WORLD METEOROLOGICAL ORGANIZATION

COMMISSION FOR BASIC SYSTEMS

SIXTH MEETING OF THE STEERING GROUP OF THE SEVERE WEATHER FORECASTING DEMONSTRATION PROJECT (SWFDP)

GENEVA, SWITZERLAND, 14 – 18 MARCH 2016

FINAL REPORT

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EXECUTIVE SUMMARY

The sixth meeting of the Steering Group for the Severe Weather Forecasting Demonstration Project (SWFDP) was held in Geneva, Switzerland, from 14 to 18 March 2016.

The Steering Group reviewed progress and provided guidance for further implementation of the SWFDP in Southern Africa, South Pacific Islands, Eastern Africa, Southeast Asia and Bay of Bengal. It also provided guidance to the future implementation of the SWFDP in Central Asia, Western Africa, Caribbean, Southeast Europe, Southern-south America, and Southeast Asia and Oceania, taking into account their different stages, approaches and requirements.

The Steering Group discussed the expansion of the SWFDP, synergies with other programmes and projects, and sustainability issues, including the mechanism to strengthen operational centres. It agreed on a clear definition for both the transition of mature projects to operations, and the engagement of other programmes and projects, as described in Annex III. The Steering Group also develop a strategy for addressing training, which should be implemented in collaboration with the Education and Training Department.

The Steering Group reviewed its documentation, including the overall project plan and guidebook. It agreed that the overall project plan should be a very short document for presentation to donor agencies, while the guidebook needed to be expanded to address all technical and management aspects of the SWFDP. The Steering Group requested the Secretariat to complete this task after the meeting.

The Steering Group reviewed its Terms of Reference, as per Annex IV to this report.

GENERAL SUMMARY OF THE WORK OF THE SESSION

1. OPENING OF THE SESSION

1.1 The sixth meeting of the Steering Group for the Severe Weather Forecasting Demonstration Project (SWFDP) was opened at 09:30 hours on Monday, 14 March 2016, at the WMO Headquarters, in Geneva, Switzerland, by the chairperson of the Group, Mr Ken Mylne. Mr Mylne welcomed participants to the meeting, and invited Mr Xu Tang, Director of the Weather and Disaster Risk Reduction Services (WDS) Department, to address the meeting on behalf of the WMO Secretary-General.

1.2 Mr Xu Tang welcomed participants to the WMO Headquarters and to Geneva. He recalled that the IPCC Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), which WMO co-sponsors, states with increased confidence that some weather events and extremes would become even more frequent, more widespread and/or more intense during the 21st century. This poses the immediate question of how Members are delivering warning services to their populations. Mr Tang therefore noted that NWP systems generally provide an accurate indication of developing extreme weather events, thereby being a very relevant component of routine and severe weather forecasting and warning programmes at National Meteorological and Hydrological Services (NMHSs), which could support their impact-based forecasting and risk-based warning services. He further noted that it is in this context that the Severe Weather Forecasting Demonstration Project (SWFDP) initiative and its cascading process is intended, to: 1) further explore and enhance the use and application of outputs of existing NWP systems, available through WMO's Global Data-Processing and Forecasting System (GDPFS), in the improvement of severe weather forecasting in countries where sophisticated NWP outputs are not currently used, or poorly used; and, 2) improve the delivery of services to various user sectors in society.

1.3 Mr Tang highlighted that the SWFDP represents a systematic and practical approach for building capacity, and for transferring new knowledge and skills, therefore contributing to reducing the gaps in the quality and variety of services between developed and least developed countries. He therefore recalled that the World Meteorological Congress, at its sixteenth session (Cg-16, 2011) approved a vision for the SWFDP as an end-to-end, cross-programme collaborative activity led by the GDPFS, and recommended that the SWFDP should engage all WMO programmes that concern the real-time prediction of hydro-meteorological hazards, through their respective technical commissions, from observations, to information exchange, to delivery of services, education and training, and to the transfer of relevant promising research outputs into operations. Mr Tang also recalled that Cg-17 (2015) reinforced this statement and approved the establishment of an expanded mechanism to strengthen operational centres at global, regional and national levels, built upon the lessons learnt through the SWFDP. While noting that Cg-17 agreed that the SWFDP concept should be further expanded into more regions, he noted that Cg-17 recognized that the SWFDP expansion can only be realized with an appropriate and resourced Project Office at the WMO Secretariat, and extrabudgetary contributions to augment the regular budget allocations. Cg-17 also recognized that in sub-regions where the demonstration phase of the SWFDP had been concluded, it would be necessary to pass into the operational phase and to rename the project appropriately as an operational activity.

1.4 Mr Tang encouraged the meeting to consider and guide the future implementations of this project in different regions of the world, the expansion of the SWFDP framework to facilitate cross-programme synergy or integration as a meaning of increasing the overall effectiveness of the results, the future implementation of the mechanism to strengthen operational centres, the transition of the demonstration project into operations, and sustainability and resource mobilization issues, taking in consideration the recent developments, including the Global Framework for Climate Services and UN Agenda. Mr Tang expressed gratitude to the meeting participants for their contributions to the work of

the Steering Group for the SWFDP, which would continue to assist WMO to provide even better assistance to its Members in facing the challenges of improving severe weather forecasting and warning services. He concluded by wishing everyone a successful meeting and an enjoyable stay in Geneva.

2. ORGANIZATION OF THE MEETING

2.1 Adoption of the agenda

2.1.1 The meeting adopted the provisional agenda, as provided in Annex I to this report.

2.2 Working arrangements

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

http://www.wmo.int/pages/prog/www/BAS/CBS-meetings.html

2.2.2 The meeting agreed its hours of work and other practical arrangements for the meeting. Participants 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. STRATEGIC OVERVIEW OF SWFDP

3.1 Outcomes of WMO Constituent Body sessions related or relevant to the SWFDP

3.1.1 Ms Alice Soares (WMO Secretariat) provided background information related to the outcomes of the seventeenth session of the World Meteorological Congress (Cg-17, 2015) and of the 2014 extraordinary session of the Commission for Basic Systems (CBS-Ext.(2014), 2014) related and/or relevant to the SWFDP. These include:

a) Cg-17 acknowledged the successful implementation of the project in Southern Africa, South Pacific, and Eastern Africa, and the recent developments in Southeast Asia and Bay of Bengal. It acknowledged that the SWFDP in Southern Africa was no longer a demonstration project, and therefore stressed that, in sub-regions where the demonstration phase of the SWFDP had been concluded, it would be necessary to pass into the operational phase and to rename the project appropriately as an operational activity. It also noted that the operational phase would require a regional entity responsible for ensuring all countries achieve and maintain compliance and oversee management and related aspects with continuing support from the Project Office at the WMO Secretariat.

b) Cg-17 noted that forecast verification activities, including application of new verification methods, have been implemented through the SWFDP. The Steering Group noted that guidelines on Forecast Verification for the African SWFDPs (WMO-No. 1132) have been developed, however it stressed that this document is more appropriate to NMHSs' already carrying out verification activities, and that a more simple document is required for those NMHSs initiating such activity.

c) Cg-17 also noted the proposed expansion of SWFDP in Africa as suggested by RA I-16 and the planned expansion in the Caribbean SIDS, Central Asia and South-east Europe

would require significant increase of resources to support training, contributions by participating global products centres and RSMCs, and coordination functions by the WMO Secretariat. Cg-17 recalled that it did recognize at its sixteenth session (Cg-XVI, 2011), that SWFDP expansion could only be realized with an appropriate and resourced Project Office at the WMO Secretariat, and extrabudgetary contributions to augment the regular budget allocations. In addition to financial resources, the Steering Group noted with concern the human resource requirements for the implementation of SWFDP, and stressed the difficulties in getting voluntary contributions by Members (e.g. for training).

d) Cg-17 recalled its direction, at its sixteenth session (Cg-XVI, 2011), for the SWFDP to engage all WMO Programmes concerned with the real-time prediction of hydrometeorological hazards, through their respective technical commissions, from observations, to information exchange, to delivery of services, education and training, and to the transfer of relevant promising research outputs into operations. Following recommendation by CBS-Ext.(2014), Cg-17 was pleased to note the collaboration between CBS and the Commission for Hydrology (CHy) for the integration of SWFDP with the Flash Flood Guidance System (FFGS) in Southern Africa and encouraged them to consider expansion of this approach to other regions, as appropriate. Cg-17 agreed that such integration (including synergy with CIFDP) would facilitate implementation of operational support to Multi-Hazard Early Warning Systems.

e) Cg-17 noted that the Executive Council, at its sixty-fifth session (EC-65, 2013), acknowledged that, in the context of the implementation of the GFCS, Global Producing Centres (GPCs) for Long-range Forecasts (LRF), Regional Climate Centres (RCCs) and Regional Climate Outlook Forums (RCOFs) could also have a role in the SWFDP model, in support of developing seamless regional early warning systems. Cg-17 supported EC-65 observations that in principle the SWFDP model could also be applied to prediction at longer-time scales, and therefore requested CBS and the Commission for Climatology (CCl) to explore ways to bridge the gap “weather/climate” at least from medium-range to sub-seasonal prediction to ensure seamless prediction across time-scales.

f) Following the recommendation by CBS-Ext.(2014), Cg-17 was pleased to note the productive work of CBS experts in relation to the overall SWFDP development, management and implementation, and adopted Recommendation 23 (CBS-Ext.(2014)) which establishes an expanded mechanism to strengthen operational centres at global, regional and national levels, built upon the lessons learnt through the SWFDP.

3.1.2 The Steering Group noted that the level of engagement and uptake by participating countries vary significantly, and that developing countries are those getting real benefits from the SWFDP. It therefore recognized the need for further attention and support to LDCs and SIDSs within the SWFDP.

3.1.3 The Steering Group agreed to address those aspects requiring guidance by the Group at the relevant agenda items.

3.2 Strategic overview of the status of the SWFDP

3.2.1 The chairperson, Mr Ken Mylne, provided introductory remarks regarding the SWFDP strategic directions. He noted that SWFDP was developed and operated under the auspices of the GDPFS (Global Data-processing and Forecasting System) in collaboration with the PWS (Public Weather Service) programme, and many other WMO activities. Mr Mylne recalled that the aim of the SWFDP is to spread the availability of prediction information to many Members with little or no access

to such capabilities, and thus support their capability to issue warnings and other forecasts within their countries and areas of responsibility. He further recalled that SWFDP delivers forecasting capability through a "Cascading Forecasting Process" whereby real-time forecast data and information are cascaded from global forecasting centres with a global capability to the NMHSs of Members within a region through a designated Regional Centre. The Regional Centre interprets the information in terms of severe weather risks and provides summary guidance to the NMHSs. The Regional Centre may also provide additional forecast information generated locally, such as from more detailed regional forecast models. The SWFDP also provides a number of supporting services to aid Members to exploit the cascaded information, including:

a) Training in the interpretation and exploitation of cascaded data for the generation of forecasts and warnings;

b) Training in the development of PWS services and the development of relationships with user organizations to ensure that warnings are effective in stimulating actions to protect populations and properties from the impact of severe weather;

c) Access to observational data sources such as satellite data, and training in their use;

d) Support in the development of effective dialogues and support networks between Regional Centres and NMHSs in the regions, including also mutual support between NMHSs which helps ensure consistency of messaging across borders;

e) Support in the development/improvement by participating NMHSs of multi-channel communication systems to provide effective benefits from improved forecasting (e.g. TV weather presentations, use of mobile technology, and websites).

3.2.2 The Steering Group acknowledged that the SWFDP provides one component of a wider use of the Cascading Forecasting Process to support NMHSs, and that similar cascading processes are used in long-range forecasting to share information from Global Producing Centres (GPCs) through Regional Climate Centres (RCCs) and Regional Climate Outlook Forums (RCOFs). In addition, the Steering Group recognized that the SWFDP is increasingly operating in collaboration with other projects operating similar cascading processes, such as the CIFDP (Coastal Inundation Forecasting Demonstration Project) and the FFGS (Flash Flood Guidance Service). It therefore agreed that there is much scope for further development of a consistent approach across multiple hazards in collaboration with other technical commissions (e.g. the Cascading Forecasting Process in hydrological forecasting with CHy, and in marine forecasting with JCOMM), as well as in providing wider coverage across the globe. The Steering Group noted that this approach is aligned with the WMO Strategy for Service Delivery and the agreement at Cg-17 to initiate a process for the gradual establishment of a future enhanced integrated and seamless WMO Data-processing and Forecasting System, and adoption of Resolution 11 (Cg-17) – Towards a future enhanced integrated and seamless WMO Data-processing and Forecasting System.

3.2.3 The Steering Group noted that following the WWOSC in Montreal in Aug 2014, which defined "seamless" to include the link from forecasting weather to forecasting the impact of the weather as part of a risk-based warning system, CBS-Ext.(2014) established a TT-IMPACT to develop procedures for impact-based forecasting and risk-based warnings. While noting that SWFDP uses a regional approach and impact-based forecasting is better addressed at the national level, the Steering Group agreed that it would be important for the strategy for SWFDP to support the development of impact-based forecasting and risk-based warnings in order to remain relevant and support the wider WMO goals.

3.2.4 The Steering Group recalled that in its previous meeting (Dec 2013), it has developed aspects of the strategy for future developments of SWFDP, including:

a) The establishment of a Severe Weather Forecasting programme (or mechanism) for strengthening/sustaining operational centres, especially RSMCs, to sustain and increase the capacity of NMHSS to deliver relevant services to the various user-sectors;

b) Expansion to Global coverage;

c) Establishment of a Project Office with funded staff;

d) Engagement with the Resource Mobilisation office and with potential funding agencies including the World Bank to address issues of sustainability;

e) Recognition of the need for a defined regional manager/coordinator for each project, in collaboration with the relevant RA and/or TCP Regional Body, to ensure the future sustainability of the project and its future operational status;

f) Defined criteria for the transition of projects from demonstration to operation.

3.2.5 The Steering Group noted that the new Manual of the GDPFS (WMO-No. 485), which would be presented for recommendation at CBS-16 (Nov 2016) and adoption at EC-69 (Jun 2017), defines a new set of designations for GDPFS Centres, including recognizing the operational status of an SWFDP Regional Centre, following transition from demonstration to operations, as an RSMC for Severe Weather Forecasting. The Steering Group agreed to review the proposed functions of such an RSMC under agenda item 12.

3.3 Growing scope of SWFDP and relationship to other projects

3.3.1 Mr Mylne stressed that in the past the Steering Group had sought to limit the scope of SWFDP projects in order to keep them manageable in scale. There had been considerable concern that if the scope was allowed to grow then the projects would become too complex and in particular too demanding for the Regional Centres to support, undermining the success of the whole project. However, due to the demands for expanding the SWFDP, he noted that this limitation in scope was becoming increasingly difficult to sustain, due in part to the success of the SWFDP. The Steering Group noted that there are potential demands on the SWFDP to:

a) Support multi-hazards;

b) Support impact-based forecasts and warnings;

c) Collaborate with other projects across other technical commissions and disciplines

d) Engage in much more detailed support and dialogue with individual NMHSs engaging in, for example, impact-based forecasting projects, and in national modernization programmes supported by the World Bank.

3.3.2 The meeting enquired about the role and responsibilities of the Steering Group for the SWFDP. It noted that the Terms of Reference (ToRs) of the Steering Group are very general and agreed to reviewed its ToRs under agenda item 12, taking into account the discussions at the meeting.

4. REVIEW AND EVALUATION (INCLUDING PROGRESS AND ISSUES) OF EXISTING SWFDP SUBPROJECTS (both Forecasting and PWS components)

4.1 Southern Africa

4.1.1 Mr Ezekiel Sebego (South Africa) provided background information on the implementation of the SWFDP in Southern Africa. The Steering Group recalled that Phase 1 started with a planning meeting in Aug 2006 in Pretoria, South Africa, followed by the first regional training session in November 2006 in Pretoria, South Africa. The demonstration phase (Phase 2) kicked off in November 2006 lasting for one year till November 2007. Five countries were involved in the demonstration phase, namely Botswana, Madagascar, Mozambique, Tanzania and Zimbabwe. The principal regional centre was RSMC Pretoria, with the support from RSMC for Tropical Cyclone Forecasting La Reunion (France) and three global centres namely ECMWF, NCEP (NOAA) and the Met Office UK. As Phase 2 drew towards a close, the Meteorological Association of Southern Africa, representing the NMSs of the SADC (Southern African Development Community) countries, requested WMO to roll SWFDP out to the entire region, based on the successes of the demonstration phase. This led to Phase 3 in which the SWFDP activities were rolled out to all 15 SADC countries, as well as the Comoros, and evaluated on the sub-regional scale. Following the conclusion of Phase 3 in December 2011, the SWFDP – Southern Africa entered Phase 4 (Regional Subproject Long-term Sustainability and Future Developments).

4.1.2 The Steering Group noted that Phase 4 of the SWFDP – Southern Africa continued to apply the cascading forecasting process. The global centres and RSMC-TC La Reunion continued to provide products from their models to RSMC Pretoria, operated by the South African Weather Service (SAWS). RSMC Pretoria in turn linked these products on the SWFDP – Southern Africa website used by the countries. RSMC Pretoria also continued to provide every day guidance products for the next five days. Other products provided by RSMC Pretoria include satellite nowcasting tools, and products from the 12 km Unified Model (UM SA12) run by SAWS over the SADC domain. The Steering Group noted that a significant development is the operational implementation of a 4-km resolution Unified Model (UM SA4) run by SAWS, which would become operational on 1 April 2016, and its products would be disseminated via the SWFDP – Southern Africa website. The Steering Group noted that the domain is slightly smaller over the western and southern areas, but still covers all the SADC countries as in the past, and requested Météo-France to consider providing products from the 10-km Aladin regional model to complement and cover the domain, especially over the Indian Ocean islands.

4.1.3 The Steering Group was pleased to note that other developments in the SWFDP – Southern Africa include the SWFDP-SARFFG Twinning Project, funded by USAid. The Twinning Project aims to streamline the activities of SWFDP and the Southern African Regional Flash Flood Guidance (SARFFG) through integrations of SARFFG processes with SWFDP processes, supported by technological enhancements and enhanced user products for forecasters and disaster management. One of the activities is to integrate the training needs of both into the annual 2-week Training Workshop. The Steering Group agreed that this is a good approach that could be replicated in other regions.

4.1.4 The Steering Group noted that since the beginning of Phase 4, the SWFDP – Southern Africa has been managed and coordinated by MASA, with the support of the WMO Secretariat, covering topics under resource mobilization, training, development, promotion and leadership. Continued training is regarded as of high importance and needs to be addressed through a variety of approaches. These include traditional training workshops at RSMC Pretoria for forecasters of all the countries, the concept of a SWFDP Training Desk at RSMC Pretoria where forecasters from the region can spend some time on attachment, training visits by regional experts to various NMHSs, and particularly those lagging behind, to train forecasters at their desks. Other initiatives explored include

e-learning options and regular internet based monthly training sessions similar to the SATREP-Online sessions conducted by the EUMETSAT Centre of Excellence in Pretoria on a monthly basis.

4.1.5 The Steering Group was very pleased with the developments of the SWFDP – Southern Africa, however it expressed some concerns about the sustainability of the SWFDP mature subprojects and agreed to address this issue under agenda item 9. Other challenges include: (a) disaster management collaboration in various countries still needs to be strengthened; (b) application at local level also needs to be continuously improved, including effective dissemination of warnings and information and end-user response; and (c) enhancement of communication bandwidth by countries is essential since this appears to be a major limiting factor for effective use of products. The Steering Group noted with concern that there are a few countries which face varying difficulties with full participation and agreed that these countries need special attention to bring them properly on board. The Steering Group also agreed to address this issue under agenda item 9.

4.2 South Pacific

4.2.1 Mr James Lunny (New Zealand) provided a brief overview of progress of SWFDP in the South Pacific and issues that require attention. The Steering Group recalled that the Severe Weather Forecasting and Disaster risk reduction Demonstration Project (SWFDDP) for the South Pacific Islands started as a Pilot in November 2009, involving NMHSs from Solomon Islands, Vanuatu, Fiji and Samoa. In November 2010, the SWFDDP entered a Full Demonstration phase with the addition of five other participating countries: Kiribati; Tuvalu; Tonga; Niue; and Cook Islands. After nearly three years running in the Full Demonstration phase, the Regional Subproject Management Team (RSMT), at its 2013 meeting, evaluated the overall progress of the subproject and determined what should happen next and whether the subproject was in a position to transition to Phase 4 – the Operational Phase. The RSMT meeting agreed that the subproject was not ready to enter Phase 4 and decided on a set of criteria to be implemented by each participating NMHS. The criteria are being evaluated as part of the six monthly Progress reports, which includes:

a) An appropriate non-TC warning system is implemented and operating smoothly;

b) Severe weather and wave forecasts & warnings are being verified using the spreadsheet specially designed;

c) At least one case study per year is completed;

d) All SWFDDP progress reports completed in full before the deadlines prescribed (six monthly); and

e) Demonstrate on a continuing basis that the relationships between NMHSs and Disaster Management and Civil Protection Authorities (DMCPAs), the media and the public are strong and healthy, with regular communications before, during and after severe weather events

4.2.2 The Steering Group noted that it has been a challenge for the participating NMHSs to meet the above criteria. Further, besides anecdotal evidence, it has been difficult to obtain information about: the value of the contribution of RSMCs; and the value of the products supplied by global centres. A full evaluation of the Project is now due along with a fourth RSMT meeting, planned to be held in the Salomon Islands, in late August-early September 2016, back-to-back to the RA V Tropical Cyclone Committee session.

4.2.3 The Steering Group noted with concern that a challenge lies in the transfer of overall management and coordination of SWFDDP outside the WMO Secretariat. The Lead RSMC (i.e. RSMC Wellington) would continue the focus on the day-to-day operational requirements (production of South Pacific Guidance charts and the maintenance of the subproject website – MetConnect Pacific) while some other body would need to take responsibility for the overall management and coordination of subproject activities including organization of resources for future training, meetings and upgrades to MetConnect Pacific. There continues to be sustainability issues especially in relation to long-term funding for training and the ongoing redevelopment of the Project website. The Steering Group recommended from early stages of implementation, engagement with groupings of directors of NMHSs within the regional economic bodies (i.e. comprising Heads of Meteorological Services and Ministries in charge of meteorology) to garner their support and to ensure sustainability (i.e. recognition of SWFDP as a contributing mechanism for the implementation of their regional meteorological development plans and investment strategies). Nevertheless, the Steering Group recognized that there may not be such regional body in all SWFDP regions and therefore recommended to strengthening the relationship with the Regional Associations and the WMO Regional Offices. The Steering Group agreed to further discuss this issue under agenda item 9.

4.3 Eastern Africa

4.3.1 Mr James Kongoti (Kenya) presented the status of implementation and progress of the SWFDP – Eastern Africa. The Steering Group recalled that the SWFDP – Eastern Africa commenced in September 2011 (following a planning workshop in October 2010), with the participation of the NMHSs of Burundi, Ethiopia, Kenya, Rwanda, Tanzania and Uganda; and in May 2013 had been expanded to also include the NMHS of South Sudan. The Regional Specialized Meteorological Centre (RSMC) Nairobi acts as the regional centre for the project, providing daily guidance products covering the entire project footprint. A SWFDP – Eastern Africa Web site and Portal for the subproject had been developed, and is running at RSMC Nairobi. Global centres are the Met Office UK, NOAA/NEC, ECMWF and DWD (for providing the GME data needed for nesting HRM and COSMO).

4.3.2 The Steering Group noted that the SWFDP – Eastern Africa had provided an opportunity to trial a number of new activities associated with the subproject. The Steering Group noted that RSMC Nairobi and RSFC Dar prepared regional daily guidance containing an interpretation of the global and regional guidance out to 5 days. Information on Heavy Rain (> 50mm in 24 hours), Strong Winds (≥25knots; 20knots over the Lake Victoria), Hazardous Waves – Indian Ocean and Lake Victoria (≥ 2m) was included whenever the criteria (in brackets) were expected to be met. The Steering Group noted that while the project was also focusing on dry spells, limited guidance has been provided. Users include general public, disaster management, media, agriculture and fisheries. Verification had also been a major component of the project. Daily videoconferences, which entail real-time interpretation of the model outputs and verification by RSMC Nairobi and RFSC Dar, initially with the support by Met Office UK Global Guidance Unit (GGU), have been ongoing and it is being expanded to include all SWFDP – Eastern Africa participants in the full demonstration phase, internet bandwidth permitting.

4.3.3 The Steering Group noted that annual training workshops were carried out for the NMHSs of participating countries, to enable them to utilize the products on project website for generating their own forecasts and warnings. These workshops included one week training on forecasting and the other week on public weather services and agricultural meteorology.

4.3.4 The Steering Group noted that feedback from the participating NMHSs was generally very positive about the guidance and model products. The achievements relative to the project's goals were summarized below:

a) Improved accuracy in the high-impact weather forecasts, warnings, alerts and advisories;

b) Enhanced capacity development;

c) Created a “critical-mass” of champions at all levels (Sectors);

d) Created a platform for data/product/information sharing;

e) Created confidence among the weather/climate producers and users;

f) Forecasters appreciated the usefulness of the NWP products;

g) Improved service delivery.

4.3.5 Provisional issues identified from the SWFDP – Eastern Africa include:

a) Build strong feedback mechanisms;

b) Prepare simple and clear forecast information and warning/advisory messages, giving clear statements on what is happening, when it’s happening, where it’s happening and what action should be taken;

c) Strengthen the open discussions or fora of the “Expert Group” among the participating NMCs

d) Utilize the social media in the delivery of the weather services.

4.3.6 The Steering Group was pleased to note that the SWFDP – Eastern Africa has been considered under the EAC’s Five-years Meteorological Development Plan and Investment Strategy (2013-2018).

4.4 Southeast Asia

4.4.1 Mr Ata Hussain (WMO Secretariat) informed the Steering Group that second meeting of Regional Subproject Management Team (RSMT) for SWFDP-Southeast Asia was held in Ha Noi, Viet Nam, in August 2015. The meeting was attended by RSMT members from all five participating countries as well as from contributing global and regional centres, including ECMWF, CMA, JMA, KMA, RSMC Tokyo and RSMC New Delhi. The RSMT reviewed and updated the Regional Subproject Implementation Plan (RSIP) and developed future activities including timeline to start demonstration of the subproject.

4.4.2 The Steering Group noted that RFSC Ha Noi started issuing Daily Guidance products for both short- (1-2 days) and medium-range (3-5 days) towards the benefitting NMHSs and the demonstration phase of the subproject started on 1 January 2016 as agreed by the RSMT. The benefitting NMHSs are required to submit their first Quarterly Progress Report for the period January-March 2016 through SWFDP database (see agenda item 8) in April 2016. The Steering Group also noted that RFSC Ha Noi provided two expert lecturers for SWFDP training workshop in Quezon City, Philippines, in 2014, and one expert lecturer for a similar training in 2015, in Bangkok, Thailand.

4.4.3 The Steering Group was informed of the plans to establish an RFSC Training Desk, as per recommendation of the 2015 RSMT meeting, based on the experiences and lessons learnt from RSMC Pretoria Training Desk for SWFDP-Southern Africa. This RFSC Training Desk aims of

improving RFSC Ha Noi Daily Guidance product through sharing of local knowledge and experience among the RFSC forecasters and invited forecasters from the participating countries.

4.4.4 The Steering Group was informed that since its inception in 2011, the various activities towards the implementation of the SWFDP – Southeast Asia have been carried out with funding from the WMO regular budget.

4.5 Bay of Bengal

4.5.1 Mr Hussain informed the Steering Group of the steady progress of the SWFDP-Bay of Bengal development during recent years. Since the Technical-Planning Workshop in January 2012 (New Delhi, India), the Regional Subproject Implementation Plan (RSIP) for the SWFDP-Bay of Bengal has been developed by IMD and further updated with input from other contributing global centres (i.e. JMA, UKMO, NOAA/NCEP and ECMWF). ECMWF agreed to take part in the subproject in 2015. The Steering Group noted that IMD provided one expert lecturer for the SWFDP training workshop held in Bangkok, Thailand in September 2015.

4.5.2 The Steering Group noted that as a contributing global centre, IMD is supported by the National Centre for Medium Range Weather Forecasting (NCMRWF) and the Indian National Centre for Ocean Information Services (INCOIS) for NWP and marine related products. INCOIS would provide location specific products for participating countries including tide and swell wave, high swell and wave alerts, and coastal inundation in line with those provided currently to Sri Lanka and Maldives. Archival and retrieval of operational data and products would be made up to 7 days by IMD. The Steering Group was informed that recently the Indian Institute of Tropical Meteorology (IITM), upon request by IMD, agreed to provide extended-range forecast products for dry and wet spells. The Steering Group further noted that India has an exceptional role in the subproject for being one of the contributing global NWP centres, the lead Regional Centre for SWFDP-Bay of Bengal, the RSMC for tropical cyclone forecasting and a beneficiary country of the subproject.

4.5.3 The Steering Group was informed that based on Members' interest in SWFDP-Bay of Bengal and considering the expansion of the subproject to benefit more countries in South Asia, WMO Secretariat in January 2016 sent out formal letters to nine countries in the region requesting for designating their representatives to the RSMT of SWFDP-Bay of Bengal in order to update the list of RSMT. Eight out of nine countries have already responded to the Secretariat. The RSMT will review and update the RSIP based on recent developments and expansion of the subproject including reviewing the format of the RSMC Daily Guidance product and providing timeline to start the demonstration phase of the subproject. The NMHSs of participating countries were requested to provide an updated list of EPSgram stations in each country for consideration by the global centres to develop location specific products. The Steering Group was further informed that RSMC New Delhi had developed the web portal for the subproject in 2015, which was demonstrated to participants in the SWFDP training workshop in Bangkok, Thailand, in September 2015. Presently, only products from Indian centres (i.e. IMD, NCMRWF and INCOIS) are available through the subproject website, but products from other global NWP centres are expected to become available mid-2016. RSMC New Delhi would start issuing the Daily Guidance product (in graphics format) towards the participating NMHSs on experimental basis from 16 May 2016.

4.5.4 The Steering Group was informed that since the inception of the subproject in 2012, most of its activities have been carried out with funding from UNESCAP through RIMES as part of a WMO-RIMES joint project, which ended in December 2015.

5. REVIEW OF SWFDP SUBPROJECTS IN PLANNING AND/OR INITIAL DEVELOPMENT STAGE (both Forecasting and PWS components)

5.1 Central Asia

5.1.1 Mr Dmitry Kiktev provided information on the establishment of the new SWFDP regional subproject in Central Asia. The Steering Group noted that the SWFDP – Central Asia has been supported by the World Bank and coordinated by the WMO, and is targeted at strengthening the capacity of the Central Asia NHMSs of Kazakhstah, Kirgizstan, Tadjikistan and Uzbekistan. Global centres supporting the SWFDP – Central Asia are: CMA, ECMWF, ROSHYDROMET, KMA and JMA. The subproject is focused on heavy rain, heavy snow, strong winds, extreme temperatures. In the prospect, it may address flash floods, and dust storms.

5.1.2 The Steering Group noted that a prototype demonstration started in August 2015. Currently, the project is provided with graphical products (maps and meteograms) of global medium-range deterministic and ensemble forecasts of Roshydromet. Forecast products from other participating global centres are expected to be available in late 2016. Along with global NWP products, the SWFDP – Central Asia is provided with numerical forecasts of COSMO mesoscale limited area model run by Roshydromet as a member of the international consortium COSMO (Consortium for Small-scale Modeling). As part of the technical modernization programme for Central Asia supported by the World Bank, there would be the upgrade of the RSMC Tashkent (Uzbekistan) computer facilities. After that, the RSMC Tashkent is planned to run COSMO model on its own technical facilities providing SWFDP – Central Asia with high-resolution numerical guidance for key (mostly mountainous) regions of the Central Asia. Discussions are ongoing to run high-resolution COSMO model for two additional sub-domains to support the implementation of the Flash Flood Guidance System in the Central Asia region.

5.1.3 The Steering Group noted that the SWFDP – Central Asia website and portal (in Russian) was launched in July 2015, and provides inter alia regional NWP products, archive of analysis and forecast maps, satellite images. It noted that a specific feature of the SWFDP – Central Asia subproject website is a built-in forecasters' toolkit for forming MeteoAlert maps, rather than the regional guidance product typically prepared by the SWFDP regional centre. Each NMHS of the Central Asia was provided with authorized access to a specialized web-interface for manual assignment of weather alerts (if any) to their countries and the interior administrative regions. The MeteoAlert maps from the SWFDP – Central Asia website can be exported to other web-resources and thus contribute to project service delivery.

5.1.4 The Steering Group noted that the SWFDP – Central Asia Implementation Plan was discussed and approved at the project kick-off meeting in Almaty, Kazakhstan, in April 2015. Two training workshops were organized afterwards (Moscow, Russia, July 2015; Almaty, Kazakhstan, February-March 2016). Besides the general SWFDP-CA training workshops in Moscow (Jul 2015) and Almaty (Feb-Mar 2016), a series of in-site trainings was conducted by Roshydromet for local forecasters and IT-specialists in Astana (Kazakhstan), Tashkent (Uzbekistan) and Bishkek (Kirgizstan) in 2015. The first trial versions of the NMHSs reports (in Russian) on the use of SWFDP – Central Asia products were prepared in October 2015. Since Q4 2015, regular quarterly reporting of the Central Asia NMHSs on the use of SWFDP-CA products has started.

5.2 Western Africa

5.2.1 Mr Samuel Muchemi (WMO Secretariat) informed the Steering Group of the status of implementation of the SWFDP in Western Africa and pointed out the following:

a) A Meeting to discuss the subproject was held in Dakar, Senegal, in November 2015 (18 countries attended). The aim of the meeting was to collect information that would assist in the decision of how the implementation of the subproject could be approached.

b) RSMC Dakar was identified as the centre that would provide regional support, and initiated the development of the web site for the subproject. However, the roles of the *Agence Pour la Sécurité de la Navigation Aérienne En Afrique et à Madagascar* (ASCECNA) as well as of the African Centre for Meteorological Applications for Development (ACMAD) still need to be determined.

c) One of the challenges in implementing the subproject is that Western and Central Africa constitute a very large area with many countries whose official languages are English and French, mixed across varying climatic regions with diverse extreme weather concerns. This situation may result in a need for interpretation which would be expensive. This may affect the way implementation is approached.

5.2.2 The Steering Group noted that during the meeting in Dakar, an assessment was done to determine the forecasting and service delivery status of each country in terms of: (a) major hazards of concern to the country; (b) number of days in a week the NMHS is open, as well as the hours of operation; (c) forecasts issued by the NMHS; (d) challenges in forecasting; (e) whether the NMHS provided weather warnings to the public; (f) whether the NMHS had a PWS unit, and if so, how many staff in the unit; (g) the communication channels used to deliver services to users (e.g. TV, radio); (h) challenges in service delivery. The Steering Group noted that responses vary significantly.

5.2.3 The Steering Group recommended the following aspects in the development of the SWFDP in Western Africa: (1) there should be consideration to include flash flood forecasting in the project as the region has basins covering several countries; (2) ACMAD has the role of the RCC for the Region and its contribution to the subproject should contain this aspect; (3) the extreme weather types are many and varied, hence there should be more than just one regional centre providing support; (4) ASCECNA could contribute in terms of Nowcasting; and (5) possible role of AGRYMET should be examined. The Steering Group noted that Canada is willing to provide support especially for training considering its bilingual status. It further noted that funding for this subproject is being sought from Republic of Korea and USAID.

5.3 Caribbean

5.3.1 The Steering Group was informed that the concept of developing a SWFDP for the southern portions of RA IV was discussed in a formal manner for the first time by the 16th meeting of the RA IV Management Group (Geneva, May-June 2015), who decided to create an Expert Group (EG) to provide orientation about this demonstration project.

5.3.2 In considering the idea of a SWFDP for the southern portions of RAIV, it is worthwhile to note that a large number of States and Territories in southern RA IV are actually Member States of the Caribbean Meteorological Organization (CMO. The aim of the CMO is to build on the existing collaboration between CMO and Météo-France (Martinique), particularly those elements that can be built into a SWFDP. In October 2015, CMO and Météo-France have developed a more formal set of "Working Arrangements" to guide this collaboration, which would be subject to acceptance by the governing structures of both Météo-France and CMO. In November 2015, the Caribbean Meteorological Council, which is the ministerial-level governing Council of the CMO, met in Belize. WMO was represented by Mr Oscar Arango, WMO Representative in Costa Rica. The Council considered the proposed Working Arrangement between CMO and Météo-France, together with a number of other aspects including the future coordination under a Severe Weather Demonstration

Project (SWFDP) in WMO Region IV. In its discussion, the Caribbean Meteorological Council specifically noted that the Caribbean area continued to be extremely well served by a very effective Tropical Cyclone Programme (TCP), which sets out the processes and procedures in the forecast and warning system for tropical cyclones among all States and Territories in the Region. That includes the coordination between the RSMC in Miami (US National Hurricane Center) and individual forecast and warning offices in the Caribbean area. Nonetheless, it was aware that the TCP does not spell out the coordination process between NMHSs themselves when the RSMC was not involved, nor required. Such coordination could be of particular value for the many severe weather events that were not necessarily related to tropical cyclones, or for severe marine conditions on the high seas that adversely affected coastal zones.

5.3.3 The Steering Group noted that further discussions on the development of an SWFDP in the Caribbean will be held during the Hurricane Committee, in April 2016. The Steering Group recommended the engagement of the WMO Secretariat and of a representative from the SWFDP – South Pacific due to possible similarities, in order to provide guidance to RA IV on SWFDP implementation.

5.3.4 The Steering Group noted that a Flash Flood Guidance System (FFGS) is under the development in the region, however no such working arrangements have been established, neither the support by the Caribbean Meteorological Council has been required.

5.4 Southeast Europe

5.4.1 Mr Milan Dacic (WMO Secretariat) informed that Steering Group that the Informal Conference of NMHS Directors from South-east Europe, at its session held in Bucharest in November 2015, concluded that it is desirable and fully possible to implement a project like SWFDP in South-east Europe.

5.4.2 Even though there are countries with strong modelling background in South East Europe, the Steering Group noted that there was a noticeable difference in capacity amongst the SEE Members. It therefore proposed to cluster the NMHSs according to their capacity building needs and consider them in tiered manner with regard to the implementation of cascading forecasting process under SWFDP. It was expected that SWFDP project could help South-east Europe to move quicker from research developments to operations, and provide tangible links between NWP operational weather prediction and operational hydrological predictions. This could substantially contribute to building of multi-hazard early warning system in South-east Europe.

5.4.3 The Steering Group noted that NMHS Directors from South-east Europe suggested that, due to strong political background of collaboration in past decades in the sub-region, the regional virtual centre organization would be a preferred approach for the SWFDP implementation in South-east Europe. The Steering Group noted that Croatia offered to host the initial technical-planning workshop for the development of the SWFDP – South-east Europe.

5.5 Southern-south America

5.5.1 Mr Alaor Dall'Antonia provided information on the status of implementation of the Severe Weather Virtual Warning Centre (called ALERT-AS) and its potential extension to all South America. The Steering Group noted that the idea of creating a Virtual Centre for Severe Weather Warnings for the Southern of the South America was developed during the Ibero-American Conference of Directors of National Meteorological and Hydrological Services (NMHS) after drastic severe weather events hit Montevideo, Uruguay, in 2004. A project was initiated to develop forecasting tools to be integrated into a virtual severe weather virtual centre to cover initially the southern part of South America,

involving Argentina, Brazil, Paraguay and Uruguay. The Steering Group noted that this project was initially funded by Spain, through Spanish Met Service (AEMET), which provided technical support and training for experts of the participating countries. The subsequent development was funded by Brazil, through its Met Service (INMET) and other Brazilian Government Financing Agency (FINEP). ALERT-AS system was initially developed for Brazil. The system was presented to RA III-16 session (Asunción, Paraguay, 2014), who considered its future implementation and further extension to all South America. The RA III-16 session recommended "the incorporation of PWS concepts contained in SWFDP into the Virtual Centre for Disaster Prevention in Southern America (ALERT-AS)".

5.5.2 The Steering Group noted that the ALERT-AS system uses an affordable PC-based platform under Linux. The core function of the ALERT-AS is to use meteorological data to classify the current meteorological hazards and the Principal Component Analysis (PCA) related with the Numerical Weather Prediction to generate the meteorological hazards forecasting analysis. The system allows the forecaster to intervene in the outcome by changing the degree of risk and coverage area of severe weather event. The ALERT-AS system allows direct collaborative work, via the Web, by engaged forecasters from concerned NMHS and from civil protection agencies. The system includes an evaluation mechanism to monitor the performance of the warnings produced by the ALERT-AS to compare with the actual events occurrence. The warning bulletins are automatically converted into Common Alerting Protocol (CAP) messages.

5.5.3 The Steering Group noted the plans to extend the ALERT-AS to Argentina, Paraguay and Uruguay. Other countries of South America would be able to join progressively. The main objective is to have an integrated regional warning system, preferably using common meteorological tools to increase the exchange of information and professional experience among forecasters and have a common RA III Web page for severe weather warnings. There have been discussions about the possibility of the use of the ALERT-AS platform by some countries in Central America and the Caribbean.

5.5.4 The Steering Group note that currently the ALERT-AS uses numerical forecast products from COSMO model run by INMET (Brazil), and encouraged the use of deterministic and ensemble products from global centres, following the cascading forecasting process implemented through the SWFDP.

5.6 Southeast Asia and Oceania (SAO)

5.6.1 Mr Ayhan Sayin informed the Steering Group that South-eastern Asia-Oceania Flash Flood Guidance (SAOFFG) initial planning meeting was held in Jakarta, Indonesia, in February 2016. The purposes of the meeting were to provide (1) an overview of an SAOFFG project to the representatives of the participating NMHSs, seeking their interests to participate in the project; (b) an overview of the SWFDP. Representatives from Indonesia, Malaysia, Papua New Guinea, Philippines, and Singapore attended the meeting. The outcomes of the meeting were, inter alia: (1) participants agreed on the development and implementation of the SAOFFG project; (2) participants agreed on the parallel implementation of SAOFFGS and SWFDP-SAO projects; and (3) participants recommended that president of RA V should send invitation letters to the NMHSs in the sub-region to seek their consent for the development and implementation of the SWFDP-SAO in the region. Upon receiving their positive responses, the president of RA V would send an official letter to WMO Secretary-General requesting the parallel implementation of the SAOFFG and SWFDP-SAO in the sub-region.

6. DEVELOPMENTS REQUIRED IN SWFDP

6.1 Impact-based Forecasting and Risk-based Warning services

6.1.1 Ms Haleh Kootval (WMO Secretariat) provided information on the WMO activities in impact-based forecasting and risk-based warnings. The Steering Group acknowledged that the primary responsibility of National Meteorological and Hydrological Services (NMHSs) is to provide timely and accurate forecasts and warnings of hydrometeorological events and hazards. However, each year the impacts of severe hydrometeorological hazards cause multiple casualties as well as significant loss and damage to property and infrastructure in spite of the fact that many of these severe events had been well forecast, with accurate warning information disseminated by the responsible NMHSs. The risk associated with the hydrometeorological hazard depends on knowing how that hazard impacts human beings, their livelihoods, and assets due to their vulnerability and exposure.

6.1.2 In order for governments, economic sectors and the public to take appropriate action, they need to know how the hydrometeorological hazard will impact their lives, livelihoods, property and the economy. The reasons for this apparent disconnect lie in the gap between forecasts and warnings of hydrometeorological events and an understanding of their potential impacts, both by the authorities responsible for civil protection/emergency management and by the population at large. Closing this gap, and improving the understanding of the potential impacts of severe hydrometeorological events poses a challenge to NMHSs and their partner agencies, particularly Disaster Reduction and Civil Protection Agencies (DRCPAs). Progressing from weather forecasts and warnings to multi-hazard impact-based forecast and warning services represents a paradigm shift in service delivery for many NMHSs, but a necessary step to enable those at risk take appropriate action to avoid harm. Currently the focus of forecasts and warnings is on what the weather will be. It is now advocated that this weather-based paradigm evolve to one, which is focused primarily on forecasting impacts. In other words, the focus should evolve to what the weather will do.

6.1.3 The Steering Group recognized the merit of advancing toward this paradigm shift, despite the complexity of impact-based forecasting and risk-based warnings. It welcomed the publication of the WMO Guidelines on Multi-hazard Impact-based Forecast and Warning Services (WMO-No. 1150) by PWS experts.

6.1.4 The Steering Group welcomed the initiative by the PWS Programme, in collaboration with GDPFS, to launch pilot projects in Mozambique, Myanmar and Mauritius on the implementation of impact-based forecasting and warning to test the application of principles contained in the Guidelines. The projects, which are implemented in the framework of the modernisation of the participating countries, advocate developing effective partnerships among various stakeholders; collection of data necessary for impact-based services; and training of the staff of partner agencies on new skills in delivering impact-based information services.

6.1.5 The Steering Group noted with interest the information provided by the representative of USA, Mr Dan Bearsdley, on the NWS initiative “Weather-Ready Nation” which strongly advocates the development of decision support systems in the framework of impact-based forecast and warning services. It appreciated the offer of collaboration and support to WMO in assisting Members to develop impact based forecasting services suited to their own national requirements and development levels.

6.2 Synergies with other programmes and projects

6.2.1 Satellite information

6.2.1.1 Mr Stephan Bojinski (WMO Space Programme) briefed on support by satellite observations to SWFDP. This included four areas: (i) current support by satellite operators to SWFDP,

(ii) potential augmentation of FFGS with satellite-derived soil moisture, (iii) the new generation of geostationary meteorological satellites, (iv) education and training in satellite meteorology.

6.2.1.2 The Steering Group noted that the provision of basic satellite imagery and derived products by JMA to SWFDP subprojects in Southeast Asia and South Pacific, and a prototype web mapping application for nowcasting precipitation (rate, accumulated) globally; both activities are recognized as pilot projects in the Sustained Coordinated Processing of Environmental Satellite Data for Nowcasting (SCOPE-Nowcasting) initiative.

6.2.1.3 The Steering Group also noted the Flash Flood Guidance System (FFGS) implementation in some countries currently uses derived soil moisture using soil type maps and measurements of precipitation and runoff. A current ESA projects investigates the potential value to FFGS of using near real-time surface soil moisture (m3/m3) derived from the ESA Soil Moisture Ocean Salinity (SMOS) passive microwave instrument.

6.2.1.4 The Steering Group was informed that a new generation of geostationary satellites was being deployed in the 2015-2020 timeframe, affecting all WMO Regions, offering unprecedented observing capabilities but also posing challenges to many users due to an order of magnitude larger data volumes, and novel data types (e.g., multi-spectral imagery, geostationary lightning imagers). Higher image scan rates (down to 2.5 min rapid scans from the JMA Himawari-8, for example) and spatial resolutions have high potential benefits to severe weather forecasting.

6.2.1.5 The Steering Group noted that the WMO-CGMS VLab was providing continuing support to SWFDP needs for training on satellite meteorology. Better identification of SWFDP requirements for data, products and training would be beneficial to optimize satellite operators' responses to the needs of the Projects. The WMO Regional Satellite User Groups can serve as a coordinated interface to satellite operators in all Regions, including for the use of e.g. EumetCast, GEONetCast, and CMACast for dissemination of products.

6.2.1.6 The Steering Group recognized the benefit of having a representative from the satellite community in the Regional Subproject Management Team of the SWFDP – South Pacific, and recommended a similar approach in other SWFDP regional subprojects.

6.2.2 TIGGE developments

6.2.2.1 Ms Nanette Lomarda (WMO Secretariat) provided an overview of the TIGGE developments and its contributions to SWFDP. The Steering Group noted that since the establishment of the TIGGE (The International Grand Global Ensemble) dataset, in October 2006, it continued to provide ready access to global ensemble predictions by leading NWP centres, for a range of research studies. Several developments have been made to TIGGE with support from the EU-funded FP7 project GEOWOW, including a regional extension of TIGGE (called TIGGE-LAM). The European TIGGE-LAM archive was launched in March 2014, to complement the original TIGGE archive and enable research users to have easy access to a range of European regional EPS data. The TIGGE-LAM forecasts provide detailed short-range forecast information at high resolution. Since TIGGE had proved an invaluable resource for research, the TIGGE project partners agreed to continue TIGGE for at least a further 5 years beyond the completion of THORPEX, in December 2014.

6.2.2.2 The Steering Group noted that EU GEOWOW project had also enabled the development of products showing multi-model grand ensemble forecasts of tropical cyclones and a real-time version of the severe weather products. In collaboration with the Japan Meteorological Agency (JMA), the Met Office UK had set up a system that acquires ensemble prediction data from four of the leading global NWP centres to generate plots to support warnings of heavy rainfall and strong winds up to 5

days ahead. This had been used by the SWFDP – South Pacific and it was planned to roll the product out to other regional SWFDP subprojects in Southern Africa and South-east Asia. Feedback from participating countries was sought.

6.2.2.3 The Steering Group noted that in early 2015, a new WWRP working group was established on Predictability, Dynamics and Ensemble Forecasting (PDEF) which combines elements from the former THORPEX GIFS-TIGGE and PDP working groups. Its responsibilities include scientific oversight of TIGGE and TIGGE-LAM. A TIGGE panel, comprising representatives from all TIGGE partners, had been set up to manage TIGGE and TIGGE-LAM. The TIGGE panel chair (currently Manuel Fuentes of ECMWF) was also a member of the PDEF working group.

6.2.3 Flash Flood Forecasting

6.2.3.1 Mr Paul Pilon (WMO Secretariat) provided a presentation on linking the SWFDP with the Flash Flood Guidance System (FFGS) with global coverage project. Mr Pilon provided some context for increased collaboration by recalling Resolution 21 (Cg-XV) that was adopted to increase collaboration between meteorological and hydrological services to improve the capacity to provide flood forecasting and warnings. He also noted that it created the WMO Flood Forecasting Initiative (FFI). He also recalled the adoption of Resolution 15 (Cg-XVI) establishing the formation of the Advisory Group of the FFI. He noted that this group met 1-3 December 2015 and formulated that one of its tasks be ensuring that all major demonstration projects, including the SWFDP, CIFDP and FFGS, include the requirements for effective and sustainable flood forecasting in their design and implementation.

6.2.3.2 As part of his presentation, Mr Pilon provided an overview of the FFGS including its major objective, which is to mitigate the adverse impacts of hydrometeorological hazards, in particular flash flooding, and the modelling concept of the FFGS. He also provided an overview of the FFGS projects that are being implemented or that are under consideration. These included: Central America FFG; Southern Africa Region FFG; Mekong River Commission FFG; Black Sea and Middle East FFG; South East Europe FFG; South Asia FFG; Central Asia FFG; South American Pilot FFG; Haiti-Dominican Republic FFG; and Southeastern Asia - Oceania FFG (SAOFFG) systems. Mr Pilon also showed some of the FFGS products and stressed the importance of quantitative precipitation forecasts (QPFs) from high resolution numerical weather models for input to the FFGS.

6.2.3.3 The presentation and subsequent discussion also focused on specific needs and challenges when considering further linking of the SWFDP with the FFGS with global coverage project. One important aspect was the different implementation times of the two projects, with the SWFDP being approximately 4 years and the FFGS being approximately 18 months, provided things worked smoothly. Efforts to shorten the implementation period of SWFDPs that are aligning with FFGS projects would be most beneficial for Members. He cited the recent Initial Planning Meeting of the SAOFFG initiative where the meeting called for the president of RAV to consider sending members and subsequently WMO a request to consider fast-tracking implementation of the SWFDP for that region so as to better mesh with FFGS implementation.

6.2.3.4 Other specific points raised included: the need to have the “window-on-weather” or modelling domain provided by a specific SWFDP subproject to coincide geographically with the basins and territory being covered by the FFGS; the emphasis placed by FFGS on high resolution QPF products, particularly over basins with major damage centres; the need for telecommunications infrastructure enhancement to allow digital numerical product flow from the SWFDP Regional Centre to the FFGS Regional Centre; and the need for participating National Centres to have sufficient technology to access the products via the Internet. In response to concern raised on the possibly copious amounts of data that would be required to transfer by SWFDP, Mr Pilon indicated that not all

generated data would be needed, but that the focus would be on QPF and possibly other forecasted elements required by the FFGS, thereby greatly reducing the quantity of data to be transferred. Mention was also made that consideration could be given to the development of a joint WEB portal for disseminating forecasts and warning products for Emergency Management Agencies and other users including the general public.

6.2.4 Tropical Cyclone Forecasting

6.2.4.1 Mr Taoyong Peng (WMO Secretariat) provided an overview of the Tropical Cyclone Programme (TCP) and its synergies with the SWFDP, especially in the South Pacific. The Steering Group noted that the primary objective of the TCP is to assist Members to establish the national and regionally coordinated early warning systems to ensure that the loss of life and damage caused by tropical cyclones are reduced to a minimum. It also noted that TCP long-term goals include: (1) strengthening the capabilities of WMO Members to provide reliable and timely forecasts of tropical cyclone tracks and intensities, and related forecasts of strong winds, heavy rainfall, and storm surges, covering all tropical cyclone-prone areas; and (2) promoting the establishment of national disaster risk management and reduction mechanism of the Members with regard to tropical cyclones with multi-hazard configuration. The Steering Group also noted that SWFDP has very similar goals, focusing on severe weather.

6.2.4.2 The Steering Group was pleased to note that synergies have been established between SWFDP and TCP, including the endorsement of the SWFDP – South Pacific by the RA V Tropical Cyclone Committee (TCC), and the participation of the TCC chairperson in the Regional Subproject Management Team of the SWFDP-South Pacific (and similar arrangements for the participation of the RSMT chairperson in the TCC sessions). The Steering Group also noted that RSMCs for Tropical Cyclone Forecasting are represented at the Regional Subproject Management Teams (RSMTs) of the SWFDPs in Southern Africa, South Pacific, Southeast Asia, and Bay of Bengal, and recommended similar approaches in SWFDPs which are in development in other Tropical Cyclone-prone regions, such as the Caribbean. The Steering further noted that the development of the SWFDP in the Caribbean region would be discussed at the Hurricane Committee session, planned in April 2016.

6.2.5 Marine Meteorology

6.2.5.1 Mr Edgard Cabrera (WMO Secretariat) provided an overview of the Marine Meteorology and Oceanography Programme (MMOP). He noted that MMOP, through the activities coordinated by the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM), supports Members in addressing the continued and expanding requirements of the maritime user community for met-ocean services and information, focusing on safety of life and property at sea, integrated coastal management and societal impacts. These activities include: (a) implementing IMO-WMO World-Wide Met-Ocean Information and Warnings Service; (b) supporting improved ocean analyses and forecasting products, especially for safety at sea; (c) coordinating four projects under joint JCOMM-CHy Coastal Inundation Forecasting Demonstration Project (CIFDP), which effectively demonstrates the value of the Multi-hazard Early Warning System (MHEWS); (d) developing/delivering capacity development activities and support to regional/national projects (e.g. West Africa, Mexico); (e) developing guidelines for the implementation of quality management systems for marine meteorological services by Members, including the development of Marine Weather Forecaster Competency Requirements, which were approved by Cg-17.

The Steering Group noted that (1) CIFDP is implemented through national sub-projects, launched for a country that meets the essential requirement (i.e. national agreement); (2) CIFDP sub-projects are designed based on users' perspectives and requirements, considering existing and available open source techniques; final products of the Demonstration Project should be operated and maintained by

national operational agencies which have the responsibility/authority for coastal inundation warnings; and (3) the procedures/best practices developed through sub-projects should be applicable to other (neighbouring) countries with common issues and interests, and should be closely linked to and cooperating with related projects and activities. While noting that CIFDP is nationally-driven, the Steering Group noted that it follows a similar cascading process as SWFDP, and that is worthwhile to establish synergies between the two projects.

6.2.5.3 The Steering Group noted with appreciation that MMOP has been supporting the development and implementation of SWFDP regional subprojects, especially the regional project in the South Pacific region, and would support any SWFDP in marine-related hazard-prone areas. The Steering Group noted that MMOP is implementing a project to enhance marine Early Warning Systems in West African countries for improved maritime safety, which objectives are: (a) build up capacity of West Africans NMHS involved so that they become autonomous regarding the activities of marine meteorology monitoring and forecasting; (b) support a node of marine meteorology research based on the WMO's SWFDP Cascading Concept. This node will make possible a close collaboration of Spain, Regional Specialized Meteorological Centre at Dakar (RSMC-Dakar) and NMHSs; and (c) provide specific tools and technology transfer to the West African NMHS involved in the project to improve marine meteorology predictions, and the enhancement of marine meteorological services for maritime safety and fisheries management. Again, the Steering Group noted the similarities of this project with the SWFDP, and recommended that the development of the SWFDP – Western Africa take into consideration the development and results of the marine project in the region.

6.2.6 Agricultural Meteorology

6.2.6.1 Mr Robert Stefanski (WMO Secretariat) presented a review of agrometerological activities related with the SWFDP. It was stressed that the main focus of weather forecasting is the protection of life and safety but weather forecasts with applications to agriculture can also help with the protection of property, safeguarding the environment and sustainable development (livelihoods). A review was made of impact of agrometeorological services and the value of climate data and analysis to provide better services to the agricultural community. It was pointed out that there are many difference users of agrometeorological users including international officials (i.e. Red Cross, WFP), Government officials (Ministries of Agriculture, Water Resources), extension agents, producers (farmers, ranchers, foresters, fishers), the media and general public. A key question in agrometeorology is: what are the weather / climate events that impact agricultural decision-making?

6.2.6.2 It was shown that short-term weather forecasts (1-5) in tropical and subtropical areas can assist farmers by reduce their chemical use thereby reducing the input costs. It can also increase yields and livelihoods. Based on user requirements from East African agrometeorologists, several potential products could be developed such as cumulative forecast rainfall for 1-5 days, 1-10 days, the rainfall intensity (>20 mm per hour) and chances of dry and wet spells during rainy season. The Steering Group agreed that some of these products could be developed by the global centres participating in the project and requested them to consider these requirements.

6.2.6.3 In addition, there are weather forecast needs for tropical or semi tropical areas for agricultural advice and warning, including:

a) Extreme temperatures, frost in high plains, colder than normal in critical development periods. Warm and dry periods. (Plants, livestock, poultry very sensitive);

b) Forest/bush fire indexes;

c) Strong winds/hail associated with squall lines. Plants, livestock and lake/rivers/maritime transport and fisheries;

d) Rainfall events for agricultural work planning;

e) Rainfall events for Irrigation activities;

f) Flood warning - Evacuation livestock, poultry from lower areas.

6.2.6.4 The Steering Group noted that the WMO Agricultural Meteorology Programme (AGMP) has been administering several projects around the world but especially in West Africa that increase the interactions between NMHSs and farmers. These Roving Seminars for farmer and fishers have been conducted in 17 West African countries with about 350 seminars conducted with 13,500 farmers participating. There is currently a project proposal for West Africa that will link the seminars with farmers and fishers and the outputs of the SWFDP project. AGMP has been involved in yearly East Africa SWFDP trainings and is preparing to assist with preparing for Bay of Bengal project. AGMP is working on a small project on Sub-Seasonal to Seasonal Project for Agricultural Applications which has just started in Nov 2015.

6.2.7 Disaster Risk Reduction

6.2.7.1 Mr Alasdair Hainsworth (WMO Secretariat) provided an overview of the Disaster Risk Reduction (DRR) Programme, and noted that its objectives are: (a) to contribute to the strengthening of technical and functional capacities of WMO Members, their NMHSs and operational and research networks in order to provide meteorological, hydrological, and climate services; (b) to assist Members in reducing the risks of disasters and support decision making and planning processes in disaster risk and emergency management; and (c) to assist WMO Members to develop and deliver services that are directed at protecting lives, livelihoods and property in a cost-effective, systematic, and sustainable manner, which will ultimately contribute to more resilient communities and sustainable development and adaptation under a changing climate. The Steering Group noted that the DRR is a cross-cutting programme that underpins WMO's mission to protect lives, livelihoods and property. It ensures the integration of relevant activities being carried out under the various WMO Programmes in the area of disaster risk reduction and implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030.

6.2.7.2 The Steering Group was informed that the WMO DRR activities are overseen by the EC Working Group on DRR. This Group was established by EC-67 in 2015 and coordinates through DRR Focal Points of WMO Regional Associations, Technical Commissions and Technical Programmes. The Steering Group noted that DRR maintains a mechanism to respond to (changing) user requirements through a series of User-Interface Expert Advisory Groups. These groups in Hazard and Risk Assessment, Multi-Hazard Early Warning Systems (MHEWS), Humanitarian Assistance and Disaster Risk Financing help define users in different DRR applications and identify their requirements. The Steering Group further noted that most recently, the DRR Division, in partnership with UK Met Office, had been assisting the UNHCR Winter Cell in providing weather information in support of the refugees moving through southeast Europe. This three way partnership is considered by UNHCR to have been most effective in preventing an even greater humanitarian tragedy than was observed over Winter 2015/16. One of the key factors of success of the UNHCR initiative has been the provision of impacts based forecasts and warnings, based on intelligence received from the network of National Meteorological and Hydrological Services in the region. This demonstrated the value of impacts based forecasts ad risk based warnings and emphasized the growing requirement for all NMHS to move towards the provision of services in this style.

6.2.7.3 The Steering Group was informed of the decision by the Seventeenth Session of the World Meteorological Congress in 2015 (Cg-17) to: “standardize weather, water, climate, space weather, and other related environmental hazard and risk information and to develop identifiers for cataloguing extreme weather, water and climate events” in a form that allows data on losses and damage to be cross-referenced to these phenomena. These are seen as extremely important in WMO Members’ ability to demonstrate their progress against the Sendai Framework goals and targets. DRR Division is working towards developing the required identifiers together with colleagues in Climate and Water Department and will provide guidance and recommendations on: (a) activities on the development of hazard definitions and a classification of hazards, hazard data/metadata and modelling requirements to support loss and damage data collection and risk assessment; (b) explore and discuss the challenges and opportunities for developing international guidelines, manual and standards for NMHSs in the development of standard identifiers for cataloguing extreme weather, water, and climate events; and (c) explore the challenges and opportunities for linking such an identifier and catalogue system to the numerous hazard and loss and damage databases that exist in countries, UN organizations, and the private sector.

6.2.7.4 The Steering Group was informed that the DRR Roadmap is a coordinated organization-wide plan of action that can be used by both WMO and the external side to understand how NMHSs can contribute to reducing disaster risk and increasing the resilience. It serves to guide WMO Members, NMHSs, RAs, TCs, and the Secretariat to support DRM decisions in partnership with each other and external partners at all levels. It would eventually lay out prioritized activities and deliverables required to address DRR in line with the Sendai Framework for DRR 2015-2030 and other post-2015 frameworks. The Roadmap requires continuous updating and consistency with the Strategic and Operating Plans of WMO, its constituent bodies and related WMO programmes and projects.

6.2.8 Climate Watch

6.2.8.1 Mr Peer Hechler (WMO Secretariat) informed the Steering Group of the WMO Climate Watch concept. Based on the operational arrangements and products of the GDPFS, the Climate Watch system generates and provides advisories and statements to inform users (particularly those involved in natural hazards preparedness, mitigation and response) about evolving, ongoing and/or foreseen climate anomalies (heat waves, droughts, periods with heavy rain etc.) and their potential adverse impacts. It builds on strong climate data, climate monitoring, long-range forecasting and user interface components with WMO Regional Climate Centres (RCCs) as a key enabler and the NMHS as key actors. Designed as an element of proactive risk reduction strategies to assist nations and communities in building resilience to disasters, and facilitated by a sub-regional implementation workshop series, the Steering Group noted that the concept has certain commonalities with SWFDP.

6.2.8.2 The Steering Group discussed prospects of a closer collaboration between groups implementing Climate Watch systems and SWFDP, respectively. Climate Watch advisories provide excellent context information for severe weather forecasts, thereby promoting seamless services across meteorological time scales. The Steering Group agreed to help identifying a regional SWFDP implementation project for demonstrating operational linkages to the Climate Watch system.

6.2.9 Climate services

6.2.9.1 In a related topic, Ms Anahit Hovsepyan (WMO Secretariat) provided an overview of the Climate Applications and Services and potential synergies with the SWFDP. She highlighted that users deal with weather and climate events as well as warnings in a seamless manner, so it is important to ensure that seamless information is provided to them cutting across different time scales.

Therefore, the operational climate prediction, over a range of time and space scales – being addressed in a seamless manner – is critically important for efficient decision-making. The World Climate Services Programme (WCSP) contributes to improving the availability and access to reliable climate prediction information and services, methods, tools and systems through interdisciplinary activities. WCSP has put in place a number of appropriate institutional mechanisms to generate exchange and dissemination of climate information at global, regional and national levels on an operational basis, such as Global Producing Centres for Long Range Forecasting (GPC-LRF), Regional Climate Centres (RCC), Regional Climate Outlook Forum (RCOF) and National Climate Outlook Forum (NCOF), which uses a similar Cascading Forecasting Process. The Steering Group agreed that RCOFs and NCOFs could be viewed as effective mechanisms for integrating climate and weather communities, and stressed the need for strengthening the relationship between RSMCs and RCCs in the various sub-regions for the benefit of users.

6.2.9.2 The Steering Group was informed that, with the input from GPCs and various other institutions, WMO regularly issues EL Nino/La Nina Updates an important source of information that helps countries to prepare for anticipated weather and climate events caused by El Nino/La Nina conditions. Furthermore, a more comprehensive concept of Global Seasonal Climate Update (GSCU) had been developed that would be summarising the current status and the expected future behaviour of major general circulation features and large-scale oceanic anomalies around the globe (e.g., ENSO, North Atlantic Oscillation, Indian Ocean Dipole, etc.) and discussing briefly its likely impacts on continental-scale temperature and precipitation patterns. The Steering Group noted these products provide useful information for forecasters and therefore suggested that links to such products be incorporated into the web site and Portal of the SWFDP regional subprojects.

6.2.10 Rolling Review of Requirements (RRR)

6.2.10.1 Mr Miroslav Ondráš (WMO Secretariat) informed the Steering Group of the WMO Rolling Review of Requirements (RRR) process. This included information of 14 application areas with a focus on Nowcasting and Very Short Range Forecasting (NVSRF). Statement of Guidance (SoG) for NVSRF was introduced, presenting examples of description of requirements and gaps. The current version of the Implementation Plan for the Evolution of Global Observing System (EGOS-IP) was also introduced by providing examples of actions related to surface-based and space-based observing systems. It was explained that observational requirements as well as observing capabilities can be found in the Observing System capability Analysis and Review Tool (OSCAR, http://oscar.wmo.int) available on WMO website and operated by Météo Swiss on behalf of WMO. It was noted that surface-based capabilities are still in development. The Steering Group recommended that it should review relevant observational requirements available in OSCAR and provide feedback to Inter-Programme Expert Team on Observing Systems Design and Evolution (IPET-OSDE) for their meeting in Geneva, 11-14 April 2016, through the Steering Group chairperson. In addition, the Steering Group recommended that it should review the SoG for NVSRF and provide feedback to Mr Paolo Ambrosetti (Météo Swiss).

6.2.11 Polar and high mountains

6.2.11.1 Mr Miroslav Ondráš (WMO Secretariat) informed the Steering Group of the status in the development and implementation of the Global Cryosphere Watch (GCW, http://globalcryospherewatch.org/). He mentioned that Polar and High Mountain Regions became one of the WMO strategic priorities and that Cg-17 decided to implement GCW in the current intersessional period. It was explained that GCW mission is to provide authoritative, understandable, and usable information, analyses on the past, current and future state of the cryosphere. He brought to the attention of the Steering Group, the organizational structure of GCW as well as the GCW working structure. Mr Ondráš introduced in some details current GCW activities, especially: (a) the

development of the network of surface observation with a priority to establish a core standardized network called CryoNet, its concept and minimum requirements for stations/sites to be included in CryoNet; (b) the GCW Data Portal that is being interfaces with several data holders and data providers; (c) the GCW Website providing a dynamic information on all GCW activities, including information on the state of the cryosphere; (d) the Snow Watch and its work on snow data inventory as well as its effort to improve representation and availability of snow data in GTS; (e) measurement standards and best practices and a process to reach a consensus on best practices for each variable; (f) the current GCW observational requirements that are available on GCW Website and available also through OSCAR. The Steering Group noted the GCW intention to improve observations in high mountains and presented an example of 3rd Pole where potentially 45 % of the total population depend on the High Asia Cryosphere, and therefore recommended that it should work with the GCW Steering Group in getting data and information on the state of the cryosphere that could be used in severe weather forecasting.

6.2.12 Aviation services

6.2.12.1 The Steering Group was informed of the potential links between the SWFDP and the aviation meteorological services. Local services, such as aerodrome forecasts, alerts and warnings for aviation hazards (thunderstorms, lightning, strong winds, heavy snow) would benefit significantly from the improved capacity of NMHSs for severe weather monitoring and forecasting through the SWFDP. Regional scale aviation services, like SIGMETs and advisories, could also be improved if in the scope of SWFDP in the respective areas, in particular, where long-standing deficiencies with such services exist, e.g., some parts of RA I, RA II or RA V. The Steering Group noted the plans by ICAO for further regionalization of services related to hazardous weather by establishing Regional Hazardous Weather Advisory Centres (RHWAC) in a similar manner as the existing Volcanic Ash Advisory Centres (VAAC) and Tropical Cyclone Advisory Centres (TCAC). These centres, though designated through ICAO procedures, are operated by WMO Members' NMHSs. The current plan is that the establishment of the RHWAC system would start in 2018 and would gradually be expanded into a global network of centres. There are many governance and technical issues yet to be resolved by ICAO and WMO, however, it is likely that some of the current regional centres (e.g., VAACs) would undertake also the responsibility of RHWACs. In general, the RHWAC planning should be linked to the GDPFS with relevant RSMCs as potential candidates for becoming RHWACs.

6.2.12.2 The Steering Group discussed that the local aviation forecasts and warnings are definitely within the scope of the SWFDP, moreover, for some small NMHSs (e.g., the Pacific SIDS), aviation is one of the main responsibilities. For SIGMET-type services, the relevance of SWFDP is more evident with regard to convective phenomena that pose hazards to aviation, while some other "en-route" hazards like clear air turbulence and icing, are handled through systems like the WAFS. Aircraft-based observations (e.g., AMDAR data) could be a useful data source in some areas with sparse synoptic observations, however, the NMHSs should be suitably equipped to receive and process such data.

6.2.12.3 The Steering Group noted that an Aviation Research Demonstration Project (AvRDP) has been launched and coordinated by the Hong Kong Observatory with the objective to explore the utilization of state-of-the-art nowcasting techniques for severe weather monitoring and forecasting to support air traffic management at busy aerodromes. This project has some similarities with the SWFDP; the first results of the project will be reported in July 2016 at the WWRP Symposium on Nowcasting and Very-short-rang Forecast in Hong Kong, China.

6.3 Other developments

6.3.1 WIGOS

6.3.1.1 Mr Lars Peter Riishojgaard (WMO Secretariat) provided an overview of the WMO Integrated Global Observing System (WIGOS). The Steering Group noted that WIGOS is a WMO foundational activity addressing the observational needs of the weather, climate, water and environmental services of its Members; and provides a framework for integrating all WMO observing systems and WMO contributions to co-sponsored observing systems under a common regulatory and management framework. The Steering Group was informed of the WIGOS implementation and pre-operational phases, and noted their five main priority areas:

a) WIGOS Regulatory Material, supplemented with necessary guidance material;

b) WIGOS Information Resource, including the Observing Systems Capabilities analysis and Review tool (OSCAR, http://oscar.wmo.int), especially OSCAR/Surface;

c) WIGOS Data Quality Monitoring System (WDQMS);

d) Regional Structure, including Regional WIGOS Centres;

e) National WIGOS Implementation, coordination and governance mechanisms.

6.3.1.2 The Steering Group noted that the Rolling Review of Requirements (RRR) is supported by three key databases of OSCAR: (1) OSCAR/Requirements, in which “technology free” requirements are provided for each application area; (2) OSCAR/Space, listing the capabilities of all satellite sensors, whether historical, operational or planned; and OSCAR/Surface, which lists surface-based capabilities, developed by MeteoSwiss for WMO (in beta-testing). The Steering Group discussed possible synergies between SWFDP and WIGOS, and noted that (1) OSCAR/Surface would become operational on 2 May 2016, and over the next two years, WMO Pub. 9, Vol. A would be phased out and replaced by OSCAR/Surface as the main WMO station catalog; (2) SWFDP could help both WIGOS and itself by ensuring that relevant requirements are captured in OSCAR/Requirements; (3) taken together, these two OSCAR components are a valuable source of guidance on where to invest in additional observing systems; and (4) WIGOS capacity development components of relevance to SWFDP include: (a) support for planning and developing/rehabilitating observing networks; (b) education and training in managing observing networks; (c) support for improved integration of satellite data into operational work of NMHS; and (d) support for development of regional radar mosaics.

6.3.2 WIS

6.3.2.1 Mr Steve Foreman (WMO Secretariat) outlined the intent and structure of the WMO Information System (WIS). WIS aimed to improve the availability of information in support of all WMO Programmes, and extended beyond the capabilities of the Global Telecommunications System (GTS). It allowed users to discover sources of information, how to access them and to retrieve the information. Information that was designated for global exchange was available directly from the Global Information System Centres, either for ad hoc download or for routine delivery by email or ftp. Each GISC contained the same catalogue of information that was available, built from WIS Discovery Metadata records provided by the data suppliers.

6.3.2.2 The Steering Group noted that information used within the SWFDP should be registered in the WIS using metadata records, even if the data themselves were only available to authorized institutions. That would allow users to discover that the information existed, and would make it possible for routine supply of information directly from the GISCs in the future. The balance between routine delivery and on-demand access from a web site would depend on how the information was to

be used and on the strength of protection required for the information. The Steering Group stressed the need to strengthen the links with WIS to ensure the long-term sustainability of the SWFDP.

7. SUPPORT BY GLOBAL CENTRES

7.1 ECMWF

7.1.1 Mr Erik Anderson (ECMWF) provided background information on the current support and potential future role of ECMWF as a global centre supporting SWFDP. The Steering Group noted that ECMWF supports the SWFDP regional subprojects in Southern Africa, South Pacific and Eastern Africa. Similar support is planned to be developed for Southeast Asia, Bay of Bengal and Central Asia. An agreed set of forecast charts is provided separately for each SWFDP subproject via the ECMWF web pages (www.ecmwf.int) via user registration and login.

7.1.2 The Steering Group noted that since 2014, the specific training course for WMO countries previously run at ECMWF has been replaced by specific, targeted training activities. There had been an increasing administrative overhead associated with the WMO edition of the course, and it was felt that training a number of forecasters in their regional settings (or organizations) would have a higher impact in terms of learning. The Reading-based ECMWF training courses for forecasters still offers a few places annually to participants from WMO countries and the WMO provides financial support for these participants, often targeting participation from the SWFDP countries. In addition, ECMWF actively participates in training activities organised by the WMO under the SWFDP framework, including the SWFDP – Eastern Africa trainings in Rwanda (Nov 2014) and in Ethiopia (Nov 2015), and remotely for the SWFDP – Central Asia (Feb 2016). The topics were: (a) ensemble prediction system and probabilistic forecasting: supporting decision making processes; and (b) forecasting severe weather events: use of ECMWF's products.

7.1.3 The Steering Group noted that NMHS of Viet Nam, who hosts the regional centre for the SWFDP – Southeast Asia, is in a special situation as the NMHS had acquired a license to use ECMWF forecast products for official duty use (the so called NMHS non-commercial license). While noting that the NMHS of Viet Nam is an advanced user of ECMWF forecast products and uses ECMWF data to initialize models, it cannot pass on the ECMWF products to participating countries in the SWFDP – Southeast Asia, however is able to use the ECMWF to produce the regional daily guidance products. The Steering Group also noted that ECMWF ensemble meteograms are used in all countries participating in the SWFDP – Southeast Asia.

7.1.4 The Steering Group was informed that following the request by WMO, the ECMWF Council agreed on a new licence which includes access to the interactive charts tool ecCharts. This licence is available to the NMHSs of WMO via licence for 3,500 Euros per annum. The Steering Group noted that WMO has helped promote the licence and a number of trial licences had been issued (Kenya, Tanzania and Myanmar) and access has been demonstrated. It further noted that donor funding is being used to purchase four two-year web-charts licences for Kenya, Senegal, South Africa and Tanzania, which are regional centres for SWFDP subprojects in Africa. Two further licences would be purchased for Myanmar and for India (IMD) in support of the SWFDP – Bay of Bengal. Feedback on the utility of the ECMWF web-charts license in the context of the SWFDP would be crucial input for when the ECMWF Council in 2017 would review the licence and its price.

7.1.5 The Steering Group noted that the support from advanced global centres that provide NWP/EPS and satellite-based products, and the roles played by the regional centres are critical components for the implementation of the SWFDP regional subprojects, and has been provided by in-kind contributions by WMO Members. The Steering Group enquired about the continued support by

global centres, including the ECMWF, upon completion of the SWFDP subprojects and their transition into operations, and agreed to address such sustainability issues under agenda item 9.

7.2 CMA

7.2.1 Ms Xiaoling Zhang (China) provided background information on the current support and potential future role of CMA as a SWFDP global centre. The Steering Group noted that CMA provides support to the SWFDP regional subprojects in Southeast Asia through a dedicated website (http://eng.nmc.cn/swfdp/), and that similar support is planned to be developed for the SWFDP – Bay of Bengal and SWFDP – Central Asia.

7.2.2 The Steering Group noted that CMA operates the deterministic global model, T639L60 and GRAPES-GFS, four times a day (at 00, 06, 12 and 18 UTC with a forecast range of 240 hours) with horizontal resolution 30km and 25km, respectively. CMA also operates the global ensemble prediction system, T639L60, for ten-days forecast with 15 members once a day at 12 UTC and the tropical cyclone track prediction system, GRAPES-TY, for 120-hours forecast. CMA has provided the deterministic and ensemble NWP products for the SWFDP – Southeast Asia.

7.2.3 The Steering Group also noted that CMA has the geostationary meteorological satellite, Fengyun-2E (FY-2E) and Fengyun-2F (FY-2F). They have five channels (Visible, Infra-red, Split-window, Water Vapor and Mid-infrared). FY-2 has 48 images per day at half-hourly intervals in the warm season and 24 images per day at hourly intervals in the cold season. CMA has provided the FY-2 Visible, Infra-red and Water Vapor imagine products for the SWFDP – Southeast Asia.

7.2.4 The Steering Group noted that CMA has also been very active in SWFDP training activities, by providing lecturers and resources persons to the (1) SWFDP – Southeast Asia training workshops in Hong Kong, China (July 2011), and in Bangkok, Thailand (Sept 2015); and (2) SWFDP – Central Asia in Almaty, Kazakhstan (Feb 2016).

7.2.5 The Steering Group noted that CMA is planning to improve product quality and variety by: (1) keeping products at least 7 days in website; (2) providing digital data continuously and steadily; (3) adding ensemble products (from 4 counties 20 stations to 5 countries 100 + stations); and (4) replacing T639 products by GRAPES-GFS products. CMA is committed to more actively participate in training activities organized within the framework of the SWFDP, including the support by its RTC. CMA is planning to provide the operational forecasting platform, MICAPS, to participating countries in the SWFDP regional subprojects in Southeast Asia, Bay of Bengal and Central Asia.

7.3 KMA

7.3.1 Mr Hyuncheol Shin (South Korea) provided background information on the current support and potential future role of KMA as a SWFDP global centre. The Steering Group noted that the performance of KMA's NWP system has been greatly improved since the introduction of the Unified Model (UM) system from the Met Office UK in 2010. In 2016, KMA would set up new HPC which has 5.8PF (Peta Flops) capacity and upgrade the global model by improving model dynamic core and increasing model resolution from 25km to 17km. Ensemble model, which has currently 40km horizontal resolution and 24 members, it would be also upgraded to 32 km resolution model with 49 members. The improvement of global and ensemble model would help KMA to provide the better quality products for SWFDP.

7.3.2 The Steering Group noted that in 2013, a dedicated website (http://www.kma.go.kr/ema/nema03) was established to manage KMA's international NWP cooperation activities more effectively. This website includes 3 sections: 'SWFDP', 'RAII' and 'Africa'.

'SWFDP', which is KMA's contribution to the WMO SWFDP-SeA project, provides NWP output for 71 cities in 4 South East Asian countries. 'RAII', which is KMA's contribution to the WMO RAII Project on city-specific NWP forecasts, supports 20 Asian countries (287 cities) with a range of NWP forecast products. Positive comments on the usefulness of this site have been received from several Asian countries.

7.3.3 The Steering Group noted that the Philippines became a member of SWFDP in 2012, but SWFDP products from KMA for the Philippines are not yet available. While acknowledging that is providing NWP output for 27 cities in the Philippines through the RAII Project on City-specific NWP forecasts, the Steering Group noted that KMA would complete the work to support the Philippines as a part of SWFDP shortly.

7.3.4 The Steering Group noted that KMA decided to join the SWFDP – Central Asia as a global centre. Various NWP products from global and ensemble model would be prepared for the SWFDP – Central Asia. The Steering Group further noted that KMA is already providing weather charts, Skew-T, and EPS gram for Kazakhstan, Uzbekistan, and Kyrgyzstan, through the RAII Project on City-specific NWP forecasts. KMA plans to add NWP products for Tajikistan in RA II project page supporting all participating countries in the SWFDP – Central Asia preliminarily before products for this sub-project are formally provided.

7.3.5 The Steering Group noted that in 2011, KMA established KIAPS (Korea Institute of Atmospheric Prediction System) to develop KMA's next generation global model by 2019. Once the development of KIAPS model is completed, its performance would be compared with the current global model based on the UM, and its suitability for operational use would be evaluated.

7.4 ROSHYDROMET

7.4.1 Mr Dmitry Kiktev (Russia Federation) informed the Steering Group of the support provided by Roshydromet as a global centre contributing to the SWFDP – Central Asia. The Steering Group noted that since Q3 2015, Roshydromet has provided the SWFDP – Central Asia with deterministic and ensemble medium range forecast (MRF) products. The deterministic forecasts are issued on the basis of the global semi-Lagrangian model of the atmospheric general circulation SL-AV developed by the Hydrometcentre of Russia and the Institute of Numerical Mathematics of the Russian Academy of Science. The model is used for operational medium-range prediction and as a component of the ensemble long-range forecasting system of the GPC-LRF Moscow. The ensemble medium range forecasts are combined of forecasts of two models – SL-AV and global spectral model of the Hydrometcentre of Russia. The forecast products are available at the web-site of the SWFDP – Central Asia.

7.4.2 The Steering Group noted that seasonal ensemble forecasts of the GPC-LRF Moscow on the basis of the SL-AV model are available to RCCs at the website of the WMO Lead Centre for Long-Range Forecast (LRF) Multi-Model Ensemble (LC-LRFMME). Participants of the SWFDP – Central Asia can access this information via the North EurAsia Climate Centre (NEACC) website (http://neacc.meteoinfo.ru) and the regional Climate Outlook Fora. In the prospect the existing list of the LRF products at the NEACC website is expected to be expanded by forecasts of sub-seasonal variability.

7.5 CMC

7.5.1 Mr André Giguère (Canada) provided background information on the support capacity of Canadian Meteorological Centre (CMC) and its potential future role in SWFDP. He informed the Steering Group that CMC is not currently supporting any SWFDP regional project as a global centre.

However, the Meteorological Service of Canada (MSC) has been involved in the reconstruction phase of Haitian infrastructure following the January 2010 earthquake, jointly with Météo-France, by providing forecast services to Haïti and training to Haitian forecasters. MSC sent several senior forecasters to La Martinique office of Météo-France over more than one year, in 2010-2011, to support such activities; and during the 2012 and 2013 tropical storm season, it made available for consultation access to a 24 hours – year round team of senior operational meteorologists based at its NWP Canadian Meteorological Centre. Specific products were developed based on both Global deterministic and ensemble prediction systems; these products are still made available operationally to this day.

7.5.2 The Steering Group noted that CMC has the capacity to become to support SWFDP as a global centre. Its suite of NWP system, based on the Canadian GEM model, is mature, highly performing and covers a wide range of scales in time and space. Its LAM version can be configured to any region of the globe. While noting that there does not seem to be a need to add another global centre to any of the existing SWFDP regional subprojects, there is the opportunity to include CMC as a supporting global centre in the proposed SWFDP regional subprojects in Caribbean, Southern-south America and West Africa. The Steering Group also noted that MSC operates a well-developed Training and Career Development division that could be tapped as one potential resource.

7.6 UKMO

7.6.1 Mr Ken Mylne (UK) provided background information on the current support and potential future role of the Met Office as a SWFDP global centre. The Steering Group noted that the Met Office is currently providing:

a) selection of probability charts and meteograms for the SWFDPs – Southern Africa, South Pacific and Eastern Africa, from the Met Office Ensemble System MOGREPS, which have recently been upgraded from MOGREPS-15 to the higher resolution and improved quality MOGREPS-G, although it should be noted that MOGREPS-G extends to 7 day forecasts rather than 15. In addition ensemble tephigrams are provided to SWFDP - Eastern Africa region.

b) EPS products for the SWFDP – Bay of Bengal Region, working in partnership with the NCMWRF.

c) GIFS-TIGGE products to the SWFDP – Southern Africa and SWFDP – South Pacific.

d) Recently, through the VCP, an improved website/user interface for the visualization of deterministic model data for African forecasters, provides images of a range of model fields from an Africa 'cut-out' of the Met Office Global Model (at 25km resolution), the 4km model over the extended East Africa Region, including Lake Victoria, an ATD lightning product and a range of satellite imagery. A link will be added to the site from the SWFDPs – Southern and Eastern Africa portals.

e) A 'cut-out' from the Global model (25km) for the whole of Africa with ATD lightning data (15 minute), which continues to be transmitted as GRIB data via satellite/ EUMETCAST. Met Office is working with EUMETSAT in the hope of transmitting the updated Global model, and 4km East Africa model data, via EUMETCAST later 2016.

7.6.2 The Steering Group noted that a previous 'add-on' component to the SWFDP – Eastern Africa was the daily video conferences involving the Met Office Global Guidance Unit (GGU). Although this had to be done through additional funding through WMO, it was a highly successful

development. Forecasters from Global, Regional and National Centres spoke to each other face to face and developed great working relationships and the feedback on model performance was achieved through real-time discussions about specific events. These daily conferences are still on going, although now without the Global Centre involvement. The Steering Group also noted that the Met Office has been very active in supporting training within the SWFDP – Eastern Africa, SWFDP – Southern Africa and SWFDP – South Pacific, in both forecasting and PWS aspects. Occasionally PWS Adviser support has been provided for the SWFDP – Southeast Asia training workshop, as requested.

7.6.3 The Steering Group note that the Met Office is fully committed to supporting the SWFDP, especially the training events, however as more SWFDP regional subprojects develop, Met Office's resources through VCP would naturally become more stretched, and its contributions to new regions need to be reviewed on a case-by-case basis.

7.7 JMA

7.7.1 Mr Yuki Honda (Japan) provided background information on the JMA's contribution to the SWFDP. The Steering Group noted that JMA is currently supporting the projects in Southwest Pacific, Southeast Asia, Bay of Bengal, and Central Asia; including the provision of products and providing training. JMA has developed a specialized webpage for SWFDP (http://www.wis-jma.go.jp/swfdp/), which includes deterministic products from the Global Spectral Model (GSM), probabilistic forecasts, Himawari products (i.e. imagery with heavy rainfall potential area, and dust, microphysics, true color, etc.), and TIGGE products (including tropical cyclone ensemble forecast, and occurrence probability of extreme events).

7.7.2 The Steering Group noted that JMA operates (1) the deterministic global model GSM 4D-VAR at approximately 20km resolution, up to 264h; (2) a meso-scale model 4D-VAR with 5km resolution covering Japan and its surrounding areas, up to 39h; and (3) a local forecast model 3D-VAR with 2km resolution covering Japan and its surrounding areas, up to 9h. The JMA Ensemble Prediction System (EPS) consists of 27 members, it runs twice a day up to 11 days, with horizontal resolution of approximately 40km.

7.7.3 The Steering Group noted that JMA also provides products through the "City-specific NWP products for RA II" website at http://ra2-nwp.kishou.go.jp/cityfc/[country name]. The Steering Group also noted that JMA hosts the Lead Centre for Verification of EPS (http://epsv.kishou.go.jp/EPSv/).

7.8 Météo-France

7.8.1 Mr Bernard Strauss (France) provided background information on the current support and potential future role of Météo-France as a global centre supporting SWFDP. The Steering Group recalled that Météo-France has been a contributing regional centre to the SWFDP – Southern Africa through the RSMC for Tropical Cyclone Forecasting La Réunion, and to the SWFDP – South Pacific through New Caledonia. The Steering Group was informed that Météo-France is willing to contribute to the SWFDP in development in West Africa and the Caribbean.

7.8.2 The Steering Group noted that Météo-France operates (1) the deterministic global model ARPEGE, with resolution from 7 to 36km, ranging from 12 hours to 5 days; (2) the regional model ALADIN, coupling with ARPEGE or IFS (ECMWF), at 8km, ranging from 6 to 72 hours; and (3) the non-hydrostatic high-resolution model AROME, coupling with ARPEGE, which range is up to 36 hours. Over Africa, in 2016, Météo-France would be able to provide (a) ARPEGE model (with 4DVAR data assimilation) outputs at 0.1° resolution to 10°S, 4 times a day (00, 06, 12, 18 UTC); (b) specific products for aviation; (c) wave modelling MFWAM products at 0.5° resolution, forecast range up to 5

days; and (d) downscaling to higher resolution, tailor made for specific needs. Météo-France would also be able to provide ensemble forecast products based on ARPEGE model, 35 members, 0.5° resolution, 2 times a day (00 and 18 UTC), forecast range: 90 hours at 06 UTC, 108 hours at 18 UTC. For early detection of potentially severe weather, Météo-France uses a nowcasting technique called Rapid Developing Thunderstorm (RDT), based on satellite imagery. This product is particularly relevant in data sparse areas.

7.8.3 Regarding training, Météo-France holds the following training courses at the Ecole Nationale de la Météorologie, in Toulouse: general forecasting, tropical meteorology, use of satellite imagery for forecasters, marine meteorology, aviation meteorology, among other. The Steering Group noted that dedicated training, including training for end users, can be organized in the context of the SWFDP.

8. REPORTING, INCLUDING FEEDBACK MECHANISM – DATABASE

8.1 Mr Ata Hussain (WMO Secretariat) informed the Steering Group that an SWFDP database was developed in 2013-2014 using WMO's Country Profile Database (CPDB) platform (https://www.wmo.int/cpdb/). The main objective of the SWFDP database is to facilitate the on-line submission of quarterly progress reports by SWFDP participating countries in each region, in an efficient and convenient (paper-free) way and to improve monitoring and tracking of the progress of SWFDP regional subprojects. In addition, the Steering Group noted that progress reports are also useful for WMO Secretariat in preparing feedback for the donor agencies, to secure necessary funds for the continuity and sustainability of SWFDP regional subprojects, which are generally supported through extrabudgetary resources. The database is password protected and can be accessed by the designated representatives (of the NMHSs) for SWFDP (i.e. RSMT or RTIT Members) by using their email addresses as username and after resetting their passwords. The instructions (as PDF file) on how to access to the database and passwords were distributed to the SWFDP focal points for their convenience and ease of reference. A demonstration on how to access the SWFDP database by the NMHSs (RSMT Members) through internet and on how to provide information and feedback on-line on various elements of the progress report was presented.

8.2 The Steering Group was informed that the SWFDP database became functional for submission of progress reports by the SWFDP participating countries in January 2015. Prior to making it functional (in 2014-2015), the database was tested by the WMO Secretariat and by SWFDP-Eastern Africa participating countries, including RSMC Nairobi and RFSC Dar Es Salaam, in order to identify bugs. The database was introduced to participants in the SWFDP-Southeast Asia Training Workshop (Quezon City, Philippines, June 2014) and the SWFDP-Eastern Africa Training Workshops (Kigali, Rwanda, Nov 2014; and Addis Ababa, Ethiopia, Nov 2015).

8.3 The Steering Group noted that participating NMHSs in SWFDP-Eastern Africa had started in January 2015 the online submission of their progress reports through the SWFDP database and NMHSs in SWFDP-Southeast Asia planned to start the on-line submission of progress reports in April 2016. It also noted that RSMCs Pretoria and Wellington had also been requested to test the database before its implementation in SWFDP-Southern Africa and SWFDP-South Pacific regions.

8.4 The Steering Group expressed some concerns about the complexity and amount of information required to fill the online survey and therefore recommended an event-based approach focusing on the goals of the SWFDP. In addition, the Steering Group noted that the development of the SWFDP has not been guided by the Steering Group, and has been done in parallel with the upgrade of the MetConnect Pacific website, which is also addressing the online reporting. The Steering Group therefore tasked the representatives from the most mature projects (i.e. SWFDP –

Southern Africa and SWFDP – South Pacific) to review the content of the SWFDP database and provide feedback as appropriate by end April 2016.

9. SUSTAINABILITY ISSUES

9.1 Resource Mobilization

9.1.1 Ms Mary Power (WMO Secretariat) informed the Steering Group of the potential funding mechanism to support the SWFDP. She recalled that in the recent years, SWFDP has been primarily supported by extrabudgetary funds from donor agencies, including the Word Bank, UNESCAP, Governments of Norway and Canada, AusAid, NZAid, KMA, among others. The Steering Group was informed that proposals have been prepared and submitted to:

a) USAid – to support the SWFDP in Southeast Europe, West Africa, South Pacific and Caribbean;

b) Norad – to support the SWFDP in West Africa and Eastern and Southern Africa;

c) Canada – for Multi-hazard EWS focused on SIDSs;

d) DFID – to support Lake Victoria developments and operationalization of the SWFDP – Eastern Africa. A meeting is planned to be held in Arusha in early May 2016, to better define the scope;

e) CREWS Initiative, which is not defined but clearly holds some possibilities to support SWFDP.

9.1.2 The Steering Group noted that donor agencies tend to support projects related to climate change, climate risk management and disaster risk reduction, on which SWFDP fits well. While noting that donors typically allocate funds at the national level for the modernization of NMHSs, the Steering Group was informed that regional approaches are also supported by donors.

9.1.3 The Steering Group noted that a Donor Conference will be held in WMO, from 13 to 14 April 2016, to look at sustainability of investments. It further noted that agenda is still in preparation. The Steering Group was informed that if it wants to propose representation to this Conference, a letter should be sent to the WMO Secretary-General in this regard.

9.2 Mechanism to strengthen operational centres

9.2.1 The Steering Group broke into three groups to address aspects related to the implementation of the mechanism to strengthen operational centres, which include:

a) transition of SWFDP subprojects into operations, sustainability of global and regional support, and functions of the new RSMC for Severe Weather Forecasting in the revised Manual on the GDPFS (WMO-No. 485);

b) synergies with other programmes and projects;

c) review of the SWFDP documentation.

9.2.2 The outcomes of the discussions of the two first groups are presented in Annex III to this report. The third group reported under agenda item 10.

9.3 Training

9.3.1 The Steering Group agreed that to ensure long-term sustainability of the benefits of the SWFDP, ongoing training is a major requirement, which should take place regularly and become sustainable within the regions. The Steering Group agreed on a strategy to sustain the necessary enhancement to the mentoring and training effort to empower forecasters (as a major ongoing investment needed, a key to sustainability, and way of introducing new products from advanced centres), which includes:

(a) Combining a face-to-face training (including for sharing experiences) with e-learning approaches, by involving WMO's Regional Training Centres (RTCs) for ongoing regional and national training support;
(b) Establishing and maintaining RSMC Training Desks, as a vehicle for professional development and training of forecasters from NMHSs of countries in their geographical regions and support for attendance of forecasters at such desks. This should also include participation of these NMHSs in the technical and "engineering" enhancements (modernization) to the forecasting process;
(c) Training of trainers (i.e. regional forecasters) at or with the support of global centres. This includes training at global centres' desks and global guidance service provided by advanced global centres (for specific and limited periods, typically 1 or 2 rainy season period(s)) to assist regional centres (e.g. accelerate the uptake of global NWP model outputs and satellite-based products by regional centres) in fulfilling their regional responsibilities in providing daily regional forecasting guidance to NMHSs in their geographical region;
(d) Hands-on training of national forecasters by deploying a regional forecaster to national centres (for specific and limited periods, typically 4 weeks total per year);
(e) Utilization and creation of regular/daily weather briefings by the regional centres (focused on potential for severe and high impact weather) in support of NMHSs in their geographical regions, with the participation of global centres (as appropriate);
(f) Establishing a "Training Week(s)" (e.g. webinars) focusing on specific topics to address challenges that forecasters at NMHSs have to face in forecasting (especially severe and high impact weather) that support weather, climate and hydrological services. These "Training Week(s)" would be supported by global and regional centres;

9.3.2 The Steering Group stressed the need to work with the WMO Education and Training Department for the implementation of this strategy.

10. DOCUMENTATION (updating SWFDP Overall Project Plan and the SWFDP Guidebook on Developing Regional Subprojects)

10.1 The Steering Group decided that it should focus on reviewing the SWFDP Guidebook on Developing Regional Subprojects, and that the SWFDP Overall Project Plan should be a short high-level document to be used in approaching donor agencies. It therefore reviewed the Guidebook, and requested the Secretariat to complete this task based on the discussions at the meeting and to use this document as a basis to produce the new SWFDP Overall Project Plan.

11. ANY OTHER BUSINESS (AOB)

11.1 The Steering Group reviewed its Terms of Reference (TORs) as approved by the CBS in 2015. Noting the expansion of SWFDP in to various regions and growing involvement of the lead representatives from each SWFDP regional subprojects in the Steering Group, it recognized that membership of the Steering Group need to be reviewed to ensure representation of each SWFDP regional subproject as well as of the new contributing global centres in the emerging SWFDP subprojects. It also noted that the work of Steering Group should also be carried out within the available budgetary resources at the Secretariat. It therefore revised the TORs of Steering Group including its membership for submission to the CBS for consideration during its next session. The revised TORs are available in Annex IV.

12. CLOSING

12.1 The sixth meeting of the Steering Group for the Severe Weather Forecasting Demonstration Project (SWFDP) closed at 17:00 hours on Friday, 18 March 2016.

Annex I

AGENDA

1. OPENING

2. ORGANIZATION OF THE MEETING

- 2.1 Adoption of the agenda
- 2.2 Working arrangements

3. STRATEGIC OVERVIEW OF SWFDP

- 3.1 Outcomes of WMO Constituent Body sessions related or relevant to the SWFDP
- 3.2 Strategic overview of the status of the SWFDP
- 3.3 Growing scope of SWFDP and relationship to other projects (CIFDP, FFGS, TT-IMPACT, etc.)

4. REVIEW AND EVALUATION (INCLUDING PROGRESS AND ISSUES) OF EXISTING SWFDP SUBPROJECTS (both Forecasting and PWS components)

- 4.1 Southern Africa
- 4.2 South-west Pacific
- 4.3 Eastern Africa
- 4.4 Southeast Asia
- 4.5 Bay of Bengal

5. REVIEW OF SWFDP SUBPROJECTS IN PLANNING AND/OR INITIAL DEVELOPMENT STAGE (both Forecasting and PWS components)

- 5.1 Central Asia
- 5.2 Western Africa
- 5.3 Caribbean
- 5.4 Southeast Europe
- 5.5 Southern-south America
- 5.6 Southeast Asia and Oceania

6. DEVELOPMENTS REQUIRED IN SWFDP

- 6.1 Impact-based Forecasting and Risk-based Warning services
- 6.2 Synergies with other programmes and projects
  - 6.2.1 Satellite information
  - 6.2.2 TIGGE developments
  - 6.2.3 Flash Flood Forecasting
  - 6.2.4 Tropical Cyclone Forecasting
  - 6.2.5 Marine Meteorology
  - 6.2.6 Agricultural Meteorology
  - 6.2.7 Disaster Risk Reduction
  - 6.2.8 Climate Watch
  - 6.2.9 Climate Services
  - 6.2.10 Rolling Review of Requirements
  - 6.2.11 Polar and high mountains
  - 6.2.12 Aviation services
- 6.3 Other developments
  - 6.3.1 WIGOS

6.3.2 WIS

7. SUPPORT BY GLOBAL CENTRES (current support and potential future role, including in responding to emerging requirements)
(UK, USA, ECMWF, Japan, China, Korea, Russia, France, Canada)

8. REPORTING, INCLUDING FEEDBACK MECHANISM – DATABASE

9. SUSTAINABILITY ISSUES
9.1 Resource mobilization
9.2 Mechanism to strengthen operational centres
9.3 Training

10. DOCUMENTATION (updating *SWFDP Overall Project Plan* and the *SWFDP Guidebook on Developing Regional Subprojects*)

11. ANY OTHER BUSINESS (AOB)
11.1 Terms of Reference (ToRs)

12. CLOSING

Annex II

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Annex III

OUTCOMES OF THE DISCUSSIONS IN THE BREAKOUT GROUPS
(aligned with the mechanism to strengthen operational centres, items 3 and 4)

(a) Transition of SWFDP subprojects into operations

3. Expansion of SWFDP to a Global Mechanism or Programme to Strengthen Operational Centres

3.1 The SWFDP has demonstrated the value of the Cascading Forecasting Process in strengthening NMHSs, supporting their capability to issue severe weather warnings and to build effective relationships with disaster management and civil protection authorities for disaster risk reduction. This led the World Meteorological Congress, at its sixteenth session (Cg-XVI, May 2011), to agree that SWFDP should be an end-to-end cross-programme collaborative activity that engages with all WMO programmes that concern the real-time prediction of hydro-meteorological hazards, through their respective technical commissions: from observations, to information exchange, to delivery of services to the public and a range of targeted applications/user sectors, education and training, capacity development and support to LDCs, and to the transfer of relevant promising research outputs into operations. This paper proposes a model for the development of that programme.

3.2 The SWFDP will continue to be guided by a Steering Group led from the CBS/DPFS, but now involving all relevant technical commissions and programmes.

3.3 It is proposed that this programme should be named the Severe Weather Forecasting programme (SWFP) which would still retain a close link with the well-established acronym, SWFDP during Phases 1-3. There is also a strong emphasis on operational capability through the term forecasting.

3.6 A fully operational regional component of the SWFP requires:

- *A Regional Management Team (RMT) comprising the PRs of the participating NMHSs or their representatives;*
- *A regional entity to oversee and coordinate the project activites, including support activities such as training, organising meetings and resource mobilisation (this regional entity requires to be identified before a new SWFDP is initiated);*
- *A regional centre providing forecast guidance to NMHSs in the region through the Cascading Forecasting Process, and operating and maintaining a dedicated website;*
- *National centres ensuring that appropriate warnings of severe weather are issued;*
- *Global centres providing input data and products to the regional and national centres, as agreed;*

3.8 In addition to the activities listed above, the sustainability of operational regional components will require a number of non-operational activities to be supported and funded. These activities include:

The Regional Management Team being in charge of:

- *Strategic leadership;*
- *Assess every opportunity to combine with existing activities related to severe weather, such as for flash flood forecasting, marine and aviation;*

The regional entity being in charge of organising:

- *RMT meetings around every two years;*
- *training for RSMC and NMHS staff on a regular basis, combining on-site training and making use of e-learning facilities;*
- *Resource mobilization.:*

The NMHSs being in charge of:

- *Evaluating products, including the daily severe weather forecasting guidance, and provide feedback to the Regional Centre(s)*
- *Provide criteria for severe weather warnings to the relevant Regional Centre(s) and keep them up-to-date, according to the feedback provided by the end users;*

The regional centre being in charge of:

- *Routine website maintenance, including upgrades as required;*
- *Monitoring, evaluation and reporting;*

The global centres which contributed to the demonstration phase being expected to:

- *Continue to provide support, on the understanding that their data and products would be used only for the intended purpose by the participating regional bodies and NMHSs.*

3.9 For a sub-project to transfer from the demonstration phase to the operational phase we need:

- *The requirements from the Manual on the GDPFS to be fulfilled by the global and regional centres, and where possible the participating NMCs;*
- *Additional specific criteria to be fulfilled may be defined as appropriate by the RSMT;*

The specific RSMT will then propose to the Steering Group of the SWFDP to endorse the transfer to operations.

(b) Synergies with other programmes and projects

4. Linking SWFDP with other programmes and projects

The Cg-XVI (2011) approved a vision for the SWFDP as an end-to-end cross-programme collaborative activity led by the GDPFS, in which the participants in the Projects: Make best possible use of all existing and newly developed products and facilities at the global, regional and national levels, including high-resolution NWP and ensemble prediction products, and very-short-range forecasting, including nowcasting, tools. It is recommended that:

- *The new project/program (i.e. component) should aim to implement the cascading process (refer to 2.2 of Guidebook) utilising the existing capabilities of RSMC's, where applicable.*
- *The responsibilities of each of the parties in the cascading processes should be clearly defined (refer to 2.4 of Guidebook).*
- *The benefits of the new project/program should be outlined (refer to 2.3 of Guidebook).*
- *Training on the new project/program may be run in conjunction with the SWFDP training (refer to 3.3.2.6 of Guidebook).*
- *The new project/program should have representation in the RSMT (refer to 2.3 of Guidebook) and SG-SWFDP, if required.*

- *The new project/program should be included in the Regional Sub-Project Implementation Plan. The geographic areas for the new project/program and the SWFDP should be aligned to meet the requirements of both, wherever feasible.*
- *Data format: The information could be shared as digital data in supplement to images where required to support specific applications.*
- *Data Resolution: Higher resolution data should be shared where available and required by the new project/program.*
- *Dissemination: If so desired, products for the new project/program could be disseminated using the existing SWFDP channels. If not, the new project could develop its own.*
- *Resources-Human: SWFDP has adequate and trained human resources to cater for the new project/program before it starts.*
- *Resources-Finances: Project/program willing to join with SWFDP should have own budgets to do so, for set-up and continuous operations.*

Annex IV

SWFDP STEERING GROUP: Terms of Reference

1. Giving guidance to the further development of existing and new SWFDP regional subprojects and their transition to operation
2. Monitoring and evaluating the progress of SWFDP regional subprojects
3. Managing the integration of new components in the SWFDP, including addressing synergies with other WMO Programmes and technical commissions
4. Reviewing and updating the SWFDP Overall Plan and SWFDP Guidebook
5. Developing recommendations to support the full and sustainable participation of NMHSs, including those from LDCs and SIDSs in the SWFDP

Membership

- The chairperson of the SG-SWFDP should be the chairperson of the CBS/OPAG-DPFS
- A representative from each SWFDP regional subproject
- A representative(s) of contributing global centres as appropriate (a lead global centre would collect information from other centres)
- Representatives of new participating global centres may be invited as observers
- A technical expert from PWS
- Where particularly relevant the Chairperson may invite representatives of collaborating programmes or technical commissions