

**International Standards
and Recommended Practices**



**Annex 3
to the Convention on
International Civil Aviation**

Meteorological Service for International Air Navigation

**Part I
Core SARPs**

**Part II
Appendices and Attachments**

This edition incorporates all amendments adopted by the Council prior to 26 February 2004 and supersedes, on 25 November 2004, all previous editions of Annex 3.

For information regarding the applicability of Standards and Recommended Practices, see Foreword.

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AMENDMENTS

The issue of amendments is announced regularly in the *ICAO Journal* and in the monthly *Supplement to the Catalogue of ICAO Publications and Audio-visual Training Aids*, which holders of this publication should consult. The space below is provided to keep a record of such amendments.

RECORD OF AMENDMENTS AND CORRIGENDA

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FOREWORD

Historical background

Standards and Recommended Practices relating to meteorology were first adopted by the Council on 16 April 1948, pursuant to the provisions of Article 37 of the Convention on International Civil Aviation (Chicago, 1944), and designated as Annex 3 to the Convention with the title *Standards and Recommended Practices — Meteorological Codes*. The Standards and Recommended Practices were based on recommendations of the Special Session of the Meteorology Division, held in September 1947.

Table A shows the origin of subsequent amendments, together with a list of the principal subjects involved and the dates on which the Annex and the amendments were adopted or approved by the Council, when they became effective and when they became applicable.

Action by Contracting States

Notification of differences. The attention of Contracting States is drawn to the obligation imposed by Article 38 of the Convention by which Contracting States are required to notify the Organization of any differences between their national regulations and practices and the International Standards contained in this Annex and any amendments thereto. Contracting States are invited to extend such notification to any differences from the Recommended Practices contained in this Annex, and any amendments thereto, when the notification of such differences is important for the safety of air navigation. Further, Contracting States are invited to keep the Organization currently informed of any differences which may subsequently occur, or of the withdrawal of any differences previously notified. A specific request for notification of differences will be sent to Contracting States immediately after the adoption of each amendment to this Annex.

Attention of States is also drawn to the provisions of Annex 15 related to the publication of differences between their national regulations and practices and the related ICAO Standards and Recommended Practices through the Aeronautical Information Service, in addition to the obligation of States under Article 38 of the Convention.

Promulgation of information. The establishment and withdrawal of and changes to facilities, services and procedures affecting aircraft operations provided in accordance with the Standards and Recommended Practices specified in this Annex should be notified and take effect in accordance with the provisions of Annex 15.

Use of the text of the Annex in national regulations. The Council, on 13 April 1948, adopted a resolution inviting the attention of Contracting States to the desirability of using in their own national regulations, as far as is practicable, the precise language of those ICAO Standards that are of a regulatory character and also of indicating departures from the Standards, including any additional national regulations that are important for the safety or regularity of air navigation. Wherever possible, the provisions of this Annex have been written in such a way as would facilitate incorporation, without major textual changes, into national legislation.

Status of Annex components

An Annex is made up of the following component parts, not all of which, however, are necessarily found in every Annex; they have the status indicated:

1.— *Material comprising the Annex proper:*

- a) *Standards and Recommended Practices* adopted by the Council under the provisions of the Convention. They are defined as follows:

Standard: Any specification for physical characteristics, configuration, matériel, performance, personnel or procedure, the uniform application of which is recognized as necessary for the safety or regularity of international air navigation and to which Contracting States will conform in accordance with the Convention; in the event of impossibility of compliance, notification to the Council is compulsory under Article 38.

Recommended Practice: Any specification for physical characteristics, configuration, matériel, performance, personnel or procedure, the uniform application of which is recognized as desirable in the interest of safety, regularity or efficiency of international air navigation, and to which Contracting States will endeavour to conform in accordance with the Convention.

- b) *Appendices* comprising material grouped separately for convenience but forming part of the Standards and Recommended Practices adopted by the Council.
- c) *Definitions* of terms used in the Standards and Recommended Practices which are not self-explanatory in that they do not have accepted

dictionary meanings. A definition does not have independent status but is an essential part of each Standard and Recommended Practice in which the term is used, since a change in the meaning of the term would affect the specification.

- d) *Tables* and *Figures* which add to or illustrate a Standard or Recommended Practice and which are referred to therein, form part of the associated Standard or Recommended Practice and have the same status.

2.— *Material approved by the Council for publication in association with the Standards and Recommended Practices:*

- a) *Forewords* comprising historical and explanatory material based on the action of the Council and including an explanation of the obligations of States with regard to the application of the Standards and Recommended Practices ensuing from the Convention and the Resolution of Adoption;
- b) *Introductions* comprising explanatory material introduced at the beginning of parts, chapters or sections of the Annex to assist in the understanding of the application of the text;
- c) *Notes* included in the text, where appropriate, to give factual information or references bearing on the Standards or Recommended Practices in question, but not constituting part of the Standards or Recommended Practices;
- d) *Attachments* comprising material supplementary to the Standards and Recommended Practices, or included as a guide to their application.

Selection of language

This Annex has been adopted in five languages — English, Arabic, French, Russian and Spanish. Each Contracting State is requested to select one of those texts for the purpose of national implementation and for other effects provided for in the Convention, either through direct use or through translation into its own national language, and to notify the Organization accordingly.

Editorial practices

The following practice has been adhered to in order to indicate at a glance the status of each statement: *Standards* have been printed in light face roman; *Recommended Practices* have been printed in light face italics, the status being indicated by the prefix **Recommendation**; *Notes* have been printed in light face italics, the status being indicated by the prefix *Note*.

The following editorial practice has been followed in the writing of specifications: for Standards the operative verb “shall” is used, and for Recommended Practices the operative verb “should” is used.

Any reference to a portion of this document, which is identified by a number, includes all subdivisions of the portion.

Applicability

The Standards and Recommended Practices in this document govern the application of the *Regional Supplementary Procedures* (Doc 7030, Part 3 — Meteorology), in which document will be found statements of regional choices, where such options are permitted by this Annex.

Responsibility

In accordance with a similar provision in the Foreword to Annex 6, Part II, the responsibility which devolves upon an operator, in accordance with the provisions of Annex 3, falls upon the pilot-in-command in the case of international general aviation.

Relation to corresponding WMO publications

The regulatory material contained in Annex 3 is, except for a few minor editorial differences, identical with that appearing in the Technical Regulations (Chapter C.3.1) of the World Meteorological Organization (WMO).

The aeronautical meteorological code forms referred to in Annex 3 are developed by the World Meteorological Organization on the basis of aeronautical requirements contained in this Annex, or stated from time to time by the Council. The aeronautical meteorological code forms are promulgated by WMO in its Publication No. 306 — *Manual on Codes*, Volume I.

Table A. Amendments to Annex 3

<i>Amendment(s)</i>	<i>Source(s)</i>	<i>Subject(s)</i>	<i>Adopted/approved Effective Applicable</i>
1st Edition	Second Session of the Meteorology Division	Meteorological codes for the transmission of meteorological information for aeronautical purposes.	16 April 1948 15 September 1948 1 January 1949
1 to 21 (2nd Edition)	Special Session of the Meteorology Division	Updating and improvement of meteorological codes.	17 September 1948 23 December 1948 1 January 1949
22 to 37	Third Session of the Meteorology Division	Use of plain language and a simplified code for flight conditions in air-reports.	28 May 1951 1 October 1951 1 January 1952
38 (3rd Edition)	First Air Navigation Conference	Introduction of the radiotelephony or radiotelegraphy AIREP form of air-report.	15 December 1953 1 August 1954 1 September 1954
39	First Air Navigation Conference	Revised radiotelegraphy form of POMAR Code for air-reports.	18 May 1954 20 August 1954 1 September 1954
40	World Meteorological Organization	New aeronautical meteorological figure codes in an Attachment, replacing those (except the POMAR code) hitherto appearing in the SARPs.	28 September 1954 1 January 1955 1 January 1955
41	Fourth Session of the Meteorology Division	Introduction of Standards and Recommended Practices governing the obligations of Contracting States relating to the establishment of meteorological organization in each State, adequate to satisfy Articles 28 and 37 of the Convention; consequential change of title of Annex 3 to read <i>International Standards and Recommended Practices — Meteorology</i> .	1 April 1955 1 August 1955 1 January 1956
42 (4th Edition)	Second Air Navigation Conference	Simplification of the detailed specifications for the method of determining the position in the AIREP and POMAR forms of air-report.	8 May 1956 1 September 1956 1 December 1956
43	Third Air Navigation Conference	Introduction of the term “SIGMET information” to replace the terms “advisory message” and “warning message”; amendment of the table for “State of Sea” in the POMAR code.	13 June 1957 1 October 1957 1 December 1957
44	Rules of the Air and Air Traffic Services/ Search and Rescue Divisions	Changes in the list of elements in Section 1 (Position report) of the AIREP form of air-report — deletion of the element “Flight conditions” and amendment of the last element in the section to read “Next position and time over”.	18 February 1960 1 May 1960 1 August 1960
45	Rules of the Air and Air Traffic Services/ Search and Rescue Divisions	Amendment of model AIREP and POMAR forms of air-report consequential to Amendment 44.	18 February 1960 — 1 August 1960
46	World Meteorological Organization	Updating of aeronautical meteorological figure codes, introduced by WMO, as of 1 January 1960.	8 June 1960 — 8 June 1960

<i>Amendment(s)</i>	<i>Source(s)</i>	<i>Subject(s)</i>	<i>Adopted/approved Effective Applicable</i>
47 (5th Edition)	Fifth Session of the Meteorology Division	Amendment to the procedures for aircraft meteorological observations and reports, modifying those for special observations and introducing requirements for additional observations; deletion of the POMAR form of air-report; elimination of flight meteorological watch and the introduction of en-route forecast service to supplement area meteorological watch; amendment to the provisions concerning meteorological conditions along the route to an alternate aerodrome.	2 December 1960 1 April 1961 1 July 1961
48	Fifth Session of the Meteorology Division	Amendment to model AIREP form of air-report to reflect changes in procedures for aircraft meteorological observations and reports, consequential to an amendment to the PANS-RAC.	2 December 1960 — 1 July 1961
49	Fifth Session of the Meteorology Division	Introduction of definition of “D-value”.	8 April 1963 1 August 1963 1 November 1963
50	World Meteorological Organization	Updating of aeronautical meteorological figure codes, introduced by WMO, as of 1 January 1964.	18 March 1964 — 18 March 1964
51 (6th Edition)	Meteorology and Operations Divisional Meeting	Introduction of a requirement for observations to be made at locations where they will be representative of the area for which they are primarily required; extension of the criteria for special air-reports to cover phenomena likely to affect efficiency as well as safety, and deleting the requirement for “additional aircraft observations” according to regionally agreed criteria; deletion from the AIREP form of air-report of D-value, weather and cloud as standard items; introduction of a modified model AIREP form; changes to the provisions relating to forms of meteorological messages and providing for the exchange of information in pictorial form; introduction of definition of “plain language”.	31 May 1965 1 October 1965 10 March 1966
52	World Meteorological Organization	Updating of aeronautical meteorological figure codes, introduced by WMO, as of 10 March 1966.	12 December 1966 — 12 December 1966
53	Meteorology and Operations Divisional Meeting	Permitting regional air navigation agreement on the use of a pictorial form of message for the dissemination of forecasts; replacement of the term “symbolic form of message” by a more specific description of the form of message to which this expression was intended to refer.	12 December 1966 12 April 1967 24 August 1967
54	World Meteorological Organization	Updating of aeronautical meteorological figure codes, introduced by WMO, as of 1 January 1968.	13 June 1967 — 1 January 1968
55	France	Permitting changes to be made to air-reports before their ground-to-ground dissemination.	16 December 1968 16 April 1969 18 September 1969
56 (7th Edition)	Sixth Air Navigation Conference	Introduction of: specifications for area forecast centres; simplified specifications for meteorological offices to reflect increasing centralization; extended coverage of aircraft reports to include adverse weather conditions encountered during initial climb and final approach; routine reporting by aircraft of “spot” rather than “mean” winds; improved criteria for in-flight reports of the intensity of turbulence; new definition of “air traffic services reporting office” and changes in the definition of “air traffic services unit”; changes to the aeronautical meteorological codes introduced by WMO, as of 18 September 1969.	15 May 1970 15 September 1970 4 February 1971

<i>Amendment(s)</i>	<i>Source(s)</i>	<i>Subject(s)</i>	<i>Adopted/approved Effective Applicable</i>
57	Second Meeting of the Technical Panel on Supersonic Transport Operations	Amendment to the definition of “SIGMET information” to take account of the requirements of SST aircraft operations; introduction of provisions for making and recording special observations whenever moderate turbulence, hail or cumulonimbus clouds are encountered during transonic or supersonic flight.	19 March 1971 6 September 1971 6 January 1972
58	World Meteorological Organization	Updating of aeronautical meteorological codes, introduced by WMO, as of 1 January 1972.	19 March 1971 — 6 January 1972
59	Sixth Air Navigation Conference	Permitting the omission of information on “next position and time over” from Section 1 of air-reports exchanged between meteorological offices; introduction of changes to the formats and data conventions in the model form of air-report to make it suitable for direct input into computers.	24 March 1972 24 July 1972 7 December 1972
60 (8th Edition)	Sixth Air Navigation Conference. Eighth Air Navigation Conference. Meteorology Divisional Meeting (1974)	Complete revision of Annex 3, incorporating the PANS-MET, the specifications of which were regarded as being suitable for inclusion in Annex 3 as Standards and Recommended Practices; the revision took into account recently approved operational requirements and up-to-date methods of meeting them; introduction of new Standards and Recommended Practices, relating to service for operators and flight crew members, meteorological information for air traffic services and for search and rescue services, together with requirements for communications and their use; the title of Annex 3 was, accordingly, amended to read <i>Meteorological Service for International Air Navigation</i> .	26 November 1975 26 March 1976 12 August 1976
61	Ninth Air Navigation Conference. Meteorology Divisional Meeting (1974)	New provisions and revision of existing provisions to improve the coordination between meteorological offices/stations and air traffic services units and the supply of meteorological information to the latter; new specifications for observations and reports for take-off and landing; introduction of a note referring to the specifications of Annex 14 for the siting and construction of equipment and installations on operational areas to reduce the hazard to aircraft to a minimum; replacement of the expression “supersonic transport aircraft” by the expression “supersonic aircraft”; updating of Part 2, Appendix 2; revision of definition of “nephanalysis” and deletion of “(29.92 in.)” from definition of “flight level”; deletion of Attachment D — Aeronautical Meteorological Codes.	14 December 1977 14 April 1978 10 August 1978
62	Eighth Air Navigation Conference and ICAO Council	Inclusion in Appendix 1 of model charts and forms developed by WMO on the basis of the operational requirements contained in Annex 3; transfer of the data designators and geographical designators from Appendix 2 to Annex 3 to the <i>Manual of Aeronautical Meteorological Practice</i> (Doc 8896).	26 June 1978 26 October 1978 29 November 1979
63	MET Divisional Meeting (1974). ICAO Secretariat. Operational Flight Information Service Panel. Ninth Air Navigation Conference. Doc 9328	Definition for “meteorological bulletin”; correction to shortcomings in ground-to-ground dissemination of air-reports; decrease in SIGMET messages dealing with “active thunderstorm area”; deletion of reference to “reporting lines”; reference to new <i>Manual of Runway Visual Range Observing and Reporting Practices</i> .	23 March 1981 23 July 1981 26 November 1981
64	ICAO Secretariat	New provisions and revision of existing provisions to meet operational requirements for observing and reporting of low-level wind shear, including the introduction of wind shear warnings for the climb-out and approach phases of flight.	6 December 1982 6 April 1983 24 November 1983

<i>Amendment(s)</i>	<i>Source(s)</i>	<i>Subject(s)</i>	<i>Adopted/approved Effective Applicable</i>
65 (9th Edition)	Communications/ Meteorology Div- isional Meeting (1982). Third Meeting of the ADAPT Panel	New provisions and revision of existing provisions related to the introduction of the new world area forecast system; methods of exchange of operational meteorological data; improvement of accuracy of runway visual range assessment, and reporting.	10 June 1983 10 October 1983 22 November 1984
66 (10th Edition)	Communications/ Meteorology Divisional Meeting (1982). Second Asia/ Pacific Regional Air Navigation Meeting. Twenty-second and twenty-third meetings of the European Air Navigation Planning Group. World Meteorological Organization. Recommendations of the ANC relating to the method of reference date/time and units of measurement. ICAO Secretariat	Amendment of the provisions related to the transmission of wind shear information beyond the aerodrome, criteria for the issuance of selected special reports, inclusion of cloud information in aerodrome forecasts, flight documentation to be provided for short-haul flights, format of the SIGMET message and meteorological bulletin headings; introduction of the definition for “SIGMET information”; alignment of Annex 3 with Annex 5 in respect of units of measurement and the referencing of time.	24 March 1986 27 July 1986 20 November 1986
67	Communications/ Meteorology Divisional Meeting (1982). Twenty- second and twenty- fifth meetings of the European Air Navigation Planning Group. ICAO Secretariat. World Meteorological Organization	Amendment of the provisions related to light intensity settings used for RVR assessment; the identification of selected aerodromes and the deletion of the requirement for temperature circles on WAFS charts; the transmission time of forecasts from regional area forecast centres to users; introduction of provisions for the origination and dissemination of volcanic ash warnings; inclusion of wind speed units in examples of the aviation meteorological figure codes; alignment of Annex 3 with the PANS-RAC in respect of the elements of the air-report; editorial amendment of the example of the SIGMET message.	27 March 1987 27 July 1987 19 November 1987
68	Communications/ Meteorology Divisional Meeting (1982). ICAO Secretariat. World Meteorological Organization	Amendment of the provisions relating to identification of RVR reporting positions; the criteria for the issuance of selected special reports for changes in RVR; RVR values for touchdown zone for all runways available for landing to be included in reports disseminated beyond the aerodrome; model charts and forms for flight documentation; issuance and updating of SIGMET messages relating to volcanic ash clouds; explicit provisions regarding the need to provide the aeronautical information services units with MET information; alignment with Annex 10 in respect of definitions for aeronautical fixed telecommunication network and aeronautical mobile service; alignment with PANS-OPS, Volume II, Part III, paragraph 6.3.1 in respect of terminology; editorial amendments to paragraph 3.3.7 to delete the equivalent pressure levels; the example of the SPECI report; the reference in Attachment B, Part 3, paragraph 1.4 b); and the footnote in Attachment C concerning visibility and RVR.	21 March 1989 23 July 1989 16 November 1989

<i>Amendment(s)</i>	<i>Source(s)</i>	<i>Subject(s)</i>	<i>Adopted/approved Effective Applicable</i>
69 (11th Edition)	Communications/ Meteorology/ Operations Divisional Meeting (1990). ICAO Secretariat	Amendment of the provisions related to the transition to the final phase of the WAFS; aeronautical meteorological codes, and guidance material on the selected criteria applicable to aerodrome reports; aeronautical climatological information; SIGMET information and related guidance material for the issuance of SIGMETs; automatic weather observing stations; meteorological information for helicopter operations; and alignment with Annex 6, Parts I and II in respect of the definition for alternate aerodrome.	23 March 1992 27 July 1992 12 November 1992; 1 July 1993
70 (12th Edition)	Communications/ Meteorology/ Operations Divisional Meeting (1990). Limited North Atlantic (COM/MET/RAC) Regional Air Navigation Meeting (1992). Third Asia/ Pacific Regional Air Navigation Meeting (1993). Thirty- second meeting of the European Air Navigation Planning Group. ICAO Secretariat	Definitions of AIRMET information, extended range operation, GAMET area forecast, operational control and tropical cyclone; amendment to the provisions concerning horizontal resolution of and the code form in which the upper wind and temperature grid point forecasts are to be prepared by the world area forecast centres; issuance of special reports for changes in temperature at aerodromes; provisions related to the reporting and forecasting of meteorological information at aerodromes on which the new aeronautical meteorological codes are based and a consequential amendment to Models A1, A2, TA1, TA2 and SN to take account of the updated aeronautical meteorological codes; automated air reporting; provision of information on weather phenomenon hazardous to low-level flights; introduction of the minimum threshold value for the maximum surface wind speed for which SIGMETs for tropical cyclones should be issued; observation and reporting of wind shear to take account of new technology in ground-based wind shear observing equipment; interregional exchange of METARs and SPECIs to support extended range operations and long-haul flights conducted under centralized operational control; editorial amendments to replace the term “line squall” by “squall line”; editorial amendments to Models SWL and SN, to align the depiction of freezing level, and editorial corrections to Model A2; inclusion in Model SN of symbols for “volcanic eruptions”, “state of the sea” and “sea surface temperature”; updating operationally desirable accuracy of measurement or observation and the currently attainable accuracy of measurement or observation; introduction of criteria for the inclusion of severe mountain waves in SIGMET information.	17 March 1995 24 July 1995 1 January 1996
71 (13th Edition)	Limited North Atlantic (COM/ MET/RAC) Regional Air Navigation Meeting (1992). Third Asia/ Pacific Regional Air Navigation Meeting (1993). Thirty- eighth meeting of the European Air Navigation Planning Group (EANPG/38). United States. ICAO Secretariat	Definitions of automatic dependent surveillance, Human Factors principles, international airways volcano watch, level, tropical cyclone advisory centre, volcanic ash advisory centre and VOLMET data link service; amendment to the provisions regarding the indication of the designated meteorological authority in States’ AIPs; introduction of the role of the Human Factors principles; inclusion of 6-hour and 36-hour validity WAFS upper wind/temperature forecasts; introduction of requirements and a new model for volcanic ash advisories in graphical format; specification of the frequency of update of volcanic ash advisories and the specific role of VAACs and TCACs; an editorial amendment to ensure consistency in the order of the words “RVR” and “RWY”; an amendment to the present weather abbreviations; introduction of the requirements regarding “VOLMET” data link service; editorial amendments regarding air reporting; inclusion of “forecast temperature” in aerodrome forecasts; introduction of requirements for the standardization of area forecasts and flight documentation for low-level flights and consequential amendments to the Appendix — Model Charts and Forms; the deletion of the use of national language in connection with SIGMET messages; introduction of requirements for the provision of meteorological information by automated pre-flight information systems; introduction of the provision of meteorological information for centralized flight planning in extended range operations; quantitative definitions of CB clouds and thunderstorms to be used in WAFS SIGWX charts and consequential amendments to guidance material.	11 March 1998 20 July 1998 5 November 1998

<i>Amendment(s)</i>	<i>Source(s)</i>	<i>Subject(s)</i>	<i>Adopted/approved Effective Applicable</i>
72 (14th Edition)	Limited Middle East (COM/MET/RAC) RAN Meeting (1996). Ninth meeting of the ASIA/PAC Air Navigation Planning and Implementation Regional Group. Thirty-sixth, thirty-ninth and fortieth meetings of the European Air Navigation Planning Group. International Air Transport Association. Secretariat	Changes to the definition of flight crew member, grid point data in numerical form, pilot-in-command, regional area forecast centre and world area forecast centre; introduction of definitions for minimum sector altitude, quality assurance, quality control, quality management, quality system and visibility; introduction of requirements regarding global exchange of OPMET information; updated format for volcanic ash and tropical cyclone advisory messages; introduction of requirements on the transmission of information on the accidental release of radioactive materials, inclusion of radiation symbol on WAFS SIGWX charts; updated operational requirements for world area forecast system (WAFS) data regarding the frequency of issuance of WAFS upper wind/temperature data increased to four times per day; inclusion of FL 140 and humidity in the GRIB global data, introduction of the BUFR code, inclusion of “strong surface winds” and “mountain obscuration” symbols on low-level SIGWX charts; operational requirements for aeronautical MET codes regarding the introduction of standardized VOLMET phraseologies, uniform use of date/time groups in METAR and TAF code forms, additional reference level for height of clouds and freezing level in GAMET messages, discrimination between improvements and deterioration of visibility, cloud base and vertical visibility in aerodrome reports and forecasts; introduction of templates for local meteorological report, METAR/SPECI, TAF and SIGMET; the algorithm to report turbulence and provision of a turbulence index, and the operational interpretation of turbulence index; provisions for the MET component for automated pre-flight information systems and harmonized AIS/MET pre-flight briefing; provisions regarding quality assurance and quality control of MET information; SIGMET information in graphical format and quantitative criteria for SIGMET messages; inclusion of forward-scatter meters in RVR provisions; and editorial amendments.	7 March 2001 16 July 2001 1 November 2001
73 (15th Edition)	Meteorology (MET) Divisional Meeting (2002). Secretariat	Restructuring of Annex 3 into two parts; new and amended definitions; upgrading of certain Recommended Practices to Standards; elimination of the need to issue WAFS products in T4 chart form; introduction of the requirement to maintain the integrity of WAFS forecasts; notification of volcanic activity to ACC, MWO and VAAC by selected State volcano observatories; introduction of provisions allowing the issuance of SIGMET messages for volcanic ash and tropical cyclones in graphical format using the WMO BUFR code form; introduction of templates for special air-report (downlink), volcanic ash and tropical cyclone advisory messages and aerodrome and wind shear warnings; introduction of a requirement to issue METARs and SPECIs prior to the aerodrome resuming operations; introduction of enabling provisions to use fully automatic observing systems during non-operational hours; introduction of prevailing visibility; introduction of a requirement to cancel aerodrome forecasts that cannot be kept under continuous review; introduction of a provision for the averaging period for measuring visibility and variation in the mean wind speed; introduction of a provision to use maximum light intensity for assessment of RVR for METAR and SPECI; the deletion of Model TB Example 2; inclusion of new Examples 3 and 4 under Model SWH, deletion of Attachment A; introduction of a new Attachment C describing back-up procedures at WAFCs; and editorial amendments.	25 February 2004 12 July 2004 25 November 2004

INTERNATIONAL STANDARDS AND RECOMMENDED PRACTICES

PART I

CORE SARP_s

CHAPTER 1. DEFINITIONS

Note.— The designation (RR) in these definitions indicates a definition which has been extracted from the Radio Regulations of the International Telecommunication Union (ITU) (see Handbook on Radio Frequency Spectrum Requirements for Civil Aviation including Statement of Approved ICAO Policies (Doc 9718)).

1.1 Definitions

When the following terms are used in the Standards and Recommended Practices for Meteorological Service for International Air Navigation, they have the following meanings:

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.

Aerodrome climatological summary. Concise summary of specified meteorological elements at an aerodrome, based on statistical data.

Aerodrome climatological table. Table providing statistical data on the observed occurrence of one or more meteorological elements at an aerodrome.

Aerodrome control tower. A unit established to provide air traffic control service to aerodrome traffic.

Aerodrome elevation. The elevation of the highest point of the landing area.

Aerodrome meteorological office. An office, located at an aerodrome, designated to provide meteorological service for international air navigation.

Aeronautical fixed service (AFS). A telecommunication service between specified fixed points provided primarily for the safety of air navigation and for the regular, efficient and economical operation of air services.

Aeronautical fixed telecommunication network (AFTN). A worldwide system of aeronautical fixed circuits provided, as part of the aeronautical fixed service, for the exchange of messages and/or digital data between aeronautical fixed stations having the same or compatible communications characteristics.

Aeronautical meteorological station. A station designated to make observations and meteorological reports for use in international air navigation.

Aeronautical mobile service (RR SL32). A mobile service between aeronautical stations and aircraft stations, or between aircraft stations, in which survival craft stations may participate; emergency position-indicating radio beacon stations may also participate in this service on designated distress and emergency frequencies.

Aeronautical telecommunication station. A station in the aeronautical telecommunication service.

Aircraft. Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface.

Aircraft observation. The evaluation of one or more meteorological elements made from an aircraft in flight.

AIRMET information. Information issued by a meteorological watch office concerning the occurrence or expected occurrence of specified en-route weather phenomena which may affect the safety of low-level aircraft operations and which was not already included in the forecast issued for low-level flights in the flight information region concerned or sub-area thereof.

Air-report. A report from an aircraft in flight prepared in conformity with requirements for position, and operational and/or meteorological reporting.

Note.— Details of the AIREP form are given in the PANS-ATM (Doc 4444).

Air traffic services unit. A generic term meaning variously, air traffic control unit, flight information centre or air traffic services reporting office.

Alternate aerodrome. An aerodrome to which an aircraft may proceed when it becomes either impossible or inadvisable to proceed to or to land at the aerodrome of intended landing. Alternate aerodromes include the following:

Take-off alternate. An alternate aerodrome at which an aircraft can land should this become necessary shortly after take-off and it is not possible to use the aerodrome of departure.

En-route alternate. An aerodrome at which an aircraft would be able to land after experiencing an abnormal or emergency condition while en route.

ETOPS en-route alternate. A suitable and appropriate alternate aerodrome at which an aeroplane would be able to land after experiencing an engine shut-down or other abnormal or emergency condition while en route in an ETOPS operation.

Destination alternate. An alternate aerodrome to which an aircraft may proceed should it become impossible or inadvisable to land at the aerodrome of intended landing.

Note.— The aerodrome from which a flight departs may also be an en-route or a destination alternate aerodrome for that flight.

Altitude. The vertical distance of a level, a point or an object considered as a point, measured from mean sea level (MSL).

Approach control unit. A unit established to provide air traffic control service to controlled flights arriving at, or departing from, one or more aerodromes.

Appropriate ATS authority. The relevant authority designated by the State responsible for providing air traffic services in the airspace concerned.

Area control centre. A unit established to provide air traffic control service to controlled flights in control areas under its jurisdiction.

Automatic dependent surveillance (ADS). A surveillance technique in which aircraft automatically provide, via a data link, data derived from on-board navigation and position-fixing systems, including aircraft identification, four-dimensional position and additional data as appropriate.

Briefing. Oral commentary on existing and/or expected meteorological conditions.

Cloud of operational significance. A cloud with the height of cloud base below 1 500 m (5 000 ft) or below the highest minimum sector altitude, whichever is greater.

Consultation. Discussion with a meteorologist or another qualified person of existing and/or expected meteorological conditions relating to flight operations; a discussion includes answers to questions.

Control area. A controlled airspace extending upwards from a specified limit above the earth.

Cruising level. A level maintained during a significant portion of a flight.

Elevation. The vertical distance of a point or a level, on or affixed to the surface of the earth, measured from mean sea level.

Extended range operation. Any flight by an aeroplane with two turbine power-units where the flight time at the one power-unit inoperative cruise speed (in ISA and still air conditions), from a point on the route to an adequate alternate aerodrome, is greater than the threshold time approved by the State of the Operator.

Flight crew member. A licensed crew member charged with duties essential to the operation of an aircraft during a flight duty period.

Flight documentation. Written or printed documents, including charts or forms, containing meteorological information for a flight.

Flight information centre. A unit established to provide flight information service and alerting service.

Flight information region. An airspace of defined dimensions within which flight information service and alerting service are provided.

Flight level. A surface of constant atmospheric pressure which is related to a specific pressure datum, 1 013.2 hectopascals (hPa), and is separated from other such surfaces by specific pressure intervals.

Note 1.— A pressure type altimeter calibrated in accordance with the Standard Atmosphere:

- a) when set to a QNH altimeter setting, will indicate altitude;*
- b) when set to a QFE altimeter setting, will indicate height above the QFE reference datum; and*
- c) when set to a pressure of 1 013.2 hPa, may be used to indicate flight levels.*

Note 2.— The terms “height” and “altitude”, used in Note 1, indicate altimetric rather than geometric heights and altitudes.

Forecast. A statement of expected meteorological conditions for a specified time or period, and for a specified area or portion of airspace.

GAMET area forecast. An area forecast in abbreviated plain language for low-level flights for a flight information region or sub-area thereof, prepared by the meteorological office designated by the meteorological authority concerned and exchanged with meteorological offices in adjacent flight information regions, as agreed between the meteorological authorities concerned.

Grid point data in digital form. Computer processed meteorological data for a set of regularly spaced points on a chart, for transmission from a meteorological computer to another computer in a code form suitable for automated use.

Note.— In most cases such data are transmitted on medium or high speed telecommunications channels.

Height. The vertical distance of a level, a point or an object considered as a point, measured from a specified datum.

Human Factors principles. Principles which apply to aeronautical design, certification, training, operations and maintenance and which seek safe interface between the human and other system components by proper consideration to human performance.

International airways volcano watch (IAVW). International arrangements for monitoring and providing warnings to aircraft of volcanic ash in the atmosphere.

Note.— The IAVW is based on the cooperation of aviation and non-aviation operational units using information derived from observing sources and networks that are provided by States. The watch is coordinated by ICAO with the cooperation of other concerned international organizations.

Level. A generic term relating to vertical position of an aircraft in flight and meaning variously height, altitude or flight level.

Meteorological authority. The authority providing or arranging for the provision of meteorological service for international air navigation on behalf of a Contracting State.

Meteorological bulletin. A text comprising meteorological information preceded by an appropriate heading.

Meteorological information. Meteorological report, analysis, forecast, and any other statement relating to existing or expected meteorological conditions.

Meteorological office. An office designated to provide meteorological service for international air navigation.

Meteorological report. A statement of observed meteorological conditions related to a specified time and location.

Meteorological satellite. An artificial Earth satellite making meteorological observations and transmitting these observations to Earth.

Minimum sector altitude. The lowest altitude which may be used which will provide a minimum clearance of 300 m (1 000 ft) above all objects located in the area contained within a sector of a circle of 46 km (25 NM) radius centred on a radio aid to navigation.

Observation (meteorological). The evaluation of one or more meteorological elements.

Operational control. The exercise of authority over the initiation, continuation, diversion or termination of a flight in the interest of the safety of the aircraft and the regularity and efficiency of the flight.

Operational flight plan. The operator's plan for the safe conduct of the flight based on considerations of aeroplane performance, other operating limitations and relevant expected conditions on the route to be followed and at the aerodromes concerned.

Operational planning. The planning of flight operations by an operator.

Operator. A person, organization or enterprise engaged in or offering to engage in an aircraft operation.

Pilot-in-command. The pilot designated by the operator, or in the case of general aviation, the owner, as being in command and charged with the safe conduct of a flight.

Prevailing visibility. The visibility value, observed in accordance with the definition of "visibility", which is reached or exceeded within at least half the horizon circle or within at least half of the surface of the aerodrome. These areas could comprise contiguous or non-contiguous sectors.

Note.— This value may be assessed by human observation and/or instrumented systems. When instruments are installed, they are used to obtain the best estimate of the prevailing visibility.

Prognostic chart. A forecast of a specified meteorological element(s) for a specified time or period and a specified surface or portion of airspace, depicted graphically on a chart.

Quality assurance. All the planned and systematic activities implemented within the quality system, and demonstrated as needed, to provide adequate confidence that an entity will fulfil requirements for quality (ISO 9000:2000*).

Quality control. The operational techniques and activities that are used to fulfil requirements for quality (ISO 9000:2000*).

Quality management. All activities of the overall management function that determine the quality policy, objectives and responsibilities, and implementing them by means such as quality planning, quality control, quality assurance and quality improvement within the quality system (ISO 9000:2000*).

* ISO Standard 9000:2000 — *Quality Management Systems — Fundamentals and Vocabulary.*

Quality system. The organizational structure, procedures, processes and resources needed to implement quality management (ISO 9000:2000*).

Regional air navigation agreement. Agreement approved by the Council of ICAO normally on the advice of a regional air navigation meeting.

Reporting point. A specified geographical location in relation to which the position of an aircraft can be reported.

Rescue coordination centre. A unit responsible for promoting efficient organization of search and rescue services and for coordinating the conduct of search and rescue operations within a search and rescue region.

Runway. A defined rectangular area on a land aerodrome prepared for the landing and take-off of aircraft.

Runway visual range (RVR). The range over which the pilot of an aircraft on the centre line of a runway can see the runway surface markings or the lights delineating the runway or identifying its centre line.

Search and rescue services unit. A generic term meaning, as the case may be, rescue coordination centre, rescue subcentre or alerting post.

Service area (world area forecast system). A geographical area within which a world area forecast centre is responsible for issuing area forecasts to meteorological authorities and other users.

SIGMET information. Information issued by a meteorological watch office concerning the occurrence or expected occurrence of specified en-route weather phenomena which may affect the safety of aircraft operations.

Standard isobaric surface. An isobaric surface used on a worldwide basis for representing and analysing the conditions in the atmosphere.

Threshold. The beginning of that portion of the runway usable for landing.

Touchdown zone. The portion of a runway, beyond the threshold, where it is intended landing aeroplanes first contact the runway.

Tropical cyclone. Generic term for a non-frontal synoptic-scale cyclone originating over tropical or sub-tropical waters with organized convection and definite cyclonic surface wind circulation.

Tropical cyclone advisory centre (TCAC). A meteorological centre designated by regional air navigation agreement to provide advisory information to meteorological watch offices, world area forecast centres and international OPMET data banks regarding the position, forecast direction and speed of movement, central pressure and maximum surface wind of tropical cyclones.

Upper-air chart. A meteorological chart relating to a specified upper-air surface or layer of the atmosphere.

Visibility. Visibility for aeronautical purposes is the greater of:

- a) the greatest distance at which a black object of suitable dimensions, situated near the ground, can be seen and recognized when observed against a bright background;
- b) the greatest distance at which lights in the vicinity of 1 000 candelas can be seen and identified against an unlit background.

Note.— The two distances have different values in air of a given extinction coefficient, and the latter b) varies with the background illumination. The former a) is represented by the meteorological optical range (MOR).

Volcanic ash advisory centre (VAAC). A meteorological centre designated by regional air navigation agreement to provide advisory information to meteorological watch offices, area control centres, flight information centres, world area forecast centres and international OPMET data banks regarding the lateral and vertical extent and forecast movement of volcanic ash in the atmosphere following volcanic eruptions.

VOLMET. Meteorological information for aircraft in flight.

Data link-VOLMET (D-VOLMET). Provision of current aerodrome routine meteorological reports (METAR) and aerodrome special meteorological reports (SPECI), aerodrome forecasts (TAF), SIGMET, special air-reports not covered by a SIGMET and, where available, AIRMET via data link.

VOLMET broadcast. Provision, as appropriate, of current METAR, SPECI, TAF and SIGMET by means of continuous and repetitive voice broadcasts.

World area forecast centre (WAFc). A meteorological centre designated to prepare and issue significant weather forecasts and upper-air forecasts in digital form on a global basis direct to States by appropriate means as part of the aeronautical fixed service.

World area forecast system (WAFS). A worldwide system by which world area forecast centres provide aeronautical meteorological en-route forecasts in uniform standardized formats.

* ISO Standard 9000:2000 — *Quality Management Systems — Fundamentals and Vocabulary.*

1.2 Terms used with a limited meaning

For the purpose of this Annex, the following terms are used with a limited meaning as indicated below:

- a) to avoid confusion in respect of the term “service” between the meteorological service considered as an administrative entity and the service which is provided, “meteorological authority” is used for the former and “service” for the latter;
 - b) “provide” is used solely in connection with the provision of service;
 - c) “issue” is used solely in connection with cases where the obligation specifically extends to sending out the information to a user;
 - d) “make available” is used solely in connection with cases where the obligation ends with making the information accessible to a user; and
 - e) “supply” is used solely in connection with cases where either c) or d) applies.
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CHAPTER 2. GENERAL PROVISIONS

Introductory Note 1.— It is recognized that the provisions of this Annex with respect to meteorological information are subject to the understanding that the obligation of a Contracting State is for the supply, under Article 28 of the Convention, of meteorological information and that the responsibility for the use made of such information is that of the user.

Introductory Note 2.— Although the Convention on International Civil Aviation allocates to the State of Registry certain functions which that State is entitled to discharge, or obligated to discharge, as the case may be, the Assembly recognized, in Resolution A23-13, that the State of Registry may be unable to fulfil its responsibilities adequately in instances where aircraft are leased, chartered or interchanged — in particular without crew — by an operator of another State and that the Convention may not adequately specify the rights and obligations of the State of an operator in such instances until such time as Article 83 bis of the Convention enters into force. Accordingly, the Council urged that if, in the above-mentioned instances, the State of Registry finds itself unable to discharge adequately the functions allocated to it by the Convention, it delegate to the State of the Operator, subject to acceptance by the latter State, those functions of the State of Registry that can more adequately be discharged by the State of the Operator. It was understood that pending entry into force of Article 83 bis of the Convention the foregoing action would only be a matter of practical convenience and would not affect either the provisions of the Chicago Convention prescribing the duties of the State of Registry or any third State. However, as Article 83 bis of the Convention entered into force on 20 June 1997, such transfer agreements will have effect in respect of Contracting States which have ratified the related Protocol (Doc 9318) upon fulfilment of the conditions established in Article 83 bis.

Introductory Note 3.— In the case of international operations effected jointly with aeroplanes not all of which are registered in the same Contracting State, nothing in this Annex prevents the States concerned entering into an agreement for the joint exercise of the functions placed upon the State of Registry by the provisions of this Annex.

2.1 Objective, determination and provision of meteorological service

2.1.1 The objective of meteorological service for international air navigation shall be to contribute towards the safety, regularity and efficiency of international air navigation.

2.1.2 This objective shall be achieved by supplying the following users: 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.

2.1.3 Each Contracting State shall determine the meteorological service which it will provide to meet the needs of international air navigation. This determination shall be made in accordance with the provisions of this Annex and with due regard to regional air navigation agreements; it shall include the determination of the meteorological service to be provided for international air navigation over international waters and other areas which lie outside the territory of the State concerned.

2.1.4 Each Contracting State shall designate the authority, hereinafter referred to as the meteorological authority, to provide or to arrange for the provision of meteorological service for international air navigation on its behalf. Details of the meteorological authority so designated shall be included in the State aeronautical information publication, in accordance with Annex 15, Appendix 1, GEN 1.1.

2.1.5 Each Contracting State shall ensure that the designated meteorological authority complies with the requirements of the World Meteorological Organization in respect of qualifications and training of meteorological personnel providing service for international air navigation.

Note.— Requirements concerning qualifications and training of meteorological personnel in aeronautical meteorology are given in WMO Publication No. 49, Technical Regulations, Volume I — General Meteorological Standards and Recommended Practices, Chapter B.4 — Education and Training.

2.2 Supply, quality assurance and use of meteorological information

2.2.1 Close liaison shall be maintained between those concerned with the supply and those concerned with the use of meteorological information on matters which affect the provision of meteorological service for international air navigation.

2.2.2 **Recommendation.**— *In order to meet the objective of meteorological service for international air navigation, the*

Contracting State should ensure that the designated meteorological authority referred to in 2.1.4 establishes and implements a properly organized quality system comprising procedures, processes and resources necessary to provide for the quality management of the meteorological information to be supplied to the users listed in 2.1.2.

2.2.3 Recommendation.— *The quality system established in accordance with 2.2.2 should be in conformity with the International Organization for Standardization (ISO) 9000 series of quality assurance standards, and certified by an approved organization.*

Note.— *International Organization for Standardization (ISO) 9000 series of quality assurance standards provide a basic framework for the development of a quality assurance programme. The details of a successful programme are to be formulated by each State and in most cases are unique to the State organization.*

2.2.4 Recommendation.— *The quality system should provide the users with assurance that the meteorological information supplied complies with the stated requirements in terms of the geographical and spatial coverage, format and content, time and frequency of issuance and period of validity, as well as the accuracy of measurements, observations and forecasts. Where the quality system indicates that meteorological information to be supplied to the users does not comply with the stated requirements, and automatic error correction procedures are not appropriate, such information should not be supplied to the users unless it is validated with the originator.*

Note 1.— *Requirements concerning the geographical and spatial coverage, format and content, time and frequency of issuance and period of validity of meteorological information to be supplied to aeronautical users are given in Chapters 3, 4, 6, 7, 8, 9 and 10 and Appendices 2, 3, 5, 6, 7, 8 and 9 of this Annex and the relevant regional air navigation plans. Guidance concerning the accuracy of measurement and observation, and accuracy of forecasts is given in Attachments A and B respectively to this Annex.*

Note 2.— *Notwithstanding the provisions in 2.2.4, provisional TAF may still be issued, as necessary, in accordance with Appendix 8, 4.4.3.*

2.2.5 Recommendation.— *In regard to the exchange of meteorological information for operational purposes, the quality system should include verification and validation procedures and resources for monitoring adherence to the prescribed transmission schedules for individual messages and/or bulletins required to be exchanged, and the times of their filing for transmission. The quality system should be capable of detecting excessive transit times of messages and bulletins received.*

Note.— *Requirements concerning the exchange of operational meteorological information are given in Chapter 11 and Appendix 10 of this Annex.*

2.2.6 Recommendation.— *Demonstration of compliance of the quality system applied should be by audit. If non-conformity of the system is identified, action should be initiated to determine and correct the cause. All audit observations should be evidenced and properly documented.*

2.2.7 The meteorological information supplied to the users listed in 2.1.2 shall be consistent with Human Factors principles and shall be in forms which require a minimum of interpretation by these users, as specified in the following chapters.

Note.— *Guidance material on the application of Human Factors principles can be found in the Human Factors Training Manual (Doc 9683).*

2.3 Notifications required from operators

2.3.1 An operator requiring meteorological service or changes in existing meteorological service shall notify, sufficiently in advance, the meteorological authority or the meteorological office(s) concerned. The minimum amount of advance notice required shall be as agreed between the meteorological authority or meteorological office(s) and the operator.

2.3.2 The meteorological authority shall be notified by the operator requiring service when:

- a) new routes or new types of operations are planned;
- b) changes of a lasting character are to be made in scheduled operations; and
- c) other changes, affecting the provision of meteorological service, are planned.

Such information shall contain all details necessary for the planning of appropriate arrangements by the meteorological authority.

2.3.3 The aerodrome meteorological office, or the meteorological office concerned, shall be notified by the operator or a flight crew member:

- a) of flight schedules;
- b) when non-scheduled flights are to be operated; and
- c) when flights are delayed, advanced or cancelled.

2.3.4 Recommendation.— *The notification to the aerodrome meteorological office, or the meteorological office concerned, of individual flights should contain the following information except that, in the case of scheduled flights, the requirement for some or all of this information may be waived by agreement between the meteorological office and the operator:*

- a) aerodrome of departure and estimated time of departure;*
 - b) destination and estimated time of arrival;*
 - c) route to be flown and estimated times of arrival at, and departure from, any intermediate aerodrome(s);*
 - d) alternate aerodromes needed to complete the operational flight plan and taken from the relevant list contained in the regional air navigation plan;*
 - e) cruising level;*
 - f) for supersonic flights, the alternative subsonic cruising level and the locations of the transonic acceleration and deceleration areas and of the subsonic climb and descent paths;*
 - g) type of flight, whether under the visual or the instrument flight rules;*
 - h) type of meteorological information requested for a flight crew member; whether flight documentation and/or briefing or consultation; and*
 - i) time(s) at which briefing, consultation and/or flight documentation are required.*
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CHAPTER 3. WORLD AREA FORECAST SYSTEM AND METEOROLOGICAL OFFICES

Note.— Technical specifications and detailed criteria related to this chapter are given in Appendix 2.

3.1 Objective of the world area forecast system

The objective of the world area forecast system shall be to supply meteorological authorities and other users with forecasts of global upper wind, upper-air temperature and humidity, direction, speed and height of maximum wind, tropopause height and temperature and forecasts of significant weather phenomena in digital form. This objective shall be achieved through a comprehensive, integrated, worldwide and, as far as practicable, uniform system, and in a cost-effective manner, taking full advantage of evolving technologies.

3.2 World area forecast centres

3.2.1 A Contracting State, having accepted the responsibility for providing a WAFC within the framework of the world area forecast system, shall arrange for that centre:

- a) to prepare global forecasts for grid points in digital form for all required levels and in a standard format; the forecasts shall comprise upper winds, upper-air temperatures and humidity, tropopause heights and temperatures and maximum wind speed, direction and height;
- b) to prepare global forecasts of significant weather phenomena in digital form;
- c) to issue the forecasts referred to in a) and b) in digital form to meteorological authorities and other users in its service area, as approved by the Contracting State on advice from the meteorological authority;
- d) to prepare and issue amendments to the forecasts;
- e) to receive information concerning the accidental release of radioactive materials into the atmosphere from its associated WMO regional specialized meteorological centre for the provision of transport model products for radiological environmental emergency response, in order to include the information in significant weather forecasts; and
- f) to establish and maintain contact with VAACs for the exchange of information on volcanic activity in order to coordinate the inclusion of information on volcanic eruptions in significant weather forecasts.

Note 1.— Specifications for the preparation of significant weather and upper-air prognostic charts are contained in Part II, Appendix 1.

Note 2.— The WAFS service areas are given in the regional air navigation plans.

3.2.2 In case of interruption of the operation of a WAFC, its functions shall be carried out by the other WAFC.

Note.— Back-up procedures to be used in case of interruption of the operation of a WAFC are given in Attachment C. Back-up procedures are expected to be subject to minor revisions by the World Area Forecast System Operations Group (WAFSOPSG) and the latest revision can be found at the WAFSOPSG website at: www.icao.int/anb/wafsopsg.

3.3 Meteorological offices

3.3.1 Each Contracting State shall establish one or more aerodrome and/or other meteorological offices which shall be adequate for the provision of the meteorological service required to satisfy the needs of international air navigation.

3.3.2 An aerodrome meteorological office shall carry out all or some of the following functions as necessary to meet the needs of flight operations at the aerodrome:

- a) prepare and/or obtain forecasts and other relevant information for flights with which it is concerned; the extent of its responsibilities to prepare forecasts shall be related to the local availability and use of en-route and aerodrome forecast material received from other offices;
- b) prepare and/or obtain forecasts of local meteorological conditions;
- c) maintain a continuous survey of meteorological conditions over the aerodromes for which it is designated to prepare forecasts;
- d) provide briefing, consultation and flight documentation to flight crew members and/or other flight operations personnel;

- e) supply other meteorological information to aeronautical users;
- f) display the available meteorological information;
- g) exchange meteorological information with other meteorological offices; and
- h) supply information received on pre-eruption volcanic activity, a volcanic eruption or volcanic ash cloud, to its associated air traffic services unit, aeronautical information service unit and meteorological watch office as agreed between the meteorological, aeronautical information service and ATS authorities concerned.

3.3.3 The aerodrome meteorological offices at which flight documentation is required, as well as the areas to be covered, shall be determined by regional air navigation agreement.

3.3.4 The aerodromes for which landing forecasts are required shall be determined by regional air navigation agreement.

3.3.5 For aerodromes without meteorological offices:

- a) the meteorological authority concerned shall designate one or more meteorological offices to supply meteorological information as required; and
- b) the competent authorities shall establish means by which such information can be supplied to the aerodromes concerned.

3.4 Meteorological watch offices

3.4.1 A Contracting State, having accepted the responsibility for providing air traffic services within a flight information region or a control area, shall establish one or more meteorological watch offices, or arrange for another Contracting State to do so.

3.4.2 A meteorological watch office shall:

- a) maintain watch over meteorological conditions affecting flight operations within its area of responsibility;
- b) prepare SIGMET and other information relating to its area of responsibility;
- c) supply SIGMET information and, as required, other meteorological information to associated air traffic services units;
- d) disseminate SIGMET information;

- e) when required by regional air navigation agreement, in accordance with 7.2.1:

- 1) prepare AIRMET information related to its area of responsibility;
- 2) supply AIRMET information to associated air traffic services units; and
- 3) disseminate AIRMET information;

- f) supply information received on pre-eruption volcanic activity, a volcanic eruption and volcanic ash cloud for which a SIGMET has not already been issued, to its associated ACC/FIC, as agreed between the meteorological and ATS authorities concerned, and to its associated VAAC as determined by regional air navigation agreement; and

- g) supply information received concerning the accidental release of radioactive materials into the atmosphere, in the area for which it maintains watch or adjacent areas, to its associated ACC/FIC, as agreed between the meteorological and ATS authorities concerned, and to aeronautical information service units, as agreed between the meteorological and appropriate civil aviation authorities concerned. The information shall comprise location, date and time of the accident, and forecast trajectories of the radioactive materials.

Note.— The information is provided, at the request of the delegated authority in a State, by WMO regional specialized meteorological centres (RSMC) for the provision of transport model products for radiological environmental emergency response. The information is sent by the RSMC to a single contact point of the national meteorological service in each State. This contact point has the responsibility of redistributing the RSMC products within the State concerned.

3.4.3 **Recommendation.—** *The boundaries of the area over which meteorological watch is to be maintained by a meteorological watch office should, in so far as is practicable, be coincident with the boundaries of a flight information region or a control area or a combination of flight information regions and/or control areas.*

3.4.4 **Recommendation.—** *Meteorological watch should be maintained continuously; however, in areas with a low density of traffic the watch may be restricted to the period relevant to expected flight operations.*

3.5 Volcanic ash advisory centres

3.5.1 A Contracting State, having accepted, by regional air navigation agreement, the responsibility for providing a

VAAC within the framework of the international airways volcano watch, shall arrange for that centre to respond to a notification that a volcano has erupted, or is expected to erupt or volcanic ash is reported in its area of responsibility, by arranging for that centre to:

- a) monitor relevant geostationary and polar-orbiting satellite data to detect the existence and extent of volcanic ash in the atmosphere in the area concerned;
- b) activate the volcanic ash numerical trajectory/dispersion model in order to forecast the movement of any ash “cloud” which has been detected or reported;

Note.— The numerical model may be its own or, by agreement, that of another VAAC.

- c) issue advisory information regarding the extent and forecast movement of the volcanic ash “cloud” to:

- 1) meteorological watch offices, area control centres and flight information centres serving flight information regions in its area of responsibility which may be affected;
- 2) other VAACs whose areas of responsibility may be affected;
- 3) world area forecast centres, international OPMET data banks, international NOTAM offices, and centres designated by regional air navigation agreement for the operation of aeronautical fixed service satellite distribution systems; and
- 4) airlines requiring the advisory information through the AFTN address provided specifically for this purpose; and

Note.— The AFTN address to be used by the VAACs is given in the Handbook on the International Airways Volcano Watch (IAVW) (Doc 9766) and at: <http://www.icao.int/icao/en/anb/met/index.html>.

- d) issue updated advisory information to the meteorological watch offices, area control centres, flight information centres and VAACs referred to in c), as necessary, but at least every six hours until such time as the volcanic ash “cloud” is no longer identifiable from satellite data, no further reports of volcanic ash are received from the area, and no further eruptions of the volcano are reported.

3.5.2 Volcanic ash advisory centres shall maintain a 24-hour watch.

3.6 State volcano observatories

Contracting States that maintain volcano observatories monitoring active volcanoes shall arrange that selected State volcano observatories, as designated by regional air navigation agreement, observing significant pre-eruption volcanic activity, a volcanic eruption and/or volcanic ash in the atmosphere shall send this information as quickly as practicable to its associated ACC, MWO and VAAC.

Note.— Pre-eruption volcanic activity in this context means unusual and/or increasing volcanic activity which could presage a volcanic eruption.

3.7 Tropical cyclone advisory centres

A Contracting State having accepted, by regional air navigation agreement, the responsibility for providing a TCAC shall arrange for that centre to:

- a) monitor the development of tropical cyclones in its area of responsibility, using geostationary and polar-orbiting satellite data, radar data and other meteorological information;
- b) issue advisory information concerning the position of the cyclone centre, its direction and speed of movement, central pressure and maximum surface wind near the centre; in abbreviated plain language to:
 - 1) meteorological watch offices in its area of responsibility;
 - 2) other TCACs whose areas of responsibility may be affected; and
 - 3) world area forecast centres, international OPMET data banks, and centres designated by regional air navigation agreement for the operation of aeronautical fixed service satellite distribution systems; and
- c) issue updated advisory information to meteorological watch offices for each tropical cyclone, as necessary, but at least every six hours.

CHAPTER 4. METEOROLOGICAL OBSERVATIONS AND REPORTS

Note.— Technical specifications and detailed criteria related to this chapter are given in Appendix 3.

4.1 Aeronautical meteorological stations and observations

4.1.1 Each Contracting State shall establish at aerodromes and other points of significance to international air navigation, in its territory, such aeronautical meteorological stations as it determines to be necessary. An aeronautical meteorological station may be a separate station or may be combined with a synoptic station.

4.1.2 **Recommendation.—** *Each Contracting State should establish, or arrange for the establishment of, aeronautical meteorological stations on offshore structures or at other points of significance in support of helicopter operations to offshore structures, if required by regional air navigation agreement.*

4.1.3 Aeronautical meteorological stations shall make routine observations at fixed intervals. At aerodromes, the routine observations shall be supplemented by special observations whenever specified changes occur in respect of surface wind, visibility, runway visual range, present weather, clouds and/or air temperature.

4.1.4 **Recommendation.—** *Each Contracting State should arrange for its aeronautical meteorological stations to be inspected at sufficiently frequent intervals to ensure that a high standard of observations is maintained, that instruments and all their indicators are functioning correctly, and to check whether the exposure of the instruments has changed significantly.*

4.1.5 At aerodromes, with runways intended for Category II and III instrument approach and landing operations, automated equipment for measuring or assessing, as appropriate, and for monitoring and remote indicating of surface wind, visibility, runway visual range, height of cloud base, air and dew-point temperatures and atmospheric pressure shall be installed to support approach and landing and take-off operations. These devices shall be integrated automatic systems for acquisition, processing, dissemination and display in real time of the meteorological parameters affecting landing and take-off operations. The design of integrated automatic systems shall observe Human Factors principles and include back-up procedures.

Note 1.— Categories of precision approach and landing operations are defined in Annex 6, Part I.

Note 2.— Guidance material on the application of Human Factors principles can be found in the Human Factors Training Manual (Doc 9683).

4.1.6 **Recommendation.—** *At aerodromes, with runways intended for Category I instrument approach and landing operations, automated equipment for measuring or assessing, as appropriate, and for monitoring and remote indicating of surface wind, visibility, runway visual range, height of cloud base, air and dew-point temperatures and atmospheric pressure should be installed to support approach and landing and take-off operations. These devices should be integrated automatic systems for acquisition, processing, dissemination and display in real time of the meteorological parameters affecting landing and take-off operations. The design of integrated automatic systems should observe Human Factors principles and include back-up procedures.*

4.1.7 **Recommendation.—** *Where an integrated automatic system is used for the dissemination/display of meteorological information, it should be capable of accepting the manual insertion of data covering those meteorological elements which cannot be observed by automatic means.*

4.1.8 The observations shall form the basis for the preparation of reports to be disseminated at the aerodrome of origin and for reports to be disseminated beyond the aerodrome of origin.

4.1.9 Owing to the variability of meteorological elements in space and time, to limitations of observing techniques and to limitations caused by the definitions of some of the elements, the specific value of any of the elements given in a report shall be understood by the recipient to be the best approximation to the actual conditions at the time of observation.

Note.— Guidance on the operationally desirable and currently attainable accuracy of measurement or observation is given in Attachment A.

4.2 Agreement between air traffic services authorities and meteorological authorities

Recommendation.— *An agreement between the meteorological authority and the appropriate ATS authority should be established to cover, amongst other things:*

- a) the provision in air traffic services units of displays related to integrated automatic systems;*

- b) the calibration and maintenance of these displays/instruments;
- c) the use to be made of these displays/instruments by air traffic services personnel;
- d) as and where necessary, supplementary visual observations (for example, of meteorological phenomena of operational significance in the climb-out and approach areas) if and when made by air traffic services personnel to update or supplement the information supplied by the meteorological station;
- e) meteorological information obtained from aircraft taking off or landing (for example, on wind shear); and
- f) if available, meteorological information obtained from ground weather radar.

Note.— Guidance on the subject of coordination between ATS and aeronautical meteorological services is contained in the Manual on Coordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services (Doc 9377).

4.3 Routine observations and reports

4.3.1 At aerodromes, routine observations shall be made throughout the 24 hours each day, except as otherwise agreed between the meteorological authority, the appropriate ATS authority and the operator concerned. Such observations shall be made at intervals of one hour or, if so determined by regional air navigation agreement, at intervals of one half-hour. At other aeronautical meteorological stations, such observations shall be made as determined by the meteorological authority taking into account the requirements of air traffic services units and aircraft operations.

4.3.2 Reports of routine observations shall be issued as:

- a) local routine reports, only for dissemination at the aerodrome of origin, (intended for arriving and departing aircraft); and
- b) METAR for dissemination beyond the aerodrome of origin (mainly intended for flight planning, VOLMET broadcasts and D-VOLMET).

Note.— Meteorological information used in ATIS (voice-ATIS and D-ATIS) is to be extracted from the local routine report, in accordance with Annex 11, 4.3.6.1 g).

4.3.3 At aerodromes that are not operational throughout 24 hours in accordance with 4.3.1, METAR shall be issued prior to the aerodrome resuming operations in accordance with regional air navigation agreement.

4.4 Special observations and reports

4.4.1 A list of criteria for special observations shall be established by the meteorological authority, in consultation with the appropriate ATS authority, operators and others concerned.

4.4.2 Reports of special observations shall be issued as:

- a) local special reports, only for dissemination at the aerodrome of origin, (intended for arriving and departing aircraft); and
- b) SPECI for dissemination beyond the aerodrome of origin (mainly intended for flight planning, VOLMET broadcasts and D-VOLMET).

Note.— Meteorological information used in ATIS (voice-ATIS and D-ATIS) is to be extracted from the local special report, in accordance with Annex 11, 4.3.6.1 g).

4.4.3 At aerodromes that are not operational throughout 24 hours in accordance with 4.3.1, following the resumption of the issuance of METAR, SPECI shall be issued, as necessary.

4.5 Contents of reports

4.5.1 Local routine and special reports and METAR and 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) runway visual range, when applicable;
- h) present weather;
- i) cloud amount, cloud type (only for cumulonimbus and towering cumulus clouds) and height of cloud base or, where measured, vertical visibility;
- j) air temperature and dew-point temperature; and
- k) QNH and, when applicable, QFE (QFE included only in local routine and special reports).

Note.— The location indicators referred to under b) and their significations are published in Location Indicators (Doc 7910).

4.5.2 Recommendation.— *In addition to elements listed under 4.5.1 a) to k), local routine and special reports and METAR and SPECI should contain supplementary information to be placed after element k).*

4.5.3 Optional elements included under supplementary information shall be included in METAR and SPECI in accordance with regional air navigation agreement.

4.6 Observing and reporting meteorological elements

4.6.1 Surface wind

4.6.1.1 The mean direction and the mean speed of the surface wind shall be measured, as well as significant variations of the wind direction and speed, and reported in degrees true and kilometres per hour (or knots), respectively.

4.6.1.2 Recommendation.— *When local routine and special reports are used for departing aircraft, the surface wind observations for these reports should be representative of conditions along the runway; when local routine and special reports are used for arriving aircraft, the surface wind observations for these reports should be representative of the touchdown zone.*

4.6.1.3 Recommendation.— *For METAR and SPECI, the surface wind observations should be representative of conditions above the whole runway where there is only one runway and the whole runway complex where there is more than one runway.*

4.6.2 Visibility

4.6.2.1 The visibility as defined in Chapter 1 shall be measured or observed, and reported in metres or kilometres.

Note.— *Guidance on the conversion of instrument readings into visibility is given in Attachment E.*

4.6.2.2 Recommendation.— *When local routine and special reports are used for departing aircraft, the visibility observations for these reports should be representative of conditions along the runway; when local routine and special reports are used for arriving aircraft, the visibility observations for these reports should be representative of the touchdown zone of the runway.*

4.6.2.3 Recommendation.— *For METAR and SPECI, the visibility observations should be representative of the aerodrome.*

4.6.3 Runway visual range

Note.— *Guidance on the subject of runway visual range is contained in the Manual of Runway Visual Range Observing and Reporting Practices (Doc 9328).*

4.6.3.1 Runway visual range as defined in Chapter 1 shall be assessed on all runways intended for Category II and III instrument approach and landing operations.

4.6.3.2 Recommendation.— *Runway visual range as defined in Chapter 1 should be assessed on all runways intended for use during periods of reduced visibility, including:*

- a) precision approach runways intended for Category I instrument approach and landing operations; and*
- b) runways used for take-off and having high-intensity edge lights and/or centre line lights.*

Note.— *Precision approach runways are defined in Annex 14, Volume I, Chapter 1, under “Instrument runway”.*

4.6.3.3 The runway visual range, assessed in accordance with 4.6.3.1 and 4.6.3.2, shall be reported in metres throughout periods when either the visibility or the runway visual range is less than 1 500 m.

4.6.3.4 Runway visual range assessments shall be representative of:

- a) the touchdown zone of the runway intended for non-precision or Category I instrument approach and landing operations;*
- b) the touchdown zone and the mid-point of the runway intended for Category II instrument approach and landing operations; and*
- c) the touchdown zone, the mid-point and stop-end of the runway intended for Category III instrument approach and landing operations.*

4.6.3.5 The units providing air traffic service and aeronautical information service for an aerodrome shall be kept informed without delay of changes in the serviceability status of the automated equipment used for assessing runway visual range.

4.6.4 Present weather

4.6.4.1 The present weather occurring at the aerodrome and/or its vicinity shall be observed and reported as necessary.

4.6.4.2 Recommendation.— *For local routine and special reports, the present weather information should be representative of conditions at the aerodrome.*

4.6.4.3 Recommendation.— *For METAR and SPECI, the present weather information should be representative of conditions at the aerodrome and, for certain specified present weather phenomena, in its vicinity.*

4.6.4.4 Recommendation.— *Where observations are made using automatic observing systems, provision should be made for manual insertion of those present weather elements which cannot be determined adequately by that equipment.*

4.6.5 Clouds

4.6.5.1 Cloud amount, cloud type and height of cloud base shall be observed, and reported as necessary to describe the clouds of operational significance. When the sky is obscured, vertical visibility shall be observed and reported, where measured, in lieu of cloud amount, cloud type and height of cloud base. The height of cloud base and vertical visibility shall be reported in metres (or feet).

4.6.5.2 Recommendation.— *Cloud observations for local routine and special reports should be representative of the approach area.*

4.6.5.3 Recommendation.— *Cloud observations for METAR and SPECI should be representative of the aerodrome and its vicinity.*

4.6.5.4 Recommendation.— *Where observations of cloud amount and/or the height of cloud base are made using automatic observing systems, provision should be made for manual insertion of cloud amounts and, where appropriate, cloud type, together with the heights of those layers or masses not directly measurable by that equipment.*

4.6.6 Air temperature and dew-point temperature

4.6.6.1 The air temperature and the dew-point temperature shall be measured and reported in degrees Celsius.

4.6.6.2 Recommendation.— *Observations of air temperature and dew-point temperature for local routine and special reports and METAR and SPECI should be representative of the whole runway complex.*

4.6.7 Atmospheric pressure

The atmospheric pressure shall be measured, and QNH and QFE values shall be computed and reported in hectopascals.

4.6.8 Supplementary information

4.6.8.1 Recommendation.— *Observations made at aerodromes should include the available supplementary information concerning significant meteorological conditions, particularly those in the approach and climb-out areas. Where practicable, the information should identify the location of the meteorological condition.*

4.6.8.2 Recommendation.— *Where observations are made using automatic observing systems, provision should be made for manual insertion of information concerning significant meteorological conditions which cannot be determined adequately by that equipment.*

4.7 Reporting of meteorological information from automatic observing systems

Recommendation.— *METAR and SPECI from automatic observing systems should only be used during non-operational hours of the aerodrome. These METAR and SPECI should be identified with the word “AUTO”.*

4.8 Observations and reports of volcanic activity

Recommendation.— *The occurrence of pre-eruption volcanic activity, volcanic eruptions and volcanic ash cloud should be reported without delay to the associated air traffic services unit, aeronautical information services unit and meteorological watch office. The report should be made in the form of a volcanic activity report comprising the following information in the order indicated:*

- a) message type, VOLCANIC ACTIVITY REPORT;*
- b) station identifier, location indicator or name of station;*
- c) date/time of message;*
- d) location of volcano and name if known; and*
- e) concise description of event including, as appropriate, level of intensity of volcanic activity, occurrence of an eruption and its date and time and the existence of a volcanic ash cloud in the area together with direction of ash cloud movement and height.*

Note.— *Pre-eruption volcanic activity in this context means unusual and/or increasing volcanic activity which could presage a volcanic eruption.*

CHAPTER 5. AIRCRAFT OBSERVATIONS AND REPORTS

Note.— Technical specifications and detailed criteria related to this chapter are given in Appendix 4.

5.1 Obligations of States

Each Contracting State shall arrange, according to the provisions of this chapter, for observations to be made by aircraft of its registry operating on international air routes and for the recording and reporting of these observations.

5.2 Types of aircraft observations

The following aircraft observations shall be made:

- a) routine aircraft observations during en-route and climb-out phases of the flight; and
- b) special and other non-routine aircraft observations during any phase of the flight.

5.3 Routine aircraft observations — designation

5.3.1 Recommendation.— *When air-ground data link is used and automatic dependent surveillance (ADS) is being applied, automated routine observations should be made every 15 minutes during the en-route phase and every 30 seconds during the climb-out phase for the first 10 minutes of the flight.*

5.3.2 When voice communications are used, routine observations shall be made during the en-route phase in relation to those air traffic services reporting points or intervals:

- a) at which the applicable air traffic services procedures require routine position reports; and
- b) which are those separated by distances corresponding most closely to intervals of one hour of flying time.

5.3.3 Recommendation.— *For helicopter operations to and from aerodromes on offshore structures, routine observations should be made from helicopters at points and times as agreed between the meteorological authorities and the helicopter operators concerned.*

5.3.4 In the case of air routes with high-density air traffic (e.g. organized tracks), an aircraft from among the aircraft operating at each flight level shall be designated, at approximately hourly intervals, to make routine observations in accordance with 5.3.1 or 5.3.2, as appropriate. The designation procedures shall be subject to regional air navigation agreement.

5.3.5 In the case of the requirement to report during the climb-out phase, an aircraft shall be designated, at approximately hourly intervals, at each aerodrome to make routine observations in accordance with 5.3.1.

5.4 Routine aircraft observations — exemptions

5.4.1 When voice communications are used, an aircraft shall be exempted from making the routine observations specified in 5.3.2 when:

- a) the aircraft is not equipped with RNAV equipment; or
- b) the flight duration is 2 hours or less; or
- c) the aircraft is at a distance equivalent to less than one hour of flying time from the next intended point of landing; or
- d) the altitude of the flight path is below 1 500 m (5 000 ft).

5.4.2 Recommendation.— *When voice communications are used, additional exemptions may be prescribed by regional air navigation agreement for flights over routes and areas with high-density air traffic and/or with adequate synoptic networks. Such procedures should take the form of exemption or designation procedures and should:*

- a) *make it possible for the minimum requirements for aircraft observations of all meteorological offices concerned to be met; and*
- b) *be as simple as possible to implement and preferably not involving consideration of individual cases.*

5.5 Special aircraft observations

Special observations shall be made by all aircraft whenever the following conditions are encountered or observed:

- a) severe turbulence; or
- b) severe icing; or
- c) severe mountain wave; or
- d) thunderstorms, without hail, that are obscured, embedded, widespread or in squall lines; or
- e) thunderstorms, with hail, that are obscured, embedded, widespread or in squall lines; or
- f) heavy duststorm or heavy sandstorm; or
- g) volcanic ash cloud; or
- h) pre-eruption volcanic activity or a volcanic eruption.

Note.— Pre-eruption volcanic activity in this context means unusual and/or increasing volcanic activity which could presage a volcanic eruption.

In addition, in the case of transonic and supersonic flights:

- i) moderate turbulence; or
- j) hail; or
- k) cumulonimbus clouds.

5.6 Other non-routine aircraft observations

When other meteorological conditions not listed under 5.5, e.g. wind shear, are encountered and which, in the opinion of the pilot-in-command, may affect the safety or markedly affect the efficiency of other aircraft operations, the pilot-in-command shall advise the appropriate air traffic services unit as soon as practicable.

Note.— Icing, turbulence and, to a large extent, wind shear, are elements which, for the time being, cannot be satisfactorily observed from the ground and for which in most cases aircraft observations represent the only available evidence.

5.7 Reporting of aircraft observations during flight

5.7.1 Aircraft observations shall be reported by air-ground data link. Where air-ground data link is not available or appropriate, aircraft observations during flight shall be reported by voice communications.

5.7.2 Aircraft observations shall be reported during flight at the time the observation is made or as soon thereafter as is practicable.

5.7.3 Aircraft observations shall be reported as air-reports.

5.8 Relay of air-reports by ATS units

The meteorological authority concerned shall make arrangements with the appropriate ATS authority to ensure that, on receipt by the ATS units of:

- a) routine and special air-reports by voice communications, the ATS units relay them without delay to their associated meteorological watch office;
- b) routine air-reports by data link communications, the ATS units relay them without delay to WAFCs; and
- c) special air-reports by data link communications, the ATS units relay them without delay to their associated meteorological watch office and WAFCs.

5.9 Recording and post-flight reporting of aircraft observations of volcanic activity

Special aircraft observations of pre-eruption volcanic activity, a volcanic eruption or volcanic ash cloud shall be recorded on the special air-report of volcanic activity form. A copy of the form shall be included with the flight documentation provided to flights operating on routes which, in the opinion of the meteorological authority concerned, could be affected by volcanic ash clouds.

CHAPTER 6. FORECASTS

Note.— Technical specifications and detailed criteria related to this chapter are given in Appendix 5.

6.1 Interpretation and use of forecasts

6.1.1 Owing to the variability of meteorological elements in space and time, to limitations of forecasting techniques and to limitations caused by the definitions of some of the elements, the specific value of any of the elements given in a forecast shall be understood by the recipient to be the most probable value which the element is likely to assume during the period of the forecast. Similarly, when the time of occurrence or change of an element is given in a forecast, this time shall be understood to be the most probable time.

Note.— Guidance on the operationally desirable accuracy of forecasts is given in Attachment B.

6.1.2 The issue of a new forecast by a meteorological office, such as a routine aerodrome forecast, shall be understood to cancel automatically any forecast of the same type previously issued for the same place and for the same period of validity or part thereof.

6.2 Aerodrome forecasts

6.2.1 An aerodrome forecast shall be prepared by the meteorological office designated by the meteorological authority concerned.

6.2.2 An aerodrome forecast shall be issued at a specified time and consist of a concise statement of the expected meteorological conditions at an aerodrome for a specified period.

6.2.3 Aerodrome forecasts and amendments thereto shall be issued as TAF and include the following information in the order indicated:

- a) identification of the type of forecast;
- b) location indicator;
- c) time of issue of forecast;
- d) identification of a missing forecast, when applicable;

- e) date and period of validity of forecast;
- f) identification of a cancelled forecast, when applicable;
- g) surface wind;
- h) visibility;
- i) weather;
- j) cloud; and
- k) expected significant changes to one or more of these elements during the period of validity.

Optional elements shall be included in TAF in accordance with regional air navigation agreement.

Note.— The visibility included in TAF refers to the forecast prevailing visibility.

6.2.4 Meteorological offices preparing TAF shall keep the forecasts under continuous review and, when necessary, shall issue amendments promptly. The length of the forecast messages and the number of changes indicated in the forecast shall be kept to a minimum.

6.2.5 TAF that cannot be kept under continuous review shall be cancelled.

6.2.6 **Recommendation.—** *The period of validity of a routine TAF should be not less than 9 hours nor more than 24 hours; this period should be determined by regional air navigation agreement. Routine TAF valid for less than 12 hours should be issued every 3 hours and those valid for 12 to 24 hours should be issued every 6 hours.*

6.3 Landing forecasts

6.3.1 A landing forecast shall be prepared by the meteorological office designated by the meteorological authority concerned; such forecasts are intended to meet requirements of local users and of aircraft within about one hour's flying time from the aerodrome.

6.3.2 Landing forecasts shall be prepared in the form of a trend forecast, as determined by regional air navigation agreement.

6.3.3 A trend forecast shall consist of a concise statement of the expected significant changes in the meteorological conditions at that aerodrome to be appended to a local routine or local special report, or a METAR or SPECI. The period of validity of a trend forecast shall be 2 hours from the time of the report which forms part of the landing forecast.

6.4 Forecasts for take-off

6.4.1 A forecast for take-off shall be prepared by the meteorological office designated by the meteorological authority concerned.

6.4.2 **Recommendation.**— *A forecast for take-off should refer to a specified period of time and should contain information on expected conditions over the runway complex in regard to surface wind direction and speed and any variations thereof, temperature, pressure (QNH), and any other elements as agreed locally.*

6.4.3 **Recommendation.**— *A forecast for take-off should be supplied to operators and flight crew members on request within the 3 hours before the expected time of departure.*

6.4.4 **Recommendation.**— *Meteorological offices preparing forecasts for take-off should keep the forecasts under continuous review and, when necessary, should issue amendments promptly.*

6.5 Area and route forecasts, other than forecasts issued within the framework of the world area forecast system

Note.— Provisions concerning forecasts issued within the framework of the world area forecast system are contained in Chapter 3 and Appendix 2 and those concerning area forecasts for low-level flights, under Section 6.6 and Appendix 5.

6.5.1 Area and route forecasts shall contain upper winds, upper-air temperatures, significant en-route weather phenom-

ena and associated clouds. Other elements may be added as required. This information shall cover the flight operations for which they are intended in respect of time, altitude and geographical extent.

6.5.2 Meteorological offices preparing area and route forecasts shall keep the forecasts under continuous review and issue amendments as necessary.

6.6 Area forecasts for low-level flights

6.6.1 When the density of traffic operating below flight level 100 (or up to flight level 150 in mountainous areas, or higher, where necessary) warrants the routine issue and dissemination of area forecasts for such operations, the frequency of issue, the form and the fixed time or period of validity of those forecasts and the criteria of amendments thereto shall be determined by the meteorological authority in consultation with the users.

6.6.2 When the density of traffic operating below flight level 100 warrants the issuance of AIRMET information in accordance with 7.2.1, area forecasts for such operations shall be prepared in a format agreed upon between the meteorological authorities concerned. When abbreviated plain language is used, the forecast shall be prepared as a GAMET area forecast, employing approved ICAO abbreviations and numerical values. The area forecasts shall be issued to cover the layer between the ground and flight level 100 (or up to flight level 150 in mountainous areas, or higher, where necessary) and shall contain information on en-route weather phenomena hazardous to low-level flights, in support of the issuance of AIRMET information, and additional information required by low-level flights.

6.6.3 Area forecasts for low-level flights prepared in support of the issuance of AIRMET information shall be issued every 6 hours for a period of validity of 6 hours and transmitted to meteorological offices concerned not later than one hour prior to the beginning of their validity period.

CHAPTER 7. SIGMET AND AIRMET INFORMATION, AERODROME WARNINGS AND WIND SHEAR WARNINGS

Note.— Technical specifications and detailed criteria related to this chapter are given in Appendix 6.

7.1 SIGMET information

7.1.1 SIGMET information shall be issued by a meteorological watch office and shall give a concise description in abbreviated plain language concerning the occurrence and/or expected occurrence of specified en-route weather phenomena, which may affect the safety of aircraft operations, and of the development of those phenomena in time and space.

7.1.2 SIGMET information shall be cancelled when the phenomena are no longer occurring or are no longer expected to occur in the area.

7.1.3 The period of validity of a SIGMET message shall be not more than 6 hours, and preferably not more than 4 hours.

7.1.4 **Recommendation.**— *In the special case of SIGMET messages for volcanic ash cloud and tropical cyclones, an outlook should be included giving information for up to 12 hours beyond the period of validity specified in 7.1.3, concerning the trajectory of the volcanic ash cloud and positions of the tropical cyclone centre.*

7.1.5 **Recommendation.**— *SIGMET messages issued in accordance with 7.1.4, concerning volcanic ash cloud and tropical cyclones should be based on advisory information provided by VAACs and TCACs respectively, designated by regional air navigation agreement.*

7.1.6 Close coordination shall be maintained between the meteorological watch office and the associated area control centre/flight information centre to ensure that information on volcanic ash included in SIGMET and NOTAM messages is consistent.

7.1.7 A SIGMET message relating to the expected occurrence of weather phenomena listed in Appendix 6, 1.1.4, with the exception of volcanic ash cloud and tropical cyclones, shall be issued not more than 6 hours, and preferably not more than 4 hours, before the expected time of occurrence of that phenomenon.

7.1.8 **Recommendation.**— *SIGMET messages concerning volcanic ash cloud or tropical cyclones expected to affect a flight information region should be issued up to 12 hours before the commencement of the period of validity or as soon as practicable if such advance warning of the existence of these phenomena is not available. SIGMET messages for volcanic ash and tropical cyclones should be updated at least every 6 hours.*

7.2 AIRMET information

7.2.1 AIRMET information shall be issued by a meteorological watch office in accordance with regional air navigation agreement, taking into account the density of air traffic operating below flight level 100. AIRMET information shall give a concise description in abbreviated plain language concerning the occurrence and/or expected occurrence of specified en-route weather phenomena, which have not been included in Section I of the area forecast for low-level flights issued in accordance with Chapter 6, Section 6.6 and which may affect the safety of low-level flights, and of the development of those phenomena in time and space.

7.2.2 AIRMET information shall be cancelled when the phenomena are no longer occurring or are no longer expected to occur in the area.

7.2.3 The period of validity of an AIRMET message shall be not more than 6 hours, and preferably not more than 4 hours.

7.3 Aerodrome warnings

7.3.1 Aerodrome warnings shall be issued by the meteorological office designated by the meteorological authority concerned and shall give concise information of meteorological conditions which could adversely affect aircraft on the ground, including parked aircraft, and the aerodrome facilities and services.

7.3.2 **Recommendation.**— *Aerodrome warnings should be cancelled when the conditions are no longer occurring and/or no longer expected to occur at the aerodrome.*

7.4 Wind shear warnings

7.4.1 Wind shear warnings shall be prepared by the meteorological office designated by the meteorological authority concerned and shall give concise information of the observed or expected existence of wind shear which could adversely affect aircraft on the approach path or take-off path or during circling approach between runway level and 500 m (1 600 ft) above that level and aircraft on the runway during the landing roll or take-off run. Where local topography has been shown to produce significant wind shears at heights in excess of 500 m (1 600 ft) above runway level, then 500 m (1 600 ft) shall not be considered restrictive.

Note.— Guidance on the subject of wind shear is contained in the Manual on Wind Shear (Doc 9817, in preparation).

7.4.2 **Recommendation.—** *Wind shear warnings for arriving aircraft and/or departing aircraft should be cancelled when aircraft reports indicate that wind shear no longer exists, or alternatively, after an agreed elapsed time. The criteria for the cancellation of a wind shear warning should be defined locally for each aerodrome, as agreed between the meteorological authority, the appropriate ATS authority and the operators concerned.*

CHAPTER 8. AERONAUTICAL CLIMATOLOGICAL INFORMATION

Note.— Technical specifications and detailed criteria related to this chapter are given in Appendix 7.

8.1 General provisions

Note.— In cases where it is impracticable to meet the requirements for aeronautical climatological information on a national basis, the collection, processing and storage of observational data may be effected through computer facilities available for international use, and the responsibility for the preparation of the required aeronautical climatological information may be delegated by agreement between the meteorological authorities concerned.

8.1.1 Aeronautical climatological information required for the planning of flight operations shall be prepared in the form of aerodrome climatological tables and aerodrome climatological summaries. Such information shall be supplied to aeronautical users as agreed between the meteorological authority and those users.

Note.— Climatological data required for aerodrome planning purposes are set out in Annex 14, Volume I, 3.1.3 and in Attachment A.

8.1.2 **Recommendation.**— *Aeronautical climatological information should normally be based on observations made over a period of at least five years and the period should be indicated in the information supplied.*

8.1.3 **Recommendation.**— *Climatological data related to sites for new aerodromes and to additional runways at existing aerodromes should be collected starting as early as possible before the commissioning of those aerodromes or runways.*

8.2 Aerodrome climatological tables

Recommendation.— *Each Contracting State should make arrangements for collecting and retaining the necessary observational data and have the capability:*

- a) to prepare aerodrome climatological tables for each regular and alternate international aerodrome within its territory; and*
- b) to make available such climatological tables to an aeronautical user within a time period as agreed between the meteorological authority and that user.*

8.3 Aerodrome climatological summaries

Recommendation.— *Aerodrome climatological summaries should follow the procedures prescribed by the World Meteorological Organization. Where computer facilities are available to store, process and retrieve the information, the summaries should be published, or otherwise made available to aeronautical users on request. Where such computer facilities are not available, the summaries should be prepared using the models specified by the World Meteorological Organization, and should be published and kept up to date as necessary.*

8.4 Copies of meteorological observational data

Each meteorological authority, on request and to the extent practicable, shall make available to any other meteorological authority, to operators and to others concerned with the application of meteorology to international air navigation, meteorological observational data required for research, investigation or operational analysis.

CHAPTER 9. SERVICE FOR OPERATORS AND FLIGHT CREW MEMBERS

Note.— Technical specifications and detailed criteria related to this chapter are given in Appendix 8.

9.1 General provisions

9.1.1 Meteorological information shall be supplied to operators and flight crew members for:

- a) pre-flight planning by operators;
- b) in-flight re-planning by operators using centralized operational control of flight operations;
- c) use by flight crew members before departure; and
- d) aircraft in flight.

9.1.2 Meteorological information supplied to operators and flight crew members shall cover the flight in respect of time, altitude and geographical extent. Accordingly, the information shall relate to appropriate fixed times, or periods of time, and shall extend to the aerodrome of intended landing, also covering the meteorological conditions expected between the aerodrome of intended landing and one alternate aerodrome designated by the operator. In addition, if agreed between the meteorological authority and the operator, information up to a further aerodrome shall be supplied.

9.1.3 Meteorological information supplied to operators and flight crew members shall include upper winds and upper-air temperatures, significant en-route weather phenomena, METAR and SPECI (including trend forecasts), TAF, forecasts for take-off, SIGMET information and those special air-reports not covered by a SIGMET, and AIRMET information, which are available at the meteorological office and which are relevant to the planned flight operations.

9.1.4 Where necessary, the meteorological authority of the State providing service for operators and flight crew members shall initiate coordinating action with the meteorological authorities of other States with a view to obtaining from them the reports and/or forecasts required.

9.1.5 Meteorological information shall be supplied to operators and flight crew members at the location to be determined by the meteorological authority, after consultation with the operators and at the time to be agreed upon between the meteorological office and the operator concerned. The service shall normally be confined to flights originating within the territory of the State concerned, unless otherwise agreed between

the meteorological authority and the operator concerned. At an aerodrome without a meteorological office, arrangements for the supply of meteorological information shall be as agreed upon between the meteorological authority and the operator concerned.

9.2 Information for operators for pre-flight planning and for in-flight re-planning under centralized operational control

9.2.1 Meteorological information for pre-flight planning and in-flight re-planning by operators shall include any or all of the following information, as established by the meteorological authority in consultation with operators concerned:

- a) current and forecast: upper winds, upper-air temperatures and humidity;
- b) tropopause height and temperature, and direction, speed and height of maximum wind;
- c) existing and expected significant en-route weather phenomena and amendments thereto;
- d) a forecast for take-off;
- e) METAR and, where available, SPECI (including trend forecasts) for the aerodrome of departure, take-off and en-route alternate aerodromes, the aerodrome of intended landing and destination alternate aerodromes, as determined by regional air navigation agreement;
- f) TAF and amendments thereto for the aerodromes of departure and intended landing, and for take-off, en-route and destination alternate aerodromes as determined by regional air navigation agreement;
- g) SIGMET information and appropriate special air-reports relevant to the whole of the routes concerned as determined by regional air navigation agreement; and

Note.— Appropriate special air-reports will be those not already used in preparation of SIGMET messages.

- h) AIRMET information for low-level flights as determined by regional air navigation agreement.

9.2.2 When upper-air information is supplied in chart form, it shall consist of charts for standard flight levels.

9.2.3 Recommendation.— *The upper wind and upper-air temperature information and the significant en-route weather information requested for pre-flight planning and in-flight re-planning by the operator should be supplied as soon as it becomes available, but not later than 3 hours before departure. Other meteorological information requested for pre-flight planning and in-flight re-planning by the operator should be supplied as soon as is practicable.*

9.3 Briefing, consultation and display

Note.— *The requirements for the use of automated pre-flight information systems in providing briefing, consultation and display are given in 9.5.*

9.3.1 Briefing and/or consultation shall be provided, on request, to flight crew members and/or other flight operations personnel. Its purpose shall be to supply the latest available information on existing and expected meteorological conditions along the route to be flown, at the aerodrome of intended landing, alternate aerodromes and other aerodromes as relevant, either to explain and amplify the information contained in the flight documentation or, if so agreed between the meteorological authority and the operator, in lieu of flight documentation.

9.3.2 Meteorological information used for briefing and consultation shall include any or all of the information listed in 9.2.1.

9.3.3 If the meteorological office expresses an opinion on the development of the meteorological conditions at an aerodrome which differs appreciably from the aerodrome forecast included in the flight documentation, the attention of flight crew members shall be drawn to the divergence. The portion of the briefing dealing with the divergence shall be recorded at the time of briefing and this record shall be made available to the operator.

9.3.4 The required briefing, consultation, display and/or flight documentation shall normally be provided by the meteorological office associated with the aerodrome of departure. At an aerodrome where these services are not available, arrangements to meet the requirements of flight crew members shall be as agreed upon between the meteorological authority and the operator concerned. In exceptional circumstances, such as an undue delay, the meteorological office associated with the aerodrome shall provide or, if that is not practicable, arrange for the provision of a new briefing, consultation and/or flight documentation as necessary.

9.3.5 Recommendation.— *The flight crew member or other flight operations personnel for whom briefing, consultation and/or flight documentation has been requested should visit the meteorological office at the time agreed upon between the meteorological office and the operator concerned. Where*

local circumstances at an aerodrome make personal briefing or consultation impracticable, the meteorological office should provide those services by telephone or other suitable telecommunications facilities.

9.4 Flight documentation

Note.— *The requirements for the use of automated pre-flight information systems in providing flight documentation are given in 9.5.*

9.4.1 Recommendation.— *Flight documentation should cover the whole route to be flown and comprise information listed under 9.2.1 a), c) and e) to h). However, in accordance with regional air navigation agreement, or in the absence thereof when agreed between the meteorological authority and operator concerned, flight documentation for flights of two hours' duration or less, after a short stop or turnaround should be limited to the information operationally needed, but in all cases the flight documentation should at least comprise information on 9.2.1 e), f), g) and, if appropriate, h).*

9.4.2 Recommendation.— *Meteorological offices should provide information received within the framework of the world area forecast system for flight documentation. The flight documentation should be presented in the form of charts, tabular forms, or abbreviated plain-language texts. TAF should be presented in accordance with the template in Appendix 5 or in abbreviated plain-language text using a tabular presentation.*

Note.— *Models of charts and forms for use in the preparation of flight documentation are given in Appendix 1. These models and methods for their completion are developed by the World Meteorological Organization on the basis of relevant operational requirements stated by the International Civil Aviation Organization.*

9.4.3 Whenever it becomes apparent that the meteorological information to be included in the flight documentation will differ materially from that made available for pre-flight planning and in-flight re-planning, the operator shall be advised immediately and, if practicable, be supplied with the revised information as agreed between the operator and the meteorological office concerned.

9.4.4 Recommendation.— *Whenever necessary and possible, the flight documentation should be brought up to date, in writing or orally, before it is supplied to flight crew members. In cases where a need for amendment arises after the flight documentation has been supplied, and before take-off of the aircraft, the meteorological office should, as agreed locally, issue the necessary amendment or updated information to the operator or to the local air traffic services unit, for transmission to the aircraft.*

9.4.5 Recommendation.— *The forms and charts included in flight documentation should be printed in English, French, Russian or Spanish; they should, wherever practicable, be completed in the language requested by the operator, preferably using one of those languages. Where appropriate, approved abbreviations should be used. The units employed for each element should be indicated; they should be in accordance with Annex 5.*

9.4.6 The meteorological authority shall retain information supplied to flight crew members, either as printed copies or in computer files, for a period of at least 30 days from the date of issue. This information shall be made available, on request, for inquiries or investigations and, for these purposes, shall be retained until the inquiry or investigation is completed.

9.5 Automated pre-flight information systems for briefing, consultation, flight planning and flight documentation

9.5.1 Where the meteorological authority uses automated pre-flight information systems to supply and display meteorological information to operators and flight crew members for self-briefing, flight planning and flight documentation purposes, the information supplied and displayed shall comply with the relevant provisions in 9.1 to 9.4 inclusive.

9.5.2 Recommendation.— *Automated pre-flight information systems providing for a harmonized, common point of access to meteorological information and aeronautical information services information by operators, flight crew members and other aeronautical personnel concerned should be established by an agreement between the meteorological authority and the relevant civil aviation authority or the agency to which the authority to provide service has been delegated in accordance with Annex 15, 3.1.1 c).*

Note.— *The meteorological and aeronautical information services information concerned is specified in 9.1 to 9.4 and Appendix 8 and in Annex 15, 8.1 and 8.2, respectively.*

9.5.3 Where automated pre-flight information systems are used to provide for a harmonized, common point of access to meteorological information and aeronautical information services information by operators, flight crew members and other aeronautical personnel concerned, the meteorological authority concerned shall remain responsible for the quality control and quality management of meteorological information provided by means of such systems in accordance with Chapter 2, 2.2.2.

Note.— *The responsibilities relating to aeronautical information services information and the quality assurance of the information are given in Annex 15, Chapter 3.*

9.6 Information for aircraft in flight

9.6.1 Meteorological information for use by aircraft in flight shall be supplied by a meteorological office to its associated air traffic services unit and through D-VOLMET or VOLMET broadcasts. Meteorological information for planning by the operator for aircraft in flight shall be supplied on request, as agreed between the meteorological authority or authorities and the operator concerned.

9.6.2 Meteorological information for use by aircraft in flight shall be supplied to air traffic services units in accordance with the specifications of Chapter 10.

9.6.3 Meteorological information shall be supplied through D-VOLMET or VOLMET broadcasts as determined by regional air navigation agreement, and in accordance with the specifications of Chapter 11.

CHAPTER 10. INFORMATION FOR AIR TRAFFIC SERVICES, SEARCH AND RESCUE SERVICES AND AERONAUTICAL INFORMATION SERVICES

Note.— Technical specifications and detailed criteria related to this chapter are given in Appendix 9.

10.1 Information for air traffic services units

10.1.1 The meteorological authority shall designate a meteorological office to be associated with each air traffic services unit. The associated meteorological office shall, after coordination with the air traffic services unit, supply, or arrange for the supply of up-to-date meteorological information to the unit as necessary for the conduct of its functions.

10.1.2 **Recommendation.—** *The associated meteorological office for an aerodrome control tower or approach control office should be an aerodrome meteorological office.*

10.1.3 The associated meteorological office for a flight information centre or an area control centre shall be a meteorological watch office.

10.1.4 **Recommendation.—** *Where, owing to local circumstances, it is convenient for the duties of an associated meteorological office to be shared between two or more meteorological offices, the division of responsibility should be determined by the meteorological authority in consultation with the appropriate ATS authority.*

10.1.5 Any meteorological information requested by an air traffic services unit in connection with an aircraft emergency shall be supplied as rapidly as possible.

10.2 Information for search and rescue services units

Meteorological offices designated by the meteorological authority in accordance with regional air navigation agreement shall supply search and rescue services units with the meteorological information they require in a form established by mutual agreement. For that purpose, the designated meteorological office shall maintain liaison with the search and rescue services unit throughout a search and rescue operation.

10.3 Information for aeronautical information services units

The meteorological authority, in coordination with the appropriate civil aviation authority, shall arrange for the supply of up-to-date meteorological information to relevant aeronautical information services units, as necessary, for the conduct of their functions.

CHAPTER 11. REQUIREMENTS FOR AND USE OF COMMUNICATIONS

Note 1.— Technical specifications and detailed criteria related to this chapter are given in Appendix 10.

Note 2.— It is recognized that it is for each Contracting State to decide upon its own internal organization and responsibility for implementing the telecommunications facilities referred to in this chapter.

11.1 Requirements for communications

11.1.1 Suitable telecommunications facilities shall be made available to permit aerodrome meteorological offices and, as necessary, aeronautical meteorological stations to supply the required meteorological information to air traffic services units on the aerodromes for which those offices and stations are responsible, and in particular to aerodrome control towers, approach control offices and the aeronautical telecommunications stations serving these aerodromes.

Note.— Circuits of the aeronautical fixed service are used for the collection and regional and inter-regional exchanges of operational meteorological information as well as for access to international operational meteorological data banks. Three aeronautical fixed service satellite distribution systems providing for global coverage are used to support the regional and inter-regional exchanges of operational meteorological information. Provisions relating to the satellite distribution systems are given in Annex 10, Volume III, Part 1, 10.1 and 10.2.

11.1.2 Suitable telecommunications facilities shall be made available to permit meteorological watch offices to supply the required meteorological information to air traffic services and search and rescue services units in respect of the flight information regions, control areas and search and rescue regions for which those offices are responsible, and in particular to flight information centres, area control centres and rescue coordination centres and the associated aeronautical telecommunications stations.

11.1.3 Suitable telecommunications facilities shall be made available to permit world area forecast centres to supply the required world area forecast system products to meteorological offices, meteorological authorities and other users.

11.1.4 Telecommunications facilities between meteorological offices and, as necessary, aeronautical meteorological stations and aerodrome control towers or approach control offices shall permit communications by direct speech, the speed with which the communications can be established being such that the required points may normally be contacted within approximately 15 seconds.

11.1.5 **Recommendation.—** *Telecommunications facilities between meteorological offices and flight information centres, area control centres, rescue coordination centres and aeronautical telecommunications stations should permit:*

- a) communications by direct speech, the speed with which the communications can be established being such that the required points may normally be contacted within approximately 15 seconds; and*
- b) printed communications, when a record is required by the recipients; the message transit time should not exceed 5 minutes.*

Note.— In 11.1.4 and 11.1.5 “approximately 15 seconds” refers to telephony communications involving switchboard operation and “5 minutes” refers to printed communications involving retransmission.

11.1.6 **Recommendation.—** *The telecommunications facilities required in accordance with 11.1.4 and 11.1.5 should be supplemented, as and where necessary, by other forms of visual or audio communications, for example, closed-circuit television or separate information processing systems.*

11.1.7 **Recommendation.—** *As agreed between the meteorological authority and operators, provision should be made to enable operators to establish suitable telecommunications facilities for obtaining meteorological information from aerodrome meteorological offices or other appropriate sources.*

11.1.8 Suitable telecommunications facilities shall be made available to permit meteorological offices to exchange operational meteorological information with other meteorological offices.

11.1.9 **Recommendation.—** *The telecommunications facilities used for the exchange of operational meteorological information should be the aeronautical fixed service.*

11.2 Use of aeronautical fixed service communications — meteorological bulletins in alphanumeric format

Meteorological bulletins containing operational meteorological information to be transmitted via the aeronautical fixed service shall be originated by the appropriate meteorological office or aeronautical meteorological station.

Note.— Meteorological bulletins containing operational meteorological information authorized for transmission via the

aeronautical fixed service are listed in Annex 10, Volume II, Chapter 4, together with the relevant priorities and priority indicators.

11.3 Use of aeronautical fixed service communications — world area forecast system products

Recommendation.— *World area forecast system products in digital form should be transmitted using binary data communications techniques. The method and channels used for the dissemination of the products should be as determined by regional air navigation agreement.*

11.4 Use of aeronautical mobile service communications

The content and format of meteorological information transmitted to aircraft and by aircraft shall be consistent with the provisions of this Annex.

11.5 Use of aeronautical data link service — contents of D-VOLMET

D-VOLMET shall contain current METAR and SPECI, together with trend forecasts where available, TAF and

SIGMET, special air-reports not covered by a SIGMET and, where available, AIRMET.

Note.— *The requirement to provide METAR and SPECI may be met by the data link-flight information service (D-FIS) application entitled “Data link-aerodrome routine meteorological report (D-METAR) service”; the requirement to provide TAF may be met by the D-FIS application entitled “Data link-aerodrome forecast (D-TAF) service”; and the requirement to provide SIGMET and AIRMET messages may be met by the D-FIS application entitled “Data link-SIGMET (D-SIGMET) service”. The details of these data link services are specified in the Manual of Air Traffic Services Data Link Applications (Doc 9694).*

11.6 Use of aeronautical broadcasting service — contents of VOLMET broadcasts

11.6.1 Continuous VOLMET broadcasts, normally on very high frequencies (VHF), shall contain current METAR and SPECI, together with trend forecasts where available.

11.6.2 Scheduled VOLMET broadcasts, normally on high frequencies (HF), shall contain current METAR and SPECI, together with trend forecasts where available and, where so determined by regional air navigation agreement, TAF and SIGMET.

INTERNATIONAL STANDARDS AND RECOMMENDED PRACTICES

PART II

APPENDICES AND ATTACHMENTS

APPENDIX 1. FLIGHT DOCUMENTATION — MODEL CHARTS AND FORMS

(See Chapter 9 of this Annex.)

MODEL A	— Aerodrome forecasts Example 1 — Tabular form Example 2 — TAF
MODEL TA	— Tabular forecast of en-route conditions Example 1 — Low level Example 2 — Medium level
MODEL TB	— Tabular forecast of upper winds and upper-air temperatures Example — Spot locations
MODEL IS	— Upper wind and temperature chart for standard isobaric surface Example 1 — Arrows, feathers and pennants (Mercator projection) Example 2 — Arrows, feathers and pennants (Polar stereographic projection)
MODEL SWH	— Significant weather chart (high level) Example 1 — Mercator projection Example 2 — Polar stereographic projection Example 3 — Polar stereographic projection (showing the jet stream vertical extent and crossing jet stream depictions)

Note.— In accordance with Appendix 8, 4.3.1.1 m) additional information related to volcanic ash should be placed at the side of the charts.

MODEL SWM	— Significant weather chart (medium level)
MODEL SWL	— Significant weather chart (low level) Example 1 Example 2
MODEL VAG	— Volcanic ash advisory information in graphical format
MODEL SN	— Sheet of notations used in flight documentation

Model A. Aerodrome forecasts
Example 1 — Tabular form

ISSUED BY METEOROLOGICAL OFFICE DATE TIME (UTC)										
HEIGHTS ABOVE AERODROME ELEVATION										
Aerodrome	Date and time of issue	Period of validity (UTC)	Type and time of change	Surface wind mean direction (degrees true) mean wind speed maximum wind speed	Prevailing visibility	Weather	Cloud		Forecast temperature (degrees Celsius)	Remarks
							Lowest layer amount, height of base (feet) and type (if CB)	Higher layers amount, height of base (feet) and type (if CB)		
MOMBASA	150350	06-06	TEMPO 09-12	150/15 KT VRB/20 KT MAX 30 KT	10 KM 200 M	HVY SHRA	FEW 1500 SCT 1000 CB	BKN 1500	MAX 30 AT 1200 Z MIN 20 AT 0400 Z	
NAIROBI	142140	03-15	PROB 40 TEMPO 03-05 BECMG 05-06	060/05 KT VRB/03 KT 060/10 KT	2 000 M 500 M 10 KM	FG NSW	OVC 0200 SCT 1500		N/A	EXTRACTED FROM TAF 00-24
KHARTOUM	150400	12-18	PROB 30 TEMPO 12-15	030/05 KT 030/20 KT	10 KM 100 M	MOD BLSA	SCT 2500		MAX 30 AT 1300 Z	EXTRACTED FROM TAF 06-06
CAIRO	150345	06-06		060/10 KT		C A V O K			MAX 25 AT 1400 Z MIN 06 AT 0500 Z	
ROME	151120	12-06	FM 1400 FM 1800	270/10 KT 270/10 KT 330/15 KT	2 000 M 5 000 M 10 KM	HVY DZRA MOD RA NSW	BKN 500 BKN 1200 BKN 2500	OVC 1500 OVC 2000	MAX 06 AT 1500 Z MIN MS 02 AT 0400 Z	TAF 06-06 AMENDED

Model A. Aerodrome forecasts**Example 2 — TAF**

ISSUED BY METEOROLOGICAL OFFICE (DATE, TIME UTC)																																												
<p>INTENSITY</p> <p>“–” (light); no indicator (moderate); “+” (heavy, or well-developed in the case of dust/sand whirls (dust devils) and funnel clouds) are used to indicate the forecast intensity of certain phenomena</p> <p>DESCRIPTORS</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 25%;">MI — shallow</td> <td style="width: 25%;">DR— low drifting</td> <td style="width: 25%;">SH— shower(s)</td> <td style="width: 25%;">FZ — freezing (supercooled)</td> </tr> <tr> <td>BC— patches</td> <td>BL — blowing</td> <td>TS — thunderstorm</td> <td></td> </tr> <tr> <td>PR — partial</td> <td></td> <td></td> <td></td> </tr> </table> <p>FORECAST WEATHER ABBREVIATIONS</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 33%;">DZ — drizzle</td> <td style="width: 33%;">BR — mist</td> <td style="width: 33%;">PO — dust/sand whirls (dust devils)</td> </tr> <tr> <td>RA — rain</td> <td>FG — fog</td> <td>SQ — squall</td> </tr> <tr> <td>SN — snow</td> <td>FU — smoke</td> <td>FC — funnel cloud(s) (tornado or waterspout)</td> </tr> <tr> <td>SG — snow grains</td> <td>VA — volcanic ash</td> <td>SS — sandstorm</td> </tr> <tr> <td>IC — ice crystals (diamond dust)</td> <td>DU — widespread dust</td> <td>DS — duststorm</td> </tr> <tr> <td>PL — ice pellets</td> <td>SA — sand</td> <td></td> </tr> <tr> <td>GR — hail</td> <td>HZ — haze</td> <td></td> </tr> <tr> <td>GS — small hail and/or snow pellets</td> <td></td> <td></td> </tr> </table> <p>EXAMPLES</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">+SHRA — heavy shower of rain</td> <td style="width: 50%;">TSSN — thunderstorm with moderate snow</td> </tr> <tr> <td>FZDZ — moderate freezing drizzle</td> <td>SNRA — moderate snow and rain</td> </tr> <tr> <td>+TSSNGR — thunderstorm with heavy snow and hail</td> <td></td> </tr> </table>			MI — shallow	DR— low drifting	SH— shower(s)	FZ — freezing (supercooled)	BC— patches	BL — blowing	TS — thunderstorm		PR — partial				DZ — drizzle	BR — mist	PO — dust/sand whirls (dust devils)	RA — rain	FG — fog	SQ — squall	SN — snow	FU — smoke	FC — funnel cloud(s) (tornado or waterspout)	SG — snow grains	VA — volcanic ash	SS — sandstorm	IC — ice crystals (diamond dust)	DU — widespread dust	DS — duststorm	PL — ice pellets	SA — sand		GR — hail	HZ — haze		GS — small hail and/or snow pellets			+SHRA — heavy shower of rain	TSSN — thunderstorm with moderate snow	FZDZ — moderate freezing drizzle	SNRA — moderate snow and rain	+TSSNGR — thunderstorm with heavy snow and hail	
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RJTT	122130Z	130024 VRB03KT 4000 SCT025 BECMG 0305 9999 T30/12Z T20/06Z =																																										
EGLL	090845Z	091212 27010KT 9999 SCT020 FM2100 30015KT 3000 FZDZ BKN006 FM0000 30015KT 0800 +RASN BKN004 BECMG 0305 33020KT 5000 NSW SCT020 BECMG 0709 9999 =																																										
LFPG	160910Z	161212 10008KT CAVOK FM2000 VRB03KT 8000 SCT012 FM0400 VRB03KT 0800 FG FM0900 10008KT CAVOK =																																										
OBBI	030300Z	030624 03010KT 9999 SCT010 PROB30 TEMPO 0915 03030KT 0500 BLSA FM1800 VRB02KT 8000 SCT020 =																																										
HKJK	280215Z	280624 06010KT 9999 SCT025 TEMPO 1216 3000 SHRA BKN015 PROB40 TEMPO 1416 VRB20G30KT +TSRA SCT010CB BKN015 =																																										

Model TA. Tabular forecast of en-route conditions
Example 1 — Low level

DATE			HEIGHTS IN FEET ABOVE MSL		
ROUTE FROM BIGGIN HILL			TO AMSTERDAM VIA AIRWAYS		
VALID FOR DEPARTURE BETWEEN 1500			UTC AND 1700 UTC AND		
FOR ARRIVAL BETWEEN 1700			UTC AND 2100 UTC		
SPECIAL FEATURES OF THE METEOROLOGICAL SITUATION:					
ACTIVE COLD FRONT FROM HUMBER TO CHANNEL ISLES AT 1000 UTC MOVING EAST AT 20 KNOTS TO LIE NORTH/SOUTH ACROSS TRACK ABOUT 40 NM WEST OF AMSTERDAM BY 1900 UTC.					
ZONE	LONDON		02° E	AMSTERDAM	
UPPER WINDS (DEGREES TRUE AND KNOTS) 10 000 ft TEMPERATURES 5 000 ft (DEGREES CELSIUS) 2 000 ft	280/30 MS 12 290/25 MS 03 290/20 PS 03			250/45 MS 09 240/35 00 230/30 PS 06	
CLOUD	SCT CU <u>XXX</u> 1500 BKN SC <u>5000</u> 2500 BKN AC LYR <u>XXX</u> 8000			ISOL EMBD CB <u>XXX</u> 1000 BKN ST <u>800</u> 500 OVC SC <u>XXX</u> AS LYR 2000	
SURFACE VISIBILITY	1 500 M IN SHOWERS			4 000 M IN MODERATE RAIN AND 1 000 M IN THUNDERSTORMS	
SIGNIFICANT WEATHER	MODERATE OCNL <u>10000</u> SEVERE ICING 3500			ISOL THUNDERSTORMS MODERATE OCNL <u>XXX</u> SEVERE ICING 5000 MODERATE OCNL SEVERE TURBULENCE IN <u>XXX</u> FRONTAL ZONE 1000	
HEIGHT OF 0°C ISOTHERM	3500			5000	
FORECAST LOWEST QNH (hPa)	1008			1004	

Issued by at UTC on 20 by Forecaster.

- Notes:**
1. Positive and negative values are indicated by the prefix "PS" (plus) and "MS" (minus), respectively.
 2. When a single numerical value of an element is given in a forecast it is to be interpreted as representing the most probable mean of a range of values which the element may assume during the period of the forecast.

Abbreviations: SKC — 0 oktas, FEW — 1 to 2 oktas, SCT — 3 to 4 oktas, BKN — 5 to 7 oktas, OVC — 8 oktas, LYR — Layered, LOC — Locally, ISOL — Isolated, OCNL — Occasional, FRQ — Frequent, EMBD — Embedded.

Model TA. Tabular forecast of en-route conditions
Example 2 — Medium level

DATE		HEIGHTS IN PRESSURE ALTITUDE IN HUNDREDS OF FEET	
ROUTE FROM BIGGIN HILL		TO AMSTERDAM VIA AIRWAYS	
VALID FOR DEPARTURE BETWEEN 1500 UTC AND 1700 UTC AND		FOR ARRIVAL BETWEEN 1700 UTC AND 2100 UTC	
SPECIAL FEATURES OF THE METEOROLOGICAL SITUATION (SURFACE CENTRES AND FRONTS):			
ACTIVE COLD FRONT FROM HUMBER TO CHANNEL ISLES AT 1000 UTC MOVING EAST AT 20 KNOTS TO LIE NORTH/SOUTH ACROSS TRACK ABOUT 40 NM WEST OF AMSTERDAM BY 1900 UTC.			
ZONE		LONDON	02° E AMSTERDAM
UPPER WINDS (DEGREES TRUE AND KNOTS) FL 240 TEMPERATURES FL 180 (DEGREES CELSIUS) FL 100		260/40 MS 40 270/35 MS 26 280/30 MS 12	240/60 MS 36 240/50 MS 24 250/45 MS 09
SIGNIFICANT WEATHER AND ASSOCIATED CLOUD		MODERATE TURBULENCE $\frac{180}{XXX}$	ISOL THUNDERSTORMS MODERATE TO SEVERE $\frac{240}{XXX}$ ICING AND TURBULENCE
* TROPOPAUSE HEIGHT		_____	_____
* JET STREAM		_____	_____

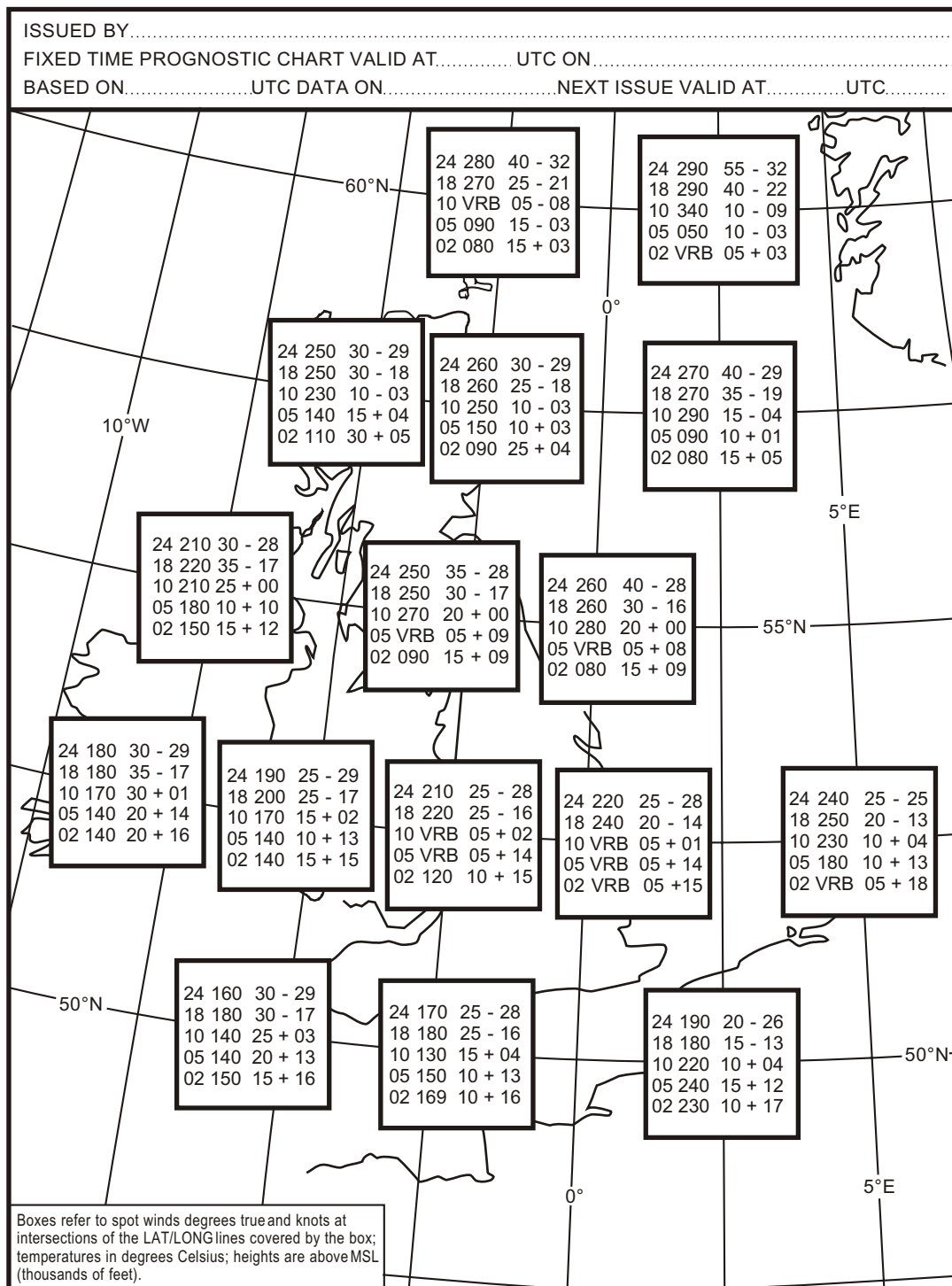
* Above planned cruise level if not specified.

Issued by **at** **UTC on** **20** **by** **Forecaster.**

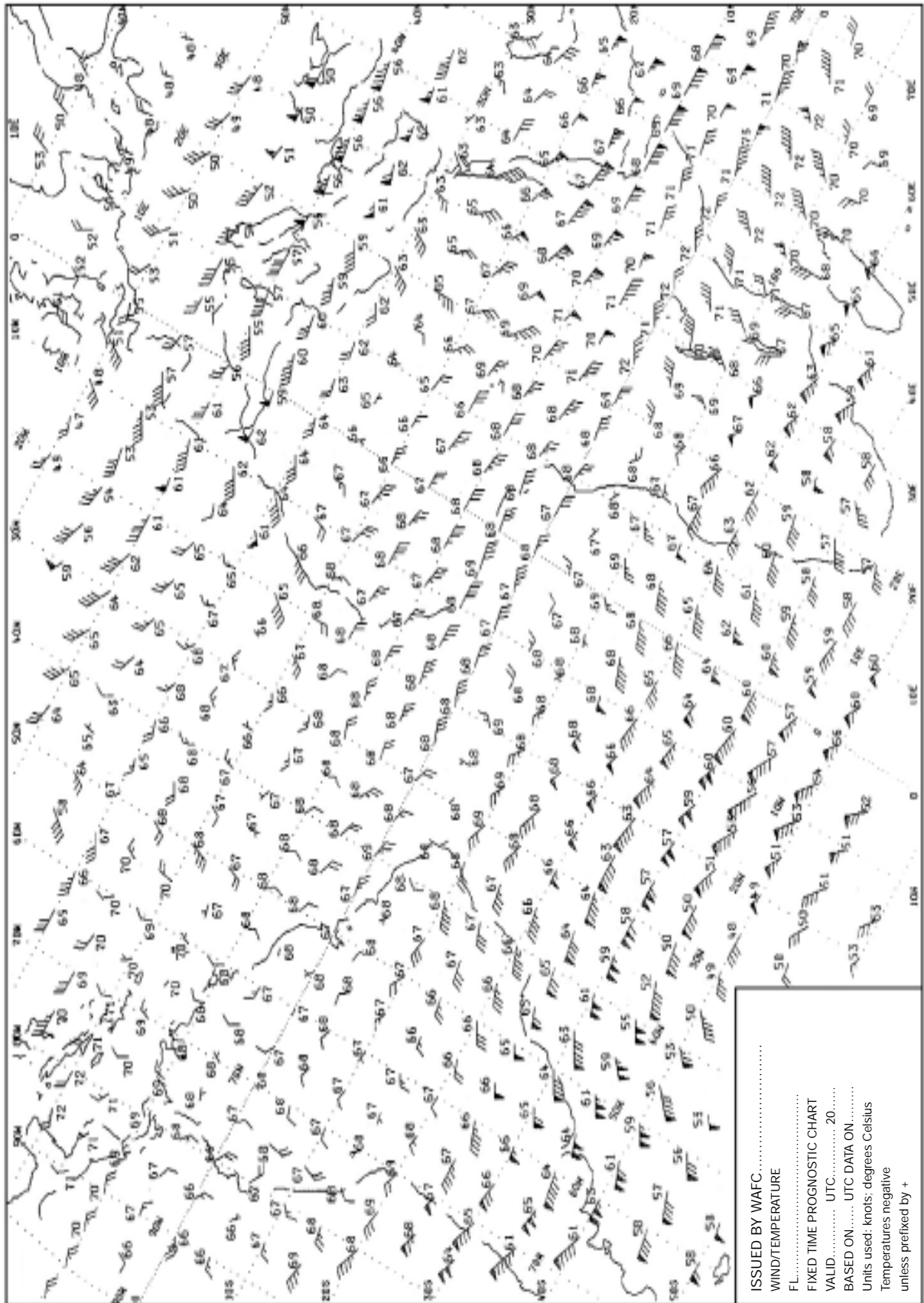
- Notes:**
1. Pressure altitude is the height in feet of a level in the standard atmosphere above the datum level corresponding to a pressure of 1 013.2 hPa.
 2. Positive and negative values are indicated by the prefix "PS" (plus) and "MS" (minus) respectively.
 3. Only cloud associated with significant weather is shown. Low stratus and fog, when expected, will be shown for terminal areas in appropriate aerodrome forecasts.
 4. When a single numerical value of an element is given in a forecast, it is to be interpreted as representing the most probable mean of a range of values which the element may assume during the period of the forecast.

Abbreviations: SKC — 0 oktas, FEW — 1 to 2 oktas, SCT — 3 to 4 oktas, BKN — 5 to 7 oktas, OVC — 8 oktas, LYR — Layered, LOC — Locally, ISOL — Isolated, OCNL — Occasional, FRQ — Frequent, EMBD — Embedded.

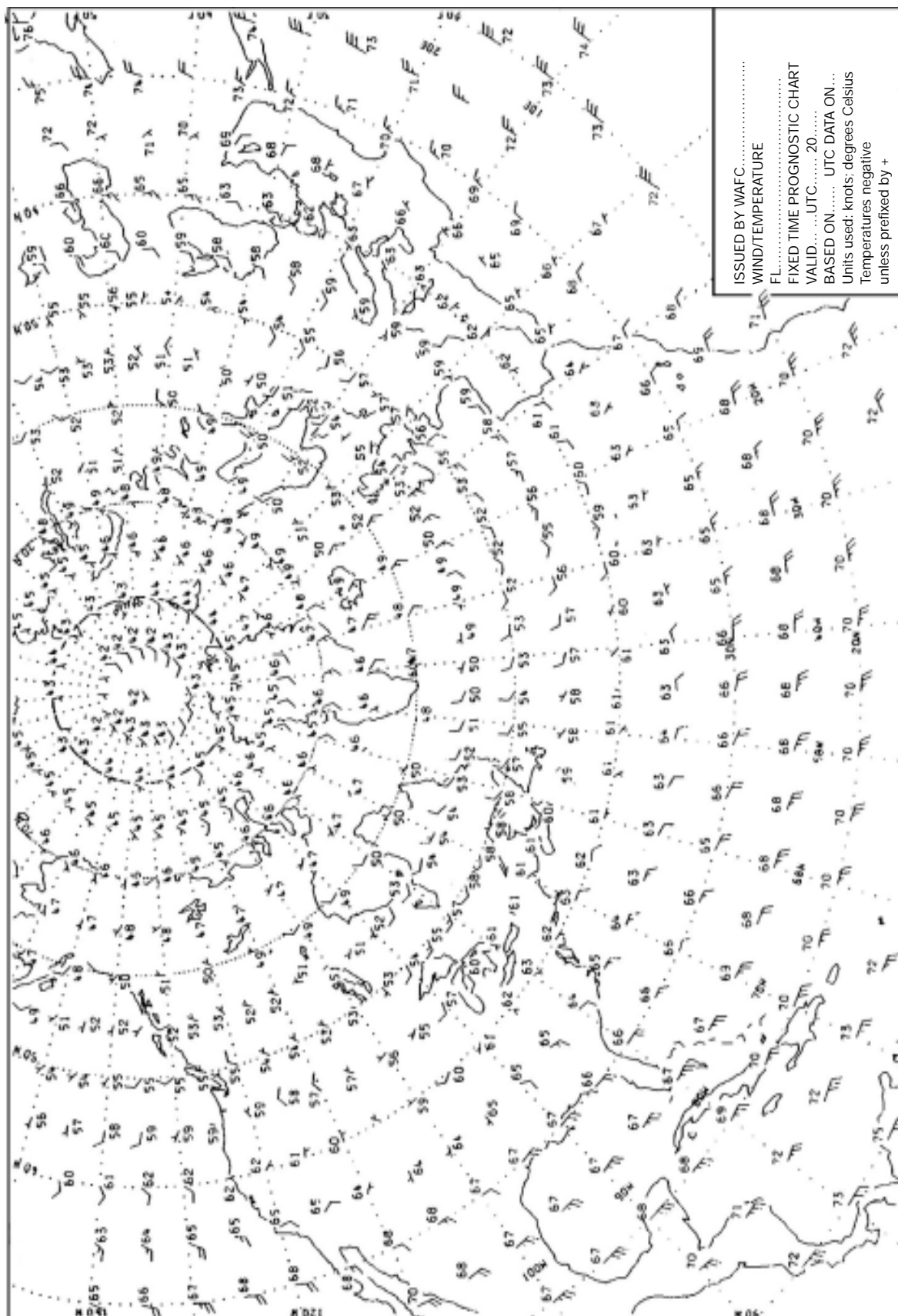
Model TB. Tabular forecast of upper winds and upper-air temperatures
Example — Spot locations



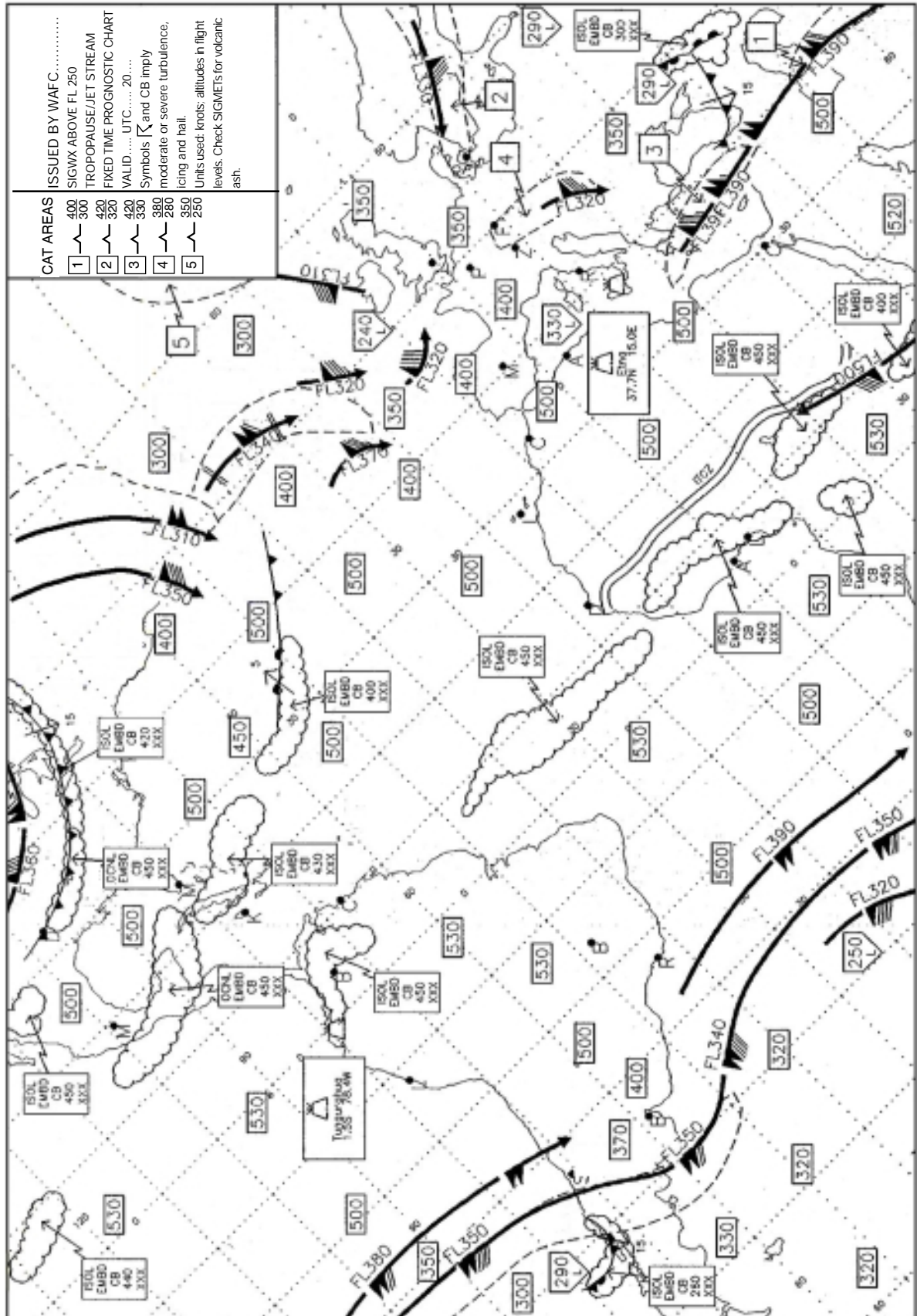
Model IS. Upper wind and temperature chart for standard isobaric surface
Example 1 — Arrows, feathers and pennants (Mercator projection)



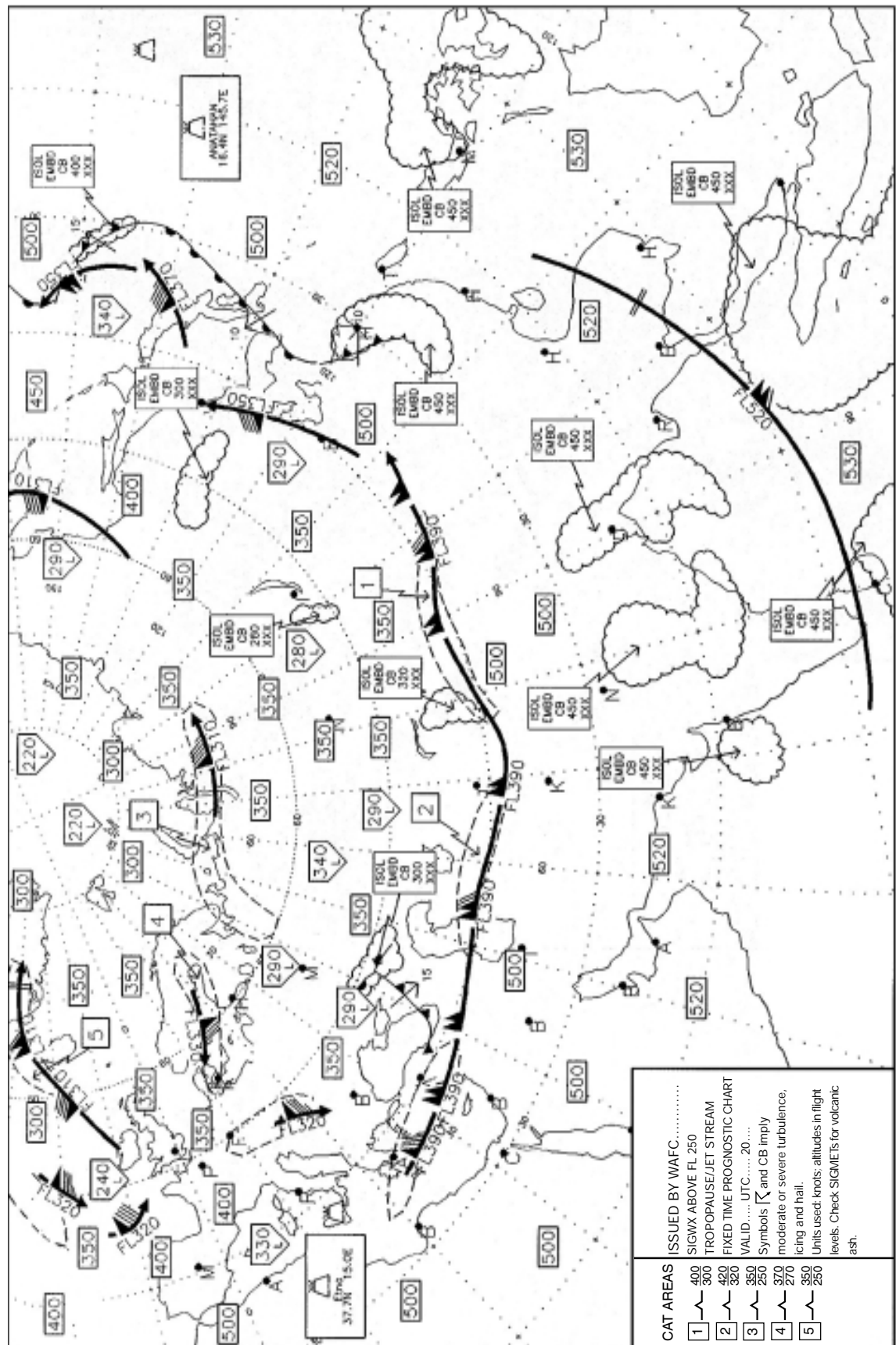
Model IS. Upper wind and temperature chart for standard isobaric surface
Example 2 — Arrows, feathers and pennants (Polar stereographic projection)



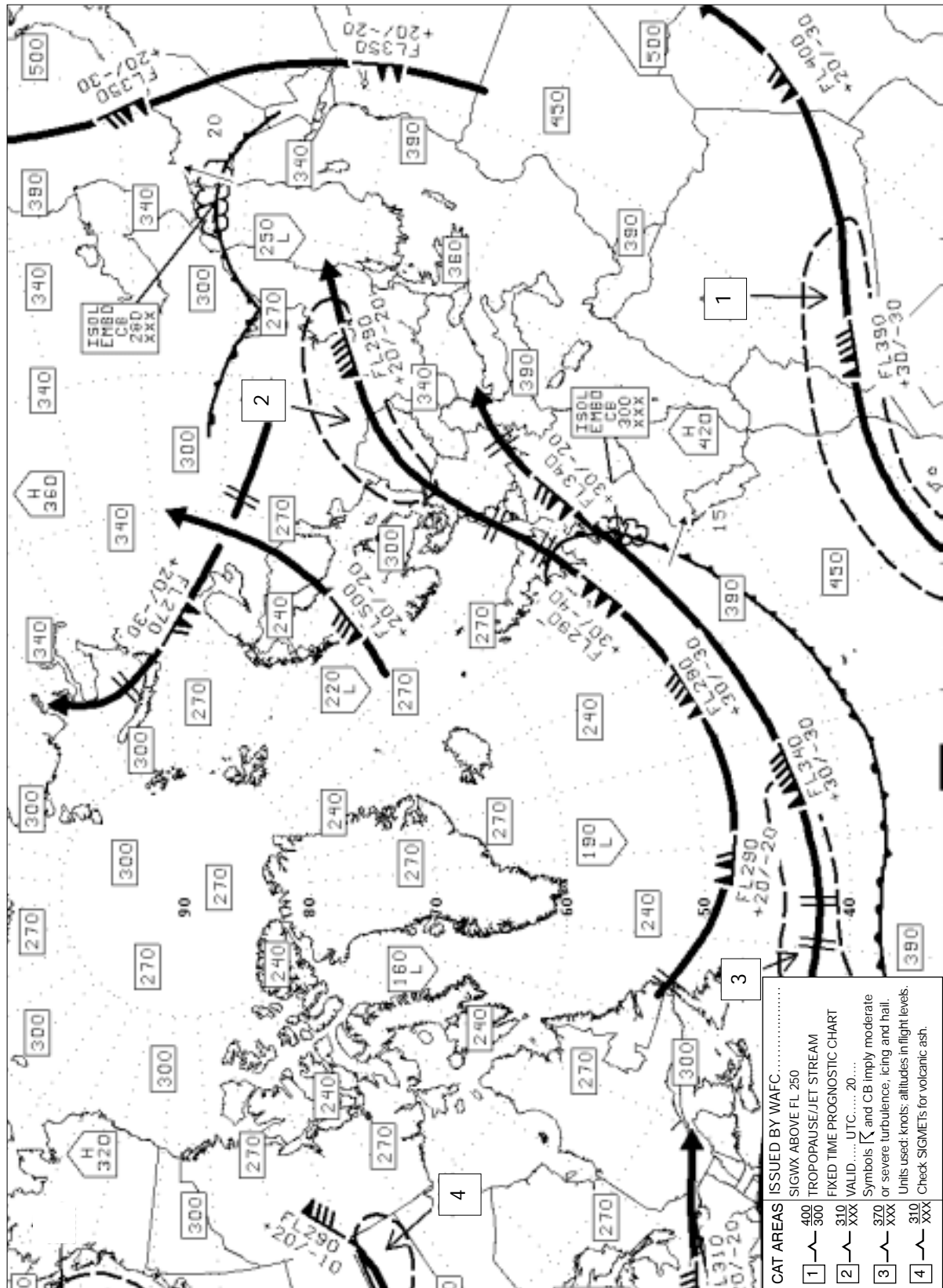
Model SWH. Significant weather chart (high level)
Example 1 — Mercator projection



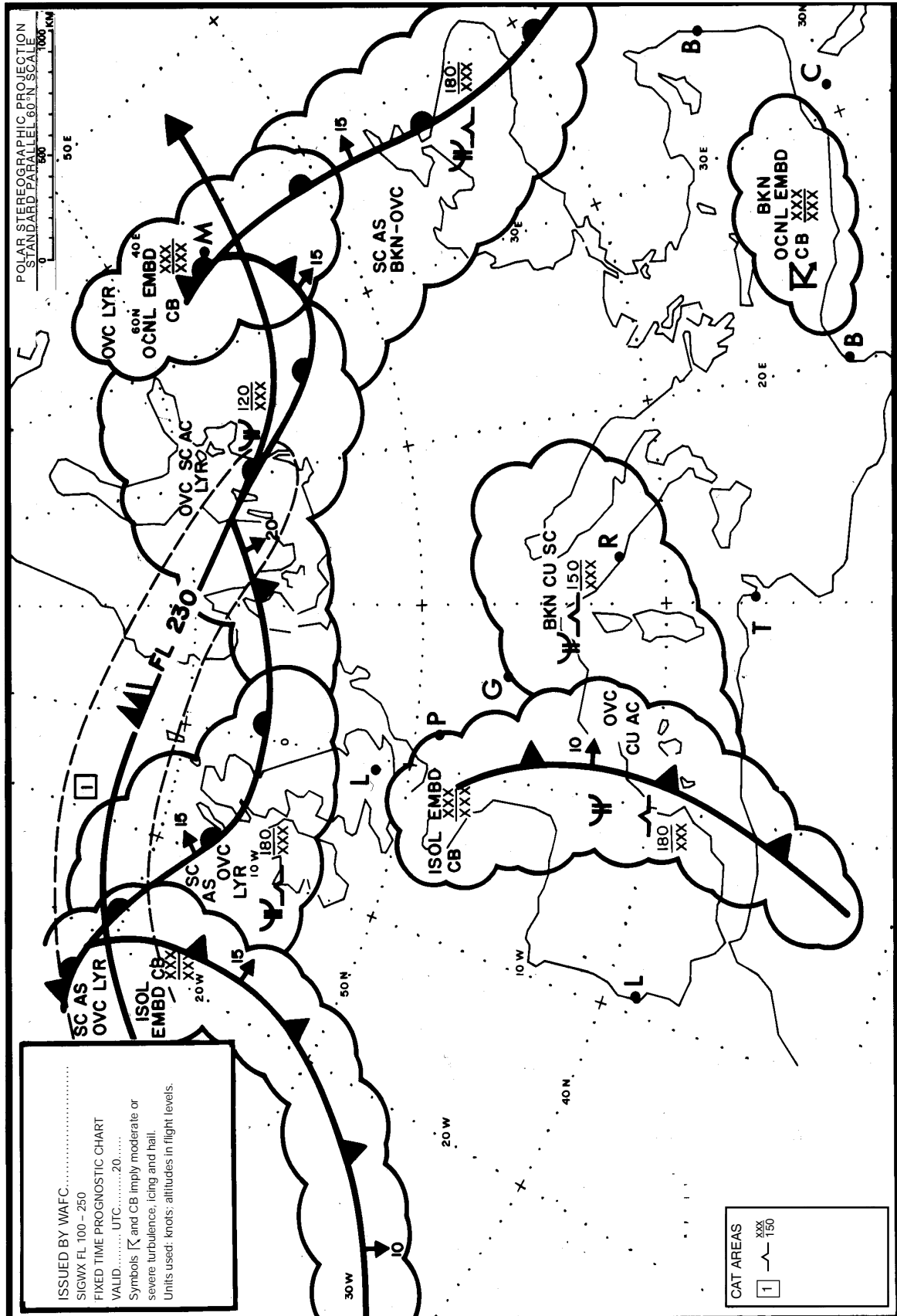
Model SWH. Significant weather chart (high level)
Example 2 — Polar stereographic projection



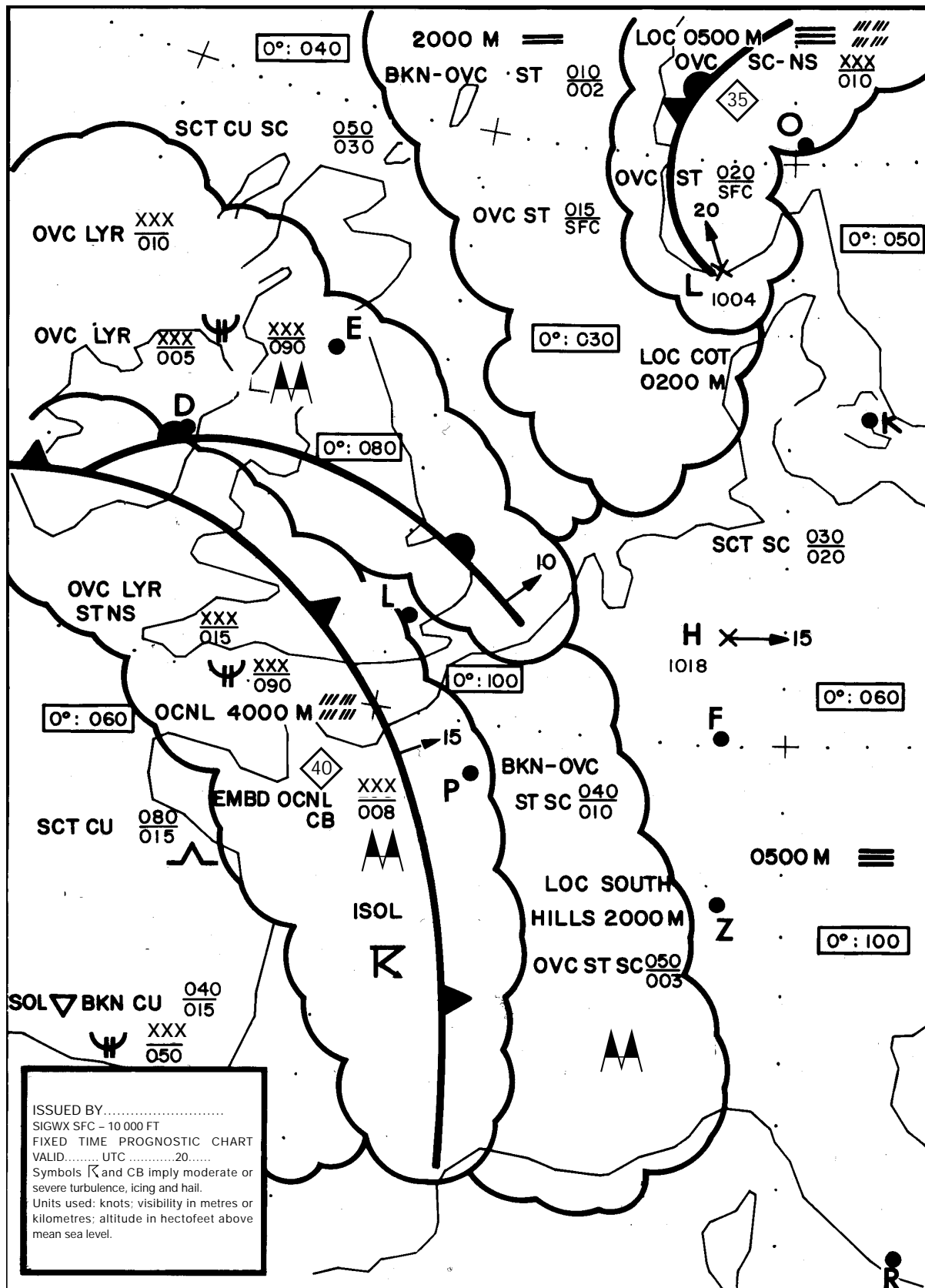
Model SWH. Significant weather chart (high level)
 Example 3 — Polar stereographic projection (showing the jet stream vertical extent and crossing jet stream depictions)



Model SWM. Significant weather chart (medium level)



Model SWL. Significant weather chart (low level)
Example 1

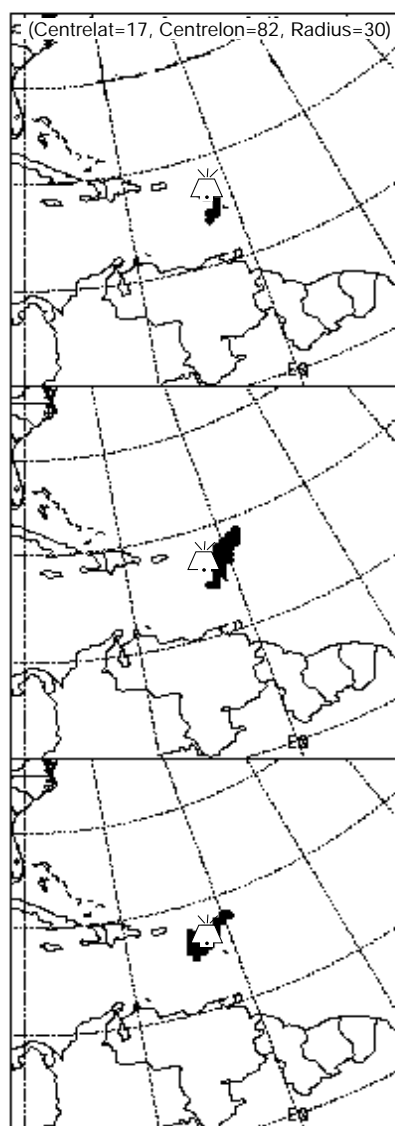


Model SWL. Significant weather chart (low level)
Example 2

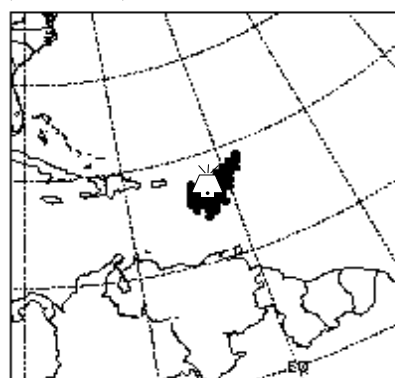
FIXED TIME PROGNOSTIC CHART VALID		UTC.....		20... BASED ON		UTC DATA ON	
		VARIANT	VIS	SIGNIFICANT WEATHER	CLOUD, TURBULENCE, ICING	0°C	
		AREA A			— SCT CU 025/080		
		ISOL			— BKN CU 015/XXX 050/XXX	50	
		AREA B			— OVC LVR ST NS 015/XXX 050/XXX		
		OCNL	4000	HEAVY RAIN	EMBD CB 008/XXX	50	
		ISOL	1000	THUNDERSTORM			
		AREA C			BKN to OVC ST SC 010/040		
		LOC SOUTH COT HILLS	2000	DRIZZLE	OVC ST SC 003/050	100	
		AREA D			OVC LVR SC NS 010/XXX		
		LOC NORTH	4500	RAIN	OVC LVR ST NS 005/XXX 090/XXX	90	
		AREA E			SCT SC 020/030		
		LOC LAND	0500	FOG		40	
		AREA F	2000	MIST	BKN to OVC ST 002/010		
LOC COT HILLS	0200	FOG	OVC ST SFC/015	30			
AREA G	4500	RAIN	— OVC CU SC NS 010/XXX 030/XXX	30			
LOC NORTH	0500	FOG	OVC ST SFC/010				
AREA J			SCT CU SC 030/050				
LOC HILLS NORTH			— BLW 070	40			
SIGWX SFC – 10 000 FT		ISSUED BY AT UTC		REMARKS: EAST TO NE GALES SHETLAND TO HEBRIDES - SEVERE MOUNTAIN WAVES NW SCOTLAND - FOG PATCHES EAST ANGLIA - WDSR FOG OVER NORTH FRANCE, BELGIUM AND THE NETHERLANDS			
<div>Notes: 1. Pressure in hPa and speeds in knots. 2. Vis in m included if less than 5 000 m. M implies vis 200 m or less. 3. Altitude in hectofeet above MSL XXX = above 10 000 ft. 4. K and CB imply MOD/SEV icing and turbulence. 5. Only significant weather and/or phenomena causing visibility reduction below 5 000 m included</div>							

Notes:

1. Pressure in hPa and speeds in knots.
2. Vis in m included if less than 5 000 m. 1000 implies vis 200 m or less.
3. Altitude in hectofeet above MSL. XXX = above 10 000 ft.
4. R and CB imply MOD/SEV icing and turbulence.
5. Only significant weather and/or weather phenomena causing visibility reduction below 5 000 m included.

Model VAG. Volcanic ash advisory information in graphical format

FIXED TIME PROGNOSTIC CHART VALID.....UTC.....20...
(ERUPTION + XX H) BASED ON.....UTC DATA ON.....20...

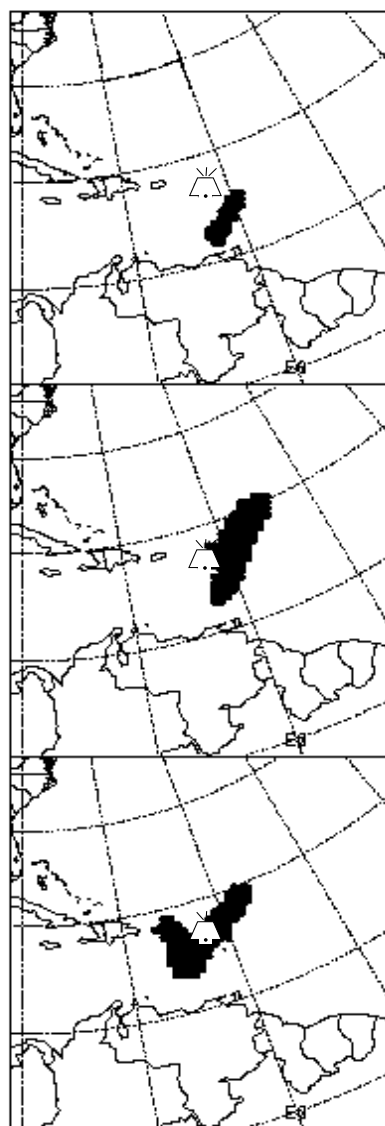


VAAC.....
Volcanic ash advisory information in graphical format (VAG)
☐ Volcano (Name.....) Lat.....N (or S) Long.....E (or W)
Date and time of first eruption.....UTC.....20...
Duration..... Hour(s)
Height of ash column of FL.....
■ Visible ash cloud

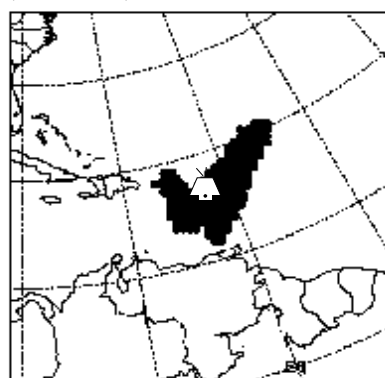
FL550
FL350

FL350
FL200

FL200
SURFACE




























FIXED TIME PROGNOSTIC CHART VALID.....UTC.....20...
(ERUPTION + YY H) BASED ON.....UTC DATA ON.....20...



FL550
SURFACE
(COMPOSITE)

Model SN. Sheet of notations used in flight documentation

1. Symbols for significant weather

	Thunderstorms		Drizzle
	Tropical cyclone		Rain
	Severe squall line*		Snow
	Moderate turbulence		 Hail
	Severe turbulence		Widespread blowing snow
	Mountain waves		Severe sand or dust haze
	Moderate aircraft icing		Widespread sandstorm or dust storm
	Severe aircraft icing		Widespread haze
	Widespread fog		Widespread mist
	Radioactive materials in the atmosphere**		Widespread smoke
	Volcanic eruption***		Freezing precipitation ****
	Mountain obscuration		Visible ash cloud *****

* In flight documentation for flights operating up to FL100. This symbol refers to "squall line".

** The following information should be included at the side of the chart: radioactive materials symbol; latitude/longitude of accident site; date and time of accident; check NOTAM for further information.



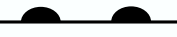
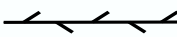











*** The following information should be included at the side of the chart: volcanic eruption symbol; name and international number of volcano (if known); latitude/longitude; date and time of the first eruption (if known); Check SIGMETs and NOTAM or ASHTAM for volcanic ash.

**** This symbol does not refer to icing due to precipitation coming into contact with an aircraft which is at a very low temperature.

***** Visible ash cloud symbol applies only to model VAG not to SIGWX charts.

NOTE: Height indications between which phenomena are expected, top above base as per chart legend.

2. Fronts and convergence zones and other symbols used

	Cold front at the surface		Position, speed and level of max. wind
	Warm front at the surface		Convergence line
	Occluded front at the surface		Freezing level
	Quasi-stationary front at the surface		Intertropical convergence zone
	Tropopause High		State of the sea
	Tropopause Low		Sea-surface temperature
	Tropopause Level		Widespread Strong surface wind *
 Wind arrows indicate the maximum wind in jet and the flight level at which it occurs. Significant changes (speed of 20 knots or more, 3 000 ft less if practicable) in flight level are marked by the double bar. In the example, at the double bar the wind speed is 225 km/h (120 kt). The heavy line delineating the jet axis begins/ends at the points where a wind speed of 150 km/h (80 kt) is forecast. * This symbol refers to widespread surface wind speeds exceeding 60 km/h (30 kt).			

3. Abbreviations used to describe clouds





3.1 Type		
CI = Cirrus	AS = Altostratus	ST = Stratus
CC = Cirrocumulus	NS = Nimbostratus	CU = Cumulus
CS = Cirrostratus	SC = Stratocumulus	CB = Cumulonimbus
AC = Altocumulus		
3.2 Amount		
Clouds except CB		
SKC = sky clear (0/8)		
FEW = few (1/8 to 2/8)		
SCT = scattered (3/8 to 4/8)		
BKN = broken (5/8 to 7/8)		
OVC = overcast (8/8)		
CB only		
ISOL = individual CBs (isolated)		
OCNL = well-separated CBs (occasional)		
FRQ = CBs with little or no separation (frequent)		
EMBD = CBs embedded in layers of other clouds or concealed by haze (embedded)		

3.3 Heights	
Heights are indicated on SWH and SWM charts in flight levels (FL), top over base. When XXX is used, tops or bases are outside the layer of the atmosphere to which the chart applies.	
In SWL charts:	
i) Heights are indicated as altitudes above mean sea level;	
ii) The abbreviation SFC is used to indicate ground level.	

4. Depicting of lines and systems on specific charts

4.1 Models SWH and SWM — Significant weather charts (high and medium)	
Scalloped line	= demarcation of areas of significant weather
Heavy broken line	= delineation of area of CAT
Heavy solid line	= position of jet stream axis with indication of wind direction, speed in kt or km/h and height in flight levels. The vertical extent of the jet stream is indicated (in flight levels) below the flight level, e.g. FL270 accompanied by +20/−30 indicates that the height of the jet extends from FL240 to FL290.
interrupted by wind arrow and flight level	
Figures on arrows	= speed in kt or km/h of movements of frontal system
Flight levels	= height in flight levels of tropopause at spot locations, e.g. [340]. Low and high points of the tropopause topography are indicated by the letters L or H, respectively, inside a pentagon with the height in flight levels.
inside small rectangles	

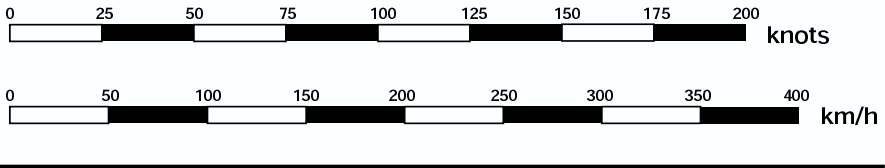
4.2 Model SWL — Significant weather charts (low level)	
X	= position of pressure centres given in hectopascals
L	= centre of low pressure
H	= centre of high pressure
Scalloped lines	= demarcation of area of significant weather
Dashed lines	= altitude of 0°C isotherm in feet (hecto feet) or metres
	NOTE: 0°C level may also be indicated by [0° : 060], i.e. 0°C level is at an altitude of 6 000 ft
Figures on arrows	= speed in kt or km/h of movement of frontal systems, depressions or anticyclones
Figure inside the state of the sea symbol	= total wave height in feet or metres
Figure inside the sea-surface temperature symbol	= sea-surface temperature in °C
Figures inside the strong surface wind symbol	= wind in kt or km/h

4.3 Arrows, feathers and pennants	
Arrows indicate direction. Number of pennants and/or feathers correspond to speed.	
Example:	
	270°/115 kt (equivalent to 213 km/h)
	Pennants correspond to 50 kt or 93 km/h
	Feathers correspond to 10 kt or 18 km/h
	Half-feathers correspond to 5 kt or 9 km/h

Conversion of knots into kilometres per hour

knots	0	1	2	3	4	5	6	7	8	9
Kilometres per hour										
00	0	1.85	3.70	5.56	7.41	9.26	11.11	12.96	14.82	16.67
10	18.52	20.37	22.22	24.08	25.93	27.78	29.63	31.48	33.34	35.19
20	37.04	38.89	40.74	42.60	44.45	46.30	48.15	50.00	51.86	53.71
30	55.56	57.41	59.26	61.12	62.97	64.82	66.67	68.52	70.38	72.23
40	74.08	75.93	77.78	79.64	81.49	83.34	85.19	87.04	88.90	90.75
50	92.60	94.45	96.30	98.16	100.01	101.86	103.71	105.56	107.42	109.27
60	111.12	112.97	114.82	116.68	118.53	120.38	122.23	124.08	125.94	127.79
70	129.64	131.49	133.34	135.20	137.05	138.90	140.75	142.60	144.46	146.31
80	148.16	150.01	151.86	153.72	155.57	157.42	159.27	161.12	162.98	164.83
90	166.68	168.53	170.38	172.24	174.09	175.94	177.79	179.64	181.50	183.35
100	185.20	187.05	188.90	190.76	192.61	194.46	196.31	198.16	200.02	201.87
110	203.72	205.57	207.42	209.28	211.13	212.98	214.83	216.68	218.54	220.39
120	222.24	224.09	225.94	227.80	229.65	231.50	233.35	235.20	237.06	238.91
130	240.76	242.61	244.46	246.32	248.17	250.02	251.87	253.72	255.58	257.43
140	259.28	261.13	262.98	264.84	266.69	268.54	270.39	272.24	274.10	275.95
150	277.80	279.65	281.50	283.36	285.21	287.06	288.91	290.76	292.62	294.47
160	296.32	298.17	300.02	301.88	303.73	305.58	307.43	309.28	311.14	312.99
170	314.84	316.69	318.54	320.40	322.25	324.10	325.95	327.80	329.66	331.51
180	333.36	335.21	337.06	338.92	340.77	342.62	344.47	346.32	348.18	350.03
190	351.88	353.73	355.58	357.44	359.29	361.14	362.99	364.84	366.70	368.55
kt:	200	210	220	230	240	250	260	270	280	290
km/h:	370.40	388.92	407.44	425.96	444.48	463.00	481.52	500.04	518.56	537.08
kt:	300	310	320	330	340	350	360	370	380	390
km/h:	555.60	574.12	592.64	611.16	629.68	648.20	666.72	685.24	703.76	722.28
kt:	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	
km/h:	0.19	0.37	0.56	0.74	0.93	1.11	1.30	1.48	1.67	

1 knot = 1.852 kilometres per hour



APPENDIX 2. TECHNICAL SPECIFICATIONS RELATED TO WORLD AREA FORECAST SYSTEM AND METEOROLOGICAL OFFICES

(See Chapter 3 of this Annex.)

1. WORLD AREA FORECAST SYSTEM

1.1 Formats and codes

WAFCs shall adopt uniform formats and codes for the supply of forecasts and amendments.

1.2 Upper-air wind, temperature and humidity information

1.2.1 The forecasts of upper winds; upper-air temperatures; and humidity; direction, speed and height of maximum winds and tropopause heights and temperatures prepared four times daily by a WAFc shall be valid for 6, 12, 18, 24, 30 and 36 hours after the time (0000, 0600, 1200 and 1800 UTC) of the synoptic data on which the forecasts were based and shall be available for start of transmission in the above order not later than 6 hours after standard time of observation.

1.2.2 **Recommendation.**— *The grid point forecasts prepared by a WAFc should comprise:*

- a) *wind and temperature data for flight levels 50 (850 hPa), 100 (700 hPa), 140 (600 hPa), 180 (500 hPa), 240 (400 hPa), 300 (300 hPa), 340 (250 hPa), 390 (200 hPa) and 450 (150 hPa);*
- b) *tropopause height and temperature, and direction, speed and height of maximum wind;*
- c) *humidity data for flight levels 50 (850 hPa), 100 (700 hPa), 140 (600 hPa) and 180 (500 hPa); and*
- d) *wind and temperature data for flight levels 530 (100 hPa) and 600 (70 hPa) when and where required.*

1.2.3 The foregoing grid point forecasts shall be issued by a WAFc in binary code form using the GRIB code form prescribed by WMO.

Note 1.— The GRIB code form is contained in WMO Publication No. 306, Manual on Codes, Volume I.2, Part B — Binary Codes.

Note 2.— WAFCs continue to issue forecasts of upper-air wind and temperature in chart form in accordance with regional air navigation plans until 1 July 2005.

1.2.4 The foregoing grid point forecasts shall be prepared by a WAFc in a fixed grid with a horizontal resolution of 140 km.

Note.— 140 km represents a distance of about 1.25° of latitude.

1.3 Significant weather information

1.3.1 Forecasts of significant weather phenomena prepared by WAFCs shall be issued four times a day for fixed valid times of 0000, 0600, 1200 and 1800 UTC. The transmission of each forecast shall be completed as soon as technically feasible but at least 12 hours before its validity time.

1.3.2 Forecasts of significant weather phenomena shall be issued in binary code form, using the BUFR code form prescribed by WMO.

Note 1.— The BUFR code form is contained in WMO Publication No. 306, Manual on Codes, Volume I.2, Part B — Binary Codes.

Note 2.— WAFCs continue to issue forecasts of significant weather in chart form in accordance with regional air navigation plans until 1 July 2005.

1.3.3 Forecasts of significant weather phenomena shall include all the items listed in Appendix 8, 4.3.1.1. The forecasts shall be issued for the following flight levels:

- a) between flight levels 250 to 630; and
- b) between flight levels 100 to 250 for limited geographical areas, as determined by regional air navigation agreement. If the average elevation of the topography of the area could extend a significant topographical effect to flight level 100, a higher level should be specified for the base of the charts, in consultation with the WAFc concerned, and in accordance with regional air navigation agreement.

1.3.4 **Recommendation.**— *Amendments to forecasts of significant weather phenomena should be issued with the minimum possible delay in accordance with the criteria in 1.4 and supplied in the form of amended BUFR files.*

1.4 Criteria for amendments to WAFS products

Recommendation.— *WAFCs should apply the following criteria for the amendment of significant en-route weather forecasts:*

SWH forecasts:

turbulence, and occasional, frequent or embedded cumulonimbus

Newly expected occurrence or non-occurrence

SWM forecasts:

aircraft icing, turbulence, cumulonimbus, and sandstorms/duststorms

Newly expected occurrence or non-occurrence

Volcanic eruptions or the accidental release of radioactive materials into the atmosphere, of significance to aircraft operations:

Inclusion or removal of volcanic activity symbol, or radiation symbol.

2. METEOROLOGICAL OFFICES

2.1 Use of WAFS products

2.1.1 The extent to which an aerodrome meteorological office prepares forecasts and/or makes use of products from WAFCs and other sources shall be determined by the meteorological authority concerned.

2.1.2 **Recommendation.**— *Aerodrome meteorological offices should use output products of the world area forecast system in the preparation of flight documentation.*

2.1.3 In order to ensure uniformity and standardization of flight documentation, the WAFS GRIB and BUFR data received shall be decoded into standard WAFS charts in accordance with relevant provisions in this Annex, and the content and identification of the originator of the WAFS forecasts shall not be amended.

2.2 Notification of WAFS concerning significant discrepancies

Meteorological offices using WAFS GRIB and/or BUFR data shall notify the WAFS concerned immediately if significant discrepancies in accordance with 1.4 are detected or reported in respect of WAFS data and products. The WAFS receiving the message shall acknowledge its receipt to the originator, together with a brief comment on the report and any action taken, using the same means of communication employed by

the originator. If it is considered necessary to issue an amendment, an appropriate ADMIN message shall be transmitted to all users through satellite broadcasts.

Note 1.— *There is no requirement for meteorological offices to report incidents of radiological emergencies.*

Note 2.— *Guidance on reporting significant discrepancies is provided in the Manual of Aeronautical Meteorological Practice (Doc 8896).*

3. METEOROLOGICAL WATCH OFFICES

3.1 Use of WAFS products

The extent to which a meteorological watch office makes use of products from WAFCs and other sources shall be determined by the meteorological authority concerned.

4. VOLCANIC ASH ADVISORY CENTRES (VAAC)

4.1 Volcanic ash advisory information

4.1.1 **Recommendation.**— *The advisory information on volcanic ash issued in abbreviated plain language, using approved ICAO abbreviations and numerical values of self-explanatory nature, should be in accordance with the template shown in Table A2-1. When no approved ICAO abbreviations are available, English plain language text, to be kept to a minimum, should be used.*

4.1.2 **Recommendation.**— *The volcanic ash advisory information listed in Table A2-1, when issued in graphical format, should be as specified in Appendix 1. When issued in binary format, the BUFR code form should be used.*

Note.— *The BUFR code form is contained in WMO Publication No. 306, Manual on Codes, Volume I.2, Part B — Binary Codes.*

5. STATE VOLCANO OBSERVATORIES

5.1 Information from State volcano observatories

Recommendation.— *The information required to be sent by State volcano observatories to their associated ACCs, MWO and VAAC should comprise for:*

- a) significant pre-eruption volcanic activity: the date/time (UTC) of report; name and, if known, number of the volcano; location (latitude/longitude); and description of volcanic activity; and
- b) volcanic eruption: the date/time (UTC) of report and time of eruption (UTC) if different from time of report; name and, if known, number of the volcano; location (latitude/longitude); and description of the eruption including whether an ash column was ejected and, if so, an estimate of height of ash column and the extent of any visible volcanic ash cloud, during and following an eruption.

Note.— Pre-eruption volcanic activity in this context means unusual and/or increasing volcanic activity which could presage a volcanic eruption.

6. TROPICAL CYCLONE ADVISORY CENTRES (TCAC)

6.1 Tropical cyclone advisory information

6.1.1 **Recommendation.**— The advisory information on tropical cyclones should be in accordance with the template shown in Table A2-2.

6.1.2 **Recommendation.**— When the tropical cyclone advisory information is issued in binary format, the BUFR code form should be used.

Note.— The BUFR code form is contained in WMO Publication No. 306, Manual on Codes, Volume I.2, Part B — Binary Codes.

Table A2-1. Template for advisory message for volcanic ash

Key: M = inclusion mandatory, part of every message;
 O = inclusion optional;
 = = a double line indicates that the text following it should be placed on the subsequent line

Note 2.— The explanations for the abbreviations can be found in the Procedures for Air Navigation Services — ICAO Abbreviations and Codes (PANS-ABC, Doc 8400).

Note 3.— Inclusion of a “colon” after each element heading is mandatory.

Note 1.— The ranges and resolutions for the numerical elements included in advisory messages for volcanic ash are shown in Appendix 6, Table A6-4.

Note 4.— The numbers 1 to 18 are included only for clarity and they are not part of the advisory message, as shown in the example.

Element	Detailed content	Template(s)	Examples
1 Identification of the type of message (M)	Type of message	VOLCANIC ASH ADVISORY	VOLCANIC ASH ADVISORY
2 Time of origin (M)	Year, month, day, time in UTC or day, month, year, time in UTC	ISSUED: nnnnnnnn/nnnnZ or nnmonth ¹ nnnn/nnnnZ	ISSUED: 20000402/0700Z ISSUED: 02APR2000/0700Z
3 Name of VAAC (M)	Name of VAAC	VAAC: nnnnnnnnnnnn	VAAC: TOKYO
4 Name of volcano (M)	Name and IAVCEI ² number of volcano	VOLCANO: nnnnnnnnnnnnnnnnnnnnn [nnnnnn] or UNKNOWN or UNNAMED	VOLCANO: USUZAN 805-03 VOLCANO: UNNAMED
5 Location of volcano (M)	Location of volcano in degrees and minutes	LOCATION: Nnnnn or Snnnn Wnnnnn or Ennnnn or UNKNOWN or UNNAMED	LOCATION: N4230 E14048 LOCATION: UNKNOWN
6 State or region (M)	State, or region if ash is not reported over a State	AREA: nnnnnnnnnnnnnnnn	AREA: JAPAN
7 Summit elevation (M)	Summit elevation in m (or ft)	SUMMIT ELEVATION: nnnnM (or nnnnnFT)	SUMMIT ELEVATION: 732M
8 Advisory number (M)	Advisory number: year in full and message number (separate sequence for each volcano)	ADVISORY NUMBER: nnnn/nnnn	ADVISORY NUMBER: 2000/432
9 Information source (M)	Information source using free text	INFORMATION SOURCE: free text up to 32 characters	INFORMATION SOURCE: GMS-JMA
10 Colour code (O)	Aviation colour code	AVIATION COLOUR CODE: RED or ORANGE or YELLOW or GREEN or UNKNOWN or NOT GIVEN or NIL	AVIATION COLOUR CODE: RED
11 Eruption details (M)	Eruption details (including date/time of eruption(s))	ERUPTION DETAILS: free text up to 64 characters or UNKNOWN	ERUPTION DETAILS: ERUPTED 20000402/0641Z ERUPTION OBS ASH TO ABV FL300
12 Time of observation of ash (M)	Day and time (in UTC) of observation of volcanic ash	OBS ASH DATE/TIME: nn/nnnnZ	OBS ASH DATE/TIME: 02/0645Z

Element	Detailed content	Template(s)	Examples
13 Observed ash cloud (M)	Horizontal (in degrees and minutes) and vertical extent of the observed ash cloud or, if the base is unknown, the top of the observed ash cloud; movement of the observed ash cloud	OBS ASH CLOUD: TOP FLnnn or SFC/FLnnn or FLnnn/nnn Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]- Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]- Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]- Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]- Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]- Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] ³ TOP FLnnn or SFC/FLnnn or FLnnn/nnn MOV N nnKMH (or KT) or MOV NE nnKMH (or KT) or MOV E nnKMH (or KT) or MOV SE nnKMH (or KT) or MOV S nnKMH (or KT) or MOV SW nnKMH (or KT) or MOV W nnKMH (or KT) or MOV NW nnKMH (or KT) ⁴ or ⁴ ASH NOT IDENTIFIABLE FROM SATELLITE DATA WINDS FLnnn/nnn nnn/nn[n] KMH (KT) ³	OBS ASH CLOUD: FL150/350 N4230 E14048 - N4300 E14130 - N4246 E14230 - N4232 E14150 - N4230 E14048 SFC/FL150 MOV NE 25KT FL150/350 MOV E 30KT TOP FL240 MOV W 40KMH
14 Forecast height and position of the ash clouds (+ 6 HR) (M)	Day and time (in UTC) (6 hours from the "Time of observation of ash" given in Item 12); Forecast height and position (in degrees and minutes) for each cloud mass for that fixed valid time	FCST ASH CLOUD+6HR: nn/nnnnZ SFC or FLnnn/[FL]nnn Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]- Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]- Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]- Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]- Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]- Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] ³ or NO ASH EXP	FCST ASH CLOUD+6HR: 02/1245Z SFC/FL200 N4230 E14048 - N4232 E14150 - N4238 E14300 - N4246 E14230 FL200/350 N4230 E14048 - N4232 E14150 - N4238 E14300 - N4246 E14230 FL350/600 NO ASH EXP
15 Forecast height and position of the ash clouds (+12 HR) (M)	Day and time (in UTC) (12 hours from the "Time of observation of ash" given in Item 12); Forecast height and position (in degrees and minutes) for each cloud mass for that fixed valid time	FCST ASH CLOUD+12HR: nn/nnnnZ SFC or FLnnn/[FL]nnn Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]- Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]- Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]- Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]- Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]- Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] ³ or NO ASH EXP	FCST ASH CLOUD+12HR: 02/1845Z SFC/FL300 N4230 E14048 - N4232 E14150 - N4238 E14300 - N4246 E14230 FL300/600 NO ASH EXP

Element	Detailed content	Template(s)	Examples
16	Forecast height and position of the ash clouds (+18 HR) (M) Forecast height and position (in degrees and minutes) for each cloud mass for that fixed valid time	FCST ASH CLOUD+18HR: nn/nnnnZ SFC or FLnnn/[FL]nnn Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]- Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]- Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]- Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]- Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]] ³ or NO ASH EXP	FCST ASH CLOUD+18HR: 03/0045Z SFC/FL600 NO ASH EXP
17	Next advisory (M) Year, month, day and time in UTC or day, month, year and time in UTC of issuance of next advisory	NEXT ADVISORY: nnnnnnnn/nnnnZ or nnmonth ¹ nnn/nnnnZ or NO LATER THAN nnnnnnnn/nnnnZ or nnmonth ¹ nnnn/nnnnZ or NO FURTHER ADVISORIES or WILL BE ISSUED BY nnnnnnnn/nnnnZ or nnmonth ¹ nnnn/nnnnZ	NEXT ADVISORY: 20000402/1300Z
18	Remarks (M) Remarks, as necessary	REMARKS: Free text up to 256 characters or NIL	REMARKS: ASH CLD CAN NO LONGER BE DETECTED ON SATELLITE IMAGE

Notes.—

1. Use abbreviations for months of the year from the PANS-ABC (Doc 8400), for example, "JAN".
2. International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI).
3. Up to 4 selected layers.
4. If ash reported (e.g. AIREP) but not identifiable from satellite data.

Example A2-1. Advisory message for volcanic ash**VOLCANIC ASH ADVISORY**

ISSUED:	20000402/0700Z
VAAC:	TOKYO
VOLCANO:	USUZAN 805-03
LOCATION:	N4230 E14048
AREA:	JAPAN
SUMMIT ELEVATION:	732M
ADVISORY NUMBER:	2000/432
INFORMATION SOURCE:	GMS JMA
AVIATION COLOUR CODE:	RED
ERUPTION DETAILS:	ERUPTED 20000402/0614Z ERUPTION OBS ASH TO ABV FL300
OBS ASH DATE/TIME:	02/0645Z
OBS ASH CLD:	FL150/350 N4230 E14048 – N4300 E14130 – N4246 E14230 – N4232 E14150 – N4230 E14048 SFC/FL150 MOV NE 25KT FL150/350 MOV E 30KT
FCST ASH CLD + 6 HR:	02/1245Z SFC/FL200 N4230 E14048 – N4232 E14150 – N4238 E14300 – N4246 E14230 FL200/350 N4230 E14048 – N4232 E14150 – N4238 E14300 – N4246 E14230 FL350/600 NO ASH EXP
FCST ASH CLD + 12 HR:	02/1845Z SFC/FL300 N4230 E14048 – N4232 E14150 – N4238 E14300 – N4246 E14230 FL300/600 NO ASH EXP
FCST ASH CLD + 18 HR:	03/0045Z SFC/FL600 NO ASH EXP
NEXT ADVISORY:	20000402/1300Z
REMARKS:	ASH CLD CAN NO LONGER BE DETECTED ON SATELLITE IMAGE

Table A2-2. Template for advisory message for tropical cyclones

Key: = = a double line indicates that the text following it should be placed on the subsequent line

Note 1.— The ranges and resolutions for the numerical elements included in advisory messages for tropical cyclones are shown in Appendix 6, Table A6-4.

Note 2.— The explanations for the abbreviations can be found in the Procedures for Air Navigation Services — ICAO

Abbreviations and Codes (*PANS-ABC, Doc 8400*).

Note 3.— All the elements are mandatory.

Note 4.— Inclusion of a “colon” after each element heading is mandatory.

Note 5.— The numbers 1 to 16 are included only for clarity and they are not part of the advisory message, as shown in the example.

Element	Detailed content	Template(s)	Examples
1	Identification of the type of message	TC ADVISORY	TC ADVISORY
2	Time of origin	DTG: nnnnnnnn/nnnnZ	DTG: 20040925/1600Z
3	Name of TCAC	TCAC: nnnn or nnnnnnnnnn	TCAC: YUFO ¹ TCAC: MIAMI
4	Name of tropical cyclone	TC: nnnnnnnnnnn	TC: GLORIA
5	Advisory number	NR: nn	NR: 01
6	Position of the centre	PSN: Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]	PSN: N2706 W07306
7	Direction and speed of movement	MOV: N nnKMH (or KT) or NE nnKMH (or KT) or E nnKMH (or KT) or SE nnKMH (or KT) or S nnKMH (or KT) or SW nnKMH (or KT) or W nnKMH (or KT) or NW nnKMH (or KT) or STNR	MOV: NW 20KMH
8	Central pressure	C: nnnHPA	C: 965HPA
9	Maximum surface wind	MAX WIND: nn[n]KMH (or nn[n]KT)	MAX WIND: 90KMH
10	Forecast of centre position (+12 HR)	FCST PSN +12 HR: nn/nnnnZ Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]	FCST PSN +12 HR: 26/0400Z N2830 W07430

Element		Detailed content	Template(s)		Examples
11	Forecast of maximum surface wind (+12 HR)	Forecast of maximum surface wind (12 hours after the "DTG" given in Item 2)	FCST MAX WIND +12 HR:	nn[n]KMH (or nn[n]KT)	FCST MAX WIND +12 HR: 90KMH
12	Forecast of centre position (+18 HR)	Day and time (in UTC) (18 hours from the "DTG" given in Item 2); Forecast position (in degrees and minutes) of the centre of the tropical cyclone	FCST PSN +18 HR:	nn/nnnnZ Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]	FCST PSN +18 HR: 26/1000Z N2852 W07500
13	Forecast of maximum surface wind (+18 HR)	Forecast of maximum surface wind (18 hours after the "DTG" given in Item 2)	FCST MAX WIND +18 HR:	nn[n]KMH (or nn[n]KT)	FCST MAX WIND +18 HR: 85KMH
14	Forecast of centre position (+24 HR)	Day and time (in UTC) (24 hours from the "DTG" given in Item 2); Forecast position (in degrees and minutes) of the centre of the tropical cyclone	FCST PSN +24 HR:	nn/nnnnZ Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]	FCST PSN +24 HR: 26/1600Z N2912 W07530
15	Forecast of maximum surface wind (+24 HR)	Forecast of maximum surface wind (24 hours after the "DTG" given in Item 2)	FCST MAX WIND +24 HR:	nn[n]KMH (or nn[n]KT)	FCST MAX WIND +24 HR: 80KMH
16	Expected time of issuance of next advisory	Expected year, month, day and time (in UTC) of issuance of next advisory	NXT MSG:	[BFR] nnnnnnnn/nnnnZ or NO MSG EXP	NXT MSG: 20040925/2000Z

Note.—

1. Fictitious location.

Example A2-2. Advisory message for tropical cyclones**TC ADVISORY**

DTG:	19970925/1600Z
TCAC:	YUFO
TC:	GLORIA
NR:	01
PSN:	N2706 W07306
MOV:	NW 20KMH
C:	965HPA
MAX WIND:	90KMH
FCST PSN + 12 HR:	26/0400Z N2830 W07430
FCST MAX WIND + 12 HR:	90KMH
FCST PSN + 18 HR:	26/1000Z N2852 W07500
FCST MAX WIND + 18 HR:	85KMH
FCST PSN + 24 HR:	26/1600Z N2912 W07530
FCST MAX WIND + 24 HR:	80KMH
NXT MSG:	19970925/2000Z

APPENDIX 3. TECHNICAL SPECIFICATIONS RELATED TO METEOROLOGICAL OBSERVATIONS AND REPORTS

(See Chapter 4 of this Annex.)

1. GENERAL PROVISIONS RELATED TO METEOROLOGICAL OBSERVATIONS

1.1 Recommendation.— *The meteorological instruments used at an aerodrome should be situated in such a way as to supply data which are representative of the area for which the measurements are required.*

Note.— *Specifications concerning the siting and construction of equipment and installations on operational areas, aimed at reducing the hazard to aircraft to a minimum, are contained in Annex 14, Volume I, Chapter 8.*

1.2 Recommendation.— *Meteorological instruments at aeronautical meteorological stations should be exposed, operated and maintained in accordance with the practices, procedures and specifications promulgated by the World Meteorological Organization.*

1.3 Recommendation.— *The observers at an aerodrome should be located, in so far as is practicable, so as to supply data which are representative of the area for which the observations are required.*

1.4 Recommendation.— *Where automated equipment forms part of an integrated semi-automatic observing system, displays of data which are made available to the local ATS units should be a subset of and displayed parallel to those available in the local meteorological service unit. In those displays, each meteorological element should be annotated to identify, as appropriate, the locations for which the element is representative.*

2. GENERAL CRITERIA RELATED TO METEOROLOGICAL REPORTS

2.1 Format of meteorological reports

2.1.1 Local routine and special reports shall be issued in abbreviated plain language, in accordance with the template shown in Table A3-1.

2.1.2 METAR and SPECI shall be issued in accordance with the template shown in Table A3-2 and disseminated in the METAR and SPECI code forms prescribed by the World Meteorological Organization.

Note.— *The METAR and SPECI code forms are contained in WMO Publication No. 306, Manual on Codes, Volume I.1, Part A — Alphanumeric Codes.*

2.2 Use of CAVOK

When the following conditions occur simultaneously at the time of observation:

a) visibility, 10 km or more;

Note.— *In local routine and special reports, visibility refers to the value(s) to be reported in accordance with 4.2.4.2 and 4.2.4.3; in METAR and SPECI, visibility refers to the value(s) to be reported in accordance with 4.2.4.4.*

b) no cloud below 1 500 m (5 000 ft) or below the highest minimum sector altitude, whichever is greater, and no cumulonimbus;

c) no weather of significance to aviation as given in 4.4.2.3 and 4.4.2.4;

information on visibility, runway visual range, present weather and cloud amount, cloud type and height of cloud base shall be replaced in all meteorological reports by the term “CAVOK”.

2.3 Criteria for issuance of local special reports and SPECI

2.3.1 The list of criteria for the issuance of local special reports shall include the following:

a) those values which most closely correspond with the operating minima of the operators using the aerodrome;

b) those values which satisfy other local requirements of the air traffic services units and of the operators;

c) an increase in air temperature of 2°C or more from that given in the latest report, or an alternative threshold value as agreed between the meteorological authority, the appropriate ATS authority and operators concerned;

d) the available supplementary information concerning the occurrence of significant meteorological conditions in the approach and climb-out areas as given in Table A3-1; and

e) those values which constitute criteria for SPECI.

2.3.2 Recommendation.— *SPECI should be issued whenever changes in accordance with the following criteria occur:*

a) *when the mean surface wind direction has changed by 60° or more from that given in the latest report, the mean speed before and/or after the change being 20 km/h (10 kt) or more;*

b) *when the mean surface wind speed has changed by 20 km/h (10 kt) or more from that given in the latest report;*

c) *when the variation from the mean surface wind speed (gusts) has increased by 20 km/h (10 kt) or more from that given in the latest report, the mean speed before and/or after the change being 30 km/h (15 kt) or more;*

d) *when the wind changes through values of operational significance. The threshold values should be established by the meteorological authority in consultation with the appropriate ATS authority and operators concerned, taking into account changes in the wind which would:*

1) *require a change in runway(s) in use; and*

2) *indicate that the runway tailwind and crosswind components have changed through values representing the main operating limits for typical aircraft operating at the aerodrome;*

e) *when 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 one or more of the following values:*

1) *800, 1 500 or 3 000 m; and*

2) *5 000 m, in cases where significant numbers of flights are operated in accordance with the visual flight rules;*

Note.— *In local special reports, visibility refers to the value(s) to be reported in accordance with 4.2.4.2 and 4.2.4.3, in SPECI, visibility refers to the value(s) to be reported in accordance with 4.2.4.4.*

f) *when the runway visual range is improving and changes to or passes through one or more of the following values, or when the runway visual range is deteriorating and passes through one or more of the following values: 150, 350, 600 or 800 m;*

g) *when the onset, cessation or change in intensity of any of the following weather phenomena or combinations thereof occurs:*

— *freezing precipitation*
— *moderate or heavy precipitation (including showers thereof)*
— *duststorm*
— *sandstorm;*

h) *when the onset or cessation of any of the following weather phenomena or combinations thereof occurs:*

— *ice crystals*
— *freezing fog*
— *low drifting dust, sand or snow*
— *blowing dust, sand or snow*
— *thunderstorm (with or without precipitation)*
— *squall*
— *funnel cloud (tornado or waterspout);*

i) *when the height of base of the lowest cloud layer of BKN or OVC extent is lifting and changes to or passes through one or more of the following values, or when the height of base of the lowest cloud layer of BKN or OVC extent is lowering and passes through one or more of the following values:*

1) *30, 60, 150 or 300 m (100, 200, 500 or 1 000 ft); and*

2) *450 m (1 500 ft), in cases where significant numbers of flights are operated in accordance with the visual flight rules;*

j) *when the amount of a cloud layer below 450 m (1 500 ft) changes:*

1) *from SKC, FEW or SCT to BKN or OVC; or*

2) *from BKN or OVC to SKC, FEW or SCT; and*

k) *when the sky is obscured and the vertical visibility is improving and changes to or passes through one or more of the following values, or when the vertical visibility is deteriorating and passes through one or more of the following values: 30, 60, 150 or 300 m (100, 200, 500 or 1 000 ft).*

2.3.3 When a deterioration of one weather element is accompanied by an improvement in another element, a single SPECI shall be issued; it shall then be treated as a deterioration report.

3. DISSEMINATION OF METEOROLOGICAL REPORTS

3.1 METAR and SPECI

3.1.1 METAR and SPECI shall be disseminated to international OPMET data banks and the centres designated

by regional air navigation agreement for the operation of aeronautical fixed service satellite distribution systems, in accordance with regional air navigation agreement.

3.1.2 METAR and SPECI shall be disseminated to other aerodromes in accordance with regional air navigation agreement.

3.1.3 **Recommendation.**— *SPECI representing a deterioration in conditions should be disseminated immediately after the observation. A SPECI representing an improvement in conditions should be disseminated only after the improvement has been maintained for 10 minutes; it should be amended before dissemination, if necessary, to indicate the conditions prevailing at the end of that 10-minute period. A SPECI representing a deterioration of one weather element and an improvement in another element should be disseminated immediately after the observation.*

3.2 Local routine and special reports

3.2.1 Local routine reports shall be transmitted to local air traffic services units and shall be made available to the operators and to other users at the aerodrome.

3.2.2 Local special reports shall be transmitted to local air traffic services units as soon as the specified conditions occur. However, by agreement between the meteorological authority and the appropriate ATS authority, they need not be issued in respect of:

- a) any element for which there is in the local air traffic services unit a display corresponding to the one in the meteorological station, and where arrangements are in force for the use of this display to update information included in local routine and special reports; and
- b) runway visual range, when all changes of one or more steps on the reporting scale in use are being reported to the local air traffic services unit by an observer on the aerodrome.

Local special reports shall also be made available to the operators and to other users at the aerodrome.

4. OBSERVING AND REPORTING OF METEOROLOGICAL ELEMENTS

Introductory Note.— *Selected criteria applicable to meteorological information referred to under 4.1 to 4.8 for inclusion in aerodrome reports are given in tabular form at Attachment D.*

4.1 Surface wind

4.1.1 Siting

4.1.1.1 **Recommendation.**— *Surface wind should be observed at a height of approximately 10 m (30 ft) above the runway(s).*

4.1.1.2 **Recommendation.**— *Representative surface wind observations should be obtained by the use of sensors appropriately sited. Sensors for surface wind observations for local routine and special reports should be sited to give the best practicable indication of conditions along the runway and touchdown zones. At aerodromes where topography or prevalent weather conditions cause significant differences in surface wind at various sections of the runway, additional sensors should be provided.*

Note.— *Since, in practice, the surface wind cannot be measured directly on the runway, surface wind observations for take-off and landing are expected to be the best practicable indication of the winds which an aircraft will encounter during take-off and landing.*

4.1.2 Displays

4.1.2.1 Surface wind displays relating to each sensor shall be located in the meteorological station with corresponding displays in the appropriate air traffic services units. The displays in the meteorological station and in the air traffic services units shall relate to the same sensors, and where separate sensors are required as specified in 4.1.1.2, the displays shall be clearly marked to identify the runway and section of runway monitored by each sensor.

4.1.2.2 **Recommendation.**— *The mean values of, and significant variations in, the surface wind direction and speed for each sensor should be derived and displayed by automated equipment.*

4.1.3 Averaging

4.1.3.1 The averaging period for surface wind observations shall be:

- a) 2 minutes for local routine and special reports and for wind displays in air traffic services units; and
- b) 10 minutes for METAR and SPECI, except that when the 10-minute period includes a marked discontinuity in the wind direction and/or speed, only data occurring since the discontinuity shall be used for obtaining mean values, hence the time interval in these circumstances should be correspondingly reduced.

Note.— A marked discontinuity occurs when there is an abrupt and sustained change in wind direction of 30° or more, with a wind speed of 20 km/h (10 kt) before or after the change, or a change in wind speed of 20 km/h (10 kt) or more, lasting at least 2 minutes.

4.1.3.2 Recommendation.— *The averaging period for measuring variations from the mean wind speed (gusts) reported in accordance with 4.1.4.2 c) should be 3 seconds for local routine and special reports and for METAR and SPECI and for wind displays used for depicting variations from the mean wind speed (gusts) in air traffic services units.*

4.1.4 Reporting

4.1.4.1 In local routine and special reports and in METAR and SPECI, the surface wind direction and speed shall be reported in steps of 10 degrees true and 1 kilometre per hour (or 1 knot), respectively. Any observed value which does not fit the reporting scale in use shall be rounded to the nearest step in the scale.

4.1.4.2 In local routine and special reports and in METAR and SPECI:

- a) the units of measurement used for the wind speed shall be indicated;
- b) variations from the mean wind direction during the past 10 minutes shall be reported as follows, if the total variation is 60° or more:
 - 1) when the total variation is between 60° and 180° and the wind speed is 6 km/h (3 kt) or more such directional variations shall be reported as the two extreme directions between which the surface wind has varied;
 - 2) when the total variation is between 60° and 180° and the wind speed is less than 6 km/h (3 kt), the wind direction shall be reported as variable with no mean wind direction; or
 - 3) when the total variation is 180° or more, the wind direction shall be reported as variable with no mean wind direction;
- c) variations from the mean wind speed (gusts) during the past 10 minutes shall be reported when the maximum wind speed exceeds the mean speed by 20 km/h (10 kt) or more;
- d) when a wind speed of less than 2 km/h (1 kt) is reported, it shall be indicated as calm;
- e) when a wind speed of 200 km/h (100 kt) or more is reported, it shall be indicated to be more than 199 km/h (99 kt); and

- f) when the 10-minute period includes a marked discontinuity in the wind direction and/or speed, only variations from the mean wind direction and mean wind speed occurring since the discontinuity shall be reported.

Note.— See note under 4.1.3.1.

4.1.4.3 In local routine and special reports:

- a) if the surface wind is observed from more than one location along the runway, the locations for which these values are representative shall be indicated;
- b) when there is more than one runway in use and the surface wind related to these runways is observed, the available wind values for each runway shall be given, and the runways to which the values refer shall be reported;
- c) when variations from the mean wind direction are reported in accordance with 4.1.4.2 b) 2), the two extreme directions between which the surface wind has varied shall be reported; and
- d) when variations from the mean wind speed (gusts) are reported in accordance with 4.1.4.2 c), they shall be reported as the maximum and minimum values of the wind speed attained.

4.1.4.4 In METAR and SPECI, when variations from the mean wind speed (gusts) are reported in accordance with 4.1.4.2 c), the maximum value of the wind speed attained shall be reported.

4.2 Visibility

4.2.1 Siting

Recommendation.— *When instrumented systems are used for the measurement of visibility, representative visibility observations should be obtained by the use of sensors appropriately sited. Sensors for visibility observations for local routine and special reports should be sited to give the best practicable indications of visibility along the runway and touchdown zone. The visibility should be measured at a height of approximately 2.5 m (7.5 ft) above the runway.*

4.2.2 Displays

Recommendation.— *When instrumented systems are used for the measurement of visibility, visibility displays relating to each sensor should be located in the meteorological station with corresponding displays in the appropriate air traffic services units. The displays in the meteorological station and in the air traffic services units should relate to the same sensors, and where separate sensors are required as specified in 4.2.1,*

the displays should be clearly marked to identify the area, e.g. runway and section of runway, monitored by each sensor.

4.2.3 Averaging

Recommendation.— When instrumented systems are used for the measurement of visibility, their output should be updated at least every 60 seconds to permit provision of current representative values. The averaging period should be:

- a) 1 minute for local routine and special reports and for visibility displays in air traffic services units; and
- b) 10 minutes for METAR and SPECI, except that when the 10-minute period immediately preceding the observation includes a marked discontinuity in the visibility, only those values occurring after the discontinuity should be used for obtaining mean values.

Note.— A marked discontinuity occurs when there is an abrupt and sustained change in visibility, lasting at least 2 minutes, which reaches or passes through criteria for the issuance of SPECI reports given in 2.3.

4.2.4 Reporting

4.2.4.1 In local routine and special reports and METAR and SPECI, the visibility shall be reported in steps of 50 m when the visibility is less than 800 m; in steps of 100 m, when it is 800 m or more but less than 5 km; in kilometre steps, when the visibility is 5 km or more but less than 10 km; and it shall be given as 10 km when the visibility is 10 km or more, except when the conditions for the use of CAVOK apply. Any observed value which does not fit the reporting scale in use shall be rounded down to the nearest lower step in the scale.

Note.— Specifications concerning the use of CAVOK are given in 2.2.

4.2.4.2 In local routine and special reports, visibility along the runway(s) shall be reported together with the units of measurement.

4.2.4.3 **Recommendation.**— In local routine and special reports, when instrumented systems are used for the measurement of visibility:

- a) if the visibility is observed from more than one location along the runway as specified in Chapter 4, 4.6.2.2, the values representative of the touchdown zone should be reported first, followed, as necessary, by the values representative of the mid-point and stop-end of the runway, and the locations for which these values are representative should be indicated; and

- b) when there is more than one runway in use and the visibility is observed related to these runways, the available visibility values for each runway should be reported, and the runways to which the values refer should be indicated.

4.2.4.4 **Recommendation.**— In METAR and SPECI, visibility should be reported as prevailing visibility, as defined in Chapter 1. When the visibility is not the same in different directions and

- a) when the lowest visibility is different from the prevailing visibility, and less than 1 500 m or less than 50 per cent of the prevailing visibility, the lowest visibility observed should also be reported 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; and
- b) 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.

4.3 Runway visual range

4.3.1 Siting

4.3.1.1 **Recommendation.**— Runway visual range should be assessed at a height of approximately 2.5 m (7.5 ft) above the runway.

4.3.1.2 **Recommendation.**— Runway visual range should be assessed at a lateral distance from the runway centre line of not more than 120 m. The site for observations to be representative of the touchdown zone should be located about 300 m along the runway from the threshold. The sites for observations to be representative of the mid-point and stop-end of the runway should be located at a distance of 1 000 to 1 500 m along the runway from the threshold and at a distance of about 300 m from the other end of the runway. The exact position of these sites and, if necessary, additional sites should be decided after considering aeronautical, meteorological and climatological factors such as long runways, swamps and other fog-prone areas.

4.3.2 Instrumented systems

Note.— Since accuracy can vary from one instrument design to another, performance characteristics are to be checked before selecting an instrument for assessing RVR. The calibration of a forward-scatter meter has to be traceable and verifiable to a transmissometer standard, the accuracy of which has been verified over the intended operational range.

Guidance on the use of transmissometers and forward-scatter meters in instrumented RVR systems is given in the Manual of Runway Visual Range Observing and Reporting Practices (Doc 9328).

4.3.2.1 Instrumented systems based on transmissometers or forward-scatter meters shall be used to assess runway visual range on runways intended for Category II and III instrument approach and landing operations.

4.3.2.2 **Recommendation.**— *Instrumented systems based on transmissometers or forward-scatter meters should be used to assess runway visual range on runways intended for Category I instrument approach and landing operations.*

4.3.3 Display

4.3.3.1 Where runway visual range is determined by instrumented systems, one display or more if required, shall be located in the meteorological station with corresponding displays, in the appropriate air traffic services units. The displays in the meteorological station and in the air traffic services units shall be related to the same sensors, and where separate sensors are required as specified in 4.3.1.2, the displays shall be clearly marked to identify the runway and section of runway monitored by each sensor.

4.3.3.2 **Recommendation.**— *Where runway visual range is determined by human observers, runway visual range should be reported to the appropriate local air traffic services units, whenever there is a change in the value to be reported in accordance with the reporting scale (except where the provisions of 3.2.2 a) or b) apply). The transmission of such reports should normally be completed within 15 seconds after the termination of the observation.*

4.3.4 Averaging

Where instrumented systems are used for the assessment of runway visual range, their output shall be updated at least every 60 seconds to permit the provision of current, representative values. The averaging period for runway visual range values shall be:

- a) 1 minute for local routine and special reports and for runway visual range displays in air traffic services units; and
- b) 10 minutes for METAR and SPECI, except that when the 10-minute period immediately preceding the observation includes a marked discontinuity in runway visual range values, only those values occurring after the discontinuity shall be used for obtaining mean values.

Note.— *A marked discontinuity occurs when there is an abrupt and sustained change in runway visual range, lasting at least 2 minutes, which reaches or passes through criteria for the issuance of SPECI reports given in 2.3.2 f).*

4.3.5 Runway light intensity

Recommendation.— *When instrumented systems are used for the assessment of runway visual range, computations should be made separately for each available runway. RVR should not be computed for a light intensity of 3 per cent or less of the maximum light intensity available on a runway. For local routine and special reports, the light intensity to be used for the computation should be:*

- a) *for a runway with the lights switched on, the light intensity actually in use on that runway; and*
- b) *for a runway with lights switched off (or at the lowest setting pending the resumption of operations), the optimum light intensity that would be appropriate for operational use in the prevailing conditions.*

In METAR and SPECI, the runway visual range should be based on the maximum light intensity available on the runway.

Note.— *Guidance on the conversion of instrumented readings into runway visual range is given at Attachment E.*

4.3.6 Reporting

4.3.6.1 In local routine and special reports and in METAR and SPECI, the runway visual range shall be reported in steps of 25 m when the runway visual range is less than 400 m; in steps of 50 m when it is between 400 m and 800 m; and in steps of 100 m when the runway visual range is more than 800 m. Any observed value which does not fit the reporting scale in use shall be rounded down to the nearest step in the scale.

4.3.6.2 **Recommendation.**— *Fifty metres should be considered the lower limit and 2 000 metres the upper limit for runway visual range. Outside of these limits, local routine and special reports and METAR and SPECI should merely indicate that the runway visual range is less than 50 m or more than 2 000 m.*

4.3.6.3 In local routine and special reports and in METAR and SPECI:

- a) *when runway visual range is above the maximum value that can be determined by the system in use, it shall be reported using the abbreviation “ABV” in local routine and special reports and the abbreviation “P” in METAR and SPECI, followed by the maximum value that can be determined by the system; and*
- b) *when the runway visual range is below the minimum value that can be determined by the system in use, it shall be reported using the abbreviation “BLW” in local routine and special reports and the abbreviation “M” in METAR and SPECI, followed by the minimum value that can be determined by the system.*

4.3.6.4 In local routine and special reports:

- a) the units of measurement used shall be included;
- b) if runway visual range is observed from only one location along the runway, i.e. the touchdown zone, it shall be included without any indication of location;
- c) if the runway visual range is observed from more than one location along the runway, the value representative of the touchdown zone shall be reported first, followed by the values representative of the mid-point and stop-end and the locations for which these values are representative shall be indicated; and
- d) when there is more than one runway in use, the available runway visual range values for each runway shall be reported and the runways to which the values refer shall be indicated.

4.3.6.5 **Recommendation.**— In METAR and SPECI:

- a) *only the value representative of the touchdown zone should be reported and no indication of location on the runway should be included; and*
- b) *where there is more than one runway available for landing, touchdown zone runway visual range values should be included for all such runways, up to a maximum of four, and the runways to which the values refer should be indicated.*

4.3.6.6 **Recommendation.**— In METAR and SPECI when instrumented systems are used for the assessment of runway visual range, the variations in runway visual range during the 10-minute period immediately preceding the observation should be included as follows:

- a) *if the runway visual range values during the 10-minute period have shown a distinct tendency, such that the mean during the first 5 minutes varies by 100 m or more from the mean during the second 5 minutes of the period, this should be indicated. When the variation of the runway visual range values shows an upward or downward tendency, this should be indicated by the abbreviation “U” or “D” respectively. In circumstances when actual fluctuations during the 10-minute period show no distinct tendency, this should be indicated using the abbreviation “N”. When indications of tendency are not available, no abbreviations should be included; and*
- b) *if the 1-minute runway visual range values during the 10-minute period vary from the mean value by more than 50 m or more than 20 per cent of the mean value, whichever is greater, the 1-minute mean minimum and the 1-minute mean maximum values should be reported instead of the 10-minute mean value. If the 10-minute period immediately preceding the observation includes a marked discontinuity in runway visual range values,*

only those values occurring after the discontinuity should be used to obtain variations.

Note.— A marked discontinuity occurs when there is an abrupt and sustained change in runway visual range, lasting at least 2 minutes, which reaches or passes through criteria for the issuance of SPECI given in 2.3.2 f).

4.4 Present weather

4.4.1 Siting

Recommendation.— When instrumented systems are used for observing present weather phenomena listed under 4.4.2.3 and 4.4.2.4, representative information should be obtained by the use of sensors appropriately sited.

4.4.2 Reporting

4.4.2.1 In local routine and special reports, observed present weather phenomena shall be reported in terms of type and characteristics and qualified with respect to intensity, as appropriate.

4.4.2.2 In METAR and SPECI, observed present weather phenomena shall be reported in terms of type and characteristics and qualified with respect to intensity or proximity to the aerodrome, as appropriate.

4.4.2.3 **Recommendation.**— In local routine and special reports and in METAR and SPECI, the following types of present weather phenomena should be reported, using their respective abbreviations and relevant criteria, as appropriate:

a) Precipitation

Drizzle	DZ
Rain	RA
Snow	SN
Snow grains	SG
Ice pellets	PL
Ice crystals (very small ice crystals in suspension, also known as diamond dust)	IC
— Reported only when associated visibility is 5 000 m or less.	
Hail	GR
— Reported when diameter of largest hailstones is 5 mm or more.	
Small hail and/or snow pellets	GS
— Reported when diameter of largest hailstones is less than 5 mm;	

b) Obscurations (hydrometeors)

Fog FG
 — Reported when visibility is less than 1 000 m, except when qualified by “MI”, “BC”, “PR” or “VC” (see 4.4.2.4 and 4.4.2.5).

Mist BR
 — Reported when visibility is at least 1 000 m but not more than 5 000 m;

c) Obscurations (lithometeors)

— The following should be used only when the obscuration consists predominantly of lithometeors and the visibility is 5 000 m or less except “SA” when qualified by “DR” (see 4.4.2.4) and volcanic ash.

Sand SA

Dust (widespread) DU

Haze HZ

Smoke FU

Volcanic ash VA

d) Other phenomena

Dust/sand whirls (dust devils) PO

Squall SQ

Funnel cloud (tornado or waterspout) FC

Duststorm DS

Sandstorm SS

4.4.2.4 Recommendation.— In local routine and special reports and in METAR and SPECI, the following characteristics of present weather phenomena, as necessary, should be reported, using their respective abbreviations and relevant criteria, as appropriate:

Thunderstorm TS
 — Used to report a thunderstorm with rain “TSRA”, snow “TSSN”, ice pellets “TSPL”, hail “TSGR” or small hail and/or snow pellets “TSGS” or combinations thereof, for example, “TSRASN”. When thunder is heard or lightning is detected at the aerodrome during the 10-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”, snow “SHSN”, ice pellets “SHPL”, hail “SHGR”, small hail and/or snow pellets “SHGS”, or combinations thereof, for example “SHRASN”. Showers observed in the vicinity of the aerodrome (see 4.4.2.5) should be reported as “VCSH” without qualification regarding type or intensity of precipitation.

Freezing FZ
 — Supercooled water droplets or precipitation, used only with FG, DZ and RA.

Blowing BL
 — Used to report DU, SA or SN raised by the wind to a height of 2 m (6 ft) or more above the ground.

Low drifting DR
 — Used with DU, SA or SN raised by the wind to less than 2 m (6 ft) above ground level.

Shallow MI
 — Less than 2 m (6 ft) above ground level.

Patches BC
 — Fog patches randomly covering the aerodrome.

Partial PR
 — A substantial part of the aerodrome covered by fog while the remainder is clear.

4.4.2.5 Recommendation.— In local routine and special reports and in METAR and SPECI, the relevant intensity or, as appropriate, the proximity to the aerodrome of the reported present weather phenomena should be indicated as follows:

	(local routine and special reports)	(METAR and SPECI)
Light	FBL	—
Moderate	MOD	(no indication)
Heavy	HVY	+

Used only with DZ, GR, GS, PL, RA, SG and SN (or in combinations involving these present weather types; in these cases, intensity refers to precipitation in accordance with 4.4.2.6); DS and SS (in the cases of DS and SS, only moderate and heavy intensities to be indicated).

Vicinity VC
 — Not at the aerodrome but not further away than approximately 8 km from the aerodrome perimeter and used only in METAR and SPECI with DS, SS, FG, FC, SH, PO, BLDU, BLSA, BLSN, TS and VA when not reported under 4.4.2.4.

4.4.2.6 Recommendation.— *In local routine and special reports and in METAR and SPECI, one or more up to a maximum of three of the present weather abbreviations given in 4.4.2.3 and 4.4.2.4 should be used, as necessary, together with an indication, where appropriate, of the characteristics and intensity or proximity to the aerodrome, so as to convey a complete description of the present weather of significance to flight operations. In reporting this information, the indication of intensity or proximity as appropriate, should be reported first followed respectively by the characteristics and the type of weather phenomena. Where two different types of weather are observed, they should be reported in two separate groups, where the intensity or proximity indicator refers to the weather phenomenon which follows the indicator. However, different types of precipitation occurring at the time of 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.*

4.5 Clouds

4.5.1 Siting

Recommendation.— *When instrumented systems are used for the measurement of the cloud amount and the height of cloud base, representative observations should be obtained by the use of sensors appropriately sited. For local routine and special reports, in the case of aerodromes with precision approach runways, sensors for cloud amount and height of cloud base should be sited to give the best practicable indications of the height of cloud base and cloud amount at the middle marker site of the instrument landing system or, at aerodromes where a middle marker beacon is not used, at a distance of 900 to 1 200 m (3 000 to 4 000 ft) from the landing threshold at the approach end of the runway.*

Note.— *Specifications concerning the middle marker site of an instrument landing system are given in Annex 10, Volume I, Chapter 3 and at Attachment C, Table C-5.*

4.5.2 Display

Recommendation.— *When automated equipment is used for the measurement of the height of cloud base, height of cloud base display(s) should be located in the meteorological station with corresponding display(s) in the appropriate air traffic services units. The displays in the meteorological station and in the air traffic services units should relate to the same sensor, and where separate sensors are required as specified in 4.5.1, the displays should clearly identify the area monitored by each sensor.*

4.5.3 Reference level

Recommendation.— *The height of cloud base should normally be reported above aerodrome elevation. When a*

precision approach runway is in use which has a threshold elevation 15 m (50 ft) or more below the aerodrome elevation, local arrangements should be made in order that the height of cloud bases reported to arriving aircraft should refer to the threshold elevation. In the case of reports from off-shore structures, the height of cloud base should be given above mean sea level.

4.5.4 Reporting

4.5.4.1 Recommendation.— *In local routine and special reports and in METAR and SPECI:*

- a) *cloud amount should be reported using the abbreviations “FEW” (1 to 2 oktas), “SCT” (3 to 4 oktas), “BKN” (5 to 7 oktas) or “OVC” (8 oktas);*
- b) *cumulonimbus clouds and towering cumulus clouds should be indicated as “CB” and “TCU”, respectively;*
- c) *the height of cloud base should be reported in steps of 30 m (100 ft) up to 3 000 m (10 000 ft) and in steps of 300 m (1 000 ft) above 3 000 m (10 000 ft);*
- d) *the vertical visibility should be reported in steps of 30 m (100 ft) up to 600 m (2 000 ft);*
- e) *if there are no clouds and no restriction on vertical visibility and the abbreviation “CAVOK” is not appropriate, the abbreviation “SKC” should be used;*
- f) *if there are no clouds of operational significance, no cumulonimbus and no restriction on vertical visibility and the abbreviations “CAVOK” and “SKC” are not appropriate, the abbreviation “NSC” should be used;*
- g) *when several layers or masses of cloud of operational significance are observed, their amount and height of cloud base should be reported in increasing order of the height of cloud base, and in accordance with the following criteria:*
 - 1) *the lowest layer or mass, regardless of amount to be reported as FEW, SCT, BKN or OVC as appropriate;*
 - 2) *the next layer or mass, covering more than 2/8 to be reported as SCT, BKN or OVC as appropriate;*
 - 3) *the next higher layer or mass, covering more than 4/8 to be reported as BKN or OVC as appropriate; and*
 - 4) *cumulonimbus and/or towering cumulus clouds, whenever observed and not reported in 1) to 3);*
- h) *when the cloud base is diffuse or ragged or fluctuating rapidly, the minimum height of cloud base, or cloud fragments, should be reported; and*

- i) when an individual layer (mass) of cloud is composed of cumulonimbus and towering cumulus clouds with a common cloud base, the type of cloud should be reported as cumulonimbus only.

Note.— Towering cumulus indicates cumulus congestus clouds of great vertical extent.

4.5.4.2 In local routine and special reports:

- a) the units of measurement used for the height of cloud base and vertical visibility shall be indicated; and
- b) when there is more than one runway in use and the heights of cloud bases are observed by instruments for these runways, the available heights of cloud bases for each runway shall be reported and the runways to which the values refer shall be indicated.

4.6 Air temperature and dew-point temperature

4.6.1 Display

Recommendation.— When automated equipment is used for the measurement of air temperature and dew-point temperature, air temperature and dew-point temperature displays should be located in the meteorological station with corresponding displays in the appropriate air traffic services units. The displays in the meteorological station and in the air traffic services units should relate to the same sensors.

4.6.2 Reporting

4.6.2.1 In local routine and special reports and in METAR and SPECI, the air temperature and the dew-point temperature shall be reported in steps of whole degrees Celsius. Any observed value which does not fit the reporting scale in use shall be rounded to the nearest whole degree Celsius, with observed values involving 0.5° rounded up to the next higher whole degree Celsius.

4.6.2.2 In local routine and special reports and in METAR and SPECI, a temperature below 0°C shall be identified.

4.7 Atmospheric pressure

4.7.1 Display

When automated equipment is used for the measurement of pressure, QNH and, if required in accordance with 4.7.3.2 b), QFE displays relating to the barometer shall be located in the meteorological station with corresponding displays in the appropriate air traffic services units. When QFE values are

displayed for more than one runway, as specified in 4.7.3.2 d), the displays shall be clearly marked to identify the runway to which the QFE value displayed refers.

4.7.2 Reference level

Recommendation.— The reference level for the computation of QFE should be the aerodrome elevation. For non-precision approach runways, the thresholds of which are 2 m (7 ft) or more below or above the aerodrome elevation, and for precision approach runways, the QFE, if required, should refer to the relevant threshold elevation.

4.7.3 Reporting

4.7.3.1 For local routine and special reports and in METAR and SPECI, QNH and QFE shall be computed in tenths of hectopascals and reported therein in steps of whole hectopascals, using four digits. Any observed value which does not fit the reporting scale in use shall be rounded down to the nearest lower whole hectopascal.

4.7.3.2 In local routine and special reports:

- a) QNH shall be included;
- b) 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;
- c) the units of measurement used for QNH and QFE values shall be included; and
- d) if QFE values are required for more than one runway, the required QFE values for each runway shall be reported and the runways to which the values refer shall be indicated.

4.7.3.3 In METAR and SPECI, only QNH values shall be included.

4.8 Supplementary information

4.8.1 Reporting

4.8.1.1 **Recommendation.—** In local routine and special reports and in METAR and SPECI, the following recent weather phenomena, i.e. weather phenomena observed at the aerodrome during the period since the last issued routine report or last hour, whichever is the shorter, but not at the time of observation, should be reported, up to a maximum of three groups, in the supplementary information:

— freezing precipitation	REFZDZ, REFZRA
— moderate or heavy precipitation (including showers thereof)	REDZ, RERA, RESN, RESG, REPL, RESHRA, RESHSN, RESHGR, RESHGS
— blowing snow	REBLSN
— duststorm, sandstorm	REDS, RESS
— thunderstorm	RETS
— funnel cloud (tornado or water spout)	REFC
— volcanic ash	REVA.

4.8.1.2 **Recommendation.**— In local routine and special reports, the following significant meteorological conditions, or combinations thereof, should be reported in supplementary information:

— cumulonimbus clouds	CB
— thunderstorm	TS
— moderate or severe turbulence	MOD TURB, SEV TURB
— wind shear	WS
— hail	GR
— severe squall line	SEV SQL
— moderate or severe icing	MOD ICE, SEV ICE
— freezing precipitation	FZDZ, FZRA
— severe mountain waves	SEV MTW
— duststorm, sandstorm	DS, SS
— blowing snow	BLSN
— funnel cloud (tornado or water spout)	FC.

The location of the condition should be indicated. Where necessary, additional information should be included using abbreviated plain language.

4.8.1.3 **Recommendation.**— In METAR and SPECI, where local circumstances so warrant, information on wind shear should be added.

Note.— The local circumstances referred to in 4.8.1.3 include, but are not necessarily limited to, wind shear of a non-transitory nature such as might be associated with low-level temperature inversions or local topography.

4.8.1.4 **Recommendation.**— In METAR and SPECI, the following information should be included in the supplementary information, in accordance with regional air navigation agreement:

- information on sea-surface temperature and the state of the sea from aeronautical meteorological stations established on off-shore structures in support of helicopter operations; and
- information on the state of the runway provided by the appropriate airport authority.

Note 1.— The state of the sea is specified in WMO Publication No. 306, Manual on Codes, Volume I.1, Part A — Alphanumeric Codes, Code Table 3700.

Note 2.— The state of the runway is specified in WMO Publication No. 306, Manual on Codes, Volume I.1, Part A — Alphanumeric Codes, Code Tables 0366, 0519, 0919 and 1079.

4.9 Meteorological information from automatic observing systems

4.9.1 Reporting

4.9.1.1 **Recommendation.**— In automated METAR and SPECI, surface wind, runway visual range, air temperature and dew-point temperature, and atmospheric pressure should be reported in accordance with provisions relevant to METAR and SPECI included in Sections 4.1, 4.3, 4.6 and 4.7, respectively.

4.9.1.2 **Recommendation.**— In automated METAR and SPECI, visibility should be reported in accordance with provisions relevant to METAR and SPECI included in Section 4.2. However, when visibility sensors are sited in such a manner that no directional variations can be given, visibility value reported should be followed by the abbreviation “NDV”.

4.9.1.3 **Recommendation.**— In automated METAR and SPECI, present weather should be reported in accordance with provisions relevant to METAR and SPECI included in Section 4.4. However, in addition to the precipitation types listed under 4.4.2.3 a), the abbreviation UP should be used for unidentified precipitation when the type of precipitation cannot be identified by the automatic observing system.

4.9.1.4 **Recommendation.**— In automated METAR and SPECI, clouds and vertical visibility should be reported in accordance with provisions relevant to METAR and SPECI included in Section 4.5. However:

- when the cloud type cannot be observed by the automatic observing system, the cloud type in each cloud group should be replaced by “///”; and
- when no clouds are detected by the automatic observing system, it should be indicated by using the abbreviation “NCD”.

4.9.1.5 **Recommendation.**— In automated METAR and SPECI, supplementary information should be reported in accordance with provisions relevant to METAR and SPECI included in Section 4.8. However, in addition to the recent weather phenomena listed under 4.8.1.2, the abbreviation REUP should be used for recent precipitation when the type of precipitation cannot be identified by the automatic observing system.

Table A3-1. Template for the local routine (MET REPORT) and local special (SPECIAL) reports

Key: M = inclusion mandatory, part of every message
 C = inclusion conditional, dependent on meteorological conditions
 O = inclusion optional

Note 1.— The ranges and resolutions for the numerical elements included in the local routine and special reports are shown in Table A3-4 of this appendix.

Note 2.— The explanations for the abbreviations used can be found in the Procedures for Air Navigation Services — ICAO Abbreviations and Codes (PANS-ABC, Doc 8400).

<i>Element as specified in Chapter 4</i>	<i>Detailed content</i>	<i>Template(s)</i>			<i>Examples</i>
Identification of the type of report (M)	Type of report	MET REPORT <i>or</i> SPECIAL			MET REPORT SPECIAL
Location indicator (M)	ICAO location indicator (M)	nnnn			YUDO ¹
Time of the observation (M)	Day and actual time of the observation in UTC	nnnnnnZ			221630Z
Surface wind (M)	Name of the element (M)	WIND			WIND 240/15KMH (WIND 240/8KT)
	Runway (O) ²	RWY nn[n]			WIND RWY 18 TDZ 190/22KMH (WIND RWY 18 TDZ 190/11KT)
	Runway section (O) ³	TDZ			
	Wind direction (M)	nnn/	VRB BTN nnn/ AND nnn/ <i>or</i> VRB	CALM	WIND VRB4KMH WIND CALM (WIND VRB2KT) WIND VRB BTN 350/ AND 050/4KMH (WIND VRB BTN 350/ AND 050/2KT)
	Wind speed (M)	[ABV] n[n][n]KMH (<i>or</i> [ABV] n[n]KT)			WIND 270/ABV 199KMH (WIND 270/ABV 99KT)
	Significant speed variations (C) ⁴	MAX [ABV] nn [n] MNM n [n]			WIND 120/12KMH MAX35 MNM8 (WIND 120/6KT MAX18 MNM4)
	Significant directional variations (C) ⁵	VRB BTN nnn/ AND nnn/	—		WIND 020/20KMH VRB BTN 350/ AND 070/ (WIND 020/10KT VRB BTN 350/ AND 070/)
	Runway section (O) ³	MID			WIND RWY 14R MID 140/22KMH (WIND RWY 14R MID 140/11KT)
	Wind direction (O) ³	nnn/	VRB BTN nnn/ AND nnn/ <i>or</i> VRB	CALM	
	Wind speed (O) ³	[ABV] n[n][n]KMH (<i>or</i> [ABV] n[n]KT)			
	Significant speed variations (C) ⁴	MAX [ABV] nn [n] MNM n [n]			
	Significant directional variations (C) ⁵	VRB BTN nnn/ AND nnn/	—		

Element as specified in Chapter 4	Detailed content	Template(s)			Examples
	Runway section (O) ³	END			WIND RWY 27 TDZ 240/32KMH MAX54 MNM20 END 250/28KMH (WIND RWY 27 TDZ 240/16KT MAX27 MNM10 END 250/14KT)
	Wind direction (O) ³	nnn/	VRB BTN nnn/ AND nnn/ or VRB	CALM	
	Wind speed (O) ³	[ABV] n[n][n]KMH (or [ABV] n[n]KT)			
	Significant speed variations (C) ⁴	MAX [ABV] nn [n] MNM n [n]			
	Significant directional variations (C) ⁵	VRB BTN nnn/ AND nnn/	—		
Visibility (M)	Name of the element (M)	VIS		CAVOK	VIS 350M CAVOK VIS 7KM VIS 10KM VIS RWY 09 TDZ 800M END 1200M VIS RWY 18 TDZ 6KM RWY 27 TDZ 4000M
	Runway (O) ²	RWY nn[n]			
	Runway section (O) ³	TDZ			
	Visibility (M)	nn[n][n]M or n[n]KM			
	Runway section (O) ³	MID			
	Visibility (O) ³	nn[n][n]M or n[n]KM			
	Runway section (O) ³	END			
	Visibility (O) ³	nn[n][n]M or n[n]KM			
RVR (C) ⁶	Name of the element (M)	RVR			RVR RWY 32 400M RVR RWY 20 500M RVR RWY 10 BLW 50M RVR RWY 14 ABV 2000M RVR RWY 10 BLW 150M RVR RWY 12 ABV 1200M RVR RWY 12 TDZ 1100M MID ABV 1400M RVR RWY 16 TDZ 600M MID 500M END 400M RVR RWY 26 500M RWY 20 800M
	Runway (C) ⁷	RWY nn[n]			
	Runway section (C) ⁸	TDZ			
	RVR (M)	[ABV or BLW] nn[n][n]M			
	Runway section (C) ⁸	MID			
	RVR (C) ⁸	[ABV or BLW] nn[n][n]M			
	Runway section (C) ⁸	END			
	RVR (C) ⁸	[ABV or BLW] nn[n][n]M			
Present weather (C) ^{9, 10}	Intensity of present weather (C) ⁹	FBL or MOD or HVY	—		

Element as specified in Chapter 4	Detailed content	Template(s)				Examples	
	Characteristics and type of present weather (C) ^{9,11}	DZ or RA or SN or SG or PL or DS or SS or FZDZ or FZRA or SHGR or SHGS or SHRA or SHSN or TSGR or TSGS or TSPL or TSRA or TSSN	IC or FG or BR or SA or DU or HZ or FU or VA or SQ or PO or FC or TS or BCFG or BLDU or BLSA or BLSN or DRDU or DRSA or DRSN or FZFG or MIFG or PRFG			MOD RA HZ HVY TSRA FG HVY DZ VA FBL SN MIFG HVY TSRASN FBL SNRA FBL DZ FG HVY SHSN BLSN	
Cloud (M) ¹²	Name of the element (M)	CLD				CLD SCT 300M OVC 600M CLD NSC (CLD SCT 1000FT OVC 2000FT) CLD OBSC VER VIS 150M CLD SKC (CLD OBSC VER VIS 500FT) CLD BKN TCU 270M (CLD BKN TCU 900FT) CLD RWY 08 BKN 60M RWY 26 BKN 90M (CLD RWY 08 BKN 200FT RWY 26 BKN 300FT)	
	Runway (O) ²	RWY nn[n]					
	Cloud amount (M) or vertical visibility (O) ⁹	FEW or SCT or BKN or OVC	OBSC	SKC or NSC			
	Cloud type (C) ⁹	CB or TCU	—				
	Height of cloud base or the value of vertical visibility (C) ⁹	nn[n][n]M (or nnn[n]FT)	[VER VIS nn[n]M (or VER VIS nnn[n]FT)]				
Air temperature (M)	Name of the element (M)	T				T17	
	Air temperature (M)	[MS]nn				TMS08	
Dew-point temperature (M)	Name of the element (M)	DP				DP15	
	Dew-point temperature (M)	[MS]nn				DPMS18	
Pressure values (M)	Name of the element (M)	QNH				QNH 0995HPA	
	QNH (M)	nnnnHPA				QNH 1009HPA	
	Name of the element (O)	QFE				QNH 1022HPA QFE 1001HPA	
	QFE (O)	[RWY nn[n]] nnnnHPA [RWY nn[n] nnnnHPA]				QNH 0987HPA QFE RWY 18 0956HPA RWY 24 0955HPA	
Supplementary information (C) ⁹	Significant meteorological phenomena (C) ⁹	CB or TS or MOD TURB or SEV TURB or WS or GR or SEV SQL or MOD ICE or SEV ICE or FZDZ or FZRA or SEV MTW or SS or DS or BLSN or FC ¹³				FC IN APCH WS IN APCH 60M-WIND: 360/50KMH WS RWY 12	
	Location of the phenomenon (C) ⁹	IN APCH [nnnM-WIND nnn/nnKMH] or IN CLIMB-OUT [nnnM-WIND nnn/nnKMH] (IN APCH [nnnFT-WIND nnn/nnKT] or IN CLIMB-OUT [nnnFT-WIND nnn/nnKT]) or RWY nn[n]					
	Recent weather (C) ^{9, 10}	REFZDZ or REFZRA or REDZ or RE[SH]RA or RE[SH]SN or RESG or RESHGR or RESHGS or REBLSN or RESS or REDS or RETSRA or RETSSN or RETSPL or RETSGR or RETSGS or REFC or REPL or REVA				REFZRA CB IN CLIMB-OUT RETSRA	

Element as specified in Chapter 4	Detailed content	Template(s)				Examples	
Trend forecast (O) ¹⁴	Name of the element (M)	TREND					TREND NOSIG TREND BECMG FEW 600M (TREND BECMG FEW 2000FT) TREND TEMPO 250/70KMH MAX 100 (TREND TEMPO 250/35KT MAX 50) TREND BECMG AT1800 VIS 10KM NSW TREND BECMG TL1700 VIS 800M FG TREND BECMG FM1030 TL1130 CAVOK TREND TEMPO TL1200 VIS 600M BECMG AT1230 VIS 8KM NSW NSC TREND TEMPO FM0300 TL0430 MOD FZRA TREND BECMG FM1900 VIS 500M HVY SNRA TREND BECMG FM1100 MOD SN TEMPO FM1130 BLSN TREND BECMG AT1130 CLD OVC 300M (TREND BECMG AT1130 CLD OVC 1000FT) TREND TEMPO TL1530 HVY SHRA CLD BKN CB 360M (TREND TEMPO TL1530 HVY SHRA CLD BKN CB 1200FT)
	Change indicator (M) ¹⁵	NOSIG	BECMG <i>or</i> TEMPO				
	Period of change (C) ⁹		FMnnnn <i>and/or</i> TLnnnn <i>or</i> ATnnnn				
	Wind (C) ⁹		nnn/ [ABV] n[n][n]KMH [MAX[ABV]nn[n]] (<i>or</i> nnn/ [ABV] n[n]KT [MAX[ABV]nn])				
	Visibility (C) ⁹		VIS nn[n][n]M <i>or</i> VIS n[n]KM		CAVOK		
	Weather phenomenon: intensity (C) ⁹		FBL <i>or</i> MOD <i>or</i> HVY	—		NSW	
	Weather phenomenon: characteristics and type (C) ^{9, 10, 12}	DZ <i>or</i> RA <i>or</i> SN <i>or</i> SG <i>or</i> PL <i>or</i> DS <i>or</i> SS <i>or</i> FZDZ <i>or</i> FZRA <i>or</i> SHGR <i>or</i> SHGS <i>or</i> SHRA <i>or</i> SHSN <i>or</i> TSGR <i>or</i> TSGS <i>or</i> TSPL <i>or</i> TSRA <i>or</i> TSSN	IC <i>or</i> FG <i>or</i> BR <i>or</i> SA <i>or</i> DU <i>or</i> HZ <i>or</i> FU <i>or</i> VA <i>or</i> SQ <i>or</i> PO <i>or</i> FC <i>or</i> TS <i>or</i> BCFG <i>or</i> BLDU <i>or</i> BLSA <i>or</i> BLSN <i>or</i> DRDU <i>or</i> DRSA <i>or</i> DRSN <i>or</i> FZFG <i>or</i> MIFG <i>or</i> PRFG				
	Name of the element (C) ⁹	CLD					
	Cloud amount and vertical visibility (C) ⁹	FEW <i>or</i> SCT <i>or</i> BKN <i>or</i> OVC	OBSC	SKC <i>or</i> NSC			
	Cloud type (C) ⁹	CB <i>or</i> TCU	—				
Height of cloud base or the value of vertical visibility (C) ⁹	nn[n][n]M (<i>or</i> nnn[n]FT)	[VER VIS nn[n]M (<i>or</i> VER VIS nnn[n]FT)]					

Notes.—

1. Fictitious location.
2. Optional values for one or more runways.
3. Optional values for one or more sections of the runway.
4. To be included in accordance with 4.1.4.2 c).
5. To be included in accordance with 4.1.4.2 b) 1).
6. To be included if visibility or RVR < 1 500 m.
7. To be included in accordance with 4.3.6.4 d).
8. To be included in accordance with 4.3.6.4 c).
9. To be included whenever applicable.
10. One or more, up to a maximum of three groups in accordance with 4.4.2.6, 4.8.1.1 and Appendix 5, 2.2.4.1.

11. Precipitation types listed under 4.4.2.3 a) may be combined in accordance with 4.4.2.6 and Appendix 5, 2.2.4.1. Only moderate or heavy precipitation to be indicated in trend forecasts in accordance with Appendix 5, 2.2.4.1.
12. Up to four cloud layers in accordance with 4.5.4.1 g).
13. Abbreviated plain language may be used in accordance with 4.8.1.2.
14. To be included in accordance with Chapter 6, 6.3.2.
15. Number of change indicators to be kept to a minimum in accordance with Appendix 5, 2.2.1, normally not exceeding three groups.

Table A3-2. Template for METAR and SPECI

Key: M = inclusion mandatory, part of every message
 C = inclusion conditional, dependent on meteorological conditions or method of observation
 O = inclusion optional

Note 1.— The ranges and resolutions for the numerical elements included in METAR and SPECI are shown in Table A3-5 of this appendix.

Note 2.— The explanations for the abbreviations used can be found in the Procedures for Air Navigation Services — ICAO Abbreviations and Codes (PANS-ABC, Doc 8400).

<i>Element as specified in Chapter 4</i>	<i>Detailed content</i>	<i>Template(s)</i>		<i>Examples</i>	
Identification of the type of report (M)	Type of report (M)	METAR, METAR COR, SPECI <i>or</i> SPECI COR		METAR METAR COR SPECI	
Location indicator (M)	ICAO location indicator (M)	nnnn		YUDO ¹	
Time of the observation (M)	Day and actual time of the observation in UTC (M)	nnnnnnZ		221630Z	
Identification of an automated or missing report (C) ²	Automated or missing report identifier (C)	AUTO <i>or</i> NIL		AUTO NIL	
END OF METAR IF THE REPORT IS MISSING.					
Surface wind (M)	Wind direction (M)	nnn	VRB	24015KMH (24008KT) 19022KMH (19011KT) 00000KMH (00000KT) 140P199KMH (140P99KT) 12012G35KMH (12006G18KT) 24032G54KMH (24016G27KT) 02020KMH 350V070 (02010KT 350V070)	VRB4KMH (VRB2KT)
	Wind speed (M)	[P]nn[n]			
	Significant speed variations (C) ³	G[P]nn[n]			
	Units of measurement (M)	KMH (<i>or</i> KT)			
	Significant directional variations (C) ⁴	nnnVnnn	—		
Visibility (M)	Prevailing or minimum visibility (M) ⁵	nnnn		C A V O K 0350 CAVOK 7000NDV 9999 0800 2000 1200NW 6000 2800E	
	Unidirectional visibility (C) ⁶	NDV			
	Minimum visibility (C) ⁷	nnnn			
	Direction of the minimum visibility (C) ⁷	N <i>or</i> NE <i>or</i> E <i>or</i> SE <i>or</i> S <i>or</i> SW <i>or</i> W <i>or</i> NW			
RVR (C) ⁸	Name of the element (M)	R		R32/0400 R10/M0050 R14L/P2000 R16L/0650 R16C/0500 R16R/0450 R17L/0450	
	Runway (M)	nn[n]/			
	RVR (M)	[P <i>or</i> M]nnnn			

Element as specified in Chapter 4	Detailed content	Template(s)			Examples
	RVR variations (C) ⁹	V[P or M]nnnn			R20/0700V1200 R19/0350VP1200
	RVR past tendency (C) ¹⁰	U, D or N			R12/1100U R26/0550N R20/0800D R09/0375V0600U R10/M0150V0500D
Present weather (C) ^{2,11}	Intensity or proximity of present weather (C) ¹²	– or +	—	VC	RA HZ VCFG +TSRA FG VCSH +DZ VA VCTS –SN MIFG VCBLA +TSRASN –SNRA DZ FG +SHSN BLSN UP FZUP
	Characteristics and type of present weather (M) ¹³	DZ or RA or SN or SG or PL or DS or SS or FZDZ or FZRA or FZUP or SHGR or SHGS or SHRA or SHSN or TSGR or TSGS or TSPL or TSRA or TSSN or UP ⁶	IC or FG or BR or SA or DU or HZ or FU or VA or SQ or PO or FC or TS or FC or TS or BCFG or BLDU or BLSA or BLSN or DRDU or DRSA or DRSN or FZFG or MIFG or PRFG	FG or PO or FC or DS or SS or TS or SH or BLSN or BLSA or BLDU or VA	
Cloud (M) ¹⁴	Cloud amount and height of cloud base or vertical visibility (M)	FEWnnn or SCTnnn or BKNnnn or OVCnnn	VVnnn or VV///	SKC or NSC or NCD ⁶	FEW015 VV005 SKC OVC030 VV/// NSC SCT010 OVC020 BKN025/// BKN009TCU NCD SCT008 BKN025CB
	Cloud type (C) ²	CB or TCU or III	—		
Air and dew-point temperature (M)	Air and dew-point temperatures (M)	[M]nn/[M]nn			17/10 02/M08 M01/M10
Pressure values (M)	Name of the element (M)	Q			Q0995 Q1009 Q1022 Q0987
	QNH (M)	nnnn			
Supplementary information (C)	Recent weather (C) ^{2, 11}	REFZDZ or REFZRA or REDZ or RE[SH]RA or RE[SH]SN or RESG or RESHGR or RESHGS or REBLSN or RESS or REDS or RETSRA or RETSSN or RETSPL or RETSGR or RETSGS or REFC or REVA or REPL or REUP			REFZRA RETSRA
	Wind shear (C) ²	WS RWYnn[n] or WS ALL RWY			WS RWY03 WS ALL RWY
	Sea-surface temperature and state of the sea (C) ¹⁵	W[M]nn/Sn			W15/S2

Element as specified in Chapter 4	Detailed content		Template(s)				Examples		
	State of the runway (C) ¹⁶	Runway designator (M)	nn			SNOCLO	99421594 SNOCLO 14CLRD//		
		Runway deposits (M)	n or /		CLRD//				
		Extent of runway contamination (M)	n or /						
		Depth of deposit (M)	nn or //						
		Friction coefficient or braking action (M)	nn or //						
Trend forecast (O) ¹⁷	Change indicator (M) ¹⁸		NOSIG	BECMG or TEMPO			NOSIG	BECMG FEW020	
	Period of change (C) ²			FMnnnn and/or TLnnnn or ATnnnn					
	Wind (C) ²			nnn[P]nn[n][G [P]nn[n]]KMH (or nnn[P]nn[G[P] nn]KT)			TEMPO 25070G100KMH (TEMPO 25035G50KT)		
	Prevailing visibility (C) ²			nnnn		C A V O K	BECMG FM1030 TL1130 CAVOK BECMG TL1700 0800 FG BECMG AT1800 9000 NSW BECMG FM1900 0500 +SNRA BECMG FM1100 SN TEMPO FM1130 BLSN TEMPO FM0330 TL0430 FZRA		
	Weather phenomenon: intensity (C) ¹²			– or +	—		N S W		
	Weather phenomenon: characteristics and type (C) ^{2,11,13}			DZ or RA or SN or SG or PL or DS or SS or FZDZ or FZRA or SHGR or SHGS or SHRA or SHSN or TSGR or TSGS or TSPL or TSRA or TSSN	IC or FG or BR or SA or DU or HZ or FU or VA or SQ or PO or FC or TS or BCFG or BLDU or BLSA or BLSN or DRDU or DRSA or DRSN or FZFG or MIFG or PRFG				
	Cloud amount and height of cloud base or vertical visibility (C) ²			FEWnnn or SCTnnn or BKNnnn or OVCnnn	VVnnn or VV///		S K C or N S C	TEMPO TL1200 0600 BECMG AT1200 8000 NSW NSC BECMG AT1130 OVC010	
	Cloud type (C) ²			CB or TCU	—			TEMPO TL1530 +SHRA BKN012CB	

Notes.—

1. Fictitious location.
2. To be included whenever applicable.
3. To be included in accordance with 4.1.4.2 c).
4. To be included in accordance with 4.1.4.2 b) 1).
5. To be included in accordance with 4.2.4.4 b).
6. For automated reports only, in accordance with Section 4.9.
7. To be included in accordance with 4.2.4.4 a).
8. To be included if visibility or RVR < 1 500 m; for up to a maximum of four runways in accordance with 4.3.6.5 b).
9. To be included in accordance with 4.3.6.6 b).
10. To be included in accordance with 4.3.6.6 a).
11. One or more, up to a maximum of three, groups in accordance with 4.4.2.6, 4.8.1.1 and Appendix 5, 2.2.4.1.
12. To be included whenever applicable; no qualifier for *moderate* intensity in accordance with 4.4.2.5.
13. Precipitation types listed under 4.4.2.3 a) may be combined in accordance with 4.4.2.6 and Appendix 5, 2.2.4.1. Only moderate or heavy precipitation to be indicated in trend forecasts in accordance with Appendix 5, 2.2.4.1.
14. Up to four cloud layers in accordance with 4.5.4.1 g).
15. To be included in accordance with 4.8.1.4 a).
16. To be included in accordance with 4.8.1.4 b).
17. To be included in accordance with Chapter 6, 6.3.2.
18. Number of change indicators to be kept to a minimum in accordance with Appendix 5, 2.2.1; normally not exceeding three groups.

Table A3-3. Use of change indicators in trend forecasts

<i>Change indicator</i>	<i>Time indicator and period</i>	<i>Meaning</i>	
NOSIG	—	no significant changes are forecast	
BECMG	FM _{n₁n₁n₁n₁} TL _{n₂n₂n₂n₂}	the change is forecast to	commence at _{n₁n₁n₁n₁} UTC and be completed by _{n₂n₂n₂n₂} UTC
	TLnnnn		commence at the beginning of the trend forecast period and be completed by nnnn UTC
	FMnnnn		commence at nnnn UTC and be completed by the end of the trend forecast period
	ATnnnn		occur at nnnn UTC (specified time)
	—		a) commence at the beginning of the trend forecast period and be completed by the end of the trend forecast period; <i>or</i> b) the time is uncertain
TEMPO	FM _{n₁n₁n₁n₁} TL _{n₂n₂n₂n₂}	temporary fluctuations are forecast to	commence at _{n₁n₁n₁n₁} UTC and cease by _{n₂n₂n₂n₂} UTC
	TLnnnn		commence at the beginning of the trend forecast period and cease by nnnn UTC
	FMnnnn		commence at nnnn UTC and cease by the end of the trend forecast period
	—		commence at the beginning of the trend forecast period and cease by the end of the trend forecast period

Table A3-4. Ranges and resolutions for the numerical elements included in local reports

<i>Element as specified in Chapter 4</i>		<i>Range</i>	<i>Resolution</i>
Runway:		01 – 36	1
Wind direction:	°true	010 – 360	10
Wind speed:	KMH	1 – 399*	1
	KT	1 – 199*	1
Visibility:	M	0 – 800	50
	M	800 – 5 000	100
	KM	5 – 10	1
RVR:	M	0 – 400	25
	M	400 – 800	50
	M	800 – 2 000	100
Vertical visibility:	M	0 – 600	30
	FT	0 – 2 000	100
Clouds: height of cloud base:	M	0 – 1 500	30
	FT	0 – 5 000	100
Air temperature; Dew-point temperature:	°C	–80 – +60	1
QNH; QFE:	hPa	0500 – 1 100	1
* There is no aeronautical requirement to report surface wind speeds of 200 km/h (100 kt) or more; however, provision has been made for reporting wind speeds up to 399 km/h (199 kt) for non-aeronautical purposes, as necessary.			

Table A3-5. Ranges and resolutions for the numerical elements included in METAR and SPECI

<i>Element as specified in Chapter 4</i>		<i>Range</i>	<i>Resolution</i>
Runway:	(no units)	01 – 36	1
Wind direction:	° true	000 – 360	10
Wind speed:	KMH	00 – 399*	1
	KT	00 – 199*	1
Visibility:	M	0000 – 0800	50
	M	0800 – 5 000	100
	M	5 000 – 9 000	1 000
	M	9 000 – 9 999	999
RVR:	M	0000 – 0400	25
	M	0400 – 0800	50
	M	0800 – 2 000	100
Vertical visibility:	30's M (100's FT)	000 – 020	1
Clouds: height of cloud base:	30's M (100's FT)	000 – 050	1
Air temperature; Dew-point temperature:	°C	–80 – +60	1
	hPa	0850 – 1 100	1
QNH:	hPa	0850 – 1 100	1
Sea-surface temperature:	°C	–10 – +40	1
State of the sea:	(no units)	0 – 9	1

Element as specified in Chapter 4		Range	Resolution
State of the runway	Runway designator: (no units)	01 – 36; 51 – 86; 88; 99	1
	Runway deposits: (no units)	0 – 9	1
	Extent of runway contamination: (no units)	1; 2; 5; 9	—
	Depth of deposit: (no units)	00 – 90; 92 – 99	1
	Friction coefficient/braking action: (no units)	00 – 95; 99	1
* There is no aeronautical requirement to report surface wind speeds of 200 km/h (100 kt) or more; however, provision has been made for reporting wind speeds up to 399 km/h (199 kt) for non-aeronautical purposes, as necessary.			

Example A3-1. Routine report*a) Local routine report (same location and weather conditions as METAR):*

MET REPORT YUDO 221630Z WIND 240/15KMH VIS 600M RVR RWY 12 TDZ 1000M MOD DZ FG CLD SCT 300M OVC 600M T17 DP16 QNH 1018 HPA TREND BECMG TL1700 VIS 800M FG BECMG AT1800 VIS 10KM NSW

b) METAR for YUDO (Donlon/International):*

METAR YUDO 221630Z 24015KMH 0600 R12/1000U DZ FG SCT010 OVC020 17/16 Q1018 BECMG TL1700 0800 FG BECMG AT1800 9999 NSW

Meaning of both reports:

Routine report for Donlon/International* issued on the 22nd of the month at 1630 UTC; surface wind direction 240 degrees; wind speed 15 kilometres per hour; visibility (along the runway(s) in the local routine report; prevailing visibility in METAR) 600 metres; runway visual range representative of the touchdown zone for runway 12 is 1 000 metres and the runway visual range values have shown an upward tendency during previous 10 minutes (RVR tendency to be included in METAR only); and moderate drizzle and fog; scattered cloud at 300 metres; overcast at 600 metres; air temperature 17 degrees Celsius; dew-point temperature 16 degrees Celsius; QNH 1 018 hectopascals; trend during next 2 hours, visibility (along the runway(s) in the local routine report; prevailing visibility in METAR) becoming 800 metres in fog by 1700 UTC; at 1800 UTC visibility (along the runway(s) in the local routine report; prevailing visibility in METAR) becoming 10 kilometres or more and nil significant weather.

* Fictitious location

Note.— In this example, the primary units “kilometre per hour” and “metre” were used for wind speed and height of cloud base, respectively. However, in accordance with Annex 5, the corresponding non-SI alternative units “knot” and “foot” may be used instead.

Example A3-2. Special report

a) *Local special report (same location and weather conditions as SPECI):*

SPECIAL YUDO 151115Z WIND 050/25KT MAX37 MNM10 VIS 1200M HVY TSRA CLD BKN CB 500FT T25 DP22 QNH 1008 HPA TREND TEMPO TL1200 VIS 600M BECMG AT1200 VIS 8KM NSW NSC

b) *SPECI for YUDO (Donlon/International)*:*

SPECI YUDO 151115Z 05025G37KT 3000 1200NE+TSRA BKN005CB 25/22 Q1008 TEMPO TL1200 0600 BECMG AT1200 8000 NSW NSC

Meaning of both reports:

Special report for Donlon/International* issued on the 15th of the month at 1115 UTC; surface wind direction 050 degrees; wind speed 25 knots gusting between 10 and 37 knots (minimum wind speed not to be included in SPECI) visibility 1 200 metres (along the runway(s) in the local special report); prevailing visibility 3 000 metres (in SPECI) with minimum visibility 1 200 metres to north east (directional variations to be included in SPECI only); thunderstorm with heavy rain; broken cumulonimbus cloud at 500 feet; air temperature 25 degrees Celsius; dew-point temperature 22 degrees Celsius; QNH 1 008 hectopascals; trend during next 2 hours, visibility (along the runway(s) in the local special report; prevailing visibility in SPECI) temporarily 600 metres from 1115 to 1200, becoming at 1200 UTC visibility (along the runway(s) in the local special report; prevailing visibility in SPECI) 8 kilometres, thunderstorm ceases and nil significant weather and nil significant cloud.

* Fictitious location

Note.— In this example, the non-SI alternative units “knot” and “foot” were used for wind speed and height of cloud base, respectively. However, in accordance with Annex 5, the corresponding primary units “kilometre per hour” and “metre” may be used instead.

Example A3-3. Volcanic activity report

VOLCANIC ACTIVITY REPORT YUSB* 231500 MT TROJEEN* VOLCANO N5605 W12652 ERUPTED 231445 LARGE ASH CLOUD EXTENDING TO APPROX 30000 FEET MOVING SW

Meaning:

Volcanic activity report issued by Siby/Bistock meteorological station at 1500 UTC on the 23rd of the month. Mt. Trojeen volcano 56 degrees 5 minutes north 126 degrees 52 minutes west erupted at 1445 UTC on the 23rd; a large ash cloud was observed extending to approximately 30 000 feet and moving in a south-westerly direction.

* Fictitious location

APPENDIX 4. TECHNICAL SPECIFICATIONS RELATED TO AIRCRAFT OBSERVATIONS AND REPORTS

(See Chapter 5 of this Annex.)

1. CONTENTS OF AIR-REPORTS

1.1 Routine air-reports by air-ground data link

1.1.1 When air-ground data link is used and automatic dependent surveillance (ADS) is being applied, the elements contained in routine air-reports shall be:

Message type designator
Aircraft identification

Data block 1
Latitude
Longitude
Level
Time

Data block 2
Wind direction
Wind speed
Wind quality flag
Temperature
Turbulence (if available)
Humidity (if available)

Note.— When ADS is being applied, the requirements of routine air-reports may be met by the combination of the basic ADS data block (data block 1) and the meteorological information data block (data block 2), available from ADS reports. The ADS message format is specified in the PANS-ATM (Doc 4444), Part II, Section 14.4 and in Annex 10, Volume III, Part I — Digital Data Communication Systems.

1.1.2 When air-ground data link is used while ADS is not being applied, the elements contained in routine reports shall be in accordance with 1.3.

Note.— When air-ground data link is used while ADS is not being applied, the requirements of routine air-reports may be met by the controller-pilot data link communication (CPDLC) application entitled “Position report”. The details of this data link application are specified in the Manual of Air Traffic Services Data Link Applications (Doc 9694) and in Annex 10, Volume III, Part I.

1.2 Special air-reports by air-ground data link

When air-ground data link is used, the elements contained in special air-reports shall be:

Message type designator
Aircraft identification

Data block 1
Latitude
Longitude
Level
Time

Data block 2
Wind direction
Wind speed
Wind quality flag
Temperature
Turbulence (if available)
Humidity (if available)

Data block 3
Condition prompting the issuance of a special air-report (one condition to be selected from the list presented in Table A4-3).

Note 1.— The requirements of special air-reports may be met by the data link flight information service (D-FIS) application entitled “Special air-report service”. The details of this data link application are specified in Doc 9694.

Note 2.— In the case of a special air-report of pre-eruption volcanic activity, volcanic eruption or volcanic ash cloud, additional requirements are indicated in 4.2.

1.3 Routine air-reports by voice communications

When voice communications are used, the elements contained in routine air-reports shall be:

Message type designator

Section 1 (Position information)
Aircraft identification
Position or latitude and longitude
Time
Flight level or altitude
Next position and time over
Ensuing significant point

Section 2 (Operational information)
Estimated time of arrival
Endurance

Section 3 (Meteorological information)

Air temperature
Wind direction
Wind speed
Turbulence
Aircraft icing
Humidity (if available)

1.4 Special air-reports by voice communications

When voice communications are used, the elements contained in special air-reports shall be:

Message type designator

Section 1 (Position information)

Aircraft identification
Position or latitude and longitude
Time
Flight level or altitude

Section 3 (Meteorological information)

Condition prompting the issuance of a special air-report, to be selected from the list presented in Table A4-3.

Note 1.— Air-reports are considered routine by default. The message type designator for special air-reports is specified in the PANS-ATM (Doc 4444), Appendix 1.

Note 2.— In the case of a special air-report of pre-eruption volcanic activity, volcanic eruption or volcanic ash cloud, additional requirements are indicated in 4.2.

2. CRITERIA FOR REPORTING

2.1 When air-ground data link is used, the wind direction, wind speed, wind quality flag, temperature, turbulence and humidity included in air-reports shall be reported in accordance with the following criteria.

2.2 Wind direction

The wind direction shall be reported in terms of degrees true, rounded to the nearest whole degree.

2.3 Wind speed

The wind speed shall be reported in kilometres per hour or knots, rounded to the nearest 2 km/h (1 knot). The units used shall be indicated.

2.4 Wind quality flag

The wind quality flag shall be reported as 0 when the roll angle is less than 5 degrees and as 1 when the roll angle is 5 degrees or more.

2.5 Temperature

The temperature shall be reported to the nearest tenth of a degree Celsius.

2.6 Turbulence

The turbulence shall be observed in terms of the eddy dissipation rate (EDR).

2.6.1 Routine air-reports

The turbulence shall be reported during the en-route phase of the flight and shall refer to the 15-minute period immediately preceding the observation. Both the average and peak value of turbulence, together with the time of occurrence of the peak value to the nearest minute, shall be observed. The average and peak values shall be reported in terms of a turbulence index comprising seven intensity levels of EDR as indicated in Table A4-1. The time of occurrence of the peak value shall be reported as indicated in Table A4-2.

2.6.2 Interpretation of the turbulence index

Turbulence shall be considered:

- a) severe when the turbulence index is between 15 and 27 (i.e. the peak value of the EDR is exceeding 0.5);
- b) moderate when the turbulence index is between 6 and 14 (i.e. the peak value of the EDR is exceeding 0.3 while not exceeding 0.5);
- c) light when the turbulence index is between 1 and 5 (i.e. the peak value of the EDR is between 0.1 and 0.3); and
- d) nil when the turbulence index is 0 (i.e. the peak value of the EDR is less than 0.1).

Note.— The EDR is an aircraft-independent measure of turbulence. However, the relationship between the EDR index and the perception of turbulence is a function of aircraft type, and the mass, altitude, configuration and airspeed of the aircraft.

2.6.3 Special air-reports

Special air-reports on turbulence shall be made during any phase of the flight whenever the peak value exceeds the EDR

value of 0.5. The special air-report on turbulence shall be made with reference to the 1-minute period immediately preceding the observation. Both the average and peak value of turbulence shall be observed. The average and peak values shall be reported in terms of a turbulence index as indicated in the shaded part of Table A4-1. Special air-reports shall be issued every minute until such time that the peak values of turbulence fall below the EDR value of 0.5.

2.7 Humidity

The humidity shall be reported as the relative humidity, rounded to the nearest whole per cent.

Note.— The ranges and resolutions for the meteorological elements included in air-reports are shown in Table A4-4.

3. EXCHANGE OF AIR-REPORTS

3.1 Responsibilities of the meteorological watch offices

3.1.1 The meteorological watch offices shall assemble the routine air-reports received by voice communications and shall disseminate them to WAFCs and other meteorological offices in accordance with regional air navigation agreement.

Note.— The exchange of collectives on an hourly basis may be found desirable when reports are numerous.

3.1.2 The meteorological watch office shall transmit without delay the special air-reports received by voice communications to WAFCs.

3.1.3 The meteorological watch office shall transmit without delay special air-reports of pre-eruption volcanic activity, a volcanic eruption or volcanic ash cloud received to the associated VAACs.

3.1.4 When a special air-report is received at the meteorological watch office but the forecaster considers that the phenomenon causing the report is not expected to persist and, therefore, does not warrant issuance of a SIGMET, the special air-report shall be disseminated in the same way that SIGMET messages are disseminated in accordance with Appendix 6, 1.2.1, i.e. to meteorological watch offices, WAFCs, and other meteorological offices in accordance with regional air navigation agreement.

3.2 Responsibilities of world area forecast centres

Air-reports received at WAFCs shall be further disseminated as basic meteorological data.

Note.— The dissemination of basic meteorological data is normally carried out on the WMO global telecommunication system.

3.3 Supplementary dissemination of air-reports

Recommendation.— *Where supplementary dissemination of air-reports is required to satisfy special aeronautical or meteorological requirements, such dissemination should be arranged between the meteorological authorities concerned.*

3.4 Format of air-reports

Air-reports shall be exchanged in the format in which they are received, except that when voice communications are used, if the position is given by reference to an ATS reporting point, it shall be converted, by the meteorological watch office, into the corresponding latitude and longitude.

4. SPECIFIC PROVISIONS RELATED TO REPORTING WIND SHEAR AND VOLCANIC ASH

4.1 Reporting of wind shear

4.1.1 **Recommendation.—** *When reporting aircraft observations of wind shear encountered during the climb-out and approach phases of flight, the aircraft type should be included.*

4.1.2 **Recommendation.—** *Where wind shear conditions in the climb-out or approach phases of flight were reported or forecast but not encountered, the pilot-in-command should advise the appropriate air traffic services unit as soon as practicable unless the pilot-in-command is aware that the appropriate air traffic services unit has already been so advised by a preceding aircraft.*

4.2 Post-flight reporting of volcanic activity

Note.— The detailed instructions for recording and reporting volcanic activity observations are given in the PANS-ATM (Doc 4444), Appendix 1.

4.2.1 On arrival of a flight at an aerodrome, the completed report of volcanic activity shall be delivered by the operator or a flight crew member, without delay, to the aerodrome meteorological office, or if such office is not easily accessible to arriving flight crew members, the completed form shall be dealt with in accordance with local arrangements made by the meteorological authority and the operator.

4.2.2 The completed report of volcanic activity received by a meteorological office shall be transmitted without delay to the meteorological watch office responsible for the provision of meteorological watch for the flight information region in which the volcanic activity was observed.

**Table A4-1. Turbulence index to be reported as a function of the average and peak value of turbulence
(Classes corresponding to severe turbulence are shaded)**

Peak value of turbulence								
Average value of turbulence	EDR ($m^{2/3} s^{-1}$)							Nil report
EDR ($m^{2/3} s^{-1}$)	< 0. 1	0.1 – 0.2	0.2 – 0.3	0.3 – 0.4	0.4 – 0.5	0.5 – 0.8	> 0.8	
< 0.1	0	1	3	6	10	15	21	
0.1 – 0.2		2	4	7	11	16	22	
0.2 – 0.3			5	8	12	17	23	
0.3 – 0.4				9	13	18	24	
0.4 – 0.5					14	19	25	
0.5 – 0.8						20	26	
> 0.8							27	
Nil report								28

Table A4-2. Time of occurrence of the peak value to be reported

Peak value of turbulence occurring during the one-minute period minutes prior to the observation	Value to be reported
0 – 1	0
1 – 2	1
2 – 3	2
...	...
13 – 14	13
14 – 15	14
No timing information available	15

Table A4-3. Template for the special air-report (downlink)

Key: M = mandatory, part of every message
 C = inclusion conditional; included whenever available

Note.— Message to be prompted by the pilot-in-command.
 Currently only the condition “SEV TURB” can be automated (see 2.6.3).

Element as specified in Chapter 5	Detailed content	Template(s)	Examples
Message type designator (M)	Type of the air-report (M)	ARS	ARS
Aircraft identification (M)	Aircraft radiotelephony call sign (M)	nnnnnn	VA812
DATA BLOCK 1			
Latitude (M)	Latitude in degrees and minutes (M)	Nnnnn or Snnnn	S4506
Longitude (M)	Longitude in degrees and minutes (M)	Wnnnnn or Ennnnn	E01056
Level (M)	Flight level (M)	FLnnn	FL330
Time (M)	Time of occurrence in hours and minutes (M)	OBS AT nnnnZ	OBS AT 1216Z
DATA BLOCK 2			
Wind direction (M)	Wind direction in degrees true (M)	nnn/	262/
Wind speed (M)	Wind speed in kilometres per hour (or knots) (M)	nnnKMH (or nnnKT)	158KMH (079KT)
Wind quality flag (M)	Wind quality flag (M)	n	1
Temperature (M)	Air temperature in tenths of degrees C (M)	T[M]nnn	T127 TM455
Turbulence (C)	Turbulence index and the time of occurrence of the peak value (C) ¹	EDRnn/nn	EDR16/08
Humidity (C)	Relative humidity in per cent (C)	RHnnn	RH054
DATA BLOCK 3			
Condition prompting the issuance of a special air-report (M)		SEV TURB [EDRnn] ² or SEV ICE or SEV MTW or TS GR ³ or TS ³ or HVY SS ⁴ or VA CLD [FL nnn/nnn] or VA ⁵ [MT nnnnnnnnnnnnnnnnnnnnn]	SEV TURB EDR16; VA CLD FL050/100

Notes.—

1. The index and the time of occurrence to be reported in accordance with Tables A4-1 and A4-2, respectively.
2. The turbulence index to be reported in accordance with 2.6.3 and Table A4-1.
3. Obscured, embedded or widespread thunderstorms or thunderstorms in squall lines.
4. Duststorm or sandstorm.
5. Pre-eruption volcanic activity or a volcanic eruption.

Table A4-4. Ranges and resolutions for the meteorological elements included in air-reports

<i>Element as specified in Chapter 5</i>		<i>Range</i>	<i>Resolution</i>
Wind direction:	°true	000 – 360	1
Wind speed:	KMH	00 – 500	2
	KT	00 – 250	1
Wind quality flag:	(index)*	0 – 1	1
Temperature:	°C	–80 – +60	0.1
Turbulence: routine air-report:	(index)*	0 – 28	1
	(time of occurrence)*	0 – 15	1
Turbulence: special air-report:	(index)*	15 – 27	1
Humidity:	%	0 – 100	1
* Non-dimensional			

APPENDIX 5. TECHNICAL SPECIFICATIONS RELATED TO FORECASTS

(See Chapter 6 of this Annex.)

1. CRITERIA RELATED TO TAF

1.1 TAF format

TAF shall be issued in accordance with the template shown in Table A5-1 and disseminated in the TAF code form prescribed by the World Meteorological Organization.

Note.— The TAF code form is contained in WMO Publication No. 306, Manual on Codes, Volume I.1, Part A — Alphanumeric Codes.

1.2 Inclusion of meteorological elements in TAF

Note.— Guidance on operationally desirable accuracy of forecasts is given in Attachment B.

1.2.1 Surface wind

Recommendation.— In forecasting surface wind, the expected prevailing direction should be given. When it is not possible to forecast a prevailing surface wind direction due to its expected variability, for example, during light wind conditions (less than 6 km/h (3 kt)) or thunderstorms, the forecast wind direction should be indicated as variable using “VRB”. When the wind is forecast to be less than 2 km/h (1 kt) the forecast wind speed should be indicated as calm. When the forecast maximum speed (gust) exceeds the forecast mean wind speed by 20 km/h (10 kt) or more, the forecast maximum wind speed should be indicated. When a wind speed of 200 km/h (100 kt) or more is forecast, it should be indicated to be more than 199 km/h (99 kt).

1.2.2 Visibility

Recommendation.— When the visibility is forecast to be less than 800 m it should be expressed in steps of 50 m; when it is forecast to be 800 m or more but less than 5 km, in steps of 100 m; 5 km or more but less than 10 km in kilometre steps and when it is forecast to be 10 km, or more it should be expressed as 10 km, except when conditions of CAVOK are forecast to apply. The prevailing visibility should be forecast. When visibility is forecast to vary in different directions and the prevailing visibility cannot be forecast, the lowest forecast visibility should be given.

1.2.3 Weather phenomena

Recommendation.— One or more, up to a maximum of three, of the following weather phenomena or combinations thereof, together with their characteristics and, where appropriate, intensity should be forecast if they are expected to occur at the aerodrome:

- freezing precipitation
- freezing fog
- moderate or heavy precipitation (including showers thereof)
- low drifting dust, sand or snow
- blowing dust, sand or snow
- duststorm
- sandstorm
- thunderstorm (with or without precipitation)
- squall
- funnel cloud (tornado or waterspout)
- other weather phenomena given in Appendix 3, 4.4.2.3 only if they are expected to cause a significant change in visibility.

The expected end of occurrence of those phenomena should be indicated by the abbreviation “NSW”.

1.2.4 Cloud

Recommendation.— Cloud amount should be forecast using the abbreviations “FEW”, “SCT”, “BKN” or “OVC” as necessary. If no clouds are forecast, and the abbreviation “CAVOK” is not appropriate, the abbreviation “SKC” should be used. When it is expected that the sky will remain or become obscured and clouds cannot be forecast and information on vertical visibility is available at the aerodrome, the vertical visibility should be forecast in the form “VV” followed by the forecast value of the vertical visibility. When several layers or masses of cloud are forecast, their amount and height of base should be included in the following order:

- a) the lowest layer or mass regardless of amount, to be forecast as FEW, SCT, BKN or OVC as appropriate;
- b) the next layer or mass covering more than 2/8, to be forecast as SCT, BKN or OVC as appropriate;
- c) the next higher layer or mass covering more than 4/8, to be forecast as BKN or OVC as appropriate; and

- d) cumulonimbus clouds, whenever forecast and not already included under a) to c).

Cloud information should be limited to cloud of operational significance, i.e. cloud below 1 500 m (5 000 ft) or the highest minimum sector altitude whichever is greater; and cumulonimbus whenever forecast. In applying this limitation, when no cumulonimbus and no cloud below 1 500 m (5 000 ft) or below the highest minimum sector altitude whichever is greater are forecast, and “CAVOK” or “SKC” are not appropriate, the abbreviation “NSC” should be used.

1.2.5 Temperature

Recommendation.— When forecast temperatures are included in accordance with regional air navigation agreement, the maximum and minimum temperatures expected to occur during the period of validity of the TAF should be given, together with their corresponding times of occurrence.

1.3 Use of change groups

1.3.1 Recommendation.— The criteria used for the inclusion of change groups in TAF or for the amendment of TAF should be based on the following:

- a) when the surface wind is forecast to change through values of operational significance the threshold values should be established by the meteorological authority in consultation with the appropriate ATS authority and operators concerned, taking into account changes in the wind which would:

- 1) require a change in runway(s) in use; and
- 2) indicate that the runway tailwind and crosswind components will change through values representing the main operating limits for typical aircraft operating at the aerodrome;

- b) when the visibility is forecast to improve and change to or pass through one or more of the following values, or when the visibility is forecast to deteriorate and pass through one or more of the following values:

- 1) 150, 350, 600, 800, 1 500 or 3 000 m; or
- 2) 5 000 m in cases where significant numbers of flights are operated in accordance with the visual flight rules;

- c) when any of the following weather phenomena or combinations thereof are forecast to begin or end or change in intensity:

— freezing precipitation

- moderate or heavy precipitation (including showers thereof)
- duststorm
- sandstorm
- other weather phenomena given in Appendix 3, 4.4.2.3 only if they are expected to cause a significant change in visibility;

- d) when the onset or cessation of any of the following weather phenomena or combinations thereof are forecast to begin or end:

- ice crystals
- freezing fog
- low drifting dust, sand or snow
- blowing dust, sand or snow
- thunderstorm (with or without precipitation)
- squall
- funnel cloud (tornado or waterspout);

- e) when the height of base of the lowest layer or mass of cloud of BKN or OVC extent is forecast to lift and change to or pass through one or more of the following values, or when the height of the lowest layer or mass of cloud of BKN or OVC extent is forecast to lower and pass through one or more of the following values:

- 1) 30, 60, 150 or 300 m (100, 200, 500 or 1 000 ft); or
- 2) 450 m (1 500 ft), in cases where significant numbers of flights are operated in accordance with the visual flight rules;

- f) when the amount of a layer or mass of cloud below 450 m (1 500 ft) is forecast to change:

- 1) from SKC, FEW or SCT to BKN or OVC; or
- 2) from BKN or OVC to SKC, FEW or SCT;

- g) when cumulonimbus clouds are forecast to develop or dissipate;

- h) when the vertical visibility is forecast to improve and change to or pass through one or more of the following values, or when the vertical visibility is forecast to deteriorate and pass through one or more of the following values: 30, 60, 150 or 300 m (100, 200, 500 or 1 000 ft); and

- i) any other criteria based on local aerodrome operating minima, as agreed between the meteorological authority and the operators.

1.3.2 Recommendation.— When a change in any of the elements given in Chapter 6, 6.2.3 is required to be indicated in accordance with the criteria given in 1.3.1, the change indicators “BECMG” or “TEMPO” should be used followed by the time period during which the change is expected to occur.

The time period should be indicated as the beginning and end of the period in whole hours UTC. Only those elements for which a significant change is expected should be included following a change indicator. However, in the case of significant changes in respect of cloud, all cloud groups, including layers or masses not expected to change, should be indicated.

1.3.3 Recommendation.— The change indicator “BECMG” and the associated time group should be used to describe changes where the meteorological conditions are expected to reach or pass through specified threshold values at a regular or irregular rate and at an unspecified time during the time period. The time period should normally not exceed 2 hours but in any case should not exceed 4 hours.

1.3.4 Recommendation.— The change indicator “TEMPO” and the associated time group should be used to describe expected frequent or infrequent temporary fluctuations in the meteorological conditions which reach or pass specified threshold values and last for a period of less than one hour in each instance and, in the aggregate, cover less than one-half of the forecast period during which the fluctuations are expected to occur. If the temporary fluctuation is expected to last one hour or longer, the change group “BECMG” should be used in accordance with 1.3.3 or the validity period should be subdivided in accordance with 1.3.5.

1.3.5 Recommendation.— Where one set of prevailing weather conditions is expected to change significantly and more or less completely to a different set of conditions, the period of validity should be subdivided into self-contained periods using the abbreviation “FM” followed immediately by a four-figure time group in whole hours and minutes UTC indicating the time the change is expected to occur. The subdivided period following the abbreviation “FM” should be self-contained and all forecast conditions given before the abbreviation should be superseded by those following the abbreviation.

1.4 Use of probability groups

Recommendation.— The probability of occurrence of an alternative value of a forecast element or elements should be indicated, as necessary, by use of the abbreviation “PROB” followed by the probability in tens of per cent and the time period during which the alternative value(s) is (are) expected to apply. The probability information should be placed after the element or elements forecast and be followed by the alternative value of the element or elements. The probability of a forecast of temporary fluctuations in meteorological conditions should be indicated, as necessary, by use of the abbreviation “PROB” followed by the probability in tens of per cent, placed before the change indicator “TEMPO” and associated time group. A probability of an alternative value or change of less than 30 per cent should not be considered

sufficiently significant to be indicated. A probability of an alternative value or change of 50 per cent or more, for aviation purposes, should not be considered a probability but instead should be indicated, as necessary, by use of the change indicators “BECMG” or “TEMPO” or by subdivision of the validity period using the abbreviation “FM”. The probability group should not be used to qualify the change indicator “BECMG” nor the time indicator “FM”.

1.5 Numbers of change and probability groups

Recommendation.— The number of change and probability groups should be kept to a minimum and should not normally exceed five groups.

1.6 Dissemination of TAF

TAF and amendments thereto shall be disseminated to international OPMET data banks and the centres designated by regional air navigation agreement for the operation of aeronautical fixed service satellite distribution systems, in accordance with regional air navigation agreement.

2. CRITERIA RELATED TO TREND FORECASTS

2.1 Format of trend forecasts

Trend forecasts shall be issued in accordance with the templates shown in Appendix 3, Tables A3-1 and A3-2. The units and scales used in the trend forecast shall be the same as those used in the report to which it is appended.

Note.— Examples of trend forecasts are given in Appendix 3.

2.2 Inclusion of meteorological elements in trend forecasts

2.2.1 General provisions

The trend forecast shall indicate significant changes in respect of one or more of the elements: surface wind, visibility, weather and clouds. Only those elements shall be included for which a significant change is expected. However, in the case of significant changes in respect of cloud, all cloud groups, including layers or masses not expected to change, shall be indicated. In the case of a significant change in visibility, the phenomenon causing the reduction of visibility shall also be indicated. When no change is expected to occur, this shall be indicated by the term “NOSIG”.

2.2.2 Surface wind

The trend forecast shall indicate changes in the surface wind which involve:

- a) a change in the mean wind direction of 60° or more, the mean speed before and/or after the change being 20 km/h (10 kt) or more;
- b) a change in mean wind speed of 20 km/h (10 kt) or more; and
- c) changes in the wind through values of operational significance. The threshold values should be established by the meteorological authority in consultation with the appropriate ATS authority and operators concerned, taking into account changes in the wind which would:
 - 1) require a change in runway(s) in use; and
 - 2) indicate that the runway tailwind and crosswind components will change through values representing the main operating limits for typical aircraft operating at the aerodrome.

2.2.3 Visibility

When the visibility is expected to improve and change to or pass through one or more of the following values, or when the visibility is expected to deteriorate and pass through one or more of the following values: 150, 350, 600, 800, 1 500 or 3 000 m, the trend forecast shall indicate the change. When significant numbers of flights are conducted in accordance with the visual flight rules, the forecast shall additionally indicate changes to or passing through 5 000 m.

Note.— In trend forecasts appended to local routine and special reports, visibility refers to the forecast visibility along the runway(s); in trend forecasts appended to METAR and SPECI, visibility refers to the forecast prevailing visibility.

2.2.4 Weather phenomena

2.2.4.1 The trend forecast shall indicate the expected onset, cessation or change in intensity of one or more, up to a maximum of three, of the following weather phenomena or combinations thereof:

- freezing precipitation
- moderate or heavy precipitation (including showers thereof)
- duststorm
- sandstorm
- other weather phenomena given in Appendix 3, 4.4.2.3, only if they are expected to cause a significant change in visibility.

2.2.4.2 The trend forecast shall indicate the expected onset or cessation of one or more, up to a maximum of three, of the following weather phenomena or combinations thereof:

- ice crystals
- freezing fog
- low drifting dust, sand or snow
- blowing dust, sand or snow
- thunderstorm (with or without precipitation)
- squall
- funnel cloud (tornado or waterspout).

2.2.4.3 The expected end of occurrence of the weather phenomena shall be indicated by the abbreviation “NSW”.

2.2.5 Clouds

When the height of the base of a cloud layer of BKN or OVC extent is expected to lift and change to or pass through one or more of the following values, or when the height of the base of a cloud layer of BKN or OVC extent is expected to lower and pass through one or more of the following values: 30, 60, 150, 300 and 450 m (100, 200, 500, 1 000 and 1 500 ft), the trend forecast shall indicate the change. When the height of the base of a cloud layer is below or is expected to fall below or rise above 450 m (1 500 ft), the trend forecast shall also indicate changes in cloud amount from SKC, FEW, or SCT increasing to BKN or OVC, or changes from BKN or OVC decreasing to SKC, FEW or SCT. When no cumulonimbus and no cloud below 1 500 m (5 000 ft) or below the highest minimum sector altitude, whichever is greater, are forecast and “CAVOK” and “SKC” are not appropriate, the abbreviation “NSC” shall be used.

2.2.6 Vertical visibility

When the sky is expected to remain or become obscured and vertical visibility observations are available at the aerodrome, and the vertical visibility is forecast to improve and change to or pass through one or more of the following values, or when the vertical visibility is forecast to deteriorate and pass through one or more of the following values: 30, 60, 150 or 300 m (100, 200, 500 or 1 000 ft), the trend forecast shall indicate the change.

2.2.7 Additional criteria

Criteria for the indication of changes based on local aerodrome operating minima, additional to those specified in 2.2.2 to 2.2.6, shall be used as agreed between the meteorological authority and the operator(s) concerned.

2.3 Use of change indicators

2.3.1 When a change is expected to occur, the trend forecast shall begin with one of the change indicators “BECMG” or “TEMPO”.

2.3.2 The change indicator “BECMG” shall be used to describe forecast changes where the meteorological conditions are expected to reach or pass through specified values at a regular or irregular rate. The period during which, or the time at which, the change is forecast to occur shall be indicated, using the abbreviations “FM”, “TL”, or “AT”, as appropriate, each followed by a time group in hours and minutes. When the change is forecast to begin and end wholly within the trend forecast period, the beginning and end of the change shall be indicated by using the abbreviations “FM” and “TL”, respectively, with their associated time groups. When the change is forecast to commence at the beginning of the trend forecast period but be completed before the end of that period, the abbreviation “FM” and its associated time group shall be omitted and only “TL” and its associated time group shall be used. When the change is forecast to begin during the trend forecast period and be completed at the end of that period, the abbreviation “TL” and its associated time group shall be omitted and only “FM” and its associated time group shall be used. When the change is forecast to occur at a specified time during the trend forecast period, the abbreviation “AT” followed by its associated time group shall be used. When the change is forecast to commence at the beginning of the trend forecast period and be completed by the end of that period or when the change is forecast to occur within the trend forecast period but the time is uncertain, the abbreviations “FM”, “TL” or “AT” and their associated time groups shall be omitted and the change indicator “BECMG” shall be used alone.

2.3.3 The change indicator “TEMPO” shall be used to describe forecast temporary fluctuations in the meteorological conditions which reach or pass specified values and last for a period of less than one hour in each instance and, in the aggregate, cover less than one-half of the period during which the fluctuations are forecast to occur. The period during which the temporary fluctuations are forecast to occur shall be indicated, using the abbreviations “FM” and/or “TL”, as appropriate, each followed by a time group in hours and minutes. When the period of temporary fluctuations in the meteorological conditions is forecast to begin and end wholly within the trend forecast period, the beginning and end of the period of temporary fluctuations shall be indicated by using the abbreviations “FM” and “TL”, respectively, with their associated time groups. When the period of temporary fluctuations is forecast to commence at the beginning of the trend forecast period but cease before the end of that period, the abbreviation “FM” and its associated time group shall be omitted and only “TL” and its associated time group shall be used. When the period of temporary fluctuations is forecast to begin during the trend forecast period and cease by the end of that period, the abbreviation “TL” and its associated time group shall be omitted and only “FM” and its associated time group shall be used. When the period of temporary fluctuations is forecast to commence at the beginning of the trend forecast period and cease by the end of that period, both abbreviations “FM” and “TL” and their associated time groups shall be omitted and the change indicator “TEMPO” shall be used alone.

2.4 Use of the probability indicator

The indicator “PROB” shall not be used in trend forecasts.

3. CRITERIA RELATED TO FORECASTS FOR TAKE-OFF

3.1 Format of forecasts for take-off

Recommendation.— *The format of the forecast should be as agreed between the meteorological authority and the operator concerned. The order of the elements and the terminology, units and scales used in forecasts for take-off should be the same as those used in reports for the same aerodrome.*

3.2 Amendments to forecasts for take-off

Recommendation.— *The criteria for the issuance of amendments for forecasts for take-off for surface wind direction and speed, temperature and pressure and any other elements agreed locally should be agreed between the meteorological authority and the operators concerned. The criteria should be consistent with the corresponding criteria for special reports established for the aerodrome in accordance with Appendix 3, 2.3.1.*

4. CRITERIA RELATED TO AREA AND ROUTE FORECASTS, OTHER THAN FORECASTS ISSUED WITHIN THE FRAMEWORK OF THE WORLD AREA FORECAST SYSTEM

4.1 Format of area and route forecasts

4.1.1 Area and route forecasts and amendments thereto, disseminated locally, shall be in one of the forms prescribed for the exchange of such information between meteorological offices or in another form as agreed locally.

4.1.2 Route forecasts and amendments thereto which are exchanged between meteorological offices shall be in the ROFOR code form prescribed by the World Meteorological Organization.

Note.— *The ROFOR code form is contained in WMO Publication No. 306, Manual on Codes, Volume I.1, Part A — Alphanumeric Codes.*

4.1.3 **Recommendation.**— *The order of the elements in area and route forecasts (or amendments thereto) in abbreviated plain language should normally follow that of the*

corresponding coded form of message. The terminology and units employed should be consistent with those used in the related aerodrome reports and forecasts. The identifier employed should be “AREA FCST” or “ROUTE FCST”, respectively, preceded in the case of amendments by “AMD”. The CAVOK procedure applied in TAF should not be used in area and route forecasts.

4.2 Amendments to area and route forecasts

4.2.1 A list of criteria to be used for amendments to area and route forecasts shall be established by the meteorological authority, in consultation with operators and other users concerned.

4.2.2 Amendments to area and route forecasts shall be issued in accordance with criteria in Appendix 2, 1.4.

5. CRITERIA RELATED TO AREA FORECASTS FOR LOW-LEVEL FLIGHTS

5.1 Format and content of GAMET area forecasts

When prepared in GAMET format, they shall contain two sections: Section I related to information on en-route weather phenomena hazardous to low-level flights, prepared in support of the issuance of AIRMET information, and Section II related to additional information required by low-level flights. The area forecasts shall contain the following information as necessary and, when prepared in GAMET format, in the order indicated. Additional elements in Section II shall be included in accordance with regional air navigation agreement:

- a) location indicator of the air traffic services unit serving the flight information region(s) to which the area forecast for low-level flights refers; for example, “YUCC”;
- b) message identification using the abbreviation “GAMET”;
- c) date-time groups indicating the period of validity in UTC; for example, “VALID 220600/221200”;
- d) location indicator of the meteorological office originating the message, followed by a hyphen to separate the preamble from the text; for example, “YUDO-”;
- e) on the next line, name of the flight information region, or a sub-area thereof, for which the area forecast for low-level flights is issued; for example “AMSWELL FIR/2 BLW FL120”;
- f) on the next line, indication of the beginning of the first section of the area forecast using the abbreviation “SECN I”;
- g) widespread mean surface wind speed exceeding 60 km/h (30 kt); for example, “SFC WSPD: 10/12 65 KMH”;
- h) widespread areas of surface visibility below 5 000 m including the weather phenomena causing the reduction of visibility; for example, “SFC VIS: 06/08 3000 M BR N OF N51”;
- i) significant weather conditions encompassing thunderstorms and heavy sand- and duststorm (except for phenomena for which a SIGMET message has already been issued); for example, “SIGWX: 11/12 ISOL TS”;
- j) mountain obscuration; for example, “MT OBSC: MT PASSES S OF N48”;
- k) widespread areas of broken or overcast cloud with height of base less than 300 m (1 000 ft) above ground level (AGL) or above mean sea level (AMSL) and/or any occurrence of cumulonimbus (CB) or towering cumulus (TCU) clouds, giving height indications of their bases and tops; for example, “SIG CLD: 06/09 OVC 800/1100 FT AGL N OF N51 10/12 ISOL TCU 1200/8000 FT AGL”;
- l) icing (except for that occurring in convective clouds and for severe icing for which a SIGMET message has already been issued); for example, “ICE: MOD FL050/080”;
- m) turbulence (except for that occurring in convective clouds and for severe turbulence for which a SIGMET message has already been issued); for example, “TURB: MOD ABV FL090”;
- n) mountain wave (except for severe mountain wave for which a SIGMET message has already been issued); for example, “MTW: MOD ABV FL080 E OF N63”;
- o) SIGMET messages applicable to the FIR concerned or the sub-area thereof, for which the area forecast is valid; for example, “SIGMET APPLICABLE: 3,5”;
- p) on the next line, indication of the beginning of the second section of the area forecast using the abbreviation “SECN II”;
- q) pressure centres and fronts and their expected movements and developments; for example, “PSYS: 06 L 1004 HPA N5130 E01000 MOV NE 25 KT WKN”;
- r) upper winds and upper-air temperatures for at least the following altitudes: 600, 1 500 and 3 000 m (2 000, 5 000 and 10 000 ft); for example, “WIND/T: 2000 FT 270/70 KMH PS03 5000 FT 250/80 KMH MS02 10000 FT 240/85 KMH MS11”;
- s) cloud information not included under k), giving cloud amount, type and height indications of the bases and

tops above ground level (AGL) or above mean sea level (AMSL); for example, “CLD: BKN SC 2500/8000 FT AGL”;

- t) height indication of 0° C level(s) above ground level (AGL) or above mean sea level (AMSL), if lower than the top of the airspace for which the forecast is supplied; for example, “FZLV: 3000 FT AGL”;
- u) forecast lowest QNH during the period of validity; for example, “MNM QNH: 1004 HPA”;
- v) sea-surface temperature and state of the sea if required by regional air navigation agreement; for example, “SEA: T15 HGT 5 M”; and
- w) location of volcanic eruptions which are producing ash clouds of significance to aircraft operations, name of volcano and time of first eruption, if known; for example, “VA: MT. HOKKAIDO KOMAGATAKE PSN N4255 E14040 ERUPTED VA CLD TOP 4900 FT MOV SE”.

Each of the items g) to o) and q) to w) shall, when applicable, be included in the GAMET area forecast beginning on a new line and include an indication of the location (referring where possible, to latitude and longitude and/or locations or geographic features well known internationally) and level, where appropriate. Items g) to o) for which no hazardous

phenomenon is expected to occur, or which are already covered by a SIGMET message, shall be omitted from the area forecast. When no weather phenomena hazardous to low-level flights occur and no SIGMET information is applicable, the term “HAZARDOUS WX NIL” shall replace all items listed under g) to o).

5.2 Amendments to GAMET area forecasts

When a weather phenomenon hazardous to low-level flights has been included in the GAMET area forecast and the phenomenon forecast does not occur, or is no longer forecast, a GAMET AMD shall be issued, amending only the weather element concerned.

Note.— Specifications regarding the issuance of AIRMET information amending the area forecast in respect of weather phenomena hazardous for low-level flights are given in Appendix 6.

5.3 Exchange of area forecasts for low-level flights

Area forecasts for low-level flights prepared in support of the issuance of AIRMET information shall be exchanged between meteorological offices responsible for the issuance of flight documentation for low-level flights in the flight information regions concerned.

Table A5-1. Template for TAF

Key: M = inclusion mandatory, part of every message
 C = inclusion conditional, dependent on meteorological conditions or method of observation
 O = inclusion optional

Note 1.— The ranges and resolutions for the numerical elements included in TAF are shown in Table A5-3 of this appendix.

Note 2.— The explanations for the abbreviations used can be found in the Procedures for Air Navigation Services — ICAO Abbreviations and Codes (PANS-ABC, Doc 8400).

<i>Element as specified in Chapter 6</i>	<i>Detailed content</i>	<i>Template(s)</i>		<i>Examples</i>
Identification of the type of forecast (M)	Type of forecast (M)	TAF <i>or</i> TAF AMD <i>or</i> TAF COR		TAF TAF AMD
Location indicator (M)	ICAO location indicator (M)	nnnn		YUDO ¹
Time of issue of forecast (M)	Day and time of issue of the forecast in UTC (M)	nnnnnnZ		160000Z
Identification of a missing forecast (C)	Missing forecast identifier (C)	NIL		NIL
END OF TAF IF THE FORECAST IS MISSING.				
Day and period of validity of forecast (M)	Day and period of the validity of the forecast in UTC (M)	nnnnnn		160624 080918
Identification of a cancelled forecast (C)	Cancelled forecast identifier (C)	CNL		CNL
END OF TAF IF THE FORECAST IS CANCELLED.				
Surface wind (M)	Wind direction (M)	nnn <i>or</i> VRB ²		24015KMH; VRB04KMH (24008KT); (VRB02KT) 19022KMH (19011KT)
	Wind speed (M)	[P]nn[n]		00000KMH (00000KT) 140P199KMH (140P99KT)
	Significant speed variations (C) ³	G[P]nn[n]		12012G35KMH (12006G18KT) 24032G54KMH (24016G27KT)
	Units of measurement (M)	KMH (<i>or</i> KT)		
Visibility (M)	Prevailing visibility (M)	nnnn	C A V O K	0350 7000 9000 9999 CAVOK

Element as specified in Chapter 6	Detailed content	Template(s)			Examples
Weather (C) ^{4, 5}	Intensity of weather phenomena (C) ⁶	– or +	—		RA +TSRA –FZDZ PRFG +TSRASN SNRA FG HZ FG
	Characteristics and type of weather phenomena (C) ⁷	DZ or RA or SN or SG or PL or DS or SS or FZDZ or FZRA or SHGR or SHGS or SHRA or SHSN or TSGR or TSGS or TSPL or TSRA or TSSN	IC or FG or BR or SA or DU or HZ or FU or VA or SQ or PO or FC or TS or BCFG or BLDU or BLSA or BLSN or DRDU or DRSA or DRSN or FZFG or MIFG or PRFG		
Cloud (M) ⁸	Cloud amount and height of base or vertical visibility (M)	FEWnnn or SCTnnn or BKNnnn or OVCnnn	VVnnn or VV ///	SKC or NSC	FEW010 VV005 SKC OVC020 VV/// NSC SCT005 BKN012 SCT008 BKN025CB
	Cloud type (C) ⁴	CB	—		
Temperature (O) ⁹	Name of the element (M)	TX			TX25/13Z TN09/05Z TX05/12Z TNM02/03Z
	Maximum temperature (M)	[M]nn/			
	Time of occurrence of the maximum temperature (M)	nnZ			
	Name of the element (M)	TN			
	Minimum temperature (M)	[M]nn/			
	Time of occurrence of the minimum temperature (M)	nnZ			
Expected significant changes to one or more of the above elements during the period of validity (C) ^{4, 10}	Change or probability indicator (M)	PROB30 [TEMPO] or PROB40 [TEMPO] or BECMG or TEMPO or FM			TEMPO 1518 25070G100KMH (TEMPO 1518 25035G50KT) TEMPO 1214 17025G50KMH 1000 TSRA SCT010CB BKN020 (TEMPO 1214 17012G25KT 1000 TSRA SCT010CB BKN020)
	Period of occurrence or change (M)	nnnn			
	Wind (C) ⁴	nnn[P]nn[n][G[P]nn[n]]KMH or VRBnnKMH (or nnn[P]nn[G[P]nn]KT or VRBnnKT)			

Element as specified in Chapter 6	Detailed content	Template(s)			Examples
	Prevailing visibility (C) ⁴	nnnn			C A V O K BECMG 1011 00000KMH 2400 OVC010 (BECMG 1011 00000KT 2400 OVC010) PROB30 1214 0800 FG BECMG 1214 RA TEMPO 0304 FZRA TEMPO 1215 BLSN PROB40 TEMPO 0608 0500 FG
	Weather phenomenon: intensity (C) ⁶	– or +	—	NSW	
	Weather phenomenon: characteristics and type (C) ^{4, 7}	DZ or RA or SN or SG or PL or DS or SS or FZDZ or FZRA or SHGR or SHGS or SHRA or SHSN or TSGR or TSGS or TSPL or TSRA or TSSN	IC or FG or BR or SA or DU or HZ or FU or VA or SQ or PO or FC or TS or BCFG or BLDU or BLSA or BLSN or DRDU or DRSA or DRSN or FZFG or MIFG or PRFG		
	Cloud amount and height of base or vertical visibility (C) ⁴	FEWnnn or SCTnnn or BKNnnn or OVCnnn	VVnnn or VV///	SKC or NSC	
	Cloud type (C) ⁴	CB	—		

Notes.—

1. Fictitious location.
2. To be used in accordance with 1.2.1.
3. To be included in accordance with 1.2.1.
4. To be included whenever applicable.
5. One or more, up to a maximum of three, groups in accordance with 1.2.3.
6. To be included whenever applicable in accordance with 1.2.3. No qualifier for *moderate* intensity.
7. Weather phenomena to be included in accordance with 1.2.3.
8. Up to four cloud layers in accordance with 1.2.4.
9. To be included in accordance with 1.2.5.
10. To be included in accordance with 1.3, 1.4 and 1.5.

Table A5-2. Use of change and time indicators in TAF

Change or time indicator		Time period	Meaning	
FM		$n_h n_m n_m$	used to indicate a significant change in most weather elements occurring at $n_h n_h$ hours and $n_m n_m$ minutes (UTC); all the elements given before “FM” are to be included following “FM” (i.e. they are all superseded by those following the abbreviation)	
BECMG		$n_1 n_1 n_2 n_2$	the change is forecast to commence at $n_1 n_1$ hours (UTC) and be completed by $n_2 n_2$ hours (UTC); only those elements for which a change is forecast are to be given following “BECMG”; the time period $n_1 n_1 n_2 n_2$ should normally be less than 2 hours and in any case should not exceed 4 hours	
TEMPO		$n_1 n_1 n_2 n_2$	temporary fluctuations are forecast to commence at $n_1 n_1$ hours (UTC) and cease by $n_2 n_2$ hours (UTC); only those elements for which fluctuations are forecast are to be given following “TEMPO”; temporary fluctuations should not last more than one hour in each instance, and in the aggregate, cover less than half of the period $n_1 n_1 n_2 n_2$	
PROBnn	—	$n_1 n_1 n_2 n_2$	probability of occurrence (in %) of an alternative value of a forecast element or elements; nn = 30 or nn = 40 only; to be placed after the element(s) concerned	—
	TEMPO	$n_1 n_1 n_2 n_2$		probability of occurrence of temporary fluctuations

Table A5-3. Ranges and resolutions for the numerical elements included in TAF

Element as specified in Chapter 6		Range	Resolution
Wind direction:	° true	000 – 360	10
Wind speed:	KMH	00 – 399*	1
	KT	00 – 199*	1
Visibility:	M	0000 – 0800	50
	M	0800 – 5 000	100
	M	5 000 – 9 000	1 000
	M	9 000 – 9 999	999
Vertical visibility:	30's M (100's FT)	000 – 020	1
Cloud: height of base:	30's M (100's FT)	000 – 050	1
Air temperature (maximum and minimum):	°C	–80 – +60	1
* There is no aeronautical requirement to report surface wind speeds of 200 km/h (100 kt) or more; however, provision has been made for reporting wind speeds up to 399 km/h (199 kt) for non-aeronautical purposes, as necessary.			

Example A5-1. TAF

TAF for YUDO (Donlon/International):*

TAF YUDO 160000Z 160624 13018KMH 9000 BKN020 BECMG 0608 SCT015CB BKN020 TEMPO 0812 17025G45KMH 1000 TSRA SCT010CB BKN020 FM1230 15015KMH 9999 BKN020

Meaning of the forecast:

TAF for Donlon/International* issued on the 16th of the month at 0000 UTC valid from 0600 UTC to 2400 UTC on the 16th of the month; surface wind direction 130 degrees; wind speed 18 kilometres per hour; visibility 9 kilometres, broken cloud at 600 metres; becoming between 0600 UTC and 0800 UTC, scattered cumulonimbus cloud at 450 metres and broken cloud at 600 metres; temporarily between 0800 UTC and 1200 UTC surface wind direction 170 degrees; wind speed 25 kilometres per hour gusting to 45 kilometres per hour; visibility 1 000 metres in a thunderstorm with moderate rain, scattered cumulonimbus cloud at 300 metres and broken cloud at 600 metres; from 1230 UTC surface wind direction 150 degrees; wind speed 15 kilometres per hour; visibility 10 kilometres or more; and broken cloud at 600 metres.

* Fictitious location

Note.— In this example, the primary units “kilometre per hour” and “metre” were used for wind speed and height of cloud base, respectively. However, in accordance with Annex 5, the corresponding non-SI alternative units “knot” and “foot” may be used instead.

Example A5-2. Cancellation of TAF

Cancellation of TAF for YUDO (Donlon/International):*

TAF AMD YUDO 161500Z 160624 CNL

Meaning of the forecast:

Amended TAF for Donlon/International* issued on the 16th of the month at 1500 UTC cancelling the previously issued TAF valid from 0600 UTC to 2400 UTC on the 16th of the month.

* Fictitious location

Example A5-3. GAMET area forecast

YUCC GAMET VALID 220600/221200 YUDO
 AMSWELL FIR/2 BLW FL100
 SECN I
 SFC WSPD: 10/12 65 KMH
 SFC VIS: 06/08 3000 M BR N OF N51
 SIGWX: 11/12 ISOL TS
 SIG CLD: 06/09 OVC 800/1100 FT AGL N OF N51 10/12 ISOL TCU 1200/8000 FT AGL
 ICE: MOD FL050/080
 TURB: MOD ABV FL090
 SIGMETS APPLICABLE: 3, 5
 SECN II
 PSYS: 06 L 1004 HPA N5130 E01000 MOV NE 25 KT WKN
 WIND/T: 2000 FT 270/70 KMH PS03 5000 FT 250/80 KMH MS02 10000 FT 240/85 KMH MS11
 CLD: BKN SC 2500/8000 FT AGL
 FZLVL: 3000 FT AGL
 MNM QNH: 1004 HPA
 SEA: T15 HGT 5M
 VA: NIL

Meaning: An area forecast for low-level flights (GAMET) issued for sub-area two of the Amswell* flight information region (identified by YUCC Amswell area control centre) for below flight level 100 by the Donlon/International* meteorological office (YUDO); the message is valid from 0600 UTC to 1200 UTC on the 22nd of the month.

Section I:

surface wind speeds: between 1000 UTC and 1200 UTC 65 kilometres per hour;
 surface visibility: between 0600 UTC and 0800 UTC 3 000 metres north of 51 degrees north (due to mist);
 significant weather phenomena: between 1100 UTC and 1200 UTC isolated thunderstorms without hail;
 significant clouds: between 0600 UTC and 0900 UTC overcast base 800, top 1 100 feet above ground level north of 51 degrees north; between 1000 UTC and 1200 UTC isolated towering cumulus base 1 200, top 8 000 feet above ground level;
 icing: moderate between flight level 050 and 080;
 turbulence: moderate above flight level 090 (at least up to flight level 100);
 SIGMET messages: 3 and 5 applicable to the validity period and sub-area concerned.

Section II:

pressure systems: at 0600 UTC low pressure of 1 004 hectopascals at 51.5 degrees north 10.0 degrees east, expected to move north-eastwards at 25 knots and to weaken;
 winds and temperatures: at 2 000 feet above ground level wind direction 270 degrees; wind speed 70 kilometres per hour, temperature plus 3 degrees Celsius; at 5 000 feet above ground level wind direction 250 degrees; wind speed 80 kilometres per hour, temperature minus 2 degrees Celsius; at 10 000 feet above ground level wind direction 240 degrees; wind speed 85 kilometres per hour, temperature minus 11 degrees Celsius;
 clouds: broken stratocumulus, base 2 500 feet, top 8 000 feet above ground level;
 freezing level: 3 000 feet above ground level;
 minimum QNH: 1 004 hectopascals;
 sea: surface temperature 15 degrees Celsius; and state of sea 5 metres;
 volcanic ash: nil.

* Fictitious locations

APPENDIX 6. TECHNICAL SPECIFICATIONS RELATED TO SIGMET AND AIRMET INFORMATION, AERODROME WARNINGS AND WIND SHEAR WARNINGS

(See Chapter 7 of this Annex.)

Note.— Data type designators to be used in abbreviated headings for SIGMET, AIRMET, tropical cyclone and volcanic ash advisory messages are given in WMO Publication No. 386, Manual on the Global Telecommunication System.

1. SPECIFICATIONS RELATED TO SIGMET INFORMATION

1.1 Format of SIGMET messages

1.1.1 The content and order of elements in a SIGMET message shall be in accordance with the template shown in Table A6-1.

1.1.2 Messages containing SIGMET information for subsonic aircraft shall be identified as “SIGMET”, those containing SIGMET information for supersonic aircraft during transonic or supersonic flight shall be identified as “SIGMET SST”.

1.1.3 The sequence number referred to in the template in Table A6-1 shall correspond with the number of SIGMET messages issued for the flight information region since 0001 UTC on the day concerned. Separate series of sequence numbers shall be used for “SIGMET” and “SIGMET SST” messages. The meteorological watch offices whose area of responsibility encompasses more than one FIR and/or CTA shall issue separate SIGMET messages for each FIR and/or CTA within its area of responsibility.

1.1.4 In accordance with the template in Table A6-1, only one of the following phenomena shall be included in a SIGMET message, using the abbreviations as indicated below:

a) at a subsonic cruising levels:

thunderstorm	
— obscured	OBSC TS
— embedded	EMBD TS
— frequent	FRQ TS
— squall line	SQL TS
— obscured with hail	OBSC TSGR
— embedded with hail	EMBD TSGR
— frequent, with hail	FRQ TSGR
— squall line with hail	SQL TSGR

tropical cyclone	
— tropical cyclone with 10-minute mean surface wind speed of 63 km/h (34 kt) or more	TC (+ cyclone name)

turbulence	
— severe turbulence	SEV TURB

icing	
— severe icing	SEV ICE
— severe icing due to freezing rain	SEV ICE (FZRA)

mountain wave	
— severe mountain wave	SEV MTW

duststorm	
— heavy duststorm	HVY DS

sandstorm	
— heavy sandstorm	HVY SS

volcanic ash	
— volcanic ash (irrespective of altitude)	VA (+ volcano name, if known)

b) at transonic levels and supersonic cruising levels:

turbulence	
— moderate turbulence	MOD TURB
— severe turbulence	SEV TURB

cumulonimbus	
— isolated cumulonimbus	ISOL CB
— occasional cumulonimbus	OCNL CB
— frequent cumulonimbus	FRQ CB

hail	
— hail	GR

volcanic ash	
— volcanic ash (irrespective of altitude)	VA (+ volcano name, if known)

1.1.5 SIGMET information shall not contain unnecessary descriptive material. In describing the weather phenomena for which the SIGMET is issued, no descriptive material

additional to that given in 1.1.4 shall be included. SIGMET information concerning thunderstorms or a tropical cyclone shall not include references to associated turbulence and icing.

1.1.6 Recommendation.— *Meteorological watch offices in a position to do so should issue SIGMET information for volcanic ash cloud and tropical cyclones in graphical format using the WMO BUFR code form, in addition to the issuance of this SIGMET information in abbreviated plain language in accordance with 1.1.1.*

Note.— *The BUFR code form is contained in WMO Publication No. 306, Manual on Codes, Volume I.2, Part B — Binary Codes.*

1.2 Dissemination of SIGMET messages

1.2.1 SIGMET messages shall be disseminated to meteorological watch offices, WAFCs and to other meteorological offices in accordance with regional air navigation agreement. SIGMET messages for volcanic ash shall also be disseminated to VAACs.

1.2.2 SIGMET messages shall be disseminated to international OPMET data banks and the centres designated by regional air navigation agreement for the operation of aeronautical fixed service satellite distribution systems, in accordance with regional air navigation agreement.

2. SPECIFICATIONS RELATED TO AIRMET INFORMATION

2.1 Format of AIRMET messages

2.1.1 The content and order of elements in an AIRMET message shall be in accordance with the template shown in Table A6-1.

2.1.2 The sequence number referred to in the template in Table A6-1 shall correspond with the number of AIRMET messages issued for the flight information region since 0001 UTC on the day concerned. The meteorological watch offices whose area of responsibility encompasses more than one FIR and/or CTA shall issue separate AIRMET messages for each FIR and/or CTA within its area of responsibility.

2.1.3 The flight information region shall be divided in sub-areas, as necessary.

2.1.4 In accordance with the template in Table A6-1, only one of the following phenomena shall be included in an AIRMET message, using the abbreviations as indicated below:

at cruising levels below flight level 100 (or below flight level 150 in mountainous areas, or higher, where necessary):

- surface wind speed
 - widespread mean surface wind speed above 60 km/h (30 kt) SFC WSPD (+ wind speed and units)
- surface visibility
 - widespread areas affected by reduction of visibility to less than 5 000 m, including the weather phenomenon causing the reduction of visibility SFC VIS (+ visibility) (+ one of the following weather phenomena or combinations thereof: BR, DS, DU, DZ, FC, FG, FU, GR, GS, HZ, IC, PL, PQ, RA, SA, SG, SN, SQ, SS or VA)
- thunderstorms
 - isolated thunderstorms without hail ISOL TS
 - occasional thunderstorms without hail OCNL TS
 - isolated thunderstorms with hail ISOL TSGR
 - occasional thunderstorms with hail OCNL TSGR
- mountain obscuration
 - mountains obscured MT OBSC
- cloud
 - widespread areas of broken or overcast cloud with height of base less than 300 m (1 000 ft) above ground level:
 - broken BKN CLD (+ height of the base and top and units)
 - overcast OVC CLD (+ height of the base and top and units)
 - cumulonimbus clouds which are:
 - isolated ISOL CB
 - occasional OCNL CB
 - frequent FRQ CB
 - towering cumulus clouds which are:
 - isolated ISOL TCU
 - occasional OCNL TCU
 - frequent FRQ TCU
- icing
 - moderate icing (except for icing in convective clouds) MOD ICE

- turbulence
 - moderate turbulence MOD TURB
(except for turbulence in convective clouds)
- mountain wave
 - moderate mountain wave MOD MTW

2.1.5 AIRMET information shall not contain unnecessary descriptive material. In describing the weather phenomena for which the AIRMET is issued, no descriptive material additional to that given in 2.1.4 shall be included. AIRMET information concerning thunderstorms or cumulonimbus clouds shall not include references to associated turbulence and icing.

Note.— The specifications for SIGMET information which is also applicable to low-level flights are given in 1.1.4.

2.2 Dissemination of AIRMET messages

2.2.1 **Recommendation.—** AIRMET messages should be disseminated to meteorological watch offices in adjacent flight information regions and to other meteorological offices, as agreed by the meteorological authorities concerned.

2.2.2 **Recommendation.—** AIRMET messages should be transmitted to international operational meteorological data banks and the centres designated by regional air navigation agreement for the operation of aeronautical fixed service satellite distribution systems, in accordance with regional air navigation agreement.

3. SPECIFICATIONS RELATED TO SPECIAL AIR-REPORTS

Note.— This appendix deals with the uplink of special air-reports. The general specifications related to special air-reports are in Appendix 4.

3.1 **Recommendation.—** Special air-reports should be uplinked for 60 minutes after their issuance.

3.2 **Recommendation.—** Information on wind and temperature included in automated special air-reports should not be uplinked to other aircraft in flight.

4. DETAILED CRITERIA RELATED TO SIGMET AND AIRMET MESSAGES AND SPECIAL AIR-REPORTS (UPLINK)

4.1 Identification of the flight information region

Recommendation.— In cases where the airspace is divided into a flight information region (FIR) and an upper

flight information region (UIR), the SIGMET should be identified by the location indicator of the air traffic services unit serving the FIR.

Note.— The SIGMET message applies to the whole airspace within the lateral limits of the FIR, i.e. to the FIR and to the UIR. The particular areas and/or flight levels affected by the meteorological phenomena causing the issuance of the SIGMET are given in the text of the message.

4.2 Criteria related to phenomena included in SIGMET and AIRMET messages and special air-reports (uplink)

4.2.1 **Recommendation.—** An area of thunderstorms and cumulonimbus clouds should be considered:

- a) obscured (OBSC) if it is obscured by haze or smoke or cannot be readily seen due to darkness;
- b) embedded (EMBD) if it is embedded within cloud layers and cannot be readily recognized;
- c) isolated (ISOL) if it consists of individual features which affect, or are forecast to affect, an area with a maximum spatial coverage less than 50 per cent of the area concerned (at a fixed time or during the period of validity); and
- d) occasional (OCNL) if it consists of well-separated features which affect, or are forecast to affect, an area with a maximum spatial coverage between 50 and 75 per cent of the area concerned (at a fixed time or during the period of validity).

4.2.2 **Recommendation.—** An area of thunderstorms should be considered frequent (FRQ) if within that area there is little or no separation between adjacent thunderstorms with a maximum spatial coverage greater than 75 per cent of the area affected, or forecast to be affected, by the phenomenon (at a fixed time or during the period of validity).

4.2.3 **Recommendation.—** Squall line (SQL) should indicate a thunderstorm along a line with little or no space between individual clouds.

4.2.4 **Recommendation.—** Hail (GR) should be used as a further description of the thunderstorm, as necessary.

4.2.5 **Recommendation.—** Severe and moderate turbulence (TURB) should refer only to: low-level turbulence associated with strong surface winds; rotor streaming; or turbulence whether in cloud or not in cloud (CAT). Turbulence should not be used in connection with convective clouds.

4.2.6 Turbulence shall be considered:

- a) severe whenever the turbulence index is between 15 and 27 (i.e. the peak value of the eddy dissipation rate (EDR) exceeds 0.5); and
- b) moderate whenever the turbulence index is between 6 and 14 (i.e. the peak value of the eddy dissipation rate (EDR) exceeds 0.3 while not exceeding 0.5).

4.2.7 **Recommendation.**— *Severe and moderate icing (ICE) should refer to icing in other than convective clouds. Freezing rain (FZRA) should refer to severe icing conditions caused by freezing rain.*

4.2.8 **Recommendation.**— *A mountain wave (MTW) should be considered:*

- a) severe whenever an accompanying downdraft of 3.0 m/s (600 ft/min) or more and/or severe turbulence is observed or forecast; and
- b) moderate whenever an accompanying downdraft of 1.75–3.0 m/s (350–600 ft/min) and/or moderate turbulence is observed or forecast.

4.2.9 **Recommendation.**— *In the outlook of SIGMET messages for volcanic ash, up to four layers or levels should be included.*

5. SPECIFICATIONS RELATED TO AERODROME WARNINGS

5.1 Format and dissemination of aerodrome warnings

5.1.1 The aerodrome warnings shall be issued in accordance with the template in Table A6-2 where required by operators or aerodrome services, and shall be disseminated in accordance with local arrangements to those concerned.

5.1.2 **Recommendation.**— *In accordance with the template in Table A6-2, aerodrome warnings should relate to the occurrence or expected occurrence of one or more of the following phenomena:*

- tropical cyclone (to be included if the 10-minute mean surface wind speed at the aerodrome is expected to be 63 km/h (34 kt) or more)
- thunderstorm
- hail
- snow (including the expected or observed snow accumulation)
- freezing precipitation
- hoar frost or rime
- sandstorm
- duststorm

- rising sand or dust
- strong surface wind and gusts
- squall
- frost
- volcanic ash
- other phenomena as agreed locally.

5.1.3 **Recommendation.**— *The use of text additional to the abbreviations listed in the template in Table A6-2 should be kept to a minimum. The additional text should be prepared in abbreviated plain language using approved ICAO abbreviations and numerical values. If no ICAO approved abbreviations are available, English plain language text should be used.*

5.2 Quantitative criteria for aerodrome warnings

Recommendation.— *When quantitative criteria are necessary for the issue of aerodrome warnings covering, for example, the expected maximum wind speed or the expected total snowfall, the criteria should be established by agreement between the meteorological office and the users of the warnings.*

6. SPECIFICATIONS RELATED TO WIND SHEAR WARNINGS

6.1 Detection of wind shear

Recommendation.— *Evidence of the existence of wind shear should be derived from:*

- a) ground-based wind shear remote-sensing equipment, for example, Doppler radar;
- b) ground-based wind shear detection equipment, for example, a system of surface wind and/or pressure sensors located in an array monitoring a specific runway or runways and associated approach and departure paths;
- c) aircraft observations during the climb-out or approach phases of flight to be made in accordance with Chapter 5; or
- d) other meteorological information, for example, from appropriate sensors located on existing masts or towers in the vicinity of the aerodrome or nearby areas of high ground.

Note.— *Wind shear conditions are normally associated with the following phenomena:*

- thunderstorms, microbursts, funnel cloud (tornado or waterspout), and gust fronts

- frontal surfaces
- strong surface winds coupled with local topography
- sea breeze fronts
- mountain waves (including low-level rotors in the terminal area)
- low-level temperature inversions.

6.2 Format and dissemination of wind shear warnings

Note.— Information on wind shear is also to be included as supplementary information in local routine and special reports and METAR and SPECI in accordance with the templates in Tables A3-1 and A3-2.

6.2.1 The wind shear warnings shall be prepared in abbreviated plain language in accordance with the template in Table A6-3 and disseminated for aerodromes where wind shear is considered a factor in accordance with local arrangements with the appropriate ATS authority and operators concerned and by the meteorological office designated to provide service for the aerodrome or disseminated directly from automated ground-based wind shear remote-sensing or detection equipment referred to in 6.1 a) and b).

6.2.2 **Recommendation.**— Where microbursts are observed, reported by pilots or detected by ground-based wind shear detection or remote-sensing equipment, the wind shear warning should include a specific reference to microburst.

6.2.3 **Recommendation.**— Where information from ground-based wind shear detection or remote-sensing

equipment is used to prepare a wind shear warning, the warning should, if practicable, relate to specific sections of the runway and distances along the approach path or take-off path as agreed between the meteorological authority, the appropriate ATS authority and the operators concerned.

6.2.4 **Recommendation.**— When an aircraft report is used to prepare a wind shear warning, or to confirm a warning previously issued, the corresponding aircraft report, including the aircraft type, should be given unchanged in the warning.

Note 1.— Following reported encounters by both arriving and departing aircraft two different wind shear warnings may exist, one for arriving aircraft and one for departing aircraft.

Note 2.— Specifications for reporting the intensity of wind shear are still undergoing development. It is recognized, however, that pilots, when reporting wind shear, may use the qualifying terms “moderate”, “strong” or “severe”, based to a large extent on their subjective assessment of the intensity of the wind shear encountered. In accordance with 6.2.4, such reports are to be incorporated unchanged in wind shear warnings.

6.2.5 **Recommendation.**— The use of text additional to the abbreviations listed in the template in Table A6-3 should be kept to a minimum. The additional text should be prepared in abbreviated plain language using approved ICAO abbreviations and numerical values. If no ICAO approved abbreviations are available, English plain language text should be used.

Table A6-1. Template for SIGMET and AIRMET messages and special air-reports (uplink)

Key: M = inclusion mandatory, part of every message
 C = inclusion conditional, included whenever applicable
 = = a double line indicates that the text following it should be placed on the subsequent line

Note.— The ranges and resolutions for the numerical elements included in SIGMET/AIRMET messages and in special air-reports are shown in Table A6-4 of this appendix.

Element as specified in Chapter 5 and Appendix 6	Detailed content	Template(s)				Examples
		SIGMET	SIGMET SST ¹	AIRMET	SPECIAL AIR-REPORT ²	
Location indicator of FIR/CTA (M) ³	ICAO location indicator of the ATS unit serving the FIR or CTA to which the SIGMET/ AIRMET refers (M)	nnnn			—	YUCC ⁴ YUDD ⁴
Identification (M)	Message identification and sequence number ⁵ (M)	SIGMET [nn]n	SIGMET SST [nn]n	AIRMET [nn]n	ARS	SIGMET 5 SIGMET A3 SIGMET SST 1 AIRMET 2 ARS
Validity period (M)	Date-time groups indicating the period of validity in UTC (M)	VALID nnnnnn/nnnnnn			— ⁶	VALID 221215/221600 VALID 101520/101800 VALID 251600/252200
Location indicator of MWO (M)	Location indicator of MWO originating the message with a separating hyphen (M)	nnnn—				YUDO— ⁴ YUSO— ⁴
Name of the FIR/ CTA or aircraft identification (M)	Location indicator and name of the FIR/CTA ⁷ for which the SIGMET/ AIRMET is issued or aircraft radiotelephony call sign (M)	nnnn nnnnnnnnnn FIR[/UIR] or nnnn nnnnnnnnnn CTA		nnnn nnnnnnnnnn FIR[/n]	nnnnnn	YUCC AMSWELL FIR ⁴ YUDD SHANLON FIR/UIR ⁴ YUCC AMSWELL FIR/2 ⁴ YUDD SHANLON FIR ⁴ VA812
IF THE SIGMET IS TO BE CANCELLED, SEE DETAILS AT THE END OF THE TEMPLATE.						

Element as specified in Chapter 5 and Appendix 6	Detailed content	Template(s)				Examples
		SIGMET	SIGMET SST ¹	AIRMET	SPECIAL AIR-REPORT ²	
Phenomenon (M) ⁸	Description of phenomenon causing the issuance of SIGMET/AIRMET (C)	OBSC ⁹ TS [GR] ¹⁰ EMBD ¹² TS [GR] FRQ ¹³ TS [GR] SQL ¹⁴ TS [GR] TC nnnnnnnnn SEV TURB ¹¹ SEV ICE ¹⁹ SEV ICE (FZRA) ²⁰ SEV MTW ²¹ HVY DS HVY SS VA[ERUPTION] [MT nnnnnnnnn] [LOC Nnn[nn] or Snn[nn] Ennn[nn] or Wnnn[nn]] VA CLD	MOD TURB ¹¹ SEV TURB ISOL ¹⁵ CB ¹⁶ OCNL ¹⁸ CB FRQ ¹³ CB GR VA[ERUPTION] [MT nnnnnnnnn] [LOC Nnn[nn] or Snn[nn] Ennn[nn] or Wnnn[nn]] VA CLD	SFC WSPD nn[n]KMH (or SFC WSPD nn[n]KT) SFC VIS nnnnM (nn) ¹⁷ ISOL ¹⁵ TS[GR] ¹⁰ OCNL ¹⁸ TS[GR] MT OBSC BKN CLD nnn/[ABV]nnnnM (or BKN CLD nnn/[ABV]nnnnFT) OVC CLD nnn/[ABV]nnnnM (or OVC CLD nnn/[ABV]nnnnFT) ISOL ¹⁵ CB ¹⁶ OCNL ¹⁸ CB FRQ ¹³ CB ISOL ¹⁵ TCU ¹⁶ OCNL ¹⁸ TCU ¹⁶ FRQ ¹³ TCU MOD TURB ¹¹ MOD ICE ¹⁹ MOD MTW ²¹	TS TSGR SEV TURB SEV ICE SEV MTW HVY SS VA CLD [FL nnn/nnn] VA [MT nnnnnnnnn] MOD TURB ¹¹ GR ¹⁰ CB ¹⁶	SEV TURB FRQ TS OBSC TSGR EMBD TSGR TC GLORIA VA ERUPTION MT ASHVAL LOC S15 E073 VA CLD MOD TURB MOD MTW ISOL CB BKN CLD 120/900M (BKN CLD 400/3000FT) OVC CLD 270/ABV3000M (OVC CLD 900/ABV10000FT) SEV ICE
Observed or forecast phenomenon (M)	Indication whether the information is observed and expected to continue, or forecast (M)	OBS [AT nnnnZ] FCST OBS [AT nnnnZ] AND FCST			OBS AT nnnnZ	OBS AT 1210Z OBS OBS AND FCST

Element as specified in Chapter 5 and Appendix 6	Detailed content	Template(s)				Examples
		SIGMET	SIGMET SST ¹	AIRMET	SPECIAL AIR-REPORT ²	
Location (C)	Location (referring to latitude and longitude (in degrees and minutes) or locations or geographic features well known internationally)	Nnn[nn] Wnnn[nn] or Nnn[nn] Ennn[nn] or Snn[nn] Wnnn[nn] or Snn[nn] Ennn[nn] or N OF Nnn[nn] or S OF Nnn[nn] or N OF Snn[nn] or S OF Snn[nn] or [AND] W OF Wnnn[nn] or E OF Wnnn[nn] or W OF Ennn[nn] or E OF Ennn[nn] or [N OF, NE OF, E OF, SE OF, S OF, SW OF, W OF, NW OF] nnnnnnnnnnn or WI Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] — Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] — Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] — [Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] — Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]]			NnnnnWnnnnn or NnnnnWnnnnn or SnnnnWnnnnn or SnnnnEnnnnn	S OF N54 N OF N50 N2020 W07005 YUSB ⁴ N2706 W07306 N48 E010 N OF N1515 AND W OF E13530 W OF E1554 WI N6030 E02550 - N6055 E02500 - N6050 E02630
Level (C)	Flight level and extent ²² (C)	FLnnn or FLnnn/nnn or TOP FLnnn or [TOP] ABV FLnnn or [TOP] BLW FLnnn or BLW nnnnM (or BLW nnnnFT) <i>or</i> ²³ CB TOP [ABV] FLnnn WI nnnKM OF CENTRE (or CB TOP [ABV] FLnnn WI nnnNM OF CENTRE) or CB TOP [BLW] FLnnn WI nnnKM OF CENTRE (or CB TOP [BLW] FLnnn WI nnnNM OF CENTRE) <i>or</i> ²⁴ FLnnn/nnn [APRX nnnKM BY nnnKM] [Nnn[nn] or Snn[nn]Wnnn[nn] or Ennn[nn] – Nnn[nn] or Snn[nn]Wnnn[nn] or Ennn[nn] [– Nnn[nn] or Snn[nn]Wnnn[nn] or Ennn[nn]] [– Nnn[nn] or Snn[nn]Wnnn[nn] or Ennn[nn]] (or FLnnn/nnn [APRX nnnNM BY nnnNM] [Nnn[nn] or Snn[nn]Wnnn[nn] or Ennn[nn] – Nnn[nn] or Snn[nn]Wnnn[nn] or Ennn[nn] [– Nnn[nn] or Snn[nn]Wnnn[nn] or Ennn[nn]] [– Nnn[nn] or Snn[nn]Wnnn[nn] or Ennn[nn]])			FLnnn	FL180 FL050/080 TOP FL390 BLW FL200 TOP ABV FL100 FL310/450 CB TOP FL500 WI 270KM OF CENTRE (CB TOP FL500 WI 150NM OF CENTRE) FL310/350 APRX 220KM BY 35KM FL390
Movement or expected movement (C)	Movement or expected movement (direction and speed) with reference to one of the eight points of compass, or stationary (C)	MOV N [nnKMH] or MOV NE [nnKMH] or MOV E [nnKMH] or MOV SE [nnKMH] or MOV S [nnKMH] or MOV SW [nnKMH] or MOV W [nnKMH] or MOVNW[nnKMH] (or MOV N [nnKT] or MOV NE [nnKT] or MOV E [nnKT] or MOV SE [nnKT] or MOVSW[nnKT] or MOV SW [nnKT] or MOV W [nnKT] or MOV NW [nnKT]) or STNR			—	MOV E 40KMH (MOV E 20KT) MOV SE STNR
Changes in intensity (C)	Expected changes in intensity (C)	INTSF or WKN or NC			—	WKN

Element as specified in Chapter 5 and Appendix 6	Detailed content	Template(s)				Examples
		SIGMET	SIGMET SST ¹	AIRMET	SPECIAL AIR-REPORT ²	
Forecast position (C) ²²	Forecast position of volcanic ash cloud or the centre of the TC at the end of the validity period of the SIGMET message (C)	FCST nnnnZ TC CENTRE Nnn[nn] or Snn[nn]Wnnn[nn] or Ennn[nn] or FCST nnnnZ VA CLD APRX Nnn[nn] or Snn[nn]Wnnn[nn] or Ennn[nn] – Nnn[nn] or Snn[nn]Wnnn[nn] or Ennn[nn] [– Nnn[nn] or Snn[nn]Wnnn[nn] or Ennn[nn]] [– Nnn[nn] or Snn[nn]Wnnn[nn] or Ennn[nn]]	—	—	—	FCST 2200Z TC CENTRE N2740 W07345 FCST 1700Z VA CLD APRX S15 E075 – S15 E081 – S17 E083 – S18 E079 – S15 E075
Outlook ²² (C)	Outlook providing information beyond the period of validity of the trajectory of the volcanic ash cloud and positions of the tropical cyclone centre (C)	OTLK nnnnnn TC CENTRE Nnnnnn or SnnnnWnnnnn or Ennnnn nnnnnn TC CENTRE Nnnnnn or SnnnnWnnnnn or Ennnnn or OTLK nnnnn VA CLD APRX [FLnnn/nnn] ²⁵ Nnn[nn] or Snn[nn]Wnnn[nn] or Ennn[nn] – Nnn[nn] or Snn[nn]Wnnn[nn] or Ennn[nn] – Nnn[nn] or Snn[nn]Wnnn[nn] or Ennn[nn] [– Nnn[nn] or Snn[nn]Wnnn[nn] or Ennn[nn]] [– Nnn[nn] or Snn[nn]Wnnn[nn] or Ennn[nn]] nnnnnn VA CLD APRX Nnn[nn] or Snn[nn]Wnnn[nn] or Ennn[nn] – Nnn[nn] or Snn[nn]Wnnn[nn] or Ennn[nn] – Nnn[nn] or Snn[nn]Wnnn[nn] or Ennn[nn] [– Nnn[nn] or Snn[nn]Wnnn[nn] or Ennn[nn]] [– Nnn[nn] or Snn[nn]Wnnn[nn] or Ennn[nn]]	—	—	—	OTLK 260400 TC CENTRE N28030 W07430 261000 TC CENTRE N3100 W07600 OTLK 212300 VA CLD APRX S16 E078 – S17 E084 – S18 E089 – S19 E081 – S16 E078 220300 VA CLD APRX S17 E081 – S18 E086 – S20 E092 – S21 E084 – S17 E081
OR						
Cancellation of SIGMET/ AIRMET ²⁶ (C)	Cancellation of SIGMET/AIRMET referring to its identification	CNL SIGMET [nn]n nnnnnn/nnnnnn or CNL SIGMET [nn]n nnnnnn/nnnnnn [VA MOV TO nnnn FIR] ²⁴	CNL SIGMET SST [nn]n nnnnnn/nnnnnn	CNL AIRMET [nn]n nnnnnn/nnnnnn	—	CNL SIGMET 2 101200/101600 ²⁶ CNL SIGMET 3 251030/251430 VA MOV TO YUDO FIR ²⁶ CNL SIGMET SST 1 212330/220130 ²⁶ CNL AIRMET 151520/151800 ²⁶

Notes.—

1. In accordance with 1.1.2.
2. No wind and temperature to be uplinked to other aircraft in flight in accordance with 3.2.
3. See 4.1.
4. Fictitious location.
5. In accordance with 1.1.3 and 2.1.2.
6. See 3.1.
7. See 2.1.3.
8. In accordance with 1.1.4 and 2.1.4.
9. In accordance with 4.2.1 a).
10. In accordance with 4.2.4.
11. In accordance with 4.2.5 and 4.2.6.
12. In accordance with 4.2.1 b).

13. In accordance with 4.2.2.
14. In accordance with 4.2.3.
15. In accordance with 4.2.1 c).
16. The use of cumulonimbus, CB, is restricted to AIRMETs and SIGMETs related to SST flight during transonic and supersonic cruise; the use of towering cumulus, TCU, is restricted to AIRMETs in accordance with 1.1.4 and 2.1.4.
17. In accordance with 2.1.4.
18. In accordance with 4.2.1 d).
19. In accordance with 4.2.7.
20. In accordance with 4.2.7.
21. In accordance with 4.2.8.
22. Only for SIGMET messages for volcanic ash cloud and tropical cyclones.
23. Only for SIGMET messages for tropical cyclones.
24. Only for SIGMET messages for volcanic ash.
25. Up to four layers (or levels) in accordance with 4.2.9.
26. End of the message (as the SIGMET/AIRMET message is being cancelled).

Note.— In accordance with 1.1.5 and 2.1.5, severe or moderate icing and severe or moderate turbulence (SEV ICE, MOD ICE, SEV TURB, MOD TURB) associated with thunderstorms, cumulonimbus clouds or tropical cyclones should not be included.

Table A6-2. Template for aerodrome warnings

Key: M = inclusion mandatory, part of every message
 C = inclusion conditional, included whenever applicable

Note 2.— The explanations for the abbreviations can be found in the Procedures for Air Navigation Services — ICAO Abbreviations and Codes (PANS-ABC, Doc 8400).

Note 1.— The ranges and resolutions for the numerical elements included in aerodrome warnings are shown in Table A6-4 of this appendix.

Element	Detailed content	Template	Example
Location indicator of the aerodrome (M)	Location indicator of the aerodrome	nnnn	YUCC ¹
Identification of the type of message (M)	Type of message and sequence number	AD WRNG n	AD WRNG 2
Validity period (M)	Day and time of validity period in UTC	VALID nnnnnn/nnnnnn	VALID 211230/211530
IF THE AERODROME WARNING IS TO BE CANCELLED, SEE DETAILS AT THE END OF THE TEMPLATE.			
Phenomenon (M) ²	Description of phenomenon causing the issuance of the aerodrome warning	TC ³ nnnnnnnnn or [HVY] TS or GR or [HVY] SN [nnCM] ³ or [HVY] FZRA or [HVY] FZDZ or RIME ⁴ or [HVY] SS or [HVY] DS or SA or DU or SFC WSPD nn[n]KMH MAX nn[n] (SFC WSPD nn[n]KT MAX nn[n]) or SQ or FROST or VA or free text up to 32 characters ⁵	TC ANDREW HVY SN 25CM SFC WSPD 80KMH MAX 120 VA
Observed or forecast phenomenon (M)	Indication whether the information is observed and expected to continue, or forecast	OBS [AT nnnnZ] or FCST or OBS [AT nnnnZ] AND FCST	OBS AT 1200Z OBS OBS AT 1220Z AND FCST
Changes in intensity (C)	Expected changes in intensity	INTSF or WKN or NC	WKN
OR			
Cancellation of aerodrome warning ⁶	Cancellation of aerodrome warning referring to its identification	CNL AD WRNG n nnnnnn/nnnnnn	CNL AD WRNG 2 211230/211530 ⁶

Notes.—

1. Fictitious location.
2. One phenomenon or a combination thereof, in accordance with 5.1.2.
3. In accordance with 5.1.2.
4. Hoar frost or rime in accordance with 5.1.2.
5. In accordance with 5.1.3.
6. End of the message (as the aerodrome warning is being cancelled).

Table A6-3. Template for wind shear warnings

Key: M = inclusion mandatory, part of every message
 C = inclusion conditional, included whenever applicable

Note 2.— The explanations for the abbreviations can be found in the Procedures for Air Navigation Services — ICAO Abbreviations and Codes (PANS-ABC, Doc 8400).

Note 1.— The ranges and resolutions for the numerical elements included in wind shear warnings are shown in Table A6-4 of this appendix.

Element	Detailed content	Template	Example
Location indicator of the aerodrome (M)	Location indicator of the aerodrome	nnnn	YUCC ¹
Identification of the type of message (M)	Type of message and sequence number	WS WRNG [nn]	WS WRNG 01
Time of origin and validity period (M)	Day and time of issue and, where applicable, validity period in UTC	nnnnnn [VALID TL nnnnnn] or [VALID nnnnnn/nnnnnn]	211230 VALID TL 211330 221200 VALID 221215/221315
IF THE WIND SHEAR WARNING IS TO BE CANCELLED, SEE DETAILS AT THE END OF THE TEMPLATE.			
Phenomenon (M)	Identification of the phenomenon and its location	[MOD] or [SEV] WS IN APCH or [MOD] or [SEV] WS [APCH] RWYnnn or [MOD] or [SEV] WS IN CLIMB-OUT or [MOD] or [SEV] WS CLIMB-OUT RWYnnn or MBST IN APCH or MBST [APCH] RWYnnn or MBST IN CLIMB-OUT or MBST CLIMB-OUT RWYnnn	WS APCH RWY12 MOD WS RWY34 WS IN CLIMB-OUT MBST APCH RWY26 MBST IN CLIMB-OUT
Observed, reported or forecast phenomenon (M)	Identification whether the phenomenon is observed or reported and expected to continue or forecast	REP AT nnnn nnnnnnnn or OBS [AT nnnn] or FCST	REP AT 1510 B747 OBS AT 1205 FCST
Details of the phenomenon (C) ²	Description of phenomenon causing the issuance of the wind shear warning	SFC WIND: nnn/nnKMH (or nnn/nnKT) nnnM (nnnFT)-WIND: nnn/nnKMH (or nnn/nnKT) or nnKMH (or nnKT) ASPEEDL nnKM (or nnNM) FNA RWYnn or nnKMH (or nnKT) ASPEEDG nnKM (or nnNM) FNA RWYnn	SFC WIND: 320/20KMH 60M-WIND: 360/50KMH (SFC WIND: 320/10KT 200FT-WIND: 360/25KT) 60KMH ASPEEDL 4KM FNA RWY13 (30KT ASPEEDL 2NM FNA RWY13)
OR			
Cancellation of wind shear warning ³	Cancellation of wind shear warning referring to its identification	CNL WS WRNG n nnnnnn/nnnnnn	CNL WS WRNG 1211230/211330 ³

Notes.—

1. Fictitious location.
2. Additional provisions in 6.2.5.
3. End of the message (as the wind shear warning is being cancelled).

Table A6-4. Ranges and resolutions for the numerical elements included in volcanic ash and tropical cyclone advisory messages, SIGMET/AIRMET messages and aerodrome and wind shear warnings

<i>Element as specified in Appendices 2 and 6</i>		<i>Range</i>	<i>Resolution</i>
Summit elevation:	M	000 – 8 100	1
	FT	000 – 27 000	1
Advisory number:	for VA (index)*	000 – 2 000	1
	for TC (index)*	00 – 99	1
Maximum surface wind:	KMH	00 – 399	1
	KT	00 – 199	1
Central pressure:	hPa	850 – 1 050	1
Surface wind speed:	KMH	60 – 199	1
	KT	30 – 99	1
Surface visibility:	M	0000 – 0800	50
	M	0800 – 5 000	100
Cloud: height of base:	M	000 – 300	30
	FT	000 – 1 000	100
Cloud: height of top:	M	000 – 3 000	30
	M	3 000 – 20 000	300
	FT	000 – 10 000	100
	FT	10 000 – 60 000	1 000
Latitudes:	° (degrees)	00 – 90	1
	' (minutes)	00 – 60	1
Longitudes:	° (degrees)	000 – 180	1
	' (minutes)	00 – 60	1
Flight levels:		000 – 650	10
Movement:	KMH	0 – 300	10
	KT	0 – 150	5
* Non-dimensional			

Example A6-1. SIGMET and AIRMET message and the corresponding cancellations**SIGMET**

YUDD SIGMET 2 VALID 101200/101600 YUSO-
YUDD SHANLON FIR/UIR OBSC TS FCST
S OF N54 TOP FL390 MOV E WKN

AIRMET

YUDD AIRMET 1 VALID 151520/151800 YUSO-
YUDD SHANLON FIR ISOL TS OBS
N OF S50 TOP ABV FL100 STNR WKN

Cancellation of SIGMET

YUDD SIGMET 3 VALID 101345/101600 YUSO-
YUDD SHANLON FIR/UIR CNL SIGMET 2 101200/101600

Cancellation of AIRMET

YUDD AIRMET 2 VALID 151650/151800 YUSO-
YUDD SHANLON FIR CNL AIRMET 1 151520/151800

Example A6-2. SIGMET message for tropical cyclone

YUCC SIGMET 3 VALID 251600/252200 YUDO-
YUCC AMSWELL FIR TC GLORIA OBS AT 1600Z N2706 W07306 CB TOP FL500 WI 150NM OF CENTRE MOV NW
10KT NC FCST 2200Z TC CENTRE N2740 W07345
OTLK TC CENTRE 260400 N2830 W07430 261000 N2912 W07530

Meaning:

The third SIGMET message issued for the AMSWELL* flight information region (identified by YUCC Amwell area control centre) by the Donlon/International* meteorological watch office (YUDO) since 0001 UTC; the message is valid from 1600 UTC to 2200 UTC on the 25th of the month; tropical cyclone Gloria was observed at 1600 UTC at 27 degrees 06 minutes north and 73 degrees 6 minutes west with cumulonimbus top at flight level 500 within 150 nautical miles of the centre; the tropical cyclone is expected to move northwestwards at 10 knots and not to undergo any changes in intensity; the forecast position of the centre of the tropical cyclone at 2200 UTC is expected to be at 27 degrees 40 minutes north and 73 degrees 45 minutes west.

Outlook:

The centre of the tropical cyclone is expected to be on the 26th of the month at 0400 UTC and 1000 UTC located at 28 degrees 30 minutes north and 74 degrees 30 minutes west, and at 29 degrees 12 minutes north and 75 degrees 30 minutes west, respectively.

* Fictitious locations

Example A6-3. SIGMET message for volcanic ash

YUDD SIGMET 2 VALID 211100/211700 YUSO-
 YUDD SHANLON FIR/UIR VA ERUPTION MT ASHVAL LOC S1500 E07348 VA CLD OBS AT 1100Z FL310/450 APRX
 220KM BY 35KM S1500 E07348 – S1530 E07642 MOV ESE 65KMH FCST 1700Z VA CLD APRX S1506 E07500 –
 S1518 E08112 – S1712 E08330 – S1824 E07836
 OTLK 212300Z VA CLD APRX S1600 E07806 – S1642 E08412 – S1824 E08900 – S1906 E08100 220500Z VA CLD APRX
 S1700 E08100 – S1812 E08636 – S2000 E09224 – S2130 E08418

Meaning:

The second SIGMET message issued for the SHANLON* flight information region (identified by YUDD Shanlon area control centre) by the Shanlon/International* meteorological watch office (YUSO) since 0001 UTC; the message is valid from 1100 UTC to 1700 UTC on the 21st of the month; volcanic ash eruption of Mount Ashval* located at 15 degrees south and 73 degrees 48 minutes east; volcanic ash cloud observed at 1100 UTC between flight levels 310 and 450 in an approximate area of 220 km by 35 km between 15 degrees south and 73 degrees 48 minutes east, and 15 degrees 30 minutes south and 76 degrees 42 minutes east; the volcanic ash cloud is expected to move east-southeastwards at 65 kilometres per hour; at 1700 UTC the volcanic ash cloud is forecast to be located approximately in an area bounded by the following points: 15 degrees 6 minutes south and 75 degrees east, 15 degrees 18 minutes south and 81 degrees 12 minutes south, 17 degrees 12 minutes south and 83 degrees 30 minutes east, and 18 degrees 24 minutes south and 78 degrees 36 minutes east.

Outlook:

The volcanic ash cloud at 2300 UTC on the 21st of the month is expected to be located approximately in an area bounded by the following points: 16 degrees south and 78 degrees 6 minutes east, 16 degrees 42 minutes south and 84 degrees 12 minutes east, 18 degrees 24 minutes south and 89 degrees east, and 19 degrees 6 minutes south and 81 degrees east; the volcanic ash cloud at 0500 UTC on the 22nd of the month is expected to be located approximately in an area bounded by the following points: 17 degrees south and 81 degrees east, 18 degrees 12 minutes south and 86 degrees 36 minutes east, 20 degrees south and 92 degrees 24 minutes east, and 21 degrees 30 minutes south and 84 degrees 18 minutes east.

* Fictitious locations

Example A6-4. SIGMET message for severe turbulence

YUCC SIGMET 5 VALID 221215/221600 YUDO-
 YUCC AMSWELL FIR SEV TURB OBS AT 1210Z YUSB FL250 MOV E 40KMH WKN

Meaning:

The fifth SIGMET message issued for the AMSWELL* flight information region (identified by YUCC Amswell area control centre) by the Donlon/International* meteorological watch office (YUDO) since 0001 UTC; the message is valid from 1215 UTC to 1600 UTC on the 22nd of the month; severe turbulence was observed at 1210 UTC over Siby/Bistock* aerodrome (YUSB) at flight level 250; the turbulence is expected to move eastwards at 40 kilometres per hour and to weaken in intensity.

* Fictitious locations

Example A6-5. AIRMET message for moderate mountain wave

YUCC AIRMET 2 VALID 221215/221600 YUDO-
 YUCC AMSWELL FIR MOD MTW OBS AT 1205Z AND FCST N48 E10 FL080 STNR NC

Meaning:

The second AIRMET message issued for the AMSWELL* flight information region (identified by YUCC Amswell area control centre) by the Donlon/International* meteorological watch office (YUDO) since 0001 UTC; the message is valid from 1215 UTC to 1600 UTC on the 22nd of the month; moderate mountain wave was observed at 1205 UTC at 48 degrees north and 10 degrees east at flight level 080; the mountain wave is expected to remain stationary and not to undergo any changes in intensity.

* Fictitious locations

APPENDIX 7. TECHNICAL SPECIFICATIONS RELATED TO AERONAUTICAL CLIMATOLOGICAL INFORMATION

(See Chapter 8 of this Annex.)

1. PROCESSING OF AERONAUTICAL CLIMATOLOGICAL INFORMATION

Recommendation.— *Meteorological observations for regular and alternate aerodromes should be collected, processed and stored in a form suitable for the preparation of aerodrome climatological information.*

example, of a combination of low visibility and low cloud).

3.1.2 Recommendation.— *Aerodrome climatological tables should include information required for the preparation of aerodrome climatological summaries in accordance with 3.2.*

2. EXCHANGE OF AERONAUTICAL CLIMATOLOGICAL INFORMATION

Recommendation.— *Aeronautical climatological information should be exchanged on request between meteorological authorities. Operators and other aeronautical users desiring such information should normally apply to the meteorological authority responsible for its preparation.*

3.2 Aerodrome climatological summaries

Recommendation.— *Aerodrome climatological summaries should cover:*

- a) frequencies of the occurrence of runway visual range/visibility and/or height of the base of the lowest cloud layer of BKN or OVC extent below specified values at specified times;*
- b) frequencies of visibility below specified values at specified times;*
- c) frequencies of the height of the base of the lowest cloud layer of BKN or OVC extent below specified values at specified times;*
- d) frequencies of occurrence of concurrent wind direction and speed within specified ranges;*
- e) frequencies of surface temperature in specified ranges of 5°C at specified times; and*
- f) mean values and variations therefrom, including maximum and minimum values of meteorological elements required for operational planning purposes, including take-off performance calculations.*

3. CONTENT OF AERONAUTICAL CLIMATOLOGICAL INFORMATION

3.1 Aerodrome climatological tables

3.1.1 Recommendation.— *An aerodrome climatological table should give as applicable:*

- a) mean values and variations therefrom, including maximum and minimum values, of meteorological elements (for example, of air temperature); and/or*
- b) the frequency of occurrence of present weather phenomena affecting flight operations at the aerodrome (for example, of sandstorms); and/or*
- c) the frequency of occurrence of specified values of one, or of a combination of two or more, elements (for*

Note.— *Models of climatological summaries related to a) to e) are given in WMO Publication No. 49, Technical Regulations, Volume II, C.3.2.*

APPENDIX 8. TECHNICAL SPECIFICATIONS RELATED TO SERVICE FOR OPERATORS AND FLIGHT CREW MEMBERS

(See Chapter 9 of this Annex.)

Note.— Specifications related to flight documentation (including the model charts and forms) are given in Appendix 1.

1. MEANS OF SUPPLY AND FORMAT OF METEOROLOGICAL INFORMATION

1.1 Meteorological information shall be supplied to operators and flight crew members by one or more of the following, as agreed between the meteorological authority and operator concerned, and with the order shown below not implying priorities:

- a) written or printed material, including specified charts and forms;
- b) data in digital form;
- c) briefing;
- d) consultation;
- e) display; or
- f) in lieu of a) to e), by means of an automated pre-flight information system providing self-briefing and flight documentation facilities while retaining access by operators and aircrew members to consultation, as necessary, with the meteorological office, in accordance with 5.1.

1.2 The meteorological authority, in consultation with the operator, shall determine:

- a) the type and format of meteorological information to be supplied; and
- b) methods and means of supplying that information.

1.3 **Recommendation.—** *On request by the operator, the meteorological information supplied for flight planning should include data for the determination of the lowest usable flight level.*

2. SPECIFICATIONS RELATED TO INFORMATION FOR PRE-FLIGHT PLANNING AND IN-FLIGHT RE-PLANNING

2.1 Format of upper-air information

Upper-air information supplied by WAFCs for pre-flight and in-flight re-planning shall be in the GRIB code form.

Note.— The GRIB code form is contained in WMO Publication No. 306, Manual on Codes, Volume I.2, Part B — Binary Codes.

2.2 Format of information on significant weather

Information on significant weather supplied by WAFCs for pre-flight and in-flight re-planning shall be in the BUFR code form.

Note.— The BUFR code form is contained in WMO Publication No. 306, Manual on Codes, Volume I.2, Part B — Binary Codes.

2.3 Specific needs of supersonic aircraft

Recommendation.— *Meteorological information for pre-flight planning and in-flight re-planning by operators for supersonic aircraft should include data covering the levels used for transonic and supersonic flight, together with the levels that may be used for subsonic flight. Particular mention should be made of occurrence and expected occurrence, location and vertical extent of cumulonimbus clouds, turbulence and precipitation.*

2.4 Specific needs of helicopter operations

Recommendation.— *Meteorological information for pre-flight planning and in-flight re-planning by operators of helicopters flying to offshore structures should include data covering the layers from sea level to flight level 100. Particular mention should be made of the expected surface visibility, the amount, type (where available), base and tops of cloud*

below flight level 100, sea state and sea surface temperature, mean sea-level pressure, and the occurrence and expected occurrence of turbulence and icing, as determined by regional air navigation agreement.

3. SPECIFICATIONS RELATED TO BRIEFING AND CONSULTATION

3.1 Specific needs of supersonic aircraft

Recommendation.— Briefing and/or consultation for flight crew members of supersonic aircraft should include meteorological information covering the flight levels of transonic and supersonic flight. Particular mention should be made of occurrence and expected occurrence, location and vertical extent of cumulonimbus clouds, turbulence and precipitation.

3.2 Specific needs of low-level flights

Recommendation.— Briefing and/or consultation for low-level flights, including those in accordance with the visual flight rules, should include meteorological information covering altitudes up to flight level 100 (or up to flight level 150 in mountainous areas or higher, where necessary). Particular mention should be made of the occurrence or expected occurrence of any phenomena causing widespread reduction of visibility to less than 5 000 m, as well as the occurrence or expected occurrence of clouds which may affect the flight.

3.3 Information required to be displayed

3.3.1 To assist the flight crew members and others concerned with the preparation of the flight and for use in briefing and consultation, the meteorological office shall display the latest available:

- a) METAR and SPECI;
- b) TAF and trend forecasts;
- c) aerodrome warnings relating to the local aerodrome;
- d) forecasts for take-off;
- e) SIGMET and AIRMET information and special air-reports not covered by a SIGMET;
- f) current and prognostic charts;
- g) meteorological satellite images or mosaics and/or nephalanalyses; and
- h) ground-based weather radar information.

3.3.2 **Recommendation.**— The material displayed should be readily accessible to the flight crew members or other flight operations personnel concerned. By agreement between the meteorological authority and the user, the display may be used in lieu of briefing and/or consultation.

4. SPECIFICATIONS RELATED TO FLIGHT DOCUMENTATION

4.1 General

4.1.1 Presentation of flight documentation

4.1.1.1 **Recommendation.**— Charts included in flight documentation should have a high standard of clarity and legibility and should have the following physical characteristics:

- a) for convenience, the largest size of charts should be about 42 × 30 cm (standard size A3) and the smallest size should be about 21 × 30 cm (standard size A4). The choice between these sizes should depend on the route lengths and the amount of detail that needs to be given in the charts as agreed between meteorological authorities and users;
- b) major geographical features, such as coastlines, major rivers and lakes should be depicted in a way that makes them easily recognizable;
- c) for charts prepared by computer, meteorological data should take preference over basic chart information, the former cancelling the latter wherever they overlap;
- d) major aerodromes should be shown as a dot and identified by the first letter of the name of the city the aerodrome serves as given in Table AOP of the relevant regional air navigation plan;
- e) a geographical grid should be shown with meridians and parallels represented by dotted lines at each 10° latitude and longitude; dots should be spaced one degree apart;
- f) latitude and longitude values should be indicated at various points throughout the charts (i.e. not only at the edges); and
- g) labels on the charts for flight documentation should be clear and simple and should present the name of the world area forecast centre or, for non-WAFS products, the originating centre, the type of chart, date and valid time and, if necessary, the types of units used in an unambiguous way.

4.1.1.2 **Recommendation.**— *Meteorological information included in flight documentation should be represented as follows:*

- a) *winds on charts should be depicted by arrows with feathers and shaded pennants on a sufficiently dense grid;*
- b) *temperatures should be depicted by figures on a sufficiently dense grid;*
- c) *wind and temperature data selected from the data sets received from a world area forecast centre should be depicted in a sufficiently dense latitude/longitude grid; and*
- d) *wind arrows should take precedence over temperatures and either should take precedence over chart background.*

4.1.1.3 **Recommendation.**— *For short-haul flights charts should be prepared covering limited areas at a scale of $1:15 \times 10^6$ as required and subject to regional air navigation agreement.*

4.1.2 Set of charts to be provided

4.1.2.1 **Recommendation.**— *The minimum number of charts for flights between flight level 250 and flight level 630 should include a high-level significant weather chart (flight level 250 to flight level 630) and a forecast 250 hPa wind and temperature chart. The actual charts provided for pre-flight and in-flight planning and for flight documentation should be as agreed between meteorological authorities and other users within a service area.*

4.1.2.2 **Recommendation.**— *The set of charts to be provided under the world area forecast system for flights below flight level 250 should be as agreed between user States and other users.*

4.1.3 Height indications

Recommendation.— *In flight documentation height indications should be given as follows:*

- a) *all references to en-route meteorological conditions, such as height indications of upper winds, turbulence or bases and tops of clouds, should preferably be expressed in flight levels; they may also be expressed in pressure, altitude or, for low-level flights, height above ground level; and*
- b) *all references to aerodrome meteorological conditions, such as height indications of the bases of clouds, should be expressed in height above the aerodrome elevation.*

4.2 Specifications related to upper wind and upper-air temperature information

4.2.1 In chart form

4.2.1.1 Where upper wind and upper-air temperature information is supplied in chart form to flight crew members before departure, the charts shall be fixed time prognostic charts for standard flight levels. In tropical areas, or for short flights, current charts may be provided in lieu of prognostic charts; in such cases, the levels depicted shall correspond to the standard isobaric levels.

4.2.1.2 Upper wind and upper-air temperature charts for low-level flights shall be supplied for points separated by no more than 500 km (300 NM) and for at least the following altitudes: 600, 1 500 and 3 000 m (2 000, 5 000 and 10 000 ft).

4.2.2 In tabular form

Recommendation.— *Where upper wind and upper-air temperature information is supplied in tabular form, it should include data for the same flight levels as for upper-air charts. This information should be given for spot locations on a regular grid.*

Note.— *Examples of the form of presentation of tabular forecasts of upper winds and upper-air temperatures are given in Appendix 1.*

4.3 Specifications related to significant weather information

4.3.1 In chart form

4.3.1.1 Where information on significant en-route weather phenomena is supplied in chart form to flight crew members before departure, the charts shall be significant weather charts valid for a specified fixed time. Such charts shall show, as appropriate to the flight:

- a) thunderstorms;
- b) tropical cyclone;
- c) severe squall lines;
- d) moderate or severe turbulence (in cloud or clear air);
- e) moderate or severe icing;
- f) widespread sandstorm/duststorm;
- g) for flight level 100 to flight level 250, clouds associated with a) to f);

- h) above flight level 250, cumulonimbus cloud associated with a) to f);
- i) surface position of well-defined convergence zones;
- j) surface positions, speed and direction of movement of frontal systems when associated with significant en-route weather phenomena;
- k) tropopause heights;
- l) jetstreams;
- m) information on the location of volcanic eruptions which are producing ash clouds of significance to aircraft operations, including those producing only steam, comprising: volcanic eruption symbol at the location of the volcano and, at the side of the chart, the volcano eruption symbol, the name of the volcano, its international number, latitude/longitude, the date and time of first eruption, if known, and a reference to SIGMETs and NOTAM or ASHTAM issued for the area concerned; and
- n) information on the location of an accidental release of radioactive materials into the atmosphere of significance to aircraft operations, comprising: the radioactivity symbol at the site of the accident and, at the side of the chart, the radioactivity symbol, latitude/longitude of the site of the accident, date and time of the accident and a reminder to users to check NOTAM for the area concerned.

Note 1.— For aircraft operating above flight level 250, items a) to f) are only required if expected to be above that level, and in the case of item a), only those thunderstorms which warrant the issuance of a SIGMET as given in Appendix 6. Guidance on the use of term “FRQ TS” is given in Appendix 6.

Note 2.— The abbreviation “CB” should only be included where it refers to the occurrence or expected occurrence of an area of widespread cumulonimbus clouds or cumulonimbus along a line with little or no space between individual clouds, or to cumulonimbus embedded in cloud layers or concealed by haze. It does not refer to isolated or scattered cumulonimbus not embedded in cloud layers or concealed by haze.

Note 3.— Where a volcanic eruption or the accidental release of radioactive materials into the atmosphere warrants the inclusion of the volcanic activity symbol or the radioactivity symbol on significant weather charts, the symbols are to be included on all such charts (low, medium and high) irrespective of the height to which the ash column or radioactive material is reported or expected to reach.

Note 4.— The international volcano number is allocated by the International Association of Volcanology and Chemistry of

the Earth’s Interior (IAVCEI) and is listed in the Manual on Volcanic Ash, Radioactive Material and Toxic Chemical Clouds (Doc 9691).

4.3.1.2 Recommendation.— *On significant weather charts, the inclusion of “CB” or the thunderstorm symbol should be understood to include all weather phenomena normally associated with cumulonimbus or thunderstorm, namely, moderate or severe icing, moderate or severe turbulence and hail.*

4.3.1.3 Recommendation.— *Significant weather charts for low-level flights, including those in accordance with the visual flight rules, operating up to flight level 100 (up to flight level 150 in mountainous areas or higher, where necessary) should show, as appropriate to the flight:*

- a) the phenomena warranting the issuance of a SIGMET as given in Appendix 6 and which are expected to affect low-level flights; and*
- b) the elements included in area forecasts for low-level flights as given in Appendix 5 except elements r) and u) concerning upper winds and upper-air temperatures and forecast lowest QNH, respectively.*

Note 1.— Examples of the form of presentation of significant weather charts are given in Appendix 1.

Note 2.— Guidance on the use of terms “ISOL”, “OCNL” and “FRQ” referring to cumulonimbus clouds and thunderstorms is given in Appendix 6.

4.3.2 In other forms

Recommendation.— *Where flight documentation covering the significant en-route weather conditions is not supplied in chart form, it should be presented in tabular form and/or as an abbreviated plain-language text.*

Note.— Examples of the form of presentation of tabular forecasts are given in Appendix 1.

4.4 Specifications related to TAF

4.4.1 Requirements for TAF

4.4.1.1 The flight documentation shall in all cases include the TAF for the aerodrome of departure, and for the aerodrome of intended landing. In addition, the flight documentation shall include TAF for one or more suitable alternate aerodromes, as needed to complete the operational flight plan and as selected by agreement between the meteorological authority and the operators, and taken from the list of aerodromes contained in the relevant regional air navigation plan.

4.4.1.2 TAF received from other meteorological offices shall be included in flight documentation without change in substance.

4.4.1.3 **Recommendation.**— *By agreement between the meteorological authority and the operator the flight documentation should include TAF for alternate aerodromes en route and of aerodromes where intermediate stops are planned.*

4.4.2 Presentation of TAF

Recommendation.— *TAF should be presented in accordance with the template in Appendix 5; they may also be presented in tabular form or in the form of an abbreviated plain-language text. The location indicators and the abbreviations used should be explained in the flight documentation. If several TAF are included, they should be presented in a manner which permits the ready identification of the beginning and end of each forecast.*

Note.— *Examples of the form of presentation of TAF are given in Appendix 1.*

4.4.3 Issuance of provisional TAF

Recommendation.— *When a TAF is not received in time, the meteorological office associated with the aerodrome of departure should make all practicable efforts to obtain the forecast but, if unobtainable, the office should, if possible, prepare a provisional forecast. The meteorological office should inform the flight crew member that the forecast is provisional and record its origin in the flight documentation.*

4.5 Specifications related to low-level flights

4.5.1 In chart form

Recommendation.— *Where the forecasts are supplied in chart form, flight documentation for low-level flights, including those in accordance with the visual flight rules, operating up to flight level 100 (or up to flight level 150 in mountainous areas or higher, where necessary), should contain the following as appropriate to the flight:*

- a) *information from relevant SIGMET and AIRMET messages;*
- b) *upper wind and upper-air temperature charts as given in 4.2.1.2; and*
- c) *significant weather charts as given in 4.3.1.3.*

4.5.2 In abbreviated plain language

Recommendation.— *Where the forecasts are not supplied in chart form, flight documentation for low-level flights,*

including those in accordance with the visual flight rules, operating up to flight level 100 (up to flight level 150 in mountainous areas or higher, where necessary), should contain the following information as appropriate to the flight:

- a) *SIGMET and AIRMET information; and*
- b) *information included in the area forecasts for low-level flights as given in Appendix 5 or, where the forecasts are issued in the form of an abbreviated plain-language text, the GAMET area forecasts.*

Note.— *An example of the GAMET area forecast is given in Appendix 5.*

5. SPECIFICATIONS RELATED TO AUTOMATED PRE-FLIGHT INFORMATION SYSTEMS FOR BRIEFING, CONSULTATION, FLIGHT PLANNING AND FLIGHT DOCUMENTATION

5.1 Access to the systems

Automated pre-flight information systems providing self-briefing facilities shall provide for access by operators and flight crew members to consultation, as necessary, with a meteorological office by telephone or other suitable telecommunications means.

5.2 Detailed specifications of the systems

Recommendation.— *Automated pre-flight information systems for the supply of meteorological information for self-briefing, pre-flight planning and flight documentation should:*

- a) *provide for the continuous and timely updating of the system database and monitoring of the validity and integrity of the meteorological information stored;*
- b) *permit access to the system by operators and flight crew members and also by other aeronautical users concerned through suitable telecommunications means;*
- c) *use access and interrogation procedures based on abbreviated plain language and, as appropriate, ICAO location indicators, and aeronautical meteorological code data-type designators prescribed by the WMO, or based on a menu-driven user interface, or other appropriate mechanisms as agreed between the meteorological authority and operators concerned; and*
- d) *provide for rapid response to a user request for information.*

Note.— *ICAO abbreviations and codes and location indicators are given respectively in the Procedures for Air*

Navigation Services — ICAO Abbreviations and Codes (PANS-ABC, Doc 8400) and Location Indicators (Doc 7910). Aeronautical meteorological code data-type designators are given in the WMO Publication No. 386, Manual on the Global Telecommunication System.

6. SPECIFICATIONS RELATED TO INFORMATION FOR AIRCRAFT IN FLIGHT

6.1 Supply of information requested by an aircraft in flight

Recommendation.— *If an aircraft in flight requests meteorological information, the meteorological office which receives the request should arrange to supply the information with the assistance, if necessary, of another meteorological office.*

6.2 Information for in-flight planning by the operator

Recommendation.— *Meteorological information for planning by the operator for aircraft in flight should be*

supplied during the period of the flight and should normally consist of any or all of the following:

- a) meteorological reports, TAF and landing forecasts;*
- b) SIGMET and AIRMET information and special air-reports relevant to the flight, unless the latter have been the subject of a SIGMET message; and*
- c) upper wind and upper-air temperature information.*

6.3 Information for supersonic flights

Recommendation.— *For supersonic aircraft in flight the meteorological office serving the aerodrome of intended landing should, on request by the operator, supply a forecast covering the transonic deceleration and subsonic descent phases. This forecast should be transmitted to the area control centre or flight information centre concerned within the two hours before arrival. The operator should advise the meteorological office, in good time, of the location of the descent path and of the time at which the aircraft is expected to commence the descent.*

APPENDIX 9. TECHNICAL SPECIFICATIONS RELATED TO INFORMATION FOR AIR TRAFFIC SERVICES, SEARCH AND RESCUE SERVICES AND AERONAUTICAL INFORMATION SERVICES

(See Chapter 10 of this Annex.)

1. INFORMATION TO BE PROVIDED FOR AIR TRAFFIC SERVICES UNITS

1.1 List of information for the aerodrome control tower

The following meteorological information shall be supplied, as necessary, to an aerodrome control tower by its associated aerodrome meteorological office:

- a) local routine and special reports, METAR and SPECI, TAF and trend forecasts and amendments thereto, for the aerodrome concerned;
- b) SIGMET and AIRMET information, wind shear warnings and aerodrome warnings;
- c) any additional meteorological information agreed upon locally, such as forecasts of surface wind for the determination of possible runway changes; and
- d) information received on volcanic ash cloud, for which a SIGMET has not already been issued, as agreed between the meteorological and ATS authorities concerned.

1.2 List of information for the approach control office

The following meteorological information shall be supplied, as necessary, to an approach control office by its associated aerodrome meteorological office:

- a) local routine and special reports, METAR and SPECI, including current pressure data, TAF and trend forecasts and amendments thereto, for the aerodrome(s) with which the approach control office is concerned;
- b) SIGMET and AIRMET information, wind shear warnings and appropriate special air-reports for the air-space with which the approach control office is concerned and aerodrome warnings;
- c) any additional meteorological information agreed upon locally; and

- d) information received on volcanic ash cloud, for which a SIGMET has not already been issued, as agreed between the meteorological and ATS authorities concerned.

1.3 List of information for the flight information centre

The following meteorological information shall be supplied, as necessary, to a flight information centre or an area control centre by its associated meteorological watch office:

- a) METAR and SPECI, including current pressure data for aerodromes and other locations, TAF and trend forecasts and amendments thereto, covering the flight information region or the control area and, if required by the flight information centre or area control centre, covering aerodromes in neighbouring flight information regions, as determined by regional air navigation agreement;
- b) forecasts of upper winds, upper-air temperatures and significant en-route weather phenomena and amendments thereto, particularly those which are likely to make operation under visual flight rules impracticable, SIGMET and AIRMET information and appropriate special air-reports for the flight information region or control area and, if determined by regional air navigation agreement and required by the flight information centre or area control centre, for neighbouring flight information regions;
- c) any other meteorological information required by the flight information centre or area control centre to meet requests from aircraft in flight; if the information requested is not available in the associated meteorological watch office, that office shall request the assistance of another meteorological office in supplying it;
- d) information received on volcanic ash cloud, for which a SIGMET has not already been issued, as agreed between the meteorological and ATS authorities concerned; and
- e) information received concerning the accidental release of radioactive materials into the atmosphere, as agreed between the meteorological and ATS authorities concerned.

1.4 Specific provisions related to the supply of information on volcanic ash and volcanic eruptions

1.4.1 Volcanic ash advisory information issued by a VAAC shall be supplied to area control centres and flight information centres concerned in its area of responsibility.

1.4.2 Information received on pre-eruption volcanic activity and/or a volcanic eruption shall be supplied, as necessary, to an ATS unit by its corresponding associated meteorological office as agreed between the meteorological and ATS authorities concerned.

1.5 Specific provisions related to the supply of information for supersonic aircraft

Recommendation.— *The information supplied to flight information centres and area control centres for supersonic aircraft should cover the levels used for transonic and supersonic flight and should include forecasts for subsonic descent paths to aerodromes in the flight information region.*

1.6 Supply of information to aeronautical telecommunications stations

Where necessary for flight information purposes, current meteorological reports and forecasts shall be supplied to designated aeronautical telecommunication stations. A copy of such information shall be forwarded, if required, to the flight information centre or the area control centre.

1.7 Format of information

1.7.1 **Recommendation.**— *Local routine and special reports, METAR and SPECI, TAF and trend forecasts, SIGMET and AIRMET information, upper wind and upper-air temperature forecasts and amendments thereto should be supplied to air traffic services units in the form in which they are prepared, disseminated to other meteorological offices or received from other meteorological offices, unless otherwise agreed locally.*

1.7.2 **Recommendation.**— *When computer-processed upper-air data for grid points are made available to air traffic services units in digital form for use by air traffic services computers, the contents, format and transmission arrangements should be as agreed between the meteorological authority and the appropriate ATS authority. The data should normally be supplied as soon as is practicable after the processing of the forecasts has been completed.*

2. INFORMATION TO BE PROVIDED FOR SEARCH AND RESCUE SERVICES UNITS

2.1 List of information

Information to be supplied to rescue coordination centres shall include the 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:

- a) significant en-route weather phenomena;
- b) cloud amount and type, particularly cumulonimbus; height indications of bases and tops;
- c) visibility and phenomena reducing visibility;
- d) surface wind and upper wind;
- e) state of ground, in particular, any snow cover or flooding;
- f) sea-surface temperature, state of the sea, ice cover if any and ocean currents, if relevant to the search area; and
- g) sea-level pressure data.

2.2 Information to be provided on request

2.2.1 **Recommendation.**— *On request from the rescue coordination centre, the designated meteorological office should arrange to obtain details of the flight documentation which was supplied to the missing aircraft, together with any amendments to the forecast which were transmitted to the aircraft in flight.*

2.2.2 **Recommendation.**— *To facilitate search and rescue operations the designated meteorological office should, on request, supply:*

- a) complete and detailed information on the current and forecast meteorological conditions in the search area; and
- b) current and forecast conditions en route, covering flights by search aircraft from and returning to the aerodrome from which the search is being conducted.

2.2.3 **Recommendation.**— *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.*

3. INFORMATION TO BE PROVIDED FOR AERONAUTICAL INFORMATION SERVICES UNITS

3.1 List of information

The following information shall be supplied, as necessary, to an aeronautical information services unit:

- a) information on meteorological service for international air navigation, intended for inclusion in the aeronautical information publication(s) concerned;

Note.— Details of this information are given in Annex 15, Appendix 1, Part 1, 3.5 and Part 3, 2.2, 2.11, 3.2 and 3.11.

- b) information necessary for the preparation of NOTAM or ASHTAM including, in particular, information on:

- 1) the establishment, withdrawal and significant changes in operation of aeronautical meteorological services. This information is required to be provided to the aeronautical information services unit sufficiently in advance of the effective date to permit

issuance of NOTAM in compliance with Annex 15, 5.1.1 and 5.1.1.1;

- 2) the occurrence of volcanic activity; and

Note.— The specific information required is given in Chapter 3, 3.3.2 and Chapter 4, 4.8.

- 3) accidental release of radioactive materials into the atmosphere, as agreed between the meteorological and appropriate civil aviation authorities concerned; and

Note.— The specific information required is given in Chapter 3, 3.4.2 g).

- c) information necessary for the preparation of aeronautical information circulars including, in particular, information on:

- 1) expected important changes in aeronautical meteorological procedures, services and facilities provided; and
- 2) effect of certain weather phenomena on aircraft operations.

APPENDIX 10. TECHNICAL SPECIFICATIONS RELATED TO REQUIREMENTS FOR AND USE OF COMMUNICATIONS

(See Chapter 11 of this Annex.)

1. SPECIFIC REQUIREMENTS FOR COMMUNICATIONS

1.1 Required transit times of meteorological information

Recommendation.— Unless otherwise determined by regional air navigation agreement, AFTN messages and bulletins containing operational meteorological information should achieve transit times of less than the following:

SIGMET and AIRMET messages, volcanic ash and tropical cyclone advisory information and special air-reports. 5 minutes

Abbreviated plain-language amendments to significant weather and upper air forecasts. . . . 5 minutes

Amended TAF and corrections to TAF 5 minutes

METAR	}	0–900 km	
		(500 NM).	5 minutes
Trend forecasts			
TAF		more than	
		900 km	
		(500 NM).	10 minutes
SPECI			

1.2 Grid point data for ATS and operators

1.2.1 Recommendation.— When upper-air data for grid points in digital form are made available for use by air traffic services computers, the transmission arrangements should be as agreed between the meteorological authority and the appropriate ATS authority.

1.2.2 Recommendation.— When upper-air data for grid points in digital form are made available to operators for flight planning by computer, the transmission arrangements should be as agreed among the world area forecast centre concerned, the meteorological authority and the operators.

2. USE OF AERONAUTICAL FIXED SERVICE COMMUNICATIONS

2.1 Meteorological bulletins in alphanumeric format

2.1.1 Composition of bulletins

Recommendation.— Whenever possible, exchanges of operational meteorological information should be made in consolidated bulletins of the same types of meteorological information.

2.1.2 Filing times of bulletins

Recommendation.— Meteorological bulletins required for scheduled transmissions should be filed regularly and at the prescribed scheduled times. METAR should be filed for transmission not later than 5 minutes after the actual time of observation. TAF should be filed for transmission at least one hour before the commencement of their period of validity, unless otherwise determined by regional air navigation agreement.

2.1.3 Heading of bulletins

Meteorological bulletins containing operational meteorological information to be transmitted via the aeronautical fixed service facilities shall contain a heading consisting of:

- a) an identifier of four letters and two figures;
- b) the ICAO four-letter location indicator corresponding to the geographical location of the meteorological office originating or compiling the meteorological bulletin;
- c) a date-time group; and
- d) if required, a three-letter indicator.

Note 1.— Detailed specifications on format and contents of the heading are given in the WMO Manual on the Global Telecommunication System, Volume I and are reproduced in the Manual of Aeronautical Meteorological Practice (Doc 8896).

Note 2.— ICAO location indicators are listed in Location Indicators (Doc 7910).

2.1.4 Structure of bulletins

Meteorological bulletins containing operational meteorological information to be transmitted via the AFTN shall be encapsulated in the text part of the AFTN message format.

2.2 World area forecast system products

2.2.1 Telecommunications for the supply of WAFS products

Recommendation.— *The telecommunications facilities used for the supply of world area forecast system products should be the aeronautical fixed service.*

2.2.2 Quality requirements for charts

Recommendation.— *Where world area forecast system products are disseminated in chart form, the quality of the charts received should be such as to permit reproduction in a sufficiently legible form for flight planning and documentation. Charts received should be legible over 95 per cent of their area.*

2.2.3 Quality requirements for transmissions

Recommendation.— *Transmissions should be such as to ensure that their interruption should not exceed 10 minutes during any period of 6 hours.*

2.2.4 Heading of bulletins containing WAFS products

Meteorological bulletins containing WAFS products in digital form to be transmitted via aeronautical fixed service facilities shall contain a heading as given in 2.1.3.

3. USE OF AERONAUTICAL MOBILE SERVICE COMMUNICATIONS

3.1 Content and format of meteorological messages

3.1.1 The contents and format of reports, forecasts and SIGMET information transmitted to aircraft shall be consistent with the provisions of Chapters 4, 6 and 7 of this Annex.

3.1.2 The contents and format of air-reports transmitted by aircraft shall be consistent with the provisions of Chapter 5 of this Annex and the *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM, Doc 4444), Appendix 1.

3.2 Content and format of meteorological bulletins

The substance of a meteorological bulletin transmitted via the aeronautical mobile service shall remain unchanged from that contained in the bulletin as originated.

4. USE OF AERONAUTICAL DATA LINK SERVICE — D-VOLMET

4.1 Detailed content of meteorological information available for D-VOLMET

4.1.1 **Recommendation.**— *The aerodromes for which METAR, SPECI and TAF are to be available for uplink to aircraft in flight should be determined by regional air navigation agreement.*

4.1.2 **Recommendation.**— *The flight information regions for which SIGMET and AIRMET messages are to be available for uplink to aircraft in flight should be determined by regional air navigation agreement.*

4.2 Criteria related to information to be available for D-VOLMET

4.2.1 **Recommendation.**— *The latest available METAR, SPECI, TAF, SIGMET and AIRMET should be used for uplink to aircraft in flight.*

4.2.2 **Recommendation.**— *TAF included in the D-VOLMET should be amended as necessary to ensure that a forecast, when made available for uplink to aircraft in flight, reflects the latest opinion of the meteorological office concerned.*

4.2.3 **Recommendation.**— *If no SIGMET message is available for a flight information region, an indication of “NIL SIGMET” should be included in the D-VOLMET.*

4.3 Format of information to be available for D-VOLMET

The content and format of reports, forecasts and SIGMET and AIRMET information included in D-VOLMET shall be consistent with the provisions of Chapters 4, 6 and 7 of this Annex.

5. USE OF AERONAUTICAL BROADCASTING SERVICE — VOLMET BROADCASTS

5.1 Detailed content of meteorological information to be included in VOLMET broadcasts

5.1.1 Recommendation.— *The aerodromes for which METAR, SPECI and TAF are to be included in VOLMET broadcasts, the sequence in which they are to be transmitted and the broadcast time should be determined by regional air navigation agreement.*

5.1.2 Recommendation.— *The flight information regions for which SIGMET messages are to be included in scheduled VOLMET broadcasts should be determined by regional air navigation agreement. Where this is done, the SIGMET message or an indication of “NIL SIGMET” should be transmitted at the beginning of the broadcast or of a five-minute time block.*

5.2 Criteria related to information to be included in VOLMET broadcasts

5.2.1 Recommendation.— *When a report has not arrived from an aerodrome in time for a broadcast, the latest*

available report should be included in the broadcast, together with the time of observation.

5.2.2 Recommendation.— *TAF included in scheduled VOLMET broadcasts should have a period of validity of 9 hours; they should be issued every 3 hours and should, between these routine issues, be amended as necessary to ensure that a forecast, when transmitted, reflects the latest opinion of the meteorological office concerned.*

5.3 Format of information to be included in VOLMET broadcasts

5.3.1 The content and format of reports, forecasts and SIGMET information included in VOLMET broadcasts shall be consistent with the provisions of Chapters 4, 6 and 7 of this Annex.

5.3.2 Recommendation.— *VOLMET broadcasts should use standard radiotelephony phraseologies.*

Note.— *Guidance on the standard radiotelephony phraseologies to be used in VOLMET broadcasts is given in the Manual on Coordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services (Doc 9377), Appendix A.*

ATTACHMENT A. OPERATIONALLY DESIRABLE AND CURRENTLY ATTAINABLE ACCURACY OF MEASUREMENT OR OBSERVATION

*Note.— The guidance contained in this table relates to Chapter 4 —
Meteorological observations and reports, in particular to 4.1.9.*

<i>Element to be observed</i>	<i>Operationally desirable accuracy of measurement or observation*</i>	<i>Attainable accuracy** of measurement or observation (1994)</i>
Mean surface wind	Direction: $\pm 10^\circ$ Speed: ± 2 km/h (1 kt) up to 19 km/h (10 kt) $\pm 10\%$ above 19 km/h (10 kt)	Direction: $\pm 5^\circ$ Speed: ± 2 km/h (1 kt) up to 37 km/h (20 kt) $\pm 5\%$ above 37 km/h (20 kt)
Variations from the mean surface wind	± 4 km/h (2 kt), in terms of longitudinal and lateral components	as above
Visibility	± 50 m up to 600 m $\pm 10\%$ between 600 m and 1 500 m $\pm 20\%$ above 1 500 m	± 50 m up to 500 m $\pm 10\%$ between 500 m and 2 000 m $\pm 20\%$ above 2 000 m up to 10 km
Runway visual range	± 10 m up to 400 m ± 25 m between 400 m and 800 m $\pm 10\%$ above 800 m	± 25 m up to 150 m ± 50 m between 150 m and 500 m $\pm 10\%$ above 500 m up to 2 000 m
Cloud amount	± 1 okta	In daylight an observer can attain 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	± 10 m (33 ft) up to 100 m (330 ft) $\pm 10\%$ above 100 m (330 ft)	± 10 m (33 ft) up to 1 000 m (3 300 ft) ± 30 m (100 ft) above 1 000 m (3 300 ft) up to 3 000 m (10 000 ft)
Air temperature and dew- point temperature	$\pm 1^\circ\text{C}$	$\pm 0.2^\circ\text{C}$
Pressure value (QNH, QFE)	± 0.5 hPa	± 0.3 hPa
<p>* The operationally desirable accuracy is not intended as an operational requirement; it is to be understood as a goal that has been expressed by the operators.</p> <p>** The accuracy stated refers to assessment by instruments (except for cloud amount); it is not normally attainable in observations made without the aid of instruments.</p>		

ATTACHMENT B. OPERATIONALLY DESIRABLE ACCURACY OF FORECASTS

Note 1.— The guidance contained in this table relates to Chapter 6 — Forecasts, in particular to 6.1.1.

Note 2.— If the accuracy of the forecasts remains within the operationally desirable range shown in the second column, for

the percentage of cases indicated in the third column, the effect of forecast errors is not considered serious in comparison with the effects of navigational errors and of other operational uncertainties.

<i>Element to be forecast</i>	<i>Operationally desirable accuracy of forecasts</i>	<i>Minimum percentage of cases within range</i>
TAF		
Wind direction	± 30°	80% of cases
Wind speed	± 9 km/h (5 kt) up to 46 km/h (25 kt) ± 20% above 46 km/h (25 kt)	80% of cases
Visibility	± 200 m up to 700 m ± 30% between 700 m and 10 km	80% of cases
Precipitation	Occurrence or non-occurrence	80% of cases
Cloud amount	± 2 oktas	70% of cases
Cloud height	± 30 m (100 ft) up to 120 m (400 ft) ± 30% between 120 m (400 ft) and 3 000 m (10 000 ft)	70% of cases
Air temperature	± 1°C	70% of cases
TREND FORECAST		
Wind direction	± 30°	90% of cases
Wind speed	± 9 km/h (5 kt) up to 46 km/h (25 kt) ± 20% above 46 km/h (25 kt)	90% of cases
Visibility	± 200 m up to 700 m ± 30% between 700 m and 10 km	90% of cases
Precipitation	Occurrence or non-occurrence	90% of cases
Cloud amount	± 2 oktas	90% of cases
Cloud height	± 30 m (100 ft) up to 120 m (400 ft) ± 30% between 120 m (400 ft) and 3 000 m (10 000 ft)	90% of cases

<i>Element to be forecast</i>	<i>Operationally desirable accuracy of forecasts</i>	<i>Minimum percentage of cases within range</i>
FORECAST FOR TAKE-OFF		
Wind direction	$\pm 30^\circ$	90% of cases
Wind speed	± 9 km/h (5 kt) up to 46 km/h (25 kt) $\pm 20\%$ above 46 km/h (25 kt)	90% of cases
Air temperature	$\pm 1^\circ\text{C}$	90% of cases
Pressure value (QNH)	± 1 hPa	90% of cases
AREA, FLIGHT AND ROUTE FORECASTS		
Upper-air temperature	$\pm 3^\circ\text{C}$ (Mean for 900 km/500 NM)	90% of cases
Upper wind	± 28 km/h (15 kt) up to flight level 250 ± 37 km/h (20 kt) above flight level 250 (Modulus of vector difference for 900 km/500 NM)	90% of cases
Significant en-route weather phenomena and cloud	Occurrence or non-occurrence	80% of cases
	Location: ± 100 km/60 NM	70% of cases
	Vertical extent: ± 600 m/2 000 ft	70% of cases

ATTACHMENT C. BACK-UP PROCEDURES AT THE WORLD AREA FORECAST CENTRES

(See Chapter 3, 3.2.2 of this Annex.)

1. INTRODUCTION

A WAFC will provide any or all of the WAFS services as needed when the interruption of the operation of the other WAFC occurs. WAFC London and WAFC Washington have studied a number of potential service interruption and outage scenarios, reviewed the current communication links between the two WAFCs, and agreed upon the appropriate responses to each interruption in service.

2. INTERRUPTIONS IN NUMERICAL WEATHER PREDICTION (NWP) OR SIGNIFICANT WEATHER (SIGWX) FORECAST PRODUCTION

2.1 WAFC London interruptions

2.1.1 A global gridpoint NWP model runs in Exeter. The output from this NWP model forms the basis for the wind and temperature forecasts in the Gridded Binary (GRIB) code form. Two, largely identical, supercomputers are housed in separate computer halls, allowing the model to run on either machine. Therefore, routine or non-routine maintenance can be performed on one of the supercomputers without affecting the operational capability of WAFC London. In the rare event that the model cannot be run on either supercomputer, the following course of action would be taken. When the first model run is delayed significantly or is not available, a decision will be made to use the output from the previous model run, incremented by the appropriate number of hours. In the event that the output from a second, consecutive run is unavailable, WAFC London would process the GRIB data routinely received from WAFC Washington to produce the required WAFS forecasts. If the WAFC Washington data cannot be processed, WAFC Washington may be notified to begin the production of the back-up SIGWX forecasts. These forecasts along with other WAFS data are then sent to the WAFC London message-switching centre for normal distribution.

2.1.2 In the event of a failure at the primary operational workstation, the forecaster would use one of the back-up workstations located on the forecast floor, or in the back-up operations centre. If WAFC London is affected by a massive failure, paragraph 5 describes the action under "Total outage of a WAFC".

2.2 WAFC Washington interruptions

2.2.1 A global spectral model runs at the National Centres for Environmental Prediction (NCEP) and produces the WAFC Washington NWP output. This forms the basis for the wind and temperature forecasts in the GRIB code form. NCEP maintains the ability to run the global model on redundant systems in the case of a failure of the primary system. If the NWP is significantly delayed or missing due to the failure of the primary or secondary computer systems, a decision is made to use the NWP data routinely received from WAFC London at the National Weather Service Telecommunications Gateway (NWSTG), incremented by the appropriate number of hours, to produce the WAFS forecasts.

2.2.2 If the primary operational workstation fails, the forecaster would use a back-up workstation located on the forecast floor. If the WAFC Washington SIGWX production centre is out, WAFC London is called on to produce all of the WAFC Washington SIGWX forecasts. These forecasts are then switched back to the NWSTG with the routine WAFC London SIGWX forecasts for dissemination via the International Satellite Communications System (ISCS). If WAFC Washington is affected by a massive failure, paragraph 5 describes the action under "Total outage of a WAFC".

3. INTERRUPTIONS IN MESSAGE SWITCHING

3.1 WAFC London interruptions

Two message switches exist at WAFC London. In the rare event of a failure at the primary switch, the back-up switch would be used to send and receive data. The back-up message switch can be immediately connected to the Washington and Toulouse WMO global telecommunication system (GTS) routes, and is permanently connected to the satellite distribution system for information relating to air navigation (SADIS) in the event of failure of the primary switch. In the extremely unlikely event that WAFC London cannot connect to the GTS, an integrated services digital network (ISDN) circuit between Silver Spring and Exeter will be used to send and receive data. This circuit is a physical back-up to the link that is normally in place, and is used only when a major failure occurs.

3.2 WAFC Washington interruptions

An integrated services digital network (ISDN) circuit is maintained between WAFC London and the ISCS uplink site. In the rare event that the message switch at the NWSTG is out WAFC London would be notified to begin sending WAFS products on the ISDN circuit directly to the ISCS uplink site. The ISCS satellites then broadcast these products normally. A back-up message switch at another site is scheduled for implementation in 2004.

4. INTERRUPTIONS IN SATELLITE UPLINK AND SATELLITE DISTRIBUTION SYSTEMS

The operation of the satellite communications systems used to provide the SADIS and ISCS broadcasts of the WAFS data is outside the control of the two WAFCs. The reliability and availability of these services is guaranteed by the commercial operators, and not by the two WAFCs.

5. TOTAL OUTAGE OF A WAFC

5.1 WAFC London outage

It is considered extremely unlikely that WAFC London would ever be totally out. A new state of the art infrastructure ensures that both computers can operate completely independent of each other. Separate primary and back-up power supplies are furnished for each computer. The back-up procedures carried out will depend on the nature of the outage. In a worst-case scenario when the primary supercomputer becomes inoperable and the WAFC Washington — WAFC London GTS link cannot be regained, the ISDN circuit described in paragraph 4

would be used to send and receive data from Washington. Thus, the failure of the primary supercomputer would not affect the ability of WAFC London to disseminate WAFS products on the SADIS broadcast or send them to Washington for broadcast on the ISCS. In the event of the forecast office at WAFC London becoming unserviceable, WAFC Washington may be contacted to initiate back-up production of all the high-level and medium-level SIGWX forecasts routinely produced by WAFC London. It should be noted that a back-up forecast office is provisioned at WAFC London in a separate wing of the building. Thus, it is considered highly unlikely that WAFC London would be totally unable to produce their WAFS SIGWX forecasts. The SIGWX forecasts would still be available for SADIS uplink from either forecast office in such a scenario assuming that either computer is available.

5.2 WAFC Washington outage

The WAFS product generation facilities are located at multiple sites. Thus, WAFC Washington would never be completely out. The back-up procedures carried out would depend on the facility affected, and have been described above. Two independent data paths exist from the message-switching centre. Thus, a cable cut would not disrupt communications to or from the switch. However, in a scenario where the Washington message switch is completely out, the distribution of products to WAFC London and to the ISCS is also severed. A separate location for a back-up message switch is planned, but will not be implemented until 2004.

6. ROUTINE AND BACK-UP SIGNIFICANT WEATHER FORECASTS

Table C-1 summarizes the ICAO areas to be used by WAFCs Washington and London for both routine and back-up SIGWX forecasts.

Table C-1. Routine and back-up SIGWX areas with WMO headers

<i>SWH area</i>	<i>Primary WAFC</i>	<i>WMO header</i>
A	Washington	PGEE07 KKCI
B	London	PGSE06 EGRR
B1	Washington	PGIE07 KKCI
C	London	PGRE06 EGRR
D	London	PGZE06 EGRR
E	London	PGGE06 EGRR
F	Washington	PGGE07 KKCI
G	London	PGCE06 EGRR
H	London Washington	PGAE06 EGRR PGAE07 KKCI
I	Washington	PGBE07 KKCI
J	Washington	PGJE07 KKCI
K	London	PGKE06 EGRR
M	Washington	PGDE30 KKCI
NAT	Washington	PGNE40 KKCI
EUR	London	PGDE15 EGRR
MID	London	PGCE15 EGRR
S ASIA	London	PGZE15 EGRR

ATTACHMENT D. SELECTED CRITERIA APPLICABLE TO
AERODROME REPORTS

(The guidance in this table relates to Chapter 4 and Appendix 3.)

	Surface wind				Visibility (VIS)				<div><div><div>$\frac{RVR^1}{-10}$</div><div>$\frac{B}{-5}$</div><div>$\frac{C}{(TIME)}$</div></div></div> <div>(OBS TIME)</div>			Present weather	Cloud					Temperature	Pressure (QNH, QFE)		Supplementary information
									Amount				Type ²								
Specifications	Directional variations ³			Speed variations ³	Directional variations ⁴				Past tendency ⁵		Variations ⁵	No general criteria applicable to all the WX phenomena (for specific criteria see 4.8.4 – 4.8.7)	Layers reported if coverage				Identification	No criteria	Parameters reported	Updated if changes > agreed magnitude	Parameter to be included
	$\geq 60^\circ$ and < 180°		$\geq 180^\circ$	Exceeding the mean speed by ≥ 20 km/h (10 kt)	General rule	Special cases Minimum VIS \neq prevailing VIS		$ \bar{R}_{5(AB)} - \bar{R}_{5(BC)} $		$ \bar{R}_1 - \bar{R}_{10} > \text{MAX} [50 \text{ m or } 20\% \times \bar{R}_{10}]$											
	Mean speed					Minimum VIS < 1 500 m or < 0.5 x prevailing VIS	VIS fluctuating and prevailing VIS cannot be determined														
	< 6 km/h (3 kt)	≥ 6 km/h (3 kt)						< 100 m	≥ 100 m												
Local routine and special report	<div>2 min⁷</div> <div>VRB + 2 extreme directions¹¹</div>	<div>2 min</div> <div>mean + 2 extreme directions¹¹</div>	<div>2 min</div> <div>VRB (no extremes)¹¹</div>	<div>2 min</div> <div>Minimum and maximum speed</div>	<div>1 min</div> <div>VIS along the runway(s)</div>	N/A	N/A	<div>1 min</div> <div>N/A⁸</div>			Always	2/8	4/8	Always	CB TCU	QNH QFE ⁹	Yes	All ¹⁰			
	METAR/ SPECI	<div>10 min</div> <div>VRB (no extremes)</div>	<div>10 min</div> <div>mean + 2 extreme directions</div>	<div>10 min</div> <div>VRB (no extremes)</div>	<div>10 min</div> <div>Maximum speed¹¹</div>	<div>10 min</div> <div>Prevailing VIS</div>	Prevailing VIS and minimum VIS + direction	Minimum VIS	<div>10 min</div> <div>No tendency observed ("N")</div>	Upward ("U") or downward ("D")									Minimum and maximum (instead of 10-minute mean)	Always	2/8
Relevant reporting scales for all messages	Direction in three figures rounded off to the nearest 10 degrees (degrees 1 – 4 down, degrees 5 – 9 up)			Speed in 1 km/h or 1 kt Speed < 2 km/h (1 kt) indicated as CALM	If Step applicable VIS < 800 m : 50 m 800 m ≤ VIS < 5 000 m : 100 m 5 000 m ≤ VIS < 10 km : 1 km VIS ≥ 10 km : None, given as 10 km or covered under CAVOK				If Step applicable RVR < 400 m : 25 m 400 ≤ RVR ≤ 800 m : 50 m 800 < RVR < 2 000 m : 100 m ¹³				N/A	If Step applicable Base ≤ 1 500 m (5 000 ft) : 30 m (100 ft) (Reference level: Aerodrome elevation ¹⁴ or mean sea level for off-shore structures)				Rounded off to whole degrees: up for decimal 5	In whole hPa ¹⁵ rounding down for decimals 1 – 9		N/A

Notes.—

1. Considered for the past 10 minutes (exception: if the 10-minute period includes a *marked discontinuity* (i.e. RVR changes or passes 150, 350, 600 or 800 m, lasting ≥ 2 minutes), only data after the discontinuity to be used). A simple diagrammatic convention is used to illustrate those parts of the 10-minute period prior to the observation relevant to RVR criteria, i.e. AB, BC and AC.
2. Layer composed of CB and TCU *with a common base* should be reported as “CB”.
3. Considered for the past 10 minutes (exception: if the 10-minute period includes a *marked discontinuity* (i.e. the direction changes $\geq 30^\circ$ with a speed ≥ 20 km/h *or* the speed changes ≥ 20 km/h lasting ≥ 2 minutes), only data after the discontinuity to be used).
4. If several directions, the most operationally significant direction used.
5. Let \bar{R}_1 = any 1-minute mean RVR-value during period AC, \bar{R}_{10} = 10-minute mean RVR-value during period AC, $\bar{R}_{5(AB)}$ = 5-minute mean RVR-value during period AB and $\bar{R}_{5(BC)}$ = 5-minute mean RVR-value during period BC.
6. CB (cumulonimbus) and TCU (towering cumulus = cumulus congestus of great vertical extent) if not already indicated as one of the other layers.
7. Time averaging, if applicable, indicated in the upper left-hand corner.
8. N/A = not applicable.

9. QFE is to be included if required. Reference elevation for QFE should be aerodrome elevation except for precision approach runways, and non-precision approach runways with threshold ≥ 2 m (7 ft) below or above aerodrome elevation, where the reference level should be the relevant threshold elevation.
10. As listed in Appendix 3, 4.8.
11. According to the WMO *Manual on Codes* (WMO-No. 306), Volume I.1, Part A — Alphanumeric Codes, paragraph 15.5.5, “it is recommended that the wind measuring systems should be such that peak gusts should represent a three-second average”.
12. Also sea-surface temperature and state of the sea from off-shore structures in accordance with regional air navigation agreement.
13. Report if RVR and/or VIS < 1 500 m, limits for assessments 50 and 2 000 m.
14. For landing at aerodromes with precision approach runways and with the threshold elevation ≥ 15 m below the aerodrome elevation, the *threshold elevation* to be used as a reference.
15. Measured in 0.1 hPa.

ATTACHMENT E. CONVERSION OF INSTRUMENTED READINGS INTO RUNWAY VISUAL RANGE AND VISIBILITY

(See Appendix 3, 4.3.5 of this Annex.)

1. The conversion of instrumented readings into runway visual range and visibility is based on Koschmieder's Law or Allard's Law, depending on whether the pilot can be expected to obtain main visual guidance from the runway and its markings or from the runway lights. In the interest of standardization in runway visual range assessments, this Attachment provides guidance on the use and application of the main conversion factors to be used in these computations.

2. In Koschmieder's Law one of the factors to be taken into account is the pilot contrast threshold. The agreed constant to be used for this is 0.05 (dimensionless).

3. In Allard's Law the corresponding factor is the illumination threshold. This is not a constant, but a continuous function dependent on the background luminance. The agreed relationship to be used in instrumented systems with continuous adjustment of the illumination threshold by a background luminance sensor is shown by the curve in Figure E-1. The use of a continuous function which approximates the step function

such as displayed in Figure E-1 is preferred, due to its higher accuracy, to the stepped relationship described in paragraph 4.

4. In instrumented systems without continuous adjustment of the illumination threshold, the use of four equally spaced illumination threshold values with agreed corresponding back-ground luminance ranges is convenient but will reduce accuracy. The four values are shown in Figure E-1 in the form of a step function; they are tabulated in Table E-1 for greater clarity.

Note 1.— Information and guidance material on the runway lights to be used for assessment of runway visual range are contained in the Manual of Runway Visual Range Observing and Reporting Practices (Doc 9328).

Note 2.— In accordance with the definition of visibility for aeronautical purposes, the intensity of lights to be used for the assessment of visibility is in the vicinity of 1 000 cd.

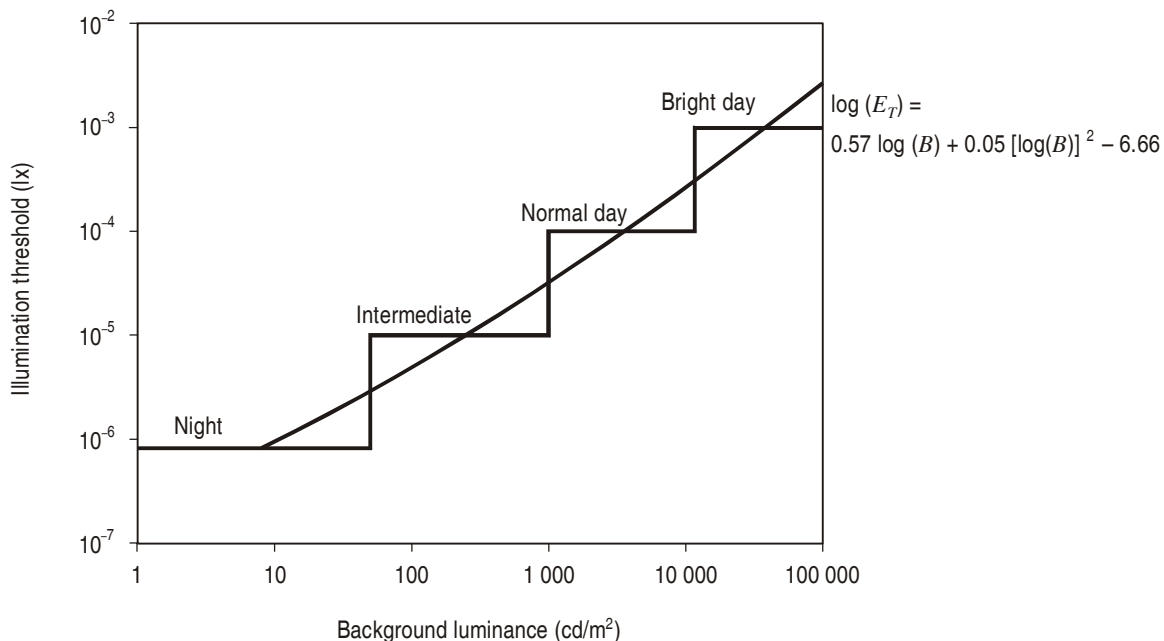


Figure E-1. Relationship between the illumination threshold E_T (lx) and background luminance B (cd/m²)

Table E-1. Illumination threshold steps

<i>Condition</i>	<i>Illumination threshold (lx)</i>	<i>Background luminance (cd/m²)</i>
Night	8×10^{-7}	≤ 50
Intermediate	10^{-5}	51 – 999
Normal day	10^{-4}	1 000 – 12 000
Bright day (sunlit fog)	10^{-3}	> 12 000

— END —