World Meteorological Organization

WMO Integrated Global Observing System
WIGOS NEWSLETTER

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1. From the Chair of CBS OPAG-IOS (Jochen Dibbern)

From the beginning, the Commission for Basic Systems' Open Programme Area Group on Integrated Observing Systems (CBS OPAG-IOS) teams have contributed to the implementation of the WIGOS Framework and it was recognized with pleasure that in June 2015 the Seventeenth World Meteorological Congress (Cg-17) agreed on the priority activities for the WIGOS Pre-operational Phase (WPP, 2016-2019). A detailed plan for the WPP has been developed by the Inter-Commission Coordination Group on WIGOS (ICG-WIGOS) and was approved by the Sixtieth Session of the Executive Council (EC-68).
It is encouraging to follow the different activities undertaken to work for the full implementation of WIGOS, among others the following:

- As demonstrated during an EC-68 (June 2016) side event, OSCAR/Surface is already available to Members and provides a comprehensive overview of WIGOS metadata for various types of stations/platforms, which should be used by Members to review/update/insert the metadata of their observing systems and could also be used as a tool to support their own activities.
- To address more efficiently at regional level Members request for support in the context of WIGOS implementation, the concept for regional WIGOS Centers has been developed and endorsed by EC-68; It includes as mandatory functions (directly linked with two of the priority areas of the WPP) the WIGOS metadata management (work with data providers of the Region to facilitate collecting, updating and providing quality control of WIGOS metadata in OSCAR/Surface) and the WIGOS performance monitoring and incident management (WIGOS Data Quality Monitoring System) (follow-up with data providers of the Region in case of data availability or data quality issues). In Region VI, a draft concept for a virtual Centre has been developed taking the unique characteristics of Region VI into account.
- The WIGOS framework calls for a more integrated view of WMO observing systems to serve the need of multiple application areas. This drives the need to redefine the Regional Basic Synoptic and Climatological Networks (RBSN, RBCN). A first workshop was held to develop a draft concept for the Regional Basic Observing Network (RBON). This will be further discussed and elaborated, at the coming CBS-16 session as well as during Regional Association sessions, before being presented to the Executive Council.
- The Inter-Programme Expert Team on Observing Systems Design and Evolution (IPET-OSDE) is continuously updating the Rolling Review of Requirements documentation and has drafted guidance material for network design. The Sixth Workshop on Impact of Observing Systems on Numerical Weather Prediction (May 2016, Shanghai, China), organized by IPET-OSDE, adopted recommendations for the future development of the observing systems and for further NWP studies.

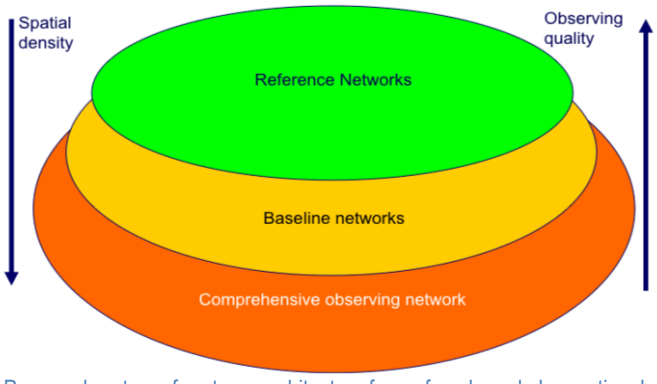
We look ahead for the 16th session of the Commission for Basic Systems where many aspects of the WIGOS pre-operational phase will be discussed and new WIGOS Regulatory Material will be reviewed. In this edition of the WIGOS newsletter we will share outcomes from different teams and workshops relevant to the WIGOS pre-operational phase. Special thanks go to all colleagues who contributed to these activities.

2. Disseminating GRUAN's value to the broader Global Observing System

The Global Climate Observing System (GCOS) Reference Upper-Air Network (GRUAN, www.gruan.org) was established following a call arising in the first GCOS Implementation Plan (2004). GRUAN measurements are reference quality [Immler et al., 2010], meaning that: they are traceable to an SI unit or an internationally accepted standard; comprehensive uncertainty analysis is included; all raw data are retained; the complete measurement chain is documented in accessible literature; measurements and their uncertainties are validated through inter-comparisons with complementary measurement systems; and a complete metadata description is included. As such, GRUAN provides long-term, high-quality climate data records from the surface, through the troposphere, and into the stratosphere, which allow a reliable determination of upper-air climate trends, constrain data from more spatially comprehensive observing systems (including satellites and current radiosonde networks), and fully characterize the properties of the atmospheric column.

GRUAN is envisaged as a global network of eventually 30-40 sites that, to the extent possible, builds on existing observational networks and capabilities. To date there are 25 sites of which 8 have undergone a rigorous certification procedure. A Lead Centre, hosted by the German Meteorological Service (DWD) at their Lindenberg facility, has been established. A fully traceable product/data stream has been developed for the Vaisala RS-92 radiosonde model and several additional products from radiosondes and various remote sensing techniques are at advanced stages of development. Many of the GRUAN sites operate frost-point hygrometers capable of measuring water vapour through the lower stratosphere. More details on the evolution of GRUAN operations to date are available in Bodeker et al. [2016]. GRUAN data are already being used in multiple analyses. Examples include papers on balloon drift statistics [Seidel et al., 2011], temporal sampling effects [Whiteman et al., 2011], [Butterfield and Gardener, 2015], assessment of tropospheric humidity changes [Yu et al., 2015], [Ciesielski et al., 2014] and instrument understanding [Wang et al., 2013], [Philipona et al., 2013]. The paper describing the GRUAN RS92 product [Dirksen et al., 2014] was the recipient of the 2016 Prof. Vilho Vaisala award.

In the GCOS status report a system of systems approach was introduced consisting of three tiers of observing network quality: reference, baseline and comprehensive (Figure 1). Subsequently, an attempt has been made to more formally define the fundamental properties of each tier in terms of measurement quality, representativeness, longevity and governance as part of the Horizon 2020 GAIA-CLIM project [GAIA-CLIM, 2015]. This definition provides a basis upon which a more formal global system of tiered networks could be built in the context of WIGOS.



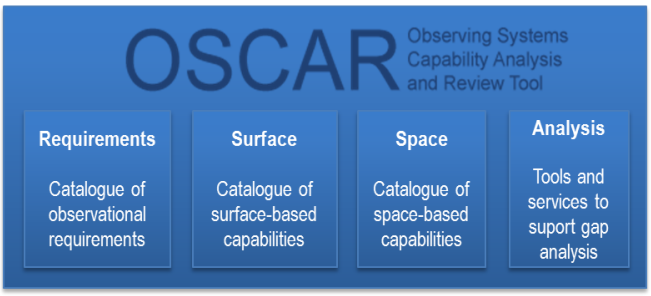
Proposed system of systems architecture for surface-based observational capabilities to maximize scientific value across all application areas

GRUAN is not expected to operate in isolation from GUAN or broader aspects of the GOS, including satellites. Indeed, GRUAN's value would be seriously compromised if it did not strongly interact with remaining aspects of the observing system. GRUAN is therefore fully seen as a key sustained contribution to WIGOS. Operating protocols developed within GRUAN are expected to be disseminated to GUAN sites with overall improved data quality as a result. By establishing itself as the Reference Network in a tiered network approach to the GOS (with GUAN acting as the Baseline Network and the global upper-air radiosonde network as the Comprehensive Observing Network), GRUAN can anchor the GOS to sound metrological practices. However, this tiered network approach only delivers value to the WMO Members if robust communication channels are established between the tiers such that valuable operating procedures developed in GRUAN flow to GUAN and to the wider global radiosonde network. Strengthening these inter-tier linkages is now an imperative for GRUAN and WIGOS. GRUAN is also already adding value to satellite characterization through activities such as GAIA-CLIM.

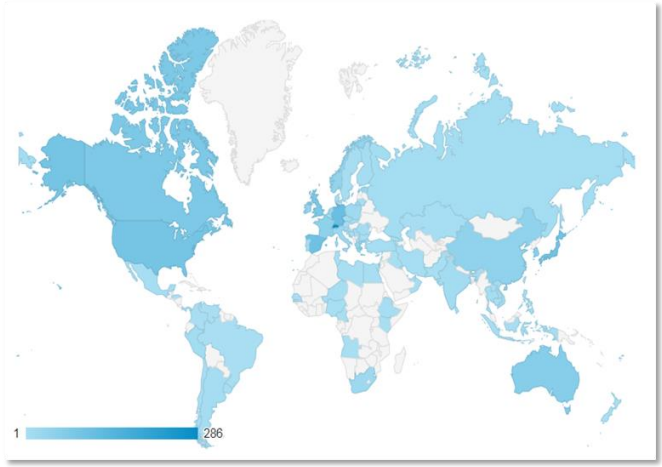
A timely demonstration of the value of GRUAN in a tiered network approach is now apparent in the challenge being faced with the forthcoming termination (mid-2017) of the production of the Vaisala RS92 radiosonde and a switch to production of the new RS41 radiosonde. This switch will directly affect over 40% of the sites in the global radiosonde network who are now faced with the need to change their sonde model either to the new RS41 or a different supplier. GRUAN, is undertaking a robust study to characterize the systematic biases between the RS92 and RS41 radiosondes and the dependence of those biases on a wide range of environmental factors. This will be achieved through sustained dual-flight measurement programmes at a number of GRUAN sites. Substantive synthesis of those systematic biases by the GRUAN community will provide the required guidance to homogenize RS92/RS41 measurement series at other upper-air sites and aid users, including near-real-time applications, in managing the effects of the transition. Discussions are ongoing with WIGOS to ensure dissemination of the results. Experts who wish to contribute to the design, execution and analysis of the results are encouraged to contact the GRUAN Lead Centre via gruan.lc@dwd.de.

3. Updates on OSCAR/Surface

The Observing Systems Capability Analysis and Review Tool (OSCAR) is a key component of the WIGOS Information Resource. It is designed to support the WIGOS Rolling Review of Requirements (RRR) process by offering eventually four web-based components:



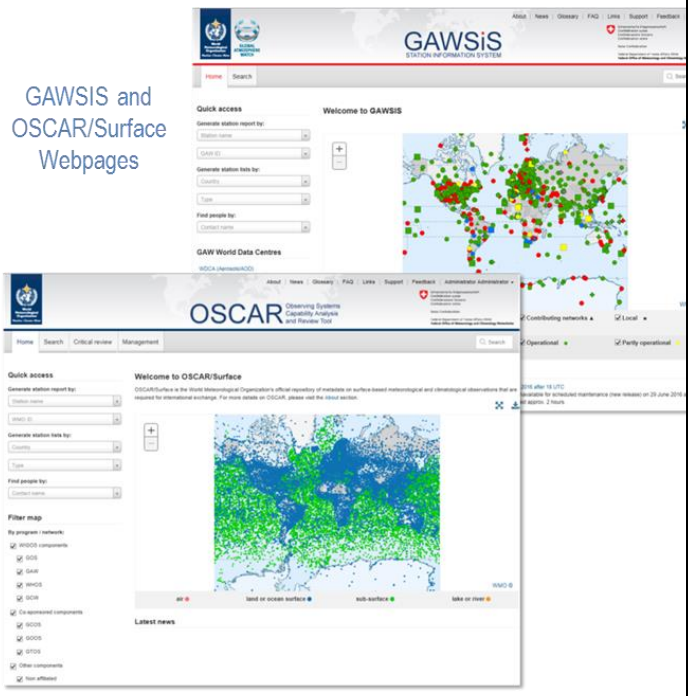
OSCAR/Space and OSCAR/Requirements have existed for quite some time already, and are regularly used. OSCAR/Analysis is still in the concept phase. Meanwhile, OSCAR/Surface was launched as an operational platform on 2 May 2016, accessible at http://oscar.wmo.int/surface. OSCAR/Surface was developed in a joint-venture of WMO and MeteoSwiss, with substantial additional support from the Swiss Federal Department of Foreign Affairs. A large number of people have helped to realize OSCAR/Surface and the WIGOS Metadata Standard it implements. It is a modern, robust web-based application providing search and reporting features that are open to the public and a management console that allows Members to make available their observing systems' metadata including their histories with a level of detail previously unheard of. OSCAR/Surface has integrated and supersedes Publication WMO No-9, Volume A. At launch, also metadata about the ocean platforms coordinated by JCOMMOPS (www.jcommops.org) and about weather radars described in the WMO Radar Database (http://wrd.mgm.gov.tr) were integrated. Moreover, the Global Atmosphere Watch Station Information System ("GAWSIS", https://gawsis.meteoswiss.ch), which integrates metadata of many of the GAW World Data Centres and a number of regional and/or program-specific data centres, is directly linked to OSCAR/Surface, thereby providing information on the capability to observe the chemical composition of the atmosphere.



Global distribution of sessions/login (2 May-12 Jun 2016) by WMO Member

In its first 2 months of operation, OSCAR/Surface has received more than 12'000 page views from users all over the planet. More than 100 users have registered and logged-in more than once, and more than 200 stations have been edited by authorized users. They have also left the operating team with more than 30 tickets, providing feedback or seeking support.

GAWSIS and OSCAR/Surface Webpages



While GAWSIS and OSCAR/Surface offer robust management consoles for people to make changes to existing metadata information, what is really missing at this point is a machine-to-machine interface, allowing Members to upload WIGOS metadata in bulk. To facilitate such automatic interaction with the platform, a sub-group of the Inter-Programme Expert Team on Metadata and Data Representation Development has developed an Extensible Markup Language (XML) application schema that formally defines how metadata can be encoded for upload to OSCAR/Surface. The schema is presently under review by a number of experts, and the plan is to publish it as an "experimental release" in WMO No-306, Manual on Codes, Part D Volume I.3 in the next few weeks. This will allow volunteering organizations to gather experience in documenting their observations in a common format. Once the application schema has passed these initial tests, it will be presented to CBS-16 for approval. In parallel, the specifications for a corresponding interface for OSCAR/Surface will be refined, and prototyping will begin. It will probably take another year until the first Members are ready to provide WIGOS metadata in the form of XML files, and for OSCAR/Surface to be able to accept them. Once these processes work, though, the only limitation to comprehensive documentation of the global meteorological and climatological observing systems is the willingness and capacity of Members to collect all this information. Fasten your seatbelt … and be prepared for a lot of metadata coming to a web-browser near you!

4. The Sixth WMO Impact Workshop
(Shanghai, China, 10-13 May 2016)

The 6th WMO Workshop on the Impact of Various Observing Systems on Numerical Weather Prediction was held 10-13 May 2016 at the Shanghai Meteorological Service (SMS) Headquarters, hosted jointly by the China Meteorological Administration (CMA) and SMS. The workshop was attended by roughly 80 participants from 14 countries and it included experts on data assimilation and observation impact, experts on climate change and seasonal forecasting, representatives from space agencies and from private industry, as well as managers of observing networks. The WMO Inter-Programme Expert Team on the Observation System Design and Evolution (IPET-OSDE) had proposed a number of topics for NWP impact studies relevant to the evolution of global observing systems (GOS) and participants were encouraged to present results on those topics in particular.

The meeting included 43 oral presentations distributed over three sessions, and 41 poster presentations. Each oral session was followed by a dedicated discussion period where salient points from the presentations were discussed and agreed on along with recommendations for the WMO Members, the space agencies, the NWP community and other entities for eventual inclusion in the Final Report of the meeting.

As has been the case for the previous workshops in this series, the Shanghai event was very successful. Both the studies presented and the lively discussion during the wrap-up sessions gave clear evidence of how deeply the NWP community is engaged in supporting the WIGOS activities toward assessing the impact of the WMO observing systems and providing guidance for the future evolution.

Participants at the 6th WMO Workshop on the Impact of Various Observing Systems on Numerical Weather Prediction, Shanghai China, 10-13 May 16

Much progress had been made in the use of observational data since the Fifth Impact Workshop, held in Sedona, Arizona, USA, in May 2012. Among the notable findings was that in spite of the steady growth in the number of available observations, especially from satellites, there is little or no evidence of saturation of impact. Adding a new observing system or a new satellite instrument to the assimilation systems thus nearly always results in a positive impact on skill.

In terms of the overall contribution to forecast skill, the top five contributing observing systems were the same as they were in 2012, namely (in no ranking order): Satellite microwave sounders, hyperspectral infrared satellite sounders, radiosondes, aircraft observations (including ascent/descent profile data), and satellite winds (AMVs).

The space here does not permit a full listing of specific findings and conclusions from the Workshop, but once the Final Report is ready by the end of the summer, it will be published as a WIGOS Technical Report. In order to give broad visibility to this important work, it is also planned to present the major findings from this Workshop in relevant international fora over the next year, and finally a number of the formal recommendations listed in the report will be taken up and discussed during the CBS Session in Guangzhou in November 2016.

5. Outcomes of the RBON Workshop
(Geneva, Switzerland, 18-20 May 2016)

The Regional Basic Observing Network (RBON) workshop was held at the WMO Secretariat in Geneva, Switzerland, from 18 to 20 May 2016. The workshop was chaired by Dr Jochen Dibbern, co-chair, CBS Open Programme Area Group on Integrated Observing Systems (OPAG-IOS). A draft concept of RBON, as the core document, was presented and discussed from many different perspectives, focusing on aspects that should be taken into account for its further development.

The current Regional Basic Synoptic Networks (RBSN) and Regional Basic Climatological Networks (RBCN) consist of surface and upper-air stations designated by the Regional Associations. They have proven to be highly effective, and made valuable regional contributions to the activities of WMO and its Members. The observations from these stations, which are maintained by WMO Members, have been exchanged globally in real time without restriction. Originally designed to support operational meteorology and climatology, these observations have produced significant benefits across a wide range of applications. However, additional and emerging requirements for observations across diverse application areas are driving the need to redefine them.

New and improved observational technologies provide the opportunity to reassess regional observational strategies. As part of the regional WIGOS implementation during its Pre-operational phase (2016-2019), the RBON is being introduced to replace the existing RBSN and RBCN networks, while their stations are expected to constitute the backbone of the new RBON; They will lead to improved services by delivering more and better observations to stakeholders, and enable the full benefit of regional observing capabilities to be realized in combination with space-based and remaining surface-based observing elements of WIGOS.

The RBON concept includes the following key attributes (non-exhaustive list):

- real-time and near-real-time data exchange at the global level;
- updated WIGOS metadata in Observing Systems Capability Analysis and Review tool (OSCAR);
- data exchange in defined WMO formats;
- commitment to operate and maintain the station/platform for a minimum of four (4) years;
- high frequency of data (hourly and sub-hourly data) and daily climate summaries;
- provision of required climate messages;
- complying with the WIGOS quality management according to the Manual on WIGOS;
- change management according to the Manual on WIGOS;
- multilateral arrangements for inclusion of systems that cover more than one Regional Association;
- support as many as possible of the WMO application areas;
- stations/platforms are not limited to those under the responsibility of the National Meteorological and Hydrological Services (NMHSs).

Design, execution and management of each RBON will be made by its Regional Association in the context of the broader WIGOS.
The workshop finalized the RBON concept; however, the need for further consultation on this topic with all the relevant prospective components of RBON was identified. The concept will have to be communicated appropriately to all WMO regional associations.

6. Outcomes of RA VI TT-WIGOS-3 (Belgrade, Serbia, 6-7 June 2016)

The 3rd session of the RA VI Working Group on Infrastructures Task Team on WIGOS Implementation (WG-INF/TT-WIGOS) was held from 6 to 7 June 2016 at Belgrade, Serbia, at the kind invitation of the Serbian Meteorological and Hydrological Service (SMHS). The meeting was attended by 19 participants, including representatives of the WMO Regional Office for Europe and from the WIGOS and GCW Offices and it was chaired by Mr Ercan Büyükbaş, Chair of the RA VI TT-WIGOS.

The main topic on the agenda of the meeting was the application of the concept of Regional WIGOS Centres (RWC) to RA VI, but it also included a review of the priorities of the WIGOS Pre-operational Phase and the update of the Regional WIGOS Implementation Plan for RA VI (R-WIP-VI), as well as an introduction to the Global Cryospheric Watch (GCW).

The results of the request for RA VI Members to use and fill in the WIGOS self-assessment checklist were presented and discussed. The session decided to try to get more replies to the WIGOS self-assessment checklist, so agreed to update it and to investigate if an online version would be feasible.

Regarding the RWC concept, the meeting developed two versions of a draft proposal for the establishment of RWC in RA VI, which should be reviewed, updated and brought before RA VI Management Group and finally to RA VI Session.

The meeting agreed to run an experiment named “RA VI RWC in a nutshell” with the objectives of testing and demonstrating the practical implementation in RA VI of the two mandatory functions for RWCs (as approved by EC-68): Regional WIGOS metadata management (OSCAR/Surface)” and the Regional WIGOS performance monitoring and incident management; Also a third function related to the expansion of the E-AMDAR Program to non-EUMETNET countries of RA VI. The experiment will be led by the Chair TT-WIGOS in collaboration with the Chair WG-INF and the first function will involve TT-WIGOS representatives from Turkey, UK and Lebanon; The second function will involve representatives of EUMETNET, Serbia, Turkey and Bosnia and Herzegovina.

Participants in the 3rd session of RA VI Working Group on Infrastructures Task Team on WIGOS Implementation, 6-7 June 2016, Belgrade, Serbia

7. GCOS Special Announcement

The GCOS Programme has prepared a new implementation plan in consultation with the global climate scientific and observing community. GCOS published its first Implementation Plan in 2004 and updated it in 2010. This new 2016 GCOS Implementation Plan “The Global Observing System for Climate: Implementation Needs" is not an update, but a new plan taking into account the latest developments in earth observations and climate policy. It will not be updated for 5 years, and a new plan will not be written within the next 10 years. It will be open for public review from **25 July to 5 September 2016**. Following approval by the GCOS steering committee a final version will be submitted to the United Nations Framework Convention on Climate Change (UNFCCC) for the 22nd session of the Conference of the Parties (COP 22, 7-18 November 2016, Marrakesh, Morocco). Anyone interested in climate observations is invited to comment on the draft which is available, together with the instructions on how to submit comments, at: gcos.wmo.int.

8. WIGOS Related Events/Meetings

8.1 Recent Events/Meetings

- 6th WMO Workshop on the Impact of Various Observing Systems on Numerical Weather Prediction, 10-13 May 2016, Shanghai, China
- 4th Session of the Inter-Programme Expert Team on Metadata and Data Representation Development (IPET-MDRD-4, 9-13 May 2016, Geneva, Switzerland
- Workshop on the Regional Basic Observing Networks (RBON), 18-20 May 2016, Geneva, Switzerland
- 3rd Session of the RA-VI Task Team on WIGOS Implementation TT-WIGOS-3, 6-7 June 2016, Belgrade, Serbia
- ICG-WIGOS Editorial Board on the WIGOS Guide, 13-15 June 2016, Geneva, Switzerland
- Sixty-Eight Session of the Executive Council, 15-24 June 2016, Geneva, Switzerland

8.2 Coming Events/Meetings

- Drafting Workshop for the WIGOS Surface Vision for 2040, 23-25 August 2016, Offenbach, Germany
- WMO Ocean Observation Workshop, 5-8 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
- RA-I WG-Observations, Telecommunications and Infrastructure and RA-I WIGOS Workshop, 26-30 September 2016, Dakar, Senegal
- WIGOS Surface Vision for 2040 Workshop (tentative), 11-13 October 2016, Geneva, Switzerland
- 7th Asia-Oceania Meteorological Satellite Users Conference (AOMSUC-7), 21-28 October 2016, Songdo, Incheon, Republic of Korea - abstract submission deadline is August 31
- CBS Technical Conference (CBS-TECO-2016), 21-23 November 2016, Guangzhou, China
- Sixteen Session of Commission for Basic Systems (CBS-16), 23-29 November 2016, Guangzhou, China

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Dr Jörg Klausen

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