

# **WMO Integrated Processing and Prediction System (WIPPS) & Integration of AI-ESP into WIPPS**

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WIPPS section, WMO



WORLD  
METEOROLOGICAL  
ORGANIZATION

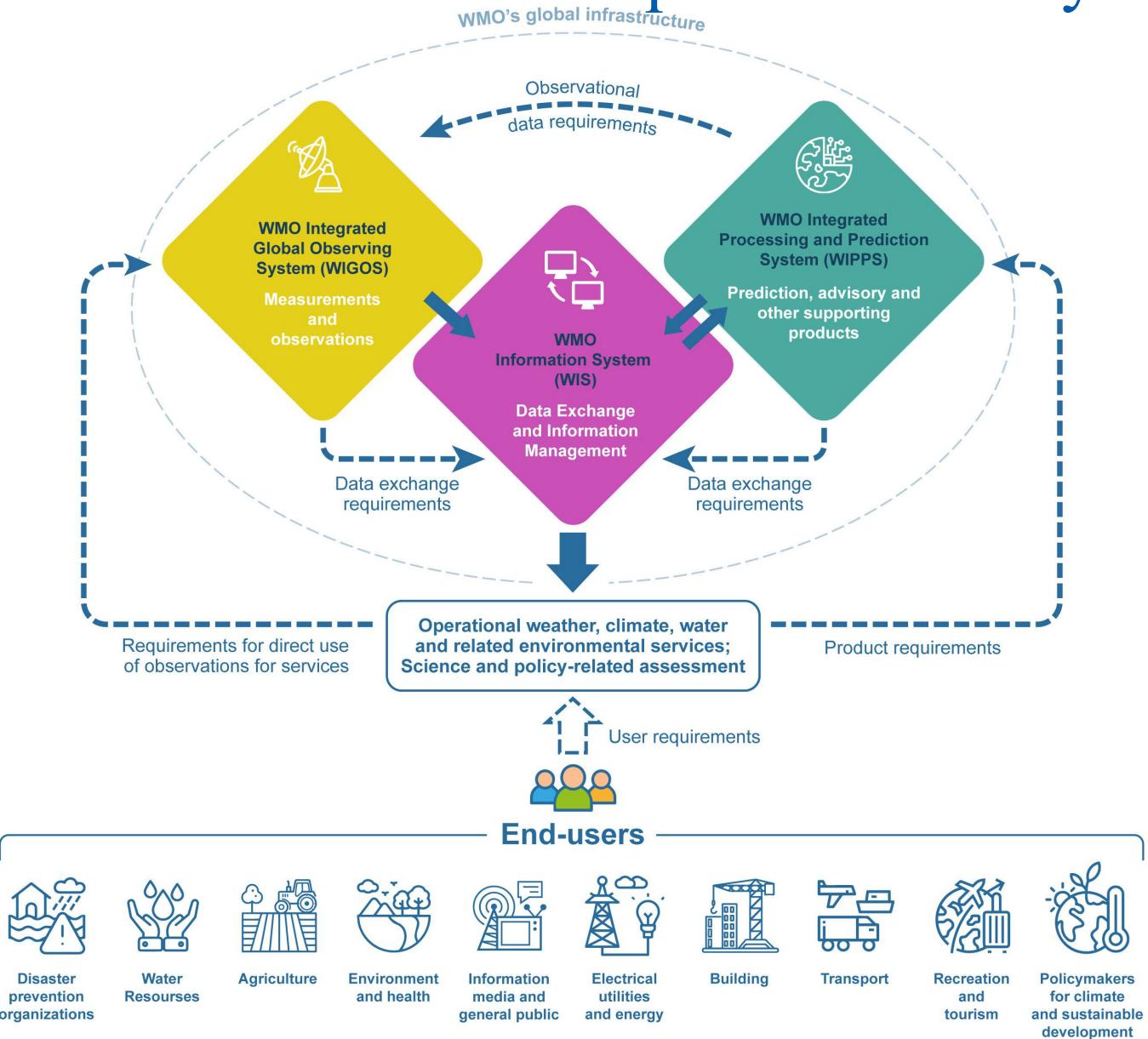
# Contents

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- I. WMO Integrated processing and prediction System (WIPPS)  
introduction
  - Role in WMO Operational infrastructure
  - Structure and working mechanisms
  - WIPPS Designated Centres (WIPPS-DCs) and their products
    - Seasonal prediction
  - Working mechanism between an RCC and WIPPS-DCs
- II. AI in WIPPS toward new strategy plan and pilot projects
- III. Skills and Knowledge Framework for Weather and Climate

# I. WIPPS Introduction

# WIPPS in WMO Operational System



- **WIGOS:** WMO Integrated Global Observing System
- **WIS:** WMO Information System (Data exchange)
- **WIPPS:** WMO Integrated processing and Prediction System

# WIPPS is

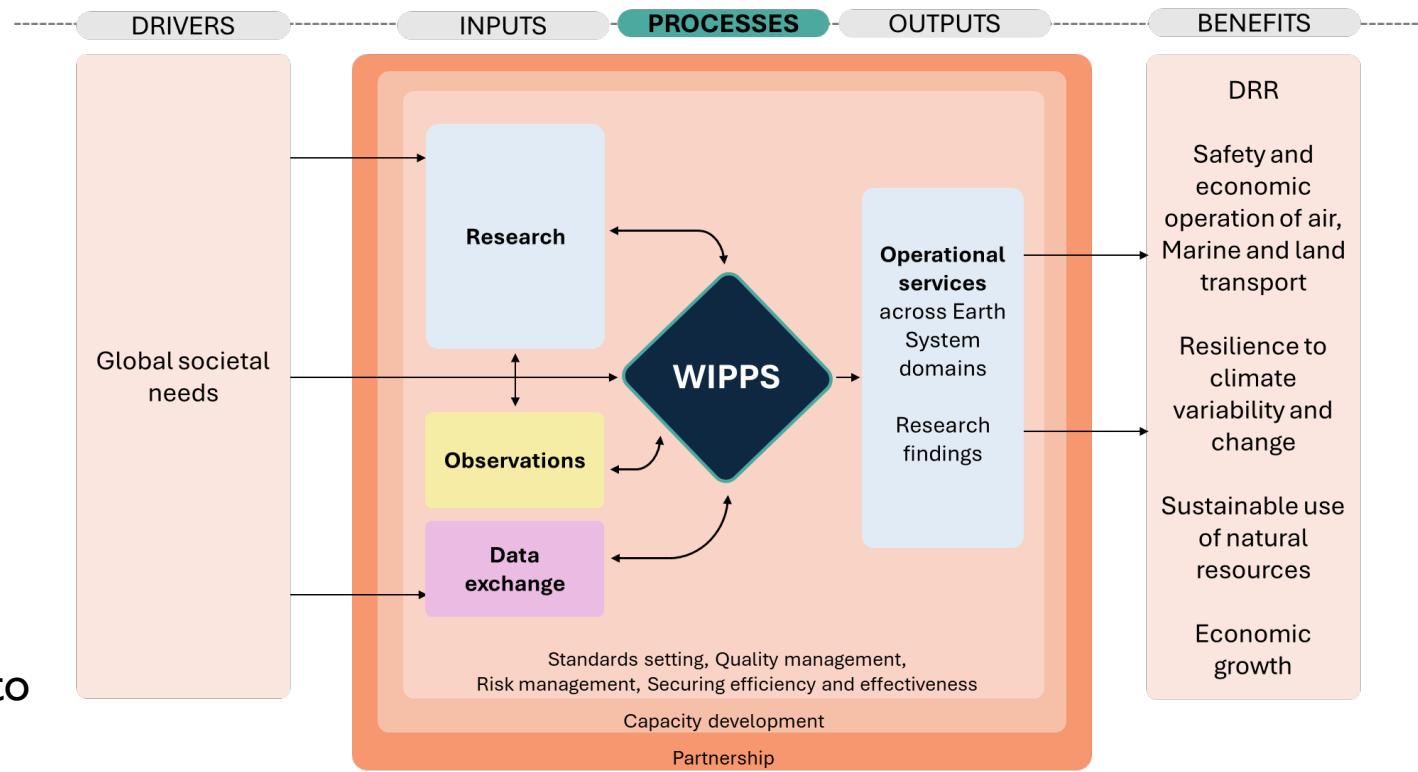
WIPPS is a worldwide network of **operational centres operated by WMO Members** and partner organizations.

## PURPOSE

- to make **operationally available** among WMO Members and relevant operational organizations **defined products and services** for applications related to weather, climate, water and environment .

## ROLE

- **to add value** to the observation based on science and technology
- **to generate** analysis and forecast products to meet users' needs.



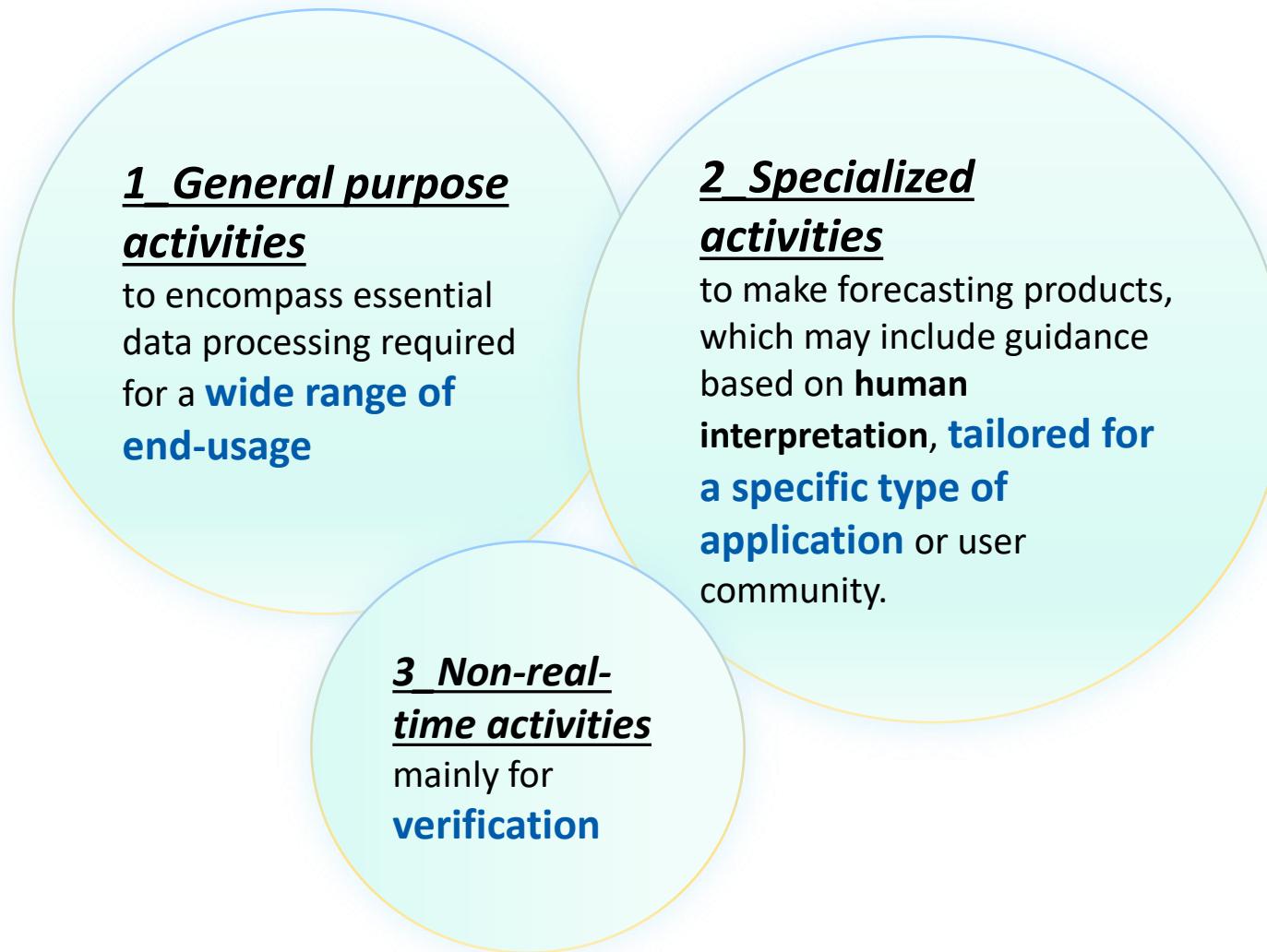
the heart of the WMO operational system

# WIPPS provides

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- **Defined products**
  - Analysis, forecast, including probabilistic information
  - Specialized products tailored for specific applications
- **Operational centres** that produce the defined products
  - **WIPPS Designated Centres** (WIPPS DCs) and National Meteorological Centres (**NMCs**)
    - WIPPS Centres consist of WIPPS DCs and NMCs
    - WIPPS DCs encompass different names, such as World Meteorological Centre (WMC), Global Producing Centre (GPC), Regional Specialized Meteorological Centre (RSMC), Regional Climate Centre (RCC) (RCC-Network), Regional Specialized Hydrological Centre (RSHC) and Lead Centre (LC)
- **Modalities** for delivering the products
  - WIS –*mandatory products defined in the Manual on the WIPPS (WMO-No. 485) (minimum set)*
  - Websites of WIPPS Centres
    - Direct download from the WIPPS Centres – ftp, API and ...
  - Other platforms such as Copernicus

# WIPPS Activities : Categories



- ✓ The activity specifications are defined for each type of WIPPS activities.
- ✓ The **minimum list of mandatory products** is defined for each type of WIPPS activities (If defined).
- ✓ A Centre that can fulfil the responsibilities of one of WIPPS activities is **designated** as a WIPPS Designated Centre (WIPPS-DC) by **EC or Congress upon Members' application**.

# WIPPS Activities : Full list

## General purpose activities (14)

- Global deterministic numerical weather prediction
- Limited area deterministic numerical weather prediction
- Global ensemble numerical weather prediction
- Limited area ensemble numerical weather prediction
- **Global numerical sub-seasonal forecasts**
- **Global numerical seasonal prediction**
- **Annual to decadal climate prediction**
- **Global climate reanalysis**
- Numerical ocean wave prediction
- Global numerical ocean prediction
- Global numerical storm surge prediction
- Nowcasting
- Sub-seasonal to seasonal hydrological prediction
- Snow cover prediction

GPC

## Specialized activities (15)

- Regional climate prediction and monitoring (RCC)
- **Coordination of multi-model ensemble for sub-seasonal prediction**
- **Coordination of multi-model ensemble for seasonal prediction**
- **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
- Vegetation fire and smoke pollution forecasts
- Volcano watch services for international air navigation
- Marine meteorological services
- Marine environmental emergency response
- Flash flood forecasting

LC

## Non-real-time activities (5)

- Coordination of deterministic numerical weather prediction (NWP) verification
- Coordination of ensemble prediction system (EPS) verification
- Coordination of wave forecast verification
- Coordination of tropical cyclone forecast verification
- Coordination of observation monitoring

**34 activities**

2024 updated

# WIPPS Web Portal: Exploring WIPPS Designated Centres

Designated WIPPS Centres Web portal for the WMO Integrated Processing and Prediction System

Filter by Region

I II III IV V VI

Filter by WIPPS Activities

Search...

World Meteorological Centre

Global deterministic numerical weather prediction

Limited-area deterministic numerical weather prediction

Global ensemble numerical weather prediction

Limited-area ensemble numerical weather prediction

Global sub-seasonal prediction

Global seasonal prediction

Annual to decadal climate prediction

Global climate reanalysis

Numerical ocean wave prediction

Global numerical ocean prediction

Nowcasting

Regional climate prediction and monitoring

Coordination of multi-model ensembles for sub-seasonal forecasts

Coordination of multi-model ensemble prediction for long-range forecasts

**9 centres/networks**

**1 activities**

Geo-statistics on the selected activities

RA II 2  
RA IV 2  
RA VI 5

RSMC Beijing  
RSMC ECMWF  
RSMC Exeter  
RSMC Montreal  
RSMC Moscow  
RSMC Offenbach  
RSMC Tokyo  
RSMC Toulouse  
RSMC Washington

Easy data access: graphical products and gridded data

Information about RSMC ECMWF (Global deterministic numerical weather prediction)

Graphical display, ECMWF website

Product inventory. Open data from ECMWF website, old version. Gridded products at 0.4 degrees resolution.

Information on key characteristics of the model and documentation

Geopotential height, 850 hPa [Inventory] [WIS Metadata]

Geopotential height, 500 hPa [Inventory] [WIS Metadata]

Geopotential height, 250 hPa [Inventory] [WIS Metadata]

Temperature, 850 hPa [Inventory] [WIS Metadata]

Temperature, 500 hPa [Inventory] [WIS Metadata]

Temperature, 250 hPa [Inventory] [WIS Metadata]

Wind zonal velocity (u), 925 hPa [Inventory] [WIS Metadata]

Wind zonal velocity (u), 850 hPa [Inventory] [WIS Metadata]

Wind zonal velocity (u), 700 hPa [Inventory] [WIS Metadata]

Wind zonal velocity (u), 500 hPa [Inventory] [WIS Metadata]

Wind zonal velocity (u), 250 hPa [Inventory] [WIS Metadata]

Wind meridional velocity (u), 850 hPa [Inventory] [WIS Metadata]

Wind meridional velocity (v), 850 hPa [Inventory] [WIS Metadata]

Wind meridional velocity (u), 500 hPa [Inventory] [WIS Metadata]

Wind meridional velocity (v), 500 hPa [Inventory] [WIS Metadata]

Wind meridional velocity (u), 250 hPa [Inventory] [WIS Metadata]

Wind meridional velocity (v), 250 hPa [Inventory] [WIS Metadata]

Mandatory products described in the Manual on the WIPPS are listed here.

RA indicates mandatory products.

2,000 km  
1,000 mi

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Useful links

- A full list of designated WIPPS centres (Part III of Manual on the WMO Integrated Processing and Prediction System)
- WIPPS Community site

ECMWF

Website: [Link](#)

Focal Point: [Dr Matthieu Chevallier](#)

Principal GISC: [Exeter](#)

This centre was designated in year 2017

Notes to User

1. This page is updated quarterly, updating information to the Focal Point and the Principal GISC.

2. A list of designated WIPPS centres are linked to the WMO Community Platform. WMO members will be able to get detailed contact information of the focal points after login.

Disclaimer

Quick info on the centre, website, focal point, etc.

This centre performs the following WIPPS activities:

- World Meteorological Centre
- Global deterministic numerical weather prediction
- Global ensemble numerical weather prediction
- Global sub-seasonal prediction
- Global seasonal prediction
- Global climate reanalysis
- Coordination of multi-model ensembles for sub-seasonal forecasts

# WIPPS Centres : Working mechanism

WMCs are advanced NWP centres that can carry

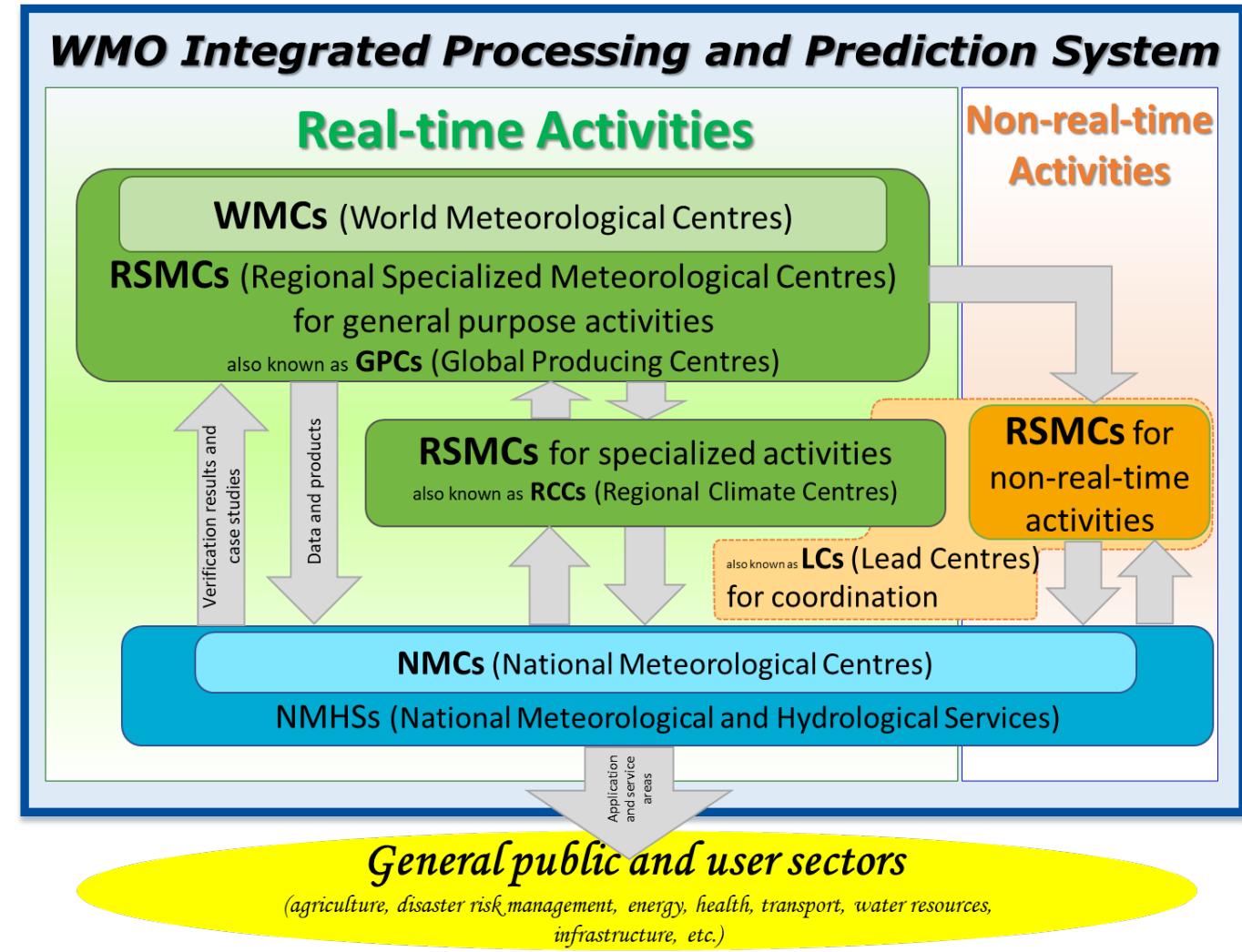
out the following activities:

- Global deterministic NWP;
- Global ensemble NWP;
- Global numerical seasonal prediction.

## RSMCs (Three types)

- (1) for **general purpose activities**: essential data processing for a wide range of end use.
- (2) for **specialized activities**: tailored for a specific type of application and user community.
- (3) for **non-real-time activities**: to coordinate verification activities to support Members in using RSMCs' products.

**NMCs** prepare **forecasts and warnings** at all forecasting ranges necessary to meet the requirements of the Member.



# Lead Centre and Global Producing Centres

## Seasonal Prediction

## Functions



### LC-SPMME (Seoul & Washington)

Home About us N Seasonal Related Sites WMO lead centre

Latest Forecast data



#### Notice & News

Check! System Requirements

NOTICE WMO Global Seasonal Climate Update (GSCU) for ASO 2025

NOTICE GPCs(14) for ASO 2025 are uploaded

NOTICE Manual of download digital data

| More Links

How to download data

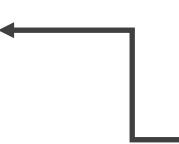
2025-07-25

2025-07-25

2023-07-26

today : 3,891

total : 5,793,589



15 GPCs-SP

[WMO SPMME \(wmoclc.org\)](http://wmoclc.org)

# LC-SPMME products

## Deterministic MME

- Simple composite method
- Regular multiple regression
- Singular value decomposition
- Generic Algorithm

## Verification: Hindcast

- Deterministic: ACC, RMSE, MSSS, GSS
- Probabilistic: ROC and reliability map
- Indices: ACC, RMSE

## Verification: Forecast

- Deterministic: ACC, RMSE
- Probabilistic: ROC, REL, BS, BSS
- Indices: TCC, RMSE

## Observation

- ERA-5 anomaly relative to the chosen period

## Data Exchange

- Hindcast, forecast
- GRIB & NetCDF

WMO Lead Centre  
Long-Range Forecas

Seasonal

Information

- » Probabilistic MME
- » Deterministic MME
- » Climate Indices
- » References

Forecast

- » Probabilistic MME
- Deterministic MME**
- » Individual Forecast
- » Indices

Verification

- » Hindcast
- » Forecast

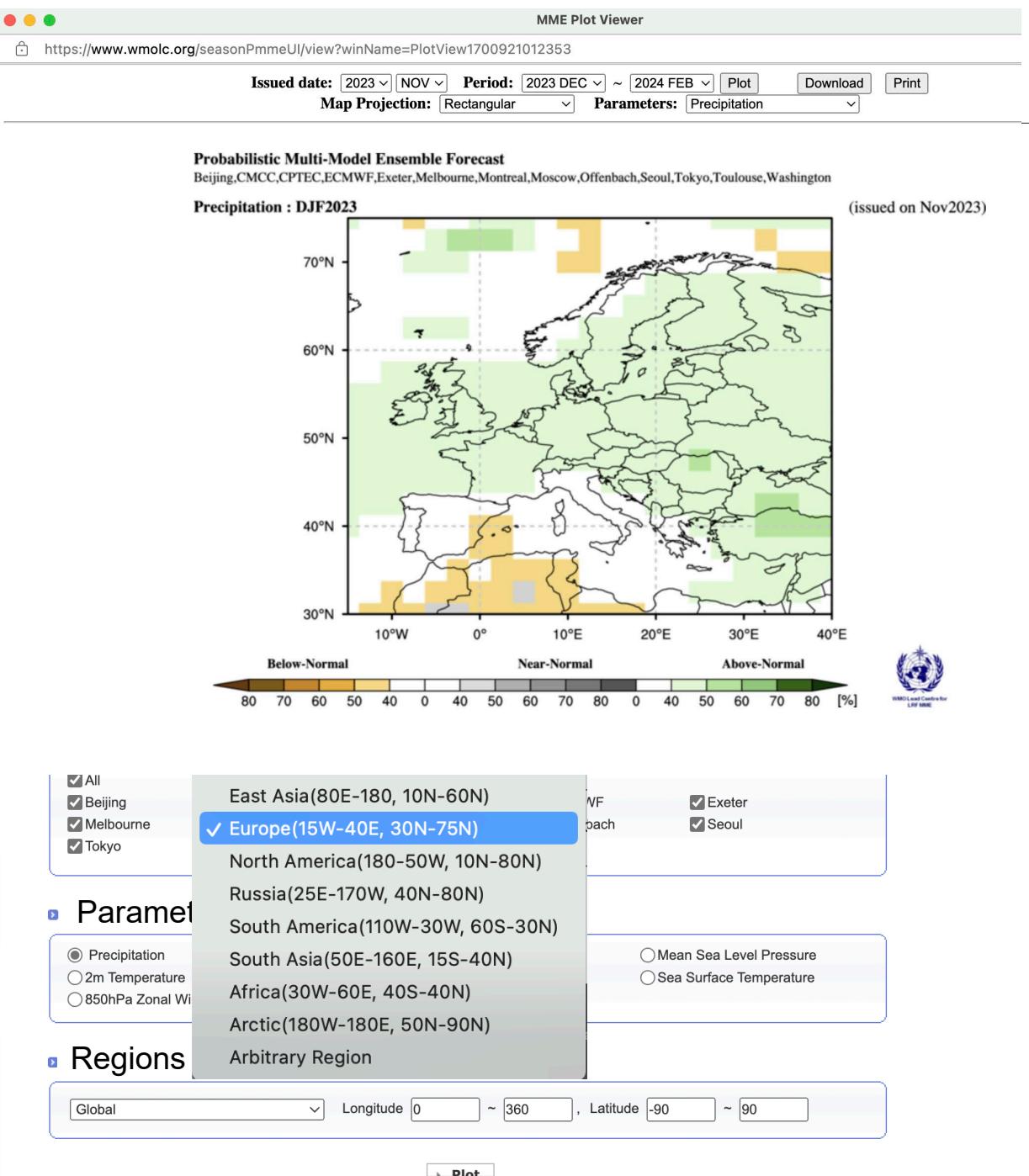
Observation

Data Exchange

- » Search & Download
- » Direct Download

System Configuration Information

Global Seasonal Climate Update



# Key WIPPS Documents: Manual, Guide, and Guideline



**Manual** on the WMO Integrated Processing and Prediction System (WMO-No. 485) (2023 edition, updated in 2024) - available in English, French, Russian, Spanish, Arabic, Chinese

The **Manual** provides detailed information on WIPPS activities: mandatory/recommended functions including production, verification and documentation etc.



**Guide** to the WMO Integrated Processing and Prediction System (WMO-No. 305) (2023 edition, updated in 2024) - available in English (2023 edition is available in French, Russian, Spanish, Arabic, Chinese)



## Guidelines on/for

- Ensemble Prediction Systems and Forecasting ([WMO-No. 1091](#))
- Ensemble Prediction System Postprocessing ([WMO-No. 1254](#))
- Nowcasting Techniques ([WMO-No. 1198](#))
- Operational Practices for Objective Seasonal Forecasting ([WMO-No. 1246](#))
- Verification of Operational Seasonal Climate Forecasts ([WMO-No. 1220](#))
- Satellite-based Nowcasting in Africa ([WMO-No. 1309](#))
- High-resolution Numerical Weather Prediction ([WMO-No. 1311](#))



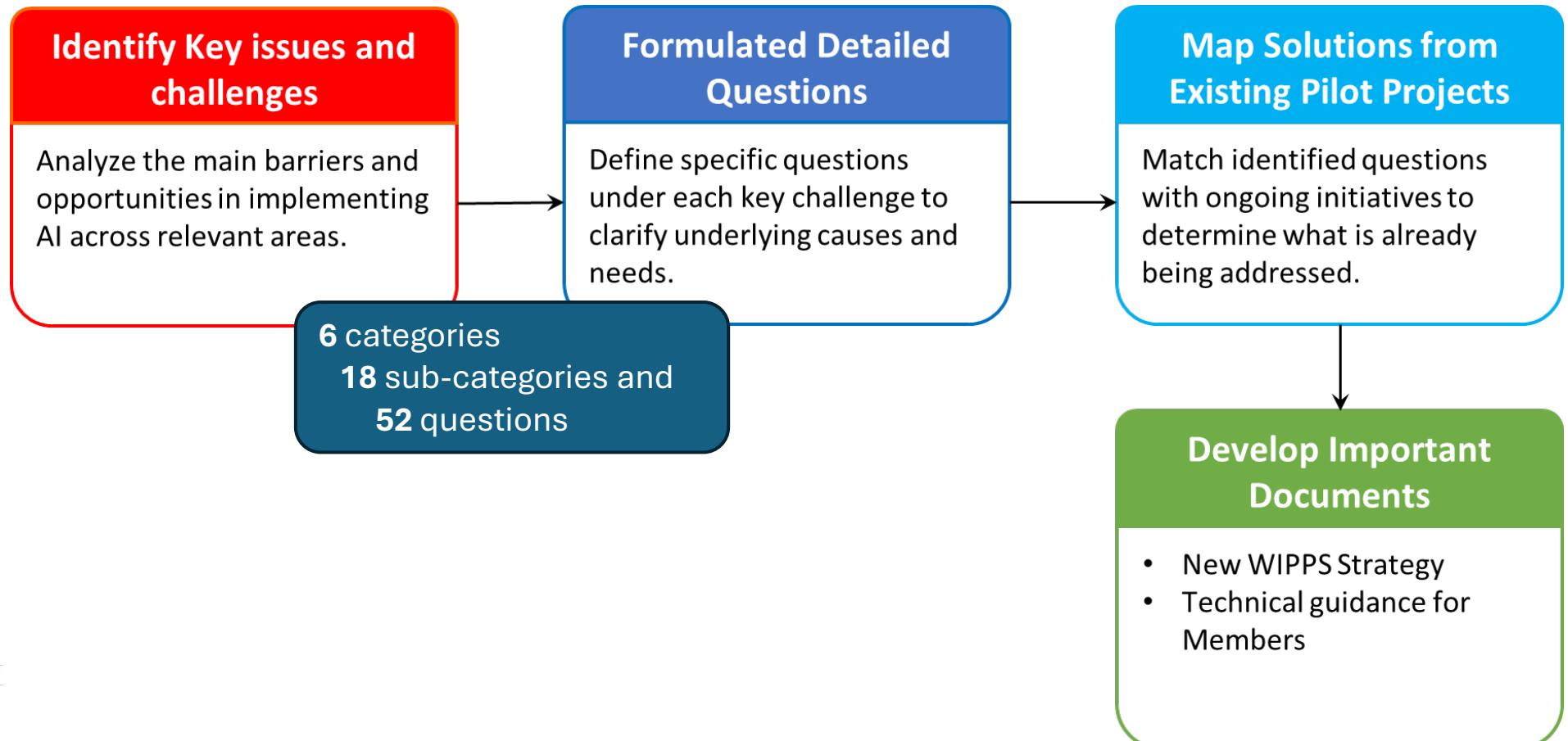
## II. WIPPS AI Plan toward new strategy plan and pilot projects

# WIPPS Exploration AI Roadmap

- [WIPPS Exploration AI Roadmap full version](#)

## Primary Objective

- Provide WMO Members with **guidance regarding the potential and limitations of new AI technologies** and;
- Identify **good approaches** for integrating these technologies into their operational practices.



# Challenges and specific questions to be addressed

## 1. Data Availability and Quality

- a. Provision of long-term observation/(re)analysis dataset for AI training and verification
- b. Observation requirements for high-impact forecasting
- c. Quality control of observations

## 2. Prediction and post-processing

- a. Benefit and applicability of AI-ESP for nowcasting and forecasting
- b. High-resolution AI-based forecasts for local area
- c. Compatibility between initial fields and training dataset
- d. High-resolution data-driven models
- e. Benefit and necessity of post-processing

## 3. Verification

- a. WIPPS standard verification of AI-ESP model outputs
- b. Verification of AI-ESP model outputs for local weather elements and extremes
- c. Verification of meteorological consistency between variables of AI-ESP model outputs
- d. Verification of forecast scenarios

## 4. NMHS infrastructure and capacity requirements

- a. Use of AI-ESP model outputs in operational forecasting and warning
- b. Implementation and maintenance of AI-based systems

## 5. Model Explainability and Transparency

- a. Guidelines on the use and interpretation of AI-ESP model outputs
- b. Guidelines on developing explainable AI-ESP

## 6. WIPPS Framework and Technical Regulations

- a. Expansion of WIPPS activities to accommodate AI-ESP model outputs
- b. Impact of AI on the WIPPS cascading process

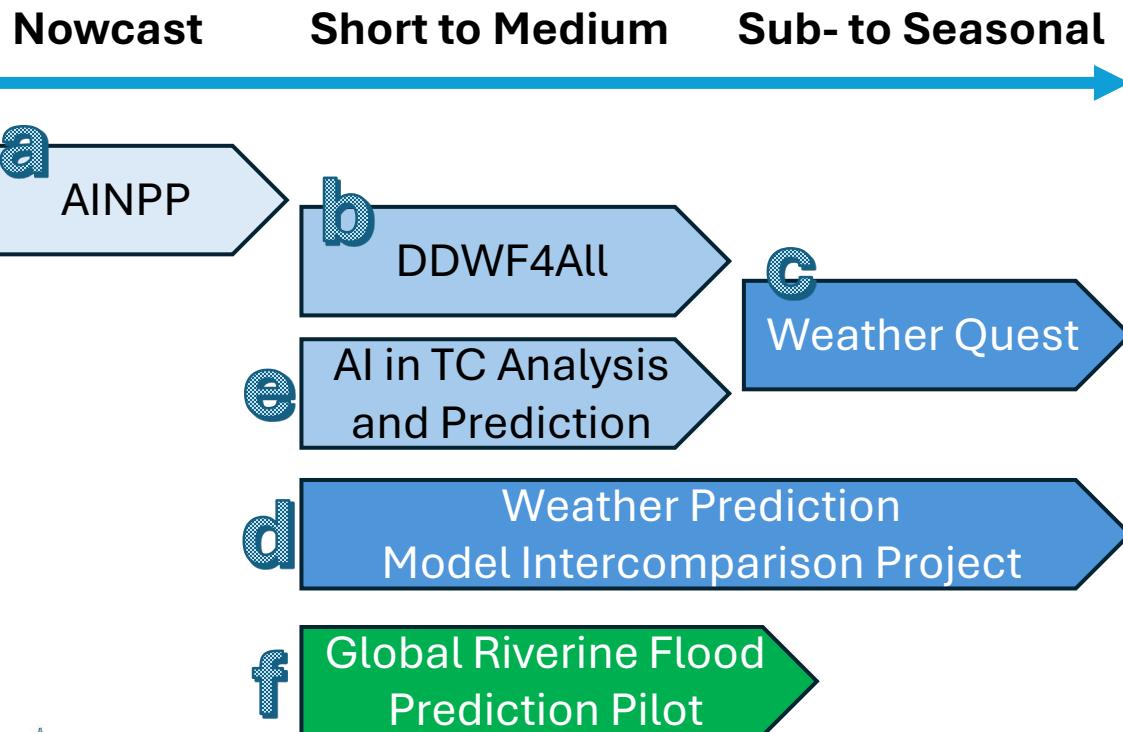
6 categories

18 sub-categories and  
52 questions

# Map Solutions from Existing Pilot Projects

## Testing through WIPPS Pilot Project

Key issues and challenges identified will be addressed through pilot projects. Each of these pilot projects will serve as a proof of concept for broader AI integration into WIPPS and will be designed to test the scalability and effectiveness of AI solutions in operational settings.



		4.1 AI-related projects					
		a. AINPP	b. DDWF4All	c. AI Weather Quest	d. WP-MIP	e. AI-TC	f. Global Flood
1	a			x	x		
	b	x	x				
	c	x	x				
2	a	x		x	x	x	x
	b		x			x	x
	c		x	x	x	x	
	d		x			x	
	e			x	x	x	x
3	a	x		x	x		
	b	x	x		x	x	
	c	x			x		
	d	x	x		x	x	
4	a	x	x		x	x	
	b	x	x	x	x	x	
5	a		x		x	x	
	b		x	x	x	x	x
	a						
6	b	x	x	x	x	x	x

# Develop important documents

- [Draft Resolution 2.3\(1\)/1 \(Cg-Ext\(2025\)\)](#)

- A New WIPPS Strategy,
  - including the incorporation of AI into WIPPS, to replace the WIPPS Collaborative Framework and WIPPS Roadmap (2022–2026),
- Guidelines on the use of AI-based Earth System Prediction (AI-ESP)
  - Maintain these technical Guidelines as an **online** resource.
  - Propose list of Guidelines
    - **General Guidelines on the use of AI**
    - Guidance on specific topics
      - **Guidelines on nowcasting technique**
      - **Guidelines on tropical cyclone forecasting**
      - **Guidelines on short to medium-range prediction**
- Timeline
  - INFCOM-4 (Q4 2026)

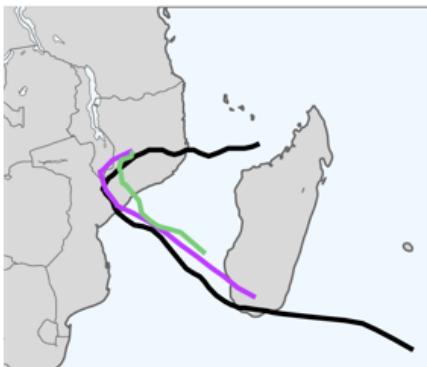
# PP: Data-Driven Weather Forecasting for All – Met Norway

**Objective:** To enhance the capacity of NMHSs, particularly LDCs and SIDS, to provide accurate, reliable, and localized multi-hazard early warnings by deploying AI- and data-driven forecasting systems, tailored to local conditions, and building technical capacity through training and knowledge sharing.



Cyclone Jude track

Reference time: 2025-03-11



Prepare Initial  
Conditions

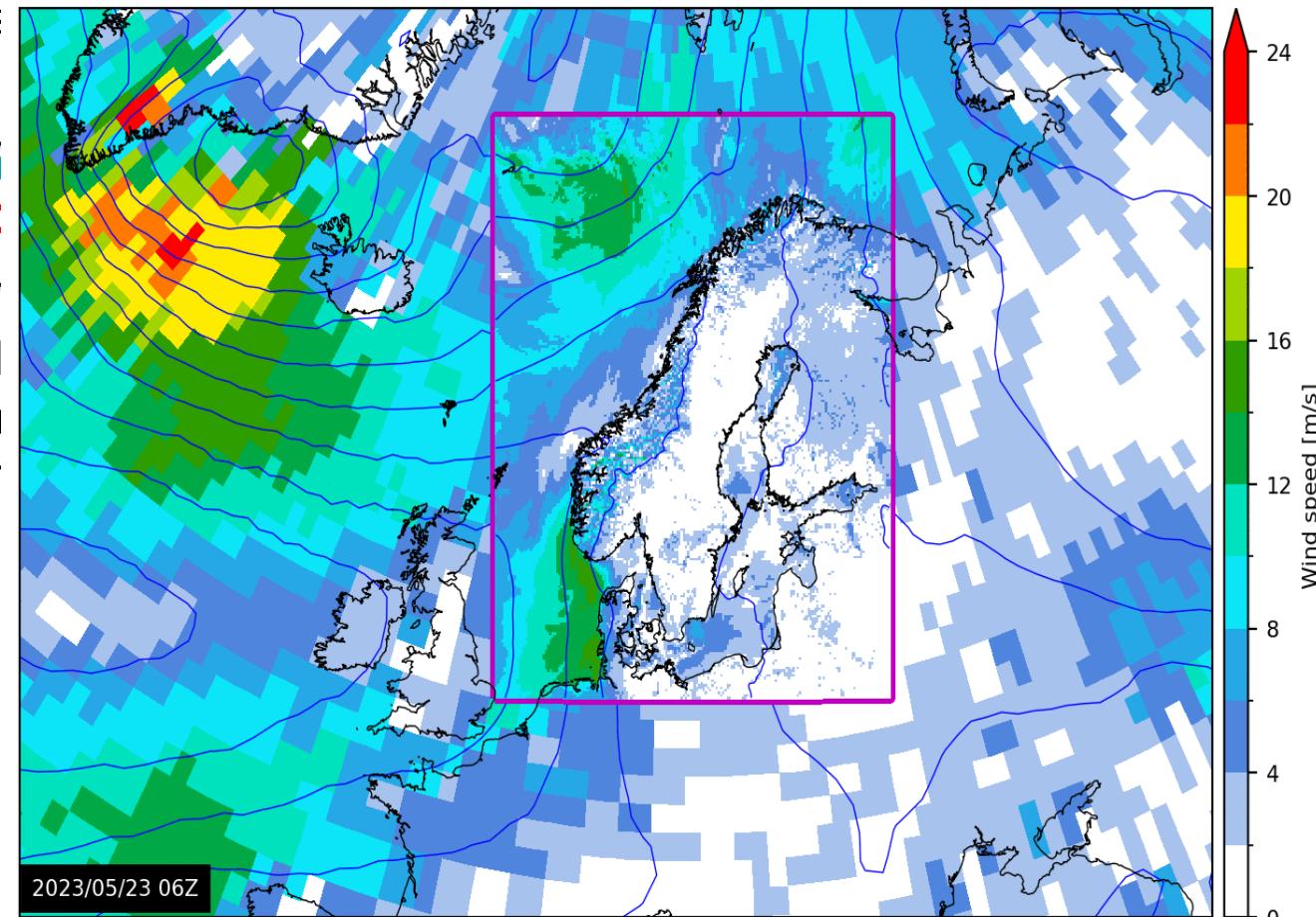


**Anemoi:** an open-source, M forecasting system centers across Eur

over Malawi.

- Mac Studio (Apple M4 Max, 128G memory)
- Run time: 19 minutes

**Forecast-in-a-Box:** a prototype system by ECMWF aimed at packaging a forecasting workflow (including AI models deployed flexibly (cl



# PP: AI Weather Quest - ECMWF

A global competition, organised by ECMWF and endorsed by WMO, for the **best-performing AI/ML models for sub-seasonal predictions**.

17/03/25      15/05/25      14/08/25      13/11/25      12/02/26      14/05/26      06/08/26

## Initial Training Phase:

Develop / refine your models

## Competition Phase:

Submit weekly, real-time forecasts over as many 13- week periods as you choose.

**AI/ML sub-seasonal forecasts**

Home / AI Weather Quest

Search products...

Parameters

Mean sea level pressure

Near-surface temperature

Accumulated precipitation

Teams

2

AIFC

AIFS

BrAlnfall

CAMExpedition

CLINT

CMAandFDU

FengWuW2S

HAPPY

HYT

IgnisNeuralis42

JR

KITKangu

Lambda1

LP

AI Weather Quest

AIFC: WRFcast Accumulated precipitation quintile probabilities

You are viewing forecast probabilities submitted by the respective team to the AI ...

AI Weather Quest

AIFS: AIFSgai Accumulated precipitation quintile probabilities

You are viewing forecast probabilities submitted by the respective team to the AI ...

AI Weather Quest

AIFS: AIFShera Accumulated precipitation quintile probabilities

You are viewing forecast probabilities submitted by the respective team to the AI ...

AI Weather Quest

AIFS: AIFStalassa Accumulated precipitation quintile probabilities

You are viewing forecast probabilities submitted by the respective team to the AI ...

AI Weather Quest

BrAlnfall: LSTMMAP Accumulated precipitation quintile probabilities

You are viewing forecast probabilities submitted by the respective team to the AI ...

AI Weather Quest

BrAlnfall: PreAlmhyd Accumulated precipitation quintile probabilities

You are viewing forecast probabilities submitted by the respective team to the AI ...

AI Weather Quest

CAMExpedition: SBCDiff Accumulated precipitation quintile probabilities

You are viewing forecast probabilities submitted by the respective team to the AI ...

AI Weather Quest

CAMExpedition: VAEtherCast Accumulated precipitation quintile probabilities

You are viewing forecast probabilities submitted by the respective team to the AI ...

Evolution of teams' rankings based on period-aggregated RPSS scores in the SON 2025 period, for near-surface (2m) temperature and for the first forecast window:

Search

AIFC

AIFS

CAMExpedition

CLIMA

CLINT

CMAandFDU

FengWuW2S

HAPPY

HYT

IgnisNeuralis42

JR

KITKangu

Lambda1

LP

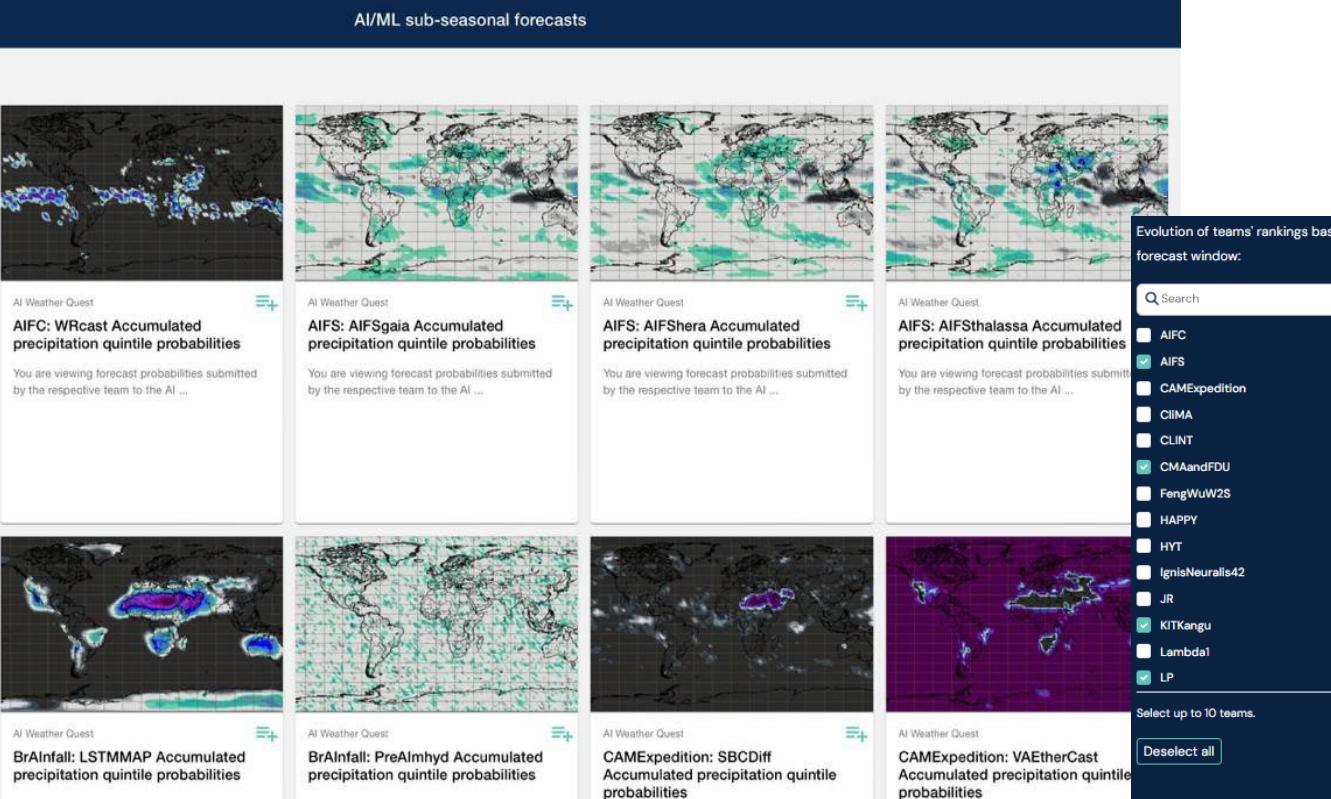
Select up to 10 teams.

Deselect all

Team ranks

Competition weeks

● AIFS   ● CMAandFDU   ● KITKangu   ● LP   ● MicroEnsemble



# More information on WIPPS including AI

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- [WMO Integrated Processing and Prediction System \(WIPPS\)](#)
- [New Web Portal Eases Access of Forecast Products](#)
- [WIPPS Webinar](#)
- [WIPPS Pilot Project](#)
- [WIPPS Newsletter No. 3-2025 \(2\)](#)

1.2 Operationalizing AI-Driven Forecasting at World Meteorological Centres

### III. Development of Skills & Knowledge Framework for WIPPS products: Weather & Climate

# Compendium of WMO Competency Framework (WMO-No. 1209)

<b>1. KNOWLEDGE AND SKILL FRAMEWORKS.....</b>	<b>2</b>
1.1 Satellite skills and knowledge for operational meteorologists .....	2
1.2 Radar skills and knowledge for operational meteorologists .....	10
<b>2. COMPETENCY REQUIREMENTS.....</b>	<b>16</b>
2.1 Public weather service forecasters and advisers .....	16
2.1.1 Fundamental WMO competency requirements for public weather forecasters	16
2.1.2 Weather broadcasters and communicators .....	21
2.1.3 Personnel working in the development and delivery of meteorological and hydrological products and services .....	25
2.1.4 Public weather service advisers supporting disaster prevention and mitigation and other user activities .....	29
2.2 Competency Standards for Aeronautical Meteorological Personnel .....	34
2.2.1 Aeronautical Meteorological Forecaster .....	36
2.2.2 Aeronautical Meteorological Observer .....	44
2.3 Education and training providers.....	48
2.4 Competency requirements for operating and exploiting the WMO Information Systems.....	54
2.5 Marine weather forecasters.....	69
2.6 Provision of climate services .....	77
2.7 Instrumentation, calibration, meteorological observations, and observing programme and network management .....	85
2.7.1 Competency framework for personnel performing meteorological observations .....	85
2.7.2 Competency framework for personnel installing and maintaining instrumentation .....	92
2.7.3 Competency framework for personnel performing instrument calibrations .....	97
2.7.4 Competency framework for personnel managing observing programmes and networks.....	103

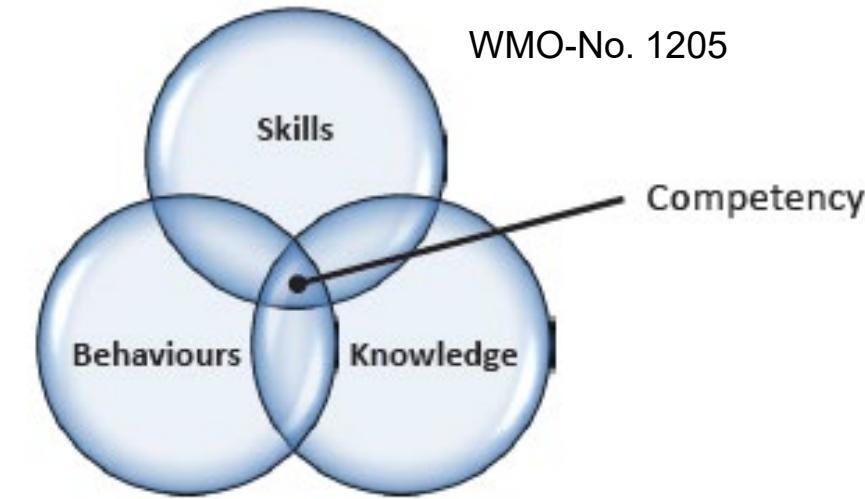
To develop a **Skills and Knowledge Framework** to enhance the interpretation of WIPPS products related to;

- **Weather (Phase I) and**
- **Climate (Phase II).**



# Skills and Knowledge Framework for Weather

- **Purpose**
  - To enhance the capacity of the **operational forecasters** in NMHSs of WMO Members to effectively and confidently understand and interpret **WIPPS products**.
- **This is aligned with WMO's frameworks and initiatives**
  - WMO Strategic and Operating Plan 2024-2027 ([Recommendation 11 \(EC-76\)](#)), particularly Long-Term Goals (LTGs) 2 and 4, which focus on fully accessing and utilizing the WIPPS products and closing the capacity gap.
  - WMO Capacity Development Framework (WCDF) ([Resolution 36 \(Cg-19\)](#)), which provides an overarching strategic framework for capacity development.
  - United Nations Early Warnings for All initiative, as outlined in [Resolution 2 \(EC-78\)](#) – WMO Road Map for the Early Warnings for All Initiative.
  - [Guide to Competency](#) (WMO-No. 1205), which describes 'NWP Skills and Knowledge for Forecasters', is one of the three Skills and Knowledge Framework to be developed or prepared.



# Skills and Knowledge Framework for Weather

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- Further focus and consideration
  - **Probabilistic forecast** and associated tools/products
  - **AI (Data-driven model products)**

[Draft Resolution 2.3\(1\)/1](#) (Cg-Ext(2025))

**Requests** INFCOM, in consultation with the Research Board and SERCOM:

- (2) To develop a draft new WIPPS strategy, including the incorporation of AI into WIPPS, to replace the WIPPS Collaborative Framework and WIPPS Roadmap (2022–2026), considering the **technical guidelines on the use of artificial intelligence-based Earth System Prediction (AI-ESP)**, for consideration at the fourth session of the INFCOM-4 in 2026;

**Further requests** INFCOM, in coordination with SERCOM, the Research Board and the EC Capacity Development Panel with the contribution of Regional Training Centres (RTCs), to **enhance the capacity development on the use of AI** under WIPPS for low- and middle-income countries, LDCs and SIDS;

# Implementation procedure in WMO ETRP Moodle Platform

: **I**: Designated Working Group  
: **I, III, IV, V**: an instructional/learning designer.

## I. In the Framework

- Skill 1. Assess recent model performance by interpreting verification statistics;
- Skill 2. Analyse observations and apply conceptual models to the current weather;
- Skill 3. Determine level of confidence in NWP output;
- Skill 4. Diagnose causes of model departure from observations;
- Skill 5. Determine possible future outcomes;
- Skill 6. Formulate forecast policy and products
- Skill 7. AI (under development)

## II. During the gap analysis

- Unit 1. Introduction of WIPPS
- Unit 2. Access to WIPPS products
- Unit 3. ...
- Unit 4 - Skill 1. Assess recent model performance by interpreting verification statistics;**
- ...
- Unit 10. Skill 7. Use/Interpret AI-based products (TBD)
- Unit 11. Introduction to Case Study Development**

Added to Moodle as pre-requisite

## III. Training Development Plan

Designed for targeted audience's learning objectives/outcomes, scope, constraints...

## V. Moodle

[ETRP Moodle Site](#)

## IV. Storyboard

**Mapping existing online materials**

Illustrated the blueprint of the **course**, including exact the narration, media, quizzes, interactions, and sequencing.

# A Glance at the planned WIPPS Learning Portal

In WMO ETRP Moodle Platform



## WMO Integrated Processing and Prediction System (WIPPS)

MODEL

As a worldwide network of operational centres operated by WMO Members, the **WMO Integrated Processing and Prediction System (WIPPS)** makes defined products and services operationally available among WMO Members and relevant operational organizations for applications related to weather, climate, water and the environment.

High-quality products and services are generated using advanced science and technology such as Numerical Weather Prediction (NWP) and Earth system modelling, better observations, improved data assimilation, increased computing power, and enhanced knowledge of weather dynamics and physics.

These advancements have led to more accurate predictions, benefiting operational



Centres



Newsletter



Webinar

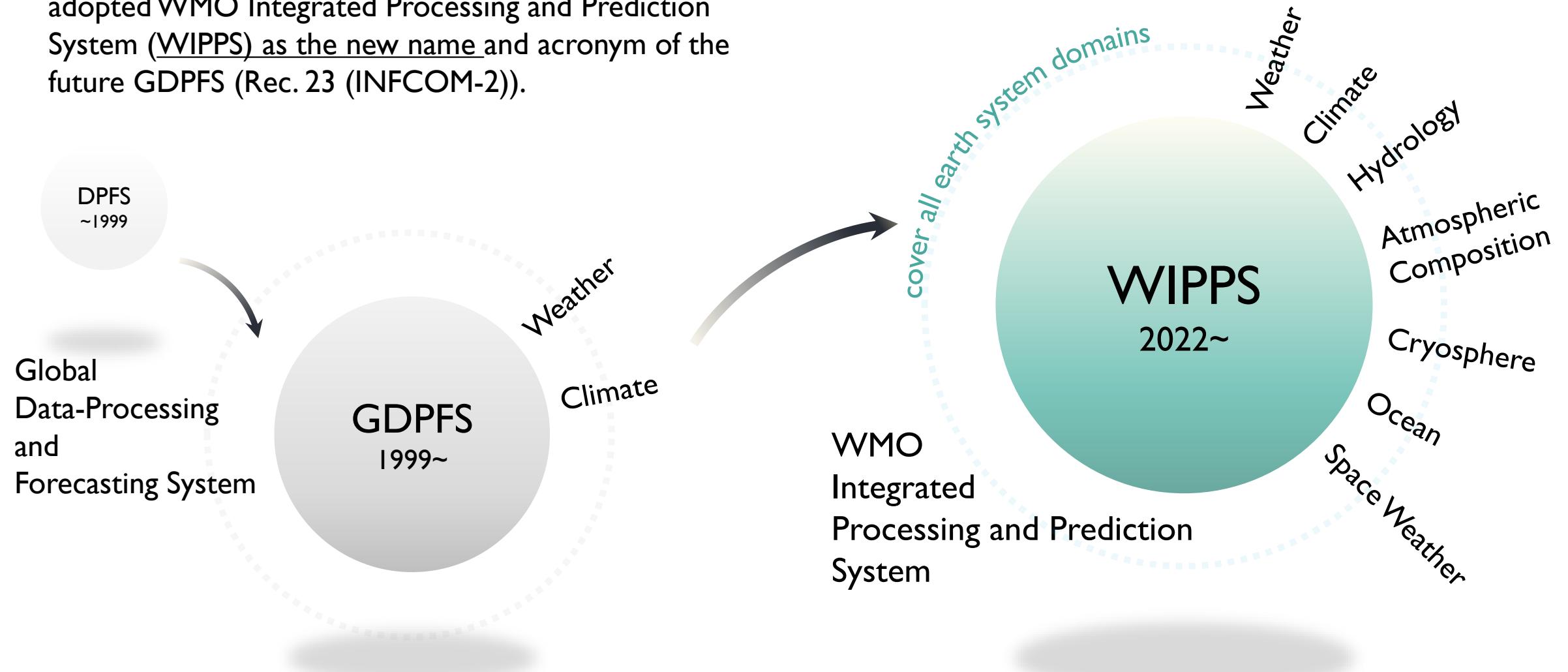


Training

# Thank you

# WIPPS from GDPFS

In 2022, the Commission for Observation, Infrastructure and Information Systems (INFCOM) adopted WMO Integrated Processing and Prediction System (WIPPS) as the new name and acronym of the future GDPFS (Rec. 23 (INFCOM-2)).



# Roles of LCs and GPCs : Seasonal prediction

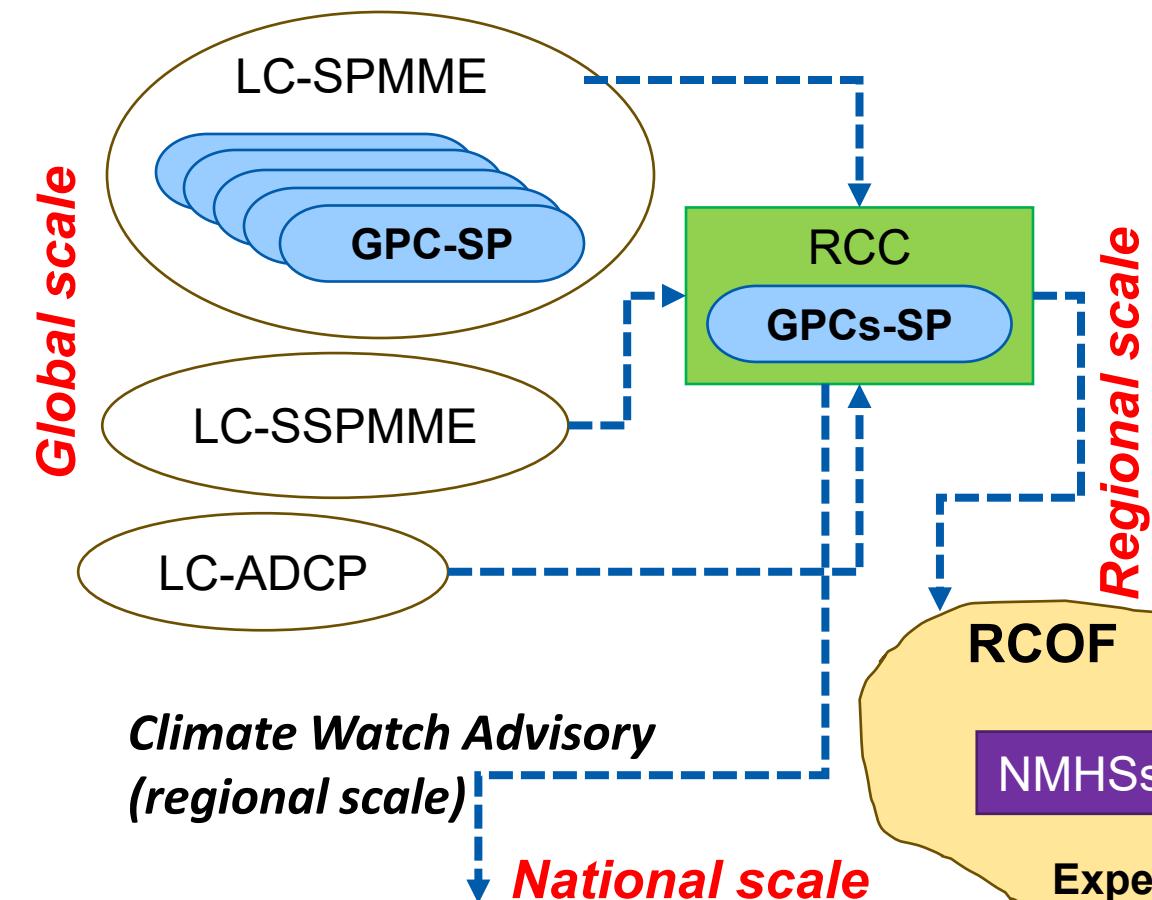
## LC-SPMME

1. Collect an agreed set of forecasts and hindcasts data from GPCs-SP.
2. Generate a **multi-model ensemble** of GPCs-SP forecasts.
3. Generate **verification** for GPCs-SP forecasts and multi-model ensemble products.
4. Display the aforementioned data and products in a **standard graphic format**.
5. Archive and distribute the aforementioned **digital data and products** in a standard format (GRIB and NetCDF).



Each GPC-SP is required to send its ensemble forecast to LC-SPMME by the 15th of each month.

# ROCF's composition, functions and products



**NMHSs** participating in RCOF should consider how the results of the RCOF in their region should be integrated into the **Climate Watch Advisory** issued by the NMHSs

## Functions:

Regional Climate Outlook Forums (RCOFs) produce **consensus-based**, user-relevant **climate outlook products** in real time in order to reduce climate-related risks and support sustainable development for the coming season in sectors of critical socioeconomic significance for the region in question.

