifier **VIS**, followed by the sector referenced to 8 points of the compass, and the sector visibility in statute miles. For example, a visibility of 2 1/2 statute miles in the northeastern octant is coded **VIS NE 2 1/2**.

2.1.3.13.9 Visibility at Second Location

At designated automated stations, the visibility at a second location is coded in the following format: the remark identifier **VIS**, followed by the measured visibility value and the specific location of the visibility sensor(s) at the station. This remark will only be generated when the condition is lower than that contained in the body of the report. For example, a visibility of 2 1/2 statute miles measured by a second sensor located at runway 11 is coded **VIS 2 1/2 RWY11**.

2.1.3.13.10 Lightning

When lightning is observed at a manual station, the frequency, type of lightning and location is reported. The contractions for the type and frequency of lightning are based on Table 2-6, for example, **OCNL LTGICCG NW**, **FRQ LTG VC**, or **LTG DSNT W**.

- When lightning is detected by an automated system:
- Within 5 nautical miles of the Airport Location Point (ALP), it is reported as **TS** in the body of the report with no remark;
- Between 5 and 10 nautical miles of the ALP, it is reported as **VCTS** in the body of the report with no remark; and
- Beyond 10 but less than 30 nautical miles of the ALP, it is reported in remarks only as **LTG DSNT** followed by the direction from the ALP.

Table 2-6 METAR/SPECI Type and Frequency of Lightning

Type of Lightning		
Type	**Contraction**	**Definition**
Cloud-ground	CG	Lightning occurring between cloud and ground.
In-cloud	IC	Lightning which takes place within the cloud.
Cloud-cloud	CC	Streaks of lightning reaching from one cloud to another.
Cloud-air	CA	Streaks of lightning which pass from a cloud to the air, but do not strike the ground.
Frequency of Lightning		
Frequency	**Contraction**	**Definition**

Occasional	OCNL	Less than 1 flash/minute.
Frequent	FRQ	About 1 to 6 flashes/minute.
Continuous	CONS	More than 6 flashes/minute.

2.1.3.13.11 Beginning and Ending of Precipitation

At designated stations, the beginning and ending time of precipitation is coded in the following format: the type of precipitation, followed by either a **B** for beginning or an **E** for ending, and the time of occurrence. No spaces are coded between the elements. The coded times of the precipitation start and stop times are found in the remarks section of the next METAR. The times are not required to be in the SPECI. The intensity qualifiers are coded. For example, if rain began at 0005 and ended at 0030 and then snow began at 0020 and ended at 0055, the remarks would be coded as **RAB05E30SNB20E55**. If the precipitation were showery, the remark is coded **SHRAB05E30SHSNB20E55**. If rain ended and snow began at 0042, the remark would be coded as **RAESNB42**.

2.1.3.13.12 Beginning and Ending of Thunderstorms

The beginning and ending of thunderstorms are coded in the following format: **TS** for thunderstorms, followed by either a **B** for beginning or an **E** for ending and the time of occurrence. No spaces are between the elements. For example, if a thunderstorm began at 0159 and ended at 0230, the remark is coded **TSB0159E30**.

2.1.3.13.13 Thunderstorm Location (Plain Language)

Thunderstorm locations are coded in the following format: the thunderstorm identifier, **TS**, followed by location of the thunderstorm(s) from the station and the direction of movement when known. For example, a thunderstorm southeast of the station and moving toward the northeast is coded **TS SE MOV NE**.

2.1.3.13.14 Hailstone Size (Plain Language)

At designated stations the hailstone size is coded in the following format: the hail identifier **GR**, followed by the size of the largest hailstone. The hailstone size is coded in ¼ inch increments. For example, **GR 1 3/4** would indicate that the largest hailstone were 1 ¾ inches in diameter. If small hail or snow pellets, **GS,** is coded in the body of the report, no hailstone size remark is required.

2.1.3.13.15 Virga (Plain Language)

Virga is coded in the following format: the identifier **VIRGA**, followed by the direction from the station. The direction of the phenomena from the station is optional, e.g., **VIRGA** or **VIRGA SW**.

2.1.3.13.16 Variable Ceiling Height

The variable ceiling height is coded in the following format: the identifier **CIG**, followed by the lowest ceiling height recorded, **V** denoting variability between two values, and ending with the highest ceiling height. A single space follows the identifier with no other spaces between the letter **V** and the lowest/highest ceiling values. For example, **CIG 005V010** would indicate a ceiling is variable between 500 and 1,000 feet.

2.1.3.13.17 Obscurations (Plain Language)

Obscurations, surface-based or aloft, are coded in the following format: the weather identifier causing the obscuration at the surface or aloft followed by the sky cover of the obscuration aloft (FEW, SCT, BKN, OVC) or at the surface (FEW, SCT, BKN), and the height. Surface-based obscurations have a height of **000**. A space separates the weather causing the obscuration and the sky cover; no space is between the sky cover and the height. For example, fog hiding 3/8 to 4/8 of the sky is coded **FG SCT000**; a broken layer at 2,000 feet composed of smoke is coded **FU BKN020**.

2.1.3.13.18 Variable Sky Condition (Plain Language)

Variable sky condition remarks are coded in the following format: the two operationally significant sky conditions (FEW, SCT, BKN, OVC) separated by spaces and **V** denoting the variability between the two ranges. If several layers have the same condition amount, the layer height of the variable layer is coded. For example, a cloud layer at 1,400 feet varying between broken and overcast is coded **BKN014 V OVC**.

2.1.3.13.19 Significant Cloud Types (Plain Language)

Significant cloud type remarks are coded in all reports.

2.1.3.13.19.1 Cumulonimbus or Cumulonimbus Mammatus

Cumulonimbus or Cumulonimbus Mammatus not associated with thunderstorms are coded in the following format: the cloud type (**CB** or **CBMAM**) followed by the direction from the station and the direction of movement when known. The cloud type, location, direction, and direction of movement entries are separated from each other by a space. For example, a CB up to 10 statute miles west of the station moving toward the east would be coded **CB W MOV E**. If the CB was more than 10 statute miles to the west, the remark is coded **CB DSNT W**.

Cumulonimbus (CB) always evolves from the further development of towering cumulus (TCU). The unusual occurrence of lightning and thunder within or from a CB leads to its popular titl, thunderstorm. A thunderstorm usually contains severe or greater turbulence, severe icing, low level wind shear (LLWS), and instrument flight rules (IFR) conditions.

Figure 2-5 Cumulonimbus (CB) Example

CB always evolves from the further development of towering cumulus (TCU). The usual occurrence of lightning and thunder within or from a CB leads to its popular title, thunderstorm. A thunderstorm usually contains severe or greater turbulence, severe icing, low level wind shear (LLWS), and instrument flight rules (IFR) conditions. (Copyright Robert A. Prentice, 1990)

Figure 2-6 Cumulonimbus Mammatus (CBMAM) Example

Cumulonimbus Mammatus (CBMAM) (also called mammatus) appears as hanging protuberances, like pouches, on the undersurface of a cloud. (Copyright Robert A. Prentice, 1993)

2.1.3.13.19.2 Towering Cumulus

Towering cumulus clouds are coded in the following format: the identifier **TCU** followed by the direction from the station. The cloud type and direction entries are separated by a space. For example, a towering cumulus cloud up to 10 statute miles west of the station is coded as **TCU W**.

Figure 2-7 Towering Cumulus (TCU) Example

Towering Cumulus (TCU). TCU is produced by strong convective updrafts and, thus, indicates turbulence. Icing is typically found above the freezing level. TCU often transforms into cumulonimbus (CB). (Copyright Charles A. Doswell, III, 1977)

2.1.3.13.19.3 Altocumulus Castellanus

Altocumulus Castellanus is coded in the following format: the identifier **ACC** followed by direction from the station. The cloud type and direction entries are separated by a space. For example, an altocumulus cloud 5 to 10 statute miles northwest of the station is coded **ACC NW**.

Figure 2-8 Altocumulus Castellanus (ACC) Example

Altocumulus Castellanus (ACC). ACC indicates convective turbulence aloft from the top of the cloud to its base and usually an undetermined height below cloud base as well. (Photo courtesy of National Severe Storms Laboratory/University of Oklahoma)

2.1.3.13.19.4 Standing Lenticular or Rotor Clouds

Stratocumulus (**SCSL**), altocumulus (**ACSL**), or cirrocumulus (**CCSL**), or rotor clouds are coded in the following format: the cloud type followed by the direction from the station. The cloud type and direction entries are separated by a space. For example, altocumulus standing lenticular clouds observed southwest through west of the station are coded **ACSL SW-W**; an apparent rotor cloud 5 to 10 statute miles northeast of the station is coded **APRNT ROTOR CLD NE**; and cirrocumulus clouds south of the station are coded **CCSL S**.

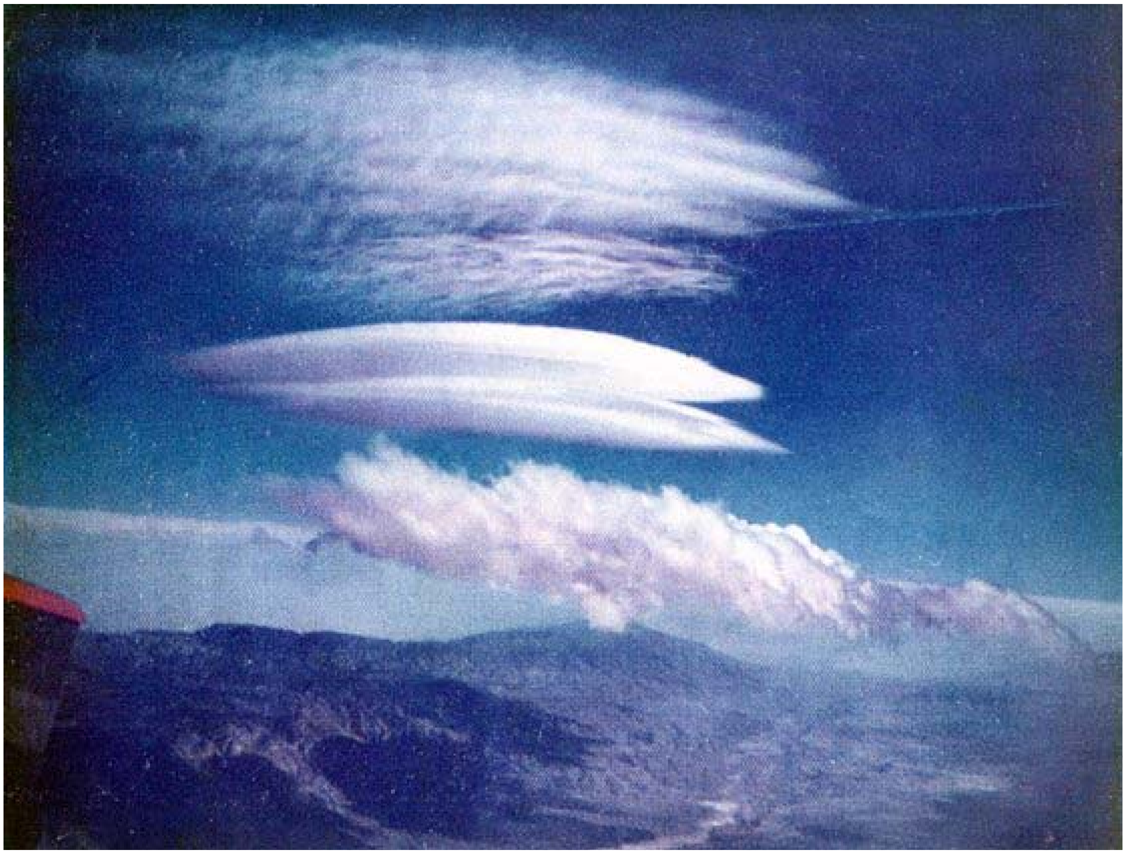

Figure 2-9 Standing Lenticular and Rotor Clouds Example

From top to bottom: Cirrocumulus standing lenticular (CCSL), altocumulus standing lenticular (ACSL), and rotor cloud. These clouds are characteristic of mountain waves. Mountain waves can occasionally produce violent downslope windstorms. Intense mountain waves can present a significant hazard to aviation by producing severe or even extreme turbulence that extends upward into the lower stratosphere.

2.1.3.13.20 Ceiling Height at Second Location

At designated stations, the ceiling height at a second location is coded in the following format: the identifier **CIG** followed by the measured height of the ceiling and the specific location of the ceilometer(s) at the station. This remark is only generated when the ceiling is lower than that contained in the body of the report. For example, if the ceiling measured by a second sensor located at runway 11 is broken at 200 feet, the remark would be **CIG 002 RWY11**.

2.1.3.13.21 Pressure Rising or Falling Rapidly

At designated stations, the reported pressure is evaluated to determine if a pressure change is occurring. If the pressure is rising or falling at a rate of at least 0.06 inch per hour and the pressure change totals 0.02 inch or more at the time of the observation, a pressure change remark is reported.

When the pressure is rising or falling rapidly at the time of observation, the remark **PRESRR** (pressure rising rapidly) or **PRESFR** (pressure falling rapidly) is included in the remarks.

2.1.3.13.22 Sea-Level Pressure

At designated stations, the sea-level pressure is coded in the following format: the identifier **SLP** immediately followed by the sea level pressure in hectopascals. The hundreds and thousands units are not coded and must be inferred. For example, a sea-level pressure of 998.2 hectopascals is coded as **SLP982**. A sea-level pressure of 1013.2 hectopascals would be coded as **SLP132**. For a METAR, if sea-level pressure is not available, it is coded as **SLPNO**.

2.1.3.13.23 Aircraft Mishap (Plain Language)

If a SPECI report is taken to document weather conditions when notified of an aircraft mishap, the remark **ACFT MSHP** is coded in the report but the SPECI not transmitted.

2.1.3.13.24 No SPECI Reports Taken (Plain Language)

At manual stations where SPECIs are not taken, the remark **NOSPECI** is coded to indicate no changes in weather conditions will be reported until the next METAR.

2.1.3.13.25 Snow Increasing Rapidly

At designated stations, the snow increasing rapidly remark is reported, in the NEXT METAR, whenever the snow depth increases by 1 inch or more in the past hour. The remark is coded in the following format: the remark indicator **SNINCR**, the depth increase in the past hour, and the total depth of snow on the ground at the time of the report. The depth of snow increase in the past hour and the total depth on the ground are separated from each other by a solidus, **/**. For example, a snow depth increase of 2 inches in the past hour with a total depth on the ground of 10 inches is coded **SNINCR 2/10**.

2.1.3.13.26 Other Significant Information (Plain Language)

Agencies may add to a report other information significant to their operations, such as information on fog dispersal operations, runway conditions, **FIRST** or **LAST** reports from station, etc.

2.1.3.14 Additive and Automated Maintenance Data

Additive data groups (Table 3-5) are only reported at designated stations and are primarily used by the NWS for climatological purposes. Most have no direct impact on the aviation community but a few are discussed below.

2.1.3.14.1 Hourly Temperature and Dew Point

At designated stations, the hourly temperature and dew point group are further coded to the tenth of a degree Celsius. For example, a recorded temperature of +2.6°C and dew point of -1.5°C would be coded as **T00261015**.

The format for the coding is as follows:

T	Group indicator
0	Indicates the following number is positive; a **1** would be used if the temperature was reported as negative at the time of observation
026	Temperature disseminated to the nearest 10th and read as 02.6
1	Indicates the following number is negative; a **0** would be used if the number was reported as positive at the time of observation
015	Dew Point disseminated to the nearest 10th and read as 01.5

No spaces are between the entries. For example, a temperature of 2.6°C and dew point of –1.5°C is reported in the body of the report as **03/M01** and the hourly temperature and dew point group as **T00261015**. If the dew point is missing only the temperature is reported; if the temperature is missing the hourly temperature and dew point group is not reported.

2.1.3.14.2 Maintenance Data Groups

The following maintenance data groups, Sensor Status Indicators and the Maintenance Indicator, are only reported from automated stations.

2.1.3.14.2.1 Sensor Status Indicators

- Sensor status indicators are reported as indicated below:
- If the Runway Visual Range is missing and would normally be reported, **RVRNO** is coded
- When automated stations are equipped with a present weather identifier and the sensor is not operating, the remark **PWINO** is coded
- When automated stations are equipped with a tipping bucket rain gauge and the sensor is not operating, **PNO** is coded
- When automated stations are equipped with a freezing rain sensor and the sensor is not operating, the remark **FZRANO** is coded
- When automated stations are equipped with a lightning detection system and the sensor is not operating, the remark **TSNO** is coded
- When automated stations are equipped with a secondary visibility sensor and the sensor is not operating, the remark **VISNO LOC** is coded
- When automated stations are equipped with a secondary ceiling height indicator and the sensor is not operating, the remark **CHINO LOC** is coded

2.1.3.14.2.2 Maintenance Indicator

A maintenance indicator, **$**, is coded when an automated system detects maintenance is needed on the system.

2.1.4 Examples of METAR Reports, Explanations, and Phraseology

METAR KMKL 021250Z 33018KT 290V360 1/2SM R31/2600FT SN BLSN FG VV008 00/M03 A2991 RMK AO2 RAESNB42 SLPNO T00111032

METAR	Aviation Routine Weather Report
KMKL	United States Jackson McKellar-Sipes Regional Airport, Tennessee
021250Z	The 2nd day of the month, 1300 hour scheduled report taken at 1250 UTC
33018KT	Wind 330 degrees at 18 knots
290V360	Wind direction variable between 290 and 360 degrees
1/2SM	Visibility one-half statute mile
R31/2600FT	Runway 31, runway visual range on runway 2,600 feet
SN	Moderate snow
BLSN FG	Blowing snow and fog
VV008	Indefinite ceiling, vertical visibility 800 feet AGL
00/M03	Temperature 0°C, dew point -3°C
A2991	Altimeter, 29.91 inches of mercury
RMK	Remarks
AO2	Automated station with a precipitation discriminator
RAESNB42	Rain ended at four two, snow began at four two past the hour
SLPNO	Sea-level pressure not available
T00111032	Temperature 1.1°C, dew point -3.2°C

Jackson McKellar-Sipes Regional Airport, wind three three zero at one eight, wind variable between two niner zero and three six zero, visibility one-half, runway three one R-V-R, two thousand six hundred, snow, blowing snow, fog, indefinite ceiling eight hundred, temperature zero, dew point minus three, altimeter two niner niner one, remarks rain ended and snow began at four two past the hour.

METAR KIPT 191254Z 00000KT 1 1/2SM -RA BR SCT034 BKN100 19/18 A2993 RMK AO2 RAB24 SLP133 P0001 T01890178

METAR	Aviation Routine Weather Report
KIPT	United States Williamsport Regional Airport, Pennsylvania
191254Z	19th day of the month, the 1300 hour scheduled report taken 1254 UTC
00000KT	Wind calm
1 1/2SM	Visibility one and one-half statute mile
-RA BR	Light rain, mist
SCT034 BKN100	Scattered 3,400 feet AGL, ceiling broken 10,000 feet AGL
19/18	Temperature 19 degrees Celsius, Dew Point 18 degrees Celsius
A2993	Altimeter, 29.93 inches of mercury
RMK	Remarks
AO2	Automated station with a precipitation discriminator
RAB24	Rain began at 1224 UTC
SLP133	Sea level pressure 1013.3 hectopascals
P0001	Precipitation over the past hour 00.01 inch
T01890178	Temperature 18.9 degrees Celsius, dew point 17.8 degrees Celsius

Williamsport Regional Airport, wind calm, visibility one and one half, light rain, mist, three thousand four hundred scattered, ceiling one zero thousand broken, temperature one niner, dew point one eight, altimeter two niner niner three, remarks rain began at two four past the hour.

SPECI KCVG 312228Z 28024G36KT 3/4SM +TSRA SQ BKN008 OVC020CB 28/23 A3000 RMK TSB24 TS OHD MOV E

SPECI	Aviation Selected Special Weather Report
KCVG	United States Covington Cincinnati/Northern Kentucky International Airport, Kentucky
312228Z	The 31st of the month Special report taken at 2228 UTC
28024G36KT	Wind 280 degrees at 24 knots, gusts 36 knots

3/4SM Visibility three-quarters statute mile

+TSRA SQ Thunderstorm with heavy rain and squalls

BKN008 OVC020CB Ceiling broken 800 feet AGL, overcast 2,000 feet AGL cumulonimbus

28/23 Temperature 28°C, dew point 23°C

A3000 Altimeter 30.00 inches of mercury

RMK Remarks

TSB24 Thunderstorm began at two four minutes past the hour

TS OHD MOV E Thunderstorm overhead moving east

Covington Cincinnati/Northern Kentucky International Airport, special report, two eight observation, wind two eight zero at two four, gusts three six, visibility three-quarters, thunderstorm, heavy rain, squall, ceiling eight hundred broken, two thousand overcast cumulonimbus, temperature two eight, dew point two three, altimeter three zero zero zero, thunderstorm began two four, thunderstorm overhead, moving east."

METAR KLAX 191350Z 08004KT 4SM HZ OVC009 18/16 A2997 RMK AO2 SLP147 T01830156

METAR Aviation Routine Weather Report

KLAX United States Los Angeles International Airport, California

191350Z The 19th day of the month, the 1400 hour scheduled report at 1350 UTC

08004KT Wind 80 degrees at 4 knots

4SM Visibility 4 statute miles

HZ Haze

OVC009 Ceiling overcast 900 feet AGL

18/16 Temperature 18°C, dew point 16°C

A2997 Altimeter 29.97 inches of mercury

RMK Remarks

AO2 Automated observation with precipitation discriminator

SLP147 Sea level pressure 1014.7 hectopascals

T01830156 Temperature 18.3oC, dew point 15.6oC

Los Angeles International Airport, wind zero eight zero at four, visibility four, haze, ceiling niner hundred overcast, temperature one eight, dew point one six, altimeter two niner niner seven.

SPECI KDEN 241310Z 09014G35KT 1/4SM +SN FG VV002 01/01 A2975 RMK AO2 TWR VIS 1/2 RAESNB08

SPECI Aviation Selected Special Weather Report

KDEN United States Denver International Airport, Colorado

241310Z The 24th of the month, Special report taken at 1310 UTC

09014G35KT Wind 90 degrees at 14 knots, gusts to 35 knots

1/4SM Visibility one-quarter statute mile

+SN FG Heavy snow, fog

VV002 Indefinite ceiling, vertical visibility 200 feet AGL

01/01 Temperature 1°C, dew point 1°C

A2975 Altimeter 29.75 inches of mercury

RMK Remarks

AO2 Automated observation with precipitation discriminator

TWR VIS 1/2 Tower visibility one-half statute mile

RAE08SNB08 Rain ended at 08 past the hour and snow began at 08 minutes past the hour

Denver International Airport, wind zero niner zero at one four, gusts three five, visibility one-quarter, heavy snow, fog, indefinite ceiling two hundred, temperature one, dew point one, altimeter two niner seven five, remarks tower visibility one half, ran ended and snow began at zero eight.

METAR KSPS 301656Z 06014KT 020V090 3SM -TSRA FEW040 BKN060CB 12/ A2982 RMK OCNL LTGICCG NE TSB17 TS E MOV NE PRESRR SLP093

METAR Aviation Routine Weather Report

KSPS United States Sheppard Air Force Base/Wichita Falls Municipal Airport, Texas

301656Z The 30th day of the month, the 1700 scheduled report taken at 1656 UTC

06014KT 020V090 Wind 60 degrees at 14 knots, wind variable between 020 and 090 degrees

3SM	Visibility 3 statute miles
-TSRA	Thunderstorm, light rain
FEW040 BKN060CB	Few 4,000 feet AGL, ceiling broken 6,000 feet AGL cumulonimbus
12/	Temperature 12°C, dew point missing
A2982	Altimeter 29.82 inches of mercury
RMK	Remarks
OCNL LTGICCG NE	Occasional lightning in cloud, cloud-to-ground northeast
TSB17	Thunderstorm began at 17 minutes past the hour
TS E MOV NE	Thunderstorm east moving northeast
PRESRR	Pressure rising rapidly
SLP093	Sea-level pressure 1009.3 hectopascals

Sheppard Air Force Base/Wichita Falls Municipal Airport, automated, wind zero six zero at one four, wind variable between zero two zero and zero niner zero, visibility three, thunderstorm, light rain, few clouds at four thousand, ceiling six thousand broken cumulonimbus, temperature one two, dew point missing, remarks occasional lightning in-cloud, cloud-to-ground northeast, thunderstorm began at one seven, thunderstorm east moving northeast, pressure rising rapidly.

SPECI KBOS 051237Z VRB02KT 3/4SM R15R/4000FT BR OVC004 05/05 A2998 RMK AO2 CIG 002V006 T00520048

SPECI	Aviation Selected Special Weather Report
KBOS	United States Boston, Massachusetts
051237Z	The 5th of the month, Special report taken at 1237 UTC
VRB02KT	Wind variable at 2 knots
3/4SM	Visibility three-quarters statute mile
R15R/4000FT	Runway 15R, visual range on runway 4,000 feet
BR	Mist
OVC004	Ceiling overcast 400 feet AGL
05/05	Temperature 5°C, dew point 5°C

A2998	Altimeter 29.98 inches of mercury
RMK	Remarks
AO2	Automated observation with precipitation discriminator
CIG 002V006	Ceiling variable between 200 to 600 feet
T00520048	Temperature 5.2$_{o}$C, dew point 4.8$_{o}$C

Boston General Edward Lawrence Logan International Airport, special report, three seven observation, wind variable at two, visibility three-quarters, runway one five right R-V-R four thousand, mist, ceiling four hundred overcast, temperature five, dew point five, altimeter two niner niner eight, remarks, ceiling variable between two hundred and six hundred.

3 WXXM Encoding

A METAR report typically includes an airport identifier, time of observation, wind, visibility, runway visual range, present weather phenomena, sky conditions, temperature, dew point, and altimeter setting in a human-readable text-based format. This type of data lends itself to encoding using the human-readable, text-based Extensible Markup Language (XML) format, rather than a gridded format such as NetCDF.

XML schema files (.xsd files) utilize an XML grammar to specify what elements may be used in XML documents, the order of the elements, the number of occurrences of each element, and the content and data type of each element and attribute. Thus, the schemas serve as a type of format description for the XML data files. Every XML data file should not only be well-formed (syntactically correct XML), but must also be valid in that it obeys the element ordering, frequency, and types defined in the associated schema. The application schemas that support the METAR data format draw upon multiple layers of XML data content models. These include the basic XML data types as well as data types developed in accordance with Open Geospatial Consortium (OGC) and ISO standards including Geography Markup Language (GML), Observations & Measurements (OM), and weather and aviation weather-specific data types collaboratively developed by various US and European agencies including Weather Exchange Schema (WXXS) and a general weather data type schema (WX).

The complete set of supporting XML schema can be downloaded by running subversion to anonymously check out the schema directory tree from the wxforge subversion repository. The following is an example series of commands for downloading the schema into a local directory named “wxforge”

```
chdir ~
mkdir wxforge
chdir wxforge
```

```
svn checkout http://wxforge.wx.ll.mit.edu/svn/ogc-
bindings/trunk/schemas schemas
```

If a username is requested, enter "anonymous", followed with a password of your e-mail address, e.g., "joe-client@company.com". The subversion checkout will populate a directory named "schemas".

Namespace prefixes are used within XML element tags to avoided naming conflicts when utilizing data types from multiple packages. The METAR XML data are encoded utilizing data types from the namespaces described in Table 3-1 XML Schema Namespace DescriptionsTable 3-1:

Table 3-1 XML Schema Namespace Descriptions

Namespace Prefix	**Namespace**	**Schema Directory**	**Description**
Default (no prefix)	http://www.w3.org/2001/XMLSchema	*N/A*	XML standard schema
gml	http://www.opengis.net/gml/3.2	net/opengis/gml/3.2.1	OGC GML schema
om	http://www.opengis.net/om/1.0/gml32	net/opengis/om/1.0.0_gml32	OGC Observations & Measurements (O&M) schema
wx	http://www.eurocontrol.in/wx/1.1	int/eurocontrol/wx/1.1.0	General weather schema
avwx	http://www.eurocontrol.int/wxxs/1.1	int/eurocontrol/wxxs/1.1.0	Aviation weather schema implementation of Eurocontrol's WXXM
nawx	http://www.faa.gov/nawx/1.1	gov/faa/nawx/1.1.0	North American (e.g., FAA) aviation weather schema

The METAR product data model makes strong use of the feature model of GML and the OGC schema for Observations and Measurements, which defines an observation as follows:

> *"An Observation is an action with a result which has a value describing some phenomenon. […] An observation feature binds a result to a feature of interest, upon which the observation was made. The observed property is a property of the feature of interest. An observation uses a*

procedure to determine the value of the result, which may involve a sensor or observer, analytical procedure, simulation, or other numerical process."[3]

XML Application Schema

The table below lists some of the important application-level schema used to encode this product.

Namespace	Schema Location	Schema File
Wx	int/eurocontrol/wx/1.1.0	wxBase.xsd
Wx	int/eurocontrol/wx/1.1.0	wxObservation.xsd

4 Appendix A WXXM Examples

The following are WXXM examples for the METAR data products.

Basic example:

```
<avwx:SurfaceObservation xmlns:avwx="http://www.eurocontrol.int/wxxs/1.1"
  xmlns:wx="http://www.eurocontrol.int/wx/1.1"
xmlns:wxont="http://wmo.int/ontologies/wx.owl#"
  xmlns:om="http://www.opengis.net/om/1.0/gml32"
xmlns:gml="http://www.opengis.net/gml/3.2"
  xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  gml:id="id0" xsi:schemaLocation="http://www.eurocontrol.int/wxxs/1.1
../wxxs.xsd">

  <avwx:rawText>
    METAR KTTN 051853Z 04011KT 1/2SM VCTS SN FZFG BKN003 OVC010 M02/M02 A3006
RMK AO2 TSB40 SLP176 P0002 T10171017=
  </avwx:rawText>

  <avwx:type>METAR</avwx:type>
  <avwx:stationId
codeSpace="urn:icao:code:weatherStation:">KDEN</avwx:stationId>

  <avwx:appliesTo>
    <avwx:Aerodrome gml:id="id2">
      <gml:identifier
codeSpace="urn:icao:code:Aerodrome:">DEN</gml:identifier>
      <gml:name>BOS</gml:name>
      <gml:location>
```

[3] Cox, S., ed. (2006), "Observations and Measurements", OpenGIS Consortium document 05- 087r4, Version 0.14.7, [Web URL: http://portal.opengeospatial.org/files/?artifact_id=17038 (March, 2009)]

```
        <gml:Point  srsName="urn:ogc:crs:EPSG:4XXX"  srsDimension="3"
gml:id="id4">
          <gml:pos>40.0 -70.0 1000.0</gml:pos>
        </gml:Point>
      </gml:location>
    </avwx:Aerodrome>
  </avwx:appliesTo>

  <avwx:automated>true</avwx:automated>
  <avwx:missing>false</avwx:missing>

  <!--
    Aerodrome weather observation. Note that there is no
'AerodromeWxObservation' sub type of
    wx:Observation used in this example. The 'avwx:aerodromeWxObservation'
property provides
    sufficient context for the generic wx:Observation child object that a
strong-typed specialization
    of wx:Observation is really not needed.
   -->
  <avwx:aerodromeWxObservation>
    <wx:Observation gml:id="id6">

      <om:samplingTime>
        <gml:TimeInstant gml:id="id8">
          <gml:timePosition>2008-11-04T12:00:00Z</gml:timePosition>
        </gml:TimeInstant>
      </om:samplingTime>

      <om:procedure
xlink:href="urn:fdc:faa.gov:Sensor:WeatherStation:01234"/>

      <!-- Observed property links to higher-level Ontology  concept that
corresponds to result type -->
      <om:observedProperty
xlink:href="http://www.eurocontrol.int/ont/avwx/1.1/wx.owl#AerodromeWx"/>

      <!-- Feature of interest links to Aerodrome feature within this METAR
instance. -->
      <om:featureOfInterest xlink:href="#id2"/>

      <!-- Result contains weather properties relevant to Aerodrome area of
interest -->
      <om:result>
        <avwx:AerodromeWx gml:id="id10">
          <avwx:windSpeed uom="kt">15</avwx:windSpeed>
          <avwx:windDirection uom="deg">30</avwx:windDirection>
          <avwx:airTemperature uom="C">30</avwx:airTemperature>
          <avwx:dewpointTemperature uom="C">20</avwx:dewpointTemperature>
          <avwx:airPressure uom="bar">900</avwx:airPressure>
          <avwx:verticalVisibility uom="NM">2</avwx:verticalVisibility>
          <avwx:horizontalVisibility>
            <avwx:HorizontalVisibility gml:id="id12">
              <avwx:minimumVisibility uom="NM">5</avwx:minimumVisibility>
              <avwx:directionMinimum>NW</avwx:directionMinimum>
```

```
          </avwx:HorizontalVisibility>
        </avwx:horizontalVisibility>
        <avwx:qnh uom="bar">900</avwx:qnh>
        <avwx:qfe uom="bar">900</avwx:qfe>
        <avwx:cloudConditions>
          <wx:CloudCondition gml:id="id14">
            <wx:base uom="ft">2000</wx:base>
            <wx:type>CUMULUS</wx:type>
          </wx:CloudCondition>
          <wx:CloudCondition gml:id="id16">
            <wx:base uom="ft">15000</wx:base>
            <wx:type>CIRRUS</wx:type>
          </wx:CloudCondition>
        </avwx:cloudConditions>
        <avwx:seaWx>
          <avwx:SeaWx gml:id="id18">
            <avwx:surfaceTemperature uom="C">20.0</avwx:surfaceTemperature>
            <avwx:state>CALM RIPPLED</avwx:state>
          </avwx:SeaWx>
        </avwx:seaWx>
      </avwx:AerodromeWx>
    </om:result>

  </wx:Observation>
</avwx:aerodromeWxObservation>

</avwx:SurfaceObservation>
```

Full example:

```
<avwx:SurfaceObservation xmlns:avwx="http://www.eurocontrol.int/wxxs/1.1"
  xmlns:wx="http://www.eurocontrol.int/wx/1.1"
xmlns:wxont="http://wmo.int/ontologies/wx.owl#"
  xmlns:om="http://www.opengis.net/om/1.0/gml32"
xmlns:gml="http://www.opengis.net/gml/3.2"
  xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  gml:id="id0" xsi:schemaLocation="http://www.eurocontrol.int/wxxs/1.1
../wxxs.xsd">

  <avwx:rawText>
    METAR KTTN 051853Z 04011KT 1/2SM VCTS SN FZFG BKN003 OVC010 M02/M02 A3006
RMK AO2 TSB40 SLP176 P0002 T10171017=
  </avwx:rawText>

  <avwx:type>METAR</avwx:type>
  <avwx:stationId
codeSpace="urn:icao:code:weatherStation">KDEN</avwx:stationId>

  <avwx:appliesTo>
    <avwx:Aerodrome gml:id="id2">
      <gml:identifier
codeSpace="urn:icao:code:Aerodrome">DEN</gml:identifier>
      <gml:name>BOS</gml:name>
```

```
      <gml:location>
        <gml:Point srsName="urn:ogc:crs:EPSG:4XXX" srsDimension="3"
gml:id="id4">
          <gml:pos>40.0 -70.0 1000.0</gml:pos>
        </gml:Point>
      </gml:location>
    </avwx:Aerodrome>
  </avwx:appliesTo>

  <avwx:automated>true</avwx:automated>
  <avwx:missing>false</avwx:missing>

  <avwx:aerodromeWxObservation>
    <wx:Observation gml:id="id6">
      <om:samplingTime>
        <gml:TimeInstant gml:id="id8">
          <gml:timePosition>2008-11-04T12:00:00Z</gml:timePosition>
        </gml:TimeInstant>
      </om:samplingTime>

      <om:procedure
xlink:href="urn:fdc:faa.gov:Sensor:WeatherStation:01234"/>
      <om:observedProperty
xlink:href="http://www.eurocontrol.int/ont/avwx/1.1/wx.owl#AerodromeWx"/>
      <!-- Feature of interest links to Aerodrome feature within this METAR
instance. -->
      <om:featureOfInterest xlink:href="#id2"/>

      <om:result>
        <avwx:AerodromeWx gml:id="id10">
          <avwx:windSpeed uom="kt">15</avwx:windSpeed>
          <avwx:windDirection uom="deg">30</avwx:windDirection>
          <avwx:airTemperature uom="C">30</avwx:airTemperature>
          <avwx:dewpointTemperature uom="C">20</avwx:dewpointTemperature>
          <avwx:airPressure uom="bar">900</avwx:airPressure>
          <avwx:verticalVisibility uom="NM">2</avwx:verticalVisibility>
          <avwx:horizontalVisibility>
            <avwx:HorizontalVisibility gml:id="id12">
              <avwx:minimumVisibility uom="NM">5</avwx:minimumVisibility>
              <avwx:directionMinimum>NW</avwx:directionMinimum>
            </avwx:HorizontalVisibility>
          </avwx:horizontalVisibility>
          <avwx:qnh uom="bar">900</avwx:qnh>
          <avwx:qfe uom="bar">900</avwx:qfe>
          <avwx:cloudConditions>
            <wx:CloudCondition gml:id="id14">
              <wx:base uom="ft">2000</wx:base>
              <wx:type>CUMULUS</wx:type>
            </wx:CloudCondition>
            <wx:CloudCondition gml:id="id16">
              <wx:base uom="ft">15000</wx:base>
              <wx:type>CIRRUS</wx:type>
            </wx:CloudCondition>
          </avwx:cloudConditions>
          <avwx:cavok>true</avwx:cavok>
```

```
          <avwx:colourState>GREEN</avwx:colourState>
          <avwx:seaWx>
            <avwx:SeaWx gml:id="id18">
              <avwx:surfaceTemperature uom="C">20.0</avwx:surfaceTemperature>
              <avwx:state>CALM RIPPLED</avwx:state>
            </avwx:SeaWx>
          </avwx:seaWx>
        </avwx:AerodromeWx>
      </om:result>
    </wx:Observation>
  </avwx:aerodromeWxObservation>

  <!--
    METAR Trend forecasts represent forecasted changes within the two hours
following
    the observation issue time. Single high level Forecast object with
multiple
    sub-forecasts used to represent multiple forecasts (avoids duplication of
    O+M procedure/property/feature-of-interest
  -->
  <avwx:aerodromeWxForecast>
    <wx:Forecast gml:id="id22">
      <!--
        Forecast accompanying a METAR is nominally for the two hour period
following
        the observation. As with a TAF, there may be multiple sub-forecasts
representing
        different conditions at different times. The forecast time here
represents the
        two-hour window.
      -->
      <wx:forecastTime>
        <gml:TimePeriod gml:id="id24">
          <gml:beginPosition>2008-11-04T120000Z</gml:beginPosition>
          <gml:endPosition>2008-11-04T140000Z</gml:endPosition>
        </gml:TimePeriod>
      </wx:forecastTime>

      <wx:procedure
xlink:href="urn:fdc:faa.gov:Sensor:WeatherStation:01234"/>
      <wx:forecastProperty
xlink:href="http://www.eurocontrol.int/ont/avwx/1.1/wx.owl#AerodromeWx"/>
      <!-- Feature of interest links to Aerodrome feature within this METAR
instance. -->
      <wx:featureOfInterest xlink:href="#id2"/>

      <wx:result>
        <!--
           Result forecast contains only those properties that will be
changing
           relative to parent observation
        -->
        <wx:WxFeatureCollection gml:id="id26">
          <wx:featureMember>
```

```
            <!-- Forecast of changing conditions in 2nd hour of two-hour
forecast period -->
            <avwx:AerodromeWx gml:id="id27">
              <wx:changeIndicator>BECOMING</wx:changeIndicator>
              <wx:forecastTime>
                <gml:TimePeriod gml:id="id28">
                  <gml:beginPosition>2008-11-04T130000Z</gml:beginPosition>
                  <gml:endPosition>2008-11-04T140000Z</gml:endPosition>
                </gml:TimePeriod>
              </wx:forecastTime>
              <avwx:airTemperature uom="C">24</avwx:airTemperature>
              <avwx:horizontalVisibility>
                <avwx:HorizontalVisibility gml:id="id29">
                  <avwx:minimumVisibility uom="NM">4</avwx:minimumVisibility>
                  <avwx:directionMinimum>NW</avwx:directionMinimum>
                </avwx:HorizontalVisibility>
              </avwx:horizontalVisibility>
              <avwx:cloudConditions>
                <!-- Empty set of cloud conditions indicates forecasted
'clear' condition-->
              </avwx:cloudConditions>
            </avwx:AerodromeWx>
          </wx:featureMember>
        </wx:WxFeatureCollection>
      </wx:result>
    </wx:Forecast>
  </avwx:aerodromeWxForecast>

  <avwx:runwayWxObservation>
    <wx:Observation gml:id="id30">
      <!-- Time is reference to aerodrome observation time earlier in
document -->
      <om:samplingTime xlink:href="#id8"/>
      <om:procedure
xlink:href="urn:fdc:noaa.gov:Sensor:WeatherStation:01234"/>
      <om:observedProperty
xlink:href="http://www.eurocontrol.int/ont/avwx/1.1/wx.owl#RunwayWx"/>
      <om:featureOfInterest>
        <avwx:Runway gml:id="id32">
          <gml:identifier
codeSpace="urn:icao:code:Aerodrome:Runway:DEN">20A</gml:identifier>
          <gml:name>20A</gml:name>
        </avwx:Runway>
      </om:featureOfInterest>

      <om:result>
        <avwx:RunwayWx gml:id="id34">
          <avwx:rvr>
            <avwx:RVR gml:id="id36">
              <avwx:range uom="NM">6</avwx:range>
              <avwx:rangeVariesTo uom="NM">10</avwx:rangeVariesTo>
              <avwx:pastTendency>NO CHANGE</avwx:pastTendency>
            </avwx:RVR>
          </avwx:rvr>
          <avwx:surfaceState>
```

```
            <avwx:RunwaySurfaceState gml:id="id38">
              <avwx:cleared>true</avwx:cleared>
              <avwx:frictionCoefficient>0.9</avwx:frictionCoefficient>
              <avwx:brakingAction>MEDIUM</avwx:brakingAction>
              <avwx:surfaceDeposit>
                <avwx:SurfaceDeposit gml:id="id40">
                  <avwx:type>DRY SNOW</avwx:type>
                  <avwx:contaminationExtent>0.5</avwx:contaminationExtent>
                  <avwx:depositDepth uom="cm">2.0</avwx:depositDepth>
                </avwx:SurfaceDeposit>
              </avwx:surfaceDeposit>
            </avwx:RunwaySurfaceState>
          </avwx:surfaceState>
        </avwx:RunwayWx>
      </om:result>
    </wx:Observation>
  </avwx:runwayWxObservation>
</avwx:SurfaceObservation>
```