

# METAR

**METAR** is a format for reporting weather information. A METAR weather report is predominantly used by pilots in fulfillment of a part of a pre-flight weather briefing, and by meteorologists, who use aggregated METAR information to assist in weather forecasting.

Raw METAR is the most common format in the world for the transmission of observational weather data.<sup>[citation needed]</sup> It is highly standardized through the International Civil Aviation Organization (ICAO), which allows it to be understood throughout most of the world.

## Information contained in a METAR

A typical METAR contains data for the temperature, dew point, wind speed and direction, precipitation, cloud cover and heights, visibility, and barometric pressure. A METAR may also contain information on precipitation amounts, lightning, and other information that would be of interest to pilots or meteorologists such as a pilot report or PIREP, colour states and runway visual range (RVR).

In addition, a short period forecast called a *TREND* may be added at the end of the METAR covering likely changes in weather conditions in the two hours following the observation. These are in the same format as a Terminal Aerodrome Forecast (TAF).

The complement to METARs, reporting forecast weather rather than current weather, are TAFs. METARs and TAFs are used in VOLMET broadcasts.

## Example METAR codes

### International METAR codes

The following is an example METAR from Burgas Airport in Burgas, Bulgaria. It was taken on 4 February 2005 at 16:00 Coordinated Universal Time (UTC).

**METAR LBBG 041600Z 12003MPS 310V290 1400 R04/P1500N R22/P1500U +SN BKN022 OVC050 M04/M07 Q1020 NOSIG 9949//91=**

- **METAR** indicates that the following is a standard hourly observation.
- **LBBG** is the ICAO airport code for Burgas Airport.
- **041600Z** indicates the time of the observation. It is the day of the month (the 4th) followed by the time of day (1600 Zulu time, which equals 4:00 pm Greenwich Mean Time).

- **12003MPS** indicates the wind direction is from 120° (east-southeast) at a speed of 3 MPS (5.8 KT; 6.7 mph; 11 km/h). Speed measurements can vary from knots (KT) or meters/second (MPS).
- **290V310** indicates the wind direction is varying from 290° true (west northwest) to 310° true (northwest).
- **1400** indicates the prevailing visibility is 1,400 m (4,600 ft).
- **R04/P1500N** indicates the Runway Visual Range (RVR) along runway 04 is 1,500 m (4,900 ft) and not changing significantly.
- **R22/P1500U** indicates RVR along runway 22 is 1,500 m (4,900 ft) and rising.
- **+SN** indicates snow is falling at a heavy intensity. If any precipitation begins with a minus or plus (-/+), it's either light or heavy.
- **BKN022** indicates a broken (over half the sky) cloud layer with its base at 2,200 ft (670 m) above ground level (AGL). The lowest "BKN" or "OVC" layer specifies the cloud ceiling.
- **OVC050** indicates an unbroken cloud layer (overcast) with its base at 5,000 ft (1,500 m) above ground level.
- **M04/M07** indicates the temperature is -4 °C (25 °F) and the dewpoint is -7 °C (19 °F). An M in front of the number indicates that the temperature/dew point is below zero (0) Celsius.
- **Q1020** indicates the current altimeter setting (QNH) is 1,020 hPa (30.12 inHg).
- **NOSIG** is an example of a TREND forecast which is appended to METARs at stations while a forecaster is on watch. NOSIG means that no significant change is expected to the reported conditions within the next 2 hours.
- **9949//91** indicates the condition of the runway:
  - **99** indicates either a specific runway (e.g. 25 = Rwy 25 or 25L; adding 50 will indicate Right Runway) or all the airport's runways ("99"). Some locations will report the runway using 3 characters (e.g. 25L)
  - **4** means the runway is coated with dry snow
  - **9** means 51% to 100% of the runway is covered
  - **//** means the thickness of the coating was either not measurable or not affecting usage of the runway
  - **91** means the braking index is bad, in other words the tires have bad grip on the runway
- **CAVOK** is an abbreviation for *Ceiling And Visibility OKay*, indicating no cloud below 5,000 ft (1,500 m) or the highest minimum sector altitude and no cumulonimbus or towering cumulus at any level, a visibility of 10 km (6 mi) or more and no significant weather.<sup>[6]</sup>
- **=** indicates the end of the METAR

## North American METAR codes

North American METARs deviate from the WMO (who write the code on behalf of ICAO) FM 15-XII code. Details are listed in the FAA's Aeronautical Information Manual (AIM), but the non-compliant elements are mostly based on the use of non-standard units of measurement. This METAR example is from Trenton-Mercer Airport near Trenton, New Jersey, and was taken on 5 December 2003 at 18:53 UTC.

**METAR KTTN 051853Z 04011KT 1/2SM VCTS SN FZFG BKN003 OVC010 M02/M02 A3006 RMK AO2 TSB40 SLP176 P0002 T10171017**<sup>[7]</sup>

- **METAR** indicates that the following is a standard hourly observation.
- **KTTN** is the ICAO identifier for the Trenton-Mercer Airport.
- **051853Z** indicates the day of the month is the 5th and the time of day is 1853 Zulu/UTC, 6:53PM GMT, or 1:53PM Eastern Standard Time.
- **04011KT** indicates the wind is from 040° true (north east) at 11 knots (20 km/h; 13 mph). In the United States, the wind direction must have a 60° or greater variance for variable wind direction to be reported and the wind speed must be greater than 3 knots (5.6 km/h; 3.5 mph).
- **1/2SM** indicates the prevailing visibility is 1/2 mi (800 m) SM = statute mile.
- **VCTS** indicates a thunderstorm (TS) in the vicinity (VC), which means from 5–10 mi (8–16 km).
- **SN** indicates snow is falling at a moderate intensity; a preceding plus or minus sign (+/-) indicates heavy or light precipitation.
- **FZFG** indicates the presence of freezing fog.
- **BKN003 OVC010** indicates a broken (5/8 to 7/8 of the sky covered) cloud layer at 300 ft (91 m) above ground level (AGL) and an overcast (8/8 of the sky covered) layer at 1,000 ft (300 m).
- **M02/M02** indicates the temperature is –2 °C (28 °F) and the dewpoint is –2 °C (28 °F). An M in front of the number indicates that the temperature/dew point is "minus", *i.e.*, below zero (0) Celsius.
- **A3006** indicates the altimeter setting is 30.06 inHg (1,018 hPa).
- **RMK** indicates the remarks section follows.

*Note that what follows are not part of standard observations outside of the United States and can vary significantly.*

- **AO2** indicates that the station is automated with a precipitation discriminator (rain/snow) sensor.<sup>[8]</sup> Stations that aren't equipped with a rain/snow sensor are designated **AO1**.<sup>[9]</sup>
- **TSB40** indicates the thunderstorm began at 40 minutes past the hour at 1840 Zulu/UTC, 6:40 p.m. GMT, or 1:40 p.m. Eastern Standard Time.
- **SLP176** indicates the current barometric pressure extrapolated to sea level is 1,017.6 hPa (30.05 inHg).
- **P0002** indicates that 0.02 inches (0.5 mm) of liquid-equivalent precipitation accumulated during the last hour.
- **T10171017** is a breakdown of the temperature and dew point in eight digits separated into two groups of four. The first four digits (1017) indicate the temperature. The first digit (1) designates above or below zero Celsius (0=above zero 1=below zero). The next three digits in the group "017" give the temperature in degrees and tenths of a degree Celsius, –01.7 °C (28.9 °F). The last four digits "1017" indicate the dew point, –01.7 °C (28.9 °F). Note: ASOS software, as of this update, uses whole degrees in °F to compute the °C values in this group.<sup>[citation needed]</sup>

- = indicates the end of the METAR.

*In Canada, RMK is followed by a description of the cloud layers and opacities, in eighths (oktas). For example, CU5 would indicate a cumulus layer with 5/8 opacity.<sup>[10]</sup>*

## Cloud reporting

Cloud coverage is reported by the number of 'oktas

' (eighths) of the sky that is occupied by cloud.

This is reported as:<sup>[11]</sup>

Abbreviation	Meaning
SKC	"No cloud/Sky clear" used worldwide but in North America is used to indicate a human generated report <sup>[12][13]</sup>
CLR	"No clouds below 12,000 ft (3,700 m) (U.S.) or 10,000 ft (3,000 m) (Canada)", used mainly within North America and indicates a station that is at least partly automated <sup>[12][13]</sup>
NSC	"No (nil) significant cloud", <i>i.e.</i> , none below 5,000 ft (1,500 m) and no TCU or CB. Not used in North America.
FEW	"Few" = 1–2 oktas
SCT	"Scattered" = 3–4 oktas
BKN	"Broken" = 5–7 oktas
OVC	"Overcast" = 8 oktas, <i>i.e.</i> , full cloud coverage
VV	Clouds cannot be seen because of fog or heavy precipitation, so vertical visibility is given instead.

## Flight categories

METARs can be expressed concisely using so-called *aviation flight categories*, which indicates what classes of flight can operate at each airport by referring to the visibility and ceiling in each METAR. Four categories are used.<sup>[14]</sup>

Category	Visibility	Ceiling
VFR	> 3 mi	and > 500 ft (below), > 1000 ft (above), > 2000 ft (horiz) <sup>[15]</sup>
Marginal VFR	Between 3 and 5 mi	and/or Between 1,000 and 3,000 ft
IFR	1 mi or more but less than 3 mi	and/or 500 ft or more but less than 1,000 ft
Low IFR	< 1 mi	and/or < 500 ft

## METAR WX codes

METAR abbreviations used in the WX section. Remarks section will also include began and end times of the weather events.<sup>[16]</sup>

Codes before remarks will be listed as "-RA" for "light rain". Codes listed after remarks may be listed as "RAB15E25" for "Rain began at 15 minutes after the top of the last hour and ended at 25 minutes after the top of the last hour."

Type	Abbreviation	Meaning	Abbreviation	Meaning
Intensity	-	Light intensity	blank	Moderate intensity
Intensity	+	Heavy intensity	VC	In the vicinity
Descriptor	MI	Shallow	PR	Partial
Descriptor	BC	Patches	DR	Low drifting
Descriptor	BL	Blowing	SH	Showers
Descriptor	TS	Thunderstorm	FZ	Freezing
Precipitation	RA	Rain	DZ	Drizzle
Precipitation	SN	Snow	SG	Snow Grains
Precipitation	IC	Ice Crystals	PL	Ice Pellets
Precipitation	GR	Hail	GS	Small Hail and/or Snow Pellets
Precipitation	UP	Unknown Precipitation		
Obscuration	FG	Fog	VA	Volcanic Ash
Obscuration	BR	Mist	HZ	Haze
Obscuration	DU	Widespread Dust	FU	Smoke
Obscuration	SA	Sand	PY	Spray
Other	SQ	Squall	PO	Dust or Sand Whirls
Other	DS	Duststorm	SS	Sandstorm
Other	FC	Funnel Cloud		
Time	B	Began At Time	E	Ended At Time
Time	2 digits	Minutes of current hour	4 digits	Hour/Minutes Zulu Time

## U.S. METAR abbreviations

The following METAR abbreviations are used in the United States; some are used worldwide:<sup>[4]</sup>

**METAR and TAF Abbreviations and Acronyms:**

<b>Abbreviation</b>	<b>Meaning</b>	<b>Abbreviation</b>	<b>Meaning</b>
\$	maintenance check indicator	/	indicator that visual range data follows; separator between temperature and dew point data.
ACC	altocumulus castellanus	ACFT MSHP	aircraft mishap
ACSL	altocumulus standing lenticular cloud	ALP	airport location point
ALQDS	All Quadrants (Official)	ALQS	All Quadrants (Unofficial)
AO1	automated station without precipitation discriminator	AO2	automated station with precipitation discriminator
APCH	Approach	APRNT	apparent
APRX	Approximately	ATCT	airport traffic control tower
AUTO	fully automated report	C	center (with reference to runway designation)
CA	cloud-air lightning	CB	cumulonimbus cloud
CBMAM	cumulonimbus mammatus cloud	CC	cloud-cloud lightning
CCSL	cirrocumulus standing lenticular cloud	cd	candela
CG	cloud-ground lightning	CHI	cloud-height indicator
CHINO	sky condition at secondary location not available	CIG	ceiling
CONS	Continuous	COR	correction to a previously disseminated observation
DOC	Department of Commerce	DOD	Department of Defense
DOT	Department of Transportation	DSIPTG	dissipating
DSNT	Distant	DVR	dispatch visual range
E	east, ended, estimated ceiling (SAO)	FAA	Federal Aviation Administration
FIBI	filed but impracticable to transmit	FIRST	first observation after a break in coverage at manual station

FMH-1	Federal Meteorological Handbook No.1, Surface Weather Observations & Reports (METAR)	FMH2	Federal Meteorological Handbook No.2, Surface Synoptic Codes
FROPA	frontal passage	FROIN	Frost On The Indicator
FRQ	Frequent	FT	feet
FZRANO	freezing rain sensor not available	G	gust
HLSTO	Hailstone	ICAO	International Civil Aviation Organization
INCRG	Increasing	INTMT	intermittent
KT	KNOTS	L	left (with reference to runway designation)
LAST	last observation before a break in coverage at a manual station	LST	Local Standard Time
LTG	lightning	LWR	lower
M	minus, less than	MAX	maximum
METAR	routine weather report provided at fixed intervals	MIN	minimum
MOV	moved/moving/movement	MT	mountains
N	North	N/A	not applicable
NCDC	National Climatic Data Center	NE	northeast
NOS	National Ocean Survey	NOSPECI	no SPECI reports are taken at the station
NOTAM	Notice to Airmen	NW	northwest
NWS	National Weather Service	OCNL	occasional
OFCM	Office of the Federal Coordinator for Meteorology	OHD	overhead
OVR	Over	P	indicates greater than the highest reportable value
PCPN	precipitation	PK WND	peak wind
PNO	precipitation amount not available	PRES	Atmospheric pressure
PRESFR	pressure falling rapidly	PRESRR	pressure rising rapidly
PWINO	precipitation identifier sensor not available	R	right (with reference to runway designation), runway
RTD	Routine Delayed (late) observation	RV	reportable value

RVR	Runway visual range	RVRNO	RVR system values not available
RWY	runway	S	south
SCSL	stratocumulus standing lenticular cloud	SE	southeast
SFC	surface, <i>i.e.</i> , ground level)	SLP	sea-level pressure
SLPNO	sea-level pressure not available	SM	statute miles
SNINCR	snow increasing rapidly	SOG	Snow on the ground
SPECI	an unscheduled report taken when certain criteria have been met	STN	station
SW	Southwest	TCU	towering cumulus
TS	thunderstorm	TSNO	thunderstorm information not available
TWR	tower	UNKN	unknown
UTC	Coordinated Universal Time	V	variable
VIS	visibility	VISNO	visibility at secondary location not available
VR	visual range	VRB	variable
W	West	WG/SO	Working Group for Surface Observations
WMO	World Meteorological Organization	WND	wind
WS	wind shear	WSHFT	wind shift
Z	Zulu, <i>i.e.</i> , Coordinated Universal Time		

## U.S. METAR numeric codes

Additional METAR numeric codes listed after RMK.<sup>[16]</sup> <sup>[17]</sup>

Code	Description
11234	6 hour maximum temperature. Follows RMK with five digits starting with 1. Second digit is 0 for positive and 1 for negative. The last 3 digits equal the temperature in tenths.  This example value equals -23.4°C.
20123	6 hour minimum temperature. Follows RMK with five digits starting with 2. Second digit is 0 for positive and 1 for negative. The last 3 digits equal the



temperature in tenths.

This example value equals 12.3 °C (54 °F).

4/012 Total snow depth in inches. Follows RMK starting with 4/ and follow by 3 digit number that equals snow depth in inches.

This example value equals 12 inches of snow currently on the ground.

402340123 24 hour maximum and minimum temperature. Follows RMK with nine digits starting with 4. The second and sixth digit equals 0 for positive for 1 for negative. Digits 3–5 equal the maximum temperature in tenths and the digits 7–9 equals the minimum temperature in tenths.

This example value equals 23.4 °C (74 °F) and 12.3 °C (54 °F).

52006 3 hour pressure tendency. Follows RMK with 5 digits starting with 5. The second digit gives the tendency. In general 0–3 is rising, 4 is steady and 5–8 is falling. The last 3 digits give the pressure change in tenths millibars in the last 3 hours.

This example indicates a rising tendency of 0.6 millibars.<sup>[18]</sup>

60123 3 or 6 hour precipitation amount. Follows RMK with 5 digits starting with 6. The last 4 digits are the inches of rain in hundredths. If used for the observation nearest to 00UTC, 06UTC, 12UTC, or 18UTC, it represents a 6-hour precipitation amount. If used in the observation nearest to 03UTC, 09UTC, 15UTC or 21UTC, it represents a 3-hour precipitation amount.

This example shows 1.23 inches of rain.

70246 24 hour precipitation amount. Follows RMK with 5 digits starting with 7. The last 4 digits are the inches of rain in hundredths.

This example shows 2.46 inches of rain.

8/765 Cloud cover using WMO Code. Follows RMK starting with 8/ followed by a 3 digit number representing WMO cloud codes.

98060 Duration of sunshine in minutes. Follows RMK with 5 digits starting with 98. The last 3 digits are the total minutes of sunshine.

This example indicates 60 minutes of sunshine.

931222 Snowfall in the last 6-hours. Follows RMK with 6 digits starting with 931. The last 3 digits are the total snowfall in inches and tenths.

This example indicates 22.2 inches of snowfall.

933021 Liquid water equivalent of the snow (SWE). Follows RMK with 6 digits starting with 933. The last 3 digits are the total inches in tenths.

This example indicates 2.1 inches SWE.

## WMO codes for cloud types

The following codes identify the cloud types used in the 8/nnn part. <sup>[16]</sup>

Code	Low Clouds	Middle Clouds	High Clouds
0	none	None	none
1	Cumulus (fair weather)	Altostratus (thin)	Cirrus (filaments)
2	Cumulus (towering)	Altostratus (thick)	Cirrus (dense)
3	Cumulonimbus (no anvil)	Altostratus (thin)	Cirrus (often with Cumulonimbus)
4	Stratocumulus (from Cumulus)	Altostratus (patchy)	Cirrus (thickening)
5	Stratocumulus (not Cumulus)	Altostratus (thickening)	Cirrus / Cirrostratus (low in sky)
6	Stratus or Fractostratus (fair)	Altostratus (from Cumulus)	Cirrus / Cirrostratus (hi in sky)
7	Fractocumulus / Fractostratus (bad weather)	Altostratus (with Altostratus, Altostratus, Nimbostratus)	Cirrostratus (entire sky)
8	Cumulus and Stratocumulus	Altostratus (with turrets)	Cirrostratus (partial)
9	Cumulonimbus (T-storm)	Altostratus (chaotic)	Cirrocumulus or Cirrocumulus / Cirrus / Cirrostratus
/	not valid	above overcast	above overcast

**Source: [www.wikipedia.org](http://www.wikipedia.org)**