

Summary and Recommendations of the GFDRR Special Sessions at InterMET Asia, 22-23 March 2017, Singapore

Summary

The weather, water and climate enterprise is a vital part of the global community's efforts to protect life and property and increase prosperity. The public, private and academic sectors, which comprise this enterprise, are all providing crucial contributions towards this goal. When severe weather forecasts and warnings are acted on, loss of life is reduced and property and livelihoods are protected; short-, medium, and long-term forecasts enable better planning and operation, taking full account of weather and climate variability and change. Tailored forecasts enable better financial decisions, increased efficiency, which improves economic performance. Research and development are the backbone and very foundation of all forecasts and underpin improvements in models; new technologies improve observations and operational concepts.

Fundamentally, the ability to protect people and achieve sustainable social and economic development everywhere depends on the full engagement, development, and funding of all of three sectors.

At InterMET Asia 2017, the Global Facility for Disaster Reduction and Recovery (GFDRR) convened special sessions to explore ways National Meteorological and Hydrological Services (NMHSs), academia, and private companies could exploit opportunities and reduce obstacles to strengthening the enterprise. Representatives of all sectors were invited along with development partners and the World Meteorological Organization (WMO). Participants are listed in Annex 1. The complete agenda is in Annex 2. The special sessions comprised four parts: an overview from key stakeholder groups; a panel focusing on opportunities for public, private and academic sector engagement in developing and developed countries; a panel focusing on the obstacles; and a roundtable aimed at a way forward to address the issues raised in the preceding dialogues.

The discussions touched on the following issues:

- The need to substantially grow the weather, water and climate enterprise to meet the ever-increasing demands of modern society;
- Recent developments in the public and private sectors in meteorology; including in (i) science and technology as well as in forecasting services, and (ii) the relationship between key operational service agents such as national met agencies, private sector providers, development partners and the World Meteorological Organization (WMO);
- Ways in which better public-private sector collaboration could benefit the enterprise;
- Obstacles that exist now or in the future that might inhibit or prevent beneficial collaboration and partnerships;
- Ways to overcome the obstacles and enable society to capitalize on the capacity and capabilities of the public and private sectors to sustain, strengthen and build the weather, water and climate enterprise;
- Changing the public and private sector perceptions of each other; For example, by WMO and the HMEI working together to lead these discussions on facilitating this change, bringing them to a timely conclusion;

- Mechanisms for partnership including the role of better regulation, legislation and clarity in the respective roles and responsibilities of the public and private sectors; opportunities for a regulatory framework for the provision of meteorological and hydrological services and the implications for society, providers, development partners, and the WMO;
- the impacts of the enlarging role for the private sector and of increasing public-private sector cooperation in developing countries, Least Developed Countries (LDCs) and Small Island Developing States (SIDS).

Recommendations

1. It was agreed that improving the engagement and co-operation between the public and private sectors¹ in meteorology would be advantageous to all in the community. Furthermore, a goal should be to create a partnership between the public and private sectors. To do so, a number of steps should be taken as outlined in this summary document.
2. The concept of an inclusive global weather enterprise (GWE)² involving all public and private sector stakeholders/actors was fully supported. Given the recent evolution and likely future evolution of the GWE, it was felt that a common vision and roadmap for the GWE should be developed that includes the public-private partnership. It was recognized that the public and private sectors share a common mission to save lives, protect property and enhance economic development. To achieve this mission, a substantial expansion of the GWE is required to reach all those exposed to and affected by high-impact weather events. A common expectation for this growth was discussed and it was projected that the global weather enterprise should have the goal to grow by a factor of 10 over the next 10 years to fill existing gaps, increase its effectiveness and maximize its benefits to society. This ambitious goal would involve growth that would be fuelled by several factors including: greatly increased societal need for more accurate and reliable forecasts, mobilisation of private capital, economic growth in many countries, sustained increased funding for research and development, stronger cohesive engagement between the public, private and academic sectors, and scientific and technological advances.
3. The complexity of the current GWE in terms of level of engagement of different stakeholders with their roles, target clients, related national and international regulatory frameworks, various technical capabilities, investment and market policies and strategies, partnerships, etc, has been recognized. This complexity will grow rapidly with the development of the enterprise; therefore, a landscaping and scoping analysis would be helpful in building common understanding and situational awareness. Such an analysis should describe the current landscape of the GWE, identify opportunities and show-stoppers as well as analyse development tendencies; thus, enabling informed strategic planning by individual stakeholders and the whole GWE.
4. Suitable fora should be created bringing the GWE stakeholders together to develop and agree this vision and roadmap, and address any issues to be resolved regarding the public-private partnership. These fora should be targeted at different groups of contributors so that the appropriate type and level of discussion can be facilitated, e.g. one forum could constitute

¹ The term public and private sectors is intended to include all actors and stakeholders in the weather enterprise including companies, NMHS's, international organisations, universities and research institutes.

² The Global Weather Enterprise includes the entirety of weather, water and climate. The discussion, however, focused mostly on weather-related issues; therefore, for the purposes of this report, the Global Weather Enterprise is restricted to the weather-related issues.

technical experts, while another could consist of the highest-level executives and decision-makers. It would be appropriate and advantageous for the WMO to support and facilitate such fora and in doing so the WMO is encouraged to further reach out to the private sector and academia so that, on an equitable basis, all sectors of the Member states of the WMO in the GWE are embraced. Additionally, independent sponsors could be sought. This dialogue should be sustained and continuous providing regular opportunities to resolve issues cooperatively thereby building positive relationships. The initiation of a public-private dialogue by the WMO at the level of its Executive Council has been recognized as a positive development, however, it should be transformed into a continuing consultative platform. The meeting proposed that whenever a consolidated representation of the private sector in such consultative mechanisms was needed that could be provided by the HMEI.

5. There is an urgent need for greater independent scrutiny, including processes such as accreditation, certification and oversight of the operational activities within the GWE so that the quality of inputs (e.g. observations) and outputs (e.g. weather forecasts) of the GWE can be rigorously quantified to provide user confidence in their sustainable quality and integrity. It would be natural for this to be managed at international level by the WMO but it would need to be implemented and enforced within national jurisdictions.
6. It was recognized that a culture change is needed within each of the sectors of the GWE such that trust, respect, and mutual support between the sectors becomes the norm, building on positive developments already occurring across the GWE. This will include overcoming the current “language” issue through unambiguous and uncontentious descriptions of key concepts for use across the breadth of the GWE. This will go a long way to remove misunderstandings that are present now between the public and private sectors. A culture of collaboration based on an agreed code of conduct is needed.
7. The global observing system is a precious resource that underpins the enterprise and that is predominantly, but not exclusively, funded by governments. Today around 40 million observations are used per day for numerical weather predictions; however, current model resolution requires over 40 billion data points to be specified so that there are far fewer observations available than needed. This means that a substantial opportunity exists to improve forecast skill if the number of observations produced by the global observing system could be greatly increased. This opportunity can be exploited by using both public and private sector additional sources of quality observations. New business models must be developed to enable effective use of privately-supported data services that are consistent with WMO Resolution 40 and WMO Resolution 60 with a goal for these be acquired through a single payment mechanism and distributed either everywhere or to public weather service providers for public weather forecasting. Without such functioning business models the risk exists, that a fragmented landscape of observational resources would result and weaken the potential quality of numerical weather models.
8. Modern weather forecasting relies on global numerical weather prediction. The necessary increases in resolution, model complexity, and ensemble size and the ability to utilise increased observation volumes requires a substantial increase in the high-performance computing used by the GWE. This can be achieved partly by so-called scalability advances as well as more rapid and effective uptake of new computing and networking technologies. Indeed, along with the observation volume, the size of the currently available computer resources is a limiting step to growing the GWE. A close cooperation of all partners of the GWE with the hardware industry is necessary to strengthen the niche of necessary hardware components specially needed for the

field of numerical weather prediction. Another essential ingredient for progress is increased scientific knowledge of the weather system and there is a recognition that sustained and indeed increased funding must be provided so these crucial advances will continue to be made.

9. The distinctive roles and responsibilities of the public, private and academic sectors should be more clearly articulated to prevent confusion and unnecessary duplication. A case in point is the concept of a “single authoritative voice” in the provision of warning services that is a key element in the mission of NMHS’s. This concept could be misinterpreted by some stakeholders as giving an exclusive role to public stakeholders, if taken out of the context of the national civil protection systems and procedures through which governments exercise their duty of protecting their citizens from natural hazards. In this regard, the designation of an official, accredited and accountable provider of decision-supporting information for crises management is normally required. Collaboration with the private sector, for instance, telecommunication companies, to ensure better outreach of the public warnings to those endangered, was a good example of public-private partnership. As warnings sit alongside general forecasts, a clear distinction between the two can sometimes be difficult to interpret, but is still necessary. An open dialogue between all stakeholders involved is a prerequisite for solutions which help users in all sectors of the economy and public safety.
10. Another challenge for the GWE is conveying uncertainty and risk-based forecasts to society. As all weather-forecasts should be probabilistic there need be no conflict between a warning with appropriate risk-based wording and any particular forecast that is a member of the grand ensemble taken into account to produce that warning. Without societal understanding of probabilistic forecasting and its intrinsic uncertainties, apparent conflicts may arise in the minds of users. Resolving the perception of such conflicts is a pressing challenge for the GWE but certainly involves a step-change in communicating the underpinning principles of probabilistic forecasting to society and understanding how society interprets and uses forecasts. This is a challenge for the public, private and academic sectors.
11. Making high-quality global predictions (for example from advanced centres) available to developing, least developed countries and small island states is a pressing need. The economic case for the benefits of good weather forecasts in creating jobs and economic activity (as well as the benefits in preventing loss of life and property) needs to be articulated so that governments of developing countries can be persuaded to invest in and support meteorological capacity in their country. The goal of improving the uptake and use of weather information within a country requires both investments within country to develop intelligent customers of forecast outputs as well as enhancements to global prediction capabilities by maintaining and developing national observations and understanding of national and local hazards and risk profiles to make forecasts as impact-based as possible. Additional support needs to be provided by international development programmes to scale up national processes and to provide best practises acquired in other countries.
12. The use of advanced weather information to help create appropriate insurance, re-insurance and hedging instruments to manage weather-dependent risks is rapidly growing. This has the potential to both provide increased funding for the GWE and to reduce people’s and businesses exposure to financial, livelihood and infrastructure losses from weather hazards. This could become a major mechanism with weather information at its core to enhance development in the developing countries, LDCs and SIDS, contributing to ending extreme poverty and protecting income growth.

13. The GWE is today producing multiple weather forecasts from both public and private sources. These range from public weather forecasts, including those to protect life and property, to tailored outputs from numerical predictions for specific applications by businesses. To create an optimal market for weather forecasts and services it is essential to ensure there is a level playing field such that commercial arms of NMHS's, where they exist, and private companies can compete on equal terms without, for example, undue subsidies distorting the nascent and fragile commercial market. The production of public weather forecasts for the protection of life and property is most appropriate for NMHSs to carry out.

Annex 1 List of Participants in GFDRR InterMET Sessions

| Contact Name | Job Title | Organisation | Country |
|------------------------------|--|---|---------------|
| Jon Porter | Vice President, Research and Development | AccuWeather, Inc | United States |
| Suekyoung Lee | Researcher/Programme Officer | APEC Climate Centre | Korea |
| Bagus Rachmat Rievan | Head of Sub Division for International Cooperation | BMKG | Indonesia |
| Clinton Rakich | Northern Australian Emerging Markets | Bureau of Meteorology | Australia |
| Shawn Boyce | Chief Hydrologist | Caribbean Institute of Meteorology and Hydrology | Barbados |
| Michael Staudinger | Director | Central Institute for Meteorology and Geodynamics | Austria |
| Aye Kyaw | Assistant Director | Department of Meteorology and Hydrology Ministry of Transport | Myanmar |
| Julien Oliver | Senior Water Resources Engineer | DHI Water & Environment (S) Pte Ltd | Singapore |
| Andry Arivelo Tatiana | Director of Meteorological Operations | Direction Générale de la Météorologie | Madagascar |
| Jim Anderson | Senior VP Global Sales | Earth Networks | USA |
| Kumar Margasahayam | Regional Business Development Manager | Earth Networks | USA |
| Ari Davidor | Director International Development | Earth Networks | USA |
| Tim Cookes | Director | Enterprise Electronics Corporation EEC | United States |
| Alan J Thorpe | Former Director General | European Centre for Medium-Range Weather Forecasts - ECMWF | UK |
| Jeff Tucker | | FTS | Canada |
| Alan deCantis | Director of Product Management | FTS | Canada |
| Stephen Yaokuma KOMLA | Director-General | Ghana Meteorological Agency | Ghana |
| Sheldon Drobot | Principal, Noble Causes | Harris | USA |
| Shopf John | | Harris | USA |
| Brian Day | Chairman | HMEI and President/CEO | Canada |
| Laxman Singh Rathore | PR of India with WMO | India Meteorological Department | India |
| Abu Saleh Khan | Deputy Executive Director (Operations) | Institute of Water Modelling | Bangladesh |

| Contact Name | Job Title | Organisation | Country |
|--------------------------------|---|--|---------------|
| Sungmin Han | Assistant Director | Korea Meteorological Administration | Korea |
| Sangsung Lee | Assistant Director | Korea Meteorological Administration | Korea |
| Younghee Cheon | Deputy Director | Korean Meteorological Industry Promotion Agency | Korea |
| Soojung Yang | Manager | Korean Meteorological Industry Promotion Agency | Korea |
| Jane Sattary | Regional Development Manager - Asia | Met Office | UK |
| Prakash Narayanan | Relationship Manager South East Asia | Met Office | UK |
| Dr Will Lang | Chief Scientist | Met Office | UK |
| Adrienn Ferreira | International Sales Manager | Meteomodem | France |
| Benjamin Termis | International Sales | Meteomodem | France |
| Durga Prakash MANANDHAR | Deputy Director General | Meteorological Network Division | Nepal |
| Peter Lennox | CEO | Meteorological Service of New Zealand Ltd. | New Zealand |
| Brian Bell | Acting Group GM Sales & Delivery | MetraWeather | New Zealand |
| Avner Furshpan | Director of Climatology | Ministry of Transport | Israel |
| Anupam Kumar | Researcher | Nanyang Technological University, Singapore | Singapore |
| Marcel Marchand | Director Singapore Operations | NUSDeltares | Viet Nam |
| Shahid Abbas, | Director, Regional Meteorological Centre, | Pakistan Meteorological Department, Karachi | Pakistan |
| Dr. Neil Jacobs | Chief Atmospheric Scientist | Panasonic Weather Solutions | United States |
| Arnel Redaja Manoos | Weather Facilities Specialist | Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) | Philippines |
| Ms Nancy Lance | Assistance Weather Services Chief, Plans and Programs Development Unit (PPDU) | Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) | Philippines |
| Bill Conway | Systems Consultant | Radiometrics | United States |
| Yasuhiko KANO | Assistant Manager | Sky Broadcasting Corporation | Japan |

| Contact Name | Job Title | Organisation | Country |
|-----------------------------|--|---|----------------|
| Peter Platzer | CEO | Spire Global Inc. | United States |
| Amitabha Ray | Head Property Treaty Underwriting | Swiss Re | Singapore |
| Pascal Waniha (PhD) | Director Infrastructure and Technical Services | Tanzania Meteorological Agency | Tanzania |
| Marc Lemmond | Senior Manager for Public Private Partnerships | The Weather Company | United States |
| Benjamin Larroquette | Regional Technical Advisor | UNDP-Global Environment Finance | Ethiopia |
| Laura Dwulet | Executive Director | Weather Risk Management Association | United States |
| Bradley Hoggatt | President | Weather Risk Management Association | United States |
| Daisuke Abe | Director | Weathernews, Inc | Japan |
| Shoichi Tateno | Section Leader | Weathernews, Inc | Japan |
| Tokiyoshi Toya | Advisor | Weathernews, Inc | Japan |
| Makoto Suwa | Senior Disaster Risk Management Specialist | World Bank GFDRR | United States |
| Dr David Rogers | Consultant | World Bank Group | UK |
| Dimitar Ivanov | Chief, Regional Office for Europe | World Meteorological Organization | Russia |
| Pete Bouchard | Chief Meteorologist | Wx Risk Global | United States |
| Dr Amos MAKARAU | Director; PR of Zimbabwe with WMO; President of RA-I | Zimbabwe's Meteorological Services Department | Zimbabwe |

Annex 2 Agenda

DAY 1, Wednesday 22 March (At the Suntec Exhibition & Conference Centre)

Session 1: 16.30 - 18.30

Setting the scene: Overviews from key stakeholder groups

Chair: Dr Makoto Suwa, Senior Disaster Risk Management Specialist, The World Bank

- International Perspective, by **Dimitar Ivanov**, Chief Aeronautical Meteorology Division, World Meteorological Organization
- National Met Service perspective, by **Dr Amos Makarau**, Director, Zimbabwe Meteorological Services Department and President, WMO Region I.
- Science & technology perspective, by **Professor Alan Thorpe**, Visiting Professor at University of Reading and Former Director-General of the European Centre for Medium-Range Weather Forecasts (ECMWF)
- International development perspective, by **Benjamin Larroquette**, Regional Technical Advisor, UNDP-Global Environment Finance
- Private sector perspective, by **Dr Neil Jacobs**, Chief Atmospheric Scientist, Panasonic Weather Solutions, Panasonic Avionics Corporation
- National Met Service perspective, by **Dr Laxman Singh Rathore**, Former Director-General, India Met Department
- National Met Service perspective, by **Dr Michael Staudinger**, Director General, Zentralanstalt für Meteorologie und Geodynamik (ZAMG), Austria

DAY 2, Thursday 23 March (At the Marina Mandarin Hotel)

Session 2: 09.00 - 10.45

Opportunities for public-private sector engagement in the developed and developing countries

Chair: Peter Lennox, CEO, Meteorological Service of New Zealand Ltd.

Panel discussion with audience participation.

Participants comprised representatives of private and public sectors and developing and developed countries. The discussion focused on the “opportunities” for engagement at each stage of the value chain – from data acquisition, processing and value adding, through to its actual use in practice. The role of institutional and legal influences was also considered.

Panelists:

Marc Lemmond, Senior Manager for Public-Private Partnerships, The weather Company

Avner Furshpan, Director of Climatology, Israel Meteorological Service

Dr Sheldon Drobot, Principal – Noble Causes, Environmental Solutions, Space and Intelligence Systems, Harris Corporation

Abu Salem Khan, Deputy Executive Director (operations) Institute of Water Modelling, Bangladesh

Dr Marcel Marchand, Specialist coastal management and flood risk management, Deltares, Delft University of Technology

Dr Neil Jacobs, Chief Atmospheric Scientist, Panasonic Weather Solutions, Panasonic Avionics Corporation

Break 10.45 - 11.15

Session 3 11.15 - 13.00

Obstacles to public-private sector engagement in the developed and developing countries and ways to overcome them

Chair: Dimitar Ivanov, Chief Aeronautical Meteorological Division, WMO

Panel discussion with audience participation.

Participants comprised representatives from private and public sectors and developing and developed countries. The discussion focused on “obstacles” to engagement at each stage of the value chain – from data acquisition, processing and value adding through to its actual use in practice. The role of institutional and legal influences was also considered.

Brian Day, Chairman, HMEI and President/CEO, Campbell Scientific (Canada) Corp.

Peter Lennox, CEO, Meteorological Service of New Zealand Ltd.

Peter Plazer, CEO, Spire Global Inc.

Dr Will Lang, Chief Meteorologist, UK Met Office

Jon Porter, Vice President, Research and Development, Accuweather

Dr Jin Ho Yoo, Climate prediction team leader, APEC Climate Centre, Busan, South Korea

Lunch 13.00 - 14.00

Session 4 14.00 - 16.00: **Bringing it all together: the next steps in developing public-private sector engagement**

Chair: Dr David Rogers, World Bank and Health & Climate Foundation.

Round table session comprised the speakers from Session 1 and the chairs from sessions 2 and 3, who summarised the main points and conclusions relating to their respective sessions.

Dr Makoto Suwa

Dimitar Ivanov

Dr Neil Jacobs

Dr Laxman Singh Rathore

Benjamin Larroquette

Professor Alan Thorpe

Dr Amos Makarau

Peter Lennox

Dr Michael Staudinger

Session 5 16.00 - 16.30 **Wrap up**

Summary and presentation of main conclusions.