World Meteorological Organization

Weather • Climate • Water

WIGOS, the WMO Rolling Review of Requirements, OSCAR, and the WMO Impact Workshops

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Overview

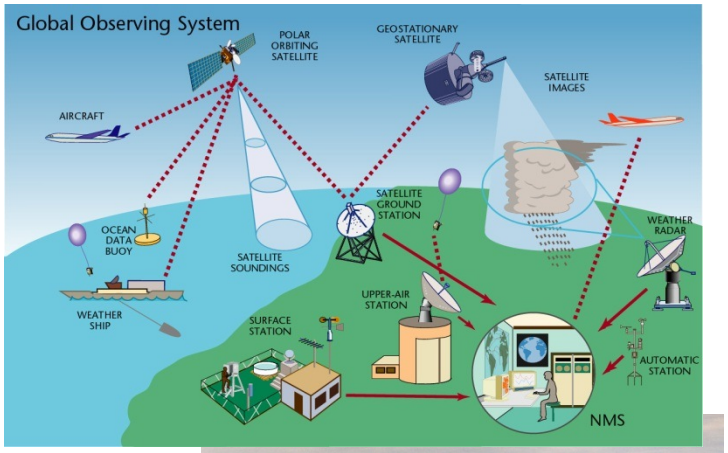
1. What is the WMO Integrated Global Observing System (WIGOS) and why do we need it?
2. What is the Rolling Review of Requirements (RRR) and the Observing System Capabilities and Review (OSCAR)
   - OSCAR/Requirements
   - OSCAR/Space
   - OSCAR Surface
5. The WMO Impact Workshops

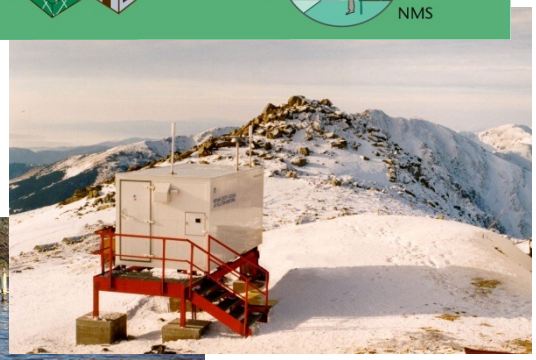
What is WIGOS?

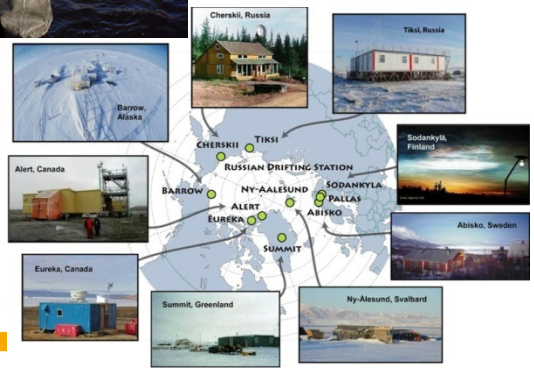
- The WMO Foundation for Meeting the Observing Needs of its Weather, Climate, Water and Environmental Services
- A framework for integrating all WMO observing systems and WMO contributions to co-sponsored observing systems.
- A WMO Strategic Priority Area
- Together with the WMO Information System (WIS), WIGOS is a WMO contribution to GEOSS.
- WIGOS is <u>not</u>:
  - Replacing or taking over existing observing systems, which will continue to be owned and operated by a diverse array of organizations and programmes, national as well as international.

WIGOS Component Systems

- Global Observing System (WWW/ GOS)
- Observing component of Global Atmospheric Watch (GAW)
- WMO Hydrological Observations (including WHYCOS)
- Observing component of Global Cryosphere Watch (GCW)







Why do we need WIGOS?

- ***The mandate of modern NMHSs (Met Services) is much broader now than it was when the World Weather Watch and the GOS were created, often including e.g.***
  - Climate monitoring, climate change, mitigation
  - Air quality, atmospheric composition from urban to planetary scales
  - Oceans
  - Cryosphere
  - Water resources
- ***Advances (scientific and technical):***
  - Observing technology
  - Telecommunications
  - Numerical modeling and data assimilation
  - Increased user demand to access and use observations in decision making

Rolling Review of Requirements

- WMO Congress: All WMO (and co-sponsored) observing systems shall use the RRR to design networks, plan evolution and assess performance.
  - The RRR is the process used by WMO to collect, vet and record user requirements for all WMO application areas and match them against observational capabilities
  - Gap analysis results in *Statement of Guidance,* one per application area, that provides a narrative of how well a given application area is supported by WIGOS; to be supported by a quantitative gap analysis module (in development)

WIGOS Framework Implementation Plan (WIP; link here)

CONTENTS

1. Introduction and Background
2. Key Activity Areas for WIGOS Implementation
3. Project Management
4. Implementation
5. Resources
6. Risk Assessment / Managem
7. Outlook

Annexes

KEY ACTIVITY AREAS

1) Management of WIGOS implementation
2) Collaboration with WMO co-sponsored observing systems & international partners
3) Design, planning and optimized evolution
4) Observing System operation and maintenance
5) Quality Management
6) Standardization, system y and data compatibility
7) Operational Information Resource
8) Data and metadata management, delivery and archival
9) Capacity development
10) Communications and outreach

Rolling Review of Requirements

WMO Application Areas listed in the RRR
(July 2015)

1. Global numerical weather prediction (GNWP)
2. High-resolution numerical weather prediction (HRNWP)
3. Nowcasting and very short range forecasting (NVSRF)
4. Seasonal and inter-annual forecasting (SIAF)
5. Aeronautical meteorology
6. Forecasting atmospheric composition
7. Monitoring atmospheric composition
8. Atmospheric composition for urban applications
9. Ocean applications
10. Agricultural meteorology
11. Hydrology
12. Climate monitoring (as undertaken through GCOS)
13. Climate applications
14. Space weather

OSCAR

- The RRR is supported by three key databases of OSCAR, the *Observation Systems Capabilities and Review* tool :
  - OSCAR/Requirements, in which “technology free” requirements are provided for each application area, expressed in units of geophysical variables (260 in total currently), not measurands; not just atmosphere, also terrestrial, ocean, cryosphere, …
  - OSCAR/Space, listing the capabilities of all satellite sensors, whether historical, operational or planned
  - OSCAR/Surface, list surface-based capabilities; developed by MeteoSwiss for WMO, in beta-testing

- http://www.wmo-sat.info/oscar/

OSCAR/Requirements

- The following requirements are listed (separately for each of the 14 application areas and for all relevant variables):
  - Spatial (horizontal and vertical) and temporal resolution, uncertainty, data latency, required coverage area, source, and level of confidence
- Each requirement is expressed in terms of three separate values:
  - Threshold (observations not useful unless this is met)
  - Break-through (optimum cost-benefit ratio)
  - Goal (exceeding this provides no additional benefit)
- OSCAR/Requirements information content is assembled by CBS and other WMO Inter-Program Expert Teams and Task Teams and is informed by the broader scientific community
  - e.g. WIGOS/ GAW Workshop on Requirements for Observations of Atmospheric Composition, Geneva, Nov. 2014
  - **WMO Impact Workshops**

WMO Workshops on the Impact of Various Observing Systems on NWP

Five Workshops held so far:

- 1st - Geneva, 1997
- 2nd – Toulouse, 2000
- 3rd – Alpbach, 2004
- 4th – Geneva, 2008
  - Workshop Report available on this page
- 5th – Sedona (AZ, USA), May 22-25 2012
  - Workshop Report, presentations available on this page

Workshops aim to bring together major NWP centers and representatives from the research community to discuss the contribution to forecast skill of various elements of the global observing system; guidance to participants provided well in advance of Workshop itself.

Some Conclusions from the Fifth WMO Impact Workshop in Sedona, May 2012

- Modern, 4-dimensional data assimilation methods (4D-VAR, ENKF) have led to greatly improved use of data, especially of
  - Asynoptic data (e.g. aircraft, satellite observations)
  - Observations with complex relationships between measured and model variables (satellite radiances, GPSRO, radar,…)
- Broad consensus about highest-ranking contributors to forecast skill, but not necessarily about their ranking order:
  - AMSU-A (microwave temperature sounder)
  - AIRS/IASI (hyper-spectral infrared sounders)
  - Radiosondes
  - Aircraft observations
  - Atmospheric motion vectors (feature tracking satellite winds)

Sedona Conclusions (II)

- Radio occultation data (GPSRO) also have substantial impact but data volumes are currently declining as COSMIC is approaching the end of its lifetime
- There is now no single, dominating satellite sensor; several sensors contribute to forecast skill in roughly equal measure
- The relative impacts of specific observation types depends on which other observations are used and how
  - If certain data are withheld, other datatypes can in some contexts compensate for the lost skill
- However, the continued value of in situ data, and in particular of wind measurements, was clearly demonstrated
- Regional data assimilation systems making progress in the use of radar and satellite observations
  - Radiance assimilation still problematic

Sixth WMO Impact Workshop

- Upon the invitation from China, the WMO Commission for Basic decided to arrange the *Sixth WMO Workshop on the Impact of Various Observing Systems on NWP* in Shanghai, May 10-13 2016
- Guidance being sent out to NWP centers shortly in terms of suggested science questions (15 in total), e.g. regarding radars, AMDAR, radiosondes, satellite constellations, …
  - An opportunity to highlight the need for polar observations, both for regional requirements and in support of overall (global) metrics