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| WEATHER CLIMATE WATER | **World Meteorological Organization****COMMISSION FOR OBSERVATION, INFRASTRUCTURE AND INFORMATION SYSTEMS****Third Session**15 to 19 April 2024, Geneva | **INFCOM-3/Doc. 8.4(1)** |
| Submitted by:Chair of SC-ESMP8.IV.2024**DRAFT 2** |

**AGENDA ITEM 8: TECHNICAL DECISIONS**

**AGENDA ITEM 8.4: WMO Integrated Processing and Prediction System**

# Amendments to the Manual on the WMO Integrated Processing and Prediction System (WMO-No. 485)

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| **Summary** |
| **Document presented by:** Chair of the Standing Committee on Data-Processing for Applied Earth System Modelling and Prediction (SC-ESMP)**Strategic objective 2024–2027:** 2.3 Enable access to and use of numerical analysis and Earth system prediction products at all temporal and spatial scales from the WMO Integrated Processing and Prediction System**Financial and administrative implications:** Within the parameters of the Strategic and Operating Plans 2024–2027.**Key implementers:** INFCOM and WIPPS Designated Centres**Time frame:** 2024–2027**Action expected:** Review the three proposed draft recommendations |

# GENERAL CONSIDERATIONS

### Introduction

1. The Commission for Observation, Infrastructure and Information Systems (INFCOM) proposed the amendments to the *Manual on the WMO Integrated Processing and Prediction System (WIPPS)* (WMO-No. 485) to evolve WIPPS considering the needs of WMO Members as the follow up of the WMO Unified Data Policy, UN Early Warnings for All initiative and others. Since there are many amendments, they are proposed by three recommendations relevant to weather prediction, climate prediction, and water and related environmental prediction.
2. The first [draft Recommendation 8.4(1)/1](#firstRec) for weather prediction includes the proposed amendments to the Manual and the Centre designation mainly regarding the WIPPS activities for short to medium-range numerical weather prediction. This recommendation also includes the proposed amendments on the general framework of WIPPS.
3. The second [draft Recommendation 8.4(1)/2](#seondRec) for climate prediction includes the proposed amendments to the Manual and the Centre designation mainly regarding the WIPPS activities for sub-seasonal through seasonal to annual to decadal prediction.
4. The third [draft Recommendation 8.4(1)/3](#thirdRec) for water and related environmental prediction includes the proposed amendments to the Manual and the Centre designation mainly regarding other WIPPS activities that are not captured in the first two recommendations, especially those for environmental emergency responses and prediction and ocean-related predictions.

**Expected action**

1. Based on the above, the INFCOM may wish to adopt draft Recommendations 8.4(1)/1–3 (INFCOM-3) along the following lines.

# DRAFT RECOMMENDATIONS

## Draft Recommendation 8.4(1)/1 (INFCOM-3)

### Amendments to the *Manual on the WMO Integrated Processing and Prediction [Secretariat] System* (WMO-No. 485) for weather prediction

THE COMMISSION FOR OBSERVATION, INFRASTRUCTURE AND INFORMATION SYSTEMS,

**Recalling**:

1. [Resolution 18 (EC-69)](https://library.wmo.int/viewer/55618/?offset=3#page=154&viewer=picture&o=bookmark&n=0&q=) – Revised *Manual on the Global Data-processing and Forecasting System* (WMO-No. 485),
2. [Resolution 1 (Cg-Ext(2021))](https://library.wmo.int/viewer/57850/?offset=2#page=9&viewer=picture&o=bookmark&n=0&q=) – WMO Unified Policy for the International Exchange of Earth System Data,
3. [Resolution 1 (SERCOM-2)](https://library.wmo.int/viewer/39647/?offset=1#page=13&viewer=picture&o=bookmark&n=0&q=) – Updates to the *Manual on the Global Data-processing and Forecasting System* (WMO-No. 485) proposed by the SERCOM standing committees,
4. [Recommendation 23 (INFCOM-2)](https://library.wmo.int/viewer/66287/?offset=1#page=1027&viewer=picture&o=bookmark&n=0&q=) – Seamless Global Data-processing and Forecasting System Roadmap with the new name of the Global Data-processing and Forecasting System,
5. [Recommendation 24 (INFCOM-2)](https://library.wmo.int/viewer/66287?viewer=picture#page=1030&viewer=picture&o=bookmark&n=0&q=) – Amendments to the *Manual on the Global Data-processing and Forecasting System* (WMO-No. 485) in alignment with the WMO Unified Data Policy,
6. [Resolution 27 (Cg-19)](https://library.wmo.int/viewer/67177/?offset=1#page=264&viewer=picture&o=bookmark&n=0&q=) – Amendments to the *Manual on the Global Data-processing and Forecasting System* (WMO-No. 485) in alignment with WMO Unified Data Policy,
7. [Decision 7(2)/1 (SERCOM-3)](https://meetings.wmo.int/SERCOM-3/English/2.%20PROVISIONAL%20REPORT%20%28Approved%20documents%29/SERCOM-3-d07%282%29-COLLABORATION-WITH-INFCOM-approved_en.docx?d=w0519bb4900db45bab2239ec5c613be4f) - Proposed amendments to the WIPPS Manual on Tropical Cyclone parameters,

**Reaffirming:**

1. That the WMO Unified Data Policy states that core data shall be provided on a free and unrestricted basis, which is necessary for the provision of services in support of the protection of life,
2. That the mandatory products of Regional Specialized Meteorological Centres (RSMCs) for global deterministic Numerical Weather Prediction (NWP) and global ensemble NWP are considered as core data in the [*Manual on the WMO Integrated Processing and Prediction System*](https://library.wmo.int/idurl/4/35703) (WMO-No. 485), Annex IV to the WMO Technical Regulations,

**Recognizing** that the name of WMO Integrated Processing and Prediction System (WIPPS) was introduced to replace the Global Data-processing and Prediction System (GDPFS) in the [*Technical Regulations*](https://library.wmo.int/records/item/35722-technical-regulations?offset=3) (WMO-No. 49), Volume I-General Meteorological Standards and Recommended Practices, the [*Manual on the WMO Integrated Processing and Prediction System*](https://library.wmo.int/idurl/4/35703) (WMO-No. 485) and the [*Guide to WMO Integrated Processing and Prediction System*](https://library.wmo.int/idurl/4/28978) (WMO‑No. 305),

**Noting:**

1. That the Standing Committee on Data-Processing for Applied Earth System Modelling and Prediction (SC-ESMP) further updated the list of the mandatory and recommended products of RSMCs for numerical weather prediction, in consideration of the outcomes of the GDPFS Symposium on Requirements for NWP Data and Products (August 2022; Geneva, Switzerland),
2. That the WMO Congress requested INFCOM to provide clear definitions on “mandatory products” and “highly recommended products” in the Manual on WIPPS,
3. That SERCOM invited INFCOM to consider the appropriateness of the name of “RSMC” as a generic name for regional centres in all Earth system domains,
4. That SC-ESMP started to review and update the standardized verification methods of deterministic and ensemble NWP products in consideration of the newly proposed mandatory products as reported in [INFCOM-3/INF.8.4(1a)](https://meetings.wmo.int/INFCOM-3/InformationDocuments/INFCOM-3-INF08-4%281a%29-REVIEW-OF-VERIFICATION-METHODS-FOR-NWP-DATA_en.docx?d=w15f6a282cab940cfb163a65fad32cea0),
5. That SC-ESMP initiated the first cycle of the compliance review of WIPPS Centres and completed the review of the compliance of RSMCs for global deterministic and ensemble NWP as reported in [draft](https://meetings.wmo.int/INFCOM-3/English/Forms/AllItems.aspx) [Decision 2/1 (INFCOM-3)](https://meetings.wmo.int/INFCOM-3/English/Forms/AllItems.aspx) – Report of the president of the Commission including the reports of the chairs of subsidiary bodies,
6. That SC-ESMP assessed the technical capabilities of Centres applying for the designation of the WIPPS Centres,

**Acknowledging** that SC-ESMP Expert Team on Operational Weather Forecasting System (ET‑OWFS) developed a list of NWP products of tropical low/cyclone vortex variables in close collaboration with Advisory Group on Tropical Cyclones under the Commission for Weather, Climate, Hydrological, Marine, and Related Environmental Services and Applications (SERCOM) and World Weather Research Programme (WWRP) Project Tropical Cyclone-Probabilistic Forecast Products (TC-PFP),

**Having examined** the following draft amendments to the [*Manual on WMO Integrated Processing and Prediction System*](https://library.wmo.int/idurl/4/35703) (WMO-No. 485). that the Standing Committee on Data-Processing for Applied Earth System Modelling and Prediction (SC-ESMP) have proposed:

1. The introduction of the definition of three activity categories of general-purpose activity, specialized activity, and non-real-time activity, as per [Annex 1](#Annex1_to_DResolution) to the draft Resolution ##/1 (EC-78),
2. The change of the generic name of designated centres of WIPPS from “Regional Specialized Meteorological Centre (RSMC)” and “RSMC Network” to “WMO Integrated Processing and Prediction System (WIPPS) Designated Centre (WIPPS-DC)” and “WIPPS Centre Network”, respectively, while “RSMC” is kept as another name of “WIPPS-DC”, as per [Annex 1](#Annex1_to_DResolution) to the draft Resolution ##/1 (EC-78),
3. The unification of the terminologies of “highly recommended products”, “additional recommended products” and “additional highly recommended products” into “recommended products”,
4. The introduction of the definition of “mandatory products” and “recommended products”, as per [Annex 1](#Annex1_to_DResolution) to the draft Resolution ##/1 (EC-78),
5. The revised list of mandatory and recommended products of RSMCs for global deterministic NWP including those of tropical low/cyclone vortex variables, as per [Annex 2](#Annex2_to_DResolution) to the draft Resolution ##/1 (EC-78),
6. The revised list of mandatory and recommended products of RSMCs for global ensemble NWP including those of tropical low/cyclone vortex variables, as per [Annex 3](#Annex3_to_DResolution) to the draft Resolution ##/1 (EC-78),
7. The classification of the mandatory products of RSMCs for limited-area deterministic and ensemble NWP as “core data”, as per [Annex 4](#Annex4_to_DResolution) to the draft Resolution ##/1 (EC-78),
8. The revised list of mandatory and recommended products of RSMCs for limited-area deterministic NWP, as per [Annex 5](#Annex5_to_DResolution) to the draft Resolution ##/1 (EC-78),
9. The revised list of mandatory and recommended products of RSMCs for limited-area ensemble NWP, as per [Annex 6](#Annex6_to_DResolution) to the draft Resolution ##/1 (EC-78),

**Having further examined** the designation of the WIPPS Centre Washington as an RSMC for global ensemble NWP and their inclusion in Part III of the [*Manual on the WMO Integrated Processing and Prediction System*](https://library.wmo.int/idurl/4/35703) (WMO-No. 485),

**Recommends** to the Executive Council the adoption of the amendments to the [*Manual on the WMO Integrated Processing and Prediction System*](https://library.wmo.int/idurl/4/35703)(WMO-No. 485) throughthe draft resolution provided in the [annex](#_Annex_to_draft_3) to the present recommendation.

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[Annex: 1](#Annex_to_draft_Recommendation)

Note: This recommendation replaces [Recommendation 23 (INFCOM-2)](https://library.wmo.int/viewer/66287/?offset=1#page=1027&viewer=picture&o=bookmark&n=0&q=) – Seamless Global Data-processing and Forecasting System Roadmap with the new name of the Global Data-processing and Forecasting System, which is no longer in force.

## Annex to draft Recommendation 8.4(1)/1 (INFCOM-3)

**Draft Resolution ##/1 (EC-78)**

### Amendments to the Manual on the WMO Integrated Processing and Prediction *[Secretariat]* System (WMO-NO. 485) for weather prediction

THE EXECUTIVE COUNCIL,

**Recalling**:

1. [Resolution 18 (EC-69)](https://library.wmo.int/viewer/55618/?offset=3#page=154&viewer=picture&o=bookmark&n=0&q=) – Revised Manual on the Global Data-processing and Forecasting System (WMO-No. 485),
2. [Resolution 1 (Cg-Ext(2021))](https://library.wmo.int/viewer/57850/?offset=2#page=9&viewer=picture&o=bookmark&n=0&q=) – WMO Unified Policy for the International Exchange of Earth System Data,
3. [Resolution 27 (Cg-19)](https://library.wmo.int/viewer/67177/?offset=1#page=264&viewer=picture&o=bookmark&n=0&q=) – Amendments to the Manual on the Global Data-processing and Forecasting System (WMO-No. 485) in alignment with WMO Unified Data Policy,

**Having examined** Recommendation 8.4/1(1) (INFCOM-3) - Amendments to the *[Manual on the WMO Integrated Processing and Prediction [Secretariat] System](https://library.wmo.int/idurl/4/35703)* (WMO-No. 485) for weather prediction,

**Considering** that “Regional Specialized Meteorological Centre (RSMC)” and “RSMC Network” are used in the [*Technical Regulations*](https://library.wmo.int/idurl/4/35631) (WMO-No. 49), Manuals and Guides,

**Having agreed**:

1. The amendments to the [*Manual on the WMO Integrated Processing and Prediction System*](https://library.wmo.int/idurl/4/35703) (WMO-No. 485) to unify the terminologies of “recommended products” and those as provided in the Annexes 1 to 6 to the present resolution except the Centre designation, with effect from 1 March 2025,
2. The amendments to the [*Manual on the WMO Integrated Processing and Prediction System*](https://library.wmo.int/idurl/4/35703) (WMO-No. 485) relevant to the designation of the WIPPS Centre Washington as a Regional Specialized Meteorological Centre (RSMC) for global ensemble numerical weather prediction (NWP), with the effective from 1 September 2024,

**Encourages** Members hosting RSMCs for global deterministic NWP, global ensemble NWP, limited-area deterministic NWP and limited-area ensemble NWP to produce and make available all the mandatory products and, if possible, recommended products as soon as possible, but not later than 1 March 2025;

**Further encourages** Members to seek the designation of RSMCs conducting limited-area deterministic and ensemble NWP to cover the areas where the existing RSMCs for limited-area NWP do not cover;

**Requests** INFCOM:

1. To review and update the standardized verification methods of deterministic and ensemble NWP products in consideration with the updated mandatory products of RSMCs for global deterministic and ensemble NWP;
2. To provide guidance to Members hosting RSMCs for global deterministic NWP, global ensemble NWP, limited-area deterministic NWP and limited-area ensemble NWP to make their NWP products available on WIS 2.0;

**Authorizes** the Secretary-General, in consultation with the president of INFCOM;

1. To make editorial amendments to the [*Manual on WMO Integrated Processing and Prediction System*](https://library.wmo.int/idurl/4/35703) (WMO-No. 485) including those relevant to the replacement of the terminologies of “recommended products”;
2. To replace “Regional Specialized Meteorological Centre (RSMC)” and “RSMC Network” with “WMO Integrated Processing and Prediction System (WIPPS) Designated Centre (WIPPS-DC)” and “WIPPS Centre Network”, respectively, as necessary in WMO publications including the [*Technical Regulations*](https://library.wmo.int/idurl/4/35631) (WMO-No. 49), Manuals and Guides.

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[Annexes: 3](#Annex1_to_DResolution)

See [INFCOM-3/INF. 8.4(1a)](https://meetings.wmo.int/INFCOM-3/InformationDocuments/INFCOM-3-INF08-4%281a%29-REVIEW-OF-VERIFICATION-METHODS-FOR-NWP-DATA_en.docx?d=w15f6a282cab940cfb163a65fad32cea0) for more information.

## Annex 1 to draft Resolution ##/1 (EC-78)

*[Proposed amendments are highlighted in addition or ~~deletion~~ to the Manual on the WMO Integrated Processing and Prediction System (WMO-No. 485) and the numbering of the text below refers to the Manual.]*

Part I. Outline of the WMO Integrated Processing and Prediction System

1.1 Purpose and supported activities

1.1.1 General description

1.1.1.1 WIPPS shall be the worldwide network of operational centres operated by WMO Members. Its purpose shall be to make operationally available among WMO Members and relevant operational organizations defined products and services for applications related to weather, climate, water and environment.

1.1.1.2 WIPPS shall enable scientific and technological advances made in meteorology and related fields to be accessible and exploitable by WMO Members.

1.1.1.3 The activities, organizational structure and operations of WIPPS shall be systematically designed in accordance with Members’ needs and their ability to contribute to, and benefit from, the system in an efficient manner and with a minimum of duplication.

1.1.1.4 A key objective of WIPPS should be to facilitate cooperation and the exchange of information, thereby also contributing to capacity development among developing countries.

1.1.1.5 Defined products and services for applications related to weather, climate, water and environment shall include:

(a) Numerical weather, oceanographic and climate prediction products (analysis and forecast, including probabilistic information);

(b) Specialized products tailored for specific applications.

1.1.1.6 Additional information necessary for an appropriate use of the identified products and services shall be available. This includes non‑real‑time information as follows:

(a) Systems description and characteristics;

(b) Product metadata;

(c) Verification and monitoring results.

1.1.2 Activities supported by the WMO Integrated Processing and Prediction System

1.1.2.1 Through WIPPS, Members shall provide and have access to meteorological, hydrological, oceanographic and climatological information supporting a range of operational activities.

1.1.2.2 WIPPS shall be organized as a ~~three‑tier~~ system ~~of activities~~ with three activity categories as follows:

(a) General‑purpose activities are those that provide real-time analyses and predictions required for a wide range of end use,

(b) Specialized activities are those that make forecasting products, which may include guidance based on human interpretation, tailored for a specific type of application or user community,

(c) Non‑real‑time activities are those that, while not providing real-time forecasts, do provide additional information needed for appropriate use of WIPPS, such as verification of WIPPS products.

Note: ~~A distinction is made between general‑purpose and specialized activities: general‑purpose activities are those that encompass essential data-processing required for a wide range of end use, while specialized activities are those that make forecasting products, which may include guidance based on human interpretation, tailored for a specific type of application or user community. In addition to these activities conducted in real time, non‑real‑time operational coordination activities are also part of WIPPS.~~ Associated commitments and other appropriate details are specified in Part II.

1.1.2.3 WIPPS shall be organized with the activities as follows:

(a) General-purpose activities:

– Global deterministic NWP

– Limited‑area deterministic NWP

– Global ensemble NWP

– Limited‑area ensemble NWP

– Global numerical sub‑seasonal forecasts (SSFs)

– Global numerical long‑range prediction

– Annual to decadal climate prediction

– Numerical ocean wave prediction

– Global numerical ocean prediction

– Nowcasting

– Sub-seasonal to seasonal hydrological prediction

– Snow cover prediction

(b) Specialized activities:

– Regional climate prediction and monitoring

– Coordination of multi‑model ensembles for sub‑seasonal forecasts

– Coordination of multi‑model ensemble prediction for long‑range forecasts (LRFs)

– Coordination of annual to decadal climate prediction

– Regional severe weather forecasting

– Tropical cyclone forecasting, including marine‑related hazards

– Nuclear environmental emergency response

– Non‑nuclear environmental emergency response

– Atmospheric sand and dust storm forecasts

– Volcano watch services for international air navigation

– Marine meteorological services

– Marine environmental emergency response

– Flash flood forecasting

(c) Non‑real‑time ~~coordination~~ activities:

– Coordination of deterministic NWP verification (DNV)

– Coordination of Ensemble Prediction System (EPS) verification

– Coordination of wave forecast verification (WFV)

– Coordination of tropical cyclone forecast verification (TCFV)

– Coordination of observation monitoring

Note: It is hoped that other activities, including those related to hydrology, agriculture, polar regions, storm‑surge prediction, and space weather, will be developed in future.

1.2 WMO Integrated Processing and Prediction System Centres

1.2.1 Definitions

1.2.1.1 The meteorological forecasting ranges shall be those defined in Appendix 1.1.

1.2.1.2 WIPPS shall be organized as a three-level system of World Meteorological Centres (WMCs), WIPPS Designated Centres (WIPPS-DC) ~~Regional Specialized Meteorological Centres (RSMCs)~~ and National Meteorological Centres (NMCs), which carry out WIPPS functions at the global, regional and national levels, respectively. These centres are referred to as WIPPS centres.

1.2.2 National Meteorological Centres

1.2.2.1 An NMC shall carry out functions to meet the national and international requirements of the Member concerned.

Note: To fulfil their national and international obligations, NMCs need to be adequately staffed and equipped to enable them to participate effectively in the World Weather Watch system.

1.2.2.2 The functions of an NMC shall include the preparation of forecasts and warnings at all forecasting ranges necessary to meet the requirements of the Member.

1.2.2.3 Depending on the context, other activities of an NMC should include the production of:

(a) Special‑application products, including climate and environmental quality monitoring and prediction products;

(b) Non‑real‑time climate‑related products.

1.2.3 WMO Integrated Processing and Prediction System Designated Centres ~~Regional Specialized Meteorological Centres~~

1.2.3.1 A Member, having accepted the responsibility for providing a~~n~~ WIPPS Designated Centre (WIPPS-DC)~~RSMC~~, shall arrange for this centre to carry out operationally at least one of the ~~general‑purpose or specialized~~ activities listed in 1.1.2.3~~2~~, for which specified standards are described in Part II.

1.2.3.2 A~~n~~ WIPPS-DC~~RSMC~~ for general‑purpose activities should provide products that a~~n~~ WIPPS-DC~~RSMC~~ carrying out at least one of the specialized activities considers necessary and makes a request to produce.

1.2.3.3 Defined products of a WIPPS-DC shall be categorized as mandatory products and recommended products defined as follows:

(a) Mandatory products shall be the products that the WIPPS-DC is required to produce and provide to fulfil its obligation as a WIPPS-DC. The list of mandatory products shall be defined in the Manual.

(b) Recommended products shall be the products that, while not mandatory, the WIPPS-DC is strongly encouraged to provide to support other WIPPS-DCs and Members. The list of recommended products shall be defined in the Manual.

1.2.3.4 Products that are necessary for the provision of services in support of the protection of life and property and for the well-being of all nations and are classified as “core data” shall be labelled as “core data” explicitly in the Manual.

Notes:

1. A WIPPS-DC can be also referred to as a Regional Specialized Meteorological Centre (RSMC) as appropriate.

2. The designation a~~s~~ WIPPS-DC~~RSMC~~ does not preclude the use of other names as defined in other contexts, for example, Global Producing Centre for Long‑range Forecasts (GPC‑LRF).

3~~2~~. A ~~s~~ WIPPS-DC~~RSMC~~ that leads a coordination activity is also referred to as a Lead Centre.

4. The definition of core data is described in the WMO Unified Data Policy, Resolution 1 (Cg-Ext. (2021)).

1.2.4 World Meteorological Centres

A Member, having accepted the responsibility for providing a WMC, shall arrange for this centre to carry out operationally at least the following activities, for which specified standards are described in Part II:

(a) Global deterministic NWP;

(b) Global ensemble NWP;

(c) Global numerical long-range prediction.

1.2.5 WMO Integrated Processing and Prediction System ~~Regional Specialized Meteorological~~ Centre Networks

1.2.5.1 A~~n~~ WIPPS Centre ~~RSMC~~ Network (an association of WIPPS-DCs~~RSMCs~~ participating in an identified activity of WIPPS) shall follow the same specifications and adhere to the same criteria and commitments as individual WIPPS-DCs~~RSMCs~~ carrying out the same activity.

1.2.5.2 Appropriate documentation shall be produced and made available by Members having accepted the responsibility to contribute to the WIPPS Centre ~~RSMC~~ Network to distribute the tasks and responsibilities among the participating WIPPS-DCs~~RSMCs~~. A unique focal point shall be designated to answer requests from users of the WIPPS Centre ~~RSMC~~ Network products.

1.2.6 Designation process

1.2.6.1 Each Member shall designate an NMC.

1.2.6.2 The WMCs, WIPPS-DCs~~RSMCs~~ and WIPPS Centre ~~RSMC~~ Networks shall be designated by a decision of the World Meteorological Congress or the WMO Executive Council. The designation of such centres shall include the specification of the activity and function (or activities and functions) to be carried out.

1.2.6.3 Requests for designation as a WMC or WIPPS-DC~~RSMC~~ shall be put forward by the Permanent Representative of the Member of the candidate centre, or, in the case of international organizations, by either the Permanent Representative of the country where the candidate centre is located or the president of the relevant regional association(s) (RA(s)).

Note: The Permanent Representative of the Member consults with the Hydrological Adviser with respect to requests for designation as a centre relevant to operational hydrology and its application to water management, as per Regulation 5 of General Regulations, ( Basic documents(WMO-No. 15)).

1.2.6.4 Requests for designation as an WIPPS Centre ~~RSMC~~ Network shall be put forward by the president of the relevant RA, or, in the case of networks established across two or more RAs, jointly by their presidents.

Note: Centres constituting a network will organize themselves as appropriate, depending on their own context and specificities, so as to ensure that the documentation requested as per paragraph 1.2.5.2 is available.

1.2.6.5 Requests for designation shall be addressed to the WMO Secretariat, which will forward them to the relevant constituent bodies as indicated in Tables 2–29 in Part II of the present Manual. Supporting information demonstrating compliance with designation criteria shall be included with the request.

1.2.6.6 Depending on the type of activity, endorsement by the RA(s) and technical commission(s) should be required before designation by the World Meteorological Congress or WMO Executive Council.

1.3 Coordination with other systems or programmes

WIPPS shall support all WMO Programmes and related programmes of other international organizations in accordance with decisions of the Organization.

Notes:

1. In many cases the activities undertaken by WIPPS centres constitute the operational component of a system developed under another structure or programme, either by WMO on its own or jointly with other international organizations. In such cases the regulations pertaining to these activities cover both:

(a) The specific requirements defined by the relevant structure;

(b) The general WIPPS criteria regarding operational quality and reliability, verification, documentation and compliance (described in Part II of the present Manual).

2. Coordination mechanisms appropriate for the context and characteristics of the various categories of activity are specified in Part II.

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## Annex 2 to draft Resolution ##/1 (EC-78)

*[Proposed amendments are highlighted in addition or ~~deletion~~ to the Manual on the WMO Integrated Processing and Prediction System (WMO-No. 485) and the numbering of the text below refers to the Manual.]*

appendix 2.2.1. Mandatory and ~~HIGHLY~~recommended global deterministic numerical weather prediction products to be made available on the WMO Information System

1. NWP gridded *[Secretariat]* products

Mandatory products:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Level (hPa) | Resolution | Forecast range | Time steps | Frequency |
| Geopotential height | 850/500/250/200 | ~~1.5~~0.5°× ~~1.5~~0.5° | Up to 3 days/Beyond 3 days up to 6 days | Every ~~6~~3 hours/Every ~~12~~6 hours | Twice a day ~~(0000 and 1200 UTC)/Once a day~~ |
| Temperature | 850/500/250/200 |
|  |  |
| Wind zonal velocity (u) and meridional velocity (v) | 925/850/700/500/250/200 |
| Relative humidity | 850/700/500/200 |
| ~~Divergence, vorticity~~ | ~~925/700/250~~ |
| Mean sea level pressure (MSLP)2-m temperature2-m minimum and maximum temperatures in the periods of the last 3/6 hours2-m dewpoint temperature10-m u, 10-m v10-m wind gusts1 Total precipitationTotal solid precipitation2CAPE3Total precipitable waterTotal cloud cover | Surface |

Notes:

1. Wind gusts are the maximum gusts in the periods of the last 3/6 hours.
2. Water equivalent of total solid precipitation, where possible, is the combination of snow and graupel (ice pellets).
3. Recommended most unstable CAPE (MUCAPE). RSMC is required to provide information on which type of CAPE is provided in the model characteristics web page.

~~Additional~~ ~~r~~Recommended products:

~~– Tropical storm tracks (latitudinal/longitudinal locations, maximum sustained wind speed, MSLP).~~

– More fields describing precipitation type

– Mid-level CAPE

– 1-hour accumulated total precipitation

– Snow depth

– Divergence and vorticity (925/850/700/500/250/200 hPa)

– Downward solar radiation at surface

– Outgoing longwave radiation at the top of atmosphere

– Heatwave Index

– Wind u and v at additional heights of 80 m, 100 m, 120 m, or 150 m above ground

– Option to access high-resolution data (up to full model resolution).

– Provide data additionally in form of map layers, graphics, or visualization.

2. Tropical low/cyclone vortex variables

Vortices of tropical cyclones that exist at analysis time or form in the forecast time range should be tracked and included in the parameter file. In this context, tropical cyclone is a generic term for a non-frontal synoptic scale low pressure system which has a cyclone wind circulation. The recommended criteria can be found in the guidelines. If a track has a fix at analysis time and can be associated with an analysis position from RSMCs for tropical cyclone forecasting, then the track shall have the RSMCs identifier and name (if it is named).

**Mandatory Products:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Parameter* | *Unit* | *Forecast range* | *Time steps* | *Frequency* |
| Location (latitude and longitude) of the vortex centre | [degree] | Up to 6 days 3 | Every 6 hours | Twice a day4 |
| Maximum sustained 10 m wind speed | [m/s] |
| Location1 (latitude and longitude) of maximum sustained 10 m wind | [degree] |
| Minimum mean sea level pressure (MSLP) | [hPa] |
| Quadrant radii of sustained 10 m winds of 28/34/502/64 kt  | [km] |

Notes:

1. Recommended procedures to calculate the location of maximum wind is provided at section x.x.x of the Guide to WIPPS (WMO-No. 305).
2. The Centre can provide the quadrant radii for 48kt winds instead of the quadrant radii for 50kt winds.
3. Beyond about 6 days users are highly recommended to use ensemble data and only to use the deterministic as an additional ensemble member. *[SERCOM]*
4. It is strongly recommended to provide all mandatory products four times a day or more frequently.

**Recommended Products:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Parameter* | *Unit* | *Forecast range* | *Time steps* | *Frequency* |
| Average steering wind zonal velocity (u) and meridional velocity (v)1 at 850/500/200 hPa | [m/s] | Up to 6 days2 | Every 6 hours | Twice a day3 |

Note:

1. Recommended procedures to calculate average steering wind is provided at section x.x.x of the [*Guide to WIPPS*](https://library.wmo.int/idurl/4/28978) (WMO-No. 305)
2. Beyond about 6 days, users are recommended to use ensemble data and only to use the deterministic as an additional ensemble member.
3. It is strongly recommended to provide all recommended products four times a day or more frequently.

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Appendix 2.2.2. Characteristics of global deterministic numerical weather prediction systems

1. System

– System name (version):

– Date of implementation:

2. Configuration

– Horizontal resolution of the model, with indication of grid spacing in km:

– Number of model levels:

– Top of model:

– Forecast length and forecast step interval:

– Runs per day (times in UTC):

– Is model coupled to ocean, wave, sea‑ice models? Specify which models:

– Integration time step:

– Additional comments:

3. Initial conditions

– Data assimilation method:

– Additional comments:

4. Surface boundary conditions

– Sea‑surface temperature? If yes, briefly describe method(s):

– Land‑surface analysis? If yes, briefly describe method(s):

– Additional comments:

5. Other details of model

– What kind of soil scheme is in use?

– How are radiations parameterized?

– What kind of large‑scale dynamics is in use (for example, grid‑point semi‑Lagrangian)? Hydrostatic or non‑hydrostatic?

– What kind of boundary layer parameterization is in use?

– What kind of convection parameterization is in use?

– What cloud scheme is in use?

– Other relevant details?

6. Products

– Method of the calculation of mandatory and recommended products, especially those of tropical low/cyclone vortex, if the method is not unique:

- Definition of tropical cyclone in numerical model output:

– Other detailed specifications, if necessary:

~~6~~7. Further information

– Operational contact point:

– URLs for system documentation:

– URL for list of products:

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## Annex 3 to draft Resolution ##/1 (EC-78)

*[Proposed amendments are highlighted in addition or ~~deletion~~ to the Manual on the WMO Integrated Processing and Prediction System (WMO-No. 485) and the numbering of the text below refers to the Manual.]*

Appendix 2.2.5. Mandatory and ~~HIGHLY~~recommended global Ensemble Prediction System products to be made available on the WMO Information System

1. NWP gridded *[Secretariat]* products

Mandatory products:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Level ~~(hPa)~~ | Thresholds 1 | Resolution(lat/lon grid) | Forecast range | Time steps | Frequency |
| Probability of total precipitation in the last 6 hours and 24 hours | Surface | 1, 5, 10, 25, 50 and 100 mm/24 hours;1, 5, 10, 25 and 50 mm/6 hours | ~~1.5~~0.5° × ~~1.5~~0.5° | ~~10~~14 days (or the maximum range if less) | ~~Every 12hours~~Every 3 hours to 72 hours, then every 6 hours. | ~~Once~~Twice a day  |
| Percentiles for total precipitation in the last 6 hours and 24 hours | Surface | 25th, 50th, 75th, max |
| Percentiles for total solid precipitation 2 in the last 6 hours | Surface | 25th, 50th, 75th, max |
| Percentiles for temperature | 2 m, 850 hPa | min, 25th, 50th, 75th, max |
| Probability of 10‑m sustained wind ~~and gusts~~  | ~~Surface~~10 m | 10, 15, 20 and 25 m s–1 |
| Probability of 10-m wind gusts 3 | 10 m | 15, 25 and 35 m s–1 |
| Percentiles for 10-m wind speed | 10 m,850 hPa, 250 hPa | min, 25th, 50th, 75th, max |
| Percentiles for 10‑m wind gusts 3 | 10 m | min, 25th, 50th, 75th, max |
| Percentiles for CAPE4 | Surface | 25th, 50th, 75th, max |
| Percentiles for magnitude of wind shear | Vector difference between 250 and 850 hPaVector difference between 700 and 925 hPa | min, 25th, 50th, 75th, max |
| Percentiles for total cloud cover | Surface | min, 25th, 50th, 75th, max |
| ~~Probability of temperature anomalies~~ | ~~850~~ | ~~±1, ±1.5, ±2 standard deviations with respect to a reanalysis climatology specified by the Producing Centre~~ |
| Ensemble mean + spread (standard deviation) of geopotential height | 500 hPa |  |
| Ensemble mean + spread (standard deviation) of mean sea level pressure (MSLP) | Surface |  |
| ~~Ensemble mean + spread (standard deviation) of wind speed~~ | ~~850/250~~ |  |

Notes:

1. The maximum and minimum percentiles should be represented by an extreme percentile. The most appropriate percentile depends on the configuration of the NWP model and any post-processing and is to be chosen by the Producing Centre;
2. Water equivalent of total solid precipitation, where possible, is the combination of snow and graupel (ice pellets);
3. Wind gusts are the maximum gusts in the periods of the last 3/6 hours;
4. Recommended most unstable CAPE (MUCAPE). RSMC is required to provide information on which type of CAPE is provided in the model characteristics web page.

~~Additional highly r~~Recommended products:

– Location specific time series of temperature, precipitation, wind speed, depicting the most likely solution and an estimation of uncertainty (“EPSgrams”); the definition, method of calculation and the locations should be documented;

~~– Tropical storm tracks (latitude/longitude locations, maximum sustained wind speed, MSLP from EPS members).~~

– Provide data additionally in form of high-resolution map layers, graphics, or visualization.

– Option to access high-resolution data (up to full model resolution)

– Options to access additional percentile values and probability thresholds

– Option to access all ensemble members

– Probability of temperature anomalies, at 850 hPa, for ±1, ±1.5, ±2 standard deviations with respect to a reanalysis climatology specified by the Producing Centre

– Percentiles of the following variables:

* Mid-level CAPE
* 1-hour or 3-hour accumulated total precipitation
* Snow depth, Snow Water Equivalent (SWE)
* Heat wave index
* Wind u and v at additional heights 80 m, 100 m, 120 m or 150 m above ground

2. Tropical low/cyclone vortex variables

Vortices for significant tropical systems that exist at analysis time or form in the forecast time range should be tracked and included in the parameter file. If a track has a fix at analysis time and can be associated with an analysis position from RSMCs for tropical cyclone forecasting, then the track should have the RSMCs identifier and name (if named).

The Centre is requested to produce the following listed parameters from all ensemble members of the global ensemble system.

**Mandatory Products:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Parameter* | *Unit* | *Forecast range* | *Time steps* | *Frequency* |
| Location (latitude and longitude) of the vortex centre | [degree] | 14 days(or the maximum range if less) | Every 6 hours | Twice a day3 |
| Maximum sustained 10 m wind speed | [m/s] |
| Location1 (latitude and longitude) of maximum sustained 10 m wind | [degree] |
| Minimum mean sea level pressure (MSLP) | [hPa] |
| Quadrant radii of sustained 10 m-winds of 28/34/502/64 kt  | [km] |

Notes:

1. Recommended procedures to calculate the location of maximum wind is provided at section x.x.x of the [*Guide to WIPPS*](https://library.wmo.int/idurl/4/28978) (WMO-No. 305);
2. The Centre can provide the quadrant radii for 48kt winds instead of the quadrant radii for 50kt winds;
3. It is strongly recommended to provide all mandatory products four times a day or more frequently.

**Recommended Products:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Parameter* | *Unit* | *Forecast range* | *Time steps* | *Frequency* |
| Average steering wind zonal velocity (u) and meridional velocity (v)1 at 850/500/200 hPa | [m/s] | 14 days(or the maximum range if less) | Every 6 hours | Twice a day2 |

Note:

1. Recommended procedures to calculate average steering wind is provided at section x.x.x of the Guide to WIPPS (WMO-No. 305)
2. It is strongly recommended to provide all recommended products four times a day or more frequently.

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Appendix 2.2.6. Characteristics of the global Ensemble Prediction SysteM

1. Ensemble system

– Ensemble name (version):

– Date of implementation:

2. Configuration of the Ensemble Prediction System

– Horizontal resolution of the model, with indication of grid spacing in km:

– Number of model levels:

– Top of model:

– Forecast length and forecast step interval:

– Runs per day (times in UTC):

– Is there an unperturbed control forecast included?

– Number of perturbed ensemble members (excluding control):

– Is model coupled to ocean, wave, sea‑ice models? Specify which models:

– Integration time step:

– Additional comments:

3. Initial conditions and perturbations

– Initial perturbation strategy:

– Optimization time in forecast (if applicable):

– Horizontal resolution of perturbations (if different from model resolution):

– Initial perturbed area:

– Data assimilation method for control analysis:

– Are perturbations to observations employed? If so, which observation types are perturbed?

– Perturbations added to control analysis or derived directly from ensemble analysis:

– Perturbations in +/‑ pairs?

– Additional comments:

4. Model uncertainty perturbations

– Is model physics perturbed? If so, briefly describe method(s):

– Do all ensemble members use exactly the same model version, or are, for example, different parameterization schemes used? Please describe any differences:

– Is model dynamics perturbed? If so, briefly describe method(s):

– Are the above model uncertainty perturbations applied to the control forecast?

– Additional comments:

5. Surface boundary perturbations

– Perturbations to SST? If so, briefly describe method(s):

– Perturbations to soil moisture? If so, briefly describe method(s):

– Perturbations to surface wind stress or roughness? If so, briefly describe method(s):

– Any other surface perturbations? If so, briefly describe method(s):

– Are the above surface perturbations applied to the control forecast?

– Additional comments:

6. Other details of model

– What kind of soil scheme is in use?

– How are radiations parameterized?

– What kind of large‑scale dynamics is in use (for example, grid‑point semi‑Lagrangian)? Hydrostatic or non‑hydrostatic?

– What kind of boundary layer parameterization is in use?

– What kind of convection parameterization is in use?

– What cloud scheme is in use?

– Other relevant details?

7. Products

– Method of the calculation~~,~~ of mandatory and recommended products, especially those of tropical low/cyclone vortex, if the method is not unique:

- Definition of tropical cyclone in numerical model output:

– Other detailed specifications, if necessary:

8. Further information

– Operational contact point:

– URLs for system documentation:

– URL for list of products:

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## Annex 4 to draft Resolution ##/1 (EC-78)

*[Proposed amendments are highlighted in addition or ~~deletion~~ to the Manual on the WMO Integrated Processing and Prediction System (WMO-No. 485) and the numbering of the text below refers to the Manual.]*

2.2.1.2 Limited-area deterministic numerical weather prediction

Centres conducting limited‑area deterministic NWP shall:

(a) Produce limited‑area analyses of the three‑dimensional structure of the atmosphere;

(b) Produce limited‑area forecast fields of basic and derived atmospheric parameters;

(c) Make available on WIS a range of these products; the list of mandatory products (considered as core data) and ~~highly~~ recommended limited‑area deterministic NWP products to be made available, including metadata, is given in Appendix 2.2.3;

(d) Produce verification statistics according to the standard defined in Appendix 2.2.34, adapted for the region covered by the model, at an appropriate resolution, and make available consistent up‑to‑date graphical displays of the verification results on a website;

(e) Make available on a website up‑to‑date information on the characteristics of their limited‑area NWP systems; the minimum information to be provided is given in Appendix 2.2.4.

Note:

1. The definition of core data is provided in Resolution 1 (Cg-Ext(2021)).

2. The bodies in charge of managing the information contained in the present Manual related to limited‑area deterministic NWP are specified in the table below.

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2.2.1.4 Limited‑area ensemble numerical weather prediction

Centres conducting limited‑area ensemble NWP shall:

(a) Produce limited‑area ensemble forecast fields of basic and derived atmospheric parameters;

(b) Make available on WIS a range of these products; the list of mandatory products (considered as core data) and ~~highly~~ recommended limited‑area ensemble NWP products to be made available is given in Appendix 2.2.7;

(c) Produce verification statistics according to the standard defined in Appendix 2.2.35, adapted for the region covered by the model, and make available consistent up‑to‑date graphical displays of the verification results on a website;

(d) Make available on a website up‑to‑date information on the characteristics of their limited‑area EPS; the minimum information to be provided is given in Appendix 2.2.8.

Notes:

1. The definition of core data is provided in Resolution 1 (Cg-Ext(2021)).

2. The bodies in charge of managing the information contained in the present Manual related to limited-area ensemble NWP are specified in the table below.

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## Annex 5 to draft Resolution ##/1 (EC-78)

*[Proposed amendments are highlighted in addition or ~~deletion~~ to the Manual on the WMO Integrated Processing and Prediction System (WMO-No. 485) and the numbering of the text below refers to the Manual.]*

Appendix 2.2.3. Mandatory and ~~HIGHLY~~recommended limited‑area deterministic numerical weather prediction products to be made available on the WMO Information System

**Mandatory Products:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Level (hPa) | Resolution | Forecast range | Time steps | Frequency |
| Geopotential height | 925/850/700/500/250 | 0.25° × 0.25° | 2~~1~~ day | Every 3~~6~~ hours (Every 1 hour for total and convective precipitation) | Twice a day |
| Temperature | 925/850/700/500/250 |
| u, v | 925/850/700/500/250 |
| Relative humidity | 925/850/700/500 |
| Divergence, vorticity | 925/850/700/500/250 |
| Mean sea level pressure (MSLP)2‑m temperature2-m dewpoint temperature2-m 3-hourly minimum and maximum temperature10‑m u, 10‑m v10-m wind gust1Total precipitation (1-hour accumulation)Convective precipitation (1-hour accumulation; where available)CAPE2Low and medium cloud coverageTotal cloud coveragePrecipitation type | Surface |

Notes:

1. Wind gusts are the maximum gusts in the periods of the last 3 hours;
2. Recommended most unstable CAPE (MUCAPE). RSMC is required to provide information on which type of CAPE is provided in the model characteristics web page.

~~Additional r~~Recommended products:

– Vertical velocity (925, 850, 700, 500);

~~– Cloud cover;~~

– Tropical storm tracks (latitudinal/longitudinal locations, maximum sustained wind speed, mean sea level pressure (MSLP)).

– Convective inhibition (CIN)

– 2-m Visibility

– Lightning

– Downward surface solar radiation

– Surface UV

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## Annex 6 to draft Resolution ##/1 (EC-78)

*[Proposed amendments are highlighted in addition or ~~deletion~~ to the Manual on the WMO Integrated Processing and Prediction System (WMO-No. 485) and the numbering of the text below refers to the Manual.]*

Appendix 2.2.7. Mandatory and ~~HIGHLY~~recommended limited-area Ensemble Prediction System products to be made available on the WMO Information System

**Mandatory Products:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Level ~~(hPa)~~ | Thresholds | Resolution(lat/lon grid) | Forecast range | Time steps | Frequency |
| Probability of total precipitation | Surface | 1, 5, 10, 25, 50 and 100 mm/24 hours1, 5, 10, 25 and 50 mm/3 hours | 0.25° × 0.25° | 2 days (or the maximum range if less) | Every 3~~6~~ hours | Once a day |
| Percentiles for total precipitation in the last 3 hours | Surface | 25th, 50th, 75th, max |
| Percentiles for temperature | 2 m, 850 hPa | min, 25th, 50th, 75th, max |
| Percentiles for dewpoint temperature | 2 m | min, 25th, 50th, 75th, max |
| Probability of 10‑m sustained wind ~~and gusts~~  | ~~Surface~~10 m | 10, 15, 20 and 25 m s–1 |
| Probability of 10-m wind gusts | 10 m | 15, 25 and 35 m s–1 |
| Percentiles for wind speed  | 10 m | min, 25th, 50th, 75th, max |
| Percentiles for wind gust (max during period) | 10 m | 25th, 50th, 75th, max |
| Percentiles for CAPE | Surface | 25th, 50th, 75th, max |
| Percentiles for magnitude of wind shear | Vector difference between 250 and 850 hPa | min, 25th, 50th, 75th, max |
| Percentiles for total cloud cover | Surface | min, 25th, 50th, 75th, max |

~~Additional highly r~~Recommended products:

– Location‑specific time series of temperature, precipitation, wind speed, depicting the most likely solution and an estimation of uncertainty (“EPSgrams”); the definition, method of calculation and the locations should be documented;

– Tropical storm tracks (latitudinal/longitudinal locations, maximum sustained wind speed, mean sea level pressure (MSLP) from EPS members) where applicable;

– Probability of Lightning;

– Probability of 2 m Visibility;

– Ensemble mean and spread of MSLP and Geopotential height at 850, 700 and 500hPa.

– Percentiles of additional variables which might include:

* Mid-level CAPE
* 1-hour accumulated total precipitation
* Downward surface solar radiation at surface
* Outgoing longwave radiation at surface
* Wind u and v at additional heights of 80 m, 100 m, 120 m or 150 m above ground

– Options to access high-resolution data (up to full model resolution), additional percentile values, probability thresholds and/or all ensemble members

– Provide data additionally in form of map layers, graphics, or visualization.

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## Draft Recommendation 8.4(1)/2 (INFCOM-3)

### Amendments to the *Manual on the WMO Integrated Processing and Prediction System* (WMO-No. 485) for climate prediction

THE COMMISSION FOR OBSERVATION, INFRASTRUCTURE AND INFORMATION SYSTEMS,

**Recalling:**

(1) [Resolution 1 (Cg-Ext(2021))](https://library.wmo.int/viewer/57850/?offset=2#page=9&viewer=picture&o=bookmark&n=0&q=) - WMO Unified Policy for the International Exchange of Earth System Data,

(2) [Resolution 26 (EC-76)](https://library.wmo.int/idviewer/66258/1017) – Designation of an additional Global Producing Centres for Long-range Forecasts, a Global Producing Centre for Sub-seasonal Forecasts and the Lead Centre for Sub-seasonal Forecast Multi-model Ensembles,

(3) [Resolution 27 (Cg-19)](https://library.wmo.int/viewer/67177/?offset=1#page=264&viewer=picture&o=bookmark&n=0&q=) – Amendments to the *Manual on the Global Data-processing and Forecasting System* (WMO-No. 485) in alignment with WMO Unified Data Policy,

**Reaffirming:**

1. That the WMO Unified Data Policy states that core data shall be provided on a free and unrestricted basis, which is necessary for the provision of services in support of the protection of life,
2. That the mandatory products of the Global Producing Centre for global numerical sub-seasonal forecasts (GPC-SSF) and the Global Producing Centre for global numerical long-range prediction (GPC-LRF) are considered as core data in the [*Manual on the WMO Integrated Processing and Prediction System*](https://library.wmo.int/idurl/4/35703)(WMO-No. 485),

**Noting:**

1. The compelling need of climate reanalysis data defined as a core data across several Earth system disciplines/domains in the WMO Unified Data Policy to underpin WMO Members' activities in climate monitoring and prediction, as well as understanding current weather extremes and climate changes,
2. That the Standing Committee on Data-Processing for Applied Earth System Modelling and Prediction (SC-ESMP) further updated the list of the mandatory and recommended products of sub-seasonal forecasts and long-range prediction, in consideration of the outcomes of the GDPFS Symposium on Requirements for NWP Data and Products (August 2022; Geneva, Switzerland),
3. That SC-ESMP assessed the technical capabilities of Centres applying for the designation of the WIPPS Centres,

**Having examined** the following draft amendments to the [*Manual on the WMO Integrated Processing and Prediction System*](https://library.wmo.int/idurl/4/35703) (WMO-No. 485) that the SC-ESMP has proposed:‎‎‎‎‎‎‎

(1) The establishment of two types of new WIPPS activities: global climate reanalysis as a general-purpose activity and coordination of assessment of multiple climate reanalysis as a specialized activity, as per [Annex 1](#Annex1_to_DResolution2) and [Annex 7](#Annex7_to_DResolution2) to the draft Resolution ##/2 (EC-78),

(2) The rearrangement of the contents structure of the WIPPS activities of global numerical sub-seasonal forecasts, global numerical long-range prediction, coordination of multi-model ensembles for sub-seasonal forecasts, and coordination of multi-model ensemble prediction for long-range forecasts to enhance the readability and clarification of both mandatory and recommended functions and products, as per [Annexes 2](#Annex2_to_DResolution2), [3](#Annex3_to_DResolution2), [4](#Annex4_to_DResolution2), and [5](#Annex5_to_DResolution2) to the draft Resolution ##/2 (EC-78),

(3) The introduction of the contribution of the “contributing centre” to the WIPPS activity of the coordination of multi-model ensembles for sub-seasonal forecasts to ensure generating a real-time multi-model ensemble given that currently there is only one GPC-SSF and included the provision of maps presenting tropical cyclone genesis and activities and other variables as recommended products, as per [Annex 3](#Annex3_to_DResolution2) to the draft Resolution ##/2 (EC-78),

(4) The removal of the password protection for downloading digital products from the Lead Centre for conducting the coordination of multi-model ensemble prediction for long-range forecasts (LC-LRFMME) and the inclusion of the provision of snow water equivalent and other variables as recommended products, as per [Annex 5](#Annex5_to_DResolution2) to the draft Resolution ##/2 (EC-78),

(5) The introduction of the provision of Global Annual to Decadal Climate Update (GADCU) as a mandatory function of the Lead Centre for conducting the coordination of annual to decadal climate prediction (Lead Centre for ADCP), as per [Annex 6](#Annex6_to_DResolution2) to the draft Resolution##/2 (EC-78),

(6) The designation of the following WIPPS Centres, as per [Annex 7](#Annex7_to_DResolution2) to the draft Resolution ##/2 (EC-78):

(a) Centres for conducting global numerical sub‑seasonal forecasts: Brazil (Centro de Previsão de Tempo e Estudos Climáticos (CPTEC)), China, Japan, and Russia,

(b) Centres for conducting the global climate reanalysis: USA (National Aeronautics and Space Administration (NASA)) and European Centre for Medium-Range Weather Forecasts (ECMWF),

(c) Lead Centre for conducting coordination of assessment of multiple climate reanalysis: ECMWF,

(7) The change of the following WIPPS activities’ name to ensure consistency across sub-seasonal, seasonal, annual, and decadal predictions in the [*Manual on the WMO Integrated Processing and Prediction System*](https://library.wmo.int/records/item/35703-manual-on-the-wmo-integrated-processing-and-prediction-system?language_id=13&back=&offset=7) (WMO-No. 485):

(a) Global numerical sub‑seasonal forecasts to global sub‑seasonal prediction,

(b) Global numerical long-range prediction to global seasonal prediction,

**Having further examined** the following draft amendments to the [*Manual on the WMO Integrated Processing and Prediction System*](https://library.wmo.int/idurl/4/35703) (WMO-No. 485)**:**

1. The designation of the Regional Climate Centres Network for the Arctic (ArcRCC-Network) endorsed by the presidents of Regional Associations of WMO Regions II, IV and VI and supported by the president of SERCOM, as per [Annex 7](#Annex7_to_DResolution2) to the draft Resolution ##/2 (EC‑78),
2. The inclusion of information regarding the linkage of the Climate Service Information System (CSIS) to the WIPPS responding to the request from the Standing Committee on Climate Service (SC-Cli) under SERCOM*,* as per [Annex 8](#Annex8_to_DResolution2) to the draft Resolution ##/2 (EC-78),

**Recommends** to Executive Council the adoption of the amendments to the [*Manual on the WMO Integrated Processing and Prediction System*](https://library.wmo.int/idurl/4/35703)(WMO-No. 485) throughthe draft resolution provided in the [annex](#_Annex_to_draft_1) to the present recommendation.

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[Annex: 1](#Annex_to_draft_Recommendation2)

## Annex to draft Recommendation 8.4(1)/2 (INFCOM-3)

**Draft Resolution ##/2 (EC-78)**

### Amendments to the Manual on the *WMO Integrated Processing and Prediction System* (WMO-No. 485) for climate prediction

THE EXECUTIVE COUNCIL,

**Recalling:**

(1) [Resolution 1 (Cg-Ext(2021))](https://library.wmo.int/viewer/57850/?offset=2#page=9&viewer=picture&o=bookmark&n=0&q=) - WMO Unified Policy for the International Exchange of Earth System Data,

(2) [Resolution 26 (EC-76)](https://library.wmo.int/idviewer/66258/1017) – Designation of an additional Global Producing Centres for Long-range Forecasts, a Global Producing Centre for Sub-seasonal Forecasts and the Lead Centre for Sub-seasonal Forecast Multi-model Ensembles,

(3) [Resolution 27 (Cg-19)](https://library.wmo.int/viewer/67177/?offset=1#page=264&viewer=picture&o=bookmark&n=0&q=) – Amendments to the *Manual on the Global Data-processing and Forecasting System* (WMO-No. 485) in alignment with WMO Unified Data Policy,

**Having examined** Recommendation 8.4(1)/2 (INFCOM-3),

**Having agreed:**

1. The amendments to the [*Manual on the WMO Integrated Processing and Prediction System*](https://library.wmo.int/idurl/4/35703) (WMO-No. 485) regarding the WIPPS activities as provided in Annexes 1 to 6 and Annex 8 to the present resolution except the Centre designation, with effect from 1 March 2025,
2. The amendments to the [*Manual on the WMO Integrated Processing and Prediction System*](https://library.wmo.int/idurl/4/35703) (WMO-No. 485) relevant to the designation of the WIPPS Centres as provided in Annex 7, with the effective from 1 September 2024,

**Acknowledging** that the vital contribution of the contributing centres in already providing their sub-seasonal forecasts in real-time to Lead Centre for the coordination of multi-model ensembles for sub-seasonal forecasts (LC-SSFMME), thereby enabling WMO Members to obtain probabilistic sub-seasonal forecasts,

**Encourages** Members producing sub-seasonal forecast in real-time to apply for Global Producing Centre conducting sub-seasonal forecast (GPC-SSF) designation,

**Authorizes** the Secretary-General, in consultation with the president of INFCOM concerned to make editorial amendments to the [*Manual on the WMO Integrated Processing and Prediction System*](https://library.wmo.int/idurl/4/35703)(WMO-No. 485), including those relevant to changing activity names to ensure consistency across sub-seasonal, seasonal, annual, and decadal predictions.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

[Annexes: 8](#Annex1_to_DResolution2)

## Annex 1 to draft Resolution ##/2 (EC-78)

*[Proposed amendments are highlighted in addition or ~~deletion~~ to the Manual on the WMO Integrated Processing and Prediction System (WMO-No. 485) and the numbering of the text below refers to the Manual.]*

2.2.1.x Global Climate Reanalysis

2.2.1.x.1 Centres conducting global climate reanalysis (GCR) shall:

(a) Produce global climate reanalyses at the surface, near-surface and throughout the atmosphere;

(b) Make digital products available within no more than 60 days behind real-time;

(c) Ensure all products cover at least the most recent WMO climatological reference period;

(d) Make available on their website digital mandatory products (considered as core data) listed in [Appendix A](#_APPENDIX_A._MANDATORY);

(e) Make available on their website up to date information on the characteristics of their global climate reanalysis systems. The minimum information to be provided is given in [Appendix B](#_Appendix__B.).

2.2.1.x.2 In addition to the mandatory functions above, GCR should:

(a) Make available on their website the graphic and digital recommended products listed in Appendix A;

(b) Produce their digital mandatory and recommended products in one of the following formats: GRIB1, GRIB2, NetCDF or HDF.

Notes:

1. The requirement for the users to be registered and/or accept terms and conditions before retrieving the data does not affect the open and free status of the data.

2. For the purpose of this document climate reanalysis is defined as the output of a prediction model which makes use of observational data to reconstruct past weather and climate in a way that strives to maximize temporal consistency.

3. The bodies in charge of managing the information contained in the present Manual related to global climate reanalysis are specified in the table below.

Table X. WMO bodies responsible for managing information related to
global climate reanalysis

|  |
| --- |
| Responsibility |
| Changes to activity specification |
| To be proposed by: | INFCOM/SC-ESMP | INFCOM/ET-OCPS |  |
| To be recommended by: | INFCOM |  |  |
| To be decided by: | EC/Congress |  |  |
| Centres designation |
| To be recommended by: | INFCOM | RA |  |
| To be decided by: | EC/Congress |  |  |
| Compliance |
| To be monitored by: | INFCOM/ET-OCPS |  |  |
| To be reported to: | INFCOM/SC-ESMP | INFCOM |  |

APPENDIX A. MANDATORY AND RECOMMENDED GCR PRODUCTS

**1. Mandatory products (as core data) – digital data**

|  |  |
| --- | --- |
| Variable | Level |
| Total precipitation | Surface |
| Pressure | Surface |
| Mean sea level pressure (MSLP) | Surface |
| Sea-surface temperature (SST) | Surface |
| Land mask | Surface (constant) |
| Topography | Surface (constant) |
| Sea-ice cover | Surface |
| Water Equivalent of Snow Cover (Snow Water Equivalent) | Surface |
| Incoming short-wave radiation | Surface |
| Outgoing longwave radiation | Top of Atmosphere (TOA) |
| Dew point temperature / specific humidity / Relative humidity  | 2 m |
| Temperature | 2 m |
| Zonal and meridional wind velocity (u, v) | 10 m |
| Geopotential height | 850, 500, 200, 100, 50, 30 and 5 hPa |
| Temperature | 850, 500, 200, 100, 50, 30 and 5 hPa |
| Zonal and meridional wind velocity (u, v) | 850, 500, 200, 100, 50, 30 and 5 hPa |
| Specific humidity | 850, 500, 200, 100, 50, 30 and 5 hPa |

Notes:

1. The centres provide one of the following variables: dew point temperature, specific humidity, or relative humidity at 2 m based on their products.

2. The centres provide the above variables with at least 1.25o x 1.25o spatial resolution.

3. The centres provide the above variables at least six hourly temporal resolution.

4. The centres also provide the monthly mean of the above variables.

The centres also provide the following products:

* The monthly climatology, calculated based on the most recent WMO climatological reference period, of the above variables
* Time series of global average monthly mean temperature at 2 m

The centres provide the documentation that explains what data are provided.

**2. Recommended products – digital data**

The centres provide daily climatology, calculated based on the most recent WMO climatological reference period, of the variables listed in the section 1 keeping the same horizontal resolution.

It is recommended to develop and maintain documentation that includes the calculation methods for generating daily climatology.

**3. Recommended products – map**

The centres provide the spatial maps of monthly mean and anomalies of variables listed in the section 1.

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APPENDIX B. CHARACTERISTICS OF Global CLIMATE REANALYSIS SYSTEMS

1. System

– System name (version):

– Date of implementation:

2. Configuration

– Earth system components included in the analysis system (e.g., ocean, sea-ice, land, etc.):

– Horizontal resolution of the model, with indication of grid spacing in km (for the different Earth system component included in the model):

– Number of levels in the different Earth system components (for the different Earth system component included in the model):

– Frequency of the outputs:

– Top of the atmospheric model:

– Number of analysis cycle per day:

– Earliest start date:

– Integration time step:

– Length and frequency of the longest forecast:

– Data set latency:

– Additional comments:

3. Analysis system

– Data assimilation method:

– Length of the analysis window:

– Number of ensemble members and their resolution:

– Additional comments:

4. Externally prescribed boundary conditions

Note: Briefly describe boundary conditions (if used) and their source:

– Sea surface temperature (SST):

– Sea-ice:

– Snow:

– Vegetation:

– Land use (and its evolution in time):

– Aerosols:

– Green House Gases:

– Solar forcing:

– Additional comments:

5. Details of model

– Dynamical core (e.g., semi-Lagrangian):

– Grid structure:

– Hydrostatic or non-hydrostatic:

– Radiations parameterization:

– Boundary layer parameterization:

– Convection parameterization:

– Cloud parameterization scheme:

– Land surface parameterization scheme:

– Other relevant details:

6. Further information

– Operational contact point:

– URL of the technical note/ reference paper:

– URL for list of products:

7. Observational data used

– URL with the list of observational data used in the reanalysis:

- DOI of data product if available.

8. Other sources for data access, if available

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***2.2.2.x Coordination of assessment of multiple climate reanalysis***

2.2.2.x.1 Centre(s) conducting the assessment of multiple climate reanalyses (Lead Centre(s) for Global Climate Reanalysis) shall:

(a) Select a group of global climate reanalysis centres to contribute to the Lead Centre(s) for Global Climate Reanalysis (referred to as 'contributing centres,' which also includes the designated GCR) that meet the GCR designation criteria and have been approved by ET-OCPS; and manage changes in the membership of the group, as and when they occur;

(b) Maintain a list of the contributing centres and the specification of their climate reanalysis systems;

(c) Collect an agreed set of digital mandatory products listed in Appendix XX from contributing centres;

(d) Interpolate the collected products onto a common horizontal grid, generate climatology, and make them available for each reanalysis;

(e) Provide a set of graphical mandatory products listed in Appendix XX;

(f) Make a set of tools to visualize the products as time series and/or maps on the Lead Centre(s)’ website.

2.2.2.x.2 In addition to the mandatory functions above, Lead Centre(s) for Global Climate Reanalysis should:

(a) Make available on the Lead Centre(s)’ website(s) the digital recommended products listed in Appendix XX;

(b) Define and provide common evaluation metrics to compare climate reanalysis outputs, jointly with other contributing centres conducting global climate reanalysis;

(c) Produce their mandatory and recommended digital products in one of the following formats: GRIB1, GRIB2, NetCDF or HDF.

Notes:

1. The requirement for the users to be registered and/or accept terms and conditions before retrieving the data does not affect the open and free status of the data.
2. The digital products will be available through the Lead Centre(s) if the contributing centres agree.
3. The bodies in charge of managing the information contained in the present Manual related to coordination of assessment of multiple climate reanalysis are specified in the table below.

Table X. WMO bodies responsible for managing information related to
coordination of assessment of multiple climate reanalysis

|  |
| --- |
| Responsibility |
| Changes to activity specification |
| To be proposed by: | INFCOM/SC-ESMP | INFCOM/ET-OCPS |  |
| To be recommended by: | INFCOM |  |  |
| To be decided by: | EC/Congress |  |  |
| Centres designation |
| To be recommended by: | INFCOM |  |  |
| To be decided by: | EC/Congress |  |  |
| Compliance |
| To be monitored by: | INFCOM/ET-OCPS |  |  |
| To be reported to: | INFCOM/SC-ESMP | INFCOM |  |

APPENDIX XX. MANDATORY AND RECOMMENDED LEAD CENTRE CLIMATE REANALYSIS PRODUCTS

**1. Digital Products**

**Mandatory products**

|  |  |
| --- | --- |
| Variable | Level |
| Total precipitation | Surface |
| Pressure | Surface |
| Mean sea level pressure (MSLP) | Surface |
| Sea surface temperature (SST) | Surface |
| Land mask | Surface (constant) |
| Topography | Surface (constant) |
| Sea-ice cover | Surface |
| Water Equivalent of Snow Cover (Snow Water Equivalent) | Surface |
| Incoming short-wave radiation | Surface |
| Outgoing longwave radiation | Top of Atmosphere (TOA) |
| Dew point temperature / specific humidity / Relative humidity  | 2 m |
| Temperature | 2 m |
| Zonal and meridional wind velocity (u, v) | 10 m |
| Geopotential height | 850, 500, 200, 100, 50, 30 and 5 hPa |
| Temperature | 850, 500, 200, 100, 50, 30 and 5 hPa |
| Zonal and meridional wind velocity (u, v) | 850, 500, 200, 100, 50, 30 and 5 hPa |
| Specific humidity | 850, 500, 200, 100, 50, 30 and 5 hPa |

Note: The Lead Centre(s) provide the monthly mean of the above variables on a common grid with at least 1.25o x 1.25o spatial resolution.

The Lead Centre(s) also provide the following products:

* The monthly climatology, calculated based on the most recent WMO climatological reference period, of the above variables;

The Lead Centre(s) provide the documentation that explains what data are provided.

**Recommended products**

The Lead Centre(s) provide to daily climatology for 2 m, daily minimum and maximum temperature, and total precipitation, calculated based on the most recent WMO climatological reference period, keeping the same horizontal resolution of mandatory products.

It is recommended to develop and maintain documentation that includes the calculation methods for generating daily climatology.

**2. Graphical Products**

**Mandatory Products**

Time series and/or maps of digital products listed in the section 1.

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## Annex 2 to draft Resolution ##/2 (EC-78)

*[Proposed amendments are highlighted in addition or ~~deletion~~ to the Manual on the WMO Integrated Processing and Prediction System (WMO-No. 485) and the numbering of the text below refers to the Manual.]*

2.2.1.5 Global numerical sub‑seasonal forecasts

2.2.1.5.1 Centres conducting global numerical SSFs (GPCs for Sub‑seasonal Forecasts (GPCs‑SSF)) shall:

Note: Functions are defined for the sub‑seasonal (10 days–4 weeks) forecasting activity.

(a) With at least weekly frequency, generate SSF products with global coverage;

(b) Make available on WIS ~~a range of these products; the list of~~ the graphical mandatory products (considered as core data) ~~and highly recommended products to be made available is given~~ listed in Appendix 2.2.41;

~~(c) Produce verification statistics according to the standard defined in Appendix 2.2.45, and make them available on a website;~~

(c~~d~~) Provide ~~an agreed set of forecast and hindcast variables~~ digital mandatory products (as defined in Appendix 2.2.43 (section 1)) to the Lead Centre(s) for Subseasonal Forecast Multi-model Ensemble (SSFMME) no more than two days behind real-time;

(d~~e~~) Make available on a website up to date information on the characteristics of their global numerical SSF systems; the minimum information to be provided is given in Appendix 2.2.42.

Note: The definition of core data is provided in Resolution 1 (Cg-Ext(2021)).

2.2.1.5.2 In addition to the mandatory ~~activities~~ functions above, GPCs-SSF should:

(a) Make available on WIS the ~~highly~~ recommended products listed in Appendix 2.2.41;

(b) Provide digital recommended products to the Lead Centre(s) for SSFMME, as detailed in Appendix 2.2.43 (section 1).

Note: The bodies in charge of managing the information contained in the present Manual related to global numerical SSFs are specified in the table below.

Table 6. WMO bodies responsible for managing information related
to global numerical SSFs

|  |
| --- |
| Responsibility |
| Changes to activity specification |
| To be proposed by: | INFCOM/SC-ESMP | INFCOM/ET‑OCPS |  |
| To be recommended by: | INFCOM | SERCOM |  |
| To be decided by: | EC/Congress |  |  |
| Centres designation |
| To be recommended by: | RA | INFCOM |  |
| To be decided by: | EC/Congress |  |  |
| Compliance |
| To be monitored by: | INFCOM/ET‑OCPS |  |  |
| To be reported to: | INFCOM/SC‑ESMP | INFCOM |  |

Appendix 2.2.41. Mandatory and ~~highly~~ recommended global numerical sub‑seasonal forecast products to be made available on the WMO Information System

Mandatory products (maps) ~~of Global Producing Centres for Sub‑Seasonal Forecasts (GPCs‑SSF)~~

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variable | Coverage | Forecast range or lead time | Temporal resolution | Output type | Issuance frequency |
| 2‑m temperature | Global | ~~Any forecast range (lead time) between zero and four weeks~~Minimum forecast range of four weeks | Averages over periods (one day to four weeks) | (1) Ensemble mean anomaly(2) Probabilities for tercile forecast categories (where applicable) | ~~Weekly~~Minimum once a week  |
| Sea surface temperature (SST) | Global oceans |
| ~~Total precipitation~~Daily accumulated total precipitation | Global |

~~Note: Probabilities for extremes, for the variables specified under mandatory products, are also highly recommended~~

Note: SST is a mandatory product only for the centres operating 1-Tier systems.

~~Highly r~~Recommended products (maps) ~~of GPCs‑SSF~~

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variable | Coverage | Forecast range or lead time | Temporal resolution | Output type | Issuance frequency |
| 500 hPa height | Global | ~~Any forecast range (lead time) between zero and four weeks~~Minimum forecast range of four weeks. | Averages over periods (one day~~-~~ to four weeks) | (1) Ensemble mean anomaly(2) Probabilities for tercile forecast categories | ~~Weekly~~Minimum once a week |
| Mean sea level pressure (MSLP) |
| 850 hPa temperature |

Notes:

1. Probabilities for extremes, for the variables specified under mandatory products, are recommended.

2. Extremes (products are recommended, not mandatory) – the recommended definitions to be used for extremes are below 10th percentile and above 90th percentile.

3~~1~~. Output types – rendered images (for example, forecast maps and diagrams). GPCs‑SSF are encouraged to make available digital data on the retrospective forecast (hindcast) and forecast fields underlying the products. Gridded binary‑2 (GRIB‑2) format should be used for fields posted on FTP sites or disseminated through WIS.~~GPCs‑SSF shall provide daily fields of hindcasts and forecasts, as variables listed in Appendix 2.2.43, to the Lead Centre(s) for SSFMME.~~

4~~2~~. ~~For all products, anomalies are to be expressed relative to a climatology using at least 15 years of retrospective forecasts~~To enable the construction of multi-model products, it is recommended the provision of retrospective forecasts covering the most recent 25–30 years period.

5~~3~~. Information on how category boundaries are defined should be made available.

6~~4~~. Indications of skill will be provided in accordance with Appendix 2.2.45.

~~Highly r~~Recommended *~~ed~~[Secretariat]* products (diagrams) ~~of GPCs‑SSF~~

Diagrams presenting forecasts of the tropical intraseasonal variability such as the Madden–Julian Oscillation (Wheeler and Hendon, 2004; Gottschalck et al., 2010) are ~~highly~~ recommended.

References

Gottschalck, J.; Wheeler, M.; Weickmann, K. Et al. A Framework for Assessing Operational Madden–Julian Oscillation Forecasts: A CLIVAR MJO Working Group Project. Bulletin of the American Meteorological Society 2010, 91 (9), 1247–1258. <https://doi.org/10.1175/2010BAMS2816.1>.

Wheeler, M. C.; Hendon, H. H. An All-Season Real-Time Multivariate MJO Index: Development of an Index for Monitoring and Prediction. Monthly Weather Review 2004, 132 (8), 1917–1932. [https://doi.org/10.1175/1520–0493(2004)132<1917:AARMMI>2.0.CO;2](https://doi.org/10.1175/1520-0493%282004%29132%3C1917%3AAARMMI%3E2.0.CO;2).

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## Annex 3 to draft Resolution ##/2 (EC-78)

*[Proposed amendments are highlighted in addition or ~~deletion~~ to the Manual on the WMO Integrated Processing and Prediction System (WMO-No. 485) and the numbering of the text below refers to the Manual.]*

2.2.2.2 Coordination of multi‑model ensembles for sub‑seasonal forecasts

Centre(s) coordinating SSF multi‑model ensembles (Lead Centre(s) for SSFMME) shall:

(a) Select a group of modelling centres to contribute to the Lead Centre(s) for SSFMME (referred to as ‘contributing centres,’ which also includes the designated GPC-SSF)) that meet the GPC-SSF designation criteria and have been approved by ET-OCPS; and manage changes in the membership of the group, as and when they occur, to maintain sufficient contributions;

(b) Maintain a list of the active contributing centres and the specification of their prediction systems;

(c~~a~~) Collect an agreed set of ~~forecast data~~ digital products listed in Appendix 2.2.43 (section 1) from contributing centres ~~GPCs‑SSF participating in numerical sub‑seasonal forecasting under activity <2.2.1.5> (GPCs‑SSF)~~;

(d~~b~~) Make available on a website of the Lead Centre(s) for SSFMME graphical products listed in ~~appropriate minimum (~~Appendix 2.2.43~~) and additional (<Attachment 2.2.5>) products as well as GPC‑SSF products in standard format~~;

(e~~c~~) Redistribute contributing centre digital products ~~forecast data as described~~listed in Appendix 2.2.44 for those GPCs-SSF that allow it;

(f~~d~~) ~~Maintain an archive of real-time GPCSSF productsand multimodel ensemble forecasts~~ Maintain an archive of real-time and hindcast digital product from the contributing centres which is used to construct the LC graphical products listed in 2.2.43;

(g~~e~~) Maintain a repository of documentation for the system configuration of all ~~GPC‑SSF~~contributing centres systems;

(h~~f~~) Verify the digital products using the ~~SVSLRF~~ Standardized Verification System for SSF (SVSSSF) in approach ~~(~~Appendix 2.2.45~~)~~;

(i~~g~~) Based on a comparison of different models, provide feedback to ~~GPCs‑SSF~~ contributing centres about model performance and make available on ~~a~~the LC-SSFMME’s website the verification results;

(j~~h~~) Promote research and expertise in multi‑model ensemble techniques and provide guidance and support on multi‑model ensemble techniques to ~~GPCs‑SSF~~contributing centres, RCCs and NMHSs.

Notes:

1. The website is provided exclusively for the outputs of the specified Lead Centre functions in support of climate services and is to be clearly distinguishable from other types of services.

2. LC-SSFMME will consult contributing centres on which forecast initial conditions to use in the development of real-time products. This will ensure a consistency between contributing centres and LC-SSFMME methodologies.

3~~2~~. The bodies in charge of managing the information contained in the present Manual related to coordination of multi‑model ensembles of SSFs are specified in the table below.

Table 15. WMO bodies responsible for managing information related
to multi‑model ensemble SSFs

|  |
| --- |
| Responsibility |
| Changes to activity specification |
| To be proposed by: | INFCOM/SC-ESMP | INFCOM/ET-OCPS |  |
| To be recommended by: | INFCOM |  |  |
| To be decided by: | EC/Congress |  |  |
| Centres designation |
| To be recommended by: | INFCOM |  |  |
| To be decided by: | EC/Congress |  |  |
| Compliance |
| To be monitored by: | INFCOM/ET‑OCPS |  |  |
| To be reported to: | INFCOM/SC‑ESMP | INFCOM |  |

Appendix 2.2.43. Minimum information to be available from the Lead Centre(s) for sub‑seasonal forecast multi‑model ensembles

1. ~~Global Producing Centre~~ Digital products

~~Global fields of forecast anomalies as supplied by GPCsSSF, including (for GPCs that allow redistribution of their digital data) weekly~~ Daily mean ~~anomalies~~ global field of forecast variables from contributing centres for ~~ensemble mean~~ individual ensemble members for at least ~~each of~~ the four weeks following the week of submission:

~~(a) Surface (2‑m) temperature;~~

~~(b) SST;~~

~~I Total precipitation rate;~~

~~(d) MSLP;~~

~~(e) 850 hPa temperature;~~

~~(f) 500 hPa geopotential height;~~

~~(g) 850 and 200 hPa wind (zonal and meridional);~~

~~(h) Outgoing long‑wave radiation at the top of the atmosphere;~~

~~(i) 10 hPa zonal wind.~~

~~Note: Definitions of the content and format for the supply of data to the Lead Centre(s) for SSFMME by GPCs and terms of exchange are available on the Lead Centre(s) website(s).~~

**Mandatory products**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Variable* | *Level (hPa)* | *Resolution* | *Forecast range* | *Time steps* | *Frequency* |
| Temperature | 2-meter | 1.5°× 1.5° | Minimum for weeks from the day of submission | Daily mean | Once a week |
| Sea surface temperature (SST) | Surface |
| Daily accumulated total precipitation | Surface |
| Mean sea level pressure (MSLP) | Surface |
| Temperature | 850 |
| Geopotential height | 500 |
| Velocity (u, v) | 850 and 200 |
| Velocity (u) | 10 |
| Outgoing long‑wave radiation | Top of the atmosphere |

Note: SST is a mandatory product only for the centres operating 1-Tier systems.

 **Recommended products**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Variable* | *Level (hPa)* | *Resolution* | *Forecast range* | *Time steps* | *Frequency* |
| Dew point temperature | 2-meter | 1.5°× 1.5° | Minimum for weeks from the day of submission | Daily mean | Once a week |
| Minimum temperature | 2-meter |
| Maximum temperature | 2-meter |
| Geopotential height | 850 and 200 |
|  Specific humidity | 850 |
| Soil moisture  | Top 20 cm and 100 cm |

Note: The minimum and maximum temperatures at 2 meters are not daily means; they are selected from a 24-hour window.

1. Graphical products

~~Plots and maps for each GPC forecast displayed in common format on the Lead Centre(s) website(s), for the variables listed in Appendix 2.2.41 and for selectable regions where appropriate,~~

~~for weeks 1, 2, 3–4 and 1–4:~~

~~(a) Ensemble mean anomalies;~~

~~(b) Probabilities for the tercile forecast categories;~~

~~(c) Model consistency plots, that is, maps showing the proportion of models predicting the same sign anomaly;~~

~~(d) Multi‑model probabilities for tercile forecast categories.~~

~~for intraseasonal variabilit~~~~a:~~

~~(a) Diagrams presenting each GPC forecast of the tropical intraseasonal variability such as the Madden–Julian Oscillation.~~

**Mandatory products**

Forecast Spatial Maps

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Forecast | *Variable* | *Forecast Type* | *Map Type* | *Digital* |
| Daily accumulated total precipitation | DMME;PMME;Individual models | Global and regional maps | No |
| 500hPa GPH |
| Mean sea level pressure (MSLP) |
| 2 m Temperature |
| 850hPa Temperature |
| Sea surface temperature (SST) |

Notes:

1. DMME: Deterministic Multi-Model Ensemble.

2. PMME: Probabilistic Multi-Model Ensemble.

3. SST is a mandatory product only for the centres operating 1-Tier systems.

Verification

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Hindcast | *Variable* | *Verification Type* | *Map Type* | *Digital* |
| Daily accumulated total precipitation | DMME;PMME;Individual models | Global and regional maps | No |
| 500hPa GPH |
| Mean sea level pressure (MSLP) |
| 2 m Temperature |
| 850hPa Temperature |
| Sea surface temperature (SST) |

Note: Verify products using Standardized Verification System for SSF (SVSSSF) (Appendix 2.2.45)

Recommended products

Forecast Indices

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Forecast | *Parameter* | *Forecast Type* | *Map type* | *Digital* |
| Nino1+2 | DMME;Individual models | Time series | No |
| Nino3 |
| Nino4 |
| Nino3.4 |
| DMI(Indian Ocean Dipole mode index) |
| TSA(Tropical South Atlantic index) |
| TNA(Tropical North Atlantic index) |

Note: SST indices are recommended products only for the centres operating 1-Tier systems.

Intraseasonal variability

Diagrams presenting each contributing centre of the tropical intraseasonal variability such as the Madden–Julian Oscillation are recommended.

Tropical cyclone

Graphical maps presenting each contributing centre of the tropical cyclone genesis and activities, including description of the tracking method, are recommended\_\_

Appendix 2.2.44. Access to Global Producing Centre for Sub‑seasonal Forecasts data and visualization products held by the lead centre(s) for sub‑seasonal forecast multi‑model ensembles

(a) Access to ~~GPC‑SSF~~ contributing centre data from the Lead Centre(s) for SSFMME website(s) will be password protected.

(b) Digital ~~GPC‑SSF~~ data will be redistributed only in cases where the ~~GPC‑SSF~~ contributing centre data policy allows it. In other cases, requests for ~~GPC‑SSF~~ contributing centre digital output should be directed to the relevant ~~GPC‑SSF~~ contributing centre *[Secretariat]*

(c) Formally designated GPCs‑SSF, GPCs‑LRF and RCCs, NMHSs and institutions coordinating RCOFs are eligible for password‑protected access to information held and produced by the Lead Centre(s) for SSFMME. Entities that are in demonstration phase to seek designation as GPCs or RCCs are also eligible for password‑protected access to information held and produced by the Lead Centre(s) for SSFMME, provided a formal notification has been issued in this regard by the WMO Secretary‑General.

(d) Institutions other than, but providing contributions to, those identified in (c) may also request access to Lead Centre(s) for SSFMME products. These institutions, referred to as “supporting institutions”, which include research centres, require endorsement letters from: (i) the Permanent Representative of the country where they are hosted, and (ii) the executive manager of the entity they wish to provide contributions to (that is, RCCs, institutions coordinating RCOFs and NMHSs). The use by supporting institutions of products from the Lead Centre(s) for SSFMME is restricted to assistance of the organizations identified in (c) in their production of official forecast outputs. Supporting institutions may not use such products to generate and display or disseminate independent forecast products. Supporting institutions must agree with these restrictions to be eligible for access. Prior to access being granted to an applicant supporting institution, the Lead Centre(s) for SSFMME will refer the application to the INFCOM/ET‑OCPS through the WMO Secretariat, for final consultation and review. Decisions to allow access must be unanimous. The Lead Centre(s) will be informed by the WMO Secretariat of such new users accepted for access.

(e) A list of users provided with password access will be maintained by the Lead Centre(s) for SSFMME and reviewed periodically by the INFCOM/ET‑OCPS, to measure the degree of effective use and also to identify any changes in status of eligible users, and determine further necessary follow‑up.

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Appendix 2.2.45. Standardized verification system for sub‑seasonal forecasts

1. Introduction

This appendix describes procedures for the production ~~and exchange~~ of a standard set of verification scores for SSFs produced by WIPPS centres. ~~Provision of the verification products described here is mandatory for GPCs‑SSF.~~ The goal is to provide consistent verification information on the SSF products of GPCs that will assist forecasters in RCCs, NMHSs and at RCOFs to prepare regional and national seasonal outlooks, and also to help the GPCs compare and improve their forecast systems. The verification scores described are to be calculated on retrospective forecasts (hindcasts). GPCs will produce and display the verification scores via their websites. Skill measures recommended for use by RCCs in verification of regional forecasts include those described here.

This appendix describes the verification scores and the variables, regions, relevant time averages and lead times for which the scores shall be applied.

2. Verification statistics

The following sections describe the scores that are mandatory for GPCs.

…

~~Attachment 2.2.5.~~ ~~Additional information to be available from the Lead Centre(s) for sub‑seasonal forecast multi‑model ensemble~~

~~The Lead Centre(s) for SSFMME may make available products based on forecast and hindcast data provided by GPCs‑SSF. These products are additional information to help GPCs, RCCs and NMCs to further develop multi‑model ensemble techniques and their application.~~

~~1. Global Producing Centre digital products~~

~~Products should include global forecast fields and corresponding hindcasts for the fields listed in Appendix 2.2.43 and additional variables to be agreed, for those GPCs that allow redistribution.~~

~~2. Graphical products~~

~~Graphical products should include forecast maps for each GPC displayed in common format on the Lead Centre for SSFMME website(s), for the variables listed in Appendix 2.2.43 and for selectable regions where appropriate, showing the following for the means for week 1, week 2, weeks 3 and 4, and weeks 1–4:~~

~~(a) Tercile category probabilities;~~

~~(b) Model consistency plots for most likely tercile category;~~

~~(c) Multi‑model probabilities for tercile categories.~~

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## Annex 4 to draft Resolution ##/2 (EC-78)

*[Proposed amendments are highlighted in addition or ~~deletion~~ to the Manual on the WMO Integrated Processing and Prediction System (WMO-No. 485) and the numbering of the text below refers to the Manual.]*

2.2.1.6 Global numerical long-range prediction

2.2.1.6.1 Centres conducting global numerical long‑range prediction (GPCs for Long‑range Forecasts (GPCs‑LRF)) shall:

Note: Functions are defined for the seasonal (1–6 month) prediction activity.

(a) With at least monthly frequency, ~~G~~generate LRF products with global coverage;

(b) Make available on WIS ~~a range of these products;~~ the list of graphical mandatory products (considered as core data) ~~and highly recommended products to be made available is given~~ listed in Appendix 2.2.9;

~~(c) Produce verification statistics according to the standard defined in Appendix 2.2.36, and make them available on a website;~~

(c~~d~~) Make available on a website up‑to‑date information on the characteristics of their global long‑range numerical prediction systems; the minimum information to be provided is given in Appendix 2.2.10;

(d~~e~~) ~~Agree~~ ~~to~~ Provide digital mandatory products ~~forecast~~ ~~output~~ to the Lead Centre(s) for LRF multi‑model ensembles (Lead Centre(s) for LRFMME), as detailed in Appendix 2.2.17 (section 1).

Note: The definition of core data is provided in Resolution 1 (Cg-Ext(2021)).

2.2.1.6.2 In addition to the mandatory activities above, GPCs-LRF should:

(a) Make available on WIS the ~~highly~~ recommended products listed in Appendix 2.2.9;

~~(b) Make available, on request by Regional Climate Centres (RCCs) or NMCs, the additional data, products and services listed in Attachment 2.2.1, noting that these products and services may be subject to conditions attached by GPCs-LRF.~~

(b) Provide digital recommended products to the Lead Centre(s) for LRFMME, as detailed in Appendix 2.2.17 (section 1).

Notes:

1. A candidate to be considered for designation as GPC-LRF are required to produce hindcast verification statistics according to the standard defined in Appendix 2.2.36 and make them available on the candidate’s website.

2. It is recommended that the hindcast should cover 1993 – 2016 at the minimum.

3. The bodies in charge of managing the information contained in the present Manual related to global numerical long-range prediction are specified in the table below.

Table 7. WMO bodies responsible for managing information related to global numerical long‑range prediction

|  |
| --- |
| Responsibility |
| Changes to activity specification |
| To be proposed by: | INFCOM/SC-ESMP | INFCOM/ET-OCPS |  |
| To be recommended by: | INFCOM | SERCOM |  |
| To be decided by: | EC/Congress |  |  |
| Centres designation |
| To be recommended by: | RA | INFCOM |  |
| To be decided by: | EC/Congress |  |  |
| Compliance |
| To be monitored by: | INFCOM/ET‑OCPS |  |  |
| To be reported to: | INFCOM/SC‑ESMP | INFCOM |  |

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Appendix 2.2.9. Mandatory and ~~highly~~ recommended global numerical long-range prediction products to be made available on the WMO Information System

~~Global~~ ~~Producing~~ ~~Centre~~ ~~m~~Mandatory products (maps)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variable | Coverage | Forecast range or lead time | Temporal resolution | Output type | Issuance frequency |
| 2‑m temperature | Global | ~~Any forecast range (lead time) between zero and four months~~ Minimum forecast range to four months | Averages over one month or longer periods (seasons) | (1) Ensemble mean anomaly(2) Probabilities for tercile forecast categories (where applicable) | Monthly  |
| Sea surface temperature (SST) | Global oceans |
| ~~Total precipitation~~ Monthly accumulated total precipitation | Global |

~~Probabilities for extremes are not mandatory but are highly recommended.~~

Note: SST is a mandatory product only for the centres operating 1-Tier systems.

~~Global Producing Centre highly~~ ~~r~~Recommended products (maps)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variable | Coverage | Forecast range or lead time | Temporal resolution | Output type | Issuance frequency |
| 500 hPa height | Global | ~~Any forecast range (lead time) between zero and four months~~Minimum forecast range to four months | Averages over one month or longer periods (seasons) | (1) Ensemble mean anomaly(2) Probabilities for tercile forecast categories | Monthly |
| Mean sea level pressure (MSLP) |
| 850 hPa temperature |

Note: Provision of probabilities for extremes, for the variables specified under mandatory products, are recommended.

~~Global Producing Centre highly~~ ~~r~~Recommended products (SST indices)

|  |  |  |
| --- | --- | --- |
| Index | Description | Coordinates |
| Pacific Ocean |
| Niño 1+2 | Region off coasts of Peru and Chile | 90°W–80°W, 10°S–0° |
| Niño 3 | Eastern/central tropical Pacific | 150°W–90°W, 5°S–5°N |
| Niño 3.4 | Central tropical Pacific | 170°W–120°W, 5°S–5°N |
| Niño 4 | Western/central tropical Pacific | 160°E–150°W, 5°S–5°N |
| Atlantic Ocean |
| TNA | Tropical North Atlantic | 55°W–15°W, 5°N–25°N |
| TSA | Tropical South Atlantic | 30°W–10°E, 20°S–0°  |
| TAD | Tropical Atlantic Dipole | TNA‑TSA |
| Indian Ocean |
| WTIO | Western tropical Indian Ocean | 50°E–70°E, 10°S–10°N |
| SETIO | South‑eastern tropical Indian Ocean | 90°E–110°E, 10°S–0° |
| IOD (DMI) | Indian Ocean Dipole (Dipole Mode Index) | WTIO–SETIO |

Notes:

1. Extremes (products are ~~highly~~ recommended, not mandatory) – the recommended definitions to be used for extremes are below 20th percentile and above 80th percentile.

2. Output types – rendered images (for example, forecast maps and diagrams). Note: GPCs‑LRF are encouraged to make available the retrospective forecast (hindcast) and forecast fields underlying the products. Gridded binary‑2 (GRIB‑2) format should be used for fields posted on FTP sites or disseminated through WIS. ~~GPCs‑LRF are also encouraged to provide hindcast and forecast fields, as listed in Attachment 2.2.4 section 1, to the Lead Centre(s) for LRFMME.~~

3. Definition of lead time – for example, a three‑monthly forecast issued on 31 December has a lead time of zero months for a January to March seasonal mean forecast, and a lead time of one month for a February to April seasonal mean forecast.

4. For all products, forecasts are to be expressed relative to a climatology using at least 15 years of retrospective forecasts.

5. Information on how category boundaries are defined should be made available.

6. Indices are to be displayed using “plumes” of individual ensemble members and/or the “climagram” approach.

7. Indications of skill will be provided in accordance with Appendix 2.2.37.

8. SST indices are recommended products only for the centres operating 1-Tier systems.

~~Attachment 2.2.1. Additional global numerical long‑range prediction products to be made available on the WMO Information System~~

~~Other long‑range seasonal forecast data, products or other information, in addition to the minimum list in Appendix 2.2.9, which could also be provided by GPCs‑LRF on request by RCCs or NMCs (the RCCs and NMCs would adhere to conditions, if any, attached by the GPCs‑LRF to these data and products):~~

**~~1. Grid‑point data values:~~**

~~– Hindcast and forecast data for downscaling algorithms;~~

~~– Data for regional climate model boundary and initial conditions;~~

~~– Predicted global weekly values of SST.~~

**~~2. Information to assist in building capacity in areas such as:~~**

~~– Interpretation and use of seasonal forecast products;~~

~~– Downscaling techniques (both statistical and dynamical);~~

~~– Verification techniques (to be used for local verification of RCC‑generated products);~~

~~– Development of local user applications for RCC downscaled products;~~

~~– Use and implementation of regional climate models.~~

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## Annex 5 to draft Resolution ##/2 (EC-78)

*[Proposed amendments are highlighted in addition or ~~deletion~~ to the Manual on the WMO Integrated Processing and Prediction System (WMO-No. 485) and the numbering of the text below refers to the Manual.]*

2.2.2.3 Coordination of multi‑model ensemble prediction for long‑range forecasts

Centre(s) coordinating LRF multi‑model ensembles (Lead Centre(s) for LRFMME) shall:

(a) Collect an agreed set of ~~forecast data~~ digital products listed in Appendix 2.2.17 (section 1) from ~~RSMCs participating in longrange‑ forecast numerical prediction~~ GPC-LRF under activity 2.2.1.6~~(GPCs‑LRF)~~;

(b) Make available on a website of the Lead Centre(s) for LRFMME graphical ~~appropriate minimum (~~products listed in Appendix 2.2.17~~) and additional (Attachment 2.2.4) products and GPC-LRF forecasts in standard format~~;

(c) Redistribute GPCs-LRF digital ~~forecast data~~ products ~~as described~~ in Appendix 2.2.17~~8 for those GPCs-LRF that allow it~~;

(d) Maintain an archive of the ~~real‑time~~ GPCs-LRF digital products ~~‑LRF~~ and multi‑model ensemble ~~forecasts~~ products used for graphical products listed in Appendix 2.2.17 ~~orecasts~~;

(e) Maintain a repository of documentation for the system configuration of all GPCs‑LRF systems;

(f) Verify the products using Standardized Verification System for LRF(SVSLRF)(Appendix 2.2.36);

(g) Based on comparison among different models, provide feedback to GPCs‑LRF about model performance and make available on ~~a~~ the LC-LRFMME’s website the verification results;

(h) Promote research and experience in multi‑model ensemble techniques and provide guidance and support on multi‑model ensemble techniques to GPCs‑LRF, RCCs and NMHSs;~~.~~

(i) Prepare and make available ~~on a website~~ monthly updates of Global Seasonal Climate Update (GSCU) and maintain its archive on the LC-LRFMME’s website.

Notes:

1. The requirement for the users to be registered and/or accept terms and conditions before retrieving the data does not affect the open and free status of the data.

2. The GSCU, issued quarterly, summarizes the current status (monitoring) and the expected future behaviour (prediction) of the global seasonal climate focusing on the major general circulation features and large‐scale oceanic anomalies around the globe (e.g., El Niño/Southern Oscillation, North Atlantic Oscillation, Indian Ocean Dipole, etc.) and their potential impacts on the worldwide surface temperature and precipitation patterns.

3~~2~~. The bodies in charge of managing the information contained in the present Manual related to coordination of multi-model ensemble prediction for LRFs are specified in the table below.

Table 16. WMO bodies responsible for managing information related to multi‑model ensemble prediction for LRFs

|  |
| --- |
| Responsibility |
| Changes to activity specification |
| To be proposed by: | INFCOM/SC-ESMP | INFCOM/ET-OCPS |  |
| To be recommended by: | INFCOM |  |  |
| To be decided by: | EC/Congress |  |  |
| Centres designation |
| To be recommended by: | INFCOM |  |  |
| To be decided by: | EC/Congress |  |  |
| Compliance |
| To be monitored by: | INFCOM/ET‑OCPS |  |  |
| To be reported to: | INFCOM/SC‑ESMP | INFCOM |  |

appendix 2.2.17. Minimum information to be COLLECTED BY AND available from the Lead Centre(s) for long‑range forecast SEASONAL PREDICTION multi‑model ensembles

1. ~~Global Producing Centre d~~Digital products

~~Global fields of forecast anomalies as supplied by GPCs‑LRF, including (for GPCs that allow redistribution of their digital data)~~ Collect monthly mean ~~anomalies~~global fields of forecast variables from GPCs-LRF for individual ensemble members ~~and ensemble mean~~ for at least each of the three months following the month of submission, for example, March, April, May if the month of submission is February:

~~(a) Surface (2‑m) temperature;~~

~~(b) SST;~~

~~(c) Total precipitation rate;~~

~~(d) MSLP;~~

~~(e) 850 hPa temperature;~~

~~(f) 500 hPa geopotential height;~~

~~(g) 850 hPa zonal and meridional velocity;~~

~~(h) Sea ice extent.~~

~~Note: Definitions of the content and format for the supply of data to the Lead Centre(s) by GPCs‑LRF and terms of exchange are available on the Lead Centre(s) for LRFMME website(s).~~

~~GPCs‑LRF not currently able to participate in this additional exchange of data are encouraged to do so in the future.~~

~~Mandatory products to be collected by the Lead Centres for seasonal prediction multi-model ensemble~~

Mandatory products

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Variable* | *Level (hPa)* | *Resolution* | *Forecast range* | *Time steps* | *Frequency* |
| Surface temperature | 2-meter | 2.5°× 2.5° | Minimum three months from the month of submissions | Monthly mean | Once a month |
| Sea surface temperature (SST) | Surface |
| Monthly accumulated total precipitation | Surface |
| Mean sea level pressure (MSLP) | Surface |
| Temperature | 850 |
| Geopotential height | 500 |
| Velocity (u,v) | 850 |

Note: SST is a mandatory product only for the centres operating 1-Tier systems.

Recommended products

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Variable* | *Level (hPa)* | *Resolution* | *Forecast range* | *Time steps* | *Frequency* |
| Sea-ice concentration | Surface | 2.5°× 2.5° | Minimum three months from the month of submissions | Monthly mean | Once a month |
| Snow Water Equivalent (SWE) | Surface |
| Velocity (u,v) | 10-meter |
| Velocity (u,v) | 200 hPa |

2. Graphical mandatory products

~~Plots and maps for each GPC-LRF forecast displayed in common format on the Lead Centre(s) website(s), for the variables listed in the previous section and for selectable regions, where appropriate, showing for three-month means or accumulations:~~

~~(a) Ensemble “plumes” of Niño indices (one‑month means);~~

~~(b) Ensemble mean anomalies;~~

~~(c) Probabilities of above/below median;~~

~~(d) Model consistency plots, that is, maps showing the proportion of models predicting the same sign anomaly;~~

~~(e) Multi‑model probabilities of above/below median.~~

Forecast Spatial Maps

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Forecast | *Variable* | *Forecast Type* | *Map Type* | *Digital* |
| Monthly accumulated total precipitation | DMME;PMME;Individual GPCsConsistency maps | Global and regional maps; Various projections | Yes(Only Global) |
| 500hPa GPH |
| Mean sea level pressure (MSLP) |
| 2 m Temperature |
| 850hPa Temperature |
| Sea surface temperature (SST) |
| 850hPa Zonal wind |
| 850hPa Meridional Wind |

Note: The digital mandatory products required for generating the "individual GPCs' consistency map" are not provided.

Forecast Indices

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Forecast | *Parameter* | *Forecast Type* | *Map type* | *Digital* |
| Nino1+2 | DMME;Individual GPCs | Time series | No |
| Nino3 |
| Nino4 |
| Nino3.4 |
| DMI(Indian Ocean Dipole mode index) |
| TSA(Tropical South Atlantic index) |
| TNA(Tropical North Atlantic index) |

Verifications

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Hindcast | *Variable* | *Verification Type* | *Map Type* | *Digital* |
| Monthly accumulated total precipitation | Deterministic;Probabilistic;Individual GPCs | Global and regional maps | Yes(Only Global) |
| 500hPa GPH |
| Mean sea level pressure (MSLP) |
| 2 m Temperature |
| 850hPa Temperature |
| Sea surface temperature (SST) |
| 850hPa Zonal wind |
| 850hPa Meridional Wind |

Notes:

1. DMME: Deterministic Multi-Model Ensemble.

2. PMME: Probabilistic Multi-Model Ensemble.

3. Verify products using Standardized Verification System for LRF (SVSLRF) (Appendix 2.2.36).

3. Mandatory post-processed and original Global Producing Centre digital products

Monthly means of global fields of forecast variables collected from GPCs-LRF for individual ensemble members listed in table of mandatory variables in the section 1 of this Appendix.

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~~Appendix 2.2.18. Access to Global Producing Centre data and visualization products held by the Lead Centre(s) for long‑range forecast multi‑model ensembles~~

~~(a) Access to GPC data from the Lead Centre(s) for LRFMME website(s) will be password protected.~~

~~(b) Digital GPC data will be redistributed only in cases where the GPC‑LRF data policy allows it. In other cases, requests for GPC‑LRF output should be referred to the relevant GPC‑LRF.~~

~~(c) Formally designated GPCs‑LRF and RCCs, NMHSs and institutions coordinating RCOFs are eligible for password‑protected access to information held and produced by the Lead Centre(s) for LRFMME. Entities that are in demonstration phase to seek designation as GPCs‑LRF or RCCs are also eligible for password‑protected access to information held and produced by the Lead Centre(s) for LRFMME, provided a formal notification has been issued in this regard by the WMO Secretary‑General.~~

~~(d) Institutions other than, but providing contributions to, those identified in (c) may also request access to Lead Centre(s) for LRFMME products. These institutions, referred to as “supporting institutions”, which include research centres, require endorsement letters from: (i) the Permanent Representative of the country where they are hosted, and (ii) the executive manager of the entity they wish to provide contributions to (that is, RCCs, institutions coordinating RCOFs and NMHSs). The use by supporting institutions of products from the Lead Centre(s) for LRFMME is restricted to assistance of the organizations identified in (c) in their production of official forecast outputs. Supporting institutions may not use such products to generate and display or disseminate independent forecast products. Supporting institutions must agree with these restrictions to be eligible for access. Prior to access being granted to an applicant supporting institution, the Lead Centre(s) for LRFMME will refer the application to the INFCOM/ET‑OCPS through the WMO Secretariat, for final consultation and review. Decisions to allow access must be unanimous. The Lead Centre(s) will be informed by the WMO Secretariat of such new users accepted for access.~~

~~(e) A list of users provided with password access will be maintained by the Lead Centre(s) for LRFMME and reviewed periodically by the INFCOM/ET‑OCPS, to measure the degree of effective use and also to identify any changes in status of eligible users, and determine further necessary follow‑up.~~

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appendix 2.2.36. Standardized verification system for long‑range forecasts SEASONAL PREDICTION

1. Introduction

This appendix describes procedures for the production ~~and exchange~~ of a standard set of verification scores for LRFs produced by WIPPS centres. ~~Provision of the verification products described is mandatory for GPCs‑LRF.~~ The goal is to provide consistent verification information on the LRF products of GPCs that will assist forecasters in RCCs, NMHSs and at RCOFs to prepare regional and national seasonal outlooks, and also to help the GPCs compare and improve their forecast systems. The verification scores described are to be calculated on retrospective forecasts (hindcasts). Skill measures recommended for use by RCCs in verification of regional forecasts include those described here.

This appendix describes the verification scores and the variables, regions, seasons and lead times for which the scores shall be applied.The mathematical formulation of the scores is documented on the Lead Centre(s) for LRFMME website(s), together with supplementary information on score calculation, the observational datasets to be used for verification ~~and procedures for submitting scores~~.

…

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~~Attachment 2.2.4. Additional information to be available from the Lead Centre(s) for long‑range forecast Multi‑Model Ensembles~~

~~As part of research and development, the Lead Centre(s) for LRFMME may make available products based on forecast and hindcast data from the subset of GPCs-LRF that are able to supply them. These products are additional information to help GPCs-LRF, RCCs and NMCs to further develop multi-model ensemble techniques and their application.~~

~~GPCs-LRF not currently able to participate in this additional exchange of data are encouraged to do so in the future.~~

~~1. Global Producing Centre digital products~~

~~Products should include global forecast fields and corresponding hindcasts for the fields listed in Appendix 2.2.17, and additional variables to be agreed, for those GPCs-LRF that allow redistribution.~~

~~2. Graphical products~~

~~Graphical products should include forecast maps for each GPC-LRF displayed in common format on the Lead Centre(s) website(s), for the variables listed in Appendix 2.2.17 and for selectable regions where appropriate, showing for three-month means or accumulations:~~

~~(a) Tercile category probabilities;~~

~~(b) Model consistency plots for most likely tercile category;~~

~~(c) Multi-model probabilities for probabilities for tercile categories, using various established and experimental multi-modelling methods.~~

~~These additional products will be distinguished from Lead Centre core products listed in Appendix 2.2.17.~~

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## Annex 6 to draft Resolution ##/2 (EC-78)

*[Proposed amendments are highlighted in addition or ~~deletion~~ to the Manual on the WMO Integrated Processing and Prediction System (WMO-No. 485) and the numbering of the text below refers to the Manual.]*

## 2.2.2.4 Coordination of annual to decadal climate prediction

2.2.2.4.1 The centre(s) conducting coordination of ADCP (Lead Centre(s) for ADCP) shall:

(a) Select a group of modelling centres to contribute to the Lead Centre(s) for ADCP (the “contributing centres”) that meet the GPC‑ADCP designation criteria and have been approved by ET‑OCPS; and manage changes in the membership of the group, as and when they occur, to maintain sufficient contributions;

(b) Maintain a list of the active contributing centres and the specification of their prediction systems;

(c) Collect an agreed set of hindcast, forecast and verification data (Appendices 2.2.20 and 2.2.21) from the contributing centres;

(d) Make available agreed forecast products in standard format, including multi‑model ensemble products (Appendix 2.2.20);

(e) Make available on the website agreed hindcast verification products in standard format, including verification of the multi‑model ensemble products (Appendix 2.2.21);

(f) Redistribute digital hindcast and forecast data for those contributing centres that allow it;

(g) Maintain an archive of the real‑time forecasts from individual contributing centres and from the multi‑model ensemble system;

(h) Promote research and experience in ADCP techniques and provide guidance and support on ADCP to RCCs and NMHSs;

(i) Based on comparison among different models, provide feedback to the contributing centres on model performance;

(j) Make available on a website the Global Annual to Decadal Climate Update (GADCU) and maintain its archive;

(k~~j~~) Coordinate, in liaison with relevant World Climate Research Programme activities, an annual consensus prediction product giving global prospects for the next 1–5 years.

2.2.2.4.2 Access to data and visualization products held by a Lead Centre for ADCP should follow the rules as detailed in Appendix 2.2.19.

Notes:

1. The GADCU, issued annually in May, summarizes the predicted future of the global climate over the next year and the next five years. The focus is on climate indices such as global mean near-surface temperature, Atlantic multidecadal variability and the El Niño/Southern Oscillation, as well as regional indices and annual and multi-year seasonal means of near-surface temperature, mean sea level pressure and precipitation. Maps of prediction skill are available to help with interpretation. A short summary of the observed global climate over the past five years is also included, to provide the current climate context.

2. The bodies in charge of managing the information contained in the present Manual related to coordination of ADCP are specified in the table below.

Table 17. WMO bodies responsible for managing information related to
coordination of ADCP

|  |
| --- |
| Responsibility |
| Changes to activity specification |
| To be proposed by: | INFCOM/SC-ESMP | INFCOM/ET‑OCPS |  |
| To be recommended by: | INFCOM |  |  |
| To be decided by: | EC/Congress |  |  |
| Centres designation |
| To be recommended by: | INFCOM |  |  |
| To be decided by: | EC/Congress |  |  |
| Compliance |
| To be monitored by: | INFCOM/ET‑OCPS |  |  |
| To be reported to: | INFCOM/SC‑ESMP | INFCOM |  |

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## Annex 7 to draft Resolution ##/2 (EC-78)

*[Proposed amendments are highlighted in addition or ~~deletion~~ to the Manual on the WMO Integrated Processing and Prediction System (WMO-No. 485) and the numbering of the text below refers to the Manual.]*

Part III. Current designated WMO Integrated Processing and Prediction System Centres

3. The Regional Specialized Meteorological Centres for general-purpose activities are:

Global numerical sub-seasonal forecasts:

GPC Beijing

GPC CPTEC (Brazil)

 GPC ECMWF

GPC Moscow

GPC Tokyo

Global climate reanalysis

GCR ECMWF

GCR NASA (USA)

Acronyms not previously defined: NASA – National Aeronautics and Space Administration

4. The Regional Specialized Meteorological Centres for specialized activities are:

Regional climate prediction and monitoring:

 RCC Africa hosted by the African Centre of Meteorological Applications for Development (RA I)

 RCC Beijing (RA II)

 RCC Caribbean hosted by the Caribbean Institute for Meteorology and Hydrology (RA IV)

 RCC Intergovernmental Authority on Development (IGAD) hosted by the IGAD Climate Prediction and Applications Centre (RA I)

 RCC Moscow (RA II)

 Arctic RCC Network (RA II, IV and VI): Nordic Node with pan-Arctic Climate Data function, Northern Eurasian Node with pan-Arctic Climate Monitoring function, Northern American Node with pan-Arctic Long-Range Forecast function

 RCC Network (RA VI): De Bilt node on climate data services, Offenbach node on climate monitoring, and Toulouse and Moscow node on long‑range forecasting

 RCC Network Northern Africa (RA I)

 RCC Network Southern South America (RA III)

 RCC Pune (RA II)

 RCC Tokyo (RA II)

 RCC Washington (RA IV)

 RCC Western South America hosted by the International Research Centre on El Niño (RA III)

Notes:

1. RCC Moscow (RA II) – North Eurasian Climate Centre.

2. The RA VI RCC network consists of three nodes: (a) climate data services, led by the Koninklijk Nederlands Meteorologisch Instituut (KNMI), Netherlands; (b) climate monitoring, led by Deutscher Wetterdienst (DWD), Germany; (c) long‑range forecasting, jointly led by Météo‑France and Roshydromet, Russian Federation. These Lead Centres are fully responsible for discharging the mandatory functions of the RA VI RCC network, with the support of the following contributing NMHSs:

– RA VI RCC node on climate data services:
KNMI (lead), Météo‑France, [Országos Meteorológiai Szolgálat](https://www.google.ch/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&ved=0ahUKEwj9waqx2f7WAhVPa1AKHY1OCXoQFgg3MAI&url=http%3A%2F%2Fwww.met.hu%2F&usg=AOvVaw1cZLHOj91qMQ_1_Av-GQ9o)/Hungary, Meteorologisk Institutt (met.no)/Norway, Republic Hydrometeorological Servise (RHMS)/Serbia, Swedish Meteorological and Hydrological Institute/Sweden and the Turkish State Meteorological Service (TSMS)/Turkey;

– RA VI RCC node on climate monitoring:
DWD (lead), Armstatehydromet/Armenia, Météo‑France, KNMI, RHMS and TSMS;

– RA VI RCC node on long‑range forecasting:
Météo‑France and Roshydromet (joint leads), met.no, RHMS and TSMS;

– Overall coordination:
DWD is responsible for the overall coordination.

1. The Arctic RCC Network (ArcRCC-Network) comprises three nodes, each performing mandatory functions and relevant recommended functions for a well-defined subregional domain. Additionally, each node consolidates a specific cross-node mandatory function for the entire Arctic region. The structure for ArcRCC-Network is as follows:
* North American Node, responsible for pan-Arctic Long-Range Forecasting function:
Environment and Climate Change Canada (Lead); National Oceanic and Atmospheric Administration/USA (consortium member)
* Nordic Node, responsible for pan-Arctic Climate Data Services function:
Norwegian Meteorological Institute/Norway (Lead); Danish Meteorological Institute/Denmark,
Finnish Meteorological Institute/Finland, Icelandic Meteorological Office/Iceland, Swedish Meteorological and
Hydrological Institute/Sweden – consortium members
* Northern Eurasia Node, responsible for pan-Arctic Climate Monitoring function:
Russian Service for Hydrometeorology and Environmental Monitoring (Roshydromet)/Russian Federation (Lead)
* Training function – a common responsibility for all the Nodes
* Overall coordination by Norwegian Meteorological Institute

Coordination of assessment of multiple climate reanalysis:

ECMWF

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## Annex 8 to draft Resolution ##/2 (EC-78)

*[Proposed amendments are highlighted in addition or ~~deletion~~ to the Manual on the WMO Integrated Processing and Prediction System (WMO-No. 485) and the numbering of the text below refers to the Manual.]*

1.1.2 Activities supported by the WMO Integrated Processing and Prediction System

1.1.2.1 Through WIPPS, Members shall provide and have access to meteorological, hydrological, oceanographic and climatological information supporting a range of operational activities.

1.1.2.2 WIPPS shall be organized as a three‑tier system of activities as follows:

Note: A distinction is made between general‑purpose and specialized activities: general‑purpose activities are those that encompass essential data-processing required for a wide range of end use, while specialized activities are those that make forecasting products, which may include guidance based on human interpretation, tailored for a specific type of application or user community. In addition to these activities conducted in real time, non‑real‑time operational coordination activities are also part of WIPPS. Associated commitments and other appropriate details are specified in Part II.

(a) General‑purpose activities:

– Global deterministic NWP

– Limited‑area deterministic NWP

– Global ensemble NWP

– Limited‑area ensemble NWP

– Global numerical sub‑seasonal forecasts (SSFs)

– Global numerical long‑range prediction

– Annual to decadal climate prediction

– Global climate reanalysis

– Numerical ocean wave prediction

– Global numerical ocean prediction

– Nowcasting

– Sub-seasonal to seasonal hydrological prediction

– Snow cover prediction

(b) Specialized activities:

– Regional climate prediction and monitoring

– Coordination of multi‑model ensembles for sub‑seasonal forecasts

– Coordination of multi‑model ensemble prediction for long‑range forecasts (LRFs)

– Coordination of annual to decadal climate prediction

– Coordination of assessment of multiple climate reanalysis

– Regional severe weather forecasting

– Tropical cyclone forecasting, including marine‑related hazards

– Nuclear environmental emergency response

– Non‑nuclear environmental emergency response

– Atmospheric sand and dust storm forecasts

– Volcano watch services for international air navigation

– Marine meteorological services

– Marine environmental emergency response

– Flash flood forecasting

(c) Non‑real‑time coordination activities:

– Coordination of deterministic NWP verification (DNV)

– Coordination of Ensemble Prediction System (EPS) verification

– Coordination of wave forecast verification (WFV)

– Coordination of tropical cyclone forecast verification (TCFV)

– Coordination of observation monitoring

Note: 1. It is hoped that other activities, including those related to hydrology, agriculture, polar regions, storm‑surge prediction, and space weather, will be developed in future.

2. The WIPPS centres responsible for the WIPPS activities such as global numerical sub‑seasonal forecasts, global numerical long‑range prediction, annual to decadal climate prediction, coordination of multi‑model ensembles for sub‑seasonal forecasts, coordination of multi‑model ensemble prediction for long‑range forecasts, coordination of annual to decadal climate prediction, global climate reanalysis and regional climate prediction and monitoring enable the Climate Services Information System (CSIS) through a cascading process from global to regional to national levels. The WMO CSIS is the principal mechanism through which information about climate – past, present and future – is routinely produced, archived, analysed, modelled, exchanged and processed, cascading through global, regional and national levels.

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## Draft Recommendation 8.4(1)/3 (INFCOM-3)

### Amendments to the *Manual on the WMO Integrated processing and Prediction System* (WMO-No. 485) for water and related environmental prediction

THE COMMISSION FOR OBSERVATION, INFRASTRUCTURE AND INFORMATION SYSTEMS,

**Recalling:**

1. [Resolution 59 (Cg-18)](https://library.wmo.int/idviewer/56690/199) - Amendments to the *Manual on the Global Data-Processing and Forecasting System* (WMO-No. 485),
2. [Decision 7(2)/2 (SERCOM-3)](https://meetings.wmo.int/SERCOM-3/English/2.%20PROVISIONAL%20REPORT%20%28Approved%20documents%29/SERCOM-3-d07%282%29-COLLABORATION-WITH-INFCOM-approved_en.docx?d=w0519bb4900db45bab2239ec5c613be4f) - Proposed amendments to the WIPPS Manual on requirements regarding Regional Specialized Meteorological Centres (RSMCs) conducting Marine Emergency Response (MER),
3. [Decision 7(2)/3 (SERCOM-3)](https://meetings.wmo.int/SERCOM-3/English/2.%20PROVISIONAL%20REPORT%20%28Approved%20documents%29/SERCOM-3-d07%282%29-COLLABORATION-WITH-INFCOM-approved_en.docx?d=w0519bb4900db45bab2239ec5c613be4f) - Proposed amendments to the WIPPS Manual on designation criteria and establishment of RSMCs for Global Numerical Storm Surge Prediction (GNSSP),

**Having considered** the status of the WMO research activity toward the development of warning advisory systems on vegetation fire and smoke pollution as reported in [INFCOM-3/ INF. 8.4(1b)](https://meetings.wmo.int/INFCOM-3/InformationDocuments/Forms/AllItems.aspx),

**Having examined** the following draft amendments to the [*Manual on the* *WMO Integrated Processing and Prediction System*](https://library.wmo.int/idurl/4/35703) (WMO-No. 485)‎‎‎‎‎‎‎:

(1) The provision of enhanced temporal and spatial resolution in backward transport and dispersion products and the addition of noble-gas-related products to meet the request from the Comprehensive Nuclear test ban Treaty Organization (CTBTO), as per [Annex 1](#_Annex_1_to) to draft Resolution ##/3 (EC-78),

(2) The change of the method of sending the requested forms by both CTBTO and the International Atomic Energy Agency (IAEA) to RSMCs conducting nuclear environmental emergency response from fax to email, while keeping fax as an alternative, as per [Annex 1](#_Annex_1_to) to draft Resolution ##/3 (EC-78),

(3) The introduction of the global arrangement for RSMCs conducting non-nuclear environmental emergency response in Regions IV and VI, with the aim of providing services for non-radiological emergencies to Members outside their responsible Regions, as per [Annex 2](#_Annex_2_to) to draft Resolution ##/3 (EC-78),

(4) The inclusion of the Regional Association as a responsible body in the designation of centres conducting nuclear and non-nuclear environmental emergency responses, as per [Annexes 1](#_Annex_1_to) and [2](#_Annex_2_to) to draft Resolution ##/3 (EC-78),

(5) The rename of the WIPPS activity from “marine environmental emergency response” to “marine emergency response” and the updated designation criteria of RSMC for marine emergency response, as per [Annex 3](#_Annex_3_to) to the draft Resolution ##/3 (EC-78),

(6) The new designation criteria of RSMC for global numerical storm surge prediction as a general-purpose activity, as per [Annex 4](#_Annex_4_to) to the draft Resolution ##/3 (EC-78),

(7) The change of the WMO bodies responsible for managing information related to atmospheric sand and dust storm forecasts, as per [Annex 5](#_Annex_5_to) to the draft Resolution ##/3 (EC-78),

(8) The new designation criteria of RSMC for vegetation fire and smoke pollution forecasts as a specialized activity, as per [Annex 5](#_Annex_5_to) to the draft Resolution ##/3 (EC-78),

(9) The designation of Canada and Singapore as RSMCs for vegetation fire and smoke pollution forecasts below as per [Annex 6](#_Annex_6_to) to the draft Resolution ##/3 (EC-78)

**Recommends** to Executive Council the adoption of the amendments to the [*Manual on the WMO Integrated processing and Prediction System*](https://library.wmo.int/idurl/4/35703) (WMO-No. 485) for water and related environmental prediction throughthe draft resolution provided in the [Annex](#_Annex_to_draft_4) to the present recommendation.

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[Annex: 1](#Annex_to_draft_Recommendation3)

## Annex to draft Recommendation 8.4(1)/3 (INFCOM-3)

**Draft Resolution ##/3 (EC-78)**

### Amendments to the *Manual on the WMO Integrated Processing and Prediction System* (WMO-No. 485) for water and related environmental prediction

THE EXECUTIVE COUNCIL,

**Recalling:**

(1) [Resolution 59 (Cg-18)](https://library.wmo.int/idviewer/56690/199) - Amendments to the *Manual on the Global Data-Processing and Forecasting System* (WMO-No. 485),

(2) [Resolution 30 (EC-76)](https://library.wmo.int/viewer/66258/?offset=2#page=1106&viewer=picture&o=bookmark&n=0&q=) – Amendments to the Manual on Global Data-*p*rocessing and Forecasting System (WMO-No. 485) jointly proposed by the Commission for Observation, Infrastructure and Information Systems and the Commission for Weather, Climate, Water and Related Environmental Services and Applications,

**Noting** that the Commission for Observation, Infrastructure and Information Systems (INFCOM) is developing the WMO Integrated Processing and Prediction System Rolling Review of Requirements (WIPPS RRR) as a systematic and transparent process to support the high-level design and evolution of WIPPS based on evolving user requirements as per in draft [INFCOM-3/Doc 8.4(4)](https://meetings.wmo.int/INFCOM-3/English/Forms/AllItems.aspx),

**Having examined** Recommendation 8.4(1)/3 (INFCOM-3),

**Having agreed:**

1. The amendments to the [*Manual on the WMO Integrated processing and Prediction System*](https://library.wmo.int/idurl/4/35703) (WMO-No. 485) as provided in Annexes 1 to 5 to the present resolution except the Centre designation, with effect from 1 March 2025,
2. The amendments to the [*Manual on the WMO Integrated processing and Prediction System*](https://library.wmo.int/idurl/4/35703) (WMO-No. 485) relevant to the designation of the WIPPS Centres as provided in Annex 6, with the effective from 1 September 2024,

**Invites** the Members to conduct exercises with RSMCs for conducting non-nuclear environmental emergency response in preparation for real emergencies such as forest, grass, or peat fires, major industrial fires, and chemical releases involving hazardous non-nuclear contaminants;

**Requests** SERCOM to continuously review the required functionalities and products of vegetation fire and smoke pollution forecasts using the WIPPS RRR;

**Authorizes** the Secretary-General, in consultation with the president of INFCOM concerned to make editorial amendments to the [*Manual on the WMO Integrated Processing and Prediction System*](https://library.wmo.int/idurl/4/35703)(WMO-No. 485).

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[Annexes: 6](#_Annex_1_to)

See [INFCOM-3/INF. 8.4(1b)](https://meetings.wmo.int/INFCOM-3/InformationDocuments/Forms/AllItems.aspx) for more information.

## Annex 1 to draft Resolution ##/3 (EC-78)

*[Proposed amendments are highlighted in addition or ~~deletion~~ to the Manual on the WMO Integrated Processing and Prediction System (WMO-No. 485) and the numbering of the text below refers to the Manual.]*

2.2.2.7 Nuclear environmental emergency response

Centres conducting nuclear environmental emergency response shall:

(a) Contribute to support for WMO Members and the International Atomic Energy Agency (IAEA):

(i) Prepare, on request from a delegated authority[[1]](#footnote-2) and/or IAEA, basic information relating to events in which nuclear contaminants have been released into the atmosphere; the activation of the support for nuclear emergency response is described in Appendix 2.2.22;

(ii) As soon as possible but no longer than ~~Within two to~~ three hours of reception of a request, make a range of products available to the NMHS operational contact point[[2]](#footnote-3) and/or IAEA~~on WIS~~.[[3]](#footnote-4) The minimum list, including parameters, forecast range, time steps and frequency, is given in Appendix 2.2.23;

(iii) Use agreed standard emission source parameters for atmospheric transport and dispersion modelling (ATDM) when source information is not available; default source parameters are given in Appendix 2.2.24;

(iv) Make available up‑to‑date information on the characteristics of their ATDM systems (minimum information to be provided is given in Appendix 2.2.25) and a user interpretation guide for ATDM products.

**Note: The forms to request WMO support by a delegated authority and by IAEA are given in Appendix 2.2.26.**

(b) Contribute to support for the Comprehensive Nuclear‑test‑ban Treaty Organization (CTBTO):

(i) Prepare, on request from CTBTO, relevant atmospheric ~~backtracking~~ backward transport and dispersion products;

(ii) Make the requested products available to CTBTO.

Notes:

1. Arrangements for activation and product specifications are given in Appendix 2.2.27.

2. The bodies in charge of managing the information contained in the Manual related to nuclear environmental emergency response are specified in the table below.

Table 20. WMO bodies responsible for managing information related to nuclear environmental emergency response

|  |
| --- |
| Responsibility |
| Changes to activity specification |
| To be proposed by: | INFCOM/SC-ESMP | INFCOM/ET‑ERA |  |
| To be recommended by: | INFCOM |  |  |
| To be decided by: | EC/Congress |  |  |
| Centres designation |
| To be recommended by: | INFCOM | RA |  |
| To be decided by: | EC/Congress |  |  |
| Compliance |
| To be monitored by: | INFCOM/ET‑ERA |  |  |
| To be reported to: | INFCOM/SC‑ESMP | INFCOM |  |

Acronym not previously defined: ET‑ERA – Expert Team on Emergency Response Activities.

Appendix 2.2.26. Request forms to activate Regional Specialized Meteorological Centre support (nuclear)

**ENVIRONMENTAL EMERGENCY RESPONSE ALERT REQUEST FOR WMO RSMC SUPPORT BY DELEGATED AUTHORITY**

*This form should be ~~by fax~~ sent to the RSMC by email. Fax is an alternative. At the same time, the Delegated Authority must immediately call the RSMC to confirm the transmission of this request for RSMC support.*



**ENVIRONMENTAL EMERGENCY RESPONSE REQUEST FOR WMO RSMC SUPPORT BY IAEA**

The IAEA sends the completed form by email ~~fax~~ to all RSMCs and RTH Offenbach. Fax is an alternative.

At the same time the IAEA calls the ‘Lead’ RSMCs (selected on the form) to ensure receipt of this form.



Appendix 2.2.27. Specifications for support to the comprehensive nuclear-test-ban treaty organization

1. Global arrangements for all Regional Specialized Meteorological Centres to distribute products to the Comprehensive Nuclear-test-ban Treaty Organization

Within the framework of the cooperation agreement between the Preparatory Commission for the CTBTO and WMO that entered into force on 23 May 2003, the Provisional Technical Secretariat (PTS) notifies both the RSMCs designated for the provision of atmospheric ~~backtracking~~ backward transport and dispersion products and also the WMO Secretariat in the case that anomalous radionuclide measurements occur in the International Monitoring System. The notification will be in the form of an email message that will specify the coordinates of the requested stations as well as the start and termination of the measurements. The measurement scenario will not be revealed.

(a) All notified RSMCs shall acknowledge the receipt of the request and deliver the requested atmospheric ~~backtracking~~ backward transport and dispersion products in electronic form and in the predefined format to a server specified by CTBTO PTS as part of the notification.

(b) The products shall be delivered as fast as technically possible within defined timelines.

(c) Every participating RSMC that is temporarily unable to honour the request should notify CTBTO PTS and the WMO Secretariat as soon as possible, but in any case, within 24 hours. The contact officer of the PTS is specified in the email message.

(d) Requests for support from CTBTO PTS are considered confidential and must not be disclosed.

2. Products provided by Regional Specialized Meteorological Centres with activity specialization in atmospheric transport and dispersion modelling (~~backtracking~~ backward transport and dispersion for Comprehensive Nuclear-test-ban Treaty verification support)

The CTBTO PTS requests support from RSMCs for ATDM (~~backtracking~~ backward transport and dispersion) products by using an email message with the subject line “====== PTS REQUEST FOR SUPPORT =====” to all RSMCs. This will initiate a response from all RSMCs.

The designated RSMCs shall:

(a) Email back the response form to the responsible officer at PTS within three hours;

(b) Conduct standardized ~~backtracking~~ backward transport and dispersion computations according to the specifications listed below for all measurements included in the request email message;

(c) Upload the results on a secured FTP server, as defined in the request email message, within 24 hours of reception and according to the format as defined below.

The specifications for the ~~backtracking~~ backward transport and dispersion are as follows:

– Simulate a release of 1.3 1015 Bq of a tracer integrated backward in time (no deposition, no decay) at a constant rate at the point of the station location from surface to 30 m from measurement stop to measurement start.

– Calculate the respective (backward) tracer concentrations in Bq m3 at a global ~~1° × 1° or~~ 0.5° × 0.5° grid, with an output frequency of ~~three~~ one hours, time average of output ~~three~~one hour, from surface to 30 m.

– Simulate backwards in time to the requested end date/time (up to 30 days from issuance of request).

The PTS shall:

(a) Restrict requests to cases of anomalous radionuclide measurements or system tests;

(b) Contact the RSMCs in case no confirmation of a request was received within three hours;

(c) Conduct regular announced and/or unannounced system tests;

(d) Share the results of tests with the other RSMCs at a website;

(e) Send a cancellation message of the request for support to RSMCs when an issued request is cancelled.

The PTS will not request any graphical products or products other than those specified above. Customized end-user products will be produced by the PTS for submission to the national authorities, along with RSMC model output. Measurements and end-user products will not be shared by PTS with RSMCs or WMO Secretariat for reasons of confidentiality.

**REQUEST MAIL MESSAGE FOR SUPPORT SENT OUT BY THE PTS TO WMO RSMCs**

====== PTS REQUEST FOR SUPPORT =====

Date issued: YYYYMMDD hhmm Responsible officer: NAME

Point of contact:

NAME

Tel. …………………

Fax. …………………. name@\*\*\*\*.\*\*\*

Secure website (location/user/password)

---------------

Download of information:

\*\*\*\*://\*\*\*\*\*\*\*\*\*\*\*\*\*\* username

Password

---------------

Data upload:

\*\*\*\*://\*\*\*\*\*\*\*\*\*\*\*\*\*\* Username

Password

---------------

For authentication purposes, this mail message is also available on the website:

\*\*\*\*://\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*.txt

==============================================

Source-receptor matrix results are requested for 005

stations

# LON LAT ID Measurement Start/stop time YYYYMMDD hh)

001 -70.90 -53.10 CLP18 20050328 15 20050329 15

002 -70.90 -53.10 CLP18 20050329 15 20050330 15

003 -71.25 -41.10 ARP03 20050329 12 20050330 12

004 -58.47 -34.54 ARP01 20050329 18 20050330 18

005 -70.90 -53.10 CLP18 20050330 15 20050331 15

006 -71.25 -41.10 ARX03 20050329 12 20050330 00

===============================================

Please calculate backward to YYYYMMDD hh

===============================================

Please upload data within 24

hours

==RESPONSE FORM======================================

=== WMO Centre response form ===

=== Please send back this form ===

=== to the sender of the request as ===

=== soon as possible ===

================================================

(x) We will send our contributions within the time limit (default)

( ) We will send our contributions kkk hours later then the time limit

( ) We got your request but are not able to perform computations

================================================

===== PTS REQUEST FOR SUPPORT =====

**CANCELLATION MAIL MESSAGE SENT OUT BY THE PTS TO WMO RSMCs**

====== PTS CANCELS REQUEST FOR SUPPORT =====

Date issued: YYYYMMDD hhmm

**FORMAT OF THE MODEL RESULTS AS DELIVERED BY THE RSMCs**

Line 1: Header line (station longitude, latitude, start of measurement interval (YYYYMMDD hh), end of measurement interval (YYYYMMDD hh), release strength (Bq), number of hours backward, output every “k” hours, time average of output, horizontal grid space in x direction, horizontal grid space in y direction, station name)

Line 2-k: data lines (latitude, longitude, time step number, value)

17.57 59.23 20030106 09 20030107 09 0.13E+16 144 3 3 1.0 1.0 “SEP63”

58.00 15.00 1 0.1209120E-01

59.00 15.00 1 0.6446140E-01

60.00 15.00 1 0.3212887E-02

58.00 16.00 1 0.2649441E+01

59.00 16.00 1 0.9029172E+01

60.00 16.00 1 0.7616042E-01

58.00 17.00 1 0.1073919E+02

59.00 17.00 1 0.3082339E+02

60.00 17.00 1 0.1408468E-01

58.00 18.00 1 0.2643455E+00

59.00 18.00 1 0.7357535E+00

58.00 14.00 2 0.7759376E-02

59.00 14.00 2 0.6508716E-01

60.00 14.00 2 0.2403110E-01

61.00 14.00 2 0.6662516E-03

62.00 14.00 2 0.2838572E-04

58.00 15.00 2 0.1015775E+01

59.00 15.00 2 0.5030275E+01

60.00 15.00 2 0.8239139E+00

61.00 15.00 2 0.6797127E-02

62.00 15.00 2 0.6521360E-04

58.00 16.00 2 0.8181147E+01

59.00 16.00 2 0.2503959E+02

60.00 16.00 2 0.5937406E+00

61.00 16.00 2 0.1784474E-02

58.00 17.00 2 0.1403705E+02

59.00 17.00 2 0.3715418E+02

60.00 17.00 2 0.1306086E-01

58.00 18.00 2 0.2718492E+00

59.00 18.00 2 0.7555131E+00

……

## Annex 2 to draft Resolution ##/3 (EC-78)

*[Proposed amendments are highlighted in addition or ~~deletion~~ to the Manual on the WMO Integrated Processing and Prediction System (WMO-No. 485) and the numbering of the text below refers to the Manual.]*

2.2.2.8 Non‑nuclear environmental emergency response

Note: This activity includes a network of regional centres and NMCs within a geographical region.

Centres conducting non‑nuclear environmental emergency response shall:

(a) Prepare, on request from an authorized person,[[4]](#footnote-5) ATDM forecast or hindcast products relating to events in which hazardous non‑nuclear contaminants have been released into the atmosphere; the criteria for activation of the regional support procedures and the request form are given in Appendices 2.2.28 and 2.2.32, respectively;

(b) As soon as possible, but usually within two hours of a request from an authorized person, make available a range of products to the NMHS operational contact point[[5]](#footnote-6) by email or retrieval from the RSMC password‑protected designated website; the list of mandatory and ~~highly~~ recommended products to be made available, including parameters, forecast range, time steps and frequency, is given in Appendix 2.2.29;

(c) Use agreed default emission source parameters for essential parameters when actual source information is not available; default source parameters for a range of release scenarios are given in Appendix 2.2.30;

(d) Make available on a website up‑to‑date information on the characteristics of their ATDM systems (minimum information to be provided is given in Appendix 2.2.31) and a user interpretation guide for ATDM products.

Note: The bodies in charge of managing the information contained in the present Manual related to non‑nuclear environmental emergency response are specified in the table below.

Table 21. WMO bodies responsible for managing information related to non‑nuclear environmental emergency response

|  |
| --- |
| Responsibility |
| Changes to activity specification |
| To be proposed by: | INFCOM/SC-ESMP | INFCOM/ET-ERA |  |
| To be recommended by: | INFCOM |  |  |
| To be decided by: | EC/Congress |  |  |
| Centres designation |
| To be recommended by: | INFCOM | RA |  |
| To be decided by: | EC/Congress |  |  |
| Compliance |
| To be monitored by: | INFCOM/ET‑ERA |  |  |
| To be reported to: | INFCOM/SC‑ESMP | INFCOM |  |

Appendix 2.2.28. Activation of support for non‑nuclear environmental emergency response

Environmental emergencies can be caused by a broad range of events with various temporal and spatial scales involving the release of hazardous substances into the environment. The scope of non‑nuclear emergency response activities includes: smoke from large fires, chemical releases and industrial fire/smoke. Atmospheric sand and dust storm forecasts are covered under activity 2.2.2.9. Ash emitted by volcanic eruptions, in relation to aviation, is covered under activity 2.2.2.10 – Volcano watch services for international air navigation.

National Meteorological and Hydrological Services may request RSMC support for releases that have the potential for long‑range impacts (distances greater than 50 km), according to the capability of the RSMC. Products of RSMCs are typically not applicable to shorter‑range incidents. Regional Specialized Meteorological Centres may be able to provide services for other types of incident on a case‑by‑case basis and will advise NMHSs if requests are not within their capabilities.

National Meteorological and Hydrological Services requesting RSMC support shall:

– Request via the authorized person[[6]](#footnote-7) that an RSMC provides, in accordance to its designation, products relating to events in which hazardous non‑nuclear contaminants have been released into the atmosphere;

– Send, by email (preferred) or fax, the completed form in Appendix 2.2.32 to the appropriate RSMC; if the RSMC has not confirmed reception within 20 minutes, the requester shall contact the RSMC by phone or email;

– Provide the RSMCs with the essential information specified on the request form;

– Distribute the products within their State or territory based on their national arrangements.

Global arrangements

Until such time as new RSMCs have been designated, it is proposed that RA VI‑designated RSMCs be responsible for providing services for non-radiological emergencies to RA I and RA II; RA IV‑designated RSMCs be responsible for providing services to RA III, RA V and the Antarctic.

Appendix 2.2.30. Default emission source parameters (non‑nuclear)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Scenario\* | Type of event | Material released | Rate of emission | Vertical distribution |
| Forest, grass or peat fires | Smoke | Tracer | One unit mass per hour over 36 hours | Constant from the surface to 500 m |
| Major industrial fire | Smoke | Tracer | One unit mass per hour over 6 hours | Constant from the surface to 500 m |
| Chemical release not involving fire | Chemical | Tracer | One unit mass per hour over 6 hours | Constant from the surface to 20 m |
| Other events | RSMC defined | Tracer | RSMC defined | RSMC defined |

\* Default date and start time of release are those given in the request form (mandatory information). If not provided, the date and time of reception of the request will be used.

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## Annex 3 to draft Resolution ##/3 (EC-78)

*[Proposed amendments are highlighted in addition or ~~deletion~~ to the Manual on the WMO Integrated Processing and Prediction System (WMO-No. 485) and the numbering of the text below refers to the Manual.]*

*[All changes in Draft 2 have been made responding to draft Decision 7(2) (SERCOM-3), unless otherwise indicated.]*

2.2.2.12 ***Marine ~~environmental~~ emergency response***

**Centres conducting Marine Emergency Response (MER) shall:**

**(a) Prepare, on request from an authorized person, MER analysis and forecast products relating to non-nuclear marine pollution (MER-Non-nuclear Pollution) and/or Search and Rescue (MER-SAR) incidents for global or ocean basin (Atlantic, Pacific, Indian, Arctic and Southern1) [depending on their designation], or part of an ocean basin; the procedures for activation of the regional support and the request form are given in Appendices 2.2.X and 2.2.X+1;**

**(b) As soon as possible, but usually within one hour for a SAR event / four hours for a non-nuclear marine pollution of a request is received from an authorized person, make available a range of products to the requester only in pre-agreed secured method (e.g. by email, retrieval from the RSMC password protected designated website and/or FTP server); the list of mandatory and recommended products to be made available, including parameters, forecast range, time steps and frequency, is given in Appendix 2.2.XX+2;**

**(c) Use default emission source parameters for a Marine Drifting Modelling (MDM) when actual source information is not available; default emission source parameters for a range of scenarios are given in Appendix 2.2.XX+3;**

**(d) Make available on a website up-to-date information on the characteristics of their MDM systems (minimum information to be provided is given in Appendix 2.2.XX+4), including type of incidents and geographic coverage, and a user interpretation guide for MER products, including a list of oil and/or other hazardous and noxious substances, as well as the classification of objects that could be used in the drift models;**

**(e) Participate in MER testing exercises at the request of WMO or International Maritime Organization (IMO), and their Members/Member States, including national authorities; all products provided in this context shall be labelled as “EXERCISE – EXERCISE – EXERCISE" in all pages and in large font.**

Notes:

1. A hazardous and noxious substance in this Manual is defined as any substance, including oil, which, if introduced into the marine environment is likely to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea.

2. An authorized person is a 24/7 operational contact point from an NMHS, a Rescue Coordination Centre, and/or a Regional Marine Pollution Emergency Response Centre. This(ese) person(s) is(are) nominated by the General-Director(s) of the NMHS, the Rescue Coordination Centre, and the Regional Marine Pollution Emergency Response Centre; and are authorized by Permanent Representative of the WMO Member hosting these Centres. The WMO Secretariat maintains a list of operational contact points and authorized persons on its website, and regularly informs WMO Members through a circular letter;~~Operations, including practices, procedures and specifications are described in the Manual on Marine Meteorological Services (WMO-No. 558), Volume I;~~

3. Centres can be designated to conduct MER-SAR or MER-Non-nuclear Pollution or both;~~Functions and responsibilities to be defined by the SERCOM/SC-MMO during the intersessional period;~~

4. Cenres can be designated to conduct MER-Non-nuclear Pollution for oil and/or other non-nuclear hazardous and noxious substance(s) depending on their capabilities;

5. Designated centres can have a global, an ocean basin (Atlantic, Pacific, Indian, Arctic and Southern Ocean), or part of an ocean basin (e.g. North/South Atlantic/Pacific/Indian Ocean) coverage;

6. Designated RSMC-MER may wish to develop a web interface for registered users to submit the Request Form in case of incident;

~~3.~~7. The bodies in charge of managing the information contained in the *Manual* related to marine ~~environmental~~ emergency response are specified in the table below.

Table 24. Bodies responsible for managing information related to
marine ~~environmental~~ emergency response

|  |
| --- |
| Responsibility |
| Changes to activity specification |
| To be proposed by: | INFCOM/SC‑ESMP | SERCOM/SC-MMO |  |
| To be recommended by: | SERCOM | INFCOM |  |
| To be decided by: | EC/Congress |  |  |
| Centres designation |
| To be approved by: | SERCOM | INFCOM |  |
| To be decided by: | EC/Congress |  |  |
| Compliance |
| To be monitored by: | SERCOM/SC-MMO |  |  |
| To be reported to: | INFCOM | SERCOM |  |

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**APPENDIX 2.2.XX PROCEDURES FOR ACTIVATION OF SUPPORT FOR MARINE EMERGENCY RESPONSE**

Marine emergencies are a range of scenarios and types of events listed in Appendix 2.2.XX+3. The scope of marine emergency response (MER) activities includes: spills of oil and other non-nuclear hazardous and noxious substances; and SAR.

The MER request for WMO Regional Specialized Meteorological Centre support by an authorized person is activated based on the following procedures:

(a) The request form shall be sent by email to one of the operational contacts in the RSMC-MER (either MER-SAR or MER-Non-nuclear Pollution) covering the related ocean basin (Atlantic, Pacific, Indian, Arctic and Southern Ocean) or part of it or, in case of non-existence, to an RSMC-MER with global coverage, when marine meteorological and specialized services (as listed in APPEDIX 2.2.XX+2) are required in support of MER;

(b) Any submission of a request shall be accompanied by a confirmation of receipt of request in pre-agreed method (e.g. a telephone call);

(c) In case the requester is a Rescue Coordination Centre or a Regional Marine Pollution Emergency Response Centre, it shall always copy the email with the Request Form to the NMHS(s) of the nearest country(ies) of the incident, who shall also receive the MER products from the RSMC-MER;

(d) The RSMC-MER (either MER-SAR or MER-Non-nuclear Pollution) shall make available its products as high priority for timely response, preferably within one hour in case of a SAR incident and four hours in case of a release of non-nuclear hazardous and noxious substances. An email shall be sent by the RSMC-MER with information on where to access the products. The requester must acknowledge receipt of the products by email. The requester may also inquire with the RSMC-MER in relation to the interpretation of the products, if required.

Note: Operational contacts in the RSMC-MER are nominated by the Permanent Representative of the WMO Member hosting the designated RSMC-MER.

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**APPENDIX 2.2.XX+1 REQUEST FORM TO ACTIVATE REGIONAL SPECIALIZED METEOROLOGICAL CENTRE SUPPORT (MER)**

**EXERCISE – EXERCISE – EXERCISE / REAL INCIDENT [Select as appropriate]**

Notes:

1. Please acknowledge receipt of the Request Form.

2. Delay of Response: (a) for SAR incident, MER products shall be provided within 1 hour; (b) for Non-nuclear Pollution, MER products shall be provided within 4 hours.

|  |  |
| --- | --- |
| **From (Institution):****Name (Focal Point):****Tel.(s):****Fax.:****Email:** | **To (Institution):****Tel.(s):****Fax.:****Email:** |

Date and time of Request (DD/MM/YYYY and UTC):..........................................................

(a) Mandatory information:

Select type of incident and provide brief description or details:

– Release of non-nuclear hazardous and noxious substances

– Search and Rescue of a floating object (e.g. person, container, etc.)

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Note: A list of non-nuclear hazardous and noxious substances, as well as the classification of objects that can be used in the drift models, are provided on the RSMC-MER website.

Date and start time of the incident (DD/MM/YYYY and UTC):................................................

Note: If appropriate, provide the uncertainty of the time of the incident, e.g. a time range.

Location of the release or the deployment of the floating object (as accurately as possible) in order of preference:

i. Geographic coordinates (degrees, minutes and hundredth of minutes):

|  |  |
| --- | --- |
| Latitude(specify N or S) | .................................. |
| Longitude(specify E or W) | .................................. |

Note: If appropriate, please provide the uncertainty in the initial location (in km/NM *[Secretariat]*)

ii. If appropriate, provide the nearest location in land (e.g. city, country):

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Expected or estimated release duration (in case of a release of non-nuclear hazardous and noxious substances) and rate:

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Duration of simulation for the drift model run (e.g. 24h, 36h, 48h):

..............................................................................................................................

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Name or type of pollutant(s) or floating object to be modelled if known (oil, container, human being etc.) – if unknown, a tracer will be used:

..............................................................................................................................

..............................................................................................................................

Quantity (mass), type of release (continuous or instantaneous) and release rate (mass per unit time) of pollutant if continuous. If unknown, one unit mass or one unit mass per hour will be used:

..............................................................................................................................

..............................................................................................................................

(b) Other information – If known, the following would be useful for the modelling and should be provided as well (if not provided, modeller will use default parameters or make a reasonable assumption):

Name of object (name of vessel, IMO number, news release etc.):

..............................................................................................................................

..............................................................................................................................

Meteorological conditions at location at the start of the release or the deployment of the floating object (wind speed and direction, weather, cloudiness, presence of inversion, etc.):

...............................................................................................................................

...............................................................................................................................

Size of area of interest (for example, within 300 nm of source):

..............................................................................................................................

..............................................................................................................................

In case of non-nuclear marine pollution, if quantity (mass) and name of pollutant(s) are provided, what concentrations should be displayed on modelling outputs? Please specify:

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Any other information that may be useful:

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**APPENDIX 2.2.XX+2 MANDATORY PRODUCTS**

The following mandatory MER products (in graphical format; at intervals of one, three or six hours; up to 24h, 36h or 48h as per the request) shall be provided by the RSMC-MER:

– To support MER-Non-nuclear Pollution operations (default values in Appendix 2.2.XX+3 shall be used for source parameters, if not provided):

• Drift forecasts/model outputs

• Relative concentrations or density of points

– To support Search and Rescue operations:

• Drift forecasts/model outputs

The RSMC shall perform a quick assessment of the products before they are issued and shall provide a short explanatory message if any issues of concern are noted.

If deemed requested, the RSMC-MER should also provide analysis and forecasts (at intervals of one, three or six hours; up to 24h, 36h or 48h as per the request) of:

• Wind speed and direction (graphical format)

• Sea state, including significant wave height and mean direction (graphical format)

• Visibility (text format)

• Cloud coverage (text format)

• Humidity (text format)

• Ocean currents and temperature (graphical format)

• Sea-ice (only applicable for Polar or seasonal ice Regions) (graphical format)

The following recommended MER products could be provided by the RSMC-MER:

• Tide height and time (observations and forecasts) (text format)

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**APPENDIX 2.2.XX+3 SCENARIO IN THE SCOPE, TYPES OF THE EVENT AND DEFAULT SOURCE PARAMETERS (MER-SAR AND MER-NON-NUCLEAR POLLUTION)**

|  |  |  |  |
| --- | --- | --- | --- |
| *Scenario\**  | *Type of event*  | *Material released*  | *Vertical distribution*  |
| Oil Spill  | Oil  | Tracer  | Surface  |
| Non-nuclear hazardous and noxious substances other than oil | Chemical, algae, etc.  | Tracer  | Constant from the surface to 200 m  |
| Search and Rescue  | Human/wrecks, container, etc.  | Tracer  | Surface  |
|   |   |   | RSMC defined  |

\* Default date and start time of release are those given in the request form (mandatory information) in Appendix 2.2.XX+1. If not provided, the date and time of reception of the request will be used.

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**APPENDIX 2.2.XX+4 CHARACTERISTICS OF MARINE DRIFTING MODELLING SYSTEMS**

1. System

– System Name (version)

– Type of a drift model

– Geographical domain

– Oceanographic model and NWP model used

– Implementation date

– References

2. Initial conditions and trajectory algorithm

– Input (pollutant/object data)

– Input (environmental data)

– Trajectory algorithm: wind

– Trajectory algorithm: current

– Trajectory algorithm: waves (generation method, effect on advection)

– Fate algorithm: evaporation, emulsification

- Any other fate and weathering processes

3. Other details of the model

– Model validation/verification for at least one event

4. Further information

– URLs for system documentation

– URLs for list of trials and actual marine pollution and SAR emergencies

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## Annex 4 to draft Resolution ##/3 (EC-78)

*[Proposed amendments are highlighted in addition or ~~deletion~~ to the Manual on the WMO Integrated Processing and Prediction System (WMO-No. 485) and the numbering of the text below refers to the Manual.]*

***2.2.1.X*** ***Global numerical storm surge prediction***

**Centres conducting global numerical storm surge prediction shall:**

**(a) Prepare as available global analyses, pseudo analyses or initial condition of variables contributing to ocean total water level;**

**(b) Prepare global forecast fields of basic and derived variables contributing to ocean total water level;**

**(c) Make available on WIS a range of these products; the list of mandatory and recommended products to be made available is given in Appendix 2.2.X;**

**(d) Prepare verification statistics and make them available on a website;**

**(e) Make available on a website up to date information on the characteristics of their global numerical storm surge prediction systems; the minimum information to be provided is given in Appendix 2.2.X+1.**

Note: The bodies in charge of managing the information contained in the Manual related to global numerical storm surge prediction are specified in the table below.

**Table X. Bodies responsible for managing information related to global numerical storm surge prediction**

|  |
| --- |
| *Responsibility* |
| *Changes to activity specification* |
| To be proposed by: | INFCOM/SC-ESMP | SERCOM/SC-MMO |  |
| To be recommended by: | INFCOM | SERCOM |  |
| To be decided by: | EC/Congress |  |  |
| *Centres designation* |
| To be recommended by: | RA | INFCOM | SERCOM |
| To be decided by: | EC/Congress |  |  |
| *Compliance* |
| To be monitored by: | SERCOM/SC-MMO |  |  |
| To be reported to: | INFCOM | SERCOM |  |

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***APPENDIX 2.2.X. MANDATORY AND RECOMMENDED GLOBAL NUMERICAL STORM SURGE PREDICTION PRODUCTS TO BE MADE AVAILABLE ON THE WMO INFORMATION SYSTEM***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Parameter*  | *Level*  | *Minimum resolution*  | *Forecast range*  | *Minimum time steps*  | *Frequency*  |
| Total Water level  | Surface   | 0.10 x 0.10  | Up to 3 days  | Hourly  | Twice a day  |
| Tide  | Surface  |
| Storm Surge  | Surface   |

**Recommended products:**

Forecast range: *[SERCOM]* Up to 7 days

Ensembles

Vertical reference for these data; e.g. mean sea level, geoid.

***APPENDIX 2.2.X+1. CHARACTERISTICS OF THE GLOBAL NUMERICAL STORM SURGE PREDICTION SYSTEMS***

**1. System**

* + System name (version):
	+ Date of implementation:

**2. Configuration**

* + Horizontal resolution of the model, with indication of grid spacing in km:
	+ Number of model vertical levels:
	+ Forecast length and forecast step interval:
	+ Runs per day (times in UTC):
		- Is model barotropic or baroclinic?
	+ Is model coupled to ocean, wave *[SERCOM]*, atmosphere, sea‑ice models? Specify which models:
		- Horizontal and vertical coordinate system of the model:
	+ Integration time step:
	+ Additional comments:

**3. Initial conditions**

* Method used to produce initial conditions and if relevant, any of the following information:
* Data assimilation method
* Climatology data of the model:
	+ Observations being assimilated:
	+ Assimilated window:
* Additional comments:

**4. Surface boundary conditions**

* Surface forcing, briefly describe method(s), spatial resolution, frequency, and origin of atmospheric surface forcing:
* Lateral or external forcings (e.g., sea-ice).
* Lateral boundary conditions (for example, sea-ice, river discharge)? If so, briefly describe method(s), frequency, and origin of lateral boundary conditions:
* Additional comments:

**5. Other details of model**

* How is total water level computed? (e.g. linear superposition)
* What is the vertical reference datum? (mean sea level, geoid)
* Wave model characteristics (such as, but not limited to configuration, initial and boundary conditions):
* Sea-ice model characteristics (such as, but not limited to resolution, rheology, number of sea-ice category):
* Are tide and surge interaction considered?
* Are ice or density effect considered?
* How is the bathymetry obtained?
* Source, resolution, and interpolation method
* Is the water depth clipped and if so at what depth?
* Is wetting and drying considered?
* Verification approach (e.g., following the Guide to Storm Surge Forecasting, or the Surge Model Intercomparison Project, or other)
* Other relevant details?

**6.** **Products delivered**

* + Numerical model data output in netCDF or GRIB2
	+ Resolution of the products
	+ Interpolation method if products are post-processed
	+ Frequency of the products
	+ Latency of the products (time between production and availability)

**7. Further information**

* + Operational contact point:
	+ URLs for system documentation:
	+ URL for list of products:

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## Annex 5 to draft Resolution ##/3 (EC-78)

*[Proposed amendments are highlighted in addition or ~~deletion~~ to the Manual on the WMO Integrated Processing and Prediction System (WMO-No. 485) and the numbering of the text below refers to the Manual.]*

2.2.2.9 Atmospheric sand and dust storm forecasts

Centres conducting atmospheric sand and dust storm forecasts shall:

(a) Operate an NWP model incorporating parameterizations of all the major phases of the atmospheric dust cycle;

(b) Prepare limited‑area analyses of variables relevant to atmospheric sand and dust storms;

(c) Prepare limited‑area forecast fields of variables relevant to atmospheric sand and dust storms;

(d) Make available on WIS and on a web portal a range of these products; the list of mandatory products to be made available is given in Appendix 2.2.33.

Note: The bodies in charge of managing the information contained in the present Manual related to atmospheric sand and dust storm forecasts are specified in the table below.

Table 22. WMO bodies responsible for managing information related to
atmospheric sand and dust storm forecasts

|  |
| --- |
| Responsibility |
| Changes to activity specification |
| To be proposed by: | INFCOM/SC-ESMP | ~~INFCOM/ET-ERA~~ | RB/SDS-WAS Steering Committee |
| To be recommended by: | ~~RB (WWRP/SSC)~~RB/EPAC SSC | INFCOM |  |
| To be decided by: | EC/Congress |  |  |
| Centres designation\* |
| To be recommended by: | ~~RB (WWRP/SSC, SDS-WAS Steering Group)~~RB/EPAC SSC | INFCOM | RA |
| To be decided by: | EC/Congress |  |  |
| Compliance |
| To be monitored by: | ~~INFCOM/ET-ERA~~INFCOM/SC-ESMP |  |  |
| To be reported to: | INFCOM/SC-ESMP | INFCOM |  |

Acronyms not previously defined: RB – Research Board; SDS‑WAS – Sand and Dust Storm Warning Advisory and Assessment System; ~~WWRP~~EPAC/SSC – ~~WMO World Weather Research Programme~~ Environmental Pollution and Atmospheric Chemistry Scientific Steering Committee.

2.2.2.x Vegetation fire and smoke pollution forecasts

**Centres conducting vegetation fire and smoke pollution forecasts shall:**

**(a) Operate at least an atmospheric chemistry model incorporating parameterizations of all major processes (emission, transport and deposition) related to fire propagation, and fire smoke dispersion in the atmosphere;**

**(b) Prepare limited‑area forecast fields of variables relevant to fire information and atmospheric pollution;**

**(c) Prepare limited-aera products on fire activity and fire risk;**

**(d) Make available on a website a range of mandatory and recommended products listed in Appendix A;**

**(e) Make available on a website up to date information on the characteristics of its atmospheric chemistry system.**

Note: The bodies in charge of managing the information contained in the present Manual related to Vegetation fire and smoke pollution forecasts are specified in the table below.

Table. WMO bodies responsible for managing information related to vegetation fire and smoke pollution forecasts

|  |
| --- |
| Responsibility |
| Changes to activity specification |
| To be proposed by:  | INFCOM/SC-ESMP | VFSP-WAS Steering Committee |  |
| To be recommended by | RB/EPAC SSC  | INFCOM |  |
| To be decided by | EC/Congress |  |  |
| Centres designation |
| To be recommended by | RB/EPAC SSC | INFCOM | RA |
| To be decided by | EC/Congress |  |  |
| Compliance |
| To be monitored by: | INFCOM/SC-ESMP |  |  |
| To be reported to: | INFCOM/SC-ESMP | INFCOM |  |

**APPENDIX A. MANDATORY AND RECOMMENDED VEGETATION FIRE AND ATMOSPHERIC SMOKE POLLUTION PRODUCTS**

**1. Mandatory products**

Analysis products for the current fire situation:

* Daily fire activity for last two days: daily release of fire energy (J), burnt area (m2), or other gridded variable quantifying the fire intensity for the specific day

Forecast products shall include the following set of variables:

* Surface concentrations of PM2.5 and PM10 (kg m-3)

Forecasts shall cover the period from the starting forecast time (0000 and/or 1200 UTC) up to a forecast time of at least 72 hours, with an output frequency of at least three hours.

Forecast shall cover the whole designated area. The horizontal resolution of model configuration shall be finer than 0.5° × 0.5°.

Forecasts shall be available on its website not later than 12 hours after the starting forecast time.

An explanatory note should be published on the web portal if operations are interrupted due to technical or organizational problems.

An explanatory note on the methodology used to produce “daily fire activity” shall be available on the web portal.

**2. Recommended products**

Forecast products, shall include the following set of variables:

* Surface concentrations of relevant gaseous compounds near the surface (kg m-3 or mole m-3) for at least the following species: CO, CO2, O3, SO2, NOx and VOC
* Surface concentration by species (kg m–3) for PM2.5 and PM10 fractions, including at least Organic Matter (OM) and Black Carbon (BC)
* Aerosol optical column depth at 550 nm (unitless)
* Aerosol optical column depth at 550 nm (unitless) by species including at least Organic Matter (OM) and Black Carbon (BC)
* Hourly emission of fire smoke composition: aerosol PM chemical speciation (including at least OM and BC), and major green house (CO2) and reactive gaseous (CO, O3, SO2, NOx and VOC) species (kg m-2 h-1 or mole m-2 h-1)
* Fire risk index: categorical map including at least four categories, i.e., low, moderate, high, and extreme.

Evaluation of the forecasts for surface concentrations and/or total aerosol optical column depth in the range between 340 nm and 1020 nm.

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## Annex 6 to draft Resolution ##/3 (EC-78)

*[Proposed amendments are highlighted in addition or ~~deletion~~ to the Manual on the WMO Integrated Processing and Prediction System (WMO-No. 485) and the numbering of the text below refers to the Manual.]*

part iII. Current designated WMO Integrated Processing and Prediction System Centres

4. The Regional Specialized Meteorological Centres for specialized activities are:

…

Vegetation fire and smoke pollution forecasts:

Montreal

Singapore

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1. The person authorized by the Permanent Representative of the WMO Member to request support. [↑](#footnote-ref-2)
2. Designated by the Permanent Representative. [↑](#footnote-ref-3)
3. Via a password‑protected dedicated website. [↑](#footnote-ref-4)
4. The person authorized by the Permanent Representative of the WMO Member to request RSMC support; normally the NMHS operational contact point. [↑](#footnote-ref-5)
5. Designated by the Permanent Representative. [↑](#footnote-ref-6)
6. The person authorized by the Permanent Representative of the WMO Member to request RSMC support; normally the NMHS operational contact point. [↑](#footnote-ref-7)