World Meteorological Organization

WMO Integrated Global Observing System
WIGOS NEWSLETTER

October 2016

Volume 2, Number 4

Contents

Contacts:

WIGOS Webpage

WIGOS Newsletter email

1. From the President of the Commission for Atmospheric Sciences (CAS), Øystein Hov

Observations in research and operations. A word from CAS:

The gap between research and operations is being reduced or disappears altogether as new services steadily evolve from the results of research and development.
Traditionally, the National Meteorological and Hydrological Services (NMHSs) focus on national weather information needs for the next few days, and are in charge of the national weather observation system. International observations come via the WMO Global Telecommunication Systems (GTS).
Meteorology is developing towards an earth system approach to better understand and describe the elements that contribute to the predictability of weather and climate. The boundaries between the atmosphere, ocean, ice, fresh water, terrestrial ecosystems, and biogeochemical cycles including their modification driven by man, need to be treated in an explicit and open way rather than as closed barriers or with just simple parameterizations of the boundary conditions.
The evolution from disciplinary systems to an earth system approach demands a close interaction between Research & Development and operations. And it demands closer interactions across institutional boundaries, between the NMHSs, across to academia, and to sector institutions in hydrology, marine research, ice and snow research, and to biogeochemical cycles research.
Observations from many disciplines are required to advance forecasting and analysis capability of the earth system elements. And not only access to data, but an intimate knowledge of their basis and validity. This calls for a profound development of distributed data management and of interdisciplinary research activities. It is no longer sufficient to adhere to the GTS protocol for the exchange of wind, temperature, pressure and precipitation observations between NMHSs, a capability is required to address all kinds of data sources in a multitude of disciplines. What kind of relevant observations exist? (discovery) Knowledge about how to use the data, their quality and intellectual property rights is needed (use). Metadata with access to expert data knowledge are required. How can data be retrieved? (retrieval) The separation between research and routine observations is becoming less important.
WIGOS provides a common framework for all sources of observations (research, operational, public and private) allowing improved efficiency of observing systems and better/known quality of observations; Together with the WMO Information System (WIS) provides interoperable and metadata governed access to observations and to the knowledge behind the data. Observations may not be free to download right away, but information is provided on what exists and under what circumstances the data can be harvested and used. CAS is strongly committed to the continued contribution to this development. Other Programmes, such as World Weather Research Programme, Global Atmosphere Watch, World Climate Research Programme and the Working Group on Numerical Experimentation (WCRP Joint Scientific Committee and CAS) cannot evolve to their potential without engaging academia and cut across institutional or disciplinary barriers in a transparent manner.

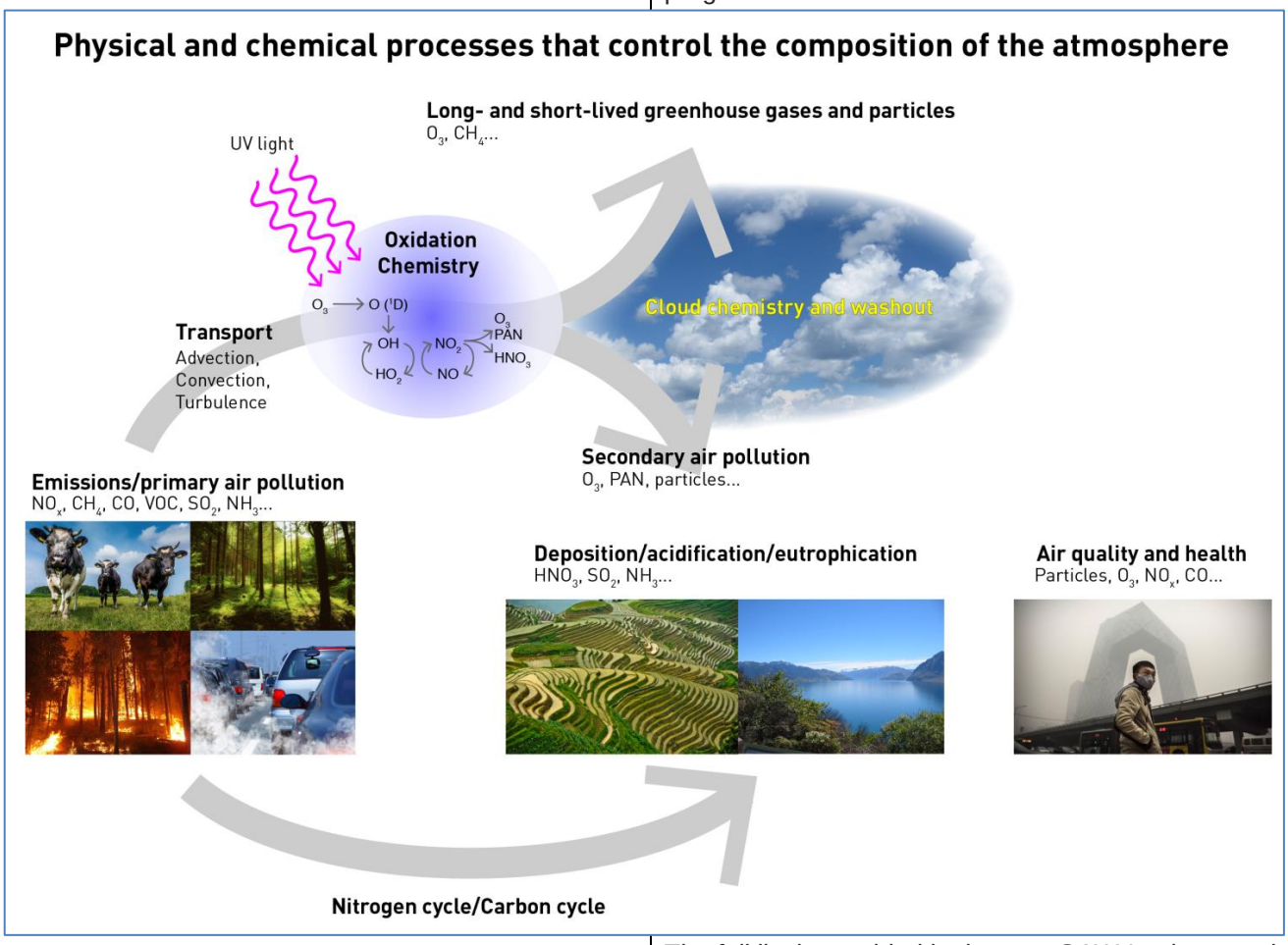
2. Atmospheric composition in WIGOS: contribution from the GAW

The Global Atmosphere Watch (GAW) is a programme of WMO that coordinates observations and analysis of the chemical composition of the atmosphere and related physical parameters, to track change and assess consequences thereof. GAW coordinates long-term global to local scale observations from more than 100 countries, emphasizing quality assurance and quality control to ensure data are consistent, complete and of known quality. GAW observations underpin atmospheric composition research, assessment and forecasting activities carried out within the programme relevant to climate change, air quality and human health, food security, ecosystem services, conventions and treaties and many other applications.

Some atmospheric composition variables are also relevant other WMO application areas, e.g. NWP and aeronautical meteorology, agricultural meteorology and Climate-AOPC.

GAW observations currently focus on six groups of variables or focal areas (Atmospheric water vapour was tentatively included in GAW in 2015 by the decision of the Environmental Pollution and Atmospheric Chemistry Scientific Steering Committee - EPAC SSC - but the infrastructure has not been defined yet): Greenhouse Gases, Ozone, Aerosol, Selected Reactive Gases, Total Atmospheric Deposition, Ultraviolet (UV) Radiation.

Each of these groups includes a set of gases or aerosol parameters critical to address specific atmospheric environmental problems (e.g. climate, air pollution, etc.). New variables are added over time to address the evolving needs of the user community. In total there are more than 60 variables included in the observational programme.



The observational component of GAW contributes to WIGOS and encompasses the WIGOS principles of network evolution, network design, observational quality management and metadata standards. The Rolling Review of Requirements process was revived within GAW to assist Members in the evolution of the observing system toward enhanced use of atmospheric composition information for research and applications. GAW is responsible for three application areas, namely Monitoring of Atmospheric Composition, Forecasting Atmospheric Composition Change and Providing Atmospheric Composition information to support services in urban and populated areas.

The full list is provided in the new GAW Implementation Plan (IP) for 2016 to 2023 (www.wmo.int/gaw).

The surface-based observational network comprises **global**, **regional**, **local** and **mobile** stations operated by WMO Members, research institutions and/or agencies. The GAW IP for 2016-2023 lists requirements for stations and networks to join the programme. Stations can be operated by national or international networks which upon signing an agreement with the GAW Programme become **contributing networks**. Contributing networks augment the information obtained from the GAW network by covering additional regions, vertical regimes, or parameters, or by employing different measurement techniques.

There are currently 31 GAW global stations, more than 400 regional stations and 10 contributing networks. All observations are linked to common reference standards and data are made available at seven designated World Data Centres and data centres of contributing networks. Depending on data submission the status or "health" of the network can be assessed. Information about GAW stations and contributing networks is summarized in the GAW Station Information System (GAWSIS, http://gawsis.meteoswiss.ch) which constitutes one of the elements of the OSCAR Database.

GAW Global stations are the flagship of the programme. In addition to core GAW parameters following QA/QC protocols, an extended set of measurements and extensive research on atmospheric composition change are performed at these stations. Global stations serve as the centres of excellence, they host international research campaigns and actively participate in capacity development through the stations' twinning initiatives. Global stations have an excellent track record of data submissions to the GAW Data Centres and actively participate in near-real time (NRT) data exchange initiatives.

GAW Regional stations generally have less extensive measurement programmes and in many cases were established to support applications in one focal area. In response to WIGOS network design principles, GAW Regional stations are encouraged to extend their measurement programmes to ensure that data can support multiple applications.

GAW Local stations are a new component of the GAW network. They reflect the growing interest in conducting research and supporting services related to urban environments, and in other locations impacted by local emissions. Possible uses of local stations include: measurements of atmospheric composition in urban areas, determination of the increment in atmospheric composition related to nearby sources, quantification of outflow from urban centres, and in support of air quality forecasting. Local stations complement air pollution data collected by air quality monitoring stations established by local regulatory authorities and/or may form a nucleus for building up such networks in regions which have no operational air quality monitoring in place. Data from local stations can also be compared with regional air quality networks (serve as an anchor).

In order to obtain a complete picture of atmospheric chemical composition, it is necessary to complement fixed-placed surface-based observations with mobile (e.g., **airborne** and **ship**) observations. A number of national aircraft monitoring networks and short-term research campaigns contribute to the GAW observational network, including IAGOS, CONTRAIL and some research aircraft observations. **Satellite** observations are crucial to the observational programme as they provide global coverage for many atmospheric composition parameters. So far the role of satellite observations in GAW has been quite limited but is expected to increase in view of many applications Satellite data on atmospheric composition are actively assimilated to improve weather forecasts, used in the air quality forecasting system as well as often used in inverse modelling for emission inventories verification.

3. WIGOS Observing Network Design Principles

As part of its contribution to WIGOS, the Inter-Programme Expert Team on Observing System Design and Evolution (IPET-OSDE) has developed the new WIGOS Observing Network Design (OND) Principles. These were approved by WMO Congress in 2015 as part of the Manual on WIGOS (Appendix 2.1). Members are encouraged to follow these twelve principles when designing and developing their observing networks:

1. Serving many application areas. Observing networks should be designed to meet the requirements of multiple application areas within WMO and WMO co-sponsored programmes.

2. Responding to user requirements. Observing networks should be designed to address stated user requirements, in terms of the geophysical variables to be observed and the space-time resolution, uncertainty, timeliness and stability needed.

3. Meeting national, regional and global requirements. Observing networks designed to meet national needs should also take into account the needs of WMO at the regional and global levels.

4. Designing appropriately spaced networks. Where high-level user requirements imply a need for spatial and temporal uniformity of observations, network design should also take account of other user requirements, such as the representativeness and usefulness of the observations.

5. Designing cost-effective networks. Observing networks should be designed to make the most cost-effective use of available resources. This will include the use of composite observing networks.

6. Achieving homogeneity in observational data. Observing networks should be designed so that the level of homogeneity of the delivered observational data meets the needs of the intended applications.

7. Designing through a tiered approach. Observing network design should use a tiered structure, through which information from reference observations of high quality can be transferred to other observations and used to improve their quality and utility.

8. Designing reliable and stable networks. Observing networks should be designed to be reliable and stable.

9. Making observational data available. Observing networks should be designed and should evolve in such a way as to ensure that the observations are made available to other WMO Members, at space-time resolutions and with a timeliness that meet the needs of regional and global applications.

10. Providing information so that the observations can be interpreted. Observing networks should be designed and operated in such a way that the details and history of instruments, their environments and operating conditions, their data processing procedures and other factors pertinent to the understanding and interpretation of the observational data (i.e. metadata) are documented and treated with the same care as the data themselves.

11. Achieving sustainable networks. Improvements in sustained availability of observations should be promoted through the design and funding of networks that are sustainable in the long-term including, where appropriate, through the transition of research systems to operational status.

12. Managing change. The design of new observing networks and changes to existing networks should ensure adequate consistency, quality and continuity of observations during the transition from the old system to the new.

The OND Principles are fully consistent with the Global Climate Observing System (GCOS) Monitoring Principles but they extend beyond climate applications; they are applicable to observing systems in support of all other applications of observations within the programmes of WMO and its Members.

OND Principle #9 deserves a special mention, as it represents a new emphasis, within the spirit of WIGOS, concerning the exchange of observations. An observation made by one WMO Members is likely to be of benefit to activities of other Members, and it should therefore be disseminated internationally. This is the single most cost-effective action that WMO Members can take to improve the supply of observations, for the benefit of the WMO community as a whole.

IPET-OSDE has now turned its attention to developing guidance material, to expand on the OND Principles and to help with their interpretation and implementation. These will form part of the **Guide to WIGOS** that is currently under development.

4. Outcomes of IPET-OSDE Workshop for Drafting "The Vision for WIGOS Surface-Based Observing Components in 2040" (Offenbach, Germany, 23-25 August 2016)

The CBS OPAG-IOS Inter Programme Expert Team on Observing System Design and Evolution (IPET-OSDE) workshop for drafting the "Vision for WIGOS Surface-Based Observing Components in 2040" took place at the Deutscher Wetterdienst (DWD) in Offenbach, Germany from 23 to 25 August 2016.

The workshop drafted a first version of the Vision 2040 Surface, agreed on immediate post meeting actions in preparation of the WIGOS Workshop for the Vision for WIGOS surface-based component Observing Systems in 2040, which was planned in Geneva, Switzerland, from 18 to 20 October 2016. The workshop also proposed an updated workplan for developing the WIGOS Vision

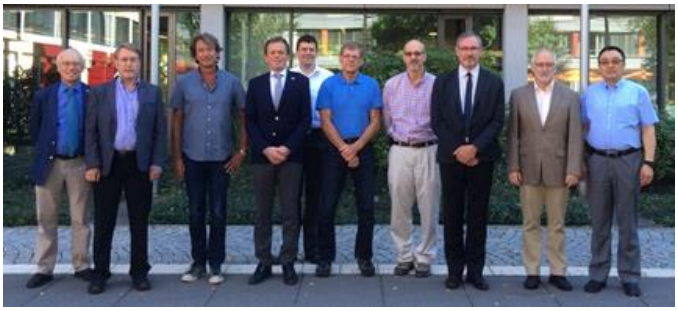
The Vision 2040 Surface should provide high-level goals to guide the evolution of the WIGOS in the coming decades. These goals are intended to be challenging but achievable.

The future WIGOS will build upon existing sub-systems, both surface- and space-based, and capitalize on existing, new and emerging observing technologies not presently incorporated or fully exploited. Incremental additions to the WIGOS will be reflected in better data, products and services from the National Meteorological and Hydrological Services (NMHSs).

The scope of the changes to the WIGOS will be major and will involve new approaches in science, data handling, product development and utilization, and training. The Vision should address the following trends and issues: Response to user needs; Integration; Expansion; Automation and technology trends; Consistency, continuity and homogeneity.

The Vision will address the observational needs for all application areas supporting the activities of WMO and the WMO Members. The respective roles of traditional NMHSs, research organizations, other government agencies and entities from the private sector in acquiring, processing and disseminating meteorological information are undergoing very rapid change, and it is impossible to predict future evolutions in this area. The Vision therefore will not prescribe the specific implementation agents. However, it is based on the general WMO principle that meteorological services - in particular weather forecasts, watches and warnings, and guidance on climate change, adaption and mitigation - are a public good and should be provided to the citizens of all nations free of charge.

This Vision will supersede the "Vision for global observing systems in 2025", which has been an important WMO guidance document but is now becoming less useful for guiding long-term strategy and planning.



Participants in the IPET-OSDE Workshop for Drafting "The Vision for WIGOS Surface-Based Observing Components in 2040", 23-25 August 2016, Offenbach, Germany

5. Outcomes of ICG-WIGOS Task Team on Data and Partnerships – 1st Session (Geneva, Switzerland, 29-31 August 2016)

The Task Team on WIGOS Data and Partnerships (TT-WDP) held its first meeting August 29-31 in Geneva. The principal work of this Task Team is to develop guidance material for Members on two themes important to the success of WIGOS.

Phase 1 of the work will focus on the principles and practical aspects of incorporating observations from external (non-NMHS) sources into the WIGOS framework. The guidance will summarize the motivations to gain access to external data to support WMO and national programs, as well as the characteristics of successful data relationships. It will also provide practical guidance on matters of data quality, WIGOS Station Identifiers, and WIGOS Metadata for external data. A key theme of this guidance will be the leadership role that NMHSs can play to strengthen national observing systems for both WMO and national benefit. Draft guidance material is targeted for discussion at the next ICG-WIGOS meeting in early 2017.

Phase 2 of the work will focus on the principles and best practices for WIGOS data management and data stewardship. Within the context of emerging information and communications technologies, the guidance will address matters of best practices related to data integrity and data preservation, and the role of WIS, NMHS and partner systems in the data lifecycle. Because effective data management is an issue of broad interest across WMO the work will also consider issues of compatibility among the legacy and emerging data management practices of the various WMO Programmes and Commissions (e.g. CBS, CIMO, CCl, CHy). Phase 2 work is planned to begin in late 2017.

6. Outcomes of the RA VI Workshop with Focus on Marine Meteorological and Oceanographic Observing Requirements (Split, Croatia, 5-7 Sep 2016)

The WIGOS Workshop for Regional Association VI (RA-VI) with Focus on Marine Meteorological and Oceanographic Observing Requirements was held from 5 to 7 September 2016 at the University of Split, Croatia. It was hosted by the Institute of Oceanography and Fisheries, and co-organized by the Croatian Meteorological and Hydrological Service. A total of 43 participants from 8 Countries and 5 international organizations/programmes attended the workshop. The workshop was organized in the framework of the development of the WIGOS Pre Operational Phase (2016-2019) at the Regional Level (RA-VI) to follow up from Congress and Executive Council decisions, particularly with regard to the development of Regional WIGOS Centres (RWCs) in RA-VI with focus on marine meteorological and oceanographic observing requirements at the regional level.

Noting that the RWCs may be implemented either centrally, at an overall regional level where a Member or a consortium of Members provide support for the entire Region, or at sub-regional level, the workshop discussed the role of such centres with regard to marine meteorological and oceanographic (metocean) observing systems and investigate potential candidates for providing all or parts of the required functions, e.g. providing assistance to Members on standards to follow, data collection using satellite data telecommunication systems, quality monitoring, collection and submission of observational metadata to OSCAR, vocabularies, etc.

Another objective of the workshop was to better understand regional and sub-regional requirements for metocean observations in support of various WMO Application Areas, including weather prediction, climate services, and ocean applications and marine services.

The workshop discussed how to enhance and develop partnerships nationally and in the region between national meteorological services and marine and/or oceanographic institutes in the view to further develop capacities in the region, and promote free and unrestricted data exchange in compliance with WIGOS technical regulations.

Based on discussions, including through breakout groups, the workshop agreed on sets of actions (some are for the RA-VI Task Team on WIGOS Implementation to consider) and recommendations (some were proposed for inclusion in the Regional WIGOS Implementation Plan for RA VI.

The relevance of the workshop recommendations to the RA-VI Operating Plan was discussed and some proposals were made in this regard, including topics relevant to the Adriatic Sea, to the Key Performance Indicators, and input to the RA VI Session in 2017.

Participants in the RA VI Workshop with Focus on Marine Meteorological and Oceanographic Observing Requirements (Split, Croatia, 5-7 Sep 2016)

7. WIGOS Related Events/Meetings

7.1 Recent Events/Meetings

- ☞ Regional Associations III and IV Workshop on AMDAR, 17-19 August 2016, Panama City, Panama
- ☞ Inter-Programme Expert Group on Observing Systems Design and Evolution (IPET-OSDE) Workshop for Drafting "The Vision for WIGOS Surface-Based Observing Components in 2040", 23-25 August 2016 Offenbach, Germany
- ☞ First Session of the ICG-WIGOS Task Team on Data and Partnerships, 29-31 August 2016, Geneva, Switzerland

- First Meeting supporting the CBS-led Review on Emerging Data Issues, 31 August - 2 September 2016, Geneva, Switzerland
- Regional Association VI Workshop with Focus on Marine Meteorological and Oceanographic Observing Requirements, 5-7 September 2016, Split, Croatia
- Global Climate Observing System (GCOS) Network Meeting - Advisory Group on GCOS Surface and Upper-Air Networks (GSN & GUAN) and CBS Lead-Centre for GCOS, 7-9 September 2016, Cambridge, United Kingdom of Great Britain and Northern Ireland
- Technical Conference on Meteorological and Environmental Instruments and Methods of Observation (CIMO TECO 2016), 27-30 September 2016, Madrid, Spain - organized in conjunction with Meteorological Technology World Expo, 2nd Conference on Metrology for Meteorology and Climate, and the SatCom Forum
- Regional Association I Working Group on Observations, Telecommunications and Infrastructure and RA I WIGOS Workshop for French Speaking Countries, 26-30 September 2016, Dakar, Senegal
- Workshop on the Vision for WIGOS in 2040 - Surface-based perspective, 18-20 October 2016, Geneva, Switzerland
- Seventh Asia-Oceania Meteorological Satellite Users Conference (AOMSUC-7), 21-28 October 2016, Songdo City, Incheon, Republic of Korea
- Fourth Session of the CIMO Task Team on Revision of the International Cloud Atlas (TT-ICA-4), 24-28 October 2016, Hong Kong, China

7.2 Coming Events/Meetings

- Regional Association II Expert Group on WIGOS meeting, WIGOS Workshop for West Asia and AMDAR Workshop for West Asia, 31 October – 4 November 2016, Abu Dhabi, United Arab Emirates
- Commission for Basic Systems Technical Conference (CBS-TECO-2016), 21-23 November 2016, Guangzhou, China
- Sixteenth Session of the Commission for Basic Systems, 23-29 November 2016, Guangzhou, China
- GFCS - Southern Africa Regional Climate Services Workshop, 29 November – 2 December 2016, Victoria Falls, Zimbabwe
- Fifth Session of the ICG-WIGOS Task Team on WIGOS Metadata (TT-WMD-5), 5-7 December 2016, Geneva, Switzerland
- First Session of the ICG-WIGOS Task Team on WIGOS Data Quality Monitoring System (TT-WDQMS-1), 13-15 December 2016, Geneva, Switzerland
- Sixth Session of the Inter-Commission Coordination Group on WIGOS (ICG-WIGOS), 12-14 January 2017, Geneva, Switzerland (tentative)

Thanks to:

Dr Oystein Hov

Dr John Eyre

Dr Mike Manore

for their contributions to this issue of the Newsletter