

MET 451: Aviation Meteorology

(3 Credit Hours)

Jeffrey N. A. Aryee (PhD)

Meteorology & Climate Science Programme

Department of Physics, KNUST, Ghana

e-mail:

jeff.jay8845@gmail.com



<https://github.com/jeffjay88/Aviation-Meteorology>

Google Classroom Code: **63zl2i**

LECTURE 2

Aviation Weather Observation



Aviation Weather Observation is used to report the various meteorological elements which collectively describe the atmosphere as observed and evaluated from the observer's position.

The meteorological elements normally observed are: Wind, Visibility, Present Weather, Sky Condition, Temperature, Dew Point, Altimeter Setting, and Remarks.

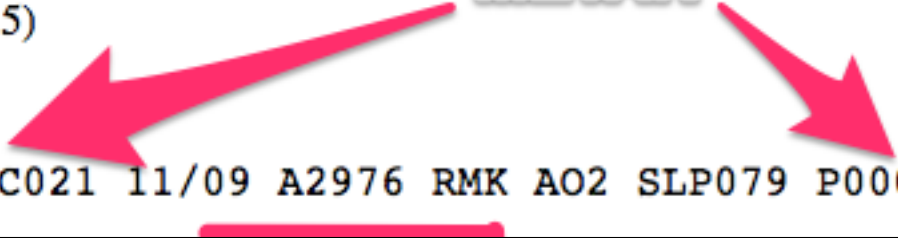
The type of report shall be **METAR** for a routine report and **SPECI** for a special report.

Aviation Digital Data Service (ADDS)

Output produced by METARs form (2024 UTC 17 December 2015)
found at <http://www.aviationweather.gov/adds/metars/>

METAR

KSLE 171956Z 18016G21KT 2SM -RA BR BKN010 OVC021 11/09 A2976 RMK AO2 SLP079 P0004 T01110094



- **METAR/SPECI** is the international standard code for hourly and special surface weather observations.
- The **METAR** acronym **[Meteorological Terminal Aerodrome Report]** roughly translates from the French as Aviation Routine Weather Report. A special report, **SPECI**, is merely a METAR-formatted report which is issued on a non-routine basis as dictated by changing meteorological conditions. The **SPECI** acronym roughly translates as Aviation Selected Special Weather Report.
- The format of the **SPECI** report is similar to that of the **METAR** and the elements used have the same meaning.

- METAR is a routine scheduled observation and is the primary observation code for reporting surface meteorological data.
- METAR contains a report of wind, visibility, present weather, sky condition, temperature, dew point, and altimeter setting collectively referred to as “the body of the report.”
- Additionally, information that elaborates on data in the body of the report may be appended to the METAR. This significant information can be found in the section referred to as “Remarks.”

- SPECI is an unscheduled observation. SPECI observations are taken when specific weather conditions have been met or observed (noted).
- SPECI reports shall contain all the data elements found in a METAR report (except single-element special) plus additional plain language information that elaborates on data in the body of the report.
- All SPECIs shall be made as soon as possible after the relevant special criteria are met or observed.
- Whenever SPECI criteria are met or observed at the time of a METAR, the type of report shall be METAR. Single-element special observations are authorized to be taken for tornadic activity and volcanic eruptions.

Content and Format of the Manual METAR/SPECI

1. Identification of the type of report: **METAR** or **SPECI**

2. location indicator (ICAO airport code): **CCCC**

eg. Kotoka International Airport has the station code DGAA

3. Time of the observation; **YYGGggZ**

“YY” is the day of the month and “GGgg” is the time. The times entered are in reference to the 24-hour clock.

YY - two-digit date

GG - two-digit hour

gg - two-digit minutes

Z - letter indicator for UTC

Wind Group - dddff(f)Gfmfm(fm)KT

Wind Direction - ddd

The direction is reported using three characters. When using direct reading dials, you determine the wind direction by averaging the direction over a 2-minute period. The true wind direction is reported in tens of degrees using three digits. The third character will always be a zero.

If the direction was determined to be variable (VRB) and the wind speed is 6 knots or less, the speed is appended to the VRB, e.g., VRB05. However, wind directions should be reported whenever they can be determined even when the wind speed is 6 knots or less, e.g., 00000KT, 15003KT

Wind Speed – ff(f)

The speed of wind is also reported with two or three characters. The magnitude of the wind speed must be stated with its reporting unit provided at the end of the wind group.

Wind speed can be reported in knots (**KT**) or mile per second (**MPS**).

WIND DIRECTION IN TENS OF DEGREES (TRUE)			
8 Points of Compass	Tens of Degrees	8 Points of Compass	Tens of Degrees
N	360	S	180
N	010	S	190
N	020	S	200
NE	030	SW	210
NE	040	SW	220
NE	050	SW	230
NE	060	SW	240
E	070	W	250
E	080	W	260
E	090	W	270
E	100	W	280
E	110	W	290
SE	120	NW	300
SE	130	NW	310
SE	140	NW	320
SE	150	NW	330
S	160	N	340
S	170	N	350

Wind Direction in Tens of Degrees

Wind Gusts - Gfmfm(fm)

- Reporting gusts is a bit challenging. The wind gust is coded in two or three digits immediately following the wind speed. The wind data for the most recent 10 minutes are evaluated.
- Gusts are indicated by rapid fluctuations in wind speed with a variation of 10 knots or more between peaks and lulls. The speed of the gust shall be the maximum instantaneous wind speed. The letter “**G**” is placed right before the wind gust speed in the transmitted coded report;
- Examples of Transmitted/Coded Data: 31015G25KT 090115G125KT

Trial Question

Class should interpret these first few lines of weather observation code below for October 1, 2019

METAR DGAA 011600Z 31020G35KT

Variable Wind Direction - dndndnVdxdxdx

- If the wind direction varies by 60° or more and wind speed is >6 knots, a variable wind group is also reported. The extreme values are coded using three digits for each direction (remember: tens of degrees, last digit is always a zero). A “V” separates the two extreme values.
- The directional variation shall be coded in a clockwise direction (remember: it can vary by more than 60°).

Example: If wind is variable from 180° to 250° at 10 knots, it would be coded as:
21010KT 180V250

Trial Question

Class should interpret these first few lines of weather observation code below for October 1, 2019

METAR DGAA 011415Z 18012G30KT 100V220

Prevailing Visibility (VVVVSM)

- Visibility can be quoted in meters or statute miles (SM).

Eg. 7SM represents prevailing visibility of 7 statute miles.

When visibility is greater or equal to 10 kilometers, it is coded as 9999.

Runway Visual Range (RVR) $RD_R D_R / V_R V_R V_R V_R$

- The 10-minute average runway visual range is reported when prevailing visibility is 1 mile or less, and/or the runway visual range is 6000 feet or less.
- **Eg. R06/1200N - Visibility of 1200 meters on runway 6 and not changing significantly.**

D indicates downward trend, U upward trend, and N no change.

Reporting CAVOK

- **CAVOK** stands for ***C**eiling **A**nd **V**isibility **OK***, 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 change at or in the aerodrome's vicinity.

Notations for Reporting Present Weather

QUALIFIER		WEATHER PHENOMENA		
INTENSITY OR PROXIMITY 1	DESCRIPTOR 2	PRECIPITATION 3	OBSCURATION 4	OTHER 5
- Light Moderate <i>(no symbol used)</i> + Heavy VC In the Vicinity	MI Shallow PR Partial BC Patches DR Low Drifting BL Blowing SH Shower(s) TS Thunderstorm FZ Freezing	DZ Drizzle RA Rain SN Snow SG Snow Grains IC Ice Crystals PE ¹ Ice Pellets GR Hail <i>(≥ 1/4 inch)</i> GS Small Hail and/or Snow Pellets <i>(<1/4 inch)</i>	BR Mist <i>(≥ 5/8SM)</i> FG Fog <i>(<5/8SM)</i> FU Smoke VA Volcanic Ash <i>(with any visibility)</i> DU Widespread Dust SA Sand HZ Haze PY Spray	PO Well-Developed Dust/Sand Whirls <i>(Dust Devils)</i> SQ Squalls FC Funnel Cloud +FC Tornado Waterspout SS Sandstorm DS Duststorm
The weather groups shall be 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.				

Eg. -SHRA: (-) is the designator for light. Precipitation will either be light (-), moderate (), or heavy (+) based on certain criteria that must be met. **SH** means showers and **RA** means rain. So the present weather is a light rain shower.

Sky / Cloud Cover

(N_sN_sN_sh_sh_sh_s)

- Sky cover amounts are cumulative. Therefore layer amounts include the sum of any layers below. Codes for sky cover amounts are:



- SKC (sky clear)
- FEW (few, <1 to 2 oktas)
- SCT (scattered, 3 to 4 oktas)
- BKN (broken, 5 to <8 oktas)
- OVC (overcast, 8 oktas)
- VV (sky obscured) [Clouds cannot be seen because of fog or heavy precipitation, so vertical visibility is given instead.]

- Cloud height is reported in 3 digits in hundreds of feet. Eg. 028 denotes 2800 feet.
- You will often have more than 1 designator (**i.e. SCT035 BKN090 OVC140**)
- Significant Clouds such as TCU (Towering Cumulus), CB (Cumulonimbus), or ACC (Alto cumulus Castellanus) will be found on the end of a category (**i.e. SCT035TCU**)

Temperature and Dewpoint ($T'T'/T'_dT'_d$)

Temperature and Dewpoint are coded as $T'T'/T'_dT'_d$ in degree Celcius.

Eg. 15/08

15 represents the temperature in Celcius

08 represents the dewpoint in Celcius

If the temperature or dewpoint falls below 0 there will be an "M" before it (i.e. 03/M02). "M" means minus.

Altimeter reading

(AP_HP_HP_HP_H)

A simply stands for Altimeter, denoting pressure reading in inches of mercury.

Eg. **3016** means 30.16 inches of mercury for the pressure.

Some countries use "Q" which indicates hectopascals.



REMARKS

(RMK)

RMK simply means REMARKS and marks the end of the standard METAR observation and the beginning of the remarks that are put in as necessary.

Eg. RMK A02 SF5NS3

- **A02** means that the site is automated and has a precipitation sensor. If it were A01, there would be no precip sensor. This does not mean the site is un-manned. If there is an AUTO after the ID in the metar obs, then there is no observer.
- **SF5NS3** means 5 oktas Stratus fractus and 3 oktas Nimbostratus

Questions?



RECAP OF LECTURE 2

1. CODING AND DECODING METAR AND SPECI

ASSESSMENT ON LECTURE 2

GROUP PRESENTATION ON TERMINAL AERODROME FORECAST (TAF)

Submission Deadline: Next Class (October 8, 2019)