

WORLD METEOROLOGICAL ORGANIZATION
MEETING OF THE COMMISSION FOR BASIC
SYSTEMS OPEN PROGRAMME AREA GROUP ON
PUBLIC WEATHER SERVICES (PWS) EXPERT TEAM
ON MEETING USER NEEDS IN REDUCING THE
IMPACTS OF HYDROMETEOROLOGICAL HAZARDS
(CBS/OPAG-PWS ET/DPM)

FLIC EN FLAC, MAURITIUS, 16-20 SEPTEMBER 2013



FINAL REPORT

EXECUTIVE SUMMARY

The “Meeting of the Commission for Basic Systems Open Programme Area Group on Public Weather Services (PWS) Expert Team on Meeting User Needs in Reducing the Impact of Hydrometeorological Hazards (CBS/OPAG-PWS ET/DPM)” was held in Flic en Flac, Mauritius from 16 to 20 September 2013. The Meeting was chaired by Mr Elliott “Eli” Jacks (NWS/NOAA, USA).

The key conclusions from the work of the Expert Team are summarized below.

The Meeting reviewed the deliverables which were agreed to at the Beijing meeting in 2011, and noted that all of the major deliverables had been completed thus far, with the exception of one related to impact-based forecasting (which still needed further work). The decision on how to progress this item is recorded in the list of the Meeting deliverables.

The Meeting also reviewed the existing Terms of Reference (TORs) for the ET/DPM, which had been approved by the Fifteenth Session of the Commission for Basic Systems (CBS-15, Jakarta, Indonesia, September 2012).

The participants focused on a number of issues relating to improved warnings and their use, and related topics, including the future role of forecasters. Based on the recognition of a growing demand on National Meteorological and Hydrological Services (NMHSs) to provide impact-based services, the Meeting’s business was dominated by the subject of impact-based information, forecast and warning services. The structure of draft guidelines on this subject, which had been developed following the Beijing meeting, was reviewed and following extensive discussions, the decision on way forward was reached and recorded in the table of deliverables resulting from the Meeting.

Another key deliverable arising from the Meeting was the preparation of training modules on the subject of early warning systems and impact-based information and services. This deliverable will be undertaken following the completion of the guidelines mentioned above.

During the course of the Meeting, the participants paid a visit to the Mauritius Meteorological Service (MMS) and were briefed on its functions and recent plans for improvement of service delivery to the public and other users.

1. INTRODUCTION

1.1 The Mauritius Meteorological Service (MMS) kindly hosted the “Meeting of the Commission for Basic Systems Open Programme Area Group on Public Weather Services (PWS) Expert Team on Meeting User Needs in Reducing the Impact of Hydrometeorological Hazards (CBS/OPAG-PWS ET/DPM)”, in Flic en Flac, Mauritius, from 16 to 20 September 2013. The Meeting was chaired by Mr Elliott “Eli” Jacks (NWS/NOAA, USA), who welcomed the participants to the meeting and outlined the objectives of the meeting and the issues that needed the focus of the Expert Team. Ms Haleh Kootval, Chief, Public Weather Services Division, World Meteorological Organization (WMO) welcomed the participants on behalf of the Secretary-General. The Chairperson drew attention to the Team’s Terms of Reference (TORs), as approved by the Fifteenth Session of the Commission for Basic Systems (CBS-15, Jakarta, Indonesia, September 2013). The TORs are as follows:

- (a) Monitor and report on the progress of recent initiatives of the Expert Team;
- (b) Develop a template for an agreement document for fostering collaboration and partnership between National Meteorological and Hydrological Services (NMHSs) and respective national Disaster Management Authorities (DMA) organizations;
- (c) Provide guidance to NMHSs on how to develop impact-based information, forecast, and warning services on various time scales for Weather, Climate and Water (WCW) hazards;
- (d) Keep under review the development of cross-border exchange of warnings with reference to the published WMO Guidelines;
- (e) Monitor and survey the usefulness of the work of the Expert Team in assisting NMHSs to deliver improved products and services in reducing impact of WCW hazards;
- (f) Engage other WMO Programmes, PWS Expert Teams, CBS OPAGs and technical commissions (TCs) to determine common areas of interest and possible collaboration;
- (g) Assist NMHSs with the definition and development of work force competencies needed to effectively interact with the user community in the context of reducing impact of WCW hazards;
- (h) Develop and maintain a list of experts in PWS aspects of reducing impact of WCW hazards who are willing to contribute to PWS training and development activities; and,
- (i) Report to and make recommendations, as appropriate, to the ICT/PWS.

The “List of Participants” is given in Appendix I. The “Meeting Programme” is contained in Appendix II.

2. ORGANIZATION OF THE MEETING

The Meeting adopted the agenda and agreed on its working hours. Appropriate time was allowed for coffee and lunch breaks.

The Expert Team Members introduced themselves and gave a brief description of their national responsibilities and the main issues that were the subject of their focus in their duties and responsibilities. It was clear from these introductions that the topic of impact-based forecasts and warnings and related issues was gaining increasing importance in nearly all NMHSs.

3. REVIEW OF RELEVANT DECISIONS OF CBS-15 AND EC-65

The Meeting was informed by Ms Kootval and Mr Jacks of some of the relevant decisions of CBS-15 and the Sixty-fifth Session of the WMO Executive Council (EC-65), and, in particular, the work relating to the Expert Team. In addition to the decisions of these Bodies, the importance of impact-based forecasting, dissemination of multi-hazard warnings through PWS channels, competency framework for PWS forecasters and advisers, issues related to the communication of hazards and warnings and working with media, as well those concerning the Common Alerting Protocol (CAP) and the WMO Register of Alerting Authorities were highlighted under this item. Ms Kootval also provided a brief overview on the structure of WMO as regards the various TCs, CBS, the OPAG on PWS, and the various Expert Teams within the OPAG.

4. REPORT OF THE CHAIRPERSON OF THE ET/DPM

The Chair summarized the work of the ET since its last meeting (Beijing, 2011) in terms of the Team deliverables, as shown in Section 4.2 of this report. In addition, the Chair stated that the best information is only useful if it is clearly understood and communicated, that there are an increasing number of modalities for disseminating and receiving our information (cell phones, tablets, social media, etc.), and the importance of developing partnership with Disaster Management Agencies (DMAs) to maximize the benefits of the NMHSs information.

4.1 Review of the current Terms of Reference (TORs) of the ET

The Meeting reviewed its current TORs, and while recognizing that the TORs could be formally amended only by CBS, agreed that based on the deliverables of the Team, it could formulate recommendations for the consideration by CBS on such amendments.

4.2 Review of the deliverables from the 2011 meeting of the ET (Beijing, China)

The Meeting reviewed the deliverables which had been agreed to at the Beijing meeting in 2011. It took note of the actions that were still outstanding and agreed on how to proceed with them depending on whether they should be maintained and completed or be dropped from the work plan of the ET. The "Action Sheets of the Beijing Meeting indicating the Team Deliverables" is given in Appendix III to this report.

DELIVERABLE 1: *Guidance on impact-based forecasts and warnings*

The draft guidance in its current form was reviewed by the Meeting and additional points from the discussions were incorporated into the draft. **Action: This item was rolled into the action item resulting from the current meeting of the ET and steps for its implementation were included in the new Team Deliverables (see Appendix IV).**

DELIVERABLES 2 and 3: *List of areas of expertise and competencies to deliver effective impact-based services and list of experts*

The list of competencies for a PWS (bench) forecaster and other additional competencies for the delivery of services have been drafted and reviewed extensively, including by the OPAG on Data Processing and Forecasting Systems (DPFS) and the EC Panel on Education and Training. Comments resulting from all reviews will be incorporated in the final draft of the competencies to be presented to CBS-Extraordinary Session in 2014 (CBS-Ext.14) for

endorsement. This process needs to be completed prior to the compilation of the list of experts to assist with training activities in relevant areas. **Action: H. Kootval to circulate the current draft to Team members.**

DELIVERABLE 4: *Feedback from NMHSs on the usefulness of deliverables*

The Meeting agreed that it would be difficult to get feedback on the work of the Expert Team as a whole, but that feedback on the individual deliverables could be requested from NMHSs, since deliverables, such as guidance materials, are sent to the Permanent Representatives (PRs) under a cover letter from the WMO Secretary-General, and request for feedback on the usefulness of those deliverables could be included in such letters. **Action: H. Kootval to inform all ET Members when new deliverables are sent to the NMHSs management so that they can assist in raising awareness to the existence of such guidance materials in their NMHSs.**

DELIVERABLE 5: *Proposal for collaboration with relevant programmes and ETs*

Closer collaboration between the PWS and Tropical Cyclone Programme (TCP) resulted in the participation by the PWS Programme (PWSP) to the Typhoon Committee on "Effective Warning Systems", and continued teamwork in the joint training activities between the two programmes. Similarly, there is a strong collaborative relationship with the OPAG on DPFS. While noting that such partnership was mostly on ad-hoc basis, as opportunities presented themselves, the ET agreed that they were useful in promulgating the results of the work of the ET and that they should be continued and strengthened in the future.

DELIVERABLE 6: *A template agreement document containing guiding principles for fostering effective partnership*

This document has been produced "Guidelines for Creating a Memorandum of Understanding and a Standard Operating Procedure between a National Meteorological or Hydrometeorological Service and a Partner Agency" (WMO-No. 1099, PWS-26), and distributed to all WMO Members, as well as being placed on the PWS Website (http://library.wmo.int/opac/index.php?lvl=etagere_see&id=41).

4.3 Presentations by ET Members on their national warning systems and related issues

Each ET Member made a presentation on the operational warning systems in their individual NMHSs, including the challenges and plans to overcome those challenges. These are reflected below.

Australia: Weather and flood forecast and warning operations at the Australian Bureau of Meteorology (BoM) is organized into seven (7) Regional Offices in state and territory capitals, and one central office in Melbourne. Three of these Offices are also tropical cyclone warning centres. Most of the official warnings made by BoM are text-based, but do contain metadata that will facilitate rendering the warnings as graphics, CAP, .XML and other formats. There are projects in place to translate the warnings into these formats in the next six (6) months. Some warnings have detailed graphics to supplement the text. These include warnings for tropical cyclones, severe thunderstorms, tsunamis and wildfires.

The BoM severe weather services include seasonal outlooks for tropical cyclones and wildfires, and the level of detail in these is expected to increase as the BoM moves from statistical to dynamical seasonal prediction with the POAMA coupled ocean / atmosphere model.

Current challenges for the BoM service offering include:

- **Graphics:** the need to move to graphical representation of all warnings to improve the delivery of warning information;
- **WMS / interoperability:** using interoperable spatial formats for warning delivery to facilitate the incorporation of weather intelligence into the business processes of partner agencies and other clients;
- **Forecast process / automation:** improvements in the efficiency of the warning process and automation of routine weather forecasts to free up forecaster time for high-impact weather;
- **Service gaps:** addressing service capability gaps including tropical cyclone storm surge and heat wave warning;
- **ConOps / NCEW / seamless prediction:** harmonizing the operation of the new National Centre for Extreme Weather with Warnings generated by regional offices and with longer timescale seasonal and climate commentaries and predictions;
- **Sharing the warnings market with the private sector:** non-National Meteorological or Hydrometeorological Service (NMS) organizations are becoming more visible in the weather warning space. These include companies that package and re-distribute NMS warnings, sometimes on new channels, and also companies and other organisations that issue their own warnings for weather and weather related hazards;
- **Move to Mobile:** more than half of the users coming to the BoM web pages are now accessing the pages from a mobile device. This highlights the need to tailor web services to the particular requirements of mobile platforms, including smaller screen sizes and usually a communications lower bandwidth;
- **Transition to warning on impacts:** it is widely accepted that the utility of weather warnings are enhanced by framing the weather in terms of the impact it will have. Doing this well is a significant undertaking; and
- **Policy around direct delivery and reach of NMS:** policy questions around the extent to which the BoM extends beyond being a pure weather service provider to a provider of broader “environmental intelligence” need to be developed.

New initiatives at the BoM to address these issues include:

- (1) Rollout of the Next Generation Forecast and Warning System (NexGenFWS) based on the Australian re-development of the US-NWS GFE forecast system is almost complete. NexGenFWS supports systematic forecast and warning process, automated text generation and the generation of gridded, graphical and interoperable weather services for a greatly expanded number of locations.
- (2) A new web map viewer called MetEye is now operational and delivers high temporal and spatial resolution weather information in an interactive, spatial environment.
- (3) BoM is setting up a new National Centre for extreme weather. This new centre will produce a range of new high impact weather services including a national weather threat graphic. Other services rolling out over the next four (4) years

include advanced storm surge forecast system, heat wave warning system, interactive warning graphics and automated thunderstorm prediction system.

- (4) The new climatologically heat wave index has been developed and has a much improved ability to predict mortality, morbidity and infrastructure failure. This index should form the basis of the planned new heat (and cold) wave warning service.
- (5) Planned expansion of warning services to include weather impacts will depend on the development of vulnerability and exposure maps and impact models, all in collaboration with partner agencies.

BoM developments that have potential for re-use in other agencies:

- (1) Heat wave definition;
- (2) Probabilistic Tropical Cyclone Storm Surge prediction system;
- (3) Impact models and methodologies.

Suggested discussion group topics:

- (1) Use of social media for disseminating warnings and for acquiring situational awareness;
- (2) Development of impact models;
- (3) Exposure, vulnerability and risk mapping;
- (4) Standards for warning delivery.

Canada: "Towards impact-based forecasting in support to Disaster Management Partners" National Prediction Program, Meteorological Service of Canada.

Since 2010, MSC has undertaken the evaluation of its weather warning program within the greater context of the next generation of its prediction system program and the delivery of products and services. The objectives of the warning re-engineering project are to increase the capacity to produce and disseminate accurate and relevant warning products through timely, efficient and modern delivery methods.

A major review of the content of its alerting bulletins and dissemination methods was initiated and implementation of new approaches related to thunderstorm and tornado warnings began in April 2013. Additional changes to the production of weather warning bulletins will be implemented in the course of 2014.

This review includes the following items, among others:

- an assessment of the types of alerting bulletins;
- the incorporation of potential impact information and calls to action statements within alerts. These information were defined in collaboration with public safety organizations;
- the eventual expansion of the alerting information to cover multi-hazards and multi-scale with increase in focus on early notification (days to months) based on increase predictability;

- information to include confidence levels;
- Geo reference information associated to the alerting information; and
- the identification of various dissemination methods to increase the push capacity of the alerting program.

Changes to the delivery of the warning program must, in parallel, consider changes to the forecaster's workflow and the tools used in the production of warnings. Hence, some of the features in the development of the display and production application (NinJo) used within the MSC incorporates:

- alert categories, types, attributes and standard descriptions of the warning phenomena;
- free format text section for the addition of relevant information;
- a risk assessment grid defining severity, likelihood (confidence) and urgency (for broadcast intrusive messaging); and
- call for action statements and potential impacts information.

The changes to the forecaster's tool also enable MSC to ensure rapid dissemination of alerting messages, in both official languages (English and French), through various dissemination channels. The availability of alerting information through the CAP has expanded this capacity.

Outputs from the alerting program available through the National Alerting Aggregating System include:

- dissemination of warnings through Google Alert;
- EC Alert Me (https://ecalertme.weather.gc.ca/guides/quickstart_e.php);
- Social Media; and
- Initiatives with Public Safety Canada through interoperable systems such as the Multi-Agency Situational Information System Information Exchange.

Other prototype examples presented relate to: (1) a vigilance approach to high risk weather events, in coordination with the Public Safety Province of Québec; and (2) risk information and displays for use of public safety organisations in other provinces.

Finally, responsibilities and challenges related to Weather Preparedness Meteorologists (WPM) and others involved in outreaching during high-impact events (such as during hurricane season) were presented. Initiatives related to how MSC is dealing with succession planning, and links with Emergency Management stakeholders were discussed. Examples were presented as to the use of high-impact weather briefings illustrating how meteorologists can provide early notification and decision making support to these stakeholders and the public through information related to the confidence in the occurrence of the meteorological hazard, potential impacts, and risks.

China: As routine services to the public for disaster prevention and mitigation, the China Meteorological Administration (CMA) issues 14 categories of warnings using standard icons/colours. The colours include red, orange, yellow and blue. CMA also provides severe weather forecasts to inform the public in graphic and text form when, where and how the severe

weather will happen. A public training and outreach program was launched to help the public to better understand and use the forecasts and warnings. CMA has developed multiple means for warning information delivery including, China Weather Channel (www.weather.com.cn), mobile phone apps, as well as the use of social media. In order to enhance the coordination with the social media, CMA set up the severe weather warning information center. CMA also provides specific services to the disaster management departments and water, agriculture, land resources, forestry and transport sectors. Compared with the public services, the services for the partners are delivered much earlier and put more emphasis on decision support.

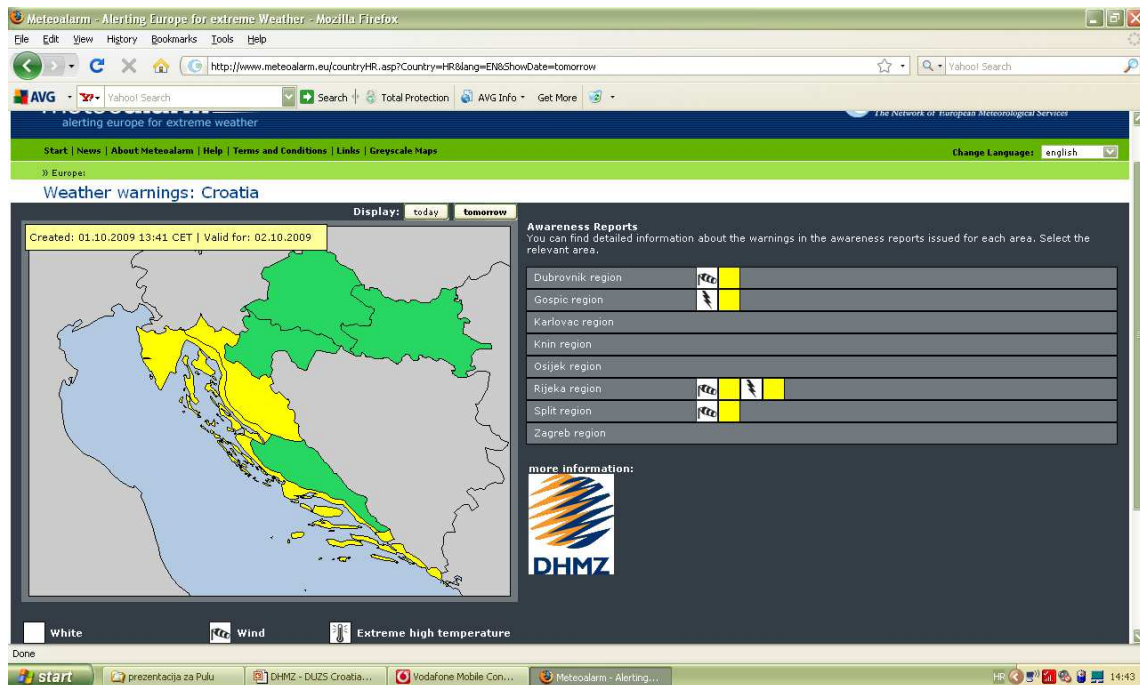
There are some challenges for CMA to provide ideal service, revolving around four (4) areas as follows: (1) the skill is still deficient to make more accurate forecasts and warnings for the meteorological hazards to avoid the "False Alarm" problem, especially for the small-scale severe convective weather; (2) the socio-economic information is hard to be fully accessed from other departments to make tailored impact forecast and risk warning; (3) the ability of users, especially the government and departments involved in disaster management, to correctly understand and use the warnings needs to improve; (4) the warning information sometimes cannot be delivered to the remote mountainous, rural areas and vulnerable groups timely.

In order to improve service delivery, impact-based forecast should be developed. Conducting disaster risk surveys to determine disaster vulnerable areas and infrastructures and their thresholds to withstand severe weather events will be a key step for doing that. The application of new communication technologies, such as Beidou satellite communications and the improvement of the mechanisms for the participation of social media in warning information delivery will improve warning information coverage and lead time. Training for key users, and interaction and information sharing with the partners should be enhanced for ideal service delivery.

Croatia: One of the most important tasks of NMHSs is the establishment of warning systems capable of distinguishing high-impact weather events, requiring widespread or special response, from routine weather events. In Croatia, the roles and responsibilities of agencies involved in different aspects of the Early Warning System (EWS) and disaster management are defined in national plans and supported by legislation, with collaboration and coordination mechanisms that are defined through standard operational procedures (SOPs). The leading partners in the EWS program are the Meteorological and Hydrological Service (DHMZ) and the National Protection and Rescue Directorate (DUZS). The cooperation between DHMZ and DUZS is based on a considerable history of joint work and previous mutual contacts in both routine and extraordinary situations. As a result, "SOPs for the Use of Weather Forecasts of the DHMZ" has been formulated regulating the content of forecasts and warnings, time of delivery, transmission methods and reception of specific warnings as well as additional data, interpretations and additional explanations. In routine situations, the DUZS is supplied all observational data and daily weather forecasts by DHMZ. The DUZS then disseminates the weather information through its own communication network to its County Centres.

Generally, there are two modes of warnings - public warnings and user-defined special forecasts and warnings. Public warnings are specially prepared for media (radio, TV, Internet). Usually, forecasters on duty are involved in TV and radio broadcasting of warnings. This form of communicating DHMZ forecasts and warnings to the public is a long tradition (for radio since 1950 and for TV since 1956) and all forecasters are especially trained for effective warning communication. Bio-meteorological and agro-meteorological forecasts and warnings are regularly issued by different media (<http://www.meteo.hr/>). DHMZ is also involved in research on severe weather and in developing nowcasting methods and forecasting tools through different national and international projects, continuously supporting training activities and educational materials for synoptic satellite meteorology (e.g., EumeTrain Project, www.eumetrain.org Manual on Synoptic Satellite Meteorology SatManu <http://www.zamg.ac.at/docu/Manual/SatManu/main.htm?/docu/Manual/SatManu/> User-defined special forecasts and warnings are tailored for specific needs and follow specific criteria suggested

by users (e.g., fire weather index for DUZS, public heat warnings in coordination with Ministry of Health, nautical warnings for tourists in coordination with Ministry of Maritime Affairs, Transport and Infrastructure: http://prognoza.hr/prognoze.php?id=jadran_e¶m. Furthermore, providing the Meteoalarm information for Croatia (shown below) has been found beneficial for both the public and DUZS. (http://www.meteoalarm.eu/hr_HR/0/0/HR-Hrvatska.html).



Hong Kong, China: As timely delivery of weather forecasts and warnings is essential, the channels through which the information is relayed keep evolving in response to user needs and by taking advantage of the advances in communication technology. In particular, mobile technology has been used recently for timely delivery of weather forecasts and warnings. The Hong Kong Observatory (HKO) launched a personalized weather service called MyObservatory in early 2010 which not only provides weather forecast and warning related information, but also includes a special feature providing push notification of weather warnings, and automatically displays the latest weather information from the weather stations closest to the user. The MyObservatory was recently enhanced with "Location-based Rain Forecast" service. Users could easily get hold of the rainfall forecast in the coming two hours specific to their actual or selected locations in Hong Kong.

Some of the other new services provided by the HKO in recent years include the use of social media tools like Twitter to deliver information. On following the official weather account of HKO on Twitter, the user will be kept posted on the latest warnings in force and the latest weather news. The Observatory also launched the Community Weather Observing Scheme (CWOS), a web platform for sharing weather observations posted by participating members. This encourages communities to participate in making weather observations, and become more aware of weather-related hazards.

Some of the current challenges faced by the Observatory relate to the public reaction. For example, a recent case of changing the tropical cyclone warning signal drew considerable attention from the public, who expressed opinions on the time of signal change and the wordings in the signal messages. To explain to the public that the Observatory's decision on signal change is based on science and the safety of the public is the prime factor; blogs were posted on the HKO Website to explain the factors considered in changing signals.

France: The French Vigilance System is about ten (10) years old and has required a number of essential partnerships to build and update a national system whose design and operative procedures do not belong solely to the Meteorological Service. The System includes:

- a four (4) colour-coding scale for all hazards;
- pictograms indicating the hazard displayed at orange and red level and then accompanied by follow-up text bulletins;
- regional and national level bulletins that all include possible impacts of the hazard and associated behaviour advice from a collaboratively predefined catalogue;
- lead time not to be extended beyond the next day;
- a routine dissemination which, takes place twice a day even if no warning is in effect (green colour); and
- a systematic warning assessment conducted taking into account the partners' points of view.

Trends are closely monitored and reported to Parliament.

Since the launch of the system in 2002, experience was shared with the EUMETNET community resulting in the Meteoalarm system where 30 countries contribute to provide a regional multilingual view of ongoing warnings in addition to the national systems. (www.meteoalarm.eu).

A special focus was placed on flood warnings that are produced by a sister organization and integrated into the national vigilance platform and products. Collaboration was initiated with co-financing observation networks (radars, automated rain gauges) and sharing a large amount of data, thus leading to an integrated production of rain and flood warnings. The central flood forecasting office (SCHAPI) is currently constructing an operational building along the Météo-France's central forecasting office in Toulouse. A bridge will link the two buildings to enable operations to actually take place in the same location.

The new operational forecasting scheme at Météo-France is as follows:

- a dedicated team performs what is described as "upstream forecasting", i.e., the activities conducted daily in routine mode such as NWP model outputs tactical analysis and associated guidance with graphical products and database initialization and adaptation; and
- a whole network of "forecast advisors" benefits from this material and delivers user-oriented products and services to a wide variety of customers according to their requirements.

Particular care was put in the overall coherency of the information provided to customers at all levels, through a variety of coordination means between forecasters. The necessity of meeting user needs regarding emergency situations was stressed. An initiative was started in 2011, and resulted in a wide usage of web-conferencing with all key stakeholders, under the leadership of National Inter-ministerial Operations and Crisis Management Center or their regional components. Challenges with respect to this initiative are switching to decision making support attitude and appropriate training. The difficulty for a Weather Service to venture alone into risk and impact assessment was highlighted and it was concluded that multi-sectoral partnerships are essential to improve the overall service to the nation.

Mauritius: Weather prediction is about people. Therefore, forecasts must be formulated with people in mind because they are the ones who are going to use it. The warning bulletins issued by the MMS cater for the following weather hazards: tropical cyclones; heavy rainfall (torrential rains); and high waves. No flash flood warning is issued at the present time.

Some of the major challenges are:

- the inability of existing models to capture the evolution and scale of weather systems in a marine environment; thus, weather forecasting beyond three (3) days in tropical areas has a lot of uncertainty;
- there is a need for further downscaling of model outputs to a small Island scale;
- existing early warning systems seem to be inadequate. The intensity of extreme weather has changed with unexpected and more severe impacts in places;
- no standard warning system exists, for example there is no standard colour coded warning;
- inadequate communication to the grass root population which is also the most vulnerable group of people; and
- keeping pace with technology is very expensive and not always within reach.

Some new Initiatives include:

- setting up a DMC is being re-invigorated;
- the way of communicating weather information on radio and television is being revisited;
- the MMS is also exploring the possibility of setting up cell broadcasts to reach the majority of the population in the event of a potential threat.
- a Doppler radar will be installed in the near future which will be a tremendous tool for nowcasting; and
- the MMS is considering to further improve the communication between the National Disaster Operations Coordination Center and the Meteorological Service, especially during an emergency situation.

Input for discussion:

- (1) to enhance the capacity of Meteorological Services in disaster prevention and mitigation, meteorologists must be trained in risk assessment and reduction and vulnerability mapping, and learn to effectively communicate impact-based early warnings in a clear and timely fashion; and
- (2) Multi-hazard standardized colour coded early warning communication should be implemented for regional and national consistency.

United Kingdom (UK): The two major flood events affecting the UK during the summer of 2007 and the subsequent independent government report highlighted the need for more joined up scientific and technical advice to support emergency management leading up to, and during natural hazard events. This ultimately led to the creation of the Flood Forecasting Centre (FFC) which is a joint partnership between the Met Office and Environment Agency whose purpose is to provide timely, relevant and accurate flood advice to Government and Categories 1 and 2 responders (civil protection). The success of the FFC in delivering a service that was greater than the sum of its Met Office and Environment Agency parts led to the creation of the Natural Hazards Partnership (NHP).

The Natural Hazards Partnership, created in 2011, is a consortium composed of leading Government agencies in the UK, whose aims are to deliver a forum for the exchange of knowledge, ideas, expertise and best practice in matters relating to natural hazards.

The NHP provides a common and consistent source of advice to Government and the emergency response community and has a programme of work to deliver hazard impact services based upon an emerging hazard impact model capability. The closer relationships developed between its members has already led to increased cross working on a range of resilience issues. These include the provision of policy advice to Government, a daily hazard assessment of the likelihood of natural hazards affecting the UK in the coming five (5) days and on the shelf scientific advice.

United States of America (USA): There are a number of activities within the U.S. National Weather Service (NWS) to advance service excellence with a focus on impact-based forecasting. For example, there are increasing collaborations between NWS forecasters and officials from the U.S. Federal Emergency Management Agency (FEMA) to prepare for extreme events. For some events, such as with Hurricane Sandy, NWS forecasters are asked to provide direct support to FEMA staff to support decision making. As another example, NWS is continuing with an initiative to clarify and simplify its hazard messaging to support public and private decision-making.

A “Hazards Simplification Demonstration” conducted during the winter of 2012 proposed clarified language and facilitated the collection of public comment on the proposals. Specific suggestions from the survey included: (1) use a 3-4 colour scale to account for forecast certainty and expected level of impact; (2) shorten hazard messages to the extent possible; and (3) include additional language within NWS hazard messages to clarify the current “Watch”, “Warning” and “Advisory” headline terms. A follow-on survey with social science support will be conducted during the winter of 2013-2014 based on prototypes to be developed using these suggestions.

Other examples include a joint government initiative to disseminate alerts for selected high-impact hazards to all enabled cell phones. These alerts have already been shown to save lives, for example, during a recent tornado event in Connecticut. The NWS is also collaborating with other disaster management partners to include additional information in its hazards messaging. A specific example is where NWS collaborated with the U.S. Occupational Health and Safety Administration (OHSA) to include specific guidance targeted to outdoor workers (and designed by OHSA) in all NWS heat hazard messages.

There is also a need to target warnings to the areas of greatest threat and minimize “false alarms” as much as possible, especially for short-duration, small scale weather events. Finally, as part of NWS’ goal of creating a “Weather Ready Nation”, there is an ongoing initiative to develop localized “Impact Catalogues” that will enable users to be notified of hazards based on thresholds *they* define for specific hazards that impact their operations.

5. DISCUSSIONS AND DECISIONS ON THE MAJOR TOPICS TO BE ADDRESSED BY THE ET

5.1 Discussions of contributions by ET members to major topics for the work of the ET

5.1.1 *Topics of future work; composition of sub-groups*

The members of the ET had been requested to suggest topics for the future work of the Team. These topics were meant to represent those areas that were important for the provision of effective warnings by NMHSs and all the associated issues, and which still needed additional work and attention. A number of suggestions had been received as listed below:

5.1.2 *Impact-Based Forecasting (IBF)*

5.1.3 *Decision Support Services (DSS)*

5.1.4 *Clear and Timely Communication of weather hazard information*

5.1.5 *Decision Support Tool (DST) Development*

5.1.6 *Evaluation Metric Development*

5.1.7 *Conducting Disaster Risk Surveys*

5.1.8 *Early Warning System (EWS) Establishment*

5.1.9 *Training Module Development*

The ET decided to combine these topics into three broad areas of work concentrating on: (1) Early Warning Systems; (2) Impact-Based Forecasting; and (3) Development of Training Modules. It was further agreed that the Team should work in two groups concentrating on areas 1 and 2 and that the result of this work would provide the material needed for the development of the training modules. The Team agreed that the results of these discussions would help populate the contents of the draft guidelines on impact-based forecasting which was under preparation.

5.1.2 *Outline for new Guideline entitled, “WMO Guide for National Meteorological and Hydrometeorological Services (NMHSs) on the Provision of Impact-Based Products and Services”*

The summary of the deliberation of the two sub-teams is shown under major headings for inclusion in the guidelines as reflected below.

I) *Introduction: Intended audience and purpose of the document*

- (a) Overall goal is to support community resilience and serve government partners in the interest of national safety.
- (b) Specify target audience: all staff within NHMSs.
- (c) Describe disaster risk reduction cycle (e.g., preparation, mitigation, response, recovery). What part(s) of cycle does this document address mitigation and recovery?

- (d) Universal Context: provision of weather-based warnings is needed as a first step. The goal, where appropriate, is to enhance the value of hydrometeorological information by including impact-based information in warnings and other services.
- (e) Describe distinction and justification for evolution (e.g., population growth, geographical vulnerabilities).
- (f) Why NMHSs are the right place to house Early Warning and Impact-based systems.
- (g) Key definitions (put at top).

II) *Multi-Hazard Early Warning Systems (MHEWS)*

- (a) Explain range of hazards and NMHSs' roles with regard to each (e.g., weather-based hazards, non-weather natural hazards, and man-made hazards where weather is a critical factor for recovery).
- (b) Clarify that scope of services will vary from one NMHS to the next (give examples).
- (c) Recommended design and implementation for a basic system, including scope; text, audio and visual formats; and delivery.
- (d) NMHSs' role in operating, maintaining and assessing system once implemented.
- (e) Limitations of purely hazard-based early warning systems and need for impact based systems.

Reference source: Guidelines on Early Warning Systems and Application of Nowcasting and Warning Operations (2010 Edition), WMO/TD No. 1559, PWS 21

III) *Overview of impact-based information, forecast and warnings*

- (a) Fundamental purpose – what is “impact-based” information and what are the expected benefits of providing it?
- (b) Overview of how NMHS' could evolve their practices to provide effective impact-based information.
- (c) Define the terms “risk”, “hazards”, “vulnerability” and “exposure” in the context of impact-based forecasting.
- (d) Some examples of traditional versus impact-based information.

IV) *Collaboration requirements for impact-based forecasting systems*

- (a) Identify potential partners (e.g., technical, planning, infrastructure, response, media and community groups) for collaboration and 2-way information sharing.
- (b) Where appropriate, and possible, formalize partner relationships via Memorandums of Understanding / Letters of Agreements (MoUs/LoAs) (e.g., agreement framework, funding model, governance, interoperability, communication strategy, training, accountabilities). *Reference source: Guidelines*

for Creating a Memorandum of Understanding and a Standard Operating Procedure between a National Meteorological or Hydrometeorological Service and Partner Agency, WMO-No. 1099, PWS 26

- (c) Plan regular interactions with partners to adjust impact-based criteria, risk maps, and other factors that support impact-based forecasting.
- (d) Effectively interact with and educate media and the public to ensure information is received and interpreted as intended.
- (e) As needed, and appropriate, secure an overarching government authority to oversee and coordinate collaborative activities.

V) *How to develop a system of impact-based information, forecasts and warnings*

- (a) How to gather, retain, manage and make accessible specific user *inputs* (requirements) for impact criteria as they vary in space and time and relate to public safety.
 - *Includes guidance on how to gather / share with partners and other NMHSs the following: vulnerability inputs, including risk maps and assessments, impact models, thresholds based on specific weather criteria as provided, and input from social media.*
- (b) How to develop *flexible criteria* informed by expected impacts for use within early warning systems, to account for critical societal factors with examples given (e.g., time of day, location of hazard, status of important infrastructure).
- (c) Recommended approaches for impact-based *outputs* that use international standards (e.g., XML/CAP), impact-based text, colour coded graphics, and interoperable GIS layers.
- (d) Recommended *dissemination guidelines* to make impact-based information accessible to partners and other users (including the general public) via mobile platforms and social media. Includes concept of an “intrusive push”/delivery system.
- (e) Best approaches for *conveying uncertainty information* in probabilistic terms within impact forecasts.
- (f) Advice on the inclusion of *effective language* in impact-based warning messages. Message characteristics should include clarity, brevity, simplicity and other features.
- (g) How to ensure forecast impact levels are informed by *climatological norms and antecedent events*.
- (h) Options for *leveraging NWP real-time observations, satellite imagery and other partner information*, to facilitate NMHSs’ focus on impact-based forecasts.
- (i) Protocols for *maintaining service* support before, during and after the event.

VI) *How to develop and maintain an impact-based forecasting framework*

- (a) Establish official positions whose job is to interpret and monitor forecast information for partners (e.g., via web conferences and co-location).

- (b) How to develop *flexible criteria* informed by expected impacts for use within early warning systems, to account for critical societal factors (e.g., time of day, location of hazard, status of important infrastructure).
- (c) Foster a culture change within NMHS' general workforce and users to migrate towards an "environmental intelligence" model (e.g., specify focus on severe weather impacts in combination with general forecast duties).
- (d) Foster familiarity with user needs so forecasters can tailor information to the production of effective impact-based services.
- (e) Work towards development of an impact-based verification program as part of the Quality Management System (QMS) framework for impact-based warning services and include specification of social and/or economic benefits.
- (f) Develop and maintain a robust professional (competency) development framework on provision of impact based information for NMHS and partners.

Appendices in the document will contain examples on various chapters.

6. IDENTIFICATION OF CLEAR DELIVERABLES RELATED TO THE MAJOR TOPICS CORRESPONDING TO THE ET TORs

Based on the discussions of the TORs and the topics of future work, the Meeting agreed to a number of activities for the implementation and finalization of the deliverables. The Action Sheet related to the deliverables and the agreed timeline is attached as Appendix IV.

7. WORK ON DELIVERABLES

The Meeting agreed to continue work on the deliverables as given in Appendix IV.

8. PREPARATION OF THE REPORT OF THE MEETING AND THE EXECUTIVE SUMMARY

The Secretariat representative agreed to compile the report of the Meeting based on the discussions of the main points in the agenda and to circulate it to the team members for review and further input prior to its adoption and posting on the Meeting Website.

9. VISIT TO THE MAURITIUS METEOROLOGICAL SERVICE

The Expert Team visited the Headquarters of the Mauritius Meteorological Service (MMS) on 19 September 2013 and was briefed on the functions of the Service by senior members of staff. The Team expressed its appreciation to the Director and staff of MMS for this informative and interesting visit and the warm hospitality it received during the visit.

10. CLOSING

The "Meeting of the CBS/OPAG-PWS ET/DPM" was closed at 1300 hours on Friday, 20 September 2013. The earlier than usual closure was to allow a number of participants to depart early, otherwise the discussions and work on deliverables could have continued further in the afternoon.

LIST OF APPENDICES TO THE FINAL REPORT OF THE “MEETING OF THE COMMISSION FOR BASIC SYSTEMS OPEN PROGRAMME AREA GROUP ON PUBLIC WEATHER SERVICES (PWS) EXPERT TEAM ON MEETING USER NEEDS IN REDUCING THE IMPACT OF HYDROMETEOROLOGICAL HAZARDS (CBS/OPAG-PWS ET/DPM)” (FLIC EN FLAC, MAURITUS, 16-20 SEPTEMBER 2013)

Appendix I: List of Participants

Appendix II: Meeting Programme

Appendix III: Action Sheets of the Beijing meeting indicating the Team Deliverables

Appendix IV: Action Sheets of the Mauritius meeting indicating the Team Deliverables

LIST OF PARTICIPANTS

NO.:	COUNTRY:	NAME AND TITLE:	ADDRESS:
1.	United States of America	Mr Elliott JACKS Chairperson <u>National Function:</u> Chief OCWWS Fire and Public Weather Services Branch	Office of Climate, Water and Weather Services National Oceanic and Atmospheric Administration - National Weather Service (NOAA/NWS) SSMC2, Room 13228, 1325 East-West Highway SILVER SPRING, MD 20910-3282 United States of America Tel.: +1 301 713 1858 x 110 Fax: +1 301 713 1520 E-mail: Elliott.Jacks@noaa.gov
2.	Hong Kong, China	Mr Lap Shun LEE Co-Chairperson <u>National Function:</u> Senior Scientific Officer	Hong Kong Observatory 134A Nathan Road KOWLOON, HONG KONG Hong Kong, China Tel.: +852 2926 8416 Fax: +852 2311 9448 E-mail: lslee@hko.gov.hk
3.	Australia	Mr John BALLY <u>National Function:</u> National Manager for Severe Weather and Disaster Mitigation	Bureau of Meteorology GPO Box 1289 MELBOURNE, VIC 3001, Australia 700 Collins Street DOCKLANDS, VIC 3008 Tel.: +61 3 9669 4505 Fax: +61 3 9669 4699 E-mail: j.bally@bom.gov.au
4.	Canada	Mrs Jennifer Ann MILTON <u>National Function:</u> Director, National Prediction Program, Weather and Environment Prediction and Services Directorate	Environment Canada 2121 TransCanada Hwy, 1 st Floor DORVAL (QUEBEC) H9P 1J3, Canada Tel.: +1 514 421 4610 Fax: +1 514 421 7250 E-mail: jennifer.milton@ec.gc.ca
5.	China	Mr WANG Zhihua <u>National Function:</u> Deputy Director-general	Department of Emergency Response Disaster Mitigation and Public Services China Meteorological Administration 46 Zhongguancun Nandajie Haidian District BEIJING 100081, China Tel.: +86 10 5899 5133 Fax: +86 10 6218 8520 E-mail: wangzh@cma.gov.cn

6.	Croatia	Dr Vlasta TUTIS <u>National Function:</u> Assistant Director, Weather and Forecasting Division	Meteorological and Hydrological Service of the Republic of Croatia Grič 3 HR-10000 ZAGREB, Croatia Tel.: +385 1 456 5768 Fax: +385 1 456 5757 E-mail: tutis@cirus.dhz.hr
7.	France	Mr Cyrille HONORÉ <u>National Function:</u> Director Adjoint, Opérations / Deputy Director, Operations	Météo-France 42, avenue Coriolis F-31057 TOULOUSE CEDEX, France Tel.: +33 5 61 07 82 05 Fax: +33 5 61 07 82 09 E-mail: cyrille.honore@meteo.fr
8.	Mauritius	Mr Premchand GOOLAUP <u>National Function:</u> Divisional Meteorologist	Mauritius Meteorological Service St. Paul Road VACOAS, Mauritius Tel.: +230 686 1031 Fax: +230 686 1033 E-mails: premgoolaup@intnet.mu meteo@intnet.mu
9.	United Kingdom	Mr Paul DAVIES <u>National Functions:</u> Head of the Met Office Hazard Centre and Chair of the Natural Hazards Partnership	Met Office FitzRoy Road EXETER EX1 3PB, United Kingdom Tel.: +44 (0) 77 9542 6901 Fax: +44 1392 88 5681 E-mail: Paul.Davies@metoffice.gov.uk
WMO SECRETARIAT 7 bis, avenue de la Paix, Case Postale No. 2300 CH-1211 GENEVA 2, Switzerland PWS Website: http://www.wmo.int/pages/prog/amp/pwsp/ET_DPM_2013.htm			
10.	WMO HQ, Switzerland	Ms Haleh KOOTVAL Chief, Public Weather Services Division	Public Weather Services Programme Public Weather Services Division Weather and Disaster Risk Reduction Services Department (WDS) Tel.: +41 22 730 8333 Fax: +41 22 730 8128 E-mail: HKootval@wmo.int

**“MEETING OF THE COMMISSION FOR BASIC SYSTEMS OPEN PROGRAMME AREA
GROUP ON PUBLIC WEATHER SERVICES EXPERT TEAM ON MEETING USER NEEDS IN
REDUCING THE IMPACTS OF HYDROMETEOROLOGICAL HAZARDS
(CBS/OPAG-PWS ET/DPM)”
(FLIC EN FLAC, MAURITIUS, 16-20 SEPTEMBER 2013)**

PROGRAMME

Monday, 16 September 2013

DAY 1			
0900-0930	1. OPENING 2. ORGANIZATION OF THE MEETING - Introductions - Agenda review and adoption - Overview of meeting goals, opening comments - Review of working arrangements and protocols	<ul style="list-style-type: none"> • Mr Eli Jacks (U.S. National Weather Service, Chairperson of the ET/DPM) • Ms Haleh Kootval (WMO Secretariat) 	30 minutes
0930-1000	3. REVIEW OF THE RELEVANT DECISIONS OF CBS-15 AND EC-65	<ul style="list-style-type: none"> • Mr Eli Jacks • Ms Haleh Kootval 	30 minutes
1000-1030	4. REPORT OF THE CHAIRPERSON OF THE ET/DPM - Review of the current Terms of Reference (TORs) of the ET - Review of the deliverables from the 2011 meeting of the ET (Beijing, China)	<ul style="list-style-type: none"> • Mr Eli Jacks 	30 minutes
1030-1100	COFFEE / TEA BREAK		30 minutes
1100-1200	5. DISCUSSION AND DECISIONS ON THE MAJOR TOPICS TO BE ADDRESSED BY THE ET - Introductory discussion by the Chair: Some Recent Challenges and Their Link to Impact Forecasting	<ul style="list-style-type: none"> • Chairperson and Team discussion 	60 minutes
1200-1330	LUNCH BREAK		90 minutes
1330-1530	5. DISCUSSION AND DECISIONS ON THE MAJOR TOPICS TO BE ADDRESSED BY THE ET (Cont.) - Status Presentations to fellow Team Members - Chair, Secretariat take notes for use by Sub-teams	<ul style="list-style-type: none"> • Mr Cyrille Honoré • Mr John Bally • Mr Lap Shun Lee • Dr Vlasta Tutiš (30 minutes each) 	120 minutes
1530-1600	COFFEE / TEA BREAK		30 minutes
1600-1700	5. DISCUSSION AND DECISIONS ON THE MAJOR TOPICS TO BE ADDRESSED BY THE ET (Cont.) - Status Presentations to fellow Team Members - Chair, Secretariat take notes for use by Sub-teams	<ul style="list-style-type: none"> • Mr Premchand Goolaup • Mr WANG Zhihua (30 minutes each) 	60 minutes

Tuesday, 17 September 2013			
DAY 2			
0900-1030	5. DISCUSSION AND DECISIONS ON THE MAJOR TOPICS TO BE ADDRESSED BY THE ET (Cont.) - Status Presentations to fellow Team Members - Instructions to Sub-teams and Group discussion	<ul style="list-style-type: none"> • Mr Eli Jacks • Mrs Jennifer Milton • Mr Eli Jacks (30 minutes each) 	90 minutes
1030-1100	COFFEE / TEA BREAK	30 minutes	1030-1100
1100-1200	5. DISCUSSION AND DECISIONS ON THE MAJOR TOPICS TO BE ADDRESSED BY THE ET (Cont.) - Sub-teams commence individual discussions	<ul style="list-style-type: none"> • All (in Sub-teams) 	60 minutes
1200-1330	LUNCH BREAK		90 minutes
1330-1530	5. DISCUSSION AND DECISIONS ON THE MAJOR TOPICS TO BE ADDRESSED BY THE ET (Cont.) - Sub-team continue and conclude discussions - Sub-teams develop short, summary presentations for plenary group (include suggested deliverables in presentations)	<ul style="list-style-type: none"> • All (in Sub-teams) 	120 minutes
1530-1545	COFFEE / TEA BREAK	15 minutes	1530-1545
1545-1700	5. DISCUSSION AND DECISIONS ON THE MAJOR TOPICS TO BE ADDRESSED BY THE ET (Cont.) - Sub-teams develop short, summary presentations for plenary group (include suggested deliverables in presentations)	<ul style="list-style-type: none"> • All (in Sub-teams) 	75 minutes
Wednesday, 18 September 2013			
DAY 3			
0900-1030	5. DISCUSSION AND DECISIONS ON THE MAJOR TOPICS TO BE ADDRESSED BY THE ET (Cont.) - Presentation of Sub-team results	<ul style="list-style-type: none"> • All Members (back in plenary) 	90 minutes
1030-1100	COFFEE / TEA BREAK	30 minutes	1030-1100
1100-1200	5. DISCUSSION AND DECISIONS ON THE MAJOR TOPICS TO BE ADDRESSED BY THE ET (Cont.) - Presentation of Sub-team results (Cont.)	<ul style="list-style-type: none"> • All Members (back in plenary) 	60 minutes
1200-1330	LUNCH BREAK		90 minutes

1330-1530	6. IDENTIFICATION OF CLEAR DELIVERABLES RELATED TO THE MAJOR TOPICS AND CORRESPONDING TO THE ET TORS - Discuss deliverables as identified based on Sub-team recommendations	<ul style="list-style-type: none"> All Members 	120 minutes
1530-1545	COFFEE / TEA BREAK		15 minutes
1545-1700	6. IDENTIFICATION OF CLEAR DELIVERABLES RELATED TO THE MAJOR TOPICS AND CORRESPONDING TO THE ET TORS (Cont.) - Reach agreement on deliverables and assign responsibilities for completion	<ul style="list-style-type: none"> Chair leads, with all Members 	75 minutes
Thursday, 19 September 2013			
DAY 4			
0900-1030	7. WORK ON DELIVERABLES - Based on agreed-upon deliverables, begin work on outlining the said deliverables	<ul style="list-style-type: none"> Chair leads, with all Members 	90 minutes
1030-1100	COFFEE / TEA BREAK		30 minutes
1100-1200	7. WORK ON DELIVERABLES (Cont.) - Continue to work on deliverables	<ul style="list-style-type: none"> Chair leads with all Members 	60 minutes
1200-1300	LUNCH BREAK		60 minutes
1300-1400	9. PREPARATION OF THE REPORT OF THE MEETING AND THE EXECUTIVE SUMMARY, INCLUDING DECISIONS FOR CONSIDERATION BY CBS-EXT. (2014) - Outline of the Final Report will be presented - Begin preparation of the Report	<ul style="list-style-type: none"> Chair leads, with all Members 	60 minutes
1400-1600	8. TOUR OF THE FORECAST CENTRE	<ul style="list-style-type: none"> All Members 	120 minutes
Friday, 20 September 2013			
DAY 5			
0900-1030	9. PREPARATION OF THE REPORT OF THE MEETING AND THE EXECUTIVE SUMMARY, INCLUDING DECISIONS FOR CONSIDERATION BY CBS-EXT. (2014) (Cont.) - Preparation of the Report (Cont.)	<ul style="list-style-type: none"> Chair leads, with all Members 	90 minutes
1000-1030	COFFEE / TEA BREAK		30 minutes
1030-1200	10. REVIEW AND ADOPTION OF THE REPORT	<ul style="list-style-type: none"> Chair leads, with all Members 	90 minutes

1200-1330	LUNCH BREAK		90 minutes
1330-1500	10. REVIEW AND ADOPTION OF THE REPORT (Cont.)	<ul style="list-style-type: none">• Chair leads, with all Members	90 minutes
1500	11. CLOSURE OF THE MEETING		

**“MEETING OF THE COMMISSION FOR BASIC SYSTEMS OPEN PROGRAMME AREA GROUP ON
PUBLIC WEATHER SERVICES (PWS) EXPERT TEAM ON MEETING USER NEEDS IN REDUCING THE
IMPACTS OF HYDROMETEOROLOGICAL HAZARDS (CBS/OPAG-PWS ET/DPM)
(BEIJING, CHINA, 17-21 OCTOBER 2011)”**

TEAM DELIVERABLES

<i>Deliverable 1: Related to TOR (b) Guidance on impact based forecasts and warnings</i>				
	Actions:	Lead(s) Responsible:	Due Date:	Status: 10 June 2013
1.	Provide common definition of impact-based information, forecast and warning services to the ET for comments and additions.	Eli and Sally	1 February 2012	
2.	Request contribution of examples from ET members of existing impact based information, forecast and warning services.	Eli and Sally	1 February 2012	
3.	Provide a common definition and gathered examples from ET members in an integrated format to WMO for final ratification.	Eli and Sally	1 May 2012	
4.	Provide this material together with a cover note explaining the context and intent from WMO to NMHSs.	Secretariat	1 Jun. 2012	The draft guidelines with input from CBS-15 and ET/SPII were sent for review and expansion by Paul Davies and Jennifer Milton (18 January). The new draft will be circulated to team members by end August for review and discussion at the ET meeting in Mauritius.
<i>Deliverables 2 and 3: Related to TORs (c and f) List of areas of expertise and competencies to deliver effective impact-based services and list of experts</i>				
	Actions:	Lead(s) Responsible:	Due Date:	Status: 10 June 2013
1.	Consult with the WMO ETR Office on the areas of competency for delivering impact-based services.	Secretariat	1 December 2012	
	Revise and amend as necessary the list of areas of expertise developed by ET/DPM for the provision of impact-based services.	Vlasta, Jennifer	1 February 2012	

2.	Request contribution of examples from ET members of existing work force competencies related to impact-based services.	Vlasta, Jennifer	1 April 2012	
3.	Develop a generic set of competencies based on the areas of expertise and the examples provided and circulate to ET members for comments.	Vlasta, Jennifer	15 September 2012	
4.	Provide the generic set to WMO for consideration by the ETR Programme as a starting step for formal introduction of competencies for the provision of impact-based services.	Secretariat	30 September 2012	
5.	Circulate the generic set to NMHSs with a covering note from WMO, and invite them to identify existing experts in these areas to assist with PWS training and development activities.	Secretariat	1 November 2012	Competencies for all areas of PWS, including DPM, have been drafted and reviewed by CBS-15. The latest draft has been reviewed by ICT-DPFS and comments incorporated in the draft. The new draft has been forwarded to ETR office for review by EC Panel of ETR prior to submission to CBS-Ext. session (2014) for approval.
<i>Deliverable 4: Related to TOR (d) Feedback from NMHSs on the usefulness of deliverables</i>				
	Actions:	Lead(s) Responsible:	Due Date:	Status: 10 June 2013
1.	When deliverables are ready, send them to NMHSs with a letter from the Secretariat and request for comments and feedbacks on their usefulness.	Secretariat	Following completion of key deliverables	Deliverable 6 (guidelines) have been sent under SG letter to all PRs. Some comments have been received.
<i>Deliverable 5: Related to TOR (h) Proposal for collaboration with relevant programmes and ETs</i>				
	Actions:	Lead(s) Responsible:	Due Date:	Status:
1.	Identify separate focal points in the ET who will contact the relevant WMO Programmes (primarily TCP and DRR).	Jim, Cyrille, Jennifer	Done	

2.	Focal points to make contacts with the WMO programmes to exchange information on common and relevant programme activities including production of guidance and other documentations (providing the programmes with the report of the work of ET).	Jim, Cyrille, Jennifer	Ongoing	
3.	Focal points to make contacts with other PWS Expert Teams and OPAGS to exchange information and establish agreed areas of common interest for collaboration, including production of guidance and other documentations (providing the programmes with the report of the work of ET).	LS, Augustine, Chen	Ongoing	Closer collaboration with the Tropical Cyclone Programme (TCP) resulted in presentation by PWSP to the Typhoon Committee on “Effective Warning Systems”. Such collaboration was strongly welcomed and encouraged and will continue in the future.
Deliverable 6: (related to TOR i) A template agreement document containing guiding principles for fostering effective partnership				
	Actions:	Lead(s) Responsible:	Due Date:	Status: 10 June 2013
1.	Expand existing outline into a full guidance document for agreement document. Send draft to ET members for them to suggest inclusion of relevant MOU excerpts to support the MOU. Circulate to ET members for comments and feedback, incorporate and send the resulting document to the Secretariat.	Eli, LS, Chen	1 February 2012 1 April 2013	
2.	Collect existing MOUs from ET members as examples on how to develop new MOUs.	Eli, LS , Chen	1 December 2011	
3.	The expanded outline and the examples will form the template to be sent to NMHSs.	Eli , LS, Chen	1 June 2012	
4.	Turn the package into a PWS guide series for WMO to forward to NMHSs with a covering letter explaining purpose, etc.	Secretariat	1 November 2012	The document has been produced and delivered to all NMHSs on the PWS Website under covering letter from SG. Limited printed version is available and request for translation to other languages have been submitted to Secretariat language services.

**“MEETING OF THE COMMISSION FOR BASIC SYSTEMS OPEN PROGRAMME AREA GROUP ON PUBLIC WEATHER SERVICES (PWS) EXPERT TEAM ON MEETING USER NEEDS IN REDUCING THE IMPACT OF HYDROMETEOROLOGICAL HAZARDS (CBS/OPAG-PWS ET/DPM)”
(FLIC EN FLAC, MAURITIUS, 16-20 SEPTEMBER 2013)**

TEAM DELIVERABLES

Deliverable 1: Finalize document entitled, “WMO Guide for National Meteorological and Hydrometeorological Services (NMHSs) on the Provision of Impact-Based Products and Services”				
	Action(s):	Responsible Member(s):	Due Date:	Status:
1.	Review outline developed at meeting and identify gaps within existing document entitled “WMO Guide for National Meteorological and Hydrometeorological Services (NMHSs) on the Provision of Impact-Based Products and Services” . Provide assessment to the Chair.	Jennifer and Paul	31 October 2013	
2.	Based on the Assessment, request team members to write specific sections as needed. This should include development of Glossary. Agreement reached on assignments.	Eli	15 November 2013	
3.	Team members complete writing assignments and sent to Chair.	All Team Members	15 March 2014	
4.	Chair completes amalgamation of submitted sections into complete draft document and sends to team for final review and comments.	Eli	15 April 2014	
5.	Team members submit final comments; Chair integrates into final document and submits to Secretariat	All Team Members	31 May 2014	
6.	Secretariat submits draft document to CBS	Secretariat	15 June 2014	
7.	Chair organizes periodic conference call to assess progress with document.	All Team Members	31 December 2013 and approximately quarterly thereafter	

Deliverable 2: Training requirements document for early warning systems and impact-based forecasting				
	Action(s):	Responsible Member(s):	Due Date:	Status:
1.	Based on final document, develop training requirements document to address needs associated with early warning systems and impact-based forecasting.	Vlasta, John, Prem lead with participation from all members	31 December 2014	
2.	Circulate competency document to all team members for information.	Secretariat	30 November 2013	
3.				
4.				
5.				
