

Resolution 60 (Cg-17)

WMO Policy for the International Exchange of Climate Data and Products to Support the Implementation of the Global Framework for Climate Services

WHY:

The exchange of climate data and products is needed to better manage risk and support adaptation to climate variability and change

As living with and adapting to climate variability and change become key features of daily life, having access to the appropriate tools to make well-informed, climate-smart decisions has become increasingly important. Climate services can provide individuals, organizations and socioeconomic sectors with relevant information to help mitigate the risks and take advantage of the opportunities brought about by climate variability and change.

Climate knows no political boundaries and connects with the world in complex ways. To develop climate services at local, national, regional and global levels, the free and unrestricted sharing of data gathered and products developed in different parts of the world is critical. This process requires the consolidation of data from far and wide to obtain the best possible understanding through analysis, to better validate models and improve predictions and projections, to monitor and assess potential consequences, and to deliver climate services to those who need them most.

In 2009, the international community established the [Global Framework for Climate Services \(GFCS\)](#) with the overarching goal of enabling better management of risk and adaptation to climate variability and change through the development and incorporation of science-based climate information and prediction into planning, policy and practice. The Global Framework for Climate Services supports the implementation of related international policy frameworks including the [United Nations Framework Convention on Climate Change \(UNFCCC\) Paris Agreement](#), the [United Nations 2030 Agenda for Sustainable Development](#), the [United Nations Conference on Sustainable Development \(Rio +20\)](#) and the [Sendai Framework for Disaster Risk Reduction](#). The Global Framework assists countries in developing and using climate services, while also promoting international collaboration, pooling of resources and expertise, and sharing of best practices.

To facilitate the international cooperation necessary to advance GFCS implementation, in 2015, the Seventeenth [World Meteorological Congress](#) of the [World Meteorological Organization \(WMO\)](#) adopted [Resolution 60 \(Cg-17\)](#) – WMO Policy for the International Exchange of Climate Data and Products to Support the Implementation of the GFCS. The adoption of this policy is in line with the Organization’s history of facilitating international cooperation in the free and unrestricted exchange of data, information, products and services related to the safety, security and economic welfare of society, and to the protection of the environment. This history includes the adoption of [Resolution 40 \(Cg XII\)](#) and [Resolution 25 \(Cg-XIII\)](#), which secured the commitment of WMO Members to the free and unrestricted international exchange of meteorological and hydrological data and products, respectively.

WHAT: An international agreement on climate data and product exchange

What is Resolution 60 (Cg-17)?

Resolution 60 (Cg-17) is an international agreement affirming the commitment of WMO Members to the free and unrestricted exchange of meteorological, hydrological, climatological and related environmental data and products, which have been developed or acquired under the auspices of WMO and which are required to support the implementation of GFCS. The resolution recognizes the rights of governments to choose the manner by, and the extent to which, they make their GFCS-relevant data and products available domestically and for international exchange, taking into consideration relevant international instruments and national policies and legislation. WMO defines free and unrestricted as the non-discriminatory distribution of data at no more than the cost of reproduction and delivery, and without charge for the data and products themselves.¹

How does the new policy relate to Resolution 40 (Cg-XII) and Resolution 25 (Cg-XIII)?

Resolution 60 (Cg-17) adopts the policies, practices and guidelines of Resolution 40 (Cg-XII) and Resolution 25 (Cg-XIII) for the exchange of GFCS-relevant data and products. Resolutions 40 and 25 will continue to be in force, including GFCS-relevant aspects implicitly covered by them.

Which types of data and products are considered necessary for GFCS implementation under Resolution 60 (Cg-17)?

In addition to the climate data and products provided under [Annex 1 to Resolution 40 \(Cg-XII\)](#), GFCS-relevant data and products subsumed within the general designation of hydrological data and products in Resolution 25 (Cg-XIII), and all data and products that are already available on a free and unrestricted basis, the following are considered necessary for the implementation of GFCS:

1. Historical climate time-series from the [Regional Basic Climate Networks \(RBCNs\)](#) and the [Global Climate Observing System \(GCOS\)](#) Upper-Air and Surface Networks at a temporal and spatial resolution necessary to resolve the statistics of climate, including trends and extremes;
2. Climate-relevant coastal interface data, in particular sea level, waves and storm surges;
3. Data on the composition of the atmosphere including aerosols;
4. Climate-relevant satellite data and products;
5. Climate-relevant cryospheric data, in particular snow cover, snow depth, glacial monitoring, permafrost, and lake and river ice;
6. Data and products illustrating the past, present and future states of the climate system and described by the [Essential Climate Variables \(ECVs\)](#) (see [Annex 1](#)).

¹ World Meteorological Organization, 1995: *Twelfth World Meteorological Congress: Abridged Final Report with Resolutions*. (WMO-No. 827), p. 134.

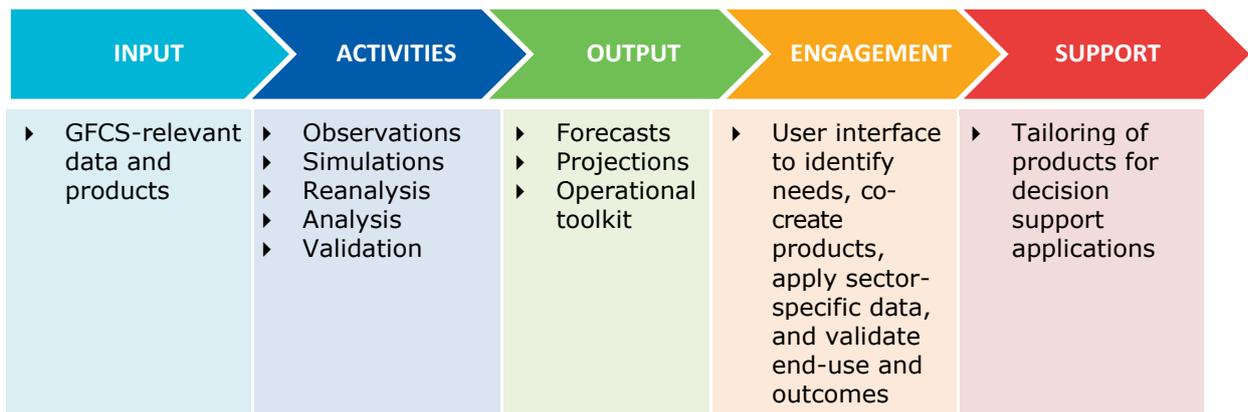
HOW:

Delivering climate data and products through the Climate Services Information System

The GFCS [Climate Services Information System \(CSIS\)](#) is the mechanism for delivering data and products covered by Resolution 60 (Cg-17), as well as value-added tailored products involving additional data not necessarily covered by the Resolution, and tools for improving GFCS-relevant data and products. Information about climate – past, present and future – is routinely archived, analysed, modelled, exchanged and processed through the CSIS, which functions as the operational core of GFCS. The functions of CSIS include climate analysis and monitoring; assessment and attribution; prediction from sub-seasonal to decadal timescales; and projection on multi-decadal to centennial timescales, on a range of spatial scales, to meet global, regional, national and local needs. Figure 1 depicts the process through which value is added to the GFCS-relevant data and products through the CSIS in order to develop the tailored products necessary for climate-smart decision-making.

A detailed illustration of the data and products relevant to CSIS, broken down by timescale, is provided in [Annex 2](#).

Figure 1: Climate Services Information System Value Chain



The Climate Services Information System is not centralized but rather involves the discovery of data and information distributed throughout a worldwide physical infrastructure of institutes, centres and computing capabilities. Together with professional human resources, this global infrastructure develops, generates and distributes a variety of climate information products and services to inform decision-making processes across a range of climate-sensitive activities and enterprises.

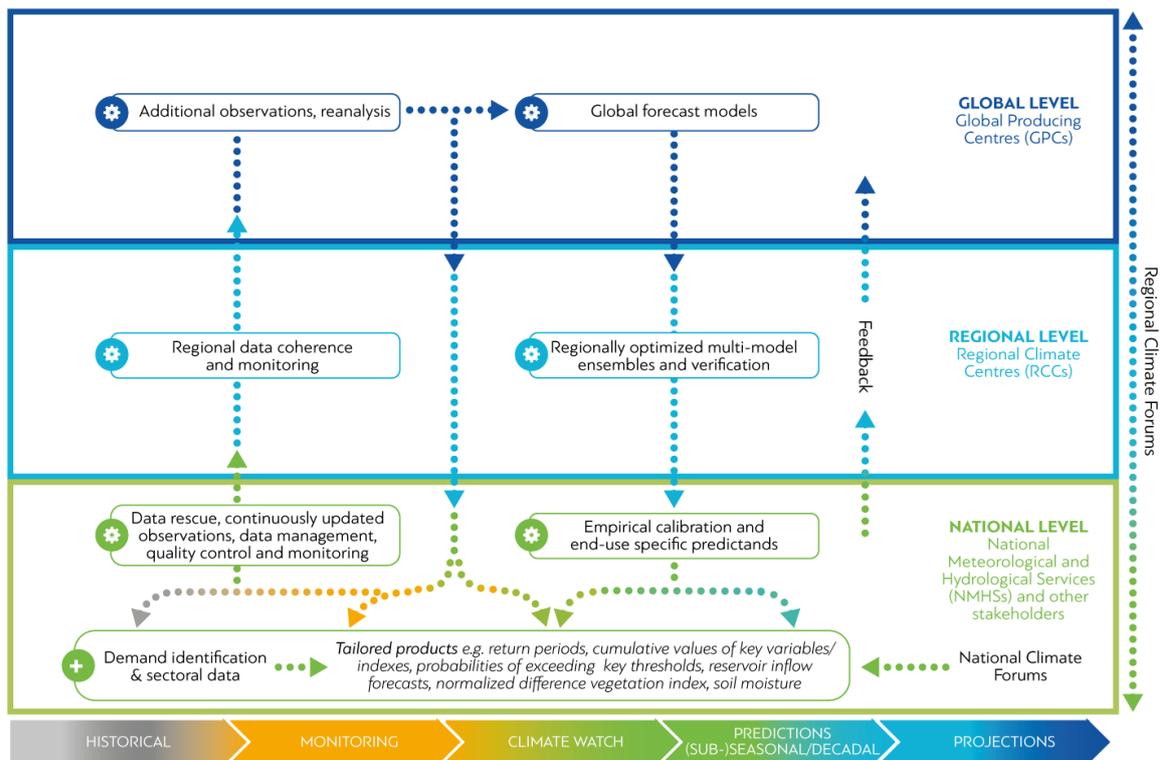
Existing technical standards and operational, communication, and authentication mechanisms are critical in ensuring the delivery of authoritative climate information products through the CSIS. Further implementation of CSIS will involve the collaborative observing systems and components covered under the [WMO Integrated Global Observing System \(WIGOS\)](#); the infrastructure for discovering, accessing and retrieving data and products provided by the [WMO Information System \(WIS\)](#); and the network of centres and arrangements for preparing meteorological analyses and forecasting, and for processing, storage and retrieval of meteorological information coordinated under the [Global Data-processing and Forecasting System \(GDPFS\)](#). For detailed information on the services and centres critical to the implementation of Resolution 60 (Cg-17), see [Annex 3](#).

NEXT STEPS:

Implementing Resolution 60 (Cg-17) and strengthening climate services

- Having secured the commitment of WMO Members to the free and unrestricted exchange of data and products needed for GFCS implementation through Resolution 60 (Cg-17), the groundwork can be laid to implement CSIS through a phased regional approach (Figure 2). A cascading system is being operationalized, which draws data and observations from the national level. These data and observations are then incorporated in global and regional models which, in turn, generate reanalyses and forecast model outputs, which can be statistically downscaled and tailored to deliver products and services at the national level. Figure 2 depicts this approach together with value-adding activities and anticipated benefits.

Figure 2: Regional implementation of the Climate Services Information System (CSIS-R)



- The Secretary-General of WMO will survey and analyse the various data policies and service provision models of Members to identify successful strategies and best practices. The information gleaned can help National Meteorological and Hydrological Services make the case to their governments and partners for establishing funding mechanisms to sustain the maintenance and operation of the network of stations and sensors needed for the global observing systems for climate, and the data preparation and management systems necessary to support the implementation of the Resolution. Engagement with private partners, who benefit from commercial applications of freely accessible data and products, as investors in building capacity and sustainable observations infrastructure, particularly in developing countries, will be explored. WMO will implement a process for monitoring the accessibility and exchange of GFCS-relevant data and products under the Resolution. Results of these exercises will be fed back to the WMO Executive Council.

- The GFCS will consider which additional data and products under the auspices of WMO are needed for the Framework and make recommendations in this respect to the Executive Council for its consideration. The GFCS will also recommend to the World Meteorological Congress how sector-specific data and products under the auspices of GFCS partners could be treated in the context of the Resolution.
- WMO technical commissions will provide advice and assistance on the technical aspects of the implementation of the Resolution and ensure that appropriate standards are identified, implemented and maintained. The technical commissions will regularly review and update the GFCS-relevant data and products to be provided by the global and regional climate centres, with a view to increasing access to and availability of GFCS-relevant data and products.
- The Executive Council will foster initiatives to support Members in implementing the Resolution, particularly those most vulnerable to climate-related hazards, and to enhance their capabilities in providing, delivering and improving access to GFCS-relevant data and products, especially least developed and developing countries.

WHO:

Role of WMO Members in supporting the implementation of Resolution 60 (Cg-17) and the Global Framework for Climate Services

Members are urged to make GFCS-relevant data and products from the [World Data Centres \(WDCs\)](#), [Global Producing Centres for Long-Range Forecasts \(GPCLRFs\)](#), [Regional Climate Centres \(RCCs\)](#), [Regional Climate Outlook Forums \(RCOFs\)](#) and [International Council for Science World Data System \(ICSU-WDS\)](#) accessible through the CSIS, as these are considered essential contributions to the GFCS. As national systems and centres provide the fundamental observations needed to support the implementation of Resolution 60 (Cg-17) and the CSIS, as well as serve as the principal interface for the development and delivery of climate services, it is crucial both for Members and for the entire system that they receive adequate support.

BIBLIOGRAPHY:

Resolution 40 (Cg-XII)

WMO policy and practice for the exchange of meteorological and related data and products including guidelines on relationships in commercial meteorological activities

Resolution 25 (Cg-XIII)

Exchange of hydrological data and products

Resolution 16 (Cg-XVI)

Climate data requirements

Resolution 48 (Cg-XVI)

Implementation of the Global Framework for Climate Services

Resolution 1 (Cg-Ext.(2012))

Implementation plan of the Global Framework for Climate Services

Resolution 2 (Cg-Ext.(2012))

Establishment of the Intergovernmental Board on Climate Services

Resolution IOC-XXII-6

IOC Oceanographic Data Exchange Policy, adopted by the Assembly of the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific and Cultural Organization (UNESCO) at its twenty-second session

Resolution 60 (Cg-17)

WMO policy for the international exchange of climate data and products to support the implementation of the Global Framework for Climate Services

Resolution 18 (EC-69)

Revised *Manual on the Global Data-processing and Forecasting System* (WMO-No- 485)

The role and operation of National Meteorological and Hydrological Services – A Statement by the World Meteorological Organization for Directors of NMHSs, Executive Council: Abridged Final Report of the Sixty-fifth Session (WMO-No. 1118), Annex II

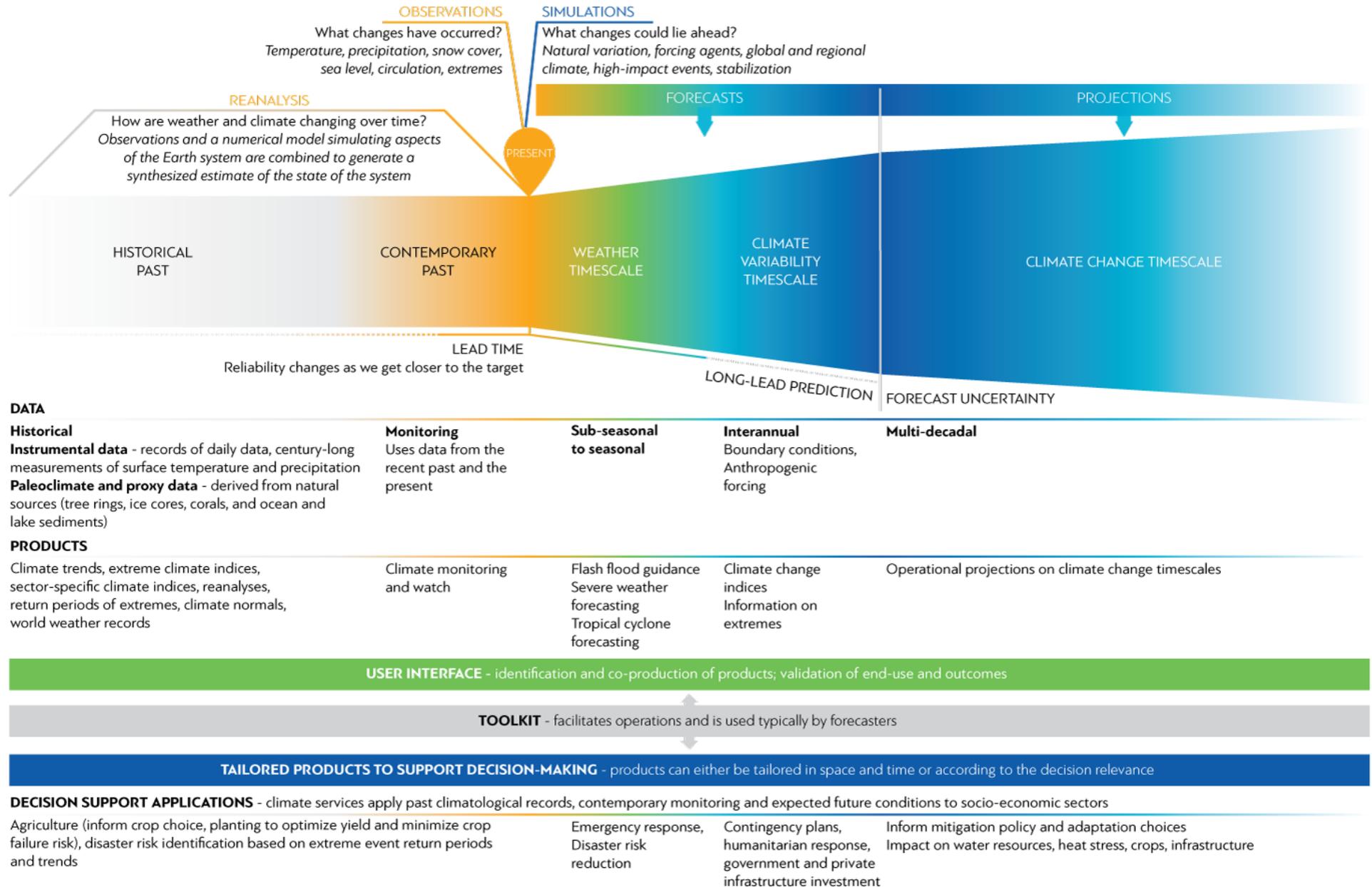
ANNEX 1: Essential Climate Variables

The 54 Essential Climate Variables (ECVs) identified by the Global Climate Observing System² are vital for the characterization of the earth’s climate and so can be used to classify GFCS-relevant data. The ECVs are physical, chemical, or biological variables that provide the basis for understanding and predicting the evolution of climate. They are used to guide mitigation and adaptation measures, assess risks, enable attribution of climatic events to underlying causes, and underpin climate services; therefore, they are important for the GFCS. The ECVs also support the UNFCCC and the [Intergovernmental Panel on Climate Change](#). To support the global aims of the GFCS, international exchange is required for both current and historical observations. Scientifically and technically feasible diagnostics, assessments, forecasts and projections of these variables are also relevant for the GFCS.

GCOS ECVs (atmospheric, oceanic and terrestrial) covered by Resolution 60 (Cg-17)		Which WMO activities provide some of this data?		
Essential Climate Variables (ECVs)		Programmes	Co-sponsored	Satellite
Atmospheric	<i>Surface:</i> Wind speed and direction, precipitation, air temperature, water vapour, pressure, surface radiation budget	WMO Integrated Global Observing System (WIGOS)		Committee on Earth Observation Satellites/Coordination Group for Meteorological Satellite Working Group on Climate (CEOS/CGMS WG Climate)
	<i>Upper-air:</i> Lightning, temperature, wind speed and direction, water vapour, cloud properties, Earth radiation budget	WIGOS		CEOS/CGMS WG Climate
	<i>Composition:</i> Carbon dioxide (CO ₂), methane (CH ₄), other long-lived greenhouse gases, ozone, aerosol, precursors for aerosol, and ozone	Global Atmosphere Watch (GAW)		CEOS/CGMS WG Climate
Oceanic	<i>Physics:</i> Subsurface temperature, subsurface salinity, subsurface currents, ocean-surface stress, ocean-surface heat flux, sea-surface temperature, surface currents, sea-surface salinity, sea level, sea state, sea ice		Global Ocean Observing System (GOOS)/Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM)	CEOS/CGMS WG Climate
	<i>Biogeochemistry:</i> Inorganic carbon, oxygen, nutrients, transient tracers, nitrous oxide (N ₂ O), ocean colour		GOOS	CEOS/CGMS WG Climate
	<i>Biology/ecosystems:</i> Plankton, marine habitat properties		GOOS	
Terrestrial	<i>Hydrology:</i> River discharge, groundwater, soil moisture, lakes	World Hydrological Cycle Observing System (WHYCOS)	Global Terrestrial Network – Hydrology (GTN-H)	CEOS/CGMS WG Climate
	<i>Cryosphere:</i> Snow, glaciers, ice sheets and ice shelves, permafrost	Global Cryosphere Watch (GCW)		CEOS/CGMS WG Climate
	<i>Biosphere:</i> Albedo, land cover, fraction of absorbed photosynthetically active radiation, leaf area index, above-ground biomass, fire, land-surface temperature, soil carbon		Baseline Surface Radiation Network (BSRN)	CEOS/CGMS WG Climate
	<i>Human use of natural resources:</i> Water use, greenhouse gas fluxes	GAW		CEOS/CGMS WG Climate

² GCOS, 2016: [The Global Observing System for Climate: Implementation Needs](#), GCOS-200, p.51.

ANNEX 2: Climate Services Information System



National Meteorological and Hydrological Services (NMHSs): National government agencies with a mission to observe, understand and predict weather and climate, and provide meteorological and related services in support of national needs. They contribute to the protection of life and property; the safeguard of the environment; and sustainable development. They ensure continuity of the observations of meteorological and related data including climatological data; promote endogenous capacity building; meet international commitments; and contribute to international cooperation. National Meteorological and Hydrological Services depend on the stable, cooperative international exchange of meteorological and related data and products for discharging their responsibilities.

DATA DISCOVERY

International Council for Science World Data System (ICSU-WDS): A system for certifying Member Organizations (holders and providers of data or products) using internationally recognized standards. The ICSU-WDS Data Portal provides access to currently available metadata catalogues using standards, and allows the retrieval of datasets from participating Members. Members of the World Data System are the building blocks of a searchable common infrastructure, from which a data system that is both interoperable and distributed can be formed.

OBSERVATIONS

WMO Integrated Global Observing System (WIGOS): A framework for integrating the governance and management functions, mechanisms and activities of contributing observing systems on global, regional and national levels. Currently, WIGOS includes the following observing components:

ATMOSPHERIC:

- [Global Atmosphere Watch \(GAW\) Programme](#) observing component

World Data Centres (WDCs): Centres that collect, document and archive atmospheric measurements and associated metadata from measurement stations worldwide in order to make these data freely available to the scientific communities. Each of the six WDCs is responsible for archiving one or more Global Atmosphere Watch (GAW) measurement parameters: ozone and ultraviolet radiation, solar radiation, greenhouse gases, aerosols, precipitation chemistry, and remote sensing data. World Data Centres are operated and maintained by their individual host institutions. In some cases, WDCs also provide additional products including data analyses, maps of data distribution, and data summaries.

OCEANIC:

- [WMO-UNESCO Intergovernmental Oceanographic Commission \(IOC\) Joint Technical Commission for Oceanography and Marine Meteorology \(JCOMM\)](#) observation programme area for marine-based stations.

TERRESTRIAL:

- [WMO Hydrological Observing System \(WHOS\)](#)
- [Global Cryosphere Watch \(GCW\)](#) observing component, including surface-based and space-based components.

COLLABORATIVE OBSERVING SYSTEMS:

- [Global Climate Observing System \(GCOS\)](#) and [Global Ocean Observing System \(GOOS\)](#), co-sponsored by the [International Council for Science \(ICSU\)](#), [IOC](#), the [United Nations Environment Programme \(UNEP\)](#) and [WMO](#);
- [Global Terrestrial Observing System \(GTOS\)](#) co-sponsored by the [United Nations Food and Agriculture Organization \(FAO\)](#), [ICSU](#), [UNEP](#), [UNESCO](#) and [WMO](#).

DATA MANAGEMENT AND TELECOMMUNICATIONS

The WMO Information System (WIS) is a single coordinated global infrastructure for telecommunications and data management providing an integrated approach for meeting requirements for routine collection and automated dissemination of observed data and products, and data discovery, access and retrieval services for all weather, climate, water and related data produced by centres and Member countries in the framework of any WMO Programme. Centres within WMO Member States that comply with the required WIS functions and technical specifications are designated as one of the three types of centre forming the core infrastructure of WIS:

- **National Centres (NCs)** are essentially existing NMHSs, which collect and distribute data on a national basis and will coordinate or authorize the use of the WIS by national users, normally under a policy established by the respective Permanent Representative with WMO;
- **Global Information System Centres (GISCs)** collect and distribute information meant for routine global dissemination, while serving as collection and distribution centres in their areas of responsibility and providing entry points, through unified portals and comprehensive metadata catalogues, for any request for data held within the WIS;
- **Data Collection or Production Centres (DCPCs)** are connected to GISCs and collect, disseminate, add value to, and archive regional or programme-specific data and products. Data Collection or Production Centres maintain catalogues of their holdings and services, which are used to update the comprehensive [Discovery, Access and Retrieval \(DAR\)](#) catalogue for the data, products and services encompassed by WIS.

DATA-PROCESSING AND FORECASTING

Global Data-processing and Forecasting System (GDPFS): The coordinated global system of meteorological centres and arrangements for the processing, storage and retrieval of meteorological information within the framework of the World Weather Watch.

The activities of the GDPFS are organized in three tiers:

- **General purpose activities:** 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, numerical ocean wave prediction, storm surge prediction, global numerical ocean prediction, and nowcasting;
- **Specialized activities:** Regional severe weather forecasting, regional climate prediction and monitoring, coordination of multi-model ensemble prediction for long-range forecasts, coordination of near-term climate prediction, tropical cyclone forecasting, including marine-related hazards, volcanic contaminants, marine meteorological services, marine environmental emergency response, nuclear environmental emergency response, non-nuclear environmental emergency response, and atmospheric sand and dust storm forecasts;
- **Non-real-time coordination activities:** Coordination of deterministic numerical weather prediction verification; coordination of ensemble prediction system verification; coordination of long-range forecast verification; coordination of wave forecast verification; coordination of tropical cyclone forecast verification; and coordination of observation monitoring.

A three-level system of GDPFS centres carries out GDPFS functions at the global, regional and national levels:

- **National Meteorological Centre (NMC):** Carries out functions to meet the national and international requirements of the Member concerned. Such functions include the preparation of forecasts and warnings at all forecasting ranges needed to meet the requirements of the Member. Depending on the context, other activities of an NMC include the production of: (a) special application-user products, including climate and environmental quality monitoring and prediction products; and (b) non-real-time climate-related products;
- **Regional Specialized Meteorological Centre (RSMC):** Carries out operationally at least one of the general purpose or specialized activities listed above;
- **World Meteorological Centre (WMC):** Carries out operationally at least the following activities: (a) global deterministic numerical weather prediction; (b) global ensemble numerical weather prediction; and (c) global numerical long-range prediction.

Global Producing Centres for Long-range Forecasts (GPCs) produce global long-range forecasts using dynamical models. WMO has designated the following Lead Centres:

- [Lead Centre for Long-range Forecast Multi-model Ensemble \(LC-LRFMME\)](#)
- [Lead Centre for Standard Verification System of Long-range Forecasts \(LC-SVSLRF\)](#)
- [Lead Centre for Coordination of Near-term Climate Prediction \(LC-NTCP\)](#).

Regional Climate Centres (RCCs) are designated by WMO to provide regional long-range forecasts and other regional climate services. Groups of centres that collectively provide these forecasts and services in a distributed network are called an RCC Network. The mandatory functions of RCCs include:

- Operational activities for long-range forecasting;
- Operational activities for climate monitoring;
- Operational data services;
- Training in the use of operational RCC products and services.

Regional Climate Centres are also encouraged to take up several highly recommended functions including climate prediction and projection (beyond 2 years timeframe), non-operational data services, coordination, training and capacity building, and research and development.

Regional Climate Outlook Forums (RCOFs) are platforms that bring together climate experts and sector representatives from countries in a climatologically homogenous region to provide consensus-based climate prediction and information, with input from global and regional producing centres and NMHSs, with the aim of gaining substantial socioeconomic benefits in climate sensitive sectors.
