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Всемирная метеорологическая организация
المنظمة العالمية للأرصاد الجوية
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Ref.: 03370/2025-L9 I/SSU

Our ref.: 03370/2025/I/SSU/Vote-Satellite-Skills-Guidelines 16 April 2025

Annexes: 5

Subject: The preliminary 2025 edition of the "*Guidelines on Satellite Skills and Knowledge for Operational Meteorologists and Specialists in Related Application Areas*" for your review and approval by correspondence

Action required: Submit vote by correspondence by **16 May 2025** to e-voting@wmo.int

Dear Sir/Madam,

I wish to refer to the preliminary 2025 edition of the "*Guidelines on Satellite Skills and Knowledge for Operational Meteorologists and Specialists in Related Application Areas*" for your review and approval.

The Guidelines have been developed by the World Meteorological Organization (WMO) – Coordination Group for Meteorological Satellites (CGMS) Virtual Laboratory for Education and Training in Satellite Meteorology (VLab), to help training centres develop appropriate learning objectives for the satellite-related elements of their courses. The aim of the Guidelines is to support implementation of the WMO Competency Frameworks (*Compendium of WMO Competency Frameworks* (WMO-No. 1209)).

In order to adopt the Guidelines in a timely manner and in advance of the convening of the fourth session of the Commission for Observation, Infrastructure and Information Systems (INFCOM-4), scheduled to take place during the third quarter of 2027, the vote by correspondence is being undertaken further to Rule 4.1.2(2) (a) of the *Rules of Procedure for Technical Commissions* (WMO-No. 1240) regarding the adoption of an amendment by correspondence. This will be particularly important as the Guidelines contribute to the Early Warnings for All (EW4All) initiative.

The vote is for the approval of the revised Guidelines, entitled "*Guidelines on Satellite Skills and Knowledge for Operational Meteorologists and Specialists in Related Application Areas*", as provided in Annex 1.

The preliminary 2025 edition of the "*Guidelines on Satellite Skills and Knowledge for Operational Meteorologists and Specialists in Related Application Areas*" has undergone extensive review by WMO Members. The attached Annex 1 contains the consolidated inputs received during the review process.

I therefore invite the Members of INFCOM to proceed with this vote by correspondence in conformity with the relevant provisions of the articles of the Convention and the General Regulations, including Regulations 53 to 56 and 61 (*Basic Documents No. 1* (WMO-No. 15)) and the Rules of Procedure for Technical Commissions (WMO-No. 1240) Annex VII, an extract of which is provided in Annex 2.

I am enclosing herewith a voting slip (Annex 3) together with an authenticating document (Annex 4) for completion.

To: Permanent Representatives of INFCOM Members with WMO (limited distribution)

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Please be aware of the following guidance in completing the vote:

(1) The voting slip should contain only one selection on the recommendation to approve the revised Guidelines, entitled "*Guidelines on Satellite Skills and Knowledge for Operational Meteorologists and Specialists in Related Application Areas*", as provided in Annex 1.
No other notation, mark or sign revealing the identity of the voter should appear on the voting slip;

(2) The authenticating document must be signed by the Permanent Representative of the Member or a person authorized to sign on behalf of the Permanent Representative and designated as such to the Secretary-General (Regulation 54(b) of the General Regulations (*Basic Documents No. 1* (WMO-No. 15))).
Please note that the absence of the authenticating document will invalidate the individual vote cast;

(3) The vote is to be sent to the Secretary-General by email to: e-voting@wmo.int, not more than 30 days after the date of dispatch of the present letter (Regulation 54(a) of the General Regulations), i.e. not later than **16 May 2025**;

(4) The vote should only be sent from an officially registered email of the Permanent Representative or their designated signatory which has been communicated to the Secretary-General and is reflected in the Secretariat records;

(5) Only votes of Members entitled to vote shall be considered (list attached Annex 5). In this connection, Resolution 37 (Cg-XI) – Suspension of Members for failure to meet financial obligations, stipulates, inter alia, that those Members who have not paid their contributions for more than two consecutive calendar years shall not be entitled to vote in sessions of constituent bodies of the Organization, nor to participate in a vote by correspondence of constituent bodies of the Organization.

I should be greatly obliged if you would return the voting slip and the authenticating document duly completed in conformity with the above-mentioned procedures and practices to the specified email address: e-voting@wmo.int, so that the vote reaches the Secretariat before the final closing date of **16 May 2025**.

In the event of any questions or clarifications on the subject, please contact Ms Zoya Andreeva by email at zandreeva@wmo.int.

Yours faithfully,

Prof. Celeste Saulo
Secretary-General

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Guidelines on Satellite Skills for Operational Meteorologists and Specialists in Related Application Areas

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The WMO–Coordination Group for Meteorological Satellites Virtual Laboratory for Education and Training in Satellite Meteorology Management Group (VLMG) initiated the enabling skills presented in this publication in consultation with the CALMet community in 2013. WMO published the first version of these guidelines in 2017, and updated this publication in 2018 and 2024.

VLMG Co-Chair, Bernadette Connell (Cooperative Institute for Research in the Atmosphere, United States of America), led the work in 2024.

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INTRODUCTION

These guidelines comprise three main sections and describe the enabling skills[1] that support WMO Competency Frameworks (*Compendium of WMO Competency Frameworks* (WMO-No. 1209)) related to the use of satellite data by operational meteorologists[2] and specialists in the provision of climate and agrometeorological services. These guidelines are presented here in WMO SP-12 and also in the Compendium of WMO Competency Frameworks.

The aim of the guidelines is to support implementation of the WMO Competency Frameworks. The first version of the guidelines (published in 2017 and revised in 2018) covered the skills associated with operational meteorology (*Guidelines on Satellite Skills and Knowledge for Operational Meteorologists* (WMO SP-12)). This 2024 version updates the guidelines for operational meteorologists and adds new guidelines for specialists in the provision of climate and agrometeorological services. See the Appendix for a detailed explanation of the changes and additions.

The guidelines were developed by the WMO–Coordination Group for Meteorological Satellites Virtual Laboratory for Education and Training in Satellite Meteorology (VLab), to help training centres develop appropriate learning objectives for the satellite-related elements of their courses. The main users of the guidelines are the training centres and trainers who implement courses to support operational meteorology and related application areas.

This publication provides guidance on the skills necessary to effectively utilize the imagery and products retrieved from various environmental satellites. It can be updated in the future to follow scientific advancements or to reflect adaptations in interpretation techniques.

How to use these guidelines

In this publication, enabling skills are defined as the identification, interpretation and application of satellite data required of operational meteorologists and specialists of climate and agrometeorological services. The order of acquiring the skills may not necessarily follow the structure presented in these guidelines and can be adapted to meet the organization's needs and training approaches.

Trainers and training managers who want to align their materials to the WMO competencies may use these guidelines to develop appropriate learning objectives for the satellite-related elements of their courses. This publication should be used in conjunction with the qualifications found in the *Guide to the Implementation of Education and Training Standards in Meteorology and Hydrology* (WMO-No. 1083), Volume I, and the *WMO Competency Frameworks* (WMO-No. 1209).

Operational meteorologists and specialists of climate and agrometeorological services can use these guidelines to assess their own levels of skills in using satellite data.

This publication covers a wide range of satellite skills. Depending on the job requirements, an individual may use only a subset of these. The background knowledge and skills, and the performance components that support this Skills Framework should be customized by each organization, its service requirements and available satellite data.

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[1] As the skills support the competencies, they have been designated "enabling skills" rather than "competencies".

[2] Although no reference is made to "operational meteorologist" in the WMO Convention, for the purpose of this publication, "operational meteorologist" refers to a person who performs the duties of analysis, diagnosis, prognosis and forecasting of the weather.

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Basic knowledge

It is assumed users of these guidelines have basic knowledge in satellite remote sensing and understand the following:

(a) Satellites include geostationary and low-Earth orbit satellites with passive and active sensing;

(b) Systems, features and phenomena of interest will be dependent on the required forecasting tasks and geographic area of responsibility;

(c) Imagery includes single and multiple channels and combinations of channels, including RGB (red/green/blue) composites, as well as derived products;

(d) Satellite data interpretation is not undertaken in isolation but occurs within the context of all other observations, guidance and situational awareness;

(e) Access, selection, display and manipulation of satellite data;

(f) Characteristics, limitations and possible errors in the satellite data.

1. SATELLITE SKILLS FOR OPERATIONAL METEOROLOGISTS

This section describes the enabling skills that support the WMO Competency Frameworks related to the use of satellite data by operational meteorologists. The skills are as follows:

1. Identify surface features.
2. Identify cloud types and their characteristics.
3. Identify and interpret broad-scale, synoptic and mesoscale systems.
4. Identify and interpret atmospheric phenomena.
5. Identify and interpret oceanic and water features and fields.
6. Compare satellite data with numerical weather prediction (NWP) outputs.

METEOROLOGY SKILL 1: IDENTIFY SURFACE FEATURES

Description

Identify geographical features, surface characteristics and conditions to provide context for interpreting meteorological conditions.

Performance components

1.1 Identify terrain and geographical features:

1.1.1 Discriminate between land, water (oceans, seas, lakes, wetlands, rivers and inlets), and ice (sea ice, glaciers, frozen rivers and lakes).

1.1.2 Distinguish mountainous from low-lying regions.

1.1.3 Differentiate natural versus human-modified areas.

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1.2 Identify surface characteristics and conditions, including dry/wet and vegetated/clear areas:

1.2.1 Identify and monitor land cover (vegetated (forested, grassland or mixed), vegetation-free (bare rock, bare soil or sand) and urban areas).

1.2.2 Identify areas of recent burning.

1.2.3 Identify hotspots (fires, volcanic activity and so forth).

1.2.4 Identify areas of recent volcanic ash cover.

1.2.5 Identify areas of flooding.

1.2.6 Identify areas of drought (indicate favoured source areas for dust storms).

1.2.7 Identify areas of human-induced land degradation/modification and water pollution.

1.3 Identify snow/ice cover and analyse its extent:

1.3.1 Discriminate between cloud, snow, and ice cover.

1.3.2 Identify frozen rivers and lakes; identify ice jams on rivers and lakes.

1.3.3 Identify sea ice, ice floes, and glaciers.

Background knowledge and skills

1.a Ability to apply remote-sensing principles to interpret infrared (including water vapour), visible and microwave data to distinguish surface features.

1.b Ability to select the appropriate multichannel RGB imagery to interpret surface features.

1.c Skill in the use of derived products to monitor drought, flooded areas and fires.

1.d Ability to interpret the surface feature of interest in satellite imagery within the context of the surrounding features, the scale of the image, the time of day, the season, the texture and colour of the feature, animation and other aspects.

1.e Knowledge of how to combine satellite data with other remotely sensed data (for example, from surface and upper air observations, drones and aircraft) and other data products to better interpret and evaluate land surface types and conditions.

METEOROLOGY SKILL 2: IDENTIFY CLOUD TYPES AND THEIR CHARACTERISTICS

Description

Identify cloud types and features, including cloud top height and temperature, thickness and microphysics. These will be used to determine the current and developing meteorological conditions.

Performance components

For each cloud type and feature, select appropriate imagery or derived products to characterize the feature and its location, extent, and stage of evolution, including precursor signatures. Recognize that departures from seasonal and regional representations occur and that some cloud features relate to more than one category. A full analysis or prediction is a higher-level task that involves using all types of available data and guidance. Satellite interpretation contributes to this higher-level task.

2.1 Identify stratiform, cumuliform and cirriform cloud regions and individual cloud types and their characteristics.

2.2 Identify cumulonimbus clouds and their stage of evolution.

2.3 Identify low clouds and fog. .

2.4 Identify contrails and ship trails.

2.5 Assess cloud top heights.

2.6 Identify clouds made of water droplets, ice particles or a mixture.

2.7 Discriminate between clouds with small or large cloud particle sizes.

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Background knowledge and skills

2.a Ability to interpret satellite data characteristics (texture, reflectance, brightness temperature, cloud microphysics, synoptic and mesoscale patterns and so forth) to identify cloud types and their characteristics (thick, thin, multi-layered, top height, developing, decaying and so forth).

2.b Ability to interpret RGB products, lightning products, microphysical parameters, and other derived products to identify clouds composed of different phases and clouds with small or large particle sizes.

2.c Ability to interpret the cloud feature of interest within the context of the surrounding features (the scale of the image, the time of day, the presence of shadows, the season, the texture and colour, animation and other aspects.

METEOROLOGY SKILL 3: IDENTIFY AND INTERPRET BROAD-SCALE, SYNOPTIC AND MESOSCALE SYSTEMS

Description

Identify, locate and interpret broad-scale, synoptic and mesoscale atmospheric systems, their characteristics, strength and stage of evolution, and deduce atmospheric dynamic and thermodynamic properties.

Performance components

For each system, select an appropriate conceptual model to characterize the system, and its orientation, strength and stage of evolution, including precursor signatures. Recognize departures from climatological or idealized models and that some features relate to more than one category.

A full analysis or prediction is a higher-level task that involves using all types of available data guidance and. Satellite interpretation contributes to this higher-level task.

3.1 Identify and locate the following broad-scale systems and features:

3.1.1 Intertropical convergence zones, monsoon and trade wind regimes, organized tropical phenomena (e.g. ENSO, MJO) and equatorial waves.

3.1.2 Westerly regimes with embedded cyclones and anticyclones.

3.1.3 Polar and tropical easterlies and systems.

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3.1.4 Large-scale atmospheric waves.

3.1.5 Zonal, meridional flows, mobile and blocking systems.

3.1.6 Upper- and low-level circulations.

3.1.7 Low-level moisture boundaries.

3.2 Identify and locate the following synoptic-scale systems and features:

3.2.1 Anticyclones.

3.2.2 Cyclones, tropical cyclones and lows, extratropical and polar lows, at upper and lower levels.

3.2.3 Jet streams, convergence and frontal zones, conveyor belts and dry slots.

3.2.4 Troughs, ridges and cols, deformation axes and waves.

3.2.5 Cloud regions – stratiform, stratocumulus, cumulus (cold air versus tradewind), cloud bands, cloud streets and cloud shields.

3.2.6 Cold pools and thermal shear.

3.3 Identify and locate the following mesoscale systems and features:

3.3.1 Local thermal and topographic circulations, including land and sea breezes, katabatic and anabatic winds, foehn winds, mountain waves, banner clouds, island and peninsula effects (including Kármán vortices and V-shaped wave clouds), heat lows and troughs, and lake effect snow.

3.3.2 Convective environments and areas of instability, convective initiation, inhibition and the breakdown of inhibition.

3.3.3 Convective cells and cloud systems (including pulse convection, multicells, supercells, squall lines, mesoscale convective complexes and systems) and associated mesoscale features, including outflow boundaries and storm-top features.

3.3.4 Convergence lines (mesoscale boundaries and interactions, dry lines and cloud streets).

3.3.5 Low-level jets.

3.3.6 Gravity waves and bores.

Background knowledge and skills

3.a Ability to compare satellite imagery, RGB products, and derived temperature, moisture and wind fields with conceptual models to identify atmospheric systems in various stages of evolution.

3.b Knowledge of the Dvorak and other techniques used to deduce tropical system development, intensity and decay.

3.c Knowledge of how satellite lightning products are used to track convective system evolution and intensity changes.

METEOROLOGY SKILL 4: IDENTIFY AND INTERPRET ATMOSPHERIC PHENOMENA

Description

Identify and interpret atmospheric phenomena, their characteristics and stages of evolution to improve the meteorological forecast.

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Performance components

For each phenomenon, locate, identify and determine its characteristics and, when appropriate, its stage of evolution.

A full analysis or prediction is a higher-level task that involves using all types of available data and guidance. Satellite interpretation contributes to this higher-level task.

4.1 Identify and locate the following:

4.1.1 Dust storms and sandstorms, and plumes and areas of raised dust.

4.1.2 Fires and smoke.

4.1.3 Moisture features, precipitation types and amounts.

4.1.4 Volcanic ash particulates, sulfur dioxide (SO_2) and other chemical emissions.

4.1.5 Aerosol and particulate pollution.

4.1.6 Features indicating regions of clear air turbulence.

4.1.7 Features indicating regions conducive to icing.

Background knowledge and skills

Knowledge of how to choose and use satellite imagery, lightning products, RGB products, and other derived products to:

4.a Discriminate between blowing dust/sand, cloud and smoke under conditions of day and night, and over land and water.

4.b Detect fires, their intensity and probable movement.

4.c Distinguish areas of varying moisture content as well as precipitation type and amount (for example, convective, stratiform and deep versus shallow precipitation).

4.d Identify and analyse volcanic emissions to determine the areal extent, height, thickness and temporal evolution of the ash cloud, SO_2 and other constituents.

4.e Identify pollutants and atmospheric constituents.

4.f Identify ozone-rich regions in the middle and upper atmosphere.

4.g Identify clear air turbulence signatures.

METEOROLOGY SKILL 5: IDENTIFY AND INTERPRET OCEANIC AND WATER FEATURES AND FIELDS

Description

Identify and interpret oceanic and water features and fields relevant to meteorological forecasting. Oceanographers would require more extensive skills that are not covered here.

Performance components

5.1 Interpret sea-surface temperature fields and their characteristic broad-scale and mesoscale patterns.

5.2 Interpret sea-surface wind data.

5.3 Identify and interpret sea-state data and relate these to wave height and swell.

5.4 Identify and interpret oil slicks and their evolution.

5.5 Identify and interpret pollution and algal blooms.

5.6 Identify and interpret areas of sun glint and dark zones.

5.7 Identify and interpret sea ice, its extent, movement and characteristics (for example, young and old sea ice, sea ice undergoing ablation and containing melt ponds).

5.8 Identify and interpret ocean currents and eddies and regions of ocean upwelling using sea-surface temperature, wind, wave and sea-surface height.

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Background knowledge and skills

5.a Recognition of sea-surface temperature limitations resulting from cloud cover, diurnal variations of skin surface water temperature and influence of deeper water temperatures.

5.b Recognition of sea-surface wind limitations, including wind direction ambiguities, wind speed inaccuracies and rain effects.

5.c Recognition of sea-state measurement limitations and errors based on active microwave sensors and synthetic aperture radar.

5.d Ability to use microwave sensors, synthetic aperture radar, multispectral imagery and derived products to detect oil slicks, algae and sea ice.

5.e Knowledge of the relationship between sun glint, dark zones, and windy and calm ocean surface conditions.

5.f Ability to distinguish between sun glint and cloud characteristics using satellite imagery, products and animations.

METEOROLOGY SKILL 6: COMPARE SATELLITE DATA WITH NUMERICAL WEATHER PREDICTION (NWP) OUTPUTS

Description

Satellite measurements are one of many inputs to NWP models. They are also used to improve operational weather forecasts by comparing the current atmospheric state with NWP model output. This is accomplished by identifying the differences in location and magnitude of specific weather features identified in NWP outputs and the current satellite imagery. Finally, NWP outputs should be validated and adjusted for the improvement of operational forecasts.

Performance components

6.1 Evaluate basic NWP output fields against satellite data.

6.2 Identify and assess various weather features by integrating satellite, NWP products and other observation data.

6.3 Use satellite data to quantify NWP limitations.

6.4 Use NWP information to enhance understanding of the features shown in the satellite data.

6.5 Use satellite data and products in conjunction with NWP at different stages of the analysis and forecast processes.

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Background knowledge and skills

6.a Basic knowledge of atmospheric dynamics.

6.b Basic knowledge of NWP outputs and their limitations.

6.c Knowledge of the dynamic relationship between satellite data and NWP outputs for diagnosing weather systems and related atmospheric circulations to improve operational forecasts.

2. SATELLITE SKILLS FOR PROVISION OF CLIMATE SERVICES

This section describes the enabling skills for using satellite data that support existing WMO Competency Frameworks on the provision of climate services (listed in the *Compendium of WMO Competency Frameworks* (WMO-No. 1209)), and should be used in parallel with *WMO Guidelines on the Creation of Climate Normals* (WMO-No. 1203).

It is assumed that creating climate data records (CDRs) based on satellite measurements is beyond the capacities of most National Climate Services. Satellite-based CDRs are created and supplied by satellite data providers and other relevant organizations. There may be different satellite-based CDRs available for the same variable. These may come from different providers, be derived from different satellite instruments, combine different satellite instruments, be retrieved using different methods, and are available on different spatial and temporal resolutions. A complete description of the creation of satellite-based CDRs is complex and far beyond the scope of these guidelines.

In this section, CDR refers to a long-term record of satellite data, stable and homogeneous over time. It is assumed all satellite measurements used in the creation of a CDR are calibrated, the algorithms and auxiliary data used in the retrieval of geophysical variables are documented for the entire data record, and uncertainty information is included. It is also assumed that the people working with CDRs know the distinction between real-time satellite data and calibrated satellite CDRs.

The enabling skills to work with satellite-based CDRs are as follows:

1. Choose a suitable satellite product for the climate task.

2. Integrate satellite-based climate data records (CDRs) with data from other sources.

3. Compute climate-related statistics using satellite-derived climate products.

4. Use satellite-based climate data records (CDRs), including climate-related indices, for climate monitoring.

It is assumed that people working with CDRs have the general data manipulation skills required for the tasks, such as: reading different format files, extracting the relevant fields from the data files and choosing a suitable software tool or programming language. Such data manipulation skills are not explained in this publication.

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CLIMATOLOGY SKILL 1: CHOOSE A SUITABLE SATELLITE PRODUCT FOR THE CLIMATE TASK

Description

Globally, sources of satellite-based Climate Data Records (CDRs) are available from different satellite operators. Currently (2024), the terminology associated with the data records from such sources are not consistent. Discussions on consistent terminology are ongoing.

To work with these data records, it is necessary to know where to search for satellite-based CDRs that are suitable for the task. Well-maintained satellite-based CDRs come with a description of the data format characteristics in the form of a product user manual or product guide, as well as a comprehensive description of the algorithms applied to generate CDRs in the form of an algorithm theoretical basis document. It is important for users of satellite-based CDRs to understand this description and be able to judge if a product is suitable for the task.

Performance components

1.1 Determine which satellite products are available for various climate applications and tasks and access the datasets.

1.2 Evaluate the strengths and limitations, including the uncertainty in the measurements of satellite products for various climate applications and tasks.

1.3 Monitor satellite product updates and changes in relation to climate applications and tasks.

Background knowledge and skills

1.a Knowledge of the main sources and databases of available CDRs, including their latest updates, and methods for accessing these data records.

1.b Ability to find and assess relevant information about CDRs, being aware of different terminology, spatial and temporal coverage and resolution, uncertainty and other characteristics.

1.c Ability to recognize uncertainties in satellite-based CDRs to properly use these data records for a specific application. Uncertainty information should be included in the data files or in the product documentation.

1.d Knowledge of the retrieval principles of climate variables and the production of CDRs and how that relates to the application of the data.

CLIMATOLOGY SKILL 2: INTEGRATE SATELLITE-BASED CLIMATE DATA RECORDS (CDRS) WITH DATA FROM OTHER SOURCES

Description

Integrate satellite-based measurements with data from different sources, including reanalysis models, and in-situ measurements. .

Performance components

2.1 Integrate satellite-based climate products with other sources of information in a scientifically and technically sound manner.

2.2 Assess if the geospatial data are on an appropriate grid for the related climate application and task.

Background knowledge and skills

2.a Knowledge of data dependencies particularly where satellite-based climate products use in situ measurements or a reanalysis model as auxiliary data during the retrieval process or where a reanalyses model assimilates satellite-based climate products.

2.b Ability to interpret temporal and spatial product resolution and appropriately apply corrections for sampling issues.

2.c Knowledge of the strengths and limitations of different projections, grids and spatial re-sampling techniques and how manipulating these may impact data quality.

2.d Skill in the use of geospatial visualization and analysis tools (for example, geographic information system (GIS) technology) to integrate data from different measurement sources to produce spatial climate information.

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CLIMATOLOGY SKILL 3: COMPUTE CLIMATE-RELATED STATISTICS USING SATELLITE-DERIVED CLIMATE PRODUCTS

Description

Use satellite-based climate variables to calculate climate-related statistics.

Performance components

3.1 Compute satellite-based climate statistics such as normals (reference values), averages and other statistical information as needed.

3.2 Compute various satellite-based sector-oriented climate products to meet the needs of different end users.

Background knowledge and skills

3.a Knowledge of the CDRs available from providers.

3.b Ability to interpret the CDR documentation and understand the assumptions, strengths and limitations of the underlying satellite retrieval and the effects these have on statistics.

3.c Skill in applying statistical methods, especially for spatial time series and extreme value analysis.

3.d Skill in processing satellite data to ensure accuracy and reliability of climate statistics.

3.e Knowledge of different quality control procedures to filter and ensure accuracy of satellite-derived climate statistics.

3.f Knowledge of the methodologies used to compute climate-related statistics.

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CLIMATOLOGY SKILL 4: USE SATELLITE-BASED CLIMATE DATA RECORDS (CDRS), INCLUDING CLIMATE-RELATED INDICES, FOR CLIMATE MONITORING

Description

Leveraging satellite-based CDRs and derived indices from data providers for comprehensive climate monitoring provides crucial insights to support informed policymaking and decision-making.

Performance components

4.1 Integrate diverse satellite-based CDRs and indices into a cohesive monitoring framework.

4.2 Use global and regional climate indices to monitor climate, climate forecasts and future projections.

4.3 Create spatial maps and visualizations to convey complex climate monitoring information derived from satellite data in a clear and accessible manner.

Background knowledge and skills

4.a Knowledge of statistical methods used to validate and interpret computed climate indices.

4.b Skill in the use of time series analysis to track climate changes over specific periods of time using satellite-derived data.

4.c Ability to apply change detection methods to identify sudden or gradual shifts in satellite-derived climate variables.

4.d Ability to use geospatial visualization and analysis tools (for example, GIS technology) to produce user-specific climate information.

3. SATELLITE SKILLS FOR PROVISION OF AGROMETEOROLOGICAL SERVICES

This section describes the enabling skills for using satellite data that support the existing guidelines for curricula in agricultural meteorology (*Guidelines for the Education and Training of Personnel in Meteorology and Operational Hydrology* (WMO-No. 258), Volume I, Supplement No. 2).

It is assumed that the creation of agrometeorological products based on satellite measurements is beyond the capacities of most National Meteorological and Hydrological Services. Satellite-based agrometeorological products are created and supplied by satellite data providers and other relevant organizations, with agrometeorologists primarily obtaining and analysing these products.

The skills enabling specialists in the provision of agrometeorological services to work with satellite-based agrometeorological data are as follows:

1. Choose a suitable satellite product for the agrometeorological task.

2. Integrate satellite-based agrometeorological data with data from other sources.

3. Monitor land and vegetation type and condition using satellite-derived products and indices.

4. Monitor meteorological parameters in relation to agrometeorological hazards.

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AGROMETEOROLOGY SKILL 1: CHOOSE A SUITABLE SATELLITE PRODUCT FOR THE AGROMETEOROLOGICAL TASK

Description

Identify and access various satellite products that can be used for agrometeorological purposes.

Performance components

1.1 Determine which satellite products are available for various agrometeorological applications and tasks and access the datasets.

1.2 Evaluate the strengths and limitations, including the uncertainty in measuring various satellite products for various agrometeorological applications and tasks.

1.3 Select the appropriate vegetation index/indices for different vegetation types and at different stages of development.

1.4 Monitor for satellite product updates and changes in relation to agrometeorological applications and tasks.

Background knowledge and skills

1.a Knowledge of the parameters that can be derived from satellite data for the agrometeorological task.

1.b Knowledge of the main sources and databases of satellite information for the agrometeorological task, including the latest updates, and methods used to access the datasets.

1.c Knowledge of the retrieval principles of the products used, such as land surface temperature, soil moisture, vegetation indices, precipitation and evapotranspiration.

1.d Knowledge of the potential limitations of satellite observations and products, including quality flags, for the agrometeorological task.

AGROMETEOROLOGY SKILL 2: INTEGRATE SATELLITE-BASED AGROMETEOROLOGICAL DATA WITH DATA FROM OTHER SOURCES

Description

Integrate, analyse and visualize satellite-based agrometeorological data and indices with in situ measurements, models and data from other sources. This allows putting the data in context, enhancing understanding and tailoring information for agricultural monitoring purposes.

Performance components

2.1 Integrate satellite-based agrometeorological products with other data sources (for example, land-use maps or surface-based measurements) in a scientifically and technically robust manner.

2.2 Assess if the geospatial data are on a grid appropriate for the related agrometeorological application and task.

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Background knowledge and skills

2.a Knowledge of the data (for example, NWP and in situ) used to create the various satellite products of interest and an understanding of how this affects the quality of satellite products.

2.b Knowledge of different projections, grids and spatial re-sampling techniques, and an understanding of how manipulating these may affect the data.

2.c Ability to interpret temporal and spatial product resolution and appropriately apply corrections for sampling issues.

2.d Ability to interpret satellite data verification methods which include ground truthing and comparison with station data.

2.e Skill in the use of geospatial visualization and analysis tools (for example, GIS technology) for mapping, analysing and communicating agrometeorological information.

AGROMETEOROLOGY SKILL 3: MONITOR LAND AND VEGETATION TYPE AND CONDITION USING SATELLITE-DERIVED PRODUCTS AND INDICES

Description

Identify land and vegetation type and assess and monitor growth and condition using various satellite-derived products and indices.

Performance components

3.1 Monitor land and vegetation type and extent using satellite-derived products and indices.
3.2 Monitor land and vegetation conditions using satellite products and images.
3.3 Monitor vegetation growth for purposes of agricultural yield prediction and food security monitoring.
3.4 Monitor relevant meteorological parameters (soil moisture, land surface temperature, precipitation, evapotranspiration and so forth).
3.5 Compare vegetation indices and meteorological parameters with climatological records to identify conditions of potential elevated stress to vegetation.

Background knowledge and skills

3.a Ability to use satellite images to identify land surface and vegetation characteristics and conditions.

3.b Knowledge of the relationship between weather conditions and vegetation status, and their impacts on satellite vegetation indices (immediate versus delayed).

3.c Knowledge of the advantages and limitations of using satellite vegetation indices for monitoring vegetation.

3.d Ability to compare time series of vegetation indices and satellite-derived meteorological parameters to detect anomalies.

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AGROMETEOROLOGY SKILL 4: MONITOR METEOROLOGICAL PARAMETERS IN RELATION TO AGROMETEOROLOGICAL HAZARDS

Description

Use satellite-derived indices and products to monitor the duration and extent of agrometeorological hazards. Such hazards include drought, excessive precipitation, fires, frost, and abnormal and extreme temperatures.

Performance components

4.1 Identify drought impact.

4.2 Monitor frost and freezing conditions.

4.3 Monitor soil moisture in relation to agricultural and hydrological hazards, particularly droughts and floods.

4.4 Monitor abnormal and extreme temperatures in relation to agrometeorological hazards.

4.5 Monitor real-time fire conditions and occurrence.

4.6 Monitor for pest and disease impacts on vegetation.

Background knowledge and skills

4.a Knowledge of droughts and other agrometeorological hazards: types, causes, mechanisms of formation and evolution, indicators and impacts on vegetation.

4.b Knowledge of the relationship between satellite-derived vegetation indices and the impacts of agrometeorological hazards, particularly droughts.

4.c Skill in applying change detection methods to identify sudden or gradual shifts in satellite-derived vegetation indices.

4.d Ability to recognize that the impact of a developing hazard may not immediately show on a vegetation index, and a hazard may be more appropriately identified by meteorological parameters.

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APPENDIX. REVISION HISTORY OF THE GUIDELINES

This appendix provides further details on the changes and additions made to the guidelines first published in 2017, revised in 2018 and updated in 2024.

2024

This edition replaces the 2018 publication of the *Guidelines on Satellite Skills and Knowledge for Operational Meteorologists* (WMO SP-12). It now comprises three main sections that describe the enabling skills for: (1) operational meteorologists (legacy), (2) specialists in the provision of climate services (new) and (3) specialists in the provision of agrometeorological services (new). The latter two sections have been added at the request of VLab members.

Updates to section 1. Satellite skills for operational meteorologists

"Skill 5: Interpret derived fields and derived products" has been removed as it was felt this was incorporated in the remaining skills. When the satellite skills were first drafted over 10 years ago, single and multi-image combination products were commonly used. With new satellites and a tremendous growth in multichannel, multisensor and multiobservation products, there is no longer a need to have this as a separate skill. The remaining skills have been renumbered as:

1. Identify surface features.

2. Identify cloud types and their characteristics.

3. Identify and interpret broad-scale, synoptic and mesoscale systems.

4. Identify and interpret atmospheric phenomena.

5. Identify and interpret oceanic and water features and fields.

6. Compare satellite data with numerical weather prediction (NWP) outputs.

Performance components have been added as follows:

1.2.7 Identify areas of human-induced land degradation/modification and water pollution.

4.1.7 Features indicating regions conducive to icing.

Several skill descriptions have been rewritten to enhance clarity and include additional aspects. The "Skills, techniques and knowledge requirements" sections have been renamed as "Background knowledge and skills" to better reflect their purpose. In a few background sections, components have been combined.

Trainers are encouraged to include satellite skills and performance components with course or workshop descriptions and on certificates provided for the course or workshop. To minimize effort in renumbering and relabelling the satellite skills addressed by training materials that use older editions of SP-12, it is recommended to add the edition date to past and new materials and a link to the SP-12 publication in the WMO e-Library. This is especially important in reference to the renumbered, deleted and new skills and performance components. Although it will not be possible to adjust certificates that have already been issued, existing web pages should be updated. It is recommended to include the top skill regularly and for special topic training, include performance components as appropriate.

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Example text referencing top skills and targeted performance components from the 2018 edition

This training supported the following satellite skills and performance components listed in the *Guidelines on Satellite Skills and Knowledge for Operational Meteorologists* (2018 edition):

Skill 2: Identify cloud types and their characteristics.
Skill 3.2.3: Jet streams, convergence and frontal zones, conveyor belts, dry slots.
Skill 5: Interpret derived fields and derived products.
Skill 6: Identify and interpret oceanic and water features and fields.

Example text referencing top skills and targeted performance components from the 2024 edition

This training supported the following satellite skills and performance components listed in the *Guidelines on Satellite Skills for Operational Meteorologists and Specialists in Related Application Areas* (2024 edition):

Meteorology Skill 2.1: Identify stratiform, cumuliform and cirriform cloud regions and individual cloud types and their characteristics.
Meteorology Skill 6.5: Use satellite data and products in conjunction with NWP at different stages of the analysis and forecast processes.
Climatology Skill 1: Choose a suitable satellite product for the climate task.
Climatology Skill 4.2: Use global and regional climate indices to monitor climate, climate forecasts and future projections.

2018

The 2017 version of the *Guidelines on Satellite Skills and Knowledge for Operational Meteorologists* (WMO SP-12) was revised in 2018. It was included under section 1 in the *Compendium of WMO Competency Frameworks* (WMO-No. 1209), published in 2019. To have a consistent reference structure, the skills were organized under a number system instead of the previous number / letter / roman number structure. This allows easy referencing of skills when used in course descriptions and on certificates.

Additions to this version included Skill 7 and other performance components listed below, as well as updates to various "Skills, techniques and knowledge requirements" sections:

Skill 7: Compare satellite data with numerical weather prediction (NWP) outputs.

Performance components:

1.2.6 Identify areas of drought.

1.3.3 Identify sea ice.

3.1.7 Low-level moisture boundaries.

3.3.2 Convective environments and areas of instability, convective initiation, inhibition and the breakdown of inhibition.

6.5 Identify and interpret pollution (including runoff and algal blooms).

2017

The *Guidelines on Satellite Skills and Knowledge for Operational Meteorologists* were first published as WMO SP-12. They included six skills:

1. Identify surface features.
2. Identify cloud types and their characteristics.
3. Identify and interpret broad-scale, synoptic and mesoscale systems.
4. Identify and interpret atmospheric phenomena.
5. Interpret derived fields and derived products.
6. Identify and interpret oceanic features and systems.

Ref.: 03370/2025-L9 I/SSU

Ref.: 03370/2025-L9 VSU

REFERENCES

World Meteorological Organization (WMO). *Guidelines for the Education and Training of Personnel in Meteorology and Operational Hydrology* (WMO-No. 258), Volume I, Supplement No. 2. Geneva, 2009.

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World Meteorological Organization (WMO). *WMO Guidelines on the Creation of Climate Normals* (WMO-No. 1203). Geneva, 2017.

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World Meteorological Organization (WMO). *Compendium of WMO Competency Frameworks* (WMO-No. 1209). Geneva, 2019.

World Meteorological Organization (WMO). *Guide to the Implementation of Education and Training Standards in Meteorology and Hydrology* (WMO-No. 1083), Volume I – Meteorology. Geneva, 2023.

Ref.: 03370/2025-1.9 SSU

EXTRACTS OF RELEVANT WMO REGULATIONS AND RULES GOVERNING VOTE BY CORRESPONDENCE FOR NON-REGULATORY GUIDELINES

General Regulations of the World Meteorological Organization	
Regulation 48	Between sessions any question within the terms of reference of a constituent body which, in the opinion of its president, could be solved by correspondence, may be submitted to a vote by correspondence subject to the following provisions: (a) A vote by correspondence by Members of the Organization, when Congress is not in session, shall be taken only on matters which are not reserved in the Convention for decision by Congress in session and Articles 11 and 12 of the Convention shall apply in any such vote by correspondence; (b) In a vote by correspondence by members of the Executive Council, Article 16 of the Convention shall apply; (c) In a vote by correspondence, upon a proposal before a commission, the votes shall be cast by the Permanent Representatives of the Members represented on the commission.
Regulation 49	Votes by correspondence, other than an election, shall be preceded by an exchange of opinion in the following cases: (a) If the president of the constituent body so decides; (b) If any of those entitled to vote requests such action within 30 days of the date of dispatch of the request to vote; (c) If the question put to the vote falls within one of the following categories: (i) Questions leading to changes in the Technical Regulations; (ii) Questions affecting the Organization's programme; (iii) Questions affecting the relations between the Organization and another intergovernmental body or an organization with which WMO has defined its relations; (iv) Proposals whose implementation, if they are accepted, would call for extensive or costly action on the part of Members. In the case of a commission the exchange of opinion shall be between the Members represented on the commission.
Regulation 50	The president of a constituent body, when requesting opinions in accordance with Regulation 49, shall present any available information for and against the proposal; suggest, whenever appropriate, a date for implementation of the proposal if it is adopted; and indicate a time limit for the receipt of comments on the proposal.
Regulation 51	(a) If any comments received in response to the action taken in accordance with Regulation 50 specifically request modifications of the proposal circulated by the president of the constituent body, the latter shall initiate a second circular to all Members or members entitled to vote informing them of each of the proposed modifications and other comments and requesting each Member or member to indicate, within 45 days of the date of dispatch of this second circular, whether that Member or member:

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General Regulations of the World Meteorological Organization	
	(i) Supports the adoption of the original proposal without change; (ii) In the case of each proposed modification, supports or opposes that modification; (iii) Prefers that a decision upon the original proposal should be deferred until the next session of the constituent body; (b) In the light of the replies received the president of the constituent body shall decide whether to proceed with the vote by correspondence or to defer further action until the next session of the constituent body; (c) If the president of the constituent body decides to proceed with the vote by correspondence, the president shall prepare an appropriate draft resolution or recommendation and shall arrange for the Secretary-General to conduct the vote by correspondence upon it. No proposal or amendment of the draft resolution or recommendation being voted upon shall be receivable from any Member or member until after the close of the ballot.
Regulation 52	Any proposal submitted to a vote by correspondence shall be arranged so that independent questions are voted on separately.
Regulation 53	The provisions applicable to a vote by correspondence shall be those in force on the date of dispatch of the request to vote.
Regulation 54	A vote, in any vote by correspondence, including an election, shall be valid only if the voting slip or electronic vote: (a) Is received by the Secretary-General not more than 30 days after the date of dispatch of the request to vote; (b) In the case of Members, the voting slip has been signed on behalf of the Minister for Foreign Affairs of the Member or, in the case of those matters to which the provisions of Regulation 5 apply, by the Permanent Representative of the Member or a person authorized to sign on behalf of the Permanent Representative and designated as such to the Secretary-General. (c) In the case of Members, the electronic vote is submitted by the Permanent Representative authorized as the normal channel of communication, or the Permanent Representative's designate, to vote. The Secretary-General shall determine whether a voting slip or electronic vote is valid or not.
Regulation 55	(a) Except in commissions, the quorum for voting by correspondence within a constituent body shall equal the quorum required for a meeting of that body; (b) The quorum for voting by correspondence within commissions shall be a majority of the number of Members represented on that commission; (c) If the number of replies received by the Secretary-General during the 30-day period referred to in Regulation 54 does not reach the quorum required for voting by correspondence, the motion shall be considered as lost.

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General Regulations of the World Meteorological Organization	
Regulation 56	All votes by correspondence, including elections, shall be conducted by the Secretary-General. At least two senior officials of the Secretariat shall be designated by the Secretary-General to check and count the voting slips or electronic votes received. A statement certifying the results of the ballot shall be established and signed by these officials after such a count. The voting slips or results of the electronic voting shall be retained by the Secretary-General for a period of 180 days after the close of the ballot and then destroyed.
Regulation 57	The president of a constituent body shall cancel a vote by correspondence in any of the following cases: (a) If the vote was not preceded by an exchange of opinion and a request is received to have an exchange of opinion in accordance with Regulation 49 (b); or (b) In case of election between sessions, if any of the persons on the final list of candidates withdraws or is no longer eligible for the office. In these cases, the voting slips or electronic votes received in response to the letter of the request to vote shall be considered null and void.
Regulation 58	The rules as given in Regulations 44 to 46 and 77 to 91 are not applicable in the case of votes conducted by correspondence.
Regulation 59	The president of a constituent body may approve a proposal on behalf of that body, without a vote by correspondence, under the following conditions: (a) When presenting the proposal to the constituent body, the president shall have indicated the intention to do so provided that no objection is expressed; (b) A period of 90 days from the date of the issue of the circular letter presenting the proposal shall have been allowed for replies; (c) No objection shall have been received within that 90-day period from any of those entitled to vote.
Regulation 60	Any decision of a constituent body adopted by a vote by correspondence shall have for all purposes of the Organization the same force, effect and status as if it had been adopted by the constituent body in session, and any provision of the Convention or these Regulations applicable to a decision adopted in session shall be equally applicable to a decision adopted by a vote by correspondence.
Regulation 61	(a) Except in votes by correspondence by the Executive Council, the result of a vote by correspondence in the form of the numbers of votes cast for and against and the number of abstentions shall be communicated to all Members invited to participate in the vote; (b) A list showing the votes of individual Members shall be sent to any Member, on request, provided such a request is received within 180 days of the close of the ballot and unless two or more Members invited to participate in the vote have requested, before the voting terminates, that this information not be communicated.

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Rules of Procedure for Technical Commissions

Annex VII. Procedures for amending the Technical Regulations (WMO-No. 49), their annexes, guides and other corresponding non-regulatory publications

1. INTRODUCTION

1.1 The present procedures describe the steps involved in drafting, evaluating and approving amendments to the Technical Regulations (WMO-No. 49) and the manuals which are annexes to the *Technical Regulations*, guides and other corresponding non-regulatory publications.

1.2 An amendment, in the context of these procedures, is any revision of the content of a publication, the addition of a new publication or the discontinuation of an existing publication. Purely editorial modifications that do not change the meaning of the content of a publication may be carried out by the Secretariat at its discretion and are not discussed herein.

2. INITIAL STEPS

Submission of the initial request

2.1 An initial request for an amendment is submitted to the Secretariat by a Member or an expert of a technical commission.

Assessment of the initial request

2.2 The initial request is assessed by the Secretariat in consultation with the chair of a relevant standing committee or study group respective technical commission to determine whether an amendment is warranted. If it is determined that an amendment is not warranted, no further action is taken.

3. DRAFTING OF THE PROPOSAL FOR AN AMENDMENT BY THE RESPONSIBLE BODY

3.1 If it is determined that an amendment is warranted, the request is sent to the responsible body standing committee or study group. If the subject of the request does not fall under the responsibility of existing bodies of a technical commission, the request should be considered by the Management Group of the commission, which should decide how to address such a request.

3.2 The responsible body (standing committee or study group) shall draft the proposal for the amendment following the principles defined in the General Provisions (paragraph 13) to the Technical Regulations, the *Guidelines on the Preparation and Promulgation of the WMO Technical Regulations* (WMO-No. 1127) and appropriate WMO editorial procedures and in consultation with other WMO bodies and technical experts, as needed.

3.3 The proposal for the amendment shall, at a minimum, contain the following information:

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Rules of Procedure for Technical Commissions

Annex VII. Procedures for amending the Technical Regulations (WMO-No. 49), their annexes, guides and other corresponding non-regulatory publications

(1) Title and, as applicable, WMO number, relevant volume, part, section, regulation, provision, paragraph or other such subdivision of the publication to which the amendment applies,

(2) Details of the amendment,

(3) Rationale for the amendment,

(4) Originator of the initial request.

3.4 The proposal should also include the following information:

(1) Expected impact of the amendment on Members, users of services, other international organizations and other WMO regulatory publications,

(2) Confirmation or estimate of the number of Members with the ability to support and follow the proposed amendment (principle 13(a) in General Provisions) to validate the proposal for standard practice (requiring strong majority of Members),

(3) Names of WMO Members and WMO bodies, including subsidiary bodies of constituent bodies, that were consulted during, or assisted with, the drafting of the proposal,

(4) Proposed implementation date, that is, the date on which the amendment will become effective,

(5) Validation information, where applicable. If the amendment concerns changes that may impact automated processing systems, these changes should be tested using at least two independently developed tool sets and two independent centres, and the resulting validation information should be included with the proposal.

3.5 All related proposals should be combined into one comprehensive proposal.

4. APPROVAL OF THE PROPOSALS FOR AN AMENDMENT

After a proposal for an amendment is drafted, the Secretariat administers its submission for approval. The principal methods for approving a proposal for an amendment are the standard approval procedure and the fast-track approval procedure.

4.1 Standard approval procedure

4.1.1 The standard approval procedure is the default procedure used to approve a proposal for an amendment to the *Technical Regulations* (WMO-No. 49) and the manuals which are annexes to the Technical Regulations, guides and other corresponding non-regulatory publications.

4.1.2 The steps involved in the standard approval procedure are the following:

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Rules of Procedure for Technical Commissions

Annex VII. Procedures for amending the Technical Regulations (WMO-No. 49), their annexes, guides and other corresponding non-regulatory publications

(1) The relevant technical commission management group shall consider the proposal for an amendment in consultation with other bodies, as needed, and either request that the proposal be further revised by the responsible body or submit the proposal to the full technical commission.

(2) The technical commission shall consider the proposal for an amendment at a session or by correspondence and either request that the proposal be further revised by the responsible body or carry out one of the following actions:

(a) If the proposal for an amendment concerns a guide or another corresponding non-regulatory publication, the commission shall normally adopt such amendment at a session or by correspondence. If a member of the commission considers that publication is not purely technical, at the request of that member the adoption of the publication may be referred to the Executive Council. The commission, at a session or by correspondence, may decide to delegate to the president approval of guides and other corresponding non-regulatory publications, in consultation with the management group of that commission and with other relevant bodies, as needed.

(b) If the proposal for an amendment concerns the *Technical Regulations* (WMO-No. 49), the commission shall recommend it for adoption by the Congress or by the Executive Council in case the new regulation needs to be implemented before the next session of Congress (according to General Provisions paragraph 15).

(c) If the proposal for an amendment concerns annexes to the *Technical Regulations*, the commission shall recommend it for adoption by the Executive Council, unless there is a Congress request to submit specific amendments to Congress.

(3) The Secretariat shall distribute a WMO circular letter to Members informing them of the proposal for the amendment with an indication of new obligations for Members, if any.

(4) Congress or the Executive Council shall consider the recommendation of a technical commission and either adopt it or request that the proposal be further revised by the commission.

4.2 Fast-track approval procedure

4.2.1 The fast-track approval procedure, as authorized by the Executive Council (Resolution 12 (EC-68) and Resolution 9 (EC-69)), is applicable to the updating of certain components (designated as technical specifications) of the following manuals: *Manual on Codes* (WMO-No. 306), *Manual on the Global Telecommunication System* (WMO-No. 386), *Manual on the WMO Integrated Processing and Prediction System* (WMO-No. 485), *Manual on the WMO Information System* (WMO-No. 1060), and *Manual on the WMO Integrated Global Observing System* (WMO-No. 1160).

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Rules of Procedure for Technical Commissions

Annex VII. Procedures for amending the Technical Regulations (WMO-No. 49), their annexes, guides and other corresponding non-regulatory publications

4.2.2 The fast-track approval procedure may also be applied to guides and other corresponding non-regulatory publications, authorized by the technical commission concerned.

4.2.3 The list of technical specifications, guides and other corresponding non-regulatory publications is made available to Members along with designated focal points or national authorities used for the fast-track approval procedure.

4.2.4 The fast-track approval procedure is normally carried out twice a year.

4.2.5 The steps involved in the fast-track approval procedure are the following:

(1) The Chair of the relevant standing committee shall examine the proposal for an amendment in consultation with other bodies and with the Secretariat, as needed. The Chair shall either request that the proposal be further revised by the responsible body or submit the proposal to the designated focal points or other such designated national authorities with technical competence in the relevant area for their review.

(2) Once the proposal for an amendment has been submitted to them, the designated focal points or other such designated national authorities with technical competence in the relevant area shall have two months to provide comments. After all comments received have been addressed, the proposal for an amendment shall be submitted to the president of the relevant technical commission.

(3) The president of the relevant technical commission shall consider the proposal for an amendment in consultation with the management group of that technical commission, the president of the other technical commission and the Secretariat, as needed, and shall either request that the proposal be further revised by the responsible body or carry out one of the following actions:

(a) If the proposal for an amendment concerns a guide or another corresponding non-regulatory publication, the president of the relevant technical commission shall approve the amendment, at which point it shall be considered to be adopted.

(b) If the proposal for an amendment concerns a manual which is an annex to the *Technical Regulations* (WMO-No. 49), the president of the relevant technical commission shall approve the proposal for submission to the President of WMO.

(4) The President of WMO shall consider the proposal for an amendment to one of the manuals which are annexes to the *Technical Regulations* (WMO-No. 49) and shall either request that the proposal be further revised by the responsible body or, on behalf of the Executive Council, approve the amendment for adoption.

(5) Upon approval of the proposal for an amendment by the President of WMO, the amendment shall be considered to be adopted, and the Secretariat shall notify the Members of its adoption and of its implementation date.

Rules of Procedure for Technical Commissions

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4.3 Variations on the standard and fast-track approval procedures

The steps outlined in 4.1 and 4.2 above are the steps customarily followed for the standard approval procedure and the fast-track approval procedure, respectively. In exceptional circumstances, alternative steps are permitted. See the General Regulations in *Basic Documents No. 1* (WMO-No. 15) and the *Guidelines on the Preparation and Promulgation of the WMO Technical Regulations* (WMO-No. 1127) for further information.

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Ref:: 03370/2025-L9 I/SSU

GUIDELINES ON SATELLITE SKILLS AND KNOWLEDGE FOR OPERATIONAL METEOROLOGISTS AND SPECIALISTS IN RELATED APPLICATION AREAS

(En/Zh/Fr/Es/Ru/Ar)

ENGLISH	CHINESE	FRENCH	SPANISH	RUSSIAN	ARABIC
Infrastructure Commission recommends to its Members to approve the revised Guidelines, entitled *Guidelines on Satellite Skills and Knowledge for Operational Meteorologists and Specialists in Related Application Areas*	基础设施委员会建议其会员批准经修订《指导方针》（题为《业务气象人员及相关应用领域专家卫星技能与知识指导方针》）。	L'INFCOM recommande à ses Membres d'approuver la version révisée des *Directives sur les aptitudes et connaissances en matière de satellites des météorologues des services d'exploitation et des spécialistes des domaines d'application connexes*	La Comisión de Infraestructura recomienda a sus Miembros la aprobación de la versión revisada de las directrices sobre aptitudes y conocimientos satelitales para meteorólogos operativos y especialistas en esferas de aplicación conexas	Комиссия по инфраструктуре рекомендует своим Членам утвердить пересмотренные Руководящие принципы под названием *Руководящие принципы по навыкам и знаниям в области использования спутниковых данных для оперативных метеорологов и специалистов в смежных прикладных областях*	توصي لجنة البنية التحتية أعضاءها بالموافقة على المبادئ التوجيهية المنقحة المعنونة *"المبادئ التوجيهية بشأن المهارات والمعارف الساتلية اللازمة لأخصائيي الأرصاد الجوية التطبيقيين والأخصائيين في مجالات التطبيق ذات الصلة"*

Yes 是 Oui Sí Да نعم	No 否 Non No Нет لا	Abstention 弃权 Abstention Abstención Воздерживаюсь امتناع
☐	☐	☐

Ref.: 03370/2025-L.9/SSU

AUTHENTICATING DOCUMENT

Name: .....

Title/Function: .....

Signature: .....

Authorized to vote for Minister for Foreign Affairs* or Permanent Representative of Member with WMO* in conformity with the provisions of Regulation 54(b) of the WMO General Regulations (*Basic Documents No. 1* (WMO-No. 15)).

*delete if not applicable

Signed at (Place): ..... Date: .....

_____

Ref.: 03370/2025-L9 ISSU

LIST OF MEMBERS OF INFCOM ELIGIBLE TO PARTICIPATE IN GUIDELINES VOTE BY CORRESPONDENCE

Algeria
Argentina
Armenia
Australia
Austria
Bangladesh
Barbados
Belarus
Belgium
Benin
Bhutan
Bosnia and Herzegovina
Botswana
Brazil
British Caribbean Territories
Brunei Darussalam
Bulgaria
Burkina Faso
Cameroon
Canada
Chile
China
Colombia
Côte d'Ivoire
Croatia
Czechia
Denmark
Ecuador
Egypt
Estonia
Ethiopia
Fiji
Finland

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France
Gambia (The)
Germany
Greece
Guyana
Hong Kong, China
Hungary
Iceland
India
Indonesia
Iraq
Ireland
Israel
Italy
Jamaica
Japan
Jordan
Kazakhstan
Kenya
Kuwait
Lao People's Democratic Republic
Latvia
Libya (State of)
Luxembourg
Macao, China
Malaysia
Maldives*
Mali
Mauritania
Mauritius
Mexico
Mongolia
Morocco
Namibia
Nauru
Nepal
Netherlands (Kingdom of the)
New Zealand

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Nicaragua
Nigeria
North Macedonia
Norway
Oman
Panama
Paraguay
Peru
Philippines
Poland
Portugal
Qatar
Republic of Korea
Republic of Moldova
Romania
Russian Federation
Samoa
Saudi Arabia
Senegal
Serbia
Seychelles
Singapore
Slovakia
Slovenia
South Africa
Spain
Sri Lanka
Sweden
Switzerland
Thailand
Togo
Tonga
Trinidad and Tobago
Tunisia
Türkiye
Uganda
Ukraine
United Arab Emirates

United Kingdom of Great Britain and Northern Ireland
United Republic of Tanzania
United States of America
Uruguay
Uzbekistan
Vanuatu
Viet Nam
Zambia
Zimbabwe

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* Pending the designation of a new Permanent Representative of the Maldives with WMO, the letter is addressed to the Permanent Mission of the Republic of Maldives to the United Nations Office and other international organizations in Geneva

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