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Manual of Aeronautical Meteorological Practice

Twelfth Edition, 2019

Approved by and published under the authority of the Secretary General

INTERNATIONAL CIVIL AVIATION ORGANIZATION

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AMENDMENTS

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.

RECORD OF AMENDMENTS AND CORRIGENDA

AMENDMENTS		
No.	Date	Entered by

CORRIGENDA		
No.	Date	Entered by

FOREWORD

1. The first edition of the *Manual of Aeronautical Meteorological Practice*, published in response to recommendations made by the Meteorology and Operations Divisional Meeting[1] (Paris, 1964), was intended as a guide for use by pilots and other aeronautical personnel on meteorological procedures, codes, symbols and abbreviations. It also contained a multilingual list of terms and phrases commonly used in meteorological briefings.

2. A second edition was prepared in 1977 to reflect, in particular, the many changes in procedures and terminology recommended by the Eighth Air Navigation Conference and the Meteorology Divisional Meeting[2] (1974).

3. As demand for the manual continued to grow and because further important changes to meteorological procedures had taken place, particularly in connection with the recommendations for the establishment of a world area forecast system (WAFS) made by the Communications/Meteorology Divisional Meeting[3] (Montréal, 1982), a third edition was prepared. That edition was rewritten aiming to meet the needs of operational aeronautical meteorologists, particularly those at the working level, as well as the needs of pilots and other aeronautical personnel.

4. As a consequence of an extensive amendment proposal to Annex 3 — *Meteorological Service for International Air Navigation* developed by the Communications/Meteorology/Operations (COM/MET/OPS) Divisional Meeting[4] (1990) including, in particular, provisions regarding the transition to the final phase of the WAFS, aerodrome observations, reports and forecasts, SIGMET information, etc., a fourth edition of the manual was published.

5. The fifth edition was the direct result of Amendment 70 to Annex 3, applicable from 1 January 1996, which constituted a comprehensive update of the provisions, in particular, those related to air-reporting and the observation and reporting of wind shear. In addition, new provisions concerning information on weather phenomena hazardous to low-level flights (AIRMET and GAMET messages) were introduced.

6. The sixth edition reflected the substantial changes made to Annex 3 in Amendments 71 and 72.

7. The seventh edition took account of the substantial changes which were introduced in Annex 3 by Amendment 73, which was developed by the Meteorological Divisional Meeting (2002)[5] and became applicable in November 2004. In view of the fact that all of the technical specifications and templates had been regrouped in Part II of Annex 3 by subject matter, it was no longer considered necessary to reproduce these templates in this manual. Furthermore, material related to coordination between aeronautical meteorological services and air traffic services, search and rescue and aeronautical information services units was eliminated since these issues were extensively covered in the *Manual on Coordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services* (Doc 9377).

1. Held conjointly with the Third Session of the Commission for Aeronautical Meteorology (CAeM) of the World Meteorological Organization (WMO).
2. Held, in part, conjointly with the Extraordinary Session (1974) of the body mentioned in Note 1.
3. Held conjointly with the Seventh Session of the body mentioned in Note 1.
4. Held conjointly with the Ninth Session of the body mentioned in Note 1.
5. Held conjointly with the Twelfth Session of the body mentioned in Note 1.

8. The eighth edition incorporated all the changes included in Amendment 74 to Annex 3. Furthermore, explanations of the terms “MET authority”, “MET inspectorate”, “MET regulator” and “MET service provider” were introduced, guidance related to issuance of SIGMET was expanded and the chapter related to meteorological service for operators and flight crew members was re-organized and clarified.

9. The ninth edition reflected the substantial changes made to Annex 3 by Amendment 75 (2010).

10. The tenth edition incorporated changes resulting from Amendment 76 (2013) including clarification of the terminology used for meteorological offices.

11. The eleventh edition incorporates changes resulting from Amendment 77 to Annex 3, which was developed by the Meteorological Divisional Meeting (2014)[6] and became applicable in November 2016. It introduces 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.

12. This twelfth edition introduces space weather centres and the requirement to disseminate OPMET information using ICAO meteorological information exchange model (IWXXM)[7] geography markup language (GML) form, introduced in Amendment 78 to Annex 3.

13. The body of the manual is based primarily on Annex 3, summarized and enlarged upon where necessary. The appendices provide information on other subjects such as location of instruments at aerodromes and use of meteorological information by operators and flight crew members.

14. It should be stressed that the material in this manual is intended for guidance only. It is not intended to replace relevant national instructions or explanatory material, nor is it intended to cover the many non-aeronautical uses of meteorological information. Nothing in this manual should be taken as contradicting or conflicting with Annex 3 provisions or any other Standards, Recommended Practices, procedures or guidance material published by ICAO or WMO. It should also be noted that in this manual the words “shall” and “should” are not used in a regulatory sense as in ICAO or WMO regulatory documents.

15. Comments concerning this manual should be addressed to:

The Secretary General
International Civil Aviation Organization
999 Robert-Bourassa Boulevard
Montréal, Quebec, Canada H3C 5H7

[6] Held conjointly with the Fifteenth Session of the body mentioned in Note 1.

[7] A data model for representing aeronautical meteorological information.

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Chapter 1

METEOROLOGICAL SERVICE FOR INTERNATIONAL AIR NAVIGATION

1.1 GENERAL

1.1.1 Meteorological service for international air navigation is provided by meteorological authorities designated by States. Details of the meteorological service to be provided for international aviation are determined by each State in accordance with the provisions of Annex 3 and with regional agreements which apply to specific areas designated as air navigation regions by ICAO. Each State also establishes a suitable number of meteorological offices and stations, i.e. aerodrome meteorological offices, meteorological watch offices (MWOs) and aeronautical meteorological stations. Aerodrome meteorological offices and aeronautical meteorological stations provide information required for operational planning, flight operations, the protection of aeronautical equipment on the ground, and for various other aeronautical uses. The information provided includes observations and reports of actual weather conditions at aerodromes and forecasts; it is made available at aerodrome meteorological offices and is disseminated as appropriate to aeronautical users, including operators, flight crew members, air traffic services (ATS) units, search and rescue services units, airport management and others concerned with the conduct or development of international air navigation.

1.1.2 Forecasts of en-route conditions, except forecasts for low-level flights issued by aerodrome meteorological offices, are prepared by world area forecast centres (WAFCs) (see 1.5). This ensures the provision of high-quality and uniform forecasts for flight planning and flight operations. It also permits MWOs to concentrate on keeping watch on weather conditions in their flight information regions (FIRs) and permits aerodrome meteorological offices to concentrate on local aerodrome forecasting, to keep watch over local (aerodrome) conditions and to issue warnings of weather conditions that could adversely affect operations and facilities at the aerodrome (e.g. aerodrome and wind shear warnings).

1.1.3 SIGMET and AIRMET information concerning the occurrence of specified en-route weather and other phenomena in the atmosphere which may affect the safety of aircraft operations is issued by MWOs (see 1.3). In the specific cases of tropical cyclones and volcanic ash, in addition to SIGMET, advisory information is issued by designated tropical cyclone advisory centres (TCACs) and volcanic ash advisory centres (VAACs) (see 1.6 and 1.7). Furthermore, advisory information is provided on space weather phenomena by designated space weather centres (see 1.9).

1.1.4 The responsibility for the provision of meteorological service to international air navigation mentioned in 1.1.1 rests with the meteorological authority designated by each State in accordance with Annex 3, 2.1.4. The meteorological authority (“MET authority”) may wish to provide the service or may arrange for the provision of the service by other providers on its behalf.

1.1.5 Terms additional to MET authority are being defined in the framework of the State Safety Oversight System. In particular, use of the terms “MET inspectorate”, “MET regulator” and “MET service provider” has raised questions. The following list attempts to clarify these terms which are neither specified nor used in Annex 3:

a) The MET authority refers to an administrative entity or the State relevant authority empowered with the oversight function to ensure that meteorological services comply with the local law and regulations. It has the power to exercise authority through the promulgation and amendment of regulation, as well as supervise and enforce such capabilities;

b) the “MET inspectorate” refers to the body of inspectors responsible for conducting safety oversight for the “MET authority” over the “MET service provider” in the State concerned;

c) the “MET regulator” can be considered to be simply another term for the “MET authority”, i.e. the body responsible for the facilities and services to be provided in accordance with Annex 3. This term is used to highlight the regulatory aspects of its functions; and

d) the “MET service provider” is the entity that is providing the facilities and services to be provided in accordance with Annex 3. In the context of safety oversight audits, the term “entity providing the MET service” is sometimes used to designate the “MET service provider”.

There are no provisions currently in place that would prevent the “MET inspectorate” to be part of the same organization as the “MET authority”. Furthermore, in accordance with Annex 3, the “MET service provider” could be either within the “MET authority” or, alternatively, within an independent organization. However, in some States or regions (e.g. under the European Single Sky), the legislation stipulates that the “MET regulator” (i.e. the “MET authority”) and the “MET service provider” must be separated, at least, functionally. When the “MET service provider” is part of the same organization as the “MET authority”, it is preferable that the oversight function be carried out by an external, independent “MET inspectorate”. In such cases, the “MET inspectorate” could be an independent MET expert involved in the International Organization for Standardization (ISO) certification audit of the “MET service provider”, or part of the ministry overseeing the “MET authority” or the civil aviation authority (CAA), provided that such a CAA-based inspectorate is a third-party, independent body with qualified meteorological personnel. Such arrangements would avoid any conflict of interest between inspection and service provision. Irrespective of the administrative arrangements, it is considered important that the “MET inspectorate” have close coordination with the entity responsible for the more general safety oversight (located in most cases within the CAA).

1.1.6 In order to meet the objectives of meteorological service for international air navigation and provide users with the assurance that the service, including the meteorological information provided, complies with the aeronautical requirements, the meteorological authority must establish and implement a properly organized quality system. It is recommended that such a system be developed in accordance with the ISO 9000 series of quality assurance standards. The system is to be certified by an approved organization.

Note.— Specific guidance on this subject is contained in the Manual on the Quality Management System for the Provision of Meteorological Service for International Air Navigation *(Doc 9873), published jointly with the World Meteorological Organization (WMO)*.

1.1.7 Properly educated and trained personnel should be employed in the provision of meteorological service to international air navigation. It is, therefore, an important responsibility of the meteorological authority to ensure that widely recognized standards are applied to the qualifications, competencies, education and training of all of the personnel involved in the provision of meteorological service to international air navigation. With respect to meteorological personnel, the requirements of the WMO should be applied.

Note 1.— The 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.

Note 2.— Qualifications, competencies, education and training in aeronautical meteorology of aeronautical personnel (e.g. pilots, air traffic control personnel, flight dispatch officers), required by the aeronautical authorities concerned, must comply with the relevant ICAO documents (i.e. Training Manual *(Doc 7192)*, *Part F-1* — Meteorology for Air Traffic Controllers and Pilots*)*.

1.2 AERODROME METEOROLOGICAL OFFICES AND OTHER METEOROLOGICAL OFFICES

1.2.1 Meteorological offices designated to provide meteorological service for aerodromes serving international air navigation are called aerodrome meteorological offices. An aerodrome meteorological office may or may not be located at an aerodrome. An aerodrome meteorological office should be associated with an aerodrome control tower or approach control unit for the provision of meteorological information. The aerodrome meteorological offices issue aerodrome forecasts (as TAF) and trend forecasts in accordance with regional air navigation agreement. In addition to maintaining a continuous survey of meteorological conditions over the aerodrome(s) under their responsibility, preparing forecasts of local meteorological conditions, aerodrome warnings and wind shear warnings, aerodrome meteorological offices also provide briefing, consultation and flight documentation or other meteorological information, and display weather charts, reports, forecasts, meteorological satellite images and information derived from ground-based weather radar or a radar network. Much of the information is obtained from WAFCs or from other meteorological offices (which may be located in a different country). Furthermore, aerodrome meteorological offices supply operational meteorological (OPMET) information to aeronautical users and exchange such information with other aerodrome meteorological offices. This also includes the exchange of OPMET information required by regional air navigation agreement. In addition, where necessary, aerodrome meteorological offices supply information regarding pre-eruption activity, volcanic ash eruptions or the presence of volcanic ash in the atmosphere to their associated ATS units, the aeronautical information services (AIS) units and the MWO concerned, as agreed between the ATS, AIS and meteorological authorities concerned. However, not all international aerodromes have an aerodrome meteorological office, and for such aerodromes the relevant air navigation plans (ANPs), Part V of Volume II, Table MET II-2 indicate the name and location of the meteorological office designated to supply OPMET information concerning the aerodrome to operators, ATS units and others concerned.

1.2.2 Owing to local circumstances, it may be convenient for the duties of an aerodrome meteorological office associated with an aerodrome to be shared between two or more aerodrome meteorological offices. In this instance, the division of responsibility should be determined by the meteorological authority in consultation with the appropriate ATS authority.

1.3 METEOROLOGICAL WATCH OFFICES (MWOs)

1.3.1 States having accepted responsibility for providing ATS within an FIR or control area (CTA) have to either designate an MWO to serve that FIR/CTA or arrange for another State to designate an MWO on its behalf (see 1.3.2). An MWO must be associated with an FIR or CTA for the provision of meteorological information. The MWOs designated in accordance with regional air navigation agreement are listed in the relevant ANP, Part V of Volume II, Table MET II-1, to indicate the overall plan for providing meteorological service for the FIR/CTA within each ICAO region. They maintain a continuous watch over meteorological conditions affecting flight operations within their areas of responsibility, issue information on the occurrence or expected occurrence of specified hazardous en-route weather and other phenomena in the atmosphere which may affect the safety of aircraft and low-level aircraft operations (SIGMET and AIRMET information, respectively) and supply this and other weather information to their associated ATS units, usually an area control centre (ACC) or a flight information centre (FIC). In addition, MWOs exchange SIGMET information issued by other MWOs as required by regional agreements. The AIRMET information issued should be transmitted to MWOs in adjacent FIRs and to other MWOs or aerodrome meteorological offices, as agreed between the meteorological authorities concerned. In addition, in accordance with regional agreements, AIRMET information should be transmitted to international OPMET databanks and to the centres designated by regional agreements for the operation of the aeronautical fixed service (AFS) Internet-based services (see Chapter 4). In preparing SIGMET and AIRMET information, MWOs normally make use of special air-reports, and satellite and radar data.