

How and what does GDPFS* support WMO Members?

** Global Data-processing and Forecasting System*



Eunha LIM

Earth System Prediction Division/ Earth System Branch/ Infrastructure Dept.

WMO OMM

World Meteorological Organization

Organisation météorologique mondiale

Contents

- General information on GDPFS
 - Definition, purpose, role and structure
- Introduction of GDPFS activities
 - Types of activities: General, specialized and non-realtime
 - plan to include new types of activities
 - Example of activities: global deterministic NWP, verification of prediction skills, nuclear environmental emergency response, severe weather forecasting
 - Flow of forecasts products to support SWFP
- Launch of the Web Portal for designated GDPFS Centres
 - Increase discoverability and accessibility of GDPFS products
- Plan to provide more products from designated GDPFS centres
 - Align with WMO Unified Data Policy
- Publications related to GDPFS



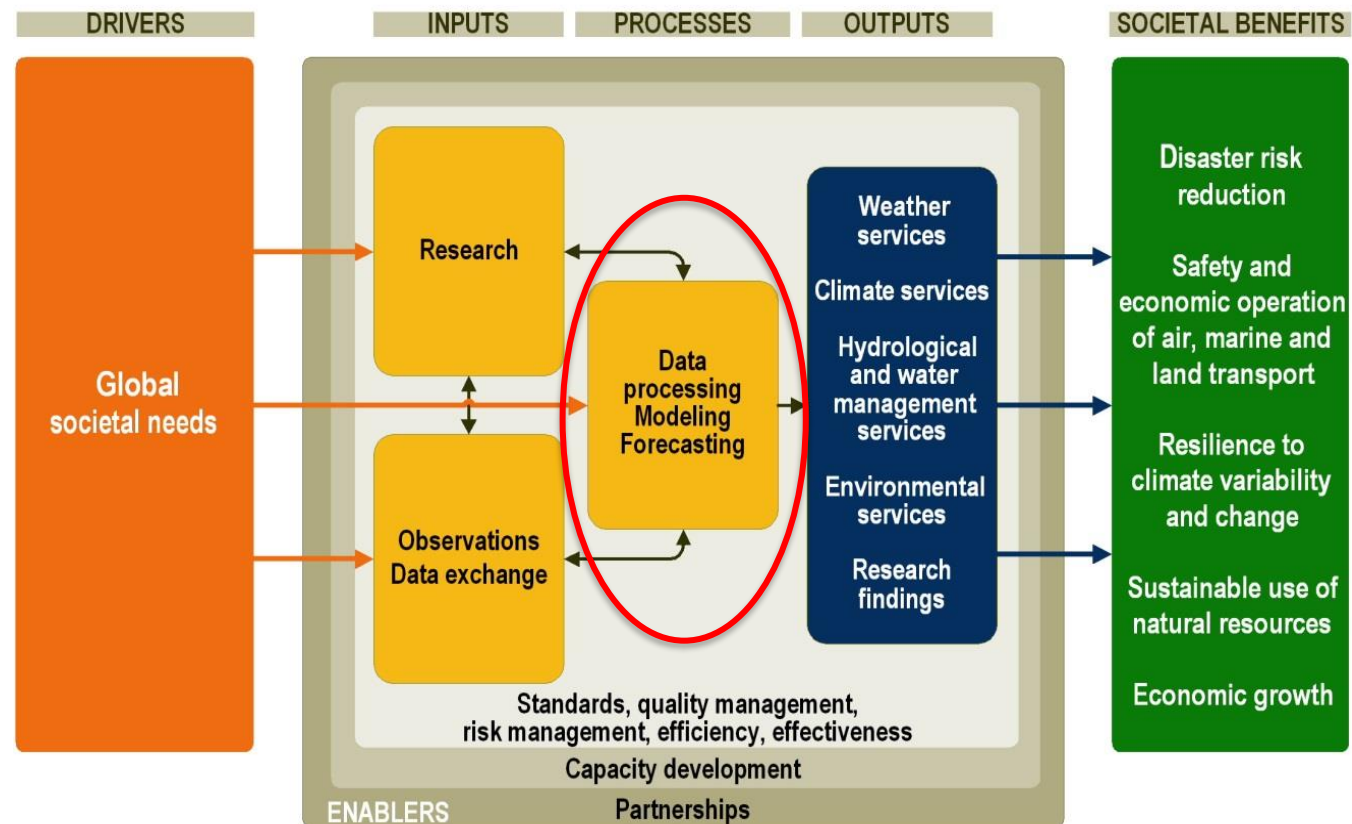
Global Data-processing and Forecasting System (GDPFS)

GDPFS is a worldwide network of operational centres operated by WMO Members.

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

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

the heart of the WMO operational system



Three-level structure ensures delivery of GDPFS products

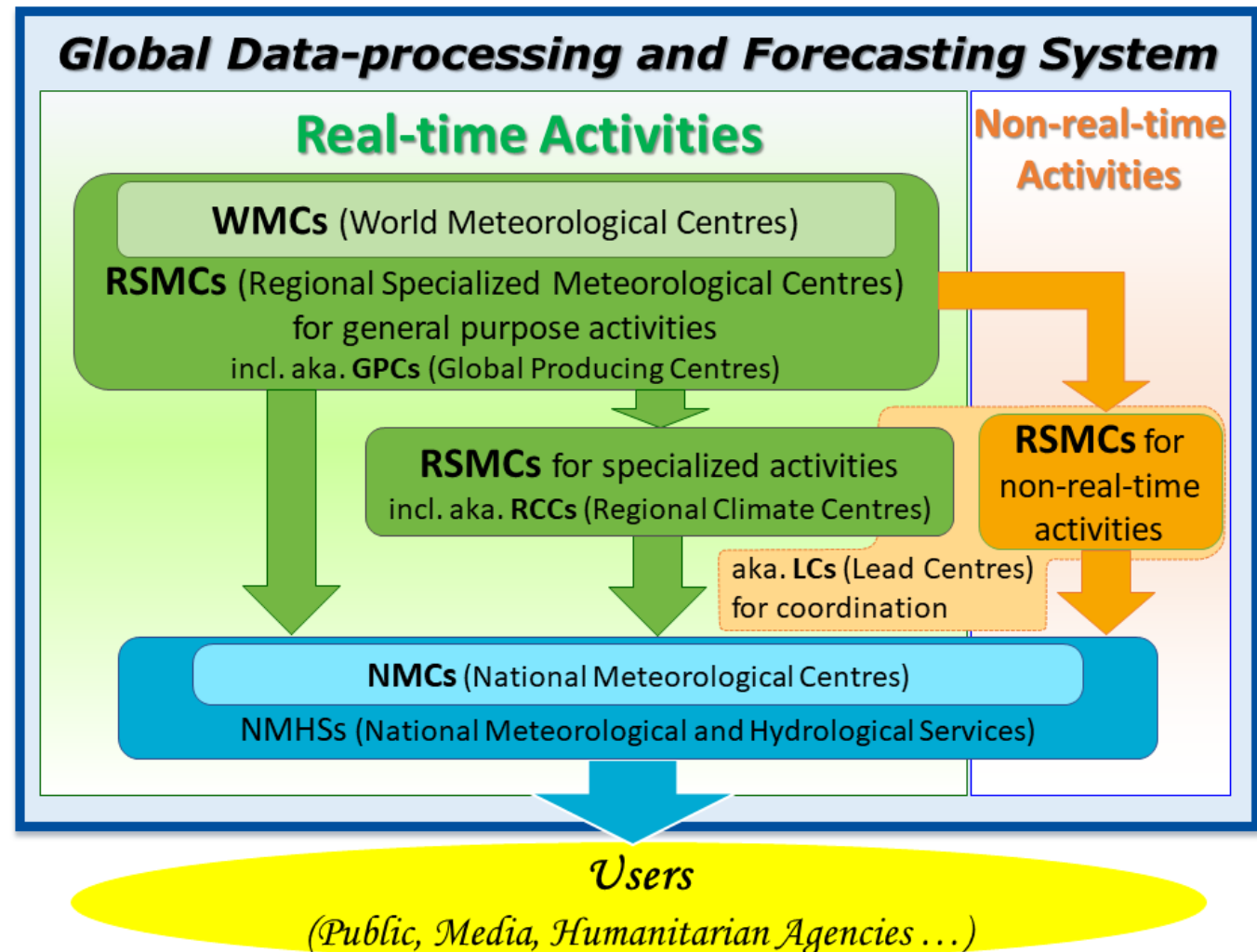
WMCs are advanced NWP centres that can carry out the following activities:

- Global deterministic NWP;
- Global ensemble NWP;
- Global numerical long-range 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-realtime activities:** to coordinate verification activities to support Members in using RSMC products.

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

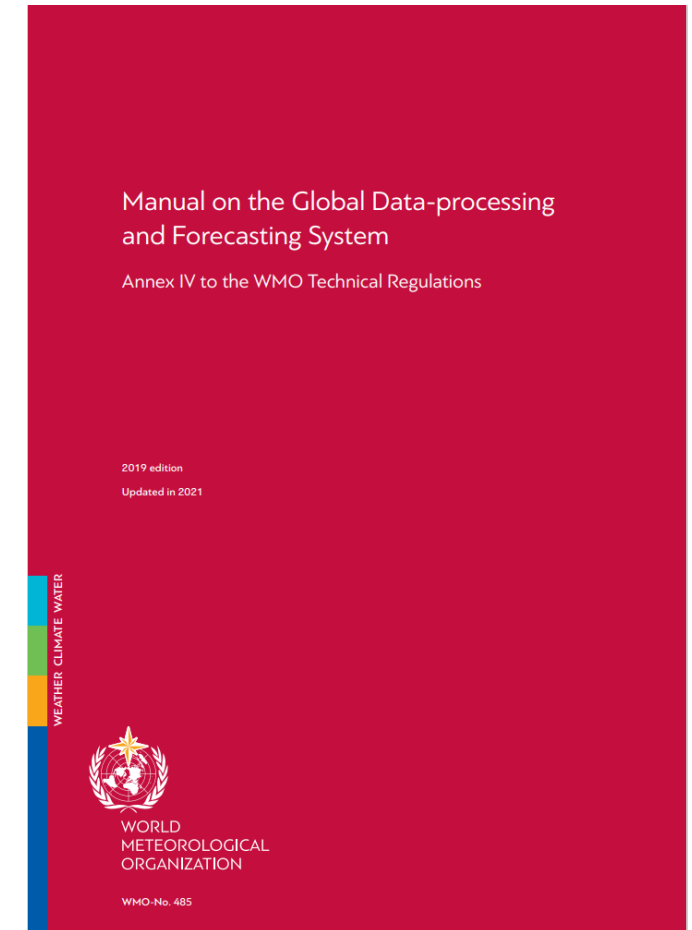


Renewed GDPFS in 2017

- GDPFS was thoroughly reviewed in 2010s. The roles and functions of designated GDPFS Centres were redefined.
- The renewed *Manual on GDPFS* (WMO-No.485) was adopted in 2017 (EC-69).
- The scope of GDPFS expands beyond World Weather Watch Programme to cover more Earth system domains, for example:
 - (i) Atmospheric Sand and Dust-storm Forecasting;
 - (ii) Marine Meteorology and Oceanography

More information is available on:

[Global Data-processing and Forecasting System | World Meteorological Organization \(wmo.int\)](https://www.wmo.int/) – Public web
[Global Data-processing and Forecasting System \(GDPFS\) | World Meteorological Organization \(wmo.int\)](#) - Extranet



[Manual on the Global Data-processing and Forecasti... | E-Library \(wmo.int\)](#)

GDPFS activities (2022)

- The activity specification and, if defined, the minimum list of mandatory products are defined for each type of GDPFS activities.
- A Centre that can fulfil the responsibilities of one of GDPFS activities is designated as RSMC.
- **General purpose activities** to encompass essential data processing required for a wide range of end-usage
 - 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
 - **Numerical ocean wave prediction**
 - **Global numerical ocean prediction**
 - Nowcasting

27 activities!

- **Specialized activities** to make forecasting products, which may include guidance based on human interpretation, tailored for a specific type of application or user community.
 - 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
 - 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**
- **Non-real-time activities** (mainly verification)
 - 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



New activities and designations to be

- New designations
 - Numerical ocean wave prediction: RSMCs Exeter, INCOIS (India)
 - **Global numerical ocean prediction**: RSMCs Exeter, INCOIS (India), Montreal
 - **Global numerical sub-seasonal forecasts**: GPC-SSF ECMWF
 - **Coordination of multi model ensembles for sub-seasonal forecasts**: LC-SSFMMME ECMWF
 - Global numerical long-range prediction: GPC-LRF Pune
- New activities (Hydrology)
 - Sub-seasonal to seasonal (S2S) hydrological prediction
 - Mandatory product: Runoff (Discharge)
 - Snow cover prediction
 - Mandatory product: Gridded snow analysis products
 - Flash flood forecasting
 - Mandatory product: Flash flood risk (in categories) (e.g., high, moderate, low)



RSMC for global deterministic NWP

Activity specification

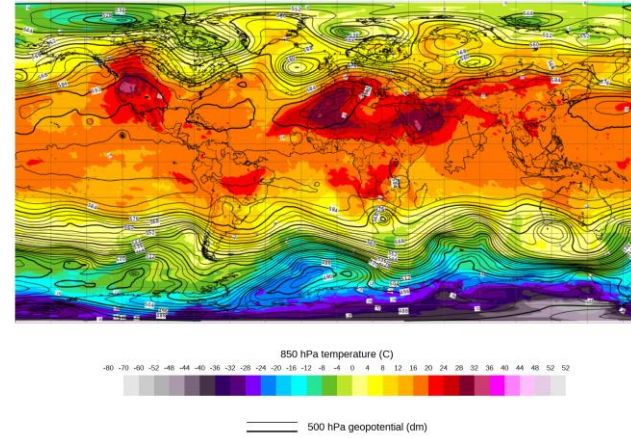
- Produce global analyses** of the three-dimensional structure of the atmosphere;
- Produce global forecast fields** of basic and derived atmospheric parameters;
- Make available on WIS a range of these products;** the list of mandatory and highly recommended global deterministic NWP products to be made available is given in Appendix 2.2.1;
- Produce verification statistics** according to the standard defined in Appendix 2.2.34, and make them available to the Lead Centre(s) for DNV;
- Make available on a website up-to-date information on the characteristics of their global

Minimum list of mandatory products

Parameter	Level (hPa)	Resolution	Forecast range	Time steps	Frequency
Geopotential height	850/500/250	1.5° × 1.5°	Up to 3 days/ Beyond 3 days up to 6 days	Every 6 hours/ Every 12 hours	Twice a day (0000 and 1200 UTC)/ Once a day
Temperature	850/500/250				
Wind zonal velocity (u) and meridional velocity (v)	925/850/700/500/250				
Relative humidity	850/700				
Divergence, vorticity	925/700/250				
MSLP	Surface				
2-m temperature	Surface				
10-m u, 10-m v					
Total precipitation					

Geopotential 500 hPa and temperature at 850 hPa

Base time: Fri 06 Aug 2021 00 UTC, Valid time: Mon 16 Aug 2021 00 UTC, - T+240 h, Area : Global

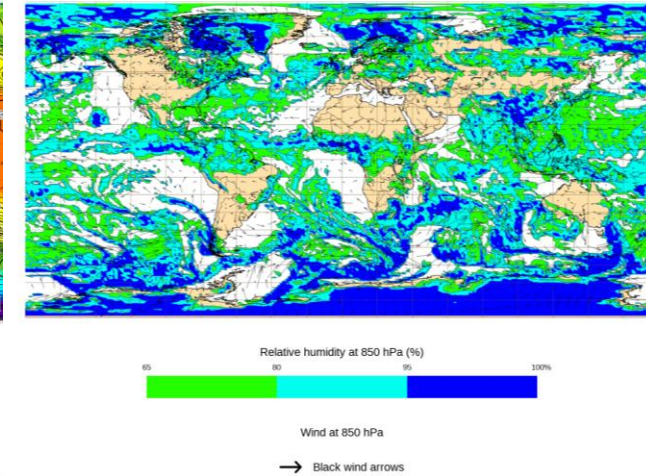


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Wind and relative humidity at various pressure levels

Base time: Fri 06 Aug 2021 00 UTC, Valid time: Mon 16 Aug 2021 00 UTC, - T+240 h, Area : Global, Level : 850



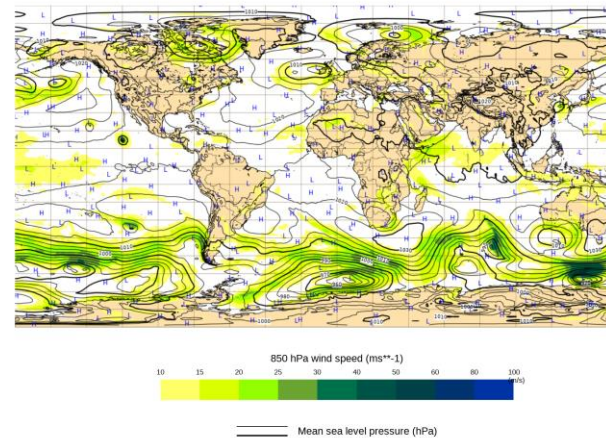
European Centre for Medium-Range Weather Forecasts (ECMWF)
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Some products of RSMC ECMWF for global deterministic NWP

Mean sea level pressure and wind speed at 850 hPa

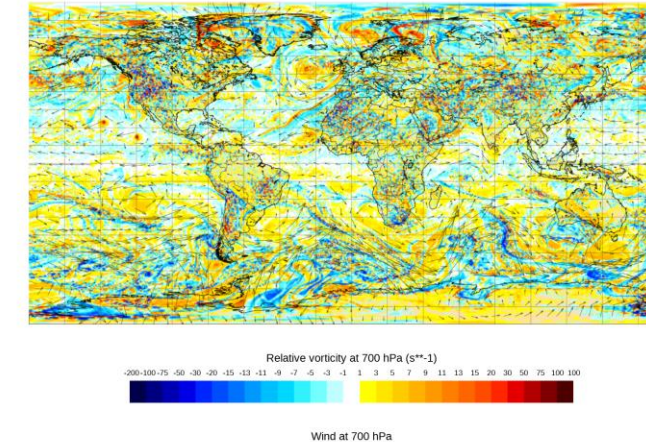
Base time: Fri 06 Aug 2021 00 UTC, Valid time: Mon 16 Aug 2021 00 UTC, - T+240 h, Area : Global



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Vorticity and wind at 700 hPa

Base time: Fri 06 Aug 2021 00 UTC, Valid time: Mon 16 Aug 2021 00 UTC, - T+240 h, Area : Global, Parameter : Relative vorticity



The products are distributed via WIS in the GRIB format.

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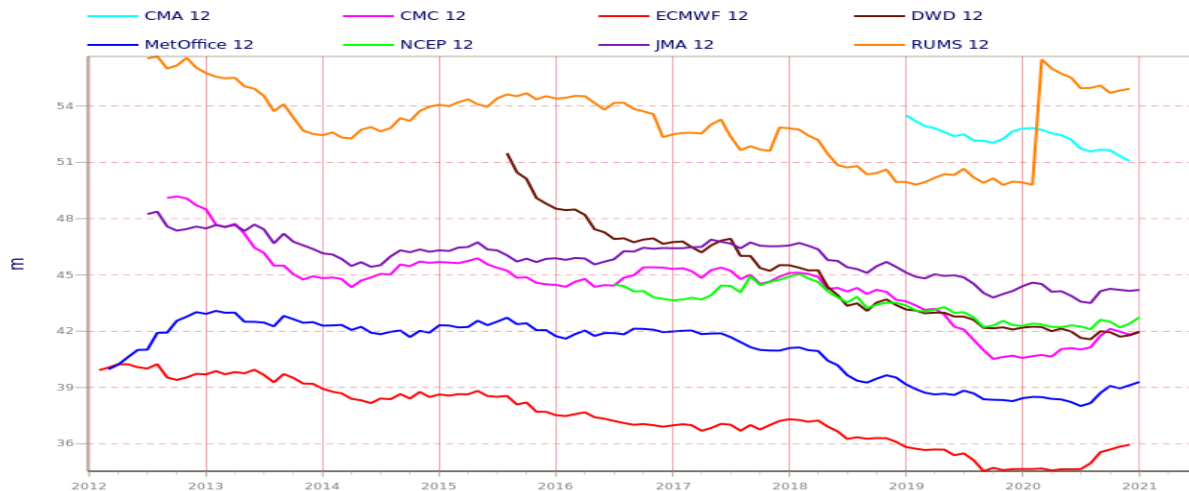
Verification of Prediction Skill of GDPFS centres products

- The standard verification methods are defined in the *Manual on GDPFS* (WMO-No.485)
- Lead Centres (LCs) collect the standard verification scores from GDPFS Centres and provide access to them.
- Product users can understand the prediction skills.

ECMWF: Deterministic NWP Verification (DNV)

<https://apps.ecmwf.int/wmolcdnv/>

- RSMCs for global deterministic NWP must provide the scores of their products to LC-DNV

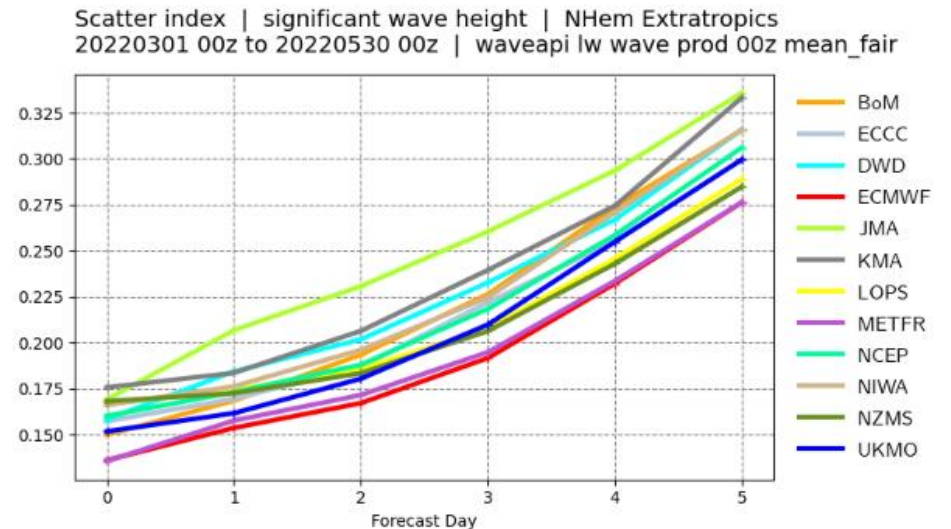


In addition to the above verifications, global ensemble NWP verification, long-range forecast verification, tropical cyclone forecast verification are also conducted at different LCs.

ECMWF: Wave forecast verification (WV) |

<https://confluence.ecmwf.int/display/WLW>

- Participating countries provide their forecast products



Variables:

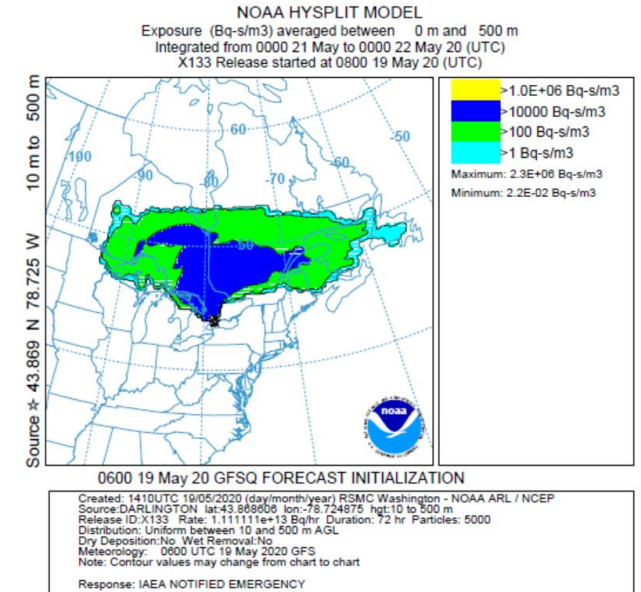
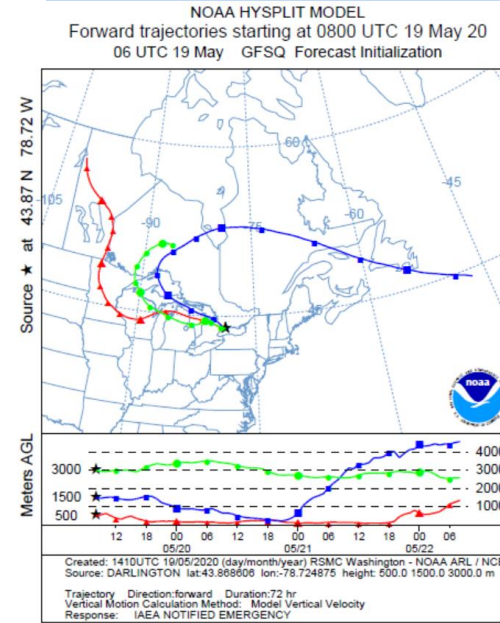
- significant wave height
- wave peak period
- 10m wind speed

Observations: moored buoys or weather ships and fixed platforms deployed in their near-shore and offshore areas of interest.

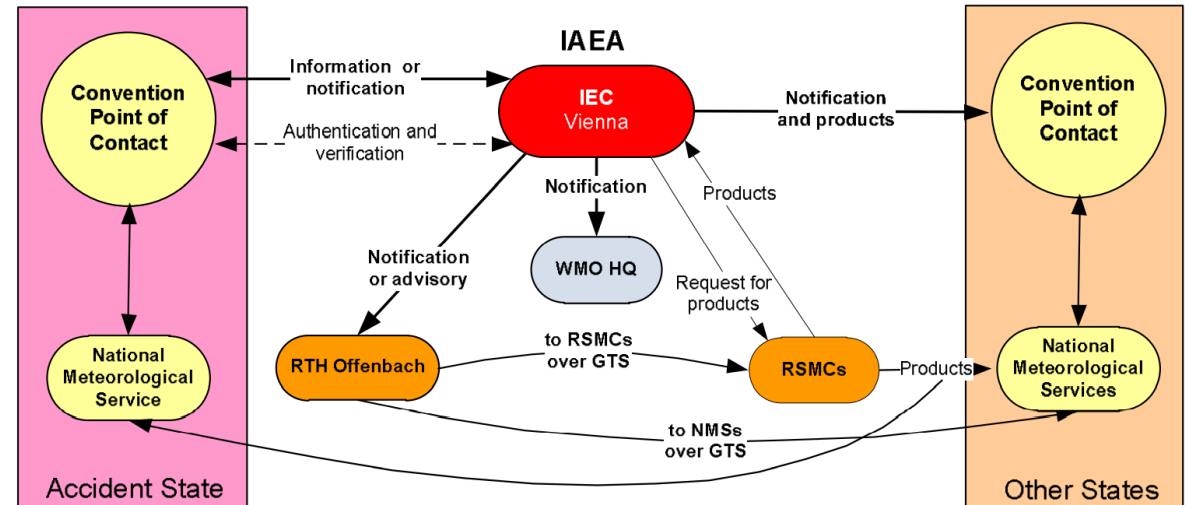
Nuclear Environmental Emergency Response

- In case of a nuclear power plant accidents, RSMCs calculate and provide the products of trajectories, air concentration and total deposition up to 3 days ahead responding requests from IAEA and Members.
- WMO also closely collaborate with IAEA as described in Joint Radiation Emergency Management Plan (2017).
- RSMCs supported IAEA and NMHSs at the Fukushima Daiichi NPP accidents in 2011.
- **Non-nuclear EER** was also established based on the experience of Nuclear EER activity.
 - Forest fires, chemical incidents, industrial fires and so on.

Some products of RSMC Washington for nuclear EER



IAEA and WMO established close collaborative framework

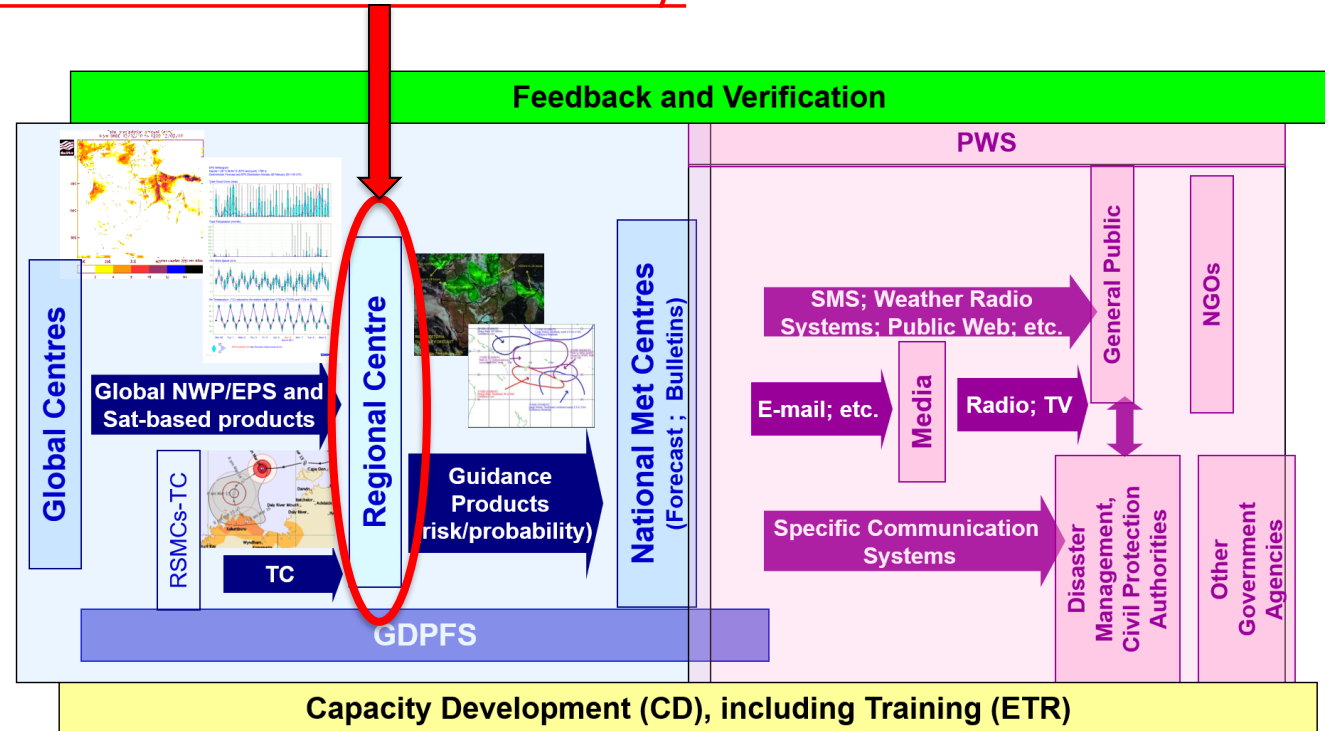
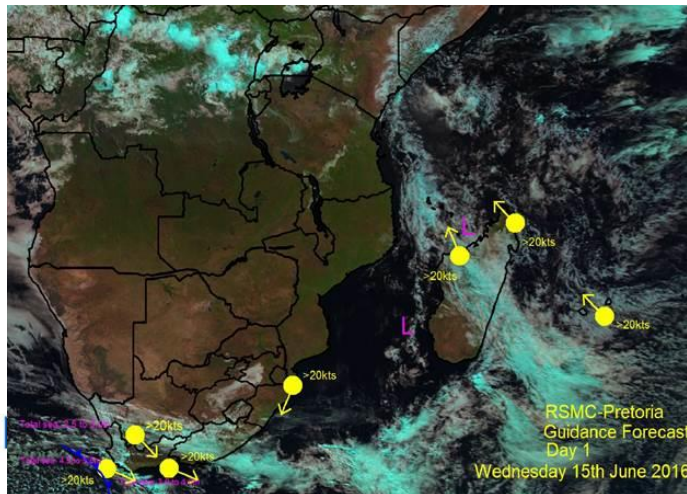


From Joint Radiation Emergency Management Plan (2017)

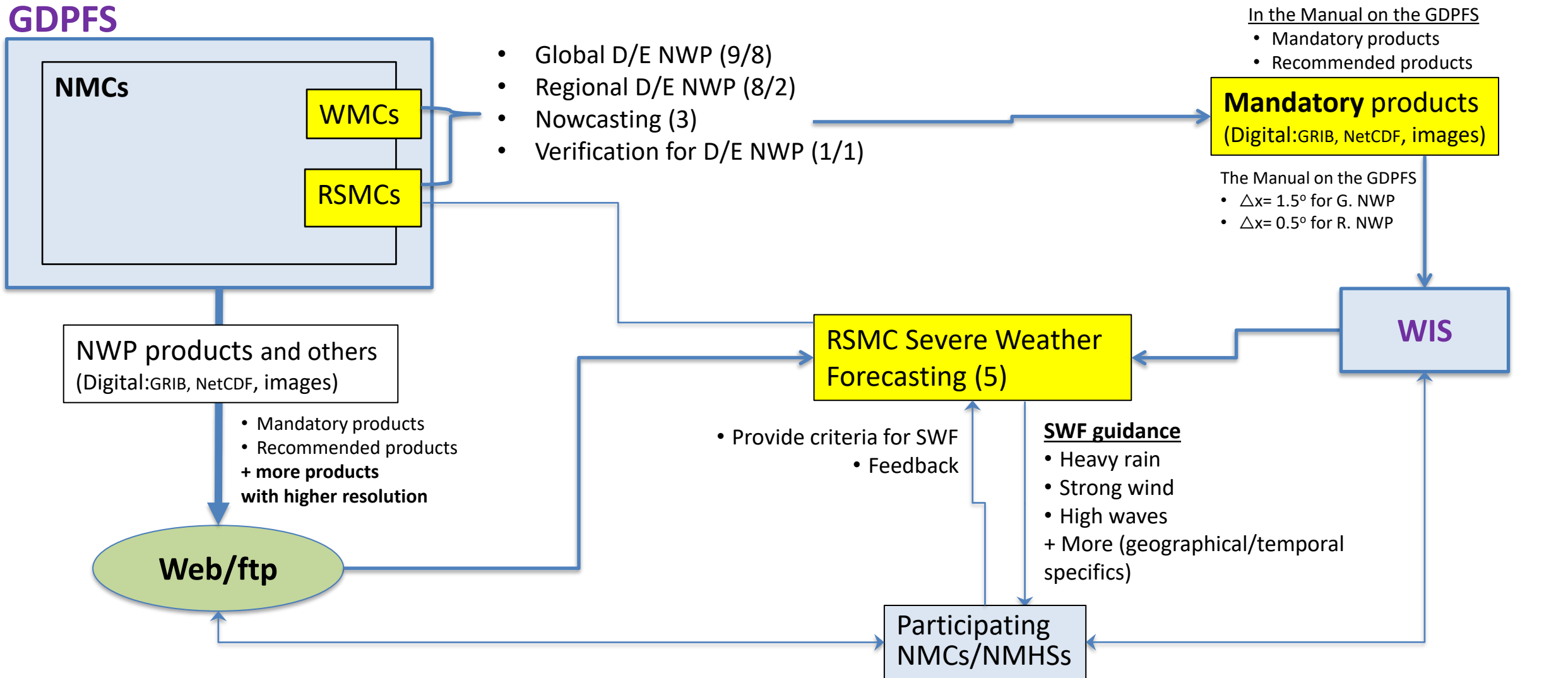
Severe Weather Forecasting Programme (SWFP) to RSMC for Regional Severe Weather Forecasting

- SWFDP aims to strengthen capacity of NMHSs in developing countries, LDCs and SIDS to deliver improved forecasts and warnings of severe weather to save lives and livelihoods, and protect property and infrastructure.
- It started in 2006 from the regional subproject in South Africa and successfully demonstrated the cascading forecast process to ensure the delivery of GDPFS products to users.
- In 2017, the role of the Regional Centre is defined as a new GDPFS activity.

RSMC shall prepare severe weather forecasting guidance products for associated NMCs containing an interpretation of deterministic NWP, EPS and remote sensing-based guidance products



Flow of NWP products for Severe Weather Forecasting



- Regional SWF Centres (not yet RSMCs SWF) (4)
- A number of Regional/National Centres doing D/E NWP (but not yet RSMCs D/E NWP)
- In several countries RSMC SWF (or Regional SWF Centres) and D/E NWP Centres are co-located (e.g. Moscow, Pretoria, New Delhi & Ha Noi etc.)

The Web Portal for Designated GDPFS Centres

improved data discoverability and accessibility

<https://community.wmo.int/gdpfs-web-portal>

Designated GDPFS Centres Web portal for the Global Data-processing and Forecasting System

Filter by Region: I II III IV V VI

Filter by GDPFS Activities: [Search box]

137 centres/networks **22** activities

Donut Chart Legend:

- RA I 13
- RA II 32
- RA III 8
- RA IV 25
- RA V 11
- RA VI 49

Designated WMCs and Mandatory Products:

- ★ **WMC Beijing** (World Meteorological Centre)
- ★ **WMC ECMWF** (World Meteorological Centre)
- ★ **WMC Exeter** (World Meteorological Centre)
- ★ **WMC Melbourne** (World Meteorological Centre)
- ★ **WMC Montreal** (World Meteorological Centre)
- ★ **WMC Moscow** (World Meteorological Centre)
- ★ **WMC Offenbach** (World Meteorological Centre)
- ★ **WMC Tokyo** (World Meteorological Centre)
- ★ **WMC Toulouse** (World Meteorological Centre)

World Map: 10000 km scale. ©WMO 2018 - Disclaimer: The designations employed in this map are in conformity with United Nations practice. The presentation of material therein does not i... Powered by Esri

Useful links

- [A full list of designated GDPFS centres \(Part III of Manual on the Global Data-processing and Forecasting System\)](#)
- [GDPFS web site](#)
- [GDPFS Community site](#)

Notes to User

1. Please address requests for updating information to the Earth System Prediction Division of the Secretariat at dpfsmail@wmo.int.
2. Focal points of designated GDPFS centres are linked to the [WMO Community Platform](#). WMO members will be able to get detailed contact information of the focal points after login.

Please select a centre to view its mandatory GDPFS products.

Please select a centre to view its information.

♥ indicates mandatory products.

GDPFS activities at a glance

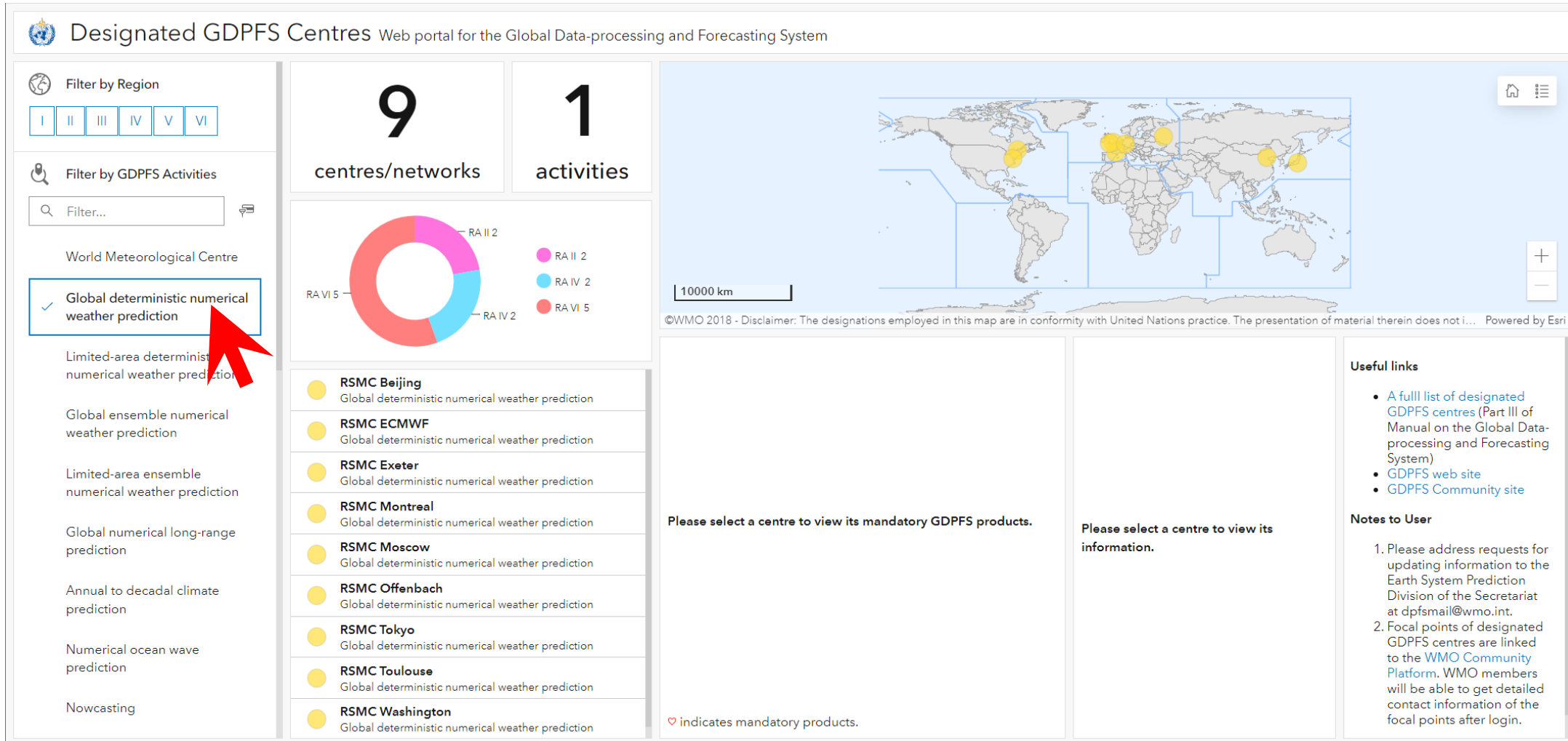
Geo-statistics

List of designated centres

The Web Portal for Designated GDPFS Centres

improved data discoverability and accessibility

 <https://community.wmo.int/gdpfs-web-portal>



The screenshot shows the web portal interface for Designated GDPFS Centres. The header includes the WMO logo and the title "Designated GDPFS Centres Web portal for the Global Data-processing and Forecasting System".

Filter by Region: I, II, III, IV, V, VI

Filter by GDPFS Activities: Search box with "Filter..." text.

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 numerical long-range prediction
- Annual to decadal climate prediction
- Numerical ocean wave prediction
- Nowcasting

Summary: 9 centres/networks, 1 activities

Donut Chart: RA II 2 (pink), RA IV 2 (cyan), RA VI 5 (red), RA V 5 (orange)

Map: World map showing designated GDPFS centres with yellow markers. Scale: 10000 km. ©WMO 2018 - Disclaimer: The designations employed in this map are in conformity with United Nations practice. The presentation of material therein does not i... Powered by Esri

Useful links:

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Instructions:

- Please select a centre to view its mandatory GDPFS products.
- Please select a centre to view its information.

♥ indicates mandatory products.

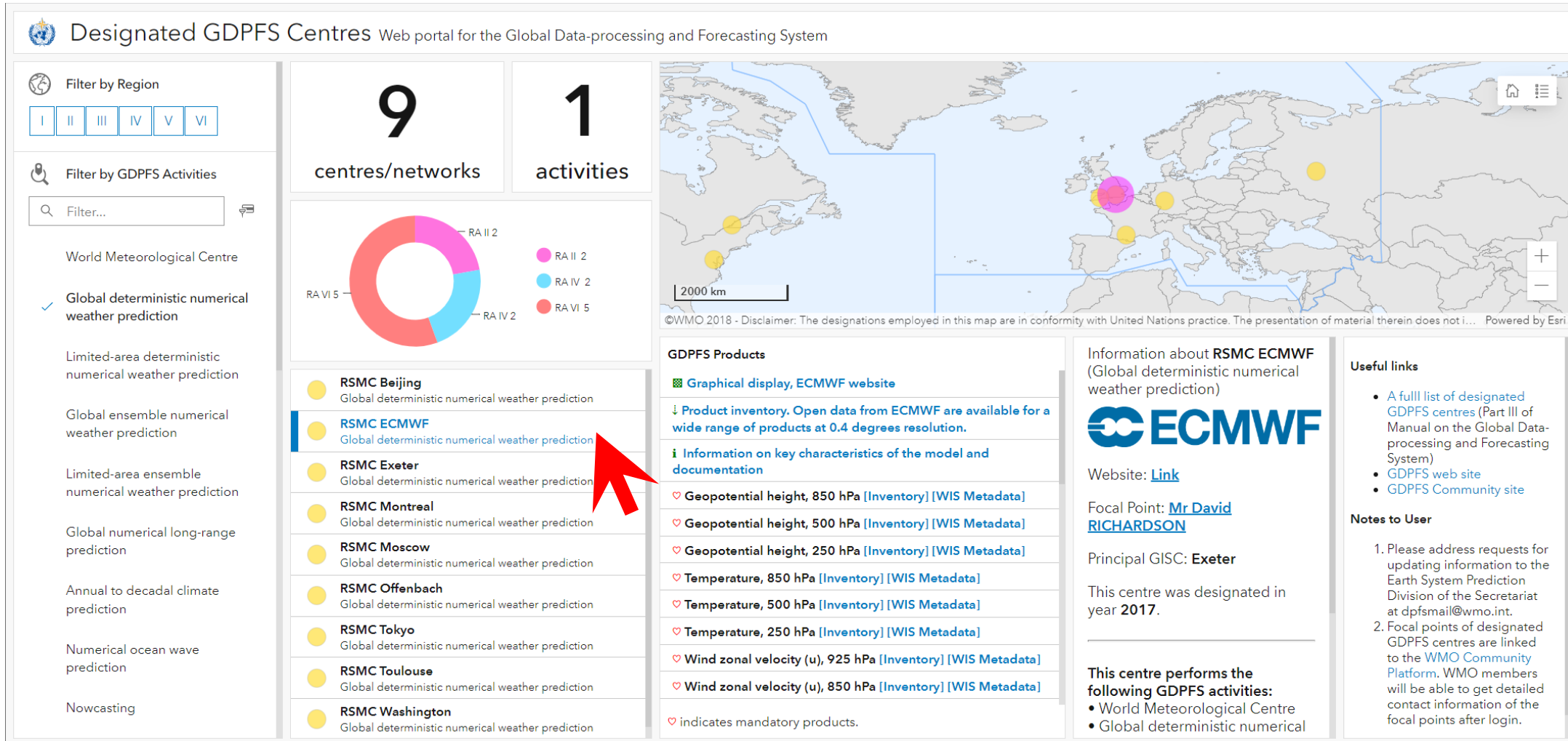


Click on a GDPFS activity will highlight the designated centres.

The Web Portal for Designated GDPFS Centres

improved data discoverability and accessibility

 <https://community.wmo.int/gdpfs-web-portal>



The screenshot shows the 'Designated GDPFS Centres' web portal. The header includes the WMO logo and the title 'Designated GDPFS Centres Web portal for the Global Data-processing and Forecasting System'. On the left, there are two filter sections: 'Filter by Region' with buttons I through VI, and 'Filter by GDPFS Activities' with a search box and a list of activities. The 'Global deterministic numerical weather prediction' activity is selected. The main content area is divided into three sections: 1. Summary statistics: '9 centres/networks' and '1 activities'. 2. Donut chart: A donut chart showing the distribution of activities across centres. The legend indicates: RA II 2 (pink), RA IV 2 (light blue), RA VI 5 (red), and RA VI 5 (red). 3. List of centres: A list of 10 designated centres, each with a yellow dot icon and a description. The 'RSMC ECMWF' entry is highlighted with a blue bar and a red arrow pointing to it. Below the list is a 'GDPFS Products' section with a list of products, each with a red heart icon and a link to its inventory and metadata. To the right of the products list is a detailed profile for 'RSMC ECMWF', including its website, focal point (Mr David RICHARDSON), principal GISC (Exeter), and a list of GDPFS activities it performs. Further right are 'Useful links' and 'Notes to User' sections.

Designated GDPFS Centres Web portal for the Global Data-processing and Forecasting System

Filter by Region: I II III IV V VI

Filter by GDPFS Activities: Filter...

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 numerical long-range prediction

Annual to decadal climate prediction

Numerical ocean wave prediction

Nowcasting

9 centres/networks

1 activities

RA II 2

RA IV 2

RA VI 5

RA VI 5

RSMC Beijing
Global deterministic numerical weather prediction

RSMC ECMWF
Global deterministic numerical weather prediction

RSMC Exeter
Global deterministic numerical weather prediction

RSMC Montreal
Global deterministic numerical weather prediction

RSMC Moscow
Global deterministic numerical weather prediction

RSMC Offenbach
Global deterministic numerical weather prediction

RSMC Tokyo
Global deterministic numerical weather prediction

RSMC Toulouse
Global deterministic numerical weather prediction

RSMC Washington
Global deterministic numerical weather prediction

GDPFS Products

Graphical display, ECMWF website

Product inventory. Open data from ECMWF are available for a wide range of 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]

indicates mandatory products.

Information about RSMC ECMWF
(Global deterministic numerical weather prediction)

ECMWF

Website: [Link](#)

Focal Point: [Mr David RICHARDSON](#)

Principal GISC: [Exeter](#)

This centre was designated in year 2017.

This centre performs the following GDPFS activities:

- World Meteorological Centre
- Global deterministic numerical

Useful links

- A full list of designated GDPFS centres (Part III of Manual on the Global Data-processing and Forecasting System)
- GDPFS web site
- GDPFS Community site

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Click on a designated centre to know more about its products.

Plan to provide more core data

- WMO Unified Policy for the International Exchange of Earth System Data ([Res.1 \(Cg-Ext\(2021\)\)](#))
 - One important outcome is broader and easier access to high-quality numerical weather prediction (NWP) and analysis products for Members.
 - The **core data** of analysis and prediction should be specified in the [Manual on the Global Data-processing and Forecasting System \(GDPFS\)](#) (WMO-No. 485).
- GDPFS Symposium on requirements for NWP data and products (29-31 Aug 2022, Geneva)
 - Develop **draft lists of the core data products** covering short-range weather forecasting to seasonal climate prediction
 - Identify **concrete actions to** ensure that the GDPFS meets all key requirements from Members, including **access to high-resolution NWP data**

Note: The Survey has sent out before the symposium

Presentations and more information are available on the Symposium website, [link](#)



Plan to provide more core data

- Review the mandatory products of general purpose activities
 - Global deterministic NWP
 - Global ensemble NWP
 - Global numerical sub-seasonal forecasts (SSF)
 - Global numerical long-range prediction (LRF)
- Outcome of the symposium tabled to INFCOM-2 expecting to be adopted at EC-76 (2023)
 - Map terminology “mandatory products” to “core data”
 - Provide the additional list of core data in INF document
- Process to update the list of core data
 - Relevant designated GDPFS centres will investigate challenges and practical issues to produce these additional core data
 - INFCOM, especially SC-ESMP, will work together with the relevant designated GDPFS centres to enable the access to the proposed core data products
 - Relevant ETs responsible for change of activity specifications will review the draft list of core data and develop the draft amendment of the *Manual on GDPFS*
 - The final draft list of core data will be tabled at INFCOM-3 (2024) to amend the *Manual on GDPFS*



Supporting GDPFS Users

Guidelines for Nowcasting Techniques

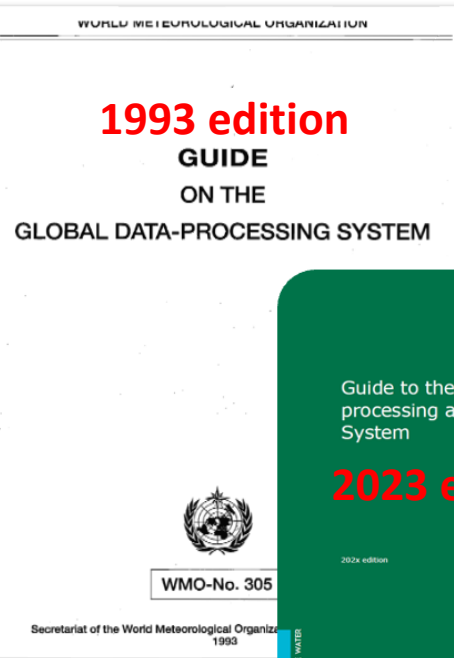
Guidelines on Nowcasting Techniques (WMO-No. 1198)

Guidelines on Ensemble Prediction System Postprocessing

Guidelines on EPSP (WMO-No. 1254)

Guidelines on Meteorological and Hydrological Aspects of Siting and Operation of Nuclear Power Plants

Guidelines on Meteorological and Hydrological Aspects of Siting and Operation of Nuclear Power Plants (WMO-No. 550)



Guide to the Global Data-processing and Forecasting System

2023 edition

2023 edition

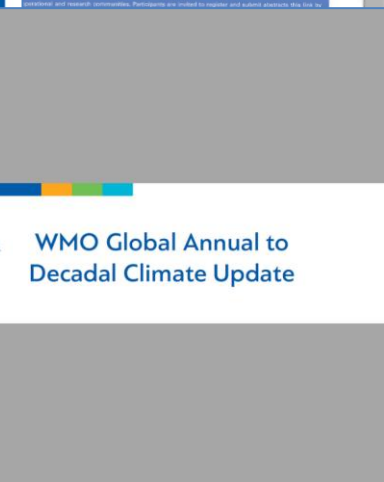
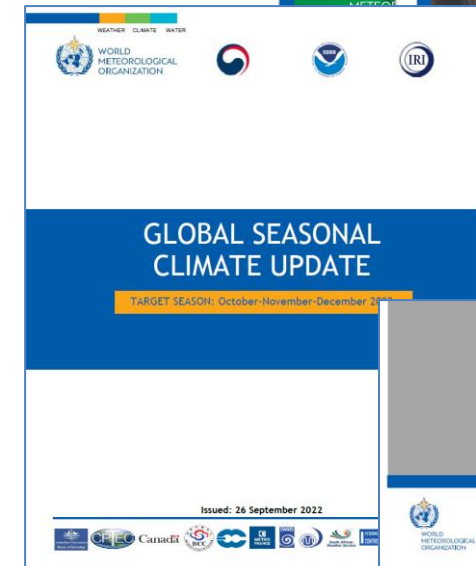


WORLD METEOROLOGICAL ORGANIZATION
WMO-No. 305

RENEW

Guidance on Operational Practices for Objective Seasonal Forecasting

Guidance on Operational Practices for Objective Seasonal Forecasting (WMO-No. 1246)



WMO



WORLD METEOROLOGICAL ORGANIZATION

WMO-No. 550

More information at : [GDPFS ExtraNet](#)



Thank you
Merci

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World Meteorological Organization

Organisation météorologique mondiale