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| **World Meteorological Organization** | **Cg-17/Doc. 4.2.2(2)** | |
| **SEVENTEENTH CONGRESS** | Submitted by: | Secretary-General |
| Date: | 1.IX.2014 |
| Geneva, 25 May to 12 June 2015 | Original Language: | English |
| Status: | **DRAFT 1** |

# EXPECTED RESULT 4

## AGENDA ITEM 4: Advancing Scientific Research and Application, as well as Development and Implementation of Technology

## AGENDA ITEM 4.2: WMO Integrated Global Observing System (WIGOS) and WMO Information System (WIS) – Priority

**(Agenda 4.2.2) WMO INTEGRATED GLOBAL OBSERVING SYSTEM (WIGOS)**

**WMO Technical Regulations (WMO-No. 49), Volume I, Part I – WIGOS**

# SUMMARY

### DECISIONS/ACTIONS REQUIRED:

(a) Adopt the text in Appendix A;

(b) Adopt draft Resolution: 4.2.2(2)/1(Cg-17);

### CONTENT OF DOCUMENT:

The Table of Contents is available only electronically as a Document Map[[1]](#footnote-2)\*.

# **APPENDIX A:**

# **DRAFT TEXT FOR INCLUSION IN THE GENERAL SUMMARY**

**4 ADVANCING SCIENTIFIC RESEARCH AND APPLICATION, AS WELL AS DEVELOPMENT AND IMPLEMENTATION OF TECHNOLOGY**

## WMO Integrated Global Observing System (WIGOS) and WMO Information System (WIS) – Priority

## 4.2.2 WMO Integrated Global Observing System (WIGOS) (Agenda 4.2.2)

## … … …

**WMO Technical Regulations (WMO-No. 49), Volume I, Part I – WIGOS**

### 4.2.2(2).1 Congress noted that the Commission for Basic Systems (CBS-Ext.(2014)) recommended that the Volume I, Part I – WIGOS of the WMO *Technical Regulations* (WMO-No. 49) be adopted by the Cg-17.

4.2.2(2).2 Congress recognized the urgent need for accelerating the development of corresponding WIGOS guidelines and guidance material to facilitate the implementation of WIGOS technical regulations specified in the Volume I, Part I and *Manual on WIGOS* *[Doc. 4.2.2(3)]* by Members. In order to assist Members to implement WIGOS regulations, Congress requested the Secretary-General to develop and publish a set of guidelines incorporated in a single *Guide to WIGOS* to be provided to WMO Members by 1 July 2016.

4.2.2(2).3 Congress adopted Draft Resolution 4.2.2(2)/1 (Cg-17).

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**APPENDIX B:   
DRAFT RESOLUTION**

## Draft Resolution 4.2.2(2)/1 (Cg-17) –

## WMO TECHNICAL REGULATIONS (WMO-No. 49), VOLUME I, PART I – WIGOS

THE WORLD METEOROLOGICAL CONGRESS,

**Having considered** the *Abridged Final Report with Resolutions and Recommendations of the Extraordinary Session 2014 of the Commission for Basic Systems* (WMO-No. 1140),

**Noting:**

(1) Articles 2 (a), 2 (c) and 8 (d) of the Convention of the World Meteorological Organization,

(2) Resolution 45 (Cg-XVI) – Technical Regulations of the World Meteorological Organization,

(3) Resolution 50 (Cg-XVI) – Implementation of the WMO Integrated Global Observing System,

(4) Resolution 26 (EC-64) – Amendments to the Technical Regulations,

(5) Recommendation 2.4/1 (CBS-Ext.(2014)) – Revised Manual on the GOS,

(6) Recommendation 3.1(1)/1 (CBS-Ext.(2014)) – WIGOS Regulatory Material,

(7) Draft Resolution 4.2.2(1)/1 (Cg-17) – Preoperational Phase of WIGOS,

(8) Draft Resolution 4.2.2(3)/1 (Cg-17) – WMO Technical Regulations (WMO-No. 49) – Manual on WIGOS,

**Recalling:**

(1) That the Sixteenth World Meteorological Congress emphasized that the implementation of WIGOS must be reflected in the revised WMO *Technical Regulations* (WMO-No. 49), documenting the WIGOS concept of operations and contributions of all observing components,

(2) The decision of the Executive Council (EC-64) on revision of the WMO *Technical Regulations* (WMO-No. 49) in line with the up-to-date and emerging WMO systems and services,

(3) The decision of the Executive Council (EC-65) on the adjustment of the Structure of the Technical Regulations (Volume I, Part I) agreed by EC-64,

(4) That the Executive Council (EC-66) agreed that the Volume I, Part I - WIGOS of the WMO *Technical Regulations* could be approved and promulgated effectively by Cg-17,

**Considering** the draft Part I – WIGOS, Volume I of the WMO *Technical Regulations* (WMO-No. 49), recommended by the Commission for Basic Systems for adoption by the Congress,

**Noting** that the draft Part I – WIGOS was circulated to all WMO Members and comments submitted by WMO Members were incorporated accordingly in the document,

**Decides to** approve the Volume I, Part I – WIGOS, of the WMO *Technical Regulations* (WMO-No. 49) as provided in the Annex to this resolution, with effect from 1 July 2016;

**Affirms** the authority of the Executive Council to approve any amendments to the Volume I, Part I – WIGOS of the WMO *Technical Regulations* if required before the time of the next Congress;

**Decides** that the Commission for Basic Systems shall act as the lead technical commission for managing changes to the Volume I, Part I – WIGOS of the WMO *Technical Regulations*;

**Requests** the Secretary-General:

(1) To incorporate Part I - WIGOS in the WMO *Technical Regulations* (WMO-No. 49), Volume I, 2015 edition, and to publish the Volume I in all official WMO languages;

(2) To ensure the editorial consistency of the relevant documents;

(3) To ensure the revision of the regulatory documents in a systematic manner and ensure that the published versions of the regulatory documents are consistent and can be used within a nationally implemented Quality Management System;

(4) To bring this resolution to the attention of all concerned.

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Annex: 1

**Annex to draft Resolution 4.2.2(2)/1 (Cg-17)**

## WORLD METEOROLOGICAL ORGANIZATION

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

**Technical Regulations**

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

**(2015 edition)**

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

**(Version 0.9)**

**DRAFT**

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WMO-No. 49

**VERSION CONTROL**

|  |  |  |  |
| --- | --- | --- | --- |
| Version | Summary of change | By | Date |
| 0.1 | First full compilation of (mostly) completed and reviewed sections, for presentation to ICG-WIGOS-3 | Chair TT-WRM | 2014-02-06 |
| 0.2 | Comments & changes for consideration | I. Zahumensky, T. Goos, L. Nunes | 2014-03-13 |
| 0.3 | Review | Russell Stringer, I. Zahumensky, T. Goos, L. Nunes | 2014-04-03 |
| 0.4 | Final editorial | I. Zahumensky | 2014-04-09 |
| 0.5 | Feedback from all TCs, EC-PORS, TT-WQM, Secretariat | R. Stringer, T. Goos,  L.P. Riishojgaard, I. Zahumensky | 2014-08-07 |
| 0.6 | Minor editorial | I. Zahumensky | 2014-08-08 |
| 0.7 | Feedback from Secretariat, and editorial | R. Stringer, M. Ondras,  L.P. Riishojgaard, I. Zahumensky | 2014-08-27 |
| 0.8 | Feedback from CBS-Ext.(2014) | L.P. Riishojgaard | 2014-09-11 |
| 0.9 | Feedback by Members, and editorial | WIGOS-PO | 26-01-2015 |
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TECHNICAL REGULATIONS

GENERAL PROVISIONS

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

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**DEFINITIONS**

Note 1: Other definitions may be found in the *Manual on Codes* (WMO-No. 306), *Manual on the Global Data Processing and Forecasting System* (WMO-No. 485), Volume I, *Manual on the Global Telecommunication System* (WMO-No. 386), Volume I 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.

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

***Aircraft meteorological station.*** Meteorological station situated aboard an aircraft.

***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.
* 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.

***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.

***Compatibility.*** A state in which two things are able to exist and be used together without problems or conflict.

***Cryosphere.*** Component of the Earth System that includes solid precipitation, snow cover, sea ice, lake and river ice, glaciers, ice caps, ice sheets, permafrost, and seasonally frozen ground.

Note: While elements of the *cryosphere* are often defined to contain frozen water, permafrost can be “dry”. The Global Cryosphere Watch (GCW) definition includes elements of the cryosphere that occur on or beneath the earth's surface, or that are measured at the surface in the case of solid precipitation. It therefore excludes ice clouds.

***Global Cryosphere Watch (GCW) Observing Network.*** Comprised of GCW sites with varying capabilities built on existing observing programmes and promoting the addition of standardized cryospheric observations to existing facilities. It covers all components of the cryosphere: glaciers, ice shelves, ice sheets, snow, permafrost, sea ice, river/lake ice, and solid precipitation.

***CryoNet.*** The core of the GCW observing network that applies GCW agreed observing practices. It comprises sites in cold climate regions, on land or sea, operating a sustained, standardized programme for observing and monitoring as many cryospheric variables as possible. CryoNet is being structured in two different classes of observational sites: Basic Sites and Integrated Sites. CryoNet Sites contain one or more CryoNet Stations: Primary Stations and Baseline Stations.

***Discovery metadata*.** Metadata consistent with the standard that is used within WMO Information System (WIS) for discovery of information shared through WIS.

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

***Geostationary Earth Orbit (GEO).*** Satellites in geostationary Earth orbits are often referred to as GEOs.

***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.

***Global Climate Observing System (GCOS).*** A long-term, user-driven operational system capable of providing the comprehensive observations required for:

* Monitoring the climate system,
* Detecting and attributing climate change,
* Assessing impacts of, and supporting adaptation to, climate variability and change,
* Application to national economic development,
* Research to improve understanding, modeling and prediction of the climate system.

***Instrument.*** Device used for making measurements, alone or in conjunction with one or more supplementary devices.

***In situ observation.*** Observation made by a device that is in physical or direct contact with the object or phenomenon under study.

***Interoperability.*** The ability of diverse systems to work together (inter-operate).

***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.

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

***Meteorological observing network.*** A group of meteorological observing stations spread over a given area for a specific purpose.

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

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

***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.

***Observation.*** Evaluation of one or more elements of the physical environment.

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 data.*** The result of the evaluation of one or more elements of the physical environment.

***Observational Metadata.*** Descriptive data about observational data; information that is needed to assess and interpret observations or to support design and management of observing systems and networks.

***Observation 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 station/platform.*** A place where observations are made; it refers to all types of observing stations and platforms, whether they are surface-based, or space-based, on land, at sea/lake/river, or in the air, fixed, or mobile (including in the air), and making in-situ or remote observations.

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

***Observing (or Observation) system.*** A coordinated system of methods, techniques and facilities for making observations using one or more sensors, instruments or types of observation at one or more stations and platforms, acting together to provide a coordinated set of observations.

***Near-real time* *observation.*** An observation which is available to a user soon after the observation is completed.

Note: the time-lags considered to be “real-time”, “near-real-time” or "non-real-time" are different in different situations and depend on several factors. A near-real-time observation is essentially a real-time observation with an identifiable delay which reduces its value to some users.

***Non-real time observation.*** An observation which is not available to a user immediately or soon after the observation is completed, but at some later time. It informs the user of conditions that prevailed at an earlier time.

Note: the time-lags considered to be “real-time”, “near-real-time” or "non-real-time" are different in different situations and depend on several factors. Factors include the user application, the dissemination method, intervening quality control or other processing steps, the frequency and sampling time of the observation, and the variability of the physical element observed.

***Real time observation.*** An observation which is available to a user immediately after the observation is completed. It informs the user of the current conditions.

Note: the time-lags considered to be “real-time”, “near-real-time” or "non-real-time" are different in different situations and depend on several factors. A key factor is the requirement of the user application, such that an observation not available quickly enough for immediate operational use (within seconds, or minutes, or hours, or for some applications days) might not be regarded as real-time for that application. Some other factors are whether the dissemination method used is the most direct and rapid possible, whether quality control or other processing steps delay availability, whether the time lag is reasonably proportionate to the frequency of observation or the sampling time taken to collect the observation, and whether the time lag is reasonably proportionate to the variability of the physical element observed.

***Remote sensing.*** Observation made by a device that is not in physical or direct contact with the object or phenomenon under study.

***Satellite systems.*** A space system using one or more artificial satellites orbiting the Earth.

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

***WMO Observing station/platform.*** Any observing station/platform currently issued with a valid WMO identifier.

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

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

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1. INTRODUCTION TO WIGOS

**1.1 Purpose and Scope 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 in support of all WMO programmes and activities.

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

1.1.2 The WIGOS shall facilitate the use by WMO Members of observations from systems that are owned, managed and operated by a diverse array of organizations and programmes.

1.1.3 The principal purpose of WIGOS shall be to meet the evolving requirements of Members for observations.

Note: The assessments of requirements and plans to meet them are achieved through the application of the Rolling Review of Requirements (RRR) process according to the *Manual on WIGOS* (WMO-No. XXXX), section 2.2.

1.1.4 Within WIGOS, Members shall collaborate to advance the state of observing systems, their compatibility and the world-wide exchange of observations.

Note: Additional benefits will emerge as the concept is adopted by entities beyond WMO itself and its partner organizations.

1.1.5 Members should enhance collaboration and cooperation amongst meteorological, hydrological, marine, oceanographic and other related academic and research institutions and services at the national level, in order to meet the goals listed in 1.1.3.

1.1.6 The WIGOS framework shall focus on the integration of governance and management functions, mechanisms and activities to be accomplished by contributing observing systems on a global, regional and national level.

**1.2 WIGOS component observing systems**

1.2.1 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.

Note: The above component systems include all WMO contributions to the co-sponsored systems, as well as the WMO contributions to the Global Framework for Climate Services (GFCS) and Global Earth Observation System of Systems (GEOSS).

**1.2.1 Global Observing System of the World Weather Watch**

1.2.1.1 The Global Observing System (GOS) 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)**

1.2.2.1 The Global Atmosphere Watch (GAW) 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) shall comprise hydrological observations, initially focusing on water level and discharge, and shall include 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.

Note: The composition of WMO hydrological observations is provided in Volume III – Hydrology, Chapter D.1.2 of the *WMO Technical Regulations* (WMO-No. 49).

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

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 7) of Volume I, Part I.

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

1.2.4.1 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.

1.2.4.2 The GCW observing network and its standardized core network (CryoNet) shall build on existing observing programmes and promote the addition of standardized cryospheric observations to existing facilities.

Note 1: The GCW Implementation Plan available at:  <http://globalcryospherewatch.org/reference/documents/> provides more information.

Note 2: Existing Cryosphere observing programmes include cryospheric observational programs within WMO programmes (including the Joint WMO/IOC Technical Commission on Oceanography and Marine Meteorology (JCOMM)), the co-sponsored Programmes (GCOS, GTOS, GOOS) and including, but are not limited to, observational programmes of the International Permafrost Association (IPA), the World Glacier Monitoring Service (WGMS), a service of the International Association of Cryospheric Sciences (IACS), the Scientific Committee for Antarctic Research (SCAR), and the Global Precipitation Climatology Centre (GPCC), and the US National Snow and Ice Data Center (NSIDC).

**1.3 Collaboration with partners responsible for co-sponsored and non-WMO observing systems**

1.3.1 Members shall support the collaboration between the WMO and its international partners responsible for the co-sponsored and non-WMO observing systems.

1.3.2 Members shall implement similar cooperation and coordination arrangements among National Meteorological and Hydrological Services (NMHSs) and through national 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.

1.4.1 Members shall implement and manage their national observing systems in accordance with the provisions of the *Technical Regulations*, Volume I, Part I, and the *Manual on WIGOS* (WMO-No. XXXX).

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2. COMMON ATTRIBUTES OF WIGOS COMPONENT SYSTEMS

2.1. Requirements

2.1.1 Members shall establish, operate and maintain their national observing systems to address observational requirements in an integrated, coordinated and sustainable manner.

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

Note: Details on the Rolling Review of Requirements (RRR) process and the WMO application areas are given in the *Manual on WIGOS* (WMO-No. XXXX), section 2.2.

2.2. Design, Planning and Evolution

**2.2.1 General**

2.2.1.1 Members, both directly and 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 component observing systems when planning and managing their 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**

Note: Standard and recommended practices and procedures with respect to instruments and methods of observation across and within all WIGOS component observing systems are specified in the *Technical Regulations* (WMO-No. 49), Volume I – III, and detailed in the *Manual on WIGOS* (WMO-No. XXXX).

**2.4 Operations**

**2.4.1 General Requirements**

2.4.1.1 Members shall install, operate and maintain their WIGOS component observing systems in accordance with the *Technical Regulations* (WMO-No. 49, Volume I-IV), the *Manual on WIGOS* (WMO-No. XXXX).

2.4.1.3 Members shall ensure the continuity of operation and availability of observations generated by the observing systems under their responsibility.

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

Note: Safety practices and procedures are those that are concerned with assuring the welfare of staff while promoting overall efficiency and effectiveness of the NMHS and responding to national laws, regulations and requirements for occupational health and safety.

**2.4.2 Observations**

2.4.2.1 Members shall ensure overall availability of observations for all WMO Application Areas in accordance with these Technical Regulations and the *Manual on WIGOS* (WMO-No. XXXX).

Note 1: The WMO Application Areas are detailed in section 2.1 of the *Manual on WIGOS* (WMO-No. XXXX).

Note 2: Special focus is to be given to meet the requirements of numerical weather prediction since many application areas depend on it.

Note 3: Special focus is to be given to climate monitoring, including the observational requirements of the Global Framework for Climate Services, which is one of the priority areas for WMO.

2.4.2.2 Members should 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 and the *Manual on WIGOS* (WMO-No. XXXX).

Note: Technical specifications and details are given mainly in the *Guide to Meteorological Instruments and Methods of Observation* (WMO-No. 8), *Guide to Climatological Practices* (WMO-No. 100), *Guide to Hydrological Practices* (WMO-No. 168), Volume I: Hydrology – From Measurement to Hydrological Information, *Guide on the Global Data-Processing Systems* (WMO-No. 305), and *Guide to the Global Observing System* (WMO-No. 488).

**2.4.3 Performance**

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

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 section 2.6 of these Technical Regulations and the *Manual on 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 Climatological Practices* (WMO-No. 100), *Guide to Hydrological Practices* (WMO-No. 168), Volume I: Hydrology – From Measurement to Hydrological Information, and *Guide to the Global Observing System* (WMO-No. 488).

**2.4.4 Quality Control**

2.4.4.1 Members shall implement quality control for all observations for which they are responsible.

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

2.4.4.2 Members not capable of implementing quality control should establish agreements with an appropriate national, regional or global organization or centre to perform the necessary quality control.

**2.4.5 Calibration**

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

2.5. Observational Metadata

2.5.1 Members shall record, retain and make available internationally the observational metadata as specified in the *Manual on WIGOS* (WMO-No. XXXX), section 2.5.

2.6. Quality Management

2.6.1 Members shall comply with the standard and recommended practices and procedures with regard to the quality of WIGOS observations and observational metadata, as detailed in these Technical Regulations and in the *Manual on WIGOS* (WMO-No. XXXX).

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

2.7. Capacity Development

2.7.1 General

2.7.1.1 Members should undertake efforts in capacity development to ensure that their observing systems comply with the standard and recommended practices and procedures specified by the WMO *Technical Regulations* (WMO-No. 49).

Note: Guidance on approaches for capacity development is found in the *WMO Capacity Development Strategy* (WMO-No. 1092) and its *Implementation Plan* (WMO-No. 1118). Such guidance includes consideration of various types of capacity: institutional, infrastructural, procedural and human resources.

**2.7.2 Training**

2.7.2.1 Members shall ensure that their personnel involved in WIGOS related activities 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 defined in Part V and Part VI of these Technical Regulations, and the *Manual on the Implementation of Education and Training Standards in Meteorology and Hydrology* (WMO-No. 1083), Volume I.

**2.7.3 Infrastructural Capacity Development**

2.7.3.1 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 section 2.2 above.

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3. 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 sub-system shall be composed of stations and platforms within the component networks (i.e. GOS, GAW, GCW, and WHOS) as described in the *Manual on WIGOS* (WMO-No. XXXX).

3.1.1.2 Members should establish and operate their surface-based sub-system as a single composite system of observing stations and 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, in accordance with section 2.1 of the *Manual on WIGOS* (WMO-No. XXXX).

**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* (WMO-No. XXXX).

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 implementation of observing networks or systems.

3.2.1.3 Members should adopt a composite network approach to their networks and include observations from a range of sources, including NMHSs and other government agencies, academic and research institutes, the commercial sector and the public.

Note 1: 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.

Note 2: In all cases users are to judge the suitability of observations for their intended application, through assessment of available metadata, which includes the identification of the source. Section 2.5 of the *Manual on WIGOS* (WMO-No. XXXX) describes the required metadata.

**3.3. Instrumentation and Methods of Observation**

**3.3.1 General**

Note: Standard and recommended practices and procedures with respect to instruments and methods of observation for all WIGOS surface-based sub-systems are specified in the *Technical Regulations* (WMO-No. 49), Volume I - III, and detailed in the *Manual on WIGOS* (WMO-No. XXXX).

**3.4. Operations**

**3.4.1 General**

3.4.1.1 Members should ensure that operators of observing systems comply with the *WMO Technical Regulations* (WMO-No. 49, Volume I-IV) and the *Manual on WIGOS* (WMO-No. XXXX).

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

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**4.** **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, i.e. data obtained from satellite systems, are a fundamental asset for meteorology, climatology and hydrology, both for operational and research applications.

**4.1.2 Observational requirements**

4.1.2.1 Satellite operators shall establish, operate, maintain and ensure the continuation of satellite systems, providing observational information as specified in the *Manual on WIGOS* (WMO-No. XXXX).

Note 1: The term “satellite operators” is used in Vol. I. Part I to refer to “Members or a coordinated group of Members operating environmental satellites”.

Note 2: A coordinated group of Members operating environmental satellites is a group of Members acting jointly to operate one or more satellites through an international space agency such as the European Space Agency or EUMETSAT.

4.1.2.2 To ensure global coverage, contingency support and to meet further requirements as stated in the *Manual on WIGOS* (WMO-No. XXXX), satellite operators shall cooperate and arrange an optimal constellation of satellite systems, including but not restricted to near-polar-orbiting and geostationary platforms.

Note: These requirements are compiled through the Rolling Review of Requirements (RRR) process (see *the Manual on WIGOS* (WMO-No. XXXX), section 2.2.), and are expressed in terms of coverage, continuity, resolution, uncertainty, frequency and observational variables.

4.1.2.4 Satellite operators shall process observational data up to a level as required by the *Manual on WIGOS* (WMO-No. XXXX) and shall do so in a timely manner for dissemination in near real-time.

4.1.2.5 Satellite operators shall report data as observed variables, defined in the *Manual on WIGOS* (WMO-No. XXXX) and expressed by environmental quantities in International Standards (SI) units.

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**5.** **ATTRIBUTES SPECIFIC TO THE**

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**6. ATTRIBUTES SPECIFIC TO THE OBSERVING COMPONENT OF THE GLOBAL ATMOSPHERE WATCH**

6.1 The purpose of the Global Atmosphere Watch (GAW) 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.

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

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

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, using observation modes such as in situ, vertical distribution and total column.

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

6.4. Members shall register their contribution in the GAW Station Information System (GAWSIS), and submit their observations to the relevant GAW Data Centre.

Note: GAW Data Centres are listed at: <http://ww.wmo.int/gaw> and <http://gaw.empa.ch/gawsis> .

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**7.** **ATTRIBUTES SPECIFIC TO THE WMO HYDROLOGICAL OBSERVING SYSTEM**

7.1 The purpose of the WMO Hydrological Observing System (WHOS) shall be to provide the hydrological observing component in fulfilment of the WIGOS objective by facilitating on-line access to already available real-time and historical data, drawing from the water information systems of Members that make their data available on a free and unrestricted basis.

7.2 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.

7.3. 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 the *Manual on WIGOS* (WMO-No. XXXX).

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**8****ATTRIBUTES SPECIFIC TO THE**

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**APPENDIX C:**

**PROGRESS REPORT FOR INFORMATION –**

**NOT TO BE INCLUDED IN THE GENERAL SUMMARY**

**WMO Technical Regulations (WMO-No. 49), Volume I, PART I – WIGOS**

### References:

* + - 1. [Sixteenth World meteorological Congress (2011) (WMO-No. 1077)](http://library.wmo.int/opac/index.php?lvl=notice_display&id=6907)
      2. [Executive Council - Sixty-fourth session (2012) (WMO-No. 1092)](http://library.wmo.int/opac/index.php?lvl=notice_display&id=12753)
      3. [Executive Council - Sixty-fifth session (2013) (WMO-No. 1118)](http://library.wmo.int/opac/index.php?lvl=notice_display&id=15859)
      4. [Executive Council - Sixty-sixth session (2014) (WMO-No. 1136)](http://library.wmo.int/opac/index.php?lvl=notice_display&id=16315)
      5. [Final Report from the Second Session of the Inter-Commission Coordination Group on WIGOS (ICG-WIGOS), Geneva, 18-22 March 2013](http://www.wmo.int/pages/prog/www/WIGOS-WIS/reports.html)
      6. [Final Report from the Third Session of the Inter-Commission Coordination Group on WIGOS (ICG-WIGOS), Geneva, 10-14 February 2014](http://www.wmo.int/pages/prog/www/WIGOS-WIS/reports.html)
      7. [Final Report from the Fourth Session of the Inter-Commission Coordination Group on WIGOS (ICG-WIGOS), Geneva, 17-20 February 2015](http://www.wmo.int/pages/prog/www/WIGOS-WIS/reports.html)
      8. [Final Reports from the sessions of ICG-WIGOS TT-WRM and TT-WMD](http://www.wmo.int/pages/prog/www/WIGOS-WIS/reports.html)
      9. [WIGOS Framework Implementation Plan (WIP), version 3.0, adopted by EC-66](http://www.wmo.int/pages/prog/www/wigos/documents.html)
      10. [Abridged Final Report with Resolutions and Recommendations of the Extraordinary Session 2014 of the Commission for Basic Systems (WMO-No. 1140)](http://cbs-ext2014.wmo.int/documents-english)
      11. Cg-17/Doc. 4.2.2(1)
      12. Cg-17/Doc. 4.2.2(3)
      13. Cg-17/Doc. 13.4(1)

Background

Following the decision of the Sixteenth World Meteorological Congress (2011) to proceed with the implementation of the WMO Integrated Global Observing System (WIGOS), the drafts of the WMO *Technical Regulations* (WMO-No. 49), Volume I, Part I - WIGOS, and the *Manual on WIGOS* (a future Annex to the Volume I) were developed by the Inter-Commission Coordination Group on WIGOS (ICG-WIGOS) through its Task Team on WIGOS Regulatory Material.

EC-64 (2012) recognized the need to revise the WMO *Technical Regulations* (WMO-No. 49), Volume I; it considered the outline of its new structure as provided in Annex VIII to the Abridged Final Report, and decided on a process for its revision in line with the up-to-date and emerging WMO systems and services.

EC-65 (2013) agreed that the proposed eight chapter headings of the Technical Regulations (WMO-No. 49), Volume I, Part I – WIGOS and the Manual on WIGOS provide a consistent structure between these two documents with additional details provided in the latter. Accordingly, the Council decided that the Structure of the Technical Regulations agreed by EC-64, Annex VIII, be adjusted as described in Annex V to the Abridged Final Report. The Council agreed that compliance with the WIGOS technical regulations, in particular the mandatory elements, would be necessary to achieve its effective implementation.

EC-66 (2014) supported the position taken by the meeting of the Presidents of WMO technical commissions (PTCs) that a formal endorsement of the draft WIGOS Regulatory Material by a regular session of each technical commission would not be mandatory. However, it was deemed important to ensure support and input from all technical commissions involved. In this regard, the Council endorsed the timelines agreed upon by PTCs for the review process of WIGOS Regulatory Material leading up to submission of the draft WIGOS Regulatory Material to Cg-17. It noted that the process ensured sufficient consultation with TCs and ICG-WIGOS.

The draft documents were reviewed by all WMO technical commissions, including CBS, in the period from early April through early July 2014, and feedback was provided to the WMO Secretariat. The feedback had been incorporated in the subsequent revised draft versions, which were submitted to the extraordinary session the Commission for the Basic Systems (CBS-Ext.(2014)).

CBS-Ext.(2014) was highly appreciative of the development of the WIGOS regulatory material and recommendedthat Volume I, Part I – WIGOS, of the WMO *Technical Regulations* (WMO-No. 49), and *Manual on WIGOS* as provided in Annex 1 and Annex 2, respectively, to the Recommendation 3.1(1)/1 (CBS-Ext.(2014)) – WIGOS Regulatory Material, be adopted by Cg-17, with effect from 1 January 2016.

The drafts endorsed by CBS-Ext.(2014) were available for a review by WMO Members during a period extending over three months from 30 September until 31 December 2014. They were accessible at the WMO web page: <http://www.wmo.int/pages/prog/www/wigos/WRM.html>. This review process was established in accordance with the General Provisions of the WMO *Technical Regulations* (WMO-No. 49), that any amendments to the Technical Regulations submitted by Members or by constituent bodies should be communicated to all Members at least three months before they are submitted to Congress.

The comments provided by Members during this review period were considered by the Secretariat in January-February 2015 for the draft WMO *Technical Regulations (WMO-No. 49)*, Volume I, Part I - WIGOS submitted to Cg-17.

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1. \* In MS Word 2007 or 2003, go to “View” > “Document Map”. In MS Word 2010, go to “View” > “Navigation Pane”.   
   In MS Word on a Mac, go to “View” > “Navigation Pane”, select “Document Map” in the drop-down list on the left. [↑](#footnote-ref-2)