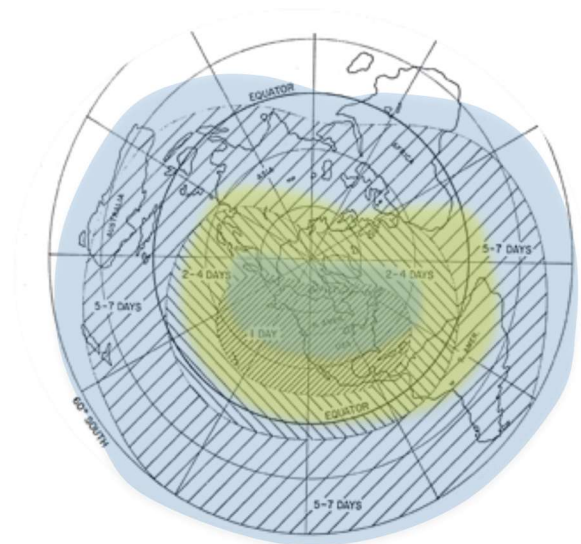




Systematic Observations Financing Facility

Collaborative thinking workshop
**Workshop outcomes
and the way ahead**

February 25-26 2020, Offenbach, Germany



Thank you!





Table of contents

1. Summary of workshop outcomes
2. Workshop setting
3. The importance of fixing the broken piece of the “weather machine”
4. The evolving SOFF concept
5. Potential role of the insurance sector
6. Who will fund the SOFF?
7. The way ahead

Annexes

Annex 1: SOFF proposed working groups to further develop the SOFF concept and design

Annex 2: Workshop concept note

Annex 3: Workshop agenda

Annex 4: Workshop participants

Annex 5: Workshop participants expectations - mentimeter®

Annex 6: Welcome to SOFF workshop

Annex 7: The foundational role of observations. Why do we need data from everywhere?

Annex 8: The Global Basic Observing Network (GBON) and the need for SOFF

Annex 9: The role of the World Meteorological Centres: from data to products

Annex 10: The global value of GBON

Annex 11: The economic value of meteorological observation data

Annex 12: The value of GBON

Annex 13: The broken piece of the weather machine

Annex 14: The SOFF journey

Annex 15: SOFF initial concept note October 2019

Annex 16: SOFF design features - initial concept note October 2019

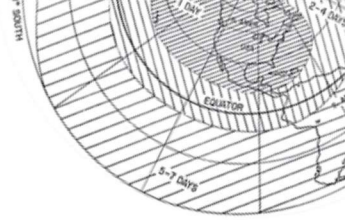
Annex 17: SOFF scope - initial concept note October 2019

Annex 18: SOFF feedback received

Annex 19 : Exploring blended finance opportunities

Annex 20: Our homework – input for working groups

Annex 21: Participants final feedback - mentimeter®



1. Summary of workshop outcomes

- **There is a broken piece of the “weather machine” that needs to be fixed urgently: missing basic observation from developing countries.** Surface-based observations are essential to better respond to extreme weather and climate change. Yet, most developing countries have major difficulties in ensuring sustained observations, severely limiting efforts towards early action and effective resilience to climate change across the globe. Despite massive development and climate finance investments, the situation is getting worse.
- **The Global Basic Observing Network (GBON)¹ offers a unique opportunity to substantially improve the observational basis for foundational weather and climate services for all nations.** The GBON concept, approved by the World Meteorological Congress in June 2019, for the first time defines the minimum density and temporal frequency of globally required surface-based observations. At COP25, the Subsidiary Body for Scientific and Technological Advice (SBSTA) welcomed the development of the GBON and re-emphasized the need for sustained funding to meet the essential needs for global climate observation.
- **There is no way to achieve GBON compliance in developing countries without a game-changing financing model** that ensures equitable, predictable and sustainable finance in a prioritized manner. The current financing model assumes that country observations are purely a national obligation; failing to recognize the global public good of such observations, and the limited fiscal space of developing countries to cover the annual operational costs which cannot be covered by traditional international development and climate finance.
- **The Systematic Observations Financing Facility (SOFF) will address the fundamental mismatch between today’s country-based financing of basic observations and the global public good value of these observations.** It will provide long-term support to developing countries - beyond today’s nationally focused, fragmented and time-bound projects - for achieving and maintaining GBON compliance and data-sharing while monetizing its global value through performance-based financing.
- **Creating the SOFF requires a concerted effort of major development and climate finance partners as well as the private sector.** Development and climate finance partners and representatives from insurance sector initiatives committed to supporting the design and establishment of the SOFF and corresponding resource mobilization efforts.
- **Participants agreed to establish multi-partner working groups to further flesh out critical elements of the SOFF concept.** The groups will deliver their work ideally ahead of the WMO Executive Council, taking place in June 2020.
- **Given the foundational importance of fixing the broken piece of the “weather machine”, participants recognized the need to speedily establish the SOFF,** with the requirement to announce its development at COP26 in 2020 and launch it at the latest at COP27 in 2021.

¹ <https://www.wmo.int/pages/prog/www/wigos/documents/GBON/GBON-exsummary.pdf>



2. Workshop setting

- **The SOFF journey so far.** The workshop built on the outcomes of a series of milestones in developing the SOFF (see *Annex 13 – the SOFF journey*), including a first workshop held in Geneva in July 2019 where participants mapped out elements of an initial concept for an innovative financing facility.²
- **Workshop objectives.** The objectives of the workshop were to (i) further advance the concept and design of the SOFF, and to (ii) establish a multi-partner team with the mandate to further engage with stakeholders including on financing options for the SOFF (see *Annex 2 and 3 – workshop concept note and agenda*).
- **Workshop host and participants.** The workshop was hosted by the WMO President, Prof. Dr. Gerhard Adrian, and brought together 45 participants from 15 development and climate institutions including the members of the Alliance for Hydromet Development,³ six insurance umbrella organizations, and senior representatives from the WMO community including three Presidents of WMO Regional Associations and the WMO Assistant Secretary-General (see *Annex 4 – workshop participants*).

3. The importance of fixing the broken piece of the “weather machine”

- **GBON value for the “weather machine”.** Surface-based observations are fundamental to realize the full value and benefits of the other pieces of the “weather machine” such as satellites and supercomputers (see *Annex 7: The foundational role of observations. Why do we need data from everywhere?*).
- **GBON value across all time ranges – from short term weather forecasts to seasonal forecasts to climate projections.** Achieving GBON compliance across the globe will improve forecasts and climate projections, along with a whole host of associated benefits for both the public and private sectors, and importantly enhancing resilience in regions most vulnerable to weather and climate extremes. (see *Annex 9 - The role of the World Meteorological Centres: from data to products* and *Annex 10 - The global value of GBON*).
- **GBON value across geography – from local protection and resilience to global impact.** Local observations are essential for protecting local communities and benefiting local populations

² 30 colleagues from the World Meteorological Organization, World Bank, Green Climate Fund, Climate Risk and Early Warning Systems Initiative Secretariat, Global Climate Observing System Secretariat, European Center for Medium-Range Weather Forecasts, and UK Met Office came together for this first joint thinking SOFF workshop.

³ Launched at COP 25 in Madrid, the Alliance for Hydromet Development is a united effort to scale up and unite our efforts to achieve the common goal of closing the hydromet capacity gap on weather, climate, hydrological, and related environmental services by 2030. The Alliance founding partners are Adaptation Fund, African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, Global Environment Facility, Green Climate Fund, Islamic Development Bank, United Nations Development Programme, United Nations Environment Programme, World Bank, World Food Programme and the World Meteorological Organization. More information at: <https://public.wmo.int/en/our-mandate/how-we-do-it/partnerships/wmo-office-of-development-partnerships>



but are even more critical for regional and global forecasting and climate analysis. Hence, it is in the self-interest of all nations to united efforts to improve GBON. (see Annex 8 - The Global Basic Observing Network (GBON) and the need for a SOFF).

- **GBON economic value for different constituencies.** Investing in surface-based observations in developing countries and treating them as a critical public good makes massive economic sense. Improvements in coverage and exchange of surface-based observations deliver benefits of at least **\$ 6 billion p.a.** and provide the foundation to realize up to **\$ 51 billion p.a.** benefits from overall improved forecasting and early warnings efforts. These figures very likely underestimate the multiplier effects that implementing GBON will have across communities, governments, and sectors (see Annex 11 - The economic value of meteorological observation data).
- **GBON gap analysis and implementation options and the value of GBON need to be further fleshed out.** Two multi-partner working groups on this topic are being established. (see Annex 1 – working group 1, the value of GBON and working group 2, GBON gap analysis and implementation options).

4. The evolving SOFF concept

- **What is the SOFF?** An innovative dedicated facility that is expected to provide equitable, predictable, sustainable, and performance-based finance to achieve and maintain GBON compliance in developing countries in a prioritized manner. In addition to providing funding for the capital costs of GBON, SOFF will provide funding for annual operational costs that cannot be provided under traditional climate and development finance programmes.
- **SOFF design features.** The facility combines four innovative features:
 - **Valuing a foundational global public good** that countries are mandated to deliver
 - **Providing performance-based financing** triggered by independent verification
 - **Providing programmatic finance and technical assistance**, beyond project-by-project
 - **Seeking funding beyond public resources**
- **SOFF support windows.** In order to achieve sustained GBON compliance, the facility will provide financial and technical support through two windows:
 - **Capacity development window – whatever it takes to achieve GBON requirements.** The facility will provide financial resources and technical assistance to support a country in achieving GBON compliance.
 - **Performance-based window – maintaining GBON compliance.** The facility will provide performance-based financing to support countries in covering operating and maintenance costs of their basic observations. Upon WMO independent verification of compliance with GBON data-sharing requirements, the facility will provide financial support to countries on an annual basis.



- **SOFF governance.** The facility will be based on and leverage existing mechanisms and institutional arrangements (*see Annexes 14, 15, and 16*).
 - **Host function.** The facility would be hosted by an international financial organization or become a window of one of the environment and climate funds. Examples of facilities valuing a global public good are the Global Concessional Financing Facility housed in the World Bank or the Green Climate Fund REDD+ window.
 - **Implementation function.** All developing countries would be able to draw on resources from the facility through implementation partners. Accredited Entities to the Green Climate Fund, Adaptation Fund, Climate Investment Funds, and the Global Environment Facility would be implementing partners of the facility. This will ensure that resources from the facility are used as co-financing to cover the observations component of larger and fully integrated hydromet development projects and programs (*see Annex 16 - SOFF scope*).
 - **Advisory function.** The Country Support Initiative (CSI),⁴ WMO's advisory services mechanism currently being established, will provide standardized technical assistance to support countries and their implementing partners to achieve and maintain GBON compliance. In a one-stop-shop manner, the CSI harvests the technical expertise of advanced national hydrological and meteorological offices (members of WMO) and the WMO Secretariat.
 - **Independent technical authority function.** WMO would independently verify GBON compliance, hence triggering payments under the performance window.
- **The SOFF design and structure is still evolving.** It needs to be further firmed up, drawing on experiences of other innovative financial mechanisms that are valuing global public goods. Two multi-partner working groups are being established on this topic. (*see Annex 1 - working group 3 - SOFF financing mechanisms and opportunities, and working group 5 - SOFF advocacy and communications*).

5. The potential role of the insurance sector

- **GBON will create benefits for the insurance sector.** Participants noted that there are other data requirements (e.g. historical loss and damage costs) which are also needed, but the removal of one of the barriers may act as a stimulus to the sector and enable it to penetrate, and increase market share in developing countries.
- **Insurance sector and other private-sector use-cases.** In order to further flesh out the potential role of the insurance sector and other private sectors in contributing to the SOFF, a few use

⁴ [WMO Country Support Initiative](#)



cases will be developed. A corresponding working group is being established. (See *Annex 1 - working group 4 - Insurance use-cases*).

- **Advocacy of insurance sector related initiatives and mechanisms.** There are several important initiatives that recognize the importance of insurance as a risk management tool for vulnerable people, communities, and countries. A fully operational and functional GBON will assist these existing initiatives in delivering against their objectives and enable the greater application of, for example, parametric insurance, in developing countries.

6. Who will fund the SOFF?

- **How much money is needed?** An initial estimation indicates that about \$ 350 million are required to achieve GBON compliance in developing countries and that annually about \$ 150 million is needed to cover operational and maintenance costs of GBON in these countries. Taking into consideration past and current investments financed by development and climate finance institutions (current global project portfolio estimated with \$5 billion of which significant part is used for observations), it is assumed that financing GBON will not require more financial resources, but it requires a fundamentally different way of investing these resources through the SOFF.
- **Resource mobilization.** A working group is being established on SOFF financing mechanisms and opportunities (see *Annex 1 - working group 3*) and another one on SOFF advocacy and communications (see *Annex 1 - working group 5*). These two working groups will jointly support SOFF resource mobilization. Potential SOFF funding sources are bilateral partners, Multilateral Development Banks, the members of the International Development Finance Club, the environment and climate funds (GCF, CIFs, AF, GEF), philanthropy, and private sector including the insurance sector.

7. The way ahead

- **Multi-partner working groups.** Workshop participants agreed to establish multi-partner, parallel and coordinated working groups to speedily flesh out critical elements of the SOFF concept. The groups are time-bound and expected to deliver their work ideally ahead of the WMO Executive Council 72th session, taking place 9-12 June 2020. The groups will work in close coordination with each other and with the support of WMO Secretariat. The following working groups are being established (see Annex 1 for more details).
 1. The value of GBON
 2. GBON gap analysis and implementation options
 3. SOFF financing mechanism and opportunities
 4. Insurance sector use-cases
 5. SOFF advocacy and communications



- **Major milestones in further developing the SOFF**
 - **May 2020 – Working groups deliver their inputs**
 - **June 2020 – WMO Executive Council.** Endorsement of detailed requirements and obligation of GBON
 - **November 2020 – COP26.** Envisioned communication on SOFF development as part of senior-level Alliance for Hydromet Development event at which also the Alliance Hydromet Gap report will be launched
 - **June 2021 – World Meteorological Congress.** Approval GBON detailed requirements and obligations and envisioned update of WMO data policy.
 - **By December 2021 – COP27.** SOFF launch



Annexes

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Annex 1: SOFF proposed working groups to further develop the SOFF concept and design

Workshop participants agreed to establish working groups to speedily flesh out critical elements of the SOFF concept. The groups are time-bound and expected to deliver their work ideally ahead of the WMO Executive Council 72th session, taking place 9-12 June 2020.

Based on workshop participants' suggestions, 5 working groups are proposed. The multi-partner groups will work in parallel and in close coordination with each other. For each working group leads are nominated who are responsible to guide the work of the groups.

For each working group deliverables are proposed, based on the workshop discussions. The final decision about the deliverables is with the working groups.

Each working group will receive full support by colleagues from WMO Secretariat and consultants. Supporting colleagues will work closely with the group leads in coordinating the work of the groups, organize virtual meetings, and produce the written outputs of the working groups under the guidance of the lead.

The workshop co-moderators, Markus Repnik (WMO Director Development Partnerships) and John Firth (CEO Acclimatise) will ensure effective coordination of the working groups and provision of support to the working groups.

Working Group 1: The value of GBON

Proposed deliverables:

- How is GBON improving forecast skill
- Further evidence of the benefits of additional surface observations in data-sparse areas
- How does this improved forecast skill translates into global and country benefits for people, in particular the most vulnerable, across time scales (0-14 days, seasonal, climate) and application areas
- The *quid pro quo* relationships with developing countries (providing data and accessing and using improved forecast and analysis products as a result of using additional local better data)
- Short note about link between WMO data policy and GBON and SOFF
- Overview about the economic benefits of GBON (as discussed during workshop)



Working Group 2: GBON gap analysis and implementation options

Proposed deliverables:

- GBON technical gap analysis: country by country assessment of number of functioning (reporting) stations, number of stations required per draft GBON provisions, and estimates of the resulting number of stations to be (i) newly established, (ii) rehabilitated, and (iii) upgraded;
- GBON institutional and human capacity gap analysis: Mapping out of gaps and cataloguing capacity gaps, through the Country Support Initiative (CSI) assessment tool;
- More detailed cost estimate to make developing country world GBON compliant and to keep developing country world GBON compliant

Working Group 3: SOFF financing mechanisms and opportunities

Proposed deliverables:

- As part of the Alliance Hydromet Gap Report production, map out existing funding for GBON related activities
- Create overview of existing financing mechanisms that value global or regional public goods and/or use performance-based payments
- Further flesh out SOFF design features, operating principles and governance drawing from lessons learned from these mechanisms.
- In collaboration with working group 5 identify funding opportunities for SOFF (bilaterals, MDBs, IDFCs, climate and environment funds, philanthropy, private sector) and seek preliminary engagement with potential funders

Working Group 4: Insurance sector use-cases

Proposed deliverables:

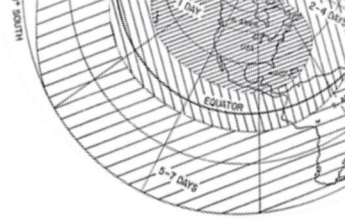
- Develop 3 insurance sector use cases as discussed during workshop, including identifying potential financing opportunities for SOFF

Working Group 5: SOFF advocacy and communications

This working group will draw on the work of the other working groups in preparing the following deliverables

Proposed deliverables:

- Develop advocacy and communications plan, including highest level engagement of potential SOFF champions from developed and developing countries and funders
- Translate outputs of the other working groups into communications products:
 - o short documents in "user" language for public and private sector beneficiaries, and key decision makers (GBON concept, SOFF concept, GBON gaps and implementation plan, GBON value)
 - o short GBON/SOFF videos based on the video-taped presentations at the SOFF workshop
 - o Podcast interviews



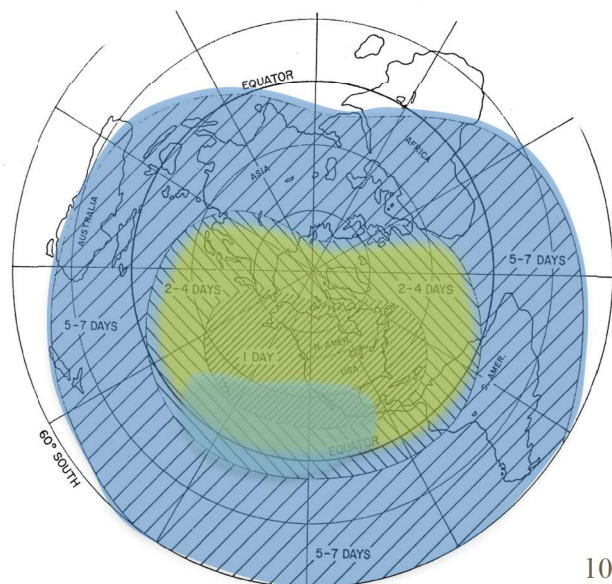
Systematic Observations Financing Facility (SOFF)

Equitable, predictable, and sustainable finance
for a foundational global public good

Further advancing SOFF concept and design
collaborative thinking workshop

Workshop concept note

25-26 February 2020
Offenbach, Germany





1. Context

Problem statement

- **There is a fundamental mismatch between today's country-based financing of basic observations and the value these observations create for the global community.** Today, the provision of systematic observations is considered a purely national obligation. Developing countries are thus in principle expected to fully fund their own observing systems. Countries may receive "aid" in terms of project funding from development and climate finance partners, but this funding is time-limited, typically aimed at capital investment rather than operating costs, and does not recognize the global value creation enabled by observational data from developing countries.
- **Essential surface-based observational data are missing in several parts of the world, particularly in developing countries.** Numerical Weather Prediction (NWP) is the basis on which all weather and climate services are built. NWP requires a constant supply of observations from around the world to ensure accurate forecasts and climate analysis. Today's lack of observational data significantly limits the quality of information used by governments and all stakeholders as the basis for vital decisions such as those related to the reduction of the impact of weather and increased resilience to climate change. Hence, the Paris Agreement recognizes the need to strengthen and enhance systematic observations.

Recognizing the need for innovating finance for basic observations

- **In June 2019, three major development and climate finance partners (World Bank, African Development Bank, Green Climate Fund) joined the 18th World Meteorological Congress** high-level events on development partnerships. A common understanding emerged that there is a need to fundamentally change the way developing country basic observations are being funded, taking advantage of the resolution adopted by Congress to establish the [Global Basic Observing Network \(GBON\)](#)⁵.
- **In July 2019, a first workshop was held in Geneva to map out elements of an initial concept for an innovative Systematic Observations Financing Facility.** About 30 colleagues from the World Meteorological Organization, World Bank, Green Climate Fund, Climate Risk and Early Warning Systems Initiative Secretariat, Global Climate Observing System Secretariat, European Center for Medium-Range Weather Forecasts, and UK Met Office came together for this first joint thinking workshop.
- **In October 2019, the outcomes of this workshop were translated into the initial SOFF concept note.**
- **December 2019 SBSTA conclusions at COP25:** The fifty-first session of the Subsidiary Body for Scientific and Technological Advice (SBSTA) to the United Nations Framework Convention on Climate Change (UNFCCC) recognized the development of the Global Basic Observing

⁵ GBON aims to improve the global availability of the most essential surface-based data by defining the obligation for countries to implement a minimal set of surface-based observations for which international exchange of observational data will be mandatory.



Network by WMO and re-emphasized the need for sustained funding to meet the essential needs for global climate observation under the Convention.

- **December 2019 [Alliance for Hydromet Development](#) launch at COP25:** 12 international organizations⁶ launched as founding members the Alliance for Hydromet Development. The Alliance unites efforts of these organizations to close the capacity gap on high-quality weather forecasts, early warning systems, and climate information. The Alliance is founded on a declaration with several commitments, including the commitment aiming at the creation of the SOFF that recognizes the economic value of observations as a global public good.

WMO data policies

- **WMO recognizes that its data policies need to be reviewed** in the context of rapid technological change and the changing balance of public and private sector data provision.
- **A WMO data conference is planned for late 2020** with a focus on making more observational data available to the international community. Under the WMO Commission for Infrastructures, a study group on data issues and policies has been established composed of public and private sector experts.
- **GBON and the review of WMO data policies are fully complementary.** GBON establishes the minimum requirement for surface and upper air (radiosondes) observations. Countries will be mandated to provide this minimum data.

The Systematic Observations Financing Facility

- **The Facility is envisaged to ensure provision of basic systematic observations as a global public good.** The facility
 - is expected to provide equitable, predictable, sustainable, and performance-based finance for developing countries
 - will also provide technical assistance for the provision of foundational observational data based on internationally agreed standards that can be quantified and independently verified
 - supports achievement of GBON compliance by 2025 as the backbone of global weather forecasts and climate information products.
- **Second SOFF workshop to further advance the concept and design.** A second workshop, hosted by the WMO President, will take place 25-26 February 2020 in Offenbach, Germany. This note presents the workshop's objectives, guiding questions, moderators, invited participants, logistics, and background material.

⁶ Adaptation Fund, African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, Global Environment Facility, Green Climate Fund, Islamic Development Bank, United Nations Development Programme, United Nations Environment Programme, World Bank, World Food Programme, World Meteorological Organization



2. Objectives and guiding questions

Objectives

- **Further advance concept and design of the Systematic Observations Financing Facility,** making the business case for financing to be explored with public and private funding sources.
- **Establish a small multi-partner team who will have the mandate** to further engage with stakeholders including on financing options.

Guiding questions

- **Socioeconomic benefits: How do we quantify the socioeconomic benefits of GBON?**
Assuming a GBON-compliant world that fully leverages improvements in observational data availability and forecasting, what gains in public welfare and economic productivity (from basic weather forecasts and early warnings to production of sector-tailored products) could be attributed to the GBON?
- **GBON financing needs: What are the financial requirements to achieve GBON compliance?**
How much does it cost (CAPEX and OPEX) to develop and maintain a sustainable and fully operational GBON in developing countries?
- **Private sector / insurance sector business case: What are the benefits of GBON to private sector operations and investments, in particular insurance industry?** What could be the potential insurance industry contributions to SOFF?
- **Governance: How to further structure the facility?**
- **Next steps: What is needed so that we potentially can announce the SOFF at COP26 in December 2020,** backed by soft commitments of initial funders?

3. Host and moderators

Host

- [Gerhard Adrian](#) WMO President; President and Chairman of the Executive Board Deutscher Wetterdienst

Co-moderators

- [Markus Repnik](#) WMO Director Development Partnerships
- [John Firth](#) CEO and co-founder [Acclimatise Group Ltd](#)



4. Participants

Principles

- **Maintain** organizations that participated in the first workshop and contributed to the development of the SOFF initial concept note
- **Expand and invite** additional organizations, in particular development and climate finance partners as well as insurance sector representatives
- **Limit** number of participants; max 30 workshop participants

Invited organizations / participants

- **Alliance for Hydromet Development members**
 - [Alliance founding members](#) are invited; World Bank and Green Climate Fund participated in the first workshop
 - Insurance sector organizations
 - Additional organizations
 - WMO Presidents Regional Associations
 - WMO Secretariat

5. Draft agenda

- See attached

6. Logistics

- See information note attached

7. Background material

- [GBON video](#)
- SOFF initial concept note
- First SOFF workshop outcome document
- [SOFF initial concept summary](#)
- [SOFF website](#)
- [Alliance for Hydromet Development website](#)
- [WMO Country Support Initiative website](#)



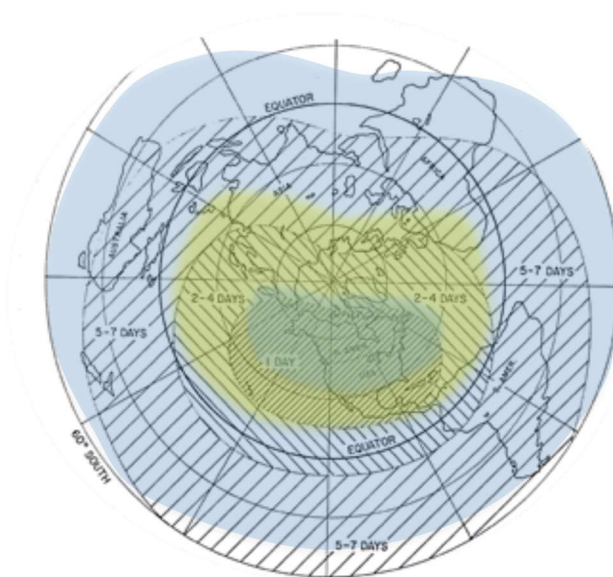
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AGENDA





Agenda – Day 1

Time	Activity	Actors
8:30 am	Registration and refreshments	
9:00 – 9:45	1. Opening <ul style="list-style-type: none"> - Welcoming remarks by WMO President - Welcoming remarks on behalf of the WMO Secretary-General 	Gerhard Adrian Wenjian Zhang
	2. Introduction to the workshop <ul style="list-style-type: none"> - Workshop objectives, agenda, approach - Introduction of participants 	Markus Repnik & John Firth
9:45 – 10:30	3. Systematic Observations: what, why, where? DWD Tour: High-Performance Computing Center and Forecasting Center (2 parallel groups)	DWD staff
10:30 – 10:45	<ul style="list-style-type: none"> - The foundational role of observations Why do we need data from everywhere? 	Gerhard Adrian
10:45 – 11:00	<ul style="list-style-type: none"> - The Global Basic Observation Network (GBON) What is it and what is the opportunity? 	Lars Peter Riishojgaard
11:00 – 11:15	<ul style="list-style-type: none"> - The role of the World Meteorological Centres From data to products 	Sarah Jones & Fabio Venuti
11:15 – 11:30	Coffee break	
11:30 – 12:15	4. What is the value of GBON? What are the benefits of a GBON compliant world?	Anthony Rea
12:15 – 13:15	5. What is the economic value of GBON? The upcoming World Bank policy research paper on “The economic value of meteorological observation data”	Rob Varley
	<ul style="list-style-type: none"> - What are we missing? - What’s next in making the economic case? 	John Firth & Markus Repnik
13:15	Group photo	
13:15 – 14:15	Lunch break	



14:15 – 14:45	Getting into the flow	DWD staff
14:45 – 15:30	6. SOFF: our today's thinking and beyond	
	- SOFF journey	Markus Repnik
	- SOFF initial concept and feedback received	Lorena Santamaria
	- Further advancing our thinking	John Firth & Markus Repnik
15:30 – 15:45	Coffee break	
15:45 – 17:45	7. Exploring the insurance sector business case	
	- What is the GBON value for the insurance sector?	Insurance sector representatives
	- Insurance sector engagement in SOFF?	
	- Private sector opportunities beyond insurance?	
17:45 – 18:00	8. Main takeaways and closing of the day	
	Walk to dinner venue	
19:00	Dinner	

Agenda - Day 2

Time	Activity	Actors
8:30 – 9:00	Welcoming refreshments	
9:00 – 9:15	9. Reflections on day 1: where do we stand?	John Firth & Markus Repnik
9:15 – 11:00	10. Exploring blended finance opportunities	
	- Examples to learn from	Lorena Santamaria
	- What are the SOFF financing opportunities?	John Firth & Markus Repnik
11:00 – 11:30	Coffee break	
11:30 – 12:50	11. Outcomes and milestones	
	- What are the outcomes of the workshop?	John Firth & Markus Repnik
	- How to move forward?	
12:50	12. Closing	
	- How did we do?	All participants Gerhard Adrian
	- Closing remarks	



Annex 4: Workshop participants

Participant list SOFF Workshop, 25-26 February 2020		
Institution	Name	Title
1. HOST AND MODERATORS		
Host		
WMO President	Gerhard Adrian	WMO President
Moderators		
	Markus Repnik	WMO Director Development Partnerships
	John Firth	CEO and co-founder Acclimatise
2. WMO COMMUNITY		
WMO Presidents Regional Associations		
WMO RA I President	Daouda Konate	Regional President Africa
WMO RA III President	Madeleine Renom	Regional President South America
WMO RA VI President	Michael Staudinger	Regional President Europe
WMO Secretariat		
	Wenjian Zhang	Assistant Secretary-General
	Anthony Rea	Director, Infrastructure
	Lars Peter Riishojgaard	Deputy Director Infrastructure
	Dimitar Ivanov	Director, Public-Private-Engagement
	Lorena Santamaria	Development Partnerships Office
	Serena Odianose	Development Partnerships Office
	Tamara Comment	Development Partnerships Office
	Leontine Kanziemo	Development Partnerships Office
Other organizations		
DWD (Deutscher Wetter Dienst)	Karolin Eichler	Special Assistant WMO President
	Sarah Jones	Vice-chair of WMO Research Board
	Claudia Rubart	Capacity Development Coordinator
European Center for Medium-Range Weather Forecasts (ECMWF) and Copernicus	Florian Pappenberger	Director of Forecasts
	Fabio Venuti	Head of Cabinet
ECOMET and EUMETNET	Willie McCairns	Chief Executive
Invited expert	Deon Terblanche	Former WMO Director Science and Research
3. DEVELOPMENT AND CLIMATE FINANCE PARTNERS		
Alliance for Hydromet Development		
Adaptation Fund	Mahamat Assouyouti	Senior Climate Change Specialist
African Development Bank	James Kinyangi	Chief Climate and Policy
	Cecil Nartey	Principal Country Program Officer



Asian Development Bank	Robert Marc Schoellhammer	Advisor
European Bank for Reconstruction and Development	Craig Davies	Head of Climate Resilience Investments
Global Environment Facility	Fareeha Y. Iqbal	Senior Climate Change Specialist
Green Climate Fund	Urvaksh D. Patel	Entity Relations Specialist
Islamic Development Bank	Daouda Ben Oumar Ndiaye	Lead Climate Change Specialist
United Nations Development Programme	Benjamin Larroquette	Regional Technical Specialist
United Nations Environment Programme	Jochem Zoetelief	Head Climate Services and Capacity Building, Science Division
World Bank	Rob Varley	Senior Consultant
Other organizations		
UK DFID	Katherine Marsden	Climate Science Adviser
	Helen Bye	Head of International Development Services and Principal Advisor
CREWS Secretariat	John Harding	Head of the CREWS Secretariat
Inter-American Development Bank	Gerard Alleng	Climate Change Division
KfW	Lutz Horn-Haacke	Director
	Brigitte Balthasar	External Consultant Financial Sector
Climate Policy Initiative	Angela Falconer	Associate Director
INSURANCE INITIATIVES		
InsuResilience	Tuga Alaskary	Risk Data Working Group at InsuResilience
Insurance Development Forum	Nick Moody	Disaster Risk Finance and Management
InsuResilience Solutions Fund	Annette Detken	Head InsuResilience Solutions Fund Management
African Risk Capacity	Federica Carfagna	Director of Research and Development
Coalition for Climate Resilient Investment (Willis Towers Watson)	Geoffrey Saville	Senior Research Manager: Weather and Climate Risk
Munich Climate Insurance Initiative	Maxime Souvignet	Project Coordinator
Participation via video-conference for the Session 10. Exploring blended finance opportunities		



Annex 5: Workshop participants expectations - mentimeter®

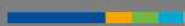
What do you expect from this workshop?

Mentimeter



21

Annex 6: Welcome to SOFF workshop



Systematic Observations Financing Facility

Collaborative thinking workshop
Offenbach, February 2020



Welcome to
[Systematic Observations Financing Facility](#)
[\(SOFF\)](#) Workshop

Wenjian Zhang, WMO



World Meteorological Organization



- UN Specialized Agency on weather, climate & water
- 193 Members, HQ in Geneva
- 2nd oldest UN Agency, 1873-
- Coordinates work of > 200 000 national experts from meteorological & hydrological services, academia (& private sector)
- Co-Founder and host agency of IPCC (1st World Climate Conference)
- Co-Founder of UNFCCC (2nd World Climate Conference)
- WMO SG UN Climate Principal (1/3)

2

CONVENTION OF THE WORLD METEOROLOGICAL ORGANIZATION

- **Considering the need for sustainable development, the reduction of loss of life and property caused by natural disasters and other catastrophic events related to weather, climate and water, as well as safeguarding the environment and the global climate for present and future generations of humankind,**
- **Recognizing** the importance of an integrated international system for the observation, collection, processing and dissemination of meteorological, hydrological and related data and products,
- **Reaffirming** the vital importance of the mission of the National Meteorological, Hydrometeorological and Hydrological Services in observing and understanding weather and climate and **in providing meteorological, hydrological and related services** in support of relevant national needs which should include the following areas:



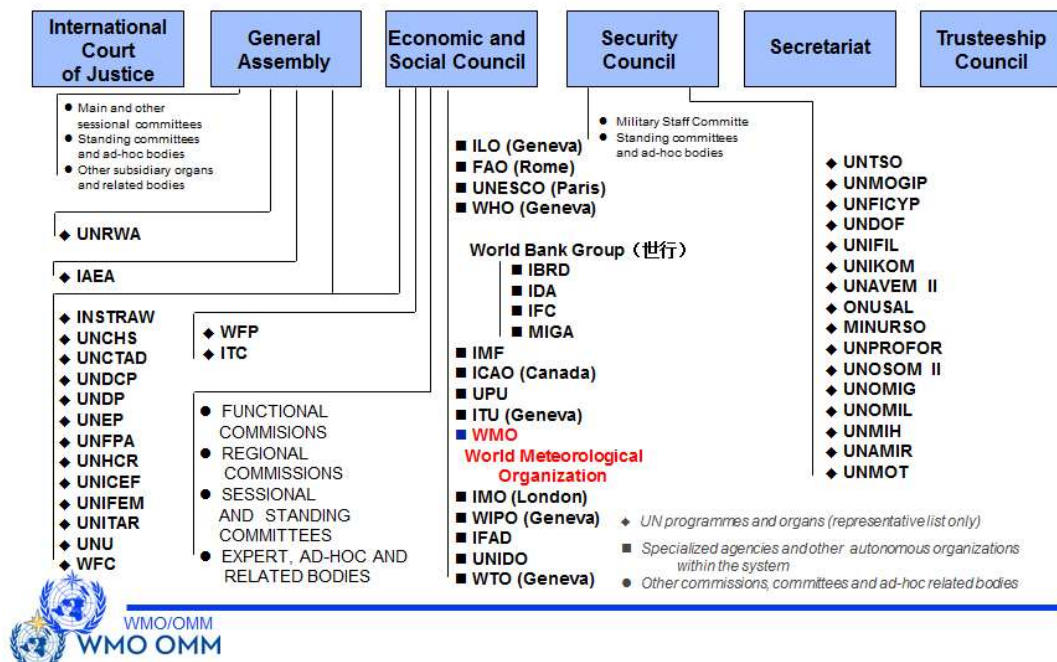


CONVENTION OF THE WORLD METEOROLOGICAL ORGANIZATION

- (a) Protection of life and property,
- (b) Safeguarding the environment,
- (c) Contributing to sustainable development,
- (d) Promoting long-term observation and collection of meteorological, hydrological and climatological data, including related environmental data,
- (e) Promotion of endogenous capacity-building,
- (f) Meeting international commitments,**
- (g) Contributing to international cooperation.**



WMO in the UN system





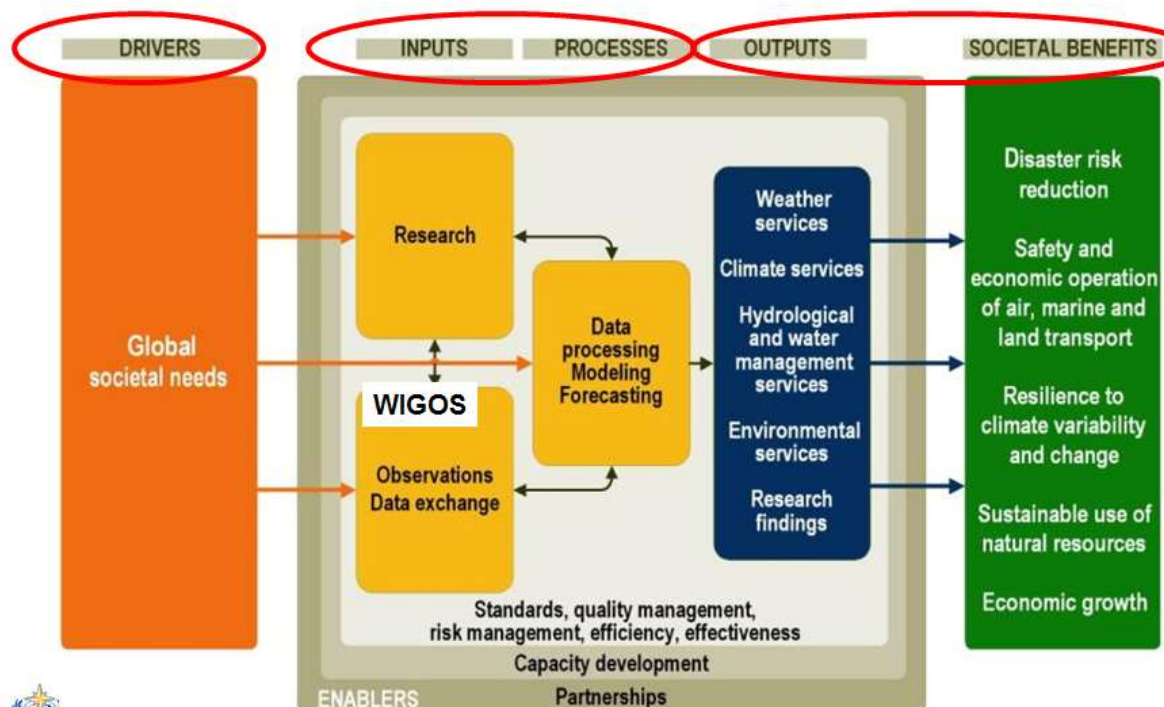
WMO STRATEGIC PLAN 2020-30

VISION 2030	A world where all nations, especially the most vulnerable, are more resilient to the socioeconomic impact of extreme weather, climate, water and other environmental events, and empowered to boost their sustainable development through the best possible weather, climate and water services				
OVERARCHING PRIORITIES	Preparedness for, and reducing losses from hydrometeorological extremes		Climate-smart decision-making to build resilience and adaptation to climate risk		Socioeconomic value of weather, climate, hydrological and related environmental services
CORE VALUES	Accountability for Results and Transparency		Collaboration and Partnership		Inclusiveness and Diversity
LONG-TERM GOALS	1 Services Better serve societal needs	2 Infrastructures Enhance Earth system observations and predictions	3 Science & Innovations Advance targeted research	4 Member Services Close the capacity gap	5 Smart Organization Strategic realignment of structure and programmes
STRATEGIC OBJECTIVES	<ul style="list-style-type: none"> Strengthen national multi-hazard early warning/alert systems Broaden provision of policy- and decision-supporting climate, water and weather services Optimize observation data acquisition Improve access to, exchange and management of Earth system observation data and products Enable access and use of numerical analysis and prediction products Advance scientific knowledge of the Earth system Enhance science-for-service value chain to improve predictive capabilities Advance policy-relevant science Enable developing countries to provide and utilize essential weather, climate, hydrological and related environmental services Develop and sustain core competencies and expertise Scale up partnerships Optimize WMO constituent body structure Streamline WMO programmes Advance equal, effective and inclusive participation 				
FOCUSED ON 2020-23					



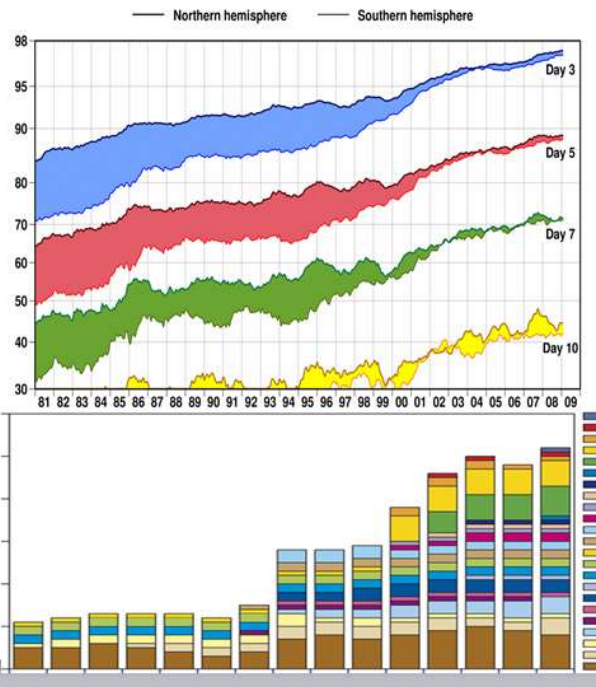
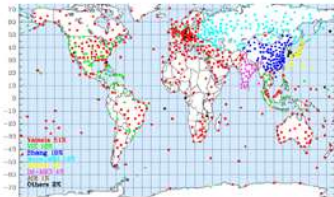
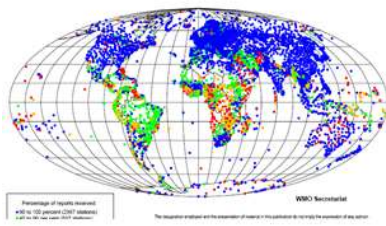
WMO OMM

WMO Global Cooperation Process – driven by Global Societal Needs

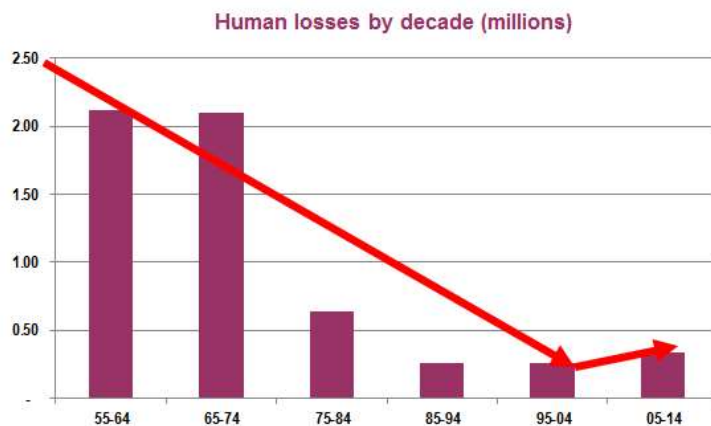


50+ years of WMO WWW and Open Data Policy built Solid Foundation to WMO

- 50+ years development of WMO Space-based observations



Great Achievement of hydrometeorological services to reducing the human losses (1955–2014)



Reduction of the number of victims thanks to greater progress of WMO for better forecasting, early warning systems and national prevention measures

Age Group	Number of People (approx.)
55-64	10
65-74	30
75-84	80
85-94	280
95-04	550
05-14	1,000



Biggest risks for world economy 2019

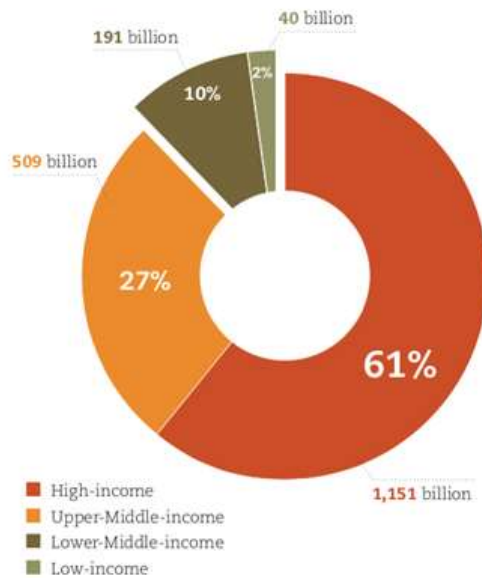


World Economic Forum Global Risks Landscape 2019

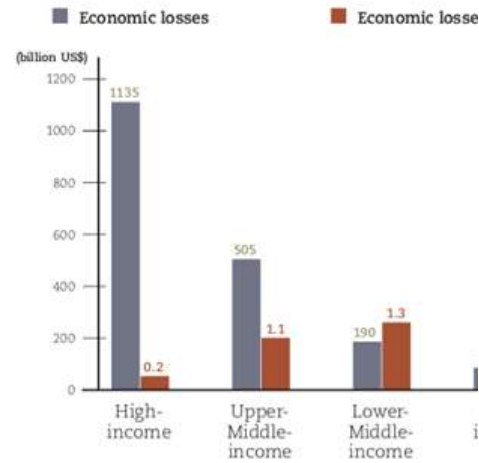


Economic damage vs % of GD

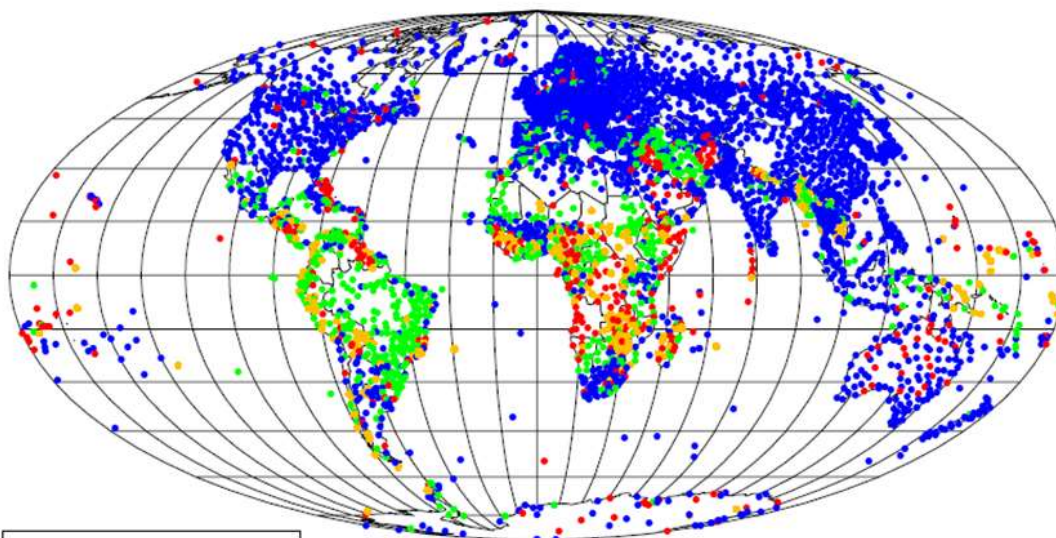
Income group analysis of economic damage (US\$)
(1995-2015)



Economic losses in absolute values
and as a percentage of GDP from
weather-related disasters (1995-2015)



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



Percentage of reports received:
 ● 90 to 100 percent (2967 stations)
 ● 45 to 90 per cent (697 stations)

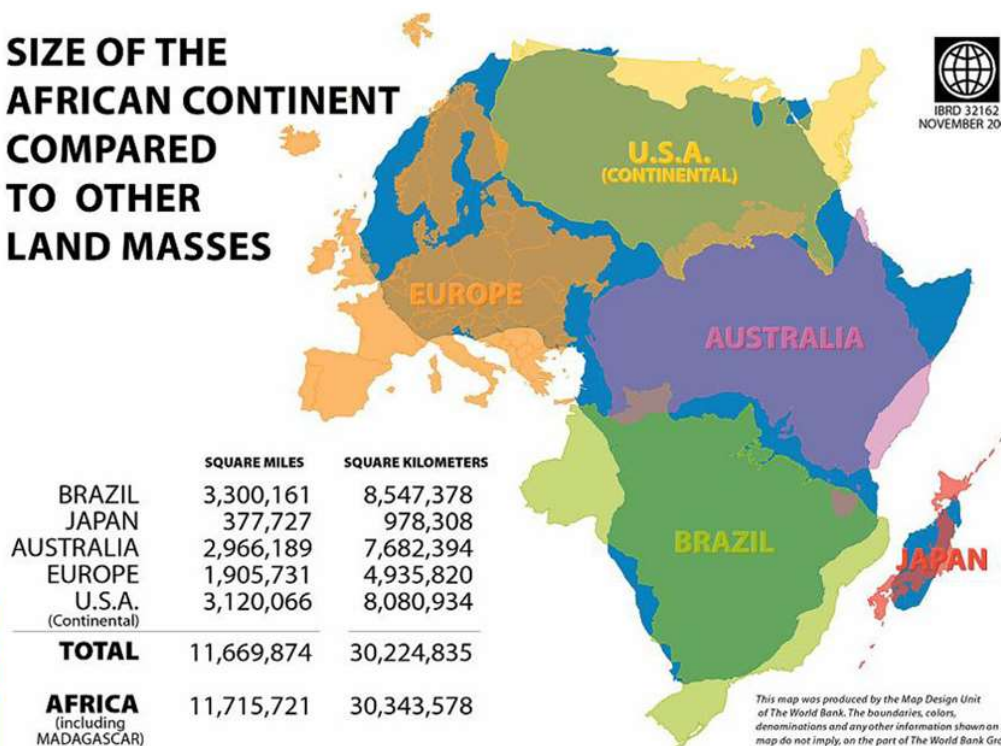
WMO Secretariat

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

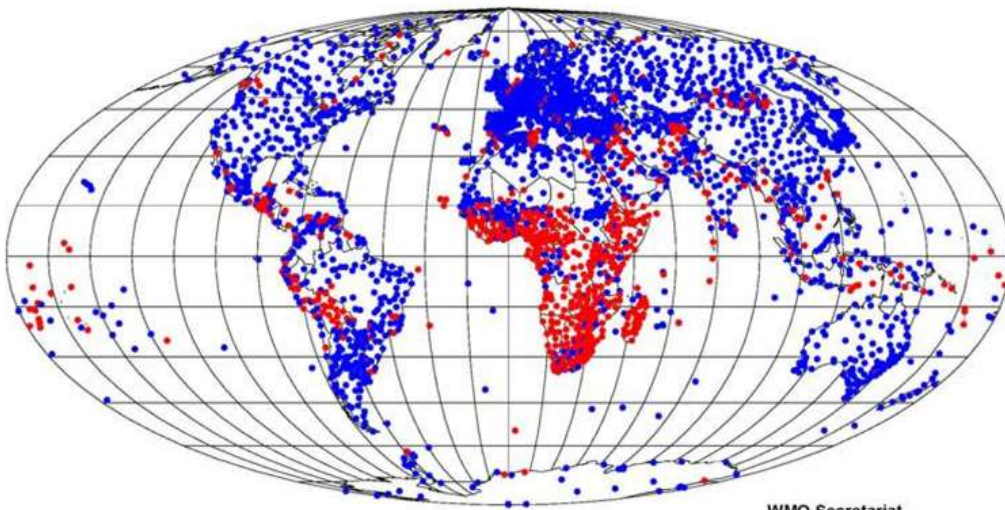


WMO OMM

SIZE OF THE AFRICAN CONTINENT COMPARED TO OTHER LAND MASSES



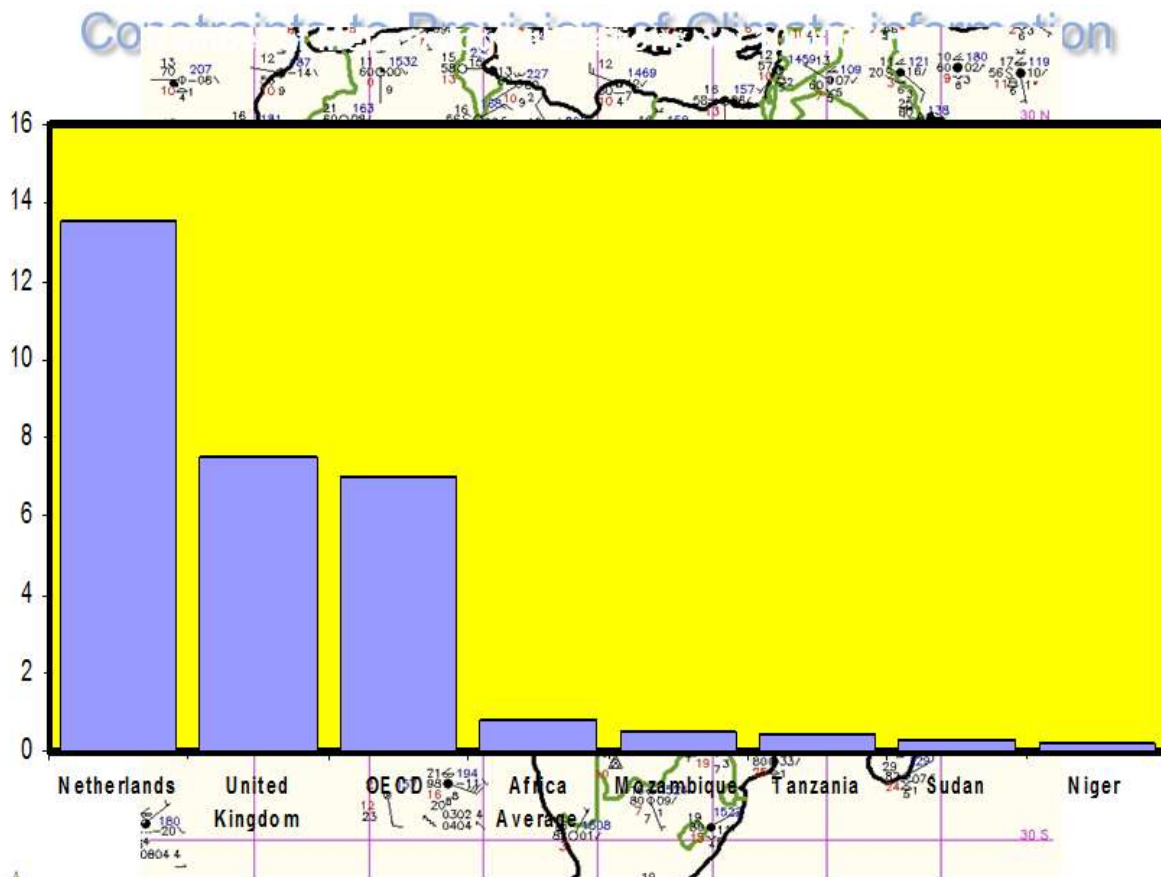
AGM-IWM 1-15/10/2010
CLIMAT reports received from RBCN stations



WMO Secretariat

- Reports received for September 2010 (2168 stations)
- Reports not received for September 2010 (755 stations)

The designation employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the WMO Secretariat concerning the legal status of any country, territory, city or area

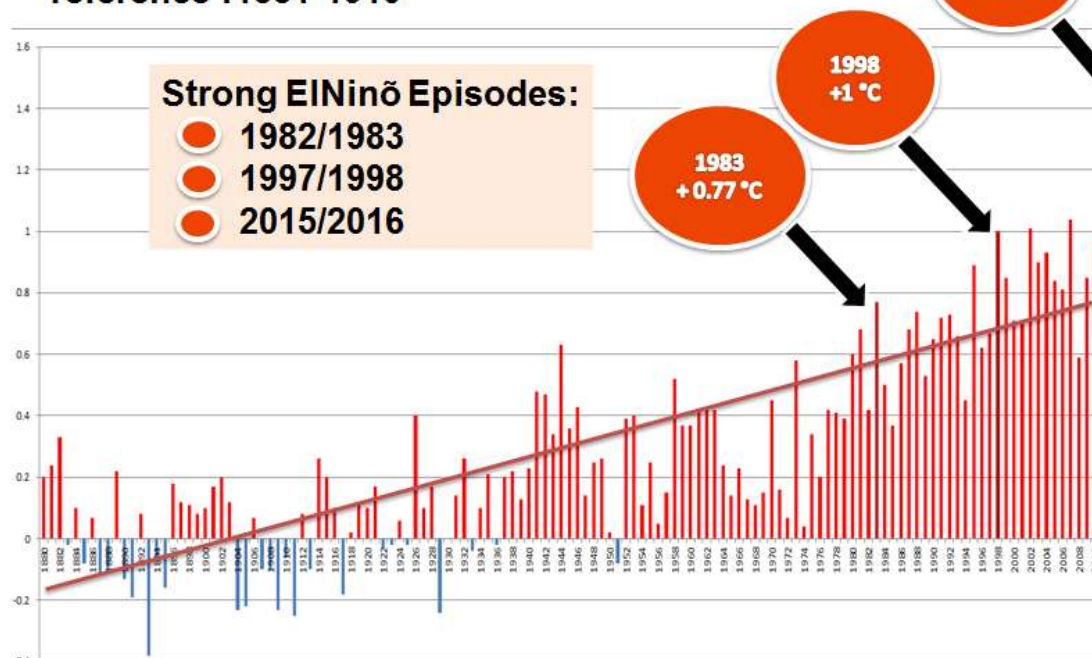


Source: United Nations Human Development Report (2007)

10/3/2010



January-February 2016 global Temperature increase reference :1881-1910



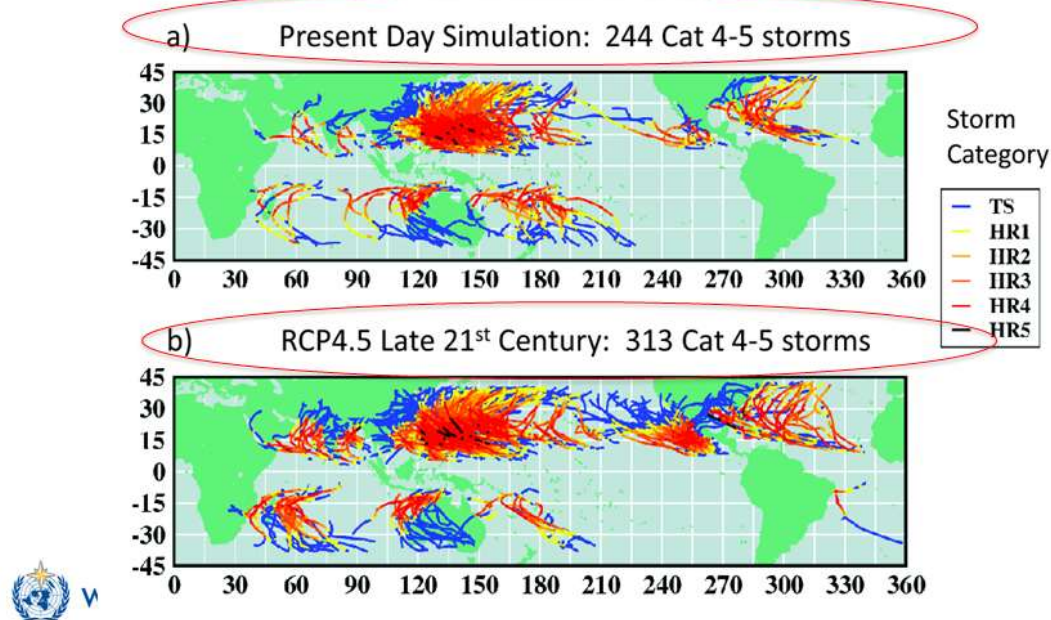
2017 Record breaking economic losses



© Munich Re NatCatSERV/ICE

Model simulations indicate **hurricanes in a warmer climate are likely to become more intense**

Tropical storms today and in 3 C warmed climate



The Observing Systems in LDCs- Barrel Theory – GBON for LDCs

- Worried/Wait...
- Puzzled





The Observing Systems in LDCs- Barrel Theory – GBON for LDCs

- Take Actions !!
- SOFF should be an STRONG MEchanism, not a SOFT one !



Expecting Intensive & Interactive Discussions, and lead to Great & Joint Actions !

Thank you !



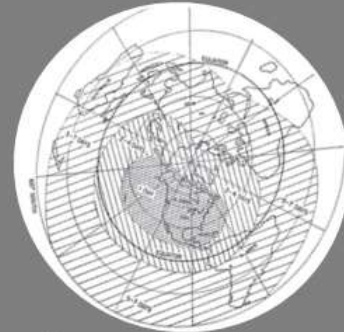
Annex 7: The foundational role of observations. Why do we need data from everywhere?

Systematic Observations Financing Facility

Collaborative thinking workshop
Offenbach, February 2020

The foundational role of observations. Why do we
need data from everywhere?

Prof. Dr. Gerhard Adrian, President WMO



**Climate information –
weather related risks**

**Weather information –
support protection
against severe weather
events**

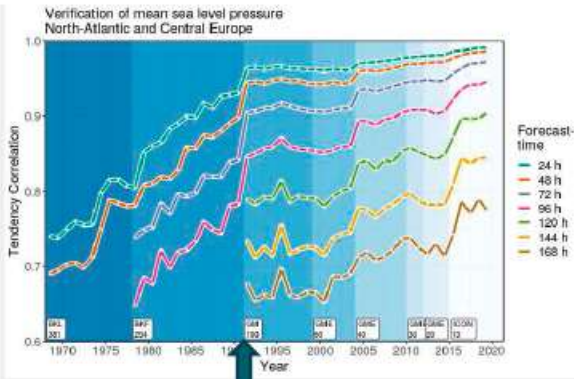
**Climate is the
ensemble of weather
events**

**Better observations
improve the quality of
weather and climate
information**

Systematic Observations Financing Facility, collaborative thinking workshop, Offenbach 25-26 February, 2020

Climate and Weather a global problems of physics

Global forecasting system – Global observing system

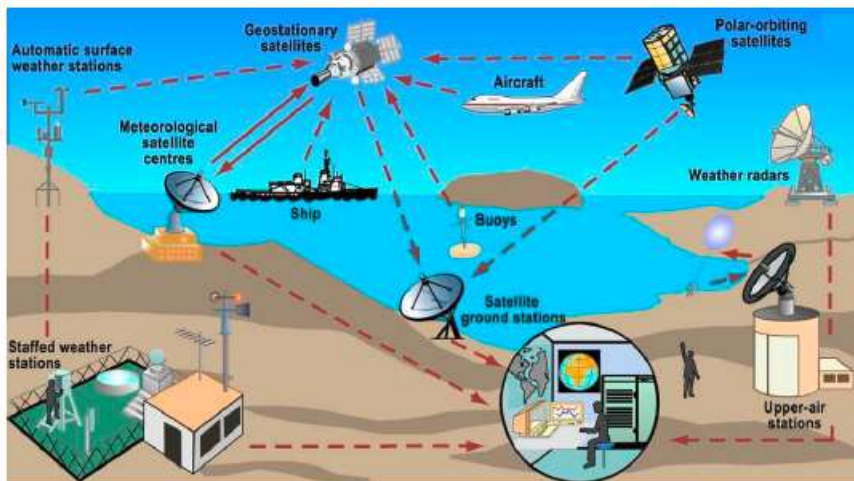


Transition from a hemispheric to a global forecasting system in DWD in 1991

Nesting of a limited area model into a global model

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Observations – what we are talking about?



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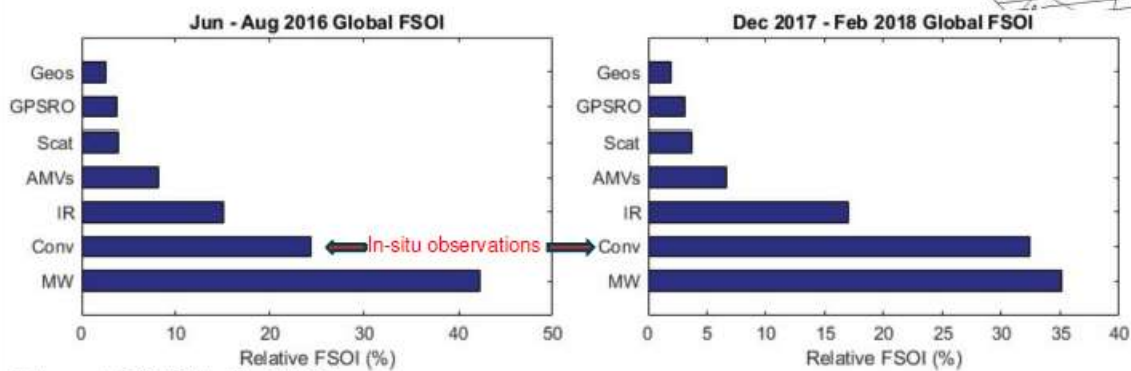
Limitations of satellite observations

- **Satellite systems observe only**
 - thermal emissions from
 - Earth surface
 - Gases in the atmosphere (water vapour, CO₂, ...)
 - backscattered radiation from
 - Aerosol, cloud particle
 - Earth surface
- **Most satellite data can be used only**
 - over water surfaces (oceans, lakes) and in cloudless areas
- **Satellite data do not provide information about surface pressure**
- **In-situ observations constrain the information implicitly contained in the satellite data**

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Impact of observations

In-situ data is as important as satellite data



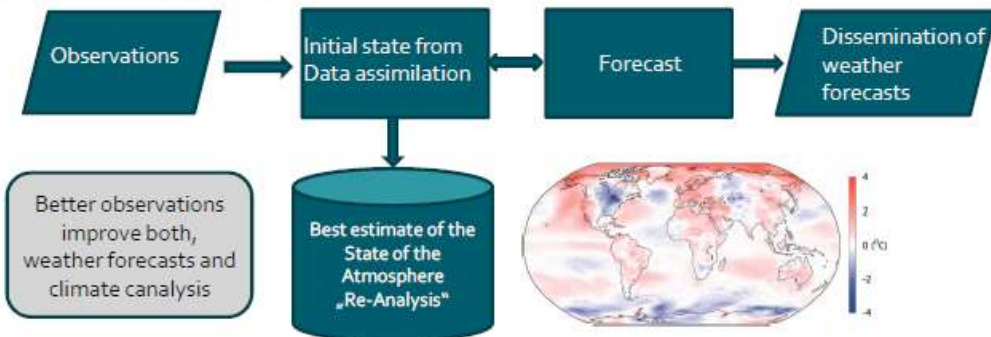
(H. Lawrence et al. ECMWF Techn. Mem. 845 (2019))

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From data to products: Numerical Weather Forecast – Climate Analysis



„Climate is the ensemble of all weather events“



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Declaration of the 18th World Meteorological Congress: *Building Community for Weather, Climate and Water Actions*

...

We recognize

The persistent capacity gap between developed and developing countries in the provision of essential services that impedes resilience to natural hazards

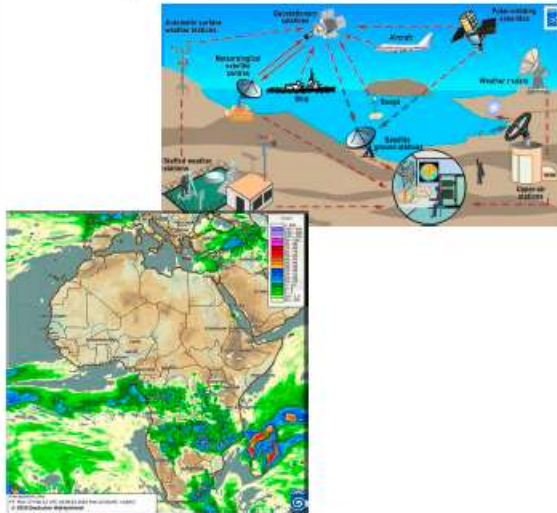
...

The crucial need for WMO to work more closely with development and funding agencies, the private sector and the international finance community in designing and guiding development assistance aimed at closing the capacity gap

...

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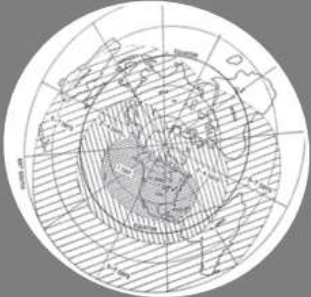
Declaration of the 18th World Meteorological Congress: *Building Community for Weather, Climate and Water Actions*



...
We welcome
The contributions of Members and partner
international organizations to sustaining
developing the global meteorological
infrastructure coordinated by WMO through
programmes;
...

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Annex 8: The Global Basic Observing Network (GBON) and the need for a Systematic Observations Financing Facility (SOFF)

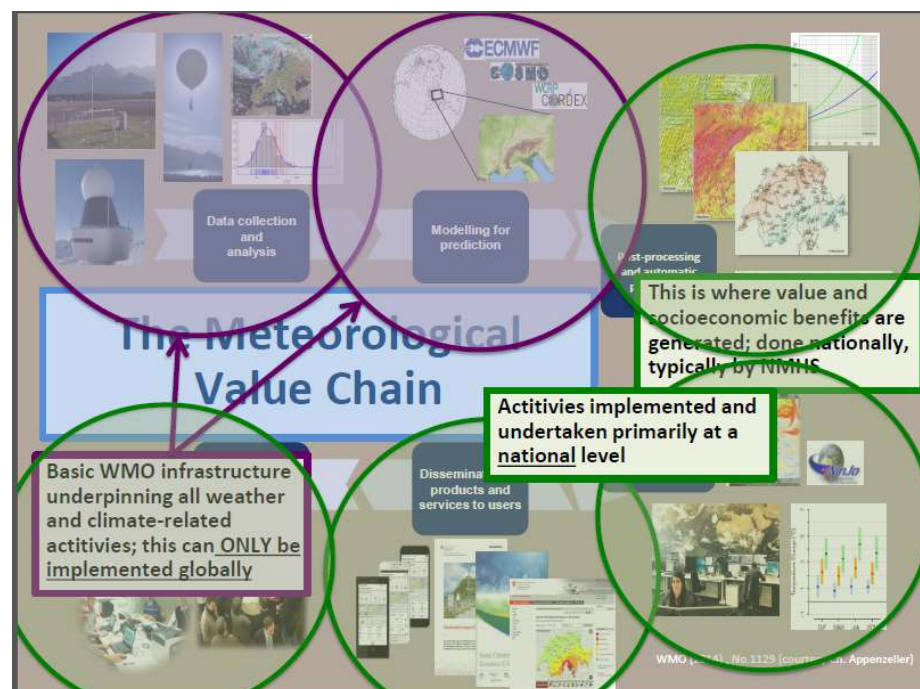


Systematic Observations Financing Facility

Collaborative thinking workshop
Offenbach, February 2020

**The Global Basic Observing Network (GBON)
and the need for a Systematic Observations Financing Facility (SOFF)**

Lars Peter Riishojgaard, WMO





Why is global Numerical Weather Prediction (NWP) so vitally important for WMO?

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

NWP and GBON directly supports three, and indirectly supports all other WMO Application Areas (except Space weather).

- Not only do "Weather and climate know no boundaries"; **the atmosphere itself has no horizontal boundaries**, and the mathematical problem of introducing artificial lateral boundaries in NWP appears to be intractable;
- **NWP is therefore global by necessity**;
 - Limited Area Models (LAMs) successfully used, *but only at short ranges, and when embedded within a global NWP system*;
- **Global NWP requires ongoing access to observations from the entire global domain**; only WMO has the reach and the authority to coordinate this;

WMO OMM

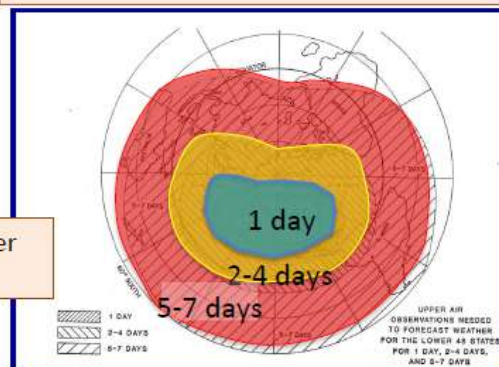
Role of observations in NWP



- 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.

WMO OMM





What is NWP?

Zonal wind:

$$\frac{\partial u}{\partial t} + u \frac{\partial u}{\partial x} + v \frac{\partial u}{\partial y} + w \frac{\partial u}{\partial z} + \frac{\partial u}{\partial \sigma} \frac{\partial \sigma}{\partial t} + \frac{\partial u}{\partial \pi} \frac{\partial \pi}{\partial t} = -\frac{\partial}{\partial x} \left(\frac{u^2 + v^2}{2} \right)$$

- (NWP is the art of solving a set of really pesky partial differential equations on a computer in order to predict the time evolution of wind, temperature, humidity and surface pressure);
- **Based on knowledge of current weather** at a given initial time, NWP **predicts** how it will evolve 6 hours later, 12 hours later, the following day, etc., out to about two weeks ahead;
- The initial knowledge of current weather comes from **observations**;
- The better our knowledge of the initial weather is (the more numerous and the more accurate observations we have), the more successful will our NWP efforts be, for both weather and climate applications!

$$\frac{\partial}{\partial t} \frac{\partial p}{\partial \sigma} = u \frac{\partial}{\partial x} x \frac{\partial p}{\partial \sigma} + v \frac{\partial}{\partial y} y \frac{\partial p}{\partial \sigma} + w \frac{\partial}{\partial z} z \frac{\partial p}{\partial \sigma}$$



WMO OMM

The “global” in global NWP has profound implications

- **Observations are valuable, BUT**
 - Single, isolated observations (even clusters of them) cannot be used alone as basis for prediction;
 - Jigsaw puzzle analogy: Individual pieces of a puzzle are useless in isolation; only when many pieces are available can a picture emerge;
 - For weather and climate this picture is global, so this requires international **data exchange**;
- **Moreover,**
 - In meteorology, you often do not make observations primarily for your own benefit, but for your fellow WMO Members – located further and further away as the prediction range increases;
 - This is very difficult for many funding managers to come to grips with; it means that taking a purely national view of the meteorological value chain may lead to misguided investments;



Attempts to implement the full value chain from observations through service delivery **via purely national approaches** are unlikely to succeed!



WMO OMM



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

• **WMO Convention (1947):
purpose of the organization:**

- Art. 2(a) To facilitate worldwide cooperation in the establishment of networks of stations for the making of meteorological {...}
- Art. 2(b) To promote the

• **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!)



WMO OMM

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



Current international exchange of data for global NWP less than optimal (Example:
Surface pressure observations received by global NWP Centers on Feb 9 2020, 18Z)



WMO OMM



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 1990, and progress since that time, and
- Congress resolutions define policy in broad technical detail to allow for country-specific implementation;
- Additional material is available in the form of recommendations, implementation guidelines, and a matter of principle, based on the WMO's mandate;
- Current WIGOS monitoring data exchange coverage over many areas (polar regions, etc.) is poor.

Top three causes of missing data, depending on country:

- Data policy;
- Missing integration;
- Lack of financial resources.

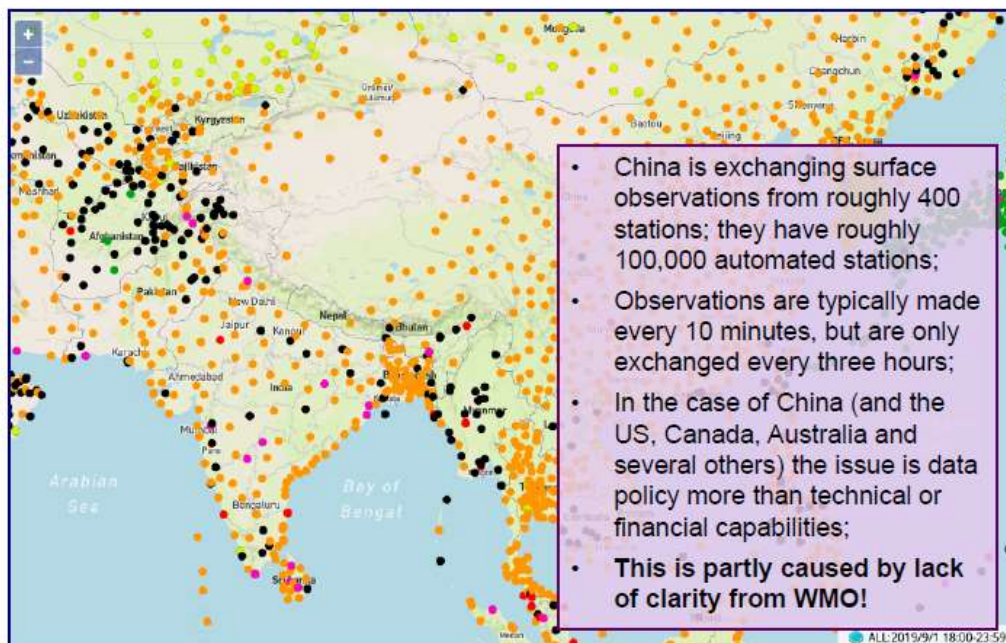
- In many cases additional observations are being made, but not currently exchanged, due to a lack of clarity from WMO regarding the obligation of the Members.



WMO OMM

Ex. 1; Data policy issues

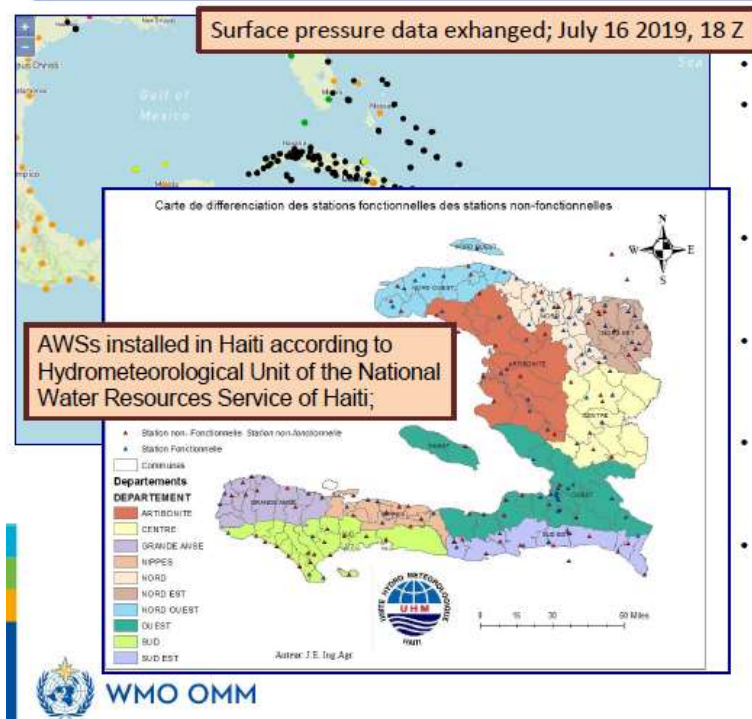
(e.g. China, observations are made, but not all are exchanged)



WMO OMM



Ex. 2; Missing integration (Haiti; an illustration of how not to use project funding)



- 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, all donor-funded but:
- Only half the AWSs are operating, only two are currently reporting to WMO
- **Number of observations exchanged would arguable better metric of success than number of stations purchased or installed!**

Ex. 3; Insufficient local financial resources (Who will pay where there are no people and hence no money?)



Switzerland

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

Kiribati

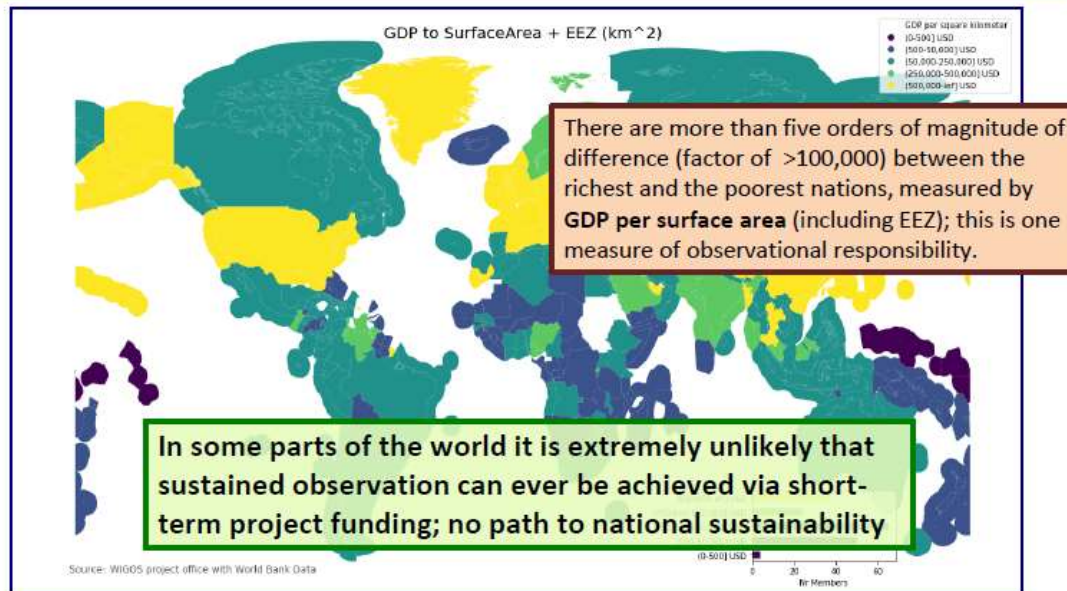
- 3,500,000 km², including EEZ (for comparison, combined area of EU Members 4.400.000 km²):

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

Capital investment alone will not solve this problem. There are not enough available resources locally to even operate the system!

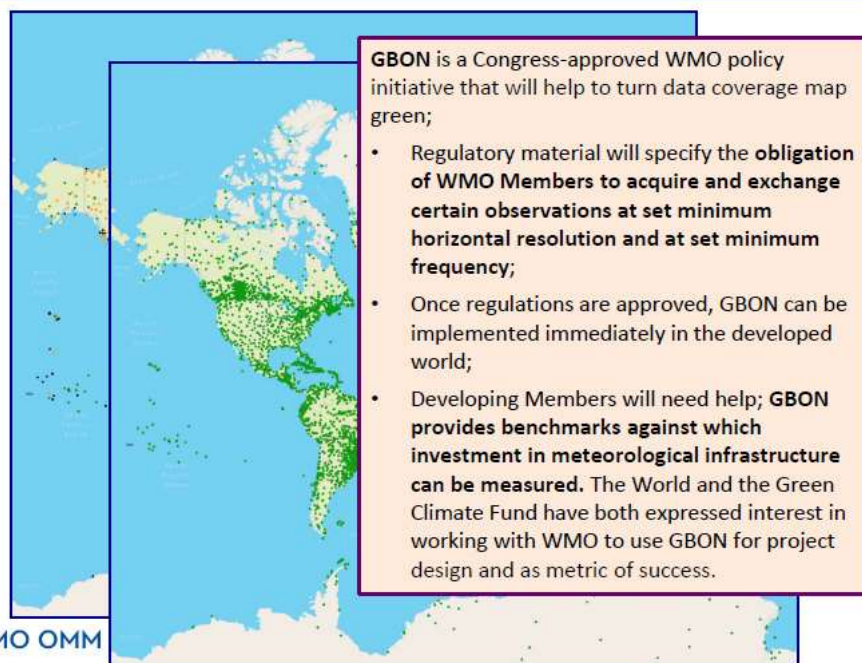


A different look at available resources



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

Global Basic Observing Network (GBON)



WMO OMM

1
4



Implementation paths and cost of GBON

- **GBON comes at a cost**; WMO Members can be divided in three 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 GBON provisions to help steer internationally funded development projects**;

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)



5

Final remarks

- GBON reflects a fundamental recommitment of WMO Members to international exchange of observations in support of Global NWP as a basis for all weather and climate-related products and services;
 - Free and open exchange of NWP data will need to be part of this conversation;
- Draft GBON regulatory material to be finalized by WMO Infrastructure Commission in April 2020, and submitted to Executive Council in June 2020 for approval;
- Implementation of GBON within all 193 WMO Members will require a mix of policy-level, technical and financial interventions, depending on circumstances;
- The SOFF is a concept for a dedicated mechanism to fund GBON implementation in areas where the local resources are (and will remain) insufficient, based on the principle that financing a global public good should be shared equitably and fairly;
- Unanimous support from WMO Congress for GBON; very strong push to expand it also into other areas, e.g. marine observations and greenhouse gases;
- **GBON and SOFF in their current incarnations represent only the beginning!**

16



Annex 9: The role of the World Meteorological Centres: from data to products



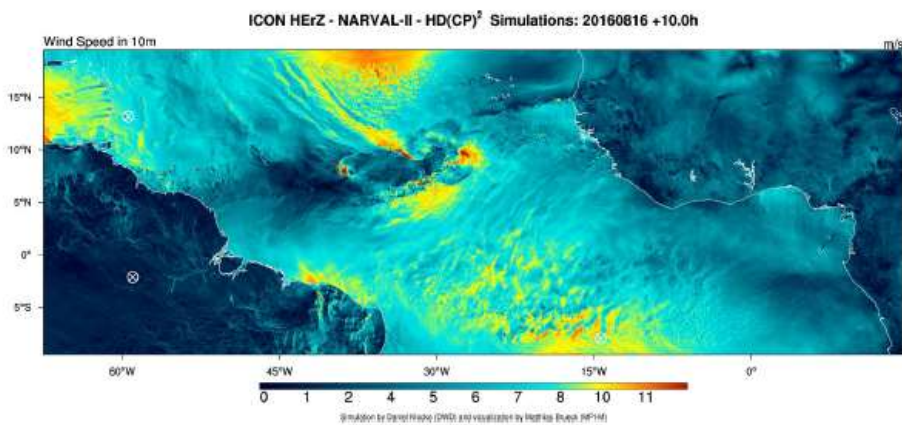
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The role of the World Meteorological Centres: from data to products

Sarah Jones, Vice chair WMO Research Board
Fabio Venuti, ECMWF

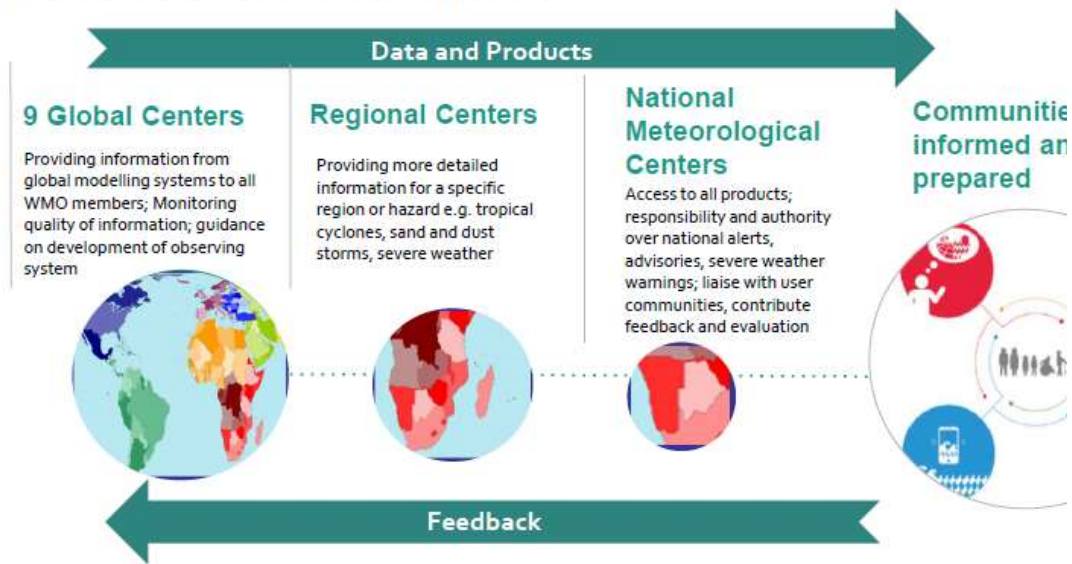


From observations to tailored weather and climate information

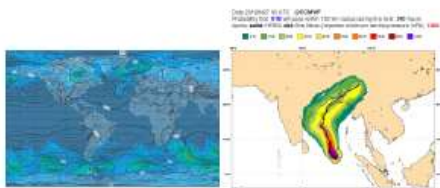




From observations to tailored weather and climate information: the WMO cascading process



Global Numerical Weather Prediction at all time ranges



High resolution forecast

- twice per day 9 km 137 levels, to 10 days ahead

Ensemble forecast

- twice per day 51 members, 18 km 91 levels, to 15 days ahead

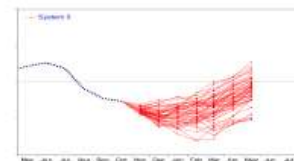
Ocean waves: twice per day

- High Res: 10 days ahead at 14 km (coupled)
- Ensemble: 15 days ahead at 28 km (coupled)



Extended Ensemble

- Monday/Thursday 00 UTC extended to 1 month ahead (Monthly Forecast, 18/36 km)



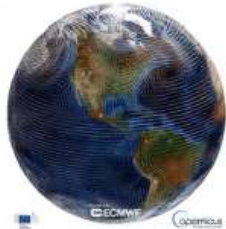
Seasonal forecast

- Once a month
- 51-members, ~35 km 91 levels, to 7 months ahead
- sub-set of 15 members is run for 13 months every quarter (30 years of hindcasts)

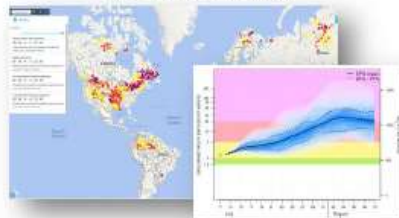


Global Environmental Prediction

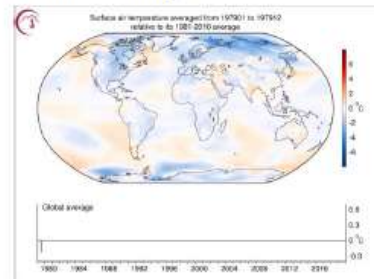
Atmosphere Monitoring



Flood Forecasting



Climate Change



Fire Forecasting



5

Distribution of ECMWF Products beyond NMSs of Member States

NMSs accessing free graphical NWP



NMSs with licence to graphical NWP



NMSs with full licence to NWP



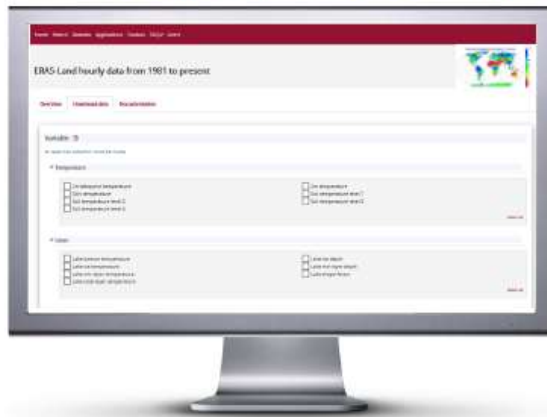
Commercial users with licence to NWP



6



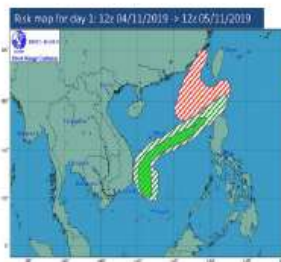
Products on the cloud: Climate Data Store (CDS)



...and the Atmosphere Data Store (ADS) available in 2020!



Generating products through the WMO cascading process



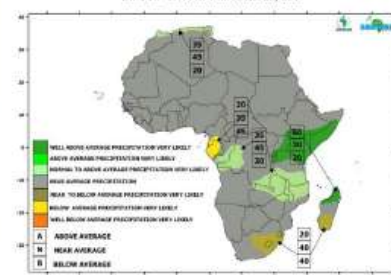
Risk of heavy rainfall and strong wind for following 24 hours from
Severe Weather Forecast
Demonstration Project
Southeast Asia



Probability of Hurricane Force winds for following 5 days from
Regional Specialized Meteorological
Center for Tropical Cyclone
Forecasting, Miami

Precipitation forecast for
following 3 months
From African Regional Climate
Centre

SEASONAL PRECIPITATION FORECAST
FOR DECEMBER-JANUARY-FEBRUARY 2019-20
ISSUED ON NOVEMBER 28, 2019



Annex 10: The global value of GBON

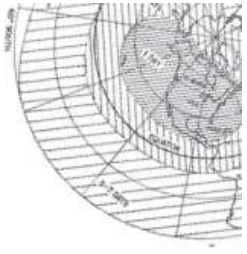


Systematic Observations Financing Facility
Collaborative thinking workshop
Offenbach, February 2020

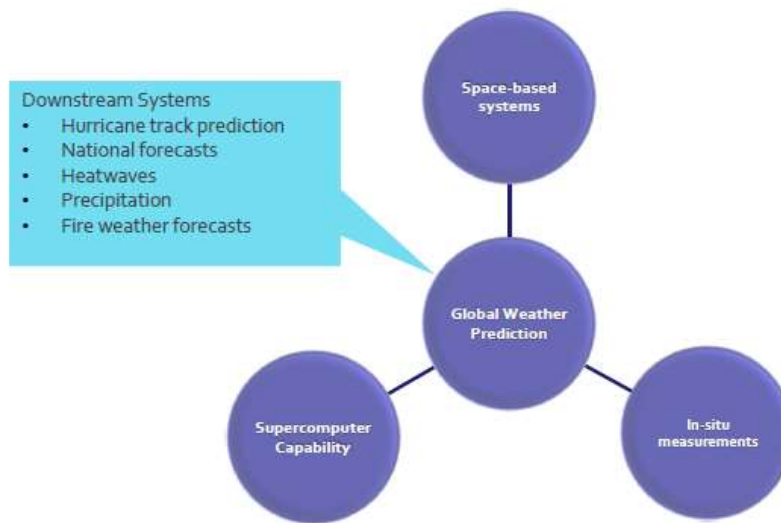
The global value of GBON

Anthony Rea, WMO
Florian Pappenberger, ECMWF

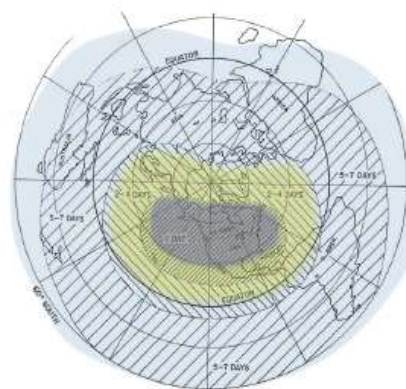
What would a GBON compliant world look like?

- 
1. **Fixed broken piece of the weather machine** - surface-based observations
 2. **Increased resilience** through improved weather prediction and climate analysis
 3. **Increased resilience** in particular for the most vulnerable
 4. **Scarce resources invested in the right place** - observations from some geographical areas have a higher forecast impact than others

The 'Global Weather Machine'



1. Fixed broken piece of the weather machine Surface-based observations

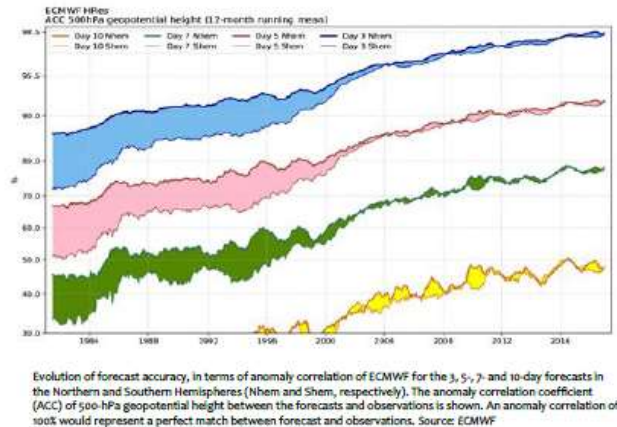


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2. Increased resilience through improved weather prediction

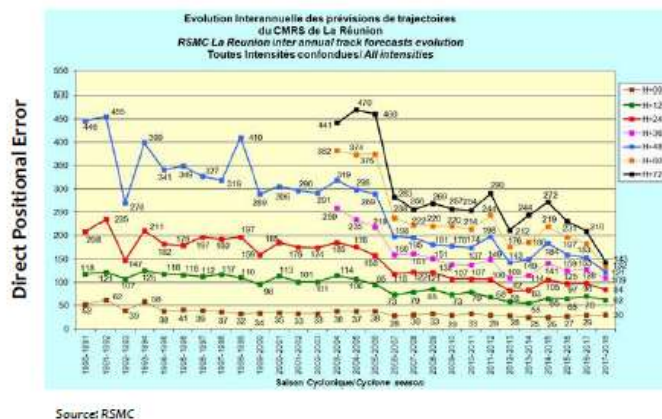
Evolution of the short-term forecast over decades



Systematic Observations Financing Facility, collaborative thinking workshop, Offenbach 15-16 February, 2020

2. Increased resilience through improved weather prediction

Evolution of tropical cyclones track forecast over decades



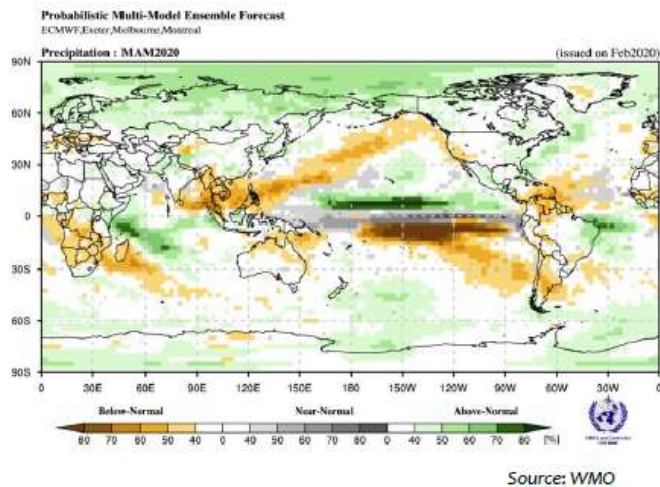
Average 3-days official forecasts errors are now below 150 km.

Today, the same type of decision can be taken 3 days before compared to 2 days in the past. The population is informed with an increased lead time and measures can be taken at an earlier stage with higher precision (e.g. reduced cost of unnecessary evacuation)

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2. Increased resilience through improved weather prediction

Seasonal forecasting



Systematic Observations Financing Facility, collaborative thinking workshop, Offenbach 25-26 February, 2020

2. Increased resilience through improved climate projection

Surface-based
observations:
crucial for climate
projections

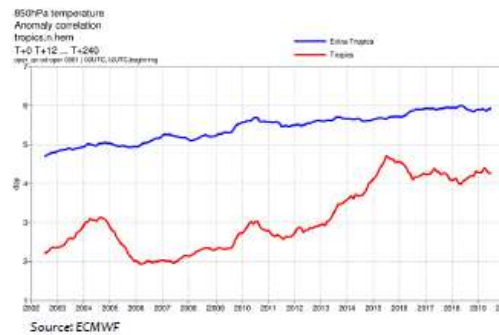


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3. Increased resilience in particular for the most vulnerable

The difference in forecast skill between the tropics and extra tropics is still 1.5- 2 days

Upper-air forecast skill - temperature



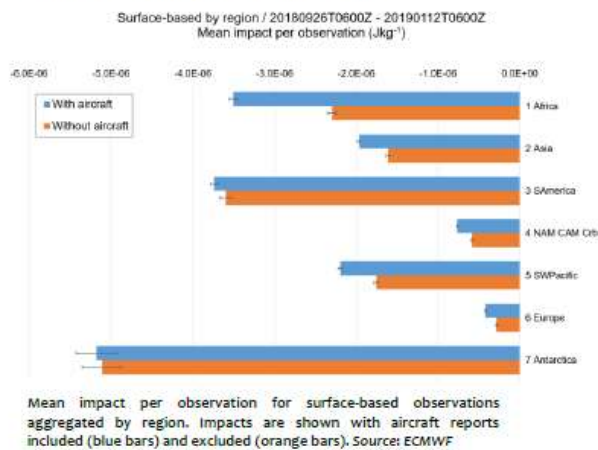
Precipitation forecast skill



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4. Investing scarce resources in the right place

Marginal value of additional observations



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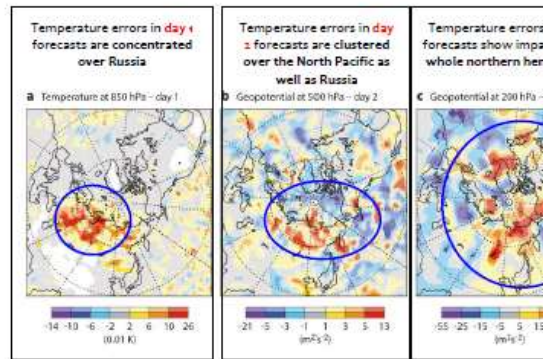
NWP can be significantly improved, particularly for regions where surface-based observations are data sparse.

More observations from these regions would improve global NWP, but especially NWP performance in the data sparse regions themselves.

4. Investing scarce resources in the right place

The value of observations beyond national boundaries: the example of radiosondes

- Balloon-borne radiosondes are critical for NWP, forecasting, climate studies and calibration of satellite data
- In 2015, Russia had to cut its radiosonde programme from 2 ascents per day to 1
- ECMWF analysis showed that reductions in Russian radiosonde reports had a significant impact on forecast performance beyond Russia

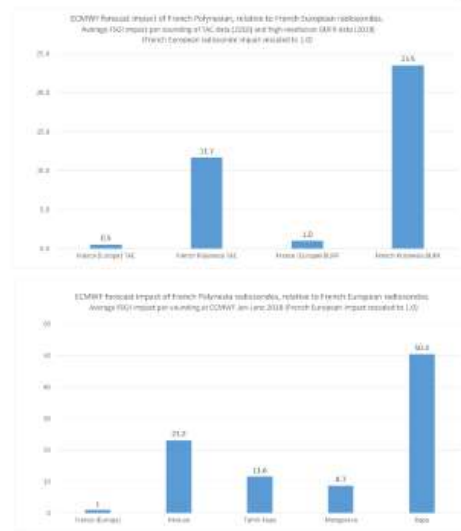


Source: adapted from ECMWF

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4. Investing scarce resources in the right place

The example of the RAPA, French Polynesia



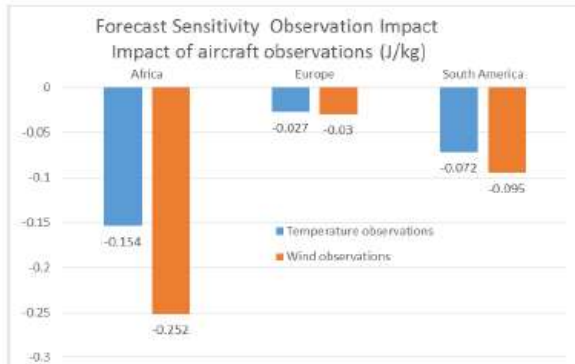
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Source: ECMWF



4. Investing scarce resources in the right place

Average Forecast Sensitivity Observation Impact per observation of AMDAR aircraft temperature and wind observations from February-October 2017



Africa: (35S-20N, 20W-35E) 4.1M obs. Europe: (35N-70N, 10W-30E) 26.4M obs. South America: 14.4M obs. Lars Isaksen, ECMWF

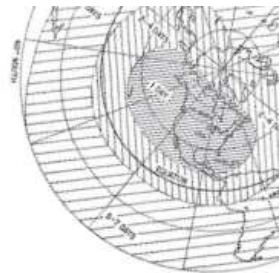
Africa impact per observation compared to Europe:

- 5.7 times bigger for temperature observations
- 8.4 times bigger for wind observations

South America impact per observation compared to Europe:

- 2.7 times bigger for temperature observations
- 3.2 times bigger for wind observations

A diagram illustrating the Earth's rotation. It shows a cross-section of the Earth with latitude and longitude lines. A point on the surface is shown moving in a circular path over a period of 5-7 days. The path is labeled "5-7 DAYS". The Earth's axis is labeled "EQUATOR". The diagram also shows the "1 DAY" period for one full rotation.

[illegible]

Value of weather prediction (hydrometeorological information and early warning systems)

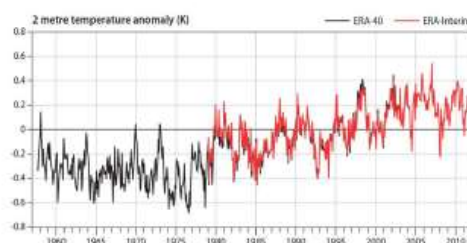
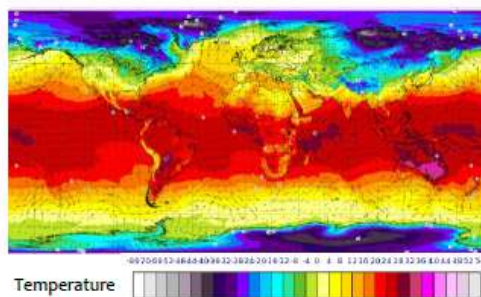
Metric	Minimum annual benefit (US\$)
Avoided asset losses	\$13 billion
Avoided well-being losses	\$22 billion
Optimized economic production	\$16 billion
Total	\$51 billion

Minimum global socioeconomic valuation of the benefits of weather prediction

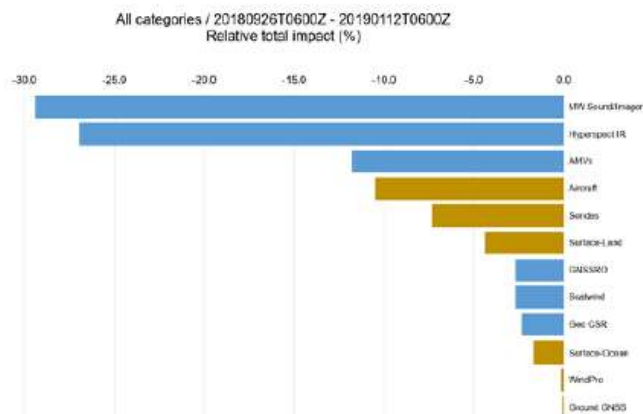
Example benefit:cost ratios from **3:1** to **36:1**
Up to **80:1** if wellbeing benefits are included

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Global observations underpin services on all timescales



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Surface-based observations: 25% of impact on forecast accuracy

Relative Forecast Sensitivity to Observations Impact (FSOI) for all observation types assimilated in the Met Office global NWP system. The impact is expressed as the percentage of the total impact on 24-hour forecast error. A negative value means a reduction in forecast error. Space-based observations are coloured blue, whilst surface-based observations are coloured gold. Source: ECMWF

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Economic benefits of optimal observations data

Region	% of global GDP*	% of global forecast improvement	Annual benefit (USD)
Africa	3%	26%	\$0.4 billion
Asia	35%	16%	\$3.2 billion
S. America	4%	32%	\$0.8 billion
NAM CAM Crb	29%	6%	\$1.0 billion
SW Pacific	4%	17%	\$0.4 billion
Europe	26%	3%	\$0.5 billion
Global	100%	100%	\$6.4 billion

*Based on 2018 GDP, sourced from <https://data.worldbank.org/>

Note that non-GDP benefits in developing countries likely to be substantial (e.g. lives saved).

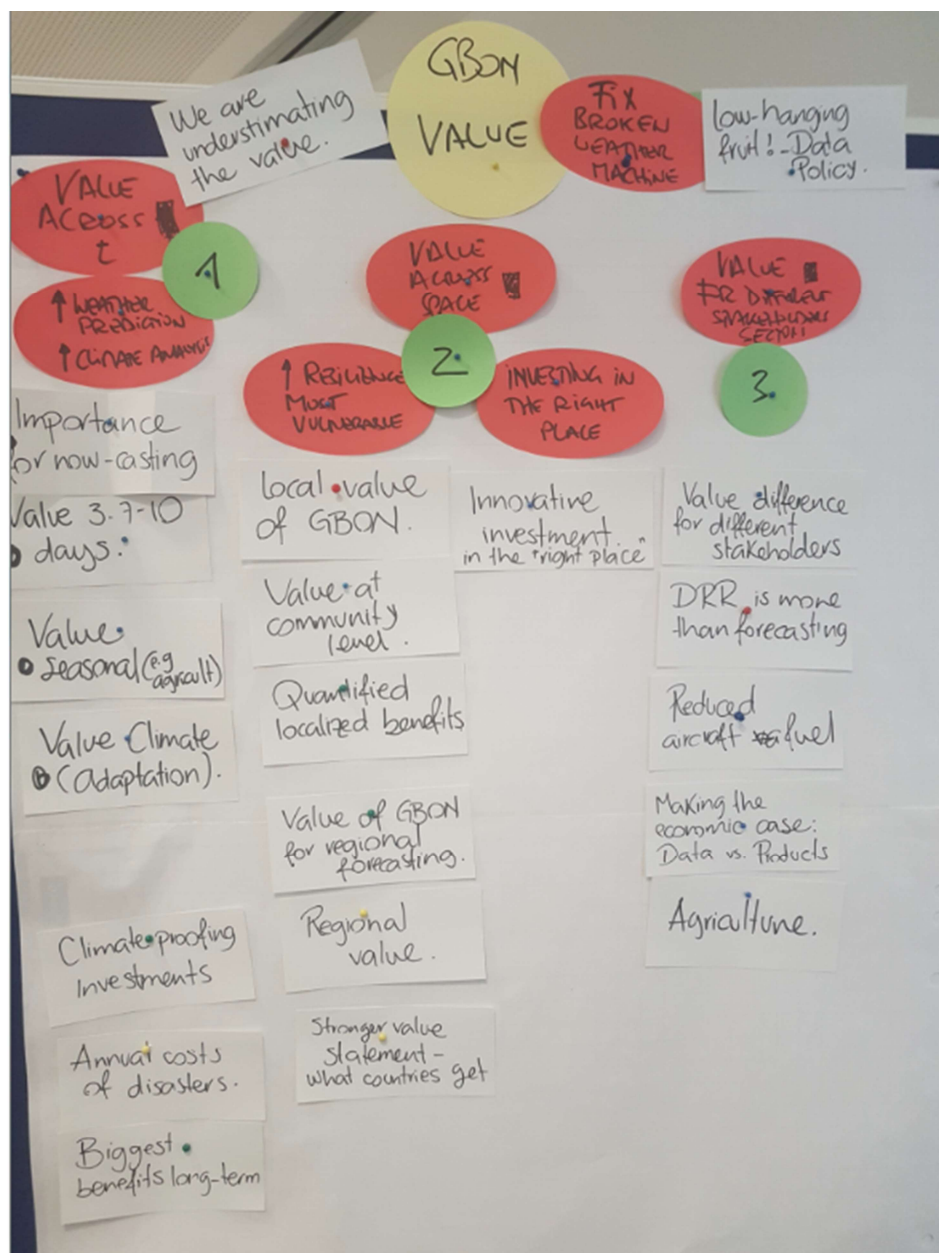
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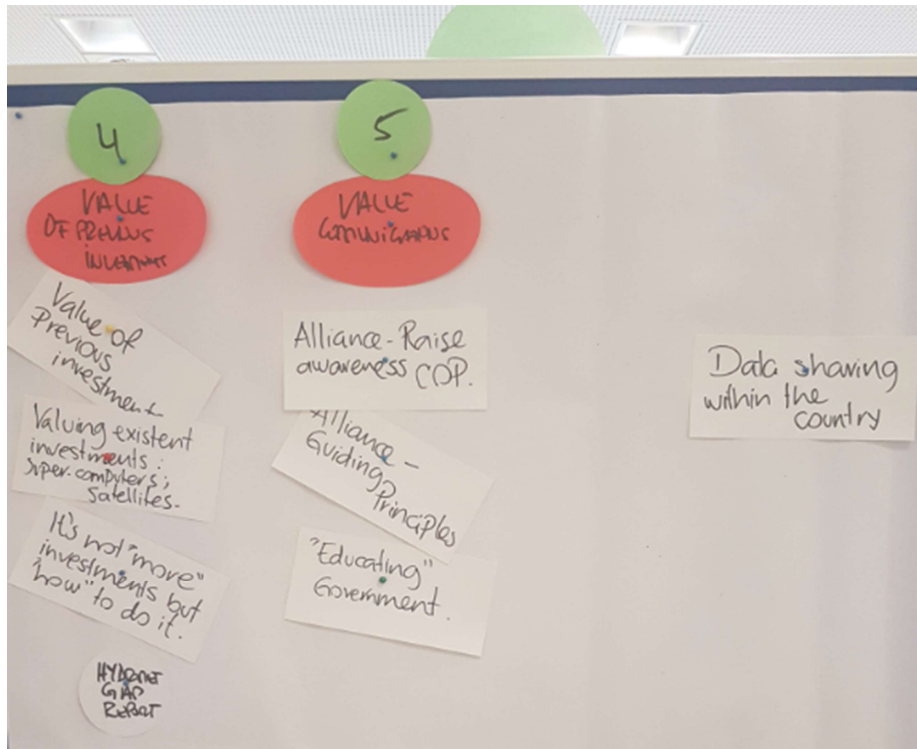
Key messages

- Improvements in coverage and exchange of surface-based observations delivers benefits **>\$6 billion p.a.** and provide the foundation to realize **>51 billion p.a.** benefits from overall weather prediction efforts.
- Investing in surface-based observations in developing countries makes massive economic sense
- International data exchange acts as a very efficient multiplier on observations value
- In view of growing climate- and weather-related challenges, surface-based observations have to be treated as a critical public good

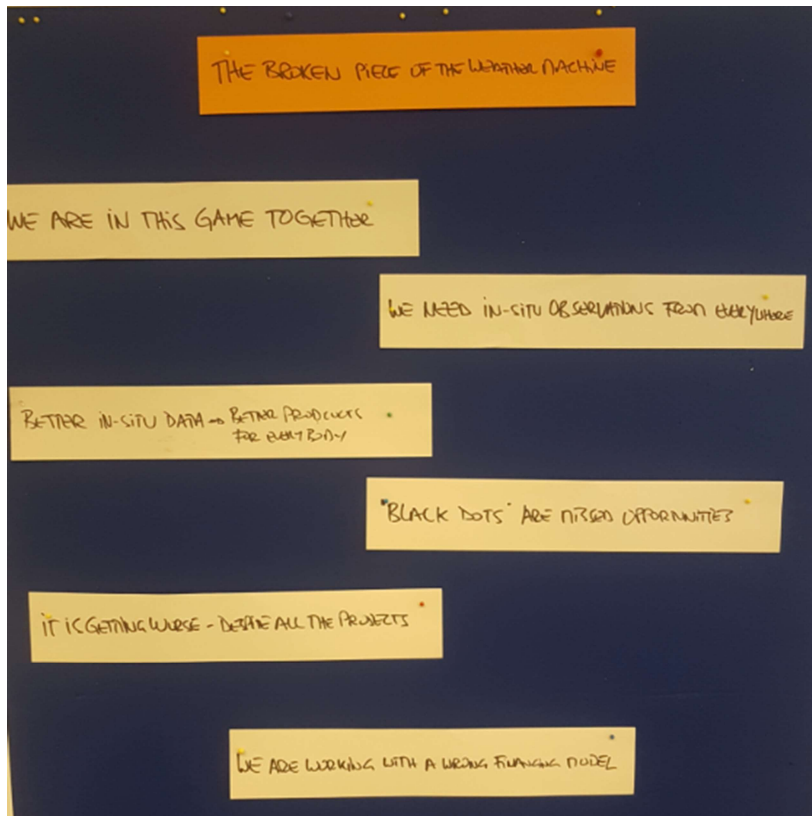
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Annex 12: The value of GBON softboard

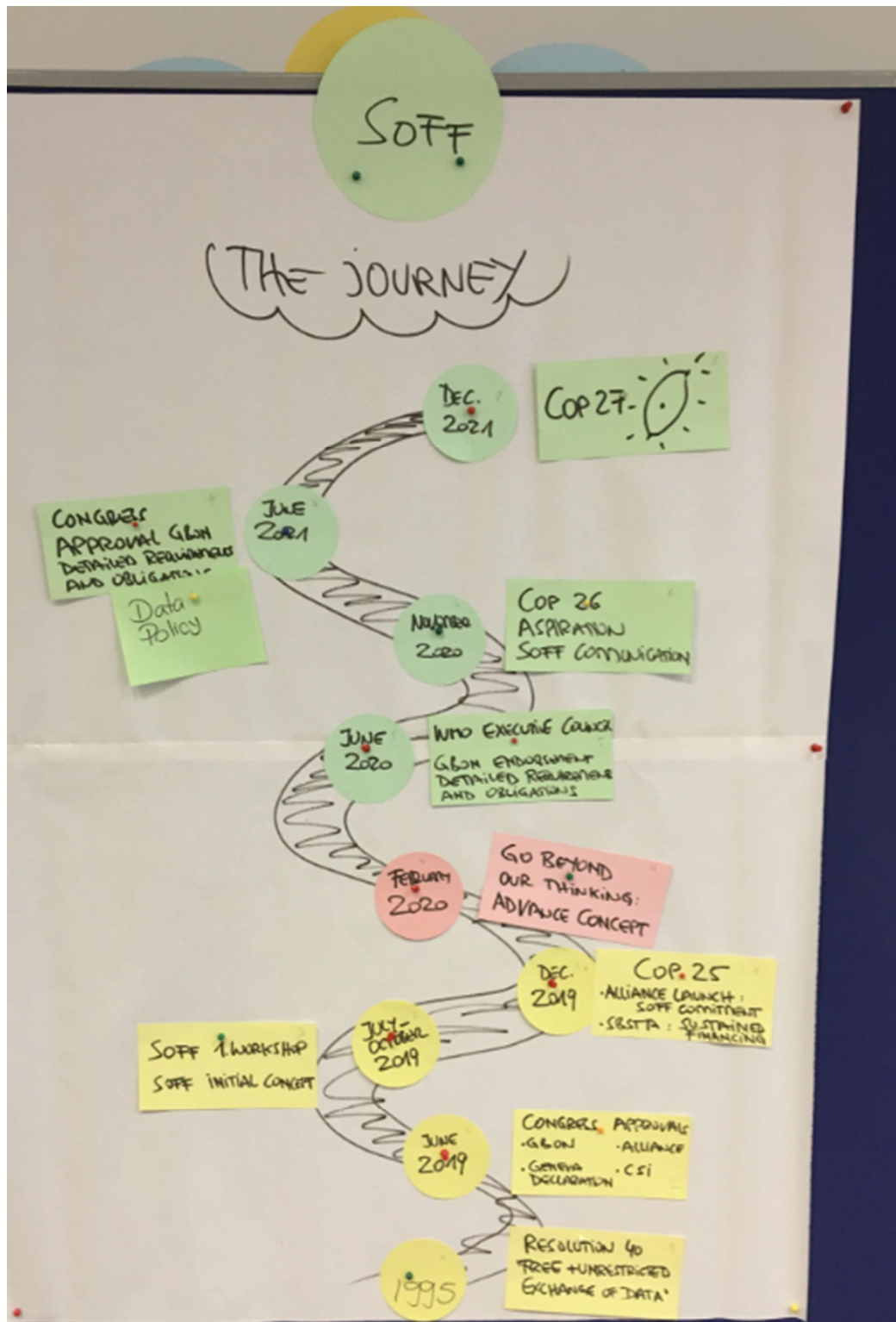




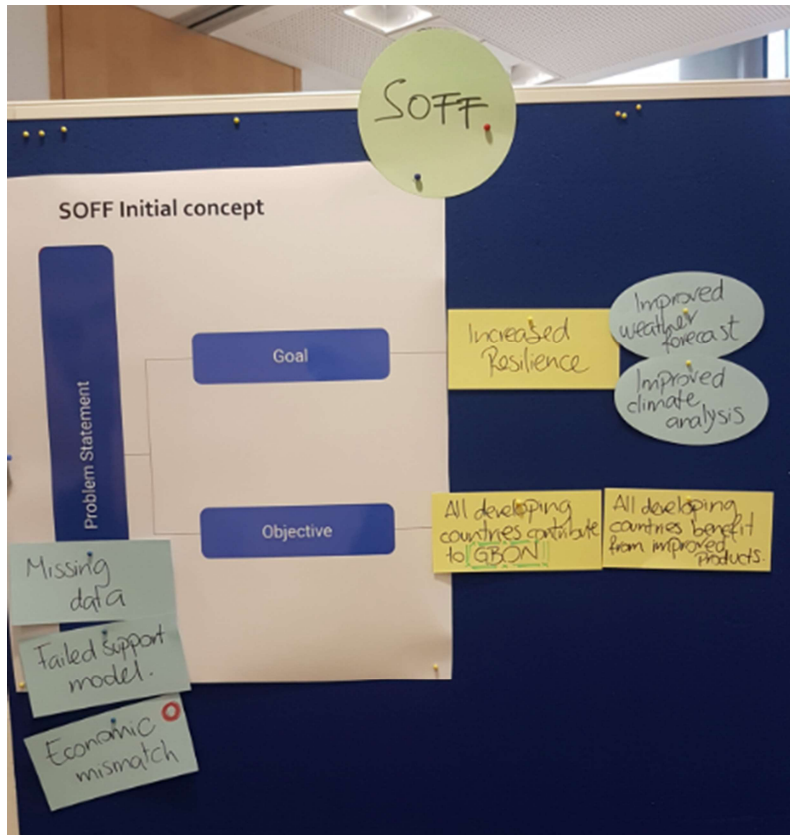
Annex 13: The broken piece of the weather machine



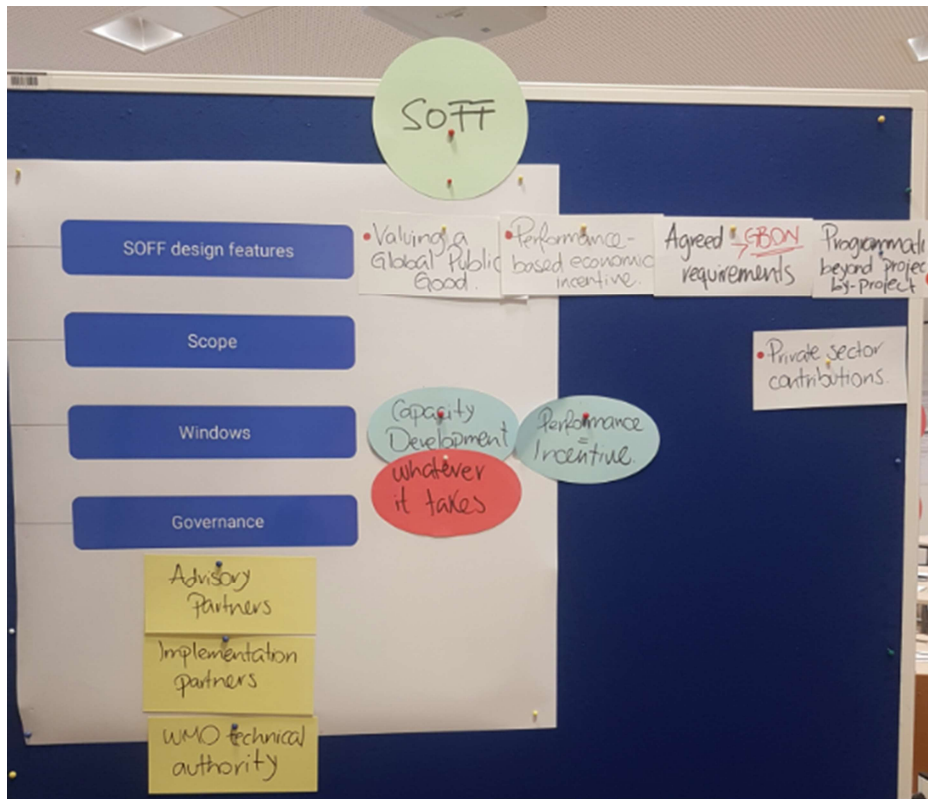
Annex 14: The SOFF journey softboard

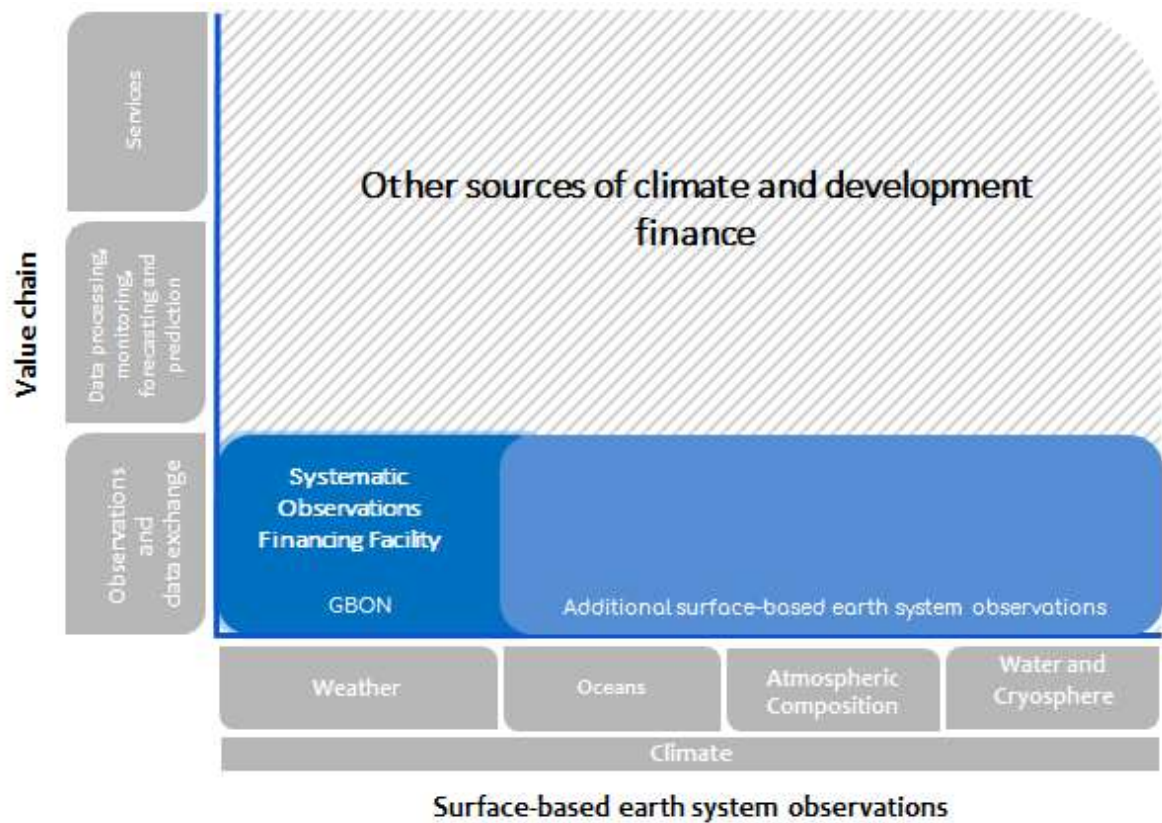


Annex 15: SOFF initial concept note October 2019 softboard

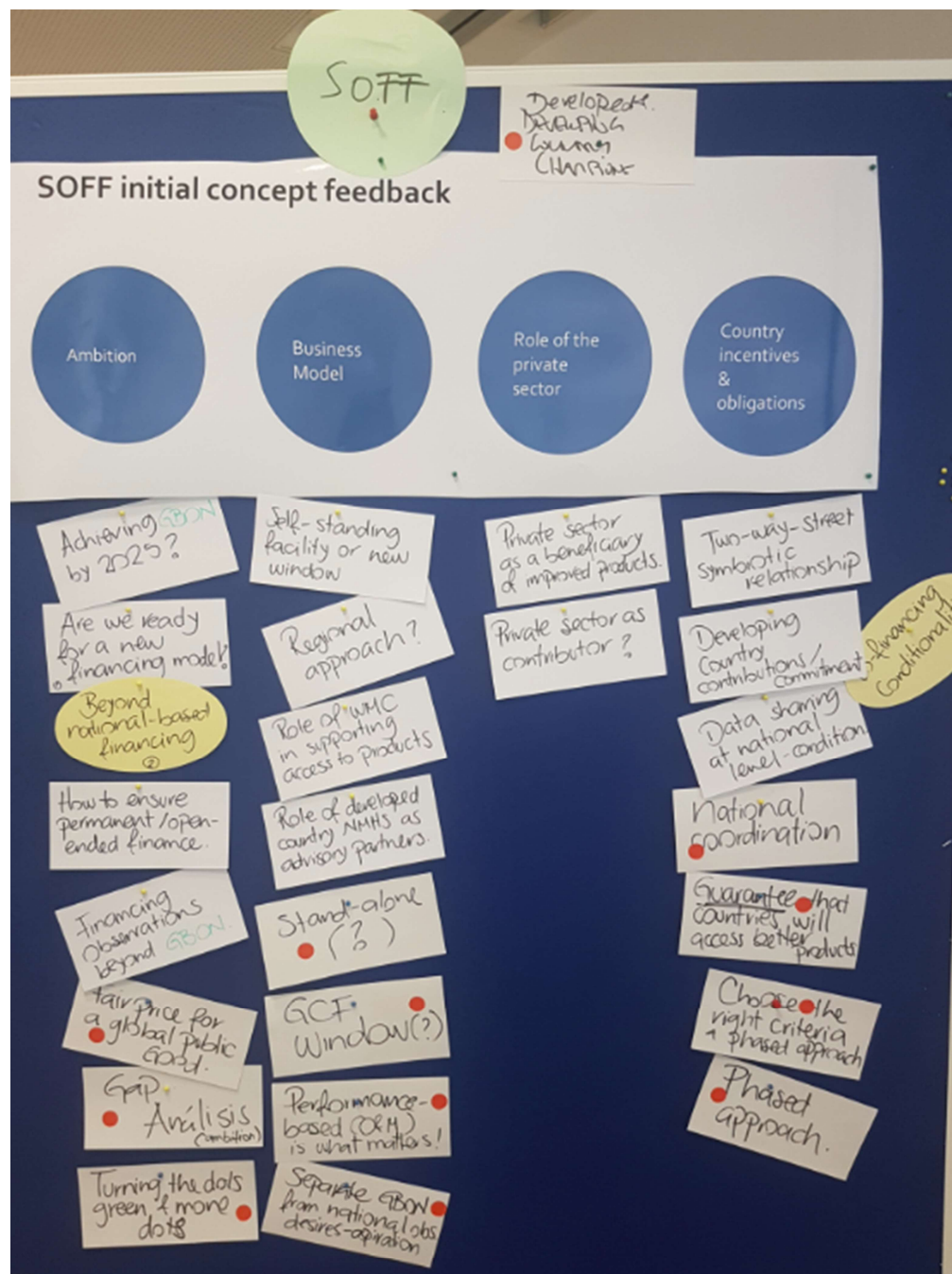


Annex 16: SOFF design features - initial concept note October 2019

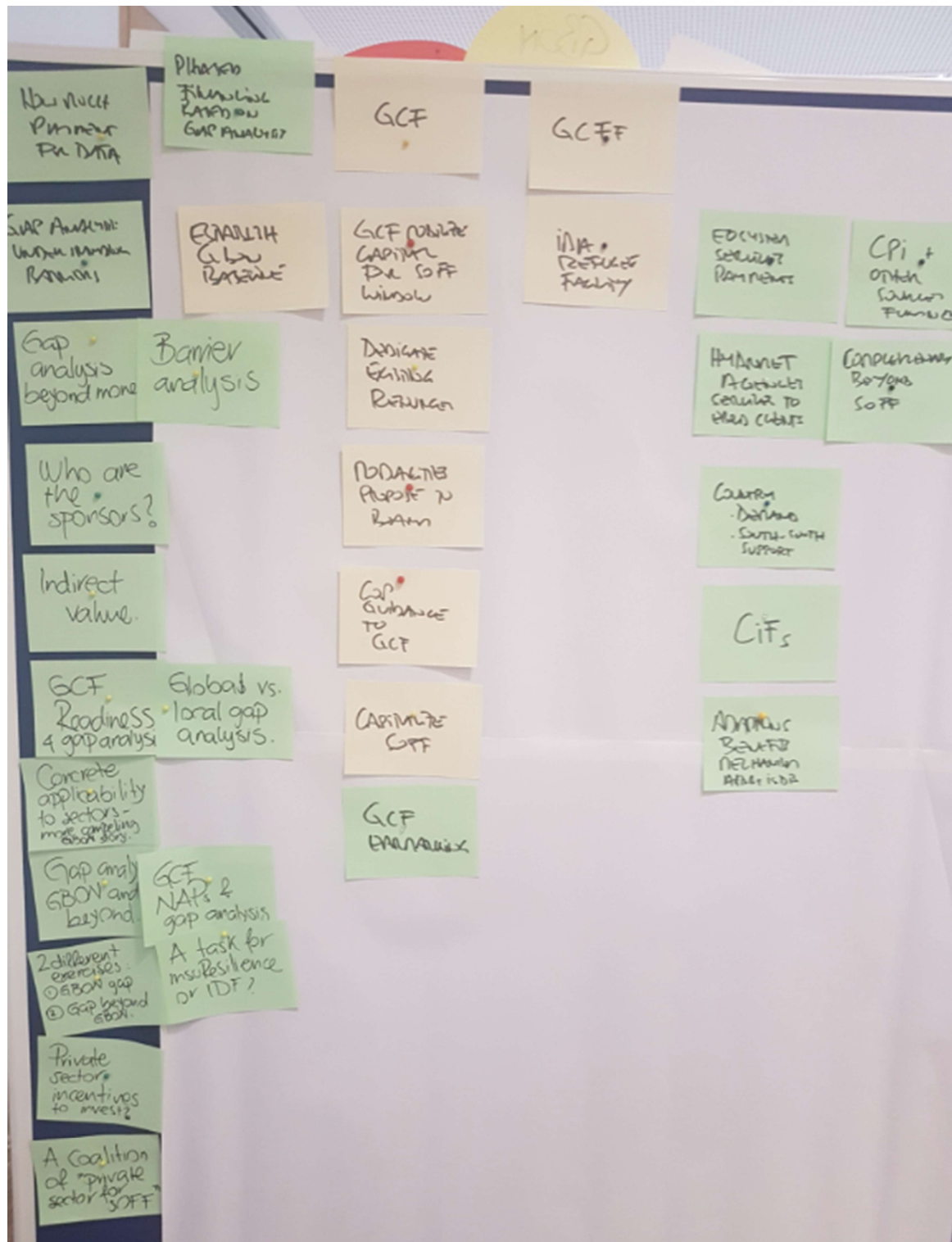




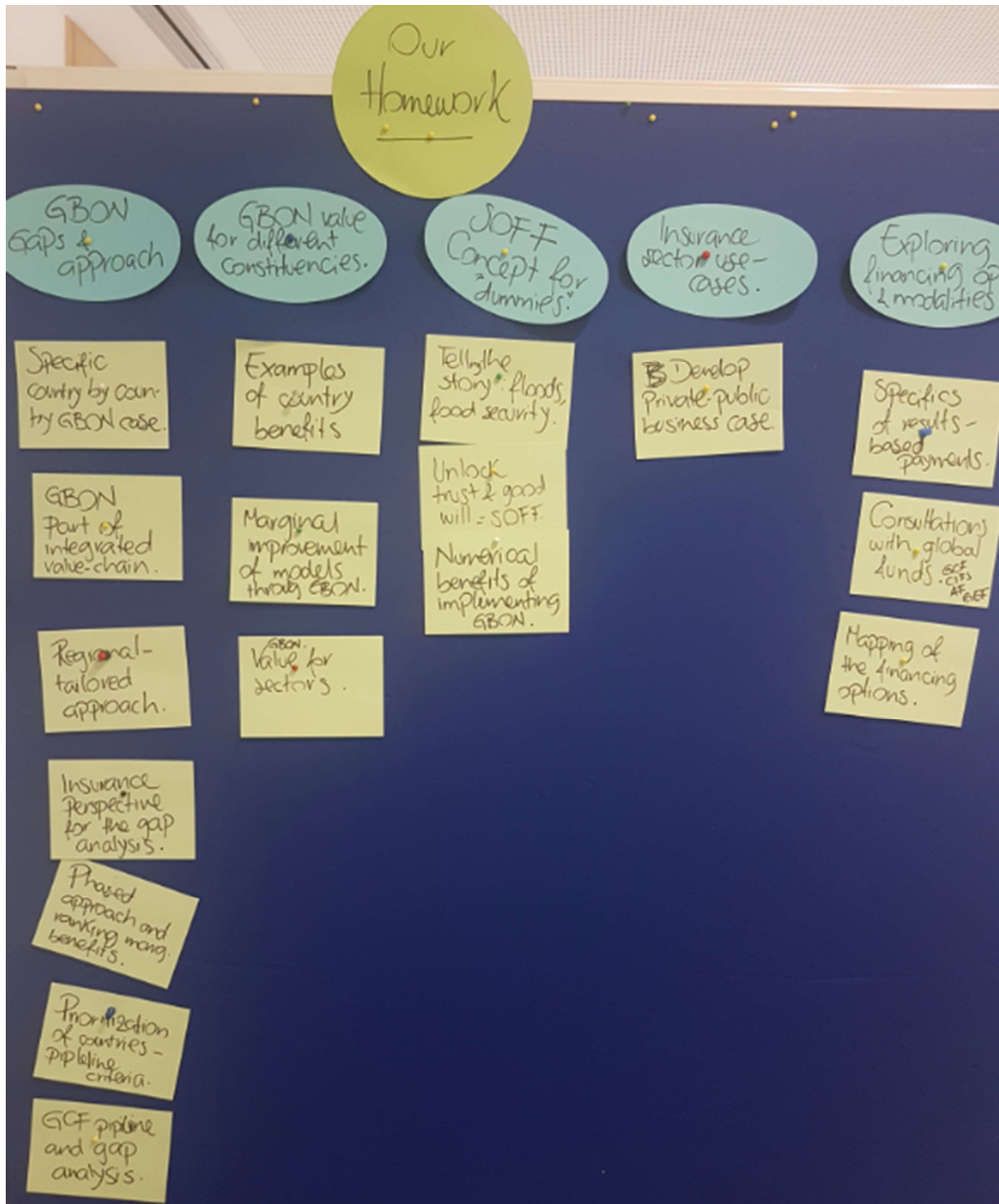
Annex 18: SOFF feedback received softboard



Annex 19 : Exploring blended finance opportunities softboard



Annex 20: Our homework – input for working groups softboard





Our Homework

Champions Advocacy.

WMO Champions

Private sector within the weather enterprise.

WMO family good will.

Country - demands for SOFF (WBS).

Mobilize Countries.

Engage ATM1.

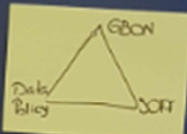
Consultation with WMO members.

Met offices contributing to CSI.

Involve humanitarian agencies

Data policy:

Change culture - benefits of sharing.



Communications material.

Glossary of terms.

Use Hydromet Gap Report.

Finish WB paper.

Get clear mandate from the EC on SOFF



Annex 21: Participants final feedback - mentimeter®

How has this workshop been beneficial to you and your organization?



How has this workshop been beneficial to you and your organization?

Mentimeter





How has this workshop been beneficial to you and your organization?

Importance of having a compelling proposition for COP

Value of GBON should take into account local adaptation benefit

Providing a vision for a brighter future forecasts globally to be even more useful

Better understanding of the arguments for GBON, and evidence of global support. But let's not underestimate the challenge of execution with country partners

Urgency to proceed

A greater understanding of the benefits and how SOFF will help make GBON have lots of work to do in a short space of time

Opportunity for investment in specific projects to support SOFF.

Importance to link local project interventions with GBON at global level

Thank you for putting this together

How has this workshop been beneficial to you and your organization?

Mentimeter

Clear alignment of GBON with our organization mandate

Looking forward to the gap analysis to go the next steps.

It has given us a strong push in the right direction

Governance structure of SOFF will be important to use fund effectively at local level.

A clear business case on national level as well as for the private sector regionally as well as globally will help advocacy.