The WMO Global Basic Observing Network (GBON)

A WIGOS approach to securing observational data for critical global weather and climate applications

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WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

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World Meteorological Organization
Organisation météorologique mondiale

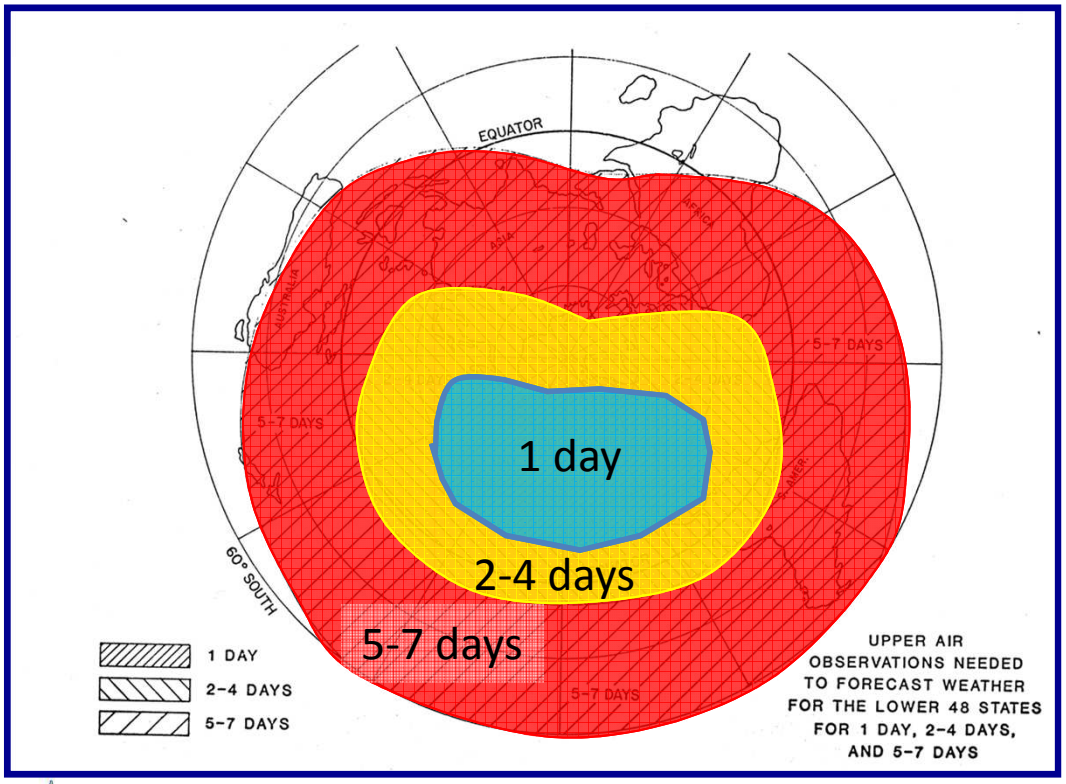
Overview

1. Why is it important to have weather and climate observations everywhere on the globe?
2. What do we need to measure from the surface?
3. Why and where are we currently missing observations?
4. What is WMO doing about this problem?
5. What is the expected impact of GBON on WMO Members?

1. Why is it important to have observations everywhere?

Global NWP:

- is a **foundational capability** for weather forecasting climate reanalysis
- needs observations **everywhere** for accurate predictions **anywhere**



Weather prediction beyond the 3-4 day range essentially requires observations from the whole world

WMO is the only organisation with the mechanisms to provide these observations

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WMO Application Areas listed in the RRR

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

Foundational capability for nearly all weather and climate applications

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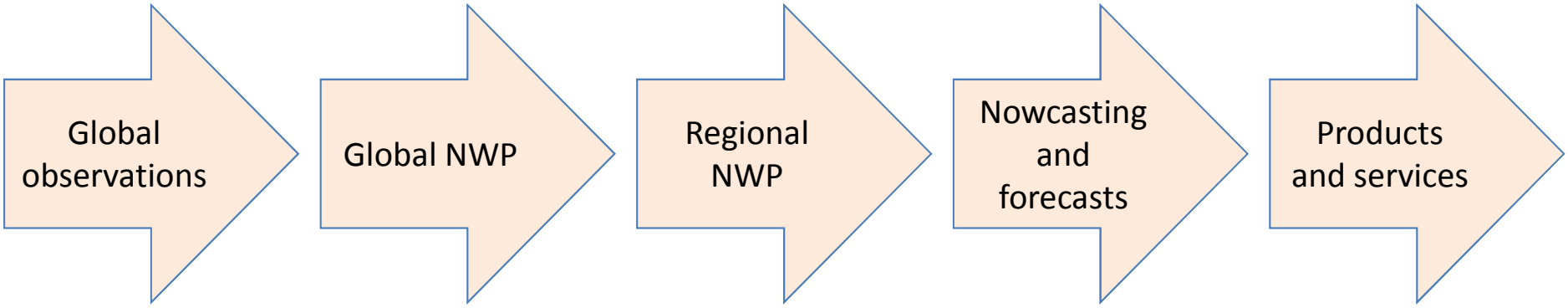
Importance of Global NWP



Without **local observations**, NWP guidance will be poor

- Leading in turn to poor services
- This is particular issue in the tropics

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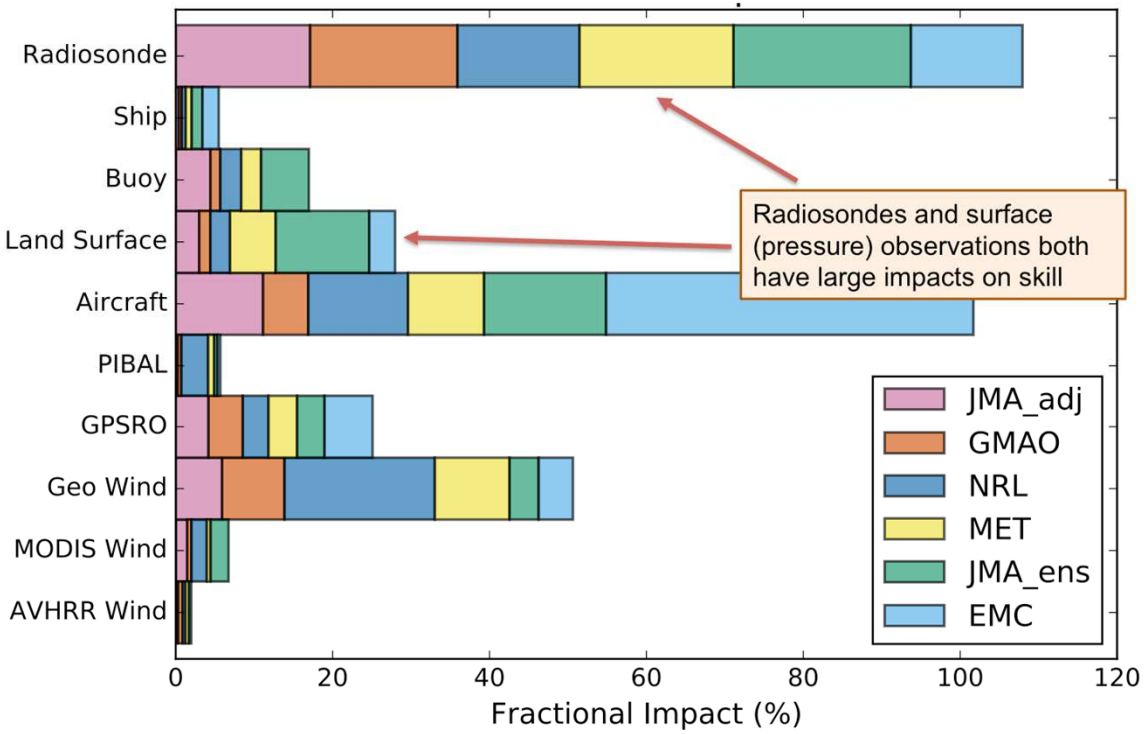
2. What do we need to measure from the surface?
(and why not just use satellite data?)

- Certain key variables are currently not measured from space
  - e.g. **surface pressure, vertical wind profiles**
- Some variables are difficult to measure from space
  - over land, over snow and ice, beneath dense cloud

- Reference data for satellite calibration and validation
- Evidence from impact studies



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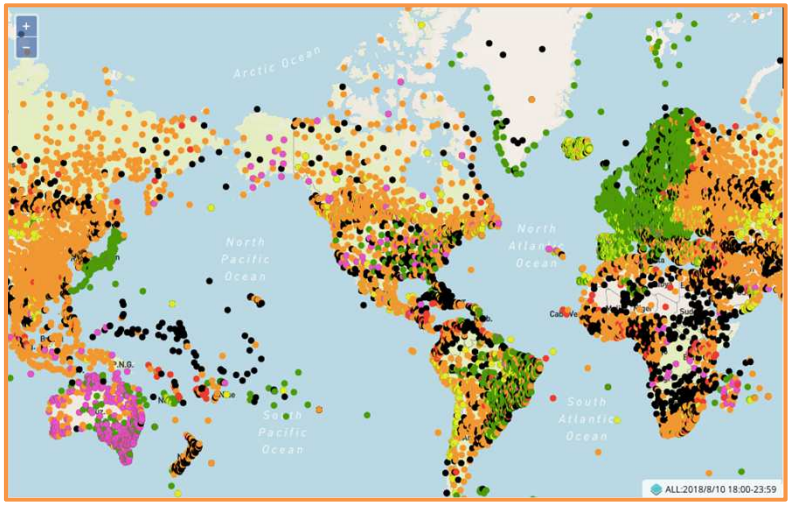
3. Why are we currently missing observations?

- Current data exchange based on WMO 540 (Manual on the GOS)
  - and WMO Resolution 40 (Cg-11)
- Resolution 40 was adopted in 1995
  - NWP requirements vastly different now
  - inconsistent implementation by Members
- More recent guidance issued
  - CBS recommendations, implementation plans, etc.
- Many Members only follow regulations
- Many more observations are being made, but not exchanged
- Current WIGOS monitoring shows unacceptable gaps in coverage



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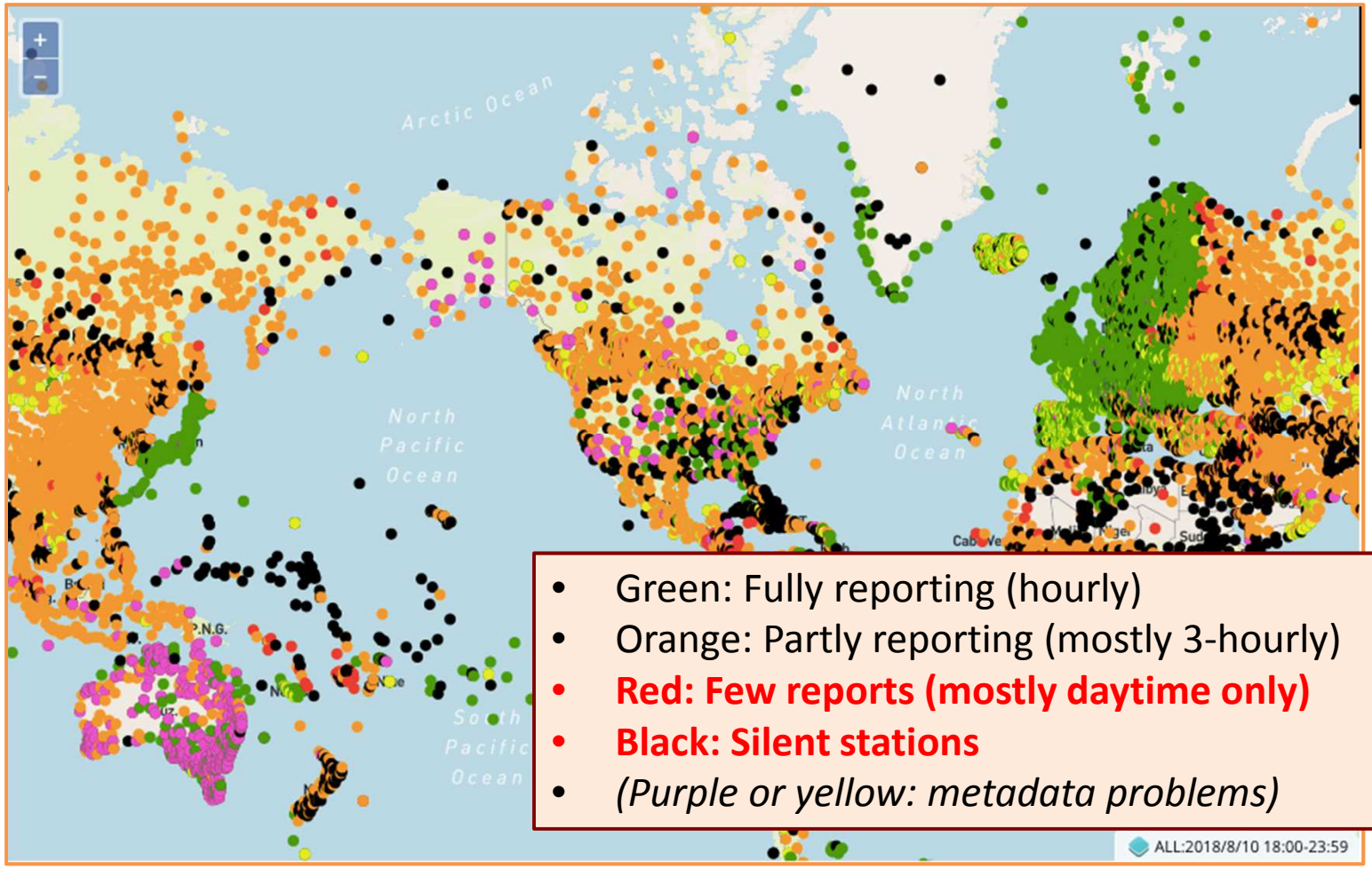
3. Where are we currently missing observations?



- 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 10 August 2018, 18Z

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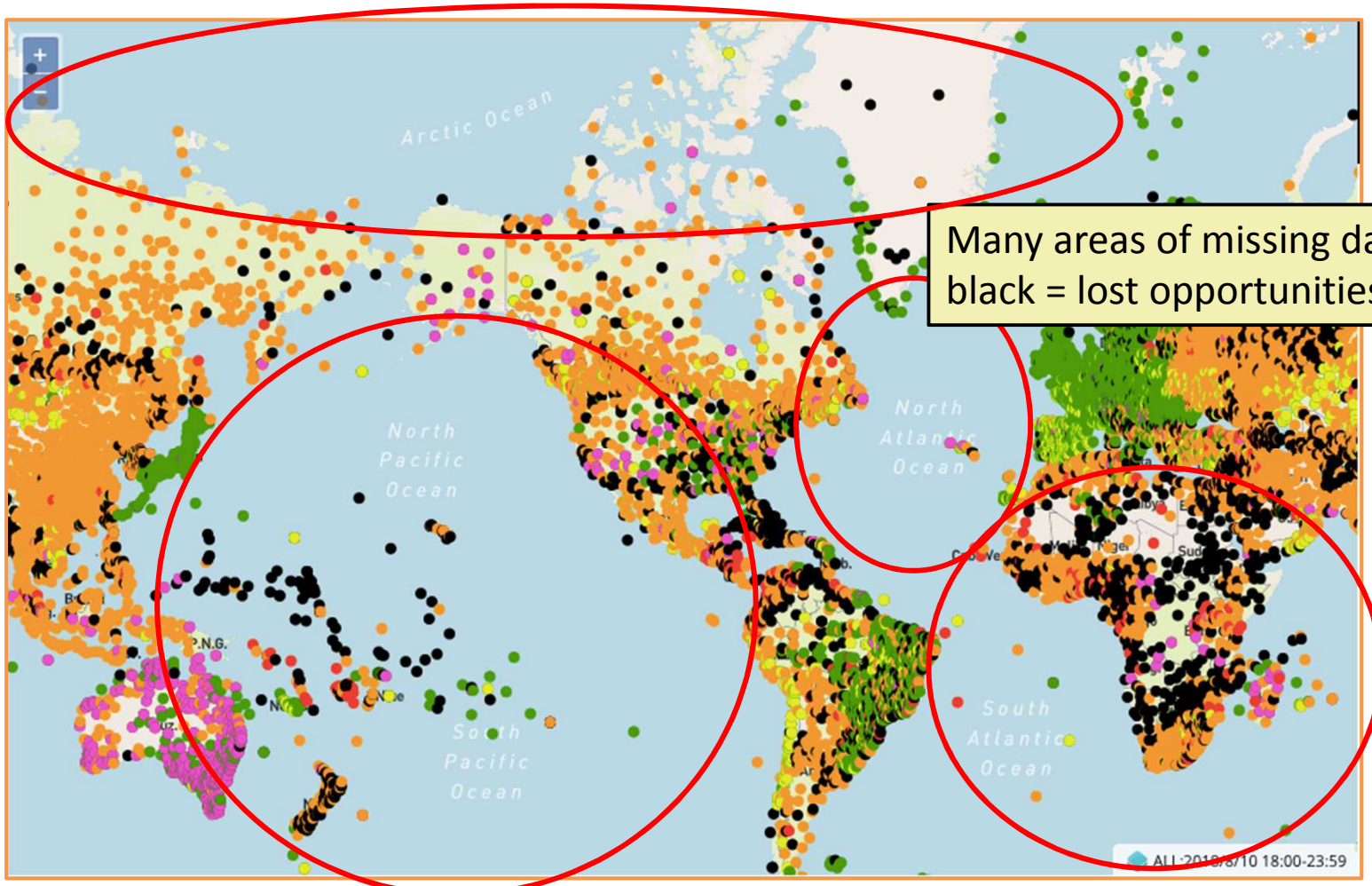
3. Where are we currently missing observations?



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4. What is WMO doing about this problem?

- To increase observations for global NWP, 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 Intercommission Coordination Group on WIGOS to *develop relevant provisions of the Manual on WIGOS regarding the implementation of the GBON and propose them to Cg-18 in 2019*

- *By WMO standards, this is an extremely rapid development schedule*
- *Testament to the EC view of the importance of this issue!*

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Draft GBON provisions: Surface Observations

(to be submitted to Cg-18 for approval)

- 3.2.2.4 Members **shall** operate a set of surface land observing stations/platforms that observe atmospheric pressure, air temperature, humidity, horizontal wind, precipitation and snow depth, located such that the GBON has a **horizontal resolution of 500 kilometres or higher** for all of these variables, with an **hourly frequency**.

- 3.2.2.5 Members **should** make available additional surface land observations of atmospheric pressure, air temperature, humidity, horizontal wind, precipitation and snow depth that enable GBON to have a **horizontal resolution of 100 kilometres or higher** for all of these variables, with an **hourly frequency**.

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Draft GBON provisions: Upper air observations

(to be submitted to Cg-18 for approval)

- 3.2.2.7 Members **shall** operate a set of upper air stations over land that observe temperature, humidity and horizontal wind profiles, with a vertical resolution of 100 m or higher, **twice a day** or better, up to a level of 30 hPa or higher, located such that GBON has a **horizontal resolution of 500 kilometres or higher** for these observations.

- 3.2.2.8 Members **should** operate a subset of the selected GBON upper air observing stations that observe temperature, humidity and horizontal wind profiles up to 10 hPa or higher, at least once per day, located such that, where geographical constraints allow, GBON has a **horizontal resolution of 1000 kilometres or higher**, for these observations.

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5. What is the expected impact of GBON on WMO Members?

- **Access to better NWP and climate analysis products**

- Four broad categories of implementation impact:
  1. GBON-compliant observations already made and exchanged internationally
  2. GBON-compliant observations currently made, but not all exchanged
  3. GBON-compliant observations are not made, but could conceivably be made with additional resources
  4. Achieving GBON compliance is unrealistic with currently available technology

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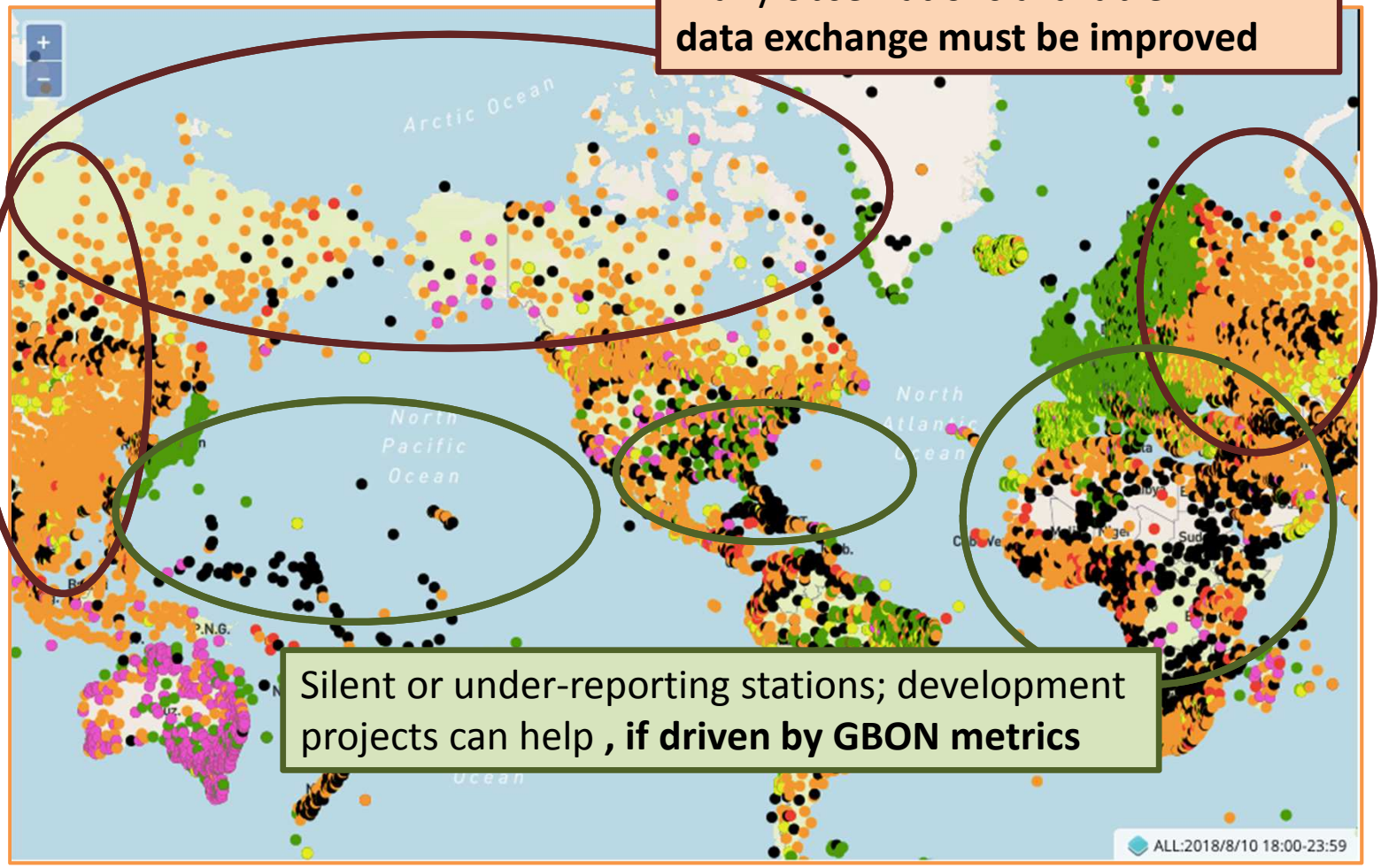
5. What is the expected impact of GBON on WMO Members?

- Four categories of implementation (examples):
  1. Members already complying with the GBON provisions (e.g. Japan, Western Europe) – *no further action is needed*
  2. GBON observations made, but not currently exchanged (e.g. USA, China); *new data exchange practices adopted*
  3. Insufficient national resources available (e.g. Africa, South Pacific); *use GBON to help steer internationally funded development projects*
  4. GBON requirements not met due to geographic constraints (e.g. Indian Ocean, North Pacific) *clear role for new or emerging technologies, space-based remote sensing*

5. What is the expected impact of GBON on WMO Members?



Surface pressure obs available to global NWP Centres on 10 August 2018, 18Z

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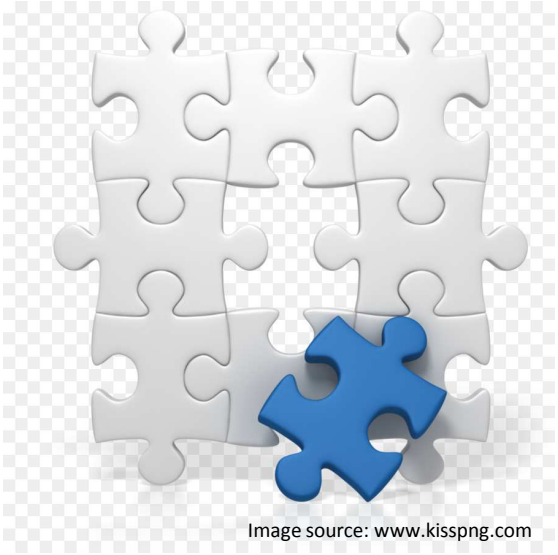
5. What is the expected impact of GBON on WMO Members?

- Better global coverage
- Massive global multiplier on investment in observations
- Like a jigsaw puzzle, the full potential realized only if all the pieces are available



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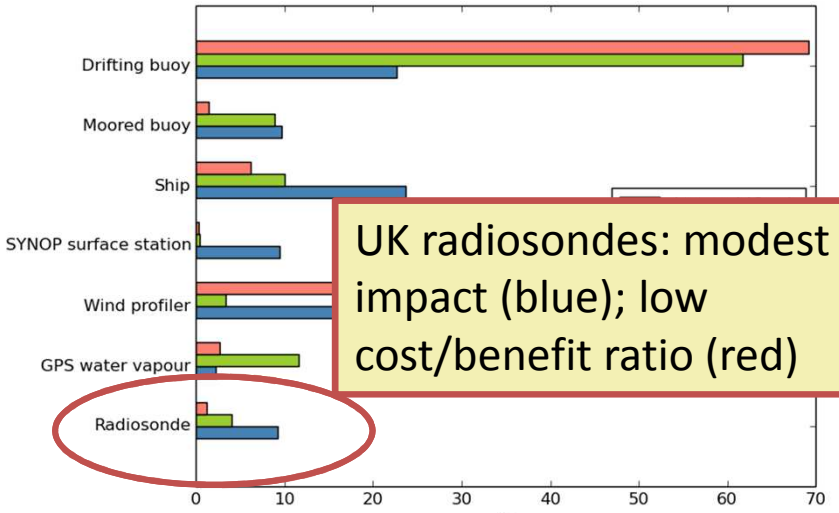
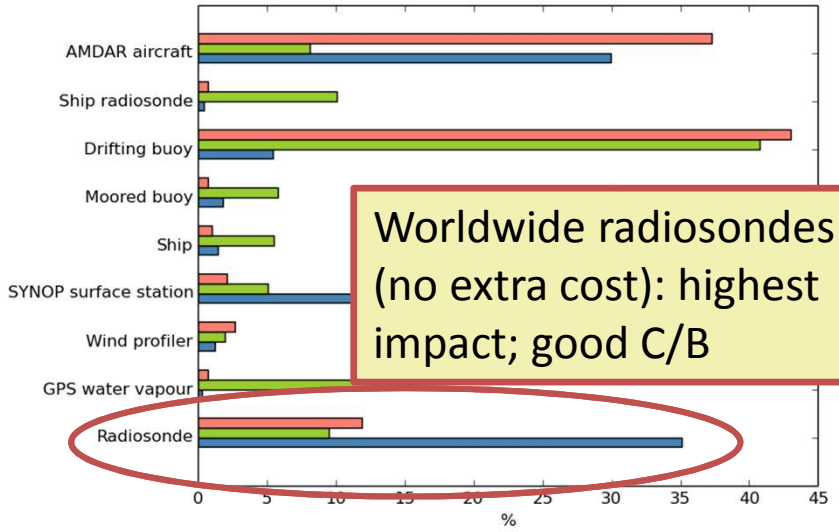


UK radiosondes: modest impact (blue); low cost/benefit ratio (red)



Worldwide radiosondes (no extra cost): highest impact; good C/B

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Summary and Conclusions

- Ensuring a continuous real-time supply of observational data from all areas of the globe to critical global NWP and climate analysis systems is **vital to product generation and service delivery capabilities of all WMO Members**
- The current availability of observational data **falls well short of agreed requirements**, this limits the ability of all WMO Members to predict and understand the atmosphere at all time-scales
- The GBON provisions in the Manual on WIGOS will **clarify the obligations of the WMO Members** in this regard, and can help guide both national WIGOS implementations and internationally funded development projects

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Thank you
Merci

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