GRUAN and the WMO INTEGRATED GLOBAL OBSERVING SYSTEM (WIGOS)

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What is WIGOS?

- 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 not:

- 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 Observing 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 WIGOS?

- The mandate of modern NMHS’s (Met Services) is much broader now than it was when WWW and the GOS were created, 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
Why WIGOS (continued)?

- **Shortcomings of the current situation:**
  - Observing networks/systems not sustainable and stable,
  - Design and planning not well coordinated,
  - Observing standards not respected (and in some cases not well defined)
  - Databases not integrated or interoperable, including metadata,
  - Deficiencies in Quality Management (maintenance, monitoring, reporting, ...)
  - Lack of qualified and trained staff;

- Through coordinated *data sharing* and *networks/systems development*, Members will be better equipped to address existing deficiencies and to meet future challenges
WIGOS Framework: Key activity areas

- To oversee, guide and coordinate WIGOS
- To plan, implement and optimise evolution
- To ensure supply of and access to WIGOS observations
- To facilitate and support the operation of WIGOS

- Data discovery, delivery & archival
- Observing system operation & maintenance
- Communications and outreach
- Operational Information Resource
- Standards, interoperability & compatibility
- Quality Management
- Design, planning and optimised evolution
- Collaboration with co-sponsors and partners
- Capacity Development
- Management of WIGOS Implementation
- To plan, implement and evolve WIGOS component systems
So where does GRUAN enter the picture?

- GRUAN is part of GCOS, which is part of WIGOS
  - It can be seen as a textbook example of how WIGOS deals with climate requirements
- In addition, seen from a traditional WWW/GOS perspective:
  - WMO users (and the people behind their NWP systems) value radiosonde observations very highly
  - The upper air part of the RBSN (Regional Basic Synoptic Network) has been in slow but steady decline for years
  - GRUAN provides radiosonde observations
  - GRUAN is leading the way on aspects like metadata, certification process, change management, …
Some WIGOS activities relevant to GRUAN

- WMO Regulatory Material:
  - Technical Regulations (WMO-49)
  - Manual on WIGOS
  - Guide to WIGOS
    - WIGOS Metadata Standards
    - Plan for Quality Management;

- CBS Activities:
  - Documentation of socioeconomic benefits of observations
  - Discussion about radiosonde scheduling - should we still be bound by the synoptic times (00 06 12 18Z) for our measurements?
...more WIGOS activities relevant to GRUAN

- Documents under development within CBS:
  - “Vision for WIGOS in 2040” (working title), following on to the “Vision for the GOS in 2025”
  - “Principles of Observational Network Design”

- Plans to initiate targeted “WIGOS Implementation Projects” at the sub-regional or national level, especially in WMO Regios I and III
  - GRUAN network expansion opportunities?
... yet more WIGOS activities of relevance to GRUAN

- Rolling Review of Requirements
  - Documentation of observational data requirements by application area (12 officially supported by WMO)
  - Documentation of observational capabilities (existing and planned)
  - Gap analysis, resulting in “Statements of Guidance”


- Impact Workshops every four years, assessing the impact of all major components of the GOS on NWP; will likely be expanded to encompass all of WIGOS and impact on applications beyond NWP
## List of all Requirements

This table shows all requirements. It can be sorted by clicking on the column headers. The filter on the right allows to display only specific requirements. *Filter instructions* 👉

*Note: In reading the values, goal is marked blue, breakthrough green and threshold orange.*

<table>
<thead>
<tr>
<th>Id</th>
<th>Variable</th>
<th>Layers</th>
<th>App Area</th>
<th>Theme(s)</th>
<th>Uncertainty</th>
<th>Stability / decade</th>
<th>Hor Res</th>
<th>Ver Res</th>
<th>Obs Cyc</th>
<th>Timeliness</th>
<th>Coverage</th>
<th>Conf Level</th>
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<tbody>
<tr>
<td>1</td>
<td>Air specific humidity (at surface)</td>
<td>Near Surface</td>
<td>CLIC</td>
<td>10 %</td>
<td>12 %</td>
<td>20 %</td>
<td>100 km</td>
<td>200 km</td>
<td>500 km</td>
<td>12 h</td>
<td>18 h</td>
<td>24 h</td>
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<td>2</td>
<td>Air temperature (at surface)</td>
<td>Near Surface</td>
<td>CLIC</td>
<td>0.2 K</td>
<td>0.3 K</td>
<td>0.5 K</td>
<td>100 km</td>
<td>200 km</td>
<td>500 km</td>
<td>12 h</td>
<td>16 h</td>
<td>24 h</td>
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<td>3</td>
<td>Cloud optical depth</td>
<td>TC</td>
<td>CLIC</td>
<td>15 dimless</td>
<td>20 dimless</td>
<td>30 dimless</td>
<td>100 km</td>
<td>200 km</td>
<td>500 km</td>
<td>12 h</td>
<td>16 h</td>
<td>24 h</td>
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<td>4</td>
<td>Cloud top height</td>
<td>n/a (2D)</td>
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<td>0.7 km</td>
<td>1 km</td>
<td>100 km</td>
<td>200 km</td>
<td>500 km</td>
<td>12 h</td>
<td>15 h</td>
<td>24 h</td>
</tr>
<tr>
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<td>Ice sheet topography</td>
<td>Land surface</td>
<td>CLIC</td>
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<td>6.3 cm</td>
<td>10 cm</td>
<td>0.1 km</td>
<td>0.171 km</td>
<td>0.5 km</td>
<td>10 y</td>
<td>11 y</td>
<td>15 y</td>
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<td>Sea surface temperature</td>
<td>Sea surface</td>
<td>CLIC</td>
<td>0.5 K</td>
<td>0.8 K</td>
<td>2 K</td>
<td>25 km</td>
<td>39.7 km</td>
<td>100 km</td>
<td>24 h</td>
<td>30 h</td>
<td>30 d</td>
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<td>7</td>
<td>Sea-ice cover</td>
<td>Sea surface</td>
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<td>Cryosphere</td>
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<td>13 %</td>
<td>20 %</td>
<td>1 km</td>
<td>2.2 km</td>
<td>10 km</td>
<td>1 y</td>
<td>2 y</td>
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</table>
What can WIGOS provide to GRUAN?

- Increased visibility among WMO members and their Permanent Representatives
- Additional substantiation for the requirements via links to all 12 WMO application areas, and GFCS
- Opportunities to grow the network, especially in the WMO Regions I and III
- Tremendous cal/val resources via NRT NWP monitoring; this is an aspect that is very well understood and heavily used by the satellite operators
Some challenges/things to think about

- How do we get more GRUAN data out in real time without interfering with the network?
  - Issues of communications capabilities, funding, organizational culture, … ?
- What is the role of for instance the “Manual on GRUAN” in the overall WIGOS Regulatory Material?
- Better integration/representation of GRUAN in RRR, impact assessments, strategic developments within CBS (and possibly CIMO)?
- Can we use the WIGOS/GFCS/CD WMO Strategic Priority Areas to solidify and expand GRUAN, especially in the tropics and in Regions I and III?
Summary

- WIGOS is maturing; there is now an actual Project Office, and the Regulatory Material is on track toward approval by WMO Congress in 2015
  - Probably a stretch to claim that it will be operational by 2016, but the major parts of the WIGOS Framework will be in place
- It is a challenge to integrate observing systems developed within separate communities and cultures for different purposes (weather, climate, atmospheric composition, agriculture, hydrology, etc.) under one umbrella
  - However, WMO members have clearly expressed the need to do so
- GRUAN is an interesting test case - there are many areas where a much closer collaboration would be mutually beneficial