ICAO

International Standards
and Recommended Practices

Annex 3 to the Convention on International Civil Aviation

Meteorological Service for International Air Navigation

Twenty-First Edition, August 2025

This edition supersedes, on 27 November 2025, all previous editions of Annex 3.

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

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Amendments are announced in the supplements to the *Products and Services Catalogue;* the Catalogue and its supplements are available on the ICAO website at www.icao.int. The space below is provided to keep a record of such amendments.

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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 six languages – English, Arabic, Chinese, 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.

In order to maintain a comprehensive edition of this Annex, the latest amendments have been consolidated in a new edition of the Annex. In so doing, provisions with particular applicability dates have been adjusted editorially, as appropriate.

Applicability

The Standards and Recommended Practices in this document govern the application of the *Procedures for Air Navigation Services – Meteorology* (PANS-MET, Doc 10157) and the *Regional Supplementary Procedures* (Doc 7030), in which latter document will be found subsidiary procedures of regional application.

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* (WMO-No. 49), Volume II – *Meteorological Service for International Air Navigation,* Parts I and II.

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 in the *Manual on Codes* (WMO-No. 306), Volume I – *International Codes*.

Table A. Amendments to Annex 3

Amendment(s)	*Source(s)*	*Subject(s)*	*Adopted/approved* *Effective* *Applicable*
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 *International Standards and Recommended Practices – Meteorology*.	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

Amendment(s)	*Source(s)*	*Subject(s)*	*Adopted/approved* *Effective* *Applicable*
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
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

Amendment(s)	*Source(s)*	*Subject(s)*	*Adopted/approved* *Effective* *Applicable*
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 *Meteorological Service for International Air Navigation*.	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 *Manual of Aeronautical Meteorological Practice* (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 *Manual of Runway Visual Range Observing and Reporting Practices*.	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
65 (9th Edition)	Communications/ Meteorology Divisional 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

Amendment(s)	*Source(s)*	*Subject(s)*	*Adopted/approved* *Effective* *Applicable*
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
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

Amendment(s)	*Source(s)*	*Subject(s)*	*Adopted/approved* *Effective* *Applicable*
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

Amendment(s)	*Source(s)*	*Subject(s)*	*Adopted/approved* *Effective* *Applicable*
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

Amendment(s)	*Source(s)*	*Subject(s)*	*Adopted/approved* *Effective* *Applicable*
74 (16th Edition)	World Area Forecast System Operations Group (WAFSOPSG). International Airways Volcano Watch Operations Group (IAVWOPSG). International Air Transport Association (IATA). ICAO Secretariat	Amendments to the definitions of "cloud of operational significance" and "prevailing visibility" and the deletion of the definition for "service area (world area forecast system)"; deletion of all requirements by SST; introduction of a requirement for volcanic ash advisory centre (VAAC) back-up procedures; elimination of the need to amend significant weather (SIGWX) forecasts; introduction of forecasts of altitude of the standard WAFS flight levels; elimination of the requirement to issue aerodrome special meteorological reports (SPECI) when half-hourly aerodrome routine meteorological reports (METAR) are issued; amendment to the reporting of gusts in local routine and special reports when noise abatement procedures are being applied; alignment of the criteria for the use of change groups in a TAF with those for the issuance of SPECI; introduction of enabling clauses to use the binary universal form for the representation of meteorological data (BUFR) code form for the dissemination of METAR/SPECI and TAF on a bilateral basis; introduction of secondary surveillance radar (SSR) Mode S data link in automatic meteorological reporting; elimination of outlook from SIGMET related to volcanic ash and tropical cyclones; introduction of the requirement to provide standard WAFS charts for fixed areas of coverage; introduction of the provision preventing modifications to the meteorological content of WAFS forecasts; upgrading of provisions in order to foster the use of WAFS forecasts; elimination of surface fronts, convergence zones and clouds other than CB from the high- and medium-level SIGWX forecasts; advancement of the lead time of issuance of SIGWX forecasts; harmonization of the volcanic ash advisory format with the tropical cyclone advisory format; introduction of a criterion related to the issuance of tropical cyclone advisories; amendments to the tropical cyclone advisory to introduce 6-hour forecasts; change to the definition of "vicinity"; expansion of the use of automatic systems to include operational hours; amendments to the automatic reporting of turbulence; introduction of a new template for GAMET messages; extension of the validity period of TAF to meet requirements for very long-haul flights; introduction of provisions for graphical SIGMET for all phenomena; update of the SIGMET template to include radioactive cloud; introduction of "tsunami" in aerodrome warnings; alignment of Annexes 3 and 11 provisions concerning meteorological information to be supplied to air traffic services (ATS); amendment of the criteria to include SIGMET and TAF in VOLMET and D-VOLMET; deletion of the attainable accuracy of observation and measurement from Attachment A; update of the desirable accuracy in Attachment B; and editorial amendments.	21 February 2007 16 July 2007 7 November 2007 5 November 2008

Amendment(s)	*Source(s)*	*Subject(s)*	*Adopted/approved* *Effective* *Applicable*
75 (17th Edition)	Meteorological Warnings Study Group (METWSG). World Area Forecast System Operations Group (WAFSOPSG). Meteorological Information Data Link Study Group (METLINKSG). International Airways Volcano Watch Operations Group (IAVWOPSG). Aerodrome Meteorological Observation and Forecast Study Group (AMOFSG). Aviation Use of the Public Internet Study Group (AUPISG). Required Navigation Performance Special Operational Requirements Study Group (RNPSORSG)	The amendment introduces provisions related to SIGMET information, wind shear warnings, quality management systems; improved horizontal, vertical and temporal resolutions for WAFS forecasts and the introduction of an enabling clause for the implementation of improved WAFS forecasts of cumulonimbus clouds, icing and turbulence; elimination of routine voice reports related to weather and the enabling of the provision of graphical MET information in the cockpit; enhancement of the provision of information on volcanic ash and toxic chemicals; aerodrome observations and forecasts enabling the use of fully automatic observing systems for the provision of local reports and the replacement of km/h by m/s for the SI unit to report wind speed. It also introduces consequential amendments related to the provision of performance-based navigation terminology and the operational use of the public Internet.	22 February 2010 12 July 2010 18 November 2010 15 November 2012
76 (18th Edition)	Special Operations Task Force (SOTF). Aerodrome Meteorological Observation and Forecast Study Group (AMOFSG). Meteorological Warnings Study Group (METWSG). International Airways Volcano Watch Operations Group (IAVWOPSG). World Area Forecast System Operations Group (WAFSOPSG). Secretariat.	Amendment to the definition of "alternate aerodrome"; clarification of terminology used for meteorological offices; amendment of provisions related to automatic meteorological observing systems; clarification of the required domain for the reporting of clouds in local routine and special reports; standardization of the lead time for the issuance of aerodrome forecasts (TAF); inclusion of a requirement for take-off forecasts at all aerodromes; amendment of requirement for the exchange of OPMET information (METAR/SPECI, TAF and SIGMET) to the use of extensible markup language (XML)/geography markup language (GML); simplification of runway visual range reporting including aligning the SPECI criteria with the operational thresholds used in Annex 6; deletion of the requirement to report ice crystals; amendment of the requirement for reporting of meteorological elements in METAR/SPECI and local reports when automatic sensors fail (missing data); deletion of the requirement for reporting recent weather in cases where SPECI are issued at the discretion of States; amendment to the requirement for reporting state of the sea to allow reporting of wave height as an alternative; alignment of TAF change group criteria with those for the issuance of SPECI; amendment of SIGMET for the observing and forecasting of sandstorm/duststorm intensity; clarification of the location of hazardous phenomena in SIGMET documentation; elimination of the reference to the accidental nature of a release of radioactive materials into the atmosphere; deletion of web addresses in certain provisions; introduction of the requirement to monitor potentially active volcanoes by concerned States; improvements of the explanation of the symbols for volcanic eruption and radioactive materials (for significant weather used in flight documentation); inclusions of a reference to the volcano observatory notice for aviation (VONA); introduction of the requirement regarding the notification of volcanic eruption cessation by State volcano	27 February 2013 15 July 2013 14 November 2013 13 November 2014 (for Appendix 3, paragraphs 2.3.1 e) and 4.1.5.2 c) 1))

Amendment(s)	*Source(s)*	*Subject(s)*	*Adopted/approved* *Effective* *Applicable*
		observatories; introduction of the concept of estimation of volcanic ash in Table A2-1; introduction of the concept of an entire FIR or entire CTA being covered by a volcanic ash cloud and other new requirements in Table A6-1 and related examples; inclusion of provisions enabling concatenated route-specific wind/temperature forecasts; addition of wind and temperature data for flight level (FL) 410 (175 hPa) and geopotential altitude data for FL 270 (350 hPa) and FL 410 (175 hPa) in grid point forecasts prepared by world area forecast centres (WAFCs); deletion of notes related to trial nature of gridded world area forecasts system (WAFS) forecasts for icing, turbulence and cumulonimbus clouds; and revision of the latitude and longitude coordinates for the corners of charts generated from the digital forecasts provided by the WAFS for fixed areas of coverage.	
77-A (19th Edition)	Meteorology (MET) Divisional Meeting (2014)	Introduction of digital format for volcanic ash and tropical cyclone advisories and AIRMET information and the provision of METAR/SPECI, TAF and SIGMET information in digital format as a recommended practice; introduction of WAFS forecast information on cumulonimbus clouds, icing and turbulence and additional flight levels for WAFS gridded forecast information; removal of reference to legacy satellite distribution systems in lieu of Internet-based services; modification of GAMET forecast requirements and clarification of runway visual range assessment requirements; and editorial amendments.	22 February 2016 11 July 2016 10 November 2016
77-B	Friction Task Force (FTF) of the Aerodrome Design and Operations Panel (ADOP)	Amendment concerning the use of a global reporting format for assessing and reporting runway surface conditions.	22 February 2016 11 July 2016 5 November 2020
78 (20th Edition)	Second meeting of the Meteorology Panel (METP/2). Twelfth meeting of the AIS-AIM Study Group (AIS-AIMSG/12). Secretariat	Introduction of space weather advisory information services; improvement of the provision of SIGMET information by meteorological watch offices (MWOs); information on the release of radioactive material into the atmosphere; SIGMET and AIRMET information; modifications of IWXXM representations of information; aeronautical meteorological personnel qualification and competency, education and training; and consequential amendment concerning change of references related to the provision of aeronautical information service.	7 March 2018 16 July 2018 8 November 2018
79	Fourth meeting of the Meteorology Panel (METP/4)	SIGMET information concerning the release of radioactive material in the atmosphere; improved harmonization of SIGMET information; space weather advisory information; routine observations at aerodromes (METAR) information; tropical cyclone advisory and related SIGMET information; the ICAO Meteorological Information Exchange Model (IWXXM); the international airways volcano watch (IAVW); the world area forecast system (WAFS); special air-reports on turbulence; quality management system; dissemination of AIRMET and GAMET; and the inclusion of heavy dust storms (HVY DS) in special air-reports.	9 March 2020 20 July 2020 5 November 2020 4 November 2021
80	Eighth meeting of the 220th Session of the ICAO Council	Postponement of the applicability date of Amendment 77-B: Amendment concerning the use of an enhanced global reporting format for assessing and reporting runway surface conditions.	19 June 2020 30 September 2020 4 November 2021
81	Second meeting of the Information Management Panel (IMP/2).	System-wide information management (SWIM) and information security.	18 March 2024 22 July 2024 28 November 2024

Amendment(s)	*Source(s)*	*Subject(s)*	*Adopted/approved* *Effective* *Applicable*
82 (21st Edition)	Fifth meeting of the Meteorology Panel (METP/5)	a) restructured Annex 3, space weather information services, the international airways volcano watch (IAVW), the ICAO meteorological information exchange model (IWXXM), the world area forecast system (WAFS), improved definition of meteorological authority and introduction of a new definition of meteorological service provider; and b) quantitative volcanic ash information as of 26 November 2026.	2 April 2025 4 August 2025 27 November 2025 26 November 2026

INTERNATIONAL STANDARDS AND RECOMMENDED PRACTICES

CHAPTER 1. DEFINITIONS

Note 1.— 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)).*

Note 2.— These Standards and Recommended Practices are to be used in conjunction with the Procedures for Air Navigation Services – Meteorology *(PANS-MET, Doc 10157).*

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

Aerodrome reference point. The designated geographical location of an aerodrome.

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 S1.32). 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 where the necessary services and facilities are available, where aircraft performance requirements can be met and which is operational at the expected time of use. Alternate aerodromes include the following:

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

En-route alternate. An alternate aerodrome at which an aircraft would be able to land in the event that a diversion becomes necessary while en route.

Destination alternate. An alternate aerodrome at which an aircraft would be able to land should it become either 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 (ACC). A unit established to provide air traffic control service to controlled flights in control areas under its jurisdiction.

Automatic dependent surveillance – contract (ADS-C). A means by which the terms of an ADS-C agreement will be exchanged between the ground system and the aircraft, via a data link, specifying under what conditions ADS-C reports would be initiated, and what data would be contained in the reports.

Note.— The abbreviated term "ADS contract" is commonly used to refer to ADS event contract, ADS demand contract, ADS periodic contract or an emergency mode.

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, or a cumulonimbus cloud or a towering cumulus cloud at any height.

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 (CTA). A controlled airspace extending upwards from a specified limit above the earth.

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

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 (FIC). A unit established to provide flight information service and alerting service.

Flight information region (FIR). 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;

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.

ICAO meteorological information exchange model (IWXXM). A data model for representing aeronautical meteorological information.

International airways volcano watch (IAVW). International arrangements for monitoring volcanic activity and providing notices, forecasts and 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 the vertical position of an aircraft in flight and meaning variously height, altitude or flight level.

Meteorological authority. The entity arranging for the provision of meteorological service for international air navigation on behalf of a Contracting State, and providing regulation and oversight of the meteorological service.

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.

Meteorological service provider. The relevant entity designated to provide meteorological service for international air navigation on behalf of a Contracting State.

Meteorological watch office (MWO). An office designated to provide information concerning the occurrence or expected occurrence of specified en-route weather and other phenomena in the atmosphere that may affect the safety of aircraft operations within its specified area of responsibility.

Minimum sector altitude (MSA). The lowest altitude which may be used which will provide a minimum clearance of 300 m (1 000 ft) above all objects located in an area contained within a sector of a circle of 46 km (25 NM) radius centred on a significant point, the aerodrome reference point (ARP) or the heliport reference point (HRP).

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.

Operator. The 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 greatest visibility value, observed in accordance with the definition of "visibility", which is reached 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. Part of quality management focused on providing confidence that quality requirements will be fulfilled (ISO 9000*).

Quality control. Part of quality management focused on fulfilling quality requirements (ISO 9000*).

Quality management. Coordinated activities to direct and control an organization with regard to quality (ISO 9000*).

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

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.

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

Space weather centre (SWXC). A global or regional centre designated by ICAO to monitor and provide advisory information on space weather phenomena expected to affect high-frequency radio communications, communications via satellite, GNSS-based navigation and surveillance systems and/or pose a radiation risk to aircraft occupants, under the framework of space weather information service.

Note.— A regional centre designated by ICAO supports global centres in the fulfilment of its responsibilities.

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* ISO Standard 9000 – Quality Management Systems – Fundamentals and Vocabulary.

Space weather information service. A globally coordinated service where space weather centres provide information on space weather phenomena that may affect communications, navigation and surveillance systems and/or pose a radiation risk to aircraft occupants.

State volcano observatory. A volcano observatory, designated by regional air navigation agreement, to monitor active or potentially active volcanoes within a State and to provide information on volcanic activity and/or volcanic ash 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 databanks regarding the position, forecast direction and speed of movement, central pressure and maximum surface wind of tropical cyclones.

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 databanks regarding the lateral and vertical extent and forecast movement of volcanic ash in the atmosphere.

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 using the aeronautical fixed service Internet-based services.

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

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) "provide" is used solely in connection with the provision of service;

b) "issue" is used solely in connection with cases where the obligation specifically extends to sending out the information to a user;

c) "make available" is used solely in connection with cases where the obligation ends with making the information accessible to a user; and

d) "supply" is used solely in connection with cases where either b) or c) applies.

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 on International Civil Aviation, 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 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 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 that 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 in accordance with regional air navigation agreement; 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 entity, hereinafter referred to as the meteorological authority, 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 – *Aeronautical Information Services*, Chapter 5.

2.1.5 Each Contracting State shall designate an entity (or several entities), hereinafter referred to as the meteorological service provider, to provide meteorological service for international air navigation on behalf of the Contracting State. Details of the meteorological service provider(s) so designated shall be included in the State aeronautical information publication, in accordance with Annex 15 – *Aeronautical Information Services*, Chapter 5.

Note.— Detailed specifications concerning presentation and contents of the aeronautical information publication is provided in the Procedures for Air Navigation Services – Aeronautical Information Management *(PANS-AIM, Doc 10066), Appendix 2.*

2.1.6 The meteorological authority shall ensure that the designated meteorological service provider complies with the requirements of the World Meteorological Organization (WMO) in respect of qualifications, competencies, education and training of meteorological personnel providing service for international air navigation.

Note.— Requirements concerning the qualifications, competencies, education and training of meteorological personnel in aeronautical meteorology are given in the Technical Regulations *(WMO-No. 49), Volume I* – General Meteorological Standards and Recommended Practices*, Part V* – Qualifications and Competencies of Personnel Involved in the Provision of Meteorological (Weather and Climate) and Hydrological Services, *Part VI* – Education and Training of Meteorological Personnel, *and Appendix A* – Basic Instruction Packages.

2.2 Supply, use, quality management and interpretation 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 The meteorological authority shall ensure that the designated meteorological service provider referred to in 2.1.5 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 should be certified by an approved organization.*

Note.— The 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. Guidance on the establishment and implementation of quality management systems is given in the Guide to the Implementation of Quality Management Systems for National Meteorological and Hydrological Services and Other Relevant Service Providers *(WMO-No. 1100).*

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. When 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.— 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 contained in Chapters 3, 4, 6, 7, 8, 9 and 10 of this Annex, Chapters 2, 4, 5, 6, 7, 8 and 9 of the PANS-MET (Doc 10157) and the relevant regional air navigation plans. Guidance concerning the accuracy of measurement and observation, and accuracy of forecasts is contained in Attachments A and B, respectively, to the PANS-MET.

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 contained in Chapter 11 of this Annex and Chapter 10 of the PANS-MET (Doc 10157).

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

2.2.7 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 of the actual conditions at the time of observation.

Note.— Guidance on the operationally desirable accuracy of measurement or observation is contained in Attachment A to the PANS-MET (Doc 10157).

2.2.8 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 contained in Attachment B to the PANS-MET (Doc 10157).

2.2.9 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).*

2.2.10 **Recommendation.—** *Contracting States should ensure that the meteorological information supplied to the users listed in 2.1.2 is provided through information services.*

Note 1.— In the context of system-wide information management (SWIM), the notion of information service addresses machine-to-machine interaction in a service-oriented architecture.

Note 2.— Procedures on information services are contained in the Procedures for Air Navigation Services – Information Management *(PANS-IM, Doc 10199).*

Note 3.— Guidance material on information services can be found in the Manual on System-wide Information Management Implementation *(Doc 10203).*

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 service provider concerned. The minimum amount of advance notice required shall be as agreed between the meteorological service provider or aerodrome meteorological office and the operator concerned.

2.3.2 The meteorological service provider 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 service provider.

2.3.3 The operator or a flight crew member shall ensure that, where required by the meteorological service provider in consultation with users, the aerodrome meteorological office concerned is notified:

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 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 as agreed between the aerodrome meteorological office and the operator concerned:*

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) type of flight, whether under visual or instrument flight rules;

g) type of meteorological information requested for a flight crew member, whether flight documentation and/or briefing or consultation; and

h) time(s) at which briefing, consultation and/or flight documentation are required.

CHAPTER 3. GLOBAL SYSTEMS, SUPPORTING CENTRES AND METEOROLOGICAL OFFICES

3.1 World area forecast centres within the framework of the world area forecast system

Note.— The objective of the world area forecast system (WAFS) is to supply meteorological authorities and other users with global aeronautical meteorological en-route forecasts in digital form. This objective is 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.

3.1.1 A Contracting State, having accepted the responsibility for providing a world area forecast centre (WAFC) within the framework of the WAFS, shall arrange for that centre:

a) to prepare gridded global forecasts of:

   1) upper wind;

   2) upper-air temperature and humidity;

   3) geopotential altitude of flight levels;

   4) flight level and temperature of tropopause;

   5) direction, speed and flight level of maximum wind;

   6) cumulonimbus clouds;

   7) icing; and

   8) turbulence;

b) to prepare global forecasts of significant weather (SIGWX) phenomena;

c) to issue the forecasts referred to in a) and b) in digital form to meteorological service providers and other users, as arranged by the meteorological authority;

d) to receive information concerning the release of radioactive materials into the atmosphere from its associated World Meteorological Organization (WMO) regional specialized meteorological centre (RSMC) for the provision of transport model products for radiological environmental emergency response, in order to include the information in SIGWX forecasts; and

e) to receive information on volcanic activity from volcanic ash advisory centres (VAACs) for the inclusion of such information in SIGWX forecasts.

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

3.2 Aerodrome meteorological offices

3.2.1 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.

3.2.2 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 aerodrome 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 (MWO) as agreed between the meteorological service provider, aeronautical information service and appropriate ATS authority concerned.

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

3.2.4 For an aerodrome without an aerodrome meteorological office located at the aerodrome:

a) the Contracting State shall designate one or more aerodrome meteorological office(s) 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.

3.3 Meteorological watch offices

3.3.1 A Contracting State, having accepted the responsibility for providing air traffic services within a flight information region (FIR) or a control area (CTA), shall establish, in accordance with regional air navigation agreement, one or more MWOs, or arrange for another Contracting State to do so.

Note.— Guidance on the bilateral or multilateral arrangements between Contracting States for the provision of MWO services, including for cooperation and delegation, can be found in the Manual of Aeronautical Meteorological Practice *(Doc 8896).*

3.3.2 An MWO shall:

a) maintain continuous 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 7.5.1.1:

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 area control centre (ACC)/flight information centre (FIC), as agreed between the meteorological service provider and appropriate ATS authority concerned, and to its associated VAAC as determined by regional air navigation agreement; and

g) supply information received concerning the 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 service provider and appropriate ATS authority concerned, and to aeronautical information service units, as agreed between the meteorological service provider and appropriate Civil Aviation Authority. The information shall comprise location, date and time of the release, and forecast trajectories of the radioactive materials.

Note.— The information is provided by RSMCs for the provision of transport model products for radiological environmental emergency response, at the request of the delegated authority of the State in which the radioactive material was released into the atmosphere, or the International Atomic Energy Agency (IAEA). 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. Furthermore, the information is provided by IAEA to RSMC co-located with VAAC London (designated as the focal point) which in turn notifies the ACCs/FICs concerned about the release.

3.3.3 **Recommendation.**— *The boundaries of the area over which meteorological watch is to be maintained by an MWO should be coincident with the boundaries of an FIR or a CTA or a combination of FIRs and/or CTAs.*

3.3.4 **Recommendation**.— *An MWO should coordinate the content of SIGMET and the provision of harmonized SIGMET information with neighbouring MWO(s), especially when the en-route weather phenomenon extends or is expected to extend beyond the MWO's specified area of responsibility.*

Note.— Guidance on the bilateral or multilateral coordination between MWOs of Contracting States for the provision of SIGMET can be found in the Manual of Aeronautical Meteorological Practice *(Doc 8896).*

3.4 Volcanic ash advisory centres

3.4.1 A Contracting State, having accepted 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 that volcanic ash is reported in its area of responsibility, by:

a) monitoring relevant geostationary and polar-orbiting satellite data and, where available, relevant ground-based and airborne data, to detect the existence and extent of volcanic ash in the atmosphere in the area concerned;

Note.— Relevant ground-based and airborne data include data derived from Doppler weather radar, ceilometers, lidar and passive infrared sensors.

b) activating 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) issuing advisory information regarding the extent and forecast movement of the volcanic ash "cloud" to:

1) MWOs, ACCs and FICs serving FIRs in its area of responsibility which may be affected;

2) other VAACs whose areas of responsibility may be affected;

3) WAFCs, international OPMET databanks, international NOTAM offices, and centres designated by regional air navigation agreement for the operation of aeronautical fixed service Internet-based services; and

4) operators 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) – Operational Procedures and Contact List *(Doc 9766) which is available on the ICAO website.*

d) issuing updated advisory information to the MWOs, ACCs, FICs and VAACs referred to in c), as necessary, but at least every six hours until such time as:

1) the volcanic ash "cloud" is no longer identifiable from satellite data and, where available, ground-based and airborne data;

2) no further reports of volcanic ash are received from the area; and

3) no further eruptions of the volcano are reported.

3.4.2 **Recommendation.**— *Until 25 November 2026, for significant volcanic ash "clouds", VAACs in a position to do so should issue forecasts of quantitative volcanic ash concentration information for a volcanic ash "cloud" to meteorological service providers and other users, as arranged by the meteorological authority.*

3.4.2 **Recommendation**.— *As of 26 November 2026, for significant volcanic ash "clouds", VAACs should issue forecasts of quantitative volcanic ash concentration information for a volcanic ash "cloud" to meteorological service providers and other users, as arranged by the meteorological authority.*

Note 1.— The VAACs in a position to provide quantitative volcanic ash concentration information are included in the Handbook on the International Airways Volcano Watch (IAVW) – Operational Procedures and Contact List *(Doc 9766)*.

Note 2.— Significant volcanic ash "clouds" in this context means an ash "cloud" that poses a widespread impact to aircraft operations and air navigation. Guidance on the criteria is provided in the Handbook on the International Airways Volcano Watch (IAVW) – Operational Procedures and Contact List *(Doc 9766).*

3.4.3 VAACs shall maintain a 24-hour watch.

3.4.4 In case of interruption of the operation of a VAAC, its functions shall be carried out by another VAAC or another meteorological centre, as designated by the VAAC Provider State concerned.

Note.— Back-up procedures to be used in case of interruption of the operation of a VAAC are included the Handbook on the International Airways Volcano Watch (IAVW) – Operational Procedures and Contact List *(Doc 9766).*

3.5 State volcano observatories

3.5.1 Contracting States with active or potentially active volcanoes shall arrange, in accordance with regional air navigation agreement, that State volcano observatories monitor these volcanoes.

Note.— The Handbook on the International Airways Volcano Watch (IAVW) – Operational Procedures and Contact List *(Doc 9766) contains guidance material about active or potentially active volcanoes.*

3.5.2 State volcano observatories shall send information on volcanic activity and/or volcanic ash in the atmosphere as quickly as practicable to their associated VAACs, MWOs, NOTAM offices, ACCs/FICs and, in accordance with regional air navigation agreement, international OPMET databanks, when observing:

a) significant pre-eruption volcanic activity;

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

b) a volcanic eruption, or a significant change in eruptive activity; and/or

c) volcanic ash in the atmosphere.

Note 1.— Where capability exists, State volcano observatories may include re-suspended volcanic ash in the context of c) above. The Handbook on the International Airways Volcano Watch (IAVW) – Operational Procedures and Contact List *(Doc 9766) contains guidance material about re-suspended volcanic ash.*

Note 2.— A significant change in this context may entail an increase, a decrease or a cessation in pre-eruption volcanic activity or eruptive activity.

3.6 Tropical cyclone advisory centres

A Contracting State having accepted the responsibility for providing a tropical cyclone advisory centre (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, changes in its intensity at the time of observation, its direction and speed of movement, central pressure and maximum surface wind near the centre, to:

1) MWOs in its area of responsibility;

2) other TCACs whose areas of responsibility may be affected; and

3) WAFCs, international OPMET databanks, and centres designated by regional air navigation agreement for the operation of aeronautical fixed service Internet-based services; and

c) issue updated advisory information for each tropical cyclone, as necessary, but at least every six hours.

3.7 Space weather centres

3.7.1 A Contracting State, having accepted the responsibility for providing a space weather centre (SWXC) within the framework of the space weather information service, shall arrange for that centre to:

a) monitor relevant ground-based, airborne and space-based observations to detect, and predict when possible, the existence of space weather phenomena that have an impact in the following areas:

1) high frequency (HF) radio communications;

2) communications via satellite;

3) GNSS-based navigation and surveillance; and

4) radiation exposure at flight levels;

b) issue advisory information regarding the extent, severity and duration of the space weather phenomena that have an impact referred to in a);

c) supply the advisory information referred to in b) to:

1) area control centres, flight information centres and aerodrome meteorological offices;

2) other SWXCs; and

3) international OPMET databanks and aeronautical fixed service Internet-based services.

d) issue updated advisory information on space weather phenomena, as necessary, but at least every six hours until such time as the space weather phenomena are no longer detected and/or are no longer expected to have an impact.

3.7.2 SWXC shall maintain a 24-hour watch.

3.7.3 In case of interruption of the operation of a SWXC, its functions shall be carried out by another SWXC, as designated by the SWXC Provider State concerned.

3.7.4 A Contracting State, having accepted the responsibility for providing a regional space weather centre (SWXC) within the framework of the space weather information service, shall arrange for that centre to support the global SWXCs in their responsibilities under 3.7.1, 3.7.2 and 3.7.3.

CHAPTER 4. AERODROME METEOROLOGICAL OBSERVATIONAL INFORMATION

Note.— The Standards and Recommended Practices in this chapter are to be used in conjunction with the Procedures for Air Navigation Services – Meteorology *(PANS-MET, Doc 10157), Chapter 2.*

4.1 Aeronautical meteorological stations and observations

4.1.1 Each Contracting State shall establish, at aerodromes 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.

Note.— Aeronautical meteorological stations may include sensors installed outside the aerodrome, where considered justified, by the meteorological authority to ensure the compliance of meteorological service for international air navigation with the provisions of this Annex.

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 The meteorological authority shall arrange for the aeronautical meteorological stations to be inspected at sufficiently frequent intervals to ensure that a high standard of observation is maintained, that instruments and all their indicators are functioning correctly, and that the exposure of the instruments has not changed significantly.

Note.— Guidance on the inspection of aeronautical meteorological stations including the frequency of inspections is given in the Manual on Automatic Meteorological Observing Systems at Aerodromes *(Doc 9837).*

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 – Operation of Aircraft*, Part I* – International Commercial Air Transport – Aeroplanes.

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 semi-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 of reports to be disseminated beyond the aerodrome of origin.

4.1.9 **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 of equipment and installations on operational areas, aimed at reducing the risk of damage to aircraft to a minimum, are contained in Annex 14 – Aerodromes*, Volume I –* Aerodrome Design and Operations*, Chapter 9.*

4.1.10 **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 (WMO).*

Note.— Practices, procedures and specifications of WMO are contained in the Guide to Instruments and Methods of Observation *(WMO-No. 8)*, *Volume I –* Measurement of Meteorological Variables, *Volume III –* Observing Systems; *and Volume V –* Quality Assurance and Management of Observing Systems.

4.1.11 **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.*

4.1.12 **Recommendation**.— *Where automated equipment forms part of an integrated semi-automatic observing system, displays of data which are made available to the local air traffic services units should be a subset of and displayed in 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.*

4.2 Agreement between meteorological service provider and appropriate air traffic services authority

Recommendation.— *An agreement between the meteorological service provider and the appropriate ATS authority should be established to cover, among 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

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 2, 2.1.1.

4.3.1 At aerodromes, routine observations shall be made throughout the 24 hours of each day, unless otherwise agreed between the meteorological service provider, 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 service provider 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

Note.— Technical specifications of the issuance of local routine reports are contained in the PANS-MET (Doc 10157), Chapter 2, 2.1.1.1.

b) METAR for dissemination beyond the aerodrome of origin (mainly intended for flight planning, VOLMET broadcasts and D-VOLMET).

Note 1.— Technical specifications of the issuance and the dissemination of METAR are contained in the PANS-MET (Doc 10157), Chapter 2, 2.1.1.2 and 2.1.1.3.

Note 2.— Meteorological information used in ATIS (voice-ATIS and D-ATIS) is to be extracted from the local routine report, in accordance with Annex 11 – Air Traffic Services*, 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

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 2, 2.1.1 and 2.1.2.

4.4.1 A list of criteria for special observations shall be established by the meteorological service provider, 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

Note.— Technical specifications of the issuance of local special reports are contained in the PANS-MET (Doc 10157) Chapter 2, 2.1.1.1.

b) SPECI for dissemination beyond the aerodrome of origin (mainly intended for flight planning, VOLMET broadcasts and D-VOLMET) unless METAR are issued at half-hourly intervals.

Note 1.— Technical specifications of the issuance and the dissemination of SPECI are contained in the PANS-MET (Doc 10157) Chapter 2, 2.1.1.2 and 2.1.1.3.

Note 2.— Meteorological information used in ATIS (voice-ATIS and D-ATIS) is to be extracted from the local special report, in accordance with Annex 11 – Air Traffic Services*, 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 Characteristics of meteorological reports

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 2, 2.1.1.

4.5.1 Local routine reports, local special reports, METAR and SPECI shall contain the following meteorological elements:

a) surface wind direction and speed;

b) visibility;

c) runway visual range, when applicable;

d) present weather;

e) cloud amount, cloud type (only for cumulonimbus and towering cumulus clouds) and height of cloud base or, where measured, vertical visibility;

f) air temperature and dew-point temperature; and

g) QNH and, when applicable, QFE (QFE included only in local routine report and local special report).

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

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

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 2, 2.2.

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 metres per second (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.

4.6.2.2 **Recommendation.**— *When a local routine report and a local special report are used for departing aircraft, the visibility observations for these reports should be representative of conditions along the runway; when a local routine report and a local special report 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 – Aerodromes*, Volume I –* Aerodrome Design and Operations*, 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 shall be observed and reported as necessary. The following present weather phenomena shall be identified, as a minimum:

a) precipitation: rain, drizzle, snow and freezing precipitation (including intensity thereof);

b) obscurations: haze, mist, fog and freezing fog; and

c) thunderstorms (including thunderstorms in the vicinity).

4.6.4.2 **Recommendation.**— *For a local routine report and a local special report, 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.*

4.6.5 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 runway threshold(s) in use.*

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

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 reports, local special reports, 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

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.*

4.7 Reporting meteorological information from automatic observing systems

4.7.1 **Recommendation.**— *METAR and SPECI from automatic observing systems should be used by States in a position to do so during non-operational hours of the aerodrome, and during operational hours of the aerodrome as determined by the meteorological service provider in consultation with users based on the availability and efficient use of personnel.*

Note.— Guidance on the use of automatic meteorological observing systems is contained in Doc 9837.

4.7.2 **Recommendation.—** *A local routine report and a local special report from automatic observing systems should be used by States in a position to do so during operational hours of the aerodrome as determined by the meteorological service provider in consultation with users based on the availability and efficient use of personnel.*

4.7.3 Local routine reports, local special reports, METAR and SPECI from automatic observing systems shall be identified with the word “AUTO”.

4.8 Observing and reporting volcanic activity

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 2, 2.3.

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.*

4.9 Dissemination of meteorological reports

4.9.1 METAR and SPECI

4.9.1.1 METAR and SPECI shall be disseminated to international OPMET databanks and the centres designated by regional air navigation agreement for the operation of aeronautical fixed service Internet-based services, in accordance with regional air navigation agreement.

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

4.9.1.3 SPECI representing a deterioration in conditions shall be disseminated immediately after the observation. A SPECI representing a deterioration of one weather element and an improvement in another element shall be disseminated immediately after the observation.

4.9.1.4 **Recommendation.**— *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.*

4.9.2 Local routine report and local special report

4.9.2.1 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.

4.9.2.2 Local special reports shall be transmitted to local air traffic services units as soon as the specified conditions occur. However, as agreed between the meteorological service provider 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 the local routine report and the local special report; 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.

CHAPTER 5. AIRCRAFT METEOROLOGICAL OBSERVATIONAL INFORMATION

Note.— The Standards and Recommended Practices in this chapter are to be used in conjunction with the Procedures for Air Navigation Services – Meteorology *(PANS-MET, Doc 10157), Chapter 3.*

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 – contract (ADS-C) or secondary surveillance radar (SSR) Mode S 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 **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 service providers and the helicopter operators concerned.*

5.3.3 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. The designation procedures shall be in accordance with regional air navigation agreement.

5.3.4 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

Aircraft not equipped with air-ground data link shall be exempted from making routine aircraft observations.

5.5 Special aircraft observations

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

a) moderate or severe turbulence; or

b) moderate or 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; or

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

i) runway braking action encountered is not as good as reported.

5.6 Other non-routine aircraft observations and reports

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 3, 3.2.

When other meteorological conditions not listed under 5.5, such as 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.

5.7 Reporting of aircraft observations

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 3, 3.1.

5.7.1 Aircraft observations shall be reported by air-ground data link. Where air-ground data link is not available or appropriate, special and other non-routine 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 Routine and special aircraft observations shall be reported as routine and special air-reports, respectively. Routine and special air-reports reported by air-ground data link shall contain, as a minimum, the following meteorological information:

a) wind direction;

b) wind speed;

c) air temperature; and

d) condition prompting the issuance of the air-report (only applicable for special air-reports).

5.8 Relay of air-reports by air traffic services units

5.8.1 The meteorological service provider concerned shall make arrangements with the appropriate ATS authority to ensure that, on receipt by the air traffic services units of:

a) special air-reports by voice communications, the air traffic services units relay them without delay to their associated meteorological watch office; and

b) routine and special air-reports by data link communications, the air traffic services units relay them without delay to their associated meteorological watch office, the WAFCs and the centres designated by regional air navigation agreement for the operation of aeronautical fixed service Internet-based services.

5.8.2 **Recommendation.**— *The meteorological authority concerned should make arrangements with the appropriate ATS authority to ensure that:*

a) special air-reports be uplinked for 60 minutes after their issuance; and

b) information on wind and temperature included in automated special air-reports not be uplinked to other aircraft in flight.

5.9 Dissemination of air-reports

5.9.1 The meteorological watch office shall transmit without delay the special air-reports received by voice communications to the world area forecast centres (WAFCs) and the centres designated by regional air navigation agreement for the operation of aeronautical fixed service Internet-based services.

5.9.2 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 volcanic ash advisory centres.

5.9.3 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 information is disseminated in accordance with 7.4.2.1, that is, to meteorological watch offices, WAFCs and other meteorological offices in accordance with regional air navigation agreement.

Note.— The template used for special air-reports which are uplinked to aircraft in flight is in the PANS-MET (Doc 10157), Appendix 3, Table A3-2.

5.9.4 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 World Meteorological Organization (WMO) Global Telecommunication System.

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

5.9.6 Air-reports shall be exchanged in the format in which they are received.

CHAPTER 6. AERODROME AND EN-ROUTE METEOROLOGICAL FORECAST INFORMATION

Note.— The Standards and Recommended Practices in this chapter are to be used in conjunction with the Procedures for Air Navigation Services – Meteorology *(PANS-MET, Doc 10157), Chapters 4 and 5.*

6.1 Use of forecasts

The issue of a new forecast by an aerodrome 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 meteorological forecast information

6.2.1 Aerodrome forecasts (TAF)

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 4, 4.1.

6.2.1.1 An aerodrome forecast shall be prepared, in accordance with regional air navigation agreement, by the aerodrome meteorological office.

Note.— The aerodromes for which aerodrome forecasts are to be prepared and the period of validity of these forecasts are listed in the relevant regional electronic air navigation plan (eANP), Volume II.

6.2.1.2 An aerodrome forecast shall be issued at a specified time not earlier than one hour prior to the beginning of its validity period and consist of a concise statement of the expected meteorological conditions at an aerodrome for a specified period.

6.2.1.3 Aerodrome forecasts and amendments thereto shall be issued as TAF, and include the following meteorological elements:

a) surface wind;

b) visibility;

c) weather;

d) cloud; and

e) 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 1.— Technical specifications of the issuance of aerodrome forecast are contained in the PANS-MET (Doc 10157), Chapter 4, 4.1.1.1 and 4.1.1.2.

Note 2.— The visibility included in TAF refers to the forecast prevailing visibility.

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

Note.— Guidance on methods to keep TAF under continuous review is contained in Chapter 3 of the Manual of Aeronautical Meteorological Practice *(Doc 8896).*

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

6.2.1.6 **Recommendation.**— *The period of validity of a routine TAF should be not less than 6 hours and not more than 30 hours; the period of validity 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 30 hours should be issued every 6 hours.*

6.2.1.7 When issuing TAF, aerodrome meteorological offices shall ensure that not more than one TAF is valid at an aerodrome at any given time.

6.2.1.8 TAF and amendments thereto shall be disseminated to international OPMET databanks and the centres designated by regional air navigation agreement for the operation of aeronautical fixed service Internet-based services, in accordance with regional air navigation agreement.

6.2.2 Landing forecasts (trend forecasts)

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 4, 4.2.

6.2.2.1 A landing forecast shall be prepared by the aerodrome meteorological office as determined by regional air navigation agreement; such forecasts are intended to meet the requirements of local users and of aircraft within about one hour's flying time from the aerodrome.

6.2.2.2 Landing forecasts shall be prepared in the form of a trend forecast.

6.2.2.3 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 report, local special report, 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.

Note.— Technical specifications of the issuance of trend forecast are contained in the PANS-MET (Doc 10157), Chapter 4, 4.2.1.1 and 4.2.1.2.

6.2.2.4 The units and scales used in the trend forecast shall be the same as those used in the report to which it is appended.

6.2.3 Forecasts for take-off

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 4, 4.3.

6.2.3.1 A forecast for take-off shall be prepared by the aerodrome meteorological office, as agreed between the meteorological service provider and the operators concerned.

6.2.3.2 **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*.

6.2.3.3 **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*.

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

6.3 En-route meteorological forecast information

6.3.1 Forecasts by world area forecast centres

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 5, 5.1.

Global upper-air gridded and significant weather forecasts shall be issued by world area forecast centres (WAFCs) in uniform formats and codes for the supply of such forecasts.

6.3.2 Area forecasts for low-level flights (GAMET and area forecasts in chart form)

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 5, 5.2.

6.3.2.1 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, the dissemination and criteria for amendments thereto shall be established by the meteorological authority in consultation with the users.

6.3.2.2 When the density of traffic operating below flight level 100 warrants the issuance of AIRMET information in accordance with 7.5.1.1, area forecasts for such operations shall be prepared in a format as agreed between the meteorological authorities in the States concerned. When abbreviated plain language is used, the forecast shall be prepared as a GAMET area forecast; when chart form is used, the forecast shall be prepared as a combination of forecasts of upper wind and upper-air temperature, and of SIGWX phenomena. 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.

Note.— The template of GAMET is contained in the PANS-MET (Doc 10157), Appendix 6, Table A6-1.

6.3.2.3 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 watch offices and/or aerodrome meteorological offices concerned not later than one hour prior to the beginning of their validity period.

6.3.2.4 Area forecasts for low-level flights prepared in support of the issuance of AIRMET information shall be exchanged between aerodrome meteorological offices and/or meteorological watch offices responsible for the issuance of flight documentation for low-level flights in the flight information regions concerned.

6.3.2.5 **Recommendation.**— *Area forecasts for low-level flights prepared in support of the issuance of AIRMET information should be disseminated to the aeronautical fixed service Internet-based services.*

Note.— Area forecasts for low-level flights in 6.3.2.4 and 6.3.2.5 are prepared in accordance with regional air navigation agreement, similar to the corresponding AIRMET information.

6.3.3 Forecasts by volcanic ash advisory centres

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 5, 5.3.

When issuing forecasts of quantitative volcanic ash concentration information for a volcanic ash "cloud" in accordance with 3.4.2, volcanic ash advisory centres shall adopt uniform formats and codes for their supply.

CHAPTER 7. METEOROLOGICAL INFORMATION CONTAINING ADVISORIES, ALERTS, WARNINGS AND NOTICES

Note.— The Standards and Recommended Practices in this chapter are to be used in conjunction with the Procedures for Air Navigation Services – Meteorology *(PANS-MET, Doc 10157), Chapter 6.*

7.1 Volcanic ash advisory information and information from State volcano observatories

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 6, 6.1.

7.1.1 The advisory information on volcanic ash shall be issued by a volcanic ash advisory centre.

7.1.2 **Recommendation.**— *Information on volcanic activity and/or volcanic ash in the atmosphere should be issued by a State volcano observatory as a Volcano Observatory Notice for Aviation (VONA).*

7.2 Tropical cyclone advisory information

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 6, 6.2.

The advisory information on tropical cyclones shall be issued by a tropical cyclone advisory centre.

7.3 Space weather advisory information

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 6, 6.3.

The advisory information on space weather shall be issued by a global space weather centre (SWXC).

7.4 SIGMET information

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 6, 6.4.

7.4.1 General provisions

7.4.1.1 SIGMET information shall be issued by a meteorological watch office and shall give a concise description concerning the occurrence or expected occurrence of specified en-route weather and other phenomena in the atmosphere that may affect the safety of aircraft operations, and of the development of those phenomena in time and space. One of the following phenomena shall be included in SIGMET information:

a) thunderstorm;

b) tropical cyclone;

c) turbulence;

d) icing;

e) mountain wave;

f) duststorm;

g) sandstorm;

h) volcanic ash; and

i) radioactive cloud.

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

7.4.1.3 The period of validity of SIGMET information shall be not more than 4 hours. In the special case of SIGMET information for volcanic ash cloud and tropical cyclones, the period of validity shall be extended up to 6 hours.

7.4.1.4 **Recommendation.**— *SIGMET information 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.*

7.4.1.5 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 is consistent.

7.4.1.6 SIGMET information shall be issued not more than 4 hours before the commencement of the period of validity. In the special case of SIGMET information for volcanic ash cloud and tropical cyclones, this information shall be issued as soon as practicable but not more than 12 hours before the commencement of the period of validity. SIGMET information for volcanic ash and tropical cyclones shall be updated at least every 6 hours.

7.4.1.7 **Recommendation.**— *In cases where the airspace is divided into an 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.— SIGMET information applies to the whole airspace within the lateral limits of the FIR, that is, to the FIR and to the UIR. The particular areas and/or flight levels affected by the meteorological phenomena prompting the issuance of the SIGMET are included in SIGMET information.

7.4.2 Dissemination of SIGMET information

7.4.2.1 SIGMET information shall be disseminated to meteorological watch offices, WAFCs and other meteorological offices in accordance with regional air navigation agreement. SIGMET information for volcanic ash shall also be disseminated to volcanic ash advisory centres.

7.4.2.2 SIGMET information shall be disseminated to international OPMET databanks and the centres designated by regional air navigation agreement for the operation of aeronautical fixed service Internet-based services, in accordance with regional air navigation agreement.

7.5 AIRMET information

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 6, 6.5.

7.5.1 General provisions

7.5.1.1 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 (or below flight level 150 in mountainous areas, or higher, where necessary). AIRMET information shall give a concise description 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, 6.3.2 and which may affect the safety of low-level flights, and of the development of those phenomena in time and space. One of the following phenomena shall be included in AIRMET information:

a) surface wind speed;

b) surface visibility;

c) thunderstorms;

d) mountain obscuration;

e) cloud;

f) icing;

g) turbulence; and

h) mountain wave.

Note.— Technical specifications of the issuance of AIRMET are contained in the PANS-MET (Doc 10157), Chapter 6, 6.5.1.

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

7.5.1.3 The period of validity of an AIRMET information shall be not more than 4 hours.

7.5.2 Dissemination of AIRMET information

7.5.2.1 **Recommendation.**— *AIRMET information should be disseminated to meteorological watch offices in adjacent FIRs and to other meteorological watch offices or aerodrome meteorological offices, as agreed between the meteorological authorities concerned.*

7.5.2.2 **Recommendation.**— *AIRMET information should be transmitted to international operational meteorological databanks and the centres designated by regional air navigation agreement for the operation of aeronautical fixed service Internet-based services, in accordance with regional air navigation agreement.*

7.6 Aerodrome warnings

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 6, 6.6.

7.6.1 General provisions

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

Note.— The template of aerodrome warnings is contained in the PANS-MET (Doc 10157), Appendix 7, Table A7-6.

7.6.1.2 **Recommendation.**— *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 17 m/s (34 kt) or more);*
- *thunderstorm;*
- *hail;*
- *snow (including the expected or observed snow accumulation);*
- *freezing precipitation;*
- *frost;*
- *hoar frost or rime;*
- *sandstorm;*
- *duststorm;*
- *rising sand or dust;*
- *strong surface wind and gusts;*
- *squall;*
- *volcanic ash (including volcanic ash deposition);*
- *tsunami;*
- *toxic chemicals; and*
- *other phenomena as agreed locally.*

Note.— Aerodrome warnings related to the occurrence or expected occurrence of tsunami are not required where a national public safety plan for tsunami is integrated with the "at risk" aerodrome concerned.

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

7.6.2 Dissemination of aerodrome warnings

Aerodrome warnings shall be disseminated in accordance with local arrangements to those concerned.

7.7 Wind shear warnings and alerts

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 6, 6.7.

7.7.1 General provisions

Note.— Wind shear alerts are expected to complement wind shear warnings and together are intended to enhance situational awareness of wind shear.

7.7.1.1 Wind shear warnings shall be issued by the aerodrome meteorological office for aerodromes where wind shear is considered a factor, in accordance with local arrangements with the appropriate air traffic services unit and the operators concerned. Wind shear warnings shall give concise information on 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.— The template of wind shear warnings is contained in the PANS-MET (Doc 10157), Appendix 7, Table A7-7.

7.7.1.2 **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 service provider, the appropriate ATS authority and the operators concerned.*

7.7.1.3 At aerodromes where wind shear is detected by automated, ground-based, wind shear remote-sensing or detection equipment, wind shear alerts generated by these systems shall be issued. Wind shear alerts shall give concise, up-to-date information related to the observed existence of wind shear which could adversely affect aircraft on the final approach path or initial take-off path and aircraft on the runway during the landing roll or take-off run.

7.7.2 Dissemination of wind shear warnings and alerts

7.7.2.1 The wind shear warnings shall be disseminated in accordance with local arrangements to those concerned.

7.7.2.2 The wind shear alerts shall be disseminated from automated, ground-based, wind shear remote-sensing or detection equipment in accordance with local arrangements to those concerned.

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CHAPTER 8. AERONAUTICAL CLIMATOLOGICAL INFORMATION

Note.— The Standards and Recommended Practices in this chapter are to be used in conjunction with the Procedures for Air Navigation Services – Meteorology *(PANS-MET, Doc 10157), Chapter 7.*

8.1 General provisions

Note 1.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 7, 7.1.

Note 2.— 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 as agreed 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 service provider and the user concerned.

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

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 7, 7.2.

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 service provider and the user concerned.

8.3 Aerodrome climatological summaries

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 7, 7.3.

Recommendation.— *Aerodrome climatological summaries should follow the procedures prescribed by the World Meteorological Organization (WMO). 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 WMO 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.

8.5 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 contact the meteorological service provider responsible for its preparation.*

CHAPTER 9. METEOROLOGICAL SERVICE FOR OPERATORS AND FLIGHT CREW MEMBERS

Note.— The Standards and Recommended Practices in this chapter are to be used in conjunction with the Procedures for Air Navigation Services – Meteorology *(PANS-MET, Doc 10157), Chapter 8.*

9.1 General provisions

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 8, 8.1.

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

a) pre-flight planning by operators;

b) in-flight replanning 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 The meteorological service provider, 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.

9.1.3 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 alternate aerodromes designated by the operator.

9.1.4 Meteorological information supplied to operators and flight crew members shall be up to date and include:

a) aerodrome and en-route observational information; and

b) aerodrome and en-route forecast information.

Note.— The list of meteorological information to be supplied to operators and flight crew members is contained in the PANS-MET (Doc 10157), 8.1.1.2.

9.1.5 En-route forecast information shall be generated from the digital forecasts provided by the WAFCs whenever these forecasts cover the intended flight path in respect of time, altitude and geographical extent, unless otherwise agreed between the meteorological service provider and the operator concerned.

9.1.6 When forecasts are identified as being originated by the WAFCs, no modifications shall be made to their meteorological content.

9.1.7 The forecasts of upper wind and upper-air temperature and of SIGWX phenomena above flight level 100 requested for pre-flight planning and in-flight replanning by the operator shall be supplied as soon as they become available, but not later than 3 hours before departure. Other meteorological information requested for pre-flight planning and in-flight replanning by the operator shall be supplied as soon as is practicable.

9.1.8 **Recommendation.**— *Meteorological information for pre-flight planning and in-flight replanning by operators of helicopters flying to offshore structures should include data covering the layers from sea level to flight level 100.*

9.1.9 When necessary, the meteorological authority of the State arranging for the provision of meteorological 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.

9.1.10 Meteorological information shall be supplied to operators and flight crew members at the location to be determined by the meteorological service provider, after consultation with the operators concerned and at the time agreed between the aerodrome meteorological office and the operator concerned. The service for pre-flight planning shall be confined to flights originating within the territory of the State concerned. At an aerodrome without an aerodrome meteorological office at the aerodrome, arrangements for the supply of meteorological information shall be as agreed between the meteorological service provider and the operator concerned.

9.2 Briefing, consultation and display

Note.— The requirements for the use of automated pre-flight information systems in providing briefing, consultation and display are contained in 9.4.

9.2.1 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 as agreed between the meteorological service provider and the operator concerned, in lieu of flight documentation.

9.2.2 Meteorological information used for briefing, consultation and display shall include any or all of the information listed in 9.1.4.

9.2.3 If the aerodrome 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.

9.2.4 The required briefing, consultation, display and/or flight documentation shall normally be provided by the aerodrome 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 between the meteorological service provider and the operator concerned. In exceptional circumstances, such as an undue delay, the aerodrome 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.

9.2.5 **Recommendation.**— *The flight crew member and/or other flight operations personnel for whom briefing, consultation and/or flight documentation has been requested should visit the aerodrome meteorological office at the time agreed between the aerodrome meteorological office and the operator concerned. Where local circumstances at an aerodrome make personal briefing or consultation impracticable, the aerodrome meteorological office should provide those services by telephone or other suitable telecommunications facilities.*

9.2.6 **Recommendation.**— *The material displayed should be readily accessible to the flight crew members or other flight operations personnel concerned.*

9.3 Flight documentation

Note 1.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 8, 8.2.

Note 2.— The requirements for the use of automated pre-flight information systems in providing flight documentation are contained in 9.4.

9.3.1 Flight documentation to be made available shall comprise information listed under 9.1.4.

9.3.2 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 replanning, the operator shall be advised immediately and, if practicable, be supplied with the revised information as agreed between the operator and the aerodrome meteorological office concerned.

9.3.3 **Recommendation.**— *In cases where a need for amendment arises after the flight documentation has been supplied, and before take-off of the aircraft, the aerodrome 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.*

9.3.4 **Recommendation.**— *The flight documentation related to concatenated route-specific upper wind and upper-air temperature forecasts should be provided as agreed between the meteorological service provider and the operator concerned.*

Note.— Guidance on the design, formulation and use of concatenated charts is contained in the Manual of Aeronautical Meteorological Practice *(Doc 8896).*

9.3.5 Meteorological information received from other meteorological offices shall be included in flight documentation without modification.

9.3.6 **Recommendation.**— *Charts included in flight documentation should have a high standard of clarity and legibility.*

Note.— The details of the characteristics of charts to be included in flight documentation are contained in the PANS-MET (Doc 10157), Chapter 8, 8.2.3.1.

9.3.7 The meteorological authority shall ensure that the meteorological service provider retains 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.

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

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 8, 8.3.

9.4.1 Where the meteorological service provider 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 9.3 inclusive.

9.4.2 **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 as agreed between the meteorological service provider and the Civil Aviation Authority or the agency to which the authority to provide service has been delegated in accordance with Annex 15 – Aeronautical Information Services, 2.1.1 c).*

Note.— The meteorological and aeronautical information services information concerned is specified in 9.1 to 9.3, in the PANS-MET (Doc 10157), Chapter 8, and in the PANS-AIM (Doc 10066), 5.5, respectively.

9.4.3 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 ensuring that the quality control and quality management of meteorological information are provided by the meteorological service provider 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 contained in Annex 15 – Aeronautical Information Services, Chapters 1, 2 and 3.

9.4.4 Automated pre-flight information systems providing self-briefing facilities shall provide for access by operators and flight crew members to consultation, as necessary, with an aerodrome meteorological office by telephone or other suitable telecommunications means.

9.5 Meteorological information for aircraft in flight

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 8, 8.4.

9.5.1 Meteorological information for use by aircraft in flight shall be supplied by an aerodrome meteorological office or meteorological watch office to its associated air traffic services unit and through D-VOLMET or VOLMET broadcasts as determined by regional air navigation agreement. 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.

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

9.5.3 **Recommendation.**— *If an aircraft in flight requests meteorological information, the aerodrome meteorological office or meteorological watch office which receives the request should arrange to supply the information with the assistance, if necessary, of another aerodrome meteorological office or meteorological watch office.*

9.5.4 Meteorological information shall be supplied through D-VOLMET or VOLMET broadcasts in accordance with the specifications of Chapter 11.

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

Note.— The Standards and Recommended Practices in this chapter are to be used in conjunction with the Procedures for Air Navigation Services – Meteorology *(PANS-MET, Doc 10157), Chapter 9.*

10.1 Information for air traffic services units

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 9, 9.1.

10.1.1 General

10.1.1.1 The Contracting State shall designate an aerodrome meteorological office or meteorological watch office to be associated with each air traffic services unit. The associated aerodrome meteorological office or meteorological watch 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.

10.1.1.2 **Recommendation.**— *An aerodrome meteorological office should be associated with an aerodrome control tower or approach control unit for the provision of meteorological information.*

10.1.1.3 A meteorological watch office shall be associated with a flight information centre or an area control centre for the provision of meteorological information.

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

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

10.1.2 Supply, dissemination and transmission arrangements

10.1.2.1 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 FIC or ACC.

10.1.2.2 **Recommendation.**— *When computer-processed upper-air grid point data in digital form is made available to air traffic services units for use by air traffic services computers, the transmission arrangements should be as agreed between the meteorological service provider and the appropriate ATS authority. The data should be supplied as soon as is practicable after the processing of the forecasts has been completed.*

10.2 Information for search and rescue services units

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 9, 9.2.

10.2.1 General

Aerodrome meteorological offices or meteorological watch offices designated by a Contracting State 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 aerodrome meteorological office or meteorological watch office shall maintain liaison with the search and rescue services unit throughout a search and rescue operation.

10.2.2 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; including 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.

10.3 Information for aeronautical information services units

10.3.1 General

The meteorological authority, in coordination with the appropriate Civil Aviation Authority, shall arrange for the supply by the meteorological service provider concerned of up-to-date meteorological information to relevant aeronautical information services units, as necessary, for the conduct of their functions.

10.3.2 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 contained in the PANS-AIM (Doc 10066), Appendix 3, Part 1, GEN 3.5 and Part 3, AD 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 – *Aeronautical Information Services*, 6.3.2.2 and 6.3.2.3;

2) the occurrence of volcanic activity; and

Note.— The specific information required is contained in Annex 3, Chapter 3, 3.2.2 h) and Chapter 4, 4.8.

3) 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 contained in Annex 3, Chapter 3, 3.3.2 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.

CHAPTER 11. USE OF COMMUNICATIONS TO EXCHANGE METEOROLOGICAL INFORMATION

Note 1.— The Standards and Recommended Practices in this chapter are to be used in conjunction with the Procedures for Air Navigation Services – Meteorology *(PANS-MET, Doc 10157), Chapter 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 units and the aeronautical telecommunications stations serving these aerodromes.

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 forecasts to aerodrome meteorological offices, meteorological service providers and other users.

11.1.4 Telecommunications facilities between aerodrome meteorological offices and, as necessary, aeronautical meteorological stations and aerodrome control towers or approach control units 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 aerodrome meteorological offices or meteorological watch 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 service provider and the operators concerned, 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 or, for the exchange of non-time critical operational meteorological information, the public Internet, subject to availability, satisfactory operation and bilateral/multilateral and/or regional air navigation agreements.*

Note 1.— Aeronautical fixed service Internet-based services, operated by the world area forecast centres, providing for global coverage are used to support the global exchanges of operational meteorological information.

Note 2.— Guidance material on non-time-critical operational meteorological information and relevant aspects of the public Internet is provided in the Guidelines on the Use of the Public Internet for Aeronautical Applications *(Doc 9855)*.

11.1.10 **Recommendation.**— *When upper-air grid point data in digital form is made available for use by air traffic services computers, the transmission arrangements should be as agreed between the meteorological service provider and the appropriate ATS authority.*

11.1.11 **Recommendation.**— *When upper-air grid point data in digital form is made available to operators for flight planning by computer, the transmission arrangements should be as agreed between the world area forecast centre concerned, the meteorological service provider and the operators concerned.*

11.2 Use of aeronautical fixed service communications and the public Internet

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 10, 10.1.

11.2.1 Meteorological bulletins

11.2.1.1 Meteorological bulletins containing operational meteorological information to be transmitted via the aeronautical fixed service or the public Internet 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 – Aeronautical Telecommunications*, Volume II –* Communication Procedures including those with PANS status*, Chapter 4, together with the relevant priorities and priority indicators.*

11.2.1.2 Messages and bulletins containing operational meteorological information shall achieve transit times of less than 5 minutes, unless otherwise determined to be lower by regional air navigation agreement.

11.2.2 World area forecast system forecasts

11.2.2.1 **Recommendation.**— *The telecommunications facilities used for the supply of WAFS forecasts should be the aeronautical fixed service or the public Internet.*

11.2.2.2 **Recommendation.**— *WAFS forecasts should be transmitted using digital data communications techniques. The method and channels used for the dissemination of the forecasts should be as determined by regional air navigation agreement.*

11.3 Use of aeronautical mobile service communications

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 10, 10.2.

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

11.4 Use of aeronautical data link service – D-VOLMET

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 10, 10.3.

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)*.

11.5 Use of aeronautical broadcasting service – VOLMET broadcasts

Note.— Procedures and technical specifications related to this section are contained in the PANS-MET (Doc 10157), Chapter 10, 10.4.

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

11.5.2 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.

— END —

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