

ORLD METEOROLOGICAL ORGANIZATION

COMMISSION FOR BASIC SYSTEMS

**REGIONAL SUBPROJECT MANAGEMENT TEAM (RSMT) OF
THE SEVERE WEATHER FORECASTING DEMONSTRATION
PROJECT (SWFDP) IN SOUTHEAST ASIA**

Ha Noi, Viet Nam, 10 - 13 October 2011



FINAL REPORT



1. OPENING

The Meeting of the Regional Subproject Management Team (RSMT) of the Severe Weather Forecasting Demonstration Project (SWFDP) for Southeast Asia opened at 09.30 hours on Monday, 10 October 2011, at the Headquarters of the National Hydro-Meteorological Service (NHMS) of Viet Nam, in Ha Noi, Viet Nam. Opening and welcome remarks were made by Mr Nguyen Van Tue, Deputy Director-General of the National Hydro-Meteorological Service (NHMS) of Viet Nam, Mr Nguyen Dai Khanh, Director of the Science and Technology and International Cooperation Office (NHMS), and the WMO Secretariat.

Mr Nguyen Van Tue highlighted the importance of improving the accuracy and lead-time of severe weather warnings, and to improve warning services to important users such as the media and the disaster management organizations. He acknowledged the development of the SWFDP has seen steady progress since early 2010, and that Viet Nam was pleased to host this meeting as another important step, to develop a project implementation plan. Mr Nguyen Dai Khanh noted the importance that the World Meteorological Congress had given to SWFDP, and that Executive Council had also encouraged CBS to further develop SWFDP projects in different WMO Regions.

On behalf of the Secretary-General, Mr Peter Chen noted the ever-increasing precision, reliability and lead-time provided by NWP systems have led to increasingly skillful weather forecasting over the recent decade and will become even more relevant in the future. NWP systems, including Ensemble Prediction Systems (EPS), 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 NMHSs. It is in this context that the SWFDP is intended, to: 1) further explore and enhance the use and application of outputs of existing NWP systems, available through WMO, to improve severe weather forecasting in countries where sophisticated NWP outputs are poorly used; and 2) deliver warning services through the Public Weather Services (PWS) Programme.

The SWFDP represents a systematic and practical approach for building capacity, and for transferring new knowledge and skills. The SWFDP has been implemented successfully in southern Africa. A second project is in progress for 9 South Pacific Islands and a new project has just begun its demonstration in Eastern Africa.

Mr Chen expressed his gratitude to Mr Yuki Honda, representative of WMO Regional Association II to the CBS Steering Group on Severe Weather Forecasting Demonstration Project, for his hard work in leading the development of the SWFDP Southeast Asia project so far. Mr Honda agreed to act as the Chair for the meeting.

2. ORGANIZATION OF THE MEETING

2.1 Adoption of the agenda

The meeting adopted the provisional agenda, which is found in Annex 1 of this report.

2.2 Working arrangements

The meeting agreed on the organization of its working hours and session arrangements. All documents that were submitted for the consideration of the meeting have been placed on the WMO web site at:

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

linked to the banner for the meeting.

2.3 A list of the participants was completed, which is found in Annex 2 of this report.

3. INTRODUCTION TO SEVERE WEATHER FORECASTING DEMONSTRATION PROJECT (SWFDP)

3.1 Overall Framework

The Secretariat provided background information on the SWFDP framework, including guidance from the Commission for Basic Systems (CBS) provided through its Steering Group on the SWFDP, through its basic documents: *SWFDP Overall Project Plan (2010)*, and *SWFDP Guidebook for Planning Regional Subprojects (2010)*, and then described the progress made on the SWFDP-Southeast Asia project so far.

3.2 Review the outcomes of the Ha Noi Workshop (February 2010)

3.2.1 The meeting reviewed the outcomes of the Workshop on SWFDP Development for Southeast Asia (RA II), held in Ha Noi, Viet Nam, in February 2010. The workshop had concluded that the implementation of a SWFDP in Southeast Asia would be technically feasible and would bring benefits in terms of enhancement of technical capacity in operational forecasting and advancement in weather service delivery to Member countries in the region, including Cambodia, Lao PDR, Thailand and Viet Nam. Specifically, the proposed regional subproject should focus on the following severe weather events in order of decreasing priority and associated hazards such as flooding, landslides, high waves and swell:

- (a) tropical cyclone (both from the South China Sea and from the Bay of Bengal) track, intensity, structure changes and landfall process (wind and gust, rainfall and storm surge);
- (b) heavy rain triggered by tropical cyclones, SW and NE monsoon, troughs and ITCZ migration, and orography;
- (c) thunderstorms and hail associated with severe convection;
- (d) cold conditions and frost;
- (e) extreme hot and dry conditions associated with *föhn* effect.

3.2.2 The workshop also had reached the following conclusions:

- (a) the domain to be covered for monitoring, analyzing and predicting the various severe weather events was proposed to be bounded by 10°S, 40°N, 80°E and 140°E;
- (b) CMA, JMA and KMA to provide NWP guidance material as Global Centres;
- (c) Viet Nam to take up the role of Regional Forecast Support, with RSMC Tokyo and RSMC New Delhi to offer TC forecasting support, and HKO to provide training and technical support where appropriate;
- (d) Cambodia (subject to formal confirmation of interest), Lao PDR, Thailand and Viet Nam to participate as National Meteorological Centres; and
- (e) further planning to be pursued following a timeline that would launch a one-year field phase in May 2011.

3.2.3 In addition, based on the above conclusions, the workshop had made the following recommendations:

- (a) Chair of RA II WGDRS to coordinate the setting up of a small project development team to undertake the drafting of an implementation plan;
- (b) WMO Secretariat to develop a programme for the Preparatory Training;
- (c) NWP Centres to have model outputs adapted to SE Asia SWFDP domain window;
- (d) NMCs to provide operational information regarding forecasting programme;
- (e) NMCs to develop plans for: warning service delivery, communication/contact channels and outreach programmes; and the review processes of validation, feedback, analysis and reporting.
- (f) Secretariat to support NMCs efforts by providing training on design of products and

services, and in the development of cross-border exchanges of alerts and warnings.

3.2.4 The meeting acknowledged that the initial implementation of the SWFDP should only address heavy rain and strong winds, and later to consider addressing other severe weather events. Since the time of the workshop, Cambodia has confirmed its interest to join the SWFDP. As well, under the leadership of Mr Honda, working with Mr Nguyen Dai Khanh, Mr L.S. Lee, and the Secretariat, a draft implementation plan was developed (Tokyo, September 2010). As well the meeting understood that the delay of the start of the project from its original estimate of May 2011 was due to a variety of reasons, however allowed for a more reasonable development period for the project, including the project's Website by the proposed Regional Forecasting Support Centre Ha Noi. As well, a preparatory training workshop was organized and carried out, which included topics on severe weather forecasting and public weather services (Hong Kong Observatory, July 2011).

3.2.5 The meeting discussed the issue of data sharing among the countries of the project, and emphasized the importance of understanding the actual situation of real-time exchange of basic observational data on the GTS from countries of this region, which is critical for weather forecasting, especially in relation to monitoring severe weather events. In addition to basic synoptic and precipitation data, radar data exchange is also very important to monitoring the development of severe weather. All participants are encouraged to review the status of data exchange among the project's countries.

3.3 Synergy with other projects in the region

The meeting was provided with two briefings: GIFS-TIGGE products for SWFDP (MRI/JMA), and relevant activities of the National Weather Service (USA/NOAA).

GIFS-TIGGE products produced by MRI/JMA

3.3.1 On behalf of Dr Munehiko Yamaguchi (Meteorological Research Institute (MRI), JMA), Mr Yuki Honda presented the activities relevant to the Global Interactive Forecast System (GIFS) - THORPEX Interactive Grand Global Ensemble (TIGGE) project at MRI and proposed the provision of their GIFS products. The RSMT accepted this proposal and requested to MRI/JMA to provide their GIFS products to the SWFDP during the project demonstration period.

3.3.2 The MRI will provide two types of GIFS-TIGGE products for SWFDP in Southeast Asia. One is the tropical cyclone (TC) track and the other is severe weather potential such as heavy rain.

3.3.3 Regarding the TC track, MRI/JMA will provide TC track forecast and TC strike probability maps using the TIGGE CXML data under the THORPEX North Western Pacific Tropical Cyclone Track Ensemble Forecast (NWP-TCTEF) research project. The products are already available at the website (<http://tparc.mri-jma.go.jp/cyclone/login.php>) with password protection. The users should request the ID and password in accordance with the instructions provided at the Website.

3.3.4 Regarding the severe weather potential, MRI/JMA has developed a Website (http://tparc.mri-jma.go.jp/TIGGE/tigge_SWFDP.html) which displays risks of high-impact weather (i.e. heavy rainfall, extremely high/low temperature, and strong wind) using the TIGGE data from 4 global NWP/EPSC centres (ECMWF, JMA, NCEP and UKMO). The Website is automatically updated every day and includes forecast up to 15 days ahead. The meeting felt it is desirable to reduce this delay to the production time required for supporting operational forecasting.

3.3.5 It is recommended to use GIFS products of TC track in real-time operations since most of these products are available within 12 hours of the forecast run-time. However, users are reminded that the GIFS products of severe weather potential are provided on the above referred Websites, delayed 48 hours from the run-time. While forecasters could test these GIFS products

in the post-event (post-mortem) evaluation, the meeting felt it is still desirable to reduce this delay to the production time required for supporting operational forecasting.

3.3.6 A contact person about this collaboration and MRI GIFS products is Dr Munehiko Yamaguchi (email: myamaqu@mri-jma.go.jp).

Relevant activities of the National Weather Service (USA/NOAA)

3.3.7 Mr Dan Beardsley briefed the meeting on activities of the NWS that are possibly relevant to the SWFDP-SeAsia. Of particular interest is the recent establishment of a new Indo-Asia Monsoon training desk at NCEP, which will provide 4-month attachment training to selected candidates. One candidate from Cambodia has already been selected, and nominations are still being sought from Lao PDR (1 person), and Viet Nam (2 persons).

3.3.8 NOAA/NWS' NWP system's global GFS and GEFS model outputs are openly available, as well as Regional WRF modeling systems. The Secretariat will continue to coordinate with NOAA/NCEP on the requirements of the SWFDP-SeAsia. The meeting was informed that a new NWP modeling system is being developed, and will eventually replace the present centrally run suite of models.

3.3.9 Flood forecasting in the region (activities of the Mekong River Commission) could benefit from improved severe weather forecasting from the SWFDP project, once implemented. The USA Department of State is involved in the Lower Mekong Initiative. The meeting noted possible collaboration with work being undertaken at the Mekong River Commission, in particular related to a regional rainfall estimation project.

3.3.10 The meeting wished to include this information at a suitable place in the Regional Subproject Implementation Plan (RSIP) for a SWFDP in Southeast Asia.

4. SATELLITE DATA-PROCESSING SYSTEMS AND PRODUCTS FOR VERY SHORT-RANGE FORECASTING, INCLUDING NOWCASTING, IN RA II

4.1.1 The issuing of warnings of imminent threat (as part of forecasting in the first few hours of the forecasting range) requires specific tools, and therefore, in absence of adequate radar coverage, the implementation for the SWFDP of new and powerful products generated by satellite data-processing systems for very short-range forecasting is highly desired. In this context, the meeting was presented with a brief report on satellite data-processing systems and products for very-short range forecasting, including nowcasting, in RA II by JMA.

4.1.2 Mr Yoshishige SHIRAKAWA from the Meteorological Satellite Center of JMA (JMA/MSC) presented satellite products for the support of severe weather monitoring in the absence of weather radar, and expressed readiness to provide a new satellite product to member countries in Southeast Asia region, as one of JMA's contributions to the SWFDP. The RSMT welcomed and unanimously agreed to request JMA to make available the new satellite product to the project.

4.1.3 JMA provides MTSAT real-time images for various specified areas in RA II through the JMA/MSC Webpage, in order to improve the accessibility to the satellite images. JMS/MSC can make additional satellite image sectors available on the Webpage, in line with user requirements.

4.1.4 In addition to the service above, JMA/MSC will create a new satellite product for severe weather monitoring that indicates potential areas of heavy rainfall associated with

deep convective clouds, and will make the new product available to member countries in Southeast Asia in RA II over the Internet.

4.1.5 The new product comes in image form and complies with the specifications of the JPEG format. The coverage is from 30°N to 0°N and from 90°E to 120°E, but can be adjusted or divided into several smaller sectors in line with user requirements. The spatial resolution of each pixel is 0.05 degrees in both latitude and longitude.

4.1.6 It should be noted that the new product indicates only the probability or possibility of heavy rainfall as MTSAT has no function to estimate rainfall quantity or rate itself; probable or potential areas of heavy rainfall do not always match areas of actual heavy rainfall.

4.1.7 The meeting agreed to include MTSAT products into the SWFDP forecasting guidance Website, and suggested that the JMA dedicated Website for SWFDP be the best location for their inclusion. The products include MTSAT real-time imagery for the Southeast Asia sector, and the "Heavy Rainfall Potential Areas" product, windowed on the project's area. Training for forecasters on these products should be provided as part of the SWFDP training for participating forecasters.

5. CASCADING FORECASTING PROCESS: ROLES OF PARTICIPATING COUNTRIES

5.1 Global: CMA, JMA, and KMA

5.1.1 The representatives of these centres informed the meeting of the general features of their respective global and regional NWP production systems and products that contribute to the SWFDP-Southeast Asia project. The main points are summarized as follows:

Contributions of China Meteorological Administration (CMA) to SWFDP-SeA

5.1.2 Ms. Xiaoling Zhang presented the CMA's contributions to SWFDP-SeA as a global products centre. Two CMA experts participated and gave the lectures about NWP technology and severe weather forecasting technology in the SWFDP-SeA meeting in Hanoi in 2-5 February 2010. CMA dispatched a trainer, Dr Chen Yun, to the SWFDP-SeA regional training workshop on severe weather forecasting in Hong Kong China in 4-8 July 2011.

5.1.3 CMA operates a deterministic global model, T639L60, four times a day (at 00, 06, 12, and 18 UTC with a forecast range of 240 hours) with horizontal resolution 30 km. CMA also operates a global ensemble prediction system, T213L31, for ten-days forecast with 15 members once a day at 12 UTC and the tropical cyclone track prediction system, T213L31, for 120-hours forecast.

5.1.4 CMA operates the geostationary meteorological satellite, Fengyun-2E (FY-2E). It has five channels (Visible, Infra-red, Split-window, Water Vapor and Mid-infrared). FY-2E provides 48 images per day at half-hourly intervals in the warm season, and 24 images per day at hourly intervals during the cold season.

5.1.5 CMA will provide its deterministic and ensemble NWP products, and the FY-2E Visible, Infra-red and Water Vapor image products for SWFDP-SeA. The list of the products is found in Annex A of Regional Subproject Implementation Plan. All products will be provided in image format on a dedicated SWFDP Webpage of NMC/CMA: <http://www.weather.gov.cn>.

Contributions of Japan Meteorological Agency (JMA) to SWFDP-SeA

5.1.6 Mr. Yuki Honda presented JMA contributions to SWFDP in Southeast Asia (SWFDP-SeA). JMA participates in SWFDP-SeA as a global products centre, as a Regional Specialized

Meteorological Centre (RSMC Tokyo) and as a satellite centre (Meteorological Satellite Centre). JMA also plans to provide products through various projects in this region.

5.1.7 JMA hosted a meeting to develop a strategy for preparing an implementation plan for a SWFDP in Southeast Asia (SWFDP-SeA) in Tokyo in September 2010. JMA also dispatched a trainer, Mr. Masakazu Higaki, to the SWFDP-SeA regional training workshop on severe weather forecasting and warning services, which was held in Hong Kong Observatory, 4-15 July 2011.

5.1.8 JMA operates a deterministic global model, the Global Spectral Model (GSM; TL959L60), four times a day (at 00,06, and 18 UTC with a forecast range of 84 hours and at 12 UTC with a forecast range of 216 hours). JMA also operates the global ensemble prediction system for one-week forecast (WEPS) once a day at 12 UTC. More detailed information on JMA NWP systems are available on the following webpage: <http://www.jma.go.jp/jma/en/Activities/nwp.html>

5.1.9 JMA plans to provide the products of GSM and WEPS for SWFDP-SeA. The list of the products is found in Annex A of Regional Subproject Implementation Plan. It is noted that the GSM products of 00 UTC runs are limited to 84-hour forecasts while the GSM products of 12 UTC runs fully cover 5-day forecast range essential for the operation of SWFDP-SeA. It is also noted that the products of the ensemble prediction system (EPS) are only provided from 12 UTC runs as WEPS runs only once a day.

5.1.10 All products will be provided in graphical format with both low and high resolutions on the dedicated Webpage of JMA for SWFDP: <http://ddb.kishou.go.jp/swfdp/index.html>. Products of the latest 7 days are available on the Webpage. This Webpage is free from password protection and will be also linked from the SWFDP-SeA Webpage maintained by the Regional Forecasting Support Centre (RFSC) Ha Noi.

5.1.11 The RSMT was also informed of the various international services that JMA offers as a RSMC with geographical specialization: JMA Webpage under the WMO Distributed Data Bases (DDB) project, JMA project on High-resolution GRIB data of GSM, RA II Project on Provision of City-Specific NWP Products to Developing Countries, JMA Pilot Project on EPS Products, a Webpage of Lead Centre on Verification of EPS.

Contribution of KMA (Republic of Korea) to the SWFDP-SeA

5.1.12 As a result of KMA's dedicated effort, KMA NWP system has been consistently improved since 1997 when KMA started to run its first global model. But it was found that the improvement of NWP performance was not so enough to satisfy the public who want higher level of service. So, KMA established new strategy which focuses on introduction of UKMO unified model (UM) in 2008. After careful test and evaluation for 2 years, KMA finally launched UM-based NWP system operationally in 2010. The performance of KMA NWP system was greatly enhanced with introduction of UM, providing the opportunity for KMA to play a better role as a global centre of SWFDP-SeA. More qualified NWP data strongly supported weather forecasters, helping them make better decision and contributed on improving the public satisfaction greatly.

5.1.13 KMA NWP system was upgraded again in 2011 by introducing the latest version of UM and increasing the model resolution. Also 4DVAR which had been used for the global model only was coupled with the regional UM, producing more reliable prediction for heavy rainfall.

5.1.14 KMA NWP system is supported by 3rd super computer which was installed at the end of 2010. It has 682.9 Tflops peak performance, 37 times improved capacity than 2nd one.

5.1.15 KMA's operational global model which has 25km horizontal resolution and 70 layers up to 80 km will be used to provide the various products for the project. The forecast output from

ensemble model which has 40km horizontal resolution, 24 members, and same vertical configuration as the global model will be also ready for the project.

5.1.16 KMA's first geo-stationary satellite, COMS (Communication, Ocean and Meteorological Satellite) which widely covers east Asian region including southeast Asia was launched in 2010. It is expected to provide the various satellite images and products for the project, after close evaluation. AMV (Atmospheric Motion Vector) and clear sky radiance data from COMS are being tested for operational use for NWP and will be introduced in near future.

5.1.17 KMA Digital Forecast System (DFS) which was started in 2008 provides the detailed weather information focusing on the small regions such as a village or town. The DFS produces 1 or 3 hourly quantitative forecasts for 12 weather elements, based on 5km horizontal resolution model over the Korean peninsula. The implementation of a digital forecast service is expected to provide more useful weather information to the public and give benefits on economic activities, industrial interests, agricultural outputs, and transportation efficiency

5.1.18 KMA is providing the city specific NWP products for 220 cities in 18 Asian countries and the various weather charts as like MSLP, precipitation, and 500 hPa vorticity, etc. through RA II project.

5.1.19 It is expected that the experience and knowledge that have been accumulated through RA II project will help KMA to assist SWFDP more efficiently, in its role as global products centre, as specified in the RSIP.

Deutscher Wetterdienst (DWD, Germany)

5.1.20 The DWD will continue to provide the necessary global GME model data and technical support for nesting, running, and maintaining the HRM, and COSMO models, at the RFSC Ha Noi as it has been for several years.

Discussion and Remarks

5.1.21 The representatives of the NMHSs, while noting that ECMWF is providing 10 EPSgrams to each of the participating countries, requested more EPSgrams from JMA and KMA. As a useful guide to the choice of locations for EPSgrams, it was suggested that at a minimum, these additional EPSgrams should include the same 10 locations (as provided by ECMWF), and also that additional ones could be requested, however they should recognize that locations have to be well separated relative to the EPS model's grid spacing, that locations should be chosen where there are observations to verify the forecasts.

5.1.22 The meeting felt it was probably most efficient that each global products centre set up a dedicated Website to host all products that are for use by SWFDP projects (i.e. like JMA has done). A hyperlink for the Website would be inserted on the Regional Centre's Website. At a future date the Regional Centre may wish to post specific products on its own Website, for ease of access, highlighting .

5.1.2 Suitable verification information should be made available for any NWP products that are provided.

5.2 Regional: RSMC Tokyo (Japan), RSMC New Delhi (India), and Hong Kong Observatory (Hong Kong, China)

Contribution of RSMC Tokyo – Typhoon forecast to SWFDP-SeA

5.2.1 On behalf of Mr Masashi Kunitsugu, Mr Yuki Honda presented the activities of RSMC Tokyo – Typhoon forecast.

5.2.2 RSMC Tokyo participates in SWFDP-SeA as one of Regional Centres. The products and services RSMC Tokyo provides on a routine basis are listed in Annex C.2 of RSIP.

Contribution of RSMC New Delhi – Tropical Cyclone forecast to SWFDP-SeA

5.2.3 The representative of RSMC New Delhi, Dr. Mohaptra, was unfortunately not able to attend the meeting, though the comprehensive report regarding planned contribution of RSMC New Delhi was submitted to the meeting in advance.

5.2.4 The RSMT appreciate the support of RSMC New Delhi. The list of products and services RSMC New Delhi provides is included in Annex C.3 of RSIP.

Hong Kong Observatory on Training and Technical Support

5.2.5 The meeting reviewed the roles of Hong Kong, China as the regional centre for training and technical support in the SWFDP-SeA. Mr L.S. Lee of the Hong Kong Observatory (HKO) reported that a two-week preparatory training workshop was successfully held in Hong Kong from 4 to 15 July 2011. The workshop demonstrated the usefulness of numerical weather prediction products in improving severe weather forecasting services and the importance of public weather services.

5.2.6 The meeting discussed the possibility of training contents and target participants of the next training workshop. More input from the RSMT about suitable candidates for training would be sought in due course. The meeting also discussed how to assist the workshop participants to pass what they learned to the others in their own NMHSs. The use of advanced IT tools for knowledge sharing would be an option.

5.3 Regional Forecasting Support Centre (Ha Noi, Viet Nam)

5.3.1 Mr. NGUYEN Dai Khanh presented the National Hydro-Meteorological Service of Viet Nam (VHMS) contributions to SWFDP in Southeast Asia (SWFDP-SeA). VHMS participates in SWFDP-SeA under two different roles: a) as a Regional Forecasting Support Centre and b) as a National Meteorological Centre.

5.3.2 As a Regional Forecasting Support Centre, during the period from the workshop on SWFDP Development for Southeast Asia that was held in Ha Noi, in February 2010 to the training workshop at the Hong Kong Observatory (4 – 15th July 2011), work commenced on the development of the SWFDP-SeA RFSC Website, hosted at the National Centre for Hydro-Meteorological Forecasts, Ha Noi. The Viet Nam Hydro-Meteorological Service (VHMS) had already implemented or was in the process of implementing many of the necessary forecasting guidance products that are required for the SWFDP project for this region.

5.3.3 Following the training workshop, the VHMS continued carrying out a extensive amount of work including:

- Establishing the web portal which provides many products from Global Models (Japan, USA, Republic of Korea, others) for forecasters from the 4 participating countries (Viet Nam, Laos PDR, Cambodia and Thailand). The Website's address is: <http://swfdp-sea.com.vn/index>
- Providing ensemble forecast from Regional Models that running in National Center for Hydro-Meteorological Forecasting (NCHMF)
- Providing NWP guidance automatically to support forecasters with very beginning point of view about weather situations over Southeast Asia
- Starting to train the forecasters to use the ensemble forecast in operational forecast procedures, especially the one from ECMWF.

5.3.4 One of the latest experiences in using these forecasting guidance in operational work was to answer the question: when would it stop raining, for the 1000 anniversary day of Hanoi capital (10th October 2010). This experience showed the very useful and skillful NWP/EPS products, now available to forecasters.

5.3.5 The meeting was invited to visit the SWFDP-SeA Website and give comments/opinions on the Web especially on its design, contents, proposed severe weather criteria, etc. for its further improvement.

5.3.6 The meeting was pleased to note that a series of recently implemented activities of VHMS that may contribute to the SWFDP-SeA, namely:

- Installation and operation of the new doppler weather radar in Dong Ha town (Quang Tri Province);
- Installation and operation of new radiosonde station in Bach Long Vi Island;
- Purchase of ECMWF NWP products;
- Installation of CMA Cast (to be implemented in November 2011)

5.3.7 The meeting appreciated Viet Nam for its contributions to the SWFDP-SeA project and wished Viet Nam could more actively participate in the implementation of the project pilot phase that commences in April 2012.

5.4 National Meteorological Centres: Cambodia, Lao PDR, Thailand, and Viet Nam

5.4.1 The representatives of Cambodia, Lao PDR, Thailand, and Viet Nam provided updates on severe weather forecasting and warning services in their respective countries, including any changes to their forecasting and services programmes, and any follow up activities or impacts of the SWFDP training that they received at the Hong Kong Observatory, July 2011.

Cambodia

5.4.2 Ms Bin Chann Mony recalled that Cambodia had missed the opportunity to participate at the last workshop on SWFDP development for Southeast Asia that was held in Ha Noi, Viet Nam, from 2 to 5 February 2010.

5.4.3 In July 2011, Department of Meteorology (DoM) has sent the representative of the project of SWFDP to attend the Regional Training Workshop on Severe Weather Forecasting and Warning Services hold on 4 - 15 July 2011 at Hong Kong Observation, China. From the Training Workshop Department of Meteorology obtained ID and Password from Global Centre with assistance of WMO to apply and use the products for City Specific forecast. The Training Workshop on Severe Weather Forecasting and Warning Services was very helpful for Cambodian weather forecasters to access and use of NWP and EPSgram from Global and Regional Centres. These products have been in use in daily production of forecasts and warnings.

Future plans for DoM of Cambodia include:

- Training the staff more on the job training how to use NWP-EPS products and how to interpret the products guidance.
- Upgrading the internet speed for NMHS
- Increasing lead time for dissemination to the end users when severe weather is expected
- Comparing the global products with observation data

- Updating WMO web about Cambodia Weather Bulletin to WWIS webpage.
- Collaborating with mass - media on how to broadcast on time of weather information and Early Warnings to public and users.

Lao PDR

5.4.4 Ms Souvanny Phonevilay informed the meeting that following the workshop on Severe Weather Forecasting Demonstration Project (SWFDP) for Southeast Asia held in Hanoi, Viet Nam 2 - 5 February 2010, the Training Workshop on Severe Weather Forecasting and Warning Services held in Hong Kong, China 4 - 15 July 2011, the following activities were undertaken to apply to operational forecasting:

Forecasting aspects:

- On the job training for weather forecasters to access and use NWP / EPS products
- With the user ID and password the forecasters rely on the internet as essential for severe weather forecasting such as : EPS and NWP products from global and regional centres of ECMWF , JMA , CMA KMA , Hong Kong Observatory etc...
- WWRP: access to NWP-TCTEF Website with user ID and Password to get Tropical Cyclone ensemble and deterministic forecasts as well as probability maps (ECMWF, NCEP, UKMO, CMA, JMA, KMA)
- For Lao NMHS, EPS are new to weather forecasters operationally
- EPS products are very useful as extend the lead-time of forecasts and warnings and increased forecaster confidence on all forecasts.

Public Weather Services aspects - Interaction with users:

- Lao NMHS cooperated with Lao Star channel to increase on broadcasting the daily weather forecast and warning to public
- Increase number of 3-day specific city forecast as LuangNamtha and Xiengkhuang stations through NMHS Website as well through the World Weather Information Service (WWIS) at: <http://worldweather.wmo.int/>
- Incorporates with mass - media (radio, Televisions, Newspapers in publishing of meteorological and Hydrological information and Early Warnings to users. Especially delivering the warning through National Disaster Management Centre (NDMC) to local authorities.
- Sharing Information for early warning disaster risk reduction (EW/DRR) with Provincial Authority of Xiengkhuang , 15 - 19 August 2011
- National Training of Trainers on DRR planning under project strengthening the EWS of Global Facility for Disaster Reduction and Recovery (GFDRR, World Bank) at Vientiane Provinces , 29 August – 02 September 2011
- Ongoing Standard Operating Procedure (SOP) for Flood Early Warning System (EWS) development in Lao PDR, which is under the Global Facility for Disaster Reduction and Recovery (GFDRR) support to Ministry of Natural Resources by World Bank. The

Implementation EWS is for 3 provinces as pilot activities. These SOPs aim for community based SOPs actions to be taken involving agencies and communities in those areas.

Future Plan

- Continue on the job training for weather forecasters to access & use NWP / EPS products for improving the severe weather forecast at NMHS
- Upgrade the speed of the internet access at NMHS
- Increase lead time, frequency of issuing forecasts and warnings through mass media to public.
- Comparison and verification of the forecast with local observations
- Strengthening cooperates with mass media as well NDMO in publishing of meteorological and Hydrological information and Early Warnings to users
- Enhancement of awareness and preparedness of residents and have plan to timely response before flood.

Thailand

5.4.5 Ms Sugunyane Yavinchan informed the meeting that the Thailand Meteorological Department (TMD) has commenced using NWP products provided through the SWFDP to improve severe weather forecasting, especially for heavy rainfall, landslides and tropical storm events. The products from global centres gave good guidance for forecasters to issue warning information. Ensemble prediction products gave a good lead-time of alerting of these events. The EPS products from ECMWF were evaluated against observations from synoptic stations and rainfall derived from TRMM. They found that these ECMWF products are good in forecasting and supporting the warning system in the lead-time range of 24 to 48 hours. But products in the case study of Tropical Storm Nalgae with initial time at 3 October 2011, 00 UTC, forecasts at 48-72h showed some features that verified poorly for small scale heavy rainfall phenomena in central Thailand.

5.4.6 For PWS aspects, Thailand is now planning to broadcast weather forecasts and severe weather information by TMD forecasters on television. They are on the job training to become TV presenters.

Viet Nam

5.4.7 Mr Hoang Phuc Lam informed the meeting that Viet Nam, located in Southeast Asia and Member of RAI, experiences the phenomena of strong destructive winds and heavy precipitation that could cause serious flooding, either associated with tropical cyclones or other weather systems over the entire year. Climatologically, there are almost 5 – 6 tropical cyclones over East Vietnam Sea which can cause extremely heavy and large rainfall, and strong destructive winds for coastal area of Viet Nam.

5.4.8 Viet Nam joined the Severe Weather Forecasting Demonstration Project (SWFDP) with the aim to improve the ability of Viet Nam Hydro-Meteorological Service (VHMS) to forecast severe weather events and to improve the lead-time of alerting these events.

5.4.9 The VHMS has very good cooperation with Disaster Management Agency (which under Ministry of Agriculture and Rural Development), and the Central Committee for Flood and Storm Control (CCFSC). The VHMS provide daily weather forecasts, severe weather warnings (tropical

cyclones, heavy rain over Hanoi area, cold front, very hot and very cold weather), medium- and long-range meteorological forecasts. The VHMS cooperates with Viet Nam TeleVision (VTV) to broadcast the weather information/ warning to the public over cable television network, and also with Digital Television (VTC) to broadcast the weather information/ warning to the public with Natural Disaster Television Chanel (VTC14).

5.4.10 The VHMS and members of CCFSC has revised the Contengency Plan for Tropical Cyclone and Flood Warnings, in early 2011.

6. PUBLIC WEATHER SERVICES: DELIVERING SERVICES TO TARGET USER GROUPS

The RSMT discussed the desirability of appointing a national PWS focal point in each NMHS, and members representing Cambodia, Lao PDR, Thailand, and Viet Nam will inform the Secretariat of these nominations by the beginning of the demonstration phase.

6.1 Target user groups to be served or engaged in the SWFDP and the determination of their requirements

Ms Haleh Kootval, Chief of Public Weather Services Programme, WMO presented the public weather services required by main target groups of the SWFDP Project and noted that the term Main Target User Groups in the SWFDP South East Asia refers to 3 groups who need the services of participating NMSs, namely the general public, the media and the disaster management organizations. These user groups may fall into a category with specific needs such as disaster managers, or be defined as the general public which forms a much broader group and whose information needs are broader and not so clearly defined. Media is a special user group since it functions both as a client and as a partner of NMSs and serves the role of intermediary in the provision of services and information to all other user groups. For the most part, national PWS programmes and activities provide public forecasts and warnings which meet most of the needs of these user groups, although in some cases, special products and services may be required which fall outside of the NMSs' PWS mandate.

6.2 First main target group: the general public

To receive the information the public must be aware of the services available, and the means by which they can be received. Because of the breadth and diversity of this audience, the most effective means of reaching it are the mass media. For the public to believe the information, the NMS must have a public image of credibility, reliability, accuracy and timeliness. Equally important is a general programme of public education and awareness. As people are more apt to believe and act on warnings and forecasts when they are weather-literate and well informed, they should be provided with general background information on weather, climate and related issues. Education ensures that warnings and forecasts provided by the NMS are understood by its intended users. An NMS can develop educational materials such as pamphlets, posters, slides, videos, materials to be posted on its Website, which target a specific audience or topic. These materials may be developed in-house or with assistance from other agencies such as government information services, the media or commercial interests.

6.3 Second main target group: the media

Most NMSs seem to have difficulties in dealing with media organisations. A forecast or warning is simply irrelevant if it is not communicated to those who might act on the information contained therein, so NMSs need the media in order to provide a service to the ultimate end-users of public weather services. In their relationships with NMSs the media can often impose conditions and restrictions which have more to do with their own institutional needs rather than any shared concern for the ultimate end-user

Media organisations recognise excellence in areas covered by their own domain. Therefore, good communication skills will be recognised and valued by media organisations. It would also be of assistance if NMSs acquired some technical knowledge of broadcast technologies, so that they

could recognise the appropriate formats in which information should be supplied – the easier it is for a media organisation to assimilate and broadcast (or print) this information, the more likely it is to be used. Therefore, a dialogue, or two-way communication, needs to be established with media representatives through which NMS personnel can gain a full understanding of the media concerns while the media representatives can gain an appreciation of the information which can flow from the meteorological side.

6.4 Third main target group: disaster management

The development of solid working relationships with public safety and emergency management agencies, is vital to the success of the delivery of weather and warning services to this user group. NMSs should have a Disaster or Emergency Response Plan which clearly spells out individual and collective responsibilities in the face of catastrophic events. The Plan should identify responsible managers, focal points and spokespersons. It should clarify the backup responsibilities of individual offices and describe the procedures for emergency communication. It should also identify key contacts in the disaster management agencies and include relevant details. Overall, it should describe in considerable detail how the Service will meet its mandated responsibilities in the face of a catastrophe. A NMSs emergency plan should be carefully coordinated with corresponding plans of agencies with emergency responsibilities. It should be exercised on a regular basis to ensure that all staff is familiar with their responsibilities under the plan and that it meshes smoothly with the overall emergency response effort.

7. VERIFICATION OF FORECASTS AND WARNINGS, AND THEIR EVALUATION, INCLUDING USEFULNESS AND USER RESPONSE

7.1 The Secretariat made a summary briefing to the meeting regarding the motivation behind and the importance of the verification activities that will be carried out as part of the project. He noted that the document provided to the meeting is a summary of the most important aspects of verifying forecasts, in a very practical way, and encouraged everyone to take some time to study it. Training at a very general level, including exercises, was provided on this subject at the training workshop (HKO, July 2011), and will be repeated at future training workshops with more specific training on how to use contingency tables for verifying warnings and severe weather events. He encouraged all participants (NMHSs) to start gathering data on severe weather events and warnings (see information required in the implementation plan).

8. DEMONSTRATION FRAMEWORK, FEEDBACK AND REPORTING

8.1 The meeting discussed the main operating aspects of the project, including:

- The format of the project Website and portal
- Criteria (thresholds for heavy precipitation and strong winds) for alerting to severe weather in the *RFSC Daily Severe Weather Forecasting Guidance Products* charts
- Severe weather events reporting and project reporting templates
- Operational contacts information (e-mail)
- Exchange of official weather warnings among forecasters

8.2 Those aspects, for which the following agreement was reached, are incorporated into the implementation plan. The aspects written in *Italic* form require additional discussion to reach consensus:

- The design of the project Website and the image format of NWP/EPS products are agreed;
- The threshold values of *RFSC Daily Severe Weather Forecasting Guidance* are determined as follows:
 - heavy rain: 50 and 100mm (the risk over 200mm/24h should be described in discussion)
 - wind speed: 30knot over the land and 30 and 50knot over the sea

- The threshold values of EPS products Global and Regional Centres provide are determined as follows:
 - 6-hour accumulated precipitation: 25,50,100mm
 - 24-hour accumulated precipitation: 50,100mm
 - 10-meter wind speed: 20kt and 30kt
 - significant wave height: 2 m, 4 m and 6 m
 - significant wave period: 10 s and 15 s
 - Thumbnails of probability of precipitation in excess of threshold of 25, 50mm/6h at 6 hours intervals
- The RFSC Daily Severe Weather Forecasting Guidance is updated once a day at 08UTC. The Guidance provides the 5 day warning advisory starting 12 UTC.
- Inclusion of a hazard map in the RFSC daily weather forecasting guidance needs to be considered to enrich its content in the future.
- WMO Secretariat will provide the PWS contents for inclusion in a resource centre on the RFSC Ha Noi Website.
- The representatives of participating NMHSs are requested to check the accessibility to the project Website and portal and return the feedback to RFSC Ha Noi as immediately as possible.
- Dedicated website of Global and Regional Centres are to be linked from the project Website. The representatives of Global and Regional Centres are requested to provide the addresses of their websites to RFSC Ha Noi when they are ready. Further request regarding the link between the project Website and a website of each Centre could be considered by the consultation with RFSC Ha Noi.
- The idea of exchanging official weather warnings needs to be discussed more among participating NMHSs.
- RFSC Ha Noi is requested to investigate the utilization of advanced IT tools to facilitate communications among operational forecasters in participating NMHSs.

9. IMPLEMENTATION OF THE SWFDP IN SOUTHEAST ASIA

9.1 Regional Subproject Management Team

9.1.1 The meeting reviewed the regional subproject management system and in particular the responsibilities of the members who are appointed to the Regional Subproject Management Team (RSMT). Membership was confirmed, and included in the implementation plan.

9.1.2 The RSMT agreed to a new position of Regional PWS representative in the team to support PWS aspects in the project. RSMT appointed Mr L.S. Lee to this position. The Terms of Reference has been included in the Implementation Plan.

9.1.3 The RSMT supported the proposal for Mr Dai Khanh to act as the chairperson of the RSMT. However the chairperson will only be confirmed through official correspondence between WMO with the Permanent Representative of Viet Nam with WMO.

9.2 Regional Subproject Implementation Plan

9.2.1 Based on discussions under previous agenda items, the meeting reached agreement on the Regional Subproject Implementation Plan (RSIP), following guidelines provided in the "SWFDP Guidebook on Planning Regional Subprojects (Rev. 2010)".

9.2.2 A new project schedule was developed. The demonstration phase will start in April 2012, prior to the storm season 2012, and for one year duration. Three regular reports are required from the NMHSs, as specified in the RSIP, which are due at the end of August and December 2012, and April 2013.

9.2.3 The RSMT recommended to maintain development efforts during this “pilot phase” of the project, with the goal of commencing the demonstration phase in April 2012. Global and regional centres should provide all agreed products at the earliest possible date, to be included in the RFSC Ha Noi Website for use by all forecasters.

9.3 Resources to implement the RSIP

9.3.1 The RSMT noted that the full implementation of the RSIP would have important resource implications, both in staff time and financial resources, for all participating centres in order to realize benefits from the project. Members of the RSMT are encouraged to estimate the cost of their respective centres, in order to support efforts to mobilize funds from potential sources, by all participating WMO Members, and the Secretariat.

10. ANY OTHER BUSINESS (AOB)

There was no additional business arising.

11. CLOSING

The meeting of the Regional Subproject Management Team (RSMT) for the SWFDP - Southeast Asia is estimated to close at 14:15 on Thursday, 13 October 2011.

Annex I – AGENDA

- 1. OPENING**
- 2. ORGANIZATION OF THE MEETING**
 - 2.1 Adoption of the agenda
 - 2.2 Working arrangements
- 3. INTRODUCTION TO SEVERE WEATHER FORECASTING DEMONSTRATION PROJECT (SWFDP)**
 - 3.1 Overall Framework
 - 3.2 Review the outcomes of the Ha Noi Workshop (February 2010)
 - 3.3 Synergy with other projects in the region
 - GIFS-TIGGE (MRI/JMA)
 - Relevant activities of the USA NOAA/NWS
- 4. SATELLITE DATA-PROCESSING SYSTEMS AND PRODUCTS FOR VERY SHORT-RANGE FORECASTING, INCLUDING NOWCASTING, IN RA II**
- 5. CASCADING FORECASTING PROCESS: ROLES OF PARTICIPATING COUNTRIES**
 - 5.1 Global centres: CMA, JMA, and KMA
 - 5.2 Regional centres: RSMC Tokyo (Japan), RSMC New Delhi (India), and Hong Kong Observatory (Hong Kong, China)
 - 5.3 Regional Forecasting Support Centre (RSFC, Ha Noi, Viet Nam)
 - 5.4 National Meteorological Centres: Cambodia, Lao PDR, Thailand, and Viet Nam
- 6. PUBLIC WEATHER SERVICES: DELIVERING SERVICES TO TARGET USER GROUPS**
 - 6.1 Target user groups to be served or engaged in the SWFDP and the determination of their requirements
 - 6.2 The general public
 - 6.3 The media
 - 6.4 Disaster management
- 7. VERIFICATION OF FORECASTS AND WARNINGS, AND THEIR EVALUATION, INCLUDING USEFULNESS AND USER RESPONSE**
- 8. DEMONSTRATION FRAMEWORK, FEEDBACK AND REPORTING**
- 9. IMPLEMENTATION OF THE SWFDP IN SOUTHEAST ASIA**
 - 9.1 Regional Subproject Management Team (RSMT)
 - 9.2 Regional Subproject Implementation Plan (RSIP)
 - 9.3 Resources to implement the RSIP
- 10. ANY OTHER BUSINESS (AOB)**
- 11. CLOSING**

Annex II – LIST OF PARTICIPANTS

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