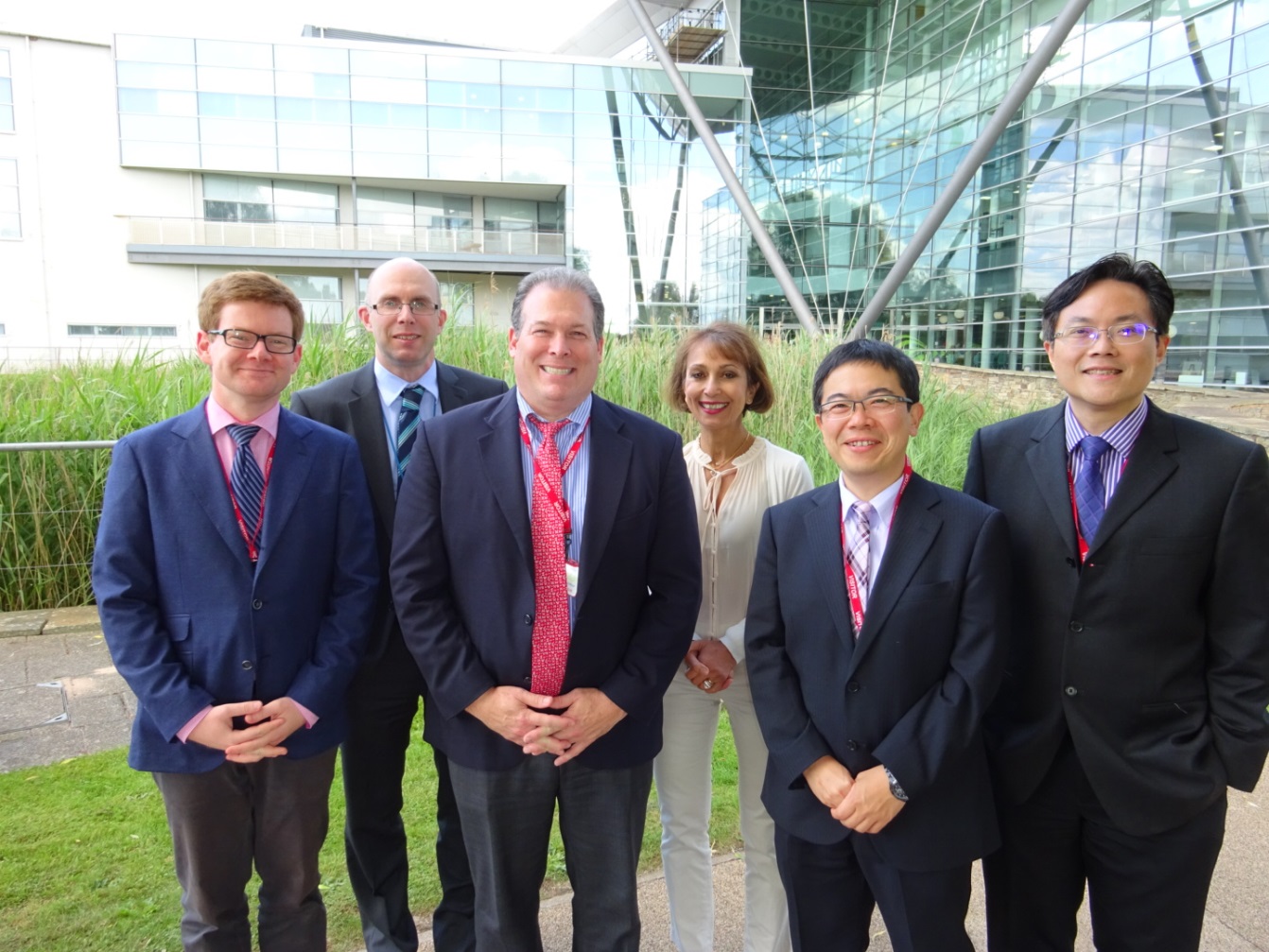
WORLD METEOROLOGICAL ORGANIZATION

meeting of the cbs/opag-pws expert team on services and producs innovation and improvement

EXETER, UNITED KINGDOM, 11-15 JULY 2016





## FINAL REPORT

EXECUTIVE SUMMARY

The “Meeting of the Commission for Basic Systems (CBS) Open Programme Area Group (OPAG) on Public Weather Services (PWS) Expert Team on Services and Products Improvement and Innovation (CBS/OPAG-PWS ET/SPII)” was held in Exeter, United Kingdom from 11 to 15 July 2016. The meeting was chaired by Mr John L. Guiney (United States of America (USA)). Under its Terms of Reference (TORs) and associated deliverables, the Expert Team (ET) had to work on several areas, which were associated with improved service delivery in accordance with “The WMO Strategy for Service Delivery”.

The key conclusions arising from the various reports, presentations and discussions are summarized below.

1. **Nowcasting services**

The Team discussed the outstanding work from its last session on preparation of guidance material for Members on applying a service-driven approach to the development of nowcasting systems, and decided that this work should continue and be concluded before the end of 2016.

1. **Big Data**

The Team agreed that although the Big Data issue dealt with many different kinds of data, of particular interest to PWS was the crowdsourced data. It decided to establish a Task Team on Big Data (TT-BD) to investigate the utilization of Big Data for monitoring, impact assessment, and forecasting and to collect and share examples of different approaches to crowdsourced data.

1. **Application of new and emerging technologies**

The Team discussed the challenges of emerging science and technologies and the their implications for service delivery. Among these are mobile apps, web-based services, application of GIS-compatible formats by NMHSs users and partners, and Common Alerting Protocol (CAP) and its integration into the WWIS and SWIC websites. The Team developed deliverables to address specific issues around some of these items.

1. **Formalization of collaboration with OPAG/DPFS**

The Team agreed that in order for ET/SPII to act as an interface between the CBS OPAGs to articulate user requirements for PWS to be passed to other technical groups within WMO, and to facilitate rapid “pull through” of new technical capabilities to PWS services, as envisioned by ICT/PWS, it would be necessary to establish close collaboration with OPAG/DPFS. This would facilitate the rapid and efficient application of new and emerging science and technology to improved service delivery.

1. **Future of WWIS and SWIC**

The Meeting noted with concern the slowness in progress as regards the participation of Members in WWIS despite regular letters of reminder and request being sent out from the Secretariat. It agreed to make proposals to Members on augmenting the number of forecast days and cities that submit forecasts through adding the official 10 EPS products that are produced by ECMWF for all Members at the request of WMO. The Meeting also agreed that it would be possible to use CAP data available on public domain for use in the enhancement of WWIS/SWIC websites.

1. **Public-private partnerships**

In discussing public-private partnerships (PPP) in the context of PWS and service delivery, the Team noted that EC-68 had proposed that WMO pursue the development of a PPP strategy. One of the guiding principles of the strategy is the preservation of NMHSs as the unambiguous and authoritative voice for warnings and official weather information, which has a potential implication for PWS and service delivery. The Team agreed that it would be useful to develop strategies for PWS exploitation of PPP and proposed the establishment of a Task Team on PPP and PWS.

1. **Terms of Reference**

The Team reviewed, and made modifications to the Terms of Reference (TORs) proposed by the ICT for ET/SPII, which will guide/inform the work plan of the Team during 2016-2020 quadrennial period, for approval by CBS-16.

8. **Future Deliveralbes**

Six deliverables as part of the ET work plan for the 2014-2016 inter-sessional period were identified as follows:

1. Publish guidance on the adoption of a service-driven approach to development of Nowcast systems;
2. Coordinate with ET-IMPACT to develop guidance on using and communicating uncertainty in impact-based forecasting;
3. Enhancement of WWIS and SWIC websites;
4. Utilisation of ‘big data’ for monitoring, impact assessment and decision-making in PWS delivery;
5. Exploiting public/private partnerships for public weather service delivery;
6. Improving PWS delivery through linking with OPAG-DPFS.

# 1. INTRODUCTION

1.1 At the kind invitation of the Government of United Kingdom of Great Britain and Northern Ireland, the “Meeting of the Commission for Basic Systems (CBS) Open Programme Area Group (OPAG) on Public Weather Services (PWS) Expert Team on Services and Products Improvement and Innovation (CBS/OPAG-PWS ET/SPII)”, was held at the Meteorological Office (MO) United Kingdom, Exeter, from 11 to 15 July 2016.

1.2 The meeting was chaired by Mr John L. Guiney (National Oceanic and Atmospheric Administration/National Weather Service (NOAA/NWS), USA), who welcomed the Team Members to the meeting. Ms Haleh Kootval, the WMO Secretariat representative, thanked the MO on behalf of the Secretary-General Prof. Taalas, and provided information on the objectives and expected outcome of the meeting of the ET/SPII. The Team was reminded that its principal role was to keep abreast of the new developments and innovations related to the delivery of PWS in order to advise the rest of the OPAG/PWS and provide the relevant input to the PWS Programme. The 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 national duties and responsibilities. The Chair 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 2012). The TORs are shown below:

1. Monitor and report on the progress of recent ET/SPII initiatives;
2. In collaboration with other CBS OPAGs and other WMO technical commissions (TCs), contribute to the implementation of “The WMO Strategy for Service Delivery” through:

(i) Reporting and advising on how to best assist Members, especially developing countries, with building an integrated approach to PWS products and services to improve their service delivery;

(ii) Keep under review the needs for new and improved products and services with emphasis on key PWS user groups;

(iii) Advise on the development, application and communication of probabilistic forecasts;

(iv) Continue to encourage the use of verification for PWS with an emphasis on user oriented methods;

1. Review and advise on the implications of the service delivery strategy for the future role of the forecaster; and
2. Advise on and keep under review the development of World Weather Information Service (WWIS) and Severe Weather Information Centre (SWIC) Websites.

The list of participants is contained in Appendix I to the report.

**2. ORGANIZATION OF THE MEETING**

2.1 Adoption of the agenda

The Meeting adopted the provisional agenda with no amendment.

2.2 Working arrangements

The Meeting agreed on its working hours as from 0900 to 1700 hrs with appropriate breaks for coffee and lunch. The programme of the meeting is attached as Appendix II to this report.

**3. REVIEW OF THE RELEVANT DECISIONS OF CBS-MG16, AND EC-68**

3.1Ms Kootval briefed the participants on the most important events that had taken place since the last meeting of the ET in Hong Kong, China in 2014. These included the 2016 CBS Management Group (Geneva, Switzerland, February 2016), and Sixty-eighth Session of the WMO Executive Council (EC-68, Geneva, Switzerland, June 2016).

3.2 The following reflects the decisions of the 2016 CBS Management Group (CBS-MG-16) of relevance to the work of ET/SPII. The Management Group considered the proposed structure for OPAG PWS that had been recommended by Implementation Coordination Team on Public Weather Services (ICT/PWS). It decided to recommend to the sixteenth session of the Commission of Basic Systems (CBS-16) that:

1. The name of the OPAG on Public Weather Services should be changed to the “OPAG on Public Weather Services Delivery (OPAG/PWSD)”.
2. The Expert Team on Communication, Outreach and Public Education (ET/COPE) should be dissolved and its responsibilities be transferred to the ICT.
3. The name of the Expert Team on Meeting User Needs in Reducing the Impact of Hydro-Meteorological Hazards (ET/DPM) should be changed to ET/IMPACT and it should assume responsibilities of the “Impact Advisory Group” of the Task Team IMPACT (TT/IMPACT), established by CBS-Ext.(2014).
4. The structure of the OPAG should move towards the establishment of transient Task Teams (TTs) that would be focused on specific, time-bound, objectives.
5. That the previous Expert Team on Services and Products Innovation and Improvement (ET/SPII) would be retained to assist Members with the application of technological developments to the effective delivery of public weather services.
6. That possible focus areas for Task Teams to be established under ET/SPII might include Big Data, Nowcasting, application of the Common Alerting Protocol (CAP), further development of World Weather Information Service/Severe Weather Information Centre (WWIS/SWIC), GIS compatibility of meteorological information, and the optimum exploitation of smartphone technology.
7. That ET /SPII should work in close collaboration with the OPAG/DPFS to facilitate the rapid and efficient application of new and emerging science and technology to improved service delivery.

3.3. The decisions of EC-68 of relevance to ET/SPII are noted below.

1. The Secretary-General was requested to take a variety of new measures to accelerate the implementation of CAP especially by developing and least developed Members, and to specifically adopt a more assertive role in advocacy for CAP, such as establishing target dates and numbers of NMHSs for CAP implementation in each WMO region; to encourage more active collaboration with the private sector to intensify training in addition to what is currently offered through CAP Jump Starts; to encourage vendor-specific training especially among vendors of products widely used in NMHSs; to initiate provisions for collaborative technical support mechanisms such as “ask-an-expert” discussions lists, and formalized support for freeware such as that used in the CAP Jump start sessions; to engage with the United States of America National Weather Service to facilitate its offer to provide a new “WMO Alert Hub” as a free service for the use of all Members, which will enhance the dissemination of official alerts in CAP format;
2. The Commission for Basic Systems was requested: (i) To develop provisions on CAP utilization in the WMO Technical Regulations to assure harmonization of CAP-enabled alerting systems operated by Members; (ii) To coordinate through the OPAG/PWS, intensified CAP-related activities such as publishing articles about CAP in popular and technical journals, preparing short videos to run as public service announcements;
3. EC-68 invited the more advanced NMHSs to provide their expertise through voluntary participation as trainers in CAP Jump Starts, thus augmenting the very small pool of mainly English-speaking trainers currently available for this purpose. In addition, EC Members to make their requirements for implementation of CAP known to each other and to the Secretariat so that appropriate actions can be taken to assist them directly or to help arrange support from other Members, NGOs such as IFRC, and other partners.
4. **REPORT OF THE CHAIRPERSON OF ET/SPII**

4.1 Review of the OPAG PWS ICT.

The Chairperson provided a review of the meeting of the OPAG/PWS Implementation Coordination Team (ICT) meeting held in Dublin, Ireland in December, 2015. The ICT made several recommendations to the 2016 CBS Management Group (CBS-MG-16) regarding the structure and focus areas of the PWS programme and associated ETs. Notable recommendations included a proposal to rename the OPAG to Public Weather Services Delivery (OPAG/PWSD); renaming the Expert Team on Meeting User Needs in Reducing the Impact of Hydro-Meteorological Hazards (ET/DPM) to ET/IMPACT; retaining ET/SPII; and the establishment of transient Task Teams (TTs) that would be focused on specific, time-bound, objectives associated with the ICT and each ET. The ICT also proposed that ET/SPII act as an interface between the CBS OPAGs, articulating user requirements for PWS to be passed to other technical groups within WMO. A close collaboration with the OPAG/DPFS would help facilitate the rapid and efficient application of new and emerging science and technology to improved service delivery.

4.2 Review of the proposed Terms of Reference (TORs) of the ET

The Meeting reviewed its TORs as proposed by the ICT/PWS and offered a number of amendments. The amended TORs are reflected in Appendix III.

4.3 Review of the deliverables from the 2014 meeting of the ET (Hong Kong, China)

4.3.1 The Meeting reviewed its deliverables, which had been agreed to at the Hong Kong meeting in 2014. The Team identified a total of eight deliverables, which include those that were either modified and/or carried over from its previous work plan. The Team had continued to work on the activities associated with the deliverables. Since the last meeting of the Team, two deliverables have been completed. The following summarizes the Team’s work regarding the deliverables.

***4.3.2 Deliverable 1: Publish Guidance on the Adoption of a Service-Driven Approach to Development of Nowcast Systems***

**Status: Open**. The Expert Team carried out a survey to gather information on the nowcast systems used by different Members. The analysis of the survey has been completed and the Team has drafted a report on the current status of members’ nowcasting capabilities. A summary of the draft report is provided in section 6.1. This deliverable was modified to reflect the remaining steps to complete the deliverable, as shown in Appendix IV. This includes finalizing the guidance developed for Members at different levels of capability in order to assist them in applying a service driven approach to the development of nowcast systems. The final report will be circulated to all WMO Members, specific groups and organisations involved in development of nowcasting services.

**4.3.3 *Deliverable 2: Provide Comments/Input on Impact-based Forecasting Document Developed by ET/DPM***

**Status: Completed**. Input provided and guideline published.

**4.3.4 *Deliverable 3: Coordinate with WMO ETR to Develop Training Material on Forecast Uncertainty for Use by NMHSs and WMO Training Activities***

**Status:** **Open**. The Team discussed the status of this deliverable. With the establishment of ET/IMPACT and its focus on impact-based forecasting, the Team has reoriented the deliverable to the development of guidance on using and communicating uncertainty in impact-based forecasting. This will be a collaborative effort with ET/IMPACT The Team will assemble examples and best practice of applying uncertainty information for use in impact-based forecasting. This will include translation of percentage probabilities into scenarios for use in decision making for emergency planning and response. This guidance information will be incorporated into ET/IMPACT’s enhanced guidelines on impact-based forecast and warning services (see report of the joint meeting of ET/DPM and TT/IMPACT, Shanghai, July 2016). Subsequently, the title of the deliverable and the associated actions has been modified. This will become new Deliverable 2. (Appendix IV).

**4.3.5 *Deliverable 4: Assess the Needs and Interest in Verification of World Weather Information Service (WWIS) Max/Min Temperature Forecasts from Participating NMHSs and Assess Uptake and Usability by Those Participating NMHSs***

**Status: Closed**. A pilot project was established to assess needs and interest in this area. The Team discussed the results of the pilot project and the remaining actions. Based on this review, the Team agreed that the deliverable should be closed as the results from the pilot indicated that there was limited interest or needs expressed for verification information via WWIS.

**4.3.6 *Deliverable 5: Enhancement of WWIS and Severe Weather Information Centre (SWIC) Websites***

**Status: Open/Ongoing**. The initial proposed enhancements to the WWIS and SWIC websites have been completed. Remaining activities are outlined in Section 6.4 and include extending forecasts to 5-days, investigation of feasibility of incorporating participating NHMS warnings via CAP, and adding real-time weather information. This deliverable will be carried forward as Deliverable 3.

**4.3.7 *Deliverable 6: Assist in the Adoption of the Service Delivery Approach to Delivering Forecast and Warning Services Through Mobile Platform.***

**Status: Completed**. The Team developed a fact sheet as guidance for Members to help them decide on the best methods for them to provide their users with weather information via mobile platforms.

**4.3.8 *Deliverable 7: Explore the Issue of Increasing Amounts of Data in the Forecast Process – Confronting the “Big Data” Issue.***

**Status: Open.** Following discussions on the big data topic at the ICT/PWS in June 2014, the Team engaged the OPAG/DPFS Chair in discussions surrounding the big data issue. The ET/SPII discussed potential collaborative opportunities to address the challenge of managing the increasing amount of data available to forecasters within the forecast process. As a result of the Team discussions, it was agreed that a joint DPFS-PWS collaborative approach would be optimal to effectively tackle this challenging issue. In the fall of 2014, the Chair ET/SPII contacted the OPAG/DPFS Chair to discuss how to jointly address the issue of managing the increasing amount of data available to forecasters. The ET/SPII further agreed that OPAG/DPFS would serve as the technical lead for defining the problems/opportunities while PWS would serve as the lead for identifying operational/user requirements. Together, ET/SPII and OPAG/DPFS established a joint view of the requirements of the forecast community in order to provide the best forecasts and warnings.

The big data issue was identified by the ICT/PWS in December 2015, as a topic for further discussion under agenda item the “Future Direction of PWS”. Mr Ken Mylne, Chair OPAG/DPFS, attended the meeting to participate in these discussions.

The deliverable was modified to include several follow-up actions including collecting and sharing examples of different approaches to crowdsourced data, and the establishment of a Task Team on Big Data. Further information is documented in Section 6.2 and Appendix IV.

**4.3.9 *Deliverable 8: Investigate NMHS Application of Geo-Spatial Data (GIS)***

**Status: Closed**. The Team discussed this deliverable and the associated proposed actions. There has been no significant progress made on this deliverable since the last Team meeting in May 2014. The deliverable was initially adopted in recognition of the value of delivering hydro-meteorological information in spatial formats compatible with GIS as growing numbers of NMHS partners/users are utilizing GIS datasets. Additional discussion on this topic is included in Section 6.3: *The Application of New and Emerging Technologies*. The Team has agreed to keep the application of GIS-compatible formats under review as part of its ongoing charge to monitor challenges and opportunities for PWS service delivery presented by emerging technology.

**5. REVIEW OF THE PROPOSED NEW OPAG-PWS STRUCTURE**

5.1 The Chairperson provided a review of the meeting of the OPAG/PWS ICT meeting held in Dublin, Ireland in December, 2015. The ICT considered the position and responsibilities of the OPAG/PWS with respect to the WMO priority areas and expected results agreed to at Cg-17. The ICT recognized that the key guiding document – the WMO Strategy for Service Delivery and its Implementation Plan – was effectively “owned” by the PWS Programme. The ICT proposed a set of recommendations to the CBS Management Group that modify the OPAG/PWS structure and functions. Of specific interest to the ET, and as noted in Section 3.2, it was decided that ET/SPII would continue into the new OPAG/PWS structure.

5.2 ET/SPII will be expected to address user requirements identified by ET/IMPACT through collaboration with OPAG/DPFS and other partners as appropriate. The ICT noted several possible focus areas for Task Teams under ET/SPII including Big Data, Nowcasting, application of the Common Alerting Protocol (CAP), further development of WWIS/SWIC, and application of new and emerging technologies including the optimum exploitation of smartphone technology. These issues are addressed in Section 6.

5.3 A schematic diagram shown in Appendix V reflects the proposed new structure of the OPAG/PWS, including the relationships between the ICT, ETs, and relevant groups outside the OPAG.

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

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 are important for the provision of effective services by NMHSs and all the associated issues, and which still need additional work and attention. The ICT/PWS resonated with several of these topic areas during its meeting in December 2015. A number of areas had been identified for discussion by ET/SPII as listed below

**6.1 *Nowcasting Services***

6.1.1 The Team reviewed the draft document which analyzed the results of the 2014 survey of Members’ Nowcasting Capabilities and included additional information provided by Team members concerning examples of Nowcasting Systems, and a pragamatic ‘building blocks’ approach to system development and maintenance. The draft will be finalized and form the basis of guidance material to be circulated to Members (Appendix IV)

6.1.2 Key outcomes from the survey were as follows:

1. Survey results suggest that nowcasting services, whatever the resources of an NMHS, are often designed and implemented without full consideration of the needs of users.
2. These users may include ‘expert users’ such as meteorologists, hydrologists and others involved in the assessment and communication of impacts and risks of natural hazards, for example emergency planners and responders.
3. The nowcasting services should also consider the requirements of ‘end users’ such as the public and the government stakeholders of an NMHS’s Public Weather Services.
4. Results suggest that very often the need for quality and sustainability in nowcasting services (for example the accuracy and availability of observations, or the resources and training for operation and maintenance of instruments and systems) is not prioritized sufficiently highly.

6.1.3 Based on the survey results noted in 6.1.2 above, the main recommendations presented in the draft document (to be finalized) were as follows:

1. Members should adopt the principles outlined in the “WMO Strategy for Service Delivery and its Implementation plan” to ensure a service-based and user-oriented approach is used when designing and delivering a nowcasting capability.
2. Members considering development or upgrade of nowcasting services should consider options for partnership and collaboration with other organisations (eg other NMHSs). This may take the form of the sharing of advice or experiences, or use of a shared capability. The latter can be particularly effective when these shared capabilities – observations, instrumentation, systems and software – are often readily and cheaply available through pre-existing consortia.
3. Nowcasting services should evolve in structured and sustainable fashion, making best use of current and planned resources at each stage while remaining aligned to user needs.

**6.2 *Big Data***

6.2.1 The Team discussed the Big Data issue dealing with the huge volumes of data flowing downstream from the observations, models, etc. through the forecasters to the end-users. In addition, there also may be feedback from theusers. In view of this, the Meeting paid special attention to the crowdsourcing data (weather reports from the public) which are currently collected by the most developed NMHSs (for example, US NWS, UK MetOffice, JMA, etc.).

6.2.2 Crowdsourced data represents the additional source of useful information, and may be considered as one of the aspects of the Big Data issue. Such data are used in weather monitoring and forecasting and can be potentially used for verification and modeling. The Team considered it necessary to investigate the utilization of Big Data for monitoring, impact assessment, and forecasting and to collect and share the examples of different approaches to crowdsourced data and benefits, which may result from using these data. For this purpose, it was proposed to establish a Task Team on Big Data (TT-BD), which should propose a strategy to optimize the use of such data in forecasting and warning services.

**6.3 *The Application of New and Emerging Technologies***

6.3.1 The meeting discussed the challenges of emerging science and technology and its implications for NMHSs public weather services and service delivery. With regard to emerging technologies, mobile apps are becoming increasingly more prevalent in NMHSs service delivery. Web-based services are also at the forefront of delivering public weather services. WWIS and SWIC serve as the source of official weather forecasts and climate information provided by NMHSs. Over the last several years, under the leadership of Hong Kong, China, the WWIS and SWIC web sites have been enhanced significantly. This includes expanded language versions of the web sites, the development of a MyWorldWeather app, and adding a social media component to WWIS.

6.3.2 It is recognized that the adoption and broad application of GIS-compatible formats by NMHSs users and partners is a key driver in merging meteorological and hydrological information with other datasets to improve decision-making. This merging of datasets, combined with the enhanced ability for graphical presentation of data/information, is especially noteworthy in the context of weather and impact-based forecasts. The team will keep the application of GIS-compatible formats under review as part of its ongoing charge to monitor challenges and opportunities for PWS service delivery presented by emerging technology.

6.3.3 The Team discussed technologies that promote service delivery and supports NMHSs authoritative voice, especially with regard to warning services. The Common Alerting Protocol (CAP) is an international standard format for emergency alerting and public warning. CAP can be utilized for a variety of hazards including meteorological and hydrological events, and other natural (e.g. earthquakes, tsunamis) and man-made hazardous events (e.g. HAZMAT, public health, power outages). CAP is also designed to work with both traditional and new and emerging communications/media systems. CAP enables broad distribution of NMHSs warnings and is being utilized in a number of countries and consortiums (MeteoAlarm). WMO has sponsored a series of CAP workshops beginning in 2006 to promote the adoption of CAP by NHMSs. The meeting discussed the integration of CAP into the WWIS and SWIC websites. This is discussed in detail in Section 6.4.

6.3.4 Following the OPAG/PWSD structure proposed at the ICT on OPAG/PWS meeting in Dublin, Ireland (December 2015), the ICT envisioned that ET/SPII will act as an interface between the CBS OPAGs, articulating user requirements for PWS to be passed to other technical groups within WMO. Conversely, ET/SPII would facilitate rapid ‘pull through’ of new technical capabilities to PWS services. This would be accomplished, in part, through a close collaboration with the OPAG/DPFS to facilitate the rapid and efficient application of new and emerging science and technology to improved service delivery.

6.3.5 The Team invited the participation of Mr Ken Mylne (Chair, OPAG/DPFS) at the meeting to discuss options for greater communication, integration and collaboration between OPAG/PWS and OPAG/DPFS. The Team and Mr Mylne agreed that Chair ET/SPII would act as a formal point of contact for communication and collaboration between the two OPAGs.

6.3.6 Seeking practical applications to exploit these new links, a discussion ensued around how best OPAG/PWS might contribute to activities surrounding the revision and implementation of the GDPFS Manual. Mr Mylne discussed the proposed structure for the GDPFS described in the new Manual, which introduces a framework for the sharing of data and products in support of operational forecasting, tailored for a specific type of application or user community (in a more service-oriented approach). The GDPFS is organized as a three-level system of Centres, categorized as World Meteorological Centres (WMCs), Regional Specialized Meteorological Centres (RSMCs) and National Meteorological Centres (NMCs). Within the new framework, these Centres would have some service-oriented functions, such as those of the existing RSMCs with geographical specialization, which would become RSMCs with a specific specialization (e.g. RSMC for regional severe weather forecasting, based on the model of the SWFDP regional centres), and NMCs which are responsible for the preparation of forecasts and warnings at all ranges necessary to meet their user requirements. Such Centres would adopt formal Quality Management Systems to ensure quality standards and promote continuous improvement. ET/SPII noted that functions of these Centres may include aspects of Service Delivery overseen by OPAG-PWS, namely the WMO Strategy for Service Delivery and Competencies for staff working in PWS areas, and proposed strengthening collaboration between the two OPAGs in the context of the revision and implementation of the GDPFS Manual. Implementation of both the Strategy and the Competencies within such Centres would help ensure standards, while also giving traction to the Strategy and Competencies at regional and national levels. Mr Mylne agreed to propose this approach to DPFS colleagues and assess the potential for ET/SPII to provide relevant content for the GDPFS Manual. Noting that the roadmap for the completion of the revision of the GDPFS Manual includes its presentation to CBS-16 (in November 2016) for consideration and a transition period up to Cg-18 (2019), the Team would recommend to CBS a more formal engagement of PWS in this revision process by reviewing the existing revised version and providing relevant content as appropriate.

6.3.7 The Team agreed to establish a new deliverable (Deliverable 6) to reflect the formalization of its collaboration with OPAG/DPFS as noted in Sections 6.3.5 and 6.3.6, respectively.

**6.4 *Future of WWIS and SWIC***

6.4.1 The meeting reviewed the current status of the WWIS project which was established to (i) provide official and authoritative source of weather information; (ii) encourage the use of official weather information by media (including emerging new media) and general public; and (iii) enhance the visibility of NMHSs especially those in developing countries and Least Developed Countries (LDCs).

6.4.2 In view of the emergence of web media (e.g. social media) and service providers (e.g. Google) and the change of user behavior in embracing the use of online services in acquiring weather information, there is an urgent need for NMHSs to adapt the delivery of their public weather services to these realities in exchange of information, in order to maintain their visibility and credibility.

6.4.3 It was observed that the usage of the WWIS has been declining since 2014. This is probably due to the emergence of new media/service providers (outside NMHSs) that makes weather information available to ordinary users very conveniently, even though the sources of information are often not clearly identified. Therefore, users have moved away from official sources of weather information. Over time, this trend will harm the visibility and credibility of NMHSs as the official and authoritative source of weather information.

6.4.4 Although the WWIS is an ideal platform for providing official weather information from NMHSs to users, there are some weaknesses that prevent it from carrying out its purposes effectively. The major ones, are the lack of forecasts for certain popular locations, and the short forecast lead-time for some of the cities.

6.4.5 The meeting reviewed the performance of the forecast submissions by Members and noted the following issues:

1. Around 40% of WWIS participating members have not been sending forecasts to the WWIS on a routine basis over the past two years;
2. The forecast lead-time of more than 40% of city forecasts on the WWIS is less than 5 days.

6.4.6 The meeting noted that there has been little progress on increasing participation in WWIS by WMO Members. This has occurred despite encouragement in numerous forums/meetings and letters from WMO, along with the development of a WWIS guide by WMO to facilitate participation in the project. To overcome this, the meeting discussed several options including the provision of processed NWP model outputs to NMHSs for forecast provision on the WWIS, and the adoption of multi-model ensemble forecasts.

6.4.7 The Team recognized the urgent need to expand the content on the WWIS in regions where either no forecast information is provided by the corresponding NMHSs or the available forecast range is shorter than 5-days. The team held a conference call with Ms Alice Soares (WMO-DPFS) to explore the availability of NWP data to augment forecasts to 5-days. Based on these discussions the Team learned that the ECMWF makes EPS forecasts available at 10 locations for all Members. The Team decided to request the WMO Secretariat to contact ECMWF to explore the provision of EPS data to augment public forecasts on the WWIS. This data could be used to expand available public weather forecasts from NMHSs that are not providing 5-day forecasts. The Team also agreed to send a letter via the Secretariat to NMHSs that currently either are not providing public forecasts at all or a full 5-day forecast on the WWIS, to provide at least 5-day of forecaster-produced public weather forecasts or NWP-derived forecasts.

6.4.8 The Meeting reviewed the current status of the Severe Weather Information Centre (SWIC) website and noted that advisory bulletins on Tropical Cyclones issued by RSMCs and Tropical Cyclone Advisory Centres (TCACs), and information on fog, gale, heavy rain, thunderstorm derived from SYNOP reports were currently available on the website.

6.4.9 The Meeting also discussed the feasibility of putting Common Alerting Protocol (CAP) warnings on the WWIS and SWIC websites. The Team noted that the WMO Alert Hub, which was under development by NOAA/NWS, would be helpful in the provision of warning messages. The Team made a videoconference with Mr Eliot Christian, former WMO advisor on CAP, to discuss the current status of the WMO Alert Hub. It was noted that the Hub was still under development. Mr John Guiney agreed to follow up with Mr Mark Paese, NOAA/NESDIS, to gather additional information/status update on the WMO Hub project.

6.4.10 As a result of the discussions with Mr Eliot Christian, the Meeting agreed that CAP data currently available on the public domain would be acquired for use on the enhancement/revamp of the WWIS and SWIC websites. Individual team members would also approach MeteoAlarm, JMA, and PAGASA (Philippines) to explor the possibility of providing CAP warnings which are currently available on the Google Public Alerts website.

**6.5 *Public-Private Partnership***

6.5.1 The Team discussed Public-Private Partnerships (PPPs) in context of PWS and service delivery. The Meeting noted the discussions at EC-68 regarding PPPs, including its strong support for a paradigm shift in how PPPs are viewed. In particular, EC-68 expressed the opinion that ideally, the partnership should be characterized by cooperation rather than competition, and by mutual reinforcement and complementarity. EC-68 has proposed that WMO pursue the development of a PPP strategy. One of the guiding principles of the strategy outlined by EC-68 is the preservation of NMHSs as the unambiguous and authoritative voice for warnings and official weather information.

6.5.2 There are a number of areas where NMHSs and the private sector have overlapping, and often complementary, interests. Chief among these is the rapid developments in information technology, and the application of new and emerging technologies coupled with the ever-growing demand for environmental data, information and services. In particular, technological advancements and related trends like “big data” and “crowdsourcing” require rapid assessment, and adaptation from both the NMHSs and the private sector.

6.5.3 Based on the potential implications of PPPs on public weather services and service delivery, the Meeting agreed that clearly defined roles, responsibilities and “rules of engagement” for PPPs are critical to retain the authoritative voice of NMHSs especially with respect to warning services. Further, the Team noted that it would be useful to develop strategies for PWS exploitation of PPPs. The Team proposed the establishment of a Task Team on PPPs and PWS to address these issues. The Team has reflected these areas of emphasis in PPPs as a proposed TOR in Appendix III, and as new deliverable (Deliverable 5) in Appendix IV.

**7. IDENTIFICATION OF CLEAR DELIVERABLES RELATED TO THE MAJOR TOPICS AND CORRESPONDING TO THE ET TORS**

7.1Following the discussions in Section 4 and Section 6, and taking into consideration the new TORs agreed to in Appendix III, the Team redefined the deliverables to represent the focus areas, formalize the collaborative relationships, and adoption of the task team approach. The new deliverables are provided in Appendix IV.

**8. WORK ON DELIVERABLES**

8.1 The Meeting agreed to continue work on the deliverables as given in Appendix IV of this draft.

**9. VISIT TO THE FORECAST OFFICE AND OTHER MET OFFICE LOCATIONS**

9.1 On the first morning of th Meeting, on Monday 11th July 2016, the Team was invited into the Operations Centre at the Met Office’s headquarters, to observe the daily Weather and Impacts Briefing given by the duty Chief and Deputy Chief Meteorologists. The team noted the use of videoconferencing facilities to allow the involvement of other forecasting teams in the briefing, such as those in Aberdeen.

9.2 On Tuesday 12th July, the Team visited the Met Office’s Informatics Lab, whose cross-disciplinary team demonstrated a number of projects to exploit new technology and to interact with and extract value from data in innovative ways.

9.3 On Wednesday 13th July, the Team attended one of the Met Office’s weekly science seminars. The subject for this presentation was Panasonic’s developing capability – very much related to one of ET/SPIIs emerging interests in Public-Private Partnerships and their implications for Public Weather Services.

9.4 Thursday 14th July’s activities concluded a social event, when members of the Met Office Guidance Unit and International Meteorology teams explained their roles while accompanying the Team to the seaside Town of Sidmouth.

**10. PREPARATION OF THE REPORT OF THE MEETING AND THE EXECUTIVE SUMMARY, INCLUDING DECISIONS FOR CONSIDERATION BY CBS 16**

10.1 The ET/SPII prepared contributions to a draft report of its work, led by the Chair of the ET, who agreed to work with the Secretariat to finalize the report.

**12. CLOSURE OF THE MEETING**

12.1 Prior to the closure of the Meeting, Mr John Guiney informed the Team that he would be stepping down as Chair of the ET and that the Co-Chair, Mr Will Lang would assume the role of the Chairperson of the ET. The Team expressed its gratitude to Mr Guiney for his able chairmanship of the Team and the many innovative and interesting ideas that he had introduced in the work of the Team, and wished him well in his future endeavors.

12.2 The meeting closed at 12:00 hours on Friday, 15 July 2016.

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List of APPENDICES to the Final Report of the “meeting of the cbs/opag-pws expert team on services and producs innovation and improvement

**EXETER, UNITED KINGDOM, 11-15 JULY 2016**

**Appendix I:** List of Participants

**Appendix II:**  Meeting Programme

**Appendix III:** Terms of Reference (TORs) of ET/SPII

**Appendix IV:** Action Sheet related to the Team deliverables

**Appendix V:** Proposed new structure of the OPAG/PWS

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**APPENDIX I**

meeting of the cbs/opag-pws expert team on services and producs innovation and improvement

EXETER, UNITED KINGDOM, 11-15 JULY 2016

**list of participants**

| **No.:** | **Country:** | **Name and Title(S):** | **Address:** |
| --- | --- | --- | --- |
| 1. | United States of America | ***Mr John L. GUINEY***  ***Chairperson of the CBS/OPAG-PWS ET/SPII***  ***National Function:***  ***Chief, Meteorological Services Division, National Oceanic and Atmospheric Administration (NOAA), National Weather Service (NWS), Eastern Region Headquarters*** | NOAA/NWS Eastern Region Headquarters  630 Johnson Avenue, Suite 202  BOHEMIA, New York 11716-2618  United States of America  Tel.: +1 631 244 0121  Fax: +1 631 244 0167  E-mail: [John.Guiney@noaa.gov](mailto:John.Guiney@noaa.gov) |
| 2. | Hong Kong, China | ***Mr Armstrong YC CHENG***  ***Member of the CBS/OPAG-PWS ET/SPII***  ***National Function:*** ***Senior Scientific Officer, Hong Kong Observatory*** | Hong Kong Observatory 134A Nathan Road KOWLOON, HONG KONG  Hong Kong, China Tel.: +852 2926 8358 Fax: +852 2311 9448 E-mail: [yccheng@hko.gov.hk](mailto:yccheng@hko.gov.hk) |
| 3. | Japan | ***Mr Yoshiro TANAKA***  ***Member of the CBS/OPAG-PWS ET/SPII***  ***National Function:*** ***Senior Scientific Officer, Forecast Department*** | Japan Meteorological Agency (JMA)  1-3-4, Otemachi, Chiyoda-ku  TOKYO 100-8122, Japan  Tel.: +81 3 3211 4966  Fax: +81 3 3211 2032  E-mail: [yoshiro.tanaka@met.kishou.go.jp](mailto:yoshiro.tanaka@met.kishou.go.jp) |
| 4. | Russian Federation | ***Dr Evgeny (Eugene) VASILYEV***  ***Member of the CBS/OPAG-PWS ET/SPII***  ***National Function:*** ***Weather Forecaster of the Department of Short-Range Weather Forecasts and Dangerous Phenomena on the Territory of the Russian Federation, Hydrometeorological Research Centre of the Russian Federation*** | Hydrometeorological Research Centre of  the Russian Federation  B. Predtechensky per. 11-13  MOSCOW, 123242, Russian Federation  Tels.: +7 499 252 3448  +7 903 429 1007  Fax: +7 499 255 1582  E-mail: [syno@inbox.ru](mailto:syno@inbox.ru) |
| 5. | United Kingdom | ***Dr William Jonathan LANG***  ***Member of the CBS/OPAG-PWS ET/SPII***  ***National Function:***  ***FRMet S, CMet / Chief Meteorologist*** | Met Office  FitzRoy Road  EXETER EX1 3PB, United Kingdom  Tel.: +44 1392 88 4910  Fax: +44 1392 88 5681  E-mail: [will.lang@metoffice.gov.uk](mailto:will.lang@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-SPII_2016.htm> | | | |
| 6. | WMO | ***Ms Haleh KOOTVAL***  ***Chief, Service Delivery Division*** | Public Weather Services Programme  Service Delivery Division  Weather and Disaster Risk Reduction Services Department (WDS)  Tel.: +41 22 730 8333  Fax: +41 22 730 8128  E-mail: [HKootval@wmo.int](mailto:HKootval@wmo.int) |

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**APPENDIX II**

meeting of the cbs/opag-pws expert team on services and producs innovation and improvement

EXETER, UNITED KINGDOM, 11-15 JULY 2016

**PROVISIONAL PROGRAMME**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***Monday, 11 July 2016*** | | | | | | | |
|  | **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 | | | * Mr John L. Guiney * Ms Haleh Kootval | | 30 minutes | |
| 0930 - 1000 | **3. REVIEW OF THE RELEVANT DECISIONS OF CBS-MG-16, AND EC-68** | | | * Mr J.L. Guiney * Ms H. Kootval | | 30 minutes | |
| 1000 - 1030 | **4. report of the chairperson of the et/SPII**  - Review of the proposed Terms of Reference (TORs) of the ET  - Review of the deliverables from the 2014 meeting of the ET (Hong Kong, China) | | | * Mr J.L. Guiney | | 30 minutes | |
| **1030 - 1100** | **COFFEE / TEA BREAK** | | | | | **30 minutes** | |
| 1100 - 1200 | **5. REVIEW OF THE PROPOSED NEW OPAG-PWS STRUCTURE** | | | * Mr J.L. Guiney * Ms H. Kootval | | 60 minutes | |
| **1200 - 1330** | **LUNCH BREAK** | | | | | **90 minutes** | |
| 1330 - 1530 | **6. DISCUSSION AND DECISIONS ON THE MAJOR TOPICS TO BE ADDRESSED BY THE ET**  **(Names show the leader of each topic but all Team members are invited to participate)**  - *Nowcasting services;*  *- Big Data;*  *- The application of new and emerging technologies*  *- Future of WWIS and SWIC;*  *- ….* | | | Chairperson and Team discussion   * TBD * Dr Will Lang * TBD * Mr Armstrong Cheng | | 120 minutes | |
| **1530 - 1600** | **COFFEE / TEA BREAK** | | | | | **30 minutes** | |
| 1600 - 1700 | **6. DISCUSSION AND DECISIONS ON THE MAJOR TOPICS TO BE ADDRESSED BY THE ET (Cont.)** | | |  | | 60 minutes | |
| ***Tuesday, 12 July 2016*** | | | | | | | |
|  | | | **Day 2** | | | |  |
| 0900 - 1030 | | | **6. DISCUSSION AND DECISIONS ON THE MAJOR TOPICS TO BE ADDRESSED BY THE ET (Cont.)**  - Any other topics to be suggested: TBD  Discussions in group or in Sub-teams on the themes | * All | | | 90 minutes |
| **1030 - 1100** | | | **COFFEE / TEA BREAK** | | | | **30 minutes** |
| 1100 - 1200 | | | **6. DISCUSSION AND DECISIONS ON THE MAJOR TOPICS TO BE ADDRESSED BY THE ET (Cont.)**  Discussion and Conclusions on the selected themes for future work | | * All | | 60 minutes |
| **1200 - 1330** | | | **LUNCH BREAK** | | | | **90 minutes** |
| 1330 - 1530 | | | **6. DISCUSSION AND DECISIONS ON THE MAJOR TOPICS TO BE ADDRESSED BY THE ET (Cont.)**  - Development of short, summary presentations for Team Members (include suggested deliverables in presentations) | | * All | | 120 minutes |
| **1530 - 1600** | | | **COFFEE / TEA BREAK** | | | | **30 minutes** |
| 1600 - 1700 | | | **6. DISCUSSION AND DECISIONS ON THE MAJOR TOPICS TO BE ADDRESSED BY THE ET (Cont.)**  - Presentations by Team Members (include suggested deliverables in presentations) | | * All | | 60 minutes |
| ***Wednesday, 13 July 2016*** | | | | | | | |
|  | | | **DAY 3** | | | |  |
| 0900 - 1030 | | | **7. IDENTIFICATION OF CLEAR DELIVERABLES RELATED TO THE MAJOR TOPICS AND CORRESPONDING TO THE ET TORS**  - Discuss deliverables as identified based on Sub-team recommendations | | * All Members | | 90 minutes |
| **1030 - 1100** | | | **COFFEE / TEA BREAK** | | | | **30 minutes** |
| 1100 - 1200 | | | **7. 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 | | * All Members  (back in plenary) | | 60 minutes |
| **1200 - 1330** | | | **LUNCH BREAK** | | | | **90 minutes** |
| 1330 - 1530 | | | **8. WORK ON DELIVERABLES**  - Based on agreed deliverables, begin work on outlining the said deliverables | | * All Members | | 120 minutes |
| **1530 - 1600** | | | **COFFEE / TEA BREAK** | | | | **30 minutes** |
| 1600 - 1700 | | | **8. WORK ON DELIVERABLES (Cont.)**  - Continue to work on deliverables | | * Chair leads, with all Members | | 60 minutes |
| ***Thursday, 14 July 2016*** | | | | | | | |
|  | | **DAY 4** | | | | |  |
| 0900 - 1030 | | **8. WORK ON DELIVERABLES (Cont.)**  - Continue to work on deliverables | | | * Chair leads, with all Members | | 90 minutes |
| **1030 - 1100** | | **COFFEE / TEA BREAK** | | | | | **30 minutes** |
| 1100 - 1200 | | **8. WORK ON DELIVERABLES (Cont.)**  - Continue to work on deliverables | | | * Chair leads with all Members | | 60 minutes |
| **1200 - 1300** | | **LUNCH BREAK** | | | | | 60 minutes |
| 1300 - 1400 | | **10. PREPARATION OF THE REPORT OF THE MEETING AND THE EXECUTIVE SUMMARY, INCLUDING DECISIONS FOR CONSIDERATION BY CBS-16**  - Outline of the Final Report will be presented  - Begin preparation of the Report | | | * Chair leads, with all Members | | 60 minutes |
| 1400 - 1600 | | **9. TOUR OF THE FORECAST OFFICE** | | | * All Members | | 120 minutes |
| ***Friday, 15 July 2016*** | | | | | | | |
|  | | **DAY 5** | | | | |  |
| 0900 - 1030 | | **10. PREPARATION OF THE REPORT OF THE MEETING AND THE EXECUTIVE SUMMARY, INCLUDING DECISIONS FOR CONSIDERATION BY CBS-16 (Cont.)**  - Preparation of the Report (Cont.) | | | * Chair leads, with all Members | | 90 minutes |
| **1000 - 1030** | | **COFFEE / TEA BREAK** | | | | | **30 minutes** |
| 1030 - 1200 | | **11. REVIEW AND ADOPTION OF THE REPORT** | | | * Chair leads, with all Members | | 90 minutes |
| **1200 - 1330** | | **LUNCH BREAK** | | | | | **90 minutes** |
| 1330 - 1500 | | **11. REVIEW AND ADOPTION OF THE REPORT (Cont.)** | | | * Chair leads, with all Members | | 90 minutes |
| 1500 | | **12. CLOSURE OF THE MEETING** | | | | | |

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**AppENDIX III**

**PROPOSED TERMS OF REFERENCE OF THE EXPERT TEAM ON SERVICES AND PRODUCTS INNOVATION AND IMPROVEMENT (ET/SPII)**

1. Monitor, evaluate and advise on challenges and opportunities for Public Weather Service Delivery presented by emerging science and technology;
2. Address the user requirements identified by ET/IMPACT for data provision, management and visualization, through collaboration with OPAG-DPFS and other partners as necessary;
3. Take responsibility for PWS guidance on, scientific and technical aspects of Service Delivery improvement, including nowcasting, uncertainty, CAP and mobile/web services;
4. Provide oversight and coordination of the continuing development of WWIS/SWIC.
5. Complement and enhance the delivery of user-oriented PWS, and devise strategies for NMHSs and partners to optimize use and analysis of non-traditional data in forecasting and warning services, using collected examples and use of such data, e.g., crowdsourced weather, impact and behavioural data or social media information;
6. Work with the relevant bodies dealing with the Public-Private Partnerships (PPPs), to define clear roles, responsibilities and ‘rules of engagement’ on retaining the authoritative voice of NMHSs, especially with respect to warning services, and create strategies to allow mutual benefits between public and private sectors through private support to PWS activities.
7. Remain mindful of the PWS needs of LDCs and SIDS when innovating and developing new services, in the spirit of the principle that ‘no country is left behind’.
8. Identify experts to advise on technical aspects of Service Delivery improvement as required by the mandate above, specifically in the areas of Big Data and Public Private Partnerships.

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**APPENDIX IV**

**COMMISSION FOR BASIC SYSTEMS OPEN PROGRAMME AREA GROUP**

**ON PUBLIC WEATHER SERVICES EXPERT TEAM ON SERVICES AND**

**PRODUCTS InnovaTION AND IMPROVEMENT(cbs/opag-pws ET-SPIi)**

**Team Deliverables**

(Exeter, UK, 11-15 July 2016)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***DELIVERABLE 1: PUBLISH GUIDANCE ON THE ADOPTION OF A SERVICE-DRIVEN APPROACH TO DEVELOPMENT OF NOWCAST SYSTEMS*** | | | | | | |
|  | **Actions:** | **Responsible Member(s):** | | **Due Date:** | | **Status:** |
| **1.** | Finalise guidance developed for members at different levels of capability to assist in applying a service driven approach to the development of nowcast systems. | Lead: WL | | 30/8/16 | |  |
| **2.** | Circulate final report to all WMO Members, specific groups, organisations involved in development of nowcasting services. | HK | | 31/12/16 | |  |
| ***DELIVERABLE 2: COORDINATE WITH ET-IMPACT TO DEVELOP GUIDANCE ON USING AND COMMUNICATING UNCERTAINTY IN IMPACT-BASED FORECASTING*** | | | | | | |
|  | **Actions:** | **Responsible Member(s):** | **Due Date:** | | **Status:** | |
| **1.** | Assemble examples and best practice of applying uncertainty information for use in impact-based forecasting, for example translation of percentage probabilities into scenarios for use in decision making for emergency planning and response. | WL | 31/3/17 | |  | |
| **2.** | Contribute to ET-IMPACT enhanced guidelines on impact-based forecasting | WL/Chair ET-IMPACT | 31/9/17 | |  | |
| ***DELIVERABLE 3: ENHANCEMENT OF WWIS AND SWIC WEBSITES*** | | | | | | |
|  | **Actions:** | **Responsible Member(s):** | **Due Date:** | | **Status:** | |
| **1.** | (a) Discuss with ECMWF in acquiring EPS data for use in WWIS forecast compilation;  (b) Write to selected PRs requesting forecast of 5-days at least and the use of ECMWF EPS data to fill the gaps otherwise;  (c) Develop and launch the revamped WWIS website with observational data with responsive design  (d) Develop and launch the revamped MyWorldWeather app for the WWIS  (e) Incorporate in WWIS CAP-based warnings currently available on the public domain  f) Check availability of CAP/XML warnings from Philippinnes, Meteoalarm, JMA  (g) Revamp the SWIC website to incorporate CAP-based warnings  (h) Gather information on the status of the development of WMO Alert-hub by NOAA (contact Mr Paese, NOAA/NESDIS) | 1. AC 2. HK 3. AC 4. AC 5. AC 6. HK/WL/YT 7. AC 8. JG | 1. 30/9/16 2. 31/12/16 3. 31/3/17 4. 30/6/17 5. 31/12/17 6. 30/8/16 7. 30/6/18   h) 30/8/16 | | (b) Done | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***DELIVERABLE 4: UTILISATION OF ‘BIG DATA’ FOR MONITORING, IMPACT ASSESSMENT AND DECISION-MAKING IN PWS DELIVERY*** | | | | |
|  | **Actions:** | **Responsible Member(s):** | **Due Date:** | **Status:** |
| **1.** | Collect and share (with TT below), through individual contacts, examples of different approaches to use of crowdsourced observations, impacts and behavioural data amongst NMHSs. | AC to lead, all contribute | 31/10/16 |  |
| **2.** | Investigate and propose possible experts as potential members of a Task Team. (AC member) | All | Asap |  |
| **3.** | Create Task Team from subject-matter experts to study and propose a strategy for PWS in utilisation of Big Data. | Chair ET/SPII | 31/10/16 |  |
| **4.** | Task Team to report on the results of its work to ET/SPII | TT | 30/8/17 |  |
| ***DELIVERABLE 5: EXPLOITING PUBLIC/PRIVATE PARTNERSHIPS FOR PUBLIC WEATHER SERVICE DELIVERY*** | | | | |
|  | **Actions:** | **Responsible Member(s):** | **Due Date:** | **Status:** |
| **1.** | Create Task Team to work with relevant bodies on formulating a strategy for PWS exploitation of Public Private Partnerships (PPPs), and influence ‘rules of engagement’ for PPPs as proposed by EC 68. | Chair ET/SPII | 30/9/16 |  |
| **2.** | Task Team to report on the results of its work to ET/SPII. |  | 30/4/17 |  |
| **3.** | ET to investigate and propose possible experts and potential members of the Task Team. | All | Asap |  |
| ***DELIVERABLE 6: IMPROVING PWS DELIVERY THROUGH LINKING WITH OPAG-DPFS*** | | | | |
|  | **Actions:** | **Responsible Member(s):** | **Due Date:** | **Status:** |
| **1** | Formalise liaison between OPAG-PWS ICT (through Chair ET/SPII) and OPAG-DPFS ICT through identification of a focal point in each team. | Chair ET-SPII | 31/7/16 |  |
| **2** | Formally contact Chair OPAG DPFS to engage OPAG-PWS in the process of revision of GDPFS Manual by revewing the revised version and providing relevant content. | Chair ET/SPII | 31/7/16 |  |

**Responsible Team Member Key:**

Armstrong Y.C. Cheng (AC)

John L. Guiney (JG)

Haleh Kootval (HK)

William J. Lang (WL)

Yoshiro Tanaka (YT)

Eugene Vasilyev (EV)

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**APPENDIX V**

**PROPOSED NEW STRUCTURE OF THE OPAG ON PWS**

