

WORLD METEOROLOGICAL ORGANIZATION

COMMISSION FOR BASIC SYSTEMS

**CBS IMPLEMENTATION COORDINATION TEAM
OF THE OPEN PROGRAMME AREA GROUP (OPAG)
ON DATA-PROCESSING AND FORECASTING SYSTEMS
(ICT-DPFS)
EXTRAORDINARY MEETING**

WMO HEADQUARTERS, GENEVA, SWITZERLAND, 21-25 JANUARY 2013



FINAL REPORT



*(back row) James Fraser Paul Davies, David Richardson, Richard Graham
(middle row) Alice Soares, Bernard Strauss, Jianjie Wang, Hamza
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(Co-chairperson), Peter Chen*

EXECUTIVE SUMMARY

The Extraordinary Meeting of the CBS Implementation Coordination Team of the Open Programme Area Group (OPAG) on Data-Processing and Forecasting Systems (ICT-DPFS) was held in Geneva, Switzerland, from 21 to 25 January 2013.

Noting the outcomes of the sixteenth session of the World Meteorological Congress (Cg-XVI, Geneva, Switzerland, May 2011) and statements adopted by CBS-XV (Jakarta, Indonesia, September 2012), the ICT developed its work programme for 2013-2014 (as given in Annex III), and agreed on its contribution to activities led by other WMO programmes. The ICT also developed a roadmap for the completion of the new Manual on the GDPFS.

The ICT was presented with a first draft of five competency requirements for PWS personnel, including weather forecasters. It reviewed the relevant parts of these materials as related to operational forecasting as given in Annex IV.

Following the request by the President of WMO, the ICT reviewed the vision for the OPAG on DPFS, taking into account the WMO high priority activities. The revised DPFS strategy (10 years) is given in Annex VI, which includes the addition of Space Weather within the vision for the DPFS. In addition, the ICT envisioned where the OPAG on DPFS would be in 2 (current capability), 6 and 10 years, with a particular emphasis on the 6-years timescale, as given in Annex VII.

GENERAL SUMMARY OF THE WORK OF THE SESSION

1. OPENING

1.1 The Extraordinary Meeting of the CBS Implementation Coordination Team of the Open Programme Area Group (OPAG) on Data-Processing and Forecasting Systems (ICT-DPFS) was opened by its chairperson, Mr Ken Mylne (Met Office UK), at 09.30 hours on Monday, 21 January 2013, at WMO Headquarters, in Geneva, Switzerland. Mr Mylne welcomed the new members to the ICT and all participants to the meeting. He noted that a meeting was held in October 2012 to handover the chairmanship and to discuss the new working structure of the OPAG on DPFS. This meeting would redevelop the working programme for the OPAG on DPFS for the coming 18 months, which should be aligned with CBS directions that further addresses WMO's High Priority Activities. He took this opportunity to thank members for their presence at this meeting and for their contributions. Mr Mylne introduced Mr Peiliang Shi, the Officer-in-Charge of the WMO Weather and Disaster Risk Reduction Services Department (WDS), to address the meeting.

1.2 On behalf of the Secretary-General of WMO, Mr Peiliang Shi welcomed participants to the WMO Headquarters and to Geneva. He recalled that the CBS working structure includes an "Open Programme Area Group" (OPAG) for each operational programme area of the WMO World Weather Watch (WWW) System. The OPAG on Data-processing and Forecasting Systems (DPFS) addresses the Numerical Weather Prediction (NWP) Systems that are implemented by WMO Members as part of the Global Data-processing and Forecasting System (GDPFS) to benefit all WMO Members. The OPAG on DPFS also includes the WMO Emergency Response Activities (ERA) Programme. He highlighted that the GDPFS and ERA Programmes, both "operational", contribute to many of the WMO's high priority activities: (i) through the Severe Weather Forecasting Demonstration Project (SWFDP) and the use of Ensemble Prediction Systems (EPS) for predicting severe and high-impact weather that contribute to Disaster Risk Reduction, and Capacity Development and LDCs; (ii) through a network of centres that carry out global long-range forecasts that are essential for the Climate Services Information System (CSIS) of the Global Framework for Climate Services (GFCS); (iii) through the use of applications of NWP/EPS such as atmospheric transport and dispersion modelling for environmental emergency response activities (ERA), thereby contributing to Disaster Risk Reduction; and (iv) through the provision of benefits to other socio-economic sectors, including aviation, agriculture, and marine safety.

1.3 Mr Shi noted that CBS, at its fifteenth session (CBS-15, Jakarta, Indonesia, September 2012), adopted a new working structure for the OPAG on DPFS, including Terms of Reference of the Implementation Coordination Team (ICT) on DPFS and three Expert Teams, to further address the evolving requirements expressed by WMO Members for expanding the WMO's GDPFS, including ERA. He also noted that CBS-15 appointed Mr Ken Mylne as the new chairperson of the OPAG on DPFS. Mr Shi congratulated Mr Mylne for his recent appointment, as well as, the chairs and co-chairpersons of the teams, and wished them much success in their new responsibilities. He concluded by wishing everyone a successful and productive meeting and an enjoyable stay in Geneva.

2. ORGANIZATION OF THE MEETING

2.1 Adoption of the agenda

2.1.1 The ICT adopted the provisional agenda without changes, as provided in Annex I to this report.

2.2 Working arrangements

2.2.1 All documents submitted for the meeting are referenced and hyperlinked in the Documentation Plan (INF. 1), which had been posted on the WMO website at:

http://www.wmo.int/pages/prog/www/DPFS/Meetings/ICT-DPFS_Geneva2013/doc-plan.html

2.2.2 The ICT agreed on its hours of work and other practical arrangements for the meeting. Noting that a number of participants were new to the ICT-DPFS, they briefly introduced themselves, to facilitate interactions throughout the meeting. The list of participants in the meeting is provided in Annex II to this report.

3. BACKGROUND AND RESPONSES TO REQUESTS BY WMO GOVERNING BODIES

3.1 The ICT was presented with background information related to the OPAG on DPFS, including recalling statements adopted by the fifteenth session of the Commission for Basic Systems (CBS-15, Jakarta, Indonesia, September 2012), and relevant decisions of the sixteenth World Meteorological Congress (Cg-16, Geneva, Switzerland, May 2011). The ICT noted that Cg-16 defined five High Priority Activities for the Organization for 2012-2015: Global Framework for Climate Services (GFCS), Disaster Risk Reduction (DRR), WMO Integrated Global Observing System (WIGOS) and WMO Information System (WIS), Aeronautical Meteorology (AeM), and Capacity Development (CD) and Least Developed Countries (LDCs).

3.2 The Chairperson of the OPAG on DPFS, Mr Ken Mylne, reported on the major outcomes of the meeting of the CBS Management Group (CBS/MG), which was held in Geneva, Switzerland, from 17 to 19 January 2013. The ICT noted that the President of WMO, Mr David Grimes (Canada) challenged the CBS/MG to: (1) rethink the overall structure of WMO Technical Commissions (TCs) in the light of the GFCS; and (2) envision where each CBS/OPAG would be in 2 (current capability), 6 and 10 years, with a particular emphasis on the 6-year timescale.

3.3 The ICT noted that SWFDP has been providing strong evidence of the real benefits of the 'bottom-up' approach in building the value of weather forecasting services and improving the 'return on investment' in the modernization process of NMHSs. It also noted that the future directions and role of the SWFDP (long-term sustainability, aiming to address hydro-meteorological hazards and providing a global framework) were addressed at the meeting of the President of Technical Commissions (PTC), in Geneva, Switzerland, from 14 to 15 January 2013. In a similar context, the ICT noted that a workshop would be held in June 2013, with the World Bank, to address how the global and regional centres could support NMHSs. In addition, the ICT noted that SWFDP provides scope for involving OPAGs on IOS and ISS, to improve observational and information systems.

3.4 The ICT noted that there was a push to improve the work of CBS with Regional Associations, and all OPAGs have been asked to address this issue in their work programmes, and membership of the Expert Teams (regional balance). In this context, the ICT reviewed the Terms of Reference of the Expert Teams, and membership, as given in Annex III. At the CBS/MG meeting, the OPAG on DPFS was tasked to include a member from RA I (Africa) in the Expert Team on ERA (ET-ERA).

3.4.1 The ICT proposed to include user representatives from RAs, which do not necessarily host an RSMC.

3.4.2 The ICT recalled that all RAs are already covered by existing RSMCs with activity specialization in Nuclear Environmental Emergency Response (RSMC-EER). With regards to establishing new RSMCs-EER, the ICT noted that prospective hosting NMHSs would be required

to have an operational global modelling capability, which is a major constraint. In addition, the RSMC designation depends on the request of RAs and assessment of the capabilities by CBS.

3.5 The ICT noted that there is a new team (which goes beyond WMO) to address Space Weather, which is chaired and co-chaired by WMO representatives. It further noted that there is a broad CBS interest, spanning WIGOS; WIS and DPFS. The CBS/MG noted that CBS-15 recommended that the revised Manual on the GDPFS continue to be organized in such a way that it should allow the future incorporation of technical aspects that may arise from the Space Weather initiative.

3.6 The Team noted that WMO would celebrate the 50th Anniversary of the World Weather Watch (WWW) on 21 March 2013, in conjunction with the World Meteorological Day (WMD) commemoration. Two Special Issues of the WMO Bulletin would be related to the WWW. The first would be focused on observing systems, and the second on the various components of the WWW, including GDPFS. The ICT will contribute authors for an article on DPFS, to be submitted by end July 2013. The Chairperson will coordinate this activity.

3.7 The ICT noted that CBS-15 established a CBS Task Team (TT) on the Provision of Meteorological Support to Humanitarian Agencies, jointly coordinated by the OPAGs on DPFS and PWS. It reviewed the Terms of Reference for this TT and membership, as given in Annex III.

4. OPAG on DPFS WORK STRUCTURE AND PROGRAMME

4.1 The ICT reviewed CBS-15/Doc. 4.4(1) on decisions for the OPAG on DPFS (https://sites.google.com/a/wmo.int/cbs-15/start-here/english/CBS-15-d04-4%281%29-approved-OPAG-DPFS-ERA_en.doc?attredirects=0&d=1), which was aligned with the new structure for the OPAG on DPFS.

4.2 Under this agenda item, and taking into account the outcomes of the CBS-15, the ICT developed Top Level Objectives (TLOs) for the OPAG on DPFS and its three Expert Teams (ETs), aligned with the CBS directions, as follows:

- (a) Operational Weather Forecasting Process and Support
 - Develop guidance to assist Members with improved access to high-resolution regional NWP
 - Coordinate upper-air verification
 - Develop standard procedures for surface verification
 - Update observation monitoring procedures
 - Use of NWP for hazard risk management
 - Develop guidelines on how to use and interpret existing very short-range forecasting (VSRF) products
 - Coordinate operational aspects of sand and dust storm
- (b) Operational Predictions from Sub-seasonal to Longer-time Scales, including contributions to the GFCS/CSIS
 - Ongoing provision LRF products from GPCs and Lead Centres
 - Development of GPCs' and LCs' services to RCCs
 - LCs' support to Global Seasonal Climate Update (GSCU), including verification issues
 - Scoping/implementation of sub-seasonal forecasts
 - Scoping/implementation of longer than seasonal forecasts
- (c) Emergency Response Activities
 - Maintain operational response readiness
 - Update joint bilateral Concept-of-Operations/MoU with IAEA

- Explore new products from RSMCs
- Maintain, review, update ERA web pages and WMO/TD-No. 778
- Complete revision of the CBS-aspects of WMO Technical Note 170 (WMO-TN 170)
- Make available web-based training and information regarding ERA to NMHSs
- Prepare annual reports on RSMC activities
- Develop operational procedures for non-Nuclear ERA, and test in an exercise

4.3 All Expert Teams would contribute to the revision of the Manual on the GDPFS. The ICT agreed to further discuss the development of the work plan for the OPAG on DPFS in the breakout sessions, under agenda item 8.

5. COOPERATION WITH OTHER WMO PROGRAMMES ON SPECIFIC ACTIVITIES (those not addressed in item 4)

5.1 With WIGOS on quality monitoring of observational data

5.1.1 The ICT was briefed on the issues of Quality Monitoring (QM) of observational data, with a particular focus on the content of the Manual on the GDPFS (as defined primarily within Part II, Attachment II.9) and the requirements for data quality monitoring for the WMO Integrated Observing System (WIGOS). The ICT was informed that a key aspect of the WIGOS Framework Implementation Plan (WIP) was an integrated approach to Quality Management across all WIGOS component networks and that quality management had a designated task in the WIP incorporating its standardization and documentation within WIGOS Regulatory Material and a review of current quality management practices at both the national and international levels.

5.1.2 Given that data quality control and quality monitoring continues to be an integral component of NWP systems and that computer model skill has a high dependence on data quality, it was agreed that updating and enhancing the procedures and practices associated with NWP observational data quality monitoring was in the interests of all data users and observing system network and data quality managers. Therefore, the ICT was requested by the OPAG on IOS to undertake the task of reviewing and updating current NWP observational data monitoring procedures and practices particularly taking into account the following requirements:

- The expansion of the monitoring of surface based systems to include the 5 basic parameters: surface pressure, air temperature, wind, humidity and precipitation; and,
- To define and implement a (near) real-time quality monitoring functionality for surface parameters.

5.1.3 Additionally, the ICT was requested to consider the following aspects in relation to NWP quality monitoring of observational data and systems:

- The nomination of a single Lead Centre responsible for global monitoring of surface based parameters;
- The establishment of a resource providing:
 - online access to NWP quality monitoring data and reports;
 - (automated) transmission of quality monitoring reports, both real-time and monthly summary, to WMO Member Focal Points; and,
 - support for feedback and documentation of data quality issues;
- The use of both assimilation QC and first guess comparison information for NWP observational data monitoring purposes;
- The additional role of quantity monitoring of observational data;
- The concept of the Lead Centre for NWP quality monitoring being able to receive and utilize NWP QM data from other NWP monitoring centres.

5.1.4 The ICT was also requested to work with the ICT-WIGOS and the Task Team on WIGOS Regulatory Material (TT-WRM) towards the update of the documentation on observational data quality monitoring procedures within the Manual on the GDPFS and its eventual migration into the WIGOS Regulatory Material. The ICT agreed to include this activity in its work programme, in collaboration with the OPAG on IOS and WIGOS. The ICT was informed that the EUMETNET Composite Observing System (EUCOS) was considering holding a workshop that could eventually address some of these aspects for Europe, and therefore tasked the Chairperson of the Expert Team on Operational Weather Forecasting Process and Support (ET-OWFPS) to follow up this issue with the appropriate experts.

5.2 With WWRP on Sand and Dust Storm Forecasts

5.2.1 The ICT was briefed on the progress of the WMO Sand and Dust Storm Warning and Advisory and Assessment System (SDS-WAS) and its future developments, including possible new RSMCs with activity specialization in Atmospheric Sand and Dust storm Forecasts (RSMC-ASDF), and verification and quality assurance of the outputs of RSMC-ASDF centres. The ICT noted that there were currently 3 research activity nodes within SDS-WAS: North Africa-Middle East-Europe, Asia and Americas, coordinated by research centres in Spain, China and the USA, respectively. The centre in Spain, as the most advanced in the SDS-WAS community, had established a Portal where experimental dust forecasts from 6 different organizations are validated against observations on a daily, monthly, seasonal and annual basis. Multi-model (ensemble) products are also available. Following a strong interest of countries in the Western Asia to improve regional capabilities for dust monitoring and prediction, WWRP is currently working on identifying observational and modelling capacities and on proposing steps necessary for establishing a new SDS-WAS activity node for the region.

5.2.2 The ICT noted that as a result of the work of the ad hoc joint CAS-CBS Task Team on Sand and Dust Storm Warning Assessment Systems (SDS-WAS), CBS-15 agreed that there is a need to incorporate the mandatory functions and criteria for the designation of RSMC-ASDF in the current version of the Manual on the GDPFS, and therefore proposed an amendment to the Manual on the GDPFS, as found in Annex 1 to Recommendation 4.4/2 (CBS-15). CBS-15 was presented with the nomination of the centre in Barcelona (Spain) to act as an RSMC-ASDF for the Northern Africa (north of Equator), Middle East and Europe. Noting that this centre complied with the mandatory functions, CBS-15 recommended its formal designation, and therefore proposed an amendment to the Manual on the GDPFS, as found in Annex 1 to Recommendation 4.4/2 (CBS-15). The ICT noted that there were aspects associated with the operational procedures that may need clarification in the mandatory functions and criteria for the designation of RSMC-ASDF, and therefore tasked the Co-chair of the OPAG on DPFS, Mr Yuki Honda, to continue to follow up this activity with CAS. The ICT suggested that experts from RSMC-ASDF Barcelona (Spain) and the Asian node (China) be also involved to address operational aspects.

5.3 With CLW (HWR and WCAS) on the Revision of WMO-TN 170

5.3.1 The ICT noted that the IAEA Safety Guide, entitled: "Meteorological and Hydrological Hazards in Site Evaluation of Nuclear Installations" (IAEA/DS-No. 417) represents an important first step to the review of the WMO Technical Note 170. This Safety Guide would act as an important guide to essential subject areas where technical methods and best practices should be updated in the revision of the WMO Technical Note.

5.3.2 The ICT noted that following the request by the World Meteorological Congress, at its fifteenth session (Cg-XV, May 2007) with regards to the outdated WMO Technical Note 170, entitled: "Meteorological and Hydrological Aspects of Siting and Operations of Nuclear Power Plants", the CG-NERA reviewed this publication and noted that only a few sections concern CBS, and several WMO Programmes (i.e. HWR and WCAS) and Technical Commissions (i.e. CHY and

CCI) should be involved in updating the Technical Note. Following a review of the CBS-relevant sections (Chapter 2, entitled Practical guidance for meteorologists in charge of the meteorological assessments and continuing services; section 2.2.4 – normal NPP operation, and 2.2.5 – NPP emergency situations), a proposed expanded outline for updating these sections was developed by the CG-NERA (Annex IV, <http://www.wmo.int/pages/prog/www/CBS-Reports/documents/Final-Report-CG-NERA-Vienna2011.pdf>). The ICT recalled that CBS-15 urged the OPAG on DPFS, in collaboration with the relevant WMO Programmes and Technical Commissions to complete the revision of this publication as required. It noted that a roadmap was developed for the revision of this publication, which should be completed by March 2014.

5.4 With WIGOS and WWRP on GIPPS (Global Integrated Polar Prediction System)

5.4.1 The ICT recalled that CBS-15 recommended that the revised Manual on the GDPFS continue to be organized in such a way that it should allow the future incorporation of, and accommodate, technical aspects that may arise from the GIPPS initiative.

5.4.2 The ICT noted that the mission statement of the World Weather Research Programme (WWRP) Polar Prediction Project (one component of GIPPS) was to promote cooperative international research enabling development of improved weather and environmental prediction services for the Polar Regions, on time scales from hourly to seasonal, as described in the Implementation Plan, which is available on the WMO web site at http://www.wmo.int/pages/prog/arep/wwrp/new/documents/WWRP_PPP_IP_Final_12Jan2013.pdf. The ICT noted that the Year of Polar Prediction (YOPP) is one of the key activities of the Project, planned up to 2017-2018, as the intensive observational and modelling period to advance polar prediction capabilities. This would be augmented by research into forecast-stakeholder interaction, verification and a strong educational component.

5.4.3 The ICT noted that the World Climate Research Project (WCRP) addresses the medium-term (from seasons to decades) and longer-term (centuries) time-scales of GIPPS. The medium-term contributions to GIPPS would be achieved by improving predictive skill of corresponding climate predictions and projections due to better understanding of factors determining predictability of polar climate and their exploitation and representation in observations, data assimilation and models. This is the main objective of the WCRP Polar Climate Predictability Initiative (PCPI), which is a sister project of the WWRP PPP. The practical outcomes of PCPI would be implemented via recommended improvement of operational practices at GDPFS centres and through a variety of improvements in models of scientific groups generating climate model runs for such WCRP projects as CHFP (Climate system Historical Forecast Project, seasonal scale), CMIP5 (Coupled Model Inter-comparison Project, Phase 5, decadal and centennial scale), and CORDEX (Coordinated Regional Downscaling Experiment). The scope of the longer-term component of GIPPS relates to factors associated with climate change in Polar Regions and the regional sea-level rise.

5.4.4 The ICT noted that the Executive Council Panel of Experts on Polar Observations, Research and Services (EC-PORS) carried out a survey to assess service requirements. It recommended that communication between science communities and operational services should be established since early stages of the GIPPS development. This would guide the research, and facilitate a smooth transfer of research achievements into operational practices. In this context, the ICT recommended CBS/DPFS involvement in GIPPS developments by nominating a representative of the Commission to participate in relevant meetings. The ICT requested the Chair of the ET-OWFPS with the Secretariat to follow up this issue.

5.4.5 In addition, the ICT recalled that Resolution 6 (Cg-16) decided that “Volume II of the Manual on the GDPFS (Regional Aspects), which has no regulatory status for Members, should be reviewed and the relevant parts (e.g. the Antarctica), including a list of products and the possibility

of designating one or more Regional Specialized Meteorological Centres (RSMCs) for Polar Regions, should be incorporated into the revised Manual". Noting that Volume II is out-of-date, the ICT sought advice by the EC-PORS (meeting in mid-March 2013) on what is required to be retained. The ICT requested the Chair of the Task Team on the Revision of the Manual to follow up on this issue.

5.5 With WWRP/WCRP on Sub-seasonal to Seasonal Prediction

5.5.1 The ICT recalled the request by Cg-16 to the LC-LRFMME to extend its role to include the exchange of sub-seasonal predictions and inviting GPCs to provide data from their monthly forecast systems for display and generation of multi-model sub-seasonal products along the same lines as for seasonal range products. Noting that standard procedures for verification of sub-seasonal forecasts would be required to support the exchange of forecasts, the ICT recommended coordination with the WWRP/THORPEX/WCRP research activities, and therefore nominated Mr Richard Graham to represent the Commission and participate in relevant meetings of this initiative.

6. COMPETENCY FRAMEWORKS FOR FORECASTERS

6.1 The ICT was informed that the WMO Education and Training Programme and various Technical Commissions had been developing competency guidelines for the core job-tasks in meteorology and hydrology. It noted that Cg-16 recommended that all Technical Commissions make this a high priority activity and incorporate this task into their current work programmes, following the model developed by the Commission for Aeronautical Meteorology (CAeM) in providing top-level competency standards that could be incorporated into the WMO Technical Regulations, as required. The ICT noted that materials have been developed under the auspices of: (1) CAeM in relation to competencies for Aeronautical Meteorological Forecasters; (2) BoM for Tropical Cyclone Forecasters; (3) JCOMM on the competencies relevant to Operational Marine Forecasters; and (4) PWS in relation to competencies for PWS Forecasters.

6.2 The ICT noted that CBS-15 requested the OPAG on PWS to develop, in collaboration with the OPAG on DPFS, competency requirements for a PWS/weather forecaster. The chairperson of the OPAG on PWS, Mr Gerald Fleming, presented a first draft of five competency requirements for PWS personnel, including weather forecasters, and invited the OPAG to DPFS to provide comments by September 2013, so that they can be considered at the WMO Symposium on Education and Training. The ICT reviewed the relevant parts of these materials as related to operational forecasting as given in Annex IV. The ICT recommended the use of the term "hydro-meteorological hazards" throughout all competency requirements for PWS personnel, to describe "meteorological and hydrological hazards", and "locally defined PWS areas of responsibility" to ensure that other hazards (such as tsunami, swell, etc.) are considered. References to "managing levels of confidence and uncertainty" were also missing. The ICT suggested that PWS consider developing a separate set of competencies for those forecasters involved in seasonal prediction.

6.3 The ICT had been asked to consider whether the competency requirements for a PWS/weather forecaster would be published as part of the revised Manual on the GDPFS. While noting that both the current version of the Manual on the GDPFS and the revised version may allow the incorporation of these materials, the ICT agreed that they are guidelines (not standards) and therefore the revised Manual may not be the appropriate publication to incorporate this information. Nevertheless, it recommended that this issue be addressed in a broader context by the Executive Council Panel of Experts on Education and Training.

7. MANUAL ON THE GDPFS (WMO-No. 485)

7.1 The ICT was informed of the status of comprehensive revision of the *Manual on the GDPFS* (WMO-No. 485). It noted that the new Manual introduces a number of changes to the

current procedures, and therefore some GDPFS centres may report temporary non-compliance with regard to some of the requirements. The ICT further noted that CBS-15 requested the Secretariat to clearly indicate the comprehensive summary of changes of functions and procedures well in advance to ensure the smooth transition, and recommended that a transition plan for the implementation of the new Manual (which would replace the current version, and would most likely be in force by 2015) be developed to manage the technical changes and the initial designation of the GDPFS centres as defined in the new Manual. In this context, the ICT agreed that any changes to the current procedures should be presented to the next session of CBS in a table format, as per the one developed at the first expert meeting on the revision of the Manual on the GDPFS (Annex VI, http://www.wmo.int/pages/prog/www/CBS-Reports/documents/FinalReport_002.doc). Experts involved in the review process are requested to submit their contributions to the Secretariat in track change mode.

7.2 The Team defined a roadmap, including timelines and assignment of responsibilities, for the completion of the new Manual and development of the transitional plan for its implementation, as follows:

Activity	By whom	By when
Call for input (missing parts)	Secretariat	End January 2013
Provide input (missing parts and updates/corrections)	Identified experts, including TTs/ETs	15 March 2013
New draft Manual (consolidated version)	Bernard Strauss, Yuki Honda, Peter Kreft and Secretariat	April 2013
Circulate the consolidated version of the Manual for review	ET chairs and other TC experts	April 2013
Get comments from ET chairs	TTs/ETs	May 2013
Final Review of the New Manual	Bernard Strauss, Yuki Honda, Peter Kreft, Russia (TBI), Secretariat	June 2013
Expert Meeting to review and prepare the final draft, develop the plan for the transitional period (designation of centres)	Identified experts, including TTs/ETs	July 2013 (TBC)
Prepare the final draft and circulate among WMO Members for feedback, including the transitional period	Secretariat	September 2013
Feedback by WMO Members	WMO Members	December 2013
Finalize the New Manual	Secretariat	One month before the ICT meeting
Review by ICT-DPFS	ICT-DPFS	May 2014
Endorsement by CBS	CBS-Ext.(14)	September 2014
Approval by Cg	Cg-17	May 2015

7.3 The ICT noted that CBS-15 recommended that the review process of the Manual should take into account the existing “Joint WMO Technical Progress Reports on the GDPFS, including NWP Research Activities” (provided annually by Members), to avoid duplication. It noted that these reports provide a source of information for WMO Members, and summary reports are provided to sessions of the Regional Associations. The ICT recognized the difficulties in maintaining up-to-date information, including the summary table. In this context, it recommended a review of the template with a view to reducing the scope and maintenance effort required in both

the Secretariat and centres. The review should also consider the option of an on-line format which Members can update directly. The ICT proposed that this review be carried out after the completion of the revision of the Manual..

8. BREAKOUT SESSIONS ON WORK PROGRAMME / PLAN (ET-OWFPS, ET-OPSLS; ET-ERA) (Wednesday PM and Thursday)

8.1 The ICT broke out into the three teams, as follows:

- (a) Operational Weather Forecasting Process and Support (OWFPS), led by Mr David Richardson, to discuss aspects related to its work programme, including, *inter alia*, (1) further development of the Global Data-processing and Forecasting System (GDPFS), including guidance to assist Members with improved access to high-resolution regional NWP; (2) integration of EPS into core operational weather forecasting; (3) integration of satellite-based and LAM products into very short-range forecasting; (4) forecast verification; (5) sand and dust storm forecasts; and (6) quality monitoring of observational data.
- (b) Operational Predictions from Sub-seasonal to Longer time-Scales (OPSLS), led by Mr Richard Graham, to discuss aspects related to its work programme, including, *inter alia*, (1) seasonal forecasting; (2) sub-seasonal forecasting; (3) longer time-scales; and (4) capacity building.
- (c) Emergency Response Activities (ERA), led by Mr René Servranckx, to discuss aspects related to its work programme, including, *inter alia*, (1) operational procedures for nuclear ERA; (2) operational procedures for non-nuclear ERA; (3) provision of operational meteorological assistance to humanitarian agencies; and (4) revision of the WMO-TN 170.

8.2 The ICT reviewed the work programmes for the ETs, as provided in Annex V. The ICT identified potential participants in the DPFS activities, which may require prior formal nomination by the Permanent Representatives of their countries with WMO. It therefore requested the Secretariat to make the necessary arrangements to ensure the participation of the identified experts in DPFS activities.

8.3 The ICT noted that, in the context of national disaster management practices, there are issues associated with the provision of specialized meteorological information to the general public, including proper representation of this information. Cg-16 therefore requested CBS to review the EER procedures to strengthen these aspects in the *Manual on the GDPFS* (WMO-No. 485). While recognizing that the provision of information for the general public is a very sensitive issue and is not part of the ERA procedures, the ICT stressed the need to address this issue in order to respond to Members. It noted that CBS-15 provided a direction on the way forward, primarily focused on further assisting NMHSs in the interpretation of ERA-related products and their application for national purposes, and agreed to further address these aspects in the WMO/TD-No. 778. In addition, the ICT noted that CBS-15 requested Members who host RSMCs to consider the provision of appropriate training courses in the use and interpretation of their guidance and products.

8.4 The ICT agreed with the directions provided by the Task Team on the Development of Operational Procedures for non-Nuclear ERA, in its meeting held in Melbourne, Australia, in November 2012 (ET-nNERA, <http://www.wmo.int/pages/prog/www/CBS-Reports/documents/TT-DOP-nNERA-final-report.pdf>). The ET-nNERA recommended that the WMO Secretariat send out a circular letter to WMO Members and an email to the ERA contact points informing/publicizing the aspects covered by the WMO/TD-No. 778, which provides documentation for Meteorologists at NMHSs on the RSMC support for Environmental Emergency Response, and agreed to include

reference (web link) to the WMO/TD-No. 778 in the dissemination of ERA products issued by RSMCs.

8.5 In addition, the ICT recommended that the WMO Bulletin article on ERA (January 2006) be updated to further promote the programme, and agreed that this could be done for the Special Issue on the 50th Anniversary of the WWW.

9. ANY OTHER BUSINESS (AOB)

9.1 Following the request by the President of WMO (see paragraph 3.2), the ICT reviewed the vision for the OPAG on DPFS, which was initially developed at the 2010 meeting of the team (Annex VIII, http://www.wmo.int/pages/prog/www/CBS-Reports/documents/ICT-DPFS_final_report_2010.pdf). This would provide a strategic direction for undertaking the activities in the future work programme for the OPAG on DPFS, taking into account the WMO high priority activities. The revised DPFS strategy (10 years) is given in Annex VI, which includes the addition of Space Weather within the vision for the DPFS.

9.2 In addition, the ICT envisioned where the OPAG on DPFS would be in 2 (current capability), 6 and 10 years, with a particular emphasis on the 6-years timescale, as given in Annex VII.

9.3 No other issues were considered under this agenda item.

10. CLOSING

10.1 The Extraordinary Meeting of the CBS Implementation Coordination Team of the Open Programme Area Group (OPAG) on Data-Processing and Forecasting Systems (ICT-DPFS) closed at 18:00 on Friday, 25 January 2013.

AGENDA

1. **OPENING**
2. **ORGANIZATION OF THE MEETING**
 - 2.1 Adoption of the agenda
 - 2.2 Working arrangements
3. **BACKGROUND AND RESPONSES TO REQUESTS BY WMO GOVERNING BODIES**
 - Review of decisions of the WMO governing bodies and statements adopted by CBS related to the OPAG on DPFS
 - WMO High Priorities: GFCS, DRR, WIGOS/WIS, Aeronautical meteorology, Capacity Development
4. **OPAG on DPFS WORK STRUCTURE AND PROGRAMME**
 - Reporting to the CBS Management Group and alignment to the CBS directions
 - Top Level Objectives
 - Milestones and deliverables
 - Terms of reference for the Task Teams (description, expected outcomes, key activities, timelines/milestones, participants, and task leader(s)), including joint Task Teams with other WMO programmes (especially those with PWS)
 - Others (e.g. SWFDP)
5. **COOPERATION WITH OTHER WMO PROGRAMMES ON SPECIFIC ACTIVITIES (those not addressed in item 4)**
 - 5.1 With WIGOS on quality monitoring of observational data
 - 5.2 With WWRP on Sand and Dust Storm Forecasts
 - 5.3 With CLW (HWR and WCAS) on the Revision of WMO-TN 170
 - 5.4 With WIGOS and WWRP on GIPPS (Global Integrated Polar Prediction System)
 - 5.5 With WWRP/WCRP on Sub-seasonal to Seasonal Prediction
6. **COMPETENCY FRAMEWORKS FOR FORECASTERS**
7. **MANUAL ON THE GDPFS (WMO-No. 485)**
8. **BREAKOUT SESSIONS ON WORK PROGRAMME / PLAN (ET-OWFPS, ET-OPSLS; ET-ERA)**
9. **ANY OTHER BUSINESS (AOB)**
10. **CLOSING**

LIST OF PARTICIPANTS

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TERMS OF REFERENCE OF THE EXPERT TEAMS, AND MEMBERSHIP

IMPLEMENTATION COORDINATION TEAM ON DATA-PROCESSING AND FORECASTING SYSTEM (ICT-DPFS)

- (a) Consider the requests and WMO priorities from Cg/EC;
- (b) Identify new emerging requirements (input required from RAs and other bodies);
- (c) Determine how GDPFS Centres can best contribute to fulfill emerging requirements;
- (d) Coordinate the implementation of decisions by CBS related to GDPFS and ERA;
- (e) Make recommendations to CBS concerning future work;
- (f) Review requirements and propose the establishment and activities of Task Teams, including Joint Task Teams.

MEMBER NAME:	COUNTRY / AGENCY:	RA	POSITION / REPRESENTING.
KEN MYLNE (CHAIR)	UNITED KINGDOM	6	CORE
YUKI HONDA (CO-CHAIR)	JAPAN	2	CORE
DAVID RICHARDSON	ECMWF	6	CORE / CHAIR, ET-OWFPS
RICHARD GRAHAM	UNITED KINGDOM	6	CORE, CHAIR, ET-OPSLS
RENÉ SERVVRANCKX	CANADA	4	CORE / CHAIR, ET-ERA
HAMZA KABELWA	TANZANIA	1	ASSOCIATE, CO-CHAIR, ET-OWFPS
JIANJIE WANG	CHINA	2	ASSOCIATE, CO-CHAIR, ET-OWFPS
CAIO COELHO	BRAZIL	3	ASSOCIATE, CO-CHAIR, ET-OPSLS
JAMES FRASER	AUSTRALIA	5	ASSOCIATE, CO-CHAIR, ET-ERA
BERNARD STRAUSS	FRANCE	6	ASSOCIATE, CHAIR, TT-REVISION OF MANUAL

EXPERT TEAM ON THE OPERATIONAL WEATHER FORECASTING PROCESS AND SUPPORT (ET-OWFPS)

- (a) Review the *Manual on the GDPFS* (WMO-No. 485) to ensure that procedures for forecasting systems and verification are adequate and meet CBS needs; propose updates as necessary;
- (b) Review GDPFS and Lead Centres' activities, support their developments and provide guidance as stated in the Manual;
- (c) Assess applications for GDPFS status against the designation criteria and make recommendations on designation to CBS;
- (d) Liaise with relevant WMO Programmes, Technical Commissions and international organizations as required to advise on requirements for practical implementations in

operational systems;

- (e) Review new developments and advances in NWP and related systems, particularly with regard to severe and high impact weather forecasting;
- (f) Provide advice to NMHSs on NWP products, including EPS, for all forecast ranges, particularly with regard to severe and high impact weather forecasting;
- (g) Liaise with the PWS programme to promote and support the use and communication of NWP, especially probabilistic, information available from the GDPFS Centres; develop interpretation guidance to facilitate their use, and encourage feedback on usefulness and application;
- (h) Promote and support the education and training of forecasters on the use and interpretation of NWP products, including EPS, and their strengths and weaknesses;
- (i) Provide guidance on capacity building concerning the implementation of operational NWP systems, including verification systems, and/or the use of NWP products.

MEMBER NAME:	COUNTRY / AGENCY:	RA	POSITION / REPRESENTING.
DAVID RICHARDSON (CHAIR)	ECMWF	6	CORE
HAMZA KABELWA (CO-CHAIR)	TANZANIA	1	CORE
JIANJIE WANG (CO-CHAIR)	CHINA	2	CORE
BERNARD STRAUSS	FRANCE	6	CORE
PAUL DAVIES	UK	6	CORE / REPRESENTING THE USE OF NWP FOR HAZARD RISK MANAGEMENT
YUKI HONDA	JAPAN	2	CORE / REPRESENTING LAM AND OPERATIONAL ATMOSPHERIC SAND AND DUST STORM FORECASTS ASPECTS
PIERRE ECKERT	SWITZERLAND	6	CORE / REPRESENTING INTEGRATION OF EPS INTO OPERATIONAL FORECASTING
ANDRÉ METHOD	CANADA	4	CORE / REPRESENTING DETERMINISTIC NWP AND EPS ASPECTS
TBD	TBD		ASSOCIATE
TBD	TBD		ASSOCIATE

EXPERT TEAM ON OPERATIONAL PREDICTIONS FROM SUB-SEASONAL TO LONGER-TIME SCALES (ET-OPSLs)

- (a) On the basis of requirements from Regional Climate Centres (RCCs), Regional Climate Outlook Forums (RCOFs) and NMHSs, and in the context of the Climate Services Information System (CSIS) of the Global Framework for Climate Services (GFCS), guide future development, outputs and coordination of components in the production of LRF. The components include Global Producing Centres (GPCs), Lead Centres for Long-range

Forecast Multi-model Ensembles (LC-LRFMME), the Lead Centre for the Standardized Verification System for Long-range Forecasts (LC-SVSLRF) and other relevant bodies generating and providing LRF products;

- (b) In coordination with CCI, promote the use of GPC and LC forecast and verification products by RCCs, RCOFs and NMHSs, develop interpretation guidance to facilitate their use, and encourage feedback on usefulness and application;
- (c) Report on production, access, dissemination and exchange of LRF products and provide recommendations for future consideration and adoption by CAS, CCI, CBS, WCRP and other appropriate bodies;
- (d) In consultation with relevant experts in CAS and CCI and with the CBS Expert Team on Operational Weather Forecasting Process and Support (ET-OWFPS), review developments in verification scores and practices with a view to updating the Standardized Verification System for Long-range Forecasts (SVSLRF);
- (e) Assess applications for GPC status against the designation criteria and make recommendations on designation to CBS;
- (f) Review the rules regarding user access to GPC and LC-LRFMME forecasts products;
- (g) Review the status of extended-range forecasting activities, and promote the availability and exchange of extended-range forecasts and verification products;
- (h) In close collaboration with WCRP, promote international cooperation and research on initialized predictions for timescales longer than seasonal and report on potential for operational predictions to CBS and CCI;
- (i) Review the *Manual on the GDPFS* (WMO-No. 485) and propose updates as necessary concerning extended and long-range forecasts.

The Expert Team shall comprise representatives from CBS and CCI to facilitate the necessary interactions and data flows between components of the CSIS. Team membership shall comprise representatives from GPCs and two CCI experts, one of which shall be the co-chair of CCI OPACE-3. In order to retain the existing focus on operational aspects, this team will report and propose amendments to the procedures and guidelines in the GDPFS to CBS through the ICT-DPFS. Reporting to the CCI management group will be through the co-chair of OPACE-3.

MEMBER NAME:	COUNTRY / AGENCY:	RA	POSITION / REPRESENTING.
RICHARD GRAHAM (CHAIR)	UNITED KINGDOM	6	CORE / REPRESENTING ALSO GPC EXETER
CAIO COELHO (CO-CHAIR)	BRAZIL	3	CORE / REPRESENTING ALSO GPC CPTEC (BRAZIL)
DAVID JONES	AUSTRALIA	5	CORE / REPRESENTING GPC MELBOURNE
BERTRAND DENIS	CANADA	4	CORE / REPRESENTING GPC MONTREAL
PEIQUN ZHANG	CHINA	2	CORE / REPRESENTING GPC BEIJING
LAURA FERRANTI	ECMWF	6	CORE / REPRESENTING GPC ECMWF
JEAN-PIERRE CÉRON	FRANCE	6	CORE / REPRESENTING

MEMBER NAME:	COUNTRY / AGENCY:	RA	POSITION / REPRESENTING.
			GPC TOULOUSE AND ALSO CCL
YUHEI TAKAYA	JAPAN	2	CORE / REPRESENTING GPC TOKYO
SUHEE PARK	REPUBLIC OF KOREA	2	CORE / REPRESENTING GPC SEOUL
VLADIMIR KRYJOV	RUSSIAN FEDERATION	6	CORE / REPRESENTING GPC MOSCOW
ASMEROM BERAKI	SOUTH AFRICA	1	CORE / REPRESENTING GPC PRETORIA
ARUN KUMAR	UNITED STATES	4	REPRESENTING GPC WASHINGTON
RCC REP	TBD		ASSOCIATE / REPRESENTING RCC AND CCL
RCC REP	TBD		ASSOCIATE / REPRESENTING RCC AND CCL

EXPERT TEAM ON EMERGENCY RESPONSE ACTIVITIES (ET-ERA)

- (a) Review the *Manual on the GDPFS* (WMO-No. 485) to ensure that procedures for ERA are adequate and meet CBS needs, and propose updates as necessary;
- (b) Promote and support the education and training of users on the use and interpretation of ERA products, and their strengths and weaknesses;
- (c) Identify the focal point of and liaise with relevant international organizations to advise on requirements for practical implementations in operational systems relevant to ERA;
- (d) Identify and promote technical resources which can assist NMHSs in developing their ERA capabilities for supporting national agencies in their preparedness, planning, response and recovering activities;
- (e) Review RSMC Environmental ERA's activities for various sources such as volcanic eruptions, dust storms, large fires, and nuclear and biological incidents, and provide guidance as stated in the Manual;
- (f) Test and improve the collective ability of all RSMCs, the IAEA, CTBTO, the RTH Offenbach and NMHSs in the environmental ERA to fulfill the operational requirements according to adopted standards and procedures stated in the Manual;
- (g) Explore the availability of atmospheric ash, dust, chemical, biological and radiological monitoring data and etc. for use in the RSMC operational environment.

MEMBER NAME:	COUNTRY / AGENCY:	RA	POSITION / REPRESENTING.
RENÉ SERVFRANCKX (CHAIR)	CANADA	4	CORE / REPRESENTING RSMC MONTREAL
JAMES FRASER (CO-CHAIR)	AUSTRALIA	5	CORE / REPRESENTING RSMC MELBOURNE
GERHARD WOTAWA	AUSTRIA	6	CORE / REPRESENTING

MEMBER NAME:	COUNTRY / AGENCY:	RA	POSITION / REPRESENTING.
			RSMC VIENNA
ZHENXIN SONG	CHINA	2	CORE / REPRESENTING RSMC BEIJING
GWENAËLLE HELLO	FRANCE	6	CORE / REPRESENTING RSMC TOULOUSE
HUBERT GLAAB	GERMANY	6	CORE / REPRESENTING RSMC AND RTH OFFENBACH
MASAMI SAKAMOTO	JAPAN	2	CORE / REPRESENTING RSMC TOKYO
VALERY KOSYKH	RUSSIAN FEDERATION	6	CORE / REPRESENTING RSMC OBNINSK
ANTON MUSCAT	UNITED KINGDOM	6	CORE / REPRESENTING RSMC EXETER
JEFFERY MCQUEEN	UNITED STATES	4	CORE / REPRESENTING RSMC WASHINGTON
TBD	TBD	1	ASSOCIATE / REPRESENTING A NMHS
MARTINA SUAYA	ARGENTINA	3	ASSOCIATE / REPRESENTING A NMHS
MIKA NIKKINEN	CTBTO	N/A	ASSOCIATE / CTBTO
GUENTHER WINKLER	IAEA	N/A	ASSOCIATE / IAEA
GREG BROCK	ICAO	N/A	ASSOCIATE / ICAO
ZHANAT CARR	WHO	N/A	ASSOCIATE / WHO

CBS TASK TEAM ON THE PROVISION OF OPERATIONAL METEOROLOGICAL ASSISTANCE TO HUMANITARIAN AGENCIES

The CBS Task Team on the Provision of Operational Meteorological Assistance to Humanitarian Agencies is established under the joint leadership/responsibility of the OPAGs on DPFS and PWS, and in liaison with other relevant Technical Commissions and Programmes. The CBS Task Team is chaired by the CBS Coordinator on DRR.

- (1) Based on the identified needs and requirements of humanitarian agencies, develop designation criteria and functions for existing GDPFS Centres that could specialize in the development and provision of operational meteorological products and services for mitigating the impacts of meteorological-related hazards;
- (2) Develop, in consultation with NMHSs, global and regional operational arrangements that would assist humanitarian agencies and disaster managers in mitigating disasters, taking into consideration the WMO Strategy for Service Delivery and the success of ERA, and provide assistance and support to strengthen NMHSs in this regard;
- (3) Assist Members, with or without NMHSs, in developing their capacity for supporting their government and humanitarian agencies in emergency preparedness efforts, including identifying the gaps in current capabilities and the opportunities to realize the benefits of addressing these gaps through close cooperation at regional and national levels.

- (3) Coordinate with relevant United Nations and international organizations on collecting and responding to their requirements;
- (4) Promote and support the education and training of users on the use, interpretation and delivery of meteorological products and services, and their strengths and limitations.

MEMBER NAME	COUNTRY / AGENCY	RA	POSITION / REPRESENTING
MICHEL JEAN (CHAIR)	CANADA	4	CORE / REPRESENTING ALSO DRR
PAUL DAVIES (CO-CHAIR)	UK	6	CORE / REPRESENTING ALSO DPFS AND PWS
JAMES FRASER	AUSTRALIA	5	CORE / REPRESENTING DPFS AND ERA
TBD	HONG KONG	2	CORE / REPRESENTING PWS
ABDOULAYE HAROU	CANADA	4	CORE / INVOLVED WITH HUMANITARIAN WORK (E.G. HAITI)
BRIAN MILLS	CANADA	4	CORE / REPRESENTING THE WWRP WORKING GROUP ON SOCIETAL AND ECONOMIC RESEARCH AND APPLICATIONS (SERA)
TBD	ECMWF	6	CORE
TBD	TBD		CORE / REPRESENTING LRF ASPECTS
HUMANITARIAN REP	TBD		CORE / REPRESENTING THE USER COMMUNITY
EUGENE POOLMAN	SOUTH AFRICA	1	REPRESENTING RSMC PRETORIA; CHAIR SWFDP-SOUTHERN AFRICA, RA I; AND DPFS AND PWS
SERGIO BUQUE (TBC)	MOZAMBIQUE	1	REPRESENTING A SWFDP-SA PARTICIPATING COUNTRY; SWFDP-SOUTHERN AFRICA, RA I; AND PWS AND DPFS

COMPETENCY REQUIREMENTS FOR A PUBLIC WEATHER SERVICES (PWS)/WEATHER FORECASTER

The competency requirements for the work of an operational forecaster can be divided into seven top level competency areas. Taking into consideration the following:

- (a) The locally defined PWS areas of responsibility;
- (b) Hydro-meteorological impacts on society; and,
- (c) Hydro-meteorological user requirements, local procedures and priorities,

A PWS/weather forecaster should have successfully completed the BIP-M (As defined in the revised WMO-No. 49, Volume I); and, in taking into account conditions a to c, should be able to perform the work indicated in the seven top level competencies below: *(this needs to be revised in accordance with the text for AeM competencies)*

1. Analyze and continually monitor the evolving hydro-meteorological situation;
2. Interpret observational and model data output to forecast hydro-meteorological phenomena and parameters;
3. Produce forecast products, and warnings of hazardous and high impact phenomena, and associated uncertainties;
4. Ensure the quality of hydro-meteorological information, systems and services;
5. Communicate weather, water and climate information, and associated uncertainties, to internal and external users; and,
6. Apply self management and good team working practices.

Each of these top-level competency areas is expanded, below, into second-level competencies that are expressed and structured in such a manner as to facilitate the clear application of an assessment procedure. Each is also associated with a range of background knowledge and skills which may not be particular to meteorology but which are nonetheless essential in the discharge of a forecaster's duties.

1. Analyze and continually monitor the evolving hydro-meteorological situation

- a. *Analyze and interpret all available data to identify weather features relevant to (or, likely to be relevant to) the area of forecast responsibility.*

Background knowledge and skills

- a. *Has knowledge of the theory, methods and practices of meteorological analysis and diagnosis;*
- b. *Can visualize/conceptualize meteorological information in multiple dimensions (spatial, temporal);*

- c. *Demonstrates an understanding of the influence of topography, land cover, and (if relevant) bodies of water and/or snow fields on local meteorology;*
- d. *Demonstrates an understanding of synoptic, dynamical, and physical meteorology;*
- e. *Can interpret remote-sensed observations and data;*
- f. *Demonstrates an understanding of the capabilities and limitations of meteorological instruments; and,*
- g. *Demonstrates familiarity with the acquisition, processing and assimilation of meteorological data, including quality control*

2. Interpret observational and model data output to forecast hydro-meteorological phenomena and parameters

- a. *Evaluates model predictions against observations and imagery and makes adjustments to the model forecast parameters, where appropriate;*
- b. *Interprets model forecasts at different time ranges in an appropriate manner; and,*
- c. *Estimates forecast uncertainty, especially for hazardous conditions, using appropriate tools, e.g. by utilizing Ensemble Prediction System (EPS) output, multi-model comparisons, and other appropriate techniques.*

Background knowledge and skills

- a. *Demonstrates an understanding of the methods used in Numerical Weather Prediction (NWP), including EPS, and other forecasting tools;*
- b. *Demonstrates an understanding of the strengths and limitations of the NWP models used in the forecast office; and,*
- c. *Can critically examine a variety of forecast models and make a reasoned estimation of the most likely evolution of the weather, and uncertainties associated with alternative outcomes.*

3. Produce forecasts and warnings of hazardous and high-impact phenomena

- a. *Uses the forecast production systems to produce and disseminate forecasts and warnings;*
- b. *Can apply procedures based on operational continuity plans in the event of a system failure; and,*
- c. *Issues, cancels or amends forecasts and warnings according to documented thresholds, criteria and regulations.*

Background knowledge and skills

- a. *Demonstrates an overview knowledge of the information and communications systems in use in the forecast office;*

- b. *Shows a working knowledge of the visualization and display systems used for weather information and forecast production, and an ability to recover/view all of the information contained therein; and,*
- c. *Demonstrates a thorough knowledge of the criteria for issuing warnings.*

4. Ensure the quality of hydro-meteorological information, systems and services

- a. *Develops and monitors, all hydro-meteorological products based on sound scientific principles;*
- b. *Assesses and interprets meteorological information objectively;*
- c. *Organizes the work required on each shift to ensure that forecasts and other output are issued in good time;*
- d. *Verifies forecasts and warnings;*
- e. *Contributes to the preparation and maintenance of operational manuals;*
- f. *Includes information on uncertainties or confidence wherever appropriate, especially for hazard weather situations.*

Background knowledge and skills

- a. *Works in a cooperative fashion with colleagues and with external stakeholders;*
- b. *Deals with confrontational situations, demonstrating respect and consideration for differing points of view;*
- c. *Has the flexibility and drive to respond to changing work pattern and demand, ensuring continuation of service to users and to the public;*
- d. *Makes sound decisions under the pressure of deadlines and high workloads;*
- e. *Demonstrates an appreciation for the varied technical knowledge and methodologies necessary across a multi-disciplinary team;*
- f. *Has the ability to respond to changing user requirements, to embrace innovative techniques and technologies; and,*
- g. *Has the ability to learn from and apply past experiences to improve quality of forecasts and warnings.*

5. Communicate weather, water and climate information to internal and external users

(repeated information; item 4)

- a. *Communicates forecast uncertainty to users;*
- b. *Provides briefings in support of operational continuity to colleagues;*
- c. *Creates training resources and delivers training as required; and,*

- d. *Creates and delivers presentations on hydro-meteorological topics to external agencies and to the public.*

Background knowledge and skills

- a. *Demonstrates an understanding of users' needs for, and use of, hydro-meteorological information; and,*
- b. *Demonstrates an understanding of the application of hydrometeorology to human activities.*

6. Apply self management and good team working practices

- a. *Promotes a team-oriented environment which encourages continuous improvement and positive work dynamic in the forecast office, while providing support and advice as required; and,*
 - b. *Manages workload effectively with due consideration for relevant deadlines, given changing circumstances.*
-

**COMPETENCY REQUIREMENTS FOR PWS ADVISORS
ENGAGED IN USER INTERACTION, MEDIA LIAISON AND OUTREACH ACTIVITIES**

These competency requirements are for PWS Advisors who specialize in media liaison work and in education/outreach. They build upon, and should be read in conjunction with, the competency requirements for a PWS/weather forecaster, although it is recognized that some people engaged in media liaison and outreach on behalf of NMHSs may not come from a forecasting background.

There are four top-level competency areas for the work of media liaison and outreach, which are as follows:

- (a) Oral and written communication;
- (b) Use of appropriate tools and systems required for the delivery of hydro-meteorological information to end-users;
- (c) User interaction; and,
- (d) Self-management and team-working.

Each of these areas is expanded below into second-level competencies that are expressed and structured in a manner that facilitates the clear application of an assessment procedure. Not all of these second-level competencies will be relevant to each PWS Advisor; the individual context of each PWS Advisor will need to be considered when establishing relevancy.

7. Oral and Written Communication

- a. *Is aware of the range of users reached through media forecasts;*
- b. *Understands the likely impact of upcoming weather on users and their activities;*
- c. *Presents warnings of hydro-meteorological hazards clearly and effectively and, in the context of past events, includes information on possible mitigating actions where appropriate;*
- d. *Understands the working environment of journalists and other media professionals;*
- e. *Communicates in an effective and timely manner;*
- f. *Works closely with colleagues responsible for Communication and Public Affairs in NMHS and assists in preparing press releases or interviews as required, and;*
- g. *Prepares and delivers educational material in clear and appropriate language to a wide range of audience, from children to fellow-professionals;*
- h. *Demonstrates an appropriate understanding of strengths and limitations of forecasts and warnings, and communicates appropriate levels of confidence and uncertainty in the message.*

8. Use of appropriate tools and systems in the delivery of hydro-meteorological information to end-users.

- a. *Has a thorough knowledge of the channels used to communicate weather and related information, and an ability to exploit this knowledge effectively; and,*
- b. *Knows the routine production protocols appropriate to their own service provision environment.*

9. User interaction

- a. *Demonstrates knowledge of the methods, operational procedures and organization relating to the investigation of user requirements and assessment of service benefits;*
- b. *Provides guidance to users to assist their proper understanding of meteorological service information in taking informed decisions;*
- c. *Provides advice and comments on the potential improvement of meteorological services and products in accordance with user requirements*
- d. *Provides users with a proper expectation of strengths and limitations of forecasts and warnings and effective and appropriate decision-making. Specifically avoids communicating excess confidence to meet users desire for certainty where such confidence is not scientific warranted and justify.*

10. Self-management and team-working

- a. *Works in a cooperative fashion with colleagues from NMHS and, where appropriate, with journalists and other media staff;*
 - b. *Is suitably groomed towards an acceptable presence, taking relevant social and cultural norms into account. Presents a professional appearance which enhances the brand value of NMHS;*
 - c. *Demonstrates appropriate levels of trust, integrity, consideration of media needs, timeliness, confidentiality and discretion in all work activities;*
 - d. *Ensures consistency of message both across NMHS and with stakeholders, both internal and external, and;*
 - e. *Mentors junior colleagues and provides support and advice as required.*
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COMPETENCY REQUIREMENTS FOR A DISASTER PREVENTION AND MITIGATION WEATHER ADVISOR

These competency requirements are for weather advisors who work in the area of Disaster Prevention and Mitigation (DPM) and engagement with the Emergency Management (EM) community. They build upon, and should be read in conjunction with, the competency requirements for a PWS/weather forecaster, although it is recognized that some people engaged in liaison and outreach in EM on behalf of NMHSs may not come from a forecasting background. In such cases, the DPM Advisor needs to work closely with the PWS/weather forecaster to develop the products and services indicated in the following sections. A DPM Advisor, taking into consideration the conditions a to c below:

- (a) The locally defined PWS areas of responsibility;
- (b) Hydro-meteorological impacts on society; and,
- (c) Hydrometeorological societal requirements, local procedures and priorities,

should be able to perform the work (in close association with the PWS/weather forecaster if needed) indicated in the five top level competencies below:

1. Communicate warnings and associated information, including uncertainty and levels of confidence, to users;
2. Develop products, procedures and services to meet community and user needs;
3. Develop and manage DPM stakeholder relationships;
4. Promote and implement impact assessments and community outreach; and,
5. Ensure the quality of information, services and procedures.

Each of these top-level competency areas is expanded, below, into second-level competencies that are expressed and structured in such a manner as to facilitate the clear application of an assessment procedure. Each is also associated with a range of background knowledge and skills which may not be particular to meteorology but are nonetheless essential for the discharge of the weather advisor's duties.

15. Communicate warnings and associated information to users

- a. *Presents information during severe weather events through the mass media, and in particular television, radio, and the press; and,*
- b. *Tailors weather warning products for communication to disaster management decision support and for other key users*
- c. *Communicate appropriate levels of confidence and uncertainty to aid effective decision-making.*

16. Develop products, procedures and services to meet community and user needs

- a. *Identifies and demonstrates a knowledge of the weather, climate and water information requirements of the disaster management and civil protection community;*

- b. *Ensures formatting and timely dissemination of warnings in order to facilitate the actions of disaster management community in safeguarding life and property;*
- c. *Ensures the use of appropriate language and terminology in NMHSs warnings;*
- d. *Informs on the development of very short-range forecasting and nowcasting methods and products tailored for the disaster management community based on user needs;*
- e. *Informs on the development of the Ensemble Prediction System (EPS)-based probabilistic forecasts of weather related threats, based on user needs for such products;*
- f. *Informs on the development of impact-based forecast products to assist the emergency management and civil protection agencies with their decision making processes based on user needs for such products;*
- g. *Assists in improving dissemination of warning information through utilisation of new communication technologies; and,*
- h. *Applies new technology and scientific research in Multi-Hazard Early Warning Systems (MHEWS), including meteorological and hydrological observations and telecommunication networks (experience sharing with success stories, and detailed synthesis of these good practices).*

17. Develop and manage DPM stakeholder relationships

- a. *Is able to establish and maintain working relationships at operational and technical levels with the emergency management and civil protection community, including identification of points of contact;*
- b. *Is able to build and maintain relationships to enable optimal dissemination of warnings prior to and during weather events;*
- c. *Facilitates the coordination between NMS and relevant agencies and public service providers to improve emergency planning, preparedness and response to weather threats, with particular emphasis on the unique needs of megacities;*
- d. *Assists in the design of effective warning systems for coordinated emergency response to hydro-meteorological hazards; and,*
- e. *Contributes in close coordination with the disaster management and civil protection authorities to the development of response advice and call-to-action statements based on the potential impact of the hazards in the region of concern*
- f. *Instils and manages an appropriate level of expectations of of capacity in DPM stakeholders.*

18. Promote and implement impact assessments and community outreach

- a. *Participates in the assessment of the socio-economic impacts of hydro-meteorological events, in collaboration with relevant experts;*
- b. *Fosters coordination with socio-economic experts in order to evaluate the benefits of Early Warning Systems (EWS) of weather, hydrological and climate hazards; and*

- c. *Promotes community awareness and preparedness for hydro-meteorological - related disasters through public education and outreach.*

19. Ensure the quality of information, services and procedures

- a. *Enables sustainable and formalised feedback mechanisms, including user-based service assessment and product verification, for evaluating and improving NMHSs warnings;*
 - b. *Works with the disaster management authorities to strengthen the role of NMHSs in the national disaster management structures as the “Single Official Voice” for warnings of severe weather;*
 - c. *Contributes to the development of a communication strategy to foster the authority of the NMS, as the “Single Official Voice” for warnings of severe weather, to ensure credibility of, and effective public response to, these warnings;*
 - d. *Coordinates internal standard operational procedures to facilitate multi-agency and multi-hazard risk management and emergency plans;*
 - e. *Advises on the development of improved documentation and archiving systems for hydro-meteorological hazard and impact data, including data retrieval, quality assurance and data management; and,*
 - f. *Engages with international projects including World Weather Information Service (WWIS), Severe Weather Information Centre (SWIC), METEOALARM and Severe Weather Forecasting Demonstration Project (SWFDP) and other WMO initiatives*
 - g. *Manages appropriate level of expectations of capability and reliability, and avoid promoting unrealistic expectations.*
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COMPETENCY REQUIREMENTS FOR PERSONS ENGAGED IN THE IMPROVEMENT, INNOVATION AND DELIVERY OF METEOROLOGICAL SERVICES AND PRODUCTS
(comment: this document is described differently; it needs to be revised in light with the others)

These competency requirements are primarily aimed at NMHSs personnel who are engaged in the area of improvement, innovation and delivery of meteorological services and products. They should be read in conjunction with the competency requirements for a PWS/weather forecaster, although it is recognized that many people engaged in these aspects of NMHSs work may not come from a forecasting background.

- (a) Sound knowledge of meteorology, and the models and systems used in operational forecasting;
- (b) Effective application of existing and new technologies;
- (c) User focus, knowledge of requirements for sectoral applications of meteorological and hydrological information, oral and written communication; and,
- (e) Self-management and team-working.

Each of these areas is expanded below into second-level competencies that are expressed and structured in a manner that facilitates the clear application of an assessment procedure.

11. Sound knowledge of meteorology, and the models and systems used in operational forecasting

- a. Demonstrates knowledge of the application of meteorology to the improvement of existing services and the creation of new products;*
- b. Demonstrates an understanding of the methods used in modelling; and,*
- c. Understands the strengths and limitations of the models used in the forecast process.*

12. Effective application of existing and new technologies

- a. Demonstrates a knowledge of the production systems in use in the forecast office and the optimum employment of these systems in producing and disseminating forecasts and warnings;*
- b. Shows a thorough knowledge of user visualization and display systems used for weather information;*
- c. Keeps abreast of the science of meteorology and related technological advances and can specify and lead the development of meteorological products and services relevant to his/her own NMHS to meet user needs; and,*
- d. Demonstrates an ability to respond quickly to users' changing needs and/or changing technologies.*

13. User focus, knowledge of requirements for sectoral applications of hydro-meteorological information, oral and written communication.

- a. Demonstrates an understanding of the application of hydro-meteorological services to meet user requirements;*

- b. *Maintains an awareness of users' current and future requirements for meteorological services;*
- c. *Demonstrates an ability to work with users to understand the nature of their business and their needs for improved or new products and services;*
- d. *Demonstrates an ability to provide clear, structured briefings to both users and colleagues;*
- e. *Demonstrates an ability to create and deliver presentations on topics related to service improvements to users, to external agencies, and to the public;*
- f. *Demonstrates effective communication skills to both internal and external stakeholders and is able to adjust key messages and content for different audiences;*
- g. *As required, contributes to the development of training material relating to service innovations and improvements; and,*
- h. *Demonstrates the ability to articulate user needs to guide the development of new or improved services.*

14. Self- management and team-working

- a. *Works in a cooperative fashion with colleagues and with external stakeholders;*
- b. *Makes sound decisions under the pressure of deadlines and heavy workloads;*
- c. *Manages differences in approach and values, deals effectively with confrontational situations, demonstrating respect and consideration for differing points of view;*
- d. *Demonstrates an understanding of the technical knowledge and methodologies necessary to work in a multi-disciplinary team;*
- e. *Demonstrates appropriate levels of trust, integrity, consideration of user needs, timelines, confidentiality and discretion in all work activities;*
- f. *Has the ability to provide vision, leadership and guidance in service improvement,*
- g. *Communicates in an effective and timely manner;*
- h. *Has the ability to provide vision, leadership and guidance in the development of service improvement;*
- i. *Serves as a role model through consistent demonstration of integrity and professional values; and,*
- j. *Holds other accountable to their professional obligations*

Suggestion: PWS consider developing a separate set of competencies for those forecasters involved in seasonal prediction.

WORK PROGRAMME FOR THE OPAG ON DPFS

Operational Weather Forecasting Process and Support

Priority	WMO HPA	DPFS TLO	Key Outcome	Key Performance Indicator	Activity	ET/TT	Responsible
P2	CD, DRR	Strategy to implement LAM	Guidance to assist Members with improved access to high-resolution regional NWP	Endorsed the Strategy by CBS Timely provision of the Guidance to CBS (or Members)	Development of the Guidance; Collect case studies of NMCs at various levels; Collect information on available LAM and Products from NWP centres;	TT	Yuki Honda
P3	CD, DRR	Coordination of sand and dust storm	1. View on uncertainty of RSMC ASDF products 2. Improvement of RSMC designation criteria and procedure	1. Provision of view on uncertainty of RSMC ASDF products 2. Endorsement of amendment of GDPFS Manual related RSMC designation criteria and procedure	Development of a new coordination mechanism with CAS; Preparation of a response to CBS request regarding uncertainty; Review of text of RSMC designation criteria and procedure; Guide of a new designation;	Coordinator	Yuki Honda
P1	CD, DRR	Standard procedures for surface verification	Addition to manual to include verification for surface parameters (deterministic and probabilistic NWP?)	New procedures endorsed by CBS	Carry out a study on interpolation methods for each surface parameter Complete and review studies on verification of surface parameters propose standard verification procedures for surface verification	TT	Thomas Haiden or Marion Mittermaier (TBC)
P1	GFCS, CD, DRR	Use of NWP for hazard risk management	more effective use of NWP in production of risk-based warning of hazard	N people participate in training workshop; and positive feedback in questionnaire endorsement of guidance document by CBS approval by CBS of strategy for implementation beyond SWFDP framework	Develop document providing guidance on use of NWP for hazard risk management provide training module within SWFDP training workshop add to questionnaire for students	TT	Paul Davies
P1	CD, DRR	Development of guidelines on how to use and interpret existing VSRF products	more effective use of the available satellite and LAM products in nowcasting and VSRF; with a special focus on S Africa	N people participate in training workshop; and positive feedback in questionnaire endorsement of guidance document by CBS approval by CBS of strategy for implementation beyond SWFDP framework	Develop document providing guidance on use and interpretation of VSRF products provide training module within SWFDP training workshop add to questionnaire for students	TT	Secretariat, J. Wang Estelle Deconing (TBC)
P2	WIGOS/WIS	Update observation monitoring procedures	up-to-date observation monitoring procedures included in appropriate manual	Updated procedures endorsed by CBS	Review current observation monitoring procedures, update as required, agree on which manual to put these in; consider near-real-time requirements; joint with WIGOS, IOS, ISS; quality and quantity; plan for implementation; implement	Joint TT (DPFS, IOS)	D Richardson
P3	GFCS, CD	Upper-air verification	global NWP centres follow updated verification procedures; results available via Lead Centre web site (both deterministic and EPS)	Up-to-date verification scores for all centres available via Lead Centres	Review deterministic and EPS verification Lead Centres' activities, support their developments and provide guidance Monitor and support progress on implementation of new verification procedures	TT	Tom Robinson (TBC) Lead Centres

Operational Predictions from Sub-seasonal to Longer-time Scales

Priority	WMO HPA	DPFS TLO	Key Outcome	Key Performance Indicator	Activity	ET/TT	Responsible
P1	GFCS	Ongoing provision of operational LRF products from GPCs and Lead Centres	Monthly issued seasonal forecasts maintained; verification information maintained	Products on GPCs and LCs websites	Ongoing provision of operational LRF products from GPCs and Lead Centres	ET	GPCs and LCs
P1	GFCS, DRR, CD	Development of GPCs' and LCs' services to RCCs	GPC and LC minimum product requirements revised to better meet assessed needs of RCCs	Recommendations for revised minimum requirements for GPCs made to CBS	GPC and RCC joint workshop to refine requirements and enhance interaction. a) May 2013: scope and aims, funding, dates and venue of workshop agreed (CBS/CCI); organising committee in place; b) July 2013: invitations to participate; c) October 2013: pre-conference tasks allocated d) January 2014: workshop held; e) March 2014: ET-OPSLS recommends revised GPC/LC data exchange/functions to CBS.	TT	Caio Coelho (TBC), Richard Graham, Secretariat (DPFS, WCP)
P1	GFCS, DRR, CD	LCs' support to the GSCU, including verification issues	Review of new requirements on LCs (and GPCs) from the developing GSCU	Recommendations on revised products/procedures made to CBS	Develop revised strategies for verification exchange, including for LC-LRFMME multi-model products, real-time verification and support to GSCU. a) July 2013: draft case for changes and proposed new strategy; b) September 2013: reviewed by GPCs; c) March 2014: recommendations made to ICT.	TT	Arun Kumar (TBC)
P2	GFCS, DRR	Scoping/ implementation of sub-seasonal forecasts	Scoping of operational subseasonal forecasts informed by WWRP/THORPEX/WCRP subseasonal to seasonal project and informal real-time exchange with LC-LRFMME	Report on relevant findings from WWRP/THORPEX/WCRP subseasonal to seasonal project and on informal exchange	a) April 2013: participants in informal exchange agreed; b) July 2013: Establish working links with the WWRP/THORPEX/WCRP subseasonal to seasonal research programme - explore rationalisation of research and operational exchanges; c) January 2014: technical challenges of exchange scoped through informal exchange between small group of GPCs; d) March 2014: Report to ET-OPSLS on lessons from informal exchange and progress WWRP/THORPEX/WCRP subseasonal to seasonal research programme. Implications for future operational provision.	TT	Suhee Park (TBC)
P2	GFCS	Scoping/ implementation of longer than seasonal forecasts	Capacity for exchange of multi-annual to decadal forecasts demonstrated	Recommendations for further assessment needed, and potential roles and functions for centres (and Lead Centres) making multi-annual to decadal forecasts.	a) Exeter to continue experimental real-time forecast exchange; b) July 2013: 1st draft of recommended roles and functions of producing centres and lead centre including response to ET-CSIS (Dec 2012) report; c) Sept 2013: reviewed by ET-OPSLS and ET-CSIS (and others); d) March 2014: Make recommendations to CBS/CCI on further development needed, and infrastructure, roles and functions to support operational exchange within GFCS (in liaison with WCRP and ET-CSIS and users).	TT	Richard Graham

Emergency Response Activities

Priority	WMO HPA	DPFS TLO	Key Outcome	Key Performance Indicator	Activity	ET/TT	Responsible
P1	DRR	Maintain operational response readiness	Ensure systems working and procedures followed correctly		Monthly and Quarterly tests	ET	ET members
P3	DRR	Update joint bilateral Concept-of-Operations/MOU with IAEA					Secretariat
P3	DRR, CD	Explore new products from RSMCs	Produce new products (e.g. GIS shapefiles, Time-Of-Arrival charts) as appropriate	User acceptance for implementation	Consult RSMCs, IAEA & WHO	ET	René Servranckx, James Fraser
P2	DRR, CD	Maintain, review, update ERA web pages & TD 778	Document current & relevant	Document current & relevant	Ongoing Develop & include nonnuclear information	ET	René Servranckx, James Fraser
P1	DRR, CD	Complete revision of Tech Note 170	Document current & relevant	Completion of revision before CBS			
P2	CD, DRR	Make available web-based training and information regarding ERA to NMHSs	NMHSs are better prepared with respect to ERA activities, capabilities and products	NMHSs are able to access information	Work with those that have been developing web-based training modules in order to allow access to those web sites which are password protected by NMHSs, and publicize this materials on the ERA website - includes capability building for dealing with smaller scale non-nuclear events * Update the WMO Bulletin article on ERA (January 2006) to further promote the programme (PART OF www?)	ET	René Servranckx, James Fraser
P3	DRR	Prepare annual reports on RSMC activities	Annual reports	All annual reports available on WMO ERA website	Each RSMC to provide report summarizing 2012 activities	ET	ET members
P1	DRR, CD	Develop operational procedures for non-Nuclear ERA	Complete the drafting of operational procedures for significant non-nuclear incidents, including the minimum information on the characteristics of the ATM (for inclusion in new Manual).	Procedures circulated prior to test	* Complete second draft of operational procedures * Circulate the draft to TT & RSMCs for comments * RSMCs to provide feedback	ET	René Servranckx, James Fraser
P1	DRR, CD	Test the procedures	Conduct experiment comprising a simulated request from NMHS to RSMC for assistance during a large chemical fire	Procedures have been tested and demonstrated to be efficient and correct (and adjusted as needed)	* Development of experiment scenario & plans * Conduct experiment		James Fraser

Manual on the GDPFS

Priority	WMO HPA	DPFS TLO	Key Outcome	Key Performance Indicator	Activity	ET/TT	Responsible
P1	CD, GFCD, AeM, DRR, WIGOS/WIS	Review Manual on GDPFS	New Manual on the GDPFS	Manual updated by Sep 2013	Complete final version of the new Manual	TT	Bernard Strauss

DPFS STRATEGY (10 years)

Background

Priority Areas (PA) for WMO for the next financial period (2012-2015):

1. Global Framework for Climate Services – climate change, variability and adaptation
2. Capacity Development
3. WIGOS/WIS
4. Disaster Risk Reduction
5. Aviation Meteorology, including QMF

Links to these priorities highlighted by PA numbers below.

Vision – in 10 years time

The GDPFS will be developed and expanded to cover all timescales from short to multi-annual range. By focusing on services for Disaster Risk Reduction and on capacity development, the GDPFS will continue to support and build members' capabilities for:

- Timely warning of severe and high impact weather;
 - Emergency response to nuclear and non-nuclear incidents;
 - Early warning of climate anomalies on monthly, seasonal and longer timescales.

Specific aims:

- Sustain and enhance quality and reliability of existing operational services including ERA, with the latest developments and findings. (PA 1, 2, 4, 5)
- Make core set of high quality NWP Products (including EPS) accessible to all NMHSs (PA 1, 2, 3, 4, 5)
 - Enhanced information access through interactive web tools and emerging technologies supported at RSMCs or global centres – allow interactive access to NWP/EPS data (PA 2, 3)
 - Enhanced preparedness for environmental change (PA 1)
 - Focus on “*what counts*” high-impact thresholds (e.g. freezing point, 10 degrees) for verification and calibration (PA 2, 5)
 - Wide availability of improved convection-allowing model forecasts (PA 2, 4, 5)
- Consolidate SWFDP into sustainable operational services (PA 1, 2, 3, 4, 5)
 - Enhanced information access through web tools supported at RSMCs or global centres from any bandwidth internet connection (PA 2, 3)
 - Support sustainable usage – annual training funded and resourced (PA 2)
- Dynamical monthly, seasonal and multi-annual products are well understood by members and integrated in production of national and regional services, and informing adaptation to climate variability and change and informing decisions related to water, health, agriculture and food security and DRR (PA 1, 2, 3, 4)
 - Implement new GPC and Lead-Centre nodes as needed to serve requirements on sub-seasonal, seasonal and longer time-scales as part of the development of the GFCS (PA 1, 4)
 - Expand existing operational services in response to the requirements of members. (PA 1, 4)
 - Consolidate data exchange between GDPFS nodes (e.g. GPCs and Regional Climate Centres) (PA1, 2, 3)
 - Capacity development, including demonstration projects (PA 2)
- ERA for non-nuclear hazards to reach same level of operational maturity as nuclear ERA (PA 4, 5)
 - Regional arrangements established including with other international organisations

- ERA guidance products for radioactive clouds in the atmosphere to meet the needs of aviation and air traffic management (*PA 5*)
- Cascading SWFDP-like framework (Global Centres and RSMCs) for hydro-meteorological hazards (*PA 1, 2, 4, 5*)
- Increased usage of NWP in applications of meteorology (flash floods, coastal flooding aviation, marine, agriculture and health) including usage by partner organisations (*PA 1, 2, 4, 5*)
 - Hi-resolution NWP including convection-allowing to meet the needs of air traffic management (*PA 5*)
 - Increased propagation of NWP outputs into impact models to deliver timely warning of high-impact weather including planning and recovery (*PA 1, 2, 4*)
 - Availability of air quality forecasts (*PA 1, 2, 4, 5*)
 - Working with other organisations for risk reduction and post-event disaster relief (e.g. UN Agencies, NGOs) (*PA 1, 2, 4*)
- Operational framework for space weather monitoring and prediction (*PA 2, 4, 5*)
- Establish a Quality Management Framework for maintenance and sustainability (*PA 5*)
 - Improved efforts and exchange of verification (deterministic, EPS and long-range) to:
 - i. inform users of forecast performance and aid decision-making;
 - ii. identify deficiencies requiring further NWP development.

OPAG on DPFS 2, 6 and 10 years' vision

Expert Team	Top Level Objectives	Current Status	2-Year	6-Year	10-Year	Contributions to GFCS, DRR, Capacity Development, WIGOS/WIS and Aviation Meteorology	Engagement with Organisations dealing Agriculture, Health, Water and DRR
Operational Weather Forecasting Process and Support (OWFPS) and Steering Group of the Severe Weather Forecasting Demonstration Project (SG-SWFDP)	Sustain and enhance quality and reliability of operational forecasting services with the latest development and findings: - guidance on access to high-resolution NWP - standard procedures for surface verification - use of NWP for hazard risk management.	Many advanced centres applying global and regional NWP, some with integrated EPS, and with sophisticated post-processing and visualisation systems. However, many NMHSs still lack access to high quality NWP data. Cascading forecast process successfully dem	Established procedures for verification of surface weather. Guidance on access to high-resolution LAM NWP Updated Manual for DPFS defines Quality Management framework for maintenance and sustainability of DPFS SWFDP Project Office established and staffe	Established SWFDP service in further areas providing wider access to NWP products and forecast guidance. Verification of surface weather implemented. Quality Management system for DPFS implemented. Increased propagation of NWP data into impact models to	Core set of high-quality NWP including EPS and VSRF systems used by all NMHSs. Consolidate SWFDP into global sustainable operational services through enhanced cascading forecast process. Wide availability of improved convection-allowing model forecasts.	All NMHSs have capability to provide hydro-meteorological forecasting and warning services in support of DRR - capacity development. Improved Aviation services from convection-allowing models. Strengthening of NMHS capabilities and reputation through SWF	Extend the range of targeted application to broaden the benefits of SWFDP to other user sectors in society. Working with other organisations for risk reduction and post-event disaster relief (e.g. UN Agencies, NGOs, Humanitarian Organisations for DRR)
OWFPS	Space Weather	A few centres providing observations and forecasts for national purposes. Some bilateral collaborations.		Develop plan for establishing RSMC for Space Weather specialisation.	Established RSMCs with Space Weather specialisation.	NMHSs have access to advice on Space Weather for DRR through the WIS.	
Operational Prediction from Sub-seasonal to Longer-time Scales (OPSLs)	Enhanced GPC and LC products (Seasonal)	Network of 12 GPCs and two facilitating Lead Centres providing seasonal forecast guidance to RCCs and NMHSs. Collaboration with CCI includes through Task Team on the Global Seasonal Climate Update (GSCU), the joint CCI/CBS Expert Team on Regional Climate	Review user needs in context of developing GFCS, including training needs, in collaboration with CCI	Enhanced set of GPC products to meet identified user needs; improved understand and take-up of products including support for Humanitarian Organisations	Dynamical seasonal forecast products are well understood by members and integrated in national and regional services, and informing decisions related to water, health, agriculture and food security and DRR.	Capacity development of RCCs and NMHSs; improved information on DRR related to climate variability available on WIS.	Contributions to users through the RCOFs (Regional Climate Outlook Forums). Support for Humanitarian Organisations for DRR.
OPSLs	Sub-seasonal forecast	Centres making forecasts but no formal WMO structure for delivery.	Collaborate with WWRP & WCRP to scope an operational framework	Operational framework implemented through a network of centres providing multi-model sub-seasonal forecasts to user requirements	Dynamical sub-seasonal forecast products are well understood by members and used in national and regional services, and informing decisions related to water, health, agriculture and food security and DRR.	Capacity development of RCCs and NMHSs; improved information on DRR related to climate variability available on WIS.	
OPSLs	Multi-annual to decadal timescale forecasts	Research centres making decadal forecasts but no formal WMO structure for delivery to RCCs and NMHSs. Experimental exchange of multiannual to decadal forecasts demonstrated. Climate change projections are available through e.g. WRCP CMIP5.	Capacity for operational exchange of multi-annual to decadal forecasts demonstrated in collaboration with CCI. Centres for operational multi-annual to decadal forecasts identified.	CBS centres for operational multi-annual to decadal forecasts defined and providing prediction guidance to RCCs and NMHSs according to a developing understanding of prediction skill and user needs. CBS contributions to longer-than-decadal projections (e	Decadal prediction services enhanced with wider application by users. CBS contributions to longer-than-decadal projections implemented.	Capacity development of RCCs and NMHSs; improved information on DRR related to climate variability available on WIS.	
Emergency Response Activities (ERA)	New ERA Products	Established set of products provided to cover nuclear incidents in all WMO Regions; on-line training materials provided.		Time-of-arrival products added to ERA products set. All products available in shapefile format		Improved presentation of ERA products through WIS.	IAEA, WHO
ERA	Non-nuclear capability	Existing RSMCs can respond on a best endeavours basis but no structured procedures in place.	Procedures agreed & demonstrated in test	ERA Service for major non-nuclear incidents operational.	ERA for non-nuclear hazards to reach the same level of operational maturity as nuclear ERA. NMHSs capable of addressing small-scale non-nuclear events in their own countries	DRR	IAEA
ERA	Radioactive clouds in the atmosphere for Aviation	Existing products are not suitable for this application.		Test demonstration of potential capability.	ERA guidance products for radioactive clouds in the atmosphere to meet the needs of aviation and ATC	Aviation Met	ICAO