## WORLD METEOROLOGICAL ORGANIZATION

**WMO INTEGRATED GLOBAL OBSERVING SYSTEM
(WIGOS)**

**VOLUME I – General Standards and Recommended Practices**

**(20xx edition)**

**PART I. WMO Integrated Global Observing System (WIGOS)**

**(Version 0.1)**

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TECHNICAL REGULATIONS

GENERAL PROVISIONS

Note: These sections will be provided in the overall Volume I.

**DEFINITIONS: WORK IN PROGRESS – SUBJECT TO CHANGE**

**DEFINITIONS**

The following terms, when used in the Volume I of the Technical Regulations, have the meanings given below:

Note 1: Other definitions may be found in the Manual on Codes (WMO-No. 306), Manual on the Global Data Processing and Forecasting System, Vol. 1 (WMO-No. 485), Manual on the Global Tele­ communication System, Vol. 1(WMO-No. 386) and other WMO publications.

Note 2: These definitions will be added to the definitions provided by other Parts to the full definition set for VOLUME I.

***Aircraft meteorological stations:*** Meteorological station situated aboard an aircraft. (IMV)

***Antarctic Observing Network:*** Comprises all operational networks in Antarctica.

***Calibration (rating)***

* Experimental determination of the relationship between the quantity to be measured and the indication of the instrument, device or process which measures it. (IGH)
* Process of relating the indicated response of an instrument to its actuating signal, or to the true value obtained independently; it is usually carried out at several points in the instrument's measurement range. (IMV)

***Climatological station:*** (1) Station from which climatological data are obtained. (2) Surface station at which observations of specified elements are made primarily for climatological purposes. (IMV)

***Cryosphere:*** elements of the Earth System containing water in its frozen state including solid precipitation, snow cover, sea ice, lake and river ice, glaciers, ice caps, ice sheets, permafrost, and seasonally frozen ground.

***Cryosphere Observing Network:*** to come.

***Data compatibility:*** to come.

**Discovery metadata:** metadata consistent with the standard that is used within WIS for discovery of information shared through WIS. (Manual on WIS)

***Framework:*** a set of principles, ideas, guidelines and provisions to enable decisions, judgments and operations.

***Geostationary:*** to come.

***Geostationary Earth Orbit (GEO):*** to come

***Geostationary satellite.*** Meteorological satellite orbiting the Earth at an altitude of approximately 36 000 km with the same angular velocity as the Earth and within the equatorial plane, thus providing nearly continuous information in an area within a range of about 50° from a fixed sub-satellite point at the Equator. (IMV)

***Global Climate Observing System (GCOS):*** to come.

***Global Atmosphere Watch (GAW):*** A partnership involving Members, contributing networks and collaborating organizations and bodies which provides reliable scientific data and information on the chemical composition of the atmosphere, its natural and anthropogenic change, and helps to improve the understanding of interactions between the atmosphere, the oceans and the biosphere.

***Global Cryosphere Watch (GCW):*** A programme to enhance the capability of the research community and operational services to predict the future state of the Cryosphere and provide quality assured global and regional products on the state of Cryosphere.

***Global Observing System (GOS).*** The coordinated system of methods, techniques and facilities for making observations on a world-wide scale within the framework of the World Weather Watch. (IMV)

***Instruments:*** to come.

***Interoperability:*** to come.

***Low Earth Orbits (LEO):*** An orbit with an altitude between 160 kilometres (99 mi), with a period of about 88 minutes, and 2,000 kilometres (1,200 mi), with a period of about 127 minutes.

***Metadata:*** information about resources (ISO 19115-1)

***Meteorological observation.*** Evaluation or measurement of one or more meteorological elements. (IMV)

***Meteorological observing network.*** A group of meteorological observing stations spread over a given area for a specific purpose. (TR Vol. I)

***Meteorological observing station (Meteorological station).*** Place where meteorological observations are made with the approval of the WMO Member or Members concerned. (IMV)

***Meteorological report (Report).*** Statement of observed meteorological conditions related to a specific time and location. (IMV)

***Near-polar orbiting satellite.***  A meteorological satellite with a nearly circular, nearly polar orbit. The combination of satellite motion and the Earth's rotation beneath the orbit provides overlapping strips of satellite data covering swaths (up to 3000 km) from pole to pole. The satellite's altitude can be chosen within a wide range (600 to 1500 km) in order to provide data over the entire globe twice a day. (IMV)

 ***Observation:*** Evaluation of one or more elements of the physical environment. (IMV)

Note: observations are level II data and may be obtained directly or derived, as defined in the Manual on the Global Data-processing and Forecasting System (WMO-No. 485, 2010 edition) Volume I – Global Aspects”

***Observational Metadata:*** information that is needed to assess and interpret observations or to support design and management of observing systems and networks, including the logging of long-term changes.

**Observations network.** One or more sensors, instruments or types of observation at more than one station or platform, acting together to provide a coordinated set of observations.

**Observing system.** One or more sensors, instruments or types of observation at one or more stations or platforms, acting together to provide a coordinated set of observations.

**Observing station**. A place where observations are made, commonly having a fixed location.

Note: the owner and operator of an observing station may be a National Meteorological and/or Hydrological Service, another agency or organisation (either governmental, non-governmental or commercial) or an individual.

**Observing platform.** A place where observations are made, commonly being mobile.

Note: the owner and operator of an observing platform may be a National Meteorological and/or Hydrological Service, another agency or organisation (either governmental, non-governmental or commercial) or an individual.

***Satellite systems:*** to come

***Space-based sub-system.*** A complementary part of the Global Observing System composed of near-polar orbiting satellites and geostationary satellites. (IMV)

***Surface-based subsystem:*** One of the two major components of the Global Observing System composed of all non-spaced-based observing stations.

***System:*** Assembly of objects, processes or concepts, most often interacting with each other, which are focussed on or result in a specific outcome.(IGH)

***WMO Hydrological Observing System (WHOS):*** to come.

**WMO Observing station/platform.** Any observing station/platform identified to WMO by the PR of a Member country as a WMO Observing station/platform.

**WMO Observing system / observations network.** An Observing system / observations network consisting of WMO stations or platforms.

**WMO Observation**. An observation made at a WMO observing station/platform.

***World Weather Watch (WWW).*** The worldwide, coordinated, developing system of meteorological facilities and services provided by Members for the purpose of ensuring that all Members obtain the meteorological information they require both for operational work and for research. The essential elements of the World Weather Watch are:

* The Global Observing System (GOS);
* The Global Data-processing and Forecasting System (GDPFS);
* The Global Telecommunication System. (GTS)

1. INTRODUCTION TO WIGOS

**1.1 Purpose of WIGOS**

1.1.1 The WMO Integrated Global Observing System (WIGOS) shall be a framework for all WMO observing systems and the contributions of WMO to co-sponsored observing systems. These systems will continue to be owned, managed and operated by a diverse array of organizations and programmes.

1.1.2 The purpose of WIGOS shall be to meet the evolving requirements of Members for observations. The assessments of requirements and plans to meet them are achieved through the application of the Rolling Review of Requirements (RRR) process (specified in section 2.).

1.1.3 Within WIGOS, Members shall collaborate to advance the state of observing systems and the compatibility and world-wide exchange of observations, with additional benefits emerging as the concept is adopted by entities beyond WMO itself and its partner organizations.

1.1.4 Members should enhance cooperation amongst meteorological, hydrological, marine/oceanographic and academic/research institutions/services where they are separated at the national level.

1.1.5 WIGOS shall focus on the integration of governance and management functions, mechanisms and activities to be accomplished by contributing observing systems, according to the resources allocated on a global, regional and national level.

1.1.6 The interoperability of WIGOS component observing systems should be achieved through their in-common utilization and application of internationally accepted standard and recommended practices and procedures including the use of standard data formats.

**1.2 WIGOS component observing systems**

The component observing systems of WIGOS shall comprise the Global Observing System (GOS) of the World Weather Watch (WWW) Programme, the observing component of the Global Atmosphere Watch (GAW) Programme, the WMO Hydrological Observing System (WHOS) of the Hydrology and Water Resources Programme (HWRP) and the observing component of the Global Cryosphere Watch (GCW), including their surface-based and space-based components. The above component systems include all WMO contributions to the co-sponsored systems, as well as the WMO contributions to GFCS and GEOSS.

Note: the co-sponsored observing systems are the Global Climate Observing System (GCOS), the Global Ocean Observing System (GOOS) and the Global Terrestrial Observing System (GTOS).

1.2.1 **Global Observing System (GOS) of the WWW**

The Global Observing System shall be a coordinated system of networks of observing stations and platforms, together with methods, techniques, facilities and arrangements for making observations on a world-wide scale and defined as one of the main components of the World Weather Watch Programme.

1.2.2 **Global Atmosphere Watch (observing component of GAW)**

The Global Atmosphere Watch Programme shall be a coordinated system of networks of observing stations, methods, techniques, facilities and arrangements encompassing the many monitoring and related scientific assessment activities devoted to the investigation of the changing chemical composition and related physical characteristics of the global atmosphere.

1.2.3 **WMO Hydrological Observing System**

1.2.3.1 The WMO Hydrological Observing System (WHOS) comprises hydrological observations, initially focusing on water level and discharge, and includes the World Hydrological Cycle Observing System programme (WHYCOS) intended to improve basic observation activities, strengthen international cooperation and promote the free exchange of data in the field of hydrology. The composition of hydrological observations is provided in Volume III – Hydrology, Chapter D.1.2.

1.2.3.2 The purpose of the WHOS shall be to provide near real-time streamflow data (both water level and discharge) from as many National Hydrological Services as possible.

1.2.3.3 Members providing hydrological observations to the WHOS shall operate in accordance with the procedures and practices set out in the following sections (2, 3, 4 and 8).

Note 3: Volume III – Hydrology, the Guide to Hydrological Practices (WMO-No.168), the Manual on Stream Gauging (WMO-No.1044) and other relevant manuals provide further provisions and guidance necessary for operating hydrological stations to prescribed standards.

1.2.4 **Global Cryosphere Watch (observing component of GCW)**

The Global Cryosphere Watch (GCW) shall be a coordinated system of networks of observing stations, methods, techniques, facilities and arrangements encompassing monitoring and related scientific assessment activities devoted to the investigation of the changing Cryosphere. The Cryosphere Observing Network (CryoNet) shall build on existing Cryosphere observing programmes and promote the addition of standardized Cryospheric observations to existing facilities.

1.3 **Collaboration with co-sponsored and non-WMO observing system**

The coordination between the WMO, the co-sponsored and non-WMO observing systems shall be supported by a high-level reconciliation mechanism to be defined by the WMO-UNESCO/IOC-UNEP-FAO-ICSU MoU. These interagency and inter-observing system coordination mechanisms shall be complemented and supported through similar cooperation and coordination arrangements among NMHSs and through national implementation mechanisms for GFCS, GCOS, GOOS, GTOS, and GEOSS.

**1.4 Governance and management**

Note: WIGOS implementation is an integrating activity for all WMO and co-sponsored observing systems: it supports all WMO Programmes and activities. The Executive Council and Regional Associations, supported by their respective working bodies, have a governing role in the implementation of WIGOS. Technical aspects of WIGOS implementation are guided by the Technical Commissions, with leadership provided through CBS and CIMO. The Sixteenth WMO Congress (Cg-XVI) recorded decisions for the governance and management of WIGOS.

1.4.1 Members shall implement and operate observing systems in accordance with the provisions of these WIGOS technical regulations.

1.4.2 Members should use the provisions of these Technical Regulations when establishing a quality management system which complies with the WMO Quality Management Framework.

Note: provisions relating to the WMO Quality Management Framework, WMO QMF, are provided in Volume IV (Technical Regulations, Volume IV – Quality Management (WMO-No.49, 2011 edition)).

2. COMMON ATTRIBUTES OF COMPONENT SYSTEMS

2.1. Requirements

2.1.1 General

Members should manage (i.e. establish, operate and maintain) their observing systems in an integrated and coordinated manner.

Note: WIGOS component observing systems have individual identities and stakeholder communities, but also support a single collective identity for all WMO observing systems including co-sponsored systems as the WIGOS.

2.1.2 **Observational requirements**

Members shall convey their observational user requirements, for each of the WMO application areas, to the Rolling Review of Requirements (RRR) process.

Note: information about the WMO application areas and the Rolling Review of Requirements (RRR) process is given in the Manual on WIGOS sections 2.1 and 2.2.

2.2. Design, planning and evolution

2.2.1 **General**

2.2.1.1 Members, both individually and also through the participation of their experts in the activities of Regional Associations and Technical Commissions, shall contribute to the Rolling Review of Requirements (RRR) process.

2.2.1.2 Members should implement the plans published by WMO for evolution of WIGOS observing systems when planning and managing their WIGOS observing systems.

2.2.1.3 Members shall maintain close coordination with their national telecommunication authorities to register their frequencies for adequate protection, and to defend the availability of frequencies for all WIGOS component observing systems.

2.3. Instrumentation and Methods of Observation

2.3.1 **General**

Members should follow the standards and recommended practices and procedures with respect to instruments and methods of observation, across and within all WIGOS component observing systems.

2.4 **Operations**

2.4.1 **General Requirements**

2.4.1.1 Members shall operate their WIGOS component observing systems in accordance with the practices, procedures and specifications set out in the Technical Regulations (WMO-No. 49), the Annex IX (Manual on the WIGOS (WMO-No. XXXX) and the other relevant Manuals.

2.4.1.2 Members shall ensure that all appropriate measures are taken for the installation and good functioning of their observing systems.

2.4.1.3 Members operating the observing systems shall/should meet the agreed requirements for uncertainty, timeliness, temporal resolution, spatial resolution, and coverage as they are stated by the Annex IX (Manual on the WIGOS (WMO-No. XXXX)).

2.4.1.4 Members shall ensure the continuity of operation and dissemination of observations\* generated by the observing systems under their responsibility.

2.4.1.5 Members shall ensure that proper safety procedures for operation of observing systems are specified documented and utilized.

2.4.2 **Observations**

2.4.2.1 Members shall ensure timely, quality-assured, quality-controlled, and well-documented compatible long-term observations in accordance with the practices and procedures specified in these Technical Regulations, the Manual on WIGOS and the other relevant Manuals.

Note: Technical specifications and details are given in the Guide to Meteorological Instruments and Methods of Observation (WMO-No. 8), Guide to the Global Observing System (WMO-No. 488), …

2.4.2.2 Members shall ensure overall availability of observations for all WMO Application Areas but especially for the numerical weather prediction in accordance with these Technical Regulations, the Manual on WIGOS and the other relevant Manuals.

Note: In accordance with Part 2.2 of these Technical Regulations and Annex IX, the WMO Application Areas are as follows: Global Numerical Weather Prediction; High Resolution Numerical Weather Prediction; Nowcasting and Very Short Range Forecasting; Seasonal and Inter-annual Forecasts; Aeronautical Meteorology; Atmospheric Chemistry; Ocean Applications; Agricultural Meteorology; Hydrology; Climate Monitoring (GCOS); Climate Applications; and Space Weather.

2.4.2.3 Members shall ensure that the record of all observations is maintained in accordance with the requirements specified in Annex IX (Manual on WIGOS (WMO-No. XXXX)).

2.4.2.4 Members shall ensure availability of WIGOS metadata in accordance with Part 2.5 of these Technical Regulations.

2.4.2.5 Members shall ensure that the record of WIGOS metadata is maintained and kept up-to-date in accordance with the requirements specified in Annex IX (Manual on WIGOS (WMO-No. XXXX)), Part 2.5.

2.4.3 **Performance**

2.4.3.1 Members operating the observing systems shall continuously monitor their performance.

2.4.3.2 Members should maintain records of the performance monitoring as part of their Quality Management System, for auditing purposes, where appropriate, in accordance with Part 2.6 of these technical regulations and Annex IX (Manual on the WIGOS (WMO-No. XXXX)).

Note: Technical specifications and details are given in the Guide to Meteorological Instruments and Methods of Observation (WMO-No. 8), Guide to the Global Observing System (WMO-No. 488), …

2.4.4 **Quality Control**

2.4.4.1 Members shall implement minimum standards of quality control at all levels for which they are responsible (e.g. observing systems/stations, National Meteorological Centres (NMCs), Regional Meteorological Centres (RMCs) and World Meteorological Centres (WMCs).

Note: Minimum standards of quality control are specified in Annex IV (Manual on the Global Data-processing and Forecasting System (WMO-No. 485), Volume I).

2.4.4.2 Members not capable of implementing these standards should establish agreements with an appropriate RMC or WMC to perform the necessary quality control.

2.4.5 **Calibration**

Members shall perform calibration of their measurement systems and instruments traceable to an international standard in accordance with Annex IX (Manual on WIGOS (WMO-No. XXXX)).

2.5. Observational Metadata

2.5.1 **Purpose and scope**

Members making WIGOS observations shall record, retain and make available internationally the observational metadata as specified in the Manual on WIGOS (WMO-No XXX section YYY).

2.6. Quality Management

 Note: provisions relating to the WMO Quality Management Framework, WMO QMF, are provided in Volume IV (Technical Regulations, Volume IV – Quality Management (WMO-No.49, 2011 edition)). Detailed guidance on how to develop and implement a quality management system is provided in the Guide to the Implementation of a Quality Management System for National Meteorological and Hydrological Services (WMO-No.1100, 2013 edition).

Members shall comply with the standards and practices with regard to the quality of WIGOS observations and observational metadata, as detailed in the Technical Regulations, Volume I – General Standards and Recommended Practices (WMO-No.49, 2015 edition) Part I, and in the Manual on WIGOS (WMO-No. XXXX, 2015 edition).

2.7. Capacity Development

2.7.1 General

Members should undertake efforts in capacity development to ensure that observing systems meet WMO requirements.

Note: guidance on approaches for capacity development is found in WMO capacity development strategies and plans. Such guidance includes consideration of various types of capacity: institutional, infrastructural, procedural and human resources.

**2.7.2 Training**

Members shall ensure that their personnel are educated and trained to comply with the WIGOS standard and recommended practices and procedures.

Note: extensive provisions applicable to the education and training of personnel are in Part V and Part VI, as well as Annex VIII.

**2.7.3 Infrastructural Capacity Development**

Members should regularly review their observing infrastructure and pursue capacity development activities to upgrade them, as required to address the priorities for evolution of observing systems identified through the Rolling Review of Requirements process as well as any additional national priorities.

Note: the Rolling Review of Requirements process and the resulting priorities for evolution of observing systems are described in sections 2.1 and 2.2.

3. COMMON ATTRIBUTES SPECIFIC TO THE SURFACE-BASED SUB-SYSTEM OF WIGOS

3.1. **Requirements**

3.1.1 **General**

3.1.1.1 The WIGOS surface-based subsystem shall be composed of surface stations within the component networks (i.e. GOS, GAW, WHOS, GCW) including but not limited to synoptic land and sea stations, hydrological stations, cryosphere sites, atmospheric composition and related physical parameters stations, upper-air synoptic stations, climatological stations, agricultural meteorological stations, aircraft meteorological stations, aeronautical meteorological stations, research and special-purpose vessel stations and special stations.

3.1.1.2 Members should, as appropriate, consider the surface-based sub-system as a single composite system of observing (fixed or mobile) sites/platforms.

3.1.2 **Observational requirements**

3.1.2.1 Members shall establish, operate, and maintain surface-based observing systems to meet the requirements of the WMO Application Areas, as established through the Rolling Review of Requirements.

3.1.2.2 Members should further consider national requirements to carry out the detailed planning for evolution of national WIGOS component observing systems.

3.2. **Design, planning and evolution**

3.2.1 **General**

3.2.1.1 Members shall plan, implement, operate and maintain national networks and observing programmes based on the standard and recommended practices and procedures as stated in the WMO Technical Regulations, including the Manual on WIGOS.

Note: Members are urged to take into account various plans and strategies developed by WMO, for WIGOS and the component observing systems.

3.2.1.2 Members should cooperate to address regional requirements, standardization, observing system interoperability, data compatibility, data management, quality management and proposed improvements in observing networks/systems.

3.2.1.3 Members should adopt a composite network approach to their networks and include the acquisition, and onward transmission, of data from a range of sources, including NMHSs and other government agencies, the commercial sector and members of the public.

Note 1: In all cases users are to judge the suitability of such data for their intended application, through assement of available metadata. Section 2.5 of the WIGOS Manual (WMO No…..) describes the required metadata, and section 2.4.4 describes the requirement for standard formats.

Note 2: the composite network approach here means the use of various types of observing systems or sources of observations to deliver a combined set of observations.

3.2.1.4 Where countries are small and geographically close or already have established multilateral working relationships, Members should consider a subregional approach to WIGOS observing infrastructure planning.

3.2.1.5 When doing so, Members shall work in close cooperation to prepare subregional reviews of requirements to be used as a basis for detailed planning at that scale.

3.3. **Instrumentation and Methods of Observation**

3.3.1 **General**

Members should follow the standard and recommended practices and procedures of the WMO Technical Regulations with respect to instruments and methods of observation, across and within all components.

3.4. **Operations**

3.4.1 **General**

Members should ensure observing system owners or custodians are operating and maintaining their systems in compliance with the technical regulations of the WMO and the co-sponsored observing systems to which they contribute.

Note: System owners are generally NMHSs or other organizations within WMO Member countries but are sometimes other entities.

3.5. **Observational Metadata**

Note: Provisions of 2.5 apply

3.6. **Quality Management**

Note: Provisions of 2.6 apply

3.7. **Capacity Development**

Note: Provisions of 2.7 apply

**Section 4: WORK IN PROGRESS – SUBJECT TO CHANGE**

4. **COMMON ATTRIBUTES SPECIFIC TO THE SPACE-BASED SUB-SYSTEM OF WIGOS**

4.1 **Scope, purpose and operation of the space-based sub-system**

4.1.1 **General**

Note: Space-based observations using satellite based systems are a fundamental asset for meteorology, climatology and hydrology, both for operational and research activities and their applications.

4.1.2 **Observational requirements**

4.1.2.1 Members or coordinated groups of Members shall guarantee to establish, operate, maintain and ensure the continuation of satellite systems, providing observational information as required in Annex IX (Manual on the WIGOS (WMO-No. XXXX)).

4.1.2.2 To ensure global coverage, contingency and further requirements as stated in Annex IX (Manual on the WIGOS (WMO-No. XXXX)), Members shall cooperate and arrange an optimal constellation of satellite systems, including near-polar-orbiting and geostationary.

4.1.2.3 Members or coordinated groups of Members shall design such environmental satellites or series of satellite systems to obtain an optimal constellation of satellite systems to provide information as required by Annex IX (Manual on the WIGOS (WMO-No. XXXX)).

Note: These requirements are compiled through the RRR and expressed in terms of coverage, continuity, resolution, uncertainty, frequency and observational variables.

4.1.2.4 Members or coordinated groups of Members shall process observational data up to a level as required by Annex IX (Manual on the WIGOS (WMO-No. XXXX)) and in a timely manner for dissemination in near-real time.

4.1.2.5 Members shall report data as observed variables, defined in Annex IX (Manual on the WIGOS (WMO-No. XXXX)), and expressed by environmental quantities, which will be in SI units.

4.1.2.6 Members and coordinated groups of Members shall ensure traceability to SI according to international approved standards.

5. **OBSERVING COMPONENT OF THE GLOBAL ATMOSPHERE WATCH (GAW)**

5.1 The mission of the Global Atmosphere Watch shall be to:

1. Reduce environmental risks to society and meet the requirements of environmental conventions.
2. Strengthen capabilities to predict climate, weather and air quality.
3. Contribute to scientific assessments in support of environmental policy.

through:

1. Maintaining and applying global, long-term observations of the chemical composition and selected physical characteristics of the atmosphere.
2. Emphasizing quality assurance and quality control.
3. Delivering integrated products and services of relevance to users.

5.2 The Global Atmosphere Watch observational network shall be developed and implemented in accordance with the provisions set out in Annex IX (Manual on the WIGOS (WMO-No. XXXX)).

5.3 The Global Atmosphere Watch observations shall be carried out in accordance with the provisions set out in Annex V (Manual on the Global Observing System (WMO-No.544), Volume I) and Annex IX (Manual on the WIGOS (WMO-No. XXXX)).

Note 1: Members may perform observations of any of the parameters included in the GAW focal areas (ozone, greenhouse gases, reactive gases, aerosols, UV radiation and precipitation chemistry). In situ content, vertical distribution and total column are the variables to be addressed.

Note 2: Members may use different platforms or their combinations (fixed stations, mobile platforms and remote sensing) to perform atmospheric composition measurements.

5.4. When doing so, Members shall register their contribution in the GAW station information system (GAWSIS), and submit their observations to the relevant GAW Data Centre.

**6.** **OBSERVING COMPONENT OF THE GLOBAL CRYOSPHERE WATCH (GCW)**

6.1 The purpose and long-term goal of the Global Cryosphere Watch shall be to provide data and other information on the global Cryosphere to improve understanding of its behaviour, interactions with other components of the climate system, and impacts on society.

6.2 The Global Cryosphere Watch shall be a coordinated system of observing stations, facilities and arrangements encompassing monitoring and related scientific assessment activities devoted to the Cryosphere.

6.3 The development of the Cryosphere Observing Network (CryoNet) shall build on existing Cryosphere observing programmes and promote the addition of standardized Cryospheric observations to existing facilities.

6.4 The Global Cryosphere Watch shall be developed and implemented in accordance with the provisions set out in Annex IX (Manual on the WIGOS (WMO-No. XXXX)).

**7.** **GLOBAL OBSERVING SYSTEM (GOS) OF WWW**

7.1 The purpose of the Global Observing System shall be to provide the meteorological and related environmental observations from all parts of the globe that are required by Members for operational and research purposes.

7.2 The Global Observing System shall be constituted as a coordinated system of methods, techniques and facilities for making observations on a world-wide scale and defined as one of the main components of the World Weather Watch.

7.3 The Global Observing System shall consist of the integration of two sub-systems: the surface-based sub-system and the space-based sub-system. The surface-based sub-system is composed of the regional basic synoptic networks and the Antarctic Observing Network of surface and upper-air stations, climatological stations, Global Climate Observing System stations, Aircraft meteorological stations, and other types of stations and special stations as detailed in Annex V (Manual on the Global Observing System (WMO-No.544), Volume I). The space-based sub-system is composed of four elements: (a) a space segment with (i) operational satellites on Geostationary Earth Orbit (GEO); (ii) operational satellites on distributed, sun-synchronous, Low Earth Orbits (LEO); (iii) other operational/sustained satellites or instruments on appropriate orbits; (iv) research and development (R&D) satellites; (b) a space-based intercalibration system; (c) associated ground segment for data reception, dissemination, and stewardship; and (d) a user segment.

7.4 The Global Observing System shall be established and operated in accordance with the provisions set out in Annex V (Manual on the Global Observing System (WMO-No.544), Volume I), Annex IX (Manual on the WIGOS (WMO-No. XXXX)) and in Annex I (International Cloud Atlas (WMO-No. 407), Volume I – Manual on the Observation of Clouds and Other Meteors).

8. **WMO HYDROLOGICAL OBSERVING SYSTEM (WHOS)**

8.1 The purpose of the WMO Hydrological Observing System shall be to provide the hydrological observing component in fulfilment of the WIGOS objective by facilitating access to already available on-line real-time and historical data, drawing from the water information systems of Members that make their data freely and openly available.

8.2 The WMO Hydrological Observing System shall be constituted as a coordinated system of methods, techniques and facilities for making hydrological observations on a world-wide scale.

8.3. The WMO Hydrological Observing System and the practice of obtaining hydrological observations shall be developed and implemented in accordance with the provisions set out in Annex IX (Manual on the WIGOS (WMO-No. XXXX)).

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