WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

WIGOS, OSCAR, WDQMS, GBON and Expected Involvement of WMO Members

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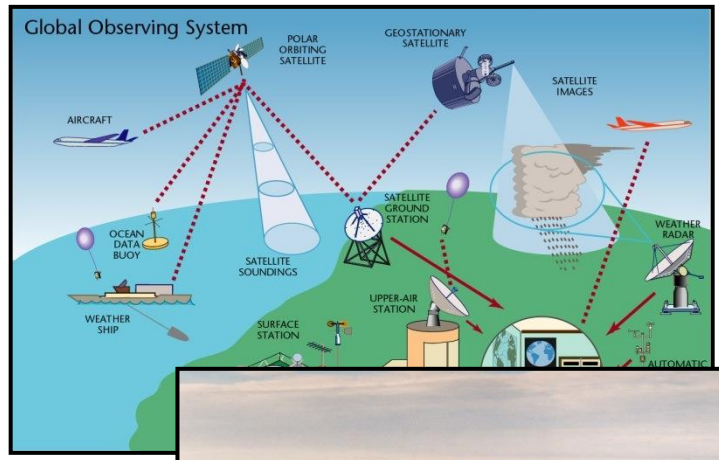
WMO OMM
World Meteorological Organization
Organisation météorologique mondiale

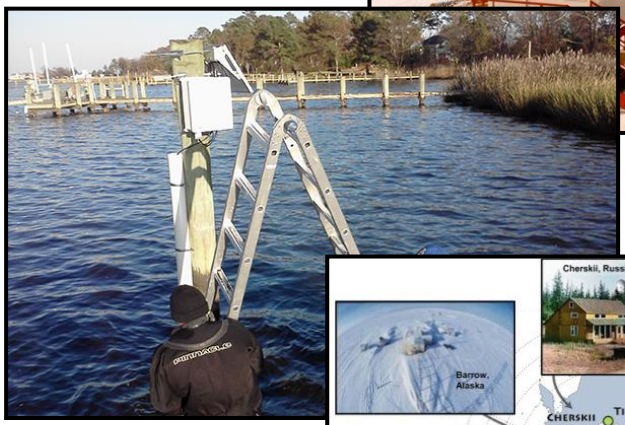
Overview

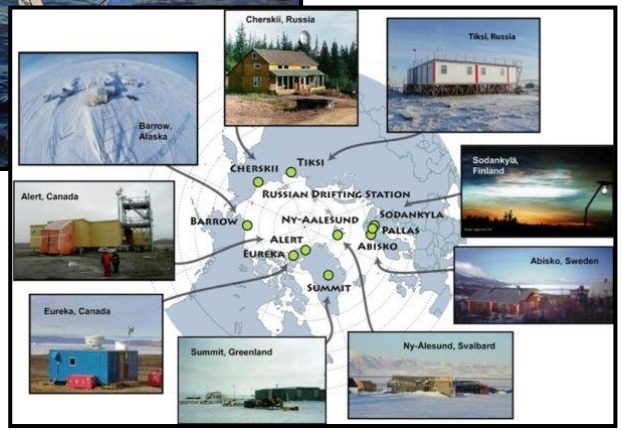
- Why WIGOS?
- What does integration mean?
- **OSCAR/Surf**ace, the WIGOS station catalog;
  – What is the role of the WMO Members in maintaining OSCAR/Surface
- **WDQMS**; how well is WIGOS working?
  – What is the role of Members vis a vis the WDQMS?
- **Regional WIGOS Centers**; why, what, where and how?
- The meteorological value chain and the role of the **Global Basic Observing System (GBON)**;
  – Impact of GBON and how to implement it?

WIGOS Component Systems

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







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Why do we need WIGOS?

- **I. NMHS mandate typically broader now than when the World Weather Watch and the GOS were created, including e.g.**
  - Climate monitoring, climate change, mitigation
  - Air quality, atmospheric composition from urban to planetary scales
  - Oceans
  - Cryosphere
  - Water resources
- **II. Technical and scientific advances:**
  - Observing technology
  - Telecommunications
  - Numerical modeling and data assimilation
  - Increased user demand to access and use observations in decision making

Why do we need WIGOS?

- **III. Economic realities**
  - Budgetary pressure on many NMHS, in spite of expanding mandates and increasing demand for services
  - Efficiency by exploiting synergies
    - Integration of observing networks across disciplines (e.g. weather and climate)
    - Integration across organizational boundaries, e.g. between different national ministries/departments operating observing systems
    - Integration across technological boundaries, e.g. between surface- and space-based systems

What do we mean by Integration?

I. Integrated network design, e.g. across national borders:

- Radar and lightning detection networks
- Radiosonde networks designed together with those of neighboring countries

II. Integration across disciplines: Multi-purpose networks

- No separate networks for application areas that rely on measurements of the same variables, e.g. weather and climate

III. Integration across organizational boundaries:

- Take advantage of other organizations outside the NMHS that operated observing systems; partner with them where possible

What do we mean by Integration? (II)

IV. Integration across technological boundaries; space- and surface-based observing system as one

- Space: excellent spatial and temporal coverage
- Ground-based: fine-scaled structure, in situ validation and can provide measurements not possible from space

V. Integration across different levels of performance; concept of tiered networks can include e.g.:

- Crowd-sourced data, IoT observations (massive amounts of data, poor or unknown quality)
- Standard networks; routine, operational quality data
- Reference data; traceable to SI standards (sparse, high quality)

VI. Operate networks as an integrated system;

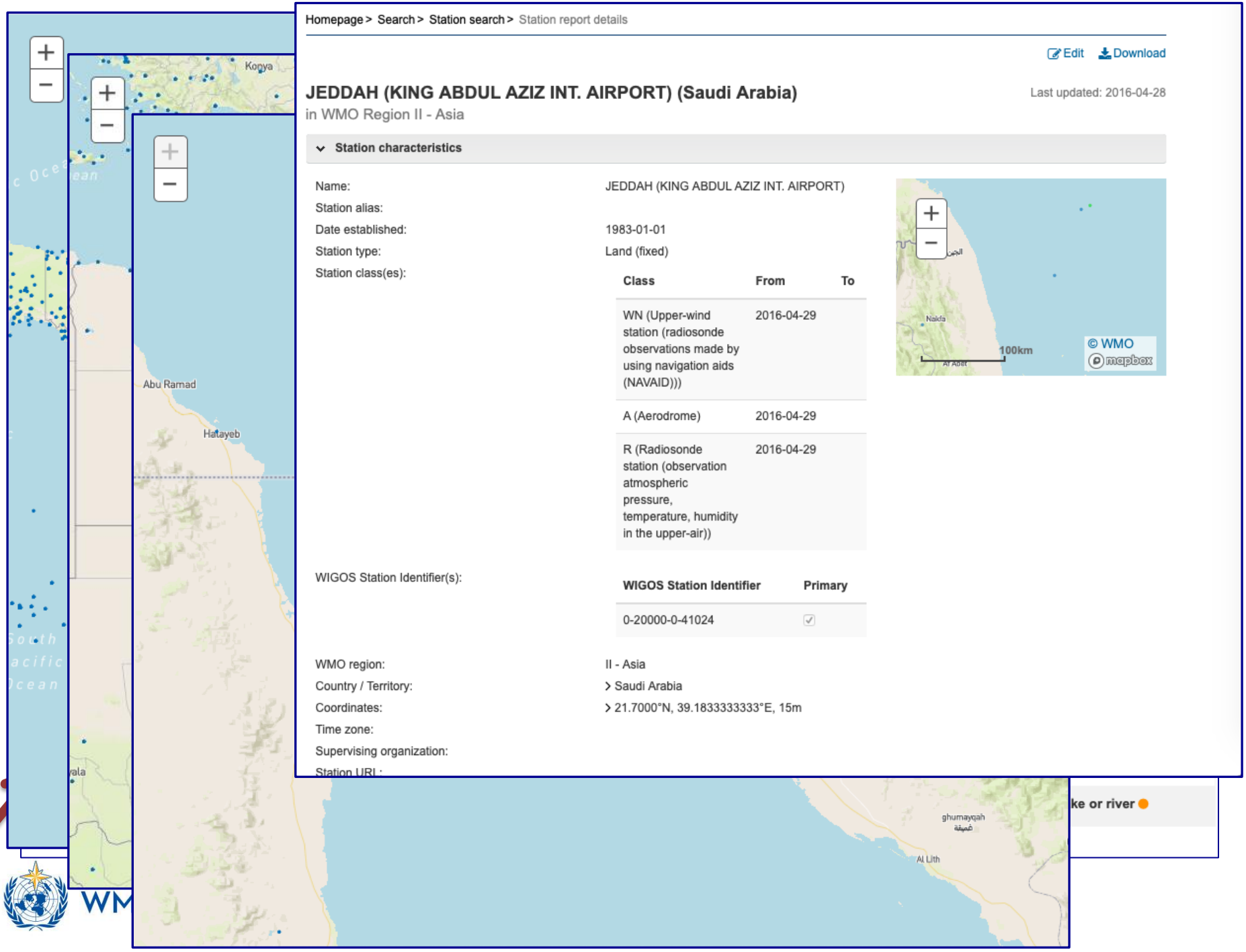
- Common data formats, common display systems;
- All data available at common access points;

OSCAR/Surface

("What are the WIGOS observing stations?")

Implementation layer of the *WIGOS Metadata Standard*: **Modern, electronic, searchable inventory of metadata for all observing stations/platforms under WIGOS**

- OSCAR/Surface has replaced *WMO Pub. 9, Volume A*, but it also includes information from similar inventories for other (non-GOS) components of WIGOS;
- Developed jointly by WMO and **MeteoSwiss**, with the Swiss government providing the major part of the funding;
- Operational since May 2016;
- Extremely important information resource for WMO and its Members and collaboration partners!



Homepage > Search > Station search > Station report details

Edit Download

JEDDAH (KING ABDUL AZIZ INT. AIRPORT) (Saudi Arabia)

in WMO Region II - Asia

Last updated: 2016-04-28

Station characteristics

Name: JEDDAH (KING ABDUL AZIZ INT. AIRPORT)

Station alias:

Date established: 1983-01-01

Station type: Land (fixed)

Station class(es):

Class	From	To
WN (Upper-wind station (radiosonde observations made by using navigation aids (NAVAID)))	2016-04-29	
A (Aerodrome)	2016-04-29	
R (Radiosonde station (observation atmospheric pressure, temperature, humidity in the upper-air))	2016-04-29	

WIGOS Station Identifier(s):

WIGOS Station Identifier	Primary
0-20000-0-41024	☑

WMO region: II - Asia

Country / Territory: Saudi Arabia

Coordinates: 21.7000°N, 39.1833333333°E, 15m

Time zone:

Supervising organization:

Station URL:

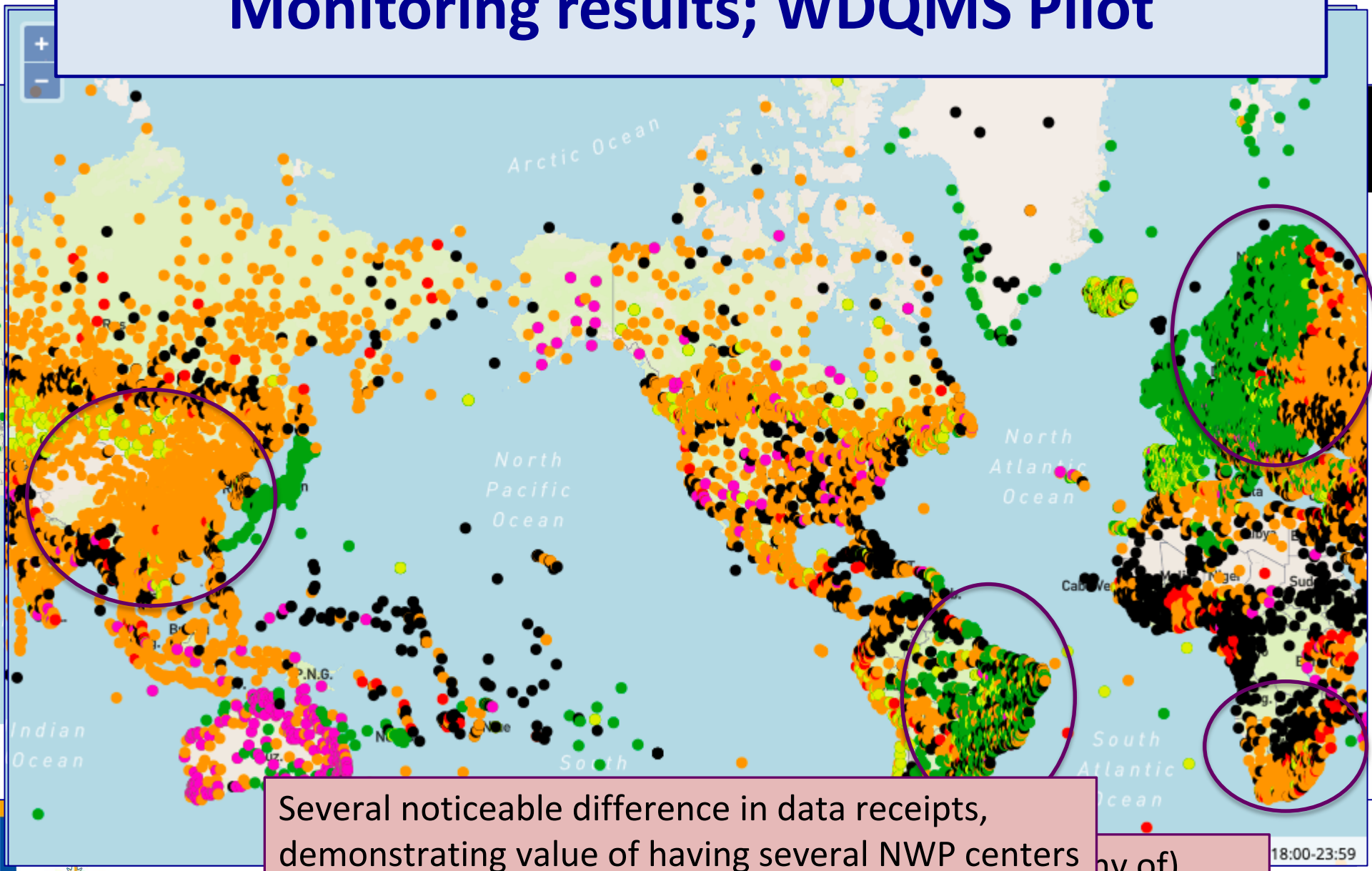
Expected involvement of Members in the OSCAR/Surface

- Nominate your National Focal Point for OSCAR if you have not already done so;
- Maintain the metadata of your stations and those of your national partners in OSCAR/Surface
  - OSCAR/Surface is a tremendously useful resource, but only if contents are maintained;
- Participate in OSCAR webinars (first Monday of the month, 11 UTC); various OSCAR-related topics introduced and discussed;
  - More info and past recordings available on the OSCAR/Surface Resources Portal;
  - Feel free to suggest topics to be highlighted.

The WIGOS Data Quality Monitoring System ("How well is WIGOS working?")

- **Real-time monitoring** of performance
  - data **availability** (implemented) and **quality** (under development),
  - searchable by region, country, station type, period, etc.
  - for all WIGOS components (GOS, GAW, WHOS, GCW, GCOS),
- **Incident management component** for mitigation of issues
- Current/recent activities:
  - **Pilot project on NWP-based** monitoring: ECMWF, NCEP, DWD, JMA;
  - Web display tool now being developed in pre-operational mode by ECMWF.

Monitoring results; WDQMS Pilot



Several noticeable difference in data receipts, demonstrating value of having several NWP centers involved in monitoring work

ny of)
19, 18 UTC

Expected involvement of Members in the WDQMS

- Nominate your National Focal Point for WDQMS if you have not already done so;
- Monitor the WDQMS plots for your country and inform WMO if there are discrepancies (e.g. red or black dots where you believe you are compliant with WMO requirements);
- Work with your Regional WIGOS Center and your GISC to resolve recurring data availability or data quality issues;

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 of RWC will be to support national WIGOS Implementation efforts, in particular as concerns
    - **OSCAR/Surface; input and updating of metadata, QC**
    - **WDQMS; monitoring and coordination of mitigation efforts**
- **How?**
  - To be decided by the WMO Regions – perhaps aligned with existing cultural, linguistic and/or political groupings

"Establishing a Regional WIGOS Centre in pilot mode" (Annex to Decision 30, EC-69; RWC Proposal Guidelines)

1. Introduction
2. Rationale for the project and its relevance to WMO
3. Project description
4. Resourcing
5. Implementation stages
6. Risk assessment/management
7. Governance, management and execution
8. Monitoring and evaluation

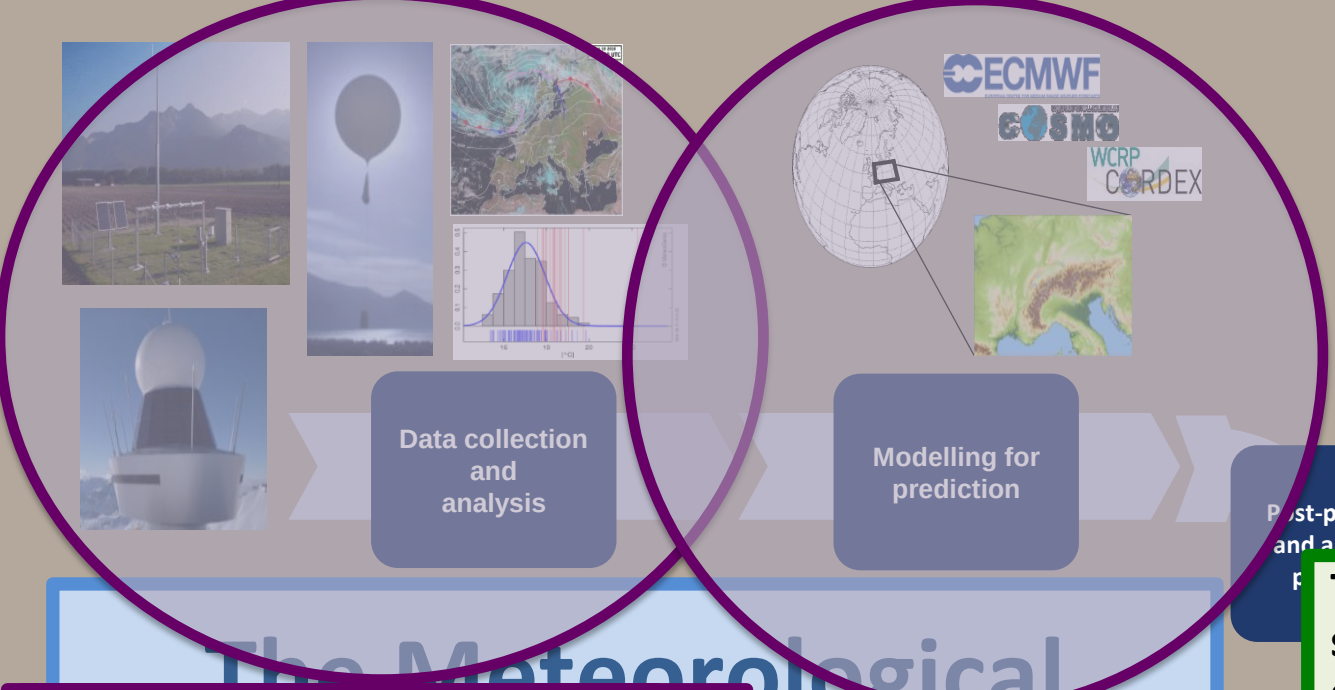
Annex 1 - Concept note on establishment of WMO Regional WIGOS Centres

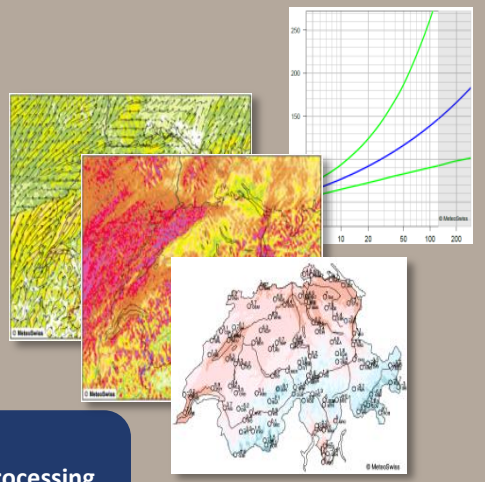
Annex 2 - Application template for a RWC candidate

Regional WIGOS Centers (RWC)

- **Region I**: RWC pilot planned in East Africa (Kenya and Tanzania); formal proposal submitted to P-RA-I; South Africa has submitted proposal; interest also expressed by Morocco;
- **Region II** : China and Japan have RA-II approved RWC pilots; national commitment from Saudi Arabia; interest from India and Russia (extending also into parts of RA-VI);
- **Region III**: Plans for Virtual RWC approved by RA-III-17 in November 2018; planning workshop to be held in Montevideo week of Sep 30;
- **Region IV**: CMO has expressed interest; Canada, USA may help; concept note to be developed and discussed by RA-IV-MG during AMS Annual Meeting 2020:
- **Region V**; Formal decision by RA-V-17 in October 2018 to request Australia and Singapore to submit RWC proposal; encouraging Fiji, Indonesia to join;
- **Region VI**: successful RWC operating in pilot mode thanks to EUMETNET*;* tentative plan for RWCs also in Russia/Belarus and Croatia (specifically for marine observing systems). Interest also from Italy, Turkey.

The meteorological value chain, the role of observations, of WMO and of the Global Basic Observing Systems (GBON)

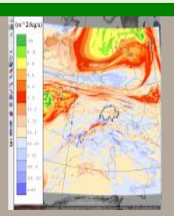


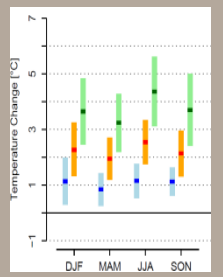


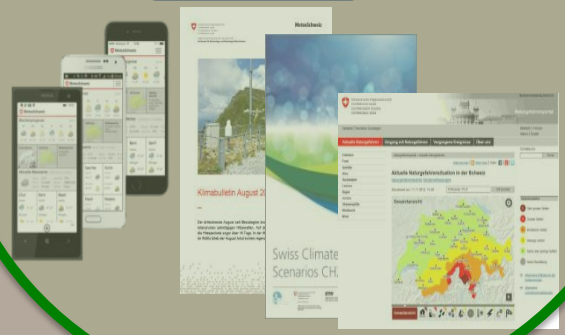
This is where value and socioeconomic benefits are generated; done nationally, typically by NMHS

GBON is a major new global element of the observing system infrastructure

GDPFS; WMO in coordinating role.







Basic WMO infrastructure underpinning all weather and climate-related actitivies; this can <u>ONLY be implemented globally</u>

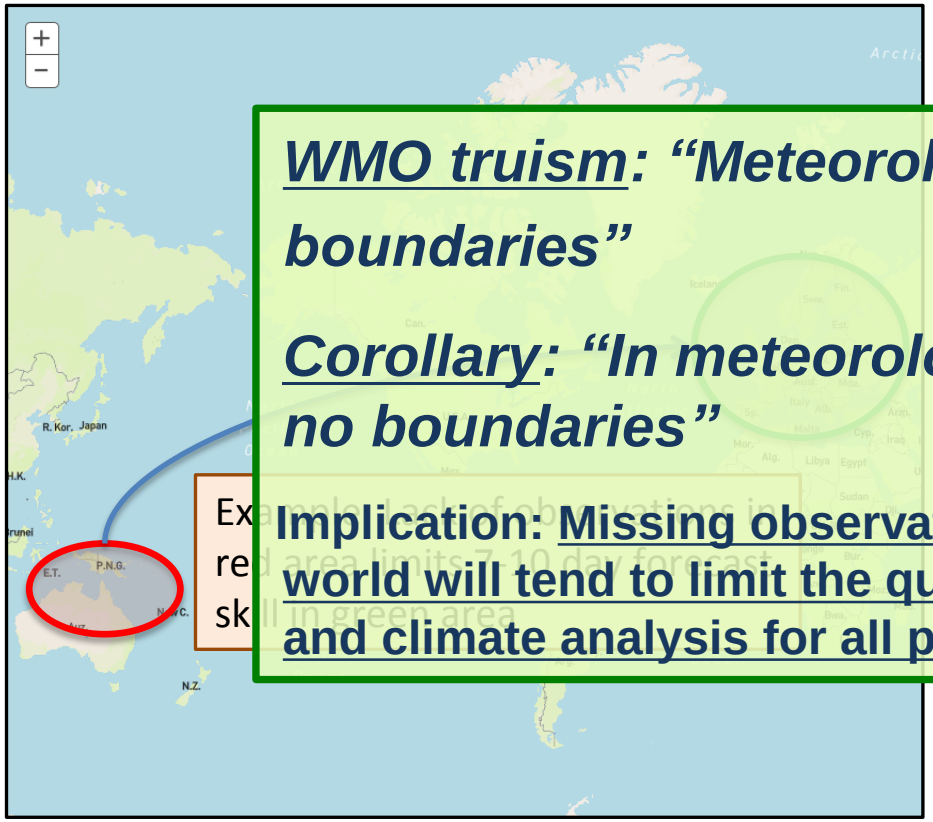
WMO (2014) , No.1129 (courtesy Ch. Appenzeller)

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 applic
9. Ocean applications
10. Agricultural meteorology
11. Hydrology
12. **Climate monitoring**
13. **Climate applications**
14. Space weather

GBON supports these three application areas in particular (Global NWP is an enabler of all other application areas).

Role of observations

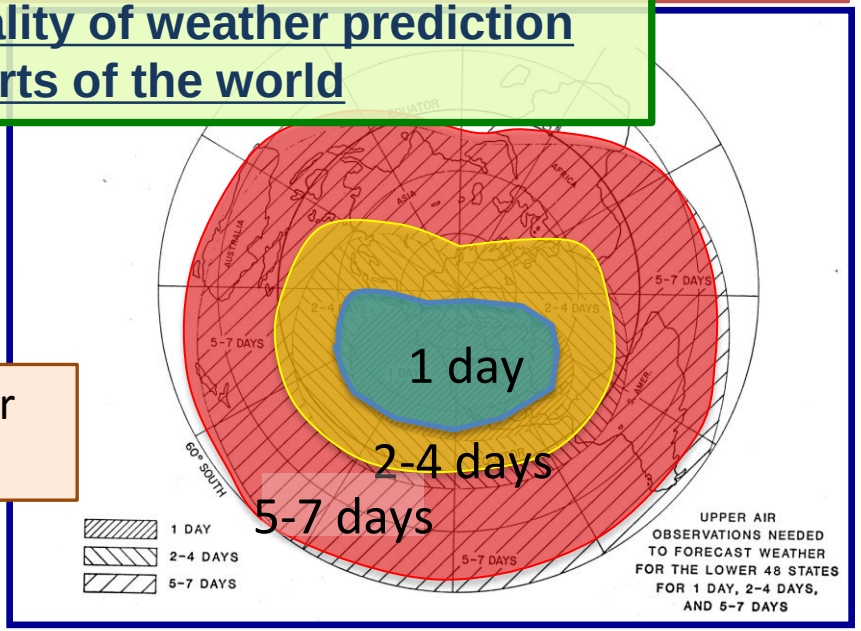


WMO truism: "Meteorology knows no boundaries"

Corollary: "In meteorology, ignorance knows no boundaries"

Implication: Missing observations in any one part of the world will tend to limit the quality of weather prediction and climate analysis for all parts of the world

- Lack of observations limits our ability to understand and predict weather and climate patterns, both locally and globally;
- Weather prediction beyond 3-4 days for any location on the globe requires observations from the whole world.



Required coverage of observation for weather prediction over the United States.

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The need for global exchange of weather and climate observations is globally understood, codified in international agreements, and in principle uncontroversial

- **WMO Convention (1947):**
  - *(a) To facilitate worldwide cooperation in the establishment of networks of stations for the making of meteorological {…}*
  - *(b) To promote the establishment and*

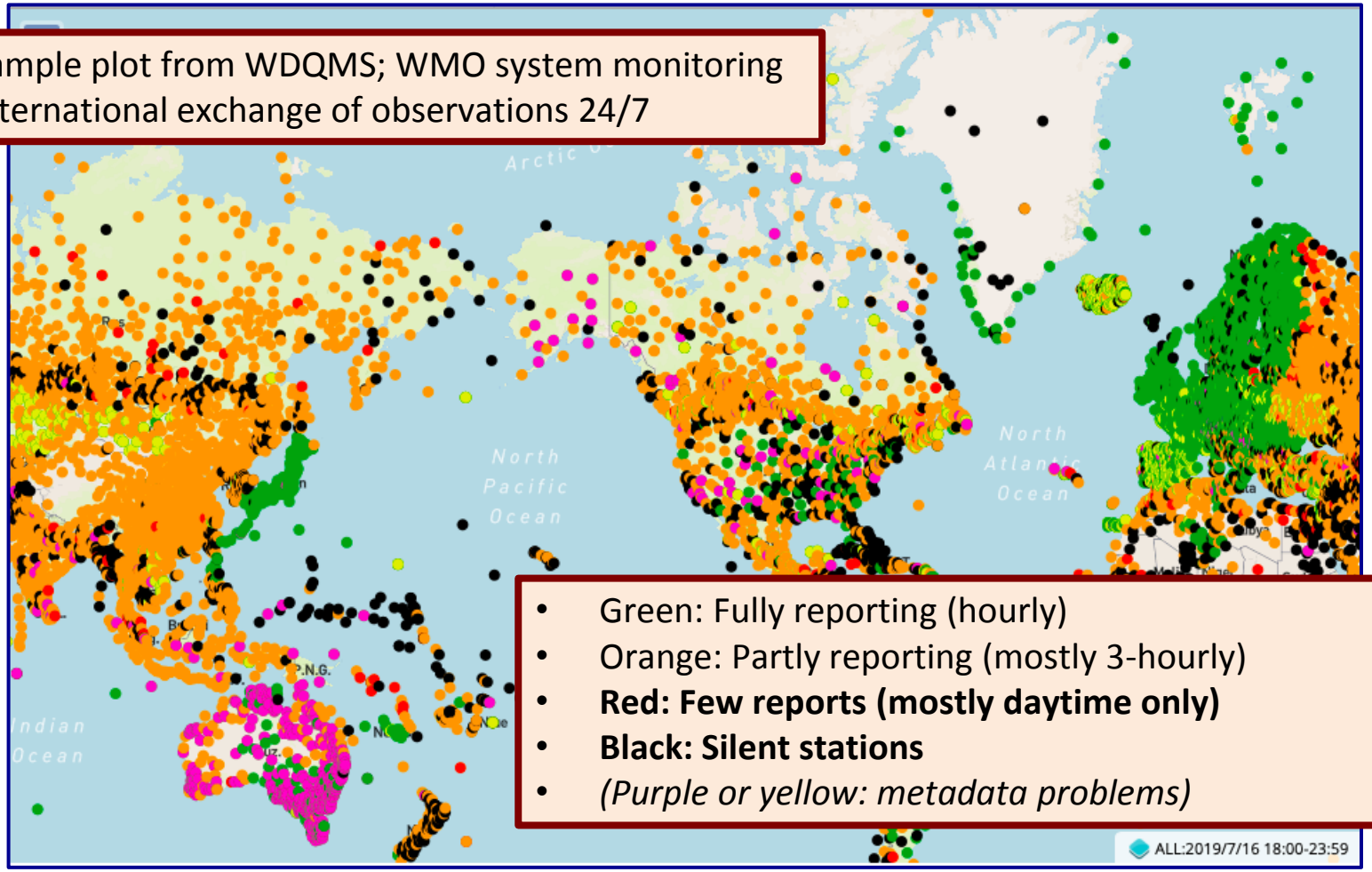
- **Paris Agreement (2015):**
  - *Article 7 (Systematic Observation): Parties should strengthen their cooperation on enhancing action on adaptation, taking into account the Cancun Adaptation Framework, including with regard to:*

- While not explicitly stated, both the WMO Convention and the Paris Agreement implicitly assume national responsibility for observations;
- **In some parts of the world this is currently not working well (and there is reason to believe that it never will)**

Which observations are we currently exchanging?

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

Sample plot from WDQMS; WMO system monitoring international exchange of observations 24/7



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

Current international exchange of data for global NWP less than optimal (Example: Surface pressure observations received by global NWP Centers on July 16 2019, 18Z)

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Why is observational data exchange falling short, and how do we improve it?

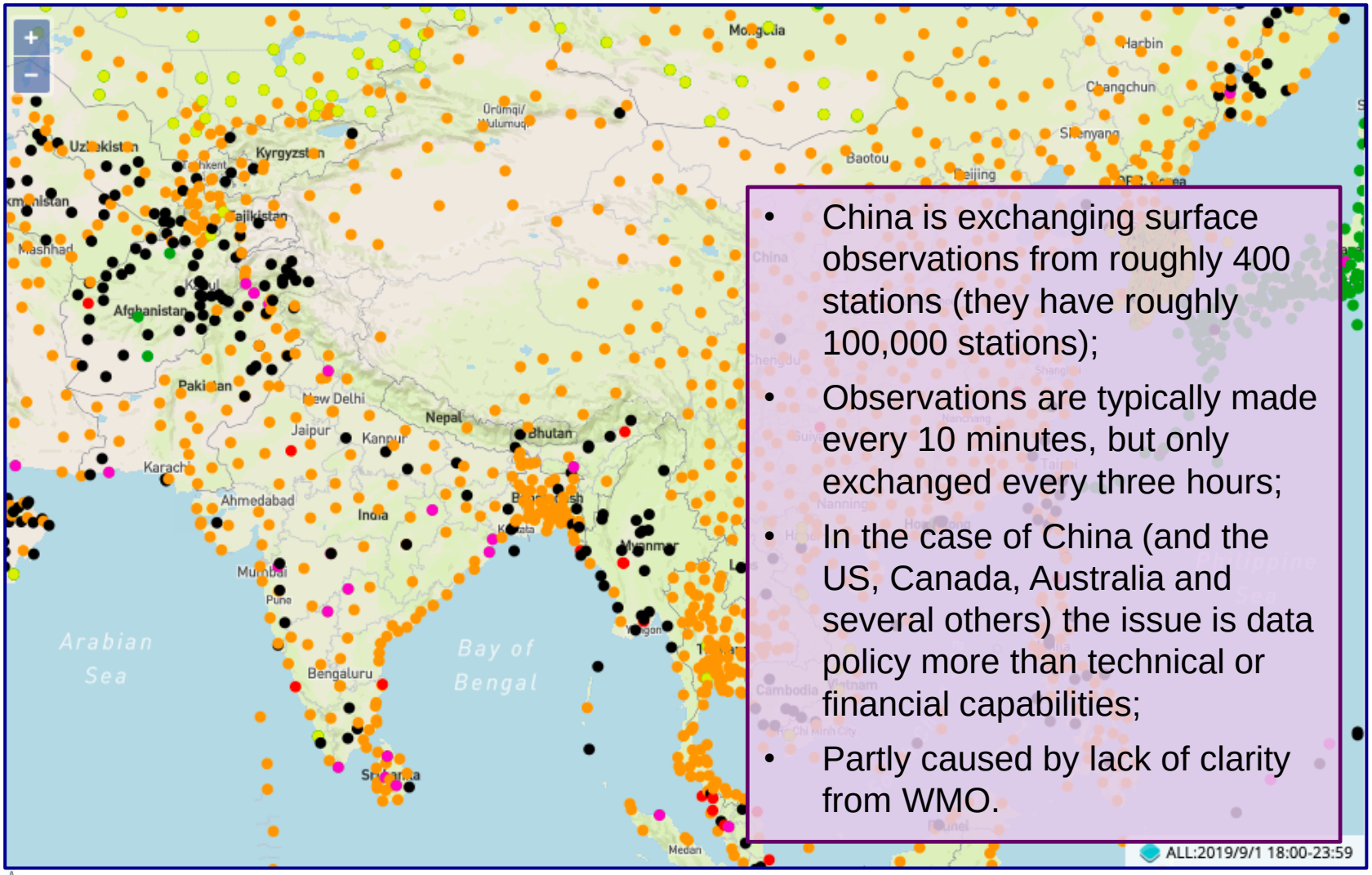
- Current data exchange practice is largely based on WMO Publication 540 (Manual on the Global Observing System) and on WMO Resolution 40 (Cg-11);
  - Resolution 40 was adopted in
    progress since that time, and
  - Congress resolutions define p
    technical detail to allow for co
  - Additional material is available
    recommendations, implement
    a matter of principle, base the
  - Current WIGOS monitoring da
    coverage over many areas (p
    - In many cases additional observations are being made, but not currently exchanged, due to a lack of clarity from WMO regarding the obligation of the Members.

Top three causes of missing data, depending on country:

- Data policy;
- Technical capabilities;
- Financial resources.

1. Data policy issues

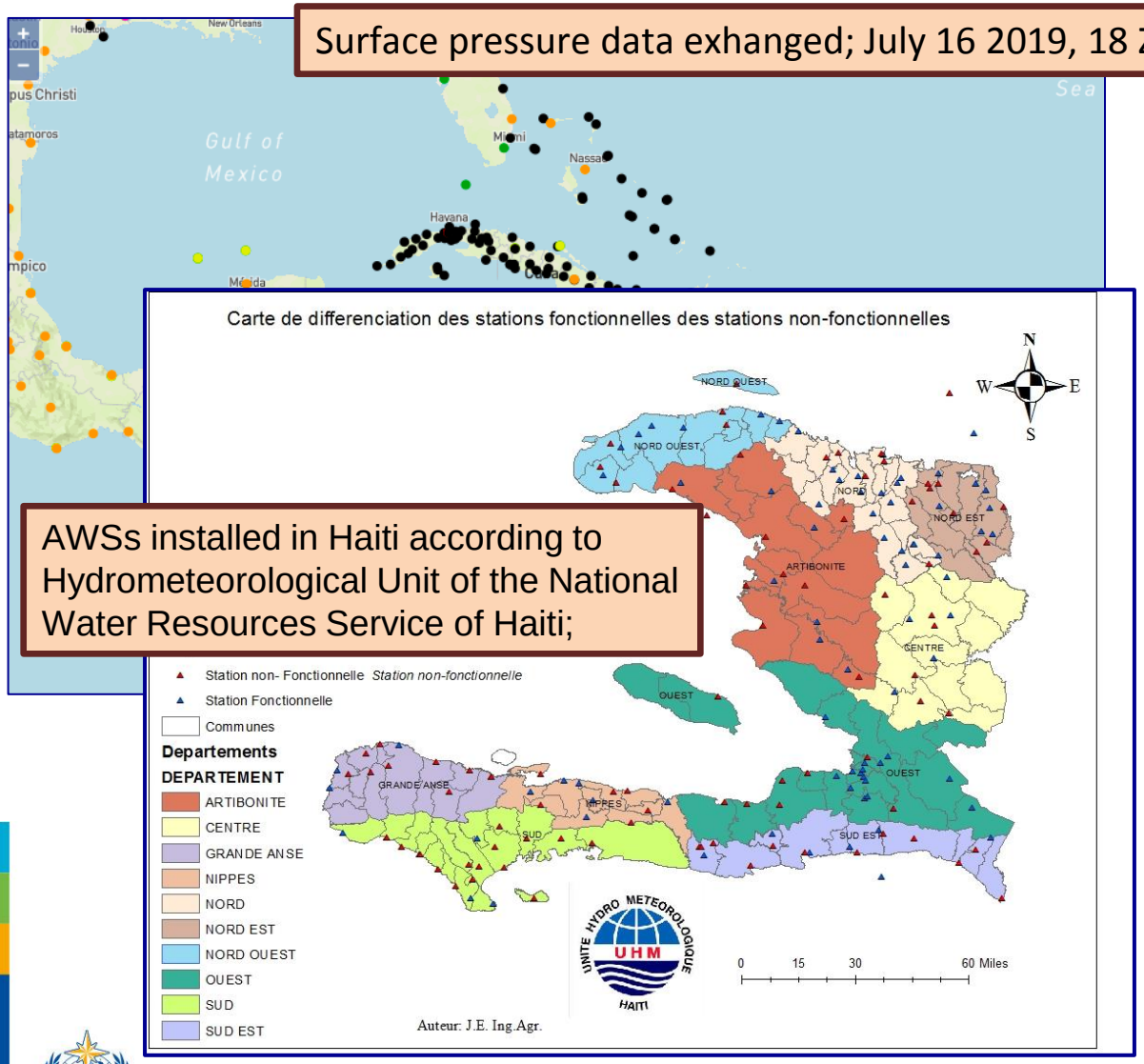
(e.g. China, observations are made, but not all are exchanged)



- China is exchanging surface observations from roughly 400 stations (they have roughly 100,000 stations);
- Observations are typically made every 10 minutes, but only exchanged every three hours;
- In the case of China (and the US, Canada, Australia and several others) the issue is data policy more than technical or financial capabilities;
- Partly caused by lack of clarity from WMO.

2. Lacking technical capabilities
(Haiti; an illustration of how not to use project funding)

Surface pressure data exhanged; July 16 2019, 18 Z



AWSs installed in Haiti according to Hydrometeorological Unit of the National Water Resources Service of Haiti;

- Too many black dots!
- **Haiti;** LDC, candidate for aid; *"Let's buy them some AWS's (Automated Weather Stations) to fix that"*;
- Basic assumption: **Lack of observations means lack of stations** *(this is often not true!)*
- There are already over 100 AWSs in Haiti, <u>all</u> donor-funded;
- Impressive network by most standards, **but**:
- Many AWSs not operating, **only two currently reporting to WMO**;
- **Number of observations exchanged would be much better metric than number of stations purchased or installed!**

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3. Insufficient national (local) financial resources

(Kiribati example; who pays where there are no people to pay?)

Switzerland

- 41,000 km2
- GDP $ 700 B
- Annual cost of observations: $20 mill

Kiribati

- 3,500,000 km2, including EEZ (for comparison, combined area of EU Members 4,400,000 km2);

A similar fraction to Switzerland's, 0.003%) of GDP, spent on observations in Kiribati would amount to less than $6,000, less than the cost of a single Automated Weather Station; a fully functioning observing system might cost 3-5% of annual GDP.

Capital investment will not solve this problem. There simply are not enough available resources locally to sustain the system!

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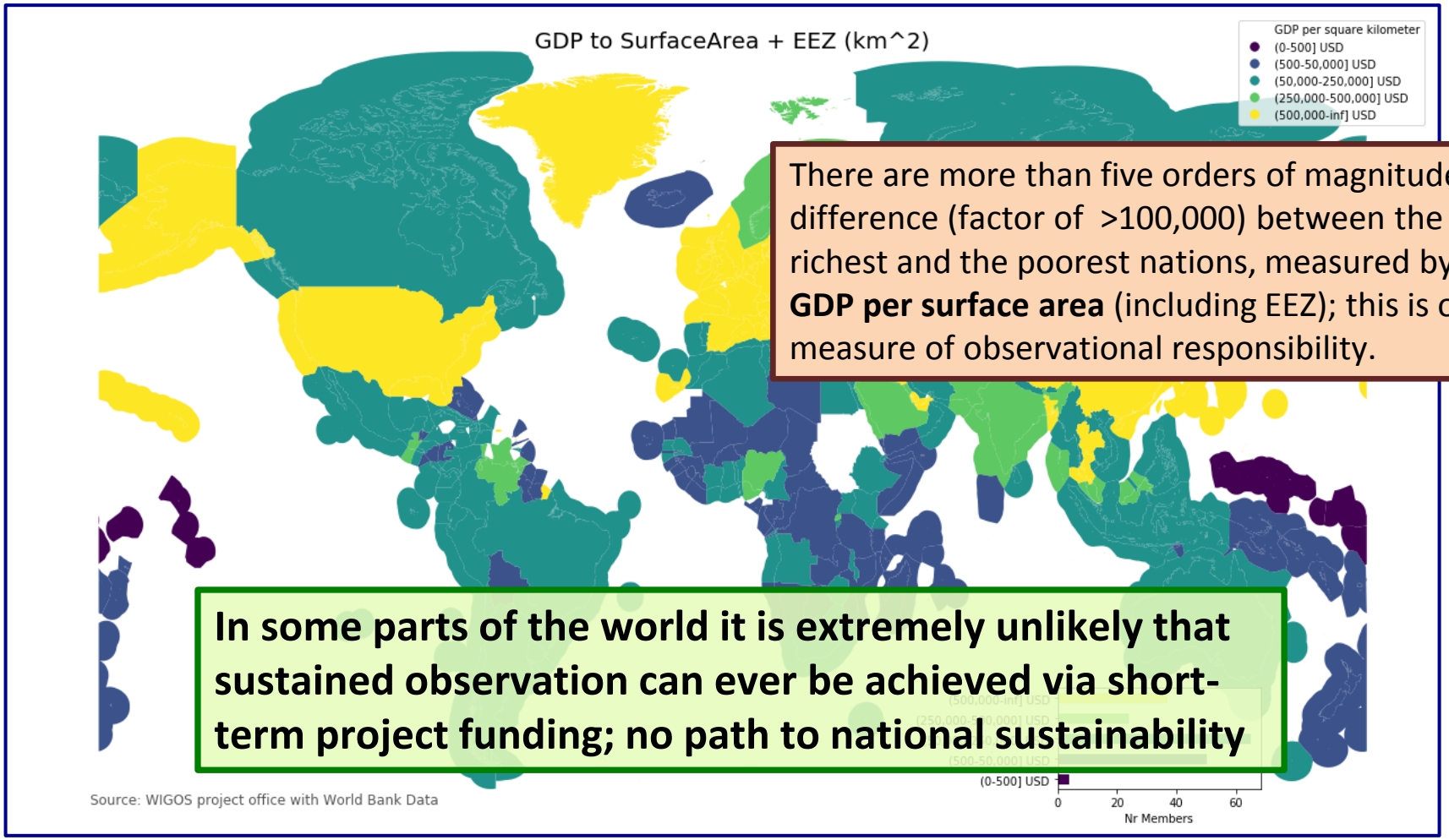
A different look at available resources



GDP (World Bank numbers) per surface area (land surface + EEZ)

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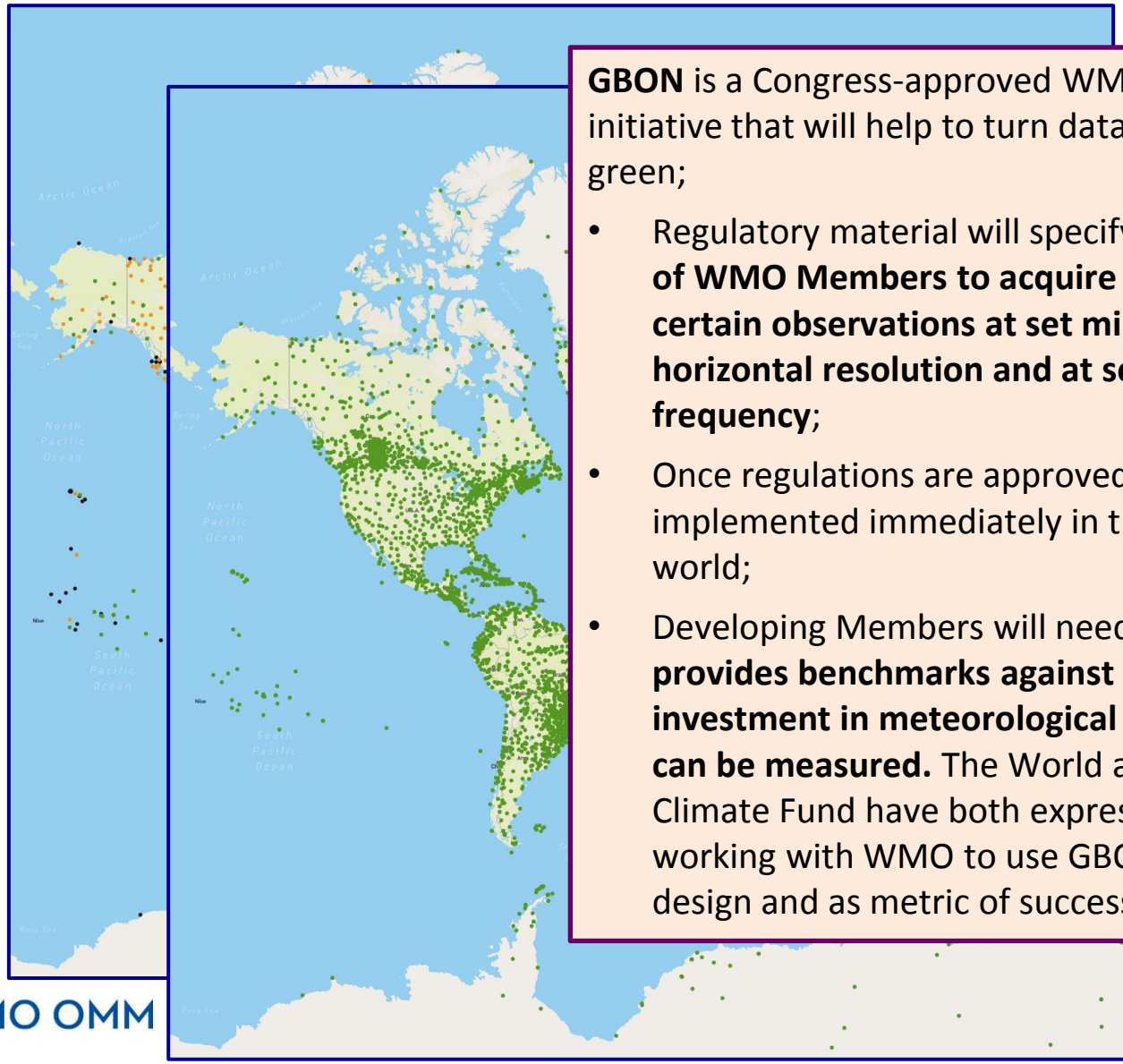
4.5 Global Basic Observing Network (GBON)



GBON is a Congress-approved WMO policy initiative that will help to turn data coverage map green;

- Regulatory material will specify the **obligation of WMO Members to acquire and exchange certain observations at set minimum horizontal resolution and at set minimum frequency**;
- Once regulations are approved, GBON can be implemented immediately in the developed world;
- Developing Members will need help; **GBON provides benchmarks against which investment in meteorological infrastructure can be measured.** The World and the Green Climate Fund have both expressed interest in working with WMO to use GBON for project design and as metric of success.

4.6 Impact on Members and cost of GBON

- **Access to better NWP model guidance and climate analysis products for all WMO Members**
- **However, GBON comes at a cost**; World is divided in four broad categories, by levels of difficulty of implementation:
  1. Members already complying with the GBON provisions (e.g. Japan, Western Europe); no further action is needed;
  2. Observations complying with the GBON requirements are made, but not currently exchanged (e.g. USA, China); **new data exchange practices need to be adopted;**
  3. Insufficient local (national) resources available to meet GBON requirements (e.g. Africa, South Pacific, Caribbean,…); **use GB… dev…**
  4. GB… con… new…

Estimated additional funding needs for item 3 globally, (USD):

- Capital investment: **350 M**
- Annual operating costs: **150 M**

(estimated cost of existing Global Observing System: 2-5 B/yr)

Summary

- WIGOS implemented by WMO to meet exploding demand for meteorological and related observational data;
- Efficiency through integration, minimize duplication of effort;
- **OSCAR/Surface;** description of WIGOS (station catalog);
- **WDQMS**; tool to measure how well WIGOS is working;
- **Regional WIGOS Centers** being implemented to support Members with respect to OSCAR/Surface and WDQMS;
- **The Global Basic Observing System (GBON)**: Major new WMO initiative to ensure adequate supply of observations to global NWP systems providing basis for weather and climate services to all WMO Members.

  – Implementation of GBON will be challenging in some parts of the world, however, Cimate Finance and development partners are ready to help WMO and its Members with this!