WIGOS AND THE CO-SPONSORED OBSERVING SYSTEMS
(GOOS, GTOS, GCOS)

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ABSTRACT

In addition to ensuring the availability of all needed information from the various World Meteorological Organization (WMO) sponsored observing systems, the WMO Integrated Global Observing System (WIGOS) is aimed at enhancing access to observations from other global observing systems such as the domain-based Global Ocean Observing System (GOOS) and Global Terrestrial Observing System (GTOS) and the cross-domain Global Climate Observing System (GCOS) which WMO co-sponsors with a number of other international organisations including the Intergovernmental Oceanographic Commission (IOC) of UNESCO, the United Nations Environment Programme (UNEP), the Food and Agriculture Organization (FAO) and the non-governmental International Council for Science (ICSU). One of the important challenges, therefore, in the planning and implementation of WIGOS is to ensure that the broader governance frameworks that have been put in place for these co-sponsored systems are respected, sustained and strengthened. Both the co-sponsoring organisations and the co-sponsored observing systems have been represented in the WIGOS planning and development of the draft WIGOS Concept of Operations (CONOPS) but the allocation of roles and responsibilities amongst those responsible for the various systems is complex and not always well understood. This creates the risk of unproductive overlap, misunderstanding and competition, rather than mutual support, amongst the various sponsoring organisations and observing systems. While the WIGOS concept is still evolving, it appears that, when fully developed, it will provide a sound basis for clear delineation of responsibility, effective communication and mutual support. It will be important, however, in the further elaboration of the WIGOS concept, to remain alert to the perspectives and interests of WMO’s partner organisations and their joint subsidiary bodies who have been assigned responsibility for the co-sponsored observing systems in order to ensure that all the necessary understandings are put in place. It will be especially important that those international understandings be reflected downwards to the national level to ensure that the implementation of WIGOS in individual countries is carried out with due regard to the established mechanisms and activities through which the various national organisations contribute to implementation of the important co-sponsored global observing systems within the emerging overall framework of the Global Earth Observation System of Systems (GEOSS).

* Representing the GOOS, GTOS and GCOS Steering Committees and Secretariats.
1 Introduction

Among the many important developments in earth system science and services in the final decades of the 20th Century was the growing commitment to a more integrated cross-domain (ocean, atmosphere, land) approach to environmental observation, data management, research, modelling and service provision (Winchester Group, 1991; Obasi, 2003; Zillman, 1997, 2008)

The decision of the 2007 Fifteenth World Meteorological Congress, on the advice of a WMO (World Meteorological Organization) Executive Council Task Team, to embark on enhancing the integration between the WMO observing systems (WMO, 2007) provided a powerful reinforcement of this trend and an important step towards more efficient use of observational resources and better co-ordinated observational support for essentially all WMO research and services programs.

The Congress recognised, however, that proceeding with increased integration of WMO observing systems in a way that would also ensure the availability of essential information provided by observing systems which WMO co-sponsors with other organisations would make it necessary to ensure that broader governance frameworks (eg inter-agency co-sponsorship of systems) and relationships with other international initiatives are respected, sustained and strengthened. The Congress noted, in particular, that “Effective and constructive co-ordination and collaboration with co-sponsoring and co-operating organisations is a sensitive issue that must be carefully undertaken to avoid misunderstandings” (WMO, 2007).

The subsequent decision of the Executive Council (EC) to progress the Congress initiative, in conjunction with the WMO Information System (WIS), as the ‘WMO Integrated Global Observing System(s)’ (WIGOS) through a WMO EC Working Group on the WIGOS and WIS provided an effective framework for integration of WMO activities but raised some complex issues and potential concerns relating to the extent to which WIGOS should embrace activities beyond the strictly WMO components of the global observing systems which WMO co-sponsors with UNESCO and its Intergovernmental Oceanographic Commission (IOC), the United Nations Environment Programme (UNEP), the Food and Agriculture Organization of the United Nations (FAO) and the non-governmental International Council for Science (ICSU); the three main such co-sponsored observing systems being the domain-based:

- Global Ocean Observing System (GOOS); and
- Global Terrestrial Observing System (GTOS);

and the cross-domain system of climate-related components of the domain-based systems known as the Global Climate Observing System (GCOS).

The WMO addressed these potential concerns by inviting representatives of its main observing system partners (IOC, UNEP, ICSU, FAO) and of the co-sponsored observing systems (GOOS, GTOS, GCOS) to participate in the work of the EC Working Group and/or its WIGOS-specific sub-group (WMO, 2008). Their input has been important, so far, in ensuring that the evolving design of WIGOS is sensitive to the needs and responsibilities of the other agencies and systems. The latest (November 2008) definition
of the WIGOS ‘Concept of Operations’ (CONOPS) broadly reflects their input but leaves many conceptual and practical details still to be resolved.

It will be important, therefore, in proceeding with the further elaboration of the WIGOS concept, to recognise that its eventual success will depend not just on effective integration of WMO observing systems but also on:

- The effectiveness of the WMO interaction with its observing system partner organisations in respect of the contribution of their systems to WIGOS; and, in particular,
- The development of clear understandings between those in WMO responsible for WIGOS and those in the joint Scientific/Steering Committees and Secretariats responsible for both the domain-based GOOS and GTOS and the cross-domain GCOS.

While it will be important that these understandings be put in place at the international agency and program level to ensure that all the UN system organisations (and ICSU) are working as one on earth observations (including in their contribution to the Global Earth Observation System of Systems (GEOSS) (GEO, 2005; Zillman, 2005) and the ‘Climate Knowledge’ initiative of ‘The UN System Delivering as One’ (Chief Executives Board, 2008)), it will be especially important that similar understandings be translated down to the inter-agency level in individual countries to ensure that the implementation of the various international observing systems is effectively co-ordinated and harmonised at the national level.

To assist in understanding the complex but important inter-relationships and overlap between WIGOS and the co-sponsored observing systems, it is useful to view these in terms of the space they occupy in a matrix of the observing system domains (ocean, atmosphere, land) and the key components (observations, data management, research, modelling, service provision and application) of an integrated ‘end-to-end’ environmental science service system (Figure 1).

![Figure 1](image.jpg)  
*Figure 1  A schematic representation of the underpinning role of observations in an integrated cross-domain ‘end-to-end’ (ie in this representation, bottom to top) environmental science service system.*
2 The WMO Global Observing Systems

The key WMO-sponsored global observing systems which will be integrated into WIGOS and the intergovernmental WMO technical commissions through which they are planned and implemented are (Figure 2):

- The Global Observing System (GOS) of the World Weather Watch which is planned and co-ordinated through the Commission for Basic Systems (CBS);
- The Global Atmosphere Watch (GAW) which is planned and co-ordinated through the Commission for Atmospheric Sciences (CAS); and
- The World Hydrological Cycle Observing System (WHYCOS) which is planned and co-ordinated through the Commission for Hydrology (CHy).

These systems, and especially the GOS, have a long history of co-ordinated international planning (Obasi, 2003) and implementation at the national level through the work of the individual National Meteorological and Hydrological Services (NMHSs) of the (now) 188 Member States and Territories of WMO. Though primarily focussed on the atmosphere and the terrestrial components of the hydrological cycle, they provide the core of the integrated cross-domain observations layer in Figure 1.

![Diagram showing the three main global observing systems sponsored by WMO and the intergovernmental technical commissions through which they are planned, co-ordinated and implemented. These are located in the ‘Atmosphere’ and ‘Land’ domains of the ‘Observations’ layer of Figure 1 with the WMO Information System (WIS) occupying the corresponding part of the ‘Data Management’ layer immediately above.](image-url)
The WMO Integrated Global Observing System (WIGOS)

The WIGOS concept is still evolving but, for purposes of consideration of its relationship with the co-sponsored observing systems, its essential elements, as set down in the November 2008 draft of its ‘Concept of Operations’ (CONOPS) document (WMO, 2008), may be summarised in terms of its:

- Purpose;
- Objectives and aims;
- Areas of standardisation;
- Components; and
- Data policy.

The stated purpose of WIGOS is to create an organisational, programmatic and procedural and governance structure that will significantly improve the availability of observational data and products and which will provide a single focus for the operational and management functions of all WMO observing systems as well as a mechanism for interactions with WMO co-sponsored observing systems. Integration, it is asserted, will lead to efficiencies and cost savings that can be reinvested to overcome known deficiencies and gaps in the present structure and working arrangements.

According to the draft CONOPS document, the integration process should encompass four broad objectives, two of which (its para 1.4(a) and (c)) bear directly on the co-sponsored observing systems as follows:

- Addressing the needs of the atmospheric, hydrologic, oceanographic, cryospheric and terrestrial domains within the operational scope of a comprehensive integrated system; and
- Ensuring that broader governance frameworks (eg interagency co-sponsorship of systems) and relationships with other international entities are sustained and strengthened.

The draft CONOPS also indicates (paras 2.1(b) and (c)) that WIGOS is aiming to:

- Ensure the availability of all required information produced within the various WMO observing systems (eg GOS, GAW, WHYCOS etc) and WMO components of co-sponsored systems (eg GCOS, GOOS, GTOS etc) including emphasis on information generated by satellite, radar, wind-profilers, airborne systems, in situ ocean platforms and other next generation observing system; and
- Facilitate the access, in real/near real time and delayed mode of observations required for WMO and WMO co-sponsored programs as well as relevant international conventions which are generated by systems implemented and managed by co-operating agencies, organisations and programs.

The draft CONOPS identifies three ‘Areas of Standardisation’ (earlier referred to as ‘Levels of Integration’) as follows:

- Standardisation of instruments and methods of observation;
- WIS information infrastructure; and
- End-product quality assurance.
In identifying the components of WIGOS, in addition to the GOS, GAW, WHYCOS and other WMO program specific observing networks, the draft CONOPS (para 5.2) lists;

- Marine meteorological and relevant oceanographic observing networks (d);
- The relevant components of atmospheric, oceanographic and terrestrial observing systems contributing to GCOS (e);
- Related terrestrial networks (f); and
- Regional, river basin and global hydrological networks.

In respect of data policy, the draft CONOPS (para 6) importantly states that ‘WIGOS will respect the data policies of partner organisations…..’

The planning and further development of WIGOS is proceeding via a series of Pilot Projects and Demonstration Projects, several of which involve, or are expected to involve, WMO’s partner organisations and co-sponsored observing systems.

It is thus clear that the successful implementation of WIGOS, as presently envisaged, will depend heavily on achieving effective co-operation and co-ordination between WMO and its partner agencies and programs on observing matters and, in particular, on establishment of appropriate working relations between those responsible for WIGOS and those responsible for the three main co-sponsored global observing systems.

4 The Observing System Co-sponsoring Organisations

It is important, at the outset, to clearly recognise the earth observation roles and responsibilities of the key international organisations which co-sponsor global observing systems with WMO and, hence, who have a direct interest in the arrangements through which WMO involves those observing systems in the implementation of WIGOS. As indicated above, the five key partner organisations are:

- The United Nations Educational Scientific and Cultural Organization (UNESCO);
- The Intergovernmental Oceanographic Commission (IOC) of UNESCO;
- The Food and Agriculture Organization (FAO) of the United Nations;
- The United Nations Environment Programme (UNEP); and
- The non-governmental International Council for Science (ICSU).

UNESCO is responsible for a number of earth observation programs and systems, both directly and through the IOC, and carries complementary international responsibilities to WMO in hydrology. Most recently, it has been assigned joint ‘convening’ responsibility with WMO for the ‘Climate Knowledge’, (science, assessment, monitoring and early warning) component of the ‘UN System Delivering as One’ initiative. (Chief Executives Board, 2008).

The IOC is responsible for a number of ocean observation and information programs including the International Oceanographic Data and Information Exchange (IODE) and the IOC-led, but jointly sponsored, Global Ocean Observing System (GOOS). The IOC carries a broad UN System mandate for ocean science and services, with responsibilities for the ocean somewhat akin to those of WMO for the atmosphere. While historically established as an intergovernmental co-ordination mechanism for ocean research, the IOC role has been broadened over time to encompass operational data collection (initially
through the Integrated Global Ocean Station System (IGOSS) which was further extended (without change of acronym) to ocean service provision as the Integrated Global Ocean Services System and, subsequently, operational oceanography more generally, through GOOS.

The FAO carries a wide range of operational observational and data management responsibilities including many which overlap significantly with WMO programs but also many which extend well beyond the domain of interest of WMO. It has emerged as the lead UN system organisation for terrestrial observations (Sessa, 2008; Sessa and Dolman, 2008) and the lead sponsor for the Global Terrestrial Observing System (GTOS).

UNEP sponsors many global and regional observational and data collection programs and systems for the oceans, land and atmosphere as well as a range of socio-economic and other variables of importance for environmental policy and management purposes. In 1974 it initiated the overarching GEMS (Global Environmental Monitoring System) framework (Maunnder, 1992; Munn et al, 1996) and, led the initial development of the GTOS concept. It has wide-ranging interests in both the collection and application of many of the same environmental variables as are encompassed within the various WMO observing programs.

ICSU has a major interest in all aspects of earth observation for the purposes of scientific research including through its International Geosphere-Biosphere Programme (IGBP) and the co-sponsored IHDP (International Human Dimensions Programme) and DIVERSITAS as well as through its co-sponsorship of GOOS, GTOS and GCOS (ICSU, 2006).

5 The Co-sponsored Observing Systems

While WMO maintains a substantial number of co-sponsorship arrangements with other international organisations, its primary focus in seeking to ensure the successful implementation of WIGOS will be on achieving mutually supportive working relations between the planning and implementation bodies responsible for WIGOS and those responsible for the global observing systems for the three physical domains of the earth system as follows:

- The WMO Global Observing System (GOS) and Global Atmosphere Watch (GAW) for the atmosphere;
- The IOC-led Global Ocean Observing System (GOOS) for the ocean; and
- The FAO-led Global Terrestrial Observing System (GTOS) for land (especially the terrestrial biosphere and cryosphere) and surface water;

as well as the cross-cutting Global Climate Observing System (GCOS) and the observing components of other cross-cutting programs such as the WMO-IOC-ICSU World Climate Research Programme (WCRP).

Since the WIGOS relationship to GOS and GAW is totally internal to WMO and the main observation functions of the WCRP and other members of the Earth System Science Partnership (ESSP) are largely reflected in the research components of the domain-based observing systems, the primary concern here is with the relationship between WIGOS and the three main co-sponsored global observing systems (Figure 3): viz:
• The IOC-WMO-UNEP-ICSU **GOOS**;
• The FAO-UNEOP-WMO-UNESCO-ICSU **GTOS**; and
• The WMO-IOC-UNEP-ICSU **GCOS**.

![Diagram of co-sponsorship arrangements for GOOS, GTOS, and GCOS]

**Figure 3** The co-sponsorship arrangements for the domain-based Global Ocean Observing System (GOOS) and Global Terrestrial Observing System (GTOS) and the cross-domain Global Climate Observing System (GCOS). The lead responsibility among the co-sponsors is shown as a heavier line in each case. The atmospheric observing systems (GOS and GAW) which, in the cross-domain framework of Figure 1, occupy the space between GOOS and GTOS and are internal to WMO, are not shown.

6 **The Global Ocean Observing System (GOOS)**

GOOS is led by the IOC with co-sponsorship (and lead responsibility for some of its components) from WMO, UNEP and ICSU.

The mission of GOOS is to build a permanent and sustained global ocean observing system covering deep ocean basins, coasts and estuaries for observations and modelling leading to the provision of information and services (Koblinsky and Smith, 2001; Alverson, 2007; Baker et al, 2007).

The overall scientific design of GOOS is the responsibility of the GOOS Scientific Steering Committee (GSSC) and the intergovernmental policy framework is set by the Intergovernmental Committee for GOOS (I-GOOS). The planning and implementation of GOOS is currently proceeding within the framework of two modules:
• Coastal GOOS for which lead responsibility lies with the GSSC Panel on Integrated Coastal Observations (PICO);
• Open Ocean GOOS for which the lead responsibility for planning lies with the joint GOOS-GCOS-WCRP Ocean Observations Panel for Climate (OOPC) and the lead responsibility for implementation resides with the joint IOC-WMO JCOMM (Joint Technical Commission for Oceanography and Marine Meteorology). The open ocean (climate) module of GOOS is made up of a number of separately managed in situ and spaced-based observing systems including:
  - The Global Sea Level Observing System (GLOSS);
  - Moored and drifting buoy networks such as the TOGA TAO Array;
  - The Argo float array;
  - The Voluntary Observing Ships (VOS) system; and
  - Various satellite altimetry and other remote sensing missions.

7 The Global Terrestrial Observing System (GTOS)

GTOS is led by the FAO with co-sponsorship (and lead responsibility for some of its components) from UNEP, WMO, UNESCO and ICSU.

The central mission of GTOS is to provide policy-makers, resource managers and researchers with access to the data they need to detect, quantify, locate, understand and warn of change (especially reductions) in the capacity of the terrestrial ecosystems to support sustainable development. Since its establishment, GTOS has been working to improve the quality, the coverage and accessibility of terrestrial ecosystem data (Sessa, 2008).

The overall scientific design of GTOS is the responsibility of the GTOS Steering Committee (GTOS SC). It is developing activities that focus on five issues of global concern:
• Change in land quality;
• Availability of fresh water resources;
• Loss of biodiversity;
• Climate change; and
• Pollution and toxicity.

GTOS is being implemented through a series of technical panels, programme activities and collaborative arrangements including a set of ‘Global Terrestrial Networks’ (GTN) under a range of individual and joint sponsors and including a number of existing hydrological and other observing systems operated by the co-sponsors. The set of GTNs includes:
• GTN-G Global Terrestrial Network for Glaciers;
• GTN-H Global Terrestrial Network for Hydrology;
• GTN-L Global Terrestrial Network for Lakes;
• GTN-P Global Terrestrial Network for Permafrost;
• GTN-R Global Terrestrial Network for Rivers; and
• GTN-SM Global Terrestrial Network for Soil Moisture.
The Global Climate Observing System (GCOS)

GCOS is a cross-cutting ‘system of climate-relevant components of observing systems’ (GCOS, 1995; 2007; Sommeria et al, 2007) which is formally co-sponsored by WMO, IOC, UNEP, and ICSU and also, in a de-facto sense, by FAO and the Subsidiary Body for Scientific and Technological Advice (SBSTA) of the UN Framework Convention on Climate Change (UNFCCC). It is recognised by the domain-based observing system co-sponsors (WMO, IOC, UNEP, UNESCO, FAO, ICSU) as the overarching climate observing framework for purposes of their interaction with the UNFCCC and by the intergovernmental Group on Earth Observations (GEO) as the climate observing component of the Global Earth Observation System of Systems (GEOSS).

The goal of GCOS is to provide comprehensive information on the total climate system, involving a multidisciplinary range of physical, chemical and biological properties, and atmospheric, oceanic, hydrologic, cryospheric and terrestrial processes.

The overall scientific design of GCOS and the primary source of advice to its sponsors and implementing organisations is provided by the GCOS Steering Committee (GCOS SC) with the support of three climate-focussed domain-based panels as follows:

- AOPC  Atmospheric Observation panel for Climate;
- OOPC  Ocean Observations Panel for Climate; and
- TOPC  Terrestrial Observation Panel for Climate;

each of which is co-sponsored by the World Climate Research Programme (WCRP) and, in the case of OOPC and TOPC, also by the lead mechanism for the relevant domain-based observing system (ie GOOS and GTOS respectively).

Thus, unlike the main domain-based global observing systems (GOS/GAW for the atmosphere, GOOS for the ocean and GTOS for the land), which are intended to provide a comprehensive global observing framework for their respective domains, GCOS consists of only the climate-relevant components of the established global observing systems but it is fully cross-cutting across the three domains. It is, in effect, the integrating framework through which the domain-based observing systems meet the total national and international need for earth observations for climate purposes.

An Integrated View of the GOS/GAW/GOOS/GTOS/WIGOS/GCOS Relationship

In order to ensure the successful implementation of WIGOS, including its effective mutual support for the domain-based GOOS and GTOS and its role in ensuring a co-ordinated WMO contribution to GCOS and the still-wider-ranging GEOSS, it will be essential that all those responsible for the various systems clearly understand how they fit together and who should be taking the lead role on what.

This is most easily understood graphically via a Venn diagram representation of each observing system in the cross-domain representation of the total observing field of activity shown in Figure 1. In such a representation (Figure 4):
• GCOS encompasses (only) the climate relevant components of GOS/GAW, GOOS and GTOS but, in so doing, includes parts of GOOS and GTOS that do not fall within the scope of WIGOS;
• WIGOS encompasses all of GOS, GAW and the WMO contributions to GOOS and GTOS (including, for example, the hydrological networks of GTN-H and WHYCOS) but does not include the climate-related functions of GOOS and GTOS that are not part of WMO programs.

Figure 4 addresses only the ‘big picture’ aspects of the relationship between the main observing systems. At this stage, management of the various interfaces and overlaps is handled mainly through cross-representation in the various planning and co-ordination bodies (GCOS SC, GSSC, GTOS SC, AOPC, OOPC, TOPC, JCOMM, PICO, EC-WG/WIGOS-WIS, I-GOOS etc) and through inter-Secretariat liaison. The co-ordination is especially facilitated at the Secretariat level by a WMO-UNESCO-IOC-FAO-UNEP-ICSU ‘Interagency Coordination and Planning Committee for Earth Observations’ (ICPC).

Figure 4. The relative coverage of the domain-based global observing systems (GOS/GAW for the atmosphere, GOOS for the ocean and GTOS (including WHYCOS) for the terrestrial domain), the WIGOS envelope of WMO observing systems and the cross-domain GCOS. Note that GCOS embraces only the climate-relevant components of the domain-based observing systems but includes parts of GOOS and GTOS that are not part of WIGOS. In this representation, GEOSS occupies the entire observing system space and thus includes all of the areas covered by GOOS, GTOS, GCOS and WIGOS. The extent to which the various ‘observing systems’ are regarded as extending into the data management and other layers above (cf. Figure 1) varies from system to system.
10 The Larger Framework of GEOSS

It is helpful to understanding of the relationship among the various observing systems, to use the same cross-domain observing space to map the still larger coverage of GEOSS (GEO, 2005; Zillman, 2005). While GEOSS is usually presented in terms of the nine Societal Benefit Areas (SBAs) which it is designed to serve, its actual observing functions relate primarily to the same three earth system domains (atmosphere, ocean, land) as were used to map the coverage of GOS, GAW, GOOS, WHYCOS, GTOS, GCOS and WIGOS in Figure 4.

In this view of the total observing system space, GEOSS thus occupies the entire area covered by all the above observing systems along with the additional space occupied by observing systems that are being built into GEOSS but are not part of the established WMO-UNESCO-IOC-UNEP-FAO-ICSU-sponsored global observing systems.

11 Implications at the National Level

The perspective on the various observing systems and how they fit together, presented here, is offered as an aid to communication, co-operation and co-ordination amongst the key players at the international agency and international program level.

It is critically important, however, to recognise the implications of the WIGOS concept for National Meteorological Services (Zillman, 1999) and the various other national agencies who are charged with national implementation of the individual observing networks and systems which collectively make up the established global observing systems.

It is suggested, therefore, that there is an urgent need, once the overall concept of operation of WIGOS has been finalised, for establishment of appropriate national observation co-ordination mechanisms, embracing the existing GEOSS and GCOS National Co-ordinators and the like, to ensure that agreed international communication and co-operation arrangements are appropriately reflected downward to the inter-agency level in individual countries.

It will be especially important for the National Meteorological Services (NMSs) of WMO Member countries to work with their colleague National Hydrological Services (NHSs) and National Ocean Services (NOSs), where they exist, to develop a co-ordinated framework for integrated earth observation at the national level within the overall framework of GEOSS. In some countries, this might even serve as the first key step towards an eventual integrated environmental observation, research and service system embracing the full range of activities shown in Figure 1 (Hallgren, 1971; Zillman, 2008).

12 The Role of WIGOS Pilot and Demonstration Projects

So far, four WIGOS pilot projects have been initiated or canvassed which directly involve the co-sponsored observing systems:
The Hydrological Applications Runoff Network (HARON). This project (Pilot Project II) is in the area of overlapping interest of the WMO Commission for Hydrology and both GTOS and GCOS;

JCOMM Pilot Project. This project (Pilot Project V), which appears to be the most advanced of the pilot projects established so far, falls in the area of joint responsibility of WMO and IOC and, in turn, of the GOS and GOOS. The extent to which it will contribute to enhanced implementation of the cross-domain GCOS has yet to become clear.

GRUAN. The WMO Commission for Basic Systems (CBS), through its Integrated Observing Systems activities, has suggested that the GCOS Reference Upper Air Network (GRUAN) should be identified as a WIGOS Pilot Project;

Integration of terrestrial carbon observing networks and other terrestrial networks into WIGOS. This has been canvassed as a WIGOS Pilot Project but has not yet been formalised.

Of even more importance to the Co-sponsored Observing Systems will be the WIGOS Demonstration Projects, since these face the challenge of reflecting and respecting the many important relationships canvassed above. It is too early to assess progress at this stage.

13 Conclusion

The external (to WMO) sponsors of the various co-sponsored global observing systems and those responsible for the planning and implementation of these systems appear to have generally welcomed the WIGOS initiative, including both the prospect of better integrated WMO observing systems and the opportunities so provided for common standards, greater inter-operability and increased synergies across all the global observing systems.

They are conscious, however, of the complexity of the communication and co-ordination arrangements that must be put in place amongst all the key players, both international and national, if the WIGOS initiative is to succeed and add value to the total international observing system arrangements as well as to WMO. They strongly endorse the stated intention in the WIGOS planning documents to work carefully and sensitively with those responsible for GOOS, GTOS and GCOS.

14 References


