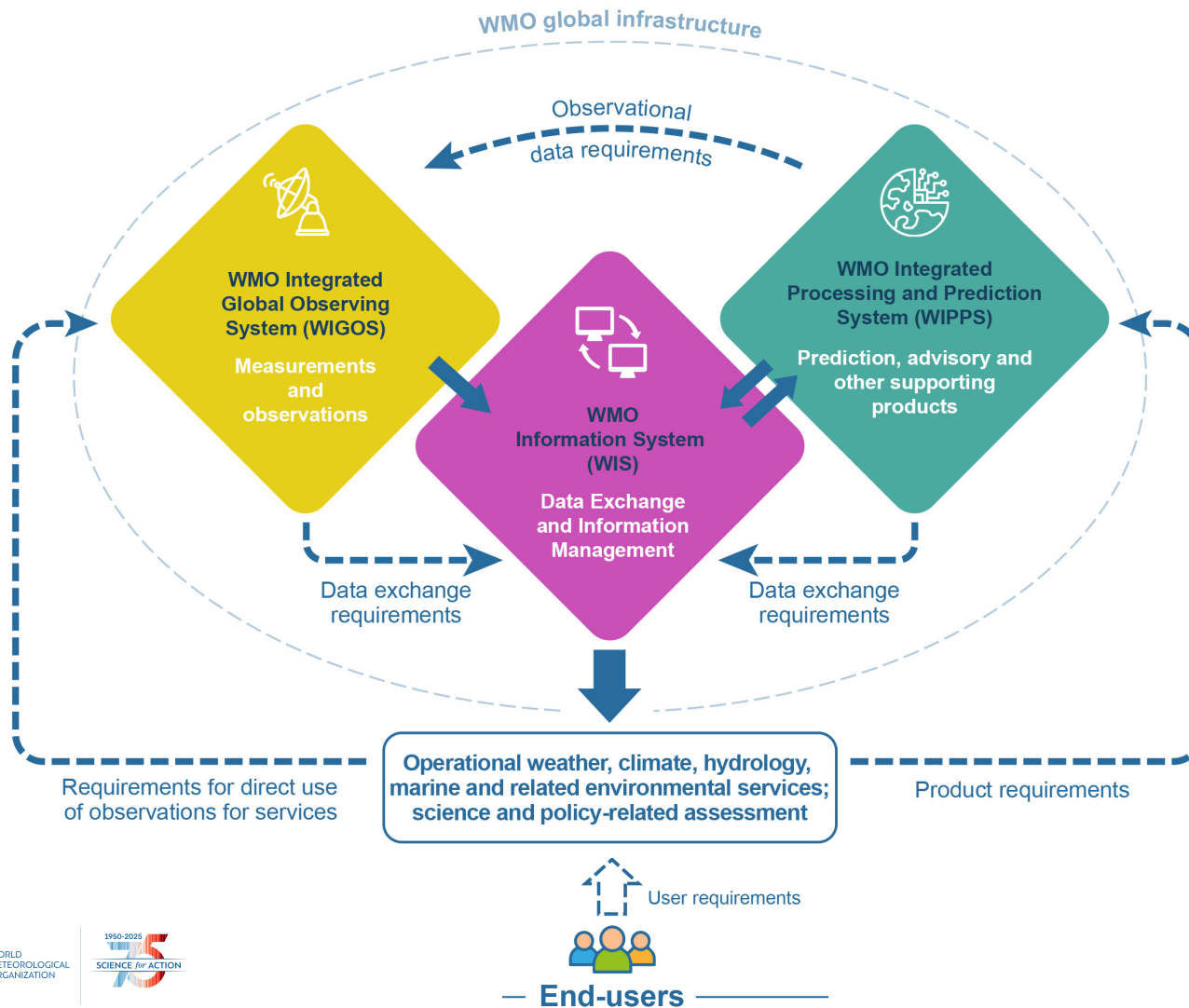# WMO Integrated Processing and Prediction System (WIPPS)

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INFCOM

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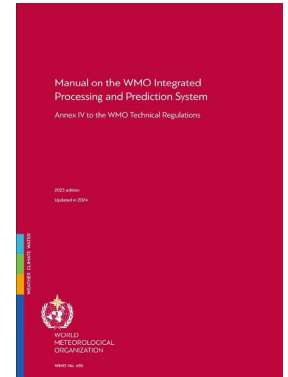
WIPPS in WMO Operational Infrastructure

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

WIPPS is …

- Definition: worldwide network of operational centres operated by WMO Members

- Aim: make defined products and services operationally available to WMO Members and relevant operational organizations

- Defined products
  - Analysis, forecast, including probabilistic information
  - Specialized products tailored for specific applications

- Entities responsible for producing the products
  - WIPPS Designated Centres (WIPPS DCs) and National Meteorological Centres (NMCs);
  - WIPPS DCs include World Meteorological Centres (WMCs);
    Global Producing Centres (GPCs), Regional Specialized Meteorological Centre (RSMCs);
    Reginal Climate Centre (RCCs), Regional Specialized Hydrological Centre (RSHCs) and Lead Centre (LCs).

- Modalities for delivering the products
  - WIS – *mandatory products defined in the Manual on the WIPPS (minimum set)*
  - Websites of WIPPS Centres; direct download from the WIPPS Centres – ftp, API, etc.

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The Web Portal for WIPPS Designated Centres

Forecasting range

- Nowcasting   0 – 2 hrs

- Very short-range weather forecasting   up to 12 hrs

- Short range weather forecasting   12 – 72 hrs

- Medium range weather forecasting   72 – 240 hrs

- Sub-seasonal prediction   10 days to 4 weeks

- Seasonal Prediction   1 – 6 months

- Annual to decadal climate prediction   1 to 10 yrs

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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 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

Specialized activities (15)

- Regional climate prediction and monitoring
- 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

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

June 2024 updated

Strategic Components in WIPPS

- Consolidating research and innovation into Earth System Modelling and Predictions

New Observations, Big Data

Exascale / Cloud Computing

AI / ML Applications

- Weather and Climate Predictions
- Climate Projections & Provision for Climate Services
- Atmospheric Composition Prediction
- Space Weather Prediction
- Hydrological Predictions
- Ocean Prediction
- Application to Geohazards & Compounding / Cascading Hazards
- Cryospheric Prediction

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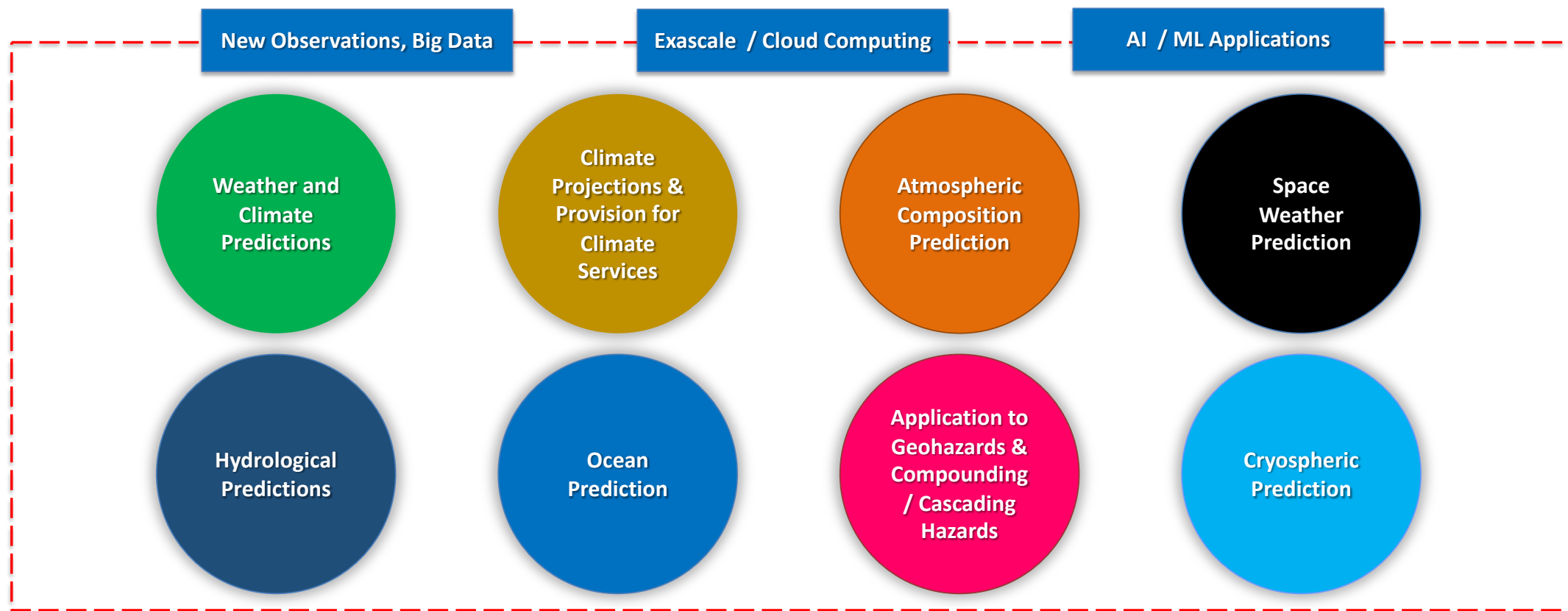
Roadmap for Incorporating AI into WIPPS

Purpose

The primary objective of this roadmap is to provide WMO Members with guidance regarding the potential and limitations of new AI technologies and to identify good approaches for integrating these technologies into their operational practices.

The roadmap then proposes an approach of utilizing WIPPS pilot projects that will enable investigating various open issues regarding the implementation of this new technology as well as demonstrations of potential value of AI in enhancing the effectiveness of early warning systems (described in Section 4).

The Joint Advisory Group on AI (JAG-AI) will focus on the promotion and acceleration of the integration of AI into global, regional and national forecasts, early warning systems and services aiming for the timely delivery of quality-assured products, contributing to the goals of the EW4All initiative.

Structure

1. Introduction
2. Objective of the Roadmap
3. Issues and Challenges for AI use by WMO Members and its integration into WIPPS
    3.1 Data Availability and Quality
    3.2 Prediction and post-processing
    3.3 Verification
    3.4 NMHS infrastructure and capacity requirements
    3.5 Applications
    3.6 Model Explainability and Transparency
    3.7 WIPPS Framework and Technical Regulations
    3.8 Partnership and Ethical Considerations
4. AI-related WIPPS Pilot Projects and other WMO activities
    4.1 Projects
    4.2 Other WMO activities
    4.3 Gap analysis of identified issues and challenges
5. Expected deliverables and Milestones

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Roadmap for Incorporating AI into WIPPS

Cg-Ext (2025)

Projects

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.

a. AI for Nowcasting Pilot Project (AINPP)
b. Global to local data-driven predictions in a common framework (Bris)
c. ECMWF/WMO AI Weather Quest
d. WGNE Models Intercomparison Project (WGNE-MIP)
e. UNESCAP /WMO Typhoon Committee initiative on AI Applications in Tropical Cyclone Analysis and Prediction
f. Pilot for global riverine flood prediction

3. Issues and challenges		a. AINPP	b. local AI model	c. AI Weather Quest	d. WGNE-MIP	e. AI-TC	f. Global Flood
		4.1 AI-related projects					
3.1	a		X	X			
	b	X	X				
	c	X	X				
3.2	a	X	X	X	X	X	X
	b		X			X	X
	c		X	X	X	X	
	d		X			X	
	e			X	X	X	X
3.3	a	X		X	X		
	b	X	X		X	X	
	c	X			X		
	d	X	X		X	X	
3.4	a	X			X		
	b	X	X	X	X		
3.5	a						
	b						
	c	X					
3.6	a		X		X	X	
	b		X	X	X		X
3.7	a						
	b	X	X	X	X	X	X
3.8	a	X					
	b	X					

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Potential interactions between WIPPS and WCRP

WIPPS activities (number of WIPPS-DCs) linked to climate forcing data

- Sub-seasonal (5), seasonal (15) and annual to decadal prediction (4).
- Use full suite or subsets of CMIP6 forcings (greenhouse gases, ozone, tropospheric aerosols, volcanic aerosols and solar forcing) in hindcasts and forecasts.
- Align with the update frequency of CMIP forcing datasets, typically every 5 to 7 years.
- Should WIPPS facilitate an annual update?

CMIP modelling groups can potentially become WIPPS endorsed 'climate change projection centres'

ESGF data servers can potentially become WIPPS-endorsed infrastructure

Do we need WMO (WIPPS) endorsed attribution centres?

- Conditional extreme event attribution modelling essentially makes use of NWP technologies.
- The WMO WMCs can potentially generate 'standardized' attribution simulations
- This can facilitate 'equal access' to attribution simulations in the Global South
- WMO standardization and frequent RRRs can strengthen the uptake of attribution science in L&D and beyond.