



WORLD  
METEOROLOGICAL  
ORGANIZATION

Open Consultative Platform



Report of  
High-Level Round Table  
5–6 June 2019  
Palexpo, Geneva

# OPEN CONSULTATIVE PLATFORM

PARTNERSHIP AND INNOVATION  
FOR THE NEXT GENERATION OF  
WEATHER AND CLIMATE INTELLIGENCE

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## Foreword

Partnership is deeply in the DNA of the WMO. The global system of systems we have built together was a collaborative effort of many players from the public, private and academic sectors, everyone playing a role in their specific fields. What we would like to see happening in the future is a more synergetic partnership through which we can help the global society mitigate the huge challenges related to climate change, extreme weather, water scarcity and environmental deterioration.

Today, there is a need to join forces for a **people-centric** and **planet-centric** future collaboration, based on a common vision and commitment. I would like to express my sincere thanks to all the leaders from our weather, climate and water community – heads of international agencies, directors of NMHSs, CEOs and other senior managers from lead companies, world-known scientists – who participated in the special event that took place during the Eighteenth World Meteorological Congress and the Meteorological Technology World Expo 2019 in Palexpo, Geneva.

The Open Consultative Platform – **Partnership and Innovation for the Next Generation of Weather and Climate Intelligence** – has been established. In order to achieve its ambition, we need to build trust and fostered joint actions to address the numerous challenges.

Eighteenth World Meteorological Congress adopted the Geneva Declaration 2019: **Building Community for Weather, Climate and Water Actions**. The declaration outlines a clear policy direction for inclusive partnerships and the Open Consultative Platform will serve as a relevant mechanism for engagement in the WMO processes for all those who wish to contribute from all sectors.

I am pleased to present this Summary of the High-Level Round Table discussions which contains a Joint Statement and a description of the way forward. I hope that we will continue to meet together on annual basis to monitor progress and would like to assure you that the WMO Secretariat will provide the necessary support to the Platform and related future initiatives.



Petteri Taalas  
Secretary-General

## General Summary

### Opening

A High-Level Round Table for the Launch of the Open Consultative Platform (OCP) was held on 5 and 6 June 2019 at Palexpo, Geneva, in parallel with the Meteorological Technology World Expo 2019 and the Eighteenth World Meteorological Congress. Forty-two executive officials, scientists and experts from partner organizations, National Meteorological and Hydrological Services, industry, academia and learned societies participated in the Round Table (The list of speakers is in [Appendix 1](#)).

The round-table event was opened by Professor Petteri Taalas, WMO Secretary-General, on Wednesday, 5 June 2019, 1 p.m. In his opening remarks, he advised on the deliberation at the Eighteenth Congress to adopt a new Geneva Declaration 2019: “Building Community for Weather, Climate and Water Actions”. The declaration provides a clear policy statement for partnerships and engagement of all sectors, and the OCP would create a leading mechanism to underpin the relevant WMO processes and furthermore to stimulate the collective and harmonised dialogue among those who wish to contribute from all sectors. Professor Taalas highlighted the WMO proposition to use its strong convening power to facilitate the dialogue between the various stakeholders that would lead to concrete actions, to include: better engagement of private sector and academia expertise in the new WMO technical commissions; convening global and regional events on the grand challenges, e.g., a Global Data Conference in 2020, which would be open to all sectors and stakeholders; organizing regular Regional Conferences where again the private sector would be welcome. He concluded that, to shape better all these plans, there is a need for a sustainable consultative mechanism where all players can raise issues and build consensus-based recommendations on identified challenges, which was the main idea behind the OCP.

### Proceeding

All information on the Round Table, including the relevant documents and presentations, are available online at the website: <https://ppe-openplatform.wmo.int>.

Prior to the Round Table, all participants were invited to contribute to a brief survey to share initial thoughts on their vision for the next 10 years and related obstacles/barriers that need to be overcome. The survey also asked about expectations and suggestion on the future operation of the OCP.

Following the “Chatham House rule”, a summary of the main views, without attribution to their originators, is presented at [Appendix 3](#). The result identified five themes as common concern and areas for opportunities: (1) data and more (shared) data; (2) forecasting and forecasters; (3) demand and supply of services which drive decision-making; (4) capacity gaps, and; (5) roles, responsibilities and partnerships for common actions. A brief description of each theme, including the key challenges within, is presented in the **following section**.

The Round Table discussion was held in five thematic parts, which are summarized in the section below. The audience was engaged in the discussions through an open email channel ([ppe@wmo.int](mailto:ppe@wmo.int)) for questions and comments, which were incorporated in the discussion as well as in the Joint Statement.

## **Brief description of themes on key challenges**

(as discussed at the High-Level Round Table)

### ***Theme 1: Data and ... more (shared data)***

Much more data from diverse traditional and non-traditional sources is expected to become available and this will create huge opportunities to improve services. Data providers will come from all sectors – public, private and academic. Issues related to future data that need to be addressed include: data ownership and rights; economic models for data provision; data policies, including WMO Resolutions; incentives for better data sharing; data standards and validation of data quality; etc.

### ***Theme 2: Forecasting and .... forecasters***

The future is in Earth System modelling with growing complexity and incorporating more datasets for diverse elements of the system. Challenges and opportunities related to NWP advancement include: improved (or making it obsolete) parametrisation and improved model physics; further finer resolutions with model grid approaching 1 km; utilization of affordable exascale computing; better assimilation of satellite data at smaller scale. The growing data volumes of NWP output will challenge the capacity of communication networks, especially in the developing world. Another group of challenges include: automation of forecast production and use of Artificial Intelligence (AI) in helping to provide more precision in local forecasting; related changes in required qualification and competence of forecasters and weather broadcasters and changing role in the value chain, especially during periods of high-impact weather; strong partnership with academia required to drive a paradigm shift in forecaster training; partnerships between the public, private and academic sectors to foster innovation in end-products and services; communication of more precise weather information to individuals and communities.

### ***Theme 3: Demand and Supply of Services ... Weather/Climate/Water/Environment intelligence driving decision-making***

The societal demands for meteorological information are increasing, in part because of climate change and in part because of the increasing complexity of society itself. Convenient and affordable access to weather services is therefore a major step forward. Challenges to be addressed include: how to achieve better partnership between public and private sectors to speed up innovation in services; tailoring to decision-makers at all levels – from nation's governments, through to cities, regions, towns and even small communities; availing of scientific advice in critical decision-making; the move to integrated decision-support systems (IDSS); addressing as a priority the protection of life and property; defining better the roles of public and private sectors; increased engagement with economic and social sciences.

### ***Theme 4: Capacity Gap – Alleviating inequality and advancing together***

The development funding that has been invested has not resulted in sufficient rising of the capacity of developing countries. Among the reasons for this are an overly strong focus of investment in high-technology infrastructure that lacks sustainability, and lack of systematic approach to the modernization process. Recognizing that perhaps 150 Members of WMO cannot fully access the richness of data created by the World Meteorological Centres and other available sources, challenges to be addressed include: the need to convince Governments of the crucial importance of sustainable investment in basic infrastructure and essential services; stimulating a paradigm shift in the work of many NMHSs towards developing user orientation to enhance the value for society through fit-for-purpose services; setting up partnerships and collaboration needed along all elements of the value chain; ensuring the people with the right skills are in the right positions; focus on "quick wins"; actions towards gender equity; evaluation of future training needs, programmes and formats; promoting the new skills needed in communication, teamworking and influencing; creating additional value at the high-technology end of the business.

## ***Theme 5: Roles, Responsibilities ... Partnerships for common action***

A cultural change was needed to adopt approaches for real partnership. Better understanding of the needs and motivation of the stakeholders in the different sectors need to be built. Building trust is essential. To generate these major elements of better partnerships, challenges to be addressed include: organize and sustain the dialogue; common endeavours to build trust, sharing of the risks involved, recognition of the inter dependences; clarify the respective roles and responsibilities of the public and private sector, including through legislation, towards maximising the strengths of both sectors; contribution to the common good of end users as a key aim; sustaining the public sector funding and capabilities; develop formal and informal mechanisms to promote partnership between the public, private and academic sectors.

## **Summary of Roundtable Discussions**

### ***Theme 1: Data and ... more (shared) data***

The contributors on this theme were Sue Barrell, Alain Ratier, Øystein Hov, Jim Anderson, Gerhard Adrian and Kjell Forsén. The discussion was summarised by Petteri Taalas.

The contributors emphasised that while the expectation was for much more data to become available, there was a need for an emphasis on quality. The impact of the data on improving services was crucial, and this could only be achieved with more high-quality data as well as devising means to properly exploit lower-quality data. Investment in new technologies would be required to help provide this increase in high-quality data.

Data rights were also an issue – an economic model was needed that would promote the free and unrestricted availability of data, and respect national sovereignty, while allowing some commercialisation of data for private sector providers. In particular, the global NWP centres needed to be able to access the same high-quality dataset to stimulate competitive improvements in modelling. A greater diversity of data was also needed, as the requirements of the front-end delivery systems were additional to the needs of the back-end NWP. The EU promotes free and unrestricted use of environmental data while balancing the rights of public and private sectors through legislative frameworks.

WMO Resolution 40 (Cg-XII) was seen as a strength which had supported the free and unrestricted use of data, but the Annex to the resolution possibly needs to be updated to reflect changes over the past two decades. WMO will convene a data conference in 2020 which provides a forum to address this issue.

### ***Theme 2: Forecasting and .... forecasters***

This theme was considered by Florence Rabier, Kevin Petty, Tim Palmer, David Parsons, Karl Gutbrod, Sarah Jones and Jay Trobec. A summary was provided by Pavel Kabat.

Earth System models are developing in complexity, and incorporating more datasets for diverse elements of the ecosystem. There is now a need for observations from many more sources. While considerations of uncertainty mean that there will never be a perfect forecast, the challenges are to improve the parametrisation and also the model physics. Parametrisation difficulties will largely disappear as model grid approach 1km, which is becoming feasible now with affordable exascale computing. Better assimilation of satellite data at these smaller grid scale will be a critical step. However, the growing data volumes of NWP output will challenge the capacity of communication networks, especially in the developing world.

While some of the larger private sector companies are now running their own NWP model suites, they still rely heavily on the public sector for support in model development. Better models can be developed if public and private can find ways to work together.

While Artificial Intelligence (AI) will contribute value, especially in helping to provide more precision in local forecasting, these developments too will need collaborative work

between public and private sectors. The public meteorological sector needs to be strong, and the political and economic decision-makers should understand this.

Forecasters and weather broadcaster will continue to play an important role in the value chain, especially during periods of high-impact weather. However, the job is changing and while some old skills will become redundant, new skills will be needed; while AI will become stronger, human intelligence will always be needed. Forecasters will be busy for a long time yet.

A strong partnership with academia is required to drive a paradigm shift in forecaster training, respecting the newly-developed didactic approaches that focus on Competencies. Partnerships between the public, private and academic sectors can also foster innovation in end-products and services. The challenge will be to communicate more precise weather information to individual communities.

### ***Theme 3: Demand and Supply of Services ... Weather/Climate/Water/Environment intelligence driving decision-making***

This theme heard contributions from Naoyuki Hasegawa, Andrew Eccleston, Ralph Renner, Christophe Cudennec, Agnes Kijazi, Young Yu, and Michel Jarraud. The contributions were summarised by Louis Uccellini.

The vision for successful weather, climate and water services was that all should be able to receive the information they need as and when they need it. The societal demands for meteorological information are increasing, in part because of climate change and in part because of the increasing complexity of society itself. Convenient access to weather services is therefore a major aspect.

To achieve this vision will require partnership between public and private sectors; the public sector providing the foundations and the private sector providing much of the innovation. For this to succeed clarity of roles is necessary, but this will vary from region to region and from country to country.

While better and more comprehensive datasets will be required, greater understanding and knowledge will also be critical in transforming improved data into better services. Partnerships with academia need to facilitate the transfer of knowledge from the academic environment to the service-delivery sector.

While WMO is organised around Members as nations, there are many important decision-makers at other levels – such as cities, regions, towns and even small communities. Many of these persons are still not availing of scientific advice when making decisions; sometimes decisions of great consequence. All of these need to be integrated into the decision-support framework if society is to attain the Sustainable Development Goals – and the time to 2030 is very short.

The priority must remain the protection of life and property, and the public sector needs to retain the primary role in issuance of warnings. Beyond that the benchmark is how to better serve society, recalling that there is no intrinsic value in a forecast or warning; the value is only generated when a forecast or warning is used or acted upon.

### ***Theme 4: Capacity Gap – Alleviating inequality and advancing together***

The contributors on this theme were Vladimir Tsirkunov, Albert Martis, Djime Adoum, Patrick Benichou, Pauline Dube, 'Ofa Fa'anunu, Deon Terblanche, Michel Jean, and Bob Riddaway. The discussion was summarised by Michael Staudinger.

There was widespread recognition that much of the development funding that has been invested has not resulted in sufficient rising of the capacity of developing countries, or close the capacity gap adequately. Among the reasons for this are an overly strong focus of investment in high-technology infrastructure without considering the sustainability of this equipment. There is a need to convince the clients of development funding of the crucial importance of sustainability.

There has thus been too little emphasis on improving service capacity and service delivery. NMHSs need to understand better the needs of users and to work with users in



designing better services. There will be some quick wins, but in the longer term the improvement of service delivery depends on people.

HR management will be a critical element in this, ensuring the people with the right skills are in the right positions. Gender equity is an important facet also – for too long the role of women both within meteorology and as users of meteorological services has been disregarded. Training is also crucial, especially given the changing role of the forecaster, and the development of the Global Campus is intended to help address this. The skills of good communication, teamworking and influencing will be paramount. Some countries have integrated social science expertise into policy development and have seen the benefits of this.

Partnerships and collaboration are needed along all elements of the value chain. The THORPEX experiment showed how, with the creation of a Grand Global Ensemble, extra value could be created at the high-technology end of our business. Meanwhile, we must recognise that perhaps 150 Members of WMO cannot fully access the richness of data created by the World Meteorological Centres as things stand.

At the service delivery end, the importance of recognising and incorporating traditional knowledge needs to be kept in mind. Knowledge must be communicated to users within a framework that they can accept, understand and use it. The Regional Climate Outlook Fora are a successful example of how the appropriate provision of advice can contribute to food provision and help avoid disasters.

The capacity gap may have reduced somewhat, but it is still a huge gap. Business-as-usual will not accelerate the closing of this; we need to stimulate a paradigm shift in the work of many NMHSs.

### ***Theme 5: Roles, Responsibilities ... Partnerships for common action***

This theme was considered by Brian Day, Andrew Johnson, Maxim Yakovenko, Abdalah Mokssit, Matthew Alto, Phil Evans, Miloslav Tlamicha, Daisuke Abe, and Roger Pulwarty, A summary was provided by Celeste Saulo.

Many of the contributions to the discussion focused on the theme of trust. A change was needed from the old "Us versus Them" approach to real partnership, but partnership can be difficult. As scientists and engineers, we tend to question everything but questioning the motivation of partners weakens us all. Real partnership means looking and the needs and problems of others. It needs sustained commitment and investment. The problem is often ourselves and the attitudes we bring.

Partnership is based on dialogue, which means listening. It helps if the partners are at different points along the value chain, and have a unique and differentiated offering. Common endeavours can help to build trust, but we do need to reflect deeply on what success might look like. Partnerships should mean a sharing of the risks involved and not focusing overly on who gets the credit.

Partnerships between public and private entities should be built on the recognition of the mutual need of one for the other. The public sector can provide the solid foundations for the weather business; the private sector can catalyse innovation. Clarity in regard to the respective roles and responsibilities is needed; sometimes this can be provided through legislation, but it should be based on maximising the strengths of both sectors.

The private sector can add value to public sector data, but users often need to better appreciate the underlying quality provided via the public sector. Contribution to the common good of end users is the key aim, and the maintenance of the public sector resource needs to be encouraged. This is especially important given the acceleration of climate change and the increasing risks to society that result.

Finally, many contributors mused on the mechanisms – both formal and informal – needed to promote partnership between the public, private and academic sectors. Leadership is essential if all partners are to move collectively together, recognising that "If you do something for me, but without me, then it is against me". There is a need to clearly articulate an "Architecture of Participation". The World Bank, through supporting the Global Weather Enterprise process, has taken some welcome steps; contributors

welcomed the leadership of WMO in convening the OCP and establishing a framework to encourage deeper public-private-academia engagement.

## **Closing and Way Forward**

After a lively and stimulating exchange of views and opinions, the participants agreed with a proposed future developments around the OCP, including: (1) the need and the benefit of participating in the OCP to make it an inclusive and sustainable dialogue mechanism; (2) the WMO's role as a convener and facilitator; (3) the need to identify and work on "grand challenges" through a collaborative process; and (4) to keep momentum by organizing annual events to review progress and provide further directions (with a proposal for the next event to be conducted in June 2020).

As a main outcome from the High-Level Round Table event, the participants overwhelmingly agreed on a Joint Statement regarding the OCP as provided in [Appendix 2](#), a blueprint for the future collaborative actions of the stakeholders.

The High-Level Round Table for the Launch of the OCP was closed at 3 p.m. on Thursday, 6 June 2019.

## Appendix 1. Speakers

### OPENING



**PETTERI TAALAS | Secretary-General, World Meteorological Organization (WMO)**

*"I regard this as a historical event because we have never brought so many private sector, public sector and science and academic sector leaders around the table. This is a demonstration WMO is moving in a new direction and you are facilitating this change. ... The key for success is the trust. We have to build more trust between the various players and join forces to build win-win partnerships."*

### THEME 1: DATA AND ... MORE (SHARED) DATA



**SUE BARRELL | Former Chief Scientist, Bureau of Meteorology, Australia**

*"Data is the lifeblood of WMO and has always been at very heart of what we do. The landscape is changing - escalating volume, sources, actors, choices... It is hoped that WMO will adapt and better capitalize on further changes in the data landscape and set a better framework for working together effectively, productively and fairly with all the players engaged in the data space."*

**ALAIN RATIER | Director-General, European Organization for the Exploitation of Meteorological Satellites**

*"We need to realize that we not only need more data but better data. ... It's absolutely essential that all global NWP centres get access to the same set of critical satellite products to work on fair competition basis ... competition in NWP is an incentive and needs to continue to bring forward meteorology and improve forecasts for citizens."*



**ØYSTEIN HOV | Secretary General, Norwegian Academy of Science and Letters**

*"The topic is data for research - "data for science, science for service". The threat is that if "data altruism" is wide spread, someone may collect everything and monopolize. We need input and intellectual capacity from everyone to get the product right."*

**JIM ANDERSON | Senior Vice President, Earth Networks**

*"... having clear consistent data rights can really help the private sector in developing more usage of those data in save life and properties... so if we can create a right economic model we come up with a way to fill those gaps and sustainable over time and to combat the challenges."*





**GERHARD ADRIAN | Permanent Representative of Germany with WMO; President, Deutsche Wetterdienst**

*"This is also a legislation of our cooperation dealing with PPE and data exchange here also include intellectual property aspects...this directive or this legislation is consistent through the WMO Resolution 40, which was mentioned by the Secretary-General and the basic principle is that free and unrestricted access to such data needs we must not give up."*

**KJELL FORSÉN | CEO, Vaisala**

*"So far to me that really has been the paradigm of the Met community that the type and quality of data is what as value. And make sure that the forecast is better and better and I think that is something which should not be compromised going forward... This is a huge investment which is needed from the entire communities very much from the cooperation between all of us really to take the art of high quality observations forward. We have done it before and we can do it also going forward. So what we really want to stress is that we should not compromise the quality of data."*



**THEME 2: FORECASTING AND ... FORECASTERS**



**FLORENCE RABIER | Director-General, ECMWF**

*"What we call earth system for doing medium-range weather forecasting is coupling the atmosphere with the land, with the ocean, the waves, the sea ice, and possibly later with aerosols and ozone, and other constituents. Earth system modelling is indeed a reality, for which we need more observations from all these fields and more exchange of observation."*

**KEVIN PETTY | Director, Science and Forecast Operations, IBM, the Weather Company**

*"There is an evolution going on ... the private sector continues to grow, not only in terms of size but in terms of the competency. When we talk about tackling some of the world's most challenging problems., the private sector cannot do it alone. ... The traditional forecasting approaches are going to continue to be a fundamental part of our community, but we'll push all other areas like artificial intelligence and machine learning to tackle these challenging problems. "*



**TIM PALMER | Royal Society Research Professor in Climate Physics, University of Oxford**

*"One thing that's holding us back in weather forecasting and climate prediction is our reliance on parametrizations for crucially important processes – the convective cloud systems, orographic gravity wave drag, and for oceans – the mesoscale eddies problem. These can all be solved if we could get down to about one-kilometre grid in global models and this is possible now with the advance of exascale computing technology. This is the single most important issue for the Numerical Weather Prediction."*

**DAVID PARSONS | President's Associates Presidential Professor, School of Meteorology, University of Oklahoma**

*"Moving to earth system and high resolution, convective permitting models really requires a transformation in our research approaches. If we're moving from drawing weather maps to deep learning techniques including machine learning, we need a paradigm shift in how we educate our atmospheric scientists, not only in leading countries with the big operational centres, but around the world. This really calls for a partnership between the operational private sector and the academic educational communities"*



**KARL GUTBROD | CEO, Meteoblue AG, Switzerland**

*"Artificial intelligence is enabling us to make better forecasts - by combining models we can get an increase of precision of 20% as compared to the single model. A message here on behalf of the private sector is that this can only be done with a big public investment in the infrastructure and the models. We will not be able to do this alone as a private sector and this fundamental infrastructure necessity has to be communicated to stakeholders, to the public and to politicians."*

**SARAH JONES | Director, Research and Development, WWRP, Deutsche Wetterdienst**

*"There is a very strong tradition of working in partnership in research and development for numerical weather prediction and forecasting tools. There is also innovative product development happening in both the private sector and the public sector. And when we try to accelerate this process, the key is co-design in research between the people using the information and the people developing the information. "*



**JAY TROBEC | Chair, International Association of Broadcast Meteorology**

*"As communicators, we are the interface between the forecasters and the people. We are always trying to get better data, to get better predictions from numerical weather predictions, but we have to keep in mind that our main task is communicating to people, especially in times of high impact weather. With the new technology, we need to figure out how to do a better job of adapting our message down to individuals and communities. "*

**PAVEL KABAT | Director of Research and Chief Scientist, WMO**

*"I will summarize this session with a call for partnership needed to meet the imminent challenges. There is a strong link with the data theme, the age of new data (big data, public data, private data). We should resolve the issue about the quality. WMO would like to see how good these data through simulation exercises. There is a clear recognition that a landslide change comes across and partnerships between the communities are a must."*



## THEME 3: DEMAND AND SUPPLY OF SERVICES ... WEATHER/CLIMATE/ WATER/ENVIRONMENT INTELLIGENCE DRIVING DECISION-MAKING



**NAOYUKI HASEGAWA** | **Director-General, Forecast Department, Japan Meteorological Agency**

*"Concerning the roles, I expect more engagement in services from the private sector because they have a variety of means to deliver the information and because they are very quick to react to changing requirements. Of course, the public service will continue playing its role; it's going to be only possible when we put in place a good framework to define the roles to be played by private sector, public sector, and perhaps academic as well."*

**ANDREW ECCLESTON** | **General Secretary, PRIMET**

*"The most important thing to emphasize is that the private sector needs the public sector to operate and be well funded. Anything that gets in the way of serving the community in the best way we can, using the best science and technology we have, is a barrier. One of the risks is that public sector may seek to control the value chain between the science and the end-user, something we should be mindful about."*



**RALPH RENNER** | **President, Weather Risk Management Association; Head of European Origination, Sompo International Holdings Ltd.**

*"I represent weather risk management industry, insurance brokers, data providers; we are part of the weather enterprise and we sit further down the value chain. We require highest quality data without which we are unable to provide the services that we offer. Our services are crucial in mitigating weather and climate risks often for societies that are very vulnerable and very exposed. We encourage you on your path to come up with better, higher quality data sets because this is really at the core of our work."*

**CRISTOPHE CUDENNEC** | **Secretary-General, International Association of Hydrological Sciences**

*"From a hydrological perspective, we really have to facilitate an intelligent articulation of interoperability of weather, climate and hydrology core services, keeping in mind the strong intrinsic complexity of hydrological systems and their interfaces with the atmosphere, the cryosphere, the oceans, etc. As scientists, we have to facilitate the translation of methods, information, knowledge out of the labs into the value chain and into services for society and end users."*





**AGNES KIJAZI | Permanent Representative of Tanzania with WMO; Director-General, Tanzania Meteorological Agency**

*"There is an increasing demand for services, especially because of the climate change and the increased amount of extreme events. However, the capacity to provide this kind of services is very low in most countries in Africa. It is important to find a way in our countries, with assistance from WMO, to integrate weather and climate services in the decision-making. Engagement with private sector is a good idea but there is a need to come up with the right procedure. It is important to define the roles of each sector and how we can work together. At the end, it should be a win-win situation."*

**YOUNG YU | Deputy administrator, China Meteorological Administration**



*"The technology has always had the potential to improve services. In China, we have achieved a record high annual satisfaction rating for the public service of 90.8% in 2018. Location specific weather services through apps are provided by both public or private sector. CMA is the authority for issuing public weather forecast and warnings, but we also share those with private companies and we encourage them to re-distribute to the public through their own apps and social media. Partnership has constructed an ecosystem of weather service in which we meet societal needs together."*



**MICHEL JARRAUD | Secretary-General Emeritus, WMO**

*"It is not sufficient to consider government, private sector, and academia only. Some emerging actors are getting extremely important in the decision-making, particularly the local and regional authorities, the big cities, etc., and they need to be integrated. It is good to be optimistic but, at the same time, the time horizon of 2030 is very near and probably we would not have completely solved the problem about the capacity gap by then. Among the most serious challenges is the fact that many top decision makers and leaders don't seem to have taken seriously onboard the climate change and disaster prevention, and often act only after the disaster. We need to work and sensitize those top decision makers and, as articulated in the WMO mission, make sure that we deliver the message – the protection of life and property is our ultimate priority."*

**LOUIS UCCELLINI | Permanent Representative of United States of America with WMO; Assistant Administrator, NOAA for Weather Services; Director, National Weather Service, USA**



*"The expectations are increasing because people understand that their lives and livelihood actually depend on what we do. This increasing demand pie is what's changing the dynamic between the public and the private sector in the provision of services. Private sector comes in and slices off part of that pie, the public sector immediately gets worried. There is no way the public sector can provide all service that's needed in this growing area because people are using the information in ways we never dreamed of. We are seeing our products and services being used in energy, in agriculture, in recreation, in transportation, in health. I think we are poised to make tremendous strides not only for customers but we are influencing humanity in a recognizable way."*



**DAVID GRIMES** | Permanent Representative of Canada with WMO; President, WMO

*"A key message that was pervasive in all the discussions was that we need to strengthen the relationships among all actors, to recognize all the practitioners. Upstream decision-makers make decisions related to large policies, but there are those who make decisions that are even on a micro scale influencing the well-being. When you start to map that out, you realize another key aspect which is that everyone has a reliance on everyone else in this process."*

**THEME 4: CAPACITY GAP ... ALLEVIATING INEQUALITY AND ADVANCING TOGETHER**



**VLADIMIR TSIRKUNOV** | Lead Specialist, Hydromet Program, Global Facility for Disaster Reduction and Recovery, World Bank Group

*"We are strongly committed to work with WMO, NMHSs, private sector, academia and all the developing partners, to improve service delivery in the developing countries. The most important priority in my view is the level of government commitment. This is still an issue in most of the developing countries and thus, one that we should address."*

**ALBERT MARTIS** | Permanent Representative of Curaçao and Sint Maarten with WMO; Director, Meteorological Department Curaçao

*"We can invest millions in a country but if you don't have the right people in the right seats they will not be able to make sustainable progress. That's why human resource goes hand in hand if you want to have a sustainable project in the country. We have to make sure to get the right people with the needed capacity."*



**DJIME ADOUM** | Executive Secretary, Permanent Interstate Committee for Drought Control in the Sahel

*"For the last 30 years, Agrimet centre has been providing technical leadership in Africa. We have not been able to avoid all disasters but our network has been extremely helpful and in developing institutional capacities for NGOs, institutions and member states. The launching of this platform will allow us to bring various experiences and then scale up to multipurpose system that could change the landscape. We are facing food shortages in Africa and CILSS would like to play a part in this new partnership together with the World Bank and other banks involved."*

**PATRICK BENICHOU** | President, Météo-France International

*"The future of many NMHSs is at stake if they do nothing. NMHSs need to rethink their strategy and business model with one single goal, being a key player in their country and contribute to the socio-economic development. PPE may help the NMHS grow and satisfy the growing service expectations and we need a proper business model for that. There is no universal tool but there is a clear win-win objective to make PPE successful and sustainable over time."*







**PAULINE DUBE | Professor, Department of Environmental Science, University of Botswana**

*"We are making progress in closing the gap, but the gap we are dealing with is huge. It's a gap that's related with prosperity in one region creating vulnerability in another region. It cannot be closed by the WMO alone or by a single individual, but there is a room for us all to contribute. The other thing which is really important is to stay alert and be ready when the optimum time come to communicate the information."*

**'OFA FA'ANUNU | Permanent Representative of Tonga with WMO; Director, Tonga Meteorological Service**

*"What is very important is to be here at this table and participate in these discussions. With the climate change affecting Pacific islands, it is crucial to form partnerships and bring funding. There are many opportunities but we need to overcome the lack of understanding how to build partnership; a lot of training is needed for the small island states – they need to be here in the room and talk about it. Having support from the top level in the country is a top priority."*



**DEON TERBLANCHE | Special Science Advisor, South African Weather Service**

*"We have the emerging seamless global data processing and forecasting system and we have various initiatives like the severe forecast demonstration project. This gives us a framework in which it's clear that everybody doesn't have to do the same thing, but we each need to do what we do best for closing the capacity gaps. The earth system approach and the seamless nature of the new strategy of the WMO brings many opportunities to us, researchers and social science together."*

**MICHEL JEAN | President, Commission for Basic Systems, WMO**

*"Gaps are along three fronts: technology, governance and people. The technology makes data available and useful, the smart AI tools allow to make information fit-for-purpose. Governments need to find a way to collectively work better to fill the gap. There should be a fundamental shift for many NMHSs around the world - rather than trying to catch up, they should look into the future. Final point on the people, gender equality is extremely important, we need to think a complete new approach on training and capacity development, because the weather service will not be the same at all in ten years."*



**BOB RIDDAWAY | President, European Meteorological Society**

*"The education and training programme has been aiming to close this gap. The gap is still large ... and there is something new, the WMO Global Campus which is a way of encouraging to share resources and collaboration. Future services will require a different kind of skills, like communication skills, team working and influencing. The challenge is going to be how do you support the services in developing that kind of work force."*

**MICHAEL STAUDINGER** | Permanent Representative of Austria with WMO; Director, Central Institute of Meteorology and Geodynamics



*"To build sustainable capacity, we need to think both short term and long term. If you do not have the long-term view, the funds which are necessary to build the capacity will be lost. A shift from infrastructure investment towards service capacity is essential. That's a paradigm shift in the development assistance. It should address the full value chain and be inclusive. This may be the way to the success."*

## THEME 5: ROLES, RESPONSIBILITIES, PARTNERSHIPS FOR COMMON ACTIONS



**BRIAN DAY** | Chairman, The Association of Hydro-Meteorological Equipment Industry

*"When it comes to partnerships, you are not looking at your need, you are looking at the needs of your partner. If you are looking at your needs only and your partner looking at their own needs, that's a negotiation which doesn't foster good solutions. Partnerships are stimulated when we articulate what the big vision is and the problem we are trying to solve. We have to look at this as a culture problem that we need to solve through building trust."*

**ANDREW JOHNSON** | Permanent Representative of Australia with WMO; CEO and Director, Australian Bureau of Meteorology



*"The lessons we could learn from other sectors include four things. First is that initiating and sustaining partnership is a serious professional undertaking; really great partnerships cannot be ad-hoc and require much rigour and discipline. The second is that great partnerships require sustained investment and commitment over a long period of time. The third thing is that those involved need to really focus on where each one has a unique and different offering that can add value to one another. Lastly, it is fundamentally required to reflect deeply on what success looks like, how success is measured and recognized"*



**MAXIM YAKOVENKO** | Permanent Representative of Russian Federation with WMO; Head, Federal Service for Hydrometeorology and Environmental Monitoring, Russian Federation

*"The public sector and private sector, we all produce a product 'the pie'. It would be most useful for us and for the user to understand what has been used to make the pie, how you can eat it in the right measure, in particular when it comes to severe events. I would call for having a quasi-catalogue for the consumer and the user, so that they could understand what the forecast means and what decision they could make based on the kind of information they receive."*

**ABDALAH MOKSSIT | Head Secretariat, Intergovernmental Panel on Climate Change**

*"IPCC can act as a role model for partnership in science. Without science, we have no information to assist decision making. To have the right solutions, we need good science, we need good demonstrations and implementations. And we need to provide a very clear, concise and strong message for the decision makers. We are promoting the concept of knowledge management rather than crisis management. We should work all together in order to make science understandable and accessible."*



**MATTHEW ALTO | Manager, Global Data Partnerships, Accuweather**

*"Misunderstanding and lack of trust still exist and this would need to be alleviated in order to achieve anyone's mission for 2030. We need to seek to better understand each other and where we can best contribute to common goals and vision. Friends and colleagues in this room we need each other in order to be successful. We need clear well-defined, mutual agreement upon roles and responsibilities of the public private and academic sectors that will allow maximize all of our strengths."*

**PHIL EVANS | Chief Operating Officer, UK Met Office**

*"We tend to neglect some elements of partnerships, we think about it being all relative to those data and models, we don't think about operability of organizations, and people. The challenge for us is not the pace of change so much as the unpredictability of the change. That puts the pressure on individual organizations to figure out our relationships in order to be able to deal with change. The best way to break down the barriers and to build trust is common endeavour and those common endeavours will demonstrate to the rest of the community what could be achieved."*



**MILOSLAV TLAMICHA | Manager of Sales, Windy**

*"Without the private sector the change will be much slower and much more expensive. If we want to the change to happen in a foreseeable future, we should deepen our cooperation. The private sector is not here to steal your job or to destroy your work. We complement each other and I will go even further to say that without the public sector, the private sector simply couldn't exist, it would be impossible."*

**DAISUKE ABE | Director and Chief Service Officer of Weathernews Inc., Japan**

*"In Japan, the public-private engagement with the clearly identified roles of JMA and private companies, has successfully been functioning under the Meteorological Service Acts since 1952. The value of weather services has been increased tremendously. As a next step, we strongly expect that the OCP, through WMO, would establish a sound PPE framework that enables the society to best utilize the meteorological services."*





**ROGER PULWARTY | Senior Scientist, Physical Sciences Division, NOAA Earth System Research Laboratory in Boulder**

*"What makes us intelligent is the use of information to reduce risks, manage and take advantage of the opportunities provided by that information... But what does this mean in the context of how we should act, how we move from just risks to resilience. We talked about broadening the actor network, to mobilize social, economic and political will. It works when we are not just talking about academics and tools, we're not just talking about agencies and private capital, but we're engaging local conveners the implementers, the transaction brokers. We need a bit bigger framing for how we think; and ethics is crucial."*

**CELESTE SAULO | Permanent Representative of Argentina with WMO; First Vice-President, WMO; Director, Argentinean National Meteorological Service**

*"Partnership is essentially for all of us. One of the main elements of the partnerships is thinking about the needs of the other. Building from that and sharing a common goal of serving the society as a whole, I think we are moving in the right direction. This platform will truly help us because we are sitting and talking together and understanding each other better."*



## Appendix 2. Joint statement of High-Level Round Table

### Background

On 5 and 6 June 2019, more than 40 leaders from public, private and academic sectors participated in a High-Level Round Table on “**Partnership and Innovation for the Next Generation of Weather and Climate Intelligence**”. The Round Table, hosted by the WMO Secretary-General and convened in parallel with the Eighteenth World Meteorological Congress and the Meteorological Technology World Expo 2019, in Palexpo, Geneva, was conducted as an open event with more than 160 in attendance including delegates from the WMO Congress and Expo visitors. After two sessions of open and constructive exchange of views and opinions, participants overwhelmingly endorsed the following joint statement.

### Joint statement

#### Scope and purpose

On the brink of the third decade of the 21<sup>st</sup> century, the Global Risk Landscape<sup>1</sup> identifies extreme weather events, failure of climate-change mitigation and adaptation, natural disasters and water crises as top societal risks defined both in terms of impacts and likelihood. A rapid advance of science and service capabilities is a paramount necessity if we are to have a successful global response to those critical challenges. To that end, a significant responsibility rests on the global meteorological, climatological and hydrological communities to embrace new ways of partnership and collaboration.

In realizing the ultimate need for a new culture of partnership among the public, private and academic sectors, articulated in the *Geneva*

*Declaration 2019: Building Community for Weather, Water and Climate Actions*, adopted by the Eighteenth World

<sup>1</sup> World Economic Forum:  
<https://www.weforum.org/agenda/2019/01/these-are-the-biggest-risks-facing-our-world-in-2019>

Meteorological Congress, the WMO initiative in establishing an Open Consultative Platform (OCP) to coordinate and streamline a high-level dialogue between the sectors is both relevant and timely. It will nurture collaboration and innovation for the **new generation of weather and climate intelligence** embracing new information and technology across the whole value chain and enabling greater benefits for society.

The aspiration of the OCP, as a vehicle for sustainable and constructive dialogue between the sectors, is to help articulate **a common vision for the future of the weather enterprise** in the coming decade and beyond. By fostering a spirit of mutual respect and trust, the platform activities will enable all stakeholders in the enterprise to recognize challenges and embrace opportunities, both institutional and technological, to incentivize win-win approaches and help remove any barriers where misunderstanding or mistrust could jeopardize the shared goals of our community.

#### Objectives

The main objective of the OCP is to foster cross-sectoral, transdisciplinary and long-term approaches in identifying and addressing collaboratively the **grand challenges** facing the weather enterprise, particularly the protection of life and property from disasters and improvement of quality of life, in an open, constructive and participatory way.

It will aim to build concerted approaches to governance, policies and practices at international and national levels by:

- Scoping and monitoring trends and developments within and across the sectors;
- Deepening the understanding of drivers and enablers of the collaborative weather, climate and water enterprise and their impacts on systems and governance;
- Identifying potential barriers to mutually beneficial partnerships and proposing new solutions;

- Highlighting the implications of these dynamics to inform strategic initiatives that foster collaboration between the sectors;
- Showcasing successful partnerships;
- Building mutual understanding and trust.

### **Working methods**

The OCP is envisaged as an open and volunteer-based platform. Its main activities will be formed around an agreed list of thematic areas to address the grand challenges for the weather, climate and water enterprise. For each theme/challenge, relevant communities of practice will be invited to exchange views and experience and collaborate in formulating concerted position, documented in white papers. Based on such collective analytics, the OCP will generate collective calls for action and provide inputs and advice to the decision-making processes of relevant organizations and stakeholders. In doing so, WMO and other partners' channels for outreach will be fully exploited. The OCP will seek to inform and catalyse key activities within the enterprise that drive partnership and collaboration between public, private and academic sectors, and to be informed by the outcomes of those activities.

In the context of OCP, the WMO will take on the role of convener and facilitator to enable a sustainable dialogue between the sectors at appropriate levels with due respect for the mandates of institutions and interests of stakeholders. In doing so, WMO will provide sustained support for coordination through its secretariat. Through OCP as an overarching mechanism, WMO will seek to leverage complementarities with existing and emerging initiatives and partnerships.

An annual leaders' meeting is envisaged to review progress and guide future actions towards innovative and mutually beneficial partnerships.

### **Way ahead**

Through the OCP, WMO and its partners will carry out activities based on the recognition of the need to address the entire value chain for the development and provision of highest standard weather, climate, water and related environmental information and services, in their multi-sector and multi-stakeholder realm.

The participants in the OCP will carry out the following activities:

- Proceed with formation of multi-sector drafting teams to work on collaborative position / white papers, for the major themes identified at the Round Table meeting;
- Identify and promote good practice in public-private cooperation models in various national and international contexts;
- Jointly develop a code of ethics to provide principles and guidance relating to ethical behaviour;
- Inform and engage communities of practice both in WMO and at other events over the coming months and years, including a WMO Global Data Conference 2020, and forthcoming regional conferences/ workshops;
- Convene and participate in the annual OCP high-level event (next event – June 2020, during the Seventy-second Session of the WMO Executive Council).

Completed in Geneva, Switzerland,  
on 6 June 2019

## Appendix 3. Summary of responses to pre-event questionnaire

The main concept of the OCP is to help articulate a common vision for the future of the weather enterprise in the coming decade and beyond with the expectation that the next decade will be the decade of digital transformation in almost every sphere of businesses and human activities. To help the Round Table discussion, participants were invited, through a small survey, to share initial thought on their vision for the next 10 years and related obstacles/barriers that need to be overcome. The survey also asked about expectations and suggestion on the future operation of the OCP.

Close to 40 responses to the surveys have been received. In summarizing these responses, five themes appeared as areas of common concern. Following the "Chatham House rule", a summary of the main views, without attribution to their originators, is presented below following the five main themes. The responses to questions 1 and 2 are summarized with some selected views presented, as in their original, in quotation marks; all responses to questions 3 and 4 are given in full, as material for further analysis.

**Q1: Use your knowledge, imagination and sixth sense and try to envision how the weather/climate/water/environment information and services in 2030 will be different to today. Outline three major advancements you can foresee.**

**"Forecasting is very difficult, especially about the future." (probably, Neils Bohr)**

### **Theme 1: Data and ... more (shared) data**

There is a strong consensus about the expected "exponential increase in the available observations including expansion of in-situ and remote sensing observations as well as observations from non-conventional platforms and sources (e.g. unmanned systems, crowd sourcing, etc.)". The technology-driven growth of data is expected to be non-linear (e.g., "sensor explosion", "data revolution", "unprecedented", "a flood of new observations") and is expected to come from various sectors, with much stronger presence of private sector, and from various sources including platforms on vehicles, buildings, bridges, etc. Personal devices and cameras will become widely used data sources and integration of conventional and non-conventional data will be mainstream.

The 2030 data landscape is highly automated, IoT and AI driven. Availability of lower cost observing equipment and systems, smaller and more affordable space-based Earth observation platforms, will help to improve the global data coverage and resolve today's data gaps. The unprecedented increase of real time digital data with much finer resolution will accelerate the provision and the availability of highly accurate and localized user-oriented products ("narrow-casting").

The 2030 vision of a completely new data situation comes with a good consensus on the data sharing and access to data mechanisms in a combined public-private domain. Such mechanisms ensure that data and services are available to everybody as a public good globally and locally and accelerate progress by urging all countries to contribute with observations in return for access to risk reducing data streams and services in all societal sectors depending on weather, water, climate and the environment.

There is expectation that 'open data' will be embraced by the whole enterprise, guided by "new WMO data policies which set standards and guidelines needed to promote the open sharing and access to meteorological and other environmental data". At the same time, incentive-driven mechanisms will make "a wide array of data available through a common "data-mart" with associated metadata".

Having more and more data will require special effort to ensure "interoperability of formats, services, databases".

While the expectation for the exponential growth of data is non-disputed, the 2030 data landscape may be flawed by issues of uncertain data quality from some sources and related data integration issues.

## **Theme 2: Forecasting and ... forecasters**

How the numerical modelling and forecasting will look like by 2030 is a key component of the 2030 vision. There is a solid consensus that the Earth System modelling will prevail – “a science supported and user driven seamless Earth system modelling capability is built on a global level, supported by interoperable observation systems for the provision of weather, water, climate, marine and environmental services. The Seamless Global Data Processing and Forecasting System forms the basis.” More specific views include that the evolution of the NWP models will be towards “global models which do not need parametrisations of deep convection, orographic gravity wave drag and ocean mesoscale eddies”, and “global convective permitting ensembles and deep learning”, and “predominance of probabilistic Earth monitoring and forecasting, with relevant user-oriented products”.

In support to the 2030 vision for a more resilient world, the expectation is that “most severe weather events will be accurately forecast through advanced Earth System Modelling and there will be concerted, science-based international action to address climate change”.

Big changes are envisaged in the future profile of “the forecaster”: “The role of forecasters would change significantly. The advisory role to various clients will become their main duty, rather than “forecasting,” which will be gradually replaced by AI”. In general, it is expected that “most weather forecasts will be direct NWP output” and that “weather forecast will be done automatically without human intervention and delivered directly to the user”. However, “there will be still the need of well-trained meteorologist”. Operational forecasters will use little to none of their time for model analysis in the way they have done it before; instead, forecasters will use model output to downscale, localize and tailor the forecasts in order to provide “specific, enhanced, and actionable information and services” that enable proper decisions. “Greater predictive capabilities through coupled models require less manual manipulation of forecast output, more attention on customer/user needs/communication.”

The overall expectation is for an improved accuracy of high-resolution forecasts at all ranges, from extremely local, to medium- and longer-range. There will be an “increase in business-to-business (B2B)” services” and services “will be more targeted and personalized, meeting the demands of the public and the industry”. The result will be \hugely positive impact for the society bringing new level of socio-economic benefits.

A summary of these expectations is: “Real time to decadal prediction of all key phenomena at microscale resolutions in space and time available to anyone, anytime, anywhere”.

## **Theme 3: Demand and Supply of Services ... Weather/Climate/Water/ Environment intelligence driving decision-making**

There is no dispute in the 2030 vision that the “service delivery will be done jointly by public and private entities” and that there will be many more players as “environmental intelligence drives decision making”. Thus, a key element of the vision is that weather and climate information will be much better integrated in decision-making at all levels and will support complex systems and decisions “in accelerating global economy, protection of life, property and poverty reduction”. The optimistic views envisage also “endless capabilities to meet the ever-growing user requirements such as reliable services at localized scale”.

A main element of the future vision is that the “multi-hazard and impact-based forecasting will live up to its name”. Weather and climate data will be regularly combined with non-environmental data using AI and machine learning to provide tailored information seamlessly to the end user, in more detail, specifying the impacts to them. The goal will be to deliver impact-based information “with a range of behaviour scenarios for the general public and businesses”.



"Going beyond the forecast to "decision makers". Impact-based Decision Support Service (IDSS) as the predominant service model and AI or machine learning becoming part of our tool box."

Regarding the delivery to end-users, it is easy to predict that "information on weather/ climate/environment will be available on everybody's smart phone in a much more individualized form than today". The "radio and television weathercasts - the primary method of weather information to the public [now] - will still exist, but with fewer outlets and higher resolution narrowcasting rather than broadcasting". As an example, "technology will enable us to see what will happen in stunning detail; if flooding rain is predicted, we'll be able to use augmented reality/virtual reality (AR /VR), etc, to show the impact on every person's street".

A comprehensive vision on demand-supply of services in the future will require better engagement with the broader user communities. "The current trend towards Integrated Decision Support Systems will bring the power of more rapid and timely data and information to the end users (society). Those users are the decision makers in Disaster Prevention and Response, Aviation, Agriculture, Water Management, Insurance, Finance, Retail, and many other areas that rely on accurate and timely weather observations and forecast services. As we better understand how weather observations and forecasts impacts the decisions need to make, collectively we can better integrate that information into decision support tools that allow a greater benefit to society."

There will be a mixture of free available and "paid services" in the various business relationships between the providers and users. There will be a much better understanding of the added value of the services by "systematically connecting weather and climate information to sectorial information (vulnerability in the most general sense)". "Weather services will be more diversified and detailed to meet the specific needs and requirements from industries, and more new meteorological businesses will be widely born."

A possible risk exists that, in the increasingly complex service delivery landscape, the traditional meteorological service provider (e.g., NMHS) may lose the direct contact with the end user of meteorological and climatological information which should be avoided through new forms of cooperation between information providers of different sectors.

The big improvements in the service delivery capability will, in return, impact on weather and climate sensitive industries, reinforcing the demand for new services. An example from the insurance sector is that "the advancements in measurements and observations will drive a massive push to manage weather and climate risks via risk transfer to insurance, reinsurance and insurance-linked securities (ILS) markets. Climate risk reporting will be mandatory for all sizeable organisations and active management of climate and weather risks will be commonplace".

In conclusion, the expectation is that in 2030, "everybody will be informed of the weather which may impact their life in the individual situation, such as daily home life, tourism, health, etc., through the best media and in the best format for the situation."

#### **Theme 4: Capacity gap ... Alleviating inequality and advancing together**

In 2030, "the capacity gap between the developed and developing world has decreased substantially and forecasts supporting the fundamental protection of life and property are available worldwide". Weather information is integrated into civil decision making, globally, mitigating the impact of severe weather, climate and water events to the extent possible in each country. "The dependencies between, on the one hand, weather, water, oceans, climate and pollution, and on the other, the risks and value associated with food, health, energy and transport availability are obvious to everybody".

Improved partnership and enhanced engagement of all sectors (Public, Private, academia, NGOs) in improving services through application of technologies and innovation for precise provision and use of information and services (weather, climate, water) for the benefit of various sectors of economy.

The improvements of data and service capacity in less developed countries is based on “more impactful and coordinated support of development partners to NMHS”.

Capacity improvements will not be automatic and are envisaged for “countries, which proactively embrace new thinking and business models, innovation, non-traditional ways of generating and delivering services, while others would struggle to make a transition to/adapt to the new landscape”. To support the proactive approach, it is expected that “due to increased impact of extreme weather the significance of weather prediction is better understood by the general public and governments”. Weather service “will become a key social infrastructure for the general public, like water, electricity, gas, transportation, or communication network”.

To allow the developing countries “advance together” with the developed world, NMHSs will still have a key role, therefore “bridging the gap between advanced and developing NMHSs need to happen through all forms of partnerships, shared interest and optimized implementation of the global/national meteorological value chain”.

The impact of an enhanced global capacity on the national capacity of developing country will be a decisive factor in bridging the capacity gap. Operational/business models with cascade value chain in which there will be “more regional/collective approach/ownership” of the parts of the chain will help utilizing national/local resources better.

Significant improvement in the provision of essential services will come from “the advancement of Information and Communication Technology (ICT) and other science and technology, including meteorology, so that every country, regardless of developed or developing, will have a practical framework and capacity to ensure that the disaster prevention authorities as well as the people receive, understand and utilize weather warnings and related data/information to take appropriate measures to protect life and properties from weather/climate/water related disasters”.

### **Theme 5: Roles, responsibilities, partnerships for common actions**

Strong consensus exists on the need for “structured global partnership with clear roles, responsibilities and contributions”. This includes “enhanced engagement of all sectors (public, private, academia, NGOs) in improving services”.

At national level, there will be changes in the role of the public and private sector entities in the service delivery; in some countries, private sector will have a major role. The expectation is that, regardless of the relative share of each sector, respective roles will be better defined through relevant national framework.

In summary, “clearly defined and mutually agreed upon roles for the public, private, and academic sectors are established which focus on obtaining the goals of enhancing awareness of hazardous and impactful weather, mitigate the negative impacts of weather on economies and global citizens, and enhancing safety and preparedness. It is important to note and understand that one model that has worked well in one country may not exactly apply to other parts of the world”.

The 2030 vision puts strong emphasis on enhanced mutually-beneficial partnerships between the sectors and stakeholders across the enterprise. “Partnerships can take many forms and can involve two or more participating partners, that utilize the strengths of each partner to achieve a set of defined goals, in a manner that is mutually beneficial to all involved. Good Partnerships will have very strong collaboration, with multiple levels of checks and balances to help ensure all partners are contributing and receiving what is necessary to sustain the Partnership”.

The evolving role of the WMO has a prominent place in the 2030 vision. “WMO - as the only technical, global, environmental organization – rises to a global leading role in fostering science hand in hand with technological and cultural enablement to maximize current and emerging capabilities to the benefit for all Members”.

"The structure of the WMO has evolved to an organization based on public-private partnerships which is wholly inclusive of all members of the GWE. WMO membership not only consists of member states, but also member organizations largely from the private and academic sectors".

"WMO has managed to keep the big-data revolution in a combined public-private domain in such a way that the opportunities and services are available to everybody as a public good globally, and has in this way avoided that "the winner takes it all" and has on the contrary accelerated progress by urging all countries to contribute with observations and user experience in return for access to the risk reducing data streams and services in all societal sectors depending on weather, water, climate and the environment."

WMO role in setting policies and standards, and the need for WMO, by 2030, to accelerate the creation and improve these policy and standards.

"Representative diversity, especially of gender, in the delivery of w/c/w/e information and services and in the governance and working bodies of WMO".

### **Special views:**

*In 2030 climate change is even more urgent today with social instability on the rise in poorer parts of the world. Geoengineering is pushed for by global companies with the support of countries with weak governance structures. WMO should prepare for this situation by supporting research of geoengineering options and uncertainties, and should pursue vigorously the development of a "Global Law of the Atmosphere" that can provide a responsible, global platform for geoengineering discussions.*

## **Q2: Which problems or barriers that exist today need to be resolved by working together in order to achieve the vision you outlined above?**

**"The job of a leader is to spot barriers that hinder information sharing and collaboration and tear them down..." (after Morten T. Hansen)**

### **Theme 1: Data and ... more (shared) data**

A number of issues exist related to the current availability and exchange of data, and related international/national policies. There is a strong consensus about the need to make more data available: "Improved observations globally are desperately needed, particularly in the observation-sparse areas of the globe". A major problem is the persistence of data-void areas in some developing countries: "Data gaps have to be filled systematically by sharing know how and funding in an appropriate way". There is a strong concern regarding potential deterioration or disruption: "Global exchange of numerous high-quality earth-system observations is needed; need to guarantee that there is no erosion of the global observing system, and the new players in the field of earth observations are complementing the system without major disruption".

"Free and open exchange of data need to be maintained" is a repetitive view of the surveyed experts. And ... "A free data policy that has a built-in prohibition of "the winner to take it all"".

There is a strong call for a comprehensive approach to data policies and data sharing practices: "Data rights and exchange rules need to be resolved globally with WMO leadership"; "The GTS and rules associated with data sharing (resolution 40, etc) need to be updated"; "More open government data and a level playing field for private sector to enable a thriving weather value chain"; "Global, homogeneous data policy is required enabling unrestricted access to relevant data by all".

Existing national data policies sometime are seen as barriers that need to be resolved "Government's restrictions or regulations against the open data policy". One response states the "lack of willingness to share data" as the major barrier. "Everything else is minor in comparison".

The utilization of the emerging new data sources needs a strong quality assurance accord: "There is a need to assure the quality of the diverse range of observations now

available, including those from non-conventional platforms and sources (e.g. unmanned systems, crowd sourcing, etc.); "Better standards for calibration and classification of measurements".

The core basic infrastructure for data needs to be sustained and developed further, which depends on sustainable public investments. At the same time, "business models which would incentivize data provision should be developed".

At least one response highlights the need for "step change in observing and understanding oceans and cryosphere".

The data exchange and providing easy access to data require fast uptake of advanced ICT solutions. "Finding a means to share all weather observations freely in the modelling, forecasting and service delivery communities" is seen as a key task for collaborative cross-sector work.

## **Theme 2: Forecasting and ... forecasters**

To progress more rapidly, there is a need to raise the ambition, for instance: "Treat the developing weather and climate models with the same ambition as we put into the Large Hadron Collider". Connected with this ambition: "Focused, aggressive investment in numerical weather prediction is needed", as well as "fundamental investment in basic science and science collaboration".

"Focusing on global modelling by many" stakeholders is seen as an inefficiency of the current enterprise; it could be overcome by the understanding that "true value" for many providers "could come from focusing exclusively on downscaling and service delivery".

Another constraint is the "reluctance of embracing probabilistic information" and another ambition may be to "give up on the concept of deterministic prediction completely".

In preparing for the evolving role of weather forecasters, adequate changes are needed in the education and training programmes "so that they become weather consultants".

A negative trend and characteristics of the current situation is in "the many sources of weather forecast and warning information which do not always provide a consistent and coherent message". Related to this, many respondents highlight the need for quality assurance and standards to spread over the forecasts and products available from various providers through different media.

To accelerate the improvements in data processing and forecasting, "there is a need to partner with IT scientists and major companies to ensure that the best technology for an efficient extraction of data information is utilized". This includes super-computing and super-storage, fast and open Internet.

## **Theme 3: Demand and Supply of Services ... Weather/Climate/Water/ Environment intelligence driving decision-making**

There is a general feeling of "underappreciation of the benefits of weather, water and climate predictions" and services among the governments. In this regard, "communication about severe weather and climate change still needs to improve". "More work is needed together with social sciences to develop the right language".

"Lack of regional or sub-regional understanding of the extent of private sector involvement along each point in the value chain" is an impeding factor.

The continuing effort on impact-based services needs "more systematic collection / management of "impact" data, and more scientific work in the field of applied meteorology, in order to help decision making process of all kinds".

"In order to adequately serve all those affected by climate change and the more extreme weather conditions we are experiencing, we need to have easy and cost-efficient access to weather data" to design products and services for "risk mitigations strategies for all those affected".

To advance the services and service delivery in all areas, there should be a “profound shift in the relationship between science and society - the transaction of trusted science into action”. “We need to reinvigorate a global Grand Challenge to advance all forecasts especially at the local level.”

Some general risks in the digitally connected world are seen also as a risk to our community, e.g., how to deal with the “Emergence of fake news in our field”.

#### **Theme 4: Capacity gap ... Alleviating inequality and advancing together**

A major obstacle in moving ahead as a global community is the “Lack of capacity in developing and specifically least developed countries to cope with emerging technological changes and lack of legislation and policies to guide partnership and engagement of all sectors. Inadequate resources (e.g. skills and infrastructure) necessary for enhanced service delivery. Shortage of skilled human resources and deterioration of infrastructure” need to be addressed urgently”.

“Capacity of all countries should be enhanced not only in the area of meteorological monitoring and prediction and related Information and Communication Technology (ICT), but of broader areas including legislation, strategical collaboration with disaster authorities and other relevant bodies, public awareness activities”.

“A seamless and sustained link exists between capacity-building, community-based implementation and the role of the natural environment in sustaining livelihoods, economies, and our values.”

The current landscape contains large gaps between the developed and less developed nations, both in observations and in services. This situation needs to be resolved in order to achieve the vision. A number of potential actions and needs have been outlined in the survey:

Development financing: “In development financing, the current way of financing simply reinforces a traditional capital-based infrastructure approach. More policy incentive type investment/results-based approaches are needed. Leveraging private financing would also be explored as well”. “Lack of long-term and coordinated grant funding to support bridging capacity gap in developing countries”. “Structure of international financing for capacity building activities needs to be looked at and addressed”. “Donor funding for capacity development in developing world needs to be reformed significantly. Funding mechanisms and structure needs to be changed”. “Coordination and prioritization of investments need to be established within the UN family of organizations”.

Sustainable business models: “There is a lack of sustainable business models for service delivery in developing countries [NMHSs]; this must be overcome or the service model must be changed (e.g. changing roles from pure service delivery to an oversight or governance role, where appropriate)”.

“An Understanding of Sustainability: It is important for all stakeholders to realize that sustainability is something that must be planned from the very beginning and designed into any organizational system being developed”.

“Loss of application of indigenous knowledge due to selective globalisation i.e. dominance of knowledge/value of other regions/countries; disproportional access to resources and technology”.

The development of capacity along the value chain includes the capacity of decision-makers. “Governments at different levels are not that aware of the risks of meteorological disasters. Their capabilities in disaster prevention need to be improved”.

“Lack of coordination on implementation across the scales of governance with unclear division of tasks and responsibilities of actors, especially under conflicting timescales of interventions, and response.”

## **Theme 5: Roles, responsibilities, partnerships for common actions**

A dominant barrier description in the responses is “lack of trust” between public and private sector. “Misunderstanding and a lack of trust still exists between the public, private and academic sectors of the global weather enterprise. This needs to be alleviated in order to achieve anyone’s vision for 2030. We need to seek to understand each other and where we can best contribute to the common goals and vision”. Neither sector can do everything on its own and each part of the enterprise need to provide their best expertise – “the whole is greater than the sum of its parts”.

A good description of the situation is the “Us vs. Them” culture: A culture that views the Public sector and Private sector as being on opposite sides of all issues, is our single largest barrier we face and which retards our forward progress”.

In addition, “there is a general fear of the recent trend toward public sector use of private sector capabilities for services of many types; Data services, Computing services, IT services, Forecast services, etc. However, it is important for public sector to realize that the private sector is not intending to replace high quality services already provided by any NMHS”.

To resolve the “lack of trust issue”, “High-level dialogue at appropriate fora is needed to facilitate a policy shift. Discussion there should be aiming at maximizing the countries’ benefits, not the benefit of any particular sector or entity”.

At this stage, the lack of “clear, well-defined, and mutually agreed upon roles and responsibilities of public, private and academic sectors” is seen as an obstacle for better synergy and cooperation. There is a strong need to identify “means and/or structures through which NMHSs and private weather service providers can work in a complementary fashion to provide a range of forecast services to the public authorities and entities, to commercial users, and to general public through broadcasters/websites/social media, etc.”.

There is an important role foreseen for WMO in resolving the existing issues and barriers. “Integrating the private sector (and academia) fully into WMO work so that regulations, standards, guidelines, competency frameworks, etc. are developed in coordination with private sector experts”; “Full integration of the private sector into the WMO and facilitation of a “level playing field” for all sectors to enable a thriving weather value chain still needs attention”. Work on “principles, pathways, processes and business models whereby all parties contributing to global w/c/w/e information and services commit to collaborating, especially to ensure the free and unrestricted exchange of data essential to global NWP and cascading seamless services”.

All above issues and barriers should be seen in a broader political context whereas “The current political evolution in a number of countries supporting a narrow national approach, rather than a collective global one need to be addressed. Decisions based on short term socio-economic return. Need for much stronger cross disciplinary and cross border cooperation”. At international level, “countries should reach a consensus and strengthen cooperation in climate change response and the protection of ecological environment”.

### **Q3: What are your expectations for the Open Consultative Platform and how do you envisage your engagement in it?**

- Broadcasters, as part of the private sector of the weather enterprise, are dependent on the free flow of weather data in order to reliably deliver high-quality weather information to the public. It would be helpful to have a weather enterprise that helps this become possible in all countries around the world.
- Support of basic concepts of data policy developed by WMO like Res. 40 of Cg. 12, recognition of the global meteorological infrastructure coordinated by WMO
- As a private sector operational forecaster, I don't foresee the Open Consultative Platform impacting my daily activities at work in the short term. As our roles change,

and especially if TV news disappears, I think I might transition to a role where I use the Platform on a regular basis to share information with colleagues in the Emergency Management community and other stakeholders as I help them make decisions.

- Positive.
- No idea!
- The Open Consultative Platform provides an enormous opportunity to align the interests of all players in the weather value chain. Equipment manufacturers, National Weather Services, Private Weather Services, Different Sectors of the economy and Society at large. This will contribute to the engagement.
- Following much talk at various fora over the past 18 months or so, it is time to decide on more concrete measures to better engage the private sector and academia with the work of WMO and the NMHSs.
- We have to understand better how OCP will work and what role is expected from partners.
- Optimism: I am optimistic that the OCP will further encourage open and honest dialogue between all sectors of the Weather, Water, and Climate community. It is only through this continual discourse that we can make progress towards improved benefits to society. However, I am a little disappointed that nowhere did the survey ask for what is the vision for the future. The survey merely asked what problems exist and what does the future look like. Neither of these questions can be resolved if you do not create a common vision that all three sectors believe in. It would be my hope that the OCP would create a true strategic process beginning with a SWOT (Strengths, Weaknesses, Opportunities and Threats) Analysis. From this we would create a vision that all would agree and adhere to when we open true discussions on the future and how to remove the barriers. While I realize that we cannot create a perfect roadmap to resolve all the issues we face, if we do not have a common understanding of the vision, we can never make progress on problems we believe are important to resolve.
- As the discussion at OCP has implication to the hydromet business of 10-20 years later, I really hope OCP would successfully engage younger generations/young leaders in this domain who will be in the central stage in 10-20 years.
- The importance of weather, climate and water for the future of the planet and mankind increases day by day, a global cross-sectoral effort is needed and welcomed. Our company, as a leader in weather observation technologies contributes actively to this ecosystem.
- It will be interesting to whether the various components of the meteorological community can work in harmony to enhance wellbeing and economic development. I will be particularly interested in ways in which meteorological societies can more effectively support the weather enterprise.
- I expect a lively discussion between various actors in the field of weather, to pin down the major challenges for the future which WMO is expected to help.
- Our company plans to be an active partner and thought leader in the Open Consultative Platform, bringing to the table our experience working in partnership with public, private, and academic sectors during our 57+ years in business. Our expectations for the OCP is to have it serve as a productive forum to open up new ways for the Global Weather Enterprise to make connections, build trust between all the players, and assist in furthering the understanding of the benefits each part of the Global Weather Enterprise brings to the discussions. If the OCP is successful in these aforementioned areas, we foresee this group playing a key role in shaping the future of the weather enterprise in the coming decade and beyond.
- Establishment of genuine collaboration and dialogue, and clear pathways to partnership and engagement across all of the parties involved in the global w/c/w/e

community, on ensuring that high integrity, high impact and highly accessible w/c/w/e information and services are available to every member of society

- I am expecting to see and listen different opinions for analysis and progress for further activity. I hope I will have dual (or other) discussions with different participants
- That's a great question. How is this different than to the GWE? How will the Private Sector be represented? How is it going to function going forward?
- I am not sure I can fully answer this question, as I need to know a little more about the OCP and the associated vision.
- A practical and concrete path forward, and I am engaged to make this work.
- Further the dialogue between various actors: public sector, private sector, civil society ...
- Open a consultative and informal forum to put proposals in the table that could be accepted by all NMHS.
- I am hopeful that this platform will continue the ideas started under the Global Weather Enterprise Forum linking the three sectors and accelerating improvements in the developing world at a speed that is sometimes not possible in a large organization, such as the WMO. Ideally, it would act much like the World Economic Forum on a smaller-scale selecting critical topics for the future and bringing nations closer together. Will do anything needed to help.
- Be part of a growing body of concerned citizens for the modernization of the sector.
- I have been involved in the GWE Forum for more than 1 year. This unique experience helped a lot fostering dialog between academic, public and private sectors. GWEF experience is valuable and can be shared before starting OCP full scale. One can have big expectations for the OCP, and be realistic at the same time: everything takes time, all the more that public organizations are involved. Important thing is to help all parties involved understand that they are working for shared interest and mutual benefits, for the sake of people. Outcome of OCP may be in the form of new (successful) practices one can adhere to, not necessarily new rules. This can happen in the field of new business models, data exchange, service delivery, etc. I am ready to be engaged in the OCP if my presence makes sense, but will always keep priority on steering my boat, trying to set the GWE and then the OCP principles to operation! Practice will validate theory always!
- In order for each country to enjoy the benefits of public-private partnership and also taking into account different national policies, social systems, etc., some kind of scheme for government-private collaboration should be established at the national level. However, considering that meteorological business can easily cross the borders, and that international data exchange and collaboration is essential for the services of NMHSs, we need to have a forum to exchange the views and information between NMHSs and between NMHSs and the private and academic sectors collectively. Open Consultative Platform should provide such broad forum for dialog. This will also provide good opportunities to identify the requirements for capacity building, particularly in the area of legislative framework and the strategic collaboration with other disaster related institutes.
- We, as a private weather information service company, would like to create new values of meteorological information with/through Public, Private and Academic Partnerships all over the world. The critical factors to achieve those goals are: recognizing and legally defining the roles and responsibilities of each sector; and establishing the collaborative environment among three sectors with mutual respect and trust. Within the Open Consultative Platform, we would like to enhance this movement by promoting and sharing the real success stories of PPP.



- A clear realization of the critical global need for all of us to work together to serve society with the best solution to deal with the primary global risks. I would like to promote trust, understanding of global realities and provide some practical directions to bridge some blockages in the critical path for success.
- Avenue for sharing ideas that may lead to appropriate action to enable Members embrace new ways of partnership and collaboration that are effective in addressing the existing global challenges.
- The Platform can establish a common vision for 2030 and the main requirements to reach it.
- Initiate a consultative platform for long term planning through engagement of diverse groups including grassroots. My role will be on the importance of an integrative approach to weather/climate information and services.
- Open-minded discussions, listening to each other and readiness for action.
- Open, constructive and respectful dialogue, where everyone has a chance to speak.
- I hope this platform can assist communication among experts, consultation and promotion of meteorological science.
- Facilitate the contribution of water/hydrology perspectives + scientific community. Articulate with existing initiatives and organized expertise such as IAHS.
- Expectations: setting achievable, measurable common goals. My engagement: I would like to contribute to achieving the goals in any way I can.
- A high-level mechanism such as the Open Consultative Platform will be useful but unless we couple that with more regular dialogue we are only solving part of the equation so it needs to be coupled with integrated efforts. Not all countries are in the same place with respect to involvement with the private sector as well as national laws and policies. The discussions should be contextual by Regional Associations. Perhaps we need to invite academia and the private sector to our technical commission working structures, not as just observers but to work together to solve the challenges identified by Members. The solutions Members develop, such as WIS and WIGOS, are largely government focused efforts, but governments are increasingly moving toward public-private models (i.e. major infrastructure projects). Therefore, we need an analysis of the status or current level of involvement of the private and academic sectors vis-a-vis the public sector, region by region and along each part of the value chain.
- Guidance and practical pathways for securing and sustaining collaborative networks across research, observations, services and decision-making at each level (local, national, regional, international). Share my experience (successes and failures) in attempting to develop such science-policy partnerships and to learn about new approaches.

#### **Q4: In this field you may wish to put additional ideas about the Next Generation of Weather and Climate Intelligence.**

- Weather broadcasting will change just as broadcasting itself changes. With the number of platforms to deliver forecasts increasing, it is advisable for us to develop new and more effective communication methods to help the public make their decisions for daily life. Among the advances will be the ability to deliver higher-quality and more precise forecasts for specific locations.
- Meteorological and climatological information will be widely used in combination with very different kinds of other information, intelligence will increase, its visibility decreases.
- There are some basic recognitions to be made: The global weather community has created one of the best functioning international cooperation structures worldwide, with the WMO as a catalysing body. The principle of the natural monopoly applies to a

functioning basic weather infrastructure as much as to a road or school system. We must ensure a functioning and unbiased base infrastructure of weather measurements and alarms, operated by national (or public) services. On the basis of a functioning base infrastructure, we must create an open and level playing field for the development of a thriving private sector and new technology, which is essential for a better service to multiple sectors of the economy. This private sector will also need some more standards and regulations, to make the services more comparable and useful for downstream customers. The example of open-data markets, such as the USA, provides evidence of the enormous value such a development brings to all stakeholders, including society at large. The advent of new technologies (remote sensing, mobile communication, micro-sensor revolution and big data management, i.a.) bring additional opportunities to more rapidly bridge the infrastructure gap existing in some regions, and leapfrog development steps into a more productive weather value chain with a better cost/benefit ratio than previous technology. Given the global impact and scale of the phenomena, it is imperative that we as community apply the principles of economic and social development to the evolution of the Global Weather Enterprise, and there is a big opportunity to do that in a structured, rapid and very effective way.

- All of the challenges facing the Global Weather Enterprise in finding better means to work together in harmony are set against a background of rapid climate change, which will bring increased threats to civil society and indeed perhaps to the very concept of nation states. There needs to be a shared recognition of the immense moral and ethical imperatives for those of us in the meteorological community to work together in a collaborative manner to keep society fully informed of the growing risks, both in terms of day-to-day weather and the changing climate.
- Weather Decision Support: Again, I would like to express my view that the Next Generation of Weather, Water, and Climate “Intelligence” will be in the form of Integrated Decision Support Systems. This will bring the power of more rapid and timely data and information to the end users we all support. Our perfect Observations and Forecasts are of little value, if the users cannot understand them and make rational and effective decisions leading to a reduction in negative impacts of severe weather events on the lives of society. We also will not be able to show the growth or positive impacts to GDP. The decision makers in all areas of our economies rely on accurate and timely observations and forecast services, in order to achieve the economic stability and growth necessary for the global community. Collectively we all need to collaborate to make that happen.
- Diversity of players, data sources, service providers and delivery channels is a fact and we must harness them all for the global good. At the same time, we must not lose sight of the responsibility of governments for the operation of a sustainable value chain, from data to the service outcomes, that ensures the safety and well-being of their citizens. While we work together to innovate and improve at all the steps along the value chain, the integrity and sustainability of the value chain is paramount, and new initiatives and business models should keep sight of the whole and not just the parts.
- As NMS representative I understand that very changeable weather and climate in composition with technical/technological progress at the same time low government budget and willingness and possibility of private sector to be on frontline of MET service, all of these factors are not positive for future NMSs. But we need to be proactive and flexible.
- We need to acknowledge the key success factors that brought us where we are (e.g. The Weather Machine as described in Time Magazine), and find the strategic decisions that we need to make now in order for that global enterprise to continue to grow... This is saving life, and key to the future of Mankind.
- The value of weather services needs to be clearly established and paid for by users.

- The requirement for sound and clearly communicated policy relevant science to inform wise choices related how best to deal with the climate challenge. Individually customized environmental intelligence across all time scales for all levels of society and business. Strengthened Global and Regional Partnership so that critical mass issues and the growing gap of service the populations of developed and developing countries can be address. I global pact and commitment between all countries to contribute and work together to serve society. Special attention on urban dwellers, the oceans and water. Changing roles and disappearing jobs and realignment of training programs and creating exciting career opportunities for the brightest young minds.
- Involvement of global enterprise in the next Generation of Weather and Climate intelligence should consider mutual benefits among partners for various sectors in Member states. Improved observation networks at national levels, improved global cooperation in data exchange, improved data processing systems, improved communication systems are of paramount importance. Furthermore, the next Generation of Weather and Climate intelligence should consider fully automation of operations and service delivery. There should be a full participation of public, private and academia sectors in support of enhanced observation networks for data availability and sharing. Improved availability and access to weather, climate, water and environmental information and services at all levels through available and emerging communication options such as mobile devices need to be considered. Finally, there is a great need to come up with proper arrangement for transfer of technology so as to ensure no Member will be left behind while addressing the available and emerging global challenges. Weather and Climate do not respect political boundaries hence a need for the next Generation of weather and climate Intelligence to ensure all Members are involved in enhancing services so as to have safe world for all.
- The next generation of Weather and Climate Intelligence is based on a value cycle/chain which is characterized by a backend system developed and supported by research, by interoperable, metadata-governed observation systems, data assimilation, operational Earth system model forecasting and ensemble predictions including verification. Post processing models and specific observations are developed and put into operation for the general public as well as for specialized applications in energy production and distribution, traffic (road, rail, air, ships), agriculture and other ecosystem services, air pollution and health impact, visibility, water availability and quality, high impact weather, offshore activities, coastal activities (storm surges and waves), the military, tourism. Other sectors can also be mentioned. This is enabled by the trend toward coupled Earth system modelling to provide prediction and analysis products at all time and space scales and to all sectors and applications that require such information. The availability of computing power is contributing to the improved accuracy at all time-scales and forecast lead-time of numerical predictions, and allowing the generation of ensemble systems that enable a probabilistic approach.
- Refined weather forecast and climate prediction. Reduced uncertainty to allow for more focused short- and long-term actions by policy makers.
- Based on the trust which was built up in the Global Weather Enterprise Forum new forms of collaboration between the public, private sector, academia and developing agencies could be built if each partner has a positive vision of how to approach the others and profit from the advantages of cooperation.
- The next generation of weather and climate intelligence will make full use of advanced technologies including cloud computing, big data, Internet of Things and mobile Internet to provide intelligent, targeted, and interactive meteorological services that can deliver benefits to and be shared by everyone. We need to provide users with accurate meteorological services by improving the supporting system, meeting the growing demand of the public for individualized and customized services.

- 1) Offer interest, value, and agenda setting to draw efforts and inputs of scientists to common objectives / counterbalancing actual trends of competition, money-driven research, bibliometrics, salami-slicing of knowledge development. 2) Reinforce hydroclimate/hydrometeorological articulation. 3) Rely on academic expertise and new didactic approaches towards capacity development.
- First need to add "water" to the Next Generation of Weather, Water and Climate Intelligence. As extreme weather becomes more common and damaging due to a confluence of physical and socioeconomic factors, citizens and decision-makers are turning to the National Meteorological and Hydrological Services to provide weather, water, and climate observations, forecasts and warnings to protect life and property and enhance the national economy. This would be done through a seamless suite of products and services from short term to weeks 3 and 4 to Sub-seasonal to Seasonal including specific weather, water, climate forecasts especially for extreme events. In the new Strategic Plan for the U.S. National Weather Service, we've recognized much has changed. Technology advancements are accelerating, leading to a more connected world with greater expectations for timely and actionable information. Technology is also driving advances in observations. Machine learning, big data analytics, the internet of things, and miniaturization are all contributing to a giant leap forward in how scientists observe the atmosphere. Furthermore, the Weather, Water, and Climate Enterprise continues to grow and is now engaged in all areas of the forecast value chain, from observations to decision support. We see the need to more rapidly and holistically evolve the agency to realize the vision of a Weather-Ready Nation. This change will require a shift from individual performance to a more collaborative operational model, whereby the collective wisdom and operations of the broader international enterprise are brought to bear on significant weather, water, and climate challenges. It will require the application of new science, tools, and technologies to process and communicate critical forecasts, warnings, and hazards. We will need to use nimble and effective approaches to keep workforce skills current and ensure that we can meet future customer needs.
- Question: What constitutes "intelligence"? How well are we using existing intelligence? and, When and how do intelligence and foresight become action, and for whose benefit?



# OPEN CONSULTATIVE PLATFORM

PARTNERSHIP AND INNOVATION  
FOR THE NEXT GENERATION OF  
WEATHER AND CLIMATE INTELLIGENCE

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