Antigua and Barbuda Meteorological Services

Guide to Surface Weather Observations

First Edition

August 2018

Forward

The contents of this guide prescribes the standard procedures of the Antigua and Barbuda Meteorological Services (ABMS) for observing, recording and reporting weather conditions. It has been prepared in accordance with internationally recommended procedures as established by the World Meteorological Organization (WMO) and the International Civil Aviation Organization (ICAO).

The practices and procedures in this document apply to all ABMS observering personnel who provide weather observation services. Weather observer personnel are required to apply the provision of this guide as it pertains to their observational responsibilities. Observers are expected to exercise experienced judgment when encountering situations not covered by this guide.

This is a living document and will be revised at intervals to take account of changes in regulations, feedback from the industry and recognised best practices. Inquiries on the content of this guide should be directed to the management of the ABMS through appropriate channels.

Record of Revisions

Section	Revision description

Record of Amendments

This document will be kept under continual review to ensure its relevance to the Quality Management System

Amendments			
No.	Date Entered	Entered by	Approved
	August 2018, initial release	S. Brown	D. Destin

Table of Contents

Introduction – Meteorological Observations

Purpose

The purpose of meteorological observations is to provide detailed information of weather and climate to meet the needs of the various users. They are used for the real time preparation of weather analysis, forecasts and severe weather warnings, for the study of climate and for local weather operations. Some users require up-to-the-minute information; others require daily, monthly or long term climatological data. For example, an aircraft operator wants current weather reports and forecasts; the farmer is interested in temperature, sunshine and precipitation information. Thus, weather observations and carefully prepared records have long range, as well as immediate value.

World Meteorological Organization (WMO)

Since weather systems and climatic conditions do not recognize international boundaries, it is necessary that weather information be freely exchanged throughout the world. This requires coordination and standardization of practices and procedures and the efficient exchange of weather transmissions. To promote these services and to further the application of meteorology to aviation, shipping, agriculture and other human activities, the WMO was formed.

The WMO was established in 1950, and originated from the International Meteorological Organization (IMO), which was founded in 1873. The WMO became the specialized agency of the United Nations (UN) in 1951 for meteorology (weather and climate), operational hydrology and related geophysical sciences; and is the UN's voice on the state of the earth's atmosphere, its interaction with the oceans, the climate it produces and the resulting distribution of water resources. Its membership is drawn from 191 member states and territories. Antigua and Barbuda has been a member state of WMO since November 1988.

The vision of the WMO is to provide world leadership and expertise in international cooperation in the delivery and use of high-quality, authoritative weather, climate, hydrological and related environmental services by its members, for the improvement of the well-being of societies of all nations.

The mission of the WMO is:

1. **World weather watch**

- Facilitate worldwide cooperation in the establishment of networks of stations for the making of meteorological observations as well as hydrological and other geophysical observations related to meteorology, and to promote the establishment and maintenance of centers charged with the provision of meteorological and related services.

2. **Global Telecommunication System (GTS).**

- Promote the establishment and maintenance of systems for the rapid exchange of meteorological and related information.

3. **Global data-processing system (GDPS)**

- Promote standardization of meteorological and related observations and to ensure the uniform publication of observations and statistics.

4. **Applied Meteorology**

- Further the application of meteorology to aviation, shipping, water problems, agriculture and other human activities.

5. **Hydrology**

- Promote activities in operational hydrology and to further close cooperation between Meteorological and Hydrological Services.

6. **Training**

- Encourage research and training in meteorology and, as appropriate, in related fields, and to assist in coordinating the international aspects of such research and training.

To carry out the resolutions of the WMO, and to discuss and coordinate meteorological activities within certain geographical areas, there are six regional associations in the WMO. One of these associations, Region IV, comprises North America, Central America and the Caribbean. (See Figure 1, page 8)

Although International, Regional and National Codes may all be used in weather reporting, weather messages for interregional broadcast are in international code form. All of the codes, International, Regional and National are listed in WMO Publication No. 306, *Manual on Codes*, Volumes I and II.

Guide Content

This guide has been prepared with due consideration to the recommended practices and procedures set down by the WMO. Four parts are included containing instructions on the following:

Part A: General Observing procedures

Part B: Synoptic observations – detailed coding and reporting

Part C: Hourly observations – detailed coding and reporting

Part D: Graphic representation of meteorological data (Synoptic and upper air plots)

Authority

All statements throughout this guide shall be regarded as authoritative and shall be considered by the observer to be instructions. The bolded word "**shall**" is used in this guide to indicate that instructions are mandatory, or must be followed. The word "**should**" is used to denote a recommended practice or a good way to do something (best practices).

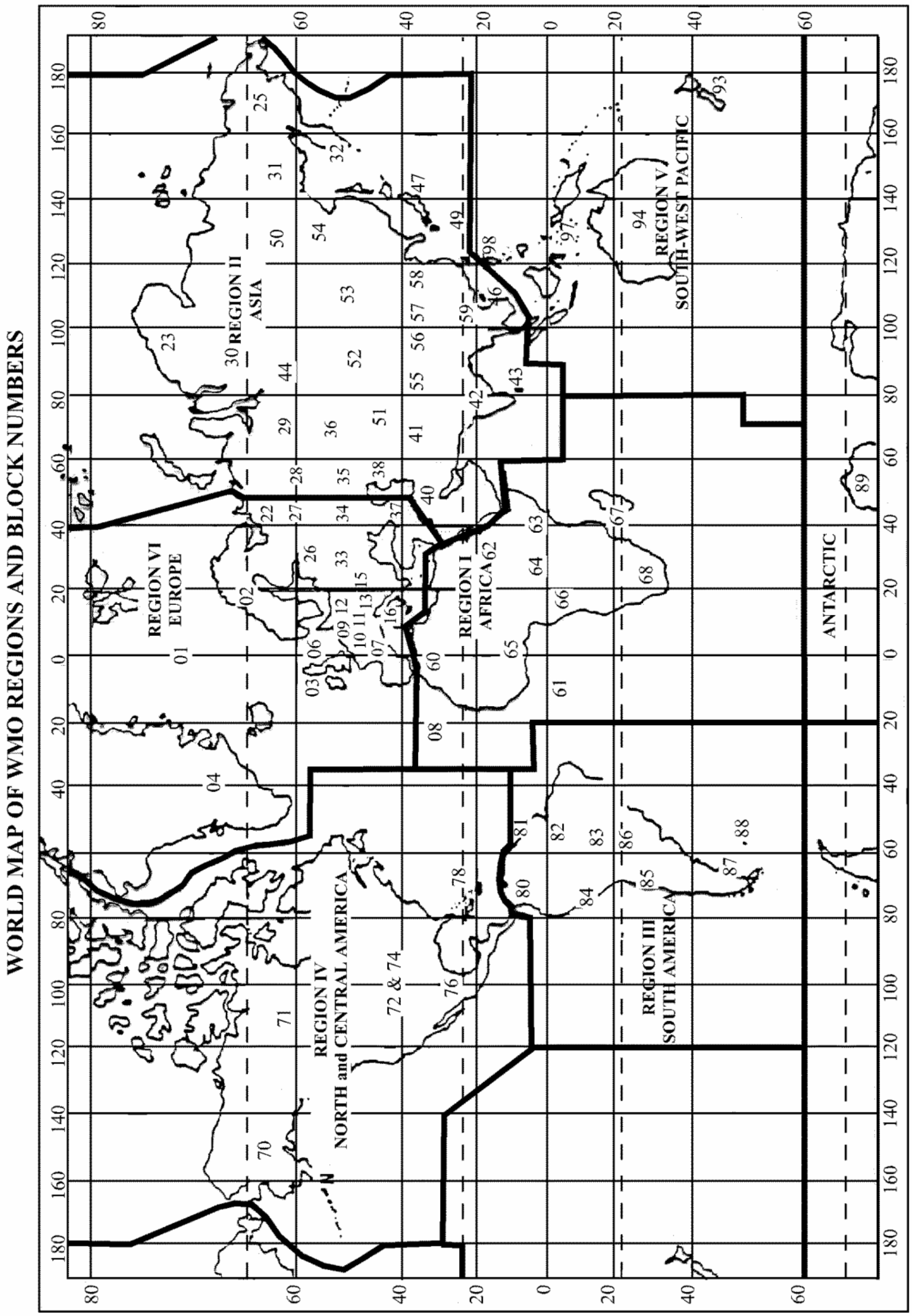


Figure 1: WMO Regions and block numbers

Part A

General Observing Procedures

Chapter 1: Accreditation and Competence of Observers

1.1 General

The weather observer must be competent and trained to make observations accurately and to code the resulting reports within the time allotted. The observer should realize, that it is neither possible nor desirable to prepare detailed instructions to cover the variety of weather in all its forms. Therefore, initiative and resourcefulness in dealing with unusual conditions are most important qualities in an observer.

1.2 Certification

In this part of Region IV, observers are trained and certified by the Caribbean Institute of Meteorology and Hydrology (CIMH) in Barbados, the designated training body for the countries affiliated with the Caribbean Meteorological Organization (CMO).

The certification process comprises two parts; theory and practical. The theoretical part provides the necessary background information on all elements of meteorological observing; this is examined to ensure that the concepts have been fully understood. The practical part entails at least a two-month period of on the job training which puts the observer in the company of an experienced observer in order to enable observing techniques to be practised and allows the following basic competencies to be assessed:

- Knowledge of procedures for the making of meteorological observations and reports.
- The ability to identify significant changes in the weather at the station that may be hazardous
- Knowledge of the technical regulations pertaining to the reporting, coding and dissemination of weather information
- Knowledge of aeronautical definitions.
- Operate conventional MET station and make manual calculations in case of failure of AWS and the Observation program.
- Procedures for meteorological services for international aviation
- WMO and ICAO documentation. Knowledge of the documents
- Knowledge of the Quality Management System

1.3 On the Job Training

The practical training will cover the all aspects of manual observing techniques including

1. Observing during daylight
2. Observing during darkness (including the transition between day/night)

During the practical training, continuous assessment shall be made of the trainee's ability to observe and correctly record the weather. If at any point during training the required standard is not being met, the trainee will be notified of deficiencies and of what standard is required.

Towards the end of the on the job training period, the trainee shall undertake a competency assessment based on the aspects of aviation observing. This assessment will entail a competency checklist to be signed off on by the supervisor and a written assessment on observing and coding and oral questions.

1.4 Duties

It is the duty of the weather observer to report weather conditions as they actually exist at the time of observation. While on duty, weather observers are required to keep a close and continuous watch on the weather. Their records and reports shall be as complete and accurate as possible. Prompt and accurate reporting is vital for forecasting and weather warning services. They may be the means of preventing financial loss, property damage and loss of life. Delayed reports rapidly lose their value for forecasting. However, if communication or other difficulties delay or prevent distribution of reports, the observer shall continue to observe the weather and record his observations on schedule. It is essential that climatological records be complete. Neatness is necessary for ready reference and for quick processing of the data; illegible or doubtful records are of little use.

The observer shall continuously monitor the weather. Observations must be updated, as necessary, in a timely manner. During any period that routine reports are being produced, special reports shall be produced as dictated by the weather conditions. Errors in reports should be quickly corrected and disseminated.

The observer shall also provide a full non-routine observation at the time of an aircraft accident on or in the vicinity of the aerodrome. This is to ensure that complete details of the weather at the time of the incident will be available to an official inquiry.

Although instruments are used, sensory observations play an important role in ensuring that prepared weather reports satisfy local and international requirements. There are however limitations that should be understood. The vision field around aerodromes can be greatly reduced due to topography and buildings and so it is imperative that the observer in so far as practicable evaluate the weather elements at an area from which the data supplied is a fair representative of the aerodrome and its vicinity.

1.5 Priority of Duties

Weather observing personnel, whose duties include observing and reporting weather conditions, **shall** give highest priority to weather observing duties. Observers must be alert to situations conducive to significant changes in weather conditions and must take and disseminate special observations as rapidly and feasible whenever changes are noted and meet the criteria specified.

Chapter 2: Observing Practices

2.1 General

Prior to taking up duty and, when necessary during the shift, the observer should, if possible, be briefed by the responsible forecaster on possible weather sequences which might occur during the duty period.

A continuous watch on the weather should be maintained as far as practicable so that a special report can be made as required using the criteria laid down for special reports. Observations made should be based, as far as possible, on instrument measurements. Any suspected faults in the instrumentation or communication system should be reported according to local arrangements so that action can be taken to ensure their prompt rectification.

2.2 Types of Observations

There are three general types of surface observations:

1. **Manual Observation.** Any observation for which the observer observes, evaluates, prepares, records, and transmits the observation without the use of an automated observing system.

2. **Automated Observation**. Any observation which has been prepared and transmitted by an automated observing system without human intervention.

3. **Augmented Observation**. Any automated observation which has been evaluated by a human observer to which additional weather information has been added that is beyond the capabilities of the automated weather observing system and/or is deemed operationally significant.

2.3 Methods of Observations

There are two methods of observations sensory and instrumental:

1. Sensory observations are made by the observer, without the use of instruments, but by estimation and experience only. Here the observer is guided by specifications and/or internationally agreed procedures.

2. Instrumental observations are any observation which has been prepared and transmitted by an automated observing system without human intervention.

2.4 Order of Observing

Elements having the greatest rate of change must be evaluated last. When conditions are relatively unchanging, the observer must evaluate the elements outdoors first, and then evaluate the elements indoors, with pressure being the last element evaluated.

2.5 Recency of Observed Elements

Individual elements entered in an observation must, as closely as possible, reflect conditions existing at the actual time of observation. At manual locations, elements entered must have been observed within 10 minutes of the actual time of observation. Gusts and squalls must be reported if observed within 10 minutes of the actual time of observation. METAR observations must be made as close to the scheduled time of the observation as possible to meet filing deadlines, but in no case will these observations be started more than 10 minutes before the scheduled time.

2.6 Dark Adaptation

When taking observations outdoors at night, sufficient time should be allowed for the observer's eyes to become adjusted to the darkness.

2.7 Weather Not Observed

Observers are not required to report occurrences they have not observed. However, the observer may use information from reliable sources, for example colleagues not at the aerodrome, pilots, airline/airport personnel or other sources deemed acceptable by the observer.

2.8 Standard Time of Observation

The standard time of observation is determined by international agreement; it is with reference to Coordinated Universal Time (UTC*) For example, the standard times for the main synoptic observation are 0000, 0600, 1200 and 1800 UTC; for Upper Air observations, the Standard Times are 0000 and 1200 UTC.

***Note**: In the aviation community, Z is often used in lieu of UTC; this guide reflects the use of both abbreviations.

2.9 Surface Observations

The time of a surface observation **shall** be the time at which the barometer is read. In the case of Aerodrome Special Meteorological Reports (SPECI), the time of the observation is the time at which the element necessitating the report was observed. The time assigned to a SPECI issued to report the end of a thunderstorm, would be 10 minutes later than the actual time of the last occurrence of thunder.

2.10 Local Standard Time

The local standard time used for record purposes **shall** be that of the standard time zone in which the station is located. For our Antigua and Barbuda this is Atlantic Standard Time (AST) which is 4 hours behind Coordinated Universal Time (UTC).

2.11 Quality Control of Observations

Observational Data are used in the preparation of official publications, and by both government and industry in the preparation of statistical analyses as a basis for decision making. The accuracy of the data determines, to a large degree, the quality of the publication or analysis, and hence it is extremely important that suitable measures be taken to ensure that this data are of the highest quality.

Observational data are subjected to review which reveals possible errors in recording or transmission, and gross errors in instrumental readings, calculations and estimation of parameters. The suspect data are checked by the unit supervisor or designated senior observer and corrected where necessary before being archived.

Although the data review does not reveal all errors in observational data, experience has shown that the number of corrections required is a reliable indicator of the likely overall quality of the data.

In order to ensure validity and reliability of the observational data, the use of standards, certification, and quality control must form a part of the observational program. Without these essential elements, the credibility of all information produced would become suspect. Quality control is therefore necessary to ensure that proper procedures are followed.
The primary objectives of quality control are to ascertain the following:

- Observers taking weather reports are qualified and certified.
- Standard procedures are being used to generate weather reports.
- The observation program at the station satisfies the local and international requirements for weather reporting.
- The quality of the reports is constantly monitored and feedback provided, as appropriate.
- The siting and exposure of instruments is the best practical, and are still within acceptable limits.

- Instruments are in good operational order and have been compared to the standard sensors.

- A proper instrument inspection and maintenance program is in place to support the operations of the station.

2.12 Distribution of Reports

The distribution of coded weather reports is done via computer, using the software Corobor Messir System and EDIS (Electronic Data Information Source).

2.13 Record Retention

Meteorological records, charts, forms, etc., are retained at the station for various periods of time. Procedures regarding the retention of documents are given in the appropriate quality management procedure and work instructions.

2.14 Meteorological Instruments

Instruments are generally installed by a person with special training. This guide deals only with the use of instruments as part of the general observing procedure. Instructions for the routine care and maintenance of instruments will be found in the appropriate work instructions.

2.15 Basic Forms of Instruments

Instruments used for meteorological observations can be anything that has an output indicator which varies with the state of the particular variable being measured.

Meteorological instruments may be divided into two basic forms

1. Direct reading instruments; and
2. Recording instruments.

Direct reading instruments are more accurate, however, measurements of meteorological elements can only be made when the instruments are read. If measurements for anytime is required, it would be necessary to use a recording instrument which maintains a continuous record.

Recording instruments provide continuous recordings on meteorological elements. Recording instruments tend to be less accurate than direct reading, however, accuracy can be improved by regular calibration.

2.16 Quality Control of Instruments and Sensors

For the purpose of quality control the following requirements are required:

1) **Comparison of instruments and sensors**. An established procedure to periodically compare the instruments and sensors used to the standard to ensure compliance with accuracy requirements.

2) **Calibration and standardization of sensors.** This should be performed yearly, or according to the manufacturers' suggestions, and after any major maintenance is performed.

3) **Routine inspection and maintenance.** An established procedure for scheduled inspection and maintenance of equipment, to determine their operational acceptability.

2.17 Sensor Evaluations

When the observer has reason to believe that the accuracy or validity of indications from meteorological sensors is questionable, the use of such equipment should be discontinued until necessary corrective maintenance has been accomplished. If the use of such equipment is discontinued, any required back-up procedures or practices must be initiated.

***Note**

If the observer believes that the AWOS information is inaccurate, inform the relevant persons and log the matter.

Chapter 3: Observing Weather Elements

3.1 General

The instructions given in this chapter together with the "Definitions and Descriptions of Meteors" contained in the *International Cloud Atlas (WMO No. 407)* *https://cloudatlas.wmo.int/home.html* **shall** be used for identifying atmospheric phenomena. Also included are instructions for measuring precipitation, for determining its intensity and character, and for observing miscellaneous phenomena and unusual weather conditions.

3.2 Wind

For the purpose of surface weather observations, Wind is defined as air in motion. It represents the horizontal flow of air at a height of 10 m above the ground. Wind information is included in all surface weather reports and shall contain both velocity (direction and speed) and character (gust or squall). For meteorological purposes, the wind direction is reported clockwise of true north and the speed is expressed in knots.

3.3 Direction

The wind direction is the direction from which the air is moving. It usually represents the average direction during the ten-minute period ending at the time of observation.

3.4 Speed

The wind speed is the rate of airflow past a fixed point on earth. It represents the average speed during the ten-minute period ending at the time of observation. The term **"calm"** is used to describe winds less than a knot.

3.5 Character

Wind character is reported when there are significant variations in the wind speed, during the ten-minute period ending at the time of the observation. The character will be reported as a **"gust"** or **"squall"** depending on the magnitude and duration of the variation.

3.6 Gusts

Gusts are sudden, rapid, and brief changes in the wind speed lasting for seconds. They are characterized by the more or less continual fluctuations between the high (peak) and low (lull) speed.

3.7 Squall

A strong wind that rises suddenly, generally lasting at least one minute. It is distinguished from a gust by its longer duration. The increase in wind speed is at least 16 knots, the speed rising to 22 knots or more and lasting for at least one minute.

3.8 Estimation of Wind

When the anemometer and anemograph are lacking or when the instruments are not in operating condition, instruments are not available for determining wind direction, the observer must estimate the direction by observing the windsock, movement of twigs, leaves, smoke drift, etc., or by facing into the wind in an unsheltered area. When estimating wind direction, the observer must note that even small obstacles may cause variations in the wind direction. The observer must not use the movement of clouds in estimating the surface wind direction regardless of how low the clouds are.

The speed may be estimated by using the Beaufort scale of winds which relates common effects of the wind and equivalent speeds.

Chapter: 4 Sky

4.1 Sky Condition

An observation of the sky requires an examination and identification of the clouds and obscuring phenomena (haze, smoke, precipitation, etc.) which prevent an uninterrupted view of the sun, moon, stars or the clear blue of the celestial dome. Each layer is analysed for its type, amount, opacity, and height of base or vertical visibility.

4.2 Definitions

Celestial Dome - the portion of the sky which is visible in all directions of the local horizon from the point of observation.

Sky Cover - the amount of the celestial dome that is hidden by clouds and/or obscuration.

Ceiling - the height of the lowest layer of clouds above the surface that are either broken or overcast.

4.3 Layer Determination

Single Layer

A layer is any amount of cloud or obscuring phenomena, the bases of which are at approximately the same level. A layer may be continuous or formed of detached elements. A similarity in cloud form indicates a formation at about the same level and is therefore a guide in determining that a number of detached elements compose a single layer.

Multiple layers

The existence of more than one layer is a common occurrence. Differences in cloud form or in direction of motion are valuable aids in distinguishing different layers. Upper layers may also be seen through openings or thin spots in lower layers.

Interconnected layers

Clouds of vertical development may build up to reach or penetrate upper layers. Also, by horizontal extension, swelling Cumulus or Cumulonimbus may form Stratocumulus, Altocumulus, or dense Cirrus. Careful examination is often necessary to determine the relationship and to distinguish such layers.

Layers aloft

Most layers occur as "layers aloft" whose bases are sufficiently high above the surface to show clear spaces beneath: e.g., "Cumulus Fractus at 0900 ft.; Stratocumulus at 3600 ft.; Altocumulus at 8000 ft."

4.4 Layer Identification

Cloud layers

The description and pictures given in the *International Cloud Atlas* (WMO No. 407), **shall** be used for identifying cloud types. Check https://public.wmo.int/en/media/news/international-cloud-atlas

Obscuring layers

An "obscuring layer" is a non-cloud layer which either wholly or partly prevents an observer from seeing the sky or clouds at higher levels. It may be a layer aloft such as smoke, or a surface-based layer such as fog. Precipitation, if heavy enough, can constitute an obscuring surface-based layer.

Layer amount and opacity

Layer amount is the amount in "eighths" of the whole sky that is observed to be covered (not necessarily concealed) by a layer aloft or concealed by a surface-based layer.

Layer amount are observed and recorded in eighths of the whole sky (celestial dome). An amount of less than one eighth shall be called a "trace".

Layer amount is determined by mentally dividing the sky in halves and estimating the amounts in each half.
During darkness, if stars are plainly visible and no cloud or obscuring phenomenon is observed, the sky **shall** be considered to be clear. When the stars are dimmed, the dimming is evidence of the presence of cloud or obscuring phenomenon and will be of assistance in determining the amount and opacity of the layer.

Total amount

Total amount is the amount in eighths, of the whole sky that is covered by all layers observed.

4.5 Height

Height to be observed

For a layer whose base is above the surface, the height of the base of the layer shall be observed.
Units

Height of layers shall be determined to the nearest 30 m (100 ft.) as this represents the order of accuracy that is usually obtainable.

Vertical visibility

Vertical visibility is the distance an observer on the ground can see vertically into a surface-based layer. Vertical visibility **shall** be considered as unlimited for a given layer when the observer can see through the layer.

4.6 Methods of Determining Heights of Layers

Estimation

Heights of layers may be estimated with a reasonable degree of accuracy. Vertical visibility, however, is very difficult to estimate even with the aid of balloons or a ceiling projector. Estimation is a matter that requires careful study and continual practice on the part of the observer. Correlation of estimated values with those determined by other methods, such as pilot reports or balloon measurements will improve the observer's ability. When the lack of a more accurate method requires the observer to estimate, he may be guided by the following:

1. The apparent size of the elements, the rolls or features visible in the layer, i.e., large rolls or elements usually indicate that the layer is relatively low while small rolls or elements usually indicate that the layer is relatively high.

2. The known heights of hills, towers, etc. in the vicinity.

Pilot Reports

Heights reported by pilots are usually given as heights above mean sea level (in feet) and require conversion to heights above the aerodrome. A report by a pilot on the height of cloud bases or vertical visibility as observed within 1.5 miles of the observing site may be regarded as highly accurate and representative of conditions at the observing site. Such reports, taken at greater distances from the site should be used by the observer in estimating heights.

Although no rigid rules can be given relating the types and heights of clouds, it is possible to specify the height ranges in which clouds of each genera are usually found. The observer must understand that there are large deviations from these heights. In general, cloud bases follow the temperature; lower in winter and in Arctic regions, and higher in summer and in southerly regions.

Chapter 5: Visibility

5.1 General

Visibility is the greatest distance at which objects of suitable dimensions can be seen and identified.

The visibility to be reported is the horizontal visibility observed at eye level, the values reported may differ depending on the type of report that is been recorded. The different types of visibility are articulated in Sections B and C respectively.

Units of measure

Visibility **shall** be reported in kilometres (km).

5.2 Guides to Determining Visibility

Point of observation

A roof is convenient for enabling the observer to obtain a complete view of the horizon circle.

Visibility markers **shall** be selected with a view to choosing prominent objects so located that they may be viewed against a background of the horizon sky. One must not, for example, select a building on the side of a hill, which would be viewed with the hill as background. The distance of markers such as hills and mountains may be determined with the aid of a large scale map of the vicinity. A suitable visibility marker should subtend an angle at the observer's eye of not less than 0.5°* vertically and horizontally above the horizon. Objects such as radio masts are therefore not desirable visibility markers for daytime use. During darkness unfocussed lights of moderate intensity at known distances should be used for visibility markers.

Visibility at night **shall** be determined with the aid of markers in the form of lights. Very powerful or focussed lights should be used with caution, as their great penetrating power tends to result in too high a value for the visibility. However, obstruction lights on towers and buildings and the various marker lights around an airport may be used for visibility markers.

The principal difficulty in determining visibility at night lies in the uncertainty as to the state of accommodation of the eyes of an observer who has recently left a brightly lit office. Therefore, in order that the observer's eyes may become as well accommodated as possible, **the visibility should be the last of the outdoor observations.**

Chapter 6: Atmospheric Phenomena

6.1 General

Any product of the condensation of atmospheric water vapour that is deposited on the earth's surface is a type of precipitation. The types of precipitation that originate aloft are classified as liquid precipitation, freezing precipitation, and frozen precipitation.

6.2 Precipitation

Reporting and Documenting Precipitation.

The type, intensity, and character of precipitation in any form must be reported in the weather report whenever it is observed to occur at the station. Precipitation observed at a distance from the station must also be reported.

To report and document precipitation, the observer must determine:

1. Time of beginning, ending, and changes in intensity; and
2. Type, character, and intensity.

Beginning and/or ending precipitation

The observer must note to the nearest minute the time that precipitation of any type is observed to begin and end. Times for separate periods must be reported only if the intervening time of no precipitation exceeds 10 minutes.

6.3 Liquid Precipitation

Rain (RA)

Precipitation of liquid water particles, either in the form of drops of larger diameter than 0.5 mm, or of smaller widely scattered drops.

Character of precipitation

Under the term "character," precipitation can be classified as showery, continuous or intermittent.

Showery precipitation: falls from cumuliform cloud and can be further identified by one or more of the following features:

1. Showers often (but not always) begin and end abruptly.

2. Showers usually occur in periods of short duration, perhaps 15 min or so, but they may last much longer.

3. Usually there are rapid fluctuations in the intensity of the precipitation.

4. There is a noticeable brightening of the sky between showers.

Rain can occur either with showery or non-showery characteristics; to indicate a showery character, the terms “rain showers,” is used.

Continuous precipitation:

Precipitation that is not showery is considered to be continuous when:

1. It continues without a break for at least one hour preceding the time of observation; or

2. It continues without a break since beginning in the hour proceeding the time of observation.

Intermittent precipitation

Precipitation that is not showery is considered to be intermittent when it has stopped and recommenced at least once during the hour proceeding the actual time of observation.

Note:

Continuous precipitation may on occasion become showery without the precipitation stopping, and showery precipitation may become continuous without stopping.

Precipitation Intensity

Intensity of precipitation is an indication of the amount of precipitation falling at the time of observation. It is expressed as light, moderate, or heavy. The intensity of rain including showers should be estimated using the guidelines given in the table below. (A more in-depth table is available in APPENDIX D).

Rain (including showers)intensity	Rate
Light	<2.5 mm/h
Moderate	2.5 ≤ 10 mm/h
Heavy	≥10.0 mm/h

Precipitation intensity criteria table.

Hail (GR)

Precipitation of small balls or pieces of ice (hailstones) with a diameter ranging from 5 mm to50 mm or sometimes more, and which fall either separately or fused into irregular lumps. Hailstones are composed almost exclusively of transparent ice, or of a series of transparent layers of ice at least 1 mm in thickness, alternating with translucent layers. Hail is generally observed during heavy thunderstorms.

6.4 Other Hydro-meteorological Deposits

Dew

Dew forms when water is condensed on grass and other objects near the ground. The surface on which the dew forms has been cooled by radiation during the night, to a temperature below the dew point of the surrounding air, but is still above freezing.

6.5 Thunderstorm (TS)

Definition

One or more sudden electrical discharges, manifested by a flash of light (lightning) and a sharp or rumbling sound (thunder). Thunderstorms are associated with convective clouds (cumulonimbus) and are usually accompanied by precipitation. The associated cumulonimbus has vertical up draughts that may reach 30 m/s in the more vigorous cells. Downdraughts also occur, especially in the later stages of development, with speeds of about half of those for up draughts.

Identification

Thunderstorm activity at the station shall be reported when:

1. Thunder is heard; or

2. Overhead lightning is observed and the local noise level is such as might prevent hearing thunder. In this case, hail may also be an indicator of a thunderstorm in progress.

Time of beginning of thunderstorm

For record purposes, the time of beginning of a thunderstorm shall be the time of the earliest occurrence that indicates thunderstorm activity at the station.

Time of ending of thunderstorm

As soon as it is no longer possible to report thunderstorm activity at the station for 10 minutes the observer shall record the thunderstorm as having ended 10 minutes ago.

Intensity

No intensity is ascribed to thunderstorms.

6.6 Funnel Cloud (FC) (Tornadoes or Waterspouts)

A phenomenon consisting of an often violent whirlwind, indicated by the presence of a cloud column or funnel-shaped cloud, extending downwards from the base of cumulonimbus cloud but not necessarily reaching the ground.

The diameter can vary from a few metres to some hundreds of metres. A well-developed funnel cloud is called a tornado if over land and a waterspout if over water. The most violent tornado can have associated wind speeds of up to about 600 km/h (300 kt, 150 m/s).

These phenomena are associated with a violently rotating column of air, pendant from a Cumulonimbus cloud. This violent whirlwind is nearly always observable as a cloud column or inverted cloud cone (funnel cloud), and a “bush” composed of water droplets raised from the surface of the sea or of dust, raised from the ground.

This phenomenon is called a **“funnel cloud”** when it occurs over land and a **“waterspout”** when it occurs over water. The observer **shall** note the direction of the storm from the station and the direction towards which it is moving. Intensity values are not ascribed to tornadoes or waterspouts.

6.7 Obstructions to Vision

An “obstruction to vision” is a meteor, other than precipitation, that reduces the horizontal visibility at eye level. Obstructions may be suspended in the atmosphere, e.g., fog or haze, or blown from the earth’s surface, e.g., blowing snow or blowing sand.

Haze (HZ)

A suspension of extremely small, dry particles invisible to the naked eye and sufficiently numerous to give the air an opalescent (milky or pearly) appearance.

Smoke (FU)

A suspension in the air of small particles produced by combustion.

Volcanic Ash (VA)

Volcanic ash consists of fine particles of rock powder that have been blown out from a volcano. The ash may remain suspended in the atmosphere for long periods, producing red sunsets thousands of kilometres away.

Chapter 7: Atmospheric Pressure

7.1 General

Atmospheric pressure, also called barometric pressure, is the force per unit area exerted by the atmosphere as a consequence of its weight, and thus is equal to the weight of a vertical column of air of unit area, extending from the level in question to the outer limit of the atmosphere.

The standard instrument for the measurement of atmospheric pressure at the ABMS is a mercury in glass barometer, the unit of measure is hectopascal (hPa) which is equivalent to the millibar (mb).

7.2 Barometric Pressure Computations

Station elevation

The station elevation is the vertical distance in metres above Mean Sea Level (MSL) of the datum level to which barometer readings are corrected to give station pressure. At surface weather observing sites on airports, the station elevation is equal to the aerodrome reference point.

Determination of station pressure

Station pressure is the atmospheric pressure at the station elevation.

Station pressure is determined by applying to the barometer reading a reduction figure obtained from the Barometric pressure Correction Chart. This chart incorporates correction for temperature to obtain the station pressure from the barometer reading.

Mean sea level pressure

This is the pressure reading most commonly used by meteorologists to track weather systems at the surface. Like altimeter setting, it is a "reduced" pressure which uses observed conditions rather than "standard" conditions to remove the effects of elevation from pressure readings. This reduction estimates the pressure that would exist at sea level at a point directly below the station using a temperature profile based on temperatures that actually exist at the station. In practice the temperature used in the reduction is a mean temperature for the preceding twelve hours. Mean sea level pressure should be used with caution at high elevations as temperatures can have a very profound effect on the reduced pressures, sometimes giving rise to fictitious pressure patterns and anomalous mean sea level pressure values.

Altimeter setting (QNH)

It is not the true barometric pressure at a station. Instead it is the pressure "reduced" to mean sea level using the temperature profile of the "standard" atmosphere, The altimeter setting is the pressure value to which an aircraft altimeter scale is set so that it will indicate the altitude (above mean sea level) of the aircraft on the ground at the location for which the pressure value was determined. The altimeter setting is an attempt to remove elevation effects from pressure readings using "standard" conditions.

7.3 Pressure Tendency

Pressure tendency is defined as the characteristic and the amount of the change in station pressure over a given period of time. The tendency is included in weather reports which are taken at 0000, 0300, 0600, 0900, 1200, 1500, 1800 and 2100 UTC. The amount of the pressure tendency is the net change in station pressure in the twenty four hours preceding the observation, and is determined in tenths of hectopascal.

7.4 Barograph use

The observer shall monitor the barograph to confirm positive or negative tendency characteristic from the barograph trace and as a means of verifying the barometer reading.

Time marks shall be made on the barograph chart at 0000 and 1200 UTC. Time marks shall be made immediately after the reading of the barometer. Barographs charts should be carefully and accurately annotated when changed to enable identification of the station and date.

Chapter 8: Temperature

8.1 Definition

Temperature The degree of hotness or coldness of a substance as measured by a thermometer. It is also a measure of the average speed or kinetic energy of the atoms and molecules in a substance.

8.2 General Requirements

Temperature s are taken to the following:

1. The air near the Earth's surface;
2. The surface of the ground;
3. The soil at various depths;
4. The surface levels of the sea;
5. The upper air (at various heights).

These measurements are required, either jointly or independently and locally or globally, for input to numerical weather prediction models, for hydrological and agricultural purposes, and as indicators of climatic variability. Local temperature also has direct physiological significance for the day-to-day activities of the world's population.

When readings are required from two or more thermometers, they **shall** be observed in the following order:

1. Dry bulb
2. Wet bulb
3. Maximum
4. Minimum

8.3 Dry-bulb Temperature

Dry-bulb temperature is the value of the observed reading of an "ordinary" thermometer.

8.4 Wet-bulb Temperature

The lowest temperature that can be obtained by evaporating water into the air.
The wet-bulb temperature differs from the dry-bulb temperature by an amount dependent on the moisture content of the air; it is normally the same as or lower (colder) than the dry-bulb temperature. The difference is called the "depression" of the wet-bulb temperature.

Depression of the wet-bulb temperature **shall** be obtained by subtracting the value of the wet-bulb temperature from the value of the dry-bulb temperature.

8.5 Maximum Temperature

This is the highest temperature reached during the interval under consideration.

8.6 Minimum Temperature

This is the lowest temperature reached during the interval under consideration.

Chapter 9: Humidity

9.1 General

A general term that refers to the airs water vapour content. Humidity is commonly expressed in terms of dew point temperature and relative humidity.

9.2 Dew Point

The dew point is the temperature at which the air would become saturated (with respect to water) if cooled at constant pressure and without the addition or removal of water vapour. The dew point is expressed in degrees Celsius.

9.3 Relative Humidity

The ratio of the amount of water vapour in the air compared to the amount required for saturation (at a particular temperature and pressure). The ratio of the air’s actual vapour pressure to its saturation vapour pressure.

Part B:

Synoptic Observations and Reports

Chapter 10: The Synoptic Code

10.1 Introduction

Weather recognizes no international boundaries. A precise synoptic picture of weather conditions over a vast area of the earth's surface is required in order to provide national and international forecasts and climatological data to satisfy the needs of aviation, agriculture, industry and the public. As a first step in meeting these requirements, surface weather reports are prepared and exchanged throughout the world in an international code developed and agreed upon by member states of the World Meteorological Organization (WMO).

Such reports are made at least four times daily and a complete report may contain over 20 pieces of information which include measurements of atmospheric pressure, calculated from barometer readings taken at precisely the same time throughout the world. The primary synoptic is reported at the standard hours of observation which are: **0000, 0600, 1200** and **1800 UTC**. The shortened form is referred to as the intermediate synoptic or the 3-hourly report. The intermediate synoptic is reported at the standard hours for the intermediate observations which are: **0300, 0900, 1500** and **2100 UTC**.

10.2 The Synoptic Code

The international meteorological code **FM 12-XIV SYNOP** is used for reporting synoptic surface observations from a land station, either manned or automatic. The code is called **FM 13-XIV SHIP** when used for reporting similar observations from a manned or automatic sea station. The common synoptic code comprises six sections numbered 0 to 5, each of which is primarily composed of five-figure code groups. Most groups in sections 0 to 5 begin with a numerical indicator and these indicators are numbered consecutively within each section. The numerical indicators identify a specific group which always contains the same weather elements. Thus the omission, whether accidental or deliberate, of any one group will not affect the identification of other groups. Indeed, provision is made within the code for omission of groups when their weather elements are either not present or cannot be observed. This also assures a code flexible enough for both staffed and automatic stations.

Very few reports will use all the groups. For example, only at coastal station would the section 222 (wave information) be included. Also, individual groups may be left out of an observation for a number of reasons. Different regions may have requirements which will include or exclude certain groups.

Section 0 contains, in the case of land stations (SYNOP report), the station identifier; in the case of sea stations (SHIP report), the ship's position and call sign (or buoy identifier number). It also contains a message type identifier group and a date-time-wind indicator group which is transmitted once at the beginning of a synoptic message bulletin.

Section 1 contains data for international as well as regional and national exchange. This section is included in both the SYNOP and the SHIP code form.

Section 2 contains maritime data pertaining to a sea station. Land stations do not use this section, except in the case of a coastal station that transmits maritime data.

Section 3 contains data for regional and national exchange only. It is always included in reports from land stations.

Section 4 is for use of designated mountain stations only, for reporting of clouds below station level.

Section 5 is used by land stations to transmit data for national exchange only.

Within a given five-figure code group, the relative position of each code figure, denoting a specific weather element is constant; thus, the synoptic code can be represented symbolically as depicted in the following section.

10.3 Symbolic Form of the Synoptic Code

Section 0

(SYNOP) $M_iM_iM_jM_j$ $YYGGi_w$ IIiii
(SHIP) $M_iM_iM_jM_j$ D....D or $A_1b_wn_bn_bn_b$ $YYGGi_w$ $99L_aL_aL_a$ $Q_cL_oL_oL_oL_o$

Section 1

i_Ri_xhVV Nddff (00fff) $1s_nTTT$ $2s_nT_dT_dT_d$ $3P_oP_oP_oP_o$ 4PPPP 5appp $6RRRt_R$ $7wwW_1W_2$ $8N_hC_LC_MC_H$ 9GGgg

Section 2

$222D_sv_s$ $0s_sT_wT_wT_w$ $1P_{wa}P_{wa}P_{wa}P_{wa}$ $2P_wP_wH_wH_w$ $3d_{w1}d_{w1}d_{w2}d_{w2}$ $4P_{w1}P_{w1}H_{w1}H_{w1}$ $5P_{w2}P_{w2}H_{w2}H_{w2}$ $6I_sE_sE_sR_s$ or ICING + plain language $70H_{wa}H_{wa}H_{wa}$ $8s_wT_bT_bT_b$ ICE + $c_iS_ib_iD_iz_i$ or plain language

Section 3

333 [$0C_SD_LD_MD_H$] $1s_nT_xT_xT_x$ $2s_nT_nT_nT_n$ [3Ejjj] 4E'sss $5j_1j_2j_3j_4$ 55SSS $j_5F_{24}F_{24}F_{24}F_{24}$ $6RRRt_R$ $7R_{24}R_{24}R_{24}R_{24}$ $8N_sCh_sh_s$ $9S_PS_Pspsp$

Section 4

[444] [$N'C'H'H'C_t$]

Section 5

555 Groups to be developed nationally

10.4 Interpretation of the Symbols

Symbol	Interpretation
Section 0-land station	
$M_iM_iM_jM_j$	Message type identifier in second line of SYNOP bulletins
$YYGGi_w$	
YY	Day of the month
GG	Actual time of observation (UTC)
I_w	Indicates units of wind speed, and whether measured or estimated.
IIiii	International index number
II	Block number-block numbers are allocated to one country, part of a country, or several countries in the same region by WMO.(See figure 1)
iii	Station number- These are assigned to individual stations within each country as station identifies.
Section 0 – sea stations	
$M_iM_iM_jM_j$	Message type identifier in second line of SHIP bulletins
D....D or $A_1b_wn_bn_bn_b$	Ship's call sign or buoy identifier number
$YYGGi_w$	Same as for land stations, but included with every individual report and iw may be coded "3" or "4"
$99L_aL_aL_a$	
99	Group identifier
$L_aL_aL_a$	Latitude of station in tenths of a degree

$Q_cL_oL_oL_oL_o$	
Q_c	Quadrant of globe
$L_oL_oL_oL_o$	Longitude of station in tenths of a degree
Section 1	
i_Ri_XhVV	**Precipitation inclusion-exclusion/type /cloud height/visibility group**
i_R	Identifier for inclusion or omission of precipitation data (group $6RRRt_R$)
i_X	Identifier for the type of station operation and for present and past weather data (group $7wwW_1W_2$)
h	Height, above ground, of the base of the lowest cloud
VV	Horizontal visibility
Nddff	**Total cloud cover and wind group**
N	Fraction of the celestial dome covered by cloud
dd	True direction, in tens of degrees, from which the wind is blowing
ff	Wind speed in knots (kt)
(00fff)	
00	Group identifier
fff	Wind speed when it is 99 kt or more
$1s_nTTT$	
1	Group identifier
S_n	Sign of temperature
TTT	temperature in tenths of a degree Celsius

$2s_nT_dT_dT_d$	
2	Group identifier
S_n	Sign of dew point temperature
$T_dT_dT_d$	Dew point temperature in tenths of a degree Celsius
$3P_oP_oP_oP_o$	
3	Group identifier
$P_oP_oP_oP_o$	Station pressure in tenths of a hectopascal
4PPPP	
4	Group identifier
PPPP	Mean sea level (MSLP) pressure in tenths of a hectopascal
$6RRRt_R$	
6	Group identifier
RRR	Amount of precipitation which has fallen during the period indicated by t_R
t_R	The coding for the period of reference ending at the time of the report, for RRR. (See 12.3.9.3, WMO code 4019.)
$7wwW_1W_2$	
7	Group identifier
ww	Present weather
W_1W_2	Past weather
$8N_hC_LC_MC_H$	
8	Group identifier
N_h	Total amount of all low clouds (C_L) clouds or, if no C_L clouds, total amount of all medium level Clouds (C_M)

C_L	Clouds of SC, ST, CU and CB types
C_M	Clouds of AS, NS, and AC types
C_H	Clouds of CI, CS, and CC types
Section 2	
222DSvS	
222	Section 2 identifier
D_s	Ship's course (true) made good during the three hours preceding the time of observation
v_s	Ship's average speed made good during the three hours preceding the time of observation
$0s_sT_wT_wT_w$	
0	Group identifier
s_s	Sign of sea surface temperature
$T_wT_wT_w$	Sea-surface temperature in tenths of a degree
$1P_{wa}P_{wa}H_{wa}H_{wa}$	
1	Group identifier
$P_{wa}P_{wa}$	Period in seconds, of sea waves, obtained by instrumental methods
$H_{wa}H_{wa}$	Height of sea waves, obtained by instrumental methods
$2P_wP_wH_wH_w$	
2	Group identifier
P_wP_w	Period in seconds, of sea waves (non-instrumental
H_wH_w	Height of sea waves (non-instrumental)

$3d_{w1}d_{w1}d_{w2}d_{w2}$	
3	Group identifier
$d_{w1}d_{w1}$	True direction, in tens of degree, from which swell waves (first system) are coming
$d_{w2}d_{w}$	True direction, in tens of degree, from which swell waves (second system) are coming
$4P_{w1}P_{w1}H_{w1}H_{w1}$	
4	Group identifier
$P_{w1}P_{w1}$	Period, in seconds, of swell waves (first system)
$H_{w1}H_{w1}$	Height of swell waves (first system)
$5P_{w2}P_{w2}H_{w2}H_{w2}$	
5	Group identifier
$P_{w2}P_{w2}$	Period, in seconds, of swell waves (second system)
$H_{w2}H_{w2}$	Height of swell waves (second system)
$6I_sE_sE_sR_s$ or ICING + plain language	
6	Group identifier
I_s	Type of ice accretion on ships
E_sE_s	Thickness of ice accretion on ships in centimetres
R_s	Rate of ice accretion on ships
$8s_wT_bT_bT_b$	
8	
s_w	Indicator for the sign and type of wet bulb temperature reported

$T_bT_bT_b$	Wet bulb temperature
ICE + $c_iS_ib_iD_iz_i$ or plain language	
Section 3	
333 Section 3 identifier	
[$0C_SD_LD_MD_H$]	
0	Group identifier
C_S	State of sky in tropics
D_L	Direction from which C_L clouds are moving
D_M	Direction from which C_M clouds are moving
D_H	Direction from which C_H clouds are moving
$1s_nT_XT_XT_X$	
1	Group identifier
S_n	Sign (negative of positive) of maximum temperature
$T_XT_XT_X$	Maximum temperature reported to the nearest tenths of a degree Celsius
$2s_nT_nT_nT_n$	
2	Group identifier
S_n	Sign of minimum temperature
$T_nT_nT_n$	Minimum temperature reported to the nearest tenths of a degree Celsius
$5j_1j_2j_3j_4$	**Regional Supplementary information group to report 24-hour pressure change.** ($58p_{24}p_{24}p_{24}$ or $59p_{24}p_{24}p_{24}$)
5	Group identifier

8$p_{24}p_{24}p_{24}p_{24}$	To report positive or zero (0) change of surface pressure over 24 hours
9$p_{24}p_{24}p_{24}p_{24}$	To report negative change of surface pressure over 24 hours
7$R_{24}R_{24}R_{24}R_{24}$	
7	Group identifier
$R_{24}R_{24}R_{24}R_{24}$	Total amount of precipitation during the 24-hour period ending at the time of observation, in tenths of a millimetre
8N_SCh_Sh_S	
8	Group identifier
N_S	Summation amount of significant layer
C	Type of significant cloud
h_Sh_S	Height above ground of the layer to which N_S refers
9$S_PS_Ps_ps_p$	
9	Group identifier
S_PS_P	Special phenomena, general description
s_ps_p	Special phenomena, detailed description

10.5 Content of the Coded Synoptic Message

Main synoptic messages from land stations will normally consist of sections 0, 1, and 3. While some groups are mandatory and must be reported in each synoptic message, other groups may be omitted, depending on specified conditions. The communications computer will normally insert the first two groups of Section 0; the observer will code and transmit the remainder of the message. Mandatory and optional groups are briefly described below.

Section 0

This section is mandatory for all synoptic reports. **$M_iM_iM_iM_i$**, $YYGGi_w$ and IIiii*[1] will normally be coded and inserted by the communications computer.

Section 1

Groups' i_Ri_xhVV, Nddff, 1snTTT, $2s_nT_dT_dT_d$, $3P_oP_oP_oP_o$ and 4PPPP **shall** always be included.

Group 00fff **shall** be included only if wind speed equals or exceeds 99 kt.

Group $6RRRt_R$ **shal**l always be included in the message.

Group $7wwW_1W_2$ **shall** be included only if present or past weather of significance is observed.

Group $8N_hC_LC_MC_H$ **shall** be included only if clouds are observed

Section 3

In main synoptic hours, the indicator group, 333, and groups $1s_nT_xT_xT_x$ and $2s_nT_nT_nT_n$ **are always included.**

$5j_1j_2j_3j_4$ ($58p_{24}p_{24}p_{24}p_{24}$ or $59p_{24}p_{24}p_{24}p_{24}$) **shall** be included in each Synoptic report.

$7R_{24}R_{24}R_{24}R_{24}$ shall be included by stations that are capable of doing so and is included once daily at one appropriate time of the main standard times. In the ABMS, this group **shall** always be included in the 1200 UTC report regardless of whether or not there was any precipitation.
Group 8NsChshs **shall** be included and the group repeated as necessary to report a number of different layers of clouds.

Group $9S_pS_ps_ps_p$ is included if precipitation has occurred.

---

*Used for FM 12 only

Intermediate synoptic reports **shall** include sections 0 and 1, omitting group $6RRRt_R$. Group $7wwW_1W_2$ is included only if present or past weather of significance is observed.

Missing Data

Elements of missing data are recorded in the Surface Weather Record by means of a solidus (/). This is also done when entering a synoptic report on a computer or communication system for transmission.

10.6 Observing Schedule

The times of the main synoptic reports are 0000, 0600, 1200 and 1800 UTC. The times of the intermediate synoptic reports are 0300, 0900, 1500 and 2100 UTC. In all cases, the barometer shall be read at the hour. The observing, recording and coding of all elements, except the pressure and tendency, should be done in the 10 minutes preceding the hour. In difficult weather it may be necessary to begin 15 minutes before the hour in order to be ready to read the barometer at the hour. All weather observers shall conform to this schedule of observing, unless permission to deviate is obtained from the management of ABMS.

Chapter 11: The Synoptic Code – Detailed Description

11.1 General

Detailed coding instructions for each element of each group of the synoptic code are given below. The observer will find that following the Synoptic code outline at the top of each column in the Observation Register (Synoptic Reports) will simplify the appropriate entries, and the Tables of Synoptic Codes detailed in this chapter will assist them in encoding the synoptic report.

11.2 Section 0

Group $M_iM_iM_jM_j$

This group is inserted by the communications computer in the message header for identification of synoptic bulletins and is encoded AAXX for synoptic reports from land stations or BBXX for synoptic reports from a sea (ship) station. It is the first group of the second line of the message header.

Group $YYGGi_w$

This group is inserted by the communications computer as the second group of the second line of the message header of a synoptic bulletin originating from a land station.

YY – day of the month

GG – actual hour of the observation (UTC)

i_w – wind indicator, showing the units of wind speed and whether the wind speed is measured or estimated. The following table for i_w is given for decoding purposes.

WMO Code Table 1855 i_w –Indicator for source and units of wind speed		
Code figure	**Description**	
0	Wind speed estimated	Wind speed in metres per second
1	Wind speed obtained from anemometer	
3	Wind speed estimated	Wind speed in knots
4	Wind speed obtained from anemometer	

Group IIiii

II – block number: All Eastern Caribbean states use 78.

iii – station number: 862(Antigua and Barbuda)

11.3 Section 1

Group $i_R i_X$hvv

i_R – this symbol is an indicator to show whether or not the precipitation group 6RRRt$_R$ is included in the message and, if included, in what section of the message it appears. The following code table **shall** be used.

WMO code 1819		
Code figure i_R	**Precipitation data as reported**	**Group 6RRRt$_R$ is**
0	In Sections 1 and 3	Included in both sections
1	In Section 1	Included
2	In Section 3	Included
3	In none of the two Sections 1 and 3	Omitted (precipitation =0)
4	In none of the two Sections 1 and 3	Omitted (precipitation amount not available)

Code figures 0, 2 and 3 are not used for i_R in Antigua. At stations normally measuring precipitation, the group 6RRRt$_R$ is always included in Section 1 with i_R being encoded 1 at main synoptic hours.

i_X – this symbol indicates whether the synoptic message has originated from a manned or an automatic station and secondly, whether or not the present and past weather group, 7wwW$_1$W$_2$ is included. The WMO Code Table 1860 **shall** be used.

WMO code 1860		
Code figure i_x	**Type of station**	**Group 7wwW$_1$W$_2$**
1	Manned	Included
2	Manned	Omitted (no significant phenomenon to report)
3	Manned	Omitted (not observed, data not available)
4	Automatic	Included using code tables 4677 and 4561
5	Automatic	Omitted (no significant phenomenon to report)

6	Automatic	Omitted (not observed, data not available)
7	Automatic	Included using Code tables 4680 and 4531

Note: Manned station operations use only the group **$7wwW_1W_2$ and indicator i_x =1, 2, and 3.**

h – Height above ground of the base of lowest cloud seen. The following code table **shall** be used.

WMO code 1600		
Code figure	**Metres**	**Feet**
0	0 to 50 m	0 to 150 ft.
1	50 m to 100 m	150ft to 300 ft.
2	100 m to 200 m	300 to 600 ft.
3	200 m to 300 m	600 to 1000 ft.
4	300 m to 600 m	1000 to 2000 ft.
5	600 m to 1000 m	2000 to 3000 ft.
6	1000 m to 1500 m	3000 to 5000 ft.
7	1500 m to 2000 m	5000 to 6500 ft.
8	2000 m to 2500 m	6500 to 8000 ft.
9	2500 m or more, or no cloud	Above 8000 ft. or no cloud
/	Height of base of cloud not known	

Note (1): A height exactly equal to one of the values at the ends of the ranges **shall** be coded in the higher range.

Example: Cloud height 600 m (2000ft) **shall** be reported by code figure 5.

Note (2): When C_H clouds are observed without C_L or C_M clouds being present, h **shall** always be coded as 9.

Note (3): If the sky is completely obscured, h is recorded as /.

VV – The horizontal visibility at the surface.

When the horizontal visibility is not the same in different directions, the shortest distance **shall** be given for VV.

VV **shall** be coded using the following code table:

WMO code 4377					
Code figure	KM	Nautical Mile (approx.)	Code figure	KM	Nautical Mile (approx.)
00	<0.1		26	2.6	1.3
01	0.1		27	2.7	1.3
02	0.2	0.1	28	2.8	1.4
03	0.3		29	2.9	1.4
04	0.4	0.2	30	3	1.5
05	0.5		31	3.1	1.5
06	0.6	0.3	32	3.2	1.6
07	0.7		33	3.3	1.6
08	0.8	0.4	34	3.4	1.7
09	0.9		35	3.5	1.7
10	1	0.5	36	3.6	1.8
11	1.1		37	3.7	1.8
12	1.2	0.6	38	3.8	1.9
13	1.3		39	3.9	1.9
14	1.4	0.7	40	4	2.0
15	1.5		41	4.1	2.0
16	1.6	0.8	42	4.2	2.1
17	1.7		43	4.3	2.1
18	1.8	0.9	44	4.4	2.2
19	1.9		45	4.5	2.2
20	2	1	46	4.6	2.3
21	2.1	1	47	4.7	2.3
22	2.2	1.1	48	4.8	2.4
23	2.3	1.1	49	4.9	2.4

24	2.4	1.2	50	5	2.5
25	2.5	1.2	51	Not used	
52	Not used		67	17	8
53			68	18	9
54			69	19	9
55			70	20	11
56	6	3	71	21	11
57	7	3	72	22	12
58	8	4	73	23	12
59	9	4	74	24	13
60	10	5	75	25	
61	11	5	76	26	
62	12	6	77	27	
63	13	6	78	28	
64	14	7	79	29	
65	15	7	80	30	
66	16	8			

Note (1): shaded columns are not part of official Code table.
Note (2): if the visibility falls between two coded figures, use the lower code figure.

Group Nddff

This group **shall** always be included, and **shall** be reported as actually seen by the observer.

N – This symbol gives the fraction of the celestial dome covered by clouds, irrespective of their type. The following code table **shall** be used.

WMO code 2700		
Code figure	**Okta(s)**	**tenths**
0	0	0
1	1 okta or less, but not zero	1/10 or less, but not zero
2	2 oktas	2/10 - 3/10
3	3 oktas	4/10
4	4 oktas	5/10
5	5 oktas	6/10
6	6 oktas	7/10 - 8/10
7	7 oktas or fewer than 8	9/10 or more, but not 10/10
8	8 oktas	10/10
9	Sky obscured by fog or other meteorological phenomena	
/	Cloud is indiscernible for reasons other than fog or other meteorological phenomena, or observation is not made.	

Note:

Because of the difference in the procedures for coding hourly and synoptic observations the following exceptions **shall** be taken into account.

1. Altocumulus perlucidus or Stratocumulus perlucidus (“mackerel sky”) shall be reported as N=7 or less (unless overlaying clouds appear to cover the whole sky) since brakes are always present in this cloud form even if it extends over the celestial dome.

2. When blue sky or stars are seen through a layer of fog or other obscuring phenomenon without any trace of cloud been seen above this layer, N is reported as 0.

3. If clouds are seen through fog or other obscuring phenomenon their amount **shall** be evaluated as though the obscuration did not exist.

4. Rapidly dissipating condensation trails shall not be considered in coding N.

5. Persistent condensation trails and cloud masses which have obviously developed from condensation trails shall be reported as cloud and considered when coding the cloud amount N, using the appropriate CH or CM code figure.

ddff – wind direction and speed measures over the ten minute period immediately preceding the observation. However, when the ten – (10) minute period includes a discontinuity in the wind characteristics, only data obtained after the discontinuity shall be used for reporting the mean values, and hence, the period in these circumstances shall be correspondingly reduced.

dd - wind direction (true). The 10-minute mean wind direction shall be coded to the nearest ten degrees (01–36) using the following table**:**

WMO code 0877					
Direction	**Degree**	**Code figure dd**	**Direction**	**Degree**	**Code figure dd**
CALM	**Calm**	**00**	**SSW**	**195° - 204°**	**20**
N	**005° - 014°**	**01**		**205° - 214°**	**21**
NNE	**015° - 024°**	**02**	**SW**	**215° - 224°**	**22**
	025° - 034°	**03**		**225° - 234°**	**23**
NE	**035° - 044°**	**04**	**WSW**	**235° - 244°**	**24**
	045° - 054°	**05**		**245° - 254°**	**25**
ENE	**055° - 064°**	**06**		**255° - 264°**	**26**
	065° - 074°	**07**	**W**	**265° - 274°**	**27**
	075° - 084°	**08**		**275° - 284°**	**28**
E	**085° - 094°**	**09**	**WNW**	**285° - 294°**	**29**
	095° - 104°	**10**		**295° - 304°**	**30**
ESE	**105° - 114°**	**11**	**NW**	**305° - 314°**	**31**
	115° - 124°	**12**		**315° - 324°**	**32**
SE	**125° - 134°**	**13**	**NNW**	**325° - 334°**	**33**
	135° - 144°	**14**		**335° - 344°**	**34**
SSE	**145° - 154°**	**15**	**N**	**345° - 354°**	**35**
	155° - 164°	**16**		**355° - 004°**	**36**
	165° - 174°	**17**	**Variable**	**Wind direction variable**	**99**
S	**175° - 184°**	**18**			
	185° - 194°	**19**			

ff- the wind speed in knots (10-minute mean).

Note:

1. When the wind speed, in units indicated by i_w is 99 knots or more:
    - ff or the Nddff group shall be encoded as 99; and
    - the group 00fff shall be included immediately following the group Nddff.

2. In the absence of wind instruments, the wind speed shall be estimated on the basis of the Beaufort wind scale.

00fff – this supplementary group is included in all synoptic reports when the wind speed, in the units indicated by i_w, is 99 knots or more. The group, when required, **shall** be included immediately following the Nddff group.

Example:

An east wind of 118 kt **shall** be coded N0999 00118.
A south wind of 99 kt **shall** be coded N1899 00099.

Group 1s_nTTT-Air temperature group

1 – Identifier for the air temperature group.

s_n – Sign of the temperature given by TTT. Use code figure 0 if the temperature is 0.0°C or warmer; use code figure 1 if the temperature is colder than 0.0°C.

TTT – Dry-bulb temperature in tenths of a degree Celsius. Code the absolute value of the temperature for TTT as read, filling in a zero for the tens and units digit if required.

Example:

Temperature	s_n	TTT	1s_nTTT
25.3	0	253	10253
-25.3	1	253	11253

Group 2$s_nT_dT_dT_d$ –Dew Point Temperature

2 – Indicator figure of the group.

s_n – sign of the temperature given by $T_dT_dT_d$. Use code figure 0 if the dew point temperature is 0.0°C or warmer; use code figure 1 if the dew point temperature is colder than 0.0°C.

$T_dT_dT_d$ – Dew point temperature in tenths of a degree Celsius. Code the absolute value of the dew point for $T_dT_dT_d$

Example:

Dew point Temperature	s_n	$T_dT_dT_d$	$2s_nT_dT_dT_d$
22.1	0	221	20221
-10.3	1	103	20103

Group $3P_oP_oP_oP_o$-station pressure group

3 – Identifier for the station pressure group.

$3P_oP_oP_oP_o$- pressure at station, in tenths of a hectopascal. If the station pressure is less than 1000.0 hPa, omitting the decimal point.

Example:

Station pressure	$3P_oP_oP_oP_o$
987.2	39872

If the station pressure is 1000.0 hPa or more, code $3P_oP_oP_oP_o$ by omitting the thousands digit and the decimal point.

Example:

Station Pressure	$3P_OP_OP_OP_O$
1012.4	30124

Group 4PPPP

4 – Indicator figure of the group.

PPPP –Sea level pressure in tenths of a hectopascal. Use all four digits when sea level pressure is less than 1000 hPa. When the sea level pressure is 1000 hPa or more, omit the thousands digit and the decimal point.

Example:

Sea level pressure	Code for 4PPPP
996.2	49962
1015.4	40154

Group 6RRRt_R- Amount of rainfall group **shall** be reported

6- Identifier for the precipitation group**.**

Note:

When precipitation data are to be exchanged in time periods of six hours at main standard times, the group is included in section 1.

RRR- amount of precipitation which has fallen during the period preceding the time of observation, as indicated by t_R. Amounts are usually for a six-hour period at the main synoptic observation.

This group **shall** be:

- Coded with RRR =000 when precipitation is measured but no precipitation occurred during the reference period.
- Coded RRR=/// when precipitation is normally measured but is not available for the current report;
- Omitted when precipitation is not normally measured. In this case, i_R shall be coded as 4.
-

RRR shall be coded using the following code table:

WMO Code table 3590			
Amount (mm)	**Code figure**	**Amount (mm)**	**Code figure**
0 (no precipitation)	000	1	001
Trace	990	2	002
0.1	991	3	003
0.2	992	4	004
0.3	993	etc.	etc.
0.4	994		
0.5	995		

0.6	996		
0.7	997		
0.8	998	988	988
0.9	999	989 or more	989

Note: Precipitation amounts which are greater than 1.0 mm **shall** be rounded to the nearest whole millimetre prior to coding

t_R- length of time covered by the group, using the following code table:

WMO code table 4019	
Code figure	**t_R- duration of period of reference for amount of precipitation ending at the time of the report**
1	Total precipitation during the 6 hours preceding the observation.
2	Total precipitation during the 12 hours preceding the observation.
3	Total precipitation during the 18 hours preceding the observation.
4	Total precipitation during the 24 hours preceding the observation.
5	Total precipitation during the 1 hour preceding the observation
6	Total precipitation during the 2 hours preceding the observation.
7	Total precipitation during the 3 hours preceding the observation.
8	Total precipitation during the 9 hours preceding the observation.
9	Total precipitation during the 15 hours preceding the observation.

Note:

1) **If the duration of the period of reference is not covered by Code table 4019 or the period does not end at the time of the report, t_r shall be coded 0.**

2) At stations where main synoptic observations and precipitation measurements are made every six hours, t_R **shall** be coded as 1.

Group 7wwW$_1$W$_2$

This group **shall** be included only if present and/or past weather phenomena of significance are observed. The 7-group is omitted when weather of no significance is observed; that is when ww may be coded 00, 01, 02, or 03 and past weather code figures 0, 1 or 2 apply.

7 – Indicator for present and past weather group.

ww –weather and obstructions to vision shall be coded at the time of observation, using the following:

- **ww codes 00–49** inclusive are used to code present weather when there is no precipitation at the station at the time of observation.

- **ww codes 50–99** inclusive are used to code present weather when precipitation is occurring at the station at the time of observation.

- **ww codes 50–99** are used not only to indicate the type of precipitation but also the intensity (light, moderate or heavy), and the character (continuous, intermittent or showery).

ww shall be coded using the following code table:

WMO Code table 4677-present weather
ww = 00 — 49 No precipitation at the station at the time of observation. **ww = 00 — 19** No precipitation, fog, ice fog (except for 11 and 12), dust storm, sandstorm, drifting or blowing snow at the station at the time of observation or, except for 09 and 17, during the preceding hour.
No meteors except photometeors 00 -- clear skies 01 -- clouds dissolving 02 -- state of sky unchanged 03 -- clouds developing (00–03: Characteristic change of the state of the sky during the past hour) **Haze, smoke, dust or sand** 04 -- visibility reduced by smoke 05 -- haze 06 -- widespread dust in suspension not raised by wind 07 -- dust or sand raised by wind 08 -- well developed dust or sand whirls 09 -- dust or sand storm within sight but not at station
Non-precipitation events 10 -- mist 11 -- patches of shallow fog 12 -- continuous shallow fog 13 -- lightning visible, no thunder heard 14 -- precipitation within sight but not hitting ground 15 -- distant precipitation but not falling at station 16 -- nearby precipitation but not falling at station 17 -- thunderstorm but no precipitation falling at station 18 -- squalls within sight but no precipitation falling at station 19 -- funnel clouds within sight

Precipitation, fog or thunderstorm at the station within past hour but not at observation time 20 -- drizzle 21 -- rain   Not falling as shower(s) 22 -- snow 23 -- rain and snow 24 -- freezing rain 25 -- rain showers 26 -- snow showers 27 -- hail showers 28 -- fog 29 – thunderstorms (with or without precipitation)
Dust storm, sandstorm, drifting or blowing snow 30 -- slight to moderate dust storm, decreasing in intensity 31 -- slight to moderate dust storm, no change 32 -- slight to moderate dust storm, increasing in intensity 33 -- severe dust storm, decreasing in intensity 34 -- severe dust storm, no change 35 -- severe dust storm, increasing in intensity 36 -- slight to moderate drifting snow, below eye level 37 -- heavy drifting snow, below eye level 38 -- slight to moderate drifting snow, above eye level 39 -- heavy drifting snow, above eye level
Fog or ice fog at the time of observation 40 -- Fog at a distance 41 -- patches of fog 42 -- fog, sky visible, thinning 43 -- fog, sky not visible, thinning 44 -- fog, sky visible, no change 45 -- fog, sky not visible, no change 46 -- fog, sky visible, becoming thicker 47 -- fog, sky not visible, becoming thicker 48 -- fog, depositing rime, sky visible 49 -- fog, depositing rime, sky not visible
ww= 50-99 Precipitation at the station at the time of observation
Drizzle 50 -- intermittent light drizzle 51 -- continuous light drizzle 52 -- intermittent moderate drizzle 53 -- continuous moderate drizzle 54 -- intermittent heavy drizzle

55 -- continuous heavy drizzle	
56 -- light freezing drizzle	
57 -- moderate to heavy freezing drizzle	
58 -- light drizzle and rain	
59 -- moderate to heavy drizzle and rain	
Rain	
60 -- intermittent light rain	Slight at time of observation
61 -- continuous light rain	
62 -- intermittent moderate rain	Moderate at time of observation
63 -- continuous moderate rain	
64 -- intermittent heavy rain	Moderate at time of observation
65 -- continuous heavy rain	
66 -- light freezing rain	
67 -- moderate to heavy freezing rain	
68 -- light rain and snow	
69 -- moderate to heavy rain and snow	
Solid precipitation not in showers	
70 -- intermittent light snow	
71 -- continuous light snow	
72 -- intermittent moderate snow	
73 -- continuous moderate snow	
74 -- intermittent heavy snow	
75 -- continuous heavy snow	
76 -- diamond dust	
77 -- snow grains	
78 -- snow crystals	
79 -- ice pellets	
Showery precipitation	
80 -- light rain showers	
81 -- moderate to heavy rain showers	
82 -- violent rain showers	
83 -- light rain and snow showers	
84 -- moderate to heavy rain and snow showers	
85 -- light snow showers	
86 -- moderate to heavy snow showers	
87 -- light snow/ice pellet showers	
88 -- moderate to heavy snow/ice pellet showers	
89 -- light hail showers	
90 -- moderate to heavy hail showers	
Precipitation with current of recent thunderstorm	
91 -- thunderstorm in past hour, currently only light rain	
92 -- thunderstorm in past hour, currently only moderate to heavy rain	

93 -- thunderstorm in past hour, currently only light snow or rain/snow mix
94 -- thunderstorm in past hour, currently only moderate to heavy snow or rain/snow mix
95 -- light to moderate thunderstorm without hail, but with rain at the time of observation.
96 -- light to moderate thunderstorm with hail
97 -- heavy thunderstorm
98 -- heavy thunderstorm with dust storm
99 -- heavy thunderstorm with hail

Notes:
Present weather reported from a manned weather station: ww

1. If more than one form of weather is observed, the highest applicable code figure shall be selected for the group $7wwW_1W_2$. In any case, in the group $7wwW_1W_2$, **code figure 17 shall have precedence over figure 20–49.**

2. In coding 01, 02 and 03, there is no limitation on the magnitude of the change of the cloud amount. ww = 00, 01 and 02 can each be used when the sky is clear at the time of observation. In this case, the following interpretation of the specifications shall apply:

   -00 is used when the preceding conditions are not known;
   -01 is used when the clouds have dissolved during the past hour;
   -02 is used when the sky has been continuously clear during the past hour.

3. When the phenomenon is not predominantly water droplets, the appropriate code figure shall be selected without regard to VV.

4. The code figure 05 shall be used when the obstruction to vision consists predominantly of lithometeors.

5. National instructions shall be used to indicate the specifications for ww = 07 and 09.

6. The visibility restriction on ww = 10 shall be 1 000 metres or more. The specification refers only to water droplets and ice crystals.

7. For ww = 11 or 12 to be reported, the apparent visibility shall be less than 1000 meters.

8. For ww = 18 (squall), the following criteria for reporting squalls shall be used:

(*a*) When wind speed is measured:

A sudden increase of wind speed of at least eight metres per second (16knots), the speed rising to 11 metres per second (22 knots) or more and lasting for at least one minute;

(*b*) When the Beaufort scale is used for estimating wind speed:

A sudden increase of wind speed by at least three stages of the Beaufort scale, the speed rising to force 6 or more and lasting for at least one minute.

9. Figures 20–29 shall never be used when precipitation is observed at the time of observation.

10. For ww = 28, visibility shall have been less than 1 000 metres.

Note: The specification refers only to visibility restrictions which occurred as a result of water droplets or ice crystals.

11. For synoptic coding purposes, a thunderstorm shall be regarded as being at the station from the time thunder is first heard, whether or not lightning is seen or precipitation is occurring at the station. A thunderstorm shall be reported in present weather if thunder is heard within the normal observational period preceding the time of the report. A thunder- storm shall be regarded as having ceased at the time thunder is last heard and the cessation is confirmed if thunder is not heard for 10 minutes after this time.

12. The necessary uniformity in reporting ww = 36, 37, 38 and 39 which may be desirable within certain regions shall be obtained by means of national instructions.

13. A visibility restriction "less than 1 000 metres" shall be applied to ww = 42–49. In the case of ww = 40 or 41, the apparent visibility in the fog or ice fog patch or bank shall be less than 1 000 metres. 40–47 shall be used when the obstructions to vision consist predominantly of water droplets or ice crystals, and 48 or 49 when the obstructions consist predominantly of water droplets.

14. When referring to precipitation, the phrase "at the station" in the ww table shall mean "at the point where the observation is normally taken".

15. The precipitation shall be encoded as intermittent if it has been discontinuous during the preceding hour, without presenting the character of a shower.

16. The intensity of precipitation shall be determined by the intensity at the time of observation.

17. Code figures 80–90 shall be used only when the precipitation is of the shower type and takes place at the time of observation.

Note:

Showers are produced by convective clouds. They are characterized by their abrupt beginning and end and by the generally rapid and sometimes great variations in the intensity of the precipitation. Drops and solid particles falling in a shower are generally larger than those falling in non-showery precipitation. Between showers openings may be observed unless stratiform clouds fill the intervals between the cumuliform clouds.

W_1W_2 – past weather

W_1W_2 **shall** be reported using the following code table. Two types of past weather may be selected. The highest applicable code figure is assigned to W1 and the second highest to W2.

WMO code 4561	
Code figure	**W_1W_2 past weather**
0	Cloud covering 1/2 or less of the sky throughout the appropriate period
1	Cloud covering more than 1/2 of the sky during part of the appropriate period and covering 1/2 or less during part of the period
2	Cloud covering more than 1/2 of the sky throughout the appropriate period
Types of significant past weather	
3	Sandstorm, dust storm or blowing snow (prevailing visibility less than 5/8 mile)
4	Fog, freezing fog or thick haze
5	Drizzle, or freezing drizzle
6	Rain
7	Snow, or rain and snow mixed
8	Shower(s), i.e., SHRA
9	Thunderstorm(s) with or without precipitation

Past weather reported from a manned weather station: W_1W_2

The period covered by W_1 and W_2 shall be:

(*a*) Six hours for observations at 0000, 0600, 1200 and 1800 UTC;
(*b*) Three hours for observations at 0300, 0900, 1500 and 2100 UTC;

The code figures for W_1 and W_2 **shall** be selected in such a way that W_1W_2 and ww together give as complete a description as possible of the weather in the time interval concerned. For example, if the type of weather undergoes a complete change during the time interval concerned, the code figures selected for W_1 and W_2 shall describe the weather prevailing before the type of weather indicated by ww began.

After selecting ww, select the most significant type of past weather, different from ww, though they may be occurring simultaneously. If only one type of weather has been occurring throughout the whole period, use that one type for ww, W_1, and W_2.

After selecting the first past weather type, select another past weather type, different, if possible, from the first past weather type that has occurred during the past weather period. If more than one code figure may be given to past weather, the highest figure **shall** be reported for W_1 and the second highest applicable code figure **shall** be reported for W_2.

Note:

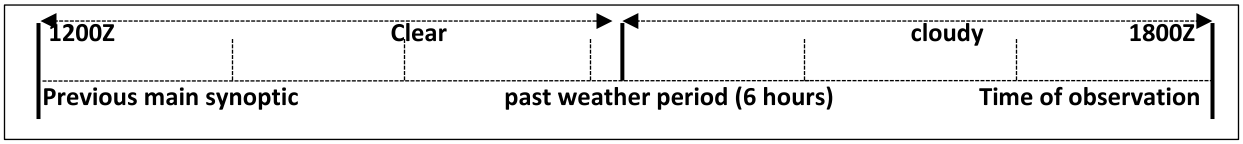
1. If precipitation has been continuous at the station throughout the past weather period, do not use codes 0, 1, or 2 for either W_1 or W_2. One code figure may be selected for the past weather, then that code figure shall be reported for both W_1 and W_2. **For example, rain during the entire period shall be reported as W_1W_2 = 66.**

2. When W_1 and W_2 are used in hourly reports other than those covered by Regulation 12.2.6.6.1 (*a*) and (*b*), they cover a short period of time and Regulation 12.2.6.6.2 shall apply.

3. The 7-group gives a qualitative rather than quantitative picture of the weather during the past weather period. It generally does not give sequence or duration of weather events, unless ww, W_1 and W_2 are all coded the same, in which case only one type of weather has prevailed throughout the period.

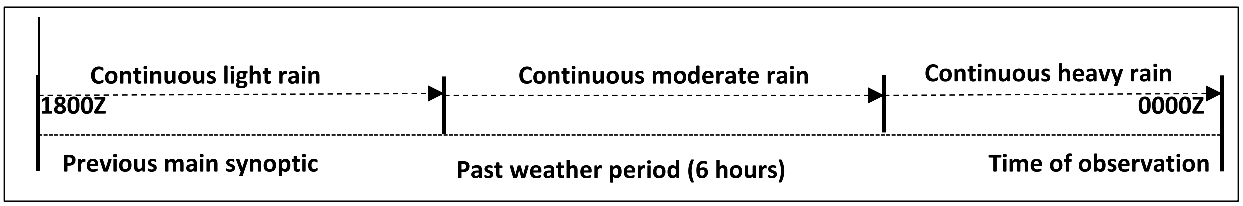
The following examples, shown graphically, of weather conditions during a "past weather" period of six hours, will illustrate how the rules are applied in coding W_1 and W_2. The proper coding of ww and W_1 and W_2 is given for each example.

Example 1:



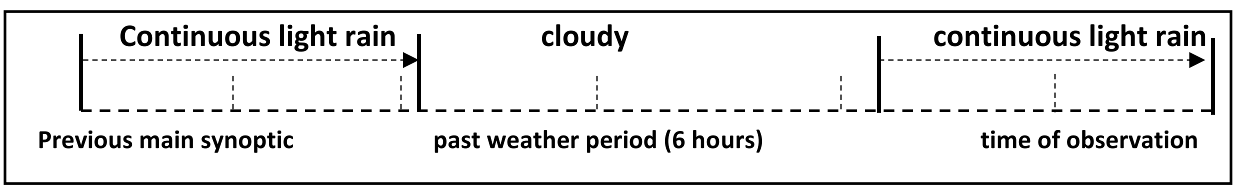
Group $7wwW_1W_2$ not included (no weather of significance).

Example 2:



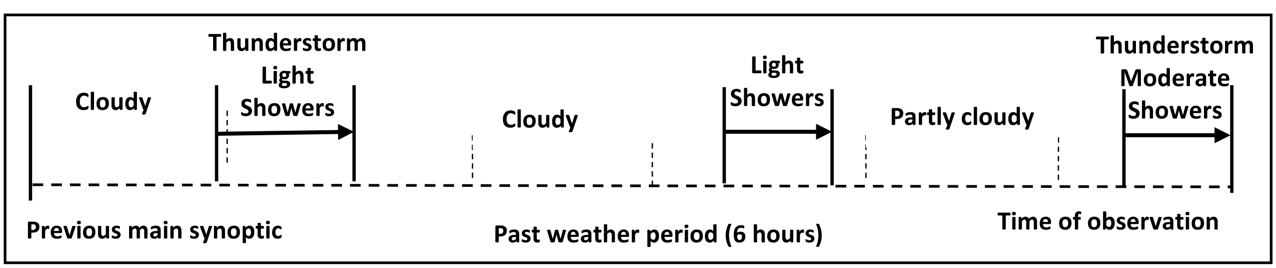
ww =65; W=6 W2=6 -The report of rain in ww, W1 and W2, shows that rain has been continuous throughout the entire weather period and no other past weather type has occurred.

Example 3:



ww =61; W_1=6 W_2=2

Example 4:



ww = 95; W_1 =9 W_2=8

If only one type of past weather was encoded, it would be code 8. In selecting past weather in addition to the code 8, the earlier thunderstorm is the most significant event, and because of its priority in the code table it is encoded as W1.

Group $8N_hC_LC_MC_H$

This group **shall** be omitted when the sky is clear (N = 0), or when the sky is totally obscured (N = 9) and no cloud is visible below the obscuration. When the cloud cover is indiscernible for any other reasons, or observation is not made (N = /).

8 – Indicator figure of the group.

N_h – amount of cloud. The amount coded for N_h **shall** be the total amount of all cloud in the C_L category, or in the absence of C_L cloud, it **shall** be the total amount of all cloud in the C_M category.

If C_H clouds alone are present N_h **shall** be coded as 0.

When blue sky or stars are seen through a layer of fog or other obscuring phenomenon, without any trace of cloud above or within this layer, the group $8N_hC_LC_MC_H$ **shall** be omitted. If clouds are seen through the fog or other obscuring phenomenon, their amount **shall** be evaluated as though the obscuration did not exist.
With a mackerel sky (AC or SC perlucidus), breaks between the cloud elements always exist. Hence, even though such a layer extends over the whole celestial dome, N_h **shall** be coded as 7 or less.

When the clouds reported for N_h are observed through fog or a similar phenomenon their amount shall be reported as if these phenomena were not present.

Persistent condensation trails and cloud masses which have obviously developed from condensation trails **shall** be reported as cloud, using the appropriate C_H or C_M code figure. Rapidly dissipating condensation trails **shall** not be reported.

N_h – **shall** be coded according to the following table: reference table above

C_L – clouds of types Stratocumulus, Stratus, Cumulus and Cumulonimbus.

C_L **shall** be coded according to the following table:

WMO code 0513 C_L -- Low cloud type
0 -- no low clouds
1 -- cumulus humulis or fractus (no vertical development)
2 -- cumulus mediocris or congestus (moderate vertical development)
3 -- cumulonimbus calvus (no outlines nor anvil)
4 -- stratocumulus cumulogenitus (formed by spreading of cumulus)
5 – stratocumulus(not formed by spreading of cumulus)
6 -- stratus nebulosus or Stratus fractus not of bad weather (continuous sheet)

7 -- stratus or cumulus fractus (bad weather) 8 -- cumulus and stratocumulus (multilevel) 9 – cumulonimbus capillatus with anvil / -- low clouds unobserved due to darkness or obscuration

Coding instructions for C_L – clouds

The coding instructions list the code figures in descending order of priority. A given code figure is used subject to the condition that all the code figures listed above it are not applicable, and irrespective of the presence of clouds corresponding to the code figures listed below it.

C_L code figure – coding criteria

Cumulonimbus present, with or without other C_L-clouds

C_L = 9 – If the upper part of at least one of the Cumulonimbus clouds present is clearly fibrous or striated[1], use C_L = 9.
C_L = 3 – If the upperpart of none of the Cumulonimbus clouds present is clearly fibrous or striated, use C_L = 3.

No cumulonimbus present

C_L = 4 – If Stratocumulus formed by the spreading out of Cumulus is present, use C_L = 4.

C_L = 8 – If the C_L code figure 4 is not applicable and if Cumulus and Stratocumulus clouds with bases at different levels are present, use C_L = 8.

C_L = 2 – If the C_L code figures 4 and 8 are not applicable and if Cumulus clouds of moderate or strong vertical extent are present, use C_L = 2.

C_L = 1, 5, 6, and 7 – If the C_L code figures 4, 8 and 2 are not applicable:

- use C_L = 1, if the C_L clouds present are predominantly[2] Cumulus with little vertical extent and seemingly flattened or ragged Cumulus other than of bad weather, or both;
- use C_L = 5, if among the C_L clouds present Stratocumulus other than that formed by the spreading out of cumulus is predominant[1];
- use C_L = 6, if the C_L clouds present are predominantly[2] Stratus in a more or less continuous sheet or layer, or in ragged shreds (other than ragged Stratus of bad weather), or both;
- use C_L = 7, if the C_L clouds present are predominantly[2] pannus (ragged shreds of Stratus of bad weather3 or ragged Cumulus of bad weather, or both).

C_L = 0 – If no Stratocumulus, Stratus, Cumulus or Cumulonimbus.

Note (1): Consult WMO Cloud Atlas on the specification $C_L = 9$.

Note (2): In the present case, consideration of the predominance is restricted to the clouds corresponding to C_L code figures 1, 5, 6 and 7 which have the same priority. Clouds of any one of these four specifications are said to be predominant when their sky cover is greater than that of the clouds of any of the three other specifications.

Note (3): "Bad weather" denotes the conditions which generally exist during precipitation and a short time before and after.

C_M – clouds of the type Altostratus, Altocumulus and nimbostratus

C_M **shall** be coded according to the following table:

WMO Code table 0515 **C_M** -- Middle cloud type
0 -- no middle clouds
1 -- altostratus translucidous (mostly transparent)
2 -- altostratus opacus or nimbostratus (sufficiently dense to hide the sun or moon)
3 -- altocumulus translucidous (mostly transparent, at a single level ,elements change slowly)
4 -- patches of altocumulus (semi-transparent, lenticular, at more than one level)
5 -- bands of altocumulus (at more than one level, progressively invading the sky)
6 -- altocumulus cumulogenitus (formed by spreading of cumulus)
7 -- altocumulus (multi or single layer not invading the sky, or with Altostratus or Nimbostratus
8 -- altocumulus castellanus (having cumuliform tufts)
9 -- altocumulus of a chaotic sky
/ -- middle clouds unobserved due to darkness or obscuration

Coding instructions for C_M – clouds

The coding instructions list the code figures in descending order of priority. A given code figure is used subject to the condition that all the code figures listed above it are not applicable, and irrespective of the presence of clouds corresponding to the code figures listed below it.

C_M code figure – coding criteria

Altocumulus present- (Altostratus or Nimbostratus may be present)

C_M= 9 – If the sky is chaotic, use C_M= 9.

C_M= 8 – If the C_M code figure 9 is not applicable and if Altocumulus with sproutings in the form of turrets or battlements or Altocumulus having the appearance of small cumuliform tufts is present, use C_M= 8.

C_M= 7 – If the C_M code figures 9 and 8 are not applicable and if Altostratus or Nimbostratus is present together with Altocumulus, use C_M= 7.

No Altostratus or Nimbostratus

C_M= 6 – If the C_M code figures 9, 8 and 7 are not applicable and if Altocumulus formed by the spreading out of Cumulus or Cumulonimbus is present, use C_M= 6.

C_M= 5 – If the C_M code figures 9, 8, 7 and 6 are not applicable, and if the Altocumulus present is progressively invading the sky, use C_M= 5.

C_M= 4 – If the C_M code figures 9, 8, 7, 6 and 5 are not applicable and if the Altocumulus present is continually changing in appearance, use C_M= 4.
C_M= 7 – If the C_M code figures 9, 8, 6, 5 and 4 are not applicable and if the Altocumulus present occurs at two or more levels, use C_M= 7.

C_M= 7, 3 – If the C_M code figures 9, 8, 6, 5 and 4 are not applicable and if the Altocumulus present occurs at one level, use C_M= 7 or 3 depending on whether the greater part of the Altocumulus is respectively opaque or semi-transparent.

No Altocumulus Present

C_M= 2 – If Nimbostratus is present or if the greater part of the Altostratus present is opaque, use C_M= 2.

C_M= 1 – If there is no Nimbostratus and if the greater part of the Altostratus present is semi-transparent, use C_M= 1.

C_M= / – If C_M clouds invisible owing to continuous layer of lower clouds or because of fog, blowing dust or other similar phenomena.

C_M= 0 – If no Altocumulus, Altostratus or Nimbostratus.

C_H – clouds of the types Cirrus, Cirrostratus and Cirrocumulus

C_H **shall** be coded according to the following table:

WMO code 0509 C_H -- High cloud type
0 -- no high clouds
1 -- cirrus fibratus (wispy, not progressively invading the sky)
2 -- cirrus spissatus (dense in patches)
3 -- cirrus spissatus cumulogenitus (dense, formed out of anvil)
4 -- cirrus unicus or fibratus (progressively invading sky)
5 -- bands of cirrus or cirrostratus invading sky (less than 45 degree above horizon)
6 -- bands of cirrus or cirrostratus invading sky (more than 45 degree above horizon)
7 -- cirrostratus covering whole sky
8 -- cirrostratus not covering sky but not invading
9 -- cirrocumulus
/ -- high clouds unobserved due to darkness or obscuration

Coding instructions for C_H-clouds

The coding instructions list the code figures in descending order of priority. A given code figure is used subject to the condition that all the code figures listed above it are not applicable, and irrespective of the presence of clouds corresponding to the code figures listed below it.

C_H code figure – coding criteria

C_H= 9 – If Cirrocumulus is present alone or if the amount of the Cirrocumulus is more than the combined sky cover of any Cirrus and Cirrostratus present, use C_H= 9.

C_H= 9 not applicable and Cirrostratus present with or without Cirrus or Cirrocumulus

C_H= 7 – If the Cirrostratus covers the whole sky, use C_H= 7.

C_H= 8 – If the Cirrostratus does not cover the whole sky and is not invading the celestial dome, use C_H= 8.

C_H= 6 – If the Cirrostratus is progressively invading the sky and if the continuous veil extends more than 45 degrees above the horizon but does not cover the whole sky, use C_H=6.

C_H= 5 – If the Cirrostratus is progressively invading the sky but if the continuous veil does not reach 45 degrees above the horizon, use C_H= 5.

C_H= 9 not applicable and no Cirrostratus present.

C_H= 4 – If the Cirrus clouds are invading the sky, use C_H= 4.

C_H= 3 – If the C_H code figure 4 is not applicable and if dense Cirrus which originated from Cumulonimbus is present in the sky, use C_H= 3.

C_H= 2, 1: If the C_H code figures 4 and 3 are not applicable,

- use C_H= 2 if the combined sky cover of dense Cirrus, of Cirrus with sproutings in the form of small turrets or battlements and of Cirrus in tufts is greater than the combined sky cover of Cirrus in the form of filaments, strands or hooks;

- use C_H= 1 if the combined sky cover of Cirrus in the form of filaments, strands or hooks is greater than the combined sky cover of dense Cirrus, of Cirrus with sproutings in the form of small turrets or battlements and of cirrus in tufts.

C_H= / – If C_H clouds invisible owing to continuous layer of lower clouds or because of fog, blowing dust or other similar phenomena.

C_H= 0 – If no Cirrus, Cirrostratus or Cirrocumulus.

11.4 Section 3

This section **shall** be used for regional exchange.
The inclusion of groups with indicator figures 1 to 6, 8 and 9 **shall** be decided regionally.

However, group $7R_{24}R_{24}R_{24}R_{24}$ shall be included by all stations (with the exception of stations situated in the Antarctic) capable of doing so, once a day at one appropriate time of the main standard times.

333 – Indicator group to show beginning of Section 3. This 3-figure group must precede the5-figure groups of Section 3 which follow.

Group (0….)

This group **shall** be used in the form **$0C_SD_LD_MD_H$**

The group $0C_SD_LD_MD_H$ **shall** be included only by stations in the southern part of Region IV, below 1000 meters elevation and 500 kilometres the shore, and only during the part of the year in which tropical weather is observed.

0 -	Identifier for the state of the sky in the tropics group.
Cs -	State of the sky in the tropics. Use code table 430.
$D_LD_MD_H$ -	Directions from which the low clouds, middle clouds, and high clouds are moving, respectively.

$0C_SD_LD_MD_H$ – shall be coded according to the following tables:

Code table 0430 Cs — State of Sky in Tropics	
Code figure	**Technical specifications**
0	Cumulus, if any, are quite small; generally less than 2/8 coverage, except on windward slopes of elevated terrain; average width of cloud is at least as great as its vertical thickness.
1	Cumulus of intermediate size with cloud cover less than 5/8; average cloud width is more than its vertical thickness; towers are vertical with little or no evidence of precipitation, except along slopes of elevated terrain; a general absence of middle and upper clouds
2	Swelling cumulus with rapidly growing tall turrets which decrease in size with height and whose tops tend to separate from the lower cloud body and evaporate within minutes of the separation.
3	Swelling cumulus with towers having a pronounced tilt in a downwind direction; vertical cloud thickness is more than 1-1½1times that of its average width.
4	Swelling cumulus with towers having a pronounced tilt in an upwind direction; vertical cloud thickness is more than 1-1½ times that of its average width.
5	Tall cumulus congestus with vertical thickness more than twice the average width; not organized in clusters or lines; one or more layers of clouds extend out from the cloud towers, no continuous cloud layers exist.
6	Isolated cumulonimbus or large clusters of cumulus turrets separated by wide areas in which clouds are absent; cloud bases are generally dark with showers observed in most cells; some scattered middle and upper clouds may be present; individual cumulus cells are one to two times higher than they are wide.
7	Numerous cumulus extending through the middle troposphere with broken to overcast sheets of middle clouds and/or cirrostratus; cumulus towers do not decrease generally in size with height; ragged dark cloud bases with some showers are present.
8	Continuous dense middle clouds and/or cirrostratus cloud sheets with some large isolated cumulonimbus or cumulus congestus clouds penetrating these sheets; light rain occasionally observed from the altostratus; cumulonimbus bases are ragged and dark with showers visible.
9	Continuous sheets of middle clouds and/or cirrostratus with cumulonimbus and cumulus congestus in organized lines or cloud bands; rain is generally observed from altostratus sheets and heavy showers from cumulonimbus; wind has a squally character.
/	State of the sky unknown or not described by any of the above.

Note:

In the event of obscuration of clouds due to heavy rain, the observer should use classification 5 or 8. Use 5 if the rain is localized or is brief in duration; use 8 if the rain is widespread or lasts for longer periods.

Code Table 0700 Direction or Bearing	
Code figure	**Description**
0	Calm, or stationary or no clouds (in DL, DM, DH).
1	NE
2	E
3	SE
4	S
5	SW
6	W
7	NW
8	N
9	All directions unknown or clouds invisible (in DL,DM,DH)

Group $1s_nT_xT_xT_x$

1 – Indicator figure of the group.

s_n – Sign of the temperature given by $T_xT_xT_x$. Use code figure 0 if the temperature is 0.0°C or warmer; use code figure 1 if the temperature is colder than 0.0°C.

$T_xT_xT_x$ – Maximum temperature in degrees and tenths Celsius **shall** be coded.

- At 1200 UTC – report the maximum temperature for the previous calendar day ending at midnight
- At 0600 UTC – report the maximum temperature for the previous 24 hours.
- At 1800 UTC and 0000 UTC – report the maximum temperature for the previous 12 hours.

Group $2s_nT_nT_nT_n$

2 – Indicator figure of the group.

s_n – sign of the temperature given by $T_nT_nT_n$. Use code figure 0 if the temperature is 0.0°Cor warmer; use code figure 1 if the temperature is colder than 0.0°C.

$T_nT_nT_n$ – minimum temperature in degrees and tenths Celsius **shall** be coded.

- At 0000 UTC – report the minimum temperature for the previous 18 hours
- At 0600 UTC and 1800UTC – report the minimum temperature for the previous 24 hours.
- At 1200 UTC – report the minimum temperature for the previous 12 hours.

Group $7R_{24}R_{24}R_{24}R_{24}$ -24-Hour Precipitation group

This group **shall** be used to report total amount of precipitation during the 24 hour period ending at the time of observation, in tenths of a millimetre. This group shall be included once daily at 1200Z regardless of whether or not there was any precipitation.
7 – Indicator figure of the group.

$R_{24}R_{24}R_{24}R_{24}$- Precipitation amount for the past 24 hours. The total amount of precipitation shall be encoded in tenths of a millimetre.

Example:

24-hour Precipitation	$7R_{24}R_{24}R_{24}R_{24}$
Nil	70000
Trace	79999
0.2 mm	70002
25.3 mm	70253
105.8 mm	71058
999.8 mm or more	79998

Group $8N_SCh_Sh_S$ – individual cloud layer group

This group shall be repeated to report a number of different layers of cloud. When reported from a manned station, the number of such groups shall in the absence of cumulonimbus clouds not exceed three. Cumulonimbus clouds, when observed, shall always be reported, so the total number of groups can be four. The group **shall** be omitted when the sky is clear (N = 0).

The order of reporting layers **shall** be from low to high levels. This group **shall** be used to report:

1. The lowest individual layer of any amount; (N_s equals 1 or more)

2. The next higher individual layer which is greater than two oktas. (N_s equal 3 or more

3. The next higher individual layer at which is greater than four oktas. (N_s equals 5 or more)

4. Cumulonimbus clouds, whenever observed and not reported under the criteria above.

Note:

1. The order of reporting shall always be from lower to higher level

2. In determining the cloud amounts to be reported for individual layers, the observer shall estimate by taking into consideration the evolution of the sky, the cloud amounts of each layer at the different levels, as no other clouds existed.
3. When the sky is obscured (Ns=9), the 8-group shall read 89/$h_s h_s$, where $h_s h_s$ is the vertical visibility.

4. When the observation of clouds is not made (N = /), the 8-group shall not be included.

When reporting a layer under requirement (1), (2) or (3) in which two or more cloud types are present at the same level, the selection for C and Ns, in order of priority, **shall** be coded as :

1) If these types **do not** include Cumulonimbus then C shall refer to the cloud type that represent the greatest amount, or if there are two or more types of clouds all having the same amount, the highest applicable code figure for C shall be reported. Ns shall refer to the total amount of cloud whose bases are all at the same level;

2) If these types **do include** Cumulonimbus then one group shall be used to describe only this type with C is coded 9 and Ns as the amount of Cumulonimbus. If the amount of the remaining type(s) of cloud (excluding Cumulonimbus) whose bases are all at the same level is greater than that require by regulation, that amount **shall** be reported with C being selected in accordance with (1) and Ns referring to the total amount of the remaining cloud.

8- Identifier for the individual cloud layer group.

N_S – the amount of the individual cloud layer reported. The code figure for N_S **shall** be selected from the following table:

WMO code 2700		
0	0	0
1	1/10 or less, but not zero	1 okta or less, but not zero
2	2/10 and 3/10.	2 oktas

3	4/10	3 oktas
4	5/10	4 oktas
5	6/10	5 oktas
6	7/10 and 8/10	6 oktas
7	9/10 or more but not 10/10	7 oktas or more, but not 8
8	10/10	8 oktas
9	Sky completely obscured by a surface-based layer or by an obscuring phenomenon based aloft.	
/	Cloud cover not discernible for reasons other than fog or other meteorological phenomena, or, an observation is not made.	

C – Cloud type for the layer. The type **shall** be selected from the following code table:

WMO Code 0500	
0	Cirrus (CI)
1	Cirrocumulus(CC)
2	Cirrostratus(CS)
3	Altocumulus or Altocumulus Castellanus(AC)
4	Altostratus (AS)
5	Nimbostratus (NS)
6	Stratocumulus (SC)
7	Stratus or Stratus Fractus(ST)
8	Cumulus, Towering Cumulus or Cumulus Fractus(CU,TCU)
9	Cumulonimbus(CB)
/	Non-cloud layer aloft, or sky totally obscured by surface-based layer.

$h_s h_s$- height above station of layer to which Ns refers. The height of the base of the significant cloud layer, or the vertical visibility if appropriate, **shall** be determined and coded using the following table:

h_sh_s – height of base of cloud layer or mass whose genus is indicated by “C”

WMO code 1677								
Code figure	Meters	feet	Code figure	meters	feet	Code figure	meters	feet
00	<30	<100	34	1020	3400	67	5100	17000
01	30	100	35	1050	3500	68	5400	18000
02	60	200	36	1080	3600	69	5700	19000
03	90	300	37	1110	3700	70	6000	20000
04	120	400	38	1140	3800	71	6300	21000
05	150	500	39	1170	3900	72	6600	22000
06	180	600	40	1200	4000	73	6900	23000
07	210	700	41	1230	4100	74	7200	24000
08	240	800	42	1260	4200	75	7500	25000
09	270	900	43	1290	4300	76	7800	26000
10	300	1000	44	1320	4400	77	8100	27000
11	330	1100	45	1350	4500	78	8400	28000
12	360	1200	46	1380	4600	79	8700	29000
13	390	1300	47	1410	4700	80	9000	30000
14	420	1400	48	1440	4800	81	10500	31000
15	450	1500	49	1470	4900	82	12000	32000
16	480	1600	50	1500	5000	83	13500	33000
17	510	1700	51			84	15000	34000
18	540	1800	52	Not used		85	16500	35000
19	570	1900	53			86	18000	36000
20	600	2000	54			87	19500	37000
21	630	2100	55			88	21000	38000

22	660	2200	56	1800	6000	89	>21000	>38000
23	690	2300	57	2100	7000	90	<50	
24	720	2400	58	2400	8000	91	50 -100	
25	750	2500	59	2700	9000	92	100-200	
26	780	2600	60	3000	10000	93	200-300	
27	810	2700	61	3300	11000	94	300-600	
28	840	2800	62	3600	12000	95	600-1000	
29	870	2900	63	3900	13000	96	1000 1500	
30	900	3000	64	4200	14000	97	1500 - 2000	
31	930	3100	65	4500	15000	98	2000 - 2500	
32	960	3200	66	4800	16000	99	>2500 or no cloud	
33	990	3300						

Note:

If the observed value is between two of the heights as given in the table, the code figure for the lower height shall be reported.

Example: 1650 m **shall** be coded as 50; 10 000 m **shall** be coded as 80.

Group $9S_pS_ps_ps_p$

This group is used to give detailed information on special phenomena. Although the codes make provision for the reporting of various special phenomena, in our region the two 9-groups **shall** be used to report **the time at which precipitation began or ended and the duration and character of precipitation.** This information **shall** be reported by means of the special phenomena group **$909R_td_c$** whenever group $6RRRt_R$ is encoded and the RRR value of this group is not coded as 000.

9- Identifier for the special phenomena group.

S_pS_p- Code figure for a particular phenomenon. Code tables are determined by each region.

s_ps_p- code value of the phenomena given by S_pS_p.

909$R_t$$d_c$ – time of beginning or ending of precipitation, duration and character group. This group is included in observations from most Caribbean stations in section 3 every time the group 6RRR t_R is reported in section 1.

909 – Indicator for time of beginning or ending of precipitation as well as the duration and the character of the precipitation.

R_t –time at which precipitation given by RRR began or ended. This information shall be coded according to the following table:

WMO Code 3552	
Code Figure	**Description**
1	Less than 1 hour before time of observation
2	1 to 2 hours before time of observation
3	2 to 3 hours before time of observation
4	3 to 4 hours before time of observation
5	4 to 5 hours before time of observation
6	5 to 6 hours before time of observation
7	6 to 12 hours before time of observation
8	More than 12 hours before time of observation
9	Unknown

Note (1): If there is a choice, use the smaller code figure.

For example: if rain ended exactly 4 hours ago, use code figure 4.
R_t shall be coded with reference to the main hour. When precipitation is occurring at the time of observation, R_t shall refer to the "time precipitation began." When precipitation is not occurring at the time of observation, R_t shall refer to the "time precipitation ended," except:

1. If the coding of ww indicates that precipitation has ended during the preceding hour (ww codes 20–27 and 29), R_t shall be coded to indicate the "time precipitation began."

2. When two or more periods of precipitation occur during a six-hour period preceding the observation, the time (beginning or ending) of the last period of precipitation shall be reported by R_t.

d_c - indicator for the duration and character of the precipitation. The information shall be coded according to the following table:

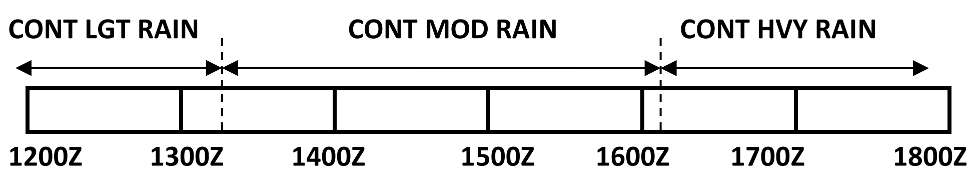
WMO code 0833		
Code Figure	**d_c–duration and character of precipitation given by RRR**	
0	Last less than one hour	Only one period of precipitation has occurred during the past 6 hours.
1	Lasted 1–3 hours	
2	Lasted 3–6 hours	
3	Lasted more than 6 hours	
4	Lasted less than 1 hour	Two or more periods of precipitation have occurred during the past 6 hours.
5	Lasted 1–3 hours	
6	Lasted 3–6 hours	
7	Lasted more than 6 hours	
8	Not used	
9	Unknown	

Notes

(1): If there is a choice, use the smaller code figure. For example, if a single period of precipitation lasted exactly three hours, use code figure 1.

(2): If only one period of precipitation has occurred during the past six hours, and is still occurring at the time of observation, the duration is defined as the time elapsed from the beginning of precipitation until the time of observation.

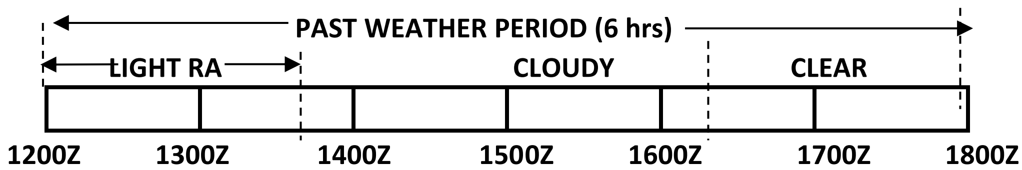
Example 1:



The report of rain ww, W_1 W_2 shows that rain has been continuous throughout the entire weather period and no other weather type has occurred.
Group ww=65; W_1=6, W_2=6. Group 909$R_t d_c$ is coded 90973

Example 2:

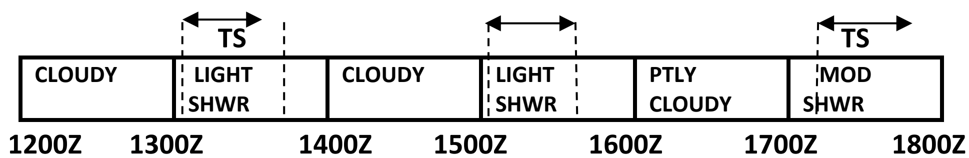
If precipitation is not occurring at the time of observation, the duration is the interval from beginning to end of the precipitation.



The report should be ww=01 W_1=6 W_2=1. Group 909$R_t d_c$ is coded 90951

Example 3:

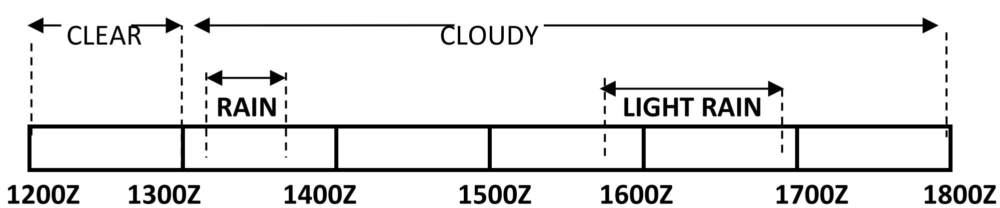
If two or more periods of precipitation have occurred during the past six hours, and precipitation is occurring at the time of observation, the duration is defined as the time elapsed from the beginning of the first period of precipitation, all or part of which occurred during the past six hours, until the time of observation.



The report should be encoded as ww=81; W_1=9, W2=8; Group 909$R_t d_c$ is coded 90916.

Example 4:

If precipitation is not occurring at the time of observation, the duration is defined as the interval from the beginning of the first period of precipitation to the end of the last period of precipitation.



The report should be coded ww=02 W_1=6 W_2=1; Group 909$R_t d_c$ is coded 90926

Part C

Hourly Observations and Reports

Chapter 12: Aviation Observations and Reports

12.1 Introduction

Requirements and standards for aerodrome meteorological observations are determined in accordance with the standards and recommended practices (SARPs) of the International Civil Aviation Organization (ICAO) and the guidance issued by the World Meteorological Organization (WMO).

Accurate, timely and complete aerodrome meteorological observations are necessary to support safe and efficient air navigation. Aerodrome meteorological observations are used for flight planning purposes and to facilitate safe operation of aircraft in the take-off and landing. The information includes:

- direction and speed of the surface wind;
- horizontal visibility;
- prevailing weather;
- atmospheric pressure information;
- surface temperature and dew point;
- cloud amounts; and
- height of the cloud base.

The purpose of this document is to describe how ICAO standards and recommended practices are applied in to Antigua and Barbuda, and to specify the requirements for observers and equipment to achieve this.

12.2 Routine (hourly) Observations and Reports

Objective

The objective of meteorological services is to contribute towards the safety, regularity and efficiency of international air navigation as well as meteorological support to the near-real-time activities of the aviation industry.

This objective shall be achieved by supplying flight operators, flight crew members, air traffic services units, search and rescue services units, airport managements and others concerned with the conduct or development of international air navigation with the meteorological information necessary for the performance of their respective functions.

All meteorological information provided, must comply with aeronautical requirements, and form part of a properly organized quality management system in accordance with the ISO 9000 series of quality assurance standards. The system must be certified by an approved organization.

Routine meteorological observations at aerodromes shall be undertaken at fixed intervals throughout the 24-hourday at aeronautical meteorological stations, which in many instances also function as synoptic stations. These observations shall be made at intervals of one hour, and are supplemented by special observations whenever specified changes occur in respect of surface wind, visibility, present weather and/or cloud.

12.3 Importance of Weather Observations in Aviation

Aviation weather observations are fundamental to all international aerodromes. Observations are the basic information upon which aerodrome forecasts and warnings are made in support of a wide range of activities performed at the aerodrome.

The importance of timely and accurate weather information made available by means of meteorological observations and reports has been stressed. An error and/or omission rate of very close to zero is essential and experience has shown that with proper procedures and well-motivated and informed personnel, this target is possible.

To achieve such a performance, it is necessary for staff at all stages of the operation to be familiar, not just with their own immediate task, but also with the overall functioning of the system. In a wider sense, they must have a deep appreciation of the overall objectives which it has been designed to attain, and of the vital use to which the information they process is put. Only with this proper understanding will they be able to choose the correct course of action when unforeseen circumstances arise.

Despite the excellent performance of modern aircraft, the weather still has a marked effect on their operation. The reliability and representativeness of observations are very important in ensuring that landings and take-offs are made safely. The wind observation will determine which runway is used and the maximum landing and take-off weights, and temperature affects engine performance.

For meteorological observations, station location is important as it is the point at which the various meteorological elements are evaluated. The observation forms the basis for the preparation of reports to be disseminated at the aerodrome and internationally. Owing to the variability of meteorological elements, limitations of observing techniques and the limitations caused by the definition of some elements, it should be understood that the values reported are the best approximation to the actual conditions at the time of the observations.

12.4 Observing and Monitoring of Meteorological Conditions at the Aerodrome

General Requirements

Observing and monitoring meteorological conditions for aviation purposes do not differ in principle from observing and monitoring for synoptic purposes. Aviation and in particular, aircraft operating under VFR, requires very detailed information on visibility, cloud base, wind, etc. which may be substantially different over short distances and change quickly with time. Therefore, the actual meteorological conditions at an aerodrome must be monitored closely and continuously during all periods of operational activity. To report current weather conditions at aerodromes, routine observations are made at fixed intervals of one hour.

Meteorological conditions are observed at aerodromes using instruments and visual estimations. Meteorological observational data are used by meteorologists for forecasting and by pilots and others concerned with landing and take-off, en-route navigation and flight performance. In addition to aerodrome observations, operational meteorological data can include weather radar data and aircraft observations.

12.5 Meteorological Elements Affecting Aircraft Operations in the Terminal Area

Aviation weather reports, usually in plain language, observed and disseminated via local circuits at the aerodrome, contain the following elements which can affect aircraft operations:

(1) Surface wind

The effect of surface wind on take-off and landing performance varies with different aircraft types. All other factors being equal, surface headwinds will allow a greater weight to be lifted on take-off. In contrast, a tailwind results in reduction of the maximum permissible take-off weight.

(2) Cloud

Low cloud limits the usable airspace where visual navigation with reference to the ground may take place. This is particularly important in the case of general aviation where the flight is to be conducted under Visual Flight Rules (VFR). For more sophisticated aircraft, low cloud is most significant in the landing phase, when the height of the base can determine the category of landing. When cumulonimbus is present, there is always the possibility of convective turbulence, wind shear, hail and lightning, all of which require the issue of a warning.

(3) Air and dew-point temperatures

Temperature is important in relation to aircraft performance, because air density depends on temperature; higher temperatures cause a decrease in density, which reduces lift, and thus reduce maximum permissible take-off weight, and also impairs engine performance, while both high and very low temperatures make limitations necessary on take-off power.

(4) Pressure

Pressure, expressed in hectopascals (hPa) and following the application of appropriate corrections, provides the altimeter setting QNH. It also reflects the air density; the lower the surface pressure the lower the air density and the poorer the lift and engine performance (and vice versa).

(5) Visibility

Visibility is reported in meters and kilometres. Important directional variations in horizontal visibility are also required to be reported. Restricted visibility will always hamper operations in the terminal area and, in the extreme, may prevent landing and take-off. (When visibility is below1500 m, runway visual range (RVR) becomes the most important parameter.)

Restricted visibility is always a limiting factor for flights conducted under visual meteorological conditions (VMC) since a pilot must maintain visual reference to the ground and to the horizon. Low visibility may reduce the acceptance capacity of aerodromes due to increased separation between landing aircraft. Some restrictions to visibility can be caused by fog, stratus clouds, haze and smoke, blowing dust, sand and snow, drizzle and rain.

(6) Other meteorological elements

Other meteorological elements affect aircraft operations, particularly in the climb-out and approach phases. These include wind shear and turbulence, thunderstorms, hail, severe line squalls and blowing sand or snow.

12.6 Observational Techniques and Practices

The essential requirement concerning an international system for aerodrome meteorological observations and reports is that these should be made in a uniform manner according to standard procedures. Such a uniform practice enables aeronautical users to interpret the reports, independently of language, as accurate information on the meteorological conditions significant to aviation with only one possible meaning. Special care may be necessary in siting instruments to ensure that the measured values are as representative as possible of conditions in the appropriate area at or near the aerodrome where such measurements are required.

The siting of meteorological instruments at aerodromes and the types of instrument used may be the same as for a synoptic station. Where, because of topography or for other reasons, the climatological values of certain elements vary significantly in different parts of an aerodrome, there is a need to make observations of the same element at two or more locations. Current observational techniques and practices for particular meteorological elements are as follows:

(1) Clouds

Observations of clouds consist of visual observations of the physical characteristics of clouds, including their vertical and horizontal extent, structure and form, and estimation of their height above ground.

(2) Pressure

For operational meteorological purposes, atmospheric pressure is generally measured by mercury barometers or (possibly digital) aneroid barometers. Barometer readings are taken to the nearest tenth of a hectopascal and then corrected to standard conditions. The value so obtained is converted to aerodrome elevation and mean sea level (MSL) by applying the appropriate corrections;

(3) Temperature

Aviation is interested primarily in the temperature at engine intake levels above the runway but it is impossible to make regular temperature observations at such locations. It is thus important that the site of the thermometer is chosen so that temperature observations approximate as closely as possible those required. Temperature readings are generally only required in whole degrees Celsius; corrections are applied before the readings are rounded off;

(4) Humidity

Aviation has no requirement for special methods of measuring humidity. Air humidity is measured at most aerodromes by the thermodynamic method using a psychrometer, or by special electronic sensors, or through a combination of a dry and wet bulb temperature reading. The humidity is used to calculate the dew-point temperature which, for aeronautical use, is reported in whole degrees Celsius;

(5) Wind

Aviation is interested in direction (true) from which the surface wind is blowing, in degrees rounded off to the nearest 10°. The units used for wind speed are either knots (kt) or kilometres per hour (km/h) and are always indicated in the reports.

Wind direction, speed and gustiness are best measured by instruments, but when instrument determination is not practicable, e.g., during a period of instrument failure, the parameters may be estimated. For synoptic and aerodrome weather observations disseminated beyond the aerodrome in which the mean wind direction over a l0 minute period is required, a recording anemometer is desirable, so that the observer can estimate the mean wind direction. This will also permit the estimation of two minute means which are required for reports for landing and take-off.

For aviation purposes, remote reading is desirable and the instrument should be capable of responding to rapid fluctuations in direction with a minimum of overshoot (the tendency for the wind vane's moment of inertia to carry it past the correct position following a change in wind direction). The siting of wind-measuring instruments should be representative of the runway area.

Since wind speed in aerodrome weather observations can be given in knots or kilometres per hour, it is desirable that anemometers and other wind-measuring instruments should be graduated in whichever of these units is chosen. Remote recording or remote indication of computed values of mean wind speed and gusts is required. For local use, a two-minute average is required as this has been demonstrated to give the most likely value of the wind to be experienced by an aircraft on landing. For METARs a 10 minute mean is needed. Gusts during the last 10 minutes are reported only when the variation from the mean wind speed has exceeded 10kt.

(6) Precipitation

Aviation has no requirements for special methods of measuring precipitation. The vital aspects of precipitation from the aviation standpoint are the reduction in visibility caused by the precipitation and the effect on runway conditions. The most significant runway state, in this respect, is when the runway is wet, particularly with areas of standing water.

(7) Visibility

Horizontal visibility and significant directional variations must be observed. The horizontal visibility is determined by an observer viewing selected objects of specified characteristics at known distances. These visual observations may be complemented by an instrumental system. . The visibility observations be representative of the aerodrome, with due account being taken of directional variations in visibility.

Chapter 13: Meteorological Observations and Reports at Aerodromes

13.1 Observations and Reports

It is important to distinguish between an observation and a report in the context of meteorological information for aviation purposes, namely:

1. An observation is the evaluation of one or more meteorological elements, carried out either by visual estimation and or with the aid of appropriate instrumentation. It includes noting the values for later use in the preparation of a report;

2. A report is a statement of the observed meteorological conditions, related to a specified time and location, and prepared according to a prescribed format for subsequent issue to users.

13.2 The Importance of Meteorological Observations and Reports for Aviation

Meteorological reports are used by aeronautical users in connection with the most critical phases of the flight, namely take-off and landing. The safety of the operation often depends directly on the timeliness and accuracy of the reports received. Hundreds of crucial decisions based on these reports are also made daily for pre-flight and in-flight planning purposes and are of vital importance to the economy and efficiency of aircraft operations.

It is therefore essential that reports always provide an accurate picture of the weather situation at the aerodrome to which they refer,, that routine reports are disseminated on schedule, and that special reports are issued as soon as weather conditions so require. Where weather conditions are changing rapidly, the observer should be prepared to meet these requirements by a series of reports in very quick succession.

13.3 Categories of Observations and Reports

Meteorological reports, and the observations on which they are based may be classified as either "routine” or "special".

Routine observations are made at aerodromes at regular intervals (normally every hour or every half-hour), and are used in the preparation of routine reports. These r reports are disseminated locally to air traffic services, local operators and, in some instances, to the Airport Authority, but also beyond the aerodrome to other meteorological offices, to data banks, and to centres which routinely broadcast meteorological information for aircraft in flight.

Special observations are made according to locally agreed criteria, in addition to the normal sequence of routine observations. These criteria are based on the requirements of local air traffic service units and on the operating minima of the aerodrome, and includes the criteria for SPECI listed in ICAO Annex 3. Special observations will also be required whenever an aircraft accident or incident occurs, or at the request of the captain of an aircraft or the local representative of an operator. Special reports are, in general, not disseminated beyond the aerodrome, but are issued locally in the same way as routine reports.

Timely and accurate meteorological information shall be available to aircraft operators and ATS providers. Also, accurate Aerodrome Forecasts (TAF) is dependent on receipt of valid METARs.

13.4 Types of Reports

Observational data are combined into a report for dissemination at the local aerodrome or beyond. Depending on their use, the reports are presented in two forms:

1. Local routine and special reports for aircraft about to land or take off including requirements for voice-ATIS (Aeronautical Terminal Information Service); and

2. METAR and SPECI for flight planning and en-route flight information service purposes, including requirements for meteorological information for aircraft in flight (VOLMET) broadcast.

Although the contents of both reports are similar, the averaging periods for certain elements and the respective operational requirements in the reports differ.

13.5 Content of Reports

Although the contents of routine and special reports are specified in the WMO No. 49 *Technical Regulations,* Volume II, [C.3.1.), Part I, section 4.5, there is considerable difference in the amount of detail required depending on whether the report is for local dissemination or for dissemination beyond the aerodrome. The content of reports for use locally, e.g. for take-off and landing, may vary depending on local agreements. Both reports however, shall contain the following elements in the order indicated:

a) Identification of the type of report (e.g. METAR or MET REPORT)

b) Location indicator

c) Time of observation, in UTC

d) Surface wind direction and speed (including variations in direction)

e) Visibility*

f) Runway visual range (Not reported at ABMS)

g) Present weather*

h) Cloud amount (and type, if applicable) and height of base*

i) Air temperature and dew point temperature
j) QNH and, where applicable QFE

k) Supplementary information, when applicable

Note:

Asterisked elements are included as necessary. The term CAVOK may replace visibility, present weather and cloud information under certain conditions

13.6 Dissemination

Types of dissemination

<u>Local transmission</u>

Meteorological reports are disseminated locally to aeronautical users including the control tower, approach control centre, area control centre, FIC, ATIS centre and the local or responsible meteorological office. Reports should also be made available to local airline operators as required.

<u>Long-line transmission</u>

Reports are disseminated for international exchange to other national meteorological offices and, in the case of designated aerodromes, to VOLMET broadcast centres as required by international agreement.

Dissemination Requirements

All reports must be given local dissemination. At stations with long-line capabilities, reports must be given long-line dissemination. When reports are corrected, the corrected report must be given the same dissemination as the report being corrected. If reports cannot be disseminated simultaneously, local and long-line, they must be disseminated first to the local airport traffic control users, then disseminated long-line. SPECI observations must be completed and transmitted as soon as possible after conditions meeting SPECI criteria are observed or detected.

Reports disseminated beyond the aerodrome

METARs and SPECIs (where appropriate) are disseminated for international exchange to other national meteorological offices and, in the case of designated aerodromes, to VOLMET broadcast centres as required by international agreement.

METAR and SPECI using the appropriate WMO code form should be filed for transmission within five minutes of the time of observation in the case of routine reports, and as soon as possible in the case of special reports.

13.7 Format of Meteorological Reports

Local routine (MET REPORT) and special (SPECIAL) reports shall be issued in abbreviated plain language. METAR and SPECI shall be issued and disseminated in the code forms prescribed by the World Meteorological Organization, Manual on Codes, International Codes, Volume I.1: (WMO No. 306).

13.8 Completeness of Reports

The purpose of a weather observation is to provide a complete picture of the conditions at the aerodrome to a variety of recipients.

The aeronautical forecaster is required to take account of all meteorological variables when preparing an aerodrome forecast; METARs are used to verify base conditions before forecasting how these elements will change with time. Missing information in the METAR may lead to greater inaccuracies in the forecast which may impact on tactical planning by pilots, operators and other aerodrome service providers.

13.9 Timing Requirements

METAR and Local Routine reports shall be transmitted hourly, SPECI and Local special reports whenever any of the criteria occurs and is noted.

Data collection for observations must begin no earlier than 10 minutes to the hour. The pressure should be the meteorological element that is read as close to the observation time as possible. Pressure readings shall not be read earlier than 5 minutes before the observation time. Special reports, when applicable, should be made without delay and recorded in the appropriate manner.

Since aerodromes have pre-determined designated places in meteorological bulletins and on VOLMET etc., it is essential that observations are completed in accordance with normal observing practices and are transmitted within five minutes of normal dispatch time. Flight information

Centres require METAR and SPECI for flight planning, and forecasters also require timely observations to ensure that amendments to Aerodrome Forecasts (TAF AMD) are issued timely, and to assist in the timely issuance of aerodrome warnings.

13.10 Time Disseminated in Reports

All times disseminated in reports shall reference the 24-hour UTC clock, e.g., 1:47 A.M. shall be referred to as 0147Z and 1:47 P.M. as 1747Z. The times 0000Z and 2359Z, (0800 P.M and 0759 P.M.) shall indicate the beginning and ending of the day respectively.

Accuracy of Time in Observations

The accuracy of the actual time of observation is very important in aviation safety investigations.

SPECI Observations upon Resumption of Observing Function

Observers must make a SPECI observation within 15 minutes after returning to duty following a break in normally scheduled observer coverage at the station unless a METAR observation is filed during that 15-minute period.

13.11 Corrections to Transmitted Data

Once an error has been detected in a transmitted report, a correction must be issued as soon as possible. Do not transmit a correction if the original transmitted observation has been superseded by a later report. Transmit the entire corrected report with (COR) as the report designator and the appropriate BBB indicator **(CC_X)**. Use the original date and time of the report being corrected. (Please see instructions for the use of the BBB indicator in the Observer's ready reference guide).

13.12 Delayed Reports

When transmission of an observation is delayed until time for the next regularly scheduled report, only the latest report must be transmitted. In the electronic log book it must be noted that that the particular report was made and the reason why it was not transmitted.

When a SPECI is not transmitted, later SPECIs must be transmitted only when the overall change between the last transmitted report and the current report satisfies the criteria for a SPECI. If the SPECI is not transmitted long-line, the procedure as described above must be followed. All SPECIAL reports must be disseminated locally. Reports of volcanic eruption must be disseminated, by any means possible, regardless of the delay.

13.15 Missing Reports

If the routine supply of METARs ceases, for whatever reason, there may be an impact on users of the meteorological information (e.g. selection of alternate aerodromes and fuel upload planning) and the provision of air traffic services. Wherever practical, suitable contingency measures shall be identified and associated operational procedures documented.

In accordance with ICAO Annex 3, if a regular supply of METARs ceases, the Aerodrome Forecast may be cancelled, as the meteorological forecaster loses the site specific information on which to confirm the forecast. The forecaster will not issue further Aerodrome Forecasts until the transmission of METARs recommences.

In practical terms this means that if a gap of two hours between METAR reports occurs then the aerodrome forecast will be cancelled. The aerodrome forecast will not be reissued until two complete METARs have been received.

13.16 Quality Control of Reports

Quality control is an essential aspect of the observing and reporting function and its importance, especially in aeronautical meteorology, cannot be overstated. Faulty or missing reports cause loss of time and may even impair aircraft safety. Observations and reports are used by pilots of aircraft in the critical take-off or landing phases of flight, where most accidents are likely to occur, must of necessity be without error.

Quality control procedures must be undertaken to ensure that the report which the end users receive, will be an accurate and complete picture of weather conditions as observed at the time of the observation. Much can be done to ensure a high quality observation before the observer goes on duty:

1. Personnel performing observing duties should have adequate training, supplemented by periodic checks on performance;

2. Familiarity with the needs of flight-crew members and even occasional familiarization flights on the flight deck for observers can help to stimulate a realization of the importance of the observation to aeronautical operations;

3. The siting and type of instrumentation provided should meet the required standards. Properly applied automation decreases the likelihood of errors;

4. The accuracy of measurements or observations should be in accordance with the guidance material set out in the WMO *Technical Regulations,* Volume II, [C.3.1.], Part II, Attachment A.

13.17 Quality Control Procedures

It is necessary that the following quality-control checks are made routinely to ensure the maintenance of a high standard of observations:

1. Tests of the observer's competence should be carried out regularly by a senior observer or manager.

2. Regular checking and monitoring, preventive maintenance, adjustments and major maintenance of instrumentation should be carried out by suitably trained technical staff and new, updated instrumentation should be acquired as necessary;

3. Observers should make regular estimates of the various parameters for comparison with readings taken from instruments to facilitate early detection of faults in the instruments. Any suspected faults in instruments should be reported immediately for prompt rectification;

4. Established and effective procedures should exist for issuing instructions relating to new observing and reporting procedures to ensure that they are brought to the attention of observers and other associated staff;

5. Observational data obtained from another source (e.g. from an auxiliary observer over the telephone) should be checked and read back to ensure that they have been correctly received;

6. To facilitate the comparison of each observation with the previous one, records of observations should be entered on a form in sequence before transmission;

7. Observations are made according to a routine, methodical procedure. For example, where pressure values such as QNH, QFE and runway threshold QFE are required, a log-book has to be provided and the following sequence of actions undertaken:

- The pressure value for the barometer is entered as read and the temperature on the attached thermometer noted;

- The pressure values at the barometer level after index and temperature correction are entered;

- The necessary corrections having been applied, the values for QNH, QFE and runway threshold QFE are entered;

- Values are compared with the previous values to detect mistakes. All digits should be compared-the tenths, units, tens, hundreds and thousands;

8. Where trend-type landing forecasts are provided, the forecaster should be alert to any errors at that point;

9. When the report is completed, ready for transmission, each item should be checked individually;

10. Where a VHF radio-receiver is available, it should be tuned to the control-tower frequency or to the ATIS broadcast to allow the observer to hear the reports being passed to pilots, and to detect any probable errors at that stage;

11. Where reports are being entered directly into a computer system for transmission or dissemination, automated quality control can be incorporated into the system which will firstly indicate if the message has been received and then query individual items if they do not conform to the criteria prescribed. The observer then checks any suspect item and insert corrections as required.

13.18 Pre-Dissemination Quality Control

The quality control performed prior to any dissemination of the weather report is the most important of all quality control operations. Once an erroneous report has been given to users, it is impossible to ensure that corrections are received by that same group of users. Therefore, all readings and data should be double checked and verified before dissemination.

13.19 Post-Dissemination Quality Control

Quality control must be exercised after the report has been disseminated. Reports are often plotted on synoptic charts for use in the preparation of forecasts, making it possible for the forecaster responsible for the analysis of these charts to check the observations. A forecaster detecting an inconsistent observation should take steps to have the error rectified immediately.

In all cases, where an error is detected, the observer should be made aware of it without delay. In this way it will be possible to bring about an overall improvement in quality. Regular checking in real-time should also be carried out by the immediate supervisor to draw the attention of the observer to any systematic deficiencies which may arise. This will help to ensure that the overall quality of the observations, coding and transmission practices are monitored.

Further, retrospective checking on all the observations for aeronautical and climatological purposes will give a reliable indication of the quality level attained by individual observers and the specific observational practices which need to be improved.

The overall responsibility for the provision of accurate observations rests with the manager of the responsible meteorological office who should examine and monitor regularly each aspect of the observing function and introduce whatever measures are necessary to bring about the required standard.

13. 20 Records and Archives

A log shall be maintained of all reports produced at the aerodrome. These data may be required in the event of an official enquiry relating to an aircraft accident or incident either at, or in the vicinity of the aerodrome. For manual observations, a record shall be maintained to log all the readings and reports.

13.21 Monitoring of Transmissions

It is of vital importance, in the interests of the safety of air operations, that the reports issued to the users are received by them with the minimum delay in accordance with agreed time schedules, and that the message received is the same as that originally issued. The originating and receiving offices should have established procedures to ensure that standards are maintained.

The observer should check each message to ensure that it is readable and correct. Where the report is disseminated by a computer system, each new report should be checked as soon as it is displayed.

Chapter 14: Observing and Reporting of Meteorological Elements

14.1 Order of Observing

Elements should be observed in the following order:

a. Elements evaluated outdoors.

b. Elements evaluated indoors, with pressure last

14.2 Observing Schedule

The following schedule for the making and recording of routine observations and the issuing of reports may be used as a guide. Local circumstances may, of course, affect the schedule for a particular site.

T-l0: Start observation (at night, or in difficult meteorological situations, an earlier start will be needed);

T-3: Enter observations on the prescribed form and contact the forecaster for a trend, if required;

T-0: Read the barometer and apply the necessary corrections to acquire the values needed;

T+ 1: Recheck visibility and cloud ceiling. Complete the report in the format agreed for local dissemination and transmit it.

14.3 Operationally Desirable Accuracy of Measurement of Observations

Extract from ICAO Annex 3, Attachment A.

Element to be observed	Operationally desirable accuracy of Measurement of observations*
Mean surface wind	Direction: ± 10° Speed: ± 1 kt up to 10 kt ± 10% 10 kt
Variations from the mean surface wind	± 2 kt(4km/h) in terms of longitudinal and lateral components
Visibility	± 50 m up to 600 m (0.3 NM) ± 10% between 600 m and 1500 m (0.8 NM) ± 20% above 1500 m (0.8 NM)
Cloud amount	± 1 okta *In daylight an observer can obtain an accuracy of ± 1 okta at the point of observation. In darkness, and when atmospheric phenomena limit the viewing of low cloud, there will be difficulty in attaining that accuracy.
Cloud height	± 33 ft. up to 330 ft. ± 10% above 330 ft.
Air temperature and dew-point temperature	± 1°C
Pressure value (QNH, QFE)	± 0.5 hPa(mb)

***the operationally desirable accuracy is not intended as operational requirement; it is to be understood as a goal that has been expressed by the operators.**

Chapter 15: METAR Structure and Coding Rules

15.1 Introduction

The standard codes used in composing METAR reports are based on WMO Document No. 306, Manual on Codes. The full METAR message may contain up to 18 groups The specific coding rules and practice detailed in this chapter are those applicable to the Antigua and Barbuda Meteorological Service.

Entries for surface wind (including variations of speed and direction), surface visibility (including directional variation), present weather, cloud details, air temperature, dew point, QNH, QFE and supplementary information are normally completed. The quality of such reports shall conform to ICAO Standards and Recommended Practices (SARPs) as specified in ICAO Annex 3.

15.2 Aviation Weather Report for METAR and SPECI- Symbolic Code

Code name	Location	Date/time of report	Wind velocity/gust	Extremes in direction(variation)	Prevailing visibility
METAR (or METAR COR), or **SPECI (or SPECI COR)**	CCCC	YYGGggZ	$dddffGf_mf_mKT$	$(d_nd_nd_nVd_xd_xd_x)$	VVVV
Minimum visibility/direction	**Present weather**	**Cloud**	**Air temperature and dew point**	**QNH**	**Recent weather**
$(V_NV_NV_ND_V)$	(w'w') (or CAVOK)	$N_sN_sN_shshshs$ **or** NSC or $VVh_sh_sh_s$	$T'T'/T_dT_d$	$QP_HP_HP_HP_H$	(REw'w')
Wind shear	**Trend**				
$(WS\ RD_RD_R$ or **WS ALL RWY)**	(BECMG ...) or (TEMPO...) or (NOSIG)				

The table above shows the METAR coding as given in WMO Document No. 306, Manual on Codes, Volume 1, Part A; FM15-X Ext.

15.3 The METAR/SPECI Code – Detailed Description and Coding Instructions

Type of report (METAR or SPECI)

The code name METAR or SPECI shall be included at the beginning of an individual report.

METAR is the name of the international meteorological code for an Aviation Routine Weather Report. METAR observations are normally taken and disseminated on the hour.

SPECI is a report issued when selected changes in weather conditions significant to aviation occur off the hour.

When an hourly observation (during the period H-10 to H) reveals that one or more of the criteria specified as requirements for SPECI observations has occurred, the observation **shall** be designated as a METAR and released on the hour.

Identification Groups

This section is reported in three groups and shall be included in each individual report:

Type of Report (code name METAR or SPECI)

The type of report, METAR or SPECI, must be included in all reports. The type of report must be separated from elements following it by a space.

Group CCCC-The ICAO aerodrome (station) identifier

The station identifier, CCCC, must be included in all reports to identify the station to which the coded report applies. The station identifier must consist of four letters and must be separated from elements following it with a space.

Date and Time of Report (YYGGggZ)

The date, YY, and time, GGgg, must be included in all reports. The time must be 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 must be the same time used in the report being corrected. The date and time group always ends with a "Z" indicating the use of UTC.

COR-Report Modifier

In the event of an error being disseminated in a report, a corrected report should be issued using the entry **COR**, inserted between the report type and station identifier.

15.4 Surface Wind Coding Requirements

General format: dddffGf_mf_mKT $d_nd_nd_n$V$d_xd_xd_x$

Where

- **ddd -** is the mean surface wind direction over the previous 10 minutes.
- **ff -** is the mean surface wind speed over the previous 10 minutes.
- **f_mf_m** - is the maximum surface wind gust speed over the previous 10 minutes.
- **$d_nd_nd_n$V$d_xd_xd_x$** - describe the variation in surface wind direction (in clockwise order) over the previous 10 minutes.
- **KT**- indicates the units are knots.

Surface wind information for the aviation reports should be taken from an anemometer located on the aerodrome. The anemometer should be sited in a suitable location to provide a representative measurement of conditions over the whole of the runway where there is only one runway, or the whole runway complex where there are two or more.

The direction from which the surface wind is blowing **shall** be given in degrees from true North and the speed shall be given in knots.

The surface wind direction and speed reported is the average taken over a ten minute period immediately preceding the time of the observation. The only exception is when a marked discontinuity occurs. This is defined as a change in the mean direction of 30 degrees or more with a mean speed of 10 knots or more before or after the change, or an increase or decrease in the wind speed of 10 knots or more, sustained for at least 2 minutes. In this case, the mean over this latter period **shall** be reported.

The maximum wind (gust) within the last 10 minutes (or since the marked discontinuity) **shall** be reported only if it exceeds the mean speed by 10 knots or more.

Variations in wind direction **shall** be reported only when the total variation in direction over the previous ten-minute period (or since the marked discontinuity) is 60 degrees or more or but less than 180 degrees and the average wind speed is greater than 3 knots. Variations are reported in clockwise order (e.g. 090V290 or 170V250).

The mean wind direction shall not be included for variable winds when the total variation in direction over the previous ten-minute period (or since the marked discontinuity) is 60 degrees or more or but less than 180 degrees and the wind speed is 3 knots or less; the wind in this case **shall** be reported as variable.
The mean wind direction shall not be included for variable winds when the total variation in direction over the previous ten-minute period (or since the marked discontinuity) is 180 degrees

or more or where it is not possible to report a mean direction e.g. when a thunderstorm passes over the aerodrome. The wind should be reported as variable and no reference should be made to the two extreme directions between which the wind has varied.

When the wind speed is less than 1 knot, this should be reported as calm.

Range and Increments

The surface wind direction and variations in direction **shall** be rounded off to the nearest 10 degrees.

Any observed value that does not fit the reporting scale shall be rounded to the nearest whole number.

Surface wind direction is reported between 010 and 360 degrees.

The surface wind mean speed and maximum speed **shall** be rounded to the nearest knot. Surface wind speed is reported between 01 and 99 knots. If the speed is 100 knots or more, the wind speed should be encoded as “P99”

Note:

There is no aeronautical requirement to report surface wind speeds of 100kt or more; however, provision has been made for reporting wind speeds up to 199kt for non-aeronautical purposes, as necessary.

Calm is encoded as ‘00000KT’.

Variable is encoded ‘VRB’.

Estimation of Wind

When suitable wind instruments are lacking, or when the wind instruments are not in operating condition, the wind direction and speed **shall be estimated** and the appropriate remarks entered to so indicate.

Examples of surface wind coding

1. **02008KT**
Wind twenty degrees, 8 knots

2. **00000KT**
Wind calm

3. **VRB02KT**
Wind variable, 2 knots (the variation in direction over the previous ten-minute period has been 60 degrees or more or but less than 180 degrees and the wind speed is less than 3 knots

4. **33022G34KT**
Wind three hundred thirty degrees, 22 knots, max 34 knots

5. **16016KT 120V190**
Wind one hundred sixty degrees, sixteen knots, varying between 120 degrees and 190 degrees

6. **21015G28KT 180V270**
Wind two hundred ten degrees, 15 knots, max 28 knots varying between 180 degrees and 270 degrees

7. **27070GP99KT**
Wind two hundred seventy zero degrees, 70 knots, max 100 knots or more.

15.5 Visibility

Evaluating Visibility

Visibility **must** be evaluated as frequently as practical. Using all available visibility markers, the observer must determine the greatest distances that can be seen in all directions around the horizon circle. When the visibility is greater than the distance to the farthest markers, the observer must estimate the greatest distance that can be seen in each direction. This estimate must be based on the appearance of all visibility markers. If they are visible with sharp outlines and little blurring of colour, the visibility is much greater than the distance to them. If a marker can barely be seen and identified, the visibility is about the same as the distance to the marker.

CAVOK -Coding Requirements

General format: CAVOK

The visibility, weather and cloud groups are replaced by CAVOK (Cloud and Visibility OK) when the following conditions exist simultaneously:

1. Prevailing visibility is 10 km or more.
2. No minimum visibility is reported.
3. No cloud below 5000 ft. or below the highest Minimum Sector Altitude, whichever is the greater.

4. No towering cumulus or cumulonimbus clouds.

5. No significant weather phenomena at or in the vicinity of the aerodrome.

Example - CAVOK should be used when the meteorological visibility is 12 km, there is no weather and there is broken cloud (5-7 oktas) at 6000 ft**.**

Visibility Coding Requirements

General format: **VVVV $V_NV_NV_NV_ND_v$**

Where:

1. **VVVV** =prevailing meteorological visibility
2. **$V_NV_NV_NV_N$** = minimum meteorological visibility
3. **D_v** = one or two letters indicating one of the eight points of the compass that best describes the direction of the meteorological visibility, relative to the aerodrome meteorological observer's station

In aviation reports, the visibility reported is the prevailing visibility and, under certain circumstances, the minimum visibility. In order to determine the prevailing visibility and any requirement to report the minimum visibility, the variation of visibility in all directions around the aerodrome should be considered.

Prevailing visibility is defined as "the greatest visibility value that is reached within at least half of the horizon circle or within at least half of the surface of the aerodrome. These areas could comprise contiguous or non-contiguous sectors."

If the visibility in one direction which is not the prevailing visibility, is less than 1500 m or less than 50% of the prevailing visibility, the lowest visibility observed should be reported after the prevailing visibility and its general direction in relation to the aerodrome indicated by reference to one of the eight points of the compass. If the lowest visibility is observed in more than one direction, then the most operationally significant direction should be reported. When the visibility is fluctuating rapidly and the prevailing visibility cannot be determined, only the lowest visibility should be reported, with no indication of direction.

There is no requirement to report the lowest visibility if it is 10 km or more.

When conditions exist such that 'CAVOK' applies, visibility shall be omitted from reports, and 'CAVOK' shall be reported instead.

VVVV shall always appear in aviation reports as four figures, expressed in metres when the visibility is less than 10 km, and coded as 9999 when the visibility is 10 km or more).

Visibility shall be recorded in metres rounded down to:

1. the nearest 50 m when the visibility is less than 800 m;
2. the nearest 100 m when the visibility is 800 m or more but less than 5000 m;
3. the nearest 1000 m when the visibility is 5000 m or more but less than 10 km.

Any observed value which does not fit the reporting scale in use shall be rounded down to the nearest lower step in the scale.

A visibility of less than 50 m shall be encoded as ‘0000’;

A visibility of 50 m shall be encoded ‘0050’;

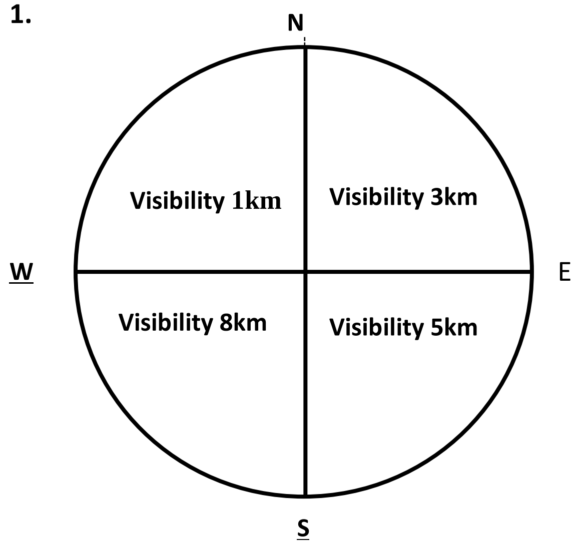
A visibility of 10 km or more shall be encoded ‘9999’ (unless CAVOK applies).

Reporting procedures related to visibility to be applied in aviation reports.

Condition	Action
Visibility not the same in different directions, with the lowest visibility 1 500 m or more and 50 per cent or more of the prevailing visibility.	Report the prevailing visibility.
the lowest visibility is less than 50 percent of the prevailing visibility and less than 5000m	Report the prevailing VIS together with the lowest VIS with its general direction in relation to the aerodrome.
the lowest visibility is <1 500 m	Report the prevailing VIS together with the lowest VIS with its general direction in relation to the aerodrome.
Visibility fluctuating rapidly; the prevailing visibility cannot be determined.	Report lowest visibility without indication of direction.

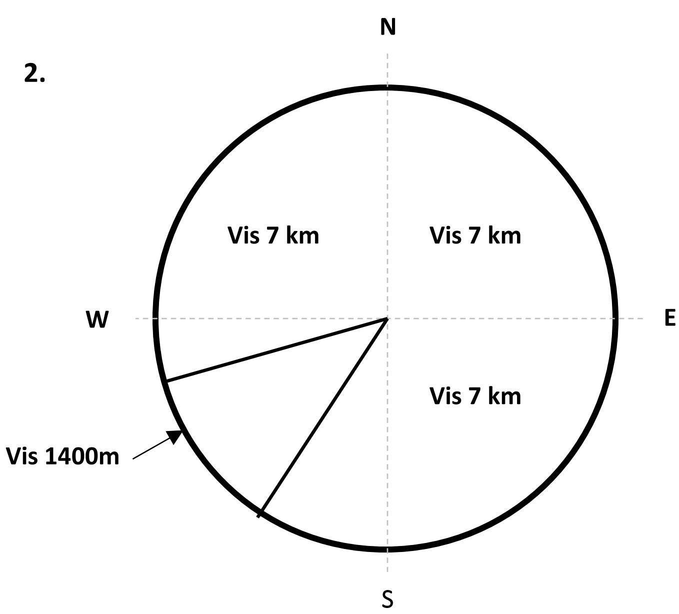
Examples of Visibility Coding

1.



3KM is considered to be the prevailing visibility because it is the greatest value common to ½ or more of the horizon circle, and is coded as **3000.**

2.



The prevailing visibility is 7 km because it is the greatest value common to ½ or more of the horizon circle. The lowest visibility is 1400 m, it is less than 1500 m, thus meets the criteria for the reporting of directional visibility. The visibility will be reported as: **7000 1400SW**

15.6 Present Weather - Coding Requirements

General Format: w'w'

Where **w'w'-** is the present weather.

Entries of present weather shall only relate to weather occurring at the time of observation on or over the aerodrome, or, in the case of reporting phenomena in the vicinity of the aerodrome, within approximately 16 km of the Aerodrome Reference Point. Visual reference points, information from radar, pilot reports and automatic sensors may be used to assist in this determination.

If there is no weather of significance to aeronautical operations at the time of the observation, either on or in the vicinity of the aerodrome, the group is omitted.

Present weather groups consist of one or more pairs of letter abbreviations, selected from WMO Code Table 4678 below. A group shall be constructed by considering the need to specify intensity or proximity, a descriptor, and finally the phenomena, in that order.

A group may contain up to nine characters, and up to three groups may be inserted to report simultaneously occurring independent phenomena. Where two different types of weather are observed, they should be reported in two separate groups. However, different types of precipitation occurring at the time of the observation should be reported as one single group with the dominant type of precipitation reported first and preceded by only one intensity qualifier, which refers to the intensity of the total precipitation.

WMO Code Table 4678				
Qualifier		**Weather phenomena**		
1 Intensity or proximity	**2 Descriptor**	**3 Precipitation**	**4 Obscuration**	**5 Other**
- Light **Moderate** (no qualifier) **+ Heavy** (well-developed in the case of dust/sand	**MI** Shallow **BC** Patches **PR** Partial (covering part of the aerodrome) **DR** Low Drifting **BL** Blowing	**DZ** Drizzle **RA** Rain **SN** Snow **SG** Snow Grains **IC** Ice Crystals (diamond dust) **PL** Ice Pellets **GR** Hail	**BR** Mist **FG** Fog **FU** Smoke **VA** Volcanic Ash **DU** Widespread Dust	**PO** Dust/Sand Whirls (dust devils) **SQ** Squalls **FC** Funnel Cloud(s) (tornado or water-spout)

whirls, dust devils and funnel clouds) **VC** In the Vicinity	**SH** Shower(s) **TS** Thunderstorm **FZ** Freezing (super cooled)	**GS** Small Hail and/or Snow Pellets **UP** Unknown Precipitation (AWOS only)	**SA** Sand **HZ** Haze	**SS** Sandstorm **DS** Dust storm

The intensity of weather phenomena shall only be reported if it relates to precipitation (including that qualified by freezing, shower or thunderstorm) and blowing snow. The intensity is indicated by the appropriate symbol given in Table 4678.

Only certain phenomena are reported if they occur within approximately 16 km of the Aerodrome Reference Point. These are funnel cloud (waterspout or tornado), shower, thunderstorm and volcanic ash. In all cases the intensity of the phenomenon is not reported. Also, in the case of shower in the vicinity and thunderstorm in the vicinity, the precipitation type is not specified.

The following restrictions apply to the use of the descriptors:

1. No more than one descriptor shall be included in a w'w' group.
2. The thunderstorm descriptor may be inserted alone if thunder is heard with no precipitation.
3. The descriptors for thunderstorm and shower shall be used only in combination with rain.

The present weather codes for mist, dust, smoke and haze shall be used only when the prevailing visibility is 5000 m or less.

When more than one independent phenomenon is occurring simultaneously, separate groups shall be inserted (up to a maximum of three groups), in the order given by the columns, that is: precipitation first, then 'obscuration', and finally 'other' (e.g. '+SHRA HZ SQ'). However, if a thunderstorm is reported, then this shall take precedence over any precipitation in the coding of present weather groups.

Thunderstorm, thunderstorm in the vicinity and thunderstorm with precipitation, shall be reported as 'present weather' if thunder is heard within ten minutes preceding the observation. If lightning is seen but thunder not heard, then it is likely that the thunderstorm is not within the Aerodrome Reference Point and should not be reported in the report. Observers should try to establish whether thunder is heard or if the thunderstorm is within the Aerodrome Reference Point or the vicinity by any appropriate means.

A guide to the descriptors and weather phenomena

Fog (FG)

A suspension in the air of very small water droplets (or at very low temperatures, minute ice crystals), the prevailing visibility within which is less than 1000 m. Relative humidity will be at or near 100% (viz. dry bulb and dew point temperatures equal or very close to each other in value).

Funnel cloud (FC)

This is a rotating column of air, often a violent whirlwind, indicated by the presence of an inverted cone-shaped cloud, extending downwards from the base of a cumulonimbus cloud or towering cumulus cloud, but not necessarily reaching the surface. The diameter can vary from a few metres to some hundreds of m. A funnel cloud that touches the surface is described as 'well developed', and known as a tornado if over land, and a waterspout if over water.

Haze (HZ)

Haze is caused by a widespread amount of extremely small dry particles in the air, invisible to the naked eye, but sufficiently numerous to give the air a pale, whitish or opalescent appearance. It shall be reported when it reduces the prevailing visibility to 5000 m or less.

Mist (BR)

A suspension of microscopic water droplets or wet hygroscopic particles in the air. It should be reported when it reduces the prevailing visibility to between 1000m and 5000m or less. In this case, the relative humidity will be 95% or more (and, as a guide, the difference between dry bulb and dew point temperatures is usually 1°C or less).

Rain (RA)

A precipitation of liquid water droplets with a diameter of 0.5 mms or more, falling from cloud. Diameter and concentration of the drops may vary considerably according to the intensity of the precipitation, its nature and source (viz. light, moderate or heavy; intermittent or continuous). If the precipitation falls from cumuliform cloud, then it is further described as a shower. (See Appendix D to determine intensity based on rate of fall.

Shower (SH)

A descriptor used to identify precipitation (rain,) falling from cumuliform clouds. Showers are often short-lived, and can be characterised by their sudden beginning and ending, and by large and rapid changes in precipitation intensity.

Smoke (FU)

A suspension in the air of small particles produced by combustion, frequently imparting a grey or blue hue to the atmosphere. It should be reported when it reduces the prevailing visibility to 5000 m or less;

Squall (SQ)

A strong wind that rises suddenly: that is by at least 16 knots, increasing to 22 knots or more, and sustained for at least one minute, then dying away quickly; distinguished from a gust by its longer duration. A squall is associated with violent convective activity.

Thunderstorm (TS)

One or more sudden electrical discharges, manifested by a flash of light (lightning) and a sharp crack or rumbling sound (thunder). Thunderstorms are associated with cumulonimbus clouds. When thunder is heard with no precipitation falling on the aerodrome, ‘TS’ alone is reported in the METAR, or ‘VCTS’ if the source is estimated to be within 16km of the Aerodrome Reference Point. To report a thunderstorm with precipitation at the aerodrome, ‘TS’ is used as a descriptor, and combined with the appropriate precipitation abbreviations and prefixed (where necessary) by an intensity symbol based on the rate of fall of the precipitation

Volcanic ash (VA)

A suspension or precipitation of dust or solid particles in the atmosphere, known to be originating from an active volcano.

15.6 Cloud Coding Requirements

General Format: $N_sN_sN_sh_sh_sh_s$ or NSC or $VVh_sh_sh_s$

Where

- **$N_sN_sN_s$** is the cloud amount expressed as either FEW, SCT, BKN or OVC.
- **$h_sh_sh_s$** is the height of the cloud base in 100s of feet above the aerodrome.
- **NSC** represents no significant cloud i.e. no cloud below 5000 feet or below the minimum sector altitude (whichever is the greater) and no towering cumulus or cumulonimbus (TCU or CB)
- **$VVh_sh_sh_s$** is the vertical visibility height. VV/// indicates that vertical visibility height is not measured, or sky obscured.

Normally up to three cloud layers may be reported (although in certain circumstances more can be reported - see (4) below):

1. the lowest layer, whatever the amount;
2. the next layer above of amount 3 oktas or more (SCT, BKN or OVC);
3. the next layer above of amount 5 oktas or more (BKN or OVC); and
4. insert any towering cumulus or cumulonimbus cloud omitted by the above rules, whilst retaining base height order from lowest to highest.

Range and Increments

The cloud amount ($N_sN_sN_s$) can be expressed as:

1. FEW no more than quarter cover (1-2 oktas)
2. SCT over ¼ but no more than ½ cover (3-4 oktas)
3. BKN over half but not complete cover (5-7 oktas)
4. OVC complete cover (8 oktas)

The height of the cloud base ($h_sh_sh_s$) is reported in hundreds of feet above aerodrome level.

Where there is no cloud below 5000 ft. or below the highest minimum sector altitude (whichever is greater) and there is no towering cumulus or cumulonimbus, 'NSC' (no significant cloud) is reported.

The cloud type is usually not specified. However, significant convective cloud, indicated by 'TCU' (Towering Cumulus), defined as 'cumulus with strong vertical development', and 'CB' (Cumulonimbus), shall be inserted (without a space) after the height of the cloud base. The amount, height of cloud base and cloud type of towering cumulus or cumulonimbus shall be reported, irrespective of the cloud base height.

When concurrent TCU and CB cloud masses appear to have a common base, the amount shall be encoded from the sum of the individual amounts, and the type reported as cumulonimbus.

The height of the cloud base is rounded down to the nearest hundred feet up to 10000 ft. and to 1000 ft. thereafter. A base height of less than 100 feet above the aerodrome is encoded '000'.

When the term CAVOK applies, 'CAVOK' is reported in lieu of cloud information.

When the sky is obscured, 'VV///' is reported in lieu of cloud information.

When 'TS' (thunderstorm) is reported as present weather, 'CB' (cumulonimbus) shall be reported.

Examples of METAR cloud coding

1. **FEW010 SCT022 BKN045**
   - 1-2 oktas of cloud base 1000 ft. above aerodrome level, 3-4 oktas of cloud base 2200 ft. above aerodrome level and 5-7 oktas of cloud base 4500 ft.

2. **FEW008 BKN013TCU**
   - 1-2 oktas of cloud base 800 ft. above aerodrome level, 5-7 oktas of towering cumulus cloud base 1300 ft. above aerodrome level.

3. **NSC**
   - No cloud below 5000 ft. and no towering cumulus or cumulonimbus observed at any level (but CAVOK conditions do not exist).

Vertical Visibility: (VV$h_s h_s$h)

When the sky is obscured and cloud details cannot be assessed, the observations of vertical visibility should be reported in lieu of cloud amount, cloud type and height of cloud base. The reporting steps for vertical visibility should be 30 m(100 ft.) up to 600 m (2 000 ft.). In METAR, the vertical visibility value is reported in the same manner as the cloud height proceeded by the letter indicator **VV**. When the vertical visibility cannot be assessed, the group is indicated by **VV///.**

Example: VV005 (vertical visibility 500 ft.).

15.7 Air and Dew Point Temperature

Coding Requirements

General Format: T'T' / T_d'T_d'

Where
T'T' = the dry bulb temperature to the nearest whole ^{o}C.
T_d'T_d' = the dew point temperature to the nearest whole ^{o}C.

Two temperatures are given in aviation reports; the outside air temperature and the dew point. The dew point is not measured directly from a thermometer; however it can be calculated from the dry bulb and wet bulb temperatures.

Range and Increments

The dry bulb and dew point temperatures are reported to the nearest whole degree Celsius (°C). A two-digit figure for each temperature is given.

When the temperature value is a 0.5 reading or above, the value is reported to the warmer temperature. Therefore 23.5°C is rounded up to 24°C.

Temperatures below 0°C are preceded by M (meaning minus)

Exceptionally, if a dew point temperature is unavailable, it is replaced by additional solidi (//).

Examples of temperature and dew point coding

1. The coding 29/24 is valid for a dry-bulb reading of 28.5°C to 29.4°C and dew point between 23.4°C and 24.4°C.
2. A dry-bulb temperature of plus 0.4°C and a dew point calculated to be minus 3.7°C would be encoded 00/M04.
3. A dry-bulb temperature of 26.5°C but the wet bulb sensor is unserviceable would be encoded 27///.

15.8 Atmospheric Pressure -Coding Requirements

General format: $QP_HP_HP_HP_H$

Where

Q is the group identifier

$P_HP_HP_HP_H$ is the atmospheric pressure, corrected to mean seal level (QNH)

Atmospheric pressure is used by aircraft altimeters and for this reason it is important to provide accurate pressure measurements.

QNH -the atmospheric pressure corrected to mean sea level (based on International Standard Atmosphere conditions throughout the height difference) and is reported in the METAR rounded down to the nearest whole hectopascal.

Note:

The SI unit of pressure is the Pascal; for reference the millibar is equivalent to 100 Pascals or 1 hectopascal).

Range and Increments

The pressure is inserted in the report rounded down to the nearest whole hectopascal, prefixed by indicator letter '**Q**'.

Pressure settings, such as QNH and QFE, are normally integer values. Pressure settings should be available to an accuracy of one tenth of a hectopascal on request.

If the value is less than 1000 hectopascals, a zero shall be inserted following '**Q**'.

Examples of METAR pressure coding

1. Q0987 Pressure reduced to mean sea level is 987 hectopascal.
2. Q1001 Pressure reduced to mean sea level is 1001 hectopascal.
3. Q0999 Pressure reduced to mean sea level is 999 hectopascal.
4. Q1023 Pressure reduced to mean sea level is 1023 hectopascal.

Calculating the QNH

Barometer readings are corrected for air temperature and height of the instrument above sea level. At the ABMS, the barometer is located at a height of 62ft above sea level; calculations are done on the conversion factor that **one hectopascal is equal to 0.02952998 inches of mercury**. After the barometer reading has been adjusted for temperature the station pressure is realized, a standard **0.1** is added to calculate the **QFE (for local use only)** and **2.3** added to calculate the **QNH.**

***A Temperature Conversion Chart and a Pressure Conversion Table are available at the observer's desk to facilitate manual calculations if necessary.**

15.9 Recent Weather

For international dissemination, the section on supplementary information shall be used only to report recent weather phenomena of operational significance and available information on wind shear in the lower levels.

Coding Requirements

General format: REw’w’

Where w'w' is the abbreviation for recent weather groups; always proceeded by **RE.**

Recent weather should be encoded and inserted in the report if, during the period since the last routine report or in the last hour (whichever is the shorter), one or more of the phenomena listed below was observed at the station and has since ceased or is still on-going, but decreased in intensity.

1. Moderate or heavy rain including showers
2. Funnel cloud (tornado, waterspout);
3. Volcanic ash.
4. Thunderstorm (that occurred with or without precipitation)

Up to three recent weather groups may be reported. Each group is formed using the appropriate present weather two-letter abbreviations prefixed by the indicator letters ‘RE’. The full list of permitted recent weather codes are detailed in the ‘Summary of recent weather codes’ table - see below.

Note:

1. Not all recent weather is regarded as operationally significant.

2. A recent weather group is not inserted if the same phenomenon of a similar or greater intensity is reported as present weather.

3. Intensity qualifiers are not used when reporting recent weather.

Summary of recent weather codes

RERA	Recent rain (moderate or heavy)
RESHRA	Recent rain showers (moderate or heavy)
RETSRA	Recent thunderstorm with rain
RETS	Recent thunderstorm without precipitation
REFC	Recent funnel cloud (tornado or waterspout)
REVA	Recent volcanic ash

Examples of Recent Weather Coding:

1. If light rain have ceased since the last report, **no recent weather group is inserted.**

2. If a moderate rain occurred since the last report, but then became a heavy rain shower:
   - **Present weather reported is +SHRA and recent weather is RERA.**

3. If moderate rain has ceased since the last report, but a moderate rain shower is falling at the time of the observation:
   - **Present weather reported is SHRA and recent weather is RERA.**

4. If a thunderstorm with moderate or heavy rain has occurred since the last report, but both have ceased;
   - **No present weather is reported and recent weather is RETSRA.**

Reporting wind shear in the lower levels

In METAR, where local circumstances so warrant, wind shear should be included as necessary.

WS RD$_R$D$_R$ -Used to report Information on the existence of wind shear along the take-off path or approach path between one runway level and 500 m (1 600 ft.) significant to aircraft operations, and is repeated as necessary. The runway designator **D$_R$D$_R$** shall be reported.

WS ALL RWY -shall be used if the wind shear along the take-off path or approach path is affecting all runways in the airport

15.10 TREND Forecast

Trend (Landing) Forecast: TTTTT or NOSIG

In most ICAO regions, trend forecasts are supplied. They consist of a concise statement indicating what significant changes are likely to occur in one or more meteorological elements during the two next hours. The trend forecast is always appended to a local routine or special report, or METAR or SPECI. These reports, together with the trend forecast, form the complete landing forecast. Detailed technical specifications concerning trend forecasts can be found in Annex 3, Appendix 3, Tables A3-1 and A3-2.

The trend forecast appended to the report has the same order of elements (i.e. surface wind, visibility, weather phenomena and cloud), terminology, units and scales as the preceding report and is introduced by one of the following change indicators if a significant change or changes are expected:

a) BECMG; or
b) TEMPO.

When no significant changes to any of the elements concerned (surface wind, visibility, weather, cloud and any other elements if so agreed between the meteorological authority and the operator concerned) are expected within two hours, the term **NOSIG** is used, representing the complete forecast statement.

Chapter 16: Aerodrome Special Meteorological Report- SPECI

16.1 General

Aerodrome special meteorological reports carry the identifier **SPECI** and, have the same content and sequence of elements as **METAR**. **SPECI** are disseminated beyond the aerodrome of origin to other aerodromes in accordance with regional air navigation agreement, which ensures that the special reports are available for VOLMET broadcasts, and for individual transmissions to aircraft in flight through ATC units or operators.

WMO No.49 [C.3.1.] 4.5.1

SPECI shall contain the following elements in the order indicated:

a. Identification of the type of report;
b. Location indicator;
c. Time of the observation;
d. Identification of an automated or missing report, when applicable;
e. Surface wind direction and speed;
f. Visibility;
g. Present weather;
h. Cloud amount, cloud type (only for cumulonimbus and towering cumulus clouds) and height of cloud base or, where vertical visibility measured;
i. Air temperature and dew-point temperature; and
j. QNH.

In addition to elements listed (a) to (j) above, SPECI should contain supplementary information to be placed after element (j). SPECI is issued in accordance with the following criteria:

16.2 Surface Wind Criteria

1. The mean surface wind direction has changed by 60 degrees of more from that given in the latest report, the mean wind speed before and/or after being 10kt or more.

2. The mean surface wind has changed by 10kt or more from that given in the latest report.

3. The variation from the mean wind speed (gusts) has increased by 10kt or more from that at the latest report, the mean wind speed before and/or after being 15kt or more.

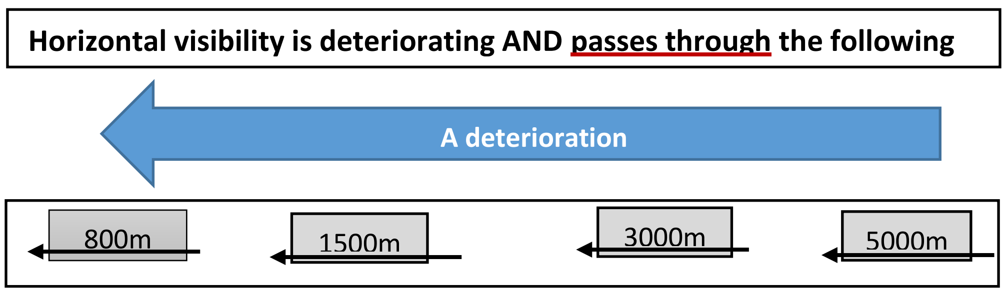
16.3 Horizontal Visibility Criteria

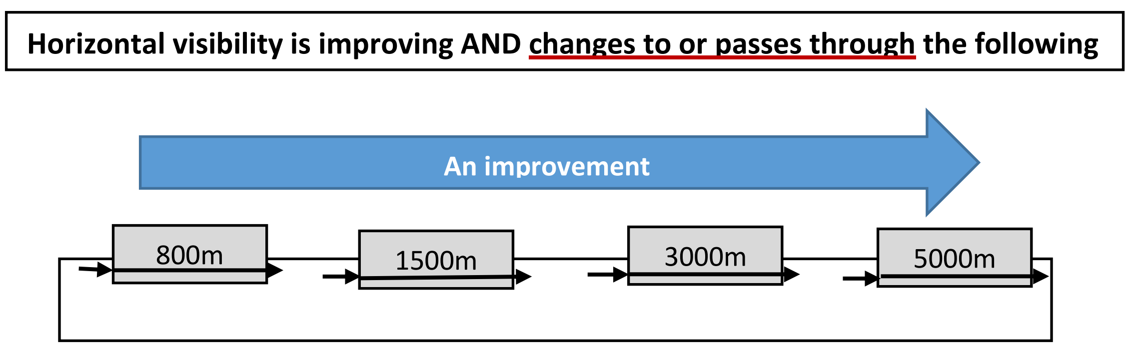
The visibility is improving and changes to or passes through one or more of the following values; or when the visibility is deteriorating and passes through:

1. 800, 1500 or 3000m and

2. 5000m, in cases where significant numbers of flights are operated in accordance with the visual flight rules.

Example:



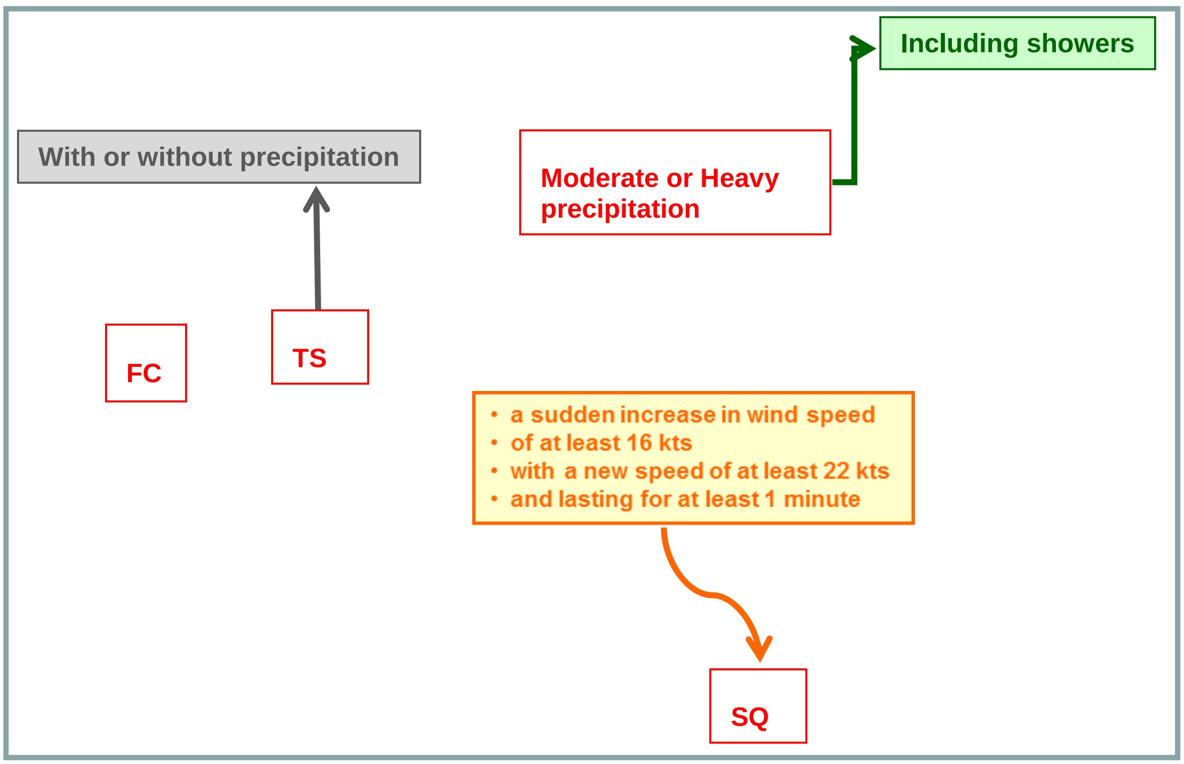


16.4 Present Weather Criteria

1. The onset, cessation or change in intensity of the moderate or heavy precipitation

2. The onset or cessation of any of the following weather phenomena of combinations thereof
    - Thunderstorm (with or without precipitation)
    - Funnel cloud (tornado or waterspout).
    - squall

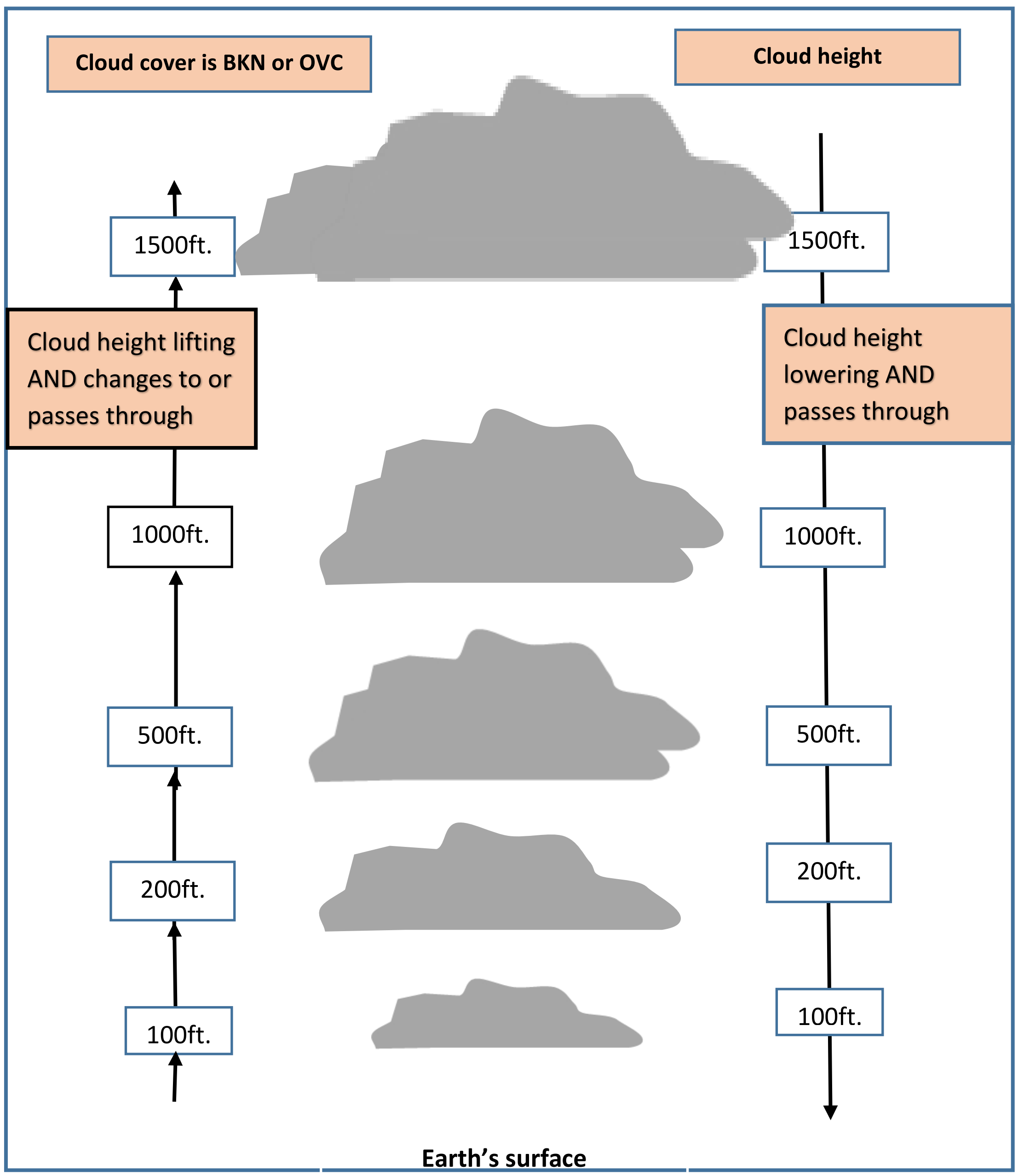
Present Weather – the start or cessation of. In the case of precipitation also change in intensity.



16.5 Cloud Base Height Criteria

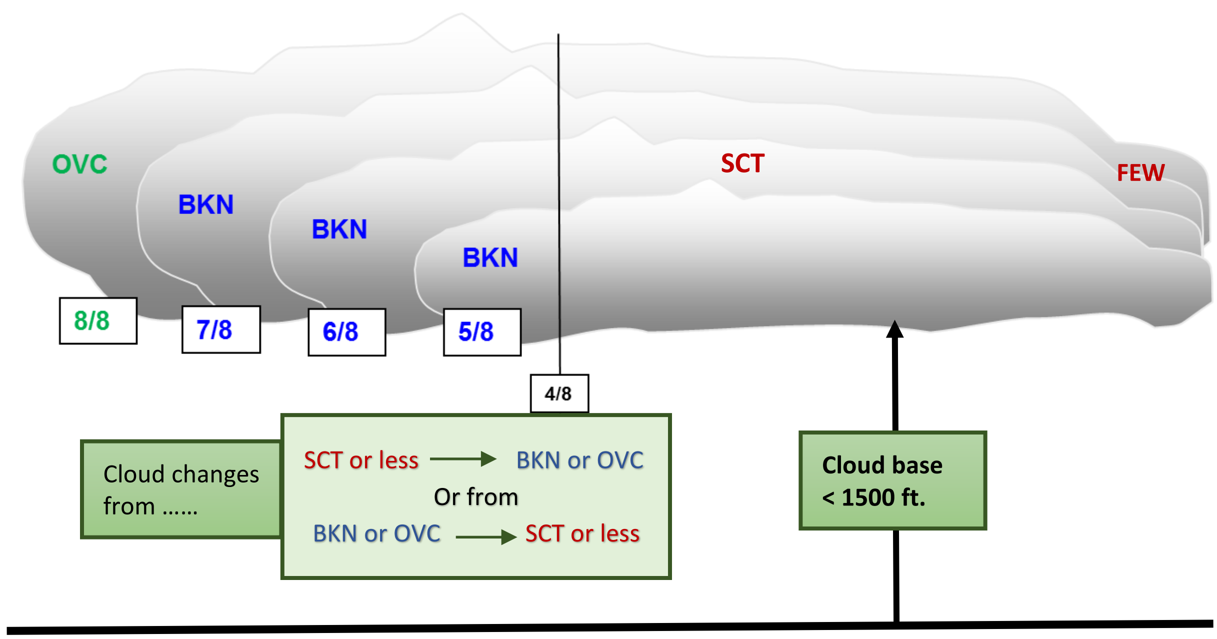
1. The height of the base of the lowest cloud layer of broken (BKN) or overcast (OVC) is lifting and changes to or passes through one or more of the following values; or when the lowest base is lowering and passes through;

    - 100,200,500 or 1000ft; or
    - 1500ft where a significant number of flights are operated in accordance with visual flight rules



16.6 Cloud Amount Criteria

1. When the amount of a cloud layer below 1500ft changes as follows:
    - FEW or SCT to BKN or OVC
    - BKN or OVC to FEW or SCT



16.7 Vertical Visibility Criteria

When the sky is obscured and the vertical visibility is deteriorating or improving through one or more of the following values 100,200,500 or 1000ft.

16.8 Other Criteria

Any other criteria based on local aerodrome operating minima as agreed between the meteorological authority and the operators.

NOTE:

1. When the deteriorating of one weather element is accompanied by an improvement in another element, a single SPECI is issued; it is treated as a deterioration report.

2. SPECI representing deterioration in conditions are disseminated immediately after the observation.

3. Improvements are disseminated only after the improvements have lasted for 10 minutes.

Chapter 17: Weather Reports for Air Traffic Services

17.1 Introduction

Weather reports to Air Traffic Services **(Local routine reports)** are issued hourly, and are used by the ATS units to provide weather information to operators, aerodrome users and pilots at or in the vicinity of the aerodrome. Whilst these reports are very similar to the METAR, there are slight differences in content and coding. In addition, the averaging periods for certain elements in the reports differ. The format is outlined below:

Identification of the type of report

Local routine report- **(MET REPORT**)

Location indicator

ICAO four letter for the aerodrome – **TAPA**

Time of the observation

Day and actual time of observation: day of the month and time in hours and minutes, in Coordinated Universal Time (UTC).

Example: 221600Z

17.2 Surface Wind

Wind observations in local reports are used for arriving or departing aircraft and should be representative of the **touchdown zone and the conditions along the runway**, respectively. In local reports, surface wind should be based on an averaging period of **two minutes**.

For local routine reports the surface wind is reported as follows:

Direction (true) from which surface wind is blowing, in degrees rounded off to the nearest 10°. The unit used for wind speed should be indicated. The direction shall be preceded by the term “WIND” and separated from the speed by solidus”/”.

Example: WIND 080/15KT

The term “CALM” is used when a wind speed of less than 1KT is observed

Example: WIND CALM

Wind speed of 100KT or more is to be indicated as ABV99KT

Significant speed and directional variations:

Variations of wind direction and speed given in meteorological reports always refer to the ten-minute period preceding the time of observation. Directional variations are indicated under the following circumstances:

1. The wind direction varies by 60° or more and when but less than 180^0 and the mean speed is 3KT or more. In such case, report the two extreme directions (reported clockwise) between which the wind has varied, in degrees, after indication of the mean wind direction and speed,

Example:

The mean surface wind direction 10°; wind speed 9KT; wind direction variable between 350° and 050°;The wind is reported as **"WIND 010/9KT VRB BTN 350/ AND 050/"**

2. The mean speed is less than 3kt and the wind direction varies by less than 180^0;Indicate the wind direction by the term "variable" (VRB) followed by the mean wind speed, with no indication of the mean wind direction,

Example:

mean surface wind direction 10°, wind speed 2kt, wind direction variable between 350° and 050°; The wind is reported as **"WIND VRB2KT"**

3. The wind direction varies by 180 degrees or more; Indicate the wind direction by the term VRB followed by the mean speed, with no indication of the mean wind direction,

Example:

mean surface wind direction 10°, wind speed 18kt; wind direction variable between 350° and 190°;The wind is reported as **"WIND VRB18KT"**

Gusts:

When the wind is gusty, with variations from the mean wind speed (gusts) exceeding 10 knots, speed variations are indicated in local reports. Speed variations are given as follows:

The maximum and minimum values of the wind speed attained, after indication of the mean wind direction and speed, in the form: **"WIND 180/20KT MAX 35 MNM 07".**

17.3 Visibility

In local reports visibility is used for:

- Departing aircraft, the visibility observations should be representative of the conditions along the runway; and
- Arriving aircraft, the visibility observations should be representative of the touchdown zone.

In local reports visibility is reported as follows;

- in steps of 50 m when visibility is less than 800 m;
- steps of 100 m when visibility is 800 m or more, but less than 5 km;
- in steps of 1 km when visibility is 5 km or more, but less than 10 km.

When visibility is 10 km or more, it is given as 10 km, except when the conditions for the use of CAVOK apply. **Any observed value that does not fit the reporting scale in use shall be rounded down to the nearest lower step in the scale**.

In local reports visibility shall be reported together with the units of measurement

Examples: VIS 550M
VIS 4000M
VIS 6KM
VIS 10KM

Determining local visibility

For local purposes the following landmarks are to be used as makers to determine the prevailing visibility:

LANDMARK	KM	NAUTICAL MILES
Long Island	3.49	1.88
Crabs Peninsula (cement plant)	3.59	1.93
Maiden Island	2.96	1.59
Sugar Mill (across runway)	0.80	0.43
Lindsay Hill (Parham)	5.96	3.21
Mount Obama	12.58	6.79
Carlisle	1.61	0.86
Osbourn	2.40	1.29

Piggots Hill (quarry)	1.48	0.79
Scotts Hill	4.96	2.67
Seatons	8.47	4.57
Monks Hill	12.62	6.81
Cherry Hill	13.27	7.16
Sugar Loaf Hill	12.26	6.61

Note:

For reporting purposes all values should be rounded down to the nearest whole value.

17.4 Present Weather

In local reports, present weather information should be representative of conditions at the aerodrome and is reported in terms of type and characteristics and is qualified with respect to intensity.

***Note**

Proximity indicator VC (vicinity) is not used in Local Routine Reports

The following types of weather phenomena are to be identified and reported:

- Precipitation–rain (RA)
- Fog(FG) – Reported when visibility is less than 1 000 m(0.5 NM)
- Mist –(BR) Reported when visibility is at least 1 000 m but not more than 5 000 m (2NM)
- Haze –(HZ) used only when the visibility is 5 000 m or less
- Volcanic ash–(VA)
- Funnel cloud– (FC) (tornado or waterspout)

Characteristics of present weather phenomena reported:

- **Thunderstorms (TS)** - Used to report a thunderstorm with rain "TSRA". When thunder is heard during the ten-minute period preceding the time of observation but no precipitation is observed at the aerodrome, the abbreviation "TS" should be used without qualification.

- **Shower (SH) -** Used to report showers of rain **"SHRA".**

Intensity of present weather phenomena reported

- Light- FBL
- Moderate- MOD
- Heavy -HVY

Example:

There is a shower of rain at station, it is heavy. In the reported it **shall** be coded **HVY SHRA**.

One or more, up to a maximum of three, of the present weather abbreviations should be used, as necessary, together with an indication, where appropriate, of the characteristics and intensity so as to convey a complete description of the present weather at aerodrome of significance to flight operations.

The following general rules apply

- an indication of intensity should be reported first

- this is followed by both the characteristics and the type of weather phenomena e.g. "HVY TSRA"

- Where two different types of weather are observed, they should be reported in two separate groups. e.g. "FLB RA HZ" where the intensity refers to the weather phenomenon which follows the indicator

17.5 Cloud

Cloud observations included in local reports should be representative of the approach area. Cloud layers 5000 feet and above shall be omitted, but CB and TCU shall always be reported whatever the height of the cloud base. 'No significant cloud' or 'NSC' shall be reported when no cloud below 5000 feet and no CB or TCU are present

The reporting scales for clouds and the use of CAVOK in MET REPORT's are the same as in METAR.

17.6 Vertical Visibility

In local reports, the abbreviations **VER VIS (vertical visibility)** are used, followed by the value of the vertical visibility and the units used, **e.g. "CLD OBSC VER VIS 150M (492FT)"**

17.7 Air Temperature/Dew-point Temperature

In local reports the temperatures are reported in steps of whole degrees Celsius, with observed values involving 0.5° rounded up to the next higher whole degree Celsius.
In local reports, the air temperature is identified by T and the dew-point temperature by DP

E.g. Temperature 27and dew- point 24 is reported as T27 DP24

17.8 Pressure

QNH is the altimeter showing aerodrome elevation when the aircraft is on the ground and QNH is set on the altimeter sub-scale. **QFE** is the altimeter showing zero elevation when the aircraft is on the ground and QFE is set on the altimeter sub-scale.

In local routine and special reports:

- QNH shall be included;
- QFE shall be included if required by users or, if so agreed locally between the meteorological and air traffic services authorities and operators concerned, on a regular basis;
- The units of measurement used for QNH and QFE values shall be included

In local reports pressure values are given in hectopascal rounded down to the nearest lower whole hectopascal and reported in four figures.

Example:
1. A QNH 1011.4 is reported as "QNH 1011HPA" and

2. A QFE 995.6 is reported as "QFE 0995HPA"

17.9 Supplementary Information

In reports to Air Traffic Services, extra data of use to pilots must be included if appropriate. This information must be separated from the altimeter group by a space.

17.9 General Procedures

The following must be included if observed:

1. Recent weather observed at the aerodrome during the period since the last issued routine report or last hour;
2. Marked variations in visibility.

3. Aircraft reports (Air-reports) of severe turbulence
4. Distance and direction of showers in the vicinity.
5. Aircraft reports (Air-reports) of wind shear.
6. Significant meteorological conditions, particularly those in the approach and climb-out areas. These may include cumulonimbus clouds, thunderstorms, ash clouds and severe squall lines.

17.11 Use of Contractions and Abbreviations

Where plain language is called for, authorized contractions, abbreviations, and symbols should be used to conserve time and space. However, in no case should an essential remark, of which the observer is aware, be omitted for the lack of readily available contractions. In such cases, the only requirement is that the remark be clear. **For a detailed list of authorized contractions, see ICAO Doc 8400-ICAO Abbreviations and Codes.**

17.12 Location Entries

The location of meteorological conditions, particularly those in the approach (out to 19 km from the aerodrome reference point) or climb out area must be reported using the following abbreviations or combinations thereof:

- CB- Cumulonimbus
- TCU-Towering Cumulus
- TS- Thunderstorm
- FC- Funnel cloud (tornado or waterspout)
- N APPCH - In the approach
- IN CLIMB-OUT-In the climb-out
- RWY - Runway

17.13 Movement Entries

Movement of clouds or weather, if known, is coded with respect to the direction toward which the phenomenon is moving.

17.14 Direction

Directions must use the eight points of the compass coded in a clockwise order beginning with north.

17.15 Special Reports for Air Traffic Services – (SPECIAL)

Local Special reports to the ATS shall be made if a deterioration or improvement in a weather element passes through pre-determined criteria but not at the time of the routine weather observation. Special reports need only be sent to the ATS.

Special reports are issued whenever one or more elements of a routine report change in accordance with the following criteria:

1. The criteria given for the issuance of SPECI.
2. those values which correspond with the operating minima of the operators using the aerodrome,
3. an increase in air temperature of 2°C or more from that given in the latest report, and
4. the available supplementary information concerning the occurrence of significant meteorological conditions in the approach and climb-out areas

Part D:

Graphical Representation of Meteorological Data

Introduction

Meteorological bulletins are distributed worldwide and must be readable by persons have all nationalities and backgrounds. That is one of the reasons these bulletins are coded. The codes have been defined exactly and they have been agreed on internationally. There are various coding types in meteorology, to distribute all sorts of bulletins worldwide. Examples of various bulletins are hourly surface observations from meteorological stations, upper-air radiosonde observations and aviation bulletins. Every coded bulletin must be recognisable, to prevent ambiguity or confusion.

A good way to learn to decode these bulletins is to plot the values of the observations on a weather map. The large amount of data in a SYNOP bulletin makes then unsuitable for getting an overview of the weather. That is why the data is usually plotted on the weather map at the location of each station that is mentioned in the bulletin. In such a 'plot' a large amount of information such as temperature, pressure, weather type, amount of clouds and humidity is presented in a consistent way. When this is done for all stations a good overview of the weather emerges.

This section contains a description, using international standards, how to 'plot' all data on the map for both land surface based and ship based observations.

The Surface Plotting Model

SYNOP of a Land Station

The basic form of the SYNOP bulletin for a land station is:

AAXX YYGGi_w IIiii
$i_R i_X$hVV Nddff 1s_nTTT 2$s_n T_d T_d T_d$ 4PPPP 5appp
6RRRt_R 7ww$W_1 W_2$ 8$N_h C_L C_M C_H$

The rain group (6RRRt_R) is not plotted. All other groups will be plotted using the plot model in Figure 1. If it is required to plot the elements shown in the model, they should be placed in the relative positions shown. The "boxes" are included in the diagram simply to fix the relative positions of the elements and are not included in the actual plot.

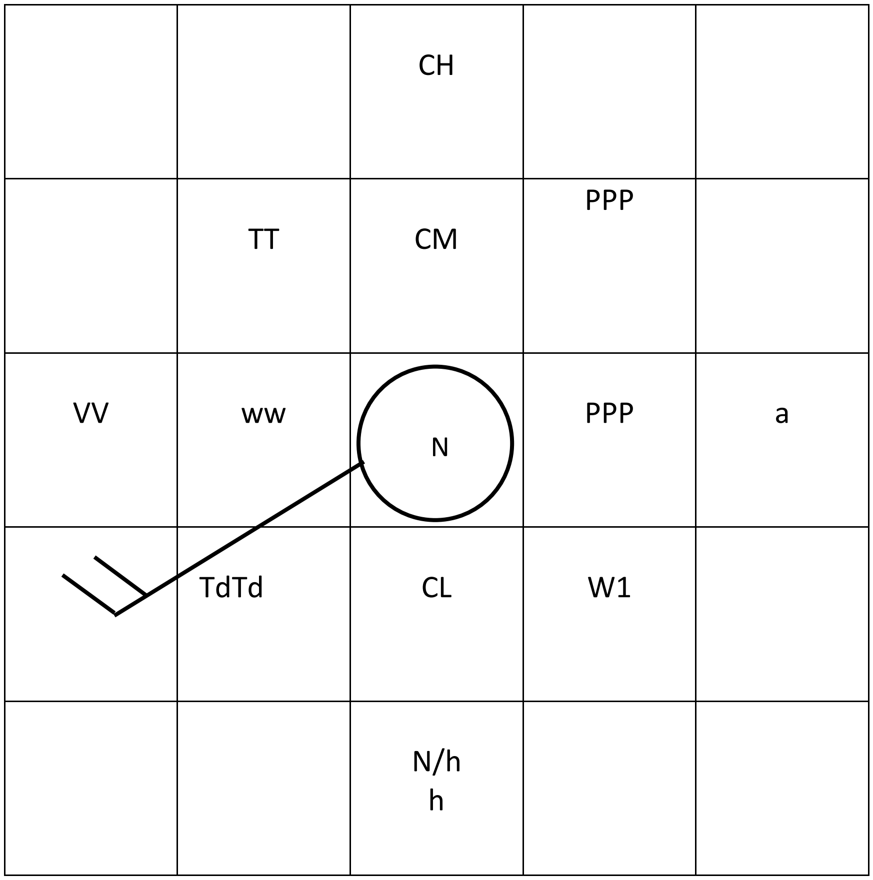


Figure 1. Plot model for land station

The following groups must be plotted in *red:*

- Temperature ***TT*** (in degrees) with optional minus sign (s_n=1)

- dew point ***TdTd*** (*ibid*), with optional minus sign (s_n=1)

- The pressure tendency ***a*** and ***pp*** if pressure is falling, i.e. if ***a*** >= 5.

- Past weather ***W1***. Note that ***W2*** is NOT plotted.

The plot symbols for ***Ch***, ***Cm***, ***Cl***, ***ww***, ***a*** and ***W1*** are given in the symbol table (see last page).

Note:
- Temperature must be rounded off to an integer value (*i.e.* no decimals).

- Sea level pressure is plotted in tenths of hPa (mbar) omitting the preceding ***10*** or ***9***, i.e. 248 instead of 1024.8 and 763 instead of 976.3.

SYNOP of a Ship Station

The SYNOP bulletin of a ship contains additional data the direction and velocity of the ship and sometimes seawater temperature and wave observation data.

The code format is:

BBXX DDDD $YYGGi_w$ $99L_aL_aL_a$ $QcL_oL_oL_oL_o$

i_Ri_xhVV Nddff $1s_nTTT$ $2s_nT_dT_dT_d$ 4PPPP 5appp
$6RRRt_R$ $7wwW_1W_2$ $8N_hC_LC_MC_H$
$222D_sv_s$ $(0s_nT_wT_wT_w)$ $(1P_wP_wH_wH_w)$ $(2P_wP_wH_wH_w)$

The plot model is given in Figure 2.

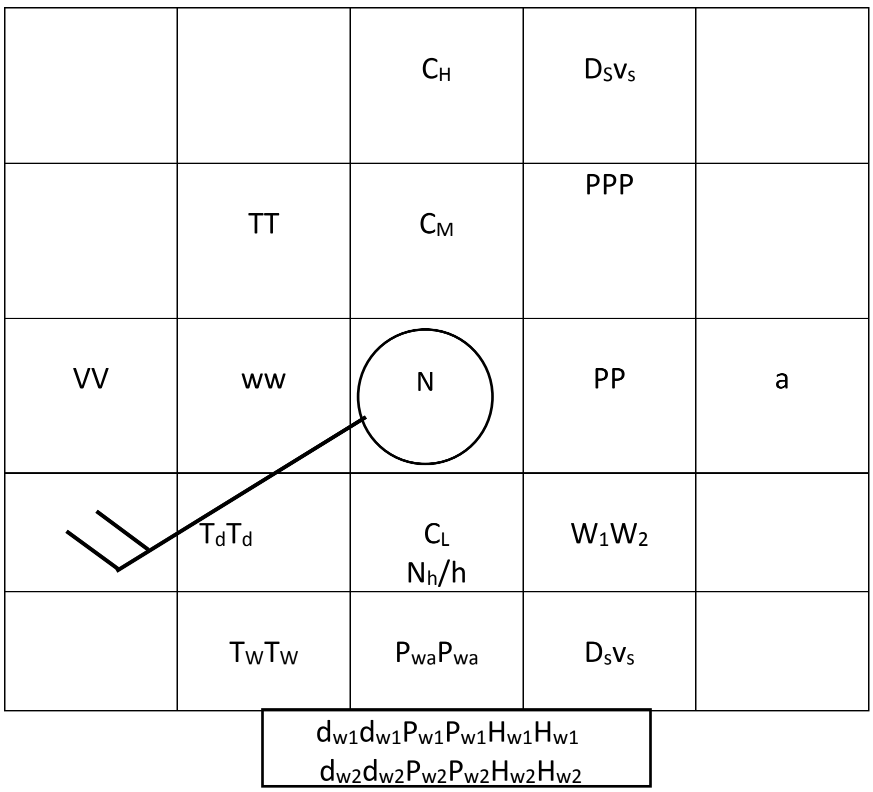


Figure 2: plot model of observations made on a ship

BBXX DDDD YYGGi_W 99$L_aL_aL_a$ $Q_cL_oL_oL_oL_o$

This is the standard code for ships. For ships we plot the data on the ship's position. Also the 'name code' of the ship (given by DDDD) is plotted. The date/time group must not be plotted. We do indicate at the bottom of the map the date and time (we would like to indicate of which date and time the observations are: do not forget this). The plots will simply be plotted on the location of the corresponding station.

In the bulletin the ship's position is indicated by the groups:

99$L_aL_aL_a$ **geographical latitude in tenths of a degree, and**

$Q_cL_oL_oL_oL_o$ geographical longitude in tenths of a degree.

Q_c indicates the quadrant as follows:

Value	Latitude	Longitude
1	North	East
2	South	East
3	South	West
4	North	West

Figure 3

The direction in which the ship is moving is given by the group **222$D_s v_s$**:

D_S direction	V_s	Velocity (knots)
0 still	0	still
1 NE	1	1-5
2 E	2	6-10
3 SE	3	11-15
4 S	4	16-20
5 SW	5	21-25
6 W	6	26-30
7 NW	7	31-35
8 N	8	36-40
9 unknown	9	<40

Figure 4

Bulletin Codes and Plotting (abbreviated)

Nddff (wind group)

N Each plot starts with indicating the (total) cloud cover. The cloud cover is plotted by (1) a digit on the position of the station, or (2) a symbol (see Figure 3). If N=9 then the amount of cloud cover cannot be determined (e.g. because of fog).

Graphic representation of data on weather charts:

The following rules concern the symbols to be used for the plotting of various elements figuring in a surface observation:

N – Total cloud cover

	Symbol		Symbol
Clear sky	○	5/8 covered	
covered 1/8 or less, but not zero		6/8 covered	
2/8 covered		7/8 covered	
3/8 covered		sky completely covered	●
4/8 covered	◑	sky obscured, e.g. by fog	⊗

Figure 5: Symbols for plotting the cloud cover N

dd Wind direction in tens of a degree (e.g. 23 means 230°). The wind direction is relative to North so drawing should be with respect with the local direction of longitude circles, which indicate true North.

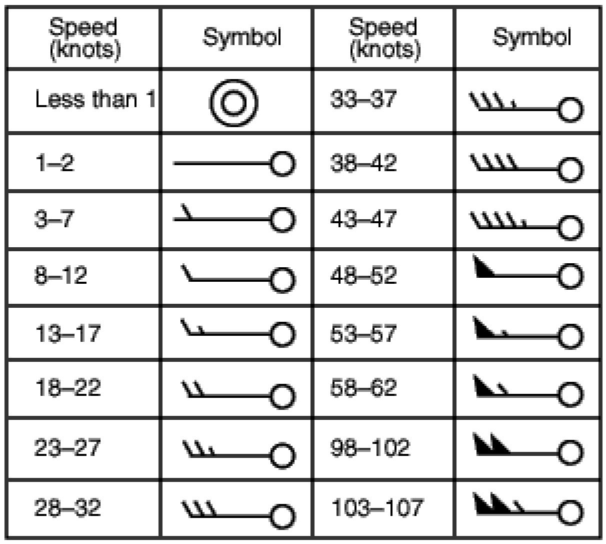
ff Wind speed in knots. Each full-barb indicates 10 knots, a half -barb equals 5 knots and a flag 50 knots (Figure 6.).

The wind direction is plotted as the shaft of an arrow extending from the station circle toward the direction from which the wind is blowing. The wind speed is plotted as feathers and half-feathers representing 10 and 5 knots, on the shaft on the wind direction arrow.

The wind shaft is plotted in black is directed along the axis of the wind towards the centre of the station circle and stops at its circumference.

All pennants and barbs lie to the left of the wind shaft in the northern hemisphere and to the right of the wind shaft in the southern hemisphere.
Barbs are at an angle of approximately 120° from the wind shaft. Pennants are triangles with their bases on the wind shaft. A calm should be indicated by a circle drawn around the station circle.

Missing wind speed should be indicated by placing an “x” at the end of the wind shaft in lieu of the wind barbs, e.g. x——. Variable wind is indicated by placing an “x” in the middle of the wind shaft in lieu of the wind barbs, e.g. —x—. When the wind direction is missing, no wind should be plotted.



Speed (knots)	Symbol	Speed (knots)	Symbol
Less than 1	◎	33–37	
1–2		38–42	
3–7		43–47	
8–12		48–52	
13–17		53–57	
18–22		58–62	
23–27		98–102	
28–32		103–107	

Figure 6: Symbols for indication of wind speed.

Note: Beware of the unit of the wind speed: meters per second or knots (a knot is approximately 0.5 m/s). We plot in knots. The unit of wind speed in the bulletin is given by the wind indicator i_w in the first group.

$1s_nTTT$ (temperature)

In the bulletin temperature is given in tenths of a degree, using s_n= 0 for T > 0°C or s_n=1 if T < 0°C. We plot the temperature in degrees, with minus sign if appropriate. Temperature is plotted in red.

$2s_nT_dT_dT_d$ (dew point)

See temperature: in degrees and in red.

4PPPP (sea level pressure)

Sea level pressure is given and plotted in tenths of hPa or mb, omitting the preceding 9 or 10: PPPP=0134 means 1013.4 mb or hPa (hectopascal). We plot sea level pressure in tenths of hPa or mb. In this example we plot 134.

5appp (change in pressure)

a Characteristic of pressure tendency during the three hours preceding the time of observation.

ppp Amount of pressure tendency at station level during the three hours preceding the time of observation, expressed in tenths of a hectopascal

Pressure tendency

The pressure trend has two components, a number and symbol, to indicate how the sea-level pressure has changed during the past three hours. The number provides the 3-hour change in tenths of millibars, while the symbol provides a graphic illustration of how this change occurred. Below are the meanings of the pressure trend symbols:

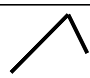
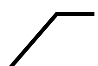
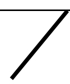
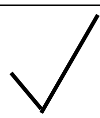
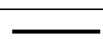
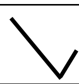
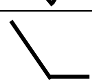
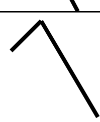
Code No.	**a**	**Pressure tendency**
0		**Increasing, then decreasing; atmospheric pressure the same as or higher than three hours ago**
1		**Increasing, then steady; or increasing, then increasing more slowly; atmospheric pressure now higher than three hours ago**
2		**Increasing (steadily or unsteadily); atmospheric pressure now higher than three hours ago**
3		**Decreasing or steady, then increasing; or increasing, then increasing more rapidly; atmospheric pressure now higher than three hours ago**
4		**Steady; atmospheric pressure the same as three hours ago**
5		**Decreasing, then increasing; atmospheric pressure the same as or lower than three hours ago**
6		**Decreasing, then steady; or decreasing, then decreasing more slowly; atmospheric pressure now lower than three hours ago**
7		**Decreasing (steadily or unsteadily); atmospheric pressure now lower than three hours ago**
8		**Steady or increasing, then decreasing; or decreasing, the decreasing more rapidly; atmospheric pressure now lower than three hours ago.**

Figure 7: Pressure tendency symbols.

7wwW₁W₂ (actual and past weather)

This group indicates the general weather type.

ww The actual weather is given by ww. This is a number between 00 and 99. For plotting use the symbols table below. Do NOT plot the ww codes 00 up to 03.

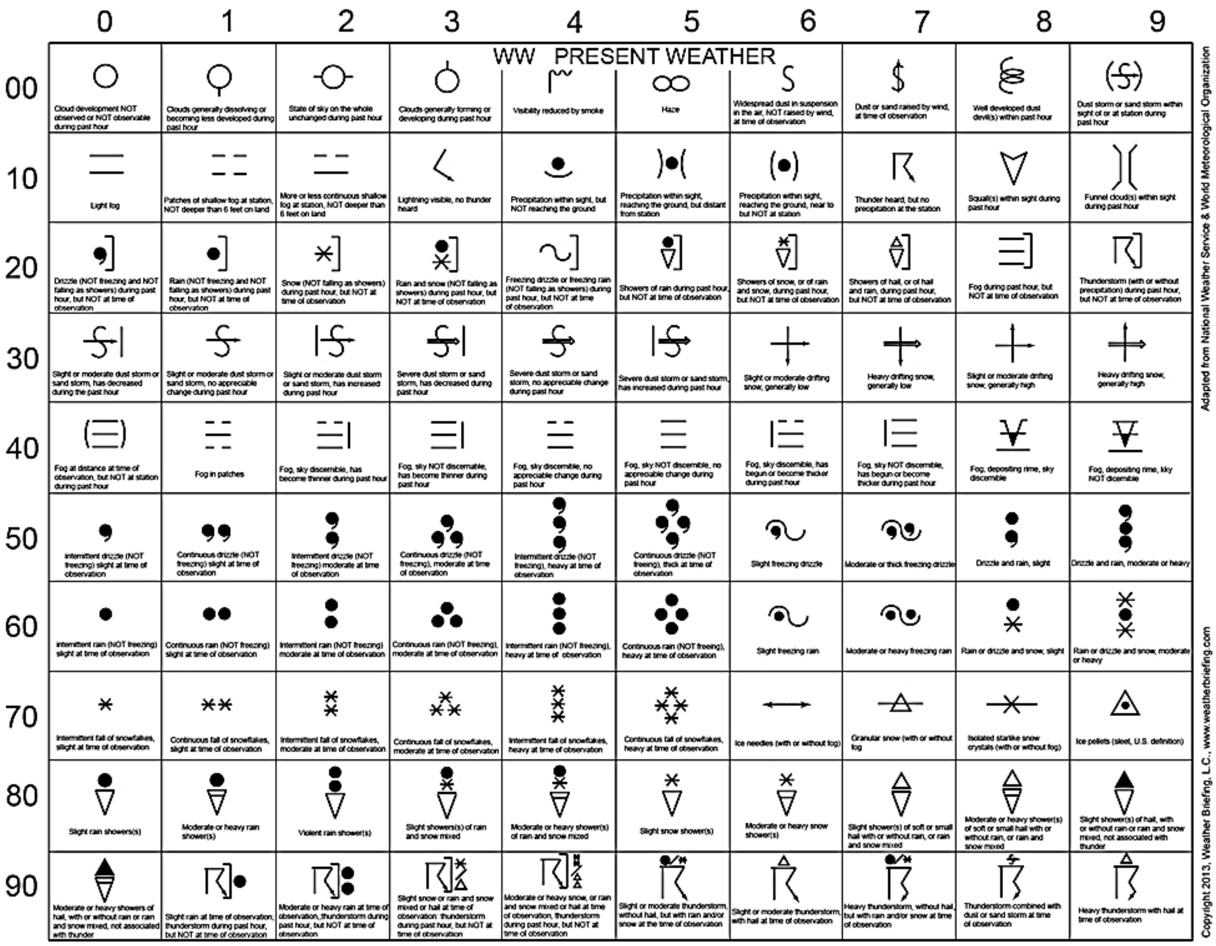


Figure 8: Present weather symbols used for plotting.

W_1- This digit indicates just like **W_2,** past weather over a number of preceding hours (the exact number of hours depend on the time of the bulletin). Only plot W_1, see the symbol table below. Note that we always have W_1>W_2.

Code Number	W	past weather
0		Clear or few clouds
1		Partly cloudy
2		Cloudy (broken or overcast)
3		Sandstorm or duststorm OR drifting or blowing snow
4	≡	Fog, smoke, or thick haze
5	,	Drizzle
6	•	Rain
7	*	Snow, rain and snow mixed, or ice pellets
8	∇	Showers
9		Thunderstorm, with or without precipitation

Figure 9: Past weather symbols used for plotting.

VV (visibility)

Visibility (in the first group iRiXhVV) is plotted next to the actual weather (ww) and is simply plotted by its coded value.

$8N_hC_LC_MC_H$ (cloud group)

We only plot this first cloud group $8N_hC_LC_MC_H$ for Low, Medium and High clouds. Each symbol (see symbol table) is plotted.

$C_LC_MC_H$ Cloud of the genera Stratocumulus, Stratus, Cumulus and Cumulonimbus (C_L); Altocumulus, Altostratus and Nimbostratus (C_M); and Cirrus, Cirrocumulus and Cirrostratus (C_H).The symbols for the appropriate code figure are given in the following table:

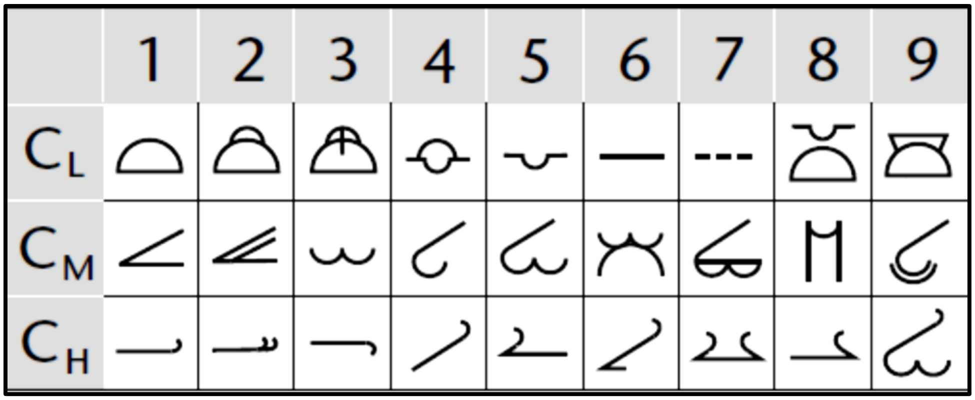


Figure 10: Cloud symbols used for plotting.

N_h Amount of all C_L cloud(s) present or, if no C_L cloud is present, the amount of all the CM cloud(s) present.

The code figure for N_h is entered to the right of the position allotted to CL.

h or hh

Height, above ground, of the base of the lowest cloud seen. The cloud figure for h is entered below the position allotted to C_L. If hh is reported, the two code figures for hh may be entered in lieu of h.

For ship plots only

$D_s v_s$ Direction (true) of resultant displacement of the ship (D_s) and ship's average speed made good (v_s) during the three hours preceding the time of observation
The direction D_s is plotted by means of an arrow pointing in the direction towards which the ship is moving and the code figure for the speed v_s is entered to the right of the arrow.

$T_wT_wT_w$

Sea-surface temperature in tenths of a degree Celsius, its sign given by s_n.
The actual value of this temperature is plotted in degrees and tenths of a degree Celsius, the tenths figure being separated by a decimal point, or it may be plotted in whole degrees Celsius, having first been rounded to the nearest degree. Negative values are preceded by a minus sign.

$d_{w1}d_{w1}$ $d_{w2}d_{w2}$

True direction, in tens of degrees, from which swell waves are coming.
This is represented by an arrow with a wavy shaft; the arrow-heads point in the direction towards which the waves are moving. If $d_{w1}d_{w1}$ is reported as 00, a wavy line without an arrow-head is drawn in a north-south direction.

If $d_{w1}d_{w1}$ is reported as 99, crossed arrows with wavy shafts are drawn one from south-west to north-east and the other from south-east to north-west, thus .

If dw1dw1 is missing, it is plotted as for $d_{w1}d_{w1}$ 99 but the arrowheads are omitted. When there is a second swell system reported by $d_{w2}d_{w2}$, this is plotted below the first.

$P_{w1}P_{w1}$ $P_{w2}P_{w2}$

Period of swell waves in seconds

The code figures for $P_{w1}P_{w1}$ and $P_{w2}P_{w2}$ are plotted immediately to the right of the symbol for $d_{w1}d_{w1}$ and $d_{w2}d_{w2}$.

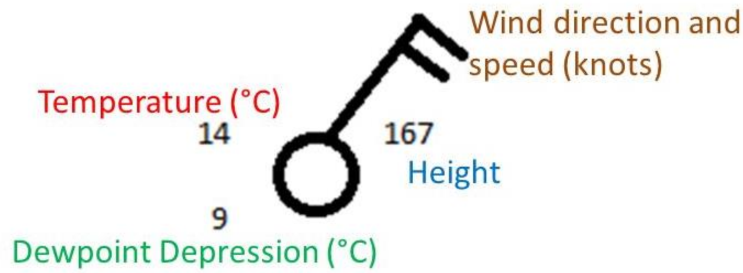
When there are no swell waves $P_{w1}P_{w1}$ and $P_{w2}P_{w2}$ are not plotted.

Decoding Upper-Air Data, Plotting Soundings

Upper-air data is collected from balloon-borne instrument packages called radiosondes. In this lesson you will learn how to decode the raw radiosonde data. Data collected by the radiosonde are commonly called "soundings" of the atmosphere.

The primary measurements taken by the radiosonde are air temperature, relative humidity, and pressure. The raw upper-air temperature and relative humidity, therefore, are reported as a function of pressure rather than height.

Upper Air plotting model



Radiosonde data are reported in 5 sections. Links give details on how to decode these sections.

1. TTAA or Mandatory Level Data

This section contains data from the so-called "mandatory" levels: surface, 1000 mb, 925, 850, 700, 500, 400, 300, 250, 200, 150, and 100 mb. Temperature, dew-point depression, height of the pressure level, wind direction and wind speed are reported.

2. TTBB or Significant Level Data

This section contains data from the so-called "significant" levels. These are levels selected from portions of the sounding where the vertical profile of temperature or relative humidity direction vary appreciably from a straight line. Enough significant points are included such that the sounding can be reconstructed reasonably accurately by drawing lines between significant levels. In other words, temperature and relative humidity can be estimated to vary linearly with height between significant level data points. The TTBB data contains temperatures and dew point depressions as significant level pressures.

3. PPBB or Significant Level Wind Data

This section contains wind direction and speed data as a function of height for "significant" levels. Enough significant levels are chosen in non-linear portions of the sounding so that the sounding can be reproduced reasonably accurately by drawing straight lines between significant level data points. In other words, wind variations can be approximated as linear between significant levels.

4. TTCC data

This section is similar to the TTAA section, except that it contains mandatory level data for pressures less than 100 mb. The levels are 70, 50, 30 and 10 mb, if the weather balloon makes it that high!

5. TTDD data

This section is the significant level data section for pressures less than 100 mb. Subsequent sections describe how to decode TTAA, TTBB, and PPBB data. Upper-air data are plotted on a variety of types of maps. Data from all stations at a particular mandatory level pressure are plotted on maps or constant pressure analysis charts.

Decoding Upper-Air Data:
MANDATORY LEVEL DATA (TTAA)

A		**B**	**A**	**C**	**D**	**E**	**F**	**G**	**H**		
72520	TTAA	60121	72520	99973	15644	19003	00120	/////	/////		
I	**J**	**K**	**L**	**M**	**N**	**O**	**P**	**Q**	**R**		
92791	18258	28008	85508	12221	26508	70108	02240	29019	50575		
S	**T**	**U**	**V**	**W**	**X**	**Y**	**Z**	**AA**	**BB**		
13965	30534	40740	26363	31044	30941	44359	32038	25060	50158		
CC	**DD**	**EE**	**FF**	**GG**	**HH**	**II**	**JJ**	**KK**	**LL**		
30360	20205	52359	32539	15391	54559	31033	10649	57559	30520		
MM	**NN**	**OO**	**PP**	**QQ**	**RR**	**SS**	**TT**	**UU**	**VV**	**WW**	**XX**
88216	53158	33548	77248	34061	42715	51515	10164	00000	10194	26507	27014

A station identifier (in this example, Pittsburgh)

B day/time group; subtract 50 from the first 2 digits to obtain day (here 60-50=10); the "12" indicates the 1200 UTC radiosonde; the "1" denotes wind data up to 100 mb.

C "99" is an identifier for surface data; the next 3 digits give the surface station pressure in whole millibars (mb); in this example 973mb.

D The temperature/dew point depression group associated with the preceding pressure level; the first 3 digits are the tens, ones, and tenths digits for temperature; if the tenths digit is an odd number, the temperature is negative; the other 2 digits are dew point depression (DD); if the DD is =< 5.0 degrees, the code will give the ones and tenths digits (in this example temperature is15.6oC, DD is 4.4oC, and hence the dew point is 15.6 - 4.4 = 11.2^{o}C). Note that DD > 5 are in whole degrees and are encoded by adding 50 to the value, e.g. 62 = 62 - 50 = 12.

E Wind direction and speed (in this example, from 190^o at 3 kt); the middle digit in the group can be a 5 for direction resolution, or a 1 if the speed is >=100 kt; if this digit needs to express both direction and speed data, add 500 to the wind, e.g. 22645 = wind from 225^o at 145 kt.

F 00 identifies the 1000 mb data; the height of the 1000mb level is 120 m above sea level. (**See "Calculating 1000 mb heights" for additional info**)

G&H the slashes represent a lack of data; in this case since PIT's station pressure is 973 mb the 1000 mb level is below ground.

I 92 identifies the 925 mb data; in this case the height of the 925 mb level is 791 m.

J&K similar to groups D and E

L 85 identifies the 850 mb level; in this case the height of the 850 mb level is 1508 m (note that the thousands digit is omitted).

M&N similar to groups D and E

O 70 identifies the 700mb level; in this case the height of the 700 mb level is 3108 m (again, the thousands digit is omitted).

P&Q similar to groups D and E

R 50 identifies the 500mb level; in this case the height of the 500 mb level is 5750m (Note the height is now encoded in decametres).

S&T similar to groups D and E

U 40 identifies the 400 mb level; in this case the height of the 400 mb level is 7400 m.

V&W similar to groups D and E

X 30 identifies the 300 mb level; in this case the height of the 300 mb level is 9140 m.

Y&Z similar to groups D and E

AA 25 identifies the 250 mb level; in this case the height of the 250 mb level is 10,600 m.

BB&CC similar to groups D and E

DD 20 identifies the 200 mb level; in this case the height of the 200 mb level is 12,050 m.

EE&FF similar to groups D and E

GG 15 identifies the 150 mb level; in this case the height of the 150 mb level is 13,910 m.

HH&II similar to groups D and E

JJ 10 identifies the 100 mb level; in this case the height of the 100 mb level is 16,490 m.

KK&LL similar to groups D and E

MM 88 indicates that the pressure of the tropopause follows; in this case it's 216 mb.

NN&OO similar to groups D and E

PP 77 indicates that the pressure level of the maximum wind follows; in this case it's 248mb.

QQ similar to group E

RR 4 indicates that the vertical wind shear data follow; the next 4 digits represent the shear (in kt) 3,000 feet below and 3,000 feet above the level of maximum wind.

SS 51515 indicates that additive data follow

TT 10164 indicates that the additive data to follow in the next group represent stability data.

UU Showalter Stability Index indicator; first 3 digits always zero; last 2 digits give index value; negative values have 50 added, e.g. 55 = -5 (Note the lower the value, the more unstable the sounding is).

VV 10194 indicates that the additive data to follow in the next 2 groups represent mean wind.

WW Mean wind from surface to 5,000 feet; similar to group E

XX Mean wind from 5,000 feet to 10,000 feet; similar to group E.

Appendices

APPENDIX I

References

- Annex 3 –Meteorological Service for International Air Navigation, Seventeenth Edition
- WMO-No. 306, Manual on Codes, International Codes volume 1 2010 Edition
- WMO-No. 49, Technical Regulations, Basic document No. 2 Vol. 11-Meteorological Service for International Air Navigation 2007 Edition.
- WMO-No.732,
- WMO-No.8-Guide to meteorological instruments and methods of observation.
- ICAO Doc 9377- Manual on Coordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services 2008 edition.

APPENDIX II

Examples of Coded Reports

Examples of completed Routine reports (MET REPORT and METAR) same weather conditions.

a) Local routine report

MET REPORT TAPA 221600Z WIND 240/18KT VIS 10KM MOD RA CLD CB SCT 1500FT OVC 4500FT T23 DP21 QNH 1018MB QFE 1016HPA RETSRA CB N APPCH

b) METAR:

METAR TAPA 221600Z 24018KT 9999 RA SCT015CB OVC045 23/21Q1018 RETSRA=

Examples of completed special reports (SPECIAL and SPECI) for same weather conditions:

a) Local special report

SPECIAL TAPA 291720Z WIND 140/15KT MAX25 MNM10 VIS 4KM HVY SHRA CLD BKN 1700FT T25 DP24 QNH 1015HPA

b) SPECI report

SAAT31 TAPA 291720

SPECI TAPA 291720Z 14015G25KT 4000 +SHRA BKN017 25/24 Q1015=

APPENDIX III

Aerodrome Operating Minima

Aerodrome operating minima (AOM) are criteria used by pilots to determine whether they may land or take off from any runway.

Definition

The limits of usability of an aerodrome for:

1. Take-off, expressed in terms of visibility and, if necessary, cloud conditions;
2. landing in precision approach and landing operations, expressed in terms of visibility and decision altitude /height (DA/H) as appropriate to the category of the operation;
3. landing in approach and landing operations with vertical guidance, expressed in terms of visibility and decision altitude/height (DA/H); and
4. landing in non-precision approach and landing operations, expressed in terms of visibility and minimum descent altitude/height (MDA/H) and, if necessary, cloud conditions.

Criteria

The aerodrome operating minima decided by national regulation shall be taken of:

1. the type, performance and handling characteristics of the aircraft
2. the composition of the flight crew, their competence and experience
3. the dimensions and characteristics of the runways which may be selected for use
4. the adequacy and performance of the available visual and non-visual ground aids
5. the equipment available on the aircraft for the purpose of navigation and/or control of the flight path during the approach to landing and the missed approach
6. the obstacles in the approach and missed approach areas and the obstacle clearance altitude/height for the instrument approach procedures
7. the means used to determine and report meteorological conditions
8. the obstacles in the climb-out areas and necessary clearance margins

Operating Minima for The V.C. Bird International Airport

* extract from Antigua and Barbuda Air Traffic Services Manual of Operations

The aerodrome/approach controller may suspend any or all VFR (visual flight rules) operations in the vicinity of the V.C. Bird International Airport whenever:

- the reported ceiling is less than 1500 feet
- the visibility is less than 5km or 3 NM

NOTE: Special VFR flights may be authorized, provided that ground visibility is not less than 1500 m or 0.8NM.

APPENDIX IV

Information to be provided for emergencies

(Extract from Manual on Coordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services chapter 3, section 3.9)

Any meteorological information requested by an ATS unit or an RCC (Rescue coordination centre) or RSC (Rescue sub-centre) in connection with an aircraft emergency is to be supplied as rapidly as possible. Following notification by the ATS unit in charge that an aircraft accident/incident has occurred in the vicinity of an airport, meteorological stations should:

1. **Make a special accident/incident observation, either manually or prompted through the automated observing system in use;**

2. **Mark the time on all instrument recordings; and**

3. **Ensure that all pertinent meteorological observation and forecast data are retained for at least 30 days.**

Copies of the flight documentation that was supplied to flight crew members and which, in accordance with Annex 3, Chapter 9, 9.3.4, is to be retained or stored in computer memory for a period of at least 30 days, should be made available on request for aircraft accident/incident inquiries. The flight documentation produced by the relevant WAFC (significant weather forecasts, upper-air forecasts, etc.) and supplied to the personnel involved in the accident/incident investigation should, if necessary, be validated by the WAFC concerned.

NOTE

Notwithstanding the above, if an Observer is made aware that an aircraft accident/incident has occurred at or in the vicinity of the aerodrome, even without a request from ATC, a Special Observation (SPECIAL) should be made and recorded.

APPENDIX V

Information to be provided for search and rescue services

The following information **shall** be supplied to search and rescue coordination centres upon notification of a search and rescue operation:

The last meteorological conditions that existed in the last known position of a missing aircraft and along the intended route of that aircraft with particular reference to:

1. significant en-route weather phenomena
2. cloud amount and type, particular cumulonimbus; height indications of base and tops
3. visibility and phenomena reducing visibility
4. surface wind and upper wind
5. state of the ground, particular flooding
6. sea level pressure

To facilitate search and rescue operations, the following information should be provided upon request:

1. complete and detailed information on the current and forecast meteorological conditions in the search area; and
2. current and forecast conditions en route, covering flights from, and returning to, the aerodrome from which the search is being conducted.

On request from the rescue coordination centre, the designated meteorological office should supply or arrange for the supply of meteorological information required by ships undertaking search and rescue operations.

APPENDIX VI

Meteorological Information relating to aircraft accidents

Extract from WMO No. 732; Section 2.5.1.5

When meteorological staff at an aerodrome becomes aware that an accident has occurs at or near the aerodrome:

1. The time should be noted as accurately as possible and a full set of observations should be made.

2. All recording instruments should be time marked.

3. A permanent record of the observation should be made forthwith in the register of observations.

4. Whenever possible, the observation should be checked in all aspects (especially pressure) by the senior member of staff on duty.

5. **All** documents, reports, etc. relevant to the flights which are in the possession of the meteorological office should be impounded without delay by the senior member of staff on duty.

6. Steps should be taken **immediately** to inform the Director and /or Deputy Director that an accident has occurred.

It is the duty of the Management to make sure that all necessary meteorological action has been taken and that all documents which may be required in evidence are in sake keeping.

Note:

The accident observation **shall** be recorded on the Accident Report Form QF:-OBS-03 and it **shall** be as complete and accurate as possible, with particular care being taken to include in "Remarks" any meteorological facts which might relate to the accident, or which might be of significance to the aircraft accident investigator.

Upon completion a copy of the form **shall** be printed, signed by the duty observer and forecaster and immediately delivered to management as to prevent any tampering, mutilation or destruction of the original record. In the absence of management the duty forecaster shall secure the record until management arrives.

APPENDIX VII

Definitions

Aerodrome: Any area of land or water designed, equipped, set apart or commonly used for affording facilities for the landing and departure of aircraft

Aerodrome Reference Point: The designated geographical location of an aerodrome.

Actual time of observation: For METARs and MET REPORTS, it is the time the last element of the report is observed or evaluated. For SPECIs and SPECIALs, it is the time that the criteria for a SPECI was met or noted.

Aircraft mishap: An inclusive term to denote the occurrence of an aircraft accident or incident.

Atmospheric pressure: The pressure exerted by the atmosphere at a given point

Barometric pressure: The actual pressure value indicated by a pressure sensor.

Body of report: That portion of a report beginning with the type of report and ending with the pressure setting.

Broken layer: A layer of cloud covering whose summation amount of sky cover is 5/8ths through 7/8ths

Calm: A condition when no motion of the air is detected

Ceiling: The lowest layer aloft reported as broken or overcast; or the vertical visibility into an indefinite ceiling.

Cloud: A visible aggregate of minute water droplets or ice particles in the atmosphere above the Earth's surface.

Cloud height: The height of the base of a cloud or cloud layer above the surface of the earth.

Cloud layer: An array of clouds whose bases are at approximately the same level.

Cloud type: A cloud form which is identified according to the WMO International Cloud Atlas.

Dew point: The temperature to which a given parcel of air must be cooled at constant pressure and constant water-vapour content in order for saturation to occur.

Dissemination: The act of delivering a completed weather report to users.

Few: A layer of cloud whose summation amount of sky cover is 1/8th through 2/8ths

Funnel cloud: A violent, rotating column of air which does not touch the surface, usually appended to a cumulonimbus cloud.

Gust: Rapid fluctuations in wind speed with a variation of 10 knots or more between peaks and lulls.

Haze: A suspension in the air of extremely small, dry particles invisible to the naked eye and sufficiently numerous to give the air an opalescent appearance.

Indefinite ceiling: The ceiling classification applied when the reported ceiling value represents the vertical visibility upward into surface-based obscuration.

Intensity qualifier: Intensity qualifiers are used to describe whether a phenomena is light (-), moderate (no symbol used), or heavy (+).

Layer: An array of clouds and/or obscurations whose bases are at approximately the same level.

Layer amount: The amount of sky covered by clouds and/or obscurations at a given level above the Earth's surface.

Layer height: The height of the bases of each reported layer of clouds and/or obscuration; or the vertical visibility into an indefinite ceiling.

Local dissemination: The transmission or delivery of a weather report to individuals or groups of users near the observing location.

Minimum Sector Altitude (MSA): is the lowest altitude which may be used for air navigation which will provide a minimum clearance of 300 m (1 000 ft.) above all objects located at the aerodrome ant its vicinity contained within a sector of a circle of 46 km (25 NM).

Point of observation: A point of observation is any site at which meteorological instruments are exposed or from which visual observations are taken. The term "At the Station" as used in this manual refers to any point of observation from which the weather data are gathered

Scattered: A layer of cloud whose summation amount of sky cover is 3/8ths through 4/8ths.

Shower: A descriptor, SH, used to qualify precipitation characterized by the suddenness with which they start and stop, by the rapid changes of intensity, and usually by rapid changes in the appearance of the sky.

SPECI: A surface weather report taken to record a change in weather conditions that meets specified criteria or is otherwise considered to be significant.

Station identifier: A four alphabetic character code group used to identify the observing location.

Surface visibility: The prevailing visibility determined from the usual point of observation

Surface weather observation: A surface weather observation is an evaluation of meteorological elements, visually and/or by measurement at a specified location on the earth's surface (usually a weather observing station)

Temperature: A measure of the hotness or coldness of the ambient air as measured by a suitable instrument.

Thunderstorm: A cumulonimbus cloud that is accompanied by lightning and thunder, or for automated systems, a storm detected by lightning detection systems.
Weather observing station

Towering cumulus (TCU): A descriptive term for a cloud with generally sharp outlines and with moderate to great vertical development, characterized by its cauliflower or tower appearance.

Vertical visibility: A subjective or instrumental evaluation of the vertical distance into a surface-based obscuration that an observer would be able to see.

Vicinity: A proximity qualifier, VC, used to indicate weather phenomena observed between 5 and 10 statute miles of the usual point of observation but not at the station.

Visual flight rules (**VFR**): a set of regulations under which a pilot operates an aircraft in weather conditions generally clear enough to allow the pilot to see where the aircraft is going. Specifically, the weather must be better than basic VFR weather minima, i.e. in visual meteorological conditions (VMC), as specified in the rules of the relevant aviation authority. The pilot must be able to operate the aircraft with visual reference to the ground, and by visually avoiding obstructions and other aircraft

Waterspout: A violent, rotating column of air that forms over a body of water, and touches the water surface; tornado or funnel cloud that touches a body of water.

Weather observing station: any site where an observer is located and from which weather observations are made. It is normally equipped with instruments for measuring some of the meteorological elements.

Wind direction: The true direction from which the wind is moving at a given location.

Wind speed: The rate at which air is moving horizontally past a given point. It may be a 10-minute average speed (reported as wind speed) or an instantaneous speed (reported as a peak wind speed or gust)

APPENDIX VIII

Aerodrome Demarcation

WMO No. 49-Technical Regulations Volume II – Meteorological Service for International Air Navigation gives the following definition:

"***Aerodrome***. A defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft."

WMO No. 306-Guide on Codes International Codes-VOLUME I.1-PART A – Alphanumeric Codes states in 15.8.10:

"The qualifier VC shall be used to indicate the following significant weather phenomena observed in the vicinity of the aerodrome: TS, FG, FC, SH, and VA.

Notes:

1. Such weather phenomena should be reported with the qualifier VC only when observed between approximately 8 km and 16 km from the aerodrome reference point. **The actual range for which the qualifier VC is to be applied will be determined locally, in consultation with aeronautical authorities"**

To facilitate best practice for our aerodrome, the ABMS has determine a local demarcation of the aerodrome. (See map below)

The white line demarcates the aerodrome, anything occurring outside of the white line out to 16KM shall be considered to be in the vicinity (VC).

The red lines on the map show the following visible markers from the observational deck and the roof of the Met Office.

- A-Climb out end of runway 07, distance 0.8 miles
- B-End of runway 10, distance 1.3 miles
- C-Fence behind AWS, distance 0.4 miles
- D-Fence behind AWS at touch down zone, distance 0.7 miles
- E-fence behind end of runway 07, distance 1.3 miles

APPENDIX IX

Criteria for the determination of rainfall intensity (including showers)

Intensity	Rain rate	Individual drops	Spray over hard surfaces	Puddles	Radar colour (Guadeloupe) Rain rate in mm/h
Light	< 2.5 mm/h	Easily seen	Hardly any	Form slowly	0.1 0.4 0.6 1.2 2.1
Moderate	≥ 2.5 to < 10.0 mm/h	Not easily seen	Noticeable	Form rapidly	3.6 6.5
Heavy	≥ 10.0 to < 50.0 mm/h	Not identifiable (rain in sheets)	Heavy to a height of several centimetres	Form very rapidly	11.5 20.5 36.5
Violent (very heavy, intense, extreme)	≥ 50.0 mm/h				64.8 115.3 ≥364.6

For U.S. radar, **light**: ≤ 30 dBZ; **moderate**: > 30 dBZ to < 40 dBZ; **heavy**: 40 to 50 dBZ; **violent**: > 50 dBZ http://wwwa.accuweather.com/phoenix2/help/adc/pr_reflect.htm#dbZ

Intensities are based on a 3-minute measurement period. The total for the 3 minutes is multiplied by 20 to get the rate per hour (mm/h). A present weather event may be well defined by a 3-minute observing period. **The highest running 3-minute average in the 10-minute period should be reported for present weather.**

Sources:

Intensity
WMO Guide to Meteorological Instruments and Methods of Observation, 2008 Edition Updated 2010 https://library.wmo.int/pmb_ged/wmo_8_en-2012.pdf

Individual drops, spray over hard surfaces and puddles
ICAO Aerodrome Meteorological Observing Systems Study Group (AMOSSG), Sixth Meeting, Exeter, United Kingdom, 17 to 20 October 2006
https://www.icao.int/safety/meteorology/amofsg/AMOFSG%2016%20Archive%20Material/AMOSSG%206/SNs/AMOSSG.6.SN.010.5.en.doc