

Congratulations to the WMO AWS 2017 Conference

--AWS in the 21st Century !



WORLD
METEOROLOGICAL
ORGANIZATION

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Assistant Secretary-General
World Meteorological Organization

Opening remarks

- Thank the **German Weather Service (DWD)** for kindly offering to host this conference and for their hospitality.
- Thank the **International Programme Committee** members, and in particular the **Conference Director, Dr Bruce Forgan**, and Ms Isabelle Ruedi, and others for preparing the Conference.
- **Thanks to all the participants for your contributions to the success of the Conferences !**



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Historical Review

- A series of conferences titled "**International Conferences on Experiences with Automatic Weather Stations in Operational Use within National Weather Services**" (ICEAWS) was started in the 90s. It was started at a time when human observers were still widely present, and when automation was becoming increasingly present. Climate scientists had a strong interest in ensuring the consistency and comparability of data originating from human and automatic instruments. This series of conferences provided a forum to exchange on best practices related to network automation, but it stop roughly 10 years ago.
- The conference that is opening today is an attempt to **revive such conferences**, and to target them to current challenges and concerns experience by WMO Members. It is very relevant to the WMO Integrated Global Observing System (WIGOS) and has been organized in a **collaborative spirit between the WMO Commission for Instruments and Methods of Observation (CIMO) and the WMO Commission for Basic Systems (CBS)**.



Members need further guidance !

- Though AWSs are now very widely deployed, **WMO Members are still seeking for guidance on the subject and new challenges are appearing as well.** Current concerns include for example:
 - Adaptation to the Minamata Convention on Mercury:
 - How to ensure AWSs networks are sustainable and provide fit-for-purpose data.
 - Large number of new instruments arriving on the market, including low-cost AWSs.
 - Using partner data
 - How to best develop tiered networks to make best use of funds, while still meeting various user requirements.
 - Telecommunications for remote locations.



Purpose of WMO – Convention (1)

- (a) To facilitate worldwide cooperation in the establishment of networks of stations for the making of meteorological observations;...
- (b) To promote the establishment and maintenance of systems for the rapid exchange of meteorological and related information;
- (c) To promote standardization of meteorological and related observations and to ensure the uniform publication of observations and statistics;



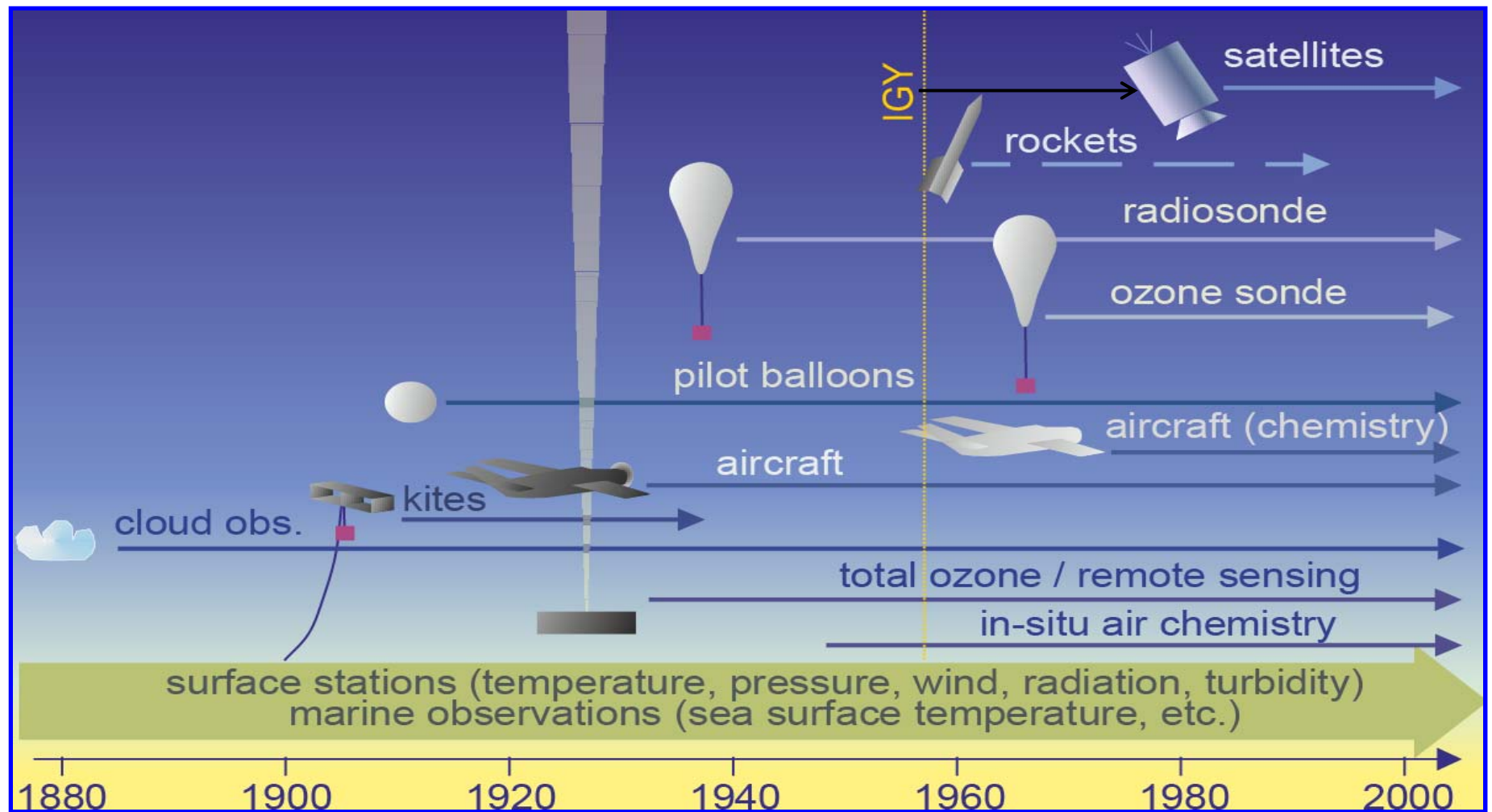
Purpose of WMO – Convention(2)

- (d) To further the application of meteorology to aviation, shipping, water problems, agriculture & other human activities;
- (e) To promote activities in operational hydrology and to further close cooperation between Meteorological and Hydrological Services; and
- (f) To encourage research and training in meteorology and, as appropriate, in related fields and to assist in coordinating the international aspects of such research and training.



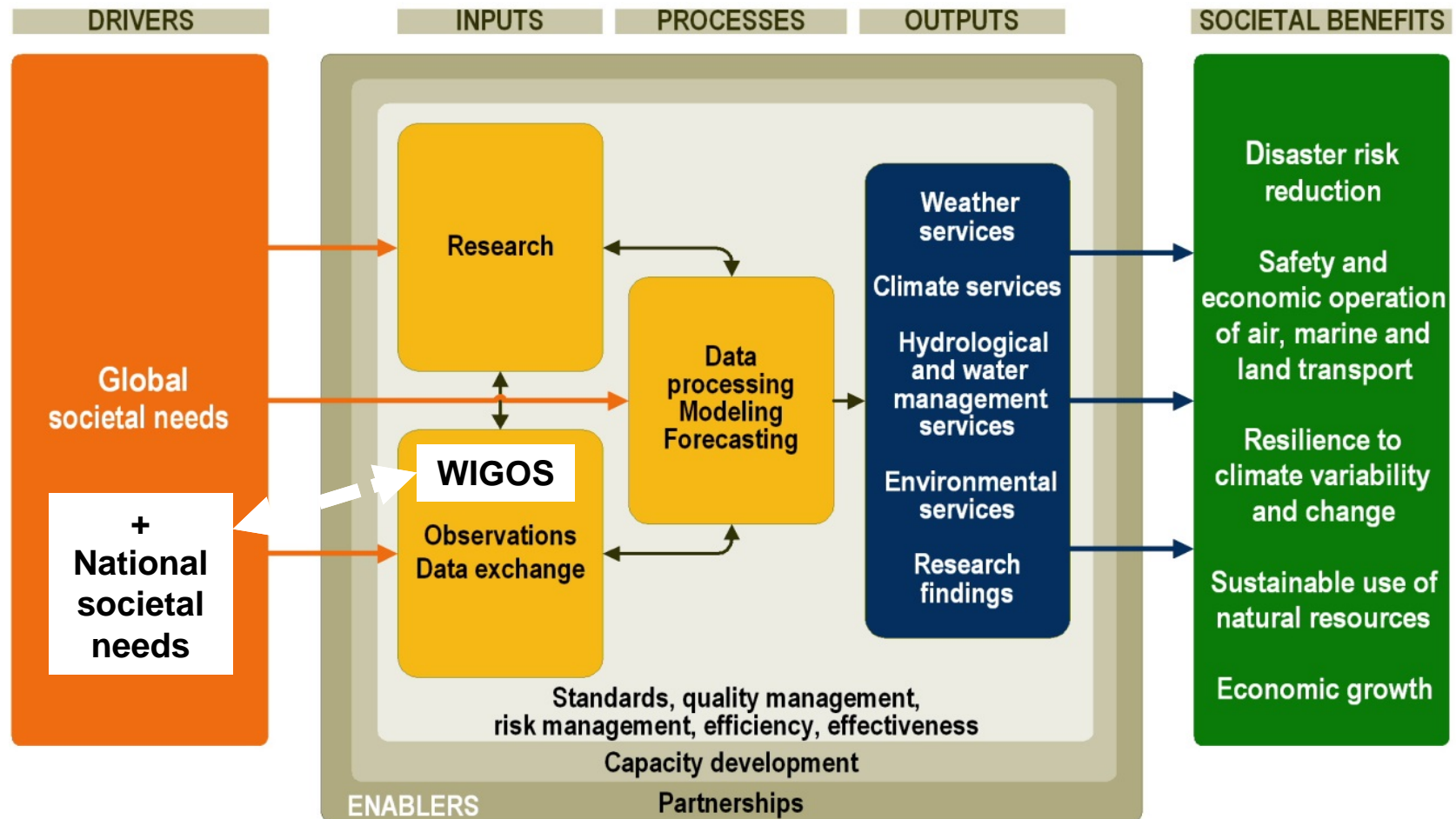
A challenge: WMO Members more contributions to the ocean Obs !!

The evolving observing systems



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WIGOS: Integral part of NMHS and key enabler of their value chain

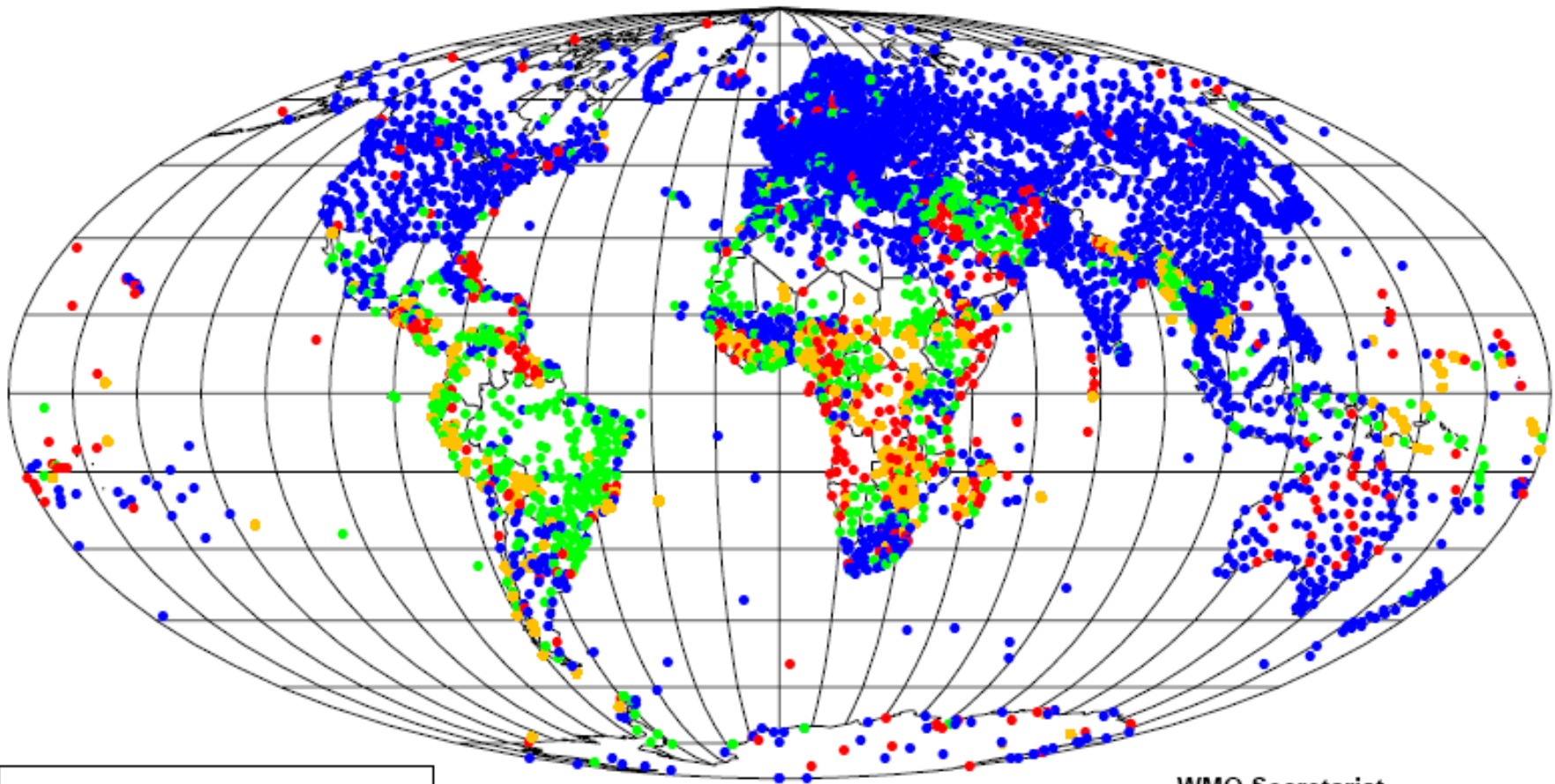


I: Great Achievements !



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WMO Global Observing Network with routine data exchange (10,000 stations)



WMO Secretariat

Percentage of reports received:

- 90 to 100 percent (2967 stations)
- 45 to 90 percent (697 stations)

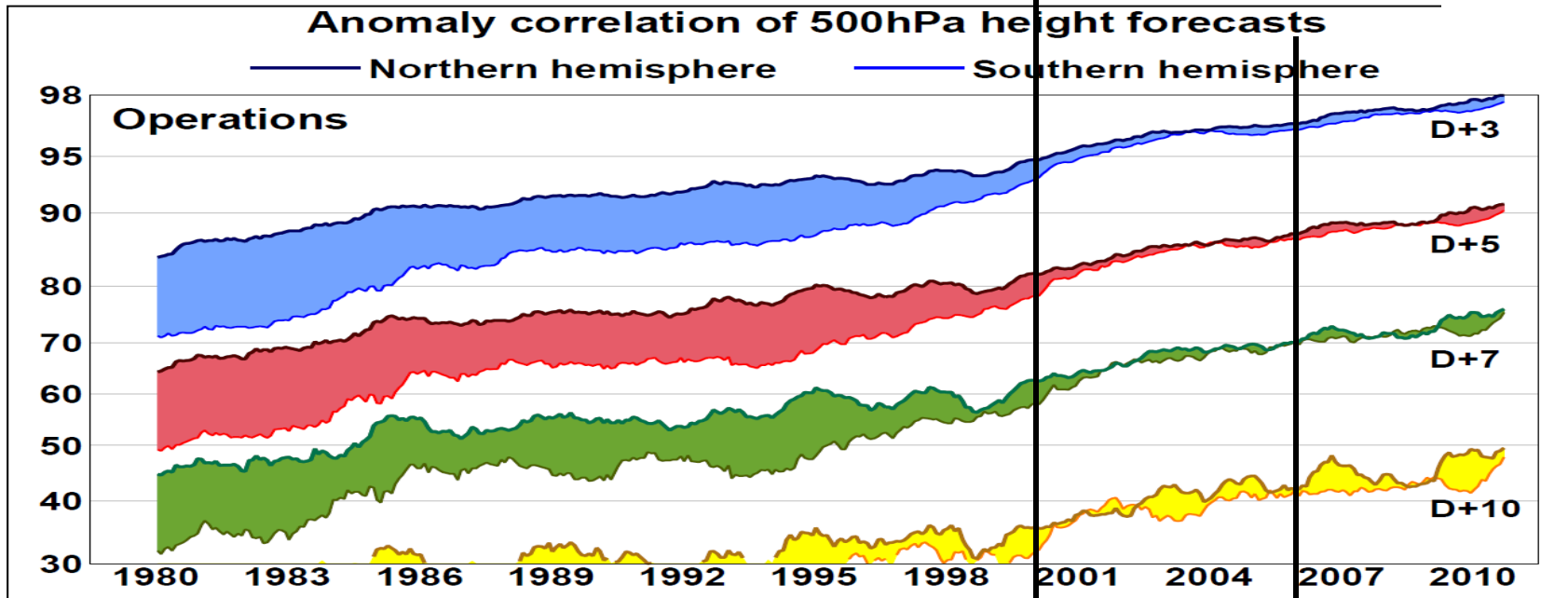
The designation employed and the presentation of material in this publication do not imply the expression of any opinion



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Over 50+ years with WMO backbone Program: World Weather Watch & Open Data Policies lead to great success for accurate weather forecasting & services

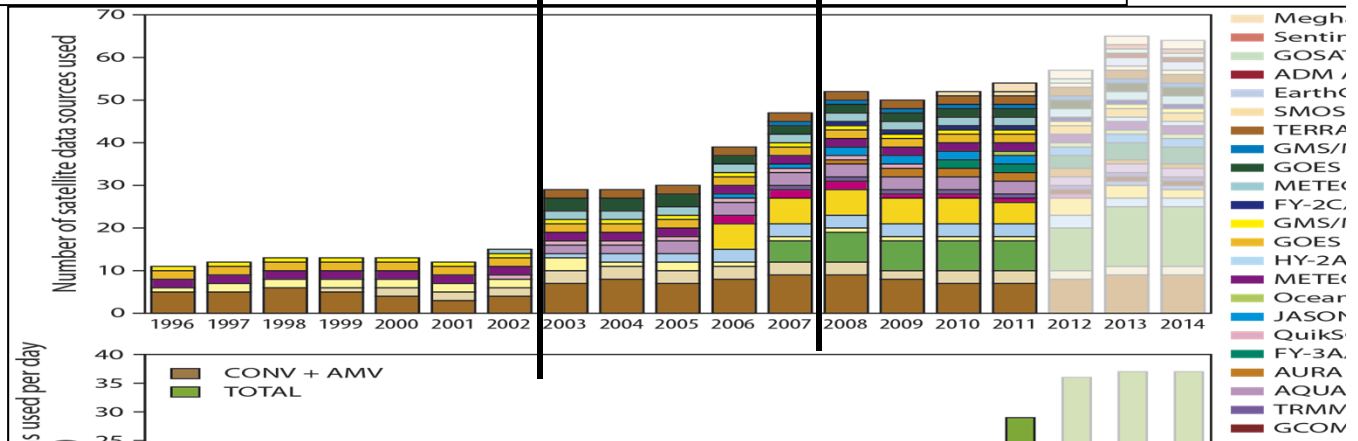
Source: ECMWF



Satellite datasets used at ECMWF



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New challenges and opportunities for observations

The role of AWS in DRR !



WMO OMM

New challenges and opportunities for observations

The role of AWS in LDCs !



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Minamata Convention on Mercury

- The **Minamata Convention on Mercury** has entered in force in August this year. Many countries will have to adapt to this and develop strategies to replace the mercury-instrument they are still heavily relying on. It will not only affect those countries who signed the convention and that will have to comply to it. It will also impact countries that have not signed it as suppliers of instrument may not be able to supply such instruments anymore.
 - Yesterday, some of you met to review draft guidance material aimed at supporting the transition process away from mercury-instruments. They looked at documentation that was specific to the instrumentation, but also at the requirements for trainings that could be supporting not only the transition away from mercury, but also more generally the transition to automated observations.

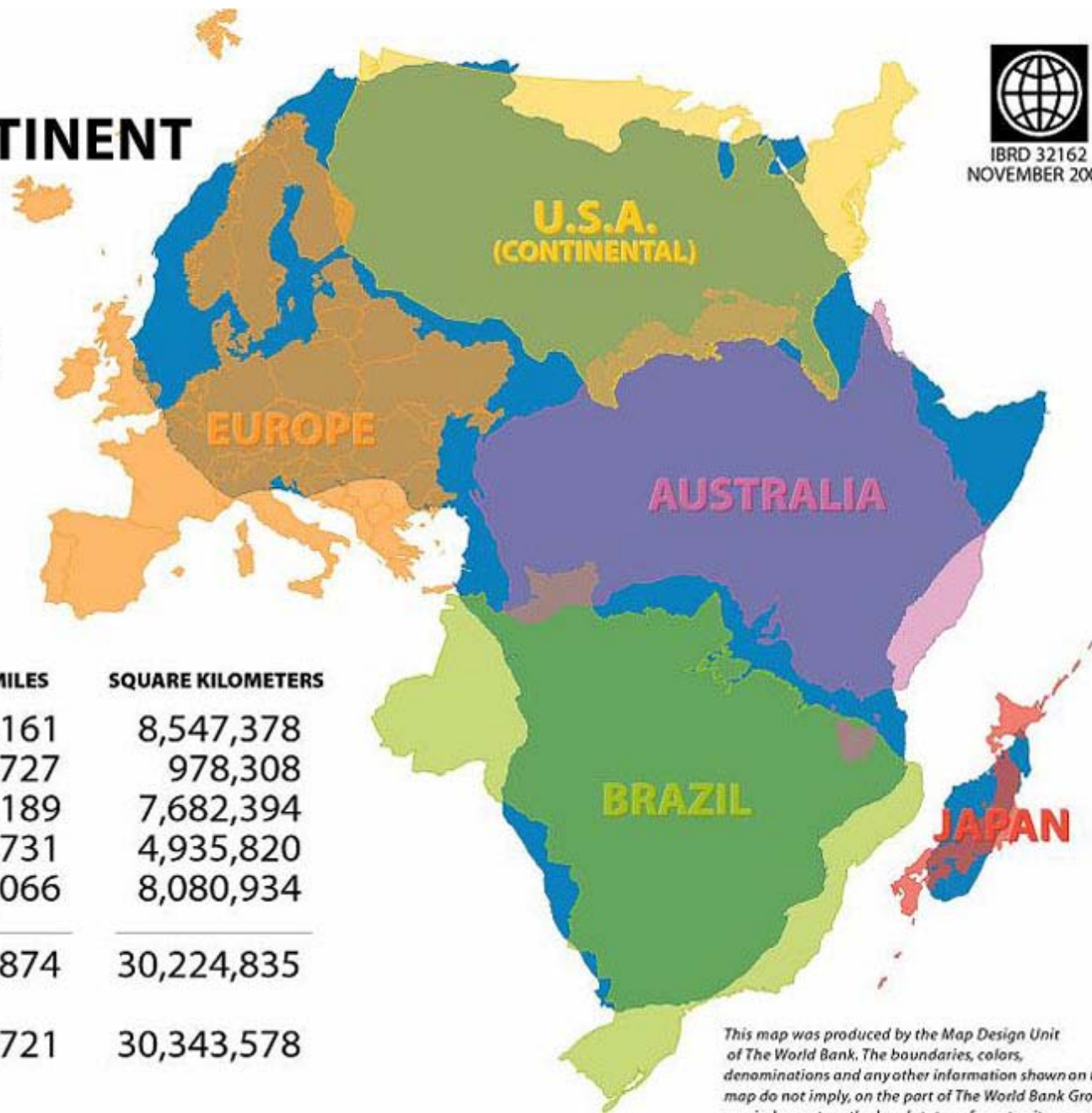


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SIZE OF THE AFRICAN CONTINENT COMPARED TO OTHER LAND MASSES



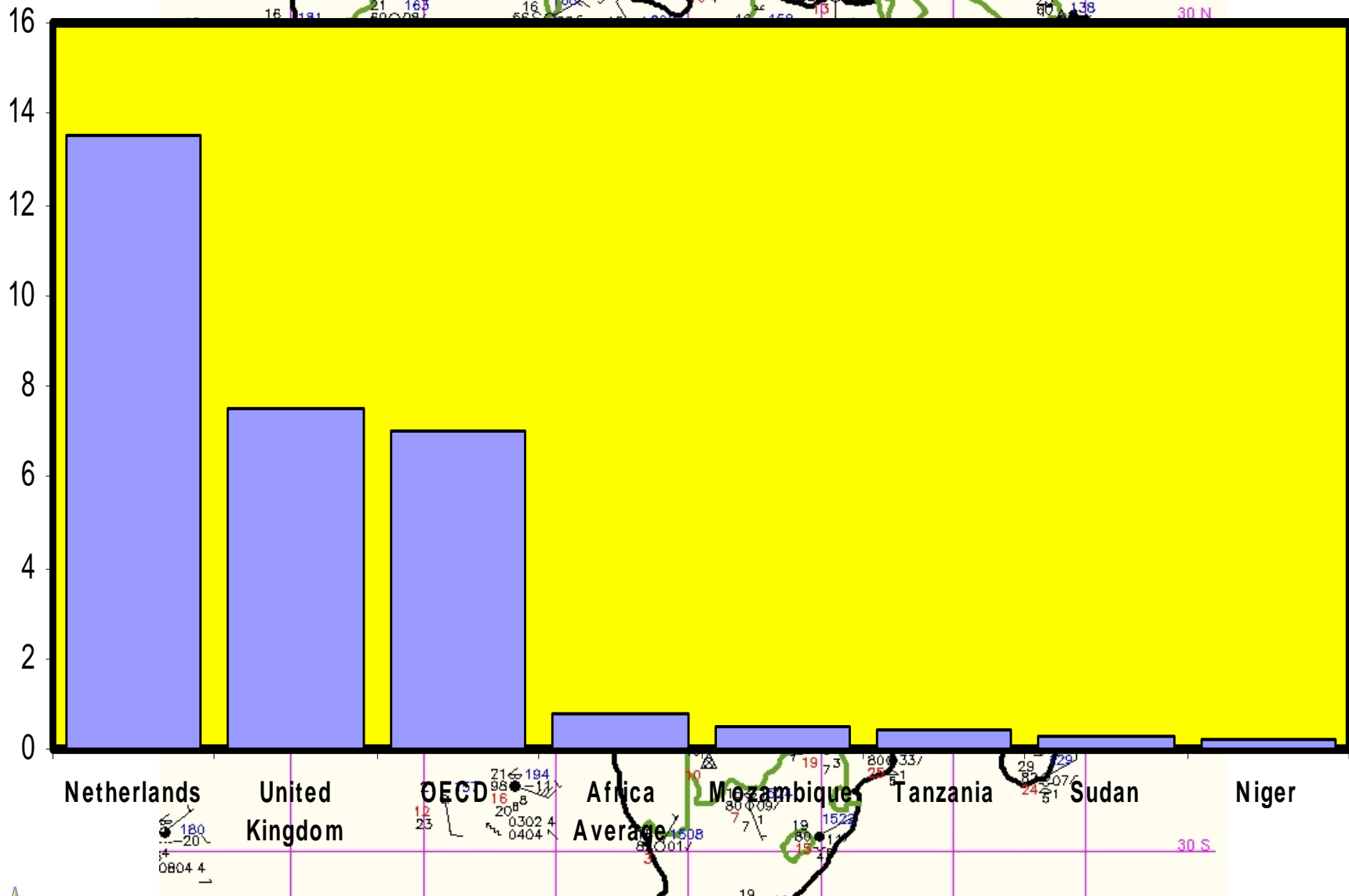
IBRD 32162
NOVEMBER 2002



	SQUARE MILES	SQUARE KILOMETERS
BRAZIL	3,300,161	8,547,378
JAPAN	377,727	978,308
AUSTRALIA	2,966,189	7,682,394
EUROPE	1,905,731	4,935,820
U.S.A. (Continental)	3,120,066	8,080,934
TOTAL	11,669,874	30,224,835
AFRICA (including MADAGASCAR)	11,715,721	30,343,578

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Constraints to Provision of Climate Information



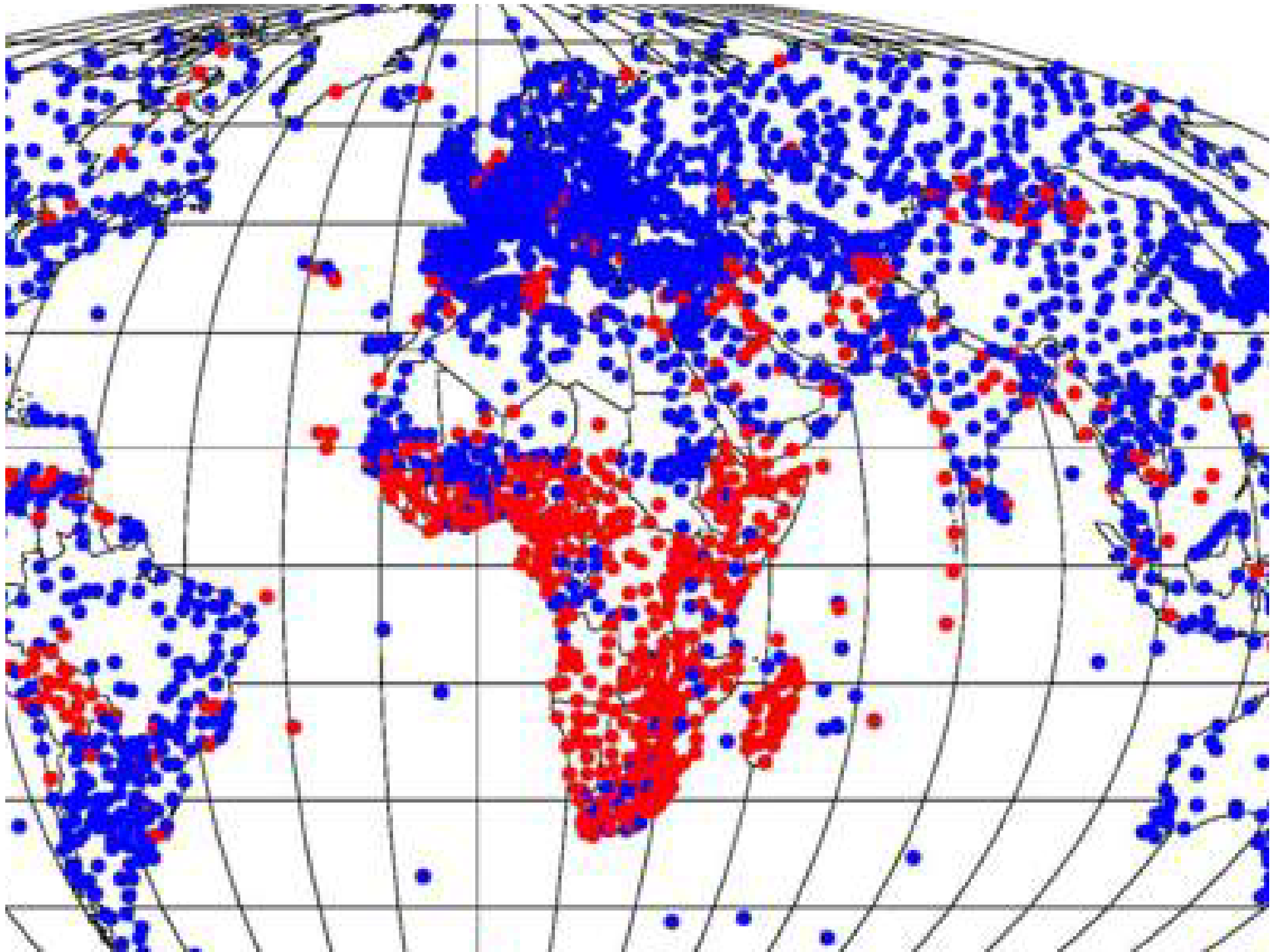
Source: United Nations Human Development Report (2007)

10/03/2010

Atcom, Nairobi, 12-16 April 2010

19°34'N 6°54'E





Good, Cheap and Fast: Possible

Cost-effective AWS !

AWSs have been deployed in most countries, but all of us are aware of **networks that were not sustainable**. Therefore exchange of experience on what is required to have sustainable network will remain a topic of interest for several years.



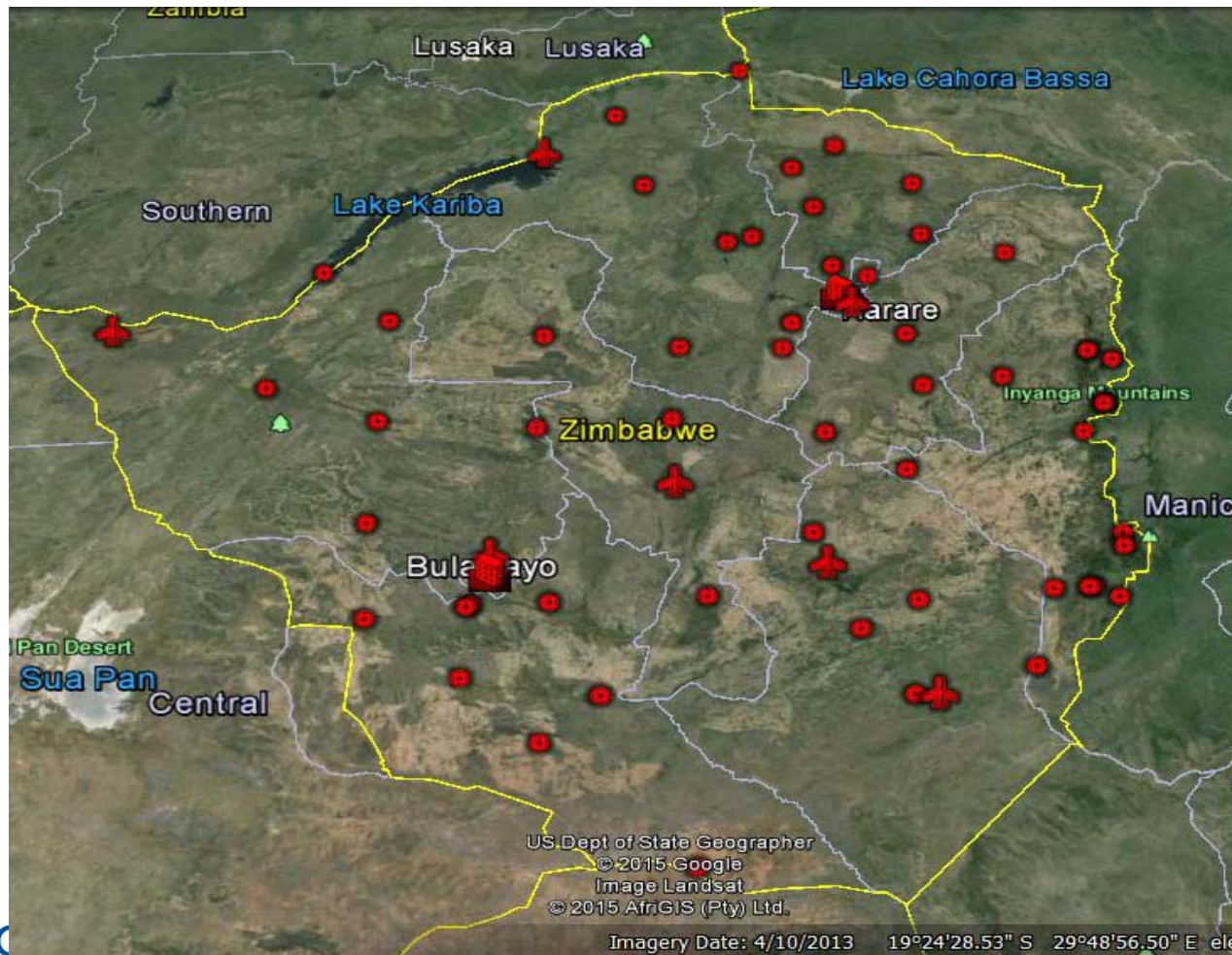
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WIGOS Value-National System

- The **proliferation of AWSs networks** that are not necessarily owned by NMHSs, or government entities is a challenge for Members. In some cases it means making best use of networks from different government entities, universities, as is promoted through the WIGOS framework. It can also mean having to deal with commercial partners or competitors which implies totally different strategies.

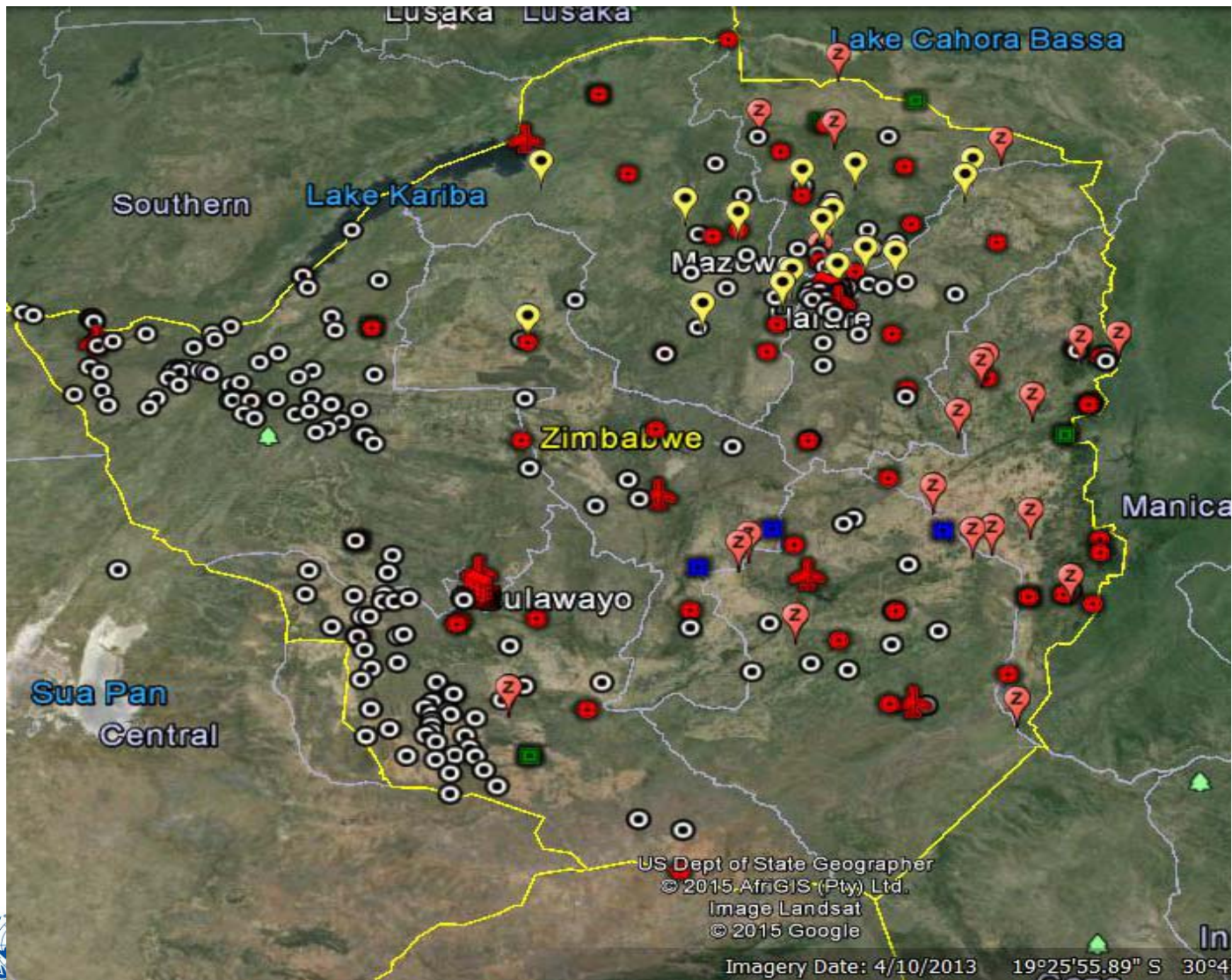


Regionalization through Nationalization MSD Synoptic & Climate Stations



WMO

Network of Networks-National WIGOS!



- Key**
- MSD Stations**
 - ZIMNAT AWS**
 - Oxfam AWS**
 - MSD AWS**



Climate – Monitoring Climate Variability and Change

**AWSs are accurate and reliable
enough for climate monitoring ?**

AWS Database & Info system



2016/07/14
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WMO Strategic Priority 2- Climate Services need more & better climate observations

Agriculture



Water (Polar
and High
Mountain focus)

Energy

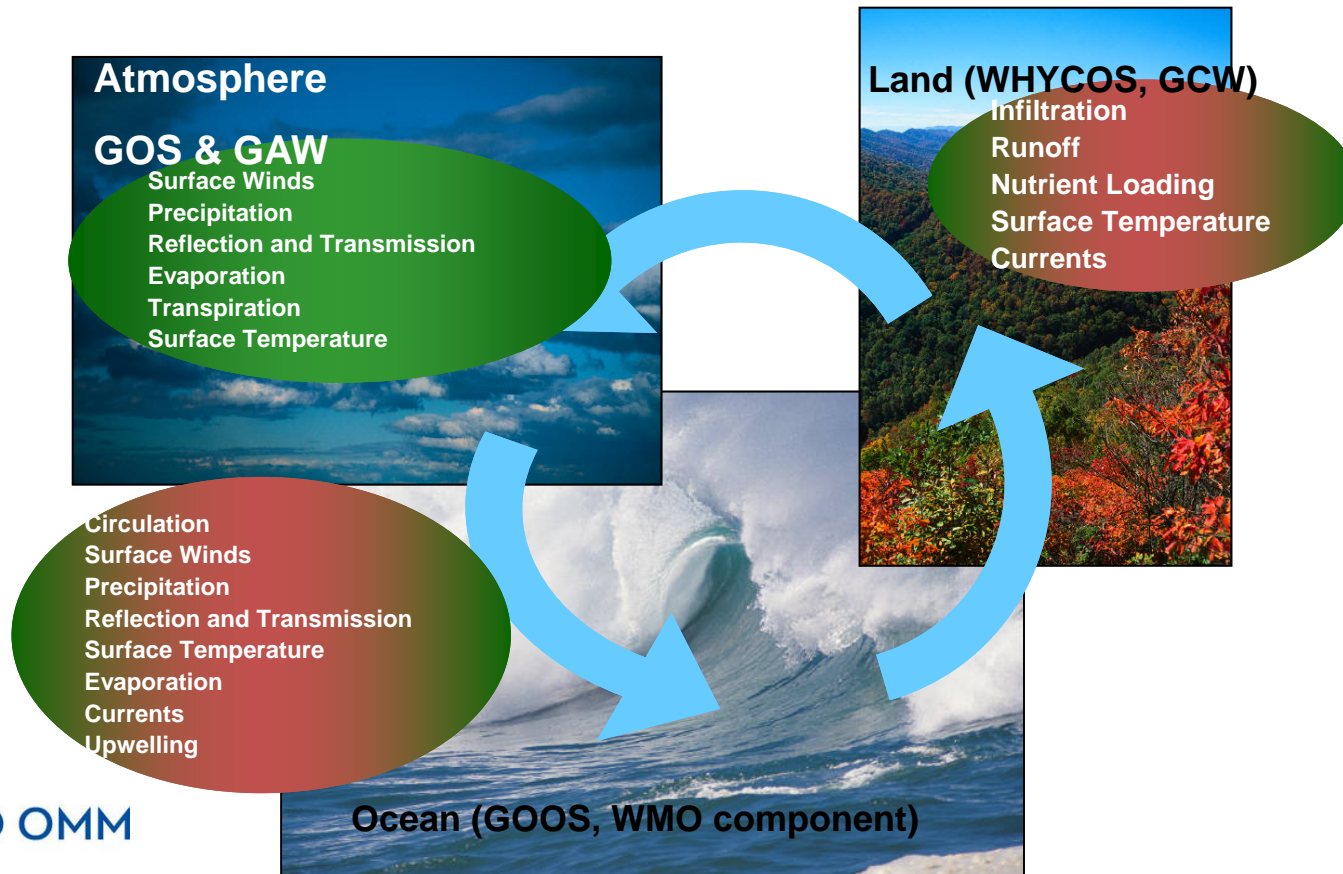


Disaster Risk
Reduction

Health



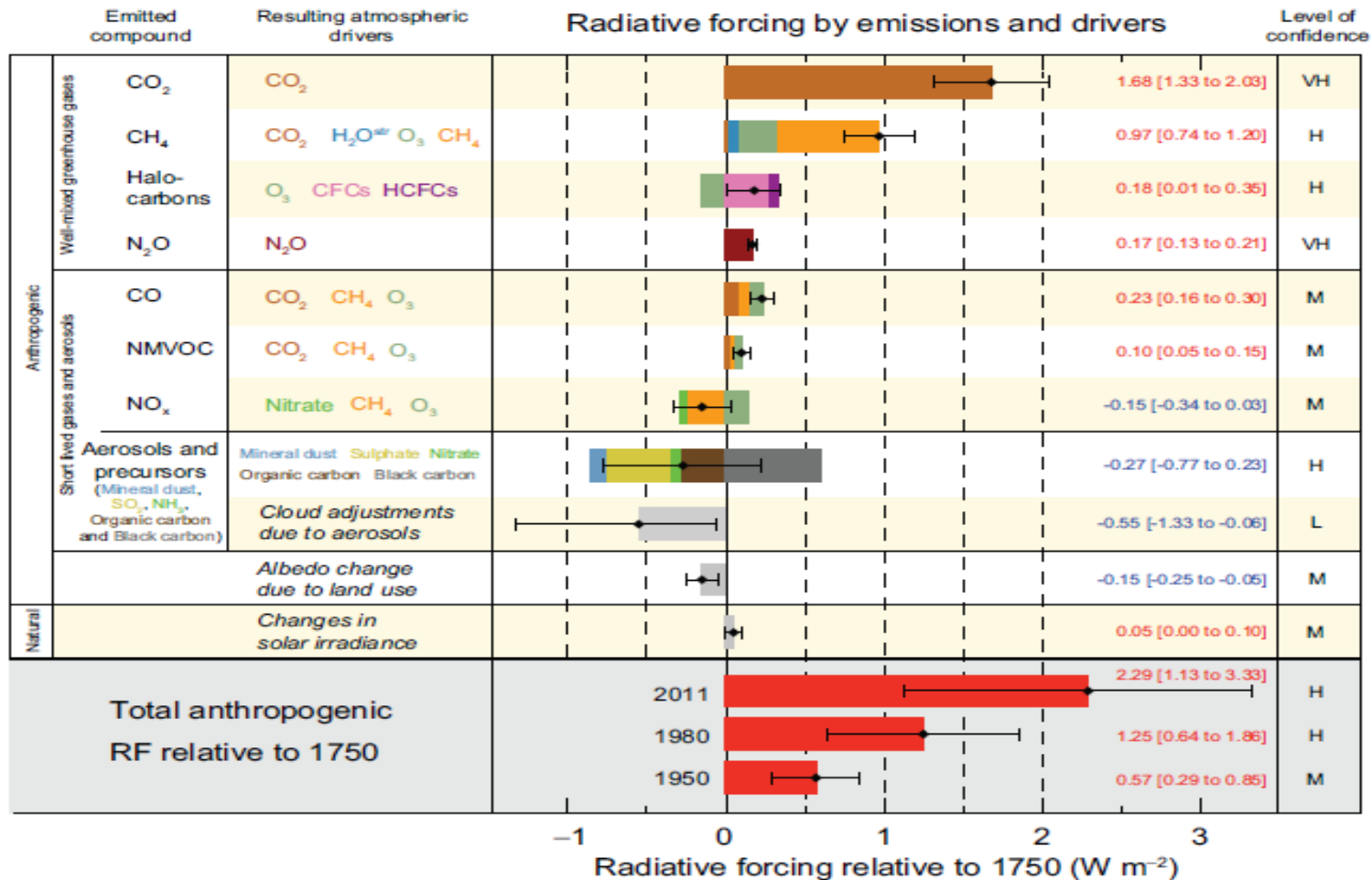
1. WMO in-situ data advantage is daily exchange of the atmospheric data over nations, covering 20% of the entire earth (RBSNs, etc);
2. Satellites provide global data coverage, with challenges for sub-surface of ocean and land observations (snow & ice depth, soil moistures);
3. Earth System modelling & monitoring need Earth System Data – request Members to evolving their observing systems vs structural change



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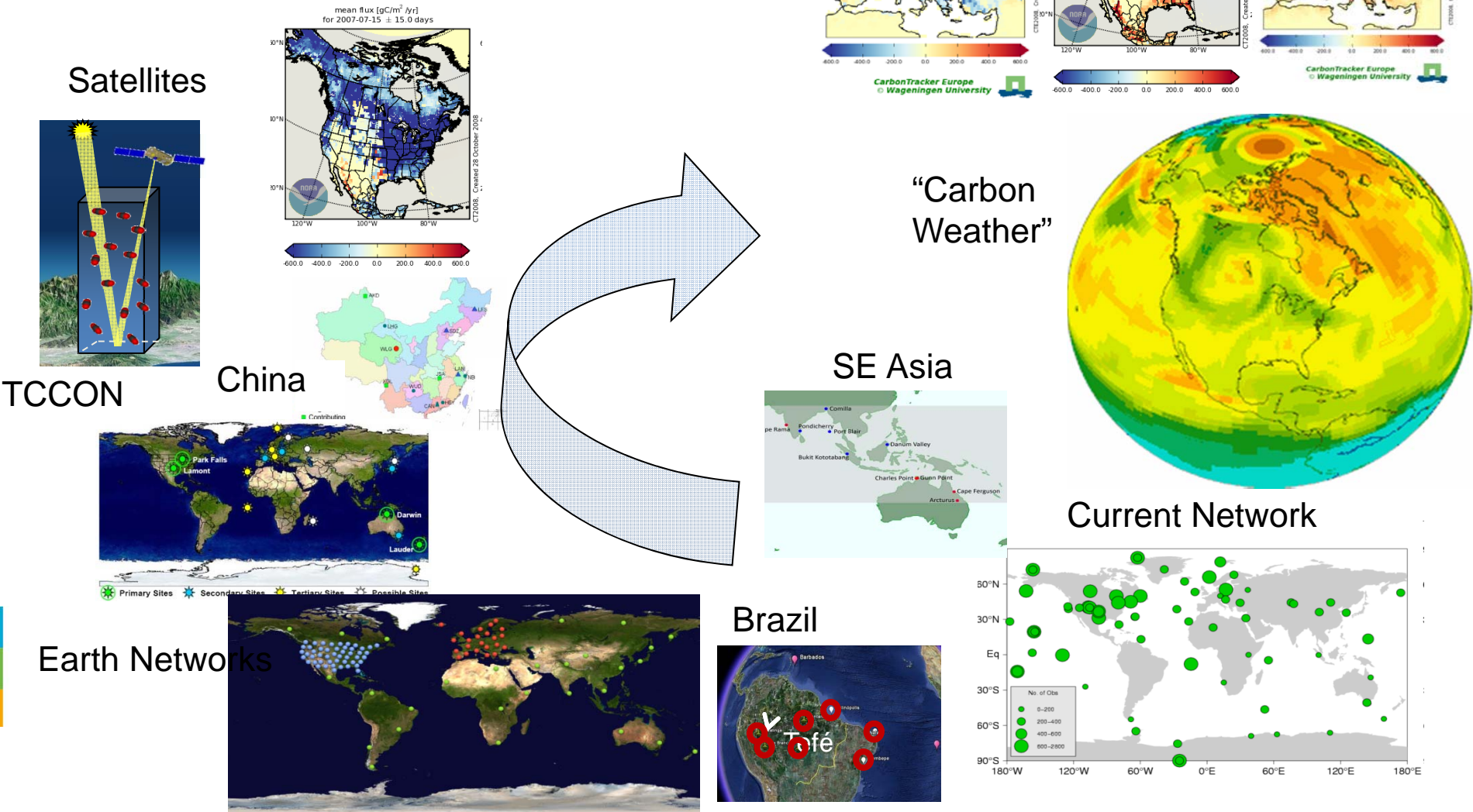
Paris Climate Agreement – Art. 7 (Adaptation)

(c) Strengthening scientific knowledge on climate, including research, systematic observation of the climate system and early warning systems, in a manner that informs climate services and supports decision-making;

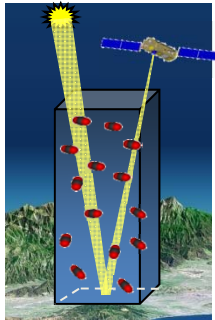


WMO New Initiative: Integrated Global Greenhouse Gas Information System (IG3IS)

-role of future AWS with GHG sensors ?

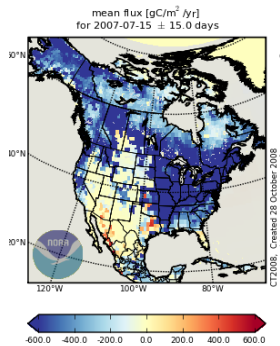


Satellites

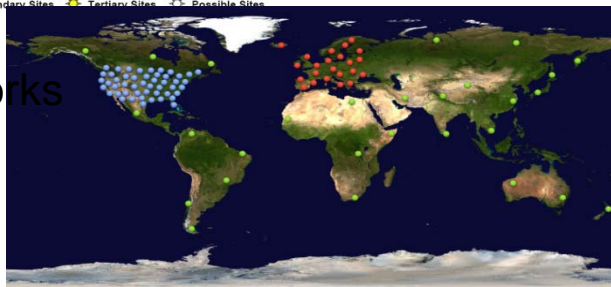


TCCON

China



Earth Networks



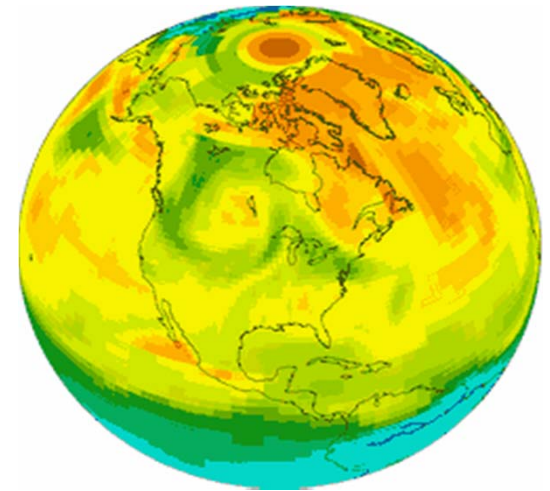
Brazil



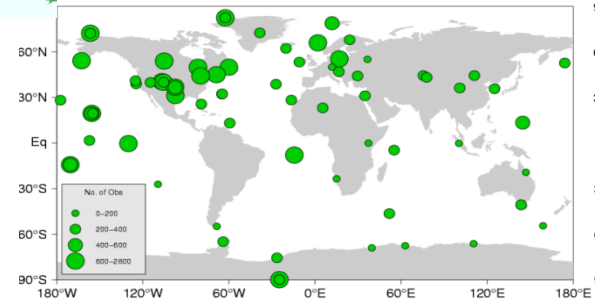
SE Asia



“Carbon Weather”



Current Network



Requirements of AWS for supporting sustainable cities and communities !

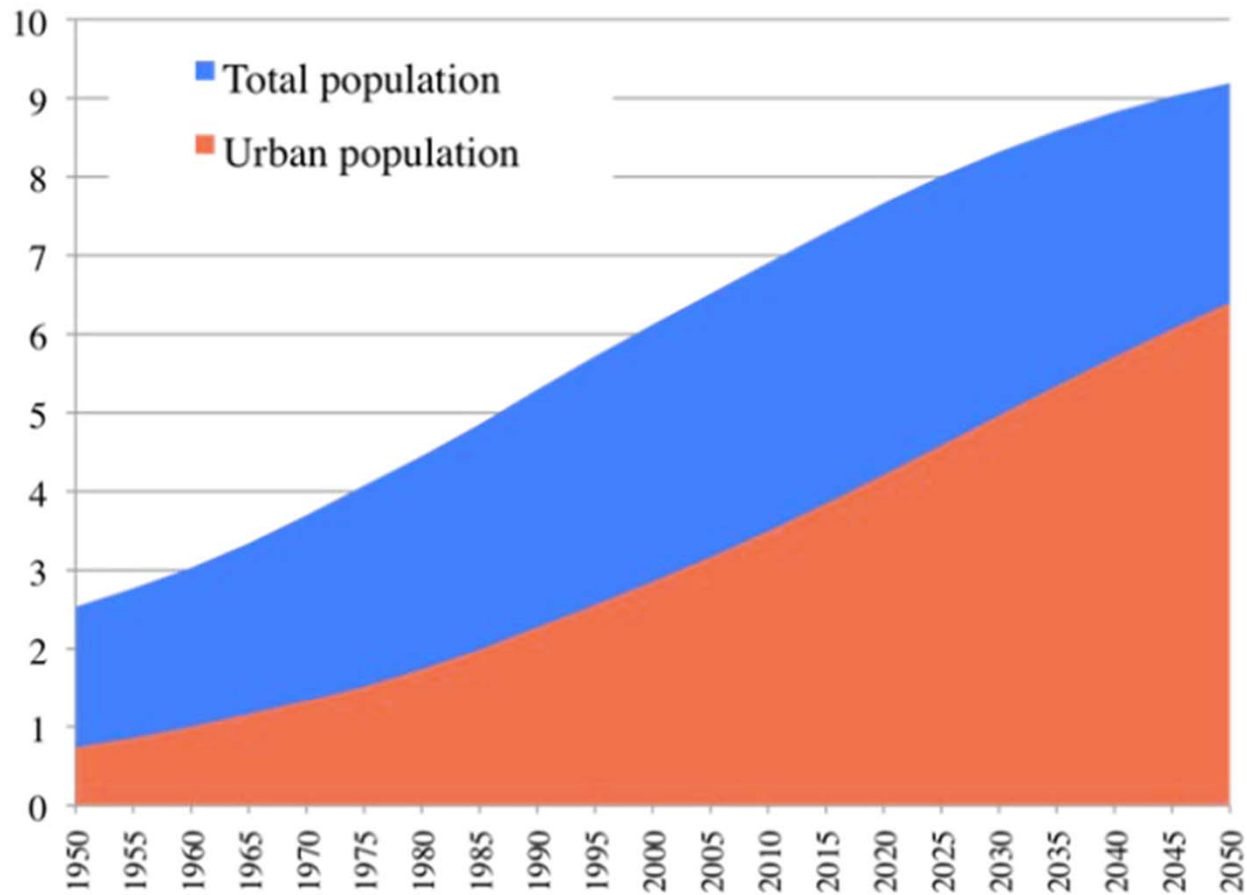


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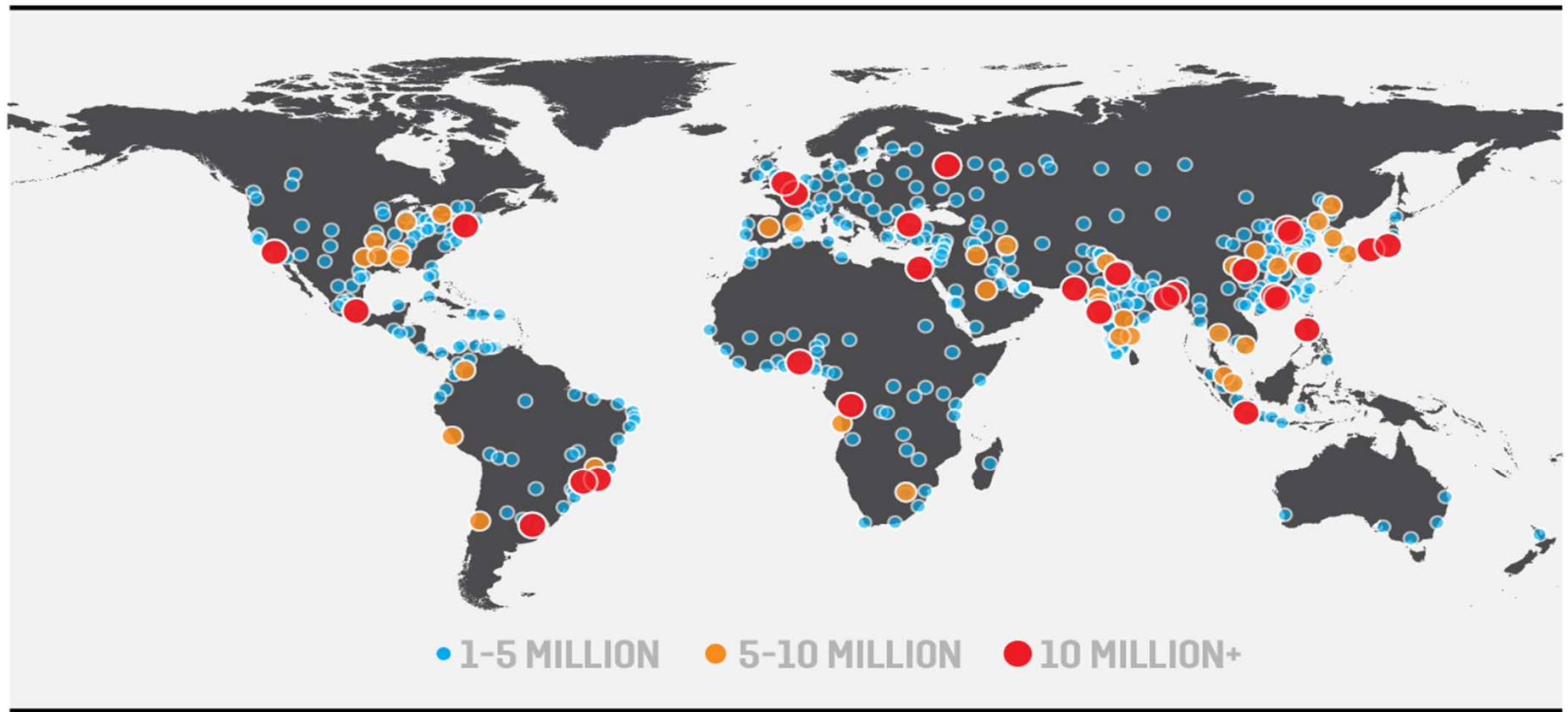
Growing Urban Population

(Billion)



Costal Megacities in 2040 may face multiple challenges: extreme weather, local climate (hot island & pollution) and water shortage – how AWS meet Megacity Observing requirements !

FP **Distribution of Cities 2014**

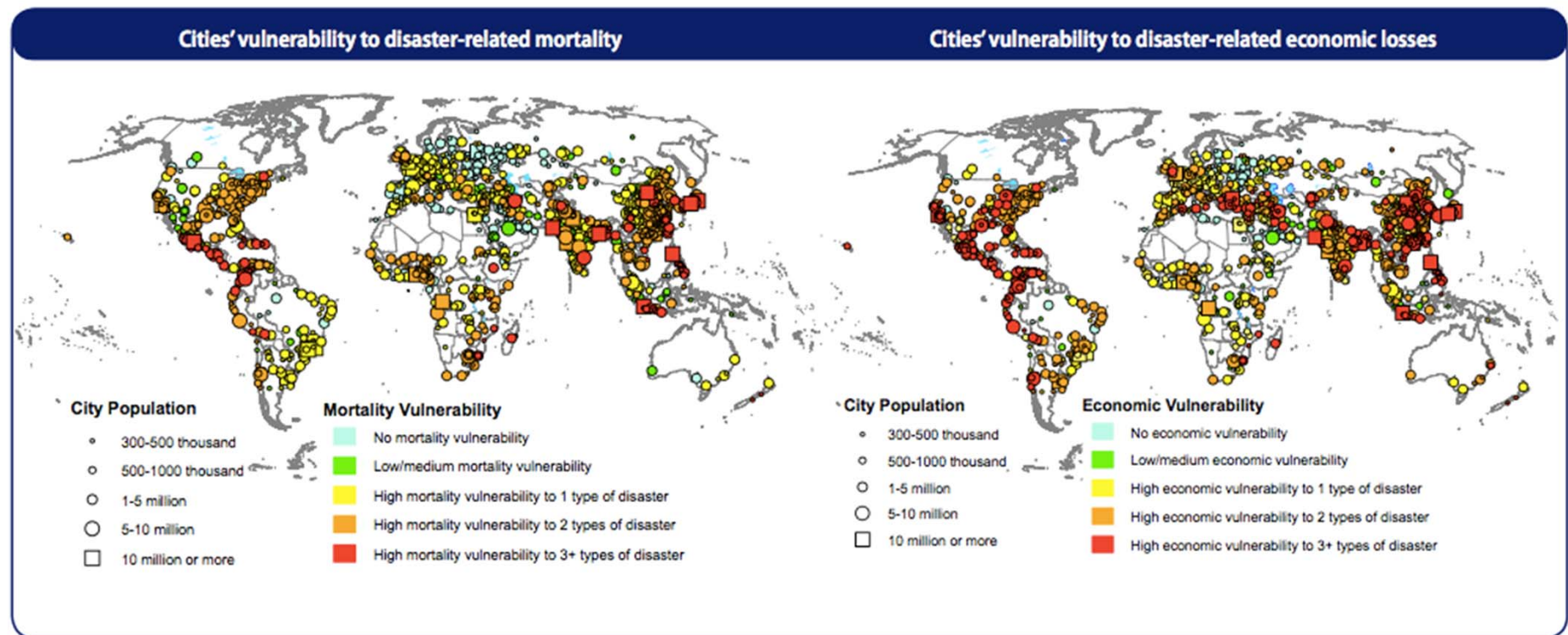


A majority of city dwellers live in cities that face high risk of disaster-related mortality or economic losses

Some 82 per cent of cities—home to 1.9 billion people in 2014—were located in areas that faced high risk of mortality associated with natural disasters. Similarly, 89 per cent of cities—home to 2.1 billion people in 2014—were located in areas that were highly vulnerable to economic losses associated with at least one of the six types of natural disaster.

On average, cities in the less developed regions were at higher risk of exposure to natural disasters and were more vulnerable to disaster-related economic losses and mortality than those in the more developed regions. Moreover, larger cities tended to be at higher risk of exposure to disasters and more vulnerable to disaster-related economic losses and mortality compared to smaller cities.

Floods were the most common type of natural disaster affecting cities, followed by droughts and cyclones. These three types of disaster were also the most devastating for city dwellers globally in terms of the mortality and economic losses they caused.



Air pollution challenges identified by SDG 2017 report



Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable

9 in 10 living in urban areas breathed air that did not meet WHO air quality guidelines in 2014



The pace of urban growth has been unprecedented. More than half the world's population, or nearly 4 billion people, lived in cities in 2015. However, while cities are incubators of innovation and help foster increased employment and economic growth, rapid urbanization has brought with it enormous challenges, including inadequate housing, increased air pollution, and lack of access to basic services and infrastructure.

- ▶ The proportion of the urban population living in slums worldwide fell from 28 per cent in 2000 to 23 per cent in 2014. However, in sub-Saharan Africa, more than half (56 per cent) of urban dwellers lived in slum conditions.
- ▶ From 2000 to 2015, in all regions of the world, the expansion of urban land outpaced the growth of urban populations, resulting in urban sprawl.
- ▶ According to data from cities in 101 countries from 2009 to 2013, approximately 65 per cent of the population was served by municipal waste collection.
- ▶ In 2014, 9 in 10 people living in urban areas breathed air that did not meet the World Health Organization's air quality guidelines value for particulate matter (PM 2.5).
- ▶ As of May 2017, 149 countries had fully or partially implemented national-level urban policies, most of which are aligned with priority areas identified in the SDGs.



Coverage of municipal waste collection was **65 per cent** in cities in 101 countries

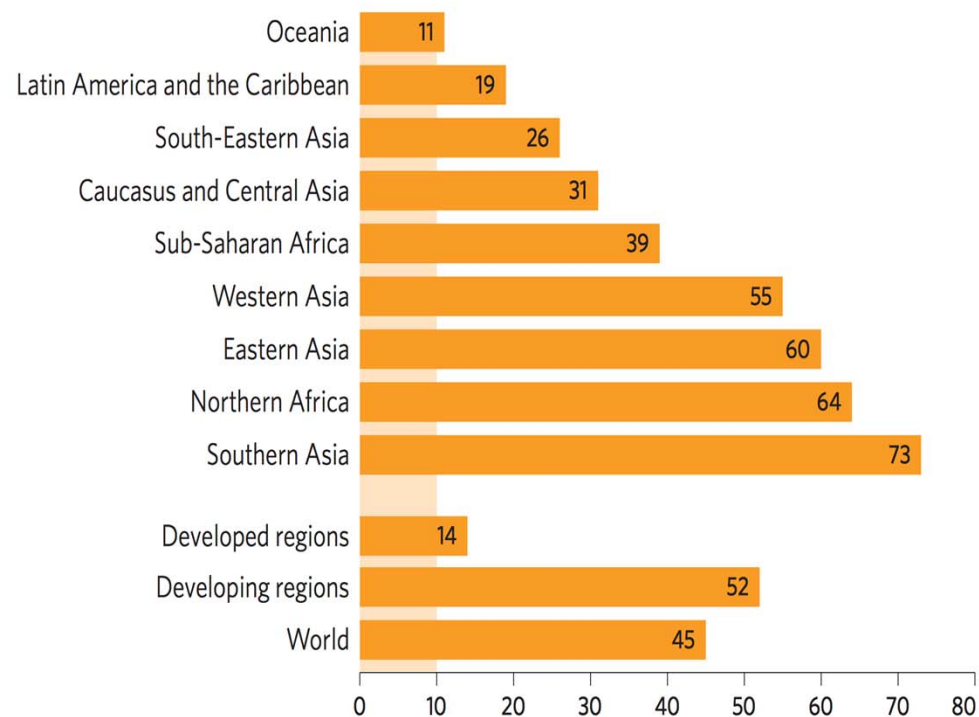


Air pollution is a major risk to health

Cities in every part of the world have dangerously high levels of air pollution

Air pollution is a major environmental risk to health. Globally, ambient (outdoor) air pollution in both cities and rural areas is estimated to have caused 3.7 million premature deaths in 2012. In 2014, about half the urban population worldwide was exposed to air pollution levels at least 2.5 times above the safety standard set by the World Health Organization (WHO). No region had annual average mean concentrations of particulate matter below the maximum level set by WHO of 10 micrograms per cubic metre ($\mu\text{g}/\text{m}^3$).

Average annual mean of particulate matter of 2.5 microns in diameter or smaller (PM2.5) concentration levels in urban areas ($\mu\text{g}/\text{m}^3$), 2014

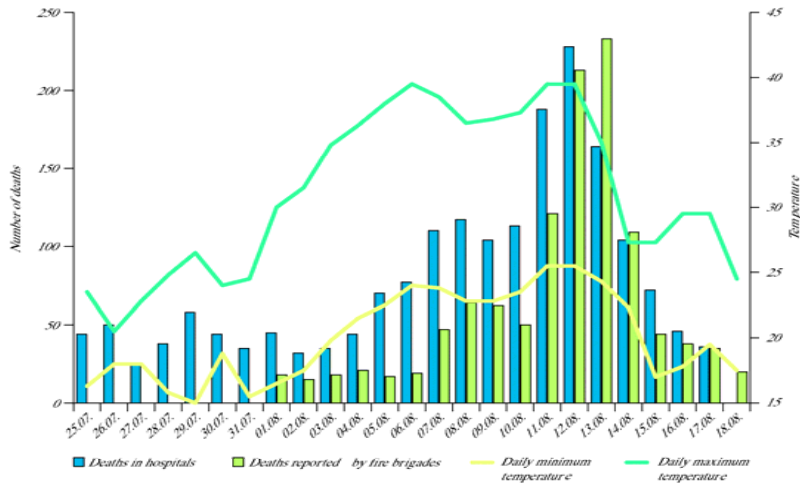


WHO maximum recommended air pollution level: 10 $\mu\text{g}/\text{m}^3$

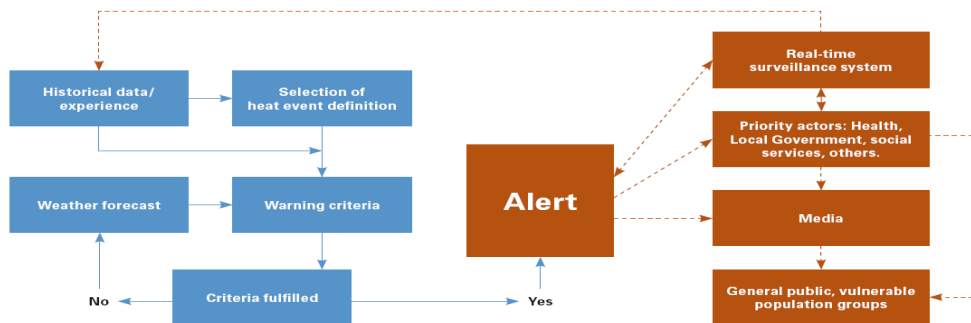
Note: Data reported only for WHO member States.



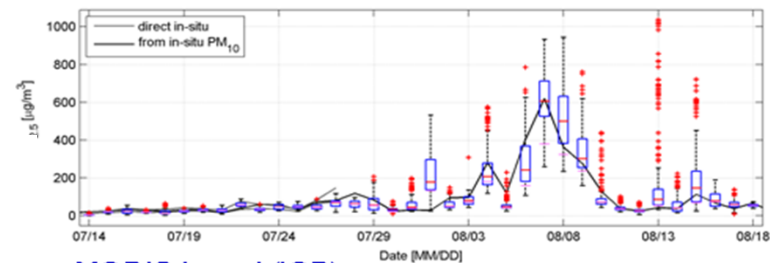
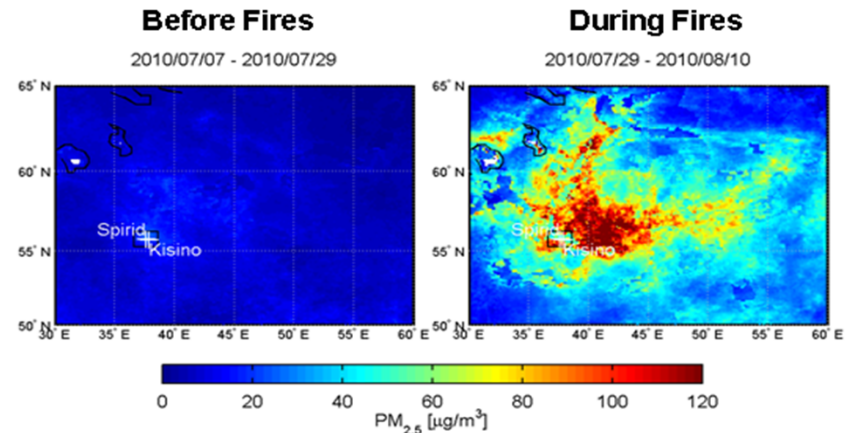
Climate Services for health: Monitoring/response to weather/pollution events



Deaths During Summer Heatwave. Paris Funeral Services (2003)



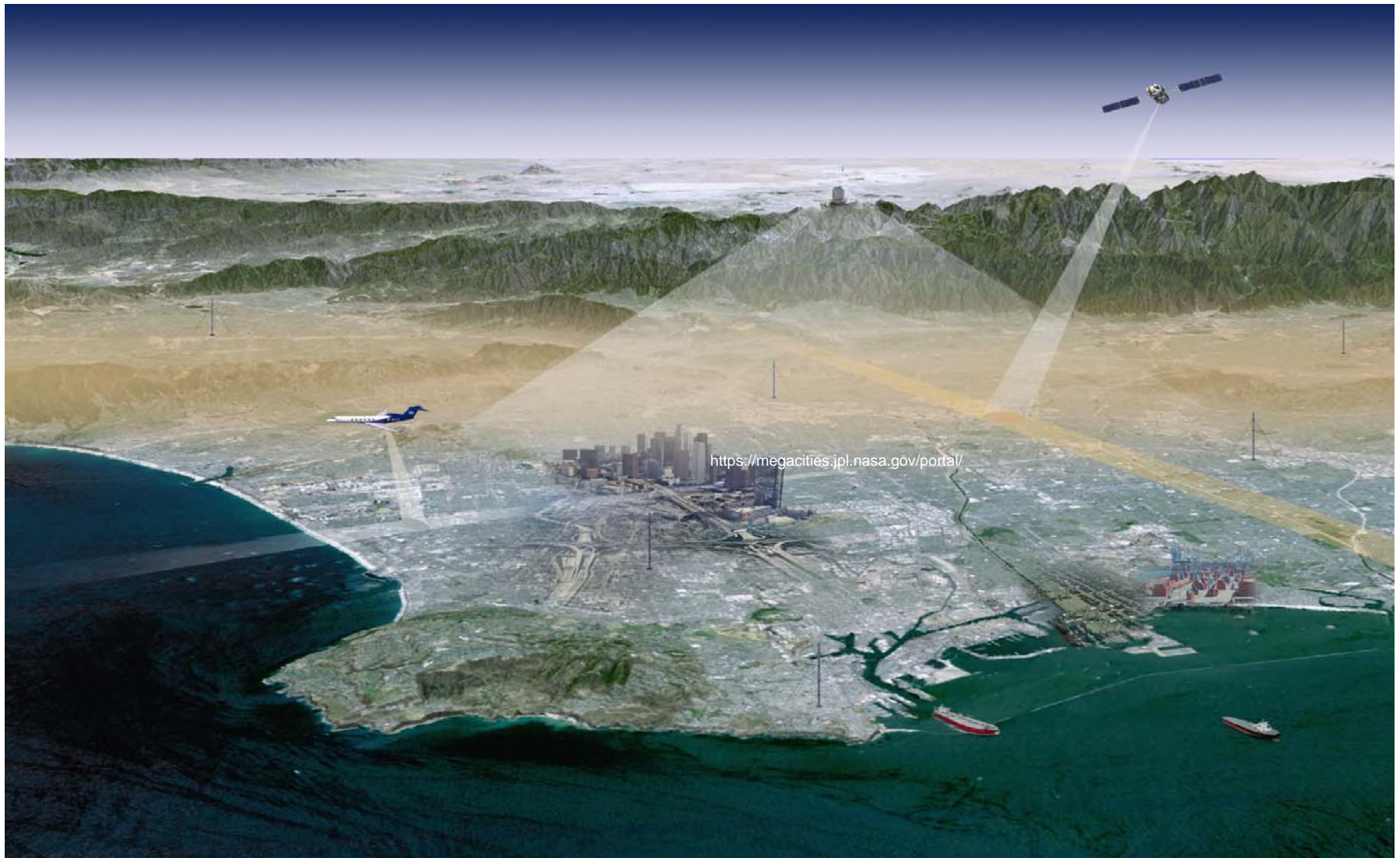
The information generated by meteorological agencies needs to be connected to preventive actions by health and other sectors to form a heat-health action plan¹³



MODIS-based (IQR)

Air pollution levels during Moscow fires in 2010

AWS as an Integrated (space, airborne and in-situ) Observing & Information System for meeting multiple requirements !



Utilization of AWS for DRR

More than merely Measurements !!

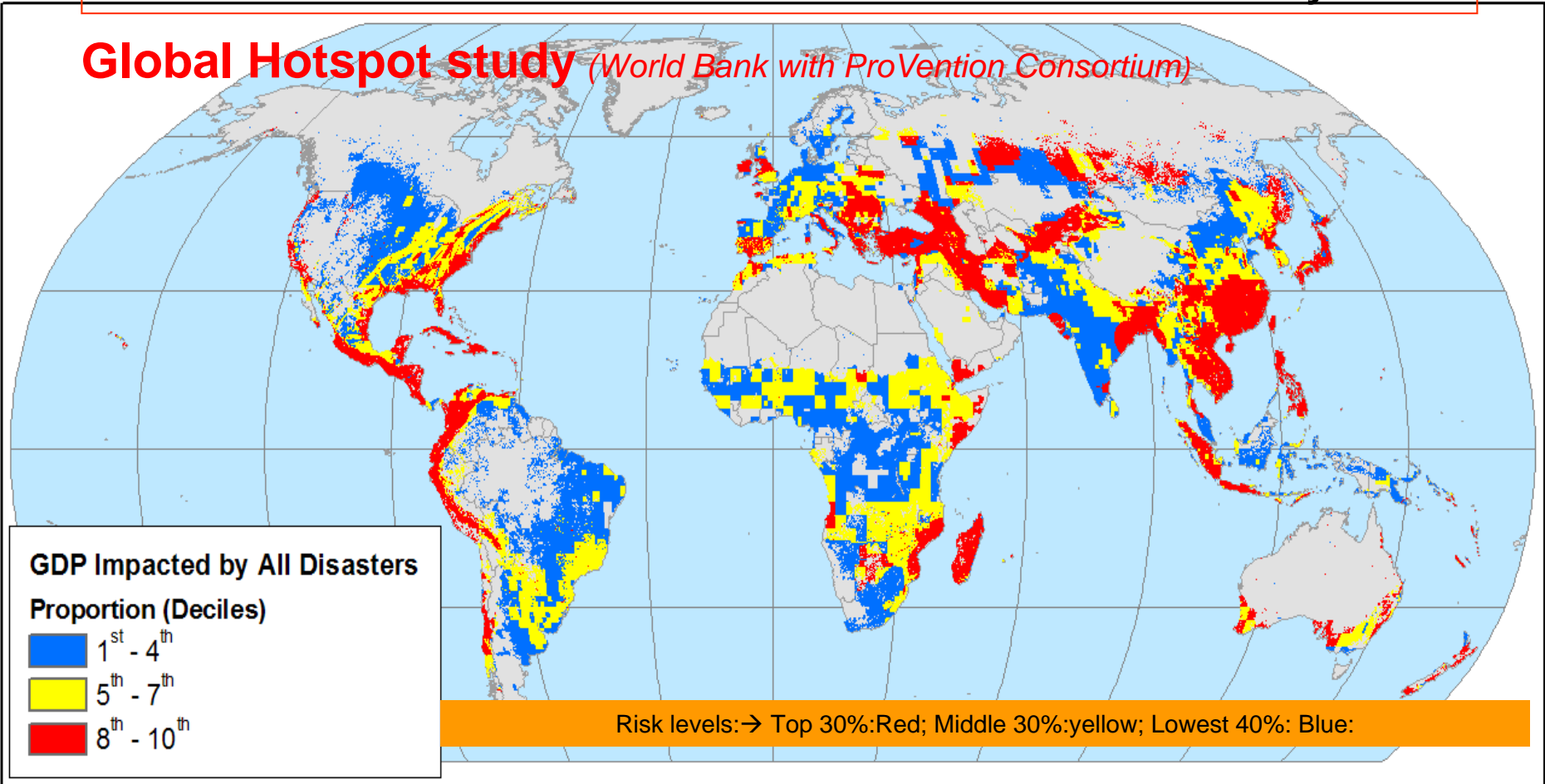


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Global Challenges We Share

As society becomes more complex we become more sensitive to natural and human induced variability.

Global Hotspot study (World Bank with ProVention Consortium)



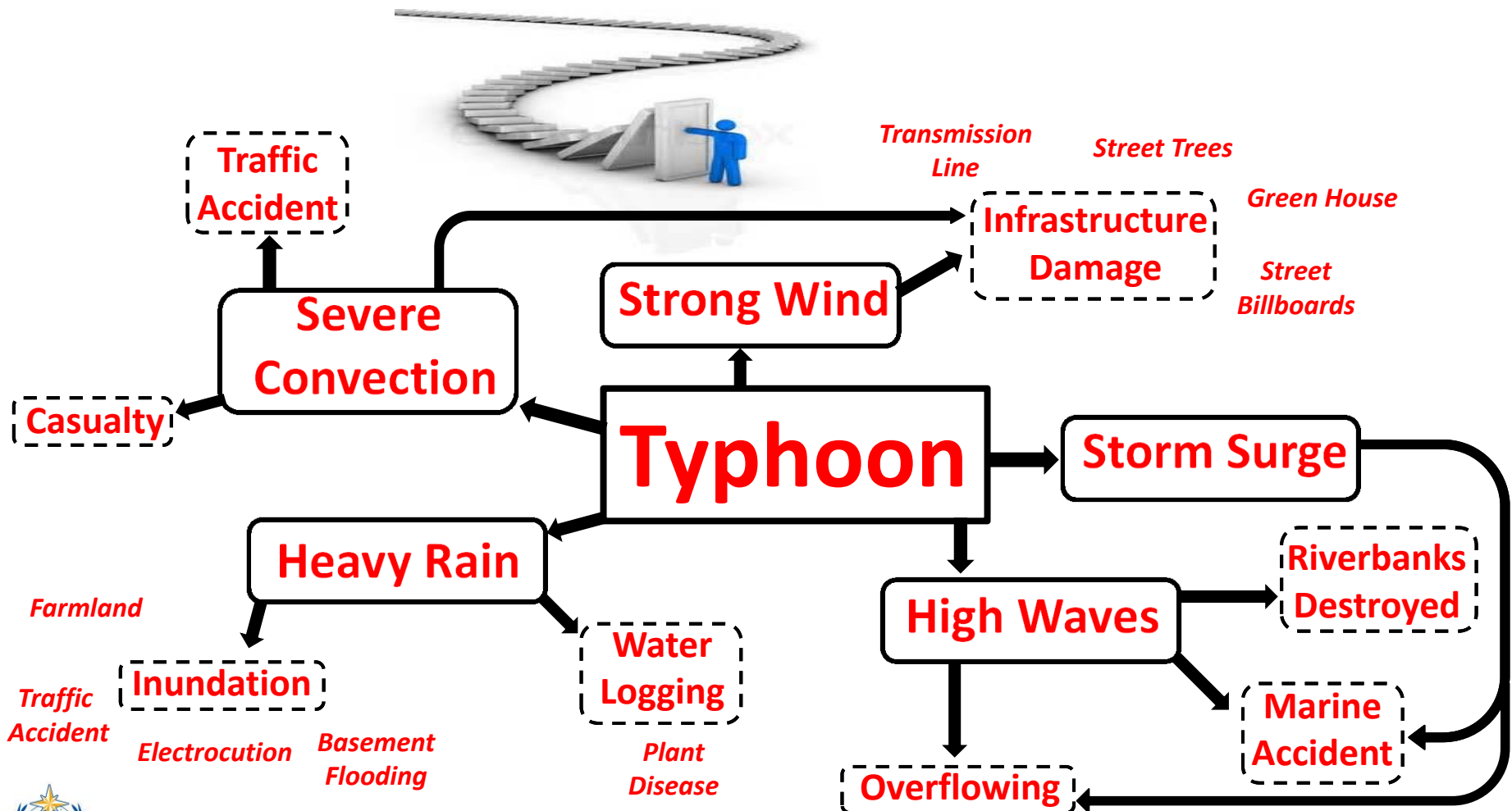
35 countries have more than 5% pop in areas at risk from three or more hazards
96 countries have more than 10% pop in areas at risk from two or more hazards
160 countries have more than 25% pop in areas at risk from one or more hazards



WHO

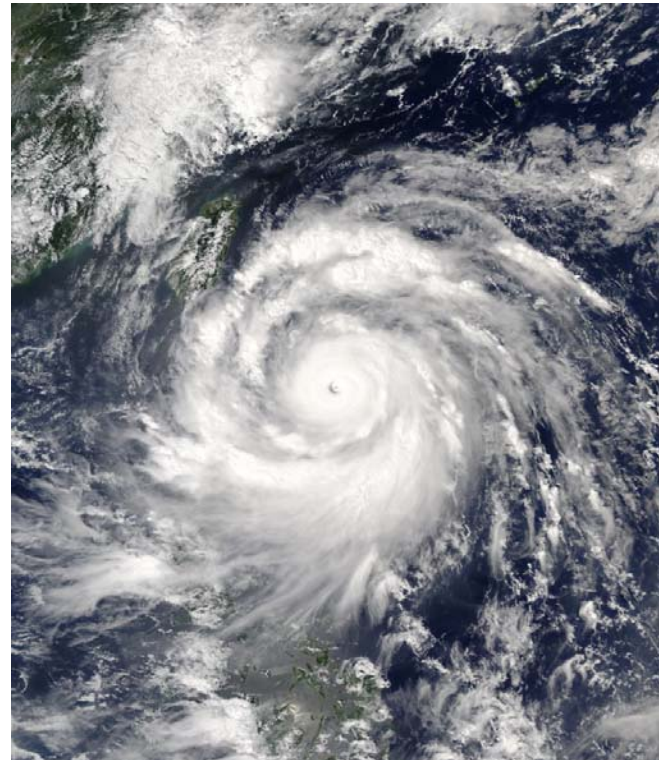
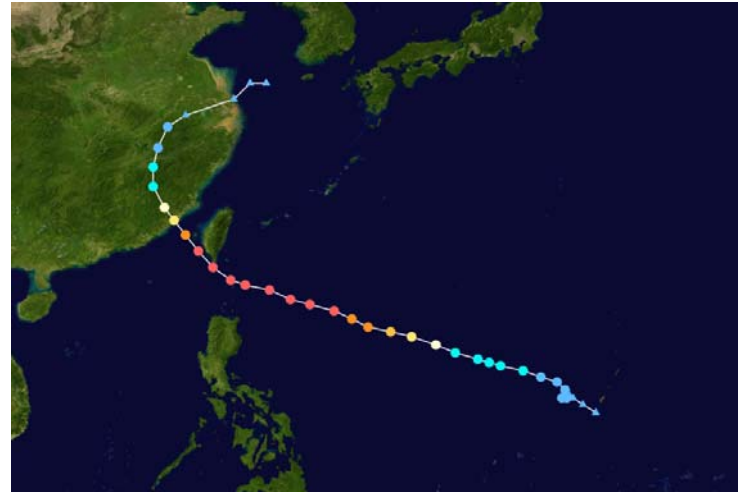
Through a domino effect, a single extreme event can lead to a broad breakdown of a city's infrastructure:

Example of Hazard Domino Effect (Typhoon)

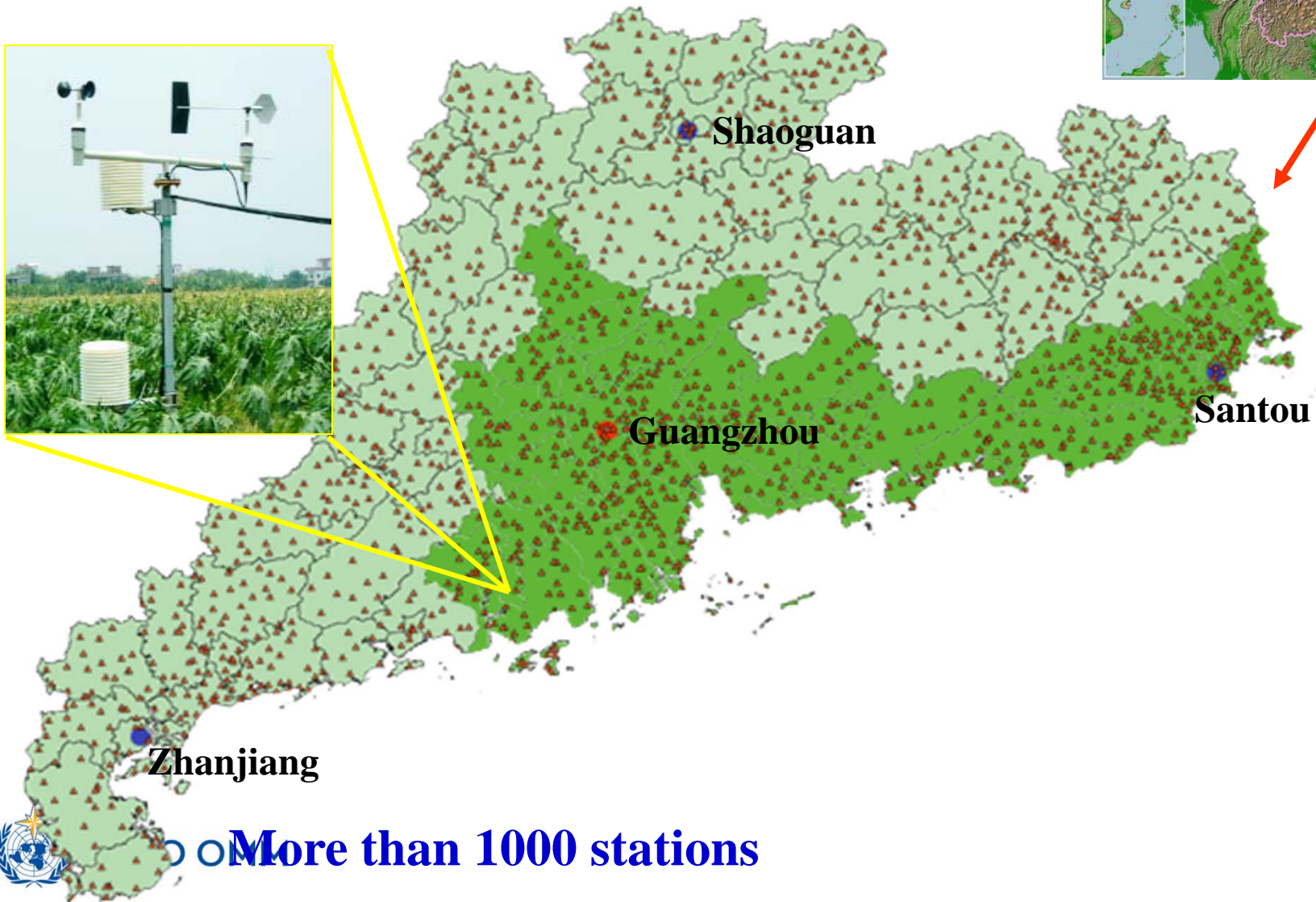


Typhoon Meranti, one of the most intense Typhoons (landing China on Sept. 15, 2016)

- Basic Data:
 - Highest Winds: 220km (10"), 305 KM (1")
 - Lowest Pressure: 890 hPa
- Impact:
 - [Philippines](#), Korea and East China ([Taiwan](#) & [Fujian](#)),
- Losses in Fujian alone
 - Died: 28
 - Missing: 15
 - Enjured: 50
 - Impacted: 304,320
 - Economic lost : 21 Billion (RMB)



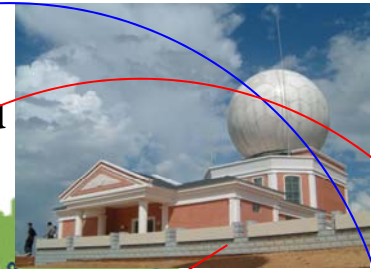
Example: Regional AWS network in Guangdong with more than **1000** AWSs. The measured data are sent up to local meteorological bureau and CMA every **10** minutes. These data are both very helpful to shorter-range weather forecast and to the warning, services, etc.



More than 1000 stations



Shaoguan



Meizhou



Yangjiang



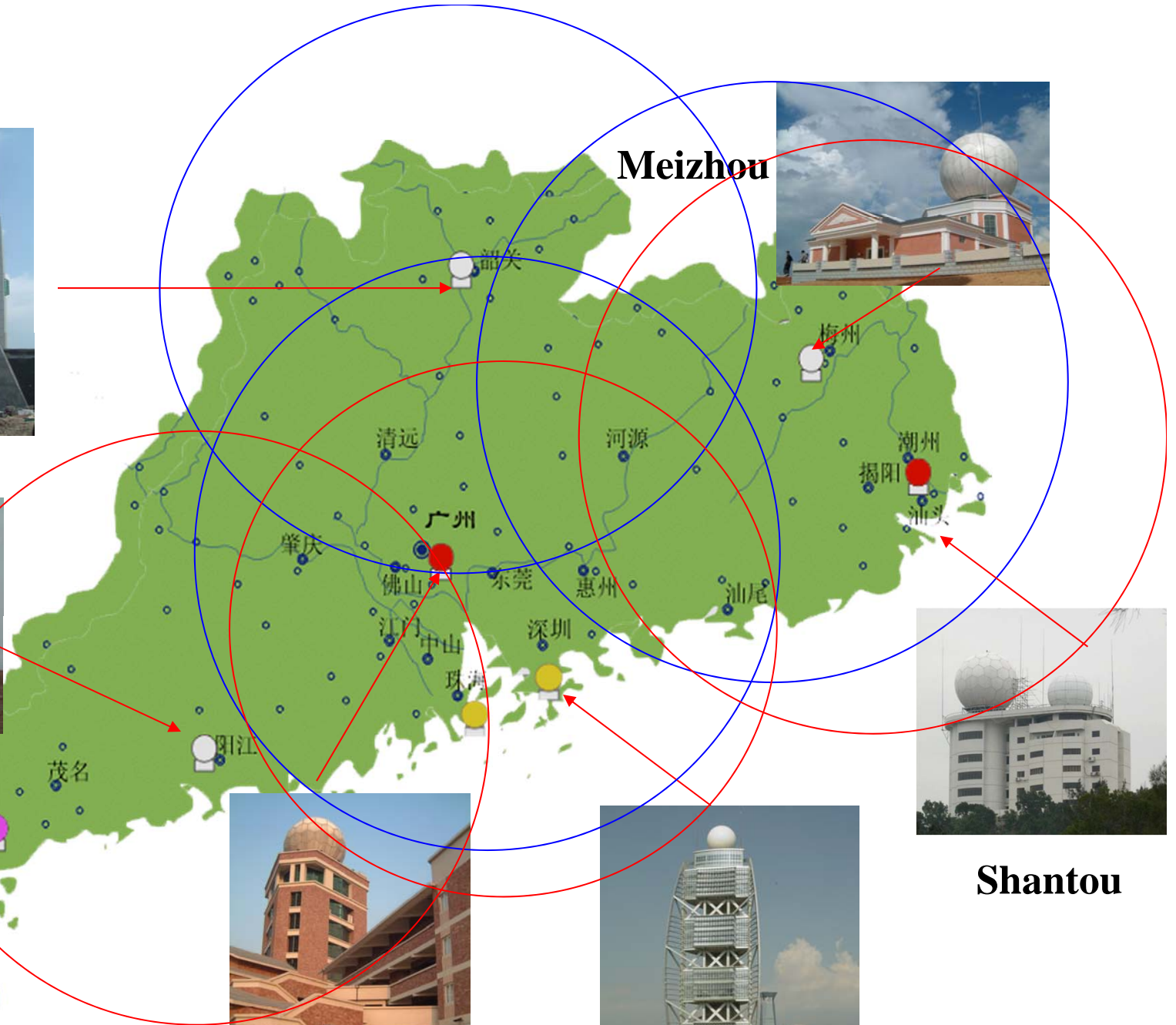
Shantou



Guangzhou



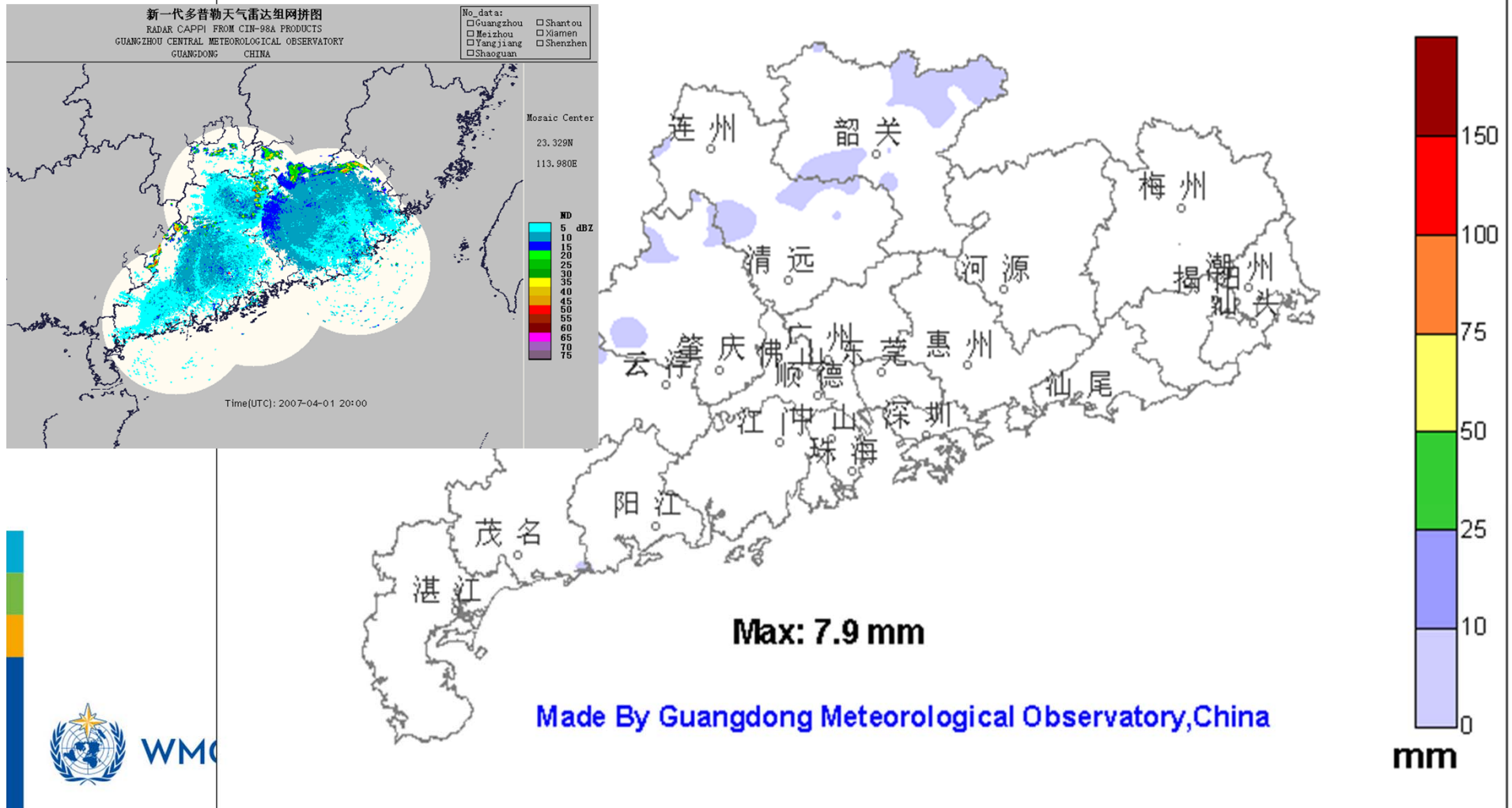
Shenzhen



Data utilization: The AWS's data are calibrated with Doppler radar data.

- 1) improving forecasting;**
- 2) real time warning;**
- 3) remote sensing rainfall algorithm development, CAL/VAL;**
- 4) information services to the local information networks (citizen, farmers, etc).**

Accumulative Precipitation 04Z-05Z 2April2007 Guangdong,China



Services are only the tip of the iceberg...



**... installation,
operation and
maintenance of
infrastructure,
observation,
research...**



WMO OMM

**WMO is a legal-binding organization, and Members need
Better guidance and standards ! – WMO standards on
AWS !**



Since 1951, WMO Cg-I

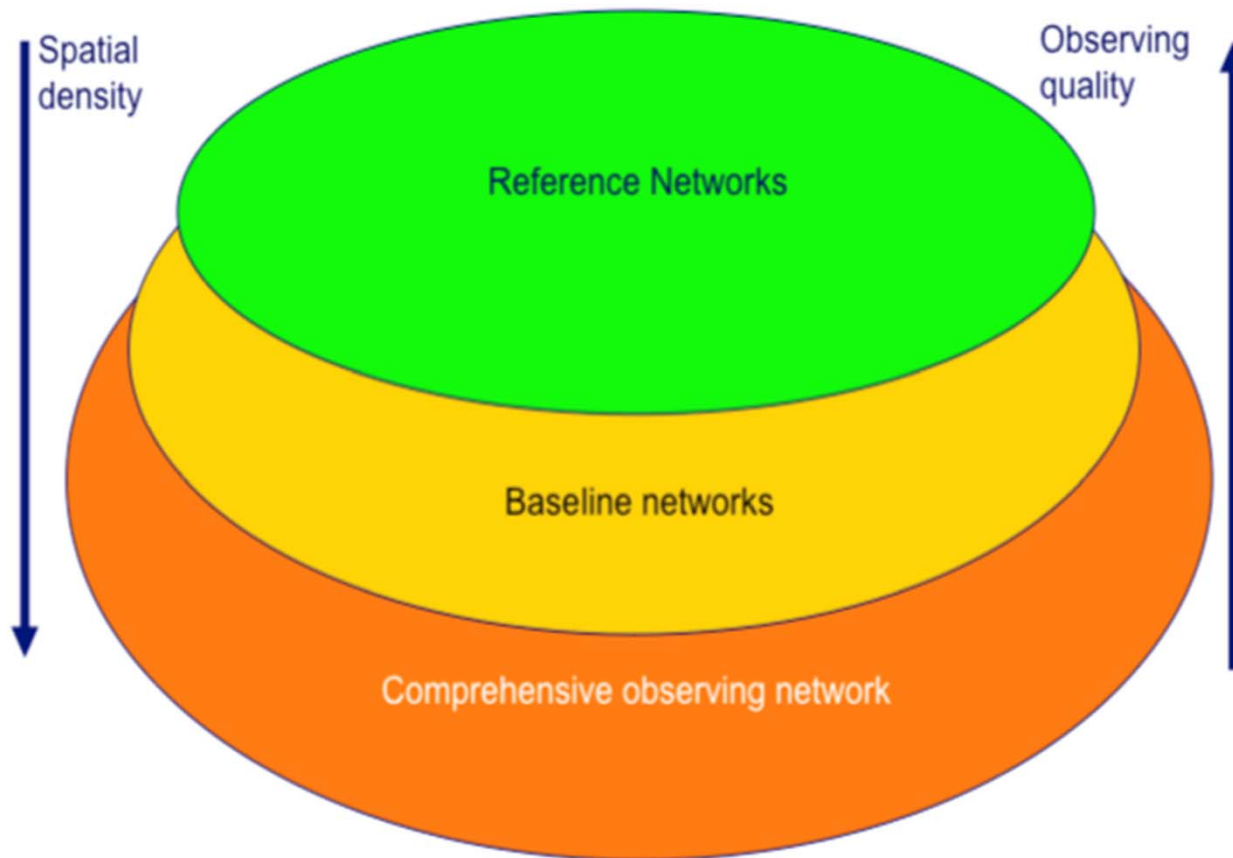
The Tiered Approach: WMO essential data

- The briefing note from the SG on what the essays could address, emphasizes a bit of tier 3 plus tier 4 of observations, which can be described as
- Tier 1 - '*reference networks*' (the highest level of networks which adhere to all monitoring principles put down in WMO regulations): WMO Centennial Stations (Cg-17, CIMO and CCI Session recommendations), GRURN
- Tier 2 - '*baseline networks*' (generally high quality subsets of NMHS observations):
 - GCOS GSN, RBCN, GRUN, GUAN stations.
- Tier 3 - '*comprehensive networks*' which refer to the entire NMHS observing networks, radars and satellites: RBON encourage all WMO Members to exchange all available observations, including meso-scale networks ! (Create WMO Big Data Approach).



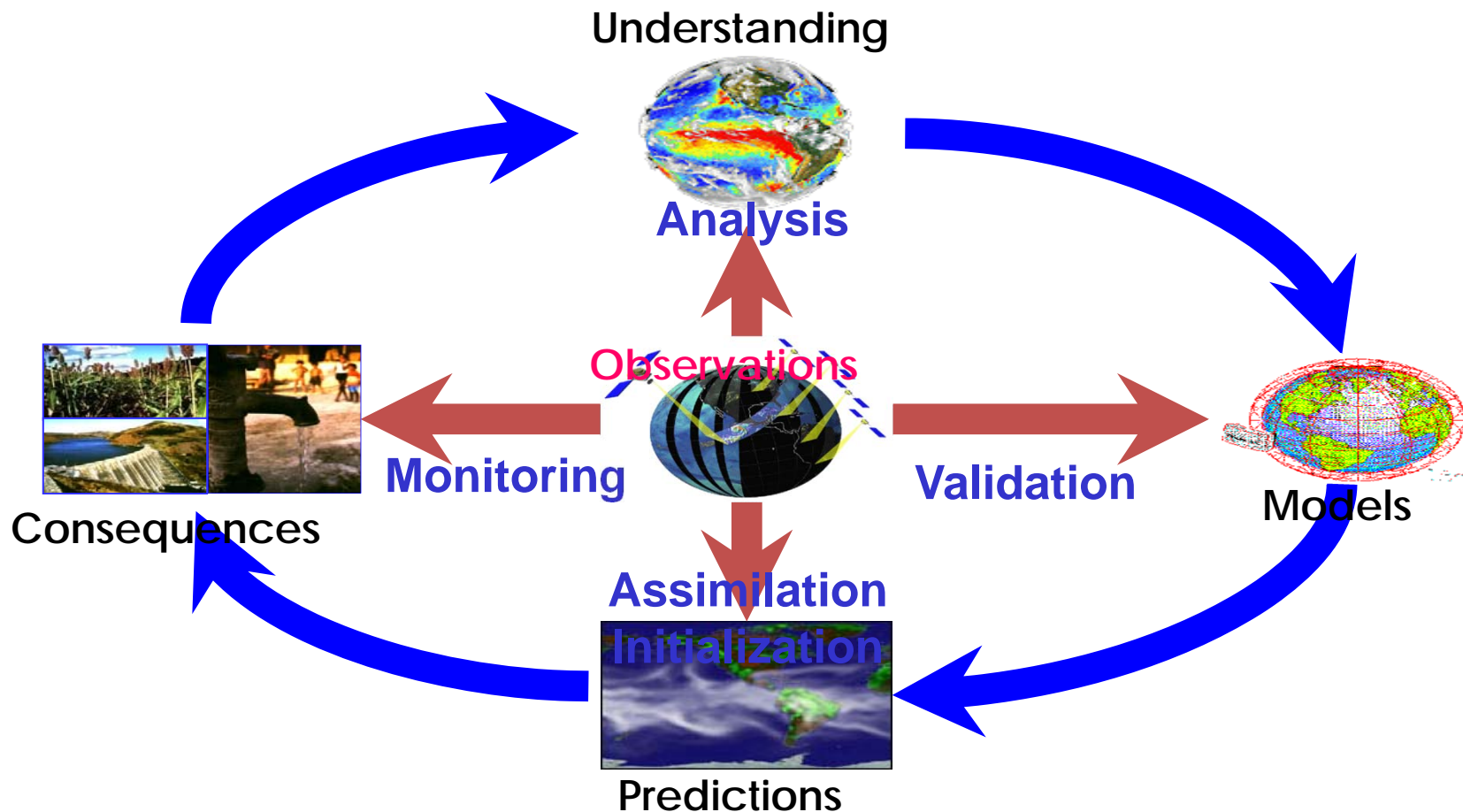
Major views of WMO Tired Observing framework

Role of AWSs vs Big Data ?!



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Observational data and products are critical for full scope meteorological services



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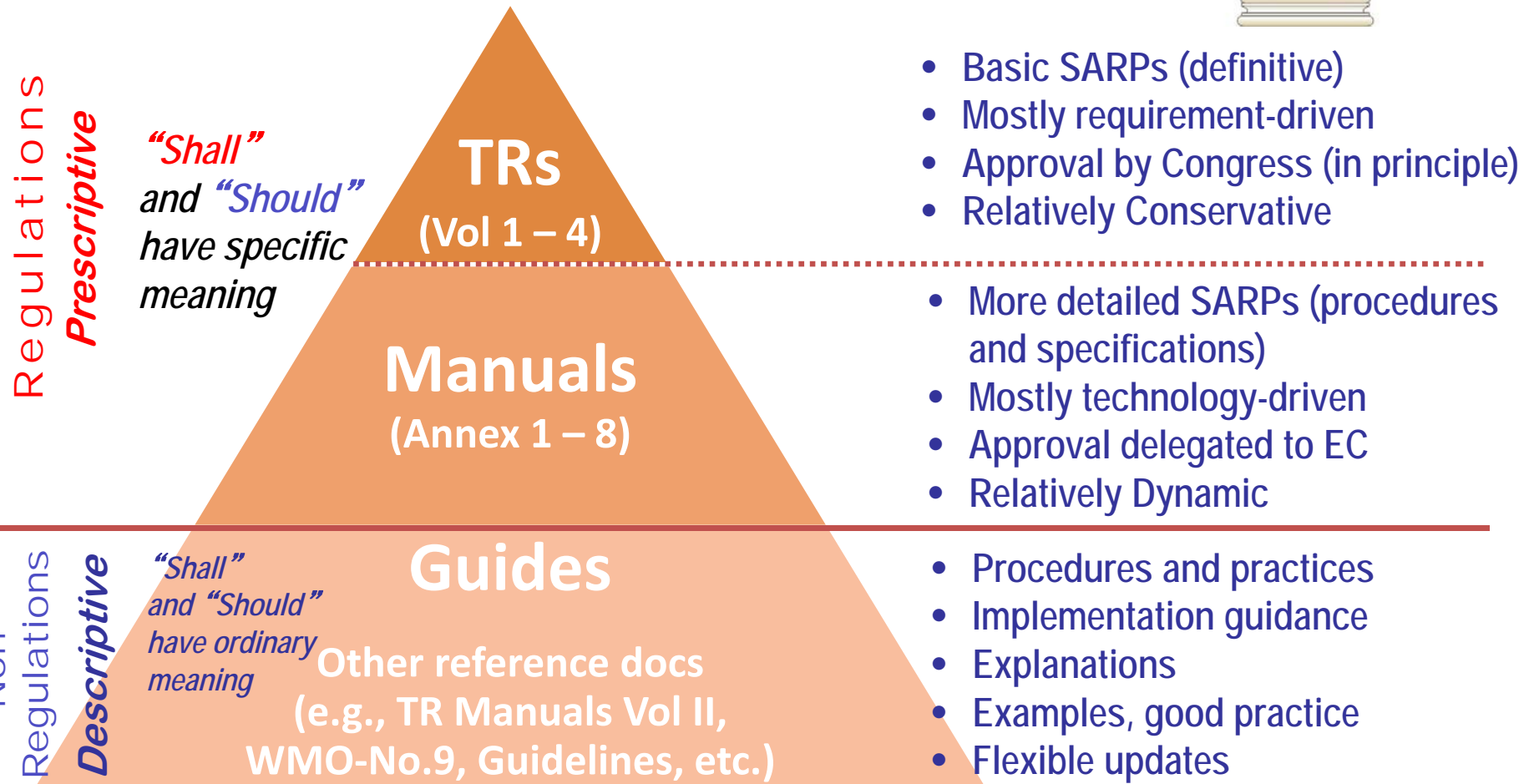
The availability of observations and data strongly motivates advances in understanding, prediction, and application in all meteorological areas.

AWS Specifications, first step

- **WMO is now working together with the Association of Hydro-Meteorological Equipment Industry (HMEI) in developing typical procurement specification for AWSs.** These should support WMO Members and aid agencies for the writing of tenders that are neutral, and that ensure the equipment will deliver fit-for-purpose data, meeting the requirement of the user.



WMO Technical Regulations: Composition & generic concept



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SARPs: Standard and Recommended Practices

Continue the AWS Conferences !

- I wish that this conference will be a success and, if the interest that we anticipate is really there, that it will be the first of a new series of conferences. It would indeed be a real opportunity for WMO Members if such conferences could be held in different WMO Regions to focus on the challenges they are experiencing. That would also enable to maximize attendance from the Region. I would therefore encourage all of you to **consider whether you would be interested to host a similar conference in the future**. Should you have any interest to do so, I invite you to approach the WMO Secretariat staff present here.



Further Strengthened Collaborations among us and promote further WMO Measurement Technologies !



07/12/2017
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WIGOS