WMO Integrated Global Observing System (WIGOS) and the HIGHWAY Project

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WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

WMO OMM
World Meteorological Organization
Organisation météorologique mondiale

Outline

- Introduction to WIGOS, OSCAR and WDQMS
- WMO view on observational data requirements, globally, and for East Africa in particular
- The new Global Basic Observing Network (GBON) concept
- WMO expectations from HIGHWAY project
- Role of Regional WIGOS Centers
- Summary and conclusions

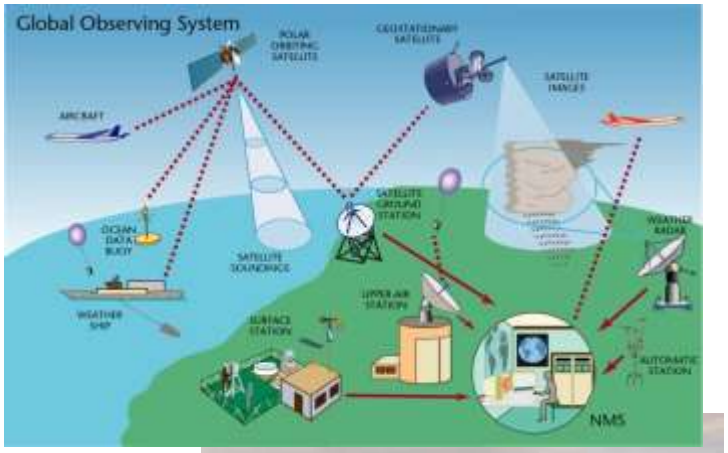
What is the WMO Integrated Global Observing System (WIGOS)?

- WMO **foundational activity** addressing the observing needs of the weather, climate, water and environmental services of its Members
- A **framework** for integrating all WMO observing systems and WMO contributions to co-sponsored observing systems under a common regulatory and management framework
- Overall purpose: ***Provide a solid and well-documented observational basis for all services in the areas of weather, climate and water, acquired in a manner that is as cost-efficient as possible***

WIGOS homepage

WIGOS Components

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



The WIGOS Pre-Operational Phase (2016-2019)

decided by Cg-17 in 2015

- Increased emphasis on regional and national activities
- Five main priority areas:

I. WIGOS Regulatory Material, supplemented with necessary guidance material

II. WIGOS Information Resource, including the Observing Systems Capabilities analysis and Review tool (OSCAR), especially OSCAR/Surface

III. WIGOS Data Quality Monitoring System (WDQMS)

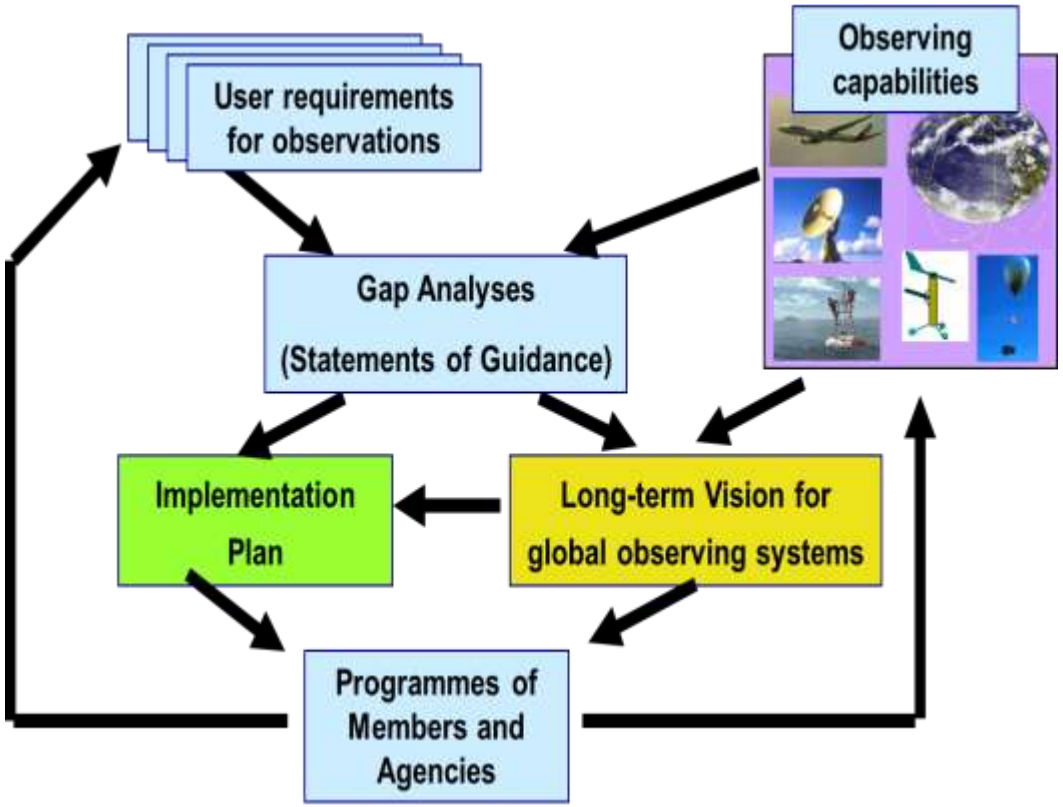
IV. Regional Structure; *Regional WIGOS Centers*

V. National WIGOS Implementation, coordination and governance mechanisms

Rolling Review of Requirements (RRR)

- WMO Congress: All WMO and WMO 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



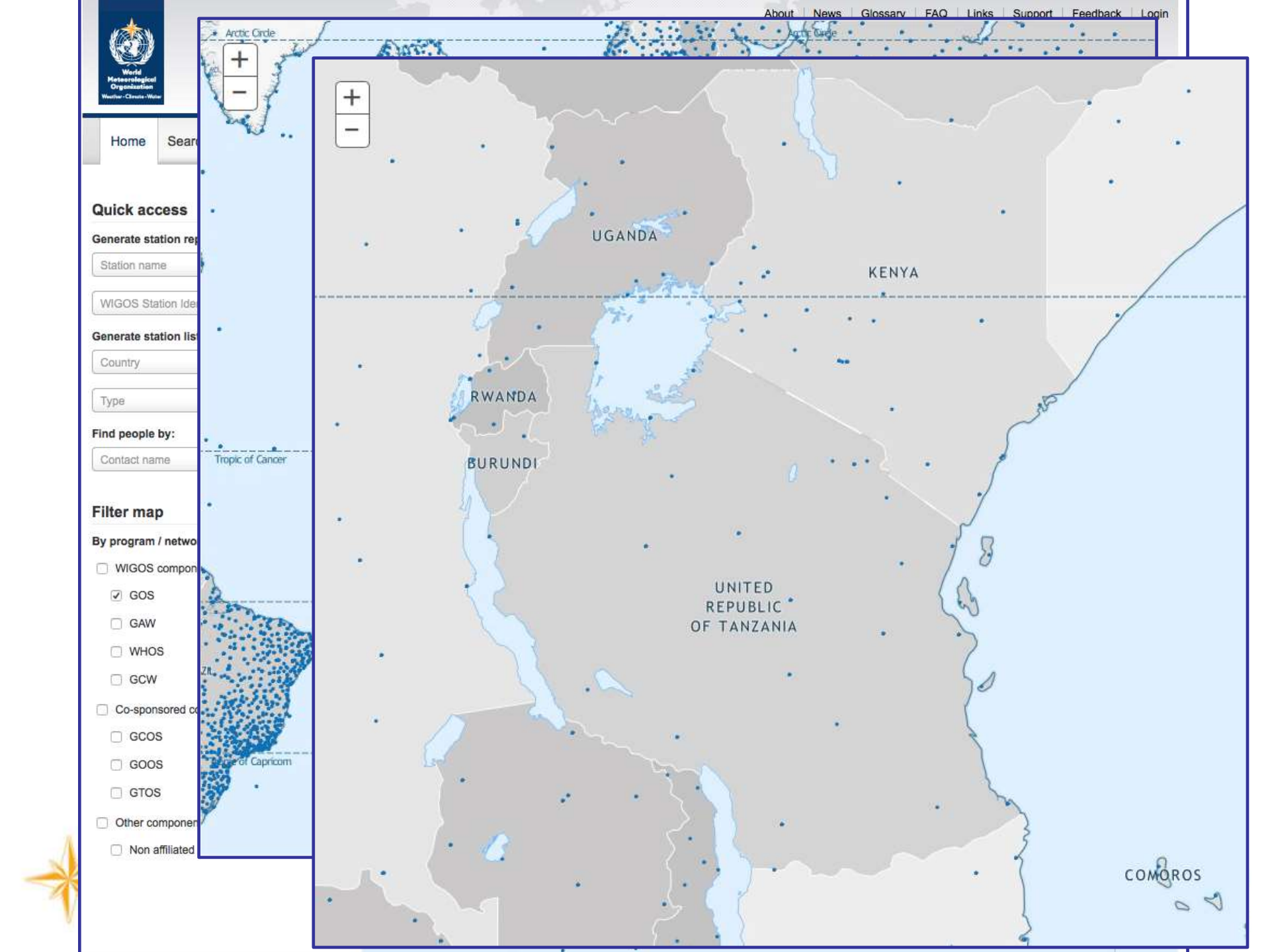
Rolling Review of Requirements

OSCAR

- The RRR is supported by three key databases of **OSCAR**, the *Observation Systems Capabilities Analysis 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);
  - **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, operational since May 2016

Gap analysis of surface observing networks

OSCAR homepage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OSCAR/Requirements

- The following **requirements are listed for each of the (currently 14) application areas** and for all relevant geophysical variables (currently more than 200):
  - 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

WMO Application Areas listed in the RRR

(January 2017)

1. **Global numerical weather prediction**
2. High-resolution numerical weather prediction
3. Nowcasting and very short range forecasting
4. Seasonal and inter-annual forecasting
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 *(currently under revision by GCOS and WCRP)*
13. Climate applications *(currently under revision by GCOS and WCRP)*
14. Space weather

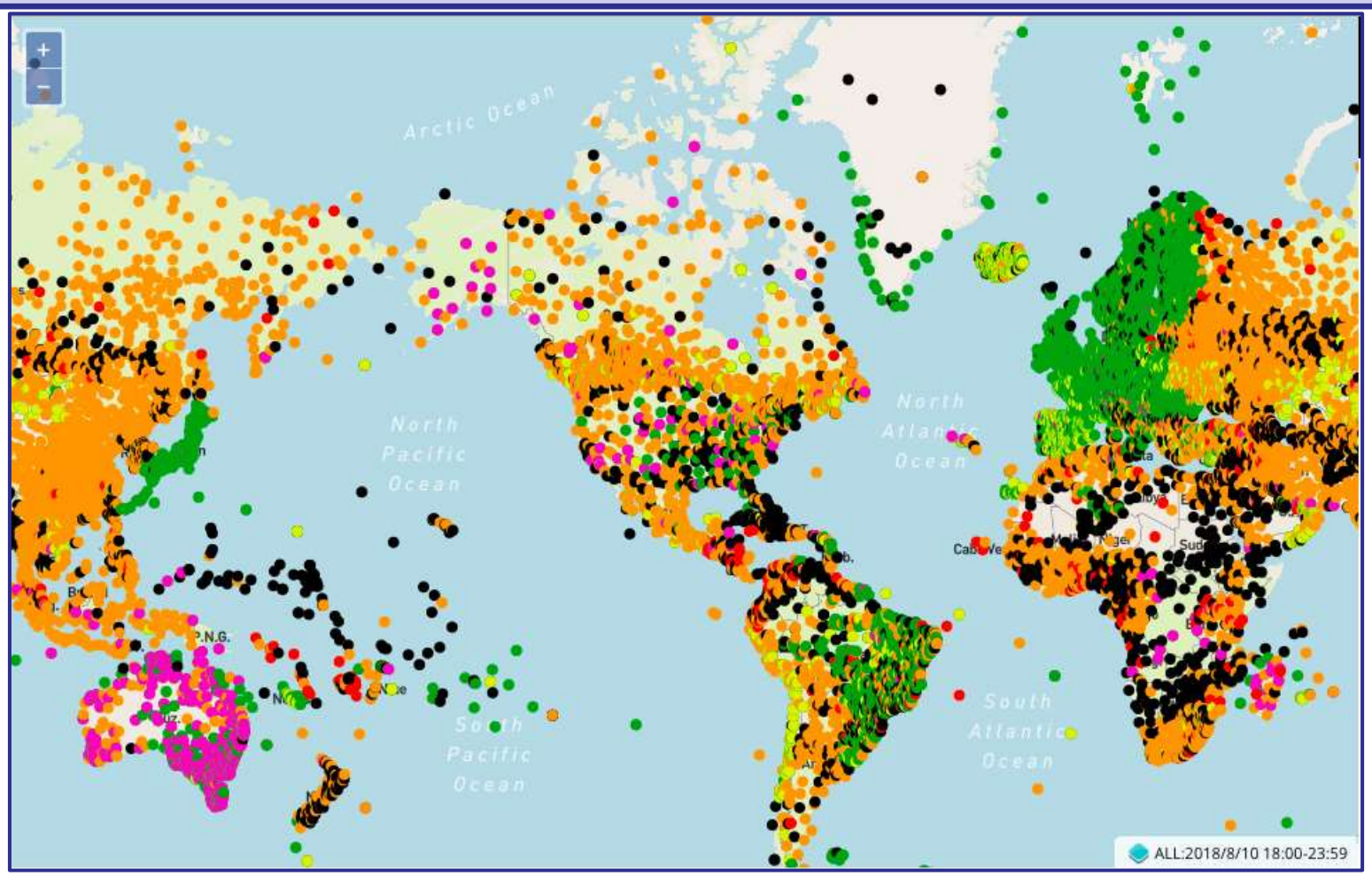
Importance to WMO and its Members of Application area 1: Global NWP

- Numerical Weather Prediction is a **foundational activity for nearly all weather and climate applications**, even for Early Warning Systems
  - Of the 14 application areas currently captured in the WMO Rolling Review of Requirements, 13 are either fully or partly **dependent of the availability of robust Global NWP input**
- Global Numerical Weather Prediction **depends on global coverage of observations**; WMO is the only organization providing the mechanisms required to acquire and exchange these observations.

Importance to HIGHWAY (Output 2) of Global NWP

- Most weather prediction **products** available to users world-wide (including in Africa) are **based on or depend** on global NWP guidance
  - **Without local observations, this guidance will be of poor quality**, especially in the tropics
- Global NWP is a **pre-requisite for high resolution NWP** and related methods used for **nowcasting** and short-range prediction
  - Global NWP shares many of its requirements with high resolution NWP, except the latter are even more stringent
  - **Regional NWP will fail unless the global model providing the boundary conditions sees the same mix of observations as the inner nested model**

Why is it urgent to strenghthen the observational basis for Global NWP?



Current state of international exchange of critical data for global NWP is poor (example: Surface pressure observations available to global NWP Centers on August 10 2018, 18Z)

Action taken by WMO to increase observational data exchange for Global NWP

- In order to increase the observational input to global NWP, the WMO Executive Council recently (EC-70) requested
  - CBS to *develop an overarching design for the **Global Basic Observing Network (GBON**) to meet threshold requirements for Global Numerical Weather Prediction and Global Climate Monitoring (Analysis) as established by the **Rolling Review of Requirements** Process {…}*,
  - The Inter-commission Coordination Group on WIGOS (ICG-WIGOS) to *develop relevant **provisions of the Manual on WIGOS** (WMO-No. 1160) regarding the implementation of the GBON and **propose them to Cg-18** in 2019*.

Gap analysis for upper air profiles
(provided primarily by radiosondes)

- Threshold requirement for global NWP: **500 km**, i.e. every cell of 500 km x 500 km = 250,000 km2 should contain on average one radiosonde station, reporting twice daily
- In principle achievable for the continental landmasses; over Europe and North America the design separation is 200 to 250 km
  - A 500 km resolution would require 120+ radiosonde stations functioning over Africa (more than 30M Km2)
    - Today we typically have fewer than 20 reporting
  - **EAC countries (1.8M km2) would need 7 radisonde stations**
    - Today only one (Nairobi) is reporting, and not consistently

WMO expectations for HIGHWAY outcome (Output 2):

- An **observing system that meets draft GBON specifications** for the project region
- An **observing systems that provides regular and timely reports on the GTS** to national and international users on the WIS/GTS
  - Minimum 3 (preferably 4) radiosonde stations reporting daily at 00Z and 12Z
  - Surface stations (ideally) corresponding to a target resolution of 100 km, **reporting hourly observations on the GTS**

Regional WIGOS Centers (RWC)

- Why?
  - Many WMO Members requesting support from Secretariat for national implementation efforts
  - Can be addressed more efficiently and effectively at regional level
- What?
  - Initial role or RWC will be to support national WIGOS Implementation efforts, in particular as concerns
    - **OSCAR/Surface; ensuring metadata input and QC**
    - **WDQMS; especially fault management component**
- How?
  - To be decided by individual WMO Regions - will likely take place primarily at the sub-Regional level, aligned with existing cultural, linguistic and/or political groupings of countries

Regional WIGOS Center in HIGHWAY countries

- Preliminary agreement from PRs of Kenya and Tanzania to jointly operate a Regional WIGOS Center in pilot mode for project countries

- Next steps:
  - Develop and submit proposal to acting President of RA I (with help from WIGOS Project Office);
  - Include required resources in HIGHWAY LOA's currently being drafted between WMO Secretariat and project countries

Summary and Conclusions

- HIGHWAY provides a unique **opportunity to strengthen** the **regional WIGOS infrastructure** and the observing systems, providing substantial **benefits to both local and global** users by:
  - **Increased international data sharing** by project countries - critical to success of HIGHWAY
  - WMO **specifications for GBON** can be used as part of the basic input to HIGHWAY Gap Analysis
  - Project countries may have different/complimentary requirements that need to be considered
- A **Regional WIGOS Center pilot** hosted within the project countries would greatly help the effort toward strengthening the observational capabilities within the sub-Region:
  - Metadata in OSCAR/Surface
  - Quality monitoring and incident management (WDQMS)

Thank you

www.wmo.int/wigos