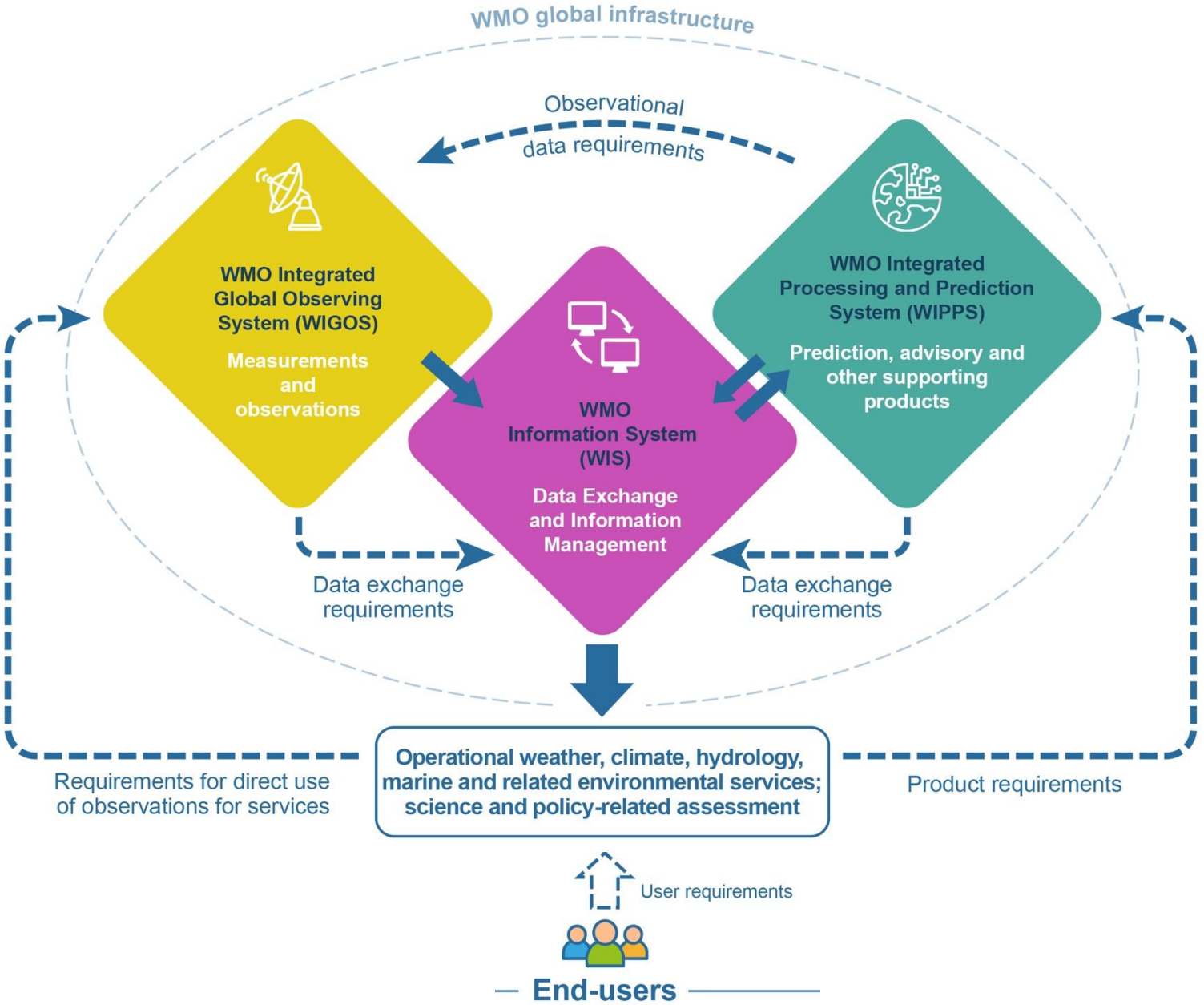
WIPPS Introduction

David Richardson
Chair of Standing Committee on WMO Integrated Processing and Prediction System (SC-WIPPS)

4 November 2024

WORLD METEOROLOGICAL ORGANIZATION

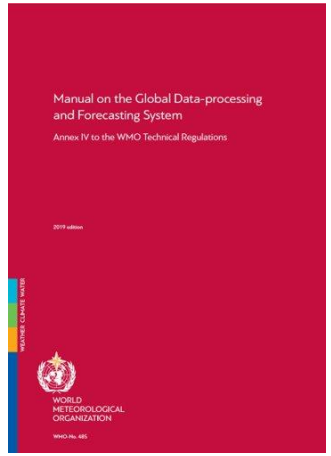
WIPPS in WMO Operational Infrastructure



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

WIPPS centres three-level structure

Manual on the Global Data-processing and Forecasti… | E-Library (wmo.int
2021 update, will be update in 2023



World Meteorological Centres (WMCs) are advanced NWP centres that can carry out the following activities:

- Global deterministic NWP;
- Global ensemble NWP;
- Global numerical long-range prediction

Designated WIPPS Centres (WIPPS-DCs): WMCs and RSMCs

WIPPS Designated Centres (WIPPS-DCs) (Regional Specialized Meteorological Centres (RSMCs), – RCCs, RCC-Networks, GPCs, LCs and RSHC (EC-76)

(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**: such as to coordinate **verification** activities to support Members in using RSMC products.

National Meteorological Centres (NMCs) prepare forecasts and **warnings** at all forecasting ranges necessary to meet the requirements of the Member.

GPC: Global Producing Centre, RCC: Regional Climate Centre, RSHC: Regional Specialized Hydrological Centre

WIPPS activities

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 long-range prediction
- Global numerical sub-seasonal forecasts
- 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

Specialized activities (15)

- Regional climate prediction and monitoring
- Coordination of multi-model ensemble prediction for long-range forecasts
- Coordination of multi-model ensemble for sub-seasonal forecasts
- 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 emergency response
- Flash flood forecasting

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

30 activities + **4** (INFCOM-3)

142 centres + **11** (INFCOM-3)

WIPPS terminology

- In the Manual on the WIPPS

Activity

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 from RSMCs participating in long-range forecast numerical prediction under activity 2.2.1.6 (GPCs-LRF);

(b) Make available on a website appropriate minimum (Appendix 2.2.17) and additional (Attachment 2.2.4) products and GPC-LRF forecasts in standard format;

(c) Redistribute digital forecast data as descri 8 for those GPCs-LRF that allow it;

Functions

(d) Maintain an archive of the real-time GPC-LRF and multi-model ensemble forecasts;

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

(f) Verify the products using SVSLRF (Appendix 2.2.36);

1. **Global Producing Centre digital products**

Global fields of forecast anomalies as supplied by GPCs-LRF, including redistribution of their digital data) monthly mean anomalies for indivic and ensemble mean for at least each of the three months following the 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 Centr exchange are available on the Lead Centre(s) for LRFMME website(s).

Mandatory products (minimum)

GPCs-LRF not currently able to participate in this additional exchange do so in the future.

2. **Graphical products**

Plots and maps for each GPC-LRF forecast displayed in common format website(s), for the variables listed in the previous section and for select appropriate, showing for three-month means or accumulations:

(a) Ensemble "plumes" of Niño indices (one-month means);

(b) Ensemble mean anomalies;

WIPPS-DC

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

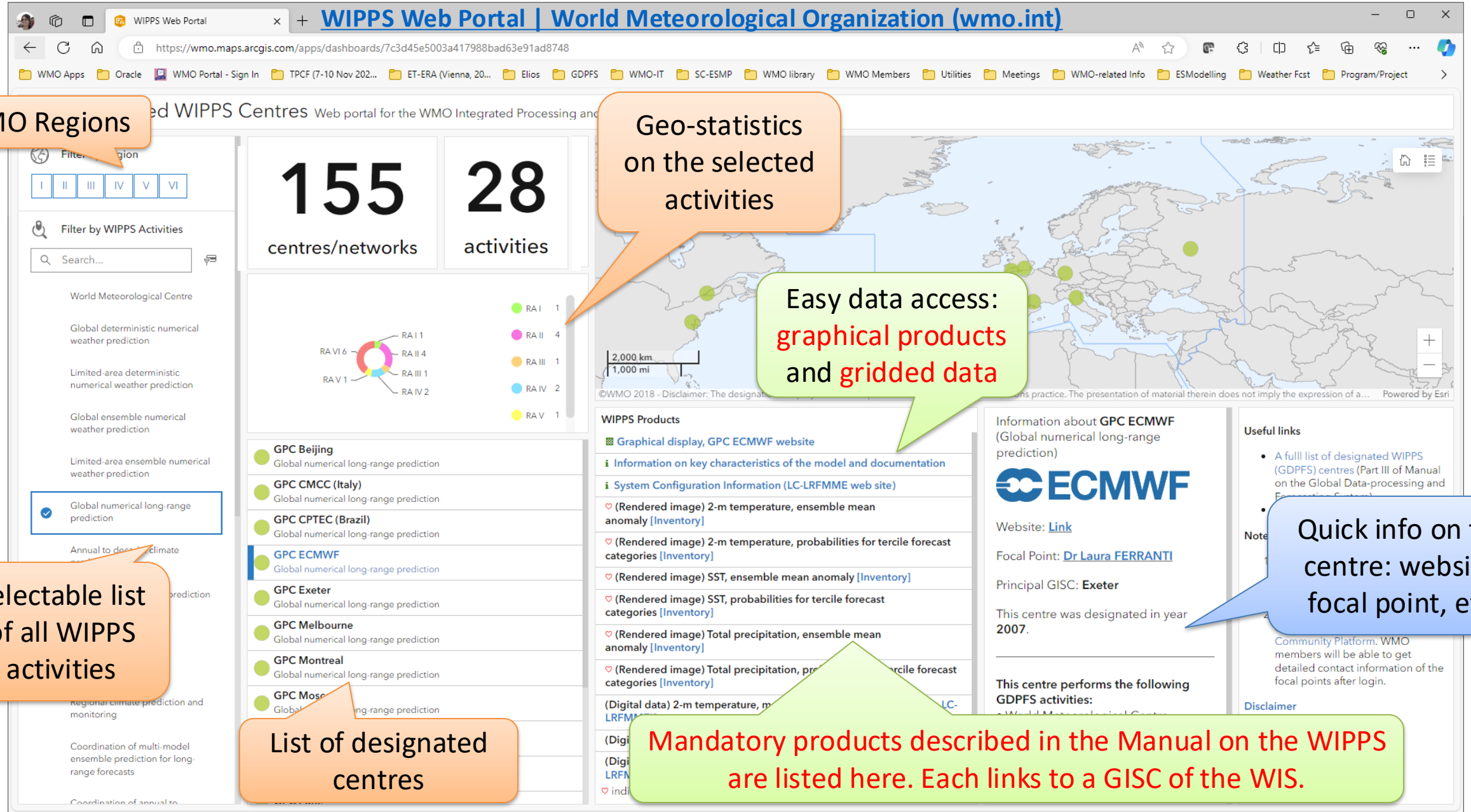
Seoul and Washington (joint centre)

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	

Responsible WMO bodies

The Web Portal for WIPPS Designated Centres



Early Warnings for All

The Early Warnings for All initiative is a groundbreaking effort to ensure everyone on Earth is protected from hazardous weather, water, or climate events through life-saving early warning systems by the end of 2027.

ADAPTATION FUND

GREEN CLIMATE FUND

CREWS CLIMATE RISK & EARLY WARNING SYSTEMS

SOFF Systematic Observations Financing Facility

USAID UNITED STATES AGENCY INTERNATIONAL DEVELOPMENT

How?

UNDRR UN Office for Disaster Risk Reduction

WORLD METEOROLOGICAL ORGANIZATION

Disaster risk knowledge

Systematically collect data and undertake risk assessments

- Are the hazards and the vulnerabilities well known by the communities?
- What are the patterns and trends in these factors?
- Are risk maps and data widely available?

Detection, observations, monitoring, analysis and forecasting of hazards

Develop hazard monitoring and early warning services

- Are the right parameters being monitored?
- Is there a sound scientific basis for making forecasts?
- Can accurate and timely warnings be generated?

Preparedness and response capabilities

Build national and community response capabilities

- Are response plans up to date and tested?
- Are local capacities and knowledge made use of?
- Are people preapred and ready to react to warnings?

Warning dissemination and communication

Communicate risk information and early warnings

- Do warnings reach all of those at risk?
- Are the risks and warnings understood?
- Is the warning information clear and usable?

IFRC

ITU

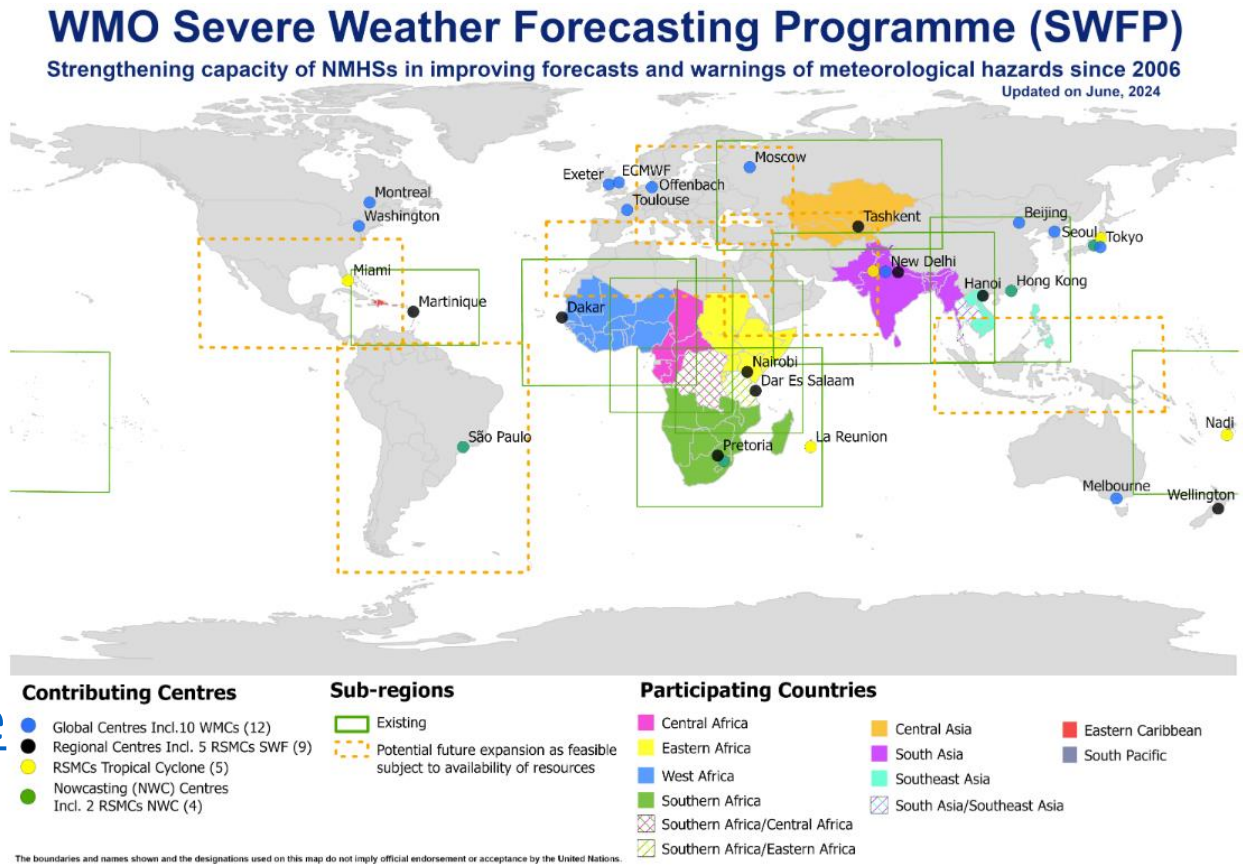
Pillar 2 is focused on delivering 5 outcomes:

- **Increased availability of quality observation data** to assess and monitor priority hazards.
- **Enhanced data exchange and access for forecasting and warning systems**.
- **Increased capabilities to forecast** all priority hydrometeorological hazards.
- **Impact-based forecasts and warnings are produced** for all priority hazards.
- **Strengthened relevant policy, institutional mechanisms**, and stakeholder engagement processes in place to support MHEWSs

The delivery of Early Warnings for All requires scale up and coordinated investments and action across the four essential pillars of end to end, people-centred Multi-Hazard Early Warning Systems

WIPPS– Regional severe weather forecasting

- Type: Specialized activity
- Domain: Regional
- Number of centres: 5
  - Each centre works with participating NMCs
- Data type:
  - Guidance products about agreed targeted severe weather events
- Data provision:
  - Their website (password-protected)
- More information:
  - [Severe Weather Forecasting Programme (SWFP)]



World Meteorological Centres (WMCs) and NHMSs

- 10 WMCs generate a set of mandatory products and disseminate through WIS.
- Mandatory product lists were just upgraded. 40 times (deterministic) and 270 times (EPS) more data

Global deterministic NWP for short to medium range

Parameter	Level (hPa)	Resolution	Forecast range	Time steps	Frequency
Geopotential height	850/500/250/200				
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~~				
MSLP	Surface				
2-m temperature 2-m minimum and maximum temperatures in the periods of the last 3/6 hours 2-m dewpoint temperature 10-m u, 10-m v 10-m wind gusts[1] Total precipitation Total Solid precipitation[2] CAPE[3] Total precipitable water Total cloud cover	Surface	~~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~~

Additional 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 surface
- Heatwave Index
- Wind u and v at additional heights 80m, 100m, 120m or 150m above ground
- Option to access high-resolution data (up to full model resolution).
- Provide data additionally in form of map layers, graphics or visualization.

Notes:
1. Wind gusts are the maximum gusts in the pe
2. Water equivalent of total solid precipitation,
3. Recommended most unstable CAPE (MUCAPE model characteristics web page

Global ensemble NWP for short to medium range (1/2)

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 12 hours~~ 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 CAPE [4]	Surface	25th, 50th, 75th, max				

WIPPS and Early Warnings for All (EW4All)

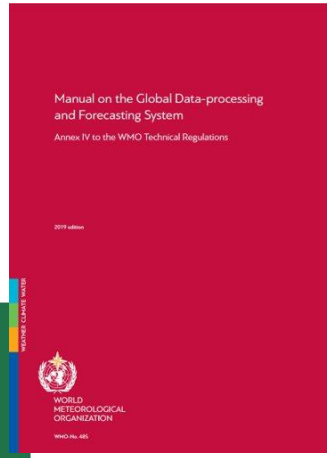
- Increase in number and resolution of NWP products from WIPPS designated centres
- User requirements: WIPPS RRR demonstration phase (SERCOM SC-DRR, SC-CLI)
  - Impact-related indices for priority hazards (with SERCOM)
- Graphical WIPPS products
  - ECMWF ecCharts
  - Pilot project MMIFA Multi-Model Integrated Forecast and Application
  - Pilot project AI for nowcasting (with WWRP)
    - WMC Beijing Workshop in November
- Pilot for global riverine flood prediction (with SERCOM)

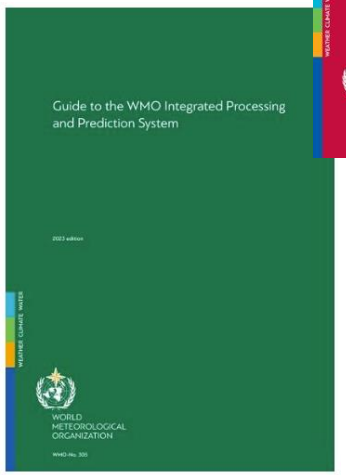
Where to find more information

- Publications (principal)
  - The Manual on WMO Integrated Processing and Prediction System (WIPPS) (WMO-No. 485)
  - The Guide to WIPPS (WMO-No. 305)

  Note: Currently 2023 edition. 2024 update will be available in due course
- ExtraNet
  - WMO Integrated Processing and Prediction System (WIPPS)
  - Emergency Response Activities (ERA)
- WIPPS Dashboard, Microsoft Power BI
  - Provide the status and capacity for utilizing WIPPS products and creating their own forecast products.
- WMO WIPPS Web Portal, WIPPS Web Portal
  - Provide the list of WIPPS-DCs and list of mandatory products and all related information

The Manual





The Guide

Thank you.

WORLD
METEOROLOGICAL
ORGANIZATION

wmo.int