WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

Observing and Information Systems Department

For Briefing to
Permanent Representatives
of WMO Members

September 2019

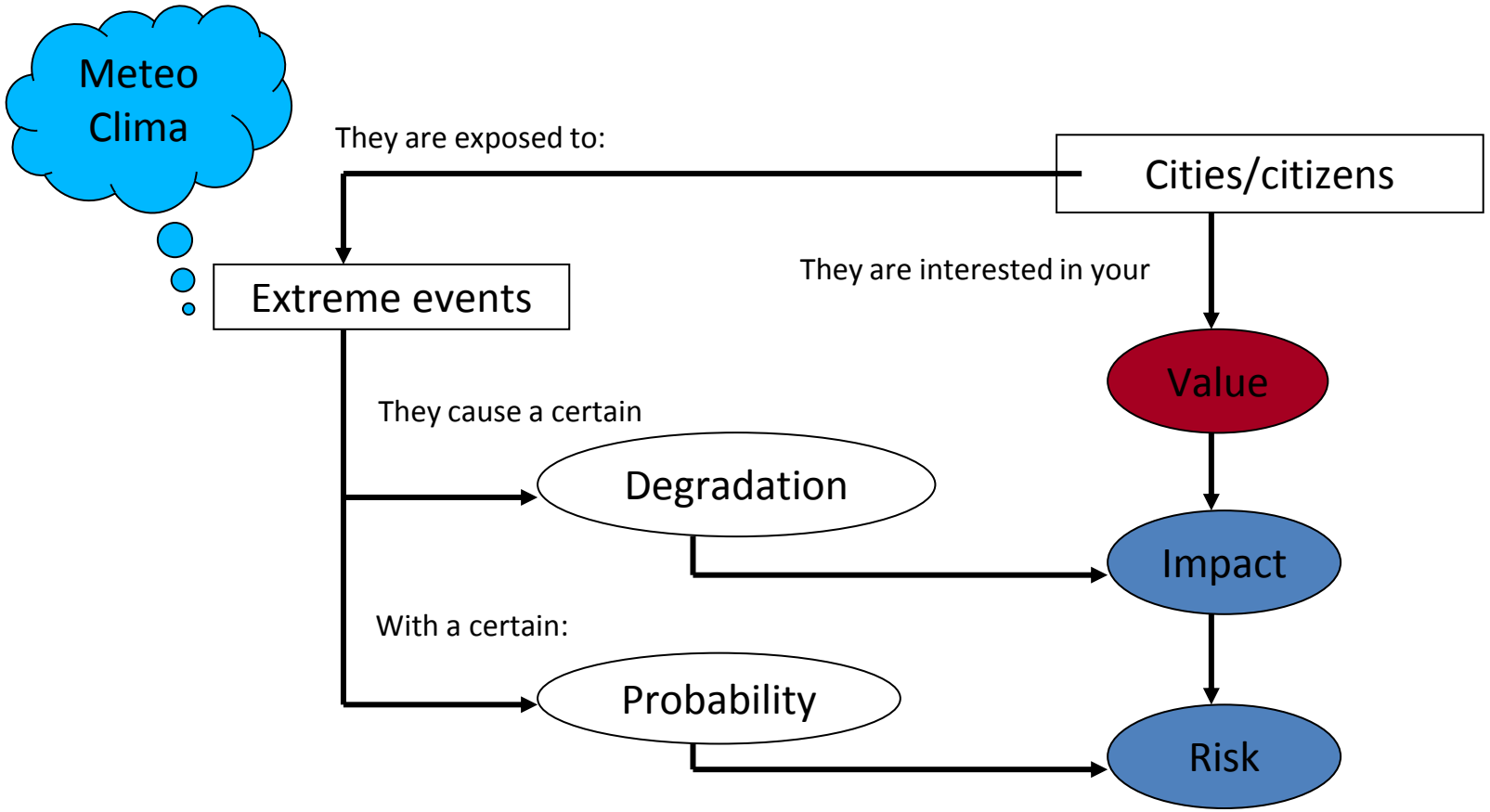
WMO OMM

World Meteorological Organization
Organisation météorologique mondiale

Outline

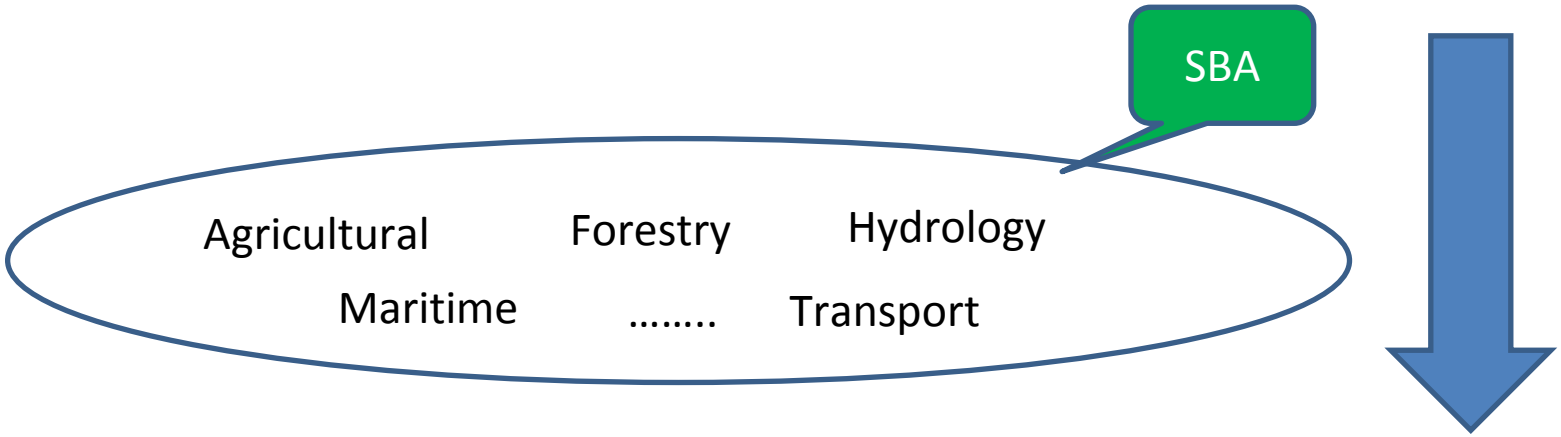
- **Background**
- Observing Systems
- WIS
- Space Program

Framework


Meteo
Clima
They are exposed to:
Cities/citizens
Extreme events
They are interested in your
Value
They cause a certain
Degradation
Impact
With a certain:
Probability
Risk

Focus on:

Observations and Numerical Weather/Climate Models Outputs (Seasonal Forecasts)



Crop Monitoring/Forecasting systems National

Early warning systems

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Data warehouse

- NMHS's network
- Agrometeorological Network
- Hydrological organizations
- Marine authority
- Regional organizations.
- Transport Authority
- Environmental Agencies
- Remote sensing data

National collaboration

NETWORKS

Data in real time

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Outline

- Background
- **Observing Systems**
- WIS
- Satellite Program

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

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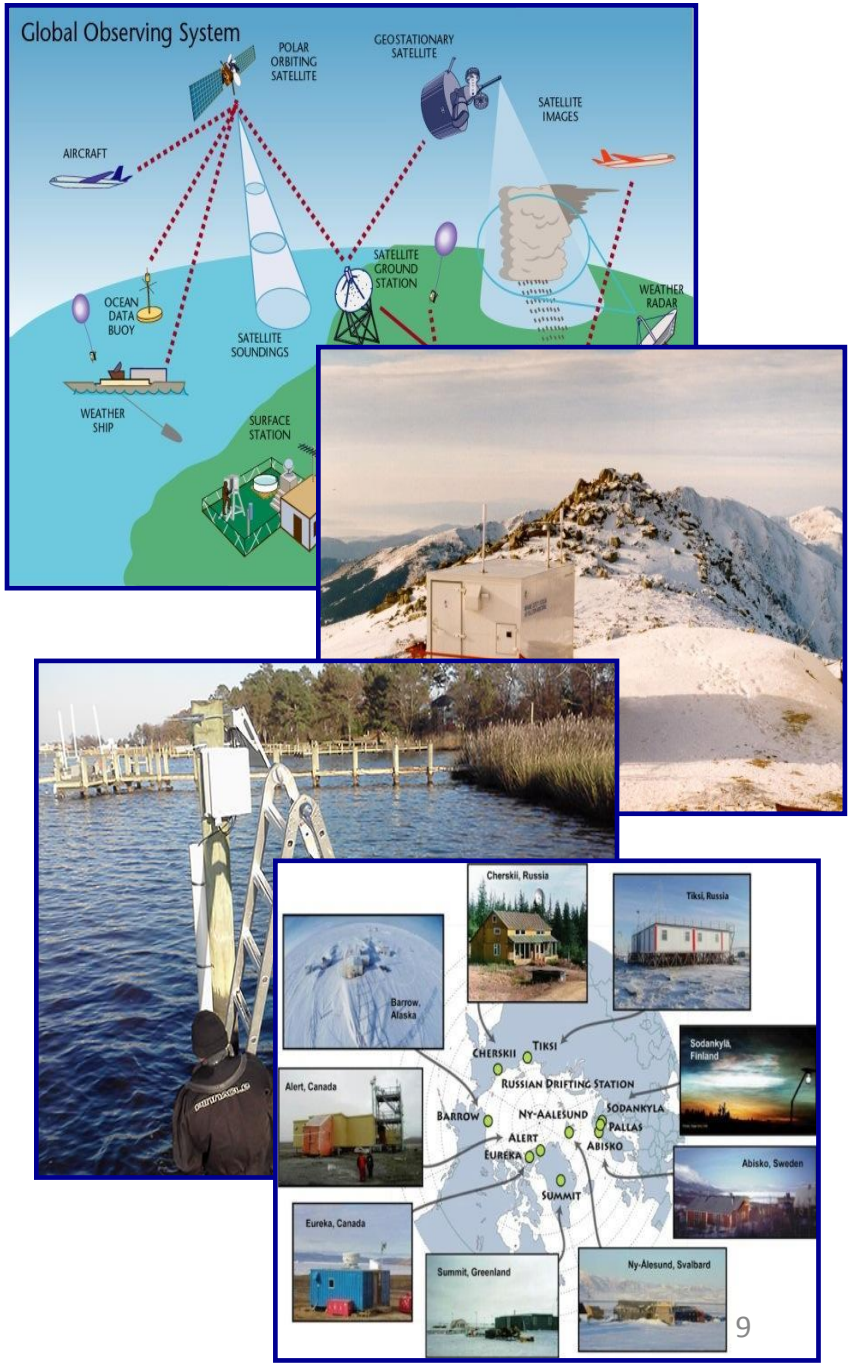
WMO Application Areas supported by WIGOS

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
13. Climate applications
14. Space weather

WIGOS Components

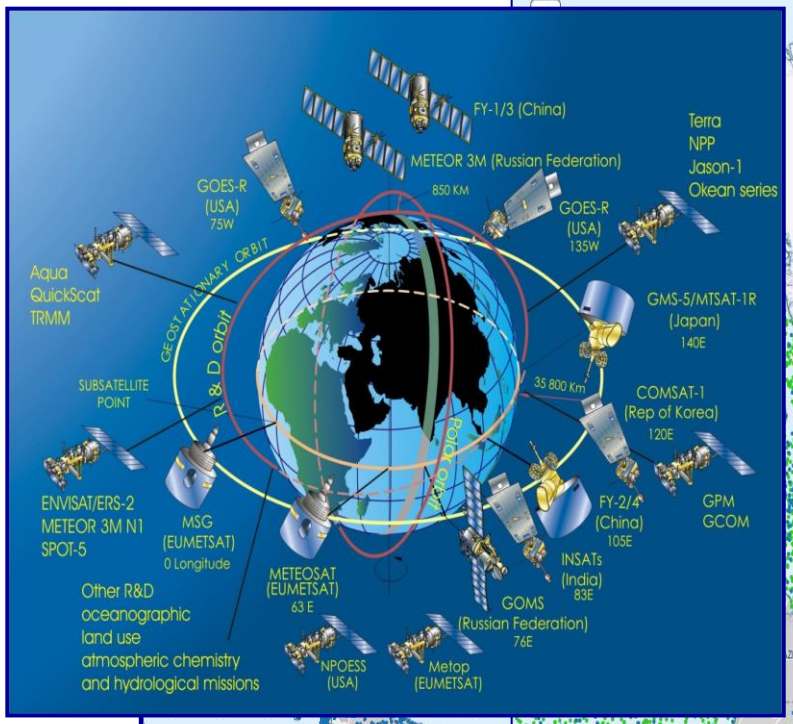
(by discipline)

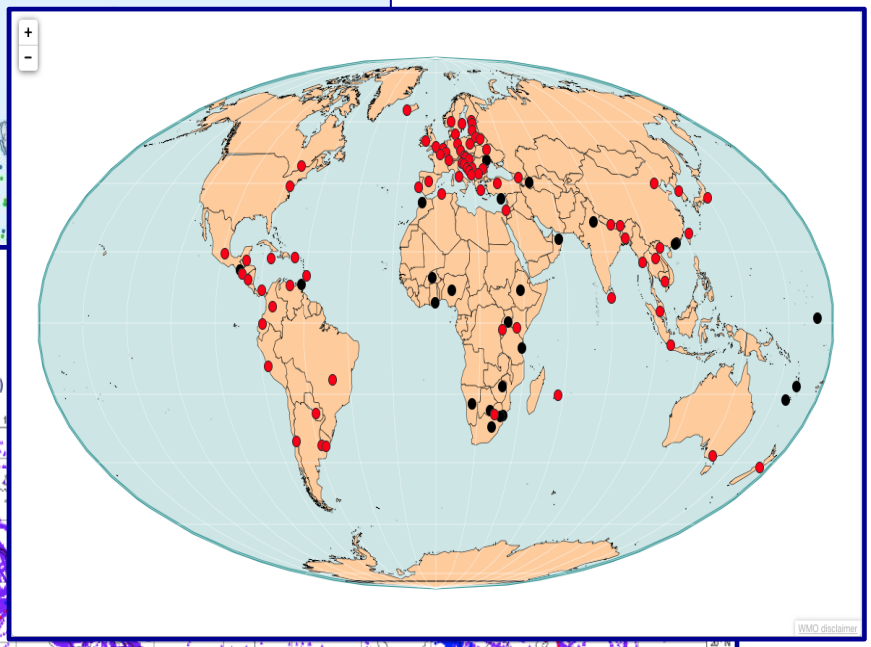
- Global Observing System (WWW/**GOS**)
- Observing component of Global Atmospheric Watch (**GAW**)
- WMO Hydrological Observations (including **WHYCOS**)
- Observing component of Global Cryosphere Watch (**GCW**)



WIGOS Components

(by operator)



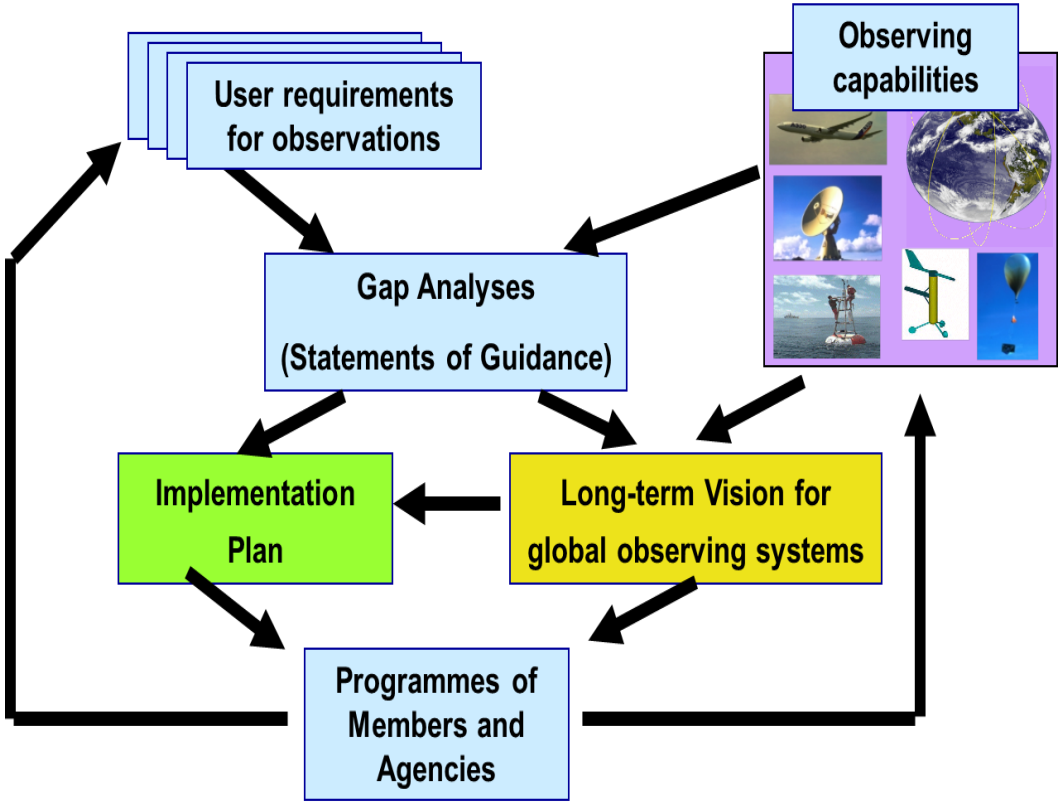


Rolling Review of Requirements (RRR)

- 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



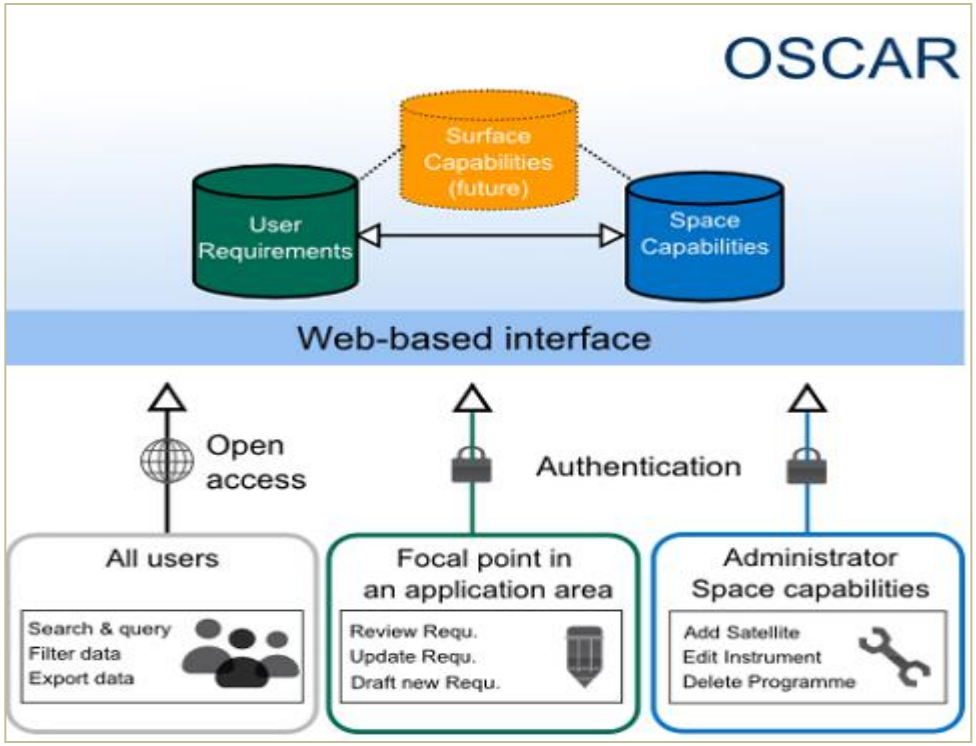
Vision for WIGOS in 2040?

- To serve as reference for WMO Members and other observing system operators, providing context and expected boundary conditions relevant for observing system developments
- To inform long-term planning of satellite agencies about expected evolution of WMO user requirements
  - This drives the 2040 timeline; current 2025 Vision too near-term
- To inform planning efforts of users of observations (NHMSs, NWP centers, …) regarding systems development and required computing and communication capabilities

OSCAR (Observing Systems Capability Analysis and Review Tools)

Web Platform for WIGOS:

- Land, upper-air, ocean and space observations
- Metadata: Current and historical
- Requirement vs Capacities (RRR)
- Facilitate the strategy plan for observations networks
- WMO Application Areas
- Support and improve your Service.



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World Meteorological Organization
Weather · Climate · Water

OSCAR Observing Systems Capability Analysis and Review Tool

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Home Affairs FDHA
Federal Office of Meteorology and Climatology MeteoSwiss

Quick access

Generate station report by:

Station name

WMO ID

Generate station lists by:

Country

Type

Find people by:

Contact name

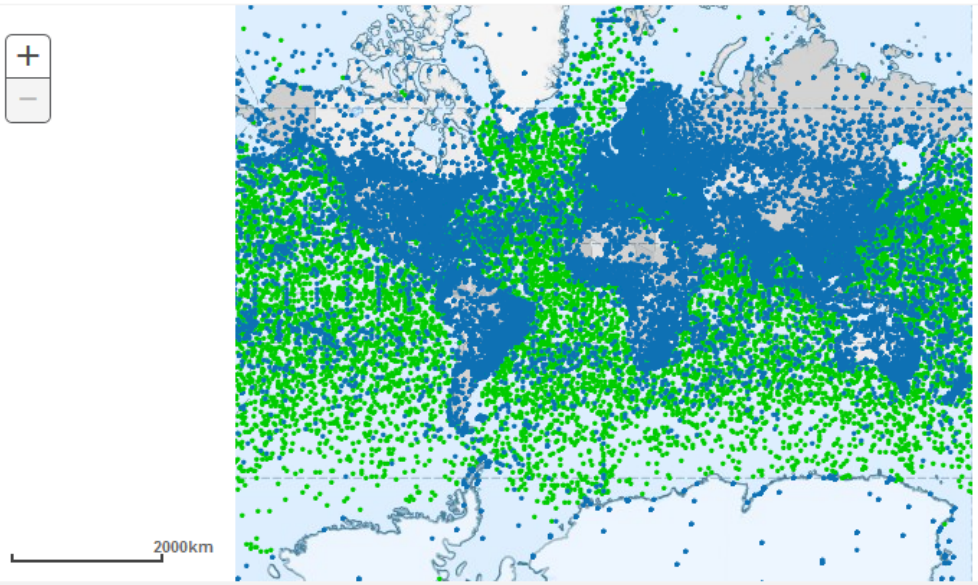
Filter map

By program / network:

- [x] WIGOS components
  - [x] GOS
  - [x] GAW
  - [x] WHOS
  - [x] GCW
- [x] Co-sponsored components
  - [x] GCOS
  - [x] GOOS
  - [x] GTOS
- [x] Other components
  - [x] Non affiliated

Welcome to OSCAR/Surface

OSCAR/Surface is the World Meteorological Organization's official repository of WIGOS metadata for all surface-based observing stations and platforms. For more details on OSCAR, please visit the About section. For additional information about WIGOS, visit the WIGOS Homepage.



air ● land or ocean surface ● sub-surface ● lake or river ●

Latest news

2017-09-25 Scheduled maintenance, 27.09.2017

GAWSIS and OSCAR might be temporarily unavailable on 27 September 2017 between 20.00 and 21.30 UTC for scheduled maintenance of the authentication service.
We apologise for any inconvenience.

2017-09-15 200 years of meteorological observations on Col du Grand St-Bernard!

We celebrate today the Swiss station Col du Grand St-Bernard, which boasts the longest meteorological time

WIGOS Operational (From 2020 onwards)

1. **National WIGOS implementation:**
2. **Implementation of the Global Basic Observing Network and the Regional Basic Observing Networks;**
3. **Operational deployment of the WIGOS** Data **Quality Monitoring System;**
4. **Operational deployment of Regional WIGOS Centres;**
5. **Further development of the OSCAR databases and integration with other system elements;**
6. **Fostering a culture of compliance with the WIGOS technical regulations**;

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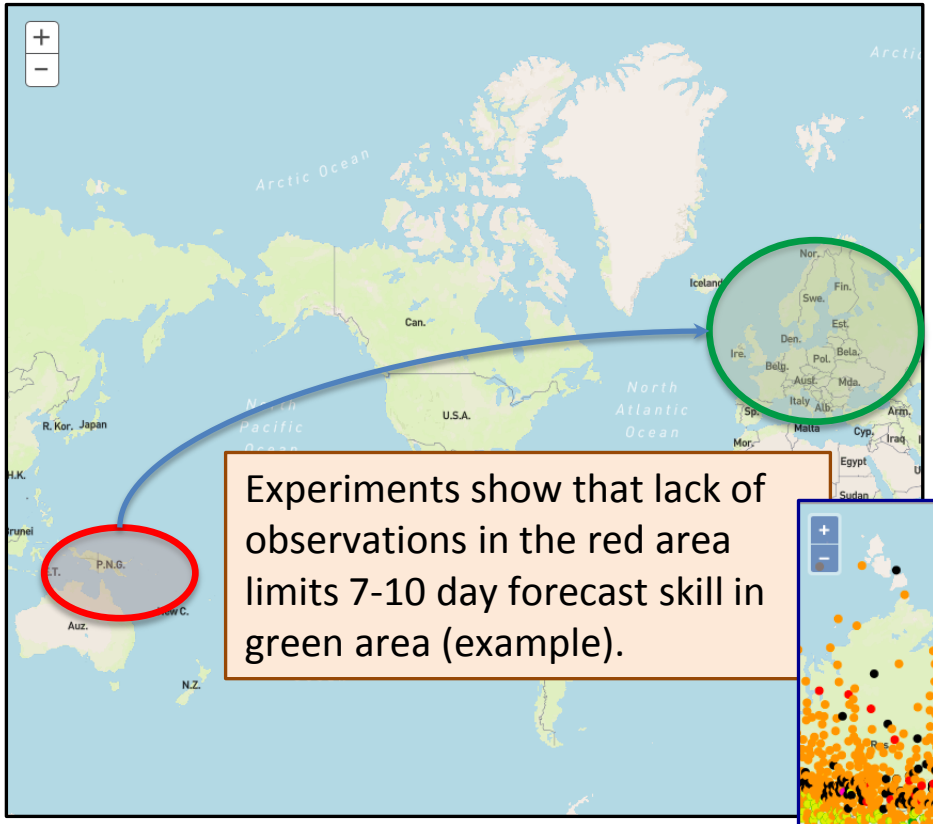
The WMO Global Basic Observing Network (GBON)

Source: RA I meeting. WIGOS PO

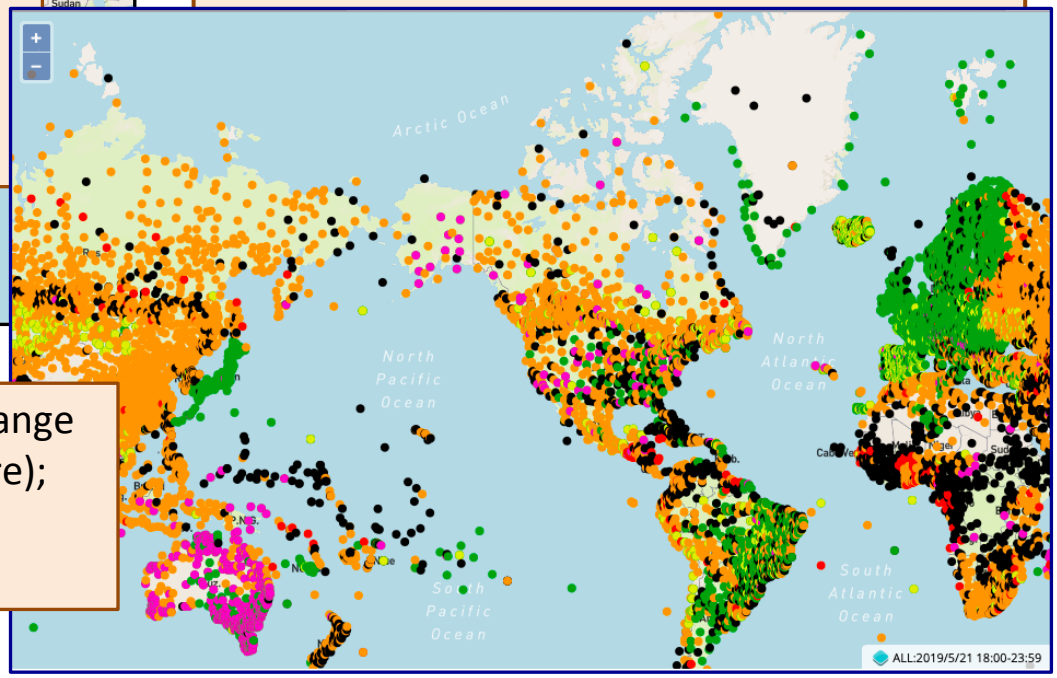
Resolution 34 - GLOBAL BASIC OBSERVING NETWORK



Experiments show that lack of observations in the red area limits 7-10 day forecast skill in green area (example).

- Generally, any lack of observations over one area of the globe will limit our ability to understand and predict weather and climate patterns everywhere else.
- Weather prediction beyond the 3-4 day range essentially requires observations from the whole world

"In meteorology, ignorance knows no boundaries"



- Monitoring results showing current exchange of observations for NWP (surface pressure); **only green areas meet requirements**;
- GBON is the response to this situation

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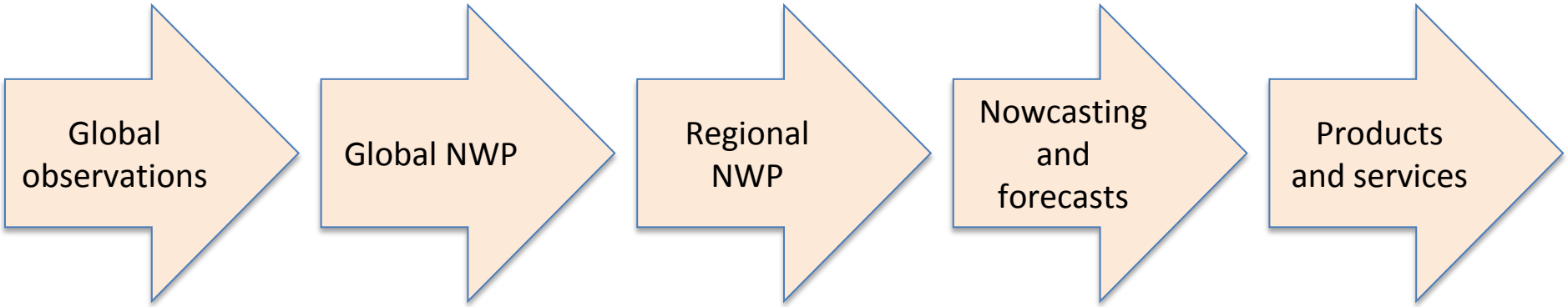
Importance of Global Numerical Weather Prediction (NWP) for all WMO Members



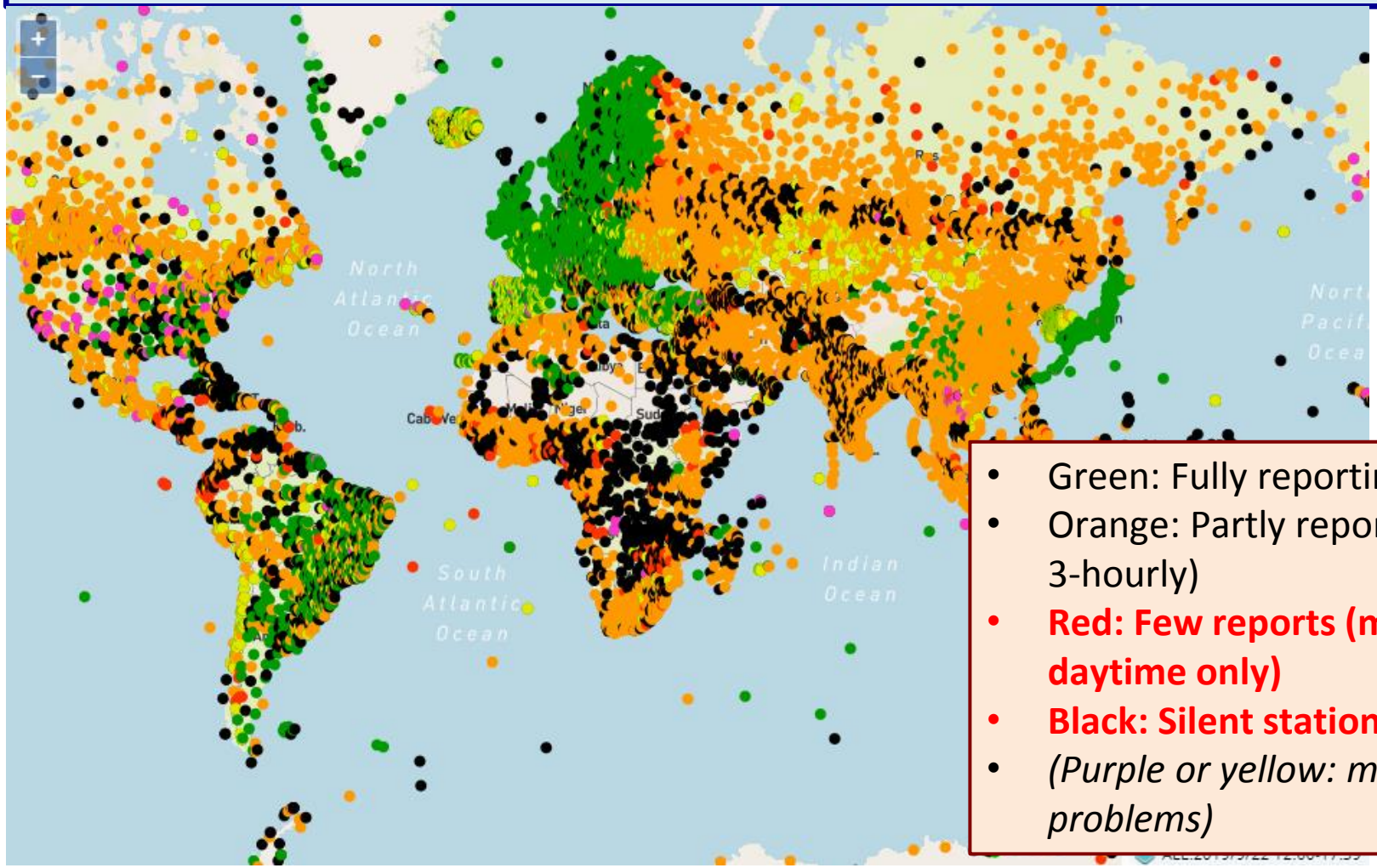
Without **local observations**, both global, regional and mesoscale NWP guidance will be poor;

- Leading in turn to poor basis for weather and climate services at all forecast ranges;

- This issue affects all WMO Members, but it is particularly serious in the tropics

2. Where are we currently missing observations?

(surface-based; satellite data can help, but cannot do the job alone)



- Green: Fully reporting (hourly)
- Orange: Partly reporting (mostly 3-hourly)
- **Red: Few reports (mostly daytime only)**
- **Black: Silent stations**
- *(Purple or yellow: metadata problems)*

Surface pressure obs available to global NWP Centres on 22 September 2019, 12Z

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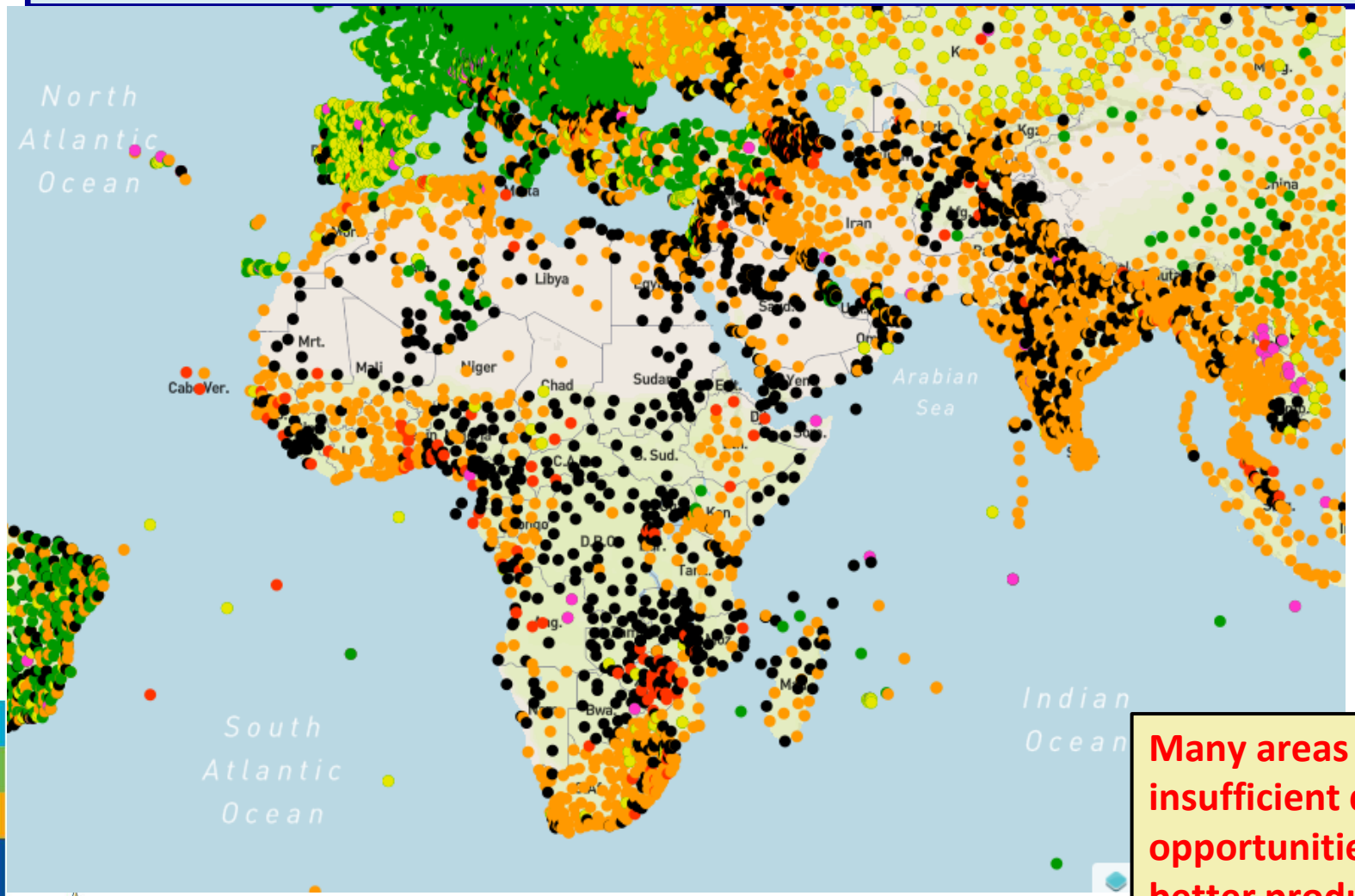
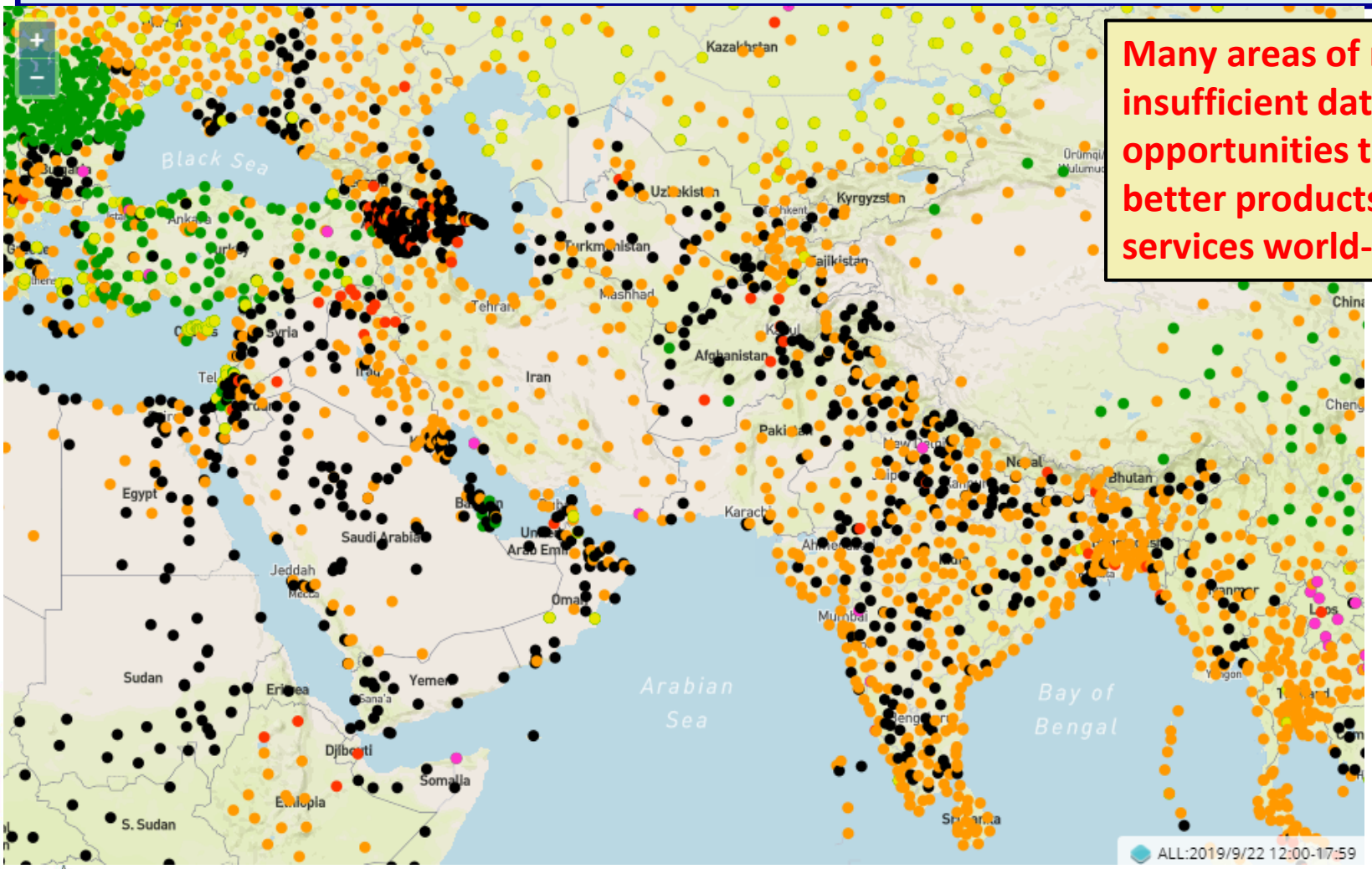
2. Missing surface observations I



Many areas of missing or insufficient data: Lost opportunities to generate better products and services world-wide

WMO OMM

2. Missing surface observations II



Many areas of missing or insufficient data: Lost opportunities to generate better products and services world-wide

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4.1 What are the benefits of GBON to WMO Members?

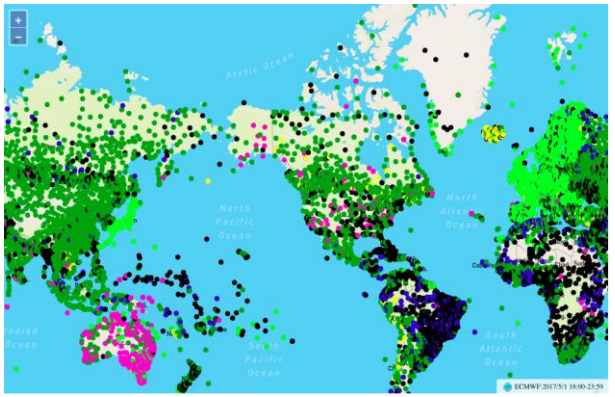
- **Better global coverage, leading to better global NWP output; direct benefits, as well as indirect benefits, thanks to better boundary conditions for regional/mesoscale NWP;**
- Observations are valuable, but single observations have little value in and of themselves;
  - **International data exchange is massive global multiplier on investment in observations;**
  - the full potential of a global observing system can be realized only if all (or nearly all) the pieces are available to its users.

4. What is the requirement for individual WMO Members?

- Four categories of implementation (examples):
  1. **Members already complying with the GBON provisions** (e.g. Japan, Western Europe) – *no further action is needed;*
  2. **Members where GBON observations are made, but not currently exchanged**, (e.g. USA, China) - *new data exchange practices must be adopted;*
  3. **Members with insufficient national resources,** (e.g. parts of Africa, Caribbean, South Pacific); *use GBON to help steer internationally funded development projects toward integrated observing systems set up for international data exchange;*
  4. **Areas where GBON requirements are not met due to geographic constraints;** (e.g. Indian Ocean, North Pacific) – *opportunities for new technologies, satellite remote sensing.*

WIGOS data quality

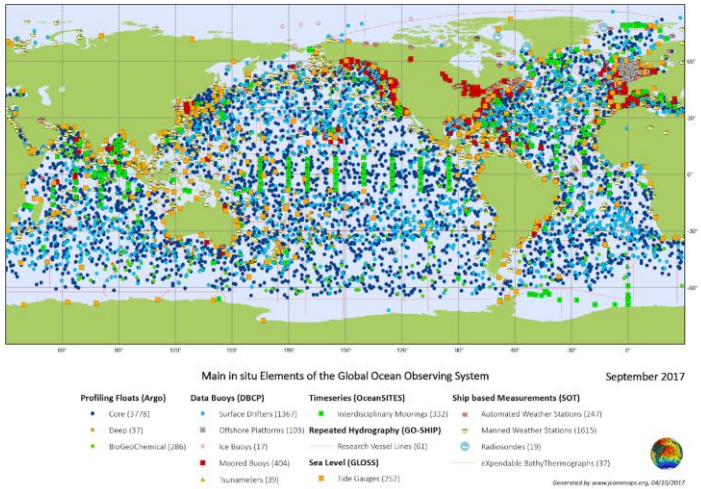
- Recommended practices and guidelines (e.g. CIMO Guide)
- Traceability of observations (calibration, intercomparisons)
- Support of Regional Instrument Centres (RICs) & RMICs (Marine)
  - Calibration service
  - Training on best practices and standards
  - Inter-laboratory comparisons
- Understanding data with WIGOS metadata & OSCAR
- WIGOS Data Quality Monitoring System (WDQMS)
  - Real-time and delayed mode monitoring of performance
  - Incident management and feedback to data producers
  - Pilot project on NWP-based monitoring (ECMWF, NCEP, DWD, JMA)

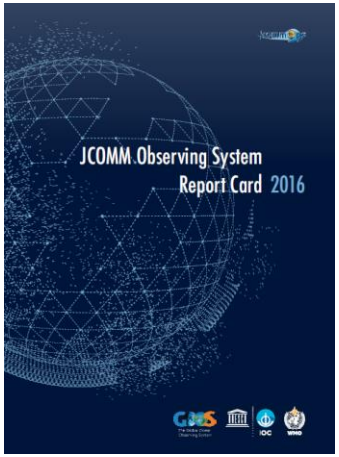


Example; monitoring of surface pressure observations received at ECMWF

Marine & Ocean Observations

- Implemented through JCOMM (Joint Technical Commission for Oceanography and Marine Meteorology).
- Address requirements of Climate Monitoring (GCOS) and services, El Niño, sea level, weather, extreme events, marine services, ocean health, sustainable ocean resources
- Redesigning observing networks and looking at emerging technologies to fill the gaps (gliders, HF radars, marine mammals borne sensors …)
  - TPOS 2020, Deep Ocean, Polar Regions
- Challenges sustaining the networks (more operational funding needed)
- JCOMMOPS providing monitoring of the networks function
- Looking at integrated data management for accessing data in real-time and delayed mode (Open GTS, MCDS)





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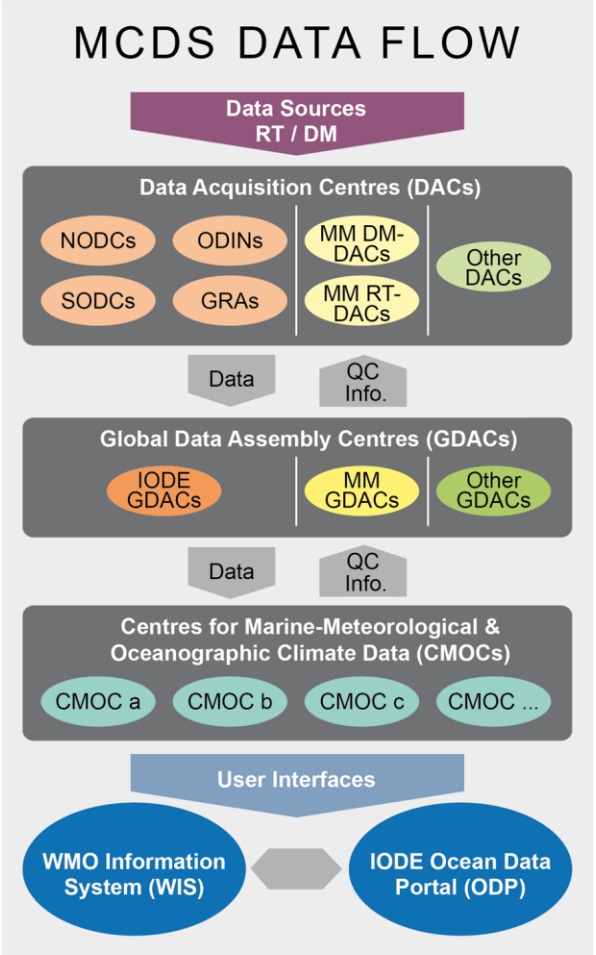
Marine Climate Data System (MCDS)

- One of JCOMM's contribution to GFCS
- Integrated data management assuring data flow in delayed mode through network of DACs, GDACs, CMOCs
- Centres for Marine Meteorological and Oceanographic Climate Data (CMOCs) providing added value data, incl. ECV-based products (higher level QC, bias correction, data rescue)
  - CMOC/China established by Cg-17
  - JCOMM-7 about to Recommend establishing World Ocean Database as CMOC
- Interoperability with WIS



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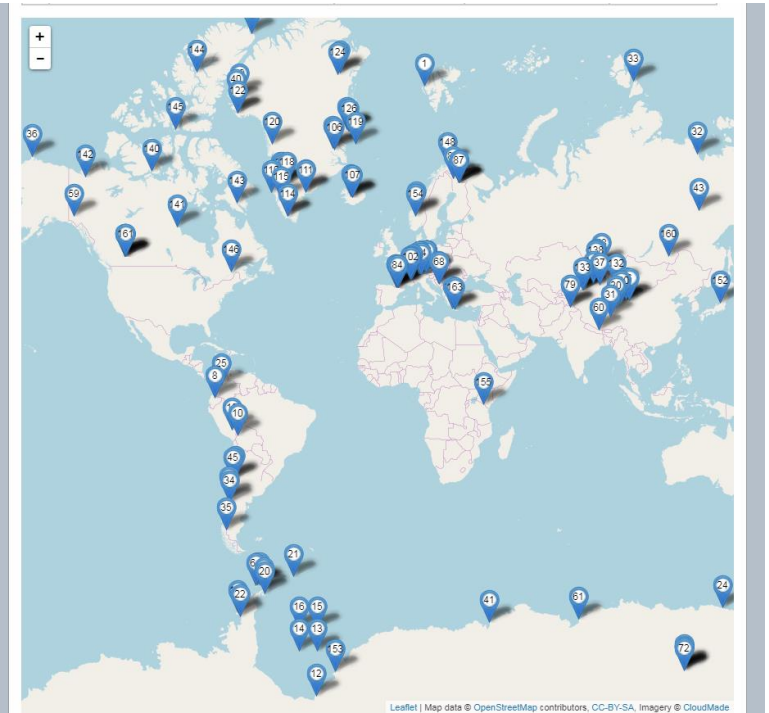
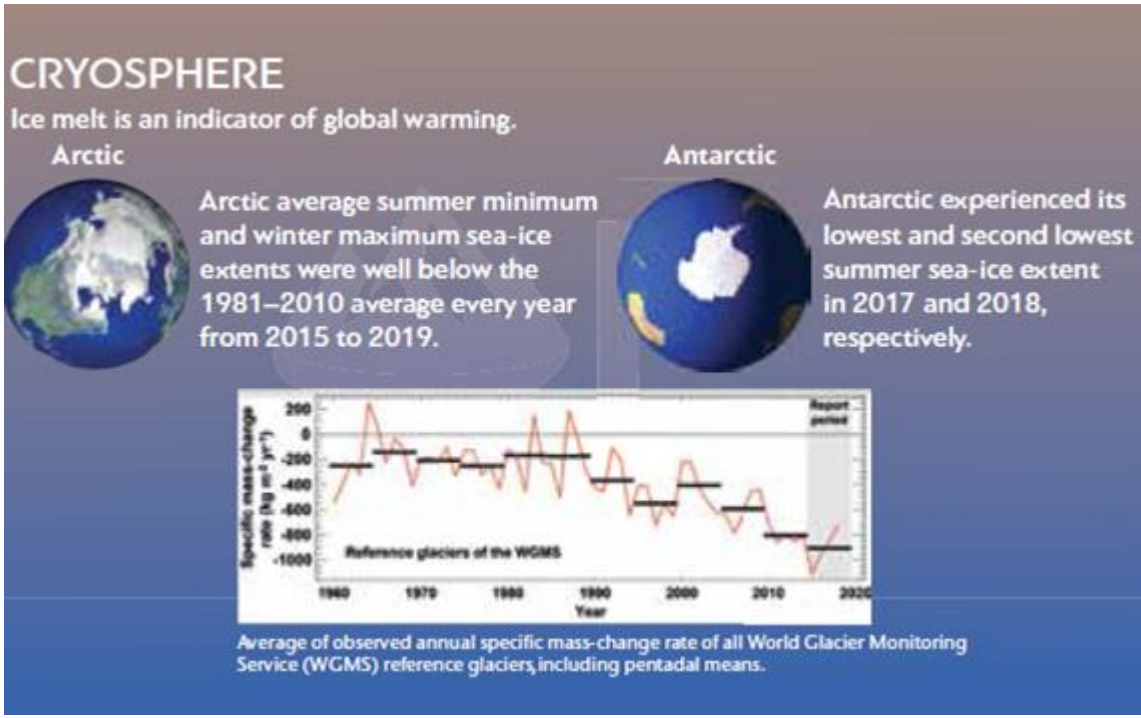
Global Cryosphere Watch (GCW)

- Cross-cutting mechanism of WMO, to facilitate access to information on the state of the cryosphere (snow, ice)

- GCW network (153 stations, 26 countries): component of WIGOS, (regulatory material, best practices, stations registered in OSCAR)

GCW Facilitates contributions from international experts to the WMO Statements on Climate (e.g. The Global Climate in 2015–2019, published on 22 Sept 2019)





Global Cryosphere Watch (GCW)

Resolution 50 (Cg-18): GCW pre-operational phase; priorities

- impact of cryosphere on water resources, as a natural hazard, support sea ice services.
- developing countries, high mountain regions.

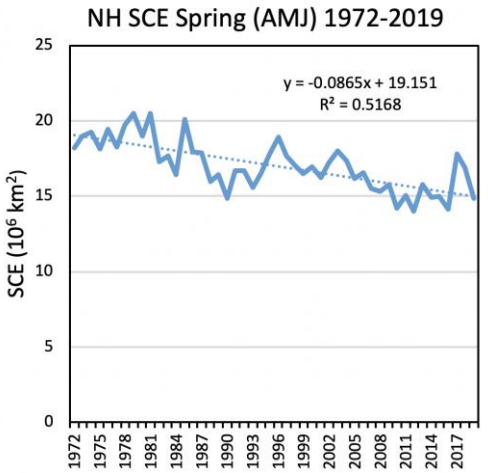
Urged Members to:

(2) enhance and sustain their cryosphere activities in data-sparse regions, (IPCC SPecial Report on Oceans and Cryosphere)

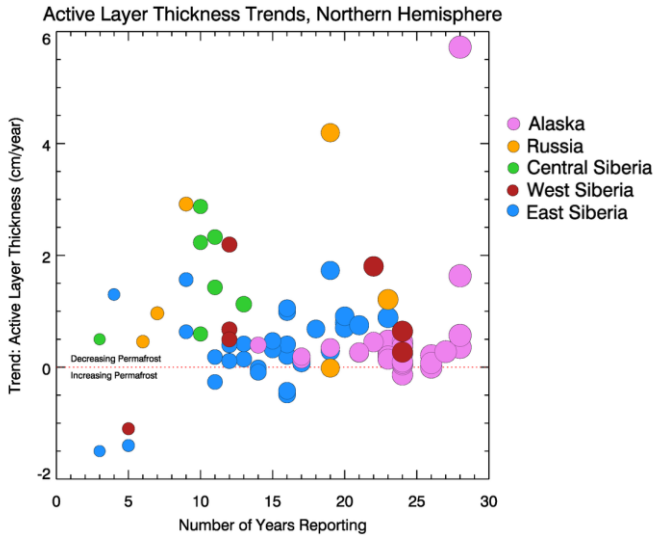
(3) foster national partnerships, on cryosphere

(4) coordinate WIGOS and WIS activities with GCW;

(5) Nominate cryosphere experts.



NH land area (excluding Greenland) spring (April, May, June) snow cover extent variability over 1972-2019



Examples of GCW assessments

active layer thickness trends versus number of years reporting over all 2018 Northern Hemisphere sites current in 2018

WMO OMM

Instruments and Methods of Observation

Standardization:

- Instrument Intercomparisons
  - –International Pyrheliometer Comparison, 2020, Davos, Switzerland,
  - –Upper-air Intercomparison, 2021, Lindenberg, Germany
- Continuous update of the Guide to Instruments and Methods of Observation (WMO-No. 8, known as CIMO Guide)
- International Cloud Atlas (web-version) soon available in all languages
- Standardization of remote-sensing instrument practices (radars, wind-profilers)
- Collaboration with ISO on joint standards (lidar, radars)
- Promoting measurement traceability (collab. with RICs, incl. evaluation of RICs) & data QA (siting & maintenance classifications)

Capacity-development:

- Guidance material on: transition to AWS, procurement of AWSs, low-cost instrumentation, new technologies, …
- Development of training courses on calibration practices, and computation of calibration uncertainties.
- Technical Conference, in conjunction with instrument exhibition

Key Congress outcomes related to observations

	WIGOS
34	Global Basis Observing Network
35	WMO Integrated Global Observing System station identifiers
36	Amendments to the Technical Regulations (WMO-No. 49), Volume I, Part I – WMO Integrated Global Observing System, and to the Manual on the WMO Integrated Global Observing System (WMO-No. 1160)
37	The WMO Integrated Global Observing System transition to operational status commencing in 2020
38	Vision for the WMO Integrated Global Observing System in 2040
39	Establishment of collaboration between the International Air Transport Association and WMO on the development and operation of the Aircraft Meteorological Data Relay Programme
40	Members' contribution to the actions specified in the Imple Evolution of Global Observing Systems, in the context of the Global Observing System Implementation Plan
41	Use of the Observing Systems Capability Analysis and Reviev (OSCAR/Surface) for the collection and recording of the WM Observing System metadata
42	Radio frequencies for meteorological and related environme
43	Report of the seventeenth session of the Commission for In Methods of Observation

	OBSERVING SYSTEMS
44	Joint World Meteorological Organization-Intergovernmental Oceanographic Commission of UNESCO Strategy for Marine Meteorological and Oceanographic Data Management (2018–2021)
45	Ensuring adequate marine meteorological and oceanographic observations and data coverage for the safety of navigation and the protection of life and property in coastal and offshore areas
46	Future collaboration between WMO and the Intergovernmental Oceanographic Commission on facilitating oceanographic observations in coastal regions in support of Earth system prediction and climate services
47	Ocean observations in support of Earth system prediction, and WMO support to the Global Ocean Observing System Strategy 2030 (including Tropical Pacific Observing System 2020)
48	Key directions of the polar and high-mountain agenda for the next WMO financial period (2020–2023)
49	Antarctic Observing Network
50	Pre-operational phase of the Global Cryosphere Watch
51	Implementation of the architecture for climate monitoring from space

WMO OMM

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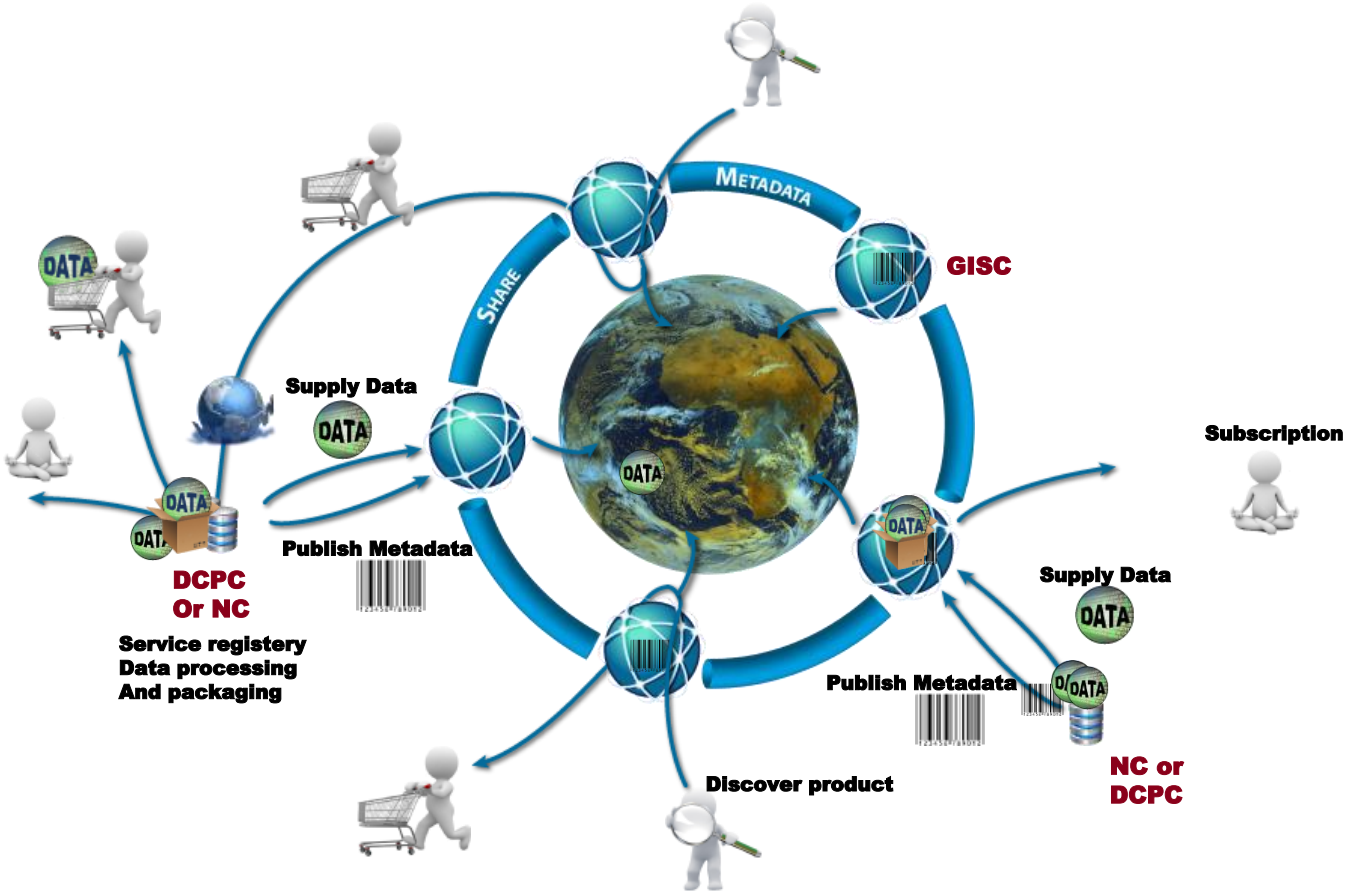
About WIS

- WIS is about finding, accessing and exchanging information. It has three parts :
  - Part A. Continued evolution of the GTS to support the exchange of operational and time critical data and products
  - Part B. Discovery, access and retrieval. A service that allows data, products and services to be registered
  - Part C. Information management (Cg-17)
- WIS includes original, repackaged and redistributed data

WIS Communities

- Users.
  - WIS provides data to any authorized user
  - WIS provides public access to data that is registered to be freely available
- Data providers
  - WIS data providers are the National Centres (NCs) and the Data Collection or Production Centres (DCPCs)
  - Data providers register the availability of their data in WIS's Global Information System Centres (GISCs)
  - WIS encourages data providers to use WMO data formats (eg GRIB BUFR NetCDF) , but can exchange any file format
  - Data providers set the data policy on services and products registered and available through WIS

WIS Communities



WIS 2.0

- All WIS data will be
  - Managed
  - Documented & Discoverable
  - Accessible and Easy to use
    - API to improve selection and granularity of requested data sets
    - Services to visualize or process the data and only ingest the required information

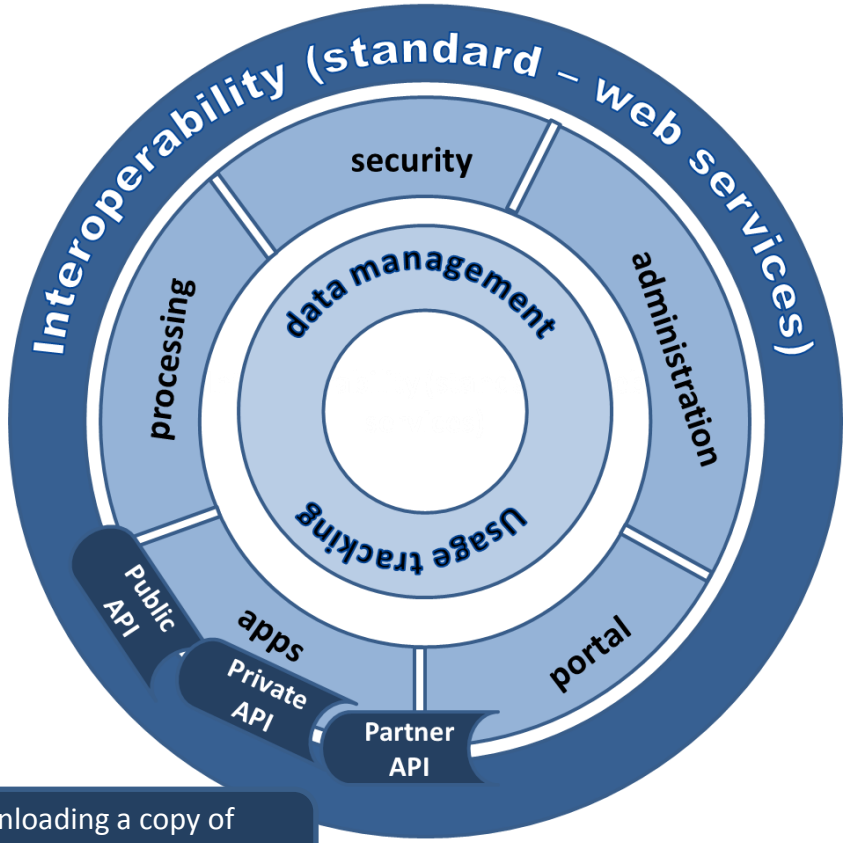
WIS 2.0 - the platform

- A global information management, processing and sharing platform

Acquisition

Dissemination

Collaboration



Change in user behaviour from downloading a copy of information for local processing to using *services* that process the information at its source

WIS 2.0 - Data Lifecycle Management

WIS 2.0 platform will be complemented by a set of principles to standardize best-practice in data life cycle management by the WMO community

Key Congress outcomes related to Information Systems

- Res 55 - Emerging data issues
  - –SG to publish 'WMO Guidelines on Emerging Data Issues' in all WMO languages
  - –SG to convene a global "WMO Data Conference" in 2020
  - –Members to participate in exploring the potential to harness innovation and emerging technical opportunities and applications for the benefit of all
- Res 56 - Data policies and practices
  - –EC to review the WMO data policies and practices expressed in Resolution 40 (Cg-12), Resolution 25 (Cg-13) and Resolution 60 (Cg-17); and to report back to Cg with proposals of corrective measures
- Res 57 - WMO Information System: Amendments to the Technical Regulations and WIS 2.0 implementation approach
  - –Adopts The WMO Information System 2.0 Implementation Approach
  - –Urges Members to participate proactively in the WIS 2.0 development and implementation process;

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- Background
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- **Space Program**

WMO Space Programme

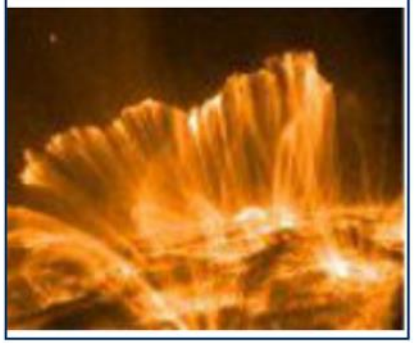
- Established by Resolution 5 (Cg-XIV) of the 14th WMO Congress in 2003
- Promote availability and utilization of satellite data and products for weather, climate, water and related applications.
- Coordinate environmental satellite matters and activities throughout all WMO Programmes.
- 16th WMO Congress in 2011 confirmed four main components:

The space-based Observing System

Access to Satellite Data and Products

Awareness and Training

Space Weather Coordination



See http://www.wmo.int/sat

WMO Space Programme Value Chain

Satellite Operators → Calibrated data sets → Quality-controlled products → Data collection, Dissemination & Access → Awareness & training → **Users**

CGMS

CEOS

GSICS Global Space-based Inter-Calibration System

SCOPE•CM

SCOPE•NWC

WIS

DBNet

VLab

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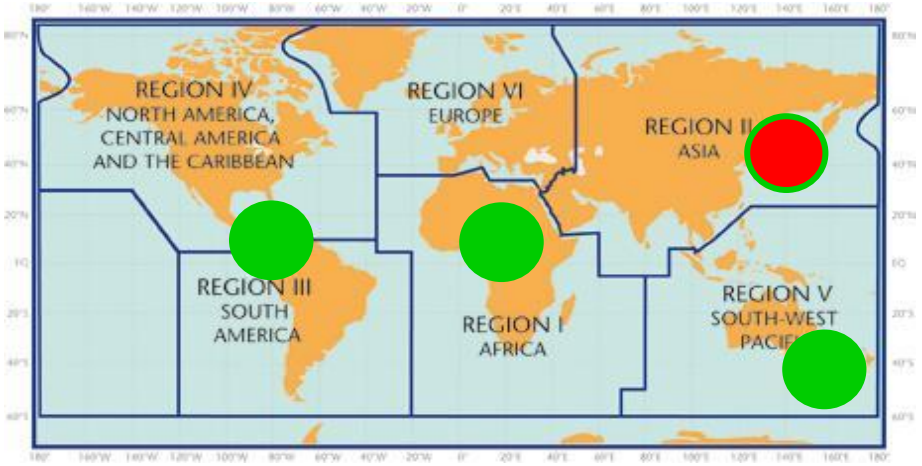
WMO Space Programme Expert Teams

ET-SAT	IPET-SUP	IPT-SWeISS
Expert Team on Satellite Systems	**Inter-Programme Expert Team on Satellite Utilization and Products**	**Inter-Programme Team on Space Weather Information, Systems and Services**

- Established under the Open Programme Area Group on Integrated Observing Systems of the Commission for Basic Systems
- Members nominated by Permanent Representatives
- IPET-SUP
  - Membership: http://www.wmo.int/pages/prog/www/CBS/Lists_WorkGroups/CBS/ICT-IOS/IPET-SUP/members
  - Terms of Reference: http://www.wmo.int/pages/prog/www/CBS/Lists_WorkGroups/CBS/ICT-IOS/IPET-SUP/tors
- To be reviewed in view of WMO Governance Reform

Satellite Data Requirements Groups

- RA I (Africa) Dissemination Expert Group (RAIDEG)
- RA II (Asia): WIGOS Project Coordination Group
- RA III/IV (Americas): Coordination Group
- RA V (SW Pacific): Task Team on Satellite Utilization



Bringing together:

- Operational users
- Satellite providers
- Training Centres of Excellence (VLab CoEs)
- Scientific users
- Others

Objectives:

- User-provider dialogue
- Expressing user requirements
- Coordinating data distribution
- Identifying training needs
- Implementing WIGOS/WIS

See http://www.wmo.int/pages/prog/sat/index_en.php (Regional Activities)

WMO/CGMS Virtual Laboratory

Home

Established by the World Meteorological Organization (WMO) and the Coordination Group for Meteorological Satellites (CGMS), the **Virtual Laboratory for Training and Education in Satellite Meteorology (VLab)** is a global network of specialized training centres and meteorological satellite operators working together to improve the utilisation of data and products from meteorological and environmental satellites.

Eight satellite operators are involved: CMA, CONAE, EUMETSAT, INPE, JMA, KMA,

NOAA and ROSHYDROMET, and thirteen training centres – called Centres of Excellence (CoEs) – located in Argentina (Buenos Aires and Cordoba), Australia (Melbourne), Barbados (Bridgetown), Brazil (Cachoeira Paulista), China (Beijing and Nanjing), Costa Rica (San Jose), Kenya (Nairobi), Morocco (Casablanca), Niger (Niamey), Oman (Muscat), Republic of Korea (Gwanghyewon), the Russian Federation (Moscow and St Petersburg) and South Africa (Pretoria). Three CoEs are linked to universities (Buenos Aires, St. Petersburg and Nanjing).

VLMG-8 Meeting in Barbados, May 2016

CoE: Moodle Login

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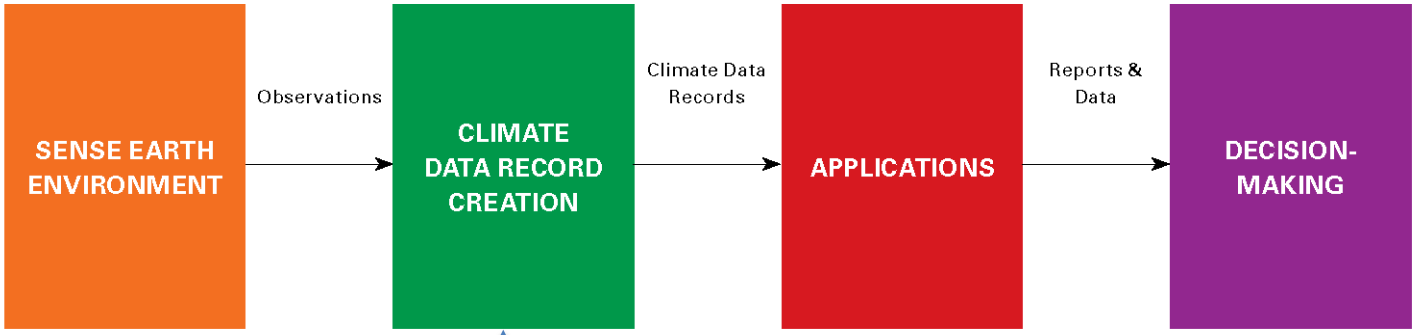
Links to Centres of Excellence

- Argentina
- Australia
- Brazil

See https://www.wmo-sat.info/vlab/

Architecture for Climate Monitoring from Space: To meet GCOS requirements, and more Satellite-based ECV Data Inventory: a baseline for gap analyses and action



Inventory of satellite-based ECV climate data records held by agencies worldwide

ECV Inventory to be published by CEOS-CGMS WGClimate in October 2017 at http://climatemonitoring.info/

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Key Congress outcomes related to Space Program

	SPACE PROGRAMM
51	Implementation of the architecture for climate monitoring from space
52	Strategy for the Virtual Laboratory for Education and Training in Satellite Meteorology 2020–2024
53	Four-year plan for WMO activities related to space weather 2020–2023
54	Implementation plan of the regional operational subproject for space-based monitoring of weather and climate extremes in East Asia and the Western Pacific

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WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

Thank you
Merci

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World Meteorological Organization
Organisation météorologique mondiale