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| 天气 气候 水 | **世界气象组织**  **世界气象大会**  **第十九次届会** 2023年5月22日至6月2日，日内瓦 | **Cg-19/文件4.1(2)** |
| 提交者： 全会主席 2023.5.30  **APPROVED** |

**议题4： 支持长期目标的技术战略**

**议题4.1： 面向社会需求的服务**

# 对《技术规则》(WMO-NO.49)第一卷的拟议修订以及对《WMO胜任力框架纲要》(WMO-NO.1209)涉及航空气象人员资格和能力等内容的更新



# 总体考虑

### 对[《技术规则》第一卷：通用气象标准和建议规范](https://library.wmo.int/index.php?lvl=notice_display&id=14073)(WMO-No. 49)的拟议修订以及对《[WMO胜任力框架纲要](https://library.wmo.int/index.php?lvl=notice_display&id=21607)》(WMO-No. 1209)涉及航空气象人员资格和能力等内容的更新

1. 服务委员会（SERCOM）航空服务常设委员会(SC-AVI)，在其教育、培训和能力专家组(ET-ETC)的协助下，已确定[《技术规则》第一卷](https://library.wmo.int/index.php?lvl=notice_display&id=14073)(WMO-No. 49)中界定的现有航空气象人员(AMP)资格和能力要求以及《[WMO胜任力框架纲要](https://library.wmo.int/index.php?lvl=notice_display&id=21607)》(WMO-No. 1209)中的指导意见所阐述的能力方面的要求并不完全适用于火山灰、空间天气和热带气旋等航空气象专业领域。实际上，负责在其责任范围内持续监测此类现象的航空气象服务提供者，目前几乎没有或根本没有办法证明其专业航空气象预报员（AMF）如何完全符合WMO的现行资格和能力要求。

2. 针对国际民用航空组织(ICAO)附件3的规定，SC-AVI确认，WMO于2011年引入AMF资格要求是为了将之作为一个“安全网”，因为认识到对大多数WMO会员来说，引入一个能力标准是一个新的重大步骤。在过去的十年中，WMO会员进一步开发、完善并接受了AMP能力框架。鉴于该十年及之后服务交付方面的预计变化，以及AMP角色和职责的预期变化，SC-AVI已确定：必须确保航空气象能力框架保持足够的灵活性和对预期变化的响应，而不是被严格应用一些基于学术的资格要求所限制。

3. 之后，SC-AVI拟就了对[《技术规则》第一卷：通用气象标准和建议规范](https://library.wmo.int/index.php?lvl=notice_display&id=14073)(WMO-No. 49)第五部分的拟议修订，和对《[WMO胜任力框架纲要](https://library.wmo.int/index.php?lvl=notice_display&id=21607)》(WMO-No. 1209)第2.2节的更新。SC-AVI认为，拟议的修改将为WMO会员提供更加务实和灵活的方法，以证明如何获得达到相应AMP能力所需的基础知识和技能。SC-AVI还认识到，成功完成“气象人员基础教学包”(BIP-M)和“气象技术人员基础教学包”(BIP-MT)仍是证明候选人拥有各自能力框架中所述的基础技能和知识的有效途径。

4. 值得注意的是，2022年初，SC-AVI/ET-ETC已就拟议的修改征求了能力发展专家组(CDP)的意见，并得到了广泛支持。此外，2022年10月举行的SERCOM-2届会对来自SC-AVI/ET-ETC的最初提案表示了广泛的支持并做了改进。为帮助WMO会员进一步了解修订的背景和合理性，以及通过采纳这些修订所能获得的益处，SC-AVI编写了一套[包括“常见问题”在内的沟通材料](https://community.wmo.int/activity-areas/aviation/resources/amp-qual-comp-amendments)。

**预期行动**

5. 通过[建议2 (SERCOM-2)](https://meetings.wmo.int/SERCOM-2/_layouts/15/WopiFrame.aspx?sourcedoc=/SERCOM-2/Chinese/2.%20PR%20-%20%E4%B8%B4%E6%97%B6%E6%8A%A5%E5%91%8A%EF%BC%88%E6%89%B9%E5%87%86%E7%9A%84%E6%96%87%E4%BB%B6%EF%BC%89/SERCOM-2-d05-1(3)-AMENDMENT-WMO-49-V1-UPDATE-WMO-1209-approved_zh.docx&action=default)，服务委员会核准了对WMO-No. 49第一卷的拟议修订和对WMO‑No. 1209的更新。基于上述内容，世界气象大会似宜通过决议4.1(2)/1 (Cg-19)。

# 决议草案

**决议草案4.1(2)/1 (Cg-19)**

**对**[**《技术规则》第一卷：通用气象标准和建议规范**](https://library.wmo.int/index.php?lvl=notice_display&id=14073)**(WMO-No. 49)的拟议修订以及对《**[**WMO胜任力框架纲要**](https://library.wmo.int/index.php?lvl=notice_display&id=21607)**》(WMO-No. 1209)涉及航空气象人员资格和能力等内容的更新**

世界气象大会，

**认识到**未来十年航空气象服务的重大全球变化，以及航空气象工作人员（AMP）在应对服务转型方面不断演变的作用；

**进一步认识到**需要更新《技术规则》第一卷：通用气象标准和建议规范（WMO-No.49）中定义的现有AMP资格和能力要求，以及《WMO胜任力框架纲要》（WMO-No. 1209）中对能力方面的指导意见，以满足航空气象部门的要求*，*包括火山灰、空间天气和热带气旋等专业方面的要求；

**注意到**[建议2(SERCOM-2)](https://meetings.wmo.int/SERCOM-2/_layouts/15/WopiFrame.aspx?sourcedoc=/SERCOM-2/Chinese/2.%20PR%20-%20%E4%B8%B4%E6%97%B6%E6%8A%A5%E5%91%8A%EF%BC%88%E6%89%B9%E5%87%86%E7%9A%84%E6%96%87%E4%BB%B6%EF%BC%89/SERCOM-2-d05-1(3)-AMENDMENT-WMO-49-V1-UPDATE-WMO-1209-approved_zh.docx&action=default) - 对[《技术规则》第一卷：通用气象标准和建议规范](https://library.wmo.int/index.php?lvl=notice_display&id=14073)(WMO-No. 49)的拟议修订和对《[WMO胜任力框架纲要](https://library.wmo.int/index.php?lvl=notice_display&id=21607)》(WMO-No. 1209)的更新；

**进一步注意到**对WMO-No. 49第一卷的拟议修订和对WMO-No. 1209的更新涉及航空气象人员 (AMP)的资格和能力要求，分别详见本决议的[附件1](#Annex1)和[附件2](#Annex2)；

**核准**对《技术规则》(WMO-No. 49)第一卷《通用气象标准和建议规范》的拟议修订，适用日期为2026年1月1日；

**批准**对《WMO胜任力框架纲要》(WMO-No. 1209)的相关更新；

**要求**秘书长迅速安排出版修订后的《技术规则》(WMO-No. 49)第一卷和更新后的《WMO胜任力框架纲要》(WMO-No. 1209)；

**要求**天气、气候、水及相关环境服务与应用委员会（SERCOM），必要时在能力发展小组（CDP）的协助下：

(1) 考虑到Cg-19的结果，进一步更新在线通信包；

(2) 根据既定程序，持续确保定期审查和更新WMO涉及AMP资格和能力的“技术规则”和指导材料，并向会员提供支持，以进一步发展其胜任力框架及相关培训计划。

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[附件：2](#Annex1)

**决议草案4.1(2)/1 (Cg-19)的附件1**

**对《技术规则》第一卷《通用气象标准和建议规范》(WMO-No. 49)的修订**

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| 编注1 - 以下拟议修订基于2021年对WMO-No. 49第一卷2019年版的更新版，详见WMO电子图书馆[这里](https://library.wmo.int/index.php?lvl=notice_display&id=14073)。  编注2 - 修订文本安排如下：横线划掉的部分表示删去的文字，带下划线的部分表示新增的文字，如下所示：   |  |  | | --- | --- | | ~~要删除的文本显示为带有一条穿过文本的线。~~ | 删去的文字 | | 要插入的新文字带有下划线。 | 新增的文字 | | ~~要删除的文本显示为一条穿过文本的线~~，后跟带下划线的替换文本 | 用新文字取代现有文字 | |

[...]

**第五部分：从事提供气象、气候、水文、海洋和相关环境服务人员的资格和能力**

1. **资格和能力**

1.1 **通用**

1.1.1 从事提供气象、气候、水文、~~气候~~海洋和相关环境服务的人员所需的资格和能力应由会员根据第1.2-1.8 节而定。

注：

~~1. 具体资格通常一次获得，终身有效。~~这里所指的资格是完成那些提供了支持能力所需的基本技能和知识的正规学习或学习课程。

~~附加服务领域人员的资格和能力将适时制定，随后纳入本章。~~1.1.2 会员应根据相关的国家、区域和/或全球要求，确定各类业务人员所需的必要资格水平。

~~1.1.2~~1.1.3 根据质量管理的良好做法和/或适用要求，会员应保存所有从事提供气象、气候、水文、海洋~~气候~~和相关环境服务的人员的资格记录。

~~1.1.3~~ ~~会员应根据各自的国情决定是否应对某些类别的业务人员制定比第 1.2–1.8节所述更 高或更具体的资格要求。~~1.1.4 会员的人员能力应通过工作业绩予以证明，并酌情通过能力评估程序予以评估。

注： 能力实施程序指南包括在《胜任力指南》（WMO-No. 1205）中。

1.1.5 会员应针对每个类别的业务人员建立多个能力评估程序；能力评估应定期反复开展，时间间隔由各会员根据质量管理实践决定。

1.1.6 会员应通过适当考虑其当地、国家和区域[坦桑尼亚联合共和国]条件、规定、要求和程序，实施WMO人员能力要求。

注：如上所述，《技术规则》仅包含顶级能力要求，其他指导材料则提供更详细的二级能力要求。各国对WMO能力要求的采纳需要仔细考虑二级信息的适用性。

1.1.7 会员应确保其业务人员不断取得专业发展，以保持能力。

1.2 **从事提供航空气象服务的人员**

1.2.1 ***资格***

1.2.1.1 在考虑责任区和责任空域、**~~气象现象和参数对航空运行的影响、~~**航空用户的需求、国际规则和地方规程与优先重点的情况下，会员须确保支撑航空气象**~~业务人员~~**预报员和所需能力的必要资格与**附录A**中~~航空气象预报员圆满完成附件A 中规定的~~“气象人员基础教学包”中的相关教育框架、背景技能和知识要求一致。~~的学习。~~

编者按. ⎯ *将下面的注释1至3直接移到上面1.2和1.2.1的标题之间。*

注：

1. 以下 所指的航空气象人员包括在国家、区域或全球一级负责提供航空气象服务的人员。

2. 每个类别所需的必要资格水平可能因会员而异。，认识到会员可能会要求业务航空气象工作人员具备额外的和/或更高级别的资格。

3. 提供航空气象服务的专业领域，如（但不限于）火山灾害和空间天气等，可能需要成功完成额外和/或替代的资格框架，以巩固提供这些专业领域业务服务的人员的必要能力。

~~1.2.1.2~~ ~~会员应根据各自国情决定是否要求航空气象观测员具备特定资格。~~

编者按. ⎯ *根据日本和澳大利亚的发言，鉴于他们就上述1.2.1.1的发言（建议删除），现存的1.2.1.2被保留（即不删除）。*

1.2.1.2 会员应决定其国家情况是否需要航空气象观察员的特定资格。

1.2.2 ***能力***

注：~~更多指导材料请参见https://www.wmo.int/aemp/implementation\_areas教育与培训章节，包括二级能力信息。~~航空气象人员的能力标准由~~航空气象委员会~~ 天气、气候、水及相关环境服务与应用委员会（SERCOM）负责维护，并在《WMO胜任力框架纲要》(WMO-No. 1209)中公布。请访问SC-AVI Moodle培训门户[[1]](#footnote-2)，以获取来自世界各地的航空气象培训和指导材料。

1.2.2.1 **航空气象预报员**

**有鉴于气象和其他相关环境现象和参数对航空运行的影响，并为符合航空用户的需求、国际规则和地方规程与优先重点，会员须确保航空气象预报员能够为其责任区和责任空域：**

**(a)** **连续分析和监测气象和/或 其他相关环境形势；**

**(b)** **预报~~航空~~气象和/或 其他相关环境现象和参数；**

**(c)** 发布**灾害性~~天气~~气象和/或 其他相关环境现象的警报；**

**(d)** **确保向用户提供的气象****和/或 其他相关环境信息和服务的质量；**

**(e)** **与内部和外部用户沟通气象和/或****其他相关环境信息。**

注：这里的其他有关环境形势、现象、参数和信息可包括(但不限于)火山灰的存在、放射性物质或有毒化学品向大气的释放以及空间天气。

1.2.2.2 **航空气象观测员**

**有鉴于气象和/**或**其他相关环境现象和参数对航空业务的影响，并为符合航空用户的需求、国际规则和地方规程与优先重点，会员须确保航空气象观测员能够为其责任区和责任空域：**

**(a)** **连续分析和监测气象和/或其他相关环境形势；**

**(b)** **观测并记录~~航空~~气象和/或其他相关环境现象和参数；**

**(c)** **确保观测系统性能以及向用户提供的气象和/或其他相关环境信息的质量；**

**(d)** **与内部和外部用户沟通气象和/或其他相关环境信息。**

注：这里的其他有关环境形势、现象、参数和信息可包括(但不限于)火山灰的存在和空间天气。

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**决议草案4.1(2)/1(Cg-19)的附件2**

**《WMO胜任力框架纲要》(WMO-No. 1209)的更新**

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| 编注1- 以下拟议修订基于WMO-No. 1209的2019年版，详见WMO电子图书馆[这里](https://library.wmo.int/index.php?lvl=notice_display&id=21607)。  编注2- 修订文本安排如下：横线划掉的部分表示删去的文字，带下划线的部分表示新增的文字，如下所示：   |  |  | | --- | --- | | ~~要删除的文本显示为带有一条穿过文本的线。~~ | 删去的文字 | | 要插入的新文字带有下划线。 | 新增的文字 | | ~~要删除的文本显示为一条穿过文本的线，~~后跟带下划线的替换文本 | 用新文字取代现有文字 | |

（译注：该出版物仅以英文提供）

[…]

2.2 **COMPETENCY STANDARDS FOR AERONAUTICAL METEOROLOGICAL PERSONNEL**

The following guidance supplements the competency standards for aeronautical meteorological personnel endorsed by the World Meteorological Congress at its sixteenth session, in May 2011, and laid out in the *Technical Regulations* (WMO-No. 49), Volume I, Part V.

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| Editorial Note. – *The foregoing reference to the sixteenth session of the World Meteorological Congress, in May 2011, will need to be replaced by a reference to the nineteenth session of the World Meteorological Congress, in May/June 2023.* |

The competency standards listed below apply to aeronautical meteorological forecasters and observers, taking into consideration the following conditions:

(a) The area and airspace of responsibility;

(b) The impact of meteorological and/or other relevant environmental phenomena and parameters on aviation operations;

(c) Compliance with aviation user requirements, international regulations, local procedures and priorities.

**Regional variations**

The importance of the conditions above is emphasized. There will be considerable variation in the legitimate functions of aeronautical meteorological offices and centres worldwide, and it is not possible to write a document that exactly matches every office~~'s~~ or centre's function(s). Therefore, the performance criteria should be applied in a way that is consistent with these variations. For example, it is recognized that aeronautical meteorological offices in the tropics will not be responsible for forecasting blowing snow (performance criterion 2.1). The conditions (a), (b) and (c) provide for this.

It is intended that the responsibility for meeting the top-level competency standards will, in the first instance, rest with the organization to which the aeronautical meteorological personnel belongs. The responsibility of the individual will then be to meet (or exceed) the particular competencies which apply to his or her specific job within the organization (usually specified in terms of a job description).

Note: In this context, the word ‘organization’ is being used to denote the aeronautical meteorological service provider of the WMO Member concerned. The aeronautical meteorological service provider may be a national meteorological and hydrological service (NMHS) or a non-NMHS entity, as designated by the meteorological authority of the WMO Member concerned.

In some organizations, the competencies may be collectively satisfied by a team or by several groups. In such cases, the organization is responsible for ensuring that each individual does his or her part of the job to the required standard so that the top-level competency standards are met.

The role of aeronautical meteorological personnel will continue to change in response to evolving technology and user requirements, and that in itself will also likely require high standards of competency and underlying knowledge definition. The guidelines presented here attempt to anticipate imminent changes as far as possible, but a review cycle of not more than 3–5 years is strongly recommended as part of the overall quality management and risk management approach.

The organization is responsible for managing a programme of competency assessments to ensure that competency standards are maintained. It is important that the programme is integrated into the organization’s quality management system.

~~An implicit requirement in the background knowledge and skills of aeronautical meteorological forecasters is that they have successfully completed the Basic Instruction Package for Meteorologists (BIP-M), as described in the~~ *~~Technical Regulations~~* ~~(WMO-No. 49) Volume I, Part V, taking into account the conditions (a) to (c) mentioned above. It should, however, be recognized that national qualification requirements for aeronautical meteorological forecasters can be set at a higher level certified, for example, by a degree.~~

The level of qualification(s) necessary to underpin the required competencies of operational aeronautical meteorological forecasters ~~and observers~~  is to be consistent with the relevant educational frameworks, background skills and knowledge requirements described in the Basic Instruction Package for Meteorologists (BIP-M~~) and the Basic Instruction Package for Meteorological Technicians (BIP-MT), respectively~~. Information on the BIP-M ~~and BIP-MT~~ is described 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)~~, Climatological, Hydrological, Marine and Related Environmental Services.

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| Editorial Note. – *The foregoing referenced title of Part V will need to be validated in light of a corresponding proposed amendment to WMO-No. 49, Volume I.* |

The aeronautical meteorological service provider is expected to record evidence that the aeronautical meteorological personnel, responsible for the provision of its services, have completed the necessary formal learning or courses of study to demonstrate they possess the background skills and knowledge as described in the relevant competency framework.

The WMO Standing Committee on Services for Aviation (SC-AVI) Moodle ~~website~~ training portal[[2]](#footnote-3) ~~of the WMO Commission for Aeronautical Meteorology~~ is a resource designed to provide aeronautical meteorology training and guidance material sourced from around the world. The ~~website’s~~ portal’s content covers both operational and non-operational aspects of aeronautical meteorology, including quality management, regulatory issues, conferences, seminars and workshops, as well as source material in different languages. The ~~site~~ portal has played a key role in assisting organizations with changes such as the implementation of competency assessment for aeronautical meteorological personnel. The ~~website~~ portal includes frequently asked questions and discussion forums, where ~~members~~ registered users can ask questions, participate in discussions and share resources and expertise.

~~1.2.1~~2.2.1 **Aeronautical Meteorological Forecaster**

An aeronautical meteorological forecaster should be able to perform the tasks specified under the following top-level competency standards:

1. Analyse and monitor continually the ~~weather and~~ meteorological and/or other relevant environmental situations;

2. Forecast ~~aeronautical~~ meteorological and/or other relevant environmental phenomena and parameters;

3. Warn of hazardous meteorological and/or other relevant environmental phenomena;

4. Ensure the quality of meteorological and/or other relevant environmental information and services supplied to users;

5. Communicate meteorological and/or other relevant environmental information to internal and external users.

Notes:

1. Other relevant environmental situations, phenomena, parameters and information in this context may include (but not be limited to) the presence of volcanic ash, the release of radioactive material or toxic chemicals into the atmosphere and space weather.

2. An aeronautical meteorological forecaster in this context may include (but not be limited to) a person with responsibility to provide aeronautical meteorological service at an aerodrome meteorological office (which may or may not be located at an aerodrome), a meteorological watch office, a world area forecast centre, a volcanic ash advisory centre, a tropical cyclone advisory centre or a space weather centre.

**COMPETENCY 1: ANALYSE AND MONITOR CONTINUALLY THE ~~WEATHER AND~~ METEOROLOGICAL AND/OR OTHER RELEVANT ENVIRONMENTAL SITUATIONS**

**Competency description**

Observations and forecasts of ~~weather~~ meteorological phenomena ~~and significant weather phenomena~~, in particular significant weather, and/or other relevant environmental phenomena and parameters are continually monitored during hours of operation to determine the need for issuance, cancellation or amendment/update of forecasts, warnings and alerts according to documented thresholds and regulations.

**Performance criteria**

1. Analyse and diagnose[[3]](#footnote-4) ~~the weather and~~ meteorological and/or other relevant environmental situations as required in forecast, warning and alert preparation;

2. Monitor ~~weather~~ meteorological phenomena~~parameters and evolving significant weather phenomena~~, in particular significant weather, and/or other relevant environmental phenomena and parameters, and validate current forecasts, warnings and alerts based on these parameters;

3. Appraise the need for amendments to forecasts and updates of warnings and alerts against documented criteria and thresholds.

**Background knowledge and skills**

 Mechanisms generating different types of cloud and precipitation, and local mechanisms enhancing cloud and precipitation;

 Topographic influences on cloud, precipitation, fog and visibility, in typical wind and moisture regimes;

 Interpretation of:

- Radar, lidar, wind profiler and satellite imagery to identify fog and stratus, gravity waves in cirrus cloud and jet streams, inference of icing potential in layer cloud, and of volcanic ash and wind shear;

- Numerical weather prediction (NWP) guidance and other forms of objective guidance, to be incorporated into forecasts, warnings and alerts;

- Observed parameters when variations result from differences between automatic sensor technologies and manual observing techniques;

 The International Standard Atmosphere (ISA);

 ~~Aeronautical wWeather and~~ Meteorological and/or other relevant environmental monitoring and observing technologies, and ~~aeronautical~~ forecasting techniques in use at the service provider;

 Common terms relevant to aeronautical meteorology, including:

- (Special) Visual and instrument Flight rules and conditions;

- Flight Information Region (FIR) and, where used, Functional Airspace Block (FAB);

- Final approach, missed approach;

- Cruising and transition level, transition layer, transition altitude, flight level;

- Minimum safe altitude (MSA), indicated altitude, true altitude;

- Category I, II and III aerodrome operations, Aeronautical Information Publication (AIP);

- NOTAMs/ASHTAMs;

- ATIS/VOLMET;

• International Civil Aviation Organization (ICAO) location indicators and/or WMO synoptic station numbers, particularly for aerodromes or stations that ~~lie~~ lay within and near the area of responsibility.

**COMPETENCY 2: FORECAST ~~AERONAUTICAL~~ METEOROLOGICAL AND/OR OTHER RELEVANT ENVIRONMENTAL PHENOMENA AND PARAMETERS**

**Competency description**

Forecasts of ~~weather~~ meteorological and/or other relevant environmental phenomena and parameters are prepared and issued in accordance with documented requirements, priorities and deadlines.

**Performance criteria**

1. Forecast the following ~~weather~~ meteorological and/or other relevant environmental phenomena and parameters:

 Temperature and relative humidity;

 Wind including temporal and spatial variability (wind shear, directional variability and gusts);

 QNH;

 Cloud (type, amount, height of cloud base and vertical extent);

 Precipitation (type, amount, intensity and temporal variations, onset and cessation or duration) and associated visibility;

 Fog or mist, including onset and cessation or duration, and associated reduced visibility;

 Other types of obscuration, including dust, smoke, haze, sandstorms, dust storms, blowing snow and associated visibility;

 Hazardous ~~weather~~ meteorological and/or other relevant environmental phenomena listed under Competency 3 below;

 Wake vortex advection and dissipation, as required;

2. Ensure that forecasts are prepared and issued in accordance with ICAO Annex 3 to the Convention on International Civil Aviation (hereafter ICAO Annex 3), the *Technical Regulations* (WMO-No. 49), Volume II, regional and national formats, codes and technical regulations on content, accuracy and timeliness;

3. Ensure that forecasts of ~~weather~~ meteorological and/or other relevant environmental phenomena and parameters are consistent (spatially and temporally) across boundaries of the area of responsibility as far as practicable, while maintaining meteorological integrity. This will include monitoring forecasts, warnings and alerts issued for other locations or regions~~, and~~ as well as liaising with adjacent locations or regions as required.

**Background knowledge and skills**

 The formation and dissipation, characteristics, occurrence and effects of fog and other forms of obscuration and low-level cloud, and associated diagnostic and prognostic parameters;

 Formation mechanisms and characteristics of other aeronautical meteorological phenomena, such as dust storms, sandstorms, dust devils and funnel clouds (tornadoes or waterspouts);

 Local topography and its effects on weather, such as gap flows, downslope windstorms, orographic turbulence, sea breezes and upslope fog;

 Ability to interpret all observational products (for example, Aerodrome Routine Meteorological Reports (METAR)) and encode forecast products (for example, Terminal Aerodrome Forecasts (TAF)) into Traditional Alphanumeric Codes (TAC) or other required formats;

 Aerodrome climatology, including frequency of occurrence of significant cloud, thunderstorms, precipitation, strong winds, low-level wind shear, reduced visibility, fog and other phenomena;

 Local forecasting guides and techniques, including diagnostic and prognostic parameters, for forecasting significant cloud, thunderstorms, turbulence, aircraft icing, precipitation, strong winds, low-level wind shear, reduced visibility, fog and other phenomena;

 International, national and local aeronautical forecast, warning and monitoring procedures, directives and instructions;

 Local diagnostic and forecast tools and aeronautical forecast preparation systems, including basic operating system functions, data processing and visualization technologies;

 Relevant ICAO and WMO documents, including ICAO Annex 3, the *Technical Regulations* (WMO-No. 49), Volume II, the *Manual on Codes* (WMO-No. 306) and the ICAO *Manual of Aeronautical Meteorological Practice* (Doc 8896);

 ICAO, WMO and national aeronautical meteorological codes and forms of data representation;

 Aviation user requirements, including:

- The effects on aircraft performance of air density, humidity, icing, low-level wind shear, turbulence and wind, and the meteorological factors related to fuel consumption;

- The requirements for en route wind, temperature and significant weather forecasts and aerodrome forecasts for pre-flight planning and in-flight ~~replanning~~ re-planning;

- Meteorological aspects of flight planning; definitions; procedures for meteorological services for international air navigation; types of meteorological information required for Air Traffic Services (ATS), aerodrome control towers, approach/area control and flight information centres;

- Low-visibility runway operating procedures;

- Effects of unfavourable meteorological and/or other relevant environmental conditions on ~~aeronautical~~ aviation operations, including air traffic disruption, holding and diversions;

- Meteorological effects on aerodrome ground services, such as snow ~~clearing~~ clearance, the effect of wet runways, and the effect of thunderstorms and strong winds on apron operations;

- Aerodrome operating minima, the need for alternates and impacts on fuel consumption;

- Altimeter setting procedures.

**COMPETENCY 3: WARN OF HAZARDOUS METEOROLOGICAL AND/OR OTHER RELEVANT ENVIRONMENTAL PHENOMENA**

**Competency description**

Warnings are issued in a timely manner when hazardous ~~meteorological and other relevant environmental~~ phenomena are occurring, expected to occur or when parameters are expected to reach documented threshold values. They are updated or cancelled according to documented warning criteria.

**Performance criteria**

1. Forecast the following hazardous ~~weather~~ meteorological and/or other relevant environmental phenomena, including spatial extent, onset and cessation, duration, and intensity and its temporal variations:

 Thunderstorms, particularly organized systems, including associated turbulence, in-flight icing, hail, heavy precipitation with poor visibility, electrical phenomena, downburst and microburst or gust front and tornadic activity (funnel cloud as tornado or waterspout);

 Turbulence (moderate or greater) including type (orographic, mechanical, convective and clear air turbulence (CAT));

 Moderate and severe low-level wind shear;

 Aircraft icing (moderate or greater) including accumulation rate (if known), spatial extent, type (rime or opaque, glaze or clear, freezing rain, hoar frost, mixed ice, ingested high-altitude ice crystals);

 Height of cloud base and/or surface visibility below aerodrome minima, affecting take-off, landing and approach procedures;

 Hazardous phenomena affecting aerodromes such as strong surface winds including cross-winds and squalls, frost, freezing precipitation, snowfall, lightning and wake vortices;

 Sandstorms and dust storms;

 Volcanic ash on the basis of observations, reports and/or advisory products;

 Tropical cyclones;

 Radioactive cloud;

2. Ensure that warnings are prepared and issued in accordance with thresholds for hazardous meteorological and other relevant environmental phenomena, and with ICAO Annex 3, *Technical Regulations* (WMO-No. 49), Volume II, regional and national formats, codes, and technical regulations on content, accuracy and timeliness;

3. Ensure that warnings of hazardous ~~weather~~ meteorological and/or other relevant environmental phenomena are consistent (spatially and temporally) across boundaries of the area of responsibility as far as practicable, while maintaining meteorological integrity. This will include monitoring forecasts and warnings issued for other locations and regions~~, and~~ as well as liaising with adjacent locations or regions as required.

**Background knowledge and skills**

 Knowledge of volcanic eruptions, volcanic ash cloud displacement, ~~and~~ dispersion and/or re-suspension;

 Areas of likely volcanic activity, especially within the region of responsibility (for offices with responsibility for issuing volcanic ash advisories and warnings and offices located close to or downwind of volcanoes);

 Meteorological hazards to aviation operations, including thunderstorms and associated phenomena, aircraft icing, turbulence, low-visibility, low-level cloud, tropical cyclones, wind shear and volcanic ash;

 The generation mechanisms of low-level jet streams, boundary layer turbulence and gusts, and their effects on aircraft performance;

 Ability to interpret all observational products (for example, METAR), and encode forecast products (for example, TAF) into TAC or other required formats;

 Aerodrome climatology, including occurrence of significant cloud, thunderstorms, precipitation, strong winds, low-level wind shear, reduced visibility, fog and other phenomena;

 Local forecasting guides and techniques, including diagnostic and prognostic parameters, for forecasting significant cloud, thunderstorms, turbulence, aircraft icing, precipitation, strong winds, low-level wind shear, reduced visibility, fog and other phenomena;

 International, national and local aeronautical forecast, warning and monitoring procedures, directives and instructions;

 Local diagnostic and forecast tools and aeronautical forecast preparation systems, including basic operating system functions, data processing and visualization technologies;

 The significance of warning thresholds on aviation operations, and the ability to describe the likely impact of warnings of hazardous ~~weather~~ meteorological and/or other relevant environmental phenomena on these aviation operations;

 Relevant ICAO and WMO documents, including ICAO Annex 3, the *Technical Regulations* (WMO-No. 49), Volume II, the *Manual on Codes* (WMO-No. 306), and the ICAO *Manual of Aeronautical Meteorological Practice* (Doc 8896);

 ICAO, WMO and national aeronautical meteorological codes and forms of data representation;

 Aviation user requirements, including:

- The effects on aircraft performance of air density, humidity, icing, low-level wind shear, turbulence and wind, and the meteorological factors related to fuel consumption;

- The requirements for en route wind, temperature and significant weather forecasts and aerodrome forecasts for pre-flight planning and in-flight ~~replanning~~ re-planning;

- Meteorological aspects of flight planning; definitions; procedures for meteorological services for international air navigation; types of meteorological information required for ATS, aerodrome control towers, approach and area control, and flight information centres;

- Low-visibility runway operating procedures;

- Effects of unfavourable meteorological and other relevant environmental conditions on ~~aeronautical~~ aviation operations, including air traffic disruption, holding and diversions;

- Meteorological and other environmental effects on aerodrome ground services, such as volcanic ash and snow ~~clearing~~ clearance, the effect of wet runways, and the effect of thunderstorms and strong winds on runway and apron operations;

- Aerodrome operating minima, the need for alternates and impacts on fuel consumption;

- Altimeter setting procedures.

**COMPETENCY 4: ENSURE THE QUALITY OF METEOROLOGICAL AND/OR OTHER RELEVANT ENVIRONMENTAL INFORMATION AND SERVICES SUPPLIED TO USERS**

**Competency description**

The quality of meteorological and/or other relevant environmental forecasts, warnings, alerts and related ~~products~~ services is ensured at the required level by the application of documented quality management processes.

**Performance criteria**

1. Apply the organization’s quality management system and procedures;

2. Assess the impact of known observational error characteristics (for example, bias and achievable accuracy of observations and sensing methods) on forecasts, warnings and alerts;

3. Validate ~~aeronautical~~ meteorological and/or other relevant environmental data and information, ~~products,~~ forecasts, warnings and alerts (timeliness, completeness, accuracy) using real-time checks;

4. Monitor the functioning of operational systems and take remedial actions when necessary.

**Background knowledge and skills**

 International, national and local ~~aeronautical~~ forecast, warning and monitoring procedures, directives and instructions;

 Local diagnostic and forecast tools and ~~aeronautical~~ forecast preparation systems, including basic operating system functions, data processing and visualization technologies;

 Applicable ~~TAF~~ forecast verification ~~system(s)~~ scheme(s) and verification statistics;

 Quality management systems;

 Aviation safety management systems, as required;

 Standards (as defined in ICAO Annex 3 and the *Technical Regulations* (WMO-No. 49), Volume II) and quality management system procedures (as defined in ISO 9001 standards and national regulations):

- Procedures for checking, ~~and~~ identifying and correcting errors and omissions;

- Methods for identifying significant differences between factual and forecast data;

- Knowing when to ignore information and where to go to resolve points of contention;

- Desirable accuracy of forecasts as stipulated in ICAO Annex 3, the *Technical Regulations* (WMO-No. 49), Volume II, and national regulations;

- Priorities and schedules;

- Actions to be taken in the event of recurrent discrepancies, inconsistencies and malfunctions;

- Fall-back procedures in the case of computer or other such system failure;

- Contingency arrangements in case of emergencies such as fire alarms, bomb alerts and natural disasters.

**COMPETENCY 5: COMMUNICATE METEOROLOGICAL AND/OR OTHER RELEVANT ENVIRONMENTAL INFORMATION TO INTERNAL AND EXTERNAL USERS**

**Competency description**

User requirements are fully understood and are addressed by communicating concise and complete forecasts, warnings and alerts in a manner that can be clearly understood by the users.

**Performance criteria**

1. Ensure that all forecasts, warnings and alerts are disseminated through the authorized communication means and channels to designated user groups;

2. Explain[[4]](#footnote-5) ~~aeronautical~~ meteorological and/or other relevant environmental data and information to users in a clear and concise manner using suitable terminology, and provide briefings and consultations that meet specific user needs.

**Background knowledge and skills**

 Ability to carry out a routine, high-quality self-briefing, which may include a shift handover briefing, of the recent and current weather situation, and to integrate all available data to produce a consolidated diagnosis;

 Ability to explain the meteorological and procedural reasons behind a forecast, ~~and~~ warning or alert decision;

 ~~The l~~Likely impact of forecasts of meteorological and/or other relevant environmental parameters and phenomena on aviation operations;

 ~~The u~~Use and interpretation of ~~products~~ information issued by World Area Forecast Centres (WAFCs), Volcanic Ash Advisory Centres (VAACs), Tropical Cyclone Advisory Centres (TCACs) and other designated centres;

 Means of dissemination of ~~aeronautical~~ meteorological data and information to users;

 ~~Local~~ Use of aeronautical meteorological telecommunications.

**REGIONAL VARIATIONS**

 Locally agreed and documented criteria and thresholds;

 The range of ~~weather~~ meteorological and/or other relevant environmental phenomena;

 Risk assessment and estimation of forecast uncertainties;

 Types and use of forecast guidance;

 Designated offices responsible for advice on volcanic ash, tropical cyclones and other phenomena;

 Regional and local regulations;

 Boundaries of forecast areas;

 Extent, scope and exclusions of quality management system implementation;

 Communication language(s);

 Communication technology for forecast, ~~and~~ warning and alert transmission, and for ~~weather~~ flight briefing.

2.2.2 **Aeronautical Meteorological Observer**

**Competency standards**

An aeronautical meteorological observer should be able to perform the tasks specified under the following top-level competency standards.

1. Monitor continually the ~~weather or~~ meteorological and/or other relevant environmental situation;

2. Observe and record ~~aeronautical~~ meteorological ~~or~~ and/or other relevant environmental phenomena and parameters;

3. Ensure the quality of the observing system performance and of meteorological ~~or~~ and/orother relevant environmental information supplied to users;

4. Communicate meteorological ~~or~~ and/orother relevant environmental information to internal and external users.

Notes:

1) Other relevant environmental situation, phenomena, parameters and information in this context may include (but not be limited to) the presence of volcanic ash.

2) An aeronautical meteorological observer in this context may include (but not be limited to) a person with responsibility to provide an aeronautical meteorological service at an aeronautical meteorological station or a State volcano observatory.

**COMPETENCY 1:~~CONTINUALLY MONITOR~~ MONITOR CONTINUALLY THE ~~WEATHER OR~~ METEOROLOGICAL AND/OR OTHER RELEVANT ENVIRONMENTAL SITUATION**

**Competency description**

~~Weather or~~ Meteorological and/or other relevant environmental phenomena and parameters are continually monitored during hours of operation to identify the significant and evolving ~~weather or~~ meteorological and/or other relevant environmental phenomena that are affecting or will likely affect the area of responsibility (typically but not exclusively the aerodrome and its vicinity).

**Performance criterion**

Analyse and describe the current local ~~weather or~~ meteorological and/or other relevant environmental conditions.

**Background knowledge and skills**

 Key characteristics of the troposphere and tropopause;

 Properties of air pressure, temperature, density and water vapour;

 Atmospheric stability, inversions;

 Generation mechanisms of wind;

 Fog and cloud formation and dissipation;

 Precipitation types and intensity;

 The general circulation of the Earth's atmosphere;

 The International Standard Atmosphere (ISA);

 Characteristics, occurrence and effects of meteorological ~~or~~ and/or other relevant environmental hazards to aviation, including but not limited to low cloud, low visibility, thunderstorms and associated phenomena, aircraft icing, freezing precipitation, turbulence, tropical cyclones, wind shear and volcanic ash;

 Interpretation of surface-weather maps, satellite and radar imagery, and seamless prediction systems’ outputs;

 Region-specific ~~weather or~~ meteorological and/or other relevant environmental phenomena and likely weather sequences that are expected to affect the station;

 Nowcasting for severe weather ~~or~~ and/or other relevant environmental phenomena;

 Local topography and climatology, including local reference points;

 ICAO location indicators and WMO synoptic station numbers, particularly for aerodromes and stations that lay within and close to the area of responsibility.

**COMPETENCY 2: OBSERVE AND RECORD ~~AERONAUTICAL~~ METEOROLOGICAL ~~OR~~ AND/OR OTHER RELEVANT ENVIRONMENTAL PHENOMENA AND PARAMETERS**

**Competency description**

Observations of ~~weather or~~ meteorological and/or other relevant environmental phenomena and parameters, and their significant changes, are recorded according to documented thresholds and regulations.

**Performance criteria**

1. As applicable, ~~P~~perform and record routine and non-routine (special) observations of the following:

 Surface wind direction and speed, including spatial and temporal variations;

 Visibility for aeronautical purposes, including spatial and temporal variations;

 Runway visual range (RVR), including spatial and temporal variations;

 Present weather phenomena (as defined in ICAO Annex 3);

 Cloud amount, cloud type and height of cloud base, including spatial and temporal variations;

 Vertical visibility;

 Air temperature and dewpoint temperature;

 Atmospheric pressure; determining QFE and QNH;

 Supplementary information concerning significant meteorological ~~or~~ and/or other environmental conditions, particularly those in the approach and climb-out areas such as wind shear;

2. Interpret ~~weather or~~ meteorological and/or other environmental parameters derived from automatic ~~weather~~ observing systems, such as lidar and weather radar, to ensure that observations remain representative of local conditions when differences occur between automatic sensor technologies and manual observing techniques;

3. Ensure that observations are prepared and issued in accordance with ICAO Annex 3, the *Technical Regulations* (WMO-No. 49), Volume II, regional and national formats, codes and technical regulations on content, representativeness and timeliness.

**Background knowledge and skills**

 Procedures for performing routine and non-routine (special) aeronautical meteorological observations and reports;

 The impact of ~~weather~~ meteorological ~~or~~ and/or other relevant environmental conditions on aircraft performance and airport operations;

 Strengths and weaknesses of manual observations and automatic ~~weather~~ observing systems;

 Observer directives, procedures and instructions;

 Validated sources of ~~weather~~ meteorological ~~or~~ and/or other relevant environmental information;

 Quality management systems;

 Aviation safety management systems, as required;

 Relevant ICAO and WMO documents, including ICAO Annex 3, the *Technical Regulations* (WMO-No. 49), Volume II, the *Manual on Codes* (WMO-No. 306), the ICAO *Manual of Aeronautical Meteorological Practice* (Doc 8896), and the ICAO *Manual on Automatic Meteorological Observing Systems at Aerodromes* (Doc 9837);

 ICAO definitions of relevance to meteorology;

 WMO Traditional Alphanumeric Codes (TAC),~~and~~ national aeronautical meteorological codes and other forms of data representation.

**COMPETENCY 3: ENSURE THE QUALITY OF THE OBSERVING SYSTEM PERFORMANCE AND OF METEOROLOGICAL ~~OR~~ AND/OR OTHER RELEVANT ENVIRONMENTAL INFORMATION SUPPLIED TO USERS**

**Competency description**

The quality of meteorological ~~or~~ and/or other relevant environmental observations is ensured at the required level by the application of documented quality management processes.

**Performance criteria**

1. Apply the organization’s quality management system and procedures;

2. Check and confirm the quality of meteorological or other relevant environmental observations before issuance, including relevance of content, time of validity and location of phenomena;

3. In accordance with prescribed procedures:

 Identify errors and omissions in meteorological ~~or~~and/or other relevant environmental observations;

 Correct and report errors and omissions;

 Make and disseminate corrections in a timely manner.

**Background knowledge and skills**

 Standards (as defined in ICAO Annex 3 and in the Technical Regulations (WMO-No. 49), Volume II) and quality management system procedures (as defined in ISO 9001 standards and national regulations);

 Procedures for checking,~~and~~ identifying and correcting errors and omissions (in automatically- and manually-derived data);

 Methods for identifying significant differences between observational and forecast data;

 Knowing when to ignore information and where to go to resolve points of contention;

 Desirable accuracies of measurement and observation as in ICAO Annex 3, the *Technical Regulations* (WMO-No. 49), Volume II, and national regulations;

 Priority tasks and time constraints;

 Action to be taken in the event of recurrent discrepancies, inconsistencies and malfunctions;

 Fall-back procedures in the case of computer or other such system failure;

 Contingency arrangements in case of emergencies such as fire alarms, bomb alerts and natural disasters.

**COMPETENCY 4: COMMUNICATE METEOROLOGICAL ~~OR~~ AND/OR OTHER RELEVANT ENVIRONMENTAL INFORMATION TO INTERNAL AND EXTERNAL USERS**

**Competency description**

All meteorological ~~or~~ and/or other relevant environmental data and information are concise, complete and communicated in a manner that will be clearly understood by the users.

**Performance criteria**

1. Ensure that all observations are disseminated through the authorized communication means and channels to designated user groups;

2. Present[[5]](#footnote-6) ~~aeronautical~~ meteorological ~~or~~ and/or other relevant environmental data and information in a clear and concise manner using suitable terminology that will be clearly understood by the users;

3. Alert forecasters to observed or imminent significant changes in the ~~weather~~ meteorological ~~or~~ and/or other relevant environmental conditions within the ~~local~~ area of responsibility.

**Background knowledge and skills**

 Knowing how ~~weather~~ meteorological ~~or~~ and/or other relevant environmental information is disseminated within and beyond the ~~aerodrome~~ area of responsibility;

 ~~Local~~ Use of aeronautical meteorological telecommunications;

 ~~Local~~ Air Traffic Service meteorological requirements applicable to the area of responsibility;

 ~~Local f~~Flight planning meteorological requirements applicable to the area of responsibility;

 Specifications related to flight documentation, briefing and consultations applicable to the area of responsibility.

**REGIONAL VARIATIONS**

 The range of significant ~~weather~~ meteorological ~~or~~ and/or other relevant environmental phenomena;

 Extent of automation of observing and sensing systems;

 Thresholds for significant ~~weather~~ changes in meteorological or other relevant environmental conditions;

 Local climatology;

 Extent, scope and exclusions of quality management system implementation;

 Regional regulations;

 Communication language(s);

 Available communication technologies.

2.3 **EDUCATION AND TRAINING PROVIDERS**

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1. https://aviationtraining.wmo.int/ [↑](#footnote-ref-2)
2. [~~http://www.caem.wmo.int/moodle/~~](http://www.caem.wmo.int/moodle/) <https://aviationtraining.wmo.int/> [↑](#footnote-ref-3)
3. "Analysis" may be defined as answering the question "what is happening?", and "diagnosis" as answering "why is it happening?" [↑](#footnote-ref-4)
4. In accordance with any language proficiency requirements stipulated by the national regulator. [↑](#footnote-ref-5)
5. In accordance with any language proficiency requirements stipulated by the national regulator. [↑](#footnote-ref-6)