WORLD METEOROLOGICAL ORGANIZATION

PUBLIC WEATHER SERVICES EXPERT TEAM ON

SERVICES AND PRODUCTS IMPROVEMENT (ET/SPI)

Hong Kong, China

24-28 May 2010

FINAL REPORT

EXECUTIVE SUMMARY

A 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 (ET/SPI) was held in Hong Kong, China, from 24 to 28 May 2010. The meeting was chaired by Mr John Guiney (USA). Under its Terms of Reference (TORs) and associated deliverables, the Expert Team had to work on several areas which broadly included: the requirements for new and improved products and services for key PWS user groups, especially in developing countries.

The results of work under the various TORs of the Expert Team are summarized below.

TOR (a) - Monitor and report on the progress of previous ET/SPI initiatives and make recommendations as appropriate to ICT-PWS.

The Team reviewed past ET/SPI initiatives and reported on their progress since the last meeting. All Team deliverables associated with the TORs, which were approved by CBS-XIII (St. Petersburg, Russian Federation, 23 February – 3 March 2005) have been completed. The 2008 PWS Implementation/Coordination (ICT) meeting was discussed including the transfer of responsibilities for the WWIS (WMO Weather Information Service) and the SWIC (Severe Weather Information Centre) Websites to Expert Team on PWS in Support of Disaster Prevention and Mitigation (ET/DPM), and implementation of PWS Pilot Projects focused on a "Learning Through Doing" approach. The Team reviewed the publication of "Supplement to Guidelines on Biometeorology and Air Quality Forecasts" and the Users Guide for the WWIS and SWIC. The ET/SPI also reviewed its contribution to the "Guidelines on Communicating Forecast Uncertainty" published by the Expert Team on Communication, Outreach and Public Education Aspects of PWS (ET/COPE).

TOR (b) - Monitor and report on aspects of services and products improvements that relate to support of major WMO activities, including the Shanghai 2010 World EXPO Multi-Hazard Early Warning Systems Project.

The Team continues to pursue and support WMO cross-cutting activities and initiatives with a focus on improving PWS products and services. The Team was briefed on the *WMO International Symposium on PWS: A Key to Service Delivery* (Geneva, Switzerland, December 2007), including a review of the primary symposium themes and recommendations: ensuring of the dependability, usability, and credibility of National Meteorological and Hydrological Service (NMHS) services, seeking out best practices in service delivery, the need for NHMSs to harness new science and technology to enhance service delivery, and providing integrated product and services to meet community needs. The Team was provided an update on PWS involvement in the Severe Weather Forecasting Demonstration Project (SWFDP) sponsored by the CBS OPAG on Global Data-Processing and Forecasting Systems (GDPFS). The Team was updated on the contributions of the PWS Programme for the World Expo 2010 in Shanghai. These included: the World Expo Nowcasting Services (WENS) Demonstration Project, a joint effort between the Australian Bureau of Meteorology (BoM), Hong Kong Observatory (HKO), Beijing Meteorological Bureau (BMB) and the Shanghai Meteorological Bureau (SMB); the display of the WWIS in the WMO/CMA Pavilion; the conceptual display with themes of the weather forecast of the future, and the future family and its relationship to weather; and, the Symposium on Meteorological Service Delivery and Disaster Risk Reduction (Shanghai, China, May 2010).

TOR (c) - Provide guidance in the development of training materials on the applications of probabilistic forecasting products and services for Multi-Hazard Early Warning Systems (MHEWS).

The Team recognized the training needs of forecasters in view of their changing and diversifying roles, including the development of skills in communication and service delivery of forecast information generated by specialized systems such as Ensemble Prediction Systems (EPS), MHEWS or nowcasting systems. The Team noted the useful guidance and information given in WMO/TD No. 1422 on "Guidelines on Communicating Forecast Uncertainty" and supported the idea of developing it further into a set of training material for use in relevant WMO training workshops. The Team also recommended the establishment of an inventory of training material on the use and communication of probabilistic information, making reference to best practices and guidelines from different regions around the world.

TOR (d) - Report and advise on how to best assist developing countries with building an integrated approach to PWS products and services to improve service delivery.

The Team discussed a number of issues focusing on how to best assist developing countries with building an integrated approach to improve products and services in support of their national PWS Programmes. These included: applications of new technologies to PWS; dissemination capabilities; general awareness programmes; and development of a culture of inclusiveness when improving products. The Team agreed that creating product development teams as defined by deliverable (d) through initiating a pilot project to work with key users in at least three countries would be a concrete way of achieving this.

TOR (e) - Explore and advise on the further development of probabilistic forecast products and services.

Probabilistic forecasting techniques have become state of the art for all kinds of meteorological forecasts and are used for all timescales. The Team discussed a study from Sweden about how to use ensemble predictions for operational flood forecasting, which indicates that effective training and communication are clearly necessary to overcome the substantial institutional and communicative challenges to applying EPS. In addition, more attention has to be paid to the specific decision structures and institutional challenges of end-users. The Team agreed that this approach should be seen as the starting point of a set of best practices for the development of such forecast products. Based on this several actions have been identified to enhance the training material for the upcoming PWS training activities.

TOR (f) - Identify, report and provide recommendations on emerging needs for new and improved products and services with emphasis on key PWS user groups.

The Team identified the key users of PWS and recognised the need for NMHSs to have a comprehensive understanding of their requirements. Surveys of key user groups can help to identify areas where improvements in PWS can be made. As an example, surveys in some NMHSs have noted the need for improved accuracy, detail and timeliness of forecasts and warnings. However, the Team recognised that surveys of the key user groups needs to be undertaken over an expanded domain to clearly identify their emerging needs. The Team also recognised that data retrieved from PWS User surveys on levels of User satisfaction with NMHS products and services could also be a valuable tool to assist in the verification of their services.

TOR (g) - Continue to encourage the use of verification for PWS.

The Team recognized that Deutscher Wetterdienst (DWD) has developed a scheme for a simple verification of WWIS temperature forecasts. The system outputs a country-based verification report which may be produced by DWD. The Team asked DWD to explore the possibility of developing a similar standard WWIS verification report for all WMO regions, since such information will be very useful, especially for developing countries. Furthermore, the Team discussed a new approach of event-oriented verification of warnings. Since this approach is of more value to users

and will help to improve warning quality, the Team stressed that further action is needed to develop expertise in this field.

TOR (h) - Keep under review the development of quality management procedures and practices relevant to PWS.

The Team noted the increasing acceptance of Quality Management Systems (QMS) as standard by many NMHSs, and that formal adoption of quality management principles by service providers was becoming a requirement for certain international user communities, such as aviation and marine. The Team recognised formal QMS certification (e.g., ISO-9000 – for at least a part of an NMHSs services should aid application of quality management in the remainder of the services, for example PWS. And, the shared experiences of NMHSs which have implemented QMS should be available to those who are seeking to implement these schemes. The Team proposed that its TORs should reflect the importance of QMS and other systems (such as the Information Technology Infrastructure Library (ITIL)) in improving service delivery, and that guidance should be provided in achieving these improvements.

TOR (i) - Develop and maintain a list of experts in Services and Products Improvements who are willing to contribute to PWS training activities.

The Team agreed that PWS training activities cut across all socio-economic sectors of a country's development and therefore while identifying subject matter experts to contribute to PWS training activities, it would be more beneficial to also consider experts from among stakeholders. The Team also noted the importance of keeping abreast of specific needs associated with developing countries, including five basic skills areas which are applicable to addressing PWS aspects namely: Verification; Quality Management; Application of Probabilistic Forecasting for PWS; Service Delivery; and, Emerging Technology/Applications. Again, this was captured as deliverable under TOR (i) in the deliverables section.

TOR (j) - Report and advise on collaborative activities with other CBS OPAGs and other WMO Technical Commissions.

The Chairman of ET/SPI is a member of the SWFDP Steering Group sponsored by CBS OPAG on GDPFS. The Team is presently pursuing potential collaboration with the World Weather Research Programme/Joint Working Group on Forecast Verification Research (WWRP/JWGFVR) on user-oriented verification.

TOR (k) - Keep abreast of advances in, and promote as appropriate, the application of emerging technology to the delivery of public weather services, with particular emphasis on the application of the database concept and the workstation and their implications for the changing role of the forecaster.

The Team noted that Numerical Weather Prediction (NWP) model outputs are increasingly 'fit for purpose' for many PWS forecast products, with forecaster input unnecessary much of the time. Forecasting tools are also becoming much more sophisticated, and the Team reviewed the benefits of the digital forecasting workstations currently used in several NHMSs. The dominance of web-technology, particularly for forecast dissemination was acknowledged. These issues are both motivating and facilitating the changing role of the forecaster, away from production and towards interpretation and interaction with users.

1. INTRODUCTION

1.1 At the kind invitation of the Government of Hong Kong, China, a 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 (ET/SPI) was held at the Hong Kong Observatory (HKO) in Hong Kong, China, from 24 to 28 May 2010. The meeting was chaired by Mr John L. Guiney (USA). Dr B.Y. Lee, Permanent Representative of Hong Kong, China with WMO and Director of the Observatory welcomed the participants. Ms Haleh Kootval (WMO Secretariat) thanked HKO on behalf of the Secretary-General and provided background information on the structure of the OPAG on PWS, especially on the objectives and expected outcome of the meeting of the ET/SPI. The CBS has defined the Expert Team's Terms of Reference (TORs) as follows:

(a) Monitor and report on the progress of previous ET/SPI initiatives and make recommendations as appropriate to ICT/PWS;

(b) Monitor and report on aspects of services and products improvements that relate to support of major WMO activities, including the Shanghai 2010 World EXPO Multi-Hazard Early Warning Systems Project;

(c) Provide guidance in the development of training materials on the applications of probabilistic forecasting products and services for Multi-Hazard Early Warning Systems;

(d) Report and advise on how to best assist developing countries with building an integrated approach to PWS products and services to improve service delivery;

(e) Explore and advise on the further development of probabilistic and other non-deterministic forecast products and services;

(f) Identify, report and provide recommendations on emerging needs for new and improved products and services with emphasis on key PWS user groups;

(g) Continue to encourage the use of verification for PWS;

(h) Keep under review the development of quality management procedures and practices relevant to PWS;

(i) Develop and maintain a list of experts in Services and Products Improvements who are willing to contribute to PWS training activities;

(j) Report and advise on collaborative activities with other CBS OPAGs and other WMO Technical Commissions; and,

(k) Keep abreast of advances in, and promote as appropriate, the application of emerging technology to the delivery of public weather services, with particular emphasis on the application of the database concept and the workstation and their implications for the changing role of the forecaster.

1.2 The list of participants is given in Appendix I. The programme of the meeting is contained in Appendix II.

2. BACKGROUND

The meeting was informed by Ms Kootval that the Fourteenth Session of the Commission for Basic Systems (CBS-XIV, Dubrovnik, Croatia, March 2009) had approved the TORs of the Open Programme Area Group (OPAG) on PWS proposed by the Implementation/Coordination Team (ICT) on PWS. The work of the PWS Programme continues to be coordinated through three expert teams and an implementation and coordination team. These Teams are: the Expert Team on Services and Products Improvement (ET/SPI); Expert Team on the Communication, Outreach

and Public Education Aspects of PWS (ET/COPE); Expert Team on PWS in Support of Disaster Prevention and Mitigation (ET/DPM); and the Implementation/Coordination (IC) Team on PWS. The TORs for all the teams reflect the areas of work which needed to be added for each team. The TORs cover all the broad issues of concern to the PWS Programme.

3. EXPERT TEAM WORK PROGRAMME

3.1 TOR (a) - Monitor and report on the progress of previous ET/SPI initiatives and make recommendations as appropriate to ICT-PWS.

3.1.1 The Chairperson of ET/SPI provided the Expert Team with a review of past ET/SPI initiatives and reported on their progress since the last meeting. The Chair noted that all Team deliverables associated with the TORs approved by CBS-XIII (St. Petersburg, Russian Federation, 23 February – 3 March 2005) have been completed. The Team was provided a summary of the last two PWS ICT meetings, held in Muscat, Oman, June 2007 and Shanghai, China, May 2008, respectively, and the *WMO International Symposium on PWS: A Key to Service Delivery,* which was held at WMO Headquarters Geneva, Switzerland, December 2007. Significant actions from the ICT include the transfer of responsibilities for the WWIS and SWIC websites to ET/DPM, and implementation of PWS Pilot Projects focused on a "Learning Through Doing" approach. This is a holistic approach which promotes NMHS collaboration with primary stakeholders to define, develop, and deliver new/improved PWS products and services followed by an evaluation of their impacts with an emphasis on socio-economic benefits.

3.1.2 The Team noted the publication of ”Supplement to Guidelines on Biometeorology and Air Quality Forecasts” led by Alan Sharp, Australian Bureau of Meteorology (BoM). The supplementary guideline document covers the issue of bio-meteorological services for the mitigation of human disease outbreaks, and the prediction of the long-term spread of human disease. This Guideline was published in 2007. A Users Guide for the WMO World Weather Information (WWIS) and Severe Weather Information Centre (SWIC) was produced with Mr Edwin S.T. Lai, Hong Kong Observatory (HKO), serving as the lead author. The Team was grateful for Mr Lai’s leadership with regard to the WWIS Website over the last several years. The ET/SPI also contributed to the “Guidelines on Communicating Forecast Uncertainty” published by ET/COPE.

3.1.3 As part of the Team's review of its last meeting (New York, USA, May 2006), it was noted that one of the follow-up actions associated with TOR (h) (Keep under review developments in verification for PWS with an emphasis on developing countries) had not yet been completed. DWD developed a pilot project to verify temperature forecasts from Regional Association VI (Europe) using data from the WWIS Website. The technical documentation was completed but was not formally published or distributed. The documentation will be included as part of the deliverable associated with the current TOR (g).

3.2 TOR (b) - Monitor and report on aspects of services and products improvements that relate to support of major WMO activities, including the Shanghai 2010 World EXPO Multi-Hazard Early Warning Systems Project.

3.2.1 The Team discussed the *WMO International Symposium on PWS: A Key to Service Delivery* that was held in Geneva, Switzerland, December 2007. Several members of the Team attended the Symposium, with the Chairperson of ET/SPI making a presentation entitled, "Innovations and new technology for improved weather services”. Other members of the PWS OPAG Expert Teams also attended and/or made presentations at the Symposium. Several of the recommendations and related themes from the Symposium are directly linked to the work of ET/SPI, including: the ensuring of the dependability, usability, and credibility of NMHS services; seeking out best practices in service delivery; the need for NHMSs to harness new science and technology to enhance service delivery; and, providing integrated product and services to meet community needs.

3.2.2 The CBS OPAG on GDPFS sponsored the second and third meetings of the Steering Group of the Severe Weather Forecasting Demonstration Project (SWFDP) held at WMO Headquarters in Geneva, Switzerland, in December 2008 and February 2010, respectively. The Steering Group (SG) reviewed the progress of the inaugural SWFDP in Southern Africa,

and the Severe Weather Forecasting Disaster Demonstration Project (SWFDDP) initiated in the South Pacific Islands. The SG discussed the issues and challenges noted from the current subprojects and identified the need for tools for very short-range forecasting, including nowcasting. The SG also discussed verification activities in the SWFDP and agreed to update the verification sections of the *SWFDP Overall Project Plan* and the *SWFDP Guidebook on Developing Regional Subprojects*. In addition, the SG updated these documents to include additional aspects relating to PWS. The SG concluded the February 2010 meeting with developing a prioritized list of possible new projects and an additional project phase defined as a "Continuing Development Phase". When an existing subproject has met its primary objectives and developed its base framework through the initial phases, the subproject would transition to the Continuing Development Phase whereby the respective Regional Association would assume responsibility for the continuation of the project, including identifying resources to sustain the Project. The Team was informed by Ms Haleh Kootval (WMO Secretariat of plans to start two more SWFDP-style initiatives: one in south-east Asia and the other in the Lake Victoria region of east Africa. PWS is an important component of both projects and its involvement in them will continue from planning through to the implementation phase.

3.2.3 Ms Kootval provided the Team with an update on PWS Programme activities in support of the World Expo in Shanghai, which opened on 1 May and will continue through 31 October 2010. The role of the WMO PWS Programme in the Expo was a major focus of the ICT meeting held in Shanghai in May 2008. Since the ICT meeting in 2008, additional discussions between the WMO PWS Programme and the Expo organizers have continued. Subsequently, the plans for the Expo, and the PWS role and involvement, were modified.

3.2.4 One of the PWS Programme's primary roles regarding the Expo was integrating the PWS "Learning Through Doing" framework into the World Expo Nowcasting Services (WENS) Demonstration Project initiated in 2008. The WENS Project is a joint effort between the Australian Bureau of Meteorology (BoM), the Hong Kong Observatory (HKO), Beijing Meteorological Bureau (BMB) and Shanghai Meteorological Bureau (SMB). The Project will provide nowcasts to the SMB and Expo organizers if hazardous weather, especially thunderstorms and typhoons, threaten the area. Given the Expo's period of operation, a wide range of potential hydrometeorological hazards could affect Shanghai and impact the Expo. In response, the WENS Science Steering Group (SSG) developed an implementation plan which incorporates contingency planning for these potential system needs.

3.2.5 The PWS Programme is also playing a role in WMO/China Meteorological Administration (CMA) Pavilion at the Expo. The entrance of the Pavilion features a display of the world city forecasts via the revamped WWIS Website – *http://www.futureweather.int*. The display of the WWIS Website information was coordinated by SMB and HKO.

3.2.6 One of the main attractions at the WMO/CMA Pavilion is a conceptual display with themes of the weather forecast of the future, and the future family and its relationship to weather. The display features several conceptual designs of how public weather services will provide forecasts information and services in the year 2030. Four NMHSs (BoM, NOAA/NWS, Met Service New Zealand and Environment Canada), the CBS OPAG/PWS and WMO Secretariat contributed their concept of the weather office of the future. These conceptual models were shared with SMB and incorporated into the Pavilion display.

3.2.7 The Expo also included an international Symposium on Meteorological Service Delivery and Disaster Risk Reduction, coinciding with the Honour Day (9 May 2010) which launched the WMO/CMA Pavilion. The target audience of the Symposium was the Permanent Representatives from Members of WMO attending the Expo. The PWS Programme led the organization of the service delivery portion of the Symposium in collaboration with the Chair of the OPAG on PWS and CMA/SMB.

3.3 TOR (c) - Provide guidance in the development of training materials on the applications of probabilistic forecasting products and services for Multi-Hazard Early Warning Systems.

3.3.1 The Team acknowledged that probabilistic guidance material now spans the entire forecast spectrum from high-resolution short-range ensembles to very long-range climate prediction. The Team discussed the training needs of forecasters in view of their changing and diversifying roles. Some of the topics discussed include: (a) technical competency in correctly and intelligently interpreting the increasing amount of forecast guidance material, including EPS and other probabilistic prognostic information generated by specialized systems such as MHEWS or nowcasting systems; (b) communication competency in translating such information into meaningful PWS output, including the conveyance of confidence and uncertainty information in media interviews and presentation; and (c) service delivery competency in interacting with users on the productive applications of such information, in particular with reference to potential collaboration with users on the development of weather risk assessment practices. (See also TOR (k) for additional information.)

3.3.2 The Team recognized the increasing amount of training material and activities specific to specialized forecasting tools and MHEWS, in particular in connection with the application of EPS information in operational forecasting. The Team is conscious that: (a) forecasting infrastructure in many NMHSs remains largely rooted in the conventional ways of formulating forecasts and delivering warnings; (b) forecasters' skill set and mentality, partly as a result of how they are trained, are still very much geared towards making decisions on the "best" deterministic assessment in time and space, despite the increasing amount of available information on alternative scenarios in the "probability dimension"; (c) terminology in communicating uncertainty information is rather loosely defined, both from the perspectives of forecasters as information providers and the public as information users; and, (d) collaboration with users on the intelligent application of MHEWS and probability information for risk assessment and decision-making process remains largely under-developed.

3.3.3 The Team noted the useful guidance and information given in WMO/TD No. 1422 "Guidelines on Communicating Forecast Uncertainty" and supported the idea of developing it further into a set of training material for use in relevant WMO training workshops. Opportunities to engage social scientists in the development of such training material, particularly on the use of terminology, should also be pursued where feasible.

3.3.4 The Team also recommended the establishment of an inventory of training material on the use and communication of probabilistic information in different regions. These materials would be particularly beneficial to SWFDP training workshops. Existing resources, as well as the need to incorporate such material within the WMO training syllabus, should also be explored. Members of the Team are expected to provide input from their respective services, supplemented by contribution from ET/COPE on the media side, as well as collation of views from American Meteorological Society (AMS) Ad Hoc Committee on Uncertainty in Forecasts (ACUF) and other recent studies. Reference should also be made to best practices and guidelines elsewhere, such as those published by CMA and taught in UK Met Office's Professional Development Programme.

3.4 TOR (d) - Report and advise on how to best assist developing countries with building an integrated approach to PWS products and services to improve service delivery.

3.4.1 The Team discussed a variety of issues focusing on how to best assist developing countries with building an integrated approach to improving products and services in support of their PWS Programme. These included: applications of new technologies to PWS; improving data and observational capabilities; improving dissemination capabilities; and general awareness raising programmes.

3.4.2 The Team noted that some of the developing countries have difficulties with basic infrastructure and therefore building an integrated approach to PWS products and services means looking at the whole spectrum of products and services development. This includes: an effective public education program; developing relationships between NMHSs and other government agencies, emergency management officials, the media; development of infrastructure for data collection data processing and dissemination methods.

3.4.3 The Team recognized that technology has and continues to advance at such a rapid pace that some developing countries are struggling to keep up, especially with limited budgetary provisions. Unless NMHSs are adequately funded by their governments and get support from other developed partners, it might be difficult to benefit from available technology. By keeping up with technology, they may gain increased credibility and rank higher in the priority for competitive funding allocations from their governments.

3.4.4 During the Team's review, the issue of examining the process of developing new products was discussed. The Team noted that NMHSs need to develop a culture of inclusiveness by creating product development teams. These teams would tap the expertise from their user community who know how to best optimize and package meteorological information for maximum usability.

3.5 TOR (e) - Explore and advise on the further development of probabilistic and other non-deterministic forecast products and services.

3.5.1 In recent years, EPS and other probabilistic forecasting techniques have developed considerably and have become state of the art for all kinds of meteorological forecasts. In particular, they are used for all timescales, from nowcasting up to long-range forecasting and climate projections.

3.5.2 From the viewpoint of the developers of these techniques it has seemed self-evident that such products should be welcomed by all customers, since the increase of forecast quality through EPS is one of the key advances in NWP in the last decade. In addition, the key benefits of EPS are their application to assessing the confidence of a specific forecast, and in estimating the probability that an event will occur. It has been assumed that these benefits can be easily appreciated by end-users.

3.5.3 Although probabilistic forecast systems have been in operation for many years, there remains a communication problem between developers and end users - many users are still unsure about the correct interpretation of probabilistic products. From their point of view, the probability of the occurrence of an event is not understood as additional information and can be seen as lack of confidence by providers. They mostly expect simple “yes” or “no” advice for this particular purpose. This means that due to user requirements most EPS or probabilistic forecasts are “translated“ into some kind of deterministic information which can be understood.

3.5.4 The Team was informed of a study from Sweden about how to use ensemble predictions for operational flood forecasting which has been undertaken under the EU Project PREVIEW. Several lessons (for more details see the PWS Website) were identified which have been of great importance in communicating and developing EPS based on the European Centre for Medium-Range Weather Forecasts (ECMWF) and the Swedish Meteorological and Hydrological Institute (SMHI) runoff model products used by the Civil Protection Agencies (CPAs). The overall conclusion is that effective training and communication are clearly necessary to overcome the substantial institutional and communicative challenges to applying EPS. In addition, more attention has to be paid to the specific decision structures and institutional challenges of how that knowledge might be used by CPAs and others to improve their response to flooding risk.

3.5.5 As a consequence, training for EPS users needs to be tailored to users' needs and delivered appropriately to their management structures. It is via discussions with users that tailored products based on their local experiences and requirements are created. EPS products will achieve much greater acceptance when users see the benefit in operational situations. The Swedish case highlights the importance of those institutional factors and their central importance in making the best use of EPS for operational flood forecasting.

3.5.6 In Germany, DWD has had similar experiences when developing probabilistic advice on change of runway direction for Frankfurt Airport which will be based on the new COSMO-DE EPS. These case studies show that an interactive development of probabilistic products in operational situations will often lead to a new perspective for both users and service providers. Hence, greater understanding of user requirements in the development process increases the likelihood of user

acceptance and understanding, through increased usability, credibility and relevance of the systems.

3.5.7 The Team agreed that the above-mentioned approach should be taken into account when developing advanced probabilistic forecast information for end-users. For this reason, the study from Sweden will be made available to the Team and will be seen as the starting point of a set of best practices for the development of such forecast products. Based on these documents, additional information may be produced to supplement the guidelines on communication uncertainty (WMO/TD No. 1422) in liaison with ET-COPE. Furthermore this will assist to produce enhanced training material for the upcoming SWFDP workshops. The Team agreed that close collaboration and consultation with OPAG DPFS should be maintained on issues related to EPS and forecast uncertainty.

3.6 TOR (f) - Identify, report and provide recommendations on emerging needs for new and improved products and services with emphasis on key PWS user groups.

3.6.1 The Team reviewed its past work and discussed PWS key user groups including the public, government agencies, emergency management/civil defense authorities, major economic sectors, media, other hydrometeorological service providers, and major international events/organizers (e.g., Olympics) and their needs for environmental information. The Team also recognized the emergence of new, non-traditional PWS user groups that require environmental information including public transportation departments, health care organizations, and the utility and alternative energy sectors. NMHSs are challenged to engage these new, environmentally sensitive user communities to ensure that they have a comprehensive understanding of their requirements for PWS products and services.

3.6.2 During their deliberations, the Team agreed that the user group term “Public” need more specificity. The Team expanded their definition of “Public” to include, in addition to the traditional users such as households, users from the following sectors: agriculture, marine, industry (particularly that which has an outdoor focus), transport and commerce.

3.6.3 In semi-annual surveys of key Public user groups by the Australian Bureau of Meteorology (BoM), a clear requirement for the following improvements to PWS forecasts has emerged, in particular: forecast accuracy; increased detail in forecasts particular to the users’ locations; and better timeliness of the forecasts and warnings delivered.

3.6.4 In terms of accuracy, the PWS users surveyed particularly refer to the key meteorological parameters of rainfall (timing and amount), and wind speed and direction. Improved seasonal forecasts were also required. With regard to the level of detail, PWS Users expressed a requirement for more meteorological information particular to their location and activity. From the timeliness perspective, PWS Users expressed a requirement for more frequent updates of forecasts and warnings to be available from a range of delivery mechanisms including the media, web and the telephony system, and for forecasts to be available for longer periods into the future.

3.6.5 Similar to BoM, other NMHSs survey their PWS user community at various frequencies to assess user needs. Examples of other NMHSs that conduct user surveys on a routine basis includes: UKMO, CMA, and HKO. For example, a recent survey by CMA of the public on PWS showed an 85% level of satisfaction with products and services. CMA also surveys specific user groups (e.g., agriculture, transportation, etc.) to gather sector-specific information. The Team recognised that survey results from NMHSs are helpful in identifying trends and commonalities among PWS programmes. In addition, similar surveys needed to be conducted to gather information from a broader cross-section of the community.

3.6.6 As part of its review of survey methods and results, the Team noted that the measurement of PWS user satisfaction with products and services obtained through surveys could be a valuable source of additional verification information. While this form of verification is initially subjective, techniques exist to transform this subjective information into objective data. These data can be assessed both immediately and over time to develop an understanding of user service requirements and trends in user satisfaction. Also, this information may have additional applications for improving products and services beyond the initial assessment. It is desirable to

maintain survey information in a database format to permit easy post-processing.

3.6.7 Providing accurate and timely warnings of severe weather is one of the main roles of NMHSs, and it is vital that this is done in close liaison with the user community. The impact of a weather event will vary significantly over an area or region. NMHSs should work with user groups to maintain an up-to-date understanding of the impacts of severe weather and the criteria for issuing warnings. Increasing the lead time for warnings will improve the quality of the warning service, and using probabilities can also assist in this area. The user community expects the NMHS, and other official organizations, to work together during severe weather events to promote a "single, authoritative voice" for all warnings. This will also promote consistent forecast information. Inconsistent forecasts and confused messages will result in a lack of confidence amongst the users. This could cause either a delayed response or no response to forecasts/warnings of severe weather.

3.6.8 Contingency planners and emergency authorities are required to deal with a wide range of events, many of which are impacted by the weather. These include, but are not limited to: environmentally hazardous events (e.g., air quality, oil spills); river and coastal flooding; contagious diseases in both humans and animals; and the impact of severe weather on communities. Planning for these events is vital to the success of dealing with them when they occur. NMHSs need to collaborate with contingency planners and emergency authorities on what information will be provided and the delivery mechanism. A well-defined collaboration process between NMHSs and contingency planners on what information will be provided to the public will ensure that they take appropriate action.

3.7 TOR (g) - Continue to encourage the use of verification for PWS.

3.7.1 NWP verification results are a basic tool to measure and improve the skill of forecast systems, since specific forecast strengths, weaknesses, and biases can be identified. It is commonly agreed that the significance of verification has increased in recent years. Without systematic verification, it would have been impossible to demonstrate the benefit of new techniques like EPS. However, verification is mainly applied to basic model outputs like 500 hPa fields and there are only a few sources of PWS forecast verification available, since it is hard to verify text bulletins and similar user oriented products. Certainly, a good model provides the basis for good PWS forecasts but verification from the end-users perspective should take into account their actions taken based on the forecasts.

3.7.2 DWD has developed a scheme for a simple verification of WWIS temperature forecasts which was discussed during the previous ET/SPI meeting (New York, USA, May 2006). As a first step, forecasts from RA VI were verified on a multi-country basis. Starting in February 2005, DWD collected forecasts (Tmin, Tmax, weather) automatically from WWIS and set up a basic verification process based on observational data from the Global Telecommunication System (GTS). Results from RA VI temperature forecasts in summer 2006 showed generally good forecast quality. Typical forecast errors for day-3 maximum temperatures were about two to three degrees Celsius. On the other hand, DWD results indicate that in some cases, temperature forecasts could be improved by post-processing techniques like Model Output Statistics (MOS).

3.7.3 Following the recommendation of ET/SPI, DWD defined a standard set of graphical information, determined the frequency of verification reporting and developed technical information on the verification technique used. The system outputs a country-based report which may be produced by DWD on request on a 6-monthly basis. After an announcement through the RA VI PWS Subgroup, some NMHSs from the region requested and received their own WWIS verification report including basic verification information such as Route Mean Square Error (RMSE), Reduction of Variance (RV) and a list of forecasts with large errors.

3.7.4 The Team agreed that such information will be very useful, especially for developing countries, and proposed in principle to make the verification reports available to all WMO regions. The Team asked DWD to explore the possibility of developing a similar standard WWIS verification report for all six WMO regions. Ideally, the multi-country reports, prepared by DWD, would be provided by HKO via the WWIS Coordinator/network to all contributing NMHSs.

3.7.5 Furthermore, the Team discussed the issue of verification of severe weather warnings given that issuing reliable user-oriented warnings is one of the most important core tasks of every NMHS. So far, there is no commonly agreed method on how to verify warnings and only a few NMHSs are currently developing a warning verification system. In addition, the warnings are becoming more localized and therefore, more complex to verify (e.g., due to lack of observational data).

3.7.6 The Team was informed that the method of a user-oriented verification of warnings was discussed during the Fourth International Verification Methods Workshop (Helsinki, Finland, June 2009). Warning verification is either process-oriented or event-oriented. The former has been used traditionally. The latter approach is arguably of more value to users (such as civil protection agencies), but is harder to implement.

3.7.7 DWD has designed an approach to deal with event-oriented verification, which takes greater account of user requirements. Based on these assumptions, a user-oriented verification of thunderstorm warnings was carried out. Applying the result of this event-oriented verification scheme has resulted in a significant reduction of the false alarm rate.

3.7.8 Due to the results of the above-mentioned workshop, the Team concluded that further action is needed to develop expertise in user-oriented warning verification. As a first step, an appropriate PWS expert should be identified to participate in a planned METEOALARM verification workshop to be organized by DWD at the beginning of 2011. As a second step, the results from this workshop should be used in upcoming SWFDP events in RAs I (Africa) and II (Asia) to ensure that these aspects contribute to the PWS verification and evaluation of SWFDP. The long-term aim should be to produce a guideline on warning verification as joint project of PWS ET/SPI and the World Weather Research Programme/Joint Working Group on Forecast Verification Research (WWRP/JWGFVR).

3.8 TOR (h) - Keep under review the development of quality management procedures and practices relevant to PWS.

3.8.1 The Team agreed that the use of quality management principles is becoming commonplace and routine in the NMHS community. There can be considerable benefits to efficiency and service delivery from adoption of such systems (as outlined in document WMO/TD No. 1256, “Guidelines on Quality Management Procedures and Practices for Public Weather Services”). In addition, quality management is increasingly becoming a necessary requirement for NMHSs engaged in certain activities, markets or areas. In particular, the aviation and marine user communities have indicated a clear requirement for service providers to demonstrate Quality Management Systems (QMS) compliance. The International Civil Aviation Organization (ICAO) specifies that all NMHSs with an international civil aviation commitment should achieve ISO 9000 certification for their services to civil aviation by November 2012. It was recognised that the majority of NMHSs have such a commitment, and the remainder would have close ties to their countries' provider of aviation services.

3.8.2 Given the assumption that most NMHSs will therefore hold ISO 9000 certification for at least some of their services in the near future, it was noted that quality management principles might then be extended to their other activities (such as PWS) with relative low cost and ease. The Team agreed that its TORs should be altered to reflect the increased acceptance of QMS as standard in NMHSs, and that the promotion of the benefits of QMS and similar systems for service delivery should be a function of the Team, along with the provision of guidance on how these benefits may be achieved.

3.8.3 The increasing adoption of quality management principles by NMHSs will lead to a growing knowledge resource concerning implementation and operation of QMS. This information should be shared between NMHSs, and accessible by those from developing nations, in particular, to aid their own QMS implementation.

3.8.4 The Team recognised that some NMHSs may remain reluctant to seek QMS certification for their non-aviation services, due to either costs of implementation and maintenance, or the perception that constraints imposed by the QMS may put them at an operational or competitive disadvantage. In such cases, pragmatism is recommended. Many of the elements of a QMS may be adopted, and consequent benefits realised, without seeking formal certification of compliance for all services.

3.8.5 Benefits to, and improvements in, service delivery are a usual (though not necessarily automatic) consequence of good quality management. Above all, a QMS should be useful and effective within each NMHS, and metrics should be in place to demonstrate these benefits.

3.8.6 Having implemented beneficial quality management systems, NMHSs should continue to seek improvements to service management and delivery. These improvements may be aided by adoption of additional standards and guidelines (such as ITIL), or by creation of organisation-specific metrics for service delivery. The Team discussed both approaches, examples of which, currently in place at the UK MO, are included in Appendix IV.

3.8.7 Quality management principles are essential to service development and delivery. The model for this 'service lifecycle' differs between NMHSs depending on the organisation's scale, resources and levels of commercial activity. The Team agreed that it is both possible and useful to define simple guidelines for improving service design and provision based on each of these models.

3.9 TOR (i) - Develop and maintain a list of experts in Services and Products Improvements who are willing to contribute to PWS training activities.

3.9.1 The Team agreed that PWS training activities cut across all socio-economic sectors of a country's development. In attempting to identify subject matter experts to contribute to PWS training activities, human resources from outside the meteorological services community should be considered. There are several subject matter experts who can provide good advice on how to best deliver or package meteorological information in a manner that can be most useful. This point is also applicable in developing new products. The Team also noted the importance of keeping abreast of specific needs associated with developing countries.

3.9.2 The Team discussed the wide range of services and products PWS would consider for improvement and noted that it would be difficult to identify experts without first identifying the areas of expertise required. The Team therefore agreed to develop criteria of required expertise based on the following broad thematic areas:

- Building partnerships with users of information;
- Building a communication strategy to improve on the presentation of services and products;
- Building capacity in computing and data management (networks, systems, new forecasting techniques); and,
- Developing skills to adapt forecasts to suit various individual user groups.

3.9.3 The Team identified five basic skills areas which are applicable to addressing PWS aspects of the above issues:

1. Verification;
2. Quality Management;
3. Application of Probabilistic Forecasting for PWS;
4. Service Delivery; and

5. Emerging Technology/Applications.

3.10 TOR (j) - Report and advise on collaborative activities with other CBS OPAGs and other WMO Technical Commissions.

3.10.1 The Team continues to pursue collaboration opportunities with other CBS OPAGs. To expand and identify additional collaboration opportunities with other CBS OPAGs, the PWS OPAG distributed a brief questionnaire, developed by ET/SPI, to the other CBS OPAGs at the CBS Extraordinary Session (CBS-Ext.(06), Seoul, Republic of Korea, November 2006). The responses indicate that the other CBS OPAGs are interested in collaborating with the OPAG on PWS on topics and/or issues of mutual interest/benefit. Based on feedback from the other CBS OPAG Chairs, the most effective method for promoting collaboration and communication on issues of common interest was for the OPAG Chairs to identify the appropriate OPAG expert(s) and have them attend relevant ET meeting(s).

3.10.2 The Team agreed that its collaboration activities with other CBS OPAGs have been most robust with CBS OPAG on GDPFS. The Chair of ET/SPI continues to serve as a member of the Steering Group for the SWFDP. The Steering Group has updated the verification sections and incorporated additional project aspects pertaining to PWS into the SWFDP Overall Project Plan and the SWFDP Guidebook on Developing Regional Subprojects.

3.11 TOR (k) - Keep abreast of advances in, and promote as appropriate, the application of emerging technology to the delivery of public weather services, with particular emphasis on the application of the database concept and the workstation and their implications for the changing role of the forecaster.

3.11.1 The Team recognised that model output is now generally of sufficient quality and reliability that minimal intervention is required by forecasters to generate many PWS products. This is especially helpful for developing countries, in that it will enable forecasters to focus on warnings and interaction with users.

3.11.2 The Team reviewed recent developments pertaining to digital forecasting systems. Many of these systems allow forecasters to interact directly with a database which provides exciting opportunities for integrating PWS forecast dissemination and service delivery. Digital forecast systems continue to be utilized by Environment Canada (SCRIBE) and NOAA/National Weather Service (NWS) (National Digital Forecast System – NDFD). BoM has been working with the NWS to implement a digital forecast system similar to the NDFD. The NWS has been populating the National Digital Forecast Database (NDFD) with base PWS forecast parameters (e.g., temperature, wind, precipitation, etc.) for about eight years. Recently, several NWS forecast offices began experimenting with populating the NDFD with aviation-specific parameters (e.g., ceilings, visibility). While in many ways this is a natural progression for evolving a fully integrated, seamless digital forecast system, it is also the first step necessary to provide forecast support for the USA aviation-centric Next Generation (NexGen) 4-D weather cube initiative. NexGen, scheduled for initial operational capability in 2013, presents a new challenge in digital forecasting. Although NexGen is primarily focused on aviation forecasting, many of the forecast challenges that confront aviation (e.g., convective initiation) are applicable to PWS. While the application of such systems remains limited, the Team agreed that digital forecasting offers one of the most exciting opportunities to integrate PWS forecast dissemination and service delivery. NMHSs are encouraged to keep abreast of new evolving techniques and technologies that will help integrate forecast dissemination and service delivery.

3.11.3 The integration of digital forecast database systems and service delivery provides several possibilities to enhance NMHSs services. The digital forecast database could be utilized to drive decision support models which provide impact focused user-specific environmental information. Currently, most digital forecast systems provide deterministic forecast information; however, both BoM and NOAA/NWS are developing and/or incorporating probabilistic forecasts information into their databases.

3.11.4 New technology is changing the way forecasters work. For example, forecasts are increasingly disseminated as 'content' for a wide variety of web-based services, and must therefore be produced in the appropriate formats. This requirement is already moving forecasters away from traditional document creation activities and towards quality control of automated forecast data, often accompanied by graphical and/or text commentaries, from which the end-products are automatically assembled.

3.11.5 The Team agreed that this evolution of forecasting practices is also motivated by the emerging role of the forecaster as advisor via application of weather expertise in tandem with in-depth knowledge of the needs of specific customers. Many NMHSs are experiencing increased demand for such services, but some have faced difficulties in supplying them due to current production demands on forecasters. Moving towards increasingly automated production systems, and introducing production tools (such as the NDFD or SCRIBE) which greatly increase production efficiency, reduces production time and cost and frees up the valuable resource of user-oriented forecaster expertise.

3.11.6 The Team recognised the vital importance of user engagement and communication skills in these advisory roles. The Team also recognised that it is important to retain forecasting knowledge and human control of the forecasting process, despite increased automation.

3.11.7 The Team noted the continued development and application of new information technology systems to deliver PWS products and services. In particular, the application of GIS and GPS technology is revolutionizing the service delivery paradigm especially for severe weather warnings. Mobile devices such as Personal Digital Assistants (PDAs), smart phones, and cell phones, continue to have the greatest potential impact, both in terms of affordability and accessibility, to effectively deliver user and location specific warnings and forecasts. In fact, some NMHSs are using cellular-based handheld phones almost exclusively to deliver a wide range of PWS products and services.

3.11.8 Several NMHSs are pursuing automated warning systems. DWD recently transitioned their AutoWARN project to a pre-operational phase. AutoWARN aims at improving methods and products for meteorological warning and serves as a database for the production of automated and more customized weather warning information. The system integrates forecast information such as observations, statistical nowcasting products, and EPS model output into a database which provides automated warning status. Forecast warning information, which includes different user requirements automatically, is produced directly from the database. The role of the forecaster will be to monitor the system and intervene as appropriate.

4. DRAFT WMO STRATEGY ON SERVICE DELIVERY

4.1 Ms Kootval provided the Team with an overview of the draft WMO Strategy for Service Delivery developed by the WMO Executive Council (EC) Working Group on Disaster Risk Reduction and Service Delivery (EC WG DRR & SD-2) to be endorsed by the Sixty second Session of the WMO Executive Council (EC-LXII, Geneva, Switzerland, June 2010) for submission to the Sixteenth session of WMO Congress (Cg-XVI, 2011,). The purpose of the Strategy is to provide guidance for NMHSs on the provision of weather-, climate-, and water-related services that incorporate user needs and appropriate performance metrics. While the draft document emphasizes guiding principles, sharing best practices, attributes/elements of effective service delivery, and Member roles and responsibilities, the intent is not to provide a prescriptive, one-size-fits-all service delivery approach. Rather, the Team recognized that several NHMS organizational/programmatic models exist among the Members. In addition to NMHSs, the strategy will serve to increase the focus of WMO programmes on service delivery. The Team agreed to collect/define the various NMHS organizational/programmatic models and define/provide some examples on how the WMO Strategy for Service Delivery guiding principles can be incorporated.

4.2 Following the overview, the Team reviewed the draft document in detail. Based on this review, the Team believes that the PWS Programme (PWSP) is best positioned to lead the implementation of the WMO Strategy for Service Delivery on behalf of the WMO. Moreover,

the ET/SPI is best suited to lead these efforts within the PWS OPAG as service delivery has been one of the focus areas of the Team's work over the last several years and is explicitly stated in two current TORs (d, k). Thus, the Team agreed to propose several actions for consideration and approval of CBS to: (1) rename the ET/SPI to incorporate service delivery explicitly; (2) adjust the Team mandate to include service delivery and incorporate service delivery within the proposed TORs for CBS; and, (3) expand the ET/SPI membership to include social scientists and representatives from the user sector.

4.3 The Team made two recommendations for consideration as part of the implementation of the strategy: (1) PWSP should engage other relevant WMO programmes in devising and executing the service delivery implementation strategy; (2) WMO should evaluate and document the resource requirements necessary to implement the strategy, and (3) allocate the necessary resources to PWSP and other contributing programmes.

5. CONCLUSIONS, DELIVERABLES AND FURTHER ACTIONS

5.1 The key conclusions arising from the meeting of the ET/SPI are given in the Executive Summary of this report. The Expert Team accomplished its task of addressing the assigned TORs and associated deliverables.

5.2 Based on the discussions of the TORs and associated deliverables, the work plan follows along with associated activities required to complete all deliverables:

Deliverable 1: Contact selected NMHSs and organizations to request inventory of probabilistic training material for forecasters to deliver and communicate uncertainty and probabilistic weather products to public/media and to request for sharing of such material … TOR (c).

1. ET/SPI members to contribute relevant material from their respective services (All to provide input to E. Lai; Deadline: 15 July 2010);

2. Obtain publication and guideline material from China (E. Lai; Deadline: 15 July 2010);

3. Provide relevant material based on UK MO Professional Development Programme on Probability Forecasting (W. Lang; Deadline: 15 July 2010);

4. Check EUMETCAL on probabilistic forecast training material (A. Thomalla; Deadline: 15 July 2010);

5. Check with WMO ETR, including COMET (H. Kootval; Deadline: 15 July 2010);

6. Collation and summary of results to WMO/PWS (E. Lai; Deadline: 15 August 2010); and,

7. Notify SWFDP of the availability of training resources (J. Guiney; Deadline: 1 September 2010).

Deliverable 2: Develop training material based on WMO/TD No. 1422 … TOR (c).

1. Identify resource person(s) to develop WMO/TD No. 1422 into a set of training material (All to provide input to J. Guiney; Deadline: 1 July 2010); and,

2. Set up resource page and links (to be determined at a later stage).

Deliverable 3: Develop a pilot project following the "learning-through-doing" concept involving no more than three developing countries to improve service delivery process through the following steps … (TOR (d)).

1. Identify NMHSs to participate in the project (A. Mwadali; dates, TBD);

2. Identify key user groups of meteorological products and services (dates, TBD);

3. Work with the users to identify their requirements of services and products (dates, TBD);

4. Implement the agreed process (dates, TBD);

5. Work with stakeholders/users that have benefited from the services/products to advocate for resource support from governments and development partners to strengthen essential components and infrastructure to continue providing better services; and,

6. Report progress or results to OPAG PWS through ET/SPI.

Deliverable 4: In close collaboration with ET/COPE develop a supplement to WMO/TD No. 1422 to describe best practices for user-oriented forecast products.

1. Make Swedish study available to the Team (A. Thomalla; Deadline: 1 July 2010);

2. Initiate discussions with ET/COPE on terms of collaboration (A. Thomalla; Deadline: 1 July 2010); and,

3. Implement results of these discussions (dates, TBD).

Deliverable 5: Provide guidance for NMHSs on developing user surveys and interpreting their results, through providing a collection of existing tried-and-tested surveys.

1. Collect examples of existing user surveys and accompanying interpretation (All - Deadline: August 2010);

2. WMO Secretariat to draft letter to be sent to all members, and invite responses to comment on usefulness of the surveys (H. Kootval – Deadline: September 2010);

3. WMO Secretariat to draft one-page summary of the attributes of a good survey (Lazo paper); and,

4. Report progress or results to CBS via PWS/OPAG (H. Kootval - Deadline: November 2010).

Deliverable 6: Contribute to the PWS verification and evaluation aspects of SWFDP.

1. Identify appropriate experts to participate in a planned METEOALARM verification Workshop (A. Thomalla – Deadline: July 2010);

2. In liaison with DPFS, provide results of the METEOALARM Workshop to upcoming SWFDP events (A. Thomalla – Deadline: March 2011); and,

3. Establish status of WWRP/JWGFVR survey on weather warnings verification, and offer to participate as appropriate (A. Thomalla – Deadline: July 2010).

Deliverable 7: Develop and provide WWIS standard verification reports.

- DWD to investigate and report to the Team on feasibility of producing multi-country standard WWIS verification reports for all six WMO regions (A. Thomalla – Deadline: December 2010).

Deliverable 8: Contingent on the above, HKO will communicate this information to the WWIS Coordinators (dates, TBD).

Deliverable 9: Identify, develop and maintain a list of ET/SPI subject matter experts willing to contribute to PWS training activities.

1. Refine the definition of the five skills areas listed above (All – Deadline: March 2011);

2. Identify and agree at least one expert willing to contribute to PWS training activities. (All – Deadline: July 2011); and,

3. Maintain list above experts (H. Kootval – Deadline: from July 2011).

Deliverable 10: Take the lead in the implementation of the WMO Strategy on Service Delivery by taking the following initial steps:

1. Identify the basic models of service delivery across NMHSs (H. Kootval – Deadline: August 2010);

2. Publish guidelines for using QMS to improve service delivery, applicable to each of these models. (W. Lang – Deadline: June 2011); and,

3. Provide to the Team examples of service delivery metrics used in NMHSs, along with suggestions of how to develop them (W. Lang – Deadline: June 2011).

6. CLOSING

Prior to its closure, the Expert team reviewed its current Terms of Reference (TORs) and made proposals for amending them (Appendix III). This information will be submitted through the Chair of OPAG to the forthcoming CBS Extraordinary Session (CBS-Ext.(10)), in November 2010. The meeting of ET/SPI closed at 1830 hours on Friday, 28 May 2010.

LIST OF APPENDICES TO THE FINAL REPORT OF THE

EXPERT TEAM ON SERVICES AND PRODUCT IMPROVEMENT (ET/SPI)

HONG KONG, CHINA, 24-28 MAY 2010

Appendix I: List of Meeting Participants;

Appendix II: Meeting Programme;

Appendix III: Revised Terms of Reference (TORs) of the ET/SPI; and,

Appendix IV: Use of Additional Service Delivery Standards in the UK Met Office.

APPENDIX I

LIST OF PARTICIPANTS AT THE MEETING OF THE

EXPERT TEAM ON SERVICES AND PRODUCT IMPROVEMENT (ET/SPI)

Hong Kong, China, 24-28 May 2010

Mr John L. GUINEY ***Chair of the CBS OPAG/PWS ET/SPI*** ***Chief, Meteorological Services Division, National Weather Service (NWS) Eastern Region***	NOAA/NWS Eastern Region Headquarters 630 Johnson Avenue, Suite 202 BOHEMIA, N.Y. 11716 United States of America Tel.: +1 631 244 0121 Fax: +1 631 244 0127 E-mail: John.Guiney@noaa.gov
Mr Ayub Shaka MWADALI ***Vice-Chair of the CBS OPAG/PWS ET/SPI*** ***Assistant Director, Public Weather and Media Services, Kenya Meteorological Department***	Kenya Meteorological Department Dagoretti Corner, Ngong Road P.O. Box 30259-00100 NAIROBI Kenya Tel.: +254 20 387 6957 Fax: +254 20 387 6955 E-mail: ayubshaka@yahoo.co.uk or mwadali@meteo.go.ke
Mr Alasdair HAINSWORTH ***Member of the CBS OPAG/PWS ET/SPI*** ***Section Head, Public, Marine & Agricultural Weather Services, Australian Bureau of Meteorology***	Regional Forecasting Centre Bureau of Meteorology GPO Box 1289 MELBOURNE, VIC. 3001 Australia Tel.: +61 3 9669 4510 Fax: +61 3 9669 4695 E-mail: a.hainsworth@bom.gov.au
Mr Axel THOMALLA ***Member of the CBS OPAG/PWS ET/SPI*** ***Deputy Head, Office of the President and International Affairs, Deutscher Wetterdienst***	Deutscher Wetterdienst (DWD) Frankfurter Strasse 135 63067 OFFENBACH Germany Tel.: +49 69 8062 4310 Fax: +49 69 8062 4130 E-mail: Axel.Thomalla@dwd.de
Dr William LANG ***Member of the CBS OPAG/PWS ET/SPI*** ***Deputy Chief Forecaster / Business and Forecasting Integration, UK Met Office***	Met Office FitzRoy Road EXETER EX1 3PB United Kingdom Tel.: +44 1392 88 4523 Fax: +44 1392 88 5681 E-mail: will.lang@metoffice.gov.uk

Mr Edwin Sau-Tak LAI ***Member of the CBS OPAG/PWS ET/SPI*** ***Senior Scientific Officer (Forecast Operation), Hong Kong Observatory***	Hong Kong Observatory 134A Nathan Road KOWLOON Hong Kong, China Tel.: +85 2 2926 8371 Fax: +85 2 2311 9448 E-mail: stlai@hko.gov.hk
Professor YAO Xiuping (Ms)	Public Weather Services Centre China Meteorological Administration 46 Zhongguancun Nandajie Haidian District BEIJING 100081 China Tel.: +86 10 5899 3512 Fax: +86 10 5899 3227 E-mail: yaoxp@cma.gov.cn
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/index_en.html
Ms Haleh KOOTVAL ***Chief, Public Weather Services***	Public Weather Services Programme Weather and Disaster Risk Reduction Services Department (WDS) Tel.: +41 22 730 8333 Fax: +41 22 730 8128 E-mail: HKootval@wmo.int

_____

APPENDIX II

EXPERT TEAM ON SERVICES AND PRODUCTS IMPROVEMENT (ET/SPI)
(Hong Kong, China, 24-28 May 2010)

PROVISIONAL PROGRAMME

	Monday, 24 May 2010	Tuesday, 25 May 2010	Wednesday, 26 May 2010	Thursday, 27 May 2010	Friday, 28 May 2010
AM **0900** **1200**	**1. Opening** **2. Background Information and Objectives (Secretariat)** **3. ET/SPI work programme** TORs (a, b, j, k): Discussions of key issues led by **John Guiney**	TOR (f): Discussions of key issues led by **John Guiney and Alasdair Hainsworth** TOR (g): Discussions of key issues led by **Axel Thomalla** TOR (h): Discussions of key issues led by **Will Lang**	General discussion on ET/SPI work Start individual group work under each TOR leading to related deliverables All participants: prepare input for reports on each subject and for the report of the meeting	Presentation by sub-groups to the ET/SPI General discussion Arrangements for follow-up actions under TORs Prepare inputs for the Executive Summary of the meeting	Preparation of report of the Expert Team (continue)
	Lunch	***Lunch***	***Lunch***	***Lunch***	***Lunch***
PM **1330** **1700**	TOR (c): Discussions of key issues led by **Edwin Lai** TOR (d): Discussions of key issues led by **Ayub Shaka Mwadali** TOR (e): Discussions of key issues led by **Axel Thomalla and Will Lang**	TOR (i): Discussions of key issues led by **Ayub Shaka Mwadali** TOR (k): Discussions of key issues led by **John Guiney, Axel Thomalla and Will Lang**	Discussion of Deliverables for the TORs	**4. WMO Strategy on Service Delivery** **5. Preparation of report of the Expert Team**	Review and adoption of the report **6. Closure**

_____

REVISED TERMS OF REFERENCE (TORS) OF THE ET/SPI

(a) Monitor and report on the progress of previous ET/SPI initiatives and make recommendations as appropriate to ICT/PWS;

(b) Monitor and report on aspects of services and products improvements that relate to support of major WMO activities;

(c) Report and advise on how to best assist developing countries with building an integrated approach to PWS products and services to improve service delivery;

(d) Keep abreast of the development and application of probabilistic forecasts;

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

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

(g) Identify and promote opportunities for improving service delivery in PWS with particular reference to the application of Quality Management Systems (QMS).

(h) Report and advise on collaborative activities with other CBS OPAGs and other WMO Technical Commissions; and,

(i) Keep abreast of advances in, and promote as appropriate, the application of emerging technology to the delivery of public weather services, and the changing role of the forecaster.

_____

USE OF ADDITIONAL SERVICE DELIVERY STANDARDS IN THE UK MET OFFICE

The UK Met Office continues to be fully ISO 9000:2000 certified. It has also adopted other industry standards for IT Service Management, as well as developing organisation-specific metrics for Service Delivery and User Perception.

Service Management – ITIL

As of 2010, the UK Met Office uses v3 of ITIL (the "Information Technology Infrastructure Library"). This provides a framework for IT strategy and decision-making, in addition to operational support, and sets standards for IT Service Management in all aspects of the "service lifecycle", including:

- Change Management – improved consideration of the impacts of change both internally and on customers. Proactive communication, and improved scheduling of change;
- Problem Management – improved identification and rectification of incidents while minimising impact. Understanding and addressing the root cause;
- Capacity Management – alignment of IT capability with business needs; and,
- Service Level Agreements – managing customer expectations for Service Delivery.

Use of ITIL principles is now 'second nature' in the UKMO, which have become a source of expertise for other organisations. For example, the UKMO is coordinating ITIL-based Service Management for the European MyOcean project, on behalf of the 61 NHMSs and research institutions involved.

Service Delivery – OTIF

OTIF ("On Time, In Full") is a collection of metrics which monitor product quality (primarily timeliness and conformance) for a representative sample of UKMO services. These are measured, analysed and published monthly enabling trends to be identified and issues swiftly addressed. In addition, a single OTIF score can be derived, which is used as a high-level performance target (KPT) for the entire organisation.

Customer Experience - MetPromoter Score

Routine, automated surveys of user and customer perception are undertaken via the UKMO PWS and Commercial webpages. This enables the MetPromoter Score (a variant of the 'Net Promoter Score' used widely elsewhere) to be calculated, which measures the difference between the percentage of users who can be seen as promoters/advocates for the UKMO, and those who might be classed as 'detractors'.

As with OTIF, the MetPromoter Score is an element of the UKMO's organisation-wide performance targets.

_____