

WORLD METEOROLOGICAL ORGANIZATION

WMO INTEGRATED GLOBAL OBSERVING SYSTEM (WIGOS)

REGIONAL WIGOS IMPLEMENTATION PLAN FOR REGIONAL ASSOCIATION VI (EUROPE)

(R-WIP-VI)

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WIGOS IMPLEMENTATION PLAN

1. INTRODUCTION AND BACKGROUND

1.1 Purpose of WIGOS and scope of the Regional WIGOS Implementation Plan for Regional Association VI (R-WIP-VI)

The WMO Integrated Global Observing System (WIGOS) provides a framework for WMO observing systems, including the contributions of WMO to co-sponsored observing systems. It is important to recognize that WIGOS is not replacing the existing observing systems, but is rather an overarching framework for the evolution of these systems which will continue to be owned and operated by a diverse array of organizations and programmes. WIGOS focuses on the integration of governance and management functions, mechanisms and activities to be accomplished by contributing observing systems, according to the resources allocated on a global, regional and national level.

This Plan is laid out in several chapters that identify and describe the various activity areas to be addressed within this Region. Specific regional/national activities for each area are included in Table 2 (see Chapter 4), which identifies deliverables, timelines, responsibilities, costs and risks, and whether the activity requires regional and/or national implementation. Similar activities are grouped under the title corresponding to the respective sections of Chapter 2.

1.2 WIGOS vision and Congress guidance for WIGOS implementation

The Seventeenth World Meteorological Congress (Cg-17) decided that the development of WIGOS, supported by WIS, as one of the WMO strategic priorities for 2016-2019¹, will continue during its pre-operational phase building upon and adding to those key building blocks of the WIGOS Framework that have already been implemented, while gradually shifting the emphasis from the global level toward implementation activities at the regional and national levels. The goal is to have Members and their partners benefit from a fully operational system from 2020 onward.

The highest priorities for the WIGOS Pre-operational Phase are: (1) National WIGOS implementation; (2) WIGOS Regulatory Material complemented with necessary guidance material to assist Members with the implementation of the WIGOS technical regulations; (3) Further development of the WIGOS Information Resource (WIR), with special emphasis on the operational deployment of the Observing Systems Capability Analysis and Review (OSCAR) databases; (4)

¹ See the WMO Strategic Plan (http://library.wmo.int/pmb_ged/wmo_1161_en.pdf)

Development and implementation of the WIGOS Data Quality Monitoring System; and (5) Concept development and initial establishment of Regional WIGOS Centres.

The Plan for the WIGOS Pre-operational Phase (PWPP) adopted by EC-68 guides the development of WIGOS over the coming four years, especially at the regional and national levels, and assists in defining priorities and targets.

Based on PWPP, R-WIP-VI has been reviewed and updated considering the regional activities, requirements and priorities.

2. KEY ACTIVITY AREAS FOR REGIONAL WIGOS IMPLEMENTATION

The component observing systems of WIGOS comprise the Global Observing System (GOS), the observing component of the Global Atmosphere Watch (GAW), the WMO Hydrological Observing Systems (including the World Hydrological Observing System (WHOS)) and the observing component of the Global Cryosphere Watch (GCW), including surface- and space-based components). The above component systems include all WMO contributions to the cosponsored systems, i.e. GCOS, GOOS and GTOS, as well as the WMO contributions to GFCS and GEOSS.

To migrate the existing observing systems into the more integrated single system that is WIGOS, focused effort is required at the regional level in the following key areas, detailed in the respective sections:

- (a) Management of WIGOS implementation;
- (b) Collaboration with WMO co-sponsored observing systems and international partner organizations and programmes;
- (c) Design, planning and optimized evolution of WIGOS component observing systems;
- (d) Observing system operation and maintenance;
- (e) Quality management;
- (f) Standardization and interoperability;
- (g) The WIGOS Information Resource (WIR);
- (h) Data discovery and availability (data and metadata);
- (i) Capacity development;
- (j) Communications and outreach.

2.1 Management of WIGOS implementation in RA VI

WIGOS implementation is an integrating activity for all regional components of WMO and co-sponsored observing systems: it supports all WMO Programmes and activities.

Executive Council

The WMO Executive Council will continue to monitor, guide, evaluate and support the overall implementation of WIGOS. Following guidance from Sixteenth Congress, the sixty-third session of the Executive Council established the Inter-Commission Coordination Group on WIGOS (ICG-WIGOS) with a view to providing technical guidance and assistance for the planning, implementation and further development of the WIGOS component observing systems. Progress in implementing WIGOS in pre-operational phase with the five priority areas stated above will be reported on to subsequent sessions of the Executive Council. The Council designated the president of CBS as chair of ICG-WIGOS.

Regional Association VI

Regional Association VI plays the key role in WIGOS implementation in the Region. Through its Working Group on Technology Development and Implementation (WG-TDI), it will coordinate the planning and implementation of WIGOS at the regional level taking into account all WMO future priorities, such as GFCS and DRR. Under the guidance of ICG-WIGOS and with the support, where required, of the WIGOS Project Office (WIGOS-PO) in the WMO Secretariat, WG-TDI will be responsible for:

- (a) The further development of the Regional WIGOS Implementation Plan;
- (b) The integration of WIGOS regional network components;
- (c) The contribution to WIGOS regulatory material;
- (d) The development of the regional WIGOS Data Quality Monitoring System;
- (e) The support and assistance in using the OSCAR;
- (f) The assistance in establishing Regional WIGOS Centers;
- (g) The coordination of capacity development activities in the Region; and
- (h) The evolution of their regional networks according to the implementation plan for the evolution of global observing systems (EGOS-IP)².

R-WIP also addresses regional aspects of requirements, standardization, observing system interoperability, data compatibility, data and metadata management, quality management system procedures, including performance monitoring and data-quality monitoring, and proposed improvements in observing networks/systems. An important role of the Regional Association will be to assess and continuously monitor regional requirements, identify regional gaps and capacity development projects within the Region to address those gaps.

Members of the Region

Building on WIP and R-WIP, Members are requested to develop a National WIGOS Implementation Plan (N-WIP) to help them plan, implement, operate and maintain national networks and observing programmes based on the standard and recommended practices and procedures stated in the WMO Technical Regulations. They will be encouraged to adopt a composite network approach and to include the acquisition and onward transmission of data from external sources, including NMHSs and other government agencies, the commercial sector and members of the public. A particular area of focus for Members of the Region will be increased attention to site protection and radio frequency spectrum protection.

Plans should also be developed to strengthen cooperation through partnership with different owners overseeing the WIGOS component observing systems within their countries. Specifically,

² <http://www.wmo.int/pages/prog/www/OSY/gos-vision.html#egos-ip>.

these activities aim to enhance cooperation amongst meteorological, hydrological, marine/oceanographic and academic/research institutions/services where they are separated at the national level.

Concerning radio-frequency spectrum protection, Members should maintain close coordination with their national telecommunication authorities to register their frequencies for adequate protection, and to defend the availability of frequencies for Meteorology, Climatology and Earth observations, influencing positively the national delegations to the World Radiocommunication Conferences.

2.2 Collaboration with WMO co-sponsored observing systems and international partner organizations and programmes

WIGOS is an integrated, comprehensive, and coordinated system primarily comprising the surface- and space-based observing components of GOS, GAW, GCW, and the WMO Hydrological Observing System (including WHYCOS) and including all WMO contributions to GCOS, GOOS and GTOS. It should be noted that in contrast with the primarily NMHS-owned observing systems upon which the World Weather Watch (WWW) was built, the proposed WIGOS component observing systems are owned and operated by a diverse array of organizations, both research and operational. The interaction of these various communities at the regional and national levels is therefore important for the implementation of WIGOS within the Region. In particular, strengthening the interaction of research and operational observing communities is important for sustaining and evolving observing systems and practices, in line with new science and technology outcomes. WIGOS is a major observing component of GFCS and will also provide indispensable contributions to GEOSS.

Partner organizations and programmes

At the regional level, coordination and cooperation will be supported by a mechanism to be defined by the Regional Association and the respective regional bodies, such as the Network of European Meteorological Services (EUMETNET)³, the Interstate Council on Hydrometeorology of the Countries of the Commonwealth of Independent States (ICH/CIS), the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), the European Centre for Medium-Range Weather Forecasts (ECMWF) and relevant European Union bodies in order to resolve possible problems in data policy, product delivery and other governance issues. This inter-agency and inter-observing system coordination mechanism will need to be complemented and supported through similar cooperation and coordination arrangements among NMHSs and through national implementation mechanisms for GFCS, GCOS, GOOS, GTOS and GEOSS.

The Architecture for Climate Monitoring from Space has been defined as an end-to-end system, involving the different stakeholders including operational satellite operators and research and development space agencies, the Coordination Group for Meteorological Satellites (CGMS), the Committee on Earth Observation Satellites, GCOS, the World Climate Research Programme and the Group on Earth Observations (GEO). Within the Regional context, the Architecture shall be part of the space-based component of WIGOS. Particular emphasis will therefore be placed on their coordinated contribution to WIGOS within the Region, building on existing coordination mechanisms stated above.

³ A grouping of 29 European National Meteorological Services that provides a framework to organize cooperative programmes between its Members in the various fields of basic meteorological activities.

2.3 Design, planning and optimized evolution of WIGOS component observing systems

WMO has agreed on the Vision for the Global Observing Systems in 2025⁴, which provides high-level goals to guide the evolution of the global observing systems during the coming decades. To complement and respond to this Vision, an EGOS-IP was approved by CBS-15 (September 2012) for consideration by the sixty-fifth session of the Executive Council (May 2013). EGOS-IP focuses on the long-term evolution of WIGOS component observing systems, while WIP focuses on the integration of these component observing systems. Beyond 2015 these plans provide Members of the Region with clear and focused guidelines, specifying actions that stimulate the cost-effective evolution of the observing systems to address the requirements of all WMO Programmes and relevant parts of co-sponsored programmes in an integrated manner.

Concerning the surface-based subsystem of WIGOS, the current composition of mainly separate networks of observing stations comprises numerous different types of sites. With the implementation of WIGOS, these separate networks will continue to evolve but will also be given a more prominent collective identity as the WIGOS surface-based subsystem and for some purposes may be considered as a single composite system of observing (fixed or mobile) sites/platforms. The Regional Association will adopt a broader role in coordinating the implementation of relevant elements of the WIGOS surface-based subsystem, evolving from the previous concepts of mainly regional synoptic and climatological networks into an integrated concept of a WIGOS Regional Network.

Similarly, the space-based subsystem of WIGOS is composed of many different platforms and types of satellites. There is already partial integration due to the existence of a globally coordinated plan, which is maintained by WMO and CGMS, and which takes into account the needs of a number of application areas. However, it should be further developed and expanded to better support certain application areas that, at present, are not benefiting from the full potential of space-based observations, such as other components of GAW and the WMO Hydrological Observing System and new initiatives such as GFCS and GCW. In addition, further integration shall be pursued in terms of intercalibration, data and product harmonization and composite product delivery. The Regional Association will adopt an active role in compiling the views of Members and maintaining documented requirements and priorities for data and products to be available for the Region from the WIGOS space-based subsystem.

Rolling Review of Requirements (RRR)⁵

Coordinated strategic planning at all levels will be based on the RRR process, and is supported by WIGOS regulatory material. This activity will be carried out primarily at the **global level** under the guidance of the ICG-WIGOS.

The RRR process involves a regular view of the observational data requirements⁶ for each of the defined WMO Application Areas and all required variables (see Table 1). The RRR process also involves reviewing the capabilities of WMO observing systems and co-sponsored systems, and the details of the networks/platforms in existence⁷, for both space- and surface-based systems, in delivering data on different variables. The comprehensive information collected for the globe on both requirements and capabilities is quantitatively recorded in a database accessible through the

⁴ Available from the WMO Website at: <http://www.wmo.int/pages/prog/www/OSY/gos-vision.html>

⁵ Currently specified in the *Manual on the Global Observing System* (WMO-No. 544), elaborated in the *Guide to the Global Observing System* (WMO-No. 488), and described further on the WMO Website at <http://www.wmo.int/pages/prog/www/OSY/GOS-RRR.html>

⁶ The RRR describes data requirements, which are expressed in terms of space/time resolution, uncertainty, timeliness, etc., for each of the required observed variables, and are measures independent of observing technology.

⁷ Capabilities are derived from the individual platforms characteristics submitted by Members to WMO e.g. through OSCAR/Surface

Observing Systems Capability Analysis and Review tool (OSCAR⁸) of WIR (see section 2.7 below). The information on surface-based networks and instrumentation details formerly recorded in *Weather Reporting* (WMO-No. 9), Volume A, are available, with additional metadata, through OSCAR/Surface. Space-based capabilities are also recorded and made available through OSCAR. OSCAR allows gap analyses to be performed, which identify weaknesses in existing observing programmes.

The above steps represent the analysis phase of the RRR, which is as objective as possible. Next is the prioritization and planning phase, in which experts from the various application areas interpret the gaps identified, draw conclusions and identify key issues and priorities for action. This input is composed of Statements of Guidance (SoG) from each application area. The technical commissions respond to the SoG by formulating new global observing system requirements and the regulatory and guidance publications to assist Members in addressing the new requirements. Additionally, CBS and other technical commissions draw on the SoGs to develop a Vision and an Implementation Plan for further developments of WIGOS.

Table 1: The 14 WMO application areas

No	Application area	No	Application area
1	Global Numerical Weather Prediction	8	Providing Atmospheric Composition information to support services in urban and populated areas
2	High-Resolution Numerical Weather Prediction	9	Ocean Applications
3	Nowcasting and Very Short-Range Forecasting	10	Agricultural Meteorology
4	Sub-seasonal to longer predictions	11	Hydrology ⁹
5	Aeronautical Meteorology	12	Climate Monitoring
6	Forecasting Atmospheric Composition	13	Climate Applications
7	Monitoring Atmospheric Composition	14	Space Weather

At the regional level

Although the primary coordination of RRR will lie with CBS for overall WIGOS planning, the Regional Association, through WG-TDI, will follow the technical guidance of the technical

⁸ The following components are currently available via the WMO website: User Requirements: <http://www.wmo.int/pages/prog/www/OSY/RRR-DB.html>; and Space-based capabilities: http://www.wmo.int/pages/prog/sat/gos-dossier_en.php. The surface-based capabilities part is currently under development

⁹ Hydrological information only; water quality monitoring and information is currently excluded.

commissions as represented in EGOS-IP and other observing system implementation plans in order to develop and implement observing systems in the Region.

The Regional Association will examine, and report back to CBS on, its requirements for data and any issues it identifies with the global WIGOS design, taking into account the particular requirements of the Region and international river basin authorities. This process will involve, in essence: (a) the use of global data to prepare Regional data requirements, (b) use of these for detailed planning of WIGOS component observing system at the regional scale; and (c) encouragement of Members of the Region to implement these components, subject to further review at the national or subregional level, where appropriate.

At the national or subregional Level

Members of the Region will contribute to the collective Regional effort to: (a) assess the Regional data requirements and plan the Regional observing system components; and (b) implement and develop observing systems following this plan, EGOS-IP and other observing system implementation plans. Members will prepare their national WIGOS implementation plan (N-WIP) in accordance with R-WIP by considering their national requirements for the observing systems.

The Members of the Region will also have available the information on global and regional data requirements available to use as guidance for the preparation of national requirements, which can then be used to assist with the detailed planning for developing national WIGOS component observing systems.

In some cases, where countries are small and geographically close or already have established multilateral working relationships, there may be more merit in taking a subregional, as opposed to a national, approach to WIGOS observing infrastructure planning. In this case, it will be necessary for the Members concerned to work in close cooperation to prepare subregional reviews of requirements to be used as a basis for detailed planning at that scale.

2.4 Observing system operation and maintenance

Observing system owners or custodians are responsible for operating and maintaining their systems and for complying with the regulations of WMO and co-sponsored observing systems to which they contribute. System owners are generally NMHSs or other organizations within WMO Member countries but are sometimes other entities.

On the regional level, WIGOS involves a process for sharing operational experiences, ideas and best practices, expertise and for pooling resources for joint activities, such as is done within EUMETNET. The benefit is to realize synergies and greater efficiencies. These interactions may be between different teams within a single organization (such as an NMHS) or between Regional organizations. These may benefit from technical guidance from relevant technical commissions and, while occurring primarily at a national level, there is a Regional role to be played. Within Regional Association VI, the following regional activities will be important:

- WIGOS metadata creation and handling;
- Quality monitoring;
- Integration of networks – redesign of the Regional Basic Observing Network (RBON);
- Compilation and publication of national good practices;
- Capacity development focused on the provision of data to GFCS, early warning system, and provision of other specialized services, such as marine services.

2.5 Quality management

The Region recognizes that meeting the quality requirements and expectations of users is critical to the success of WIGOS. This requires an in-depth examination of current practices used by WMO observing programmes, specific mission-related requirements that are already in place, and available technological opportunities. WIGOS Quality Management will specify all processes for WIGOS component observing systems including guidance on its effective management.

The WIGOS quality-management approach is to apply the WMO Quality Management Framework to WIGOS component observing systems. WIGOS Quality Management at the Regional level will strive for compliance of all components of WIGOS with international standards, such as ISO 9001/9004 and ISO 17025:2005, where appropriate (i.e. with respect to instrument calibration and traceability of data). In this context, the Region will give attention to:

- (a) The examination of current quality management practices being used in the Region;
- (b) The documentation of the quality of observations from the WIGOS Regional networks at all stages of data processing; and
- (c) Ensuring, where possible, traceability of observations to the International System of Units.

A network of Regional WIGOS Centres (RWCs) is needed to assist RA VI Members to successfully implement WIGOS at the national and regional levels. Under the governance and guidance of the management group and with the support of relevant regional working bodies, the overall purpose of the RWCs is to provide support and assistance to Members of the Region for their national and regional WIGOS implementation efforts.

Basic functions of the RWC must be regional coordination, guidance, oversight and support of WIGOS implementation and operational activities at the regional and national levels (day-to-day level of activities). The proposed mandatory functions are directly linked with two of the priority areas of the WIGOS Pre-operational Phase (2016-2019):

- (a) Regional WIGOS metadata management (work with data providers to facilitate collecting, updating and providing quality control of WIGOS metadata in OSCAR/Surface);
- (b) Regional WIGOS performance monitoring and incident management (WIGOS Data Quality Monitoring System) and follow-up with data providers in case of data availability or data quality issues.

Depending on available resources and regional needs, one or more optional functions may be adopted, e.g.: (a) assistance with the coordination of regional/sub-regional and national WIGOS projects; (b) assistance with regional and national observing network management; and (c) support for regional capacity development activities.

In coordination and collaboration with WMO, CGMS supports the development of quality assurance standards and formats for satellite observations, multi-satellite and multi-sensor algorithms for estimating retrieved data and products, and advanced atmospheric sounding derivation packages for use by WMO Members. To assist this effort, the Region will ensure that surface-based sites needed for calibration/validation of satellite data are specified.

A key aspect of regional WIGOS quality management that requires particular attention is systematic and rigorous performance monitoring and evaluation (PM&E) of WIGOS capabilities, in terms of both (a) the flow of observational data/products to models; and (b) provision of products/information for decision-support tools and services in accordance with requirements specified by end users. Effective PM&E can improve the overall performance of WIGOS and its ability to interact effectively with its user community and meet community needs and requirements.

The key priority will be the development of a modern and efficient performance monitoring and reporting system for observational data availability and data quality. This is essential for measuring the effectiveness and impact of WIGOS, and for developing robust incident management practices that will lead to improved WIGOS data quality and availability.

The plan is to put in place mechanisms and regional structures to handle incident management actions and support Members in improving the data availability and quality by 2018 (dependent on establishment of RWCs).

2.6 Standardization and interoperability¹⁰

A key area for WIGOS standardization relates to instruments and methods of observation. Standardization of observations is required to achieve system interoperability (including data compatibility) across all WIGOS component observing systems and these are key to turning observations into effective data/products that meet real needs of all Members.

WIGOS standardization should build on existing WMO and other international standards and best practices, and take into account the ongoing rapid progress in technology that will continue to provide a basis for further improvements in the capability, reliability, quality and cost-effectiveness of observations.

System interoperability and data compatibility also rely on the use of standardized data representation and formats, standardized methods for information exchange, and standardization in data management. The first two lie in the WIS domain and the third is a natural extension of WIS responsibilities. It is important that WIGOS and WIS implementation activities are closely coordinated in this respect, and that WMO agrees on an approach to standardizing data management across Programmes.

All WIGOS related standard and recommended practices and procedures are documented in the *Technical Regulations* (WMO-No. 49), its Annex VIII, the *Manual on WMO Integrated Global Observing System* (WMO-No. 1160) and other relevant Manuals. Guidance material will be documented in the Guides and other technical documentation under the responsibility of the respective technical commissions.

The Region will support all activities leading to the interoperability of WIGOS component observing systems (including data compatibility) through utilization and application of the same, internationally accepted standard and recommended practices and procedures (i.e. standardization). Data compatibility will also be supported through the use of standardized data representation and formats.

2.7 WIGOS Information Resource

Accessible via a centralized point (web portal), WIR will provide access to all WIGOS-related operational information, including observational user requirements, a description of the contributing observing networks (instrument/site/platform metadata), and their capabilities, a list of standard and recommended practices and procedures used in the WIGOS framework, applicable data policies applicable, and information on how to access data. It will also provide general information on WIGOS benefits, and impacts on Members. It will be a tool for conducting critical reviews as

¹⁰ Interoperability is a property referring to the ability of diverse systems to work together (interoperate)

part of RRR and can assist Members and the Regional Association in conducting observing network design studies as appropriate. It will provide guidance on how to develop capacities in developing countries according to WIGOS requirements, and will provide Members of the Region with a toolbox to be used nationally if and when required. The information collected is intended, in particular, to identify the gaps in the observing networks, areas where existing observing systems could be used, or where their scope could be expanded at limited cost to address the requirements of more application areas. The information provided on standard and recommended practices and procedures will support the production of more homogeneous datasets and make the observations traceable and of known quality.

The key support tools of WIGOS are: (a) a central web portal (WIGOS-Portal); (b) The WIGOS Standardization of Observations Reference Tool (SORT); and (c) OSCAR, which includes information on observational user requirements and observing systems capabilities and allows a critical review by comparing the two (see WIP for more information on each of these tools).

Understanding that sources of the individual components of WIR rely on the inputs from its Members, the Region is committed to provide regular inputs to keep the information resource up to date.

2.8 Data discovery and availability (data and metadata)

Within the WIGOS framework, WIS¹¹ provides exchange of data and interpretation metadata¹², and management of related discovery metadata¹³. The latter play an important role in the discovery, access and retrieval of WIGOS observations and products by the entire WMO community.

Submission, management and archival of the data and metadata themselves are generally the responsibility of observing system owners/data custodians. However, several World Data Centres and a number of regional or specialized data centres collect, manage and archive basic observational data that are relevant to WMO application areas. Members of the Region are responsible for submitting their data to these regional or specialized data centres. The Regional Association will encourage its Members to abide by this commitment.

Members of the Region will adopt WIGOS and WIS standards and make their data and metadata available through WIS for delivery or for discovery, access and retrieval services. In this regard, promotion and implementation of Data Collection and Production Centres (DCPCs) as well as National Centres will be supported and encouraged by the Regional Association. Guidance will be developed and provided through the appropriate WIGOS regulatory and technical documents.

2.9 Capacity development

A coordinated capacity-development effort at global, regional and national levels is of paramount importance to developing countries in the implementation of WIGOS. This is especially the case for the NMHSs of Least Developed Countries (LDCs) and Small Island Developing States (SIDS), to enable them to develop, improve and sustain national WIGOS component observing systems. This needs to be complemented by capacity development efforts outside of WIGOS but in closely related areas to improve access to and effective utilization of observations, data and products and related technologies. WIGOS capacity development activities at the Regional level are focused on:

- (a) Providing assistance to Members of the Region to introduce or improve institutional mandates and policies that enable effective implementation, operation and management of observing systems;

- (b) Filling the existing gaps in the design, operation and maintenance of WIGOS observing systems, including both infrastructure and human capacity development;
- (c) Providing guidance for the inclusion of metadata to OSCAR/Surface and efficient use of OSCAR/Surface
- (d) Technological innovation, technology transfer, technical assistance and decision support tools.

Capacity development in satellite applications for developing countries, LDCs and SIDS are also addressed in EGOS-IP (see WMO/TD-No. 1267). The virtual laboratory will continue to grow and help all WMO Members realize the benefits of satellite data.

2.10 Communications and outreach

The Region will establish its communications and outreach strategy through the efforts of WMO Members, programmes, regional associations (RAs) and technical commissions (TCs), and co-sponsors. The strategy will provide details on WIGOS benefits, increased effectiveness, and efficiency, and impact on the activities of the Members of the Region, as well as on the socio-economic benefits of WIGOS data. It will take advantage of outreach programmes developed and effectively deployed by WMO and its partner organizations within the Region.

The WIGOS portal provides convenient access to relevant information on regional communications, outreach and capacity development, aimed at complementing, not duplicating, others' efforts. A variety of outreach materials are being developed to educate Members, funding agencies, policy-makers and the general public about the importance of WIGOS to society. Materials will include posters and other educational material for elementary and high-school classes, a WIGOS brochure, a semi-annual or annual newsletter, an online photo and video library, and information on the current state of the observing systems.

A regular communication mechanism with WIGOS and OSCAR focal points is being established and maintained for the implementation and monitoring of WIGOS at a national level.

3. REGIONAL PROJECT MANAGEMENT

3.1 Regional structures

The Regional Association will be responsible for the Project through WG-TDI with support from the Regional Office for Europe. Members of the Region will be requested to provide support to the Regional Office through secondments.

3.2 Monitoring, review and reporting mechanism

- (a) The Regional Association, through its Management Group (MG), will monitor, review, guide and support the overall implementation of WIGOS in the Region, and update the Implementation Plan if and when necessary;
 - (b) The Regional Association, through the chair of WG-TDI, will report to ICG-WIGOS and WIGOS-PO on the progress in implementation of WIGOS in the Region;
 - (c) The President will report on WIGOS implementation to the RA's sessions.
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3.3 Evaluation

The evaluation methodology will be designed against WIGOS implementation activity tables, i.e. with respect to the activities, deliverables, timeline, responsibility and budget allocations. This will include a schedule of monitoring and evaluation activities and related responsibilities. Mid-term evaluation, interim progress reports and post-implementation reviews are planned as a means of providing early feedback on progress towards success and as a means of meeting accountability and transparency requirements for the whole implementation phase. The Members of the Region will provide progress reports at the request of RA Management Group.

4. IMPLEMENTATION

Activities, deliverables, milestones, costs and risks

Table 2 presents the key implementation activities that are required for Regional WIGOS implementation within the timeframe 2012-2015. The table is arranged to correspond to the activity areas presented in Chapter 2. In the table each implementation activity is presented together with its associated deliverables, timelines, responsibilities, costs and risk.

For each activity in Table 2, a detailed activity plan will be developed by the responsible entity or entities, with support of WG-TDI. WG-TDI and its Task team on WIGOS (TT-WIGOS) have responsibility for tracking execution of these activities and the plan itself.

5. RESOURCES

The both, human and monetary resources will be needed at the regional level for the implementation of many of the activities identified. As WIGOS will ultimately be implemented at the national level, the Members need to use their own resources as much as possible.

6. RISK ASSESSMENT/MANAGEMENT

The Risk Management Plan (RMP) will be developed for each implementation activity/project, including risk mitigation. The following risk areas have been identified:

- (a) Human Capacity within the NMHS and the Secretariat;
 - (b) Economic Resources;
 - (c) The ability of partner organizations to participate;
 - (d) Inability of Members to fully participate;
 - (e) Timeliness of guidance material.
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Table 2 WIGOS Implementation Activities

No.	Activity	Deliverables	Timeline	Responsibility	Potential risks
1.2.1	Regularly update R-WIP-VI	R-WIP-VI updated	2017-2021 updated as needed	Maintained by TT-WIGOS approved by WG-TDI & MG	
1.2.2	Maintain close links to CBS, CIMO, other relevant TCs and ICG-WIGOS to capture and react to evolving plans. Provide recommendations to the ICG-WIGOS	Updated R-WIP-VI and contribution to the WIP	2017-2021 Continuing	RA VI WG-TDI; RA VI representatives on TCs, RA-VI MG	
1.2.3	Report progress of R-WIP related projects to RA VI MG	Progress reports	2017-2021 Once per year	Coordinators of Projects: TT-WIGOS	
1.2.4	Assess EGOS-IP to identify actions relevant to RA VI and Member countries; assign priorities to these actions	Prioritized list of actions for RA VI and for Members arising from EGOS-IP	2017 onwards	Drafting by WG-TDI / TT-WIGOS (TBD) adoption by MG	
1.3.1	Assist Members to develop their N-WIPs	N-WIPs developed	2017 onwards	Members, TT-WIGOS WIGOS-PO	
1.3.2	RA VI Members to appoint National Focal Points (NFP) and submit reports on progress of implementation of N-WIPs	List of RA VI NFP published; N-WIPs updated	updates once per year	WIGOS-PO, ROE RA VI Members	
1.3.3	Facilitate establishing a Regional WIGOS Centre (RWC) for the Adriatic Sea area as a virtual centre, and refine the functionalities of this centre.	RWC in function	2017-2018	RA-MG; TT-WIGOS; ROE	
2.2.1	Identify and engage further potential partners for collaboration in the collection of observations on a regional scale. Clarify the target area(s) for collaboration and the mechanism for resolving governance issues.	Increased number of collaborating partners at a regional level and increased collection of observations.	2017-2021	WG-TDI; TT-WIGOS; ROE	
2.2.2	Investigate how to further develop storm surge prediction in the Mediterranean Sea in collaboration with MonGOOS, and by integrating local predictions such as those performed by the Istituzione Centro Previsioni e Segnalazioni Maree (Tidal Forecasting and Early Warning Center) (ICPSM) for the whole sub-region, and integrating observations and models, including multi-	Report of the investigation; Strengthened capacity of the Members	2017-2019	RA-MG; TT-WIGOS; ROE	

No.	Activity	Deliverables	Timeline	Responsibility	<i>Potential risks</i>
	model approaches;				
2.3.1	Encourage Member countries to identify and engage further potential partners in the collection of observations for WMO programs. Clarify the target area/s for collaboration and the mechanism for resolving governance issues.	Increased number of collaborating partners at a national level and increased collection of observations.	2017-2019	Encouragement by the President, with support of MG members, action by Members	
2.3.2	Collaborate with CIMO in developing a feedback mechanism to CIMO on the performance of instruments and systems in Region VI. Provide feedback regularly.	Meteorological observing systems are widely compliant with WMO regulations.	2017 onwards	WG-TDI; TT-RICs; Members provide feedback.	
3.2.1	Design and plan observing systems in the Region, taking into account: (i) The network design studies conducted and planned by the EUMETNET Observing Programme, and other relevant studies; (ii) Technical guidance of the TCs as represented in EGOS-IP and other observing system implementation plans; (iii) Need for applying WIGOS QM (see Key implementation activity 5) (iv) Need for “gap filling” and restoration of silent stations; and (v) Cross-regional coordination opportunities, such as Arctic HYCOS and GCW	Redesigned the Regional Observing Network.	2017-2019	Coordination by WG-TDI; TT-WIGOS, EUMETNET	
3.2.2	Validate user requirements documented by the global RRR process against regional user requirements; use the results to update the WMO RRR user requirements database and to contribute to the update of EGOS-IP and observing system plans	WMO observing systems are responsive to Regional user requirements.	2017-2019	WG-TDI; TT-WIGOS	
3.3.1	Evolve and implement national observing systems, taking into account: (i) Technical guidance of the technical commissions as represented in EGOS-IP and other observing system implementation plans;	Improved WMO observing systems in the Region	2017 onwards	Members	

No.	Activity	Deliverables	Timeline	Responsibility	<i>Potential risks</i>
	(ii) Regional priorities adopted by MG; (iii) Need for applying WIGOS QM (see Key implementation activity 5) (iv) Need for “gap filling” and restoration of silent stations				
3.3.2	Validate user requirements documented by the global RRR process against national user requirements for WMO systems; use the results to update the WMO RRR user requirements database and to contribute to the update of EGOS-IP and observing system plans	WMO observing systems are responsive to national user requirements for WMO systems	2017-2019	Members	
3.3.3	Migrate from the existing RBSN/RBCN into an integrated RBON	RBONs designed and adopted by RAs	2017 onwards	RAs, Members	
3.3.4	Define sub-Regional user requirements for observations	Updated RRR database (OSCAR)	2017-2018	Members	
3.3.5	Prepare a proposal for radar data exchange in RA VI (considering and utilizing from the existing sub-regional networks such as OPERA, NordRad, Baltrad)	Proposal submitted for review and approval	2017-2018	WG-TDI;TT-WIGOS; ROE	
3.3.6	Prepare a proposal for RBON concept to be submitted to RA-VI MG	Proposal submitted for review and approval	2017-2018	WG-TDI;TT-WIGOS; ROE	
4.2.1	Develop real-time monitoring and reporting capability to support operations; possibly using existing EUMETNET EUCOS monitoring Portal	A plan for real-time monitoring and reporting implemented Implementation of the plan	2017-2018	Relevant Members; EUMETNET and TT-WIGOS	
4.2.2	Consider setting up a project based on the experiences from the existing applications to deliver and share monitoring systems, software and tools to those not having such facilities (e.g. for real time monitoring of the status of the network, following and carrying out the maintenance and calibration activities, and managing the spare part inventory).	A project is under execution for monitoring of the observing network	2017-2021	WG-TDI;TT-WIGOS; ROE	
4.3.1	Collect and share best practices from Members with other Regions	Documented best practices of the Region on the WMO	2017 and onwards	Members, ROE	

No.	Activity	Deliverables	Timeline	Responsibility	<i>Potential risks</i>
		website			
5.2.1	Implement the real-time quality monitoring of basic surface variables (temperature, pressure, humidity, wind and precipitation) using the existing systems, such as EUMETNET/EUCOS QM portal	Extended quality monitoring implemented	2017 onwards	WG-TDI and TT-WIGOS in collaboration with ECMWF and other relevant NWP centres	
5.2.2	Consider implementation of real-time quality monitoring of data from various remote sensing instruments/systems	Decision on implementing of real-time quality monitoring of data from various remote sensing instruments/systems	2017-2019	WG-TDI and TT-WIGOS QM	
5.2.3	Improve collaboration among the RICs, and RICs and Members	Inter-Laboratory Calibration regularly conducted	2017 onwards	TT-RIC	
5.2.4	Assist Members to implement required calibration and maintenance practices and procedures.	Survey of current calibration capabilities of Members; Trainings conducted; On-site assistance provided	2017-2019	TT-RIC	
5.2.5	Combine technological knowledge to help Members in the maintenance and calibration of the surface-based remote-sensing systems	International team of experts set-up to assist Members	2017 and onwards	WG-TDI; TT-WIGOS	
5.3.1	Obtain as far as possible ISO/IEC 17025 accreditation for calibration laboratories.	Increased accredited calibration laboratories of Members	2017 and onwards	Members' national calibration laboratories	
6.3.1	Implement the WMO Siting Classification Scheme through: <ul style="list-style-type: none"> • Provision of information and training to Members, • Adoption of new procedures by Members, • A tool to classify the sites 	WMO Siting Classification Scheme is implemented in the Region	2017-2018	Members	

No.	Activity	Deliverables	Timeline	Responsibility	<i>Potential risks</i>
6.3.2	Develop a process to monitor and report on the level of regional compliance with WIGOS standards	A process is developed and implemented; Report on the level of compliance of Members' with WIGOS related standards is provided	2017 and onwards	WG-TDI and TT-WIGOS to develop a process; Members to report	
6.3.3	Collect the metadata on all observing stations according to a standard to be developed by ICG-WIGOS.	WIGOS metadata on all observing stations is collected	2017 and onwards	Members	
6.3.4	Radar data integration through the existing mechanism, i.e., OPERA, and based on existing practices adopted by OPERA	Increased number of radars integrated into the OPERA; Harmonization of sub-regional radar networks based on OPERA practices	2017 and onwards	TT -WIGOS; Members	
6.3.5	Wind profiler data integration through the existing mechanism, i.e., WINPROF, and based on existing practices adopted by WINPROF.	Increased number of WP integrated into the WINPROF	2017 and onwards	TT-WIGOS; Members	
7.3.1	Request, support and encourage Members to provide up-to-date data and metadata to the WIR and ensure its on-going maintenance	Up-to-date metadata maintained at WMO	2017 and onwards	WG-TDI and TT-WIGOS to request and support; Members to provide metadata	
8.2.1	Develop a standard for representation and format of hydrological data	A standard for representation and format of hydrological data developed	2017-2018	WG-TDI in collaboration with RA VI Hydrological advisor under the guidance of CHy	
8.2.2	Foster increased exchange of observational data and discovery metadata using WIS in the Region, through awareness raising and provision of guidance for the adoption of WIS standards, including implementation of DCPC and NCs	Increased provision of "discovery metadata" and the accessibility of data through the WIS	2017 and onwards	WG-TDI	

No.	Activity	Deliverables	Timeline	Responsibility	<i>Potential risks</i>
8.2.3	Consideration of the approaches for enhancing the integration and qualification of marine meteorological and oceanographic data (e.g., if not exchanged in real-time) and the harmonization of best practices;	Developed concepts for integration of marine data	2017-2018	TT-WIGOS	
8.3.1	Expedite the implementation of WIS-IP	Regular monitoring reports are available	2017 and onwards	Members; WG-TDI	
8.3.2	Members to share data via WIS, including data from national organizations other than NMHSs	New sources of data are available though WIS	2017 and onwards	Members; WG-TDI	

No.	Activity	Deliverables	Timeline	Responsibility	<i>Potential risks</i>
9.2.1	Assist Member countries to fill gaps (both infrastructure and human capacities) in their WIGOS observing systems	Gaps in the WIGOS observing systems of Member countries are identified and filled	2017-2019	WG-TDI; TT-WIGOS; ROE; WIGOS-PO	
9.2.2	Creating a regional Capacity Development Plan, addressing identified needs for: <ul style="list-style-type: none"> • radar data analysis and transfer; • improving availability and utilization of AMDAR data; • improving availability and utilization of high resolution radiosonde data; • improving the utilization of marine data; • Improved availability of lidar measurements for aerosol and volcanic ash 	Regional Capacity Development Plan developed and agreed by MG	2017 and onwards	WG-TDI; ROE; WIGOS-PO; Members	
9.3.1	Review the regional and national technical training requirement to identify gaps and develop training opportunities such as for: <ul style="list-style-type: none"> • Network design • QA/QC procedures; • Maintenance of instruments; • National calibration 	A regional training plan to fill the gaps is developed and agreed by the MG	2017 and onwards	Members to propose; WG-TDI in collaboration with ROE, RAVI-MG and ETR Division	
9.3.2	Assist Members in using WIR Tools for the design and management of national WIGOS networks	Initial steps taken to improve design on national networks	2017 onwards	WG-TDI in collaboration with ICG-WIGOS WMO Members	
9.3.3	Assist Members in implementing	Tools and procedures available to assist Members	2017 onwards	WMO Secretariat, WG-TDI and	

No.	Activity	Deliverables	Timeline	Responsibility	<i>Potential risks</i>
	WIGOS metadata	in providing the WIGOS metadata		Members	
10.2.1	Contribute to WIGOS communication and outreach across the Region by: <ul style="list-style-type: none"> • Responding to the role defined in the ICG-WIGOS communication strategy; • Utilizing material provided by WIGOS-PO to raise awareness and commitment to WIGOS in the Region 	Effective communication and outreach for WIGOS across the Region	2017 onwards	WG-TDI; TT-WIGOS; WIGOS-PO	
10.3.1	Contribute to WIGOS communication and outreach within Member Countries by: <ul style="list-style-type: none"> • Responding to the role defined in the ICG-WIGOS communication strategy; • Utilizing material provided by WIGOS-PO and Members to raise awareness and commitment to WIGOS in the Member Countries 	Effective communication and outreach for WIGOS within Member countries	2017 onwards	Members, PWS	

LIST OF ACRONYMS

CEOS	Committee on Earth Observation Satellites
CGMS	Coordination Group for Meteorological Satellites
CONOPS	Concept of Operations
DAR	Discovery, Access and Retrieval
DB	Database
DCPC	Data Collection or Production Centre (of WIS)
DRR	Disaster Risk Reduction
ET	Expert Team (of WMO Technical Commission)
FAO	Food and Agriculture Organization of United Nations
GAW	Global Atmosphere Watch
GCOS	Global Climate Observing System
GCW	Global Cryosphere Watch
GEO	Group on Earth Observations
GEOSS	Global Earth Observation System of Systems
GISC	Global Information System Centre (of WIS)
GFCS	Global Framework for Climate Services
GOOS	Global Ocean Observing System
GTOS	Global Terrestrial Observing System
ICG-WIGOS	Inter-Commission Coordination Group on WIGOS
ICPC	Interagency Coordination and Planning Committee for Earth Observations
ICSU	International Council for Science
IOC	Intergovernmental Oceanographic Commission
ISO	International Organization of Standardization
ITU	International Telecommunication Union
LDCs	Least Developed Countries
MOU	Memorandum of Understanding
NMHS	National Meteorological and Hydrological Service
NOS	National Observing System
OSEs	Observing Systems Experiments
OSCAR	WIGOS Observing Systems Capabilities Analysis and Review tool
OSSEs	Observing System Simulation Experiments
QA	Quality Assurance
QC	Quality Control

QMF	Quality Management Framework
QMS	Quality Management System
RA	Regional Association
RCC	Regional Climate Centre
RIC	Regional Instrument Centre
RMIC	Regional Marine Instrument Centre
RRR	Rolling Review of Requirements
SIDS	Small Island Developing States
SoG	Statement of Guidance
SORT	“Standardization of Observations” Reference Tool (of WIGOS)
SLA	Service Level Agreement
TC	Technical Commission
TOR	Terms of Reference
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WCRP	World Climate Research Programme
WIGOS	WMO Integrated Global Observing System
WIP	WIGOS framework Implementation Plan
WIR	WIGOS Information Resource
WIS	WMO Information System
WHYCOS	World Hydrological Cycle Observation System
WWW	World Weather Watch
