

Manual on the WMO Information System

2012 edition



**World
Meteorological
Organization**

WMO-No. 1060

Weather • Climate • Water

Manual on the WMO Information System

(Annex VII to WMO Technical Regulations)

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EDITORIAL NOTE

The following typographical practice has been followed: Standard practices and procedures have been printed in semi-bold roman. Recommended practices and procedures have been printed in light face roman. Notes have been printed in smaller type, light face roman, and preceded by the indication Note.

METEOTERM, the WMO terminology database, may be consulted at: http://www.wmo.int/pages/prog/lsp/meteoterm_wmo_en.html. Acronyms may also be found at: http://www.wmo.int/pages/themes/acronyms/index_en.html.

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INTRODUCTION

PURPOSE AND SCOPE

1. The *Manual on the WMO Information System* (WMO-No. 1060) is designed to ensure adequate uniformity and standardization of data, information and communications practices, procedures and specifications employed among World Meteorological Organization (WMO) Members in the operation of the WMO Information System (WIS) as it supports the mission of WMO. The Manual sets out standard practices, procedures and specifications (distinguished by the term **shall**) having the status of requirements in a technical resolution, which WMO Members are required to follow or implement in accordance with Article 9 of the Convention. The Manual also sets out recommended practices, procedures and specifications (distinguished by the term **should**), with which Members are urged to comply.

2. The Manual is Annex VII to the *Technical Regulations* (WMO-No. 49), (General meteorological standards and recommended practices), in which it is stated that WIS is established and shall be operated in accordance with the practices, procedures and specifications in the Manual.

3. The WMO Information System cuts across all WMO-related discipline areas. It intersects many WMO practices, procedures and specifications that are primarily defined in publications dedicated specifically to them, for example, the *Manual on the Global Data-processing and Forecasting System* (WMO-No. 485) and the *Manual on the Global Observing System* (WMO-No. 544), among others. Other documents that are relevant to the WMO Information System are found in Appendix A

PART I

ORGANIZATION AND RESPONSIBILITIES

1.1 ORGANIZATION OF THE WMO INFORMATION SYSTEM

1.1.1 In keeping with the *Technical Regulations* (WMO-No. 49), Volume I, A.3, Centres operated by WMO Members and their collaborating organizations shall be categorized as one of the three types of WIS Centres forming the core infrastructure of WIS:

- (a) Global Information System Centres (GISCs);
- (b) Data Collection or Production Centres (DCPCs);
- (c) National Centres (NCs).

The distinct functions of the three types of Centres (GISC, DCPC, NC) are referred to in Part III, Functions of the WMO Information System.

1.1.2 Each Permanent Representative with WMO shall be responsible for authorizing users of WIS. The right to manage the authorization process may be delegated.

1.2 COMPLIANCE WITH REQUIRED WMO INFORMATION SYSTEM FUNCTIONS

WMO Information System Centres shall comply with required WIS functions. This Manual contains instruction on practices, procedures and specifications for WIS functions. It is supplemented by additional information concerning practices, procedures and specifications for WIS functions that are set out in the *Guide to the WMO Information System* (WMO-No. 1061).

1.3 INTERACTION AMONG WMO INFORMATION SYSTEM CENTRES

Global Information System Centres shall connect to other GISCs through the WIS Core Network, which is based on the Main Telecommunication Network (MTN). Data, products and metadata shall flow to a GISC from the DCPCs and NCs that are within its area of responsibility. An Area Meteorological Data Communication Network (AMDCN) shall connect each GISC to DCPCs and

NCs in the GISC area of responsibility. An AMDCN may span multiple Regional Meteorological Telecommunication Networks (RMTNs) and parts thereof.

1.4 IMPLEMENTATION OF THE WMO INFORMATION SYSTEM

The WMO Information System shall be implemented in two parallel parts. One part involves the continued evolution of the WMO Global Telecommunication System (GTS), which focuses on further improving the delivery of time-critical and mission-critical data, products and services, including warnings. The other part extends WMO services through Discovery, Access and Retrieval (DAR) facilities, as well as through flexible timely delivery.

1.5 DISCOVERY, ACCESS AND RETRIEVAL FUNCTION

As required per the *Technical Regulations* (WMO-No. 49), Volume I, A.3, WIS shall be based on catalogues that contain metadata describing data and products available across WMO, plus metadata describing dissemination and access options. The DAR function of WIS shall be the primary means of realizing the WIS comprehensive catalogue, which is maintained collaboratively by all WIS Centres.

1.6 ROBUSTNESS AND RELIABILITY OF COMPONENTS

Highly robust and reliable WIS components are essential to the operation of WIS. Performance indicators shall be evaluated in the designation procedure for WIS Centres. This evaluation shall ascertain, among other things, whether or not data content flowing via WIS network technologies fully satisfies requirements for security, authenticity and reliability. Some aspects of service levels are identified within this Manual.

1.7 **COLLECTION AND DISSEMINATION SERVICES**

1.7.1 The WMO Information System shall provide three types of collection and dissemination services:

- (a) **Routine collection and dissemination service for time-critical and operation-critical data and products:** This service is based on real-time “push” mechanisms, including multicast and broadcast; it is implemented through dedicated telecommunication means providing a guaranteed quality of service;
- (b) **Discovery, Access and Retrieval service:** This service is based on a request/reply “pull” mechanism with relevant data management functions; it is implemented through the Internet;
- (c) **Timely delivery service for data and products:** This service is based on a delayed mode “push” mechanism; it is implemented through a combination of dedicated telecommunication means and public data telecommunication networks, especially the Internet.

1.7.2 The WMO Information System shall support the WMO virtual all-hazards network, thus ensuring the fast, secure and reliable exchange of alert and warning information, including International Telecommunication Union (ITU) Recommendation X.1303 (Common Alerting Protocol).

Note: The virtual all-hazards network encompasses all of the technical and operational arrangements necessary for the timely handling and delivery of alert and warning information involving WMO.

1.7.3 The goal of the WMO Integrated Global Data Dissemination Service (IGDDS) is to ensure the definition and operational implementation of efficient circulation of space-based observation data and products meeting the needs of WMO programmes in the context of WIS. The Integrated Global Data Dissemination Service shall remain an important component of WIS, mainly for the exchange and dissemination of data and products generated by space-based observing systems.

PART II

DESIGNATION PROCEDURES FOR WMO INFORMATION SYSTEM CENTRES

2.1 GENERAL

2.1.1 The establishment and operation of WIS depend on WMO Member organizations and those more broadly related to it, such as IOC and ICSU, taking on the functional roles of GISCs, DCPCs and NCs. Procedures for designating a WIS Centre rely on the agreed WIS Functional Architecture and the WIS Compliance Specifications.

2.1.2 As required per the *Technical Regulations* (WMO-No. 49), Volume I, A.3, Congress and the Executive Council shall consider the designation of GISCs and DCPCs based on recommendations of the Commission for Basic Systems (CBS). The development of CBS recommendations includes consultation and coordination with the relevant technical commissions that are responsible for the WMO and related international programmes concerned, as well as with the regional associations, as appropriate.

Note: The relevant groups established by the Executive Council have a role in the GISC and DCPC designation process, in accordance with their mandate.

2.2 PROCEDURE FOR DESIGNATING A GLOBAL INFORMATION SYSTEM CENTRE

2.2.1 Overview

The procedure for the designation of a GISC shall consist of four steps:

- (1) Statement of WIS requirements;
- (2) Service offer by a Member for a potential GISC;
- (3) Demonstration of GISC capabilities;
- (4) Designation of a GISC.

2.2.2 Statement of WMO Information System requirements

The WMO Technical Commissions and other bodies representing the participating programmes, including regional bodies, shall state their requirements for WIS services and review them periodically. The list of all relevant

requirements shall be compiled and regularly reviewed by CBS, and reported to the Executive Council.

2.2.3 Service offer by a Member for a potential Global Information System Centre

2.2.3.1 A WMO Member can apply for a centre to be designated as one of the GISCs forming the core infrastructure of WIS. The service offer by the Member shall include:

- (a) A statement of compliance with the required WIS functions;
- (b) A proposal regarding the area of responsibility for WIS services;
- (c) A formal commitment by the Permanent Representative of the Member that such services shall be provided on a routine basis and sustained over time.

2.2.3.2 The service offer shall be addressed to WMO. The Commission for Basic Systems, in consultation with the regional association(s) concerned, shall analyse the proposed service offer with regard to WIS requirements and compliance with GISC functions and specifications, and shall formulate a recommendation.

2.2.4 Demonstration of Global Information System Centre capabilities

2.2.4.1 The Member offering a GISC shall demonstrate to CBS the capabilities of the proposed centre to provide WIS services of the requisite reliability and quality to accredited users. Compliance shall be demonstrated for:

- (a) Real-time functions of data and product collection and dissemination;
- (b) Non-real-time services for requests;
- (c) Storage functions for the required set of data and products, and relevant up-to-date meta-data catalogues;
- (d) Coordination functions with other GISCs and the planning of mutual back-up services;
- (e) Adherence to WIS standards and relevant data exchange policies and access rights.

2.2.4.2 A formal commitment to implement the GISC and a time schedule for providing

GISC services in accordance with the offer shall be given by the Permanent Representative of the Member proposing to operate the candidate GISC.

2.2.4.3 Upon the demonstration of the capabilities of the candidate GISC, CBS shall submit its recommendation on the GISC designation to Congress or the Executive Council.

2.2.5 **Designated Global Information System Centres**

The list of GISCs as approved by Congress or the Executive Council is included in Appendix B of this Manual.

2.3 **PROCEDURE FOR DESIGNATING A DATA COLLECTION OR PRODUCTION CENTRE**

2.3.1 **Overview**

The World Meteorological Organization has determined that all WMO and related international programmes shall be served by WIS; therefore, each established Centre shall implement required WIS functions. The Commission for Basic Systems shall recommend how these Centres are categorized as DCPCs within WIS.

2.3.2 **Procedure**

The procedure for designating a DCPC shall consist of three steps:

- (1) Service offer by a potential DCPC;
- (2) Demonstration of DCPC capabilities;
- (3) Designation of a DCPC.

2.3.3 **Service Offer by a potential Data Collection or Production Centre**

2.3.3.1 Required DCPC functions should be fulfilled by a Centre that has been established under a WMO or related international programme, and/or a regional association. Accordingly, the relevant technical commission and/or regional association shall consider the service offers made by Members for potential DCPCs and shall endorse candidate DCPCs.

2.3.3.2 The service offer of candidate DCPCs shall then be submitted to CBS, which shall analyse the compliance of the candidate with

the required DCPC functions and specifications, and formulate a recommendation.

2.3.4 **Demonstration of Data Collection or Production Centre capabilities**

2.3.4.1 The Member offering a DCPC shall be invited to demonstrate to CBS the ability of the proposed Centre to provide WIS services in compliance with the DCPC functions and responsibilities, including proper synchronisation and communications with its associated GISC. Compliance shall be demonstrated, where applicable, with respect to real-time functions of data and product dissemination, non-real-time services for requests, provision of relevant up-to-date metadata catalogues, coordination and synchronization functions with the associated GISC, adherence to WIS standards, and relevant data exchange policies and access rights.

2.3.4.2 After the candidate DCPC has successfully demonstrated its capabilities, CBS shall recommend to Congress or the Executive Council that the candidate be approved.

2.3.5 **Designated Data Collection or Production Centres**

The list of DCPCs as approved by Congress or the Executive Council is included in Appendix B of this Manual. Each DCPC entry includes the name of the associated GISC.

2.4 **PROCEDURE FOR DESIGNATING A NATIONAL CENTRE**

2.4.1 **Background**

As required per the *Technical Regulations* (WMO-No. 49), Volume I, A.3, each NC shall use WIS to provide data and products that are consistent with its programme responsibilities. These data and products shall be provided with associated metadata in accordance with WIS practices, procedures and specifications. Each NC shall participate as appropriate in the relevant monitoring of the performance of WIS.

2.4.2 **Procedure**

Each WMO Member shall notify WMO of the current name and location of each of its centres

that is to be designated as an NC. The Commission for Basic Systems, with the involvement of relevant Regional Associations and with the assistance of the WMO Secretariat, shall review the Member designations to ensure support of each NC by a GISC, DCPC or other NC.

2.4.3 **Designated National Centres**

The NCs designated by Members shall be included in the list of WIS Centres in Appendix B of this Manual. Each NC entry shall include the name of the associated GISC.

PART III

FUNCTIONS OF THE WMO INFORMATION SYSTEM

3.1 ROLES IN AND REVIEW OF THE WMO INFORMATION SYSTEM FUNCTIONS

An ongoing process for understanding user requirements, including quality of service, shall determine the functional scope and physical size of WIS, thereby ensuring the continued responsiveness of WIS to the current and future needs of the supported programmes. All supported programmes and technical commissions shall participate in this process, which shall be part of general WMO requirement reviews.

3.2 LIST OF WMO INFORMATION SYSTEM FUNCTIONS

3.2.1 The WMO Information System Centres collectively support the major WIS functions listed here:

- (a) Collect observations, generate products, create metadata and archive information;
- (b) Assign user role;
- (c) Maintain and expose a catalogue of services and information;
- (d) Authorise access to information by users;
- (e) Deliver information to users (internal and external);
- (f) Manage system performance.

Note: The WMO Information System is concerned with data management and telecommunications aspects, but the actual content of data and products falls outside of the WIS scope and is a matter for the specific programme supported.

3.2.2 The required standard interfaces to these functions are described in the WIS Technical Specifications (Part IV in this Manual).

3.3 FUNCTIONAL ARCHITECTURE OF THE WMO INFORMATION SYSTEM

Note: The *Guide to the WMO Information System* (WMO-No. 1061), 4.3, references the functional architecture of WIS, provided as supplementary guidance for WIS Centres in a technical document.

3.4 DATA FLOW AMONG WMO INFORMATION SYSTEM FUNCTIONS

Note: The *Guide to the WMO Information System* (WMO-No. 1061), 4.4, provides as supplementary guidance for WIS Centres a data flow model of the WIS functional architecture for the required WIS functions, illustrating a possible implementation of major WIS functions.

3.5 FUNCTIONAL REQUIREMENTS OF A GLOBAL INFORMATION SYSTEM CENTRE

3.5.1 General

Note: The phrase “information intended for global exchange” encompasses time-critical and operation-critical information (data and products). Such information includes “essential data” and part of the “additional data”, as specified in WMO Resolution 25 (Cg-XIII) and Resolution 40 (Cg-XII).

3.5.2 Receive information from the Global Information System Centre area

3.5.2.1 Each GISC shall receive information intended for global exchange from NCs and DCPCs within its area of responsibility. This requirement also intersects the WIS DAR requirement that is noted below.

3.5.2.2 See also 4.2, WIS-TechSpec-1 (Uploading of metadata for data and products), and 4.3, WIS-TechSpec-2 (Uploading of data and products).

3.5.3 Exchange information with other Global Information System Centres

3.5.3.1 Each GISC shall collect from its area information that is intended for global exchange and shall share such information with other GISCs so that all GISCs have common information.

3.5.3.2 GISCs should employ the MTN and associated collaborative mechanisms to exchange

the information efficiently and without detriment to the performance of any GISC.

3.5.3.3 See also 4.4, WIS-TechSpec-3 (Centralization of globally distributed data).

3.5.4 **Disseminate information to the Global Information System Centre area**

3.5.4.1 Each GISC shall disseminate information to NCs and DCPCs within its area of responsibility, including but not limited to the information intended for global exchange.

3.5.4.2 See also 4.11, WIS-TechSpec-10 (Downloading files via dedicated networks), 4.12, WIS-TechSpec-11 (Downloading files via non-dedicated networks), and 4.13, WIS-TechSpec-12 (Downloading files via other methods).

3.5.5 **Maintain a 24-hour cache**

3.5.5.1 Each GISC shall hold the information intended for global exchange for at least 24 hours and make the information available via WMO request/reply ("Pull") mechanisms. This requirement intersects the WIS DAR requirement (see 3.5.6).

3.5.5.2 See also 4.4, WIS-TechSpec-3 (Centralization of Globally Distributed Data), 4.5, WIS-TechSpec-4 (Maintenance of user identification and role information), and 4.6, WIS-TechSpec-5 (Consolidated view of distributed identification and role information).

3.5.6 **Discovery, Access and Retrieval**

3.5.6.1 In support of the DAR function, each GISC shall maintain and provide access to a comprehensive catalogue of information across all WMO programmes encompassed by WIS. This includes, but is not limited to, information intended for global exchange. In order to satisfy the DAR functional requirement, GISCs are required to support, in interactive and batch modes, upload, change and deletion of metadata, user discovery of metadata, user access to metadata, and synchronization of the WIS comprehensive metadata catalogue with other GISCs.

3.5.6.2 See also 4.9, WIS-TechSpec-8 (DAR catalogue search and retrieval), and 4.10, WIS-TechSpec-9 (Consolidated view of distributed DAR metadata catalogues).

3.5.7 **Data network connectivity of a Global Information System Centre**

Each GISC shall provide around-the-clock connectivity to the public and dedicated communication networks at a capacity that is sufficient to meet its global and regional responsibilities. Each GISC should ensure that every telecommunication facility it employs in support of WIS has the appropriate level of availability and capacity, including, as necessary, routing and backup arrangements. Each GISC should maintain service level agreements with the suppliers of its communication links and associated hardware.

3.5.8 **Coordinate telecommunications in a Global Information System Centre area**

Each GISC shall coordinate with the Centres in its area of responsibility to maintain a WIS telecommunications infrastructure that can meet the WIS requirements for information exchange within the area. In the case of particular global and/or regional agreements, a GISC could also support the exchange of agreed WIS time-critical and operation-critical information with other areas. The telecommunications infrastructure shall be implemented through various technologies and services (for example, the Internet, satellite-based data distribution, dedicated data networks) in accordance with capacity and reliability requirements.

3.5.9 **Recovery arrangements of a Global Information System Centre**

Each GISC shall implement and operate proper procedures and arrangements to provide swift recovery or backup of its essential services in the event of an outage. Each GISC shall maintain arrangements for its essential services to be taken up by another GISC in case of an incapacitating system failure. Each GISC should maintain arrangements for system back up in case of total site failure (for example, an offsite Disaster Recovery Centre) and for partial back up in situations otherwise affecting WIS functions within the GISC.

3.5.10 **Performance monitoring of a Global Information System Centre**

3.5.10.1 Each GISC shall participate in monitoring the performance of WIS, including monitoring the collection and distribution of data and products intended for global exchanges.

Each GISC shall report routinely to other GISCs, as well as to the WMO Secretariat, information concerning the status and performance of connectivity to WIS Centres in its area, including capacity and technology used (for example, the Internet, satellite-based data distribution and dedicated data networks). The Commission for Basic Systems shall review and report on the status and performance of GISCs with the assistance of the WMO Secretariat.

3.5.10.2 Monitoring of the collection and dissemination of WIS information (data and products) should include, as appropriate, Integrated World Weather Watch Monitoring and other programme-related monitoring.

3.5.10.3 See also 4.16, WIS-TechSpec-15 (Reporting of quality of service).

3.6 **FUNCTIONAL REQUIREMENTS OF A DATA COLLECTION OR PRODUCTION CENTRE**

3.6.1 **General**

Note: The term “information” is used in a general sense and includes data and products.

The specific performance and functional requirements of a particular DCPC shall be determined by the programme it supports. Data Collection or Production Centres that support programmes with mission-critical responsibilities, and especially programmes with safety-of-life missions, shall maintain a high level of operational reliability, including required telecommunications. Each DCPC shall provide metadata describing the information it makes available through the WIS comprehensive catalogue, shall provide access to that information and shall participate in monitoring the overall performance of WIS.

3.6.2 **Collect information from a Data Collection or Production Centre area**

3.6.2.1 As appropriate to its programme role, a DCPC shall collect information intended for dissemination to NCs within its area of responsibility (that is, regional collections).

3.6.2.2 See also 4.2, WIS-TechSpec-1 (Uploading of metadata for data and products), and 4.3, WIS-TechSpec-2 (Uploading of data and products).

3.6.3 **Collect programme-related information**

3.6.3.1 As appropriate to its programme role, a DCPC shall collect the specific programme-related data and products.

3.6.3.2 See also 4.2, WIS-TechSpec-1 (Uploading of metadata for data and products), and 4.3, WIS-TechSpec-2 (Uploading of data and products).

3.6.4 **Production support of programme-related information**

3.6.4.1 As appropriate to its programme role, a DCPC shall provide data management and data communications that are adequate to support the production of regional or specialized data and products.

3.6.4.2 See also 4.2, WIS-TechSpec-1 (Uploading of metadata for data and products), and 4.3, WIS-TechSpec-2 (Uploading of data and products).

3.6.5 **Provide information intended for global exchange**

3.6.5.1 As appropriate to its programme role, each DCPC shall provide information intended for global exchange to its responsible GISC.

3.6.5.2 See also 4.2, WIS-TechSpec-1 (Uploading of metadata for data and products), and 4.3, WIS-TechSpec-2 (Uploading of data and products).

3.6.6 **Disseminate information**

3.6.6.1 As appropriate to its programme role, each DCPC shall disseminate information other than that intended for global exchange.

3.6.6.2 See also 4.11, WIS-TechSpec-10 (Downloading files via dedicated networks), 4.12, WIS-TechSpec-11 (Downloading files via non-dedicated networks), and 4.13, WIS-TechSpec-12 (Downloading files via other methods).

3.6.7 **Provide access to information**

3.6.7.1 Each DCPC shall support access to its products via WMO request/reply ("Pull") mechanisms in an appropriate manner.

3.6.7.2 See also 4.5, WIS-TechSpec-4 (Maintenance of user identification and role information), 4.7, WIS-TechSpec-6 (Authentication of a user), 4.8, WIS-TechSpec-7 (Authorization of a user role).

3.6.8 **Describe information with metadata**

3.6.8.1 Each DCPC shall describe its data and products according to an agreed WMO metadata standard, provide access to this catalogue of data and products, and provide these metadata as appropriate to other Centres, in particular a GISC.

3.6.8.2 See also 4.9, WIS-TechSpec-8 (DAR Catalogue Search and Retrieval) and 4.10, WIS-TechSpec-9 (Consolidated view of distributed DAR metadata catalogues).

3.6.9 **Recovery arrangements of a Data Collection or Production Centre**

As appropriate to its programme role, each DCPC shall implement and operate proper procedures and arrangements to provide swift recovery or backup of its essential services in the event of an outage.

3.6.10 **Performance monitoring of a Data Collection or Production Centre**

3.6.10.1 Each DCPC shall participate in monitoring the performance of WIS.

3.6.10.2 See also 4.16, WIS-TechSpec-15 (Reporting of quality of service).

3.7 **FUNCTIONAL REQUIREMENTS OF A NATIONAL CENTRE**

3.7.1 **Provide data, products and metadata**

3.7.1.1 As required per the *Technical Regulations* (WMO-No. 49), Volume I, A.3, each NC shall use WIS to provide data and products, in line with its programme responsibilities.

Such data and products shall be provided together with associated metadata, in accordance with WIS practices, procedures and specifications.

3.7.1.2 See also 4.2, WIS-TechSpec-1 (Uploading of metadata for data and products), and 4.3, WIS-TechSpec-2 (Uploading of data and products).

3.7.2 **Collect programme-related information**

3.7.2.1 As appropriate to its programme role, each NC shall collect programme-related data and products.

3.7.2.2 See also 4.2, WIS-TechSpec-1 (Uploading of metadata for data and products), and 4.3, WIS-TechSpec-2 (Uploading of data and products).

3.7.3 **Production support of programme-related information**

3.7.3.1 As appropriate to its programme role, each NC shall provide data management and data communications that are adequate to support the production of data and products.

3.7.3.2 See also 4.2, WIS-TechSpec-1 (Uploading of metadata for data and products), and 4.3, WIS-TechSpec-2 (Uploading of data and products).

3.7.4 **Describe information with metadata**

3.7.4.1 Each NC shall describe its data and products according to an agreed WMO metadata standard and provide this information, as appropriate, to other Centres.

3.7.4.2 See also 4.9, WIS-TechSpec-8 (DAR catalogue search and retrieval).

3.7.5 **Performance monitoring of a National Centre**

3.7.5.1 As required per the *Technical Regulations* (WMO-No. 49), Volume I, A.3, each NC shall participate in monitoring the performance of WIS.

3.7.5.2 See also 4.16, WIS-TechSpec-15 (Reporting of quality of service).

PART IV

TECHNICAL SPECIFICATIONS OF THE WMO INFORMATION SYSTEM

4.1 GENERAL

4.1.1 There are fifteen Technical Specifications (WIS TechSpecs) that define the interfaces to the major WIS functions. The specifications for these interfaces are named and numbered as follows:

1. Uploading of metadata for data and products;
2. Uploading of data and products;
3. Centralization of globally distributed data;
4. Maintenance of user identification and role information;
5. Consolidated view of distributed identification and role information;
6. Authentication of a user;
7. Authorization of a user role;
8. DAR catalogue search and retrieval;
9. Consolidated view of distributed DAR metadata catalogues;
10. Downloading files via dedicated networks;
11. Downloading files via non-dedicated networks;
12. Downloading files via other methods;
13. Maintenance of dissemination metadata;
14. Consolidated view of distributed dissemination metadata catalogues;
15. Reporting of quality of service.

4.1.2 **National Centres shall support seven of the 15 Technical Specifications, specifically WIS-TechSpec-1, -2, -4, -10, -11, -12 and -15.** An NC can arrange through bilateral agreements for another NC, a DCPC or a GISC to perform functions on its behalf.

4.1.3 **According to the particular requirements of a DCPC in its programme role, DCPCs shall support up to 13 of the 15 Technical Specifications.** DCPCs are not required to support WIS-TechSpec-3 and WIS-TechSpec-9.

4.1.4 **The WMO Information System GISCs shall support all 15 Technical Specifications.**

4.1.5 Any DCPC or NC is welcome to implement interfaces beyond the minimum required. Accordingly, the Technical Specification is mandatory wherever application of the interface is applied.

4.1.6 **The GTS file naming convention shall be used for files and the associated**

metadata record whenever necessary. The GTS file naming convention is documented in the *Manual on the Global Telecommunication System* (WMO-No. 386), Volume 1, Part II, Attachment II-15.

Note: The *Guide to the WMO Information System* (WMO-No. 1061), 5.1 references "WIS Compliance Specifications for GISCs, DCPCs, and NCs", provided as supplementary guidance for WIS Centres.

4.2 WIS-TECHSPEC-1: UPLOADING OF METADATA FOR DATA AND PRODUCTS

4.2.1 **This specification requires that each metadata record uploaded shall be represented in compliance with the WMO Core Metadata Profile of ISO 19115, version 1.2, with a unique identifier.**

Note: The *Guide to the WMO Information System* (WMO-No. 1061), 5.2, references "Metadata Representation", which defines the WMO Core Metadata Profile.

4.2.2 **Uploading shall use methods prescribed by the receiver, which is typically the host of a WIS DAR Metadata Catalogue.**

4.2.3 Discovery, Access and Retrieval metadata should be provided prior to the files or messages associated with the metadata.

4.2.4 For updating the DAR Metadata Catalogue, GISCs should support two kinds of maintenance facilities: a file upload facility for batch updating (add, replace, or delete metadata records treated as separate files) and an online form for changing metadata entries in the DAR Metadata Catalogue (add, change, or delete elements in a record, as well as whole records).

4.2.5 **Global Information System Centres shall maintain the updated DAR Metadata Catalogue as a searchable resource (see WIS-TechSpec-8).**

4.2.6 See also sections 3.5.2 (Receive information from the GISC area), 3.6.2 (Collect Information from the DCPC area), 3.6.3

(Collect programme-related information) and 3.6.4 (Production support of programme-related information).

4.3 **WIS-TECHSPEC-2: UPLOADING OF DATA AND PRODUCTS**

4.3.1 This specification requires that data or products uploaded shall be represented in the manner prescribed by the relevant programme, including, where appropriate, the *Manual on the Global Telecommunication System* (WMO-No. 386), Volume 1, Part II, Attachment II-2, and the *Manual on Codes* (WMO-No. 306), as well as other WMO Manuals and the GTS file naming convention as noted in 4.1.6.

4.3.2 Data and products should be handled as specified in the *Manual on the Global Telecommunication System* (WMO-No. 386), Volume I, Part I, 1.3, Design principles of the GTS, and other WMO manuals specific to the relevant programme.

4.3.3 See also 3.5.2 (Receive information from the GISC area), 3.6.2 (Collect information from the DCPC area), 3.6.3 (Collect programme-related information) and 3.6.4 (Production support of programme-related information).

4.4 **WIS-TECHSPEC-3: CENTRALIZATION OF GLOBALLY DISTRIBUTED DATA**

4.4.1 This specification requires that the *Manual on the Global Telecommunication System* (WMO-No. 386), Volume 1, Part I, Attachment I-3, is applied, as appropriate, to the centralized copies of information intended for global exchange (described in 3.5.1).

4.4.2 Warnings shall be transmitted end-to-end within WIS within two minutes.

4.4.3 See also 3.5.3 (Exchange information with other GISCs) and 3.5.5 (Maintain 24-hour cache).

4.5 **WIS-TECHSPEC-4: MAINTENANCE OF USER IDENTIFICATION AND ROLE INFORMATION**

4.5.1 User identification and role information shall be represented and communicated

using methods prescribed by the receiver, which is typically the host of an identification and role information database.

Note: The term “user identification” in the given context does not imply that a user is personally identifiable. Administrators of authentication and authorization at WIS Centres need to share updated identification and role information as a resource that is available across WIS Centres. The sharing of this information by administrators is also necessary to prevent the inappropriate disclosure of any personally identifiable information.

4.5.2 User identification and role information maintenance should satisfy timeliness requirements of the application and host Centre.

4.5.3 See also 3.5.5 (Maintain 24-hour cache) and 3.6.7 (Provide access to information).

4.6 **WIS-TECHSPEC-5: CONSOLIDATED VIEW OF DISTRIBUTED IDENTIFICATION AND ROLE INFORMATION**

4.6.1 This interface for a consolidated view of distributed identification and role information is not yet required (see also Note in 4.5.1).

4.6.2 WMO Information System Centres that do exchange identification and role information should do so using data encryption technologies.

4.6.3 See also 3.5.5 (Maintain 24-hour cache) and 3.6.7 (Provide access to information).

4.7 **WIS-TECHSPEC-6: AUTHENTICATION OF A USER**

4.7.1 WMO Information System Centres should employ authentication standards, which may include public key infrastructure techniques.

Note: Commercial, off-the-shelf authentication software based on industry and/or international standards should be preferred.

4.7.2 User authentication should satisfy application-specific and host Centre processing constraints, and shall provide a quality of service that meets user requirements.

4.7.3 See also 3.5.5 (Maintain 24-hour cache) and 3.6.7 (Provide access to information).

4.8 **WIS-TECHSPEC-7: AUTHORIZATION OF A USER ROLE**

4.8.1 WMO Information System Centres should employ government-endorsed standards for user authorization software, techniques and procedures.

4.8.2 User authorization should satisfy application-specific and host Centre processing constraints. **User authorization also shall provide a quality of service that meets user requirements.**

4.8.3 See also 3.5.5 (Maintain 24-hour cache) and 3.6.7 (Provide access to information).

4.9 **WIS-TECHSPEC-8: DISCOVERY ACCESS AND RETRIEVAL CATALOGUE SEARCH AND RETRIEVAL**

4.9.1 This specification requires that each metadata catalogue host shall support the Search and Retrieve via URL (SRU) specification of the ISO 23950 Information Search and Retrieval Protocol. A WIS-compliant SRU server shall support SRU version 1.1, the SRU searchRetrieve operation, the SRU Explain operation, the diagnostic schema for returning errors and the SRU Contextual Query Language (CQL) level 2.

4.9.2 In addition to full text search, a WIS-compliant SRU server shall search at least eight indexes as character strings (abstract, title, author, keywords, format, identifier, type and Coordinate Reference System (CRS)); at least five indexes as ordered dates (creationDate, modificationDate, publicationDate, beginningDate, endingDate); and the index "bounds" as geographic coordinates (decimal degrees and space delimited, in the following order: north, west, south, east).

Note: The *Guide to the WMO Information System* (WMO-No. 1061), 5.9, references the "WIS SRU Implementor's Note".

4.9.3 The search service shall provide a quality of service that meets user requirements.

4.9.4 See also 3.5.6 (Discovery, Access and Retrieval) and 3.6.8 (Describe information with metadata).

4.10 **WIS-TECHSPEC-9: CONSOLIDATED VIEW OF DISTRIBUTED DISCOVERY ACCESS AND RETRIEVAL METADATA CATALOGUES**

4.10.1 Global Information System Centres should exchange metadata catalogue updates using version 2 of the Open Archives Initiative–Protocol for Metadata Harvesting (OAI-PMH).

4.10.2 The exchange of metadata catalogue updates should satisfy the requirement for distributed instances of DAR metadata not to diverge in content by more than one day. A mechanism for rapid update on an emergency basis should also be provided.

4.10.3 See also 3.5.6 (Discovery, Access and Retrieval).

4.11 **WIS-TECHSPEC-10: DOWNLOADING FILES VIA DEDICATED NETWORKS**

4.11.1 This specification requires that data or products downloaded shall be represented in the manner prescribed by the relevant programme, including, where appropriate, the *Manual on the Global Telecommunication System* (WMO-No. 386), Volume 1, Part II, Attachment II-2, as well as other WMO Manuals and the GTS file naming convention, as noted in 4.1.6.

4.11.2 Data and products should be handled as specified in the *Manual on the Global Telecommunication System* (WMO-No. 386), Volume I, Part I, 1.3, Design principles of the GTS, and other WMO Manuals that are specific to the relevant programme.

4.11.3 See also 3.5.4 (Disseminate information to the GISC area) and 3.6.5 (Provide information intended for global exchange).

4.12 **WIS-TECHSPEC-11: DOWNLOADING FILES VIA NON-DEDICATED NETWORKS**

4.12.1 This specification requires that data or products downloaded shall be represented and communicated in a manner appropriate to the relevant programme.

4.12.2 Data and products should be handled as specified in the *Manual on the Global Telecommunications System* (WMO-No. 386), Volume I, Part I, 1.3, Design principles of the GTS, and other WMO Manuals that are specific to the relevant programme.

4.12.3 See also 3.5.4 (Disseminate information to the GISC area), and 3.6.5 (Provide information intended for global exchange).

4.13 **WIS-TECHSPEC-12: DOWNLOADING FILES VIA OTHER METHODS**

4.13.1 This specification requires that data or products downloaded shall be represented and communicated in a manner appropriate to the relevant programme.

4.13.2 Data and products should be handled as specified in the *Manual on the Global Telecommunication System* (WMO-No. 386), Volume I, Part I, 1.3, Design principles of the GTS, and other WMO manuals, specific to the relevant programme.

4.13.3 See also 3.5.4 (Disseminate information to the GISC area) and 3.6.5 (Provide information intended for global exchange).

4.14 **WIS-TECHSPEC-13: MAINTENANCE OF DISSEMINATION METADATA**

4.14.1 This specification requires that the dissemination metadata (including subscription information, such as accounts and delivery particulars) shall be represented and communicated as prescribed by the host of the database containing dissemination metadata.

4.14.2 Requests for changes to dissemination for information that are not part of the routine global exchange may be subject to the notification period for changes specified in GTS. Otherwise, changes to dissemination should apply within one day.

4.14.3 See also 3.5.6 (Discovery, Access and Retrieval) and 3.6.5 (Provide information intended for global exchange).

4.15 **WIS-TECHSPEC-14: CONSOLIDATED VIEW OF DISTRIBUTED DISSEMINATION METADATA CATALOGUES**

4.15.1 This interface is not yet required; however, it may be needed as part of a backup arrangement between Centres.

4.15.2 See also 3.5.6 (Discovery, Access and Retrieval).

4.16 **WIS-TECHSPEC-15: REPORTING OF QUALITY OF SERVICE**

4.16.1 This specification requires that reporting of quality of service shall be represented and communicated as prescribed by the host of the centralized reporting database.

4.16.2 Reports should be sent on a schedule determined by the centralized reporting manager, based on the needs of WIS Centres.

4.16.3 See also 3.5.7 (Network connectivity of GISC), 3.5.8 (Coordinate telecommunications in the GISC area), 3.5.9 (Recovery arrangements of GISC), 3.5.10 (Performance monitoring of a GISC), 3.6.9 (Recovery arrangements of a DCPC) and 3.6.10 (Performance monitoring of a DCPC).

APPENDIX A

SELECTED WORLD METEOROLOGICAL ORGANIZATION DOCUMENTS RELEVANT TO THE WMO INFORMATION SYSTEM

Policy documents

- WMO-No. 15 Basic Documents No. 1 (2011 edition)
- WMO-No. 49 *Technical Regulations:*
Volume I – General Meteorological Standards and Recommended Practices
Volume II – Meteorological Services for Air Navigation
Volume III – Hydrology
Volume IV – Quality Management
- WMO-No. 60 *Agreements and Working Arrangements*
- WMO-No. 508 *Resolutions of Congress and the Executive Council*

International exchange of data and products

The World Meteorological Organization facilitates the free and unrestricted exchange of data and information, and products and services in real or near real time on matters relating to safety and security of society, economic welfare, and the protection of the environment.

- WMO-No. 837 Exchanging Meteorological Data – Guidelines on Relationships in Commercial Meteorological Activities. WMO Policy and Practice.
- WMO-No. 827 Resolution 40 (Cg-XII) – WMO policy and practice for the exchange of meteorological and related data and products including guidelines on the relationships in commercial meteorological activities.
- WMO-No. 902 Resolution 25 (Cg-XIII) – Exchange of Hydrological Data and Products
Annex IV – Geneva Declaration of Thirteenth World Meteorological Congress

Manuals

- WMO-No. 9 *Weather Reporting:*
Volume A – Observing stations
Volume C1 – Catalogue of Meteorological Bulletins
Volume C2 – Transmission Programmes

Volume D – Information for Shipping

- WMO-No. 306 *Manual on Codes*
- WMO-No. 386 *Manual on the Global Telecommunication System, Volumes I and II*
- WMO-No. 485 *Manual on the Global Data-processing and Forecasting Systems, Parts 1, 2 and 3*
- WMO-No. 544 *Manual on Global Observing System*

Guides

- WMO-No. 8 *Guide to Meteorological Instruments and Methods of Observation*
- WMO-No. 100 *Guide to Climatological Practices*
- WMO-No. 134 *Guide to Agricultural Meteorological Practices*
- WMO-No. 168 *Guide to Hydrological Practices*
- WMO-No. 305 *Guide on the Global Data-processing System*
- WMO-No. 471 *Guide to Marine Meteorological Services*
- WMO-No. 488 *Guide to the Global Observing System*
- WMO-No. 636 *Guide on the Automation of Data-processing Centres*
- WMO-No. 702 *Guide to Wave Analysis and Forecasting*
- WMO-No. 731 *Guide on Meteorological Observation and Information Distribution Systems for Aviation Weather Services*
- WMO-No. 732 *Guide to Practices for Meteorological Offices Serving Aviation*
- WMO-No. 750 *Guide to Moored Buoys and Other Ocean Data Acquisition Systems*
- WMO-No. 788 *Guide on World Weather Watch Data Management*
- WMO-No. 834 *Guide to Public Weather Services Practices*
- WMO-No. 1061 *Guide to WMO Information System*

Technical documents

- Guide to WMO Binary Code Form GRIB 1 – Technical Report No. 17 (WMO/TD-No. 611) – May 1994
- Guide to WMO Table-Driven Code Forms: FM 94 BUFR and FM 95 CREX
- Guide to FM 92 GRIB Edition 2

Miscellaneous (GTS)

Guide on Internet Practices

Guide on VPN via the Internet between GTS centres

Guide on the use of TCP/IP on the GTS

Guide on Provisional Arrangements for the use of IP Addresses over the GTS

Guide on IT Security



APPENDIX B

APPROVED WMO INFORMATION SYSTEM CENTRES

B.1 Global Information System Centres

Note: Per Resolution 51 (Cg-XVI) of the Sixteenth World Meteorological Congress, Global Information System Centres (GISCs) in this table that are marked with an asterisk were conditionally designated as WIS GISCs, subject to their having demonstrated the pre-operational compliance requirements of the Commission for Basic Systems (CBS).

WMO Member	Centre Name	Region
Australia	* GISC – Melbourne	V
Brazil	* GISC – Brasilia	III
China	GISC – Beijing	II
France	Western European Virtual GISC (WE-VGISC) – Toulouse	VI
Germany	WE-VGISC – Offenbach	VI
India	* GISC – New Delhi	II
Iran, Islamic Republic of	* GISC – Tehran	II
Japan	GISC – Tokyo	II
Morocco	* GISC – Casablanca	I
Republic of Korea	* GISC – Seoul	II
Russian Federation	* GISC – Moscow	VI
Saudi Arabia	* GISC – Jeddah	II
South Africa	* GISC – Pretoria	I
United Kingdom of Great Britain and Northern Ireland	WE-VGISC – Exeter	VI
United States of America	* GISC – Washington	IV

B.2 Data Collection or Production Centres

Note: Per Resolution 51 (Cg-XVI), Data Collection or Production Centres (DCPCs) in this table that are marked with an asterisk were conditionally designated as WIS DCPCs, subject to their having demonstrated the pre-operational compliance requirements of CBS.

WMO Member or contributing organization	Centre name	Centre location region/city	Function	TC/ programme	GISC
Australia	* IPS (Ionospheric Prediction Service)	V Sydney	IPS	CBS	Melbourne
	* NCC (National Climate Centre)	V Melbourne	NCC	CCI	Melbourne
	* Regional Specialized Meteorological Centre (RSMC) Darwin	V Darwin	RSMC-Geographical	CBS	Melbourne
	* World Meteorological Centre (WMC) Melbourne	V Melbourne	RTH	CBS	Melbourne
	* Joint Australian Tsunami Warning Centre (JATWC)	V Melbourne	Tsunami Warning System (TWS)	JCOMM	Melbourne
Brazil	* Regional Telecommunication Hub (RTH)	III Brasilia	RTH	CBS	Brasilia
Bulgaria	* RTH	VI Sofia	RTH	CBS	WE-VGISC
Canada	* RSMC Montreal	IV Montreal	RSMC-Activity-ATM	CBS	Washington
China	* Regional Climate Centre (RCC)	II Beijing	RCC	CCI	Beijing
	* National Meteorology Satellite Centre (NMSC)	II Beijing	NMSC	CBS	Beijing
	* RSMC Beijing	II Beijing	RSMC-Geographical	CBS	Beijing
	* RSMC – EER (Environmental Emergency Response)	II Beijing	RSMC-Activity-atmospheric transport modelling (ATM)	CBS	Beijing
	RTH	II Beijing	RTH	CBS	Beijing
Croatia	* Marine Meteorology Centre	VI Zagreb	Marine Meteorology Centre	JCOMM	WE-VGISC
Czech Republic	* RTH	VI Prague	RTH	CBS	WE-VGISC
ECMWF	European Centre for Medium-Range Weather Forecasts (ECMWF)	VI Reading	RSMC-Activity-Medium-Range-Forecasting	CBS	WE-VGISC
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites (EUMETSAT)	VI Darmstadt, Germany	Satellite Centre	CBS	WE-VGISC

WMO Member or contributing organization	Centre name	Centre location region/city	Function	TC/ programme	GISC
Finland	* Finnish Meteorological Institute – Arctic Research Centre (FMI-ARC)	VI Sodankylä	Arctic Data Centre (ADC)	CBS	WE-VGISC
France	Global Producing Centre / Lead Centre for Long Range Forecast Multi-Model Ensemble (GPC/LRFMME)	VI Toulouse	GPC/LRF	CBS	WE-VGISC
	Regional Climate Centre (RCC)	VI Toulouse	RCC	CCI	WE-VGISC
	RSMC – Numerical Weather Prediction (NWP)	VI Toulouse	Regional NWP support	CBS	WE-VGISC
	RSMC – EER	VI Toulouse	RSMC-Activity-ATM	CBS	WE-VGISC
	* RSMC La Réunion – Tropical Cyclone Centre	I La Réunion	RSMC-Activity-TC	CBS	WE-VGISC
	RTH	VI Toulouse	RTH	CBS	WE-VGISC
	Volcanic Ash Advisory Centre (VAAC)	VI Toulouse	VAAC	CAeM	WE-VGISC
Germany	Global Collecting Centre (GCC) - ship observations	VI Hamburg	GCC	JCOMM	WE-VGISC
	RSMC	VI Offenbach	Global Precipitation Climatology Centre (GPCC)	CBS/CCI/CHy	WE-VGISC
	Global Runoff Data Centre (GRDC)	VI Koblenz	GRDC	CHy	WE-VGISC
	GCOS Reference Upper Air Network (GRUAN) Lead Centre	VI Tauche/Lindenberg	GRUAN-LC	CBS	WE-VGISC
	RCC – Climate Modeling (CM)	VI Offenbach	RCC (Europe)	CCI	WE-VGISC
	RSMC	VI Offenbach	RSMC-Geographical	CBS	WE-VGISC
	RTH	VI Offenbach	RTH	CBS	WE-VGISC
	ICSU World Data Centre for Climate	VI Hamburg	WDCC	CCI	WE-VGISC
	World Data Center for Remote Sensing of the Atmosphere (WDC-RSAT)	VI Oberpfaffenhofen	WDC-RSAT	CAS	WE-VGISC
WRMC	VI Bremerhaven	WRMC	WCRP (GEWEX)	WE-VGISC	
Hong Kong, China	World Weather Information Service (WWIS)	II Hong Kong	WWIS	CBS	Beijing
India	* RSMC – Tropical Cyclones New Delhi	II New Delhi	RSMC-Activity-TC	CBS	New Dehli
	* RTH	II New Delhi	RTH	CBS	New Dehli

WMO Member or contributing organization	Centre name	Centre location region/city		Function	TC/ programme	GISC
Iran, Islamic Republic of	* RTH	II	Tehran	RTH	CBS	Tehran
Italy	* RSMC – Marine and Ocean products	VI	Rome	RSMC-Geographical	CBS	WE-VGISC
	* RTH	VI	Rome	RTH	CBS	WE-VGISC
Japan	Global Producing Centre for Long-Range Forecast (GPC/LRF)	II	Tokyo	GPC/LRF	CBS	Tokyo
	Tokyo Climate Center	II	Tokyo	RCC	CCI	Tokyo
	RSMC on Atmospheric Transport Modeling Products for Environmental Emergency Response and Backtracking	II	Tokyo	RSMC-Activity-ATM	CBS	Tokyo
	RSMC on Tropical Cyclones	II	Tokyo	RSMC-Activity-TC	CBS	Tokyo
	RSMC on Data Processing and Forecasting System	II	Tokyo	RSMC-Geographical	CBS	Tokyo
	RTH	II	Tokyo	RTH	CBS	Tokyo
	Meteorological Satellite Centre	II	Tokyo	Satellite Centre	CBS	Tokyo
	WDC for Greenhouse Gases (GHG)	II	Tokyo	WDC-GHG	CAS	Tokyo
Netherlands	* RCC	VI	De Bilt	RCC	CCI	WE-VGISC
	* Satellite Centre	VI	De Bilt	Satellite Centre	CBS	WE-VGISC
Norway	Arctic Data Centre	VI	Oslo	Arctic Data Centre	CBS	WE-VGISC
	* Norwegian Institute for Air Research (NILU)	VI	Kjeller	NILU	CAS	WE-VGISC
Republic of Korea	* Global Producing Centre / Lead Centre for LRF Multi-Model Ensemble (GPC/LRFMME) – Seoul	II	Seoul	GPC / LC-LRFMME	CBS	Seoul
	* NMSC (National Meteorological Satellite Center)	II	Jincheon	NMSC	CBS	Seoul
	* WAMIS (World Agrometeorological Information Service)	II	Seoul	WAMIS	CAGM	Seoul
Russian Federation	* Responsible National Oceanographic Data Centre (RNODC) and Global Data Centre (GDC)	VI	Obninsk	RNODC and GDC	JCOMM	Moscow
	* RSMC – EER	VI	Obninsk	RSMC-Activity-ATM	CBS	Moscow
	* RSMC	VI	Moscow	RSMC-Geographical	CBS	Moscow

WMO Member or contributing organization	Centre name	Centre location region/city	Function	TC/ programme	GISC
	* World Meteorological Center (WMC) Moscow	VI Moscow	RTH	CBS	Moscow
	* Regional Telecommunication Hub/ Regional Specialized Meteorological Centre (RTH/RSMC)	II Khabarovsk	RTH/RSMC-Geographical	CBS	Moscow
	* RTH/RSMC	II Novosibirsk	RTH/RSMC-Geographical	CBS	Moscow
	* WDC (World Data Center) Ice – St Petersburg (Global Cryosphere Watch)	VI St Petersburg	WDC (ICE)	CBS	Moscow
Saudi Arabia	* RTH	II Jeddah	RTH	CBS	Jeddah
Serbia	* RCC	VI Belgrade	RCC	CCI	WE-VGISC
South Africa	* RTH	I Pretoria	RTH	CBS	Pretoria
Sweden	* IPY (International Polar Year) data repository	VI Norrköping	ADC-IPY	CAS	WE-VGISC
	* BALTRAD (Weather radar network for the Baltic Sea Region)	VI Norrköping	Regional Radar	CBS	WE-VGISC
	* RTH Norrköping	VI Norrköping	RTH	CBS	WE-VGISC
United Kingdom	RSMC – Numerical Weather Prediction (NWP)	VI Exeter	GPC/LRF	CBS	WE-VGISC
	Marine Observations Centre	VI Exeter	Marine Observations Centre	JCOMM	WE-VGISC
	RSMC – EER	VI Exeter	RSMC-Activity-ATM	CBS	WE-VGISC
	RSMC – Global and Regional Climate Centre	VI Exeter	RSMC-Geographical	CBS	WE-VGISC
	RTH Exeter	VI Exeter	RTH	CBS	WE-VGISC
	Specialized Ocean & Wave forecasting Centre	VI Exeter	Specialized Ocean/Wave Forecasting	JCOMM	WE-VGISC
United States of America	* Global Observing Systems Information Center (GOSIC)	IV Asheville, NC	GOSIC	CCI	Washington
	* National Centers for Environmental Prediction (NCEP)	IV Washington, DC	GPC/LC-LRFMME	CBS	Washington
	* National Center for Atmospheric Research (NCAR)	IV Boulder, CO	NCAR	CBS	Washington
	* National Geophysical Data Center (NGDC)	IV Washington, DC	NGDC	CBS	Washington
	* National Oceanographic Data Center (NODC)	IV Washington, DC	NODC	JCOMM	Washington

WMO Member or contributing organization	Centre name	Centre location region/city	Function	TC/ programme	GISC
	* National Environmental Satellite, Data, and Information Service (NESDIS)	IV Washington, DC	RMSC-Geographical/NESDIS	CBS	Washington
	* Air Resources Laboratory (ARL)	IV Washington, DC	RSMC-Activity-ATM	CBS	Washington
	* World Meteorological Center (WMC) Washington	IV Washington, DC	RTH	CBS	Washington
	* World Area Forecast Center (WAFC)	IV Washington, DC	WAFC	CAeM	Washington

B.3 National Centres

(none listed at this time)

