WORLD METEOROLOGICAL ORGANIZATION

PUBLIC WEATHER SERVICES EXPERT TEAM ON

SERVICES AND PRODUCTS IMPROVEMENT (ET/SPI)

NEW YORK, USA

1 - 5 May 2006

FINAL REPORT

EXECUTIVE SUMMARY

A meeting of the Public Weather Services (PWS) Expert Team on Services and Products Improvement (ET/SPI) was held in New York, USA from 1-5 May 2006. The meeting was chaired by Mr John Guiney (USA). Under its Terms of Reference (TOR) 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, issues concerning verification, quality management, the use of WWIS Website, as well as cross-cutting activities and issues.

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

(i) The Team reviewed past ET/SPI initiatives and reported on their progress since the last meeting. The discussion focused on three primary initiatives: standardized PWS product formats including warning levels, thresholds, and icons; incorporating air quality and bio-meteorology information into PWS delivery; performance assessment and quality management. The Team reviewed the comprehensive guidelines on air quality forecasts/bio-meteorology, and performance assessment and quality management.

(ii) The Team continues to pursue and support WMO cross-cutting activities and initiatives with a focus on improving PWS products and services. ET/SPI worked with the Expert Team on PWS in Support of Disaster Prevention and Mitigation to develop a survey focused on gathering information for assessing the early warning capabilities and priorities for capacity building. The Team continues to look for opportunities to collaborate with WMO Space Programme in the area of PWS product and service improvements. The Team has established a firm link with **THORPEX** (**TH**e **O**bserving-system Research and **P**redictability **Ex**periment) through the PWS Implementation Coordination Team (ICT).

(iii) The Team noted several key areas that need to be assessed in order to improve PWS products and services. These included opportunities to apply new technologies to PWS, data and observational capabilities, PWS dissemination capabilities, an effective public education program, and the relationship between NMHSs, other government agencies, emergency management officials, and the media. The Team concluded that a survey, as defined in deliverable 3, directed to NMHSs would be the most effective method to identify and support the needs of developing countries in improving their PWS programme. The survey will be distributed at the CBS Extraordinary Session in November 2006.

(iv) The Team identified the key users of PWS and recognised the need for NMHSs to have a comprehensive understating of their requirements. The continuing important role of the broadcast media in the communication of PWS was noted, emphasizing the need for NMHSs to work closely with them in the effective communication of PWS. Surveys of key user groups can help to identify areas where improvements in PWS can be made. Surveys in NMHSs from developed Members have indicated the need for improved precision and accuracy, and more timely warnings of severe weather. The benefit of improved seasonal forecasts, especially forecasts of rainfall and temperature, was also noted in those surveys. Major NWP centres producing seasonal forecasts should make these available to NMHSs.

(v) The Expert Team noted the progress achieved in the WWIS web site and made the following recommendations for its future development strategies: inclusion of precipitation type and amount based on SYNOP; progressive introduction of more severe or abnormal weather information with DPM emphasis; gradual merging of the WWIS and SWIC web sites; the establishment and hosting of more language

versions on a voluntary basis, with a meeting of WWIS hosts to be arranged by WMO to coordinate and regulate WWIS development activities; inclusion of verification statistics on a regional basis; publishing a user guide to be distributed to the general public and major media organizations.

(vi) The Expert Team reviewed the Guidelines on Biometeorology and Air Quality Forecasts – WMO/TD No. 1184, 2004. It was noted that further guidelines were required, relating to airborne and waterborne human diseases. It was agreed that a brief supplement to the guidelines will be developed by the Team to address this need.

(vii) The Team recognized that data and products from EPS have the potential to change the way forecast information is provided to the user community, and that there are significant risks in the use and interpretation of the information. Education of the user community is vital to deliver maximum benefit and to avoid confusion. The major NWP centres with EPS capability should work with the smaller NMHSs to develop a range of products to help them use EPS effectively. They will also be encouraged to make available material on the use of EPS. The Team noted the need to work with other organisations to improve the communication of probabilistic information to the user community.

(viii) The Team agreed that verification results are a very powerful tool for assessing performance and encourages NMHSs to use them to improve PWS products and services. As part of a RA VI project, a basic verification of temperature forecasts from the WWIS Internet site started in January 2005. The Team agreed that such information could be very useful, especially for developing countries, and proposed to expand it to all WMO regions and communicate individual statistics to NMHSs. To improve forecast quality, the Expert Team will assess the RA II Pilot Project on NWP City-specific Forecasts by provision of MOS techniques and software to NMHSs; and organizing specialized training courses for capacity building purposes.

(ix) The Expert Team reviewed the Guidelines on Quality Management Procedures and Practices for Public Weather Services – WMO/TD No. 1256, 2005. It was agreed that with the publication of the document, the Team should start assessing the impact of this on NMHSs' management practices. This will commence with the inclusion of questions in a survey being developed by the Team. It was recognised that quality management practices have much to offer, but their implementation was perceived by many as an onerous imposition on resources. A report on the first-hand experience of implementing quality management practices and its consequential benefits is being provided to allay these concerns. Also, information on an IT management standard is provided for information.

(x) Database forecasting techniques offer new opportunities for integrating PWS forecast dissemination and service delivery. Several NMHSs continue to explore the database forecast concept. The Team noted a variety of emerging information technology systems used to delivery PWS products. Mobile communication devices utilizing GIS and GPS technology can effectively aid delivery of PWS products. Next generation forecast workstations should be able to readily retrieve observations, nowcast and prognostic information from databases, and assist in PWS product preparation and delivery through multiple communication pathways.

(xi) The Chairman of ET/SPI is a member of the Severe Weather Forecasting Demonstration Project Steering Group sponsored by CBS OPAG on Data-Processing and Forecasting System. To expand collaboration with other CBS OPAGs, and technical commissions, the Team developed a questionnaire to be distributed to other CBS OPAGs. The results will be provided through the ICT.

1. Introduction

1.1 At the kind invitation of NOAA/National Weather Service (NWS), a meeting of the Public Weather Services (PWS) Expert Team on Services and Products Improvement (ET/SPI) was held in New York, USA from 1 to 5 May 2006 and was chaired by Mr John Guiney (USA). Ms Haleh Kootval (WMO Secretariat) welcomed the participants on behalf of the Secretary-General and provided background information on the structure of the OPAG on PWS and 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 (TOR) as follows:

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

(b) Monitor and report on aspects of services and products improvements that relate to support for major WMO cross-cutting activities such as Disaster Prevention and Mitigation, the WMO Space Programme and THORPEX;

(c) Identify how best to meet the needs of developing countries in their efforts to improve services and products in support of their national PWS programme;

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

(e) Provide guidance on the development of the World Weather Information Services (WWIS) and explore its potential both for conveying other information and for developing the web site in other languages, in addition to English, Arabic, Chinese and Portuguese;

(f) Keep under review the development of user-oriented NMHS air quality and bio-meteorological forecasts and warnings;

(g) Explore and advise on development of appropriate probabilistic forecasts products and services enabled by advances in ensemble prediction systems;

(h) Keep under review developments in verification for PWS with a special emphasis on developing countries;

(i) Keep under review the development of quality management procedures and practices;

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

(k) **Report and advise on collaborative activities with other CBS OPAGs and technical commissions.**

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

2. Background

2.1 The meeting was informed by Ms Kootval that the Thirteenth Session of the Commission for Basic Systems (CBS) (St Petersburg, February 2005) had approved the

TOR of the Open Programme Area Group (OPAG) on PWS proposed by the Implementation Coordination Team on PWS. The work of the PWS Programme continues to be coordinated through three expert teams and an implementation and coordination team. The teams are: Expert Team on Services and Products Improvement (ET/SPI); Expert Team on the Communication Aspects of PWS (ET/COM); 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 have been modified by CBS-XIII to reflect the areas of work still outstanding, or those which needed to be added for each team. The TORs cover all the broad issues of concern to the PWS Programme. Accordingly, the subsequent changes in team membership were based on the areas of expertise required to complete the assigned TORs.

3. Expert Team Work Programme

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

3.1.1 The Chair 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 discussion focused on three primary initiatives: standardized PWS product formats including warning levels, thresholds, and icons; incorporating air quality and bio-meteorology information into PWS delivery; performance assessment and quality management.

3.1.2 The issue of standardized formats for publicly disseminated forecasts, warnings, and information was initially discussed by the Expert Team at the 2003 meeting in Kuala Lumpur, Malaysia. The Team identified several key factors that support the need to examine standardized forecast and warning formats, namely: the emergence of new technologies, globalization, and the increasing impact/scope of weather-related disasters – both from a population, infrastructure and economic standpoint – across national boundaries.

3.1.3 The Expert Team in 2003 had developed a proposal for a standardized format based on the work done in developing the World Weather Information Service (WWIS) Internet site. The format has been adopted for the WWIS web site and is compatible with XML. The issue of establishing warning levels and thresholds was not considered by this Team but should be addressed in collaboration with other CBS OPAGs [see TOR (K)]. It should be noted that WWIS has adopted a standardized set of icons based on Team recommendations.

3.1.4 A joint survey by ET/SPI and ET/Disaster Prevention and Mitigation (DPM), led by Dr M.C Wong (Hong Kong Observatory), conducted earlier this year focused on assessing the early warning capabilities in various countries. The survey included several questions regarding the availability of warnings for a variety of hazards for cross-border exchange. A total of 52 NMHSs responded to the survey. Preliminary results indicate that only a small percentage of warnings are available for cross-border exchange. The survey results are currently under evaluation.

3.1.5 The Team published a comprehensive guideline on air quality forecasts and bio-meteorology in 2004. Air quality and bio-meteorology continue to be a growth area for NMHSs. In many countries, the responsibility for air quality and bio-meteorological forecasts/advisories is a shared responsibility (e.g. NHMSs and other government environmental agencies). The challenge of linking the various information sources remains. In the last several years, there has been an increased recognition of a role for the hydro-meteorological community in the mitigation of infectious diseases. During the last two years, the UKMO began providing hydro-meteorological guidance

for Chronic Obstructive Pulmonary Disease (COPD) to the Primary Care Trust in the UK – see Annex III for addition information. Environmental information provided by NMHSs can assist in the management and control of airborne and waterborne diseases. This issue is discussed in more detail in section 3.6.

3.1.6 The Team has published two guidelines regarding performance assessment and quality management: Guidelines on Performance Assessment of Public Weather Services - WMO/TD No. 1023, 2000; Supplementary Guidelines on Performance Assessment of Public Weather Services – WMO/TD No. 1103, 2002.

3.2 TOR (b): Monitor and report on aspects of services and products improvement that relate to support for major WMO cross-cutting activities such as Disaster Prevention and Mitigation, the WMO Space Programme and THORPEX.

3.2.1 The Team continues to pursue and support WMO cross-cutting activities and initiatives that will provide opportunities to assess and improve existing PWS products and services. ET/SPI worked with the Expert Team on PWS in Support of Disaster Prevention and Mitigation to develop a survey focused on gathering information for assessing the early warning capabilities in various countries and for evaluating the necessity and priorities for capacity building. The survey was issued in January 2006 and results are currently under evaluation. The WMO Disaster Prevention and Mitigation Programme has recently issued a comprehensive survey to WMO Members to determine disaster prevention and mitigation support activities and related programme services currently provided by NMHSs. When completed, the results from both these surveys will be used by the Team to focus future activities related to PWS product and service improvements.

3.2.2 The primary purpose of the WMO Space/Satellite Activities Programme (WMOSA) is to coordinate environmental satellite issues and associated activities throughout all WMO programme areas. WMOSA also provides guidance on the application of hydro-meteorological remote-sensing techniques/applications to assist other WMO programmes in attaining their goals. In recent years, PWS has been invited to attend meetings in the area of satellite applications. As part of its current work plan, the Team is developing a survey, which is focus on identifying opportunities to improve PWS products and service. The Team will continue to look for opportunities to collaborate with WMOSA in the area of PWS product and service improvements.

3.2.3 The PWS programme has established a link to **THORPEX** (**TH**e **O**bserving-system **R**esearch and **P**redictability **Ex**periment). THORPEX is a 10-year international research and development programme with a goal to accelerate improvements in the accuracy of one day to two-week high-impact weather forecasts for the benefit of society, the economy and the environment. One of the benefits of THORPEX will be the development of short-range (up to 3 days) probabilistic forecasts. The transition from deterministic to probabilistic forecasting will have a profound impact on PWS products and subsequent service improvements. As such, operational forecasters are one of the key THORPEX user groups and will need to be informed and educated on the potential benefits of the multi-model ensemble, and on the optimum use of probabilistic forecast products.

3.2.4 THORPEX has proposed a demonstration project for the Beijing Olympics offering an opportunity to assess potential PWS product and service improvements. The Team will look to leverage the findings from the demonstration project for future work, as appropriate. In recognition of THORPEX's important connection to public weather services, the OPAG PWS Chairman is a member of the THORPEX Societal and Economic Applications Working Group. To ensure continued collaboration between

PWS and THORPEX, PWS will participate in THORPEX meetings and workshops as possible.

3.3 TOR (c): Identify how best to meet the needs of developing countries in their efforts to improve services and products in support of their national PWS programme.

3.3.1 The Team discussed a variety of issues focused on how to best meet the needs of developing countries in their efforts to improve products and services in support of their PWS programme. The Team noted several key considerations that need to be assessed in order to improve PWS products and services. These included opportunities to apply new technologies to PWS, data and observational capabilities, PWS dissemination capabilities, an effective public education program, and the relationship between NMHSs, other government agencies, emergency management officials, and the media.

3.3.2 The Team noted that one of the most important elements necessary to improve PWS products and services is the forecaster's tool set. This includes a workstation that can not only assist with environmental monitoring and analysis, but allows for efficient and effective product preparation and service delivery.

3.3.3 The Team also focused on key relationships with other government agencies, the emergency management community, and media partners. These relationships are critical for effective PWS service delivery. The media plays an especially important role. If the television stations have skilled meteorologists/weather presenters, perhaps in partnership with their NMHS, it will ensure a clear and consistent message of PWS.

3.3.4 While the Team was able to identify a number of important elements that it believes are directly linked to improved PWS products and service delivery, it concluded that a survey directed to NMHSs would be the most effective method to ascertain how to meet and support the needs of developing countries in improving their PWS programme. This activity is connected to the Team's deliverable #3. The Team has drafted an outline of the survey that will provide guidance to the WMO community regarding the key challenges that exist in NHMSs with regard to provision of PWS. The survey will be completed as indicated in section 4 of this report; "Conclusions, Deliverables, and Further Actions".

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

3.4.1 The Team identified the following key user groups of PWS products and services: the public; government departments; contingency planners; emergency authorities; the media; other meteorological service providers; and major international events/organizers (e.g. Olympics). Commercial organisations may also use PWS, but are not generally considered as a separate user group. NMHSs should maintain a dialogue with user groups to ensure that they have a comprehensive understanding of the requirements of users of PWS forecasts.

3.4.2 The broadcast media remains the principal method for the communication of PWS to the public, though other channels such as the Internet and mobile communication systems are becoming more widely available and are having an increasing role in the delivery of PWS.

3.4.3 In surveys of user groups in developed countries, users of PWS forecasts have indicated a requirement for the following improvements to PWS forecasts: forecast

precision, accuracy, severe weather warnings, seasonal forecasts, and forecasts in support of contingency planners and emergency authorities.

3.4.4 Improved forecast precision refers to the detail provided for specific locations, areas and regions. Improved forecast precision can be provided by improving the graphical display of products, though there is a need to ensure a balance between too much and too little information. As horizontal and vertical resolution of NWP models increases, added to the improved use of observational data from terrestrial and space-based systems, so does the capability to provide improved precision directly from automated post-processing forecast systems. Many NMHSs in developed countries provide quite detailed automated or semi-automated site-specific forecasts for locations around the globe. This capability can be introduced in other areas where high resolution NWP output and post-processing systems are available.

3.4.5 Improved forecast accuracy refers to reducing the number and frequency of errors in PWS forecasts to make them more valuable to the user. Verification of PWS forecasts and root cause analysis of errors is required to enable NMHSs to reduce errors and to demonstrate to user groups that the quality of PWS forecasts is improving with time. Advances in NWP and informed use of probabilistic output can help to improve accuracy. Major errors in PWS forecasts, especially in relation to severe weather events, can have a significant impact on the reputation of NMHSs and the informed use of probabilistic information can help to reduce the occurrence of major errors.

3.4.6 It is important for NMHSs to respond to the needs of the public, for example in the UK the public has expressed a desire for improved general weather forecasts. Improved precision and accuracy will help to improve the quality of PWS. However, most NMHSs are dependent upon the media for the delivery of PWS to public users of forecasts, and therefore must work closely with the broadcast media. This will ensure that sufficient time is available to present forecasts and that forecasts are displayed in a manner that enables the public to derive the information they require. Forecasts for different timeframes should be presented in similar formats and terminology where possible to allow the user to easily understand how the weather is expected to evolve.

3.4.7 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 and NMHSs should work with user groups to maintain an up-to-date understanding of the impacts of severe weather and the criteria for the issuing of a warning. Increasing the lead time for warnings will improve the quality of a warning service and the use of probabilities can assist in this area. The user community expects the NMHS and other official bodies to work together in the event of severe weather to have a single voice and provide consistent information. Inconsistent forecasts and confused messages will generate a lack of confidence amongst the users, perhaps resulting in a failure to respond in an appropriate manner to forecasts of severe weather.

3.4.8 Accurate seasonal forecasts can be of value to a large range of users. This is especially the case with forecasts of rainfall and temperature which can have a major impact on agriculture in many countries. Some major NWP centres routinely produce global seasonal forecasts using numerical models and statistical methods. These forecasts should be made available to all NMHSs. In addition, these centres should provide information on how to apply this information, and historic accuracy of these forecasts where it is available. NMHSs should work closely with the user community

to encourage investment in research aimed at improving the accuracy and utility of seasonal forecasts.

3.4.9 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: pollution events; river and coastal flooding; contagious diseases in humans and animals; oil spills; and the impact of severe weather on the community. Planning for these events is vital to the success of dealing with them when they occur. NMHSs need to agree with contingency planners and emergency authorities on what information will be provided, and the delivery mechanism. Agreeing what information will be provided to the public is also necessary to ensure that they take appropriate action.

3.5 TOR (e): Provide guidance on the development of the World Weather Information Service (WWIS) and explore its potential both for conveying other information and for developing the web site in other languages, in addition to English, Arabic, Chinese and Portuguese.

3.5.1 The Expert Team reviewed progress made in the past couple of years. It noted in particular the continuing growth of NMHSs providing official forecasts, enabling the WWIS web site to move ever nearer towards the ultimate goal of global coverage. As of April 2006, 111 Members are supplying official forecasts for 1,082 cities. As a value-added service to travellers and tourists, additional features of location map, city photos, and links to national tourism authorities were added with input from participating Members.

3.5.2 The Expert Team also reviewed the contents of the WWIS web site and considered future possibilities, with special emphasis on hydro-meteorological information and DPM applications. It was noted that the current approach of retrieving cloudiness information from SYNOP and colour-coded for display had been done to good effect. Building on this strategy, the Expert Team recommended that precipitation type and amount be similarly retrieved and displayed as the first step towards the inclusion of more hydro-meteorological information. While the precipitation amount would be quantified and suitably categorized for colour-coded display, subjective descriptive terms such as “heavy rain” or “light showers” were not recommended at this stage owing to the lack of universally agreed definitions. Recommendations were also put forward to explore the possibility of displaying severe weather information in terms of return periods and departures from normal.

3.5.3 For other possibilities further down the line, the Expert Team agreed that the emphasis should be on severe weather (e.g. tropical cyclones, rainstorms, high winds and abnormal temperatures) and other natural hazards (e.g. earthquakes). In the course of the discussion, the possibility of including probabilistic forecast information from NWP model ensemble was also considered, e.g. Extreme Weather Index produced by ECMWF. In this respect, support and input from THORPEX and major NWP centres would be further explored. The Expert Team noted the potential benefits to developing countries as demonstrated by the NWP City-specific Forecasts Pilot Project recently launched in RA II. For news on natural disasters, WMO would explore the feasibility of relaying the information to the Hong Kong Observatory for the display of headline banners on the WWIS web site and the inclusion of extra links to the disaster-affected region.

3.5.4 In the light of WWIS development trend, the future role of the SWIC web site was also reviewed. The Expert Team proposed that consideration should be given to combining the WWIS and SWIC web sites for streamlined management as well as for

balanced and coordinated development. The merging process could take place in phases, with the first step simply involving the addition of an entry layer for access to WWIS and SWIC. Future enhancement of the combined web site could be pursued further subject to input from OPAG PWS and the availability of resources.

3.5.5 In addition to the operational language versions of English, Arabic, Chinese and Portuguese; versions in French, Spanish and Russian are at different stages of development. Also, DWD has recently expressed an interest in setting up a German site. The Expert Team took note of the concern expressed by Members that WWIS hosts might encounter difficulties in keeping up with the pace of development and that consistency among different language versions could become an issue. As such, it was recommended that consideration be given to setting up a meeting of WWIS Hosts for coordination of effort, including the promulgation of an operational manual to be drafted by the Hong Kong Observatory for discussion. A long-term hosting strategy should be established to cope with the large number of language versions that will become available in the future. For the time being, the Expert Team proposed to continue with the current strategy of individual Members hosting new language versions on a voluntary basis.

3.5.6 The explanatory notes currently available on the WWIS web site and the promotional pamphlet printed for WWIS/SWIC were reviewed. The Expert Team agreed that the pamphlet could be readily converted into publicity and public education material to promote the use of the WWIS web site. An outline was drafted and is available in Annex IV. It requested the assistance of the Hong Kong Observatory to expand on it for the production of a user guide for the general public and media organizations. The draft would be passed to ET/COM for review. The WMO will arrange for the translation, printing and distribution of the user guides.

3.6 TOR (f): Keep under review the development of user-oriented NMHS air quality and bio-meteorological forecasts and warnings.

3.6.1 The Expert Team noted the completed document: Guidelines on Biometeorology and Air Quality Forecasts – WMO/TD No. 1184, 2004; now available through the PWS website. This document was the culmination of previous work by the Team. It was noted that these guidelines were quite thorough and will serve NMHSs well. The Team recognises that the functions that are described here are often the responsibility of other Agencies within their country, but that the NMHS usually plays at least a support role in the provision of the service.

3.6.2 The Team discussed other emerging requirements that may need to be included in the guidelines. Meteorological services to assist in the management and control of airborne and waterborne diseases are not sufficiently covered in the guidelines. This includes bacterial, fungal and viral agents, plus diseases transmitted by airborne or waterborne vectors (e.g. mosquitoes). The discussion covered the need for services to cater for outbreak events, and the need to consider the effect of climate change on the areal scope of conditions conducive to certain diseases.

3.6.3 Discussion extended beyond human disease to discuss agricultural diseases. This led to the identification of potential additions to the document related to air quality and bio-meteorological services for agriculture. However, it was recognised that this would alter the scope of the entire document, and it is better that the current emphasis on services that mitigate impact directly on human populations be retained.

3.6.4 It was recommended that the Team produce a supplementary guideline to cover the issue of bio-meteorological services for the mitigation of human disease outbreaks

and the prediction of the long-term spread of human disease as a consequence of climate change.

3.7 TOR (g): Explore and advise on development of appropriate probabilistic forecasts products and services enabled by advances in ensemble prediction systems.

3.7.1 The development of ensemble prediction systems (EPS) is one of the key advances in NWP in recent years. Major NWP centres and many NMHSs in developed countries have an EPS capability from which PWS products are being generated. The so-called "poor-man's ensemble", typically constructed of the output from a range of deterministic NWP models, is used to express risk and uncertainty and has made a valuable contribution in this area. RSMCs with responsibility for the prediction of tropical cyclones have used these developments to produce a range of forecasts expressing the probability that a tropical cyclone and associated wind and rainfall will affect geographical areas.

3.7.2 The key benefits of EPS are its application in assessing the confidence of a specific forecast and estimating the probability that an event will occur. There are risks associated with the use of uncertainty and probabilistic information. Some users will be confused by the use of probabilities and others may interpret the expression of uncertainty as a lack of confidence in a forecast with the result that they may not take appropriate action. Many of the public have an understanding of probabilities, but confusion arises when the probability is associated with an event that is expected to occur over both time and over a region, e.g. rainfall. Phrases such as a "50% chance of rainfall" should be avoided, unless they clarify the spatial and temporal variations in the event. NMHSs should ensure that suitable information is provided to the user community on the benefits, use, and interpretation of EPS products. The Team will contact the major centres to determine if any EPS user guides are available.

3.7.3 The introduction of EPS has greatly increased the volume of data transmitted between NMHSs and it may be difficult for some to access all available data. The major NWP centres with an EPS capability should work with smaller NMHSs to develop a range of EPS-based products that will allow smaller NMHSs to derive increased benefit from this capability. This is recognized by the Team as an area of importance for the development of the capability of smaller NMHSs. This will be included in the future work plan.

3.7.4 EPS output can provide useful guidance to NMHSs on the likely occurrence of the low probability, high impact events such as intense rainfall or windstorms that might result in significant or widespread damage or disruption. Even if these events have a low probability of occurrence, their impact can be so great that contingency planners, emergency authorities, and the public need to be informed to enable them to take action in advance of the event. Noting the major role of the media in communicating PWS to the user community, NMHSs need to work closely with the media to introduce probabilistic information that will be understood by users.

3.7.5 Most NMHSs have Internet sites for the communication of forecast information and these should include information on the uses and interpretation of EPS information. Publications, especially those aimed at the education sector, is an area where information on the use and interpretation of EPS can be provided. Interactive television and Internet sites also offer the capability to provide explanatory information on the use and interpretation of EPS.

3.7.6 Although NMHSs have many years of experience in the communication of forecast information to the user community, there are other organisations that may have more knowledge and understanding of the communication of information, e.g. the media and research institutes. NMHSs should work with these organisations to improve their understanding of effective communication of information.

3.7.7 EPS information can be used for any forecast time horizon and for a wide range of events of varying spatial and temporal scales. It is important that an NMHS be consistent in how the EPS is used and that the terminology in forecasts minimises ambiguity. Explanatory information provided by NMHSs and the media will help the users derive maximum benefit from the forecast.

3.8 TOR (h): Keep under review developments in verification for PWS with a special emphasis on developing countries.

3.8.1 The Team discussed the issue of verification and agreed that the significance of verification has increased in recent time. With a good verification system, the skill of new forecast techniques can be measured. In addition, specific forecast strengths, weaknesses, and biases can be identified. This information can be used for training and education, model development, or the introduction of new forecast technologies/techniques. For detailed information about verification, the Team refers to the two guidelines developed on the subject: Guidelines on Performance Assessment of Public Weather Services (WMO/TD No. 1023, 2000) and Supplementary Guidelines on Performance Assessment of Public Weather Services (WMO/TD No. 1103, 2002). Both these documents can aid NMHSs in developing an effective verification process. According to WMO information, about 60% of NMHSs have launched a verification programme. The Team stressed that verification results are a very powerful tool for assessing performance and encourages NMHSs to use them to improve PWS products and services.

3.8.2 NWP verification results are often discussed by international working groups or in expert meetings. However, there is no known worldwide source of PWS forecast verification. This is due in large part to the fact that NMHSs produce a vast amount of different PWS forecasts for different customer and user groups. In addition, NMHSs use different verification techniques to evaluate their PWS products and services.

3.8.3 In order to assess the viability of a multi-country PWS verification process, the German Meteorological Service (DWD) launched a pilot project to verify temperature forecast for RA VI using data from the WWIS website. As part of this project, DWD collected forecasts automatically from WWIS and set up a basic verification process for RA VI with data beginning in January 2005. For the period from April to August 2005, verification of RA IV temperature forecasts shows 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 forecast could be improved by using modern post-processing techniques like Model Output Statistics (MOS).

3.8.4 The Team agreed that such information could be very useful, especially for developing countries, and proposed to expand the verification project to all WMO regions. As a first step, a brief technical document detailing the verification method applied will be developed. The Team also identified the following additional actions: define information hub for each RA; define a standard set of graphical information; determine the frequency of verification reporting (e.g. quarterly or monthly); determine the distribution method (e.g. ftp account, Internet, pulled by NMHSs).

3.8.5 In view of the provisional verification statistics run by DWD for temperature forecasts of RA VI cities posted on WWIS, the Expert Team proposed that similar verification statistics be prepared routinely on a regional basis for inclusion on the WWIS web site. However, the Team agreed that the verification statistics for individual NMHSs need to be communicated internally to the NMHSs concerned. In an attempt to provide additional resources for NMHSs to improve their forecasts, particularly in developing countries, the Expert Team will monitor the RA II Pilot Project on NWP City-specific Forecasts and assess the possibility of implementing the following strategies: (a) provision of MOS techniques and software to NMHSs; and (b) organizing specialized training courses for capacity building purposes.

3.9 TOR (i): Keep under review the development of quality management procedures and practices.

3.9.1 Following up from earlier guidelines related to performance assessment of PWS, the document: Guidelines on Quality Management Procedures and Practices for Public Weather Services – WMO/TD No. 1256, 2005, has been published and is now available on the PWS website. This document was briefly reviewed by the Team, noting the main components of the document and the role it will play for NMHSs in the development of quality management procedures. The Team agreed that it would be useful to follow up with NMHSs to assess how useful/effective this document has been in setting quality management procedures and practices in place. While it was recognised that it is too early to carry out a detailed survey of NMHSs at this time, it was agreed that it would be useful for two or three questions related to quality management practices be included in the survey that the Team is preparing in association with TOR (c) and deliverable #3.

3.9.2 The implementation of ISO-9000 status in NMHSs was discussed. It is recognised that this seems to be a daunting task that some may perceive to be excessive. Two members of the Team represent NMHSs (DWD, UKMO) that have achieved ISO-9000 certification. It was noted that DWD and UKMO dedicated considerable resources over a period of one to two years to implement ISO-9000. However, once this process was completed the ongoing overheads of running ISO-9000 procedures are quite modest. There have also been consequential changes of management practices and procedures within the organisations that have led to notable improvements in the efficiency and effectiveness of management and procedures.

3.9.3 It was recognised that most NMHSs are likely to already have many internal guidelines and practices in place that would be ISO-9000 compliant, and that achieving compliance would be an incremental improvement process for managerial and operational practices rather than a complete overhaul.

3.9.4 The Secretariat advised the Team that the WMO has recently been in discussions with the ISO to develop a special quality management standard specifically tailored for application to meteorological and hydrological environment. These discussions are still in the early stages, and more useful feedback on the progress of this initiative should be available when the Team next meets.

3.9.5 In an effort to continue to improve the efficiency and effectiveness of its management and procedures, the UKMO is investigating a standard for information technology management practices called “Information Technology Infrastructure Library” (ITIL) – see Annex V. ITIL may assist NMHSs to more efficiently manage IT operations and associated resources.

3.9.6 An overview of the UKMO experience of becoming ISO-9000 compliant, along with a summary of some examples of notable improvements within the organisation, and aspects related to PWS are included in Annex VI in this report. The Team believes that this information will assist other NMHSs when considering whether to embark on the process to map out their own plans for achieving ISO-9000 certification. Also, further information on ITIL should be sought and reported back to the Team before its next meeting.

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

3.10.1 Digital forecasting techniques based on forecaster interaction with a database offers new opportunities for integrating PWS forecast dissemination and service delivery. The Team agreed that digital forecasting offers one of the most exciting opportunities to integrate PWS forecast dissemination and service delivery to most effectively serve the public. While the Team recognizes that digital forecasting remains in its formative stages, NMHSs should become aware, and keep abreast of, new evolving techniques and technologies that will help integrate forecast dissemination and service delivery.

3.10.2 Several NMHSs continue to explore the database forecast concept including the NWS (National Digital Forecast Database – NDFD), and Environment Canada (SCRIBE). The database is stored and available for download by partners and customers via the Internet. This gives users the power to manipulate the database and extract forecast information tailored to their needs. Recently, the Australian Bureau of Meteorology have committed to implementing a database system based on the NWS NDFD.

3.10.3 The Expert Team welcomed the increasing use of information technology in the delivery of PWS products; e.g. broadband web-based services, XML and FTP relay of computer-friendly weather information, and SMS and 3G modes of weather message transmission to the general public. With the aid of GIS and GPS technology, mobile devices such as cell phones have particularly high potential, both in terms of affordability and accessibility, to effectively deliver user and location-specific warnings and forecasts. Other emerging technology such as Really Simple Syndication (RSS) should help users monitor the availability of latest information and be utilized to push automated time-critical and user-defined information to subscribers through pop-up alerts – see http://en.wikipedia.org/wiki/RSS (protocol) for additional information on RSS.

3.10.4 In the face of increasing expectation for timely and efficient delivery of user-specific weather information, the next generation of forecast workstations should be able to readily retrieve observations, nowcast and prognostic information from databases. These systems will assist in the preparation of messages, forecasts, and warnings and their dissemination through a multitude of communication channels on a user-demand basis. While the technology had become more mature, resource and capacity constraints remain key challenges in the adoption of such workstations for operational use, particularly for small services and developing countries. Nevertheless, the Team recommended that the use of this technology be explored and studied further for potential applications in all WMO Regions.

3.11 TOR (k): Report and advise on collaborative activities with other CBS OPAGs and technical commissions.

3.11.1 The Chairman of ET/SPI is a member of the CBS Severe Weather Forecasting Demonstration Project Steering Group. The steering group is chaired by the CBS OPAG on Data-Processing and Forecasting System (DPFS). The principal focus of the project is on strong destructive winds and heavy precipitation. The steering group was formed to guide the planning of a series of regional subprojects. These will explore and test the usefulness of the products currently available from NWP centres, or products which could be readily made available from current NWP systems from global and regional meteorological centres. The goal is to improve severe weather forecasting services in countries where sophisticated model outputs are not currently used or available.

3.11.2 The Team discussed how to expand its collaboration with other CBS OPAGs, and technical commissions, which can assist in improving PWS products and services. The Team developed a simple questionnaire (see Annex VII) to be distributed to other CBS OPAGs as the first step in identifying collaborative opportunities. The questionnaire will be sent to the CBS OPAG PWS Chair for distribution.

4. Conclusions, Deliverables, and Further Actions

4.1 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.

4.2 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: *Participate in THORPEX International Conference on Decision Making and Decision Support in the Era of Probabilistic Weather Forecasting (2005-2006)…TORs (b, d, g)*

The THORPEX conference has been folded into the WMO International Conference on Economic and Social Benefits of Weather, Climate, and Water Services to be held in March 2007. The OPAG/PWS will contribute to this process through the participation of the Chair of OPAG in the THORPEX Working Group on Socio-Economic Applications. ET-SPI will contribute to the input from PWS through TORs (b, d, g) and deliverable 1 which will be modified to "Contribute to the WMO International Conference on Social and Economic Benefits of Weather, Climate, and Water Services".

Deliverable 2: *Develop a user guide on the World Weather Information Services (WWIS) Internet site for distribution to NMHSs (2005-2006)…TOR (e)*

The Team has developed an outline of the user guide which will be targeted for the general public and the media – see Annex IV. The following actions and associated timelines have been established to accomplish this deliverable:

- Complete draft user guide **(E. Lai, HKO)…01 July 2006**
- ET/SPI members review user guide **(All)…01 August 2006**
- User guide provided to WMO/PWS **(H. Kootval)…15 September 2006**

Deliverable 3: *Conduct a survey to assess the needs of NMHSs in developing countries regarding the PWS programme with a focus on identifying opportunities within PWS to improve products and services (2005-2006)…TOR (c)*

The Team has developed a survey outline. The Team has targeted distribution of the survey to participants at the CBS Extraordinary Session scheduled for Seoul, Republic of Korea in November 2006. The following actions and associated timelines have been established to accomplish this deliverable:

- Retrieve results from joint ET/SPI and ET/DPM survey issued in January 2006 **(J. Guiney)…01 June 2006**

- Complete draft of survey **(K. Groves, UKMO, A. Sharp, BMO, N. Zyncenko, SMN) …01 July 2006**

- ET/SPI members review survey **(All)…01 August 2006**

- Survey provided to WMO/PWS **(H. Kootval)…15 September 2006**

- Distribute survey at CBS Extraordinary Session Nov 2006 **(H. Kootval)**

Deliverable 4: *Host a workshop (jointly with ET/DPM) to identify PWS product and service opportunities/links between DPM and PWS (2007-2008).*

ET/DPM will take the lead on completing this deliverable. A workshop on nowcasting is being organised for the **last quarter of 2006 (H. Kootval)**

Deliverable 5: *Conduct a survey to identify the emerging needs for new and improved PWS products and services with the emergency management community and media partners (jointly with ET/COM) (2007-2008).*

This survey activity has been folded into deliverable 3. **Refer to deliverable 3** for information on completing this deliverable.

Deliverable 6: *Expand the WWIS Internet site to include additional hydro-meteorological information – especially information applicable to DPM – and other languages (2007-2008)…TOR (e)*

The Team has identified two additional hydro-meteorological elements to include on the WWIS web site: precipitation type; precipitation amount. This information will be extracted from SYNOP reports. In addition, the Team has recommended a meeting of WWIS hosts to develop a plan to expand the WWIS languages. The following actions and associated timelines have been established to accomplish this deliverable:

- Develop timeline for addition of precipitation type and amount to WWIS web site **(E. Lai, HKO)…TBD**

- Schedule a meeting of the WWIS hosts in Hong Kong **(H. Kootval)…TBD**

Deliverable 7: *Organize a workshop on the applicability of probabilistic forecasts products and services facilitated by ensemble prediction systems on PWS -- to include forecasters and representatives from the emergency management community (2007-2008)..TOR (g).*

This workshop will be scheduled in 2007. A workshop organisation plan will be developed by the end of 2006. Once the workshop is completed, the Team will develop a guideline on probabilistic forecasting utilizing the workshop results. The Team has identified the following actions to accomplish this deliverable prior to the development of the organisation plan:

- Identify probabilistic forecast products expert at the following centres:

  - NCEP (J. Guiney)
  - UKMO (K. Groves)
  - DWD (A. Thomalla)
  - JMA (E. Lai)
  - ECMWF and THORPEX (H. Kootval)

4.3 Based on the discussions of the TORs, below is the additional work plan and associated activities.

TOR (f): The Team agreed to develop a supplemental document on air quality and bio-meteorology. The following action has been identified:

- develop supplemental document outline **(A. Sharp)…01 Sept 2006**
- ET/SPI review supplemental document **(All)…01 November 2006**

TOR (h): Based on discussions associated with this TOR, the following action has been identified:

- a technical document on the verification technique incorporated by DWD in the pilot project will be developed **(A. Thomalla)…TBD**
- discuss with DWD the feasibility of expanding pilot project concept and provide verification information to other Regions **(A. Thomalla)…TBD**

TOR (i): Team will utilize survey in deliverable 3 to gather additional information on quality management procedures and practices. In addition, information on ITIL and ISO-9000 will be included in report Annex V and Annex VI, respectively **(K. Groves)…01 June 2006**

TOR (k): The Team drafted a questionnaire for distribution to the other CBS OPAGs to identify collaborative opportunities. This will be sent to the CBS OPAG PWS Chair for distribution. The Chair of the OPAG PWS will report on the information collected to the next meeting of the ICT.

4.4 The Chairman of ET/SPI will provide the OPAG/PWS Chair with the final report of the Expert Team meeting.

5. Closing

Prior to its closure, the Expert team reviewed its current terms of reference and made proposals for amending them. This information will be submitted through the Chair of OPAG to the forthcoming CBS Extraordinary session in November 2006.

List of Annexes to the Final Report of the

Expert Team on Services and Product Improvement (ET/SPI)

New York, USA, 1 - 5 May 2006

PARTICIPANTS AT THE MEETING OF THE

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

New York, USA, 1-5 May 2006

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Annex II

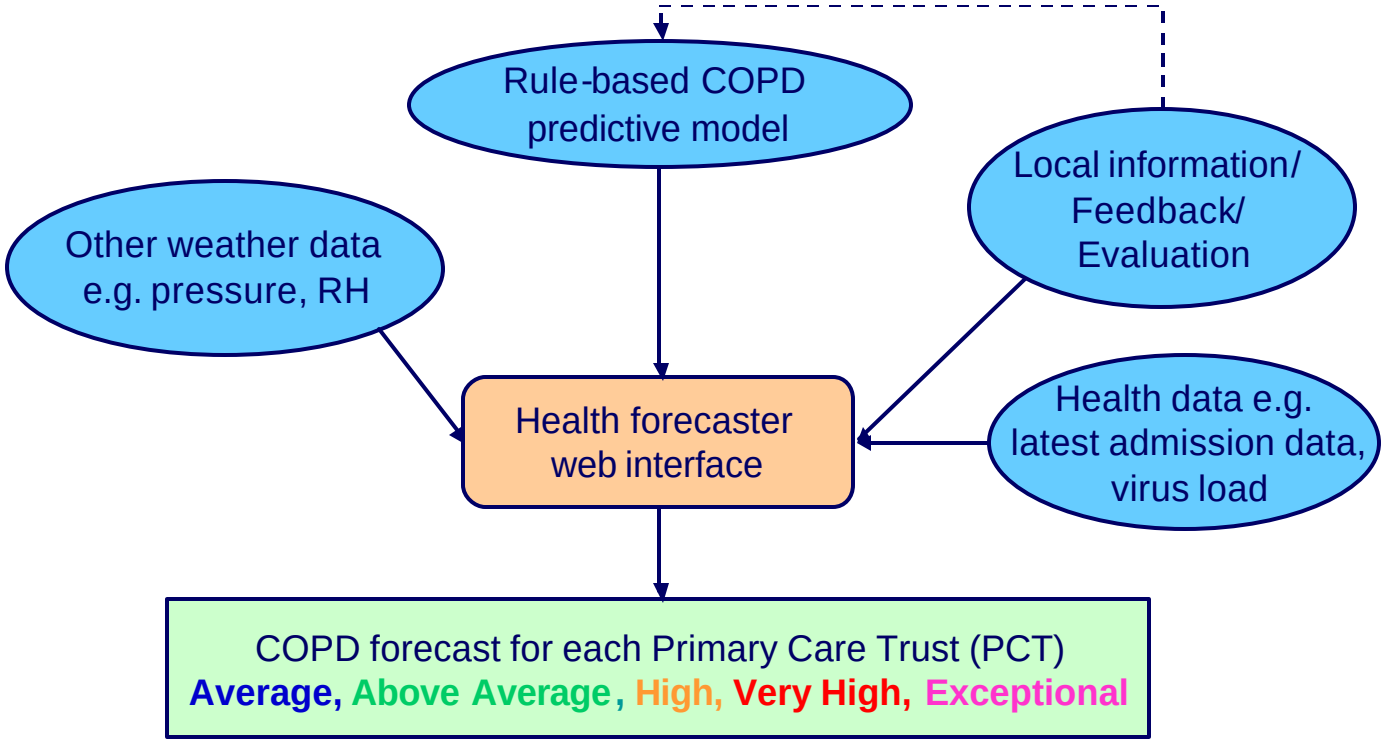
EXPERT TEAM ON SERVICES AND PRODUCTS IMPROVEMENT (ET-SPI)
(New York, USA, 1-5 May 2006)

PROGRAMME

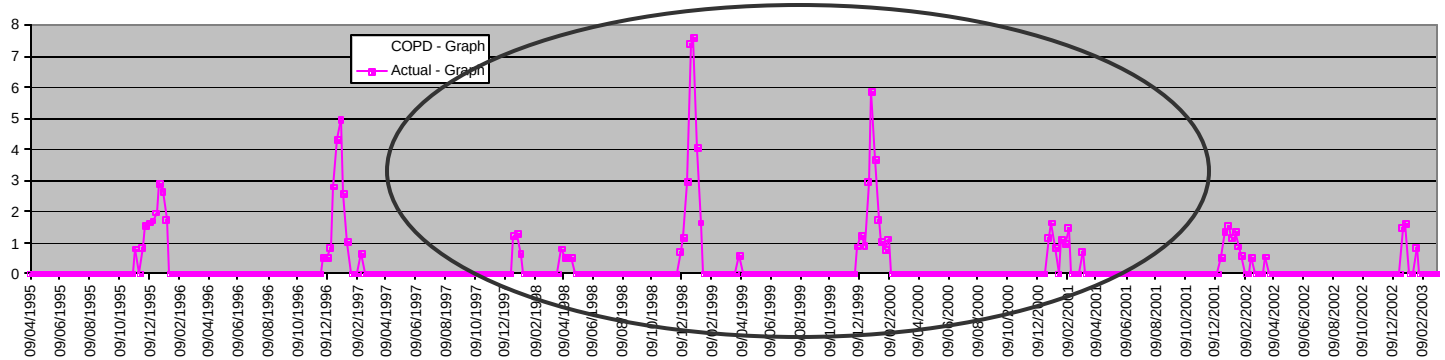
	Monday, 1 May	Tuesday, 2 May	Wednesday, 3 May	Thursday, 4 May	Friday, 5 May
AM 0900	**1. Opening** **2. Background Information and Objectives (Secretariat)** **3. ET-SPI work progamme**	TOR (f): Discussions of key issues led by **Alan Sharp** TOR (g): Discussions of key issues led by **Keith Groves** TOR (h): Discussions of key issues led by **Axel Thomalla**	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 TOR (b): (deliverable1)	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)
1200	TORs (a, b,): Discussions of key issues led by **John Guiney**				
	Lunch	***Lunch***	***Lunch***	***Lunch***	***Lunch***
PM 1330	TOR (c): Discussions of key issues led by **Nadia Zyncenko** TOR (d): Discussions of key issues led by **Keith Groves** TOR (e): Discussions of key issues led by **Edwin Lai**	TOR (i): Discussions of key issues led by **Alan Sharp** TOR (j): Discussions of key issues led by **Edwin Lai and John Guiney** TOR (k): Discussions of key issues led by **John Guiney**	TOR (c): (deliverable 3) TOR (d): (deliverable 1) TOR (e): (deliverables 2 and 6) TOR (g): (deliverable 7)	**4. Preparation of report of the Expert Team**	Review and adoption of the report **5. Closure**
1700					

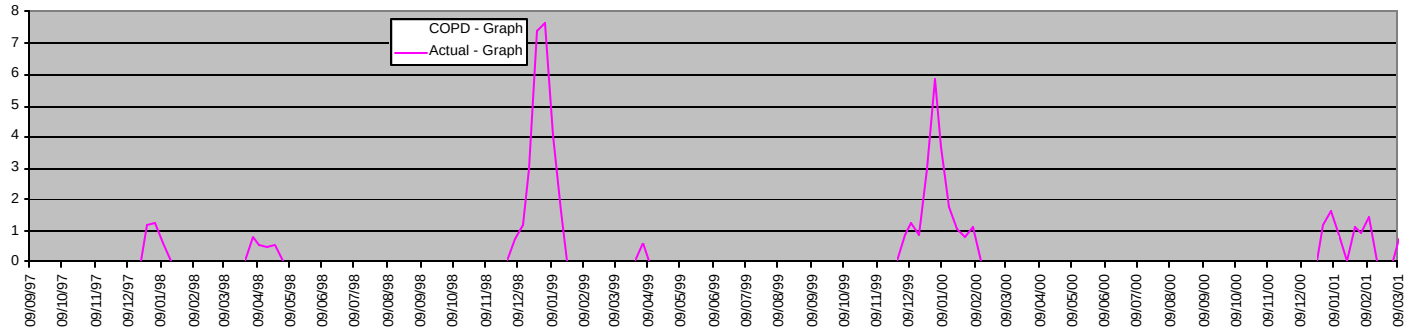
UKMO – Support for Chronic Obstructive Pulmonary Disease (COPD) for the UK Primary Care Trust

Creating a COPD forecast for each PCT

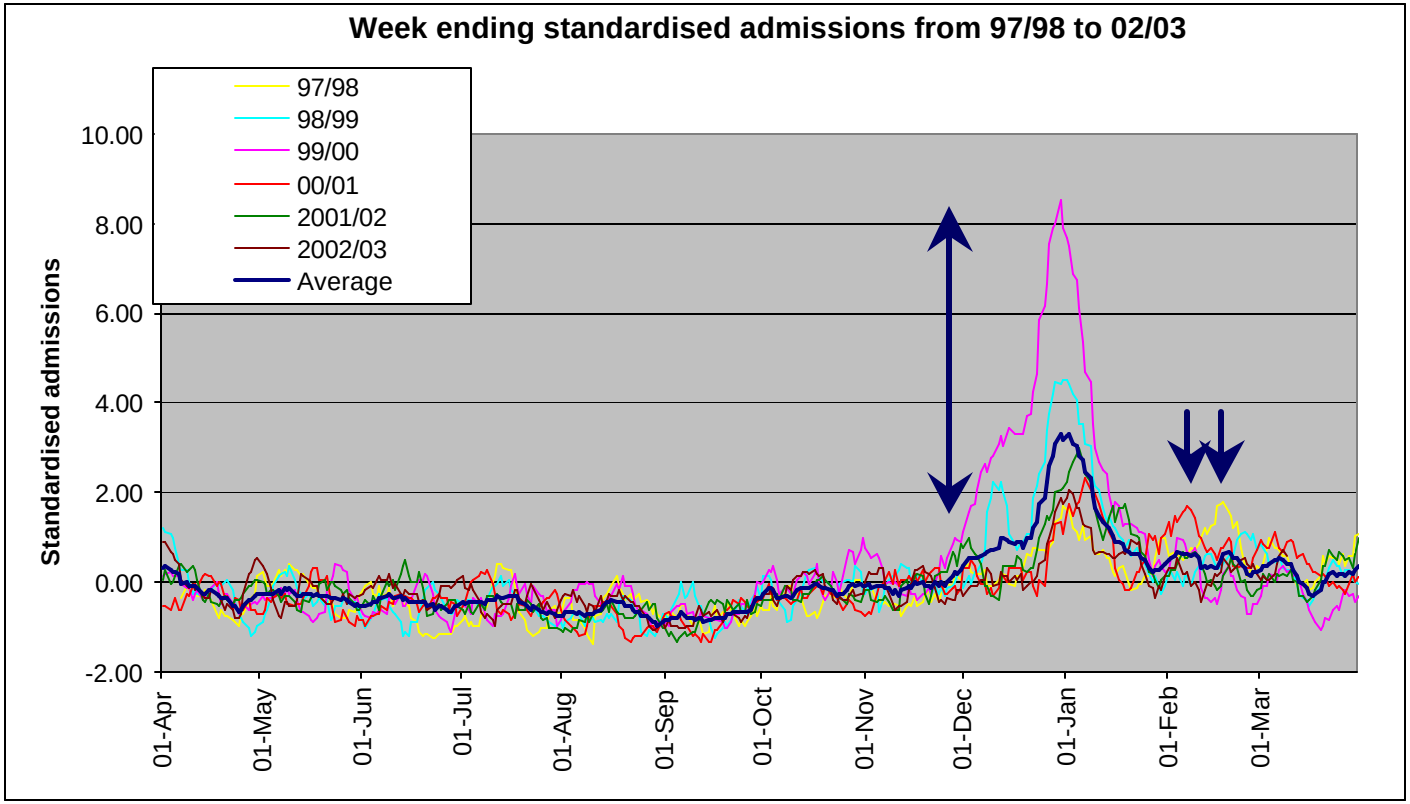


COPD Variation

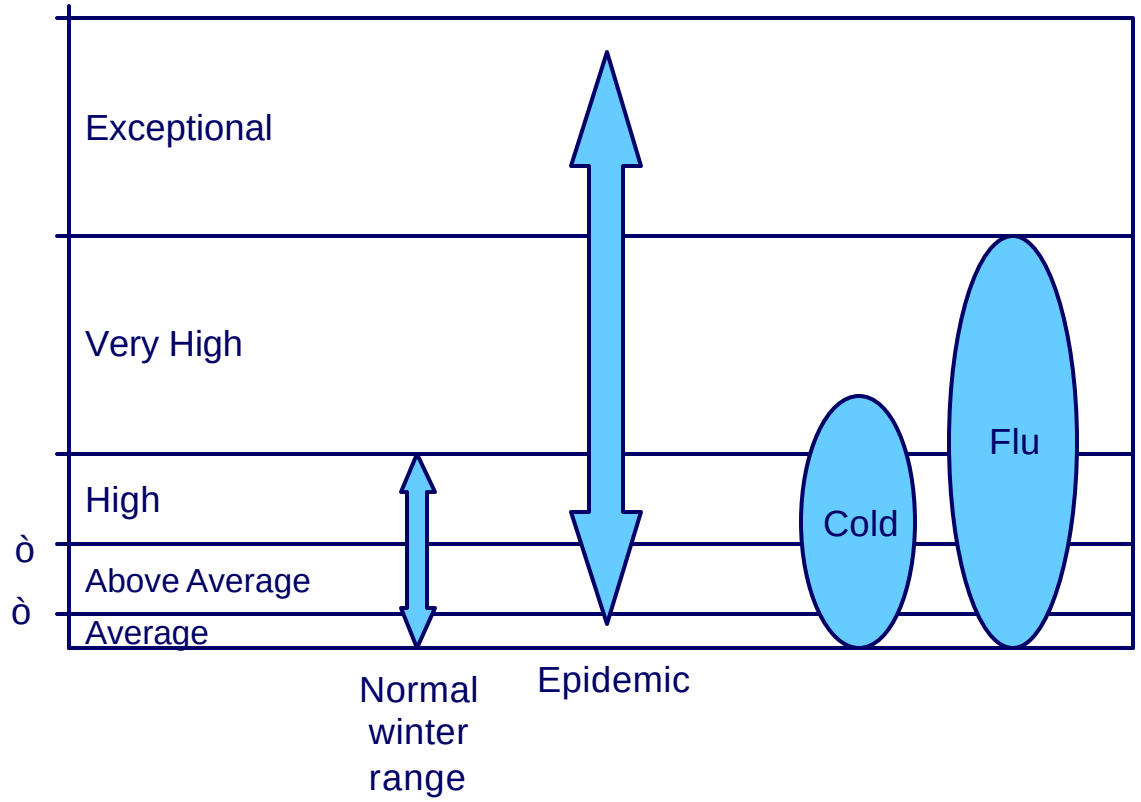




Seasonal Pattern



Forecast categories



WWIS and SWIC User Guide Outline

1. Purpose and objectives of WWIS and SWIC
   - (a) Climate information, weather forecasts and warnings around the world at one glance
   - (b) Reliable and authentic official forecasts from national weather services around the world (esp for media)
   - (c) Consistent information in different languages for international community (esp for media)

2. How can the websites be accessed?
   - (a) Any special software or hardware requirements?
   - (b) URL address

3. Climate information
   - (a) Basic explanation
   - (b) Elements, parameters, definitions and update frequency
   - (c) Where to click
   - (d) How to apply and limitations

4. Weather observations
   - (a) Basic explanation
   - (b) Elements, parameters, definitions and update frequency
   - (c) Where to click
   - (d) How to apply and limitations

5. Weather forecasts
   - (a) Basic explanation
   - (b) Elements, parameters, definitions and update frequency
   - (c) Where to click
   - (d) How to apply and limitations

6. Weather warnings
   - (a) Basic explanation
   - (b) Elements, parameters, definitions and update frequency
   - (c) Where to click
   - (d) How to apply and limitations

7. Other special features
   - (a) Links to national weather services (especially for media)
   - (b) Tourism information for travellers
   - (c) (Verification information)

8. Future development
   - (a) More cities
   - (b) More weather elements and warnings
   - (c) Will keep evolving in spatial coverage and details
   - (d) How to provide feedback for improvement

UKMO – The Information Technology Infrastructure Library (ITIL)

ITIL OVERVIEW

The IT Infrastructure Library (ITIL) is documented best practice for IT Service Management. Its aim is to align IT with business goals via a process, rather than structure based view, improving quality and reducing cost by thinking of IT in terms of services, rather than systems.

ITIL came about as a UK government initiative via the then Central Computing and Telecommunications Agency (CCTA) to achieve both consistency and best practice in IT Service Management. Although originally UK government based, the private sector around the world has taken an active part in its creation and development. The UK Office of Government Commerce (OGC) has taken over from the CCTA and both ITIL and Projects IN a Controlled Environment (Prince2) continue to be the preferred methodologies in their field for the government.

ITIL implementation high-level benefits include:

- It provides a framework of processes and functions that ensure IT Management has the required service based information on which to make decisions. This includes accurate financial information pertaining to the cost of all IT components and the services they support. This ensures IT services will be aligned to the current and future needs of the business.

- It provides a framework of processes and functions that ensures IT Staff have the service based information on which to work and make decisions for them to carry out their duties in the most cost effective and efficient manner.

- It is owned by the UK OGC, and is the governments preferred way to manage IT Services and is the basis for the standards in IT Service Management British Standard 15,000 and ISO 20,000. It is likely that over time these standards will become a requirement both for government suppliers and departments/agencies etc.

- It improves the quality of services, and reduces the long term cost. The dependence of the business on IT becomes more visible, as do the costs of providing it. This makes both business and IT decision making clearer and more consistent while enhancing the relationship between the two. IT staff, users and customers are happier.

UKMO and DWD Summary of ISO-9000 Experiences

Gaining of ISO9001:2000 Certification by the Met Office (UK)

The Plan

The decision to go for ISO9001 certification was taken by top management back in 1998.
A team of 5 internal people was set up. The structure of the team was enhanced by including external consultants, to bring ISO and Process expertise with them.

Stages

Stage1 was scheduled for completion 31 January 2002.
This was to encourage the Office to produce the guidelines and documentation needed.
Stage 2 was scheduled for completion 30 April 2002
This was to check that we were actually working the way we now said that we were.
Stage 3 was scheduled for completion 31 July 2002
This was the certification stage and included a practice audit by our certification partners, BSi.
Certification was achieved October 2002.

Scope

The scope on our certificate says that it covers:
The provision of environmental and weather related services incorporating meteorological-based research, gathering observational data, providing forecasting products, services and data, conducting climatic research, the supply of relevant training services and all other activities to support the business, including the design, implementation, operation and maintenance of software assets.
This registration includes all frontline stations.
TickIT.

Current status

The team has changed over the years. The focus has slowly changed towards a team of assessors grown internally (6) and a reduction in the use of external consultants (currently 1). This keeps the expertise of ISO auditing techniques and knowledge of other businesses in the team.
The Met Office has also achieved environmental certification and therefore is working towards an Integrated Management System

Lessons learned: pre-certification

What was useful during the transition stage:

- Top management MUST be supportive
- Make use of expertise from outside (unless you have people on the internal team with experience themselves)
- New Business Processes MUST have an Owner
- Communication is key e.g.
  - Posters
  - Memos
  - Seminars
  - Surgery sessions
  - Mentoring
  - Internal auditing
  - A countdown clock
- Treat introduction of each process as a project
- Talk to people and confirm that 'what they do' is 'what is documented'. Do not 'make up' procedures and then try to match activity to it.

Lessons learned: post-certification

Things we have thought about since October 2002:

- Accept the fact that perfection isn't immediate – it takes some time to achieve a mature Quality Management System
- Approximately 12 to 18 months after certification remind everyone what it is about, so it doesn't get forgotten
- Build a community from the Process Owners
- Emphasise the concept of records and record keeping from early in the pre-certification stage
- Emphasise the need for measurements and metrics from early in the pre-certification stage
- It might be helpful not to mention ISO9001 at all – talk about the "Business Management System", not "Quality", and treat it as Business As Usual from the start
- Things will change – manage the change
- Keep a central team with responsibility for being the Conscience of the organisation

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Gaining of ISO9001: 2000 Certification by the DWD (Germany)

Plan

The Executive Board of DWD decided in December 2001 to introduce Quality management (QM). Therefore an internal working group of 22 people representing all business areas of DWD was set up in January 2002 for working out a project plan. Since June 2002 the introduction project is started for getting the certification according to ISO 9001 standard. The final date for the full certification was planned for November 2005.

Stages of Project

- Start of the project in June 2002 by decision of the Executive Board of DWD
- External consultants start to join the project in July 2003
- Certification of QM-System of DWD (5 production and support processes) in April to July 2004
- Certification of all processes of DWD in May 2005 (13 strategic processes see Fig. 1)

Introduction strategy of the QM System

- **Process documentation:**
  - write down what you do,
  - do what you have written down,
  - prove it and improve permanently your processes.

- **Realisation and Implementation:**
  - Optimised processes,
  - Customer focus,
  - Definition of Quality objectives,
  - Training of employees.

- **Evaluation and Process Control:**
  - Carrying out internal audits,
  - Measure the processes,
  - (Recommended:) Pre-audit by the certification organization,
  - Certification audit,
  - Improve permanently the processes.

Scope

The 13 strategic processes consist of 79 sub-processes, they describe (see Fig. 1):

- Forecast-processes (Weather-Forecast including hydrometeroological, agrometeorological, human-biometeorological aspects) and weather warning

- Consulting services (including climate and environment)
- Data generation (from measurement nets)
- International affairs
- Research and development (GM-, LM-models)
- Technical Infrastructure (Computing devices (PC, Supercomputer), communication (WLAN), Services for measurement equipment, data management, IT -service management)
- Administration processes (Purchasing, financial and personnel-management, organisation, administration offices and immovables, knowledge management, central planning and controlling, legal affairs)

Experiences / lessons learned

- Support of top management is essential,
- It is recommended to implement regulations for the remedying of perturbations and incidents (e.g. failure of systems, accidents of employees),
- The staff members have to be trained in QM topics again and again,
- Continuous communication between the internal organisations and between processes is very essential,
- Communicate QM as a tool which helps to fulfil the tasks of an NMHS more efficiently and customer friendly,
- A systematic feedback from your customers is helpful for improvement of the processes,
- The consultants should be additionally experienced in natural science (physics, mathematics, meteorology).

Status

- DWD established a QM-System according to ISO 9001:2000 standard.
- The project team has changed to one contact person (Quality Representative).
- DWD prepares Accreditation of calibration laboratories (ISO 17025).
- The Department ‚Climate and Environment Consultancy' is accredited for expertises (wind, solar radiation).

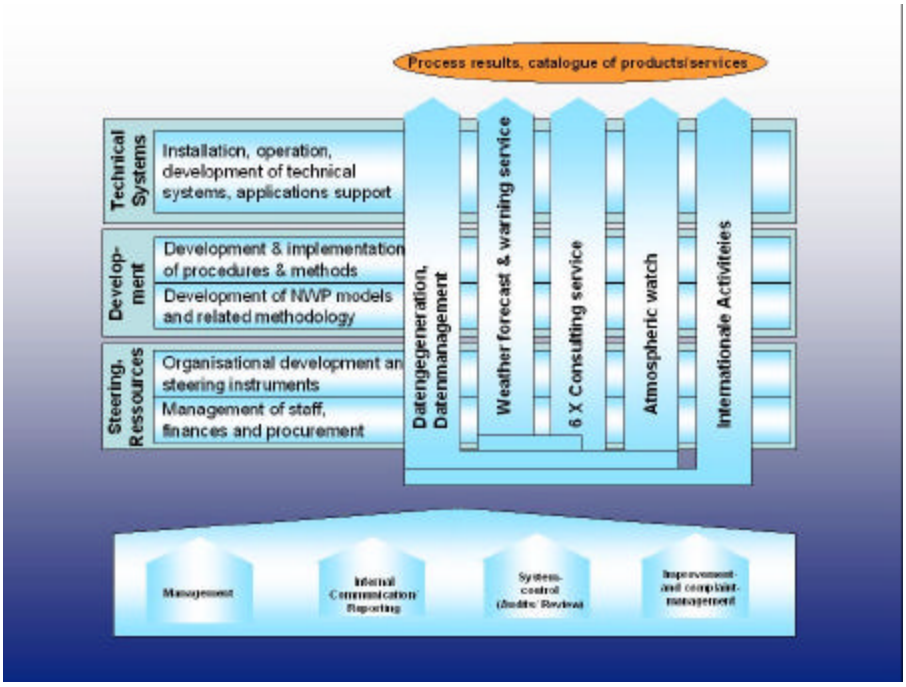

Figure 1: Process landscape of DWD

QUESTIONNAIRE ON THE

FUTURE COLLABORATION BETWEEN PWS AND OTHER CBS OPAGs

1. Does your OPAG know the task and role of PWS?

   YES ☐ NO ☐

2. If YES, does your OPAG need further information?

   YES ☐ NO ☐

3. If NO, would your OPAG like to learn more about PWS ?

   _____

   _____

4. Does your OPAG share the opinion that an exchange of information between PWS and your OPAG would be beneficial?

   YES ☐ NO ☐

5. If No, Reasons?

   _____

   _____

6. What method should be used to exchange information and collaborate?

   In written form? ☐

   Mutual participation on meetings? ☐

   Bilateral meeting? ☐

   Other? ☐ _____

   _____

7. Which special technical topics does your OPAG see as a main focus for collaboration?

_____

_____

_____

8. OPAG on PWS is composed of the following:

ICT - Implementation / Coordination Team on PWS

ET/COM - Expert Team on Communication Aspects of PWS

ET/DPM - Expert Team in Support of Disaster Prevention and Mitigation

ET/SPI – Expert Team on Services and Products Improvement

If you are willing to collaborate with our OPAG please nominate either one overall focal point for your OPAG or focal points within each of your expert teams to interact with PWS expert teams.

_____

_____

Please return the questionnaire to:

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