Introduction of the WMO Integrated Processing and Prediction System - WIPPS -

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UN Early Warning for All Initiative

EW4All Initiative

The EW4All initiative is a groundbreaking effort to ensure that everyone on Earth is protected from hazardous weather, water, or climate events through life-saving early warning systems by the end of 2027.

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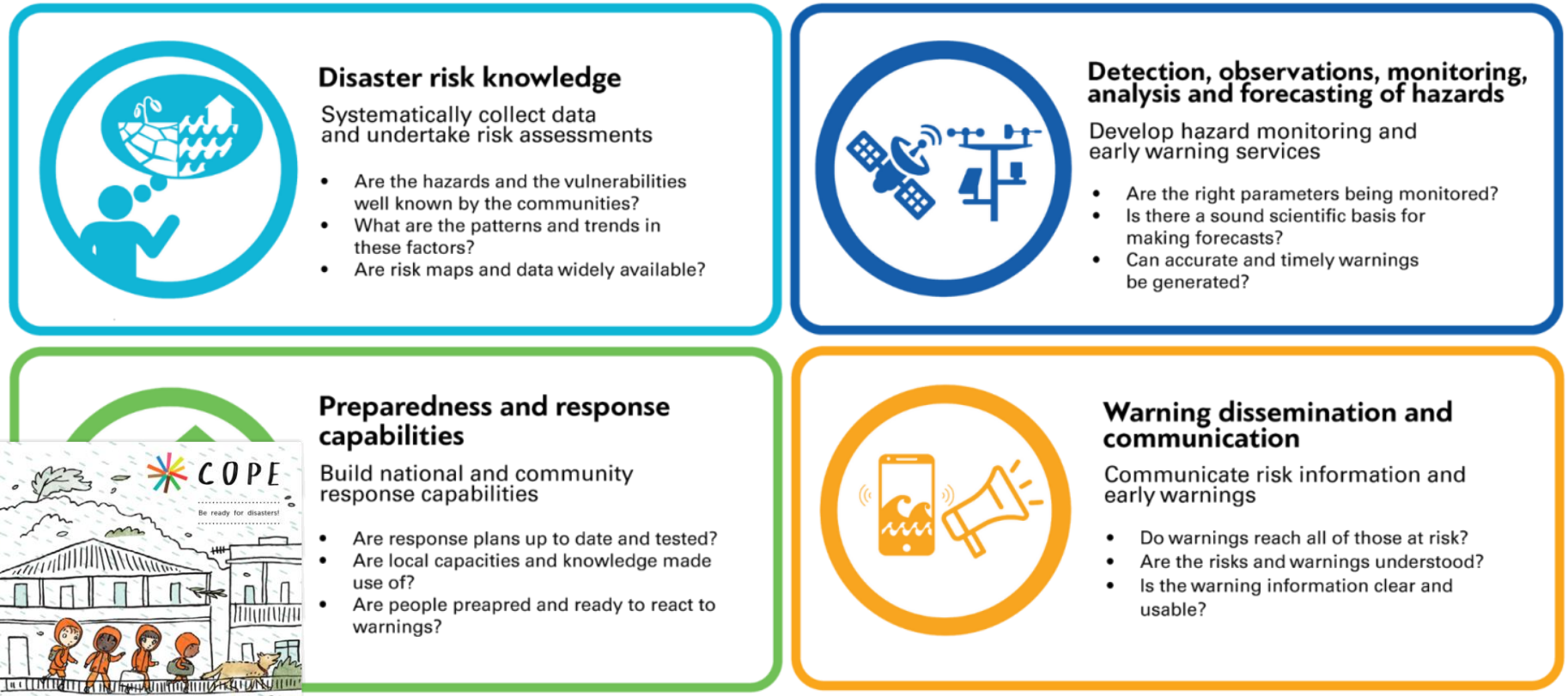
The Early Warnings for All initiative is built around four key pillars:



Please find more information here.

WMO Value Cycle/Chain

Global meteorological infrastructure designed and coordinated by INFCOM

Observations from the entire globe

International exchange of observations

Global Numerical Weather Prediction

Weather and climate-related infrastructure - **must be designed and managed globally**

Last-mile activities undertaken **primarily at regional, national and local level**

Effective decision-making and action

Delivery of weather and climate services

Local data processing, forecast, warning and advisory products

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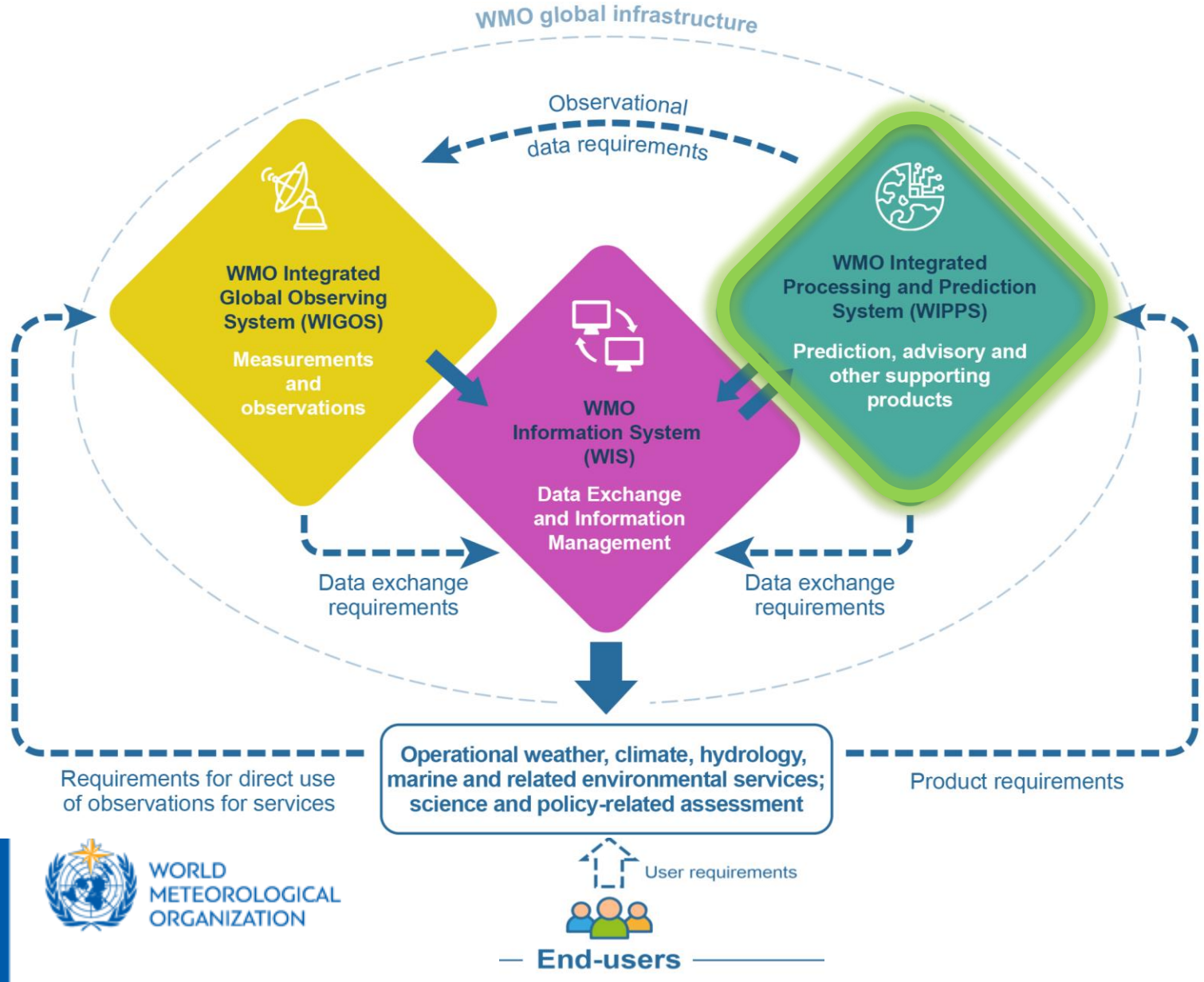
WMO IMO-WMO

WMO Integrated Processing and Prediction System in WMO Global Infrastructure



WIPPS is a worldwide network of modelling centres operated by WMO Members.

Its purpose is to make operationally available defined products and services for applications related to weather, climate, water and environment among WMO Members and relevant operational organizations (***WMO Strategic Plan - Output 2.3***)

Its role is to process observation and generate analysis and prediction products based on science and technology to meet users' needs.

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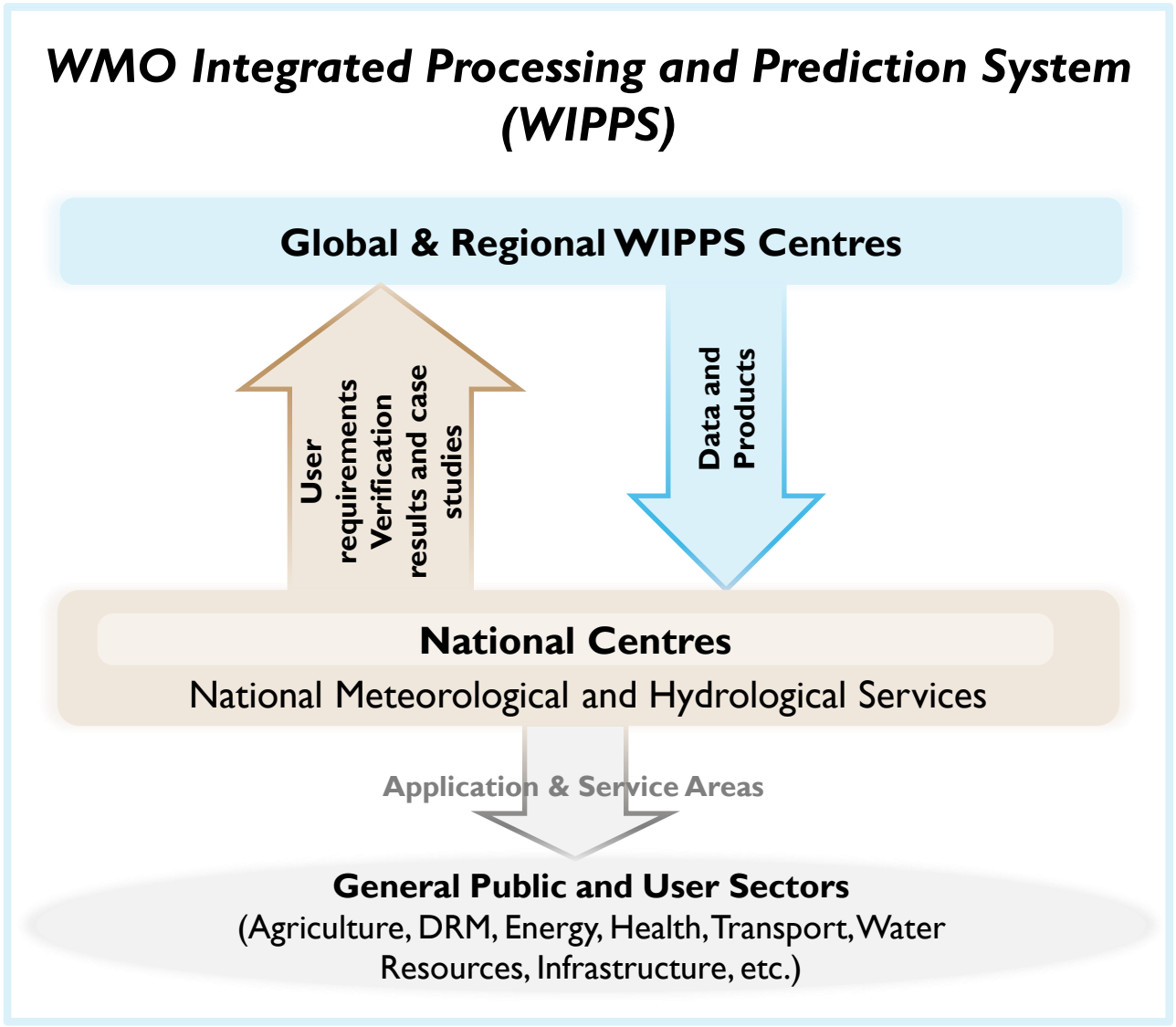
WIPPS Structure



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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

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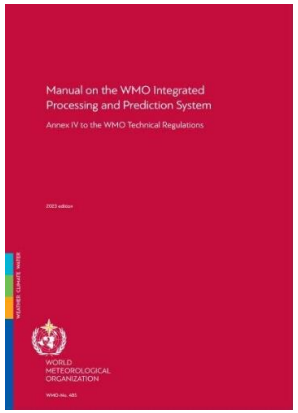
34 activities

More than 150 centres

WIPPS Manual and Guide



Manual on WIPPS (WMO-No.485)

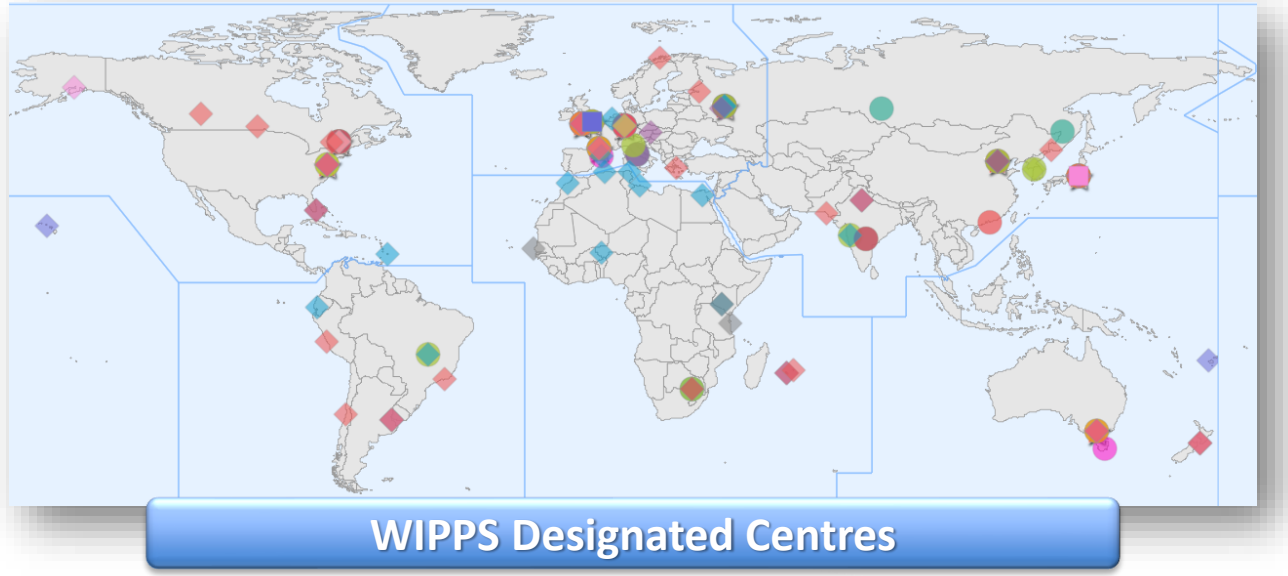
Part I) Outline the WIPPS, including its purpose and structure

Part II) Specify WIPPS activities and Centres designation criteria

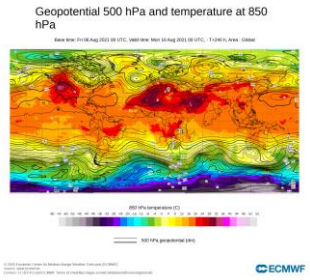
Part III) List all WIPPS Desiginated Centres

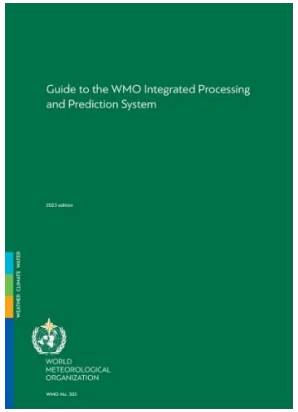
Members, especially those hosting WIPPS Designated Centres, need to be compliant

- SHALL (obligation)
- SHOULD (recommended)



WMO Members





Guide to WIPPS (WMO-No.305) provides detailed explanation of WIPPS framework, relevant procedures and activities to assist administrative and technical staff of WMO Members in understanding and implementing WIPPS activities and utilizing WIPPS products.

Members hosting WIPPS-DCs obtain guidance to be compliance. All Members learn good practice to uptake WIPPS products.

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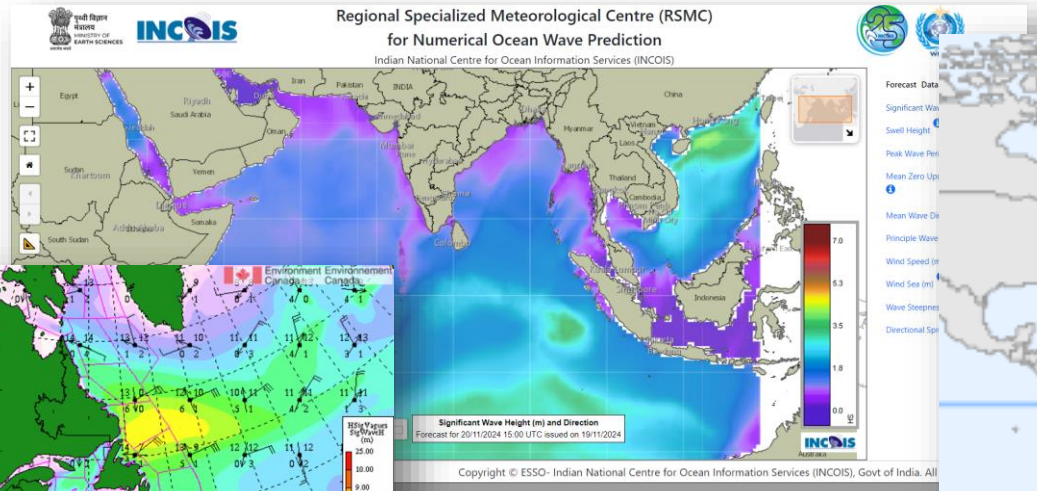
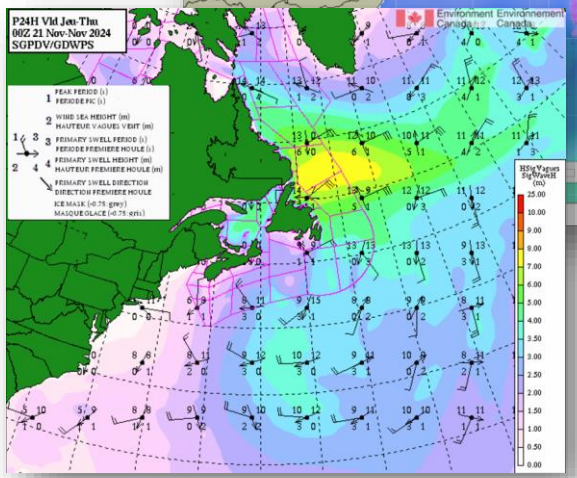
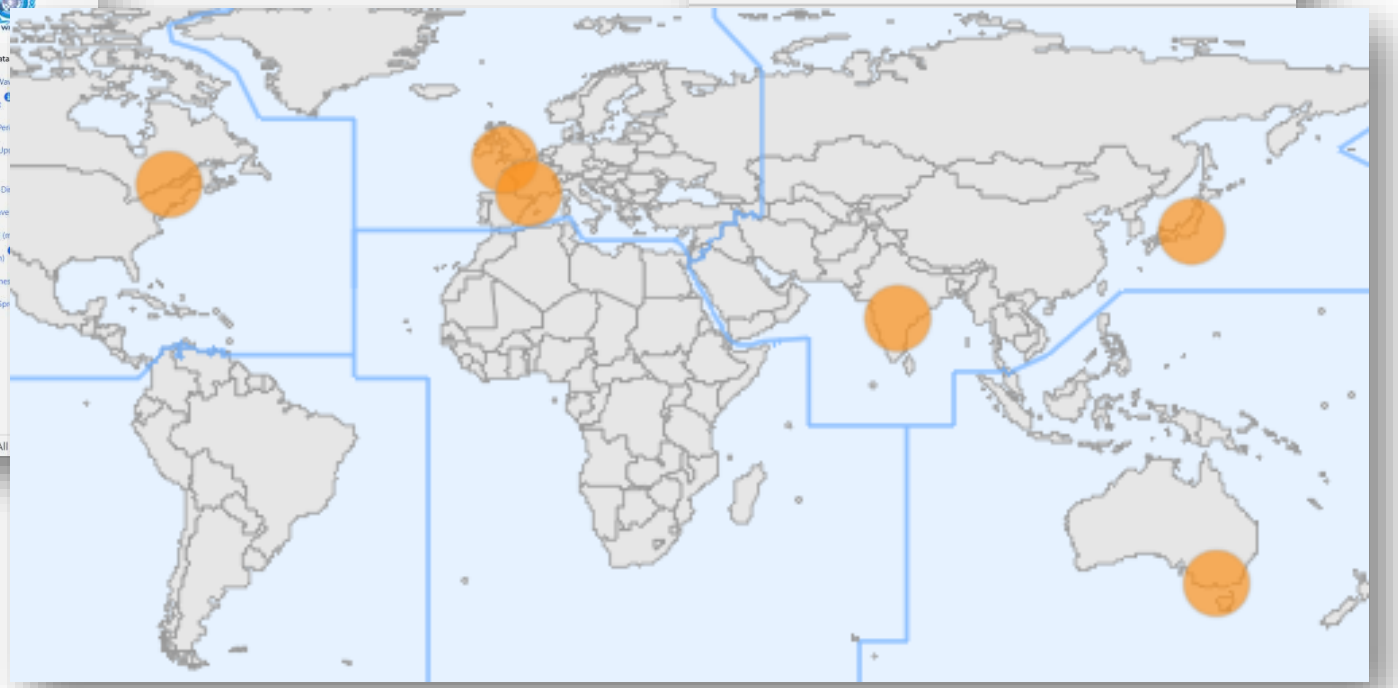
Numerical ocean wave prediction

Parameter	*Level*	*Minimum resolution*	*Forecast range*	*Time steps*	*Frequency*
Significant wave height	Surface	0.5° × 0.5°	Up to 2 days/ Beyond 3 days up to 7 days	Every 3 hours/ Every 6 hours	Twice a day
Peak wave period and mean zero-upcrossing period	Surface				
Prevailing direction – Mean wave direction and/or – Principle wave direction	Surface				

- **RSMC Exeter**
  Numerical ocean wave prediction
- **RSMC INCOIS (India)**
  Numerical ocean wave prediction
- **RSMC Melbourne**
  Numerical ocean wave prediction
- **RSMC Montreal**
  Numerical ocean wave prediction
- **RSMC Tokyo**
  Numerical ocean wave prediction
- **RSMC Toulouse**
  Numerical ocean wave prediction

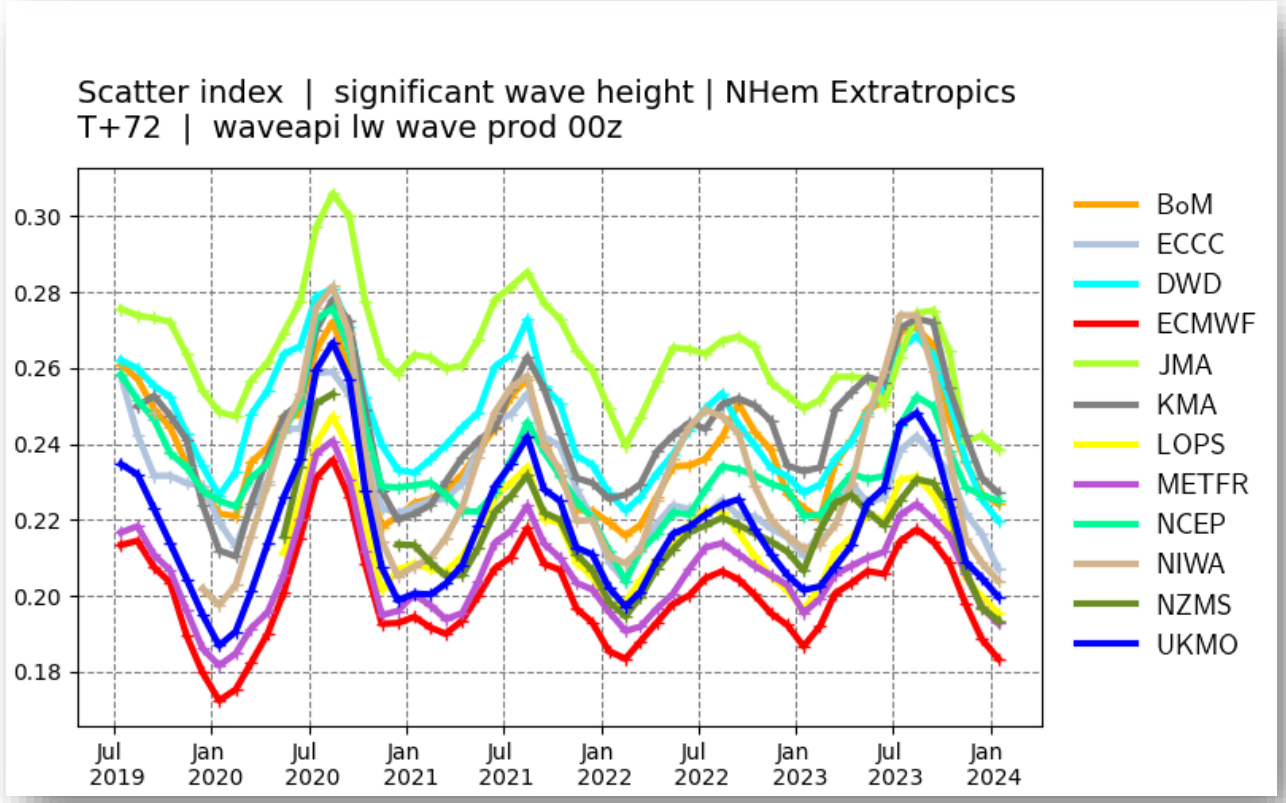






Coordination of wave forecast verification

- ECMWF was designated as WMO Lead Centre after it had been instrumental in the JCOMM Expert Team on Waves and Coastal Hazards (ETWCH) Wave Forecast Verification project (WFVP).
- LC-WFV collects from Centres on standard verification results and visualizes them.



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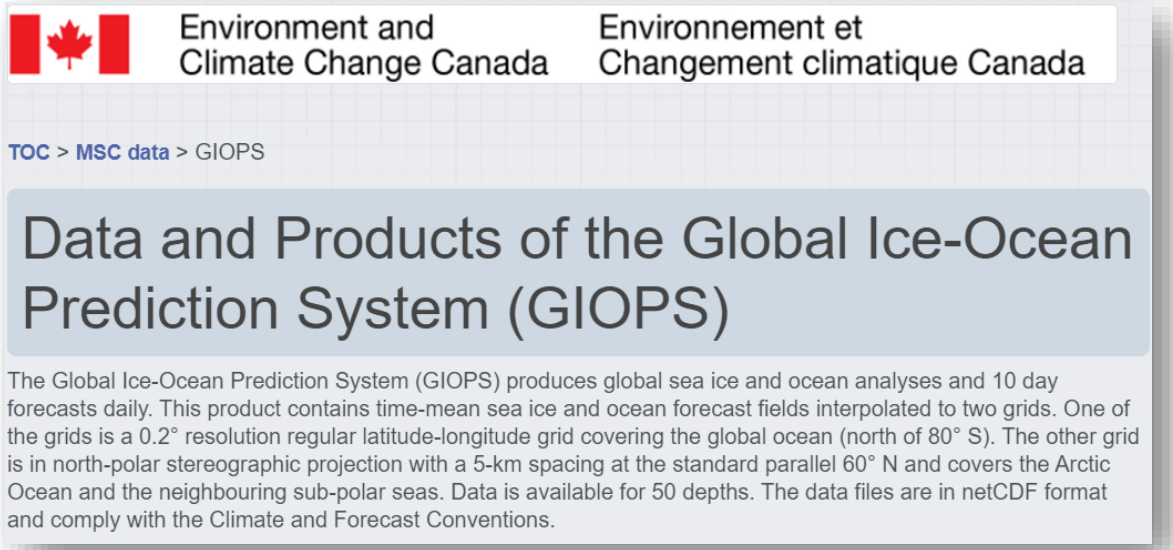
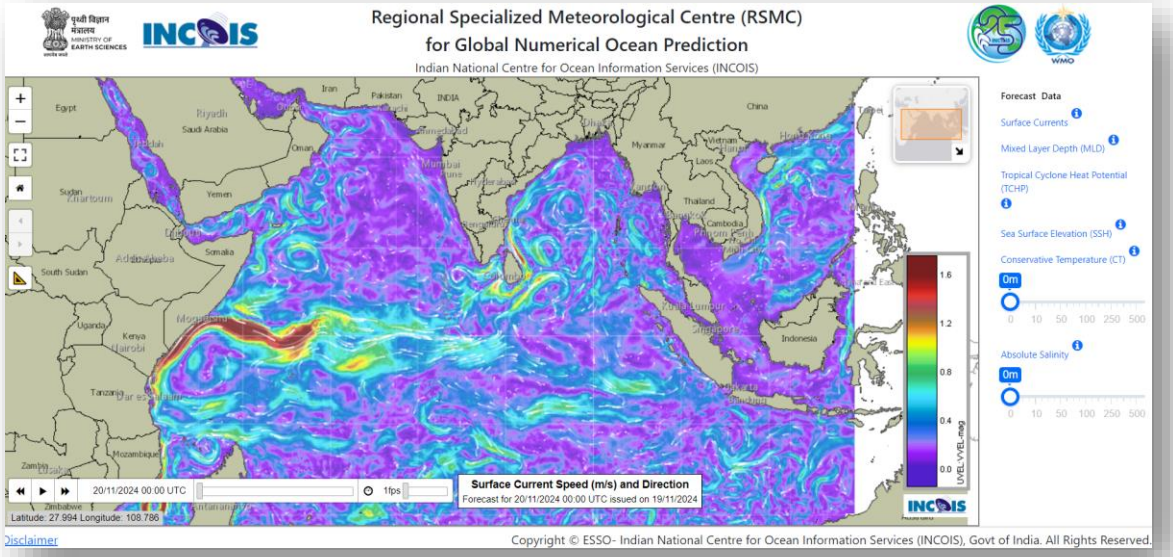
Global ocean prediction

Parameter	*Level*	*Minimum resolution*	*Forecast range*	*Minimum time steps*	*Frequency*
Sea-surface elevation	Surface	0.25° × 0.25°	Up to 6 days	Every 24 hours	Once a day
SST	Surface (mixed layer)				
Surface u, v	Surface				
Sea-surface absolute salinity	Surface				
u, v	Depth to be determined				
Conservative temperature	10/50/100/250/500 (m)				
Absolute salinity	10/50/100/250/500 (m)				
Mixed layer depth					

- Only 2 Centres are designated.
  - Canada (ECCC) and India (INCOIS)
- Standard verification has not been developed yet.





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World Meteorological Centres (WMCs)

- 10 WMCs produce a set of mandatory products from short to seasonal time range and disseminate through WIS.
- Most Centres operate numerical Earth system models coupling atmospheric and ocean models

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Global deterministic NWP for short to medium range

Parameter	Level (hPa)	Resolution	Forecast range	Time steps	Frequency
Geopotential height	850/500/250/200	1.50.5°× 1.50.5°	Up to 3 days/ Beyond 3 days up to 6 days	Every 63 hours/ Every 126 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				
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				

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	1.50.5° × 1.50.5°	1014 days (or the maximum range if less)	Every 12 hours Every 3 hours to 72 hours, then every 6 hours.	OnceTwice 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	Surface10 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				

Summary

WMO Vision

- By 2030, we see a world where all nations, especially the most vulnerable, are more resilient to the socioeconomic consequences of extreme weather, climate, water and other environmental events; and underpin their sustainable development through the best possible services, whether over land, at sea or in the air.

- **WIPPS** is a worldwide network of modelling centres operated by WMO Members.
  - WIPPS is a part of WMO global infrastructure with WIGOS and WIS.
- A wide range of numerical analysis and prediction products are made available to WMO Members by WIPPS Designated Centres.
  - Science underpins the WIPPS activities.
- Several ocean/marine-related activities have been established, but WIPPS in this domain needs to be further evolved to meet user requirements.

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Thank you

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