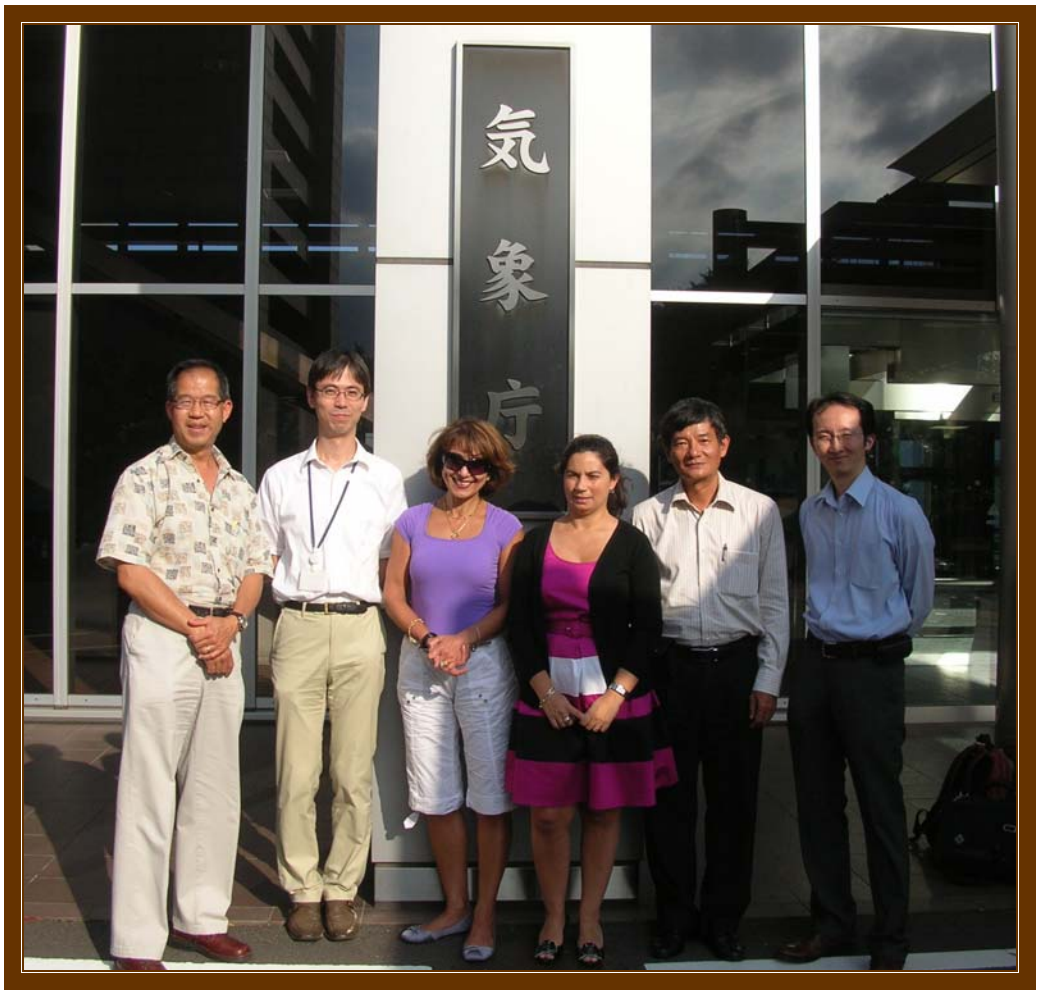
WORLD METEOROLOGICAL ORGANIZATION

COMMISSION FOR BASIC SYSTEMS

MEETING TO DEVELOP A STRATEGY FOR PREPARING AN IMPLEMENTATION PLAN FOR A SEVERE WEATHER FORECASTING DEMONSTRATION PROJECT (SWFDP) IN SOUTHEAST ASIA

TOKYO, JAPAN, 17-18 SEPTEMBER 2010

FINAL REPORT



Japan Meteorological Administration Headquarters, 18 September 2010 (left to right): Peter Chen, Yuki Honda, Haleh Kootval, Alice Soares, Nguyen Dai Khanh, Lap-Shun Lee

GENERAL SUMMARY OF THE WORK OF THE SESSION

1. OPENING

1.1 The meeting opened at 09.00 hours on Friday, 17 September 2010, at the Headquarters of Japan Meteorological Administration (JMA), in Tokyo, Japan. Opening remarks were made by the WMO Secretariat, to provide the context for the meeting.

2. ORGANIZATION OF THE MEETING

2.1 Adoption of the agenda

2.1.1 The agenda was adopted as presented, and is found in Annex I.

2.2 Working arrangements

2.2.1 The meeting agreed that Mr Yuki Honda (Japan) acts as chairperson for the meeting, and the organization of its work. The documentation for the meeting was made available through a Documentation Plan (INF. 1) and has been posted on the WMO web site at (linked to the banner for the meeting):

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

2.3 The list of participants is found in Annex II.

3. REVIEW THE OUTCOMES OF THE HA NOI WORKSHOP (FEBRUARY 2010), INCLUDING A SCHEMATIC OF THE POTENTIAL COMPONENTS OF THE SWFDP IN SOUTHEAST ASIA

3.1 The meeting reviewed the outcomes of the Workshop on SWFDP development for Southeast Asia, held in Ha Noi, Viet Nam, from 2 to 5 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 The meeting believed that the initial SWFDP demonstration should be kept simple, with a key objective in the first year to establish the demonstration framework, and therefore should include only items (a) and (b), and would consider other hazards for a later stage of the project.

3.3 The meeting agreed with the basic outcomes of the workshop, which had followed the SWFDP Guidebook on Planning Regional Sub-projects, including:

(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.

3.4 The meeting noted that Viet Nam through its NMC Ha Noi was fully prepared to operate a dedicated SWFDP Website, which would centrally collect the identified products (in the Implementation Plan that will be developed and finalized in early 2011) and provide access to the participating NMCs. Mr Dai Khanh indicated that work has already started on this SWFDP Website and is ready to include products from the global and regional centres.

3.5 NMC Ha Noi is also prepared to build its capabilities to undertake the role of producing the SWFDP Daily Guidance Product, and will soon select 4 of its forecasters to carryout the related duties, however they would need dedicated training and time to learn and build up its role as a Regional Forecasting Support Centre (“RFSC”) to the project. The meeting recognized that this is a major issue that needs urgent consideration of options, including the required training (e.g. through attachment, or expert trainer to go to Ha Noi, etc), and possibly also consider how another suitable centre could take up this role starting May 2011 for a short period of time, while RFSC Ha Noi develops and implement its own capabilities.

3.6 The meeting noted that the actions from the workshop were valid, and were being addressed.

4. ANALYSIS OF THE RESPONSES TO THE QUESTIONNAIRE FOR GATHERING INFORMATION ON FORECASTING PRODUCTS, WARNINGS AND INTERNET CAPACITY AT THE PARTICIPATING NMCs (GDPFS)

4.1 The meeting reviewed the responses to the questionnaire from Cambodia, Lao PDR, Thailand, and Vietnam. In summary, all NMHSs have warning criteria for heavy rain and strong winds, as well as for other hazards. All NMHSs access image products via the Internet, although Vietnam also accesses numeric files (e.g. GRIB, BUFR) from other centres for local processing. Cambodia and Lao PDR indicated their Internet access was essential to their forecasting responsibilities but speeds were less than or equal to 256kbps. Thailand and Vietnam indicated Internet access is essential and speeds were greater than 1 Mbps (and considered this "slow"). The meeting suggested that the NMHSs test their access to the NMC Ha Noi Web site, once it is ready for access.

4.2 The meeting learned that the Lao PDR, Thailand, and Vietnam are included in a project proposal (UN-ESCAP) to share radar data, and to develop a radar composite product for the NMHSs of the region.

5. PUBLIC WEATHER SERVICES

5.1 Response to PWS note on Service Delivery

5.1.1 The Secretariat introduced the document "Guidance on developing service delivery mechanisms in NMHSs", a PWS initiative. The NMHSs were sent this document to assist them to follow up on agreed actions. No response has yet been received in relation to these actions identified from the Ha Noi workshop (ref: workshop report, paragraph 6.6.3 (g) to (i)).

5.1.2 The meeting felt that that the work of developing service delivery related plans is a very difficult task for NMHSs and that they will require assistance to systematically build such plans. The SWFDP could be a good mechanism to assist the NMHSs, while recognizing that forecasters involved with SWFDP were not likely the suitable target audience to ensure progress. Rather, directors of NMHSs need to understand the importance of developing and supporting such plans.

5.1.3 The meeting noted that there were a few upcoming opportunities to inform and familiarize directors of NMHSs about developing and planning service delivery mechanism especially for warning services, including annual meeting of the ASEAN organization, or the RA II Technical Conference (November 2010, Rep. of Korea), or the ESCAP/Typhoon Committee.

5.1.4 The meeting felt that a concrete example of service delivery plans, illustrating the general Guidance's six steps could help NMHSs to develop their own plans. In this regard Mr Lee (HKO) agreed to provide a suitable sample(s), to share it with the

participating NMHSs, before the planned first RSMT meeting for the project. The Secretariat (PWS) agreed to review drafts of plans submitted by the participating NMHSs, and to guide them in their development.

5.2 Countries' requirements for PWS elements

5.2.1 The participants noted that in their respective countries (Japan; Hong Kong, China Viet Nam), they do have various plans related to public weather services. It was not known the situation with Cambodia, Lao PDR, and Thailand.

6. DEVELOPMENT OF A STRATEGY FOR IMPLEMENTING AN SWFDP IN SOUTHEAST ASIA

6.1 The Regional Subproject Management Team

6.1.1 The meeting reviewed the proposed membership of the Regional Subproject Management Team (RSMT), and noted that Mr Masashi Kunitsugu will represent RSMC Tokyo, while Mr Yuki Honda will represent JMA as well as the RA II member of the Steering Group of SWFDP. Mr Lap-Shun Lee will represent Hong Kong Observatory. Mr Dai Khanh will represent both the NMHS Vietnam as well as the role of NMC Ha Noi acting as the Regional Forecasting Support Centre. A draft list of members is included in the draft implementation plan, as discussed under agenda item 6.2.

6.1.2 The meeting noted that the chairperson of the RSMT in other regional SWFDP projects was decided by the RSMT, at their meeting to develop their respective implementation plans.

6.2 Drafting of the Regional Subproject Implementation Plan

6.2.1 The meeting was briefed by Mr Yuki Honda on a first draft of the Regional Subproject Implementation Plan. The meeting reviewed in detail the entire draft. The final draft of the Implementation Plan is included in Annex III. The meeting developed the list of tasks that should be completed before the next RSMT meeting (Annex IV).

7. CLOSING

7.1 The meeting closed at 15:00 on Saturday, 18 September 2010.

Annex I

AGENDA

1. OPENING

2. ORGANIZATION OF THE MEETING

2.1 Adoption of the agenda
2.2 Working arrangements

3. REVIEW THE OUTCOMES OF THE HANOI WORKSHOP (FEBRUARY 2010), INCLUDING A SCHEMATIC OF THE POTENTIAL COMPONENTS OF THE SWFDP IN SOUTHEAST ASIA

4. ANALYSIS OF THE RESPONSES TO THE QUESTIONNAIRE FOR GATHERING INFORMATION ON FORECASTING PRODUCTS, WARNINGS AND INTERNET CAPACITY AT THE PARTICIPATING NMCS (GDPFS)

5. PUBLIC WEATHER SERVICES

5.1 Response to PWS note on Service Delivery
5.2 Countries' requirements for PWS elements

6. DEVELOPMENT OF A STRATEGY FOR IMPLEMENTING AN SWFDP IN SOUTHEAST ASIA

6.1 The Regional Subproject Management Team
6.2 Drafting of the Regional Subproject Implementation Plan

7. CLOSING

Annex II

LIST OF PARTICIPANTS

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Annex III

SWFDP in South-east Asia: SWFDP-SeA

Regional Subproject Implementation Plan (Draft ver.2)

Contents

Version History

ver0	23/4/2010	Y.Honda	First circulation to Project Development Team
ver1	30/8/2010	Y.Honda	Version submitted to the meeting to develop a strategy for preparing RSIP for SWFDP-SeA (Tokyo, 17-18/9/2010).
ver2	1/10/2010	Y. Honda	Modified version as output of the above meeting. First Circulation to RSMT

1. Introduction

This section outlines the concept of the Severe Weather Forecasting Demonstration Project (SWFDP) and the foundation laid for formulation of the Regional Subproject for Southeast Asia in RA II.

1.1 Concept of SWFDP

1.1.1 Principles of SWFDP

Numerical Weather Prediction (NWP) systems have become increasingly relevant and indeed essential to the severe weather forecasting process, with a growing number and variety of sophisticated outputs, currently available from NWP producing centres, which could be beneficial to severe weather forecasting for many National Meteorological and Hydrological Services (NMHSs). The Severe Weather Forecasting Demonstration Project (SWFDP) is designed as a series of regional subprojects whose scope is to test the usefulness of NWP products produced by global and regional meteorological centres, with the goal of improving severe weather forecasting services in countries where sophisticated model outputs are currently not used.

The original focus of the project was on the phenomena of strong destructive winds and heavy precipitation that could cause serious flooding, either associated with tropical cyclones or other weather systems. Such a demonstration project would use a cascading (forecasting) approach to provide greater lead-time for severe weather and would at the same time contribute to capacity building and improving links with National Disaster Management and Civil Protection Authorities (DMCPA).

According to the recommendations of the CBS-XIII (2005), the goals of the SWFDP are defined as follows:

- to improve the ability of NMHSs to forecast severe weather events;
- to improve the lead time of alerting these events;
- to improve the interaction of NMHSswith DMCPA before and during events;
- to identify gaps and areas for improvements;
- to improve the skill of products from Global Data-Processing and Forecasting System (GDPFS) centres through feedback from NMHSs.

The CBS-Ext.(06) stressed the need to work with civil protection authorities and media organizations to improve delivery of severe weather warning services to end users. Subsequently, the Public Weather Services (PWS) and disaster risk reduction aspects have been integrated into the SWFDP.

1.1.2 The cascading process

In the framework of the general organization of the Global Data-Processing and Forecasting System (GDPFS), the SWFDP implies a coordinated functioning among three types of GDPFS centres. Conceptually, it should involve one (or more) global centre(s), one (or more) regional centre(s) and a small number of NMHSs located within the area of responsibility of the regional centre.

According to the conclusions of CBS-XIII, the proposed SWFDP is an excellent way to apply the cascading approach for forecasting severe weather in three levels, as follows:

- global NWP centres to provide available NWP products, including in the form of probabilities;
- regional centres to interpret information received from global NWP centres, run limited-area models to refine products, liaise with the participating NMCs;
- NMCs to issue alerts, advisories, severe weather warnings; to liaise and collaborate with Media, and disaster management and civil protection authorities; and to contribute to the evaluation of the project.

The SWFDP will implement a cascading forecasting process implying the participation of selected centres chosen within a geographical area affected by an agreed type of severe weather event. The cascading process aims to ensure the real-time distribution of the relevant available information produced by both a Global Centre(s) and a Regional Centre(s) to selected NMHSs. Moreover it is necessary to continue the cascade by making the final authoritative products of hazardous conditions (advisories or warnings) produced by the NMHSs available to users such as media and local Services in charge of hydrology and/or DMCPAs.

The cascading process concerns both short-range and medium-range products. In the framework of the Regional Subproject described hereafter, short-range is defined as up to and including day-2 while medium-range is defined as day-3 to day-5 inclusive. Each centre will be required to adjust and tailor the list of products to the requirements of the particular regional subproject.

A near real-time evaluation will be conducted, based on observations of the meteorological parameters collected at local meteorological stations as well as information gathered on the impacts of the severe weather phenomena as reported by DMCPA Services. This evaluation of the performance of the cascading process will then be provided as feedback to the participating centres to further fine tune the process itself.

1.1.3 Expected Benefits

The SWFDP aims to demonstrate the benefits of applying the cascading process for severe weather forecasting in the NMHSs, with the intention of not incurring research and development costs. It is viewed as way to explore how the concept could benefit several NMHSs in the same geographical region while facilitating a certain level of harmonization of forecasts and warnings to render them consistent across the region.

The SWFDP will help strengthen the links between the NMHS, the DMCPA and the media. This in turn will increase the efficiency and effectiveness of the public warning services in case of severe weather events

The SWFDP will provide the opportunity to encourage forecasters to use, and experiment with standard products and recommended procedures, which have already been introduced in GDPFS centres and which could be relevant to a number of NMHSs that have not yet used them.

The SWFDP will provide an opportunity to demonstrate and realise the benefits of new forecasting research through collaboration with the THORPEX TIGGE-GIFS project. THORPEX (The Observing System Research and Predictability Experiment) is a 10-year programme to accelerate improvements in the accuracy of 1-day to 2-week high-impact weather forecasts for the benefit of humanity. TIGGE-GIFS is developing new products, particularly from multi-model ensembles, and aims to develop the new GIFS (Global Interactive Forecast System) by developing cascading products in support of the SWFDP and involving the SERA (Societal and Economic Research & Applications) project to support effective propagation of benefits to society.

Besides, the collaboration with regional activities of other WMO programmes (i.e. research project and/or demonstration project) will produce the synergetic effect on the regional subproject of SWFDP.

1.1.4 The four phases of the SWFDP project

The SWFDP project can be divided into four phases as follows:

- Phase I: Overall Project Planning. This phase includes the preparatory work necessary to prepare the project specifications, the list of types of products to be exchanged and the work of the Project Steering Group (PSG) to identify the possible participating centres and to select suitable regional subprojects according to the geographical area, the type of severe weather and the chosen period for the experimentation.
- Phase II: Regional Subproject Implementation Planning and Execution. This phase begins with the preparation of the detailed specifications (data and products to be exchanged, performance measurements, reviewing and reporting) allowing the participants (representatives of the participating GDPFS and national centres) to develop the specific subproject implementation plan, including a training programme, and to manage its implementation and then to carry out the experimentation itself which is likely to last about one year.
- Phase III: Regional Subproject Evaluation. This phase includes the analysis and the evaluation of the entire subproject as well as contributing to the evaluation of the overall SWFDP with respect to the goals proposed initially. This phase gives the opportunity to identify gaps and deficiencies, and areas for improvement in order to ensure a sustainability of the organization tested during the regional subproject and to provide improved specifications for other similar regional subprojects.
- Phase IV: Regional Subproject Long-term Sustainability and Future Developments. This phase includes long-term sustainability of the benefits gained and a process of continual improvement. This phase gives the opportunity to continuously take

advantage of future capability and technology developments, and to foster broadening of activities in synergy with other WMO programmes. In this phase, the responsibility for management, including seeking funding, lies with the Regional Association, while the PSG continues to be informed of developments and to provide advice as appropriate.

It has to be noted that the Phase II, III and IV are specific to each regional subproject and will be repeated for each of the selected subproject. From the point of view of the project management, it is clear that the overall SWFDP project begins with the first step of the Phase I and after completion of the Phase III of the selected regional subprojects, the responsibility becomes that of the Regional Associations. It is clear also that each selected regional subproject of the SWFDP will have its own date of beginning and date of completion of Phase III and transitioning to Phase IV.

1.2 Foundation laid for formulation of the Regional Subproject for Southeast Asia

1.2.1 Regional situation in natural disaster

The region in Southeast Asia is exposed to the hazardous weather phenomena such as tropical cyclones and heavy rains that may cause the loss of human lives and properties. In 2009, the typhoon Ketsana caused the worst damage in Southeast Asia. It was formed on 23 September as tropical depression and was upgraded to typhoon early next day. After passing over Philippines, it made the landfall in Viet Nam on 29 September 2009 and hit Laos, Cambodia and Thailand. The total loss of lives is about 700 and the estimated damage reaches over $700 million to $1.0 billion USD.

(more detail would be preferred...)

(make the link between this with SWFDP)

1.2.2 Subproject approval

XIV-RAII (2009) recognized that the SWFDP has achieved significant results and benefits relative to the GDPFS and PWS programmes in its first regional project in Africa, and requested the Working Group on Disaster Risk Reduction and Service Delivery (WGDRS) to consider developing a SWFDP RA II project as a method for enhancing the GDPFS and PWS and contributing to disaster risk reduction goals in developing countries, for example, those in Southeast Asia that have recently experienced disasters.

The Workshop on Severe Weather Forecasting Demonstration Project (SWFDP) Development for Southeast Asia took place on 2 to 5 February 2010, in Hanoi, Viet Nam. The workshop 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.

The SWFDP Project Steering Group (PSG), at its third session (Geneva, Switzerland, 23-26 February 2010) decided to promote three SWFDP Regional Subprojects, including one in the Southeast Asia.

Hereafter, SWFDP in Southeast Asia is also described as SWFDP-SeA in this document.

2. Framework of the Regional Subproject in RA II – Southeast Asia

2.1 Key objectives

The key objectives of SWFDP-SeA are to produce and deliver improved severe weather forecasts and warnings services by the better use of NWP information from major NWP centres in countries where sophisticated model outputs are not currently used.

2.2 Participating countries / organizations

The participating countries and organizations in three levels of GDPFS centres are listed as follows:

- NMCs
  - Cambodia, Lao PDR, Thailand and Socialist Republic of Viet Nam
- Regional Centres
  - Hanoi (regional forecasting support)
  - Hong Kong Observatory (training and technical support)
  - RSMC Tokyo and RSMC New Delhi (Tropical Cyclone / Typhoon forecasting support)
  - DWD (possibly providing GME data needed for nesting HRM)
- Global Centres
  - China Meteorological Administration
  - Japan Meteorological Agency
  - Korea Meteorological Administration

2.3 Targeting severe weather events

The regional subproject focus on the following severe weather events in order of decreasing priority and associated hazards such as flooding, landslides, high waves and swell:

(i) 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);
(ii) heavy rain triggered by tropical cyclones, SW and NE monsoon, troughs and ITCZ migration, and orography;
(iii) thunderstorms and hail associated with severe convection;
(iv) cold conditions and frost; and
(v) extreme hot and dry conditions associated with föhn effect.

The sub-project is commencing with the first two and may consider the rest of the lists in the expanded phase.

2.4 Target domain

The domain to be covered for monitoring, analyzing and predicting the various severe weather events is proposed to be bounded by 10°S, 40°N, 80°E and 140°E (Fig. 1).

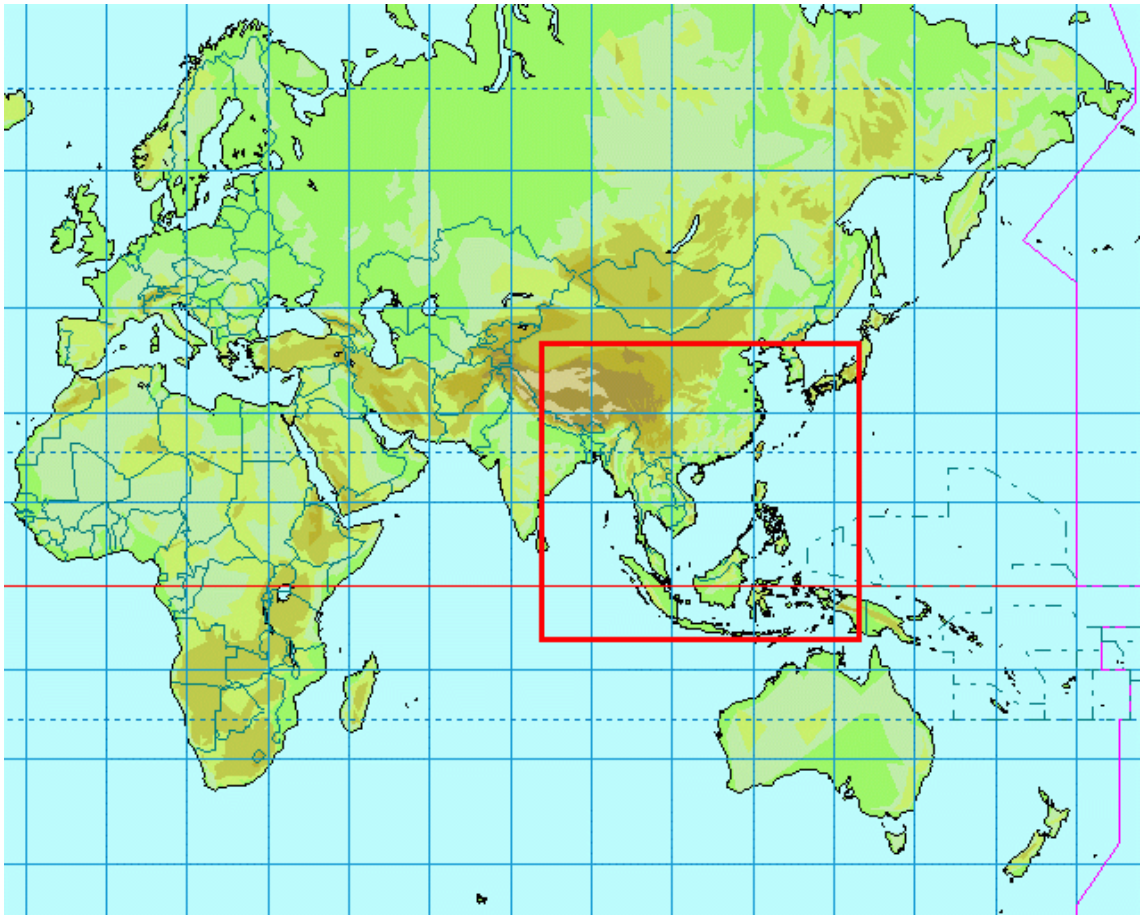

Figure 1: The red-coloured rectangle is the target domain for SWFDP-SeA.

2.5 Field phase period

The field phase will be executed from May in 2010 to May in 2011 for one year.

2.6 Project in synergy with SWFDP-SeA

The SWFDP-SeA can be provided the useful products from the following projects that are on-going or will be implemented during the field phase in the target domain :

- RA-II Pilot Project on the Provision of City-Specific NWP products
- JMA Pilot Project on EPS products
- WIS Pilot Project on Internet Virtual Private Network (VPN) in RA-II
- GIFS-Forecast Demonstration Project (FDP) (THORPEX/TIGGE/GIFS)
  - North Western Pacific Tropical Cyclone (Track) Ensemble Forecast Research Project (WWRP Research Development Project) (Mr. Watanabe?)
- RAII Pilot Project to Develop Support for NMHSs in Satellite Data, Products and Training

- Landfall Typhoon Forecast Demonstration Project (WMO-Project, ESCAP/WMO? TC) (Mr Kuroiwa)
- Flash Flood Guidance System (FFGS) in Mekong River Basin (WMO Regional Hydrology)

2.7 Possibility of development of expanded project

The SWFDP-SeA could be expanded in the future after the execution and the complete evaluation of the first field phase. During the expanded field phase, the severe weather events with lower priority (ref: Sec.2.3) could be paid more attention with additional products, some of which may be produced by new projects / initiatives in the region. Besides, more countries / organizations could be participated as the target domain is expanded.

The execution of the expanded phase would be discussed at the mid-term meeting, which is to be held to discuss the mid-term review and adjust the subproject.

3. Regional Subproject Management Team (RSMT)

A regional subproject management team (RSMT) is set up with the aim of preparing the implementation of the project and managing and controlling its execution. The management of the Regional Subproject is the responsibility of the RSMT and within the activities of CBS.

The RSMT will consult with regional groups and bodies such as the ESCAP/WMO Typhoon Committee, Regional Management Group and the WG on DRR and Service Delivery (WGDRS) in RA II and relevant ASEAN activities during the planning and implementation of the SWFDP in Southeast Asia.

3.1 Role and the responsibilities of the RSMT

The RSMT is responsible for the elaboration of an implementation plan for the Regional Subproject. The Regional Subproject Implementation Plan (RSIP) must include the following actions with milestones:

- to guide the participants in the development of the RSIP;
- to submit the RSIP to the PSG;
- to conduct preparatory training for the participants;
- to start the field phase;
- to conduct a mid-term project review;
- to submit the final report to PSG.
- to investigate the possible expansion of the current regional subproject;
- to liaise with regional groups and bodies.

3.2 Members of RSMT

The RSMT is chaired by ...

The members of the RSMT are appointed by the Permanent Representative (PR) of each participating NMHS and generally consist of the senior forecaster in charge of the forecasting team in the NMHS (able to direct and guide other forecasters). Each

member is accountable to his/her respective PRs. The list of the members of the RSMT is as follows: (The family name is written in capital letter.)

- NMHSs:
  - Ms Bin Chann MONY, Cambodia,
  - Ms Souvanny PHONEVILAY, Department of Meteorology and Hydrology, Laos, P.D.R.,
  - Mr Charoon LAOHALERTCHAI, Thai Meteorological Department, Bangkok;
- Regional Centres:
  - Mr Nguyen Dai KHAHN, National Hydro-Meteorological Service of Viet Nam,
  - Mr LEE Lap-Shun, Hong Kong Observatory
  - Mr Masashi KUNITSUGU, RSMC-Tokyo,
  - Dr M. Mohaptra, RSMC-New Delhi;
- Global Centres:
  - Ms ZHANG Xioling, China Meteorological Administration, Beijing,
  - Mr Yuki HONDA, Japan Meteorological Agency, Tokyo,
  - Mr Hyun-Cheol SHIN, Korea Meteorological Administration, Soul.

Mr Yuki HONDA (Japan Meteorological Agency, the Theme Leader in Numerical Weather Prediction Systems and Products in RA-II) is the RA II representative to the Steering Group for the SWFDP.

3.3 Responsibilities of the Members of RSMT

The tasks of the members of the management team, during the preparation phase of the SWFDP are as follows:

3.3.1 The chairperson will be responsible for:

- drafting a detailed RSIP and sharing between participating countries;
- ensuring the collaboration with other regional projects in synergy with SWFDP
- determining the requirements for and co-ordinating training activities that support the demonstration project and to provide information to WMO Secretariat;
- reporting on the project to the RA II WG on DRR and Service Delivery, RA II Management Group and ESCAP/WMO Typhoon Committee.

3.3.2 The lead person for each participating NMC will be responsible for:

- coordinating all aspects of project implementation and execution at their respective centres;
- evaluating possible data-processing developments (e.g. work required to adjust or tailor NWP products);
- arranging for forecasters in the centres to receive or have access to the agreed products;
- defining the information to be exchanged with their DMCPA and other users;
- defining the information to be transmitted to the media;
- identifying training requirements;

- preparing regular evaluation of the warnings during the field phase;
- reporting on a quarterly basis on the status of the activities in the respective centres.

3.3.3 The lead person for each participating Regional Forecasting Support Centre and Regional Centre for training and technical support will be responsible for:

- coordinating all aspects of project implementation and execution at their respective centres;
- evaluating possible data-processing developments (e.g. work required to adjust or tailor NWP products);
- identifying training requirements;
- preparing regular evaluation of the Regional Severe Weather Forecasting Guidance during the field phase;
- reporting on a quarterly basis on the status of the activities in the respective centres;
- Providing a consolidated report to the global centres.

3.3.4 The lead person for each participating Global Centre and RSMC will be responsible for:

- coordinating all aspects of project implementation and execution at their respective centres;
- evaluating possible data-processing developments (e.g. work required to adjust or tailor NWP products);

3.3.5 The regional PWS representative will be responsible for:

3.3.6 The contact person of the SWFDP Project Steering Group (PSG) will be responsible for

- liaising with the PSG on aspects of the regional subproject.

4. Responsibilities of Participating Centres in Subproject Implementation

Specific tasks are attributed to the three types of centres participating to the SWFDP in the cascading process.

4.1 The Global Centre

The responsibilities of the Global Centres are:

- to provide the other centres with medium-range NWP guidance and EPS output including probabilistic products specially adapted to the concerned severe weather events;
- to tailor products to the requirements of the Regional Centres including the provision of sub-domains and probabilistic products according to the lists given in Annex A and Annex B;
- to suggest suitable existing satellite imagery and satellite based products that are helpful in assessing the current meteorological situation, and therefore also assess the quality of global NWP/EPS products;

- to maintain a dedicated Web site to provide NWP guidance and EPS products;
- to evaluate the efficiency of products dedicated to medium-range severe weather forecasting through the feedback provided by the other centres.

4.2 The Regional Centre

There are three types of Regional Centres adopted in SWFDP-SeA. The mission of each type of Regional Centres is regional forecast support, training and technical support and tropical cyclone / typhoon forecasting support.

4.2.1 The Regional Forecasting Support Centre

The responsibilities of the Regional Forecasting Support Centre are:

- to redirect toward the NMHSs relevant products issued from the global centre (if necessary);
- to provide NMHSs with its own interpretation of the medium-range guidance, including EPS products;
- to provides the NMHSs with the short-range NWP guidance (including products adapted to severe weather events), as frequently as possible;
- to indicate existing satellite/radar imagery and satellite/radar based products that could be used for nowcasting purposes;
- to issue Daily Severe Weather Forecasting Guidance products summarizing interpretation of NWP products with respect to severe weather over the responsibility area of the NMHSs;
- to provide the other centres with short-range NWP guidance and EPS output including probabilistic products specially adapted to the concerned severe weather events;
- to tailor products to the requirements of the National Centres including the provision of sub-domains and probabilistic products according to the lists given in Annex C;
- to evaluate its own interpretation of EPS products as well as its NWP guidance;
- to provide global centres with a feedback about the usefulness and efficiency of global products;
- to facilitate the flow of all forecasting guidance information to all participating Centres in the SWFDP through a dedicated password protected Web site and portal. Ideally this Web site would be maintained on a 24/7 basis and dedicated for the Regional Subproject;
- to coordinate real-time 24/7 communications among the participating centres in the region of the project (to maintain a list of 24/7 contact information; telephone, fax, e-mail).

4.2.2 The Regional Centre for Training and Technical Support

The responsibilities of the Regional Centre are:

- to help the RSMT to organize the preparatory training workshop;
- to provide the NMHSs with the technical support in response to their requests.

4.2.3 The Regional Centres for Tropical Cyclone / Typhoon Forecasting Support

The responsibilities of the Regional Centre are:

- to provide the other centres with NWP guidance and EPS output, including probabilistic products specially adapted to tropical cyclone / typhoon;
- to provide NMHSs with its own interpretation of the NWP guidance and EPS products adapted to tropical cyclone / typhoon;
- to evaluate its own interpretation of EPS products as well as its NWP guidance;
- to facilitate the flow of all forecasting guidance information to all participating Centres in the SWFDP through a dedicated password protected Web site and portal. Ideally this Web site would be maintained on a 24/7 basis and dedicated for the Regional Subproject;

4.3 The National Meteorological Centre of the NMHS

The responsibilities of the National Meteorological Centres are:

- to interpret the guidance provided by the global centre and the regional centre;
- to issue special bulletins and warnings as required by the users (hydrological services, DMCPA services, media…) for dissemination to the end users when severe weather is expected;
- to use available nowcasting tools (satellite imagery or satellite based products, radar products) to update warnings;
- to exchange information on warnings between participating NMHS, and between NMHS and RSMC centre;
- to provide regional and global centres with a feedback on the efficiency of the global and regional products;
- to develop a communication strategy and plan with the media and end users to ensure effective response when warnings are issued;
- to establish contacts with DMCPA services and end users prior and during severe weather events;
- to obtain feedback from media, the public and other users as appropriate after the event (opportunity of warning, usefulness of warnings, lead time, degree of impacts)
- to obtain feedback from the disaster risk management agencies on utilization/benefits of warnings issued by NMHS (under the SWFDP);
- to prepare a compiled report on the severe weather events that contains all the data needed to perform the evaluation of both RSMC Daily Severe Weather Guidance relevant to the country, and actual warnings issued by the NMC;
- to evaluate the warnings;
- to develop training to facilitate improved communication with the users;
- to develop a generic basic set of standard operational procedures between NMHS and disaster risk management agencies to ensure effective use of the SWFDP products.

5. Data and Products to be issued from participating Centres

(Frequency of products and minimum products set for daily distribution should be

decided at the kick-off meeting.)

5.1 Data and Products to be issued from Global Centres

Global NWP graphical products which can be made available by the global centres CMA, JMA and KMA should be cut and formatted to fit the project area (10°S, 40°N, 80°E and 140°E).

NWP forecasts should be updated every 12 hours, or every 6 hours if available. In addition to the daily production all the forecasts should be archived for a minimum of 7 days.

The table in Annex A gives a comprehensive list of products and indicates which centre(s) will provide them. The list in Annex B shows the selected locations where the meteograms are available. (need to mention about the satellite products.)

Products which are not routinely transmitted through the GTS should be provided in graphical form (Web pages) via Internet for rapid display and dissemination. Provision of data in digital format may assist regional centres in producing charts of derived parameter.

5.1.1 Current Deterministic NWP Fields up to 5 days – at 6-h Intervals up to 2 days, 12-h intervals after 2 days)

The recommended products include:

- charts to depict the large-scale flow (e.g. 500 hPa , 700 hPa, 850 hPa geopotential height, 850 hPa temperature, upper air winds, MSLP);
- surface weather elements (e.g. 6-hour accumulated precipitation, surface (10m) wind-speed).

In tropical regions other relevant products could also include:

- charts to depict the large-scale flow (e.g. surface streamlines, 850 hPa, 700 hPa, 500 hPa, 200 hPa wind flow and relative humidity, surface streamlines);
- charts to assist with forecasts of tropical cyclone formation, movement and intensification (e.g. 850 hPa, 200hPa relative vorticity and convergence, 850-400 hPa deep layer mean flow, 850-200 hPa vertical wind shear, vertical motion);

5.1.2 Probabilistic Forecast Products based on EPS

The recommended products include:

- probability of severe weather events such as precipitation and wind higher than given thresholds;
- “spaghetti” plots (e.g. 500 hPa geopotential height in extra-tropics, precipitation and wind higher than given thresholds);
- stamp maps (e.g. streamlines in the tropics, wind speed, accumulated precipitation);

- dispersion diagrams (plumes and EPSgrams) for weather elements at specific locations;
- representative members of a classification of weather pattern such as clustering or tubing (optional product depending on possibilities of Global Centre);
- severe weather risk index such as Extreme Forecast Index (where available).

If severe weather is associated with a Tropical Cyclone other relevant products could include:

- surface or 850hPa vortex track charts;
- tropical cyclone position fix and track forecast spread (strike probability);
- tropical cyclone formation probability.

5.1.3 Satellite Imagery and Satellite based Products

The list of available satellite imagery and satellite based products that Global Centres suggest are as follows:

5.2 Data and Products to be issued from Regional Centres

Regional Forecasting Support Centre and RSMC Typhoon / Tropical Cyclone provide the different set of data and products. The Annex C gives a comprehensive list of products which Regional Centres provide.

Products which are not routinely transmitted through the GTS should be provided in graphical form (Web page) via Internet for rapid display and dissemination.

5.2.1 Current deterministic Limited Area Model fields up to 2 days at 6-hour intervals

Products could include, for example:

- charts to depict the large-scale flow (e.g. 500 hPa, 700 hPa, 850 hPa geopotential height, 850 hPa temperature, tropopause height, upper air winds, MSLP);
- surface weather elements (e.g. 6-hour accumulated precipitation, surface (10m) wind-speed and gusts (if available), 2m temperature, 850 hPa specific humidity);
- maps of vertical motion, potential vorticity or height of specified PV surface;
- maps of convective indices such as CAPE, Lifting Index, helicity…,
- relevant satellite images (where NMHSs do not have satellite receiving capability);
- special products derived from satellite images (e.g. derived precipitation or images annotated with guidance notes).

In tropical regions other relevant products could also include:

- charts to depict the large-scale flow (e.g. surface streamlines, 850 hPa, 700 hPa, 500 hPa, 200 hPa wind flow and relative humidity, surface streamlines);
- charts to assist with forecasts of tropical cyclone formation, movement and

intensification (e.g. 850 hPa, 200hPa relative vorticity and convergence, 850-400 hPa deep layer mean flow, 850-200 hPa vertical wind shear, vertical motion);

5.2.2 Regional Severe Weather Forecasting Daily Guidance

Regional Severe Weather Forecasting Daily Guidance should be issued by Regional Forecasting Support Centre Hanoi twice per day to indicate the likelihood of severe weather occurrence:

- a short range (48 h) guidance including the risk-table issued during the morning (optionally there may be a review of days 3 to 5);
- a medium range (up to 5 days) guidance issued during the afternoon.

This guidance contains:

- Synopsis of weather (analysis and forecast);
- the interpretation of deterministic and ensemble NWP products from the Global and Regional Centres;
- severe weather predictions (risk or probability estimates) including tropical cyclone information.

5.2.3 RSMC Tropical Cyclone Information/Advisory

RSMC Tropical Cyclone Information and Advisory are official information on typhoon or tropical cyclones issued by RSMC Tokyo – TC and RSMC New Delhi – TCC, respectively.

5.3 Data and Products to be issued from NMHSs

(The following sub-sections need the input from each participating NMCs.)

5.3.1 Cambodia

5.3.2 Lao P.D.R.

5.3.3 Thailand

5.3.4 Viet Nam

5.4 Data and Products to be delivered from other on-going projects or activities

The SWFDP-SeA expects the additional data and products from other on-going projects or activities in the target domain. These data and products are provided voluntarily by courtesy of these projects or activities so that these are additional materials. The available data and products are listed in ANNEX D with the contact point of respective programmes and initiatives. When the data and products become unavailable during the field phase, RSMT should contact a contact person of the programs and activities.

6. Verification of Technical Capability of participating NMCs/NMHSs

6.1 Technical feasibility

The SWFDP-SeA requests the Global and Regional Centres to provide their products on GTS or/and Internet. Therefore, the participating NMCs/NMHSs need to be

equipped with the internet infrastructure enough to accommodate the high-speed access to NWP products of foreign countries.

Regarding the PWS, the NMCs/NMHSs are requested to have the infrastructure to be developed to be able to obtain feedback from users, including media, disaster risk management agencies and pubic.

6.2 Current status of internet infrastructure and requests

6.2.1 Cambodia

The bandwidth of internet line at the NMC in Cambodia is 256 kbps. The NMHS in Cambodia relies on the internet as essential for severe weather forecasting. The internet access at the NMC is sometimes slow.

6.2.2 Lao P.D.R.

The internet access of the NMC is Asymmetric Digital Sub – Criber Line (ADSL) system whose speed normally has 128 / 256 Kbps. At the NMC the forecasters consider their internet access is slow. The forecasters rely on the Internet as essential for severe weather forecasting at the NMC such as Tropical Cyclone Advisory (RSMC products)

6.2.3 Thailand

The NMC at Thailand has the internet line whose speed has 20/6Mbps. The NMC recognized that the internet access is slow. The forecasters rely on the Internet as essential for severe weather forecasting at the NMC.

6.2.4 Viet Nam

NHMS has 3 Internet lines, including: High-speed line with 155 Mbps, normal-speed line with 5Mbps and 2Mbps. The high-speed line belongs to the Trans-Eurasia Information Network (TEIN3) and is used for accessing numeric data. The normal-speed lines are rent of ISP VDC and CMC of Viet Nam. The normal-speed line is used by forecasters for accessing graphical products from other centres.

7. PWS Aspects related to delivery of severe weather warnings

7.1 PWS Guidance on Developing Service Delivery Mechanisms in NMHSs

Effective service delivery is a fundamental requirement for NMHSs if they are to meet national needs. There are many different interpretations of the concept of service delivery as it relates to the provision of weather-, climate- and water-related services. To this end, WMO has developed a set of “Guiding Principles for Service Delivery” to guide NMHSs in the provision of weather, climate and water-related services that take into account user needs. Many of the attributes of those Guiding Principles have been incorporated into the PWS Guidance on Developing Service Delivery Mechanisms in NMHSs for the purpose of their inclusion in the development of an SWFDP in the

South East Asian region. The Guide provides step by step advice on how to deliver of effective services to users as indicated below:

Step 1: Focus on the user
Step 2: Focus on internal organization of your NMHS
Step 3: Improve communication skills of NMHS Staff
Step 4: Engage users
Step 5: Conduct Service Evaluation for Improvement

All steps are described in detail in the Guide. They specifically emphasize the importance of user focus and user feedback and evaluation as two elements that contribute to the success of SWFDP in meeting its objectives

7.2 Implementation Plan to improve the warnings and forecasts services in NMHSs

Participating NMHSs are expected to develop an implementation plan based on the Guide for achieving the improvement in delivering warnings and forecasts services to users. The plan will be tested during the field phase and be evaluated to verify its usefulness and indentify the area of improvement after the field phase. The improved plan will be applied in the following expanded field phase. (See Annex I on PWS Guidance on Developing Service Delivery)The implementation plans developed each NMHS are attached in Annex XXX.

8. Preparatory Training

8.1 Overview

Training is necessary to ensure that forecasters from Regional Centres and NMHSs are able to correctly interpret the various NWP/EPS and guidance products made available for the SWFDP regional subproject and to prepare user-focused information. Also, the training will inform forecasters of all responsibilities as outlined in the RSIP.

The training should include specific topics on coordination and collaboration between NMHSs, DMCPAs, media, governmental and non-governmental organizations and any other relevant agencies as part of the Public Weather Services component of the SWFDP. Such training should take place with reference to any documented guidelines about service delivery principles and practices.

It is important to note that any special training session devoted to a regional subproject could be planned in conjunction with existing training programmes organized by the WMO Secretariat or WMO Members. Additionally, in-country visits, especially to centres with limited human resources (forecasters) and limited capability to pass on the training locally, are of extremely value. A combination of in-country visits and 2-week training events would be ideal in the implementation of the project.

8.2 Training topics for the course

A preparatory training workshop combining DPFS and PWS requirements will be held before the start of the field phase in 2011. The SWFDP homepage and the

products from Global and Regional Centres should have been available at that time. Possible contents of this workshop are listed as follows:

- Interpretation and best practice use of deterministic and probabilistic NWP products for the forecasting of severe weather;
- Understanding and interpretation of specialized NWP products for forecasting severe weather associated with tropical cyclones:
  - Madden-Julian Oscillation (MJO) diagnostics and predictors;
  - tropical cyclone genesis parameters;
  - environmental controls on tropical cyclone movement and intensification;
  - strike probability maps;
  - Lagrangian meteograms;
  - feature-based tropical low probability maps;
  - sea state probability maps;
- Feedback mechanisms and contingency plans;
- Use of probabilities in the preparation of weather forecasts;
- Model verification as part of the forecast process;
- Interpretation of Daily Severe Weather Forecasting Guidance produced by RC Hanoi and TC guidance products produced by RSMC Tokyo and RSMC New Delhi;
- Use and applications of the SWFDP-SeA project website;
- Guidance on the completion of the SWFDP-SeA evaluation form(s);
- Coordination activities with DMCPAs
- Perhaps constructing a case-study.

Especially, PWS-related topics should typically include the following:

- User Focus
- Coordination with Disaster Prevention and Mitigation (DPM)
- Innovative Ways to Improve Working Relationships between NMHSs and DMA
- Communication Skills
- Media Skills Workshop
- Working with the Media
- Writing Workshop
- Public Education and Outreach
- Communicating Uncertainty in Forecasts
- Service Evaluation

The further more detailed information will be available later before the training workshop.

9. Evaluation

9.1 Overview

The aims of the SWFDP evaluation are:

- to assess the performances of the Regional Severe Weather Daily Guidance;
- to assess the performances of the NMHS warning system,
- to inform about the efficiency of the SWFDP system and the level of satisfaction

of the users.

To ensure that the needed information is reliably completed it is proposed that the information for the evaluation be collected by using an “evaluation form”. This evaluation form has to be completed by the NMHS when a severe weather event has been observed or when a severe weather event has been forecast (a sample template of the evaluation form is given in Annex E).

To keep regularly informed the Management Team it is proposed that each participating NMHS prepares a quarterly report. This report should contain information about the way the SWFDP is working, the feedback of the users and include a “quarterly evaluation table” containing the information needed to calculate objective scores about the performances of both Regional Severe Weather Daily Guidance and NMHS warning system. (A proposed template of this quarterly report including the quarterly evaluation table is given in the Annex F).

9.2 Continuous evaluation during the field phase

A continuous evaluation procedure must be implemented to check that the cascading process works efficiently, to assess the usefulness of guidance products in improving severe weather forecasts and the effectiveness of NMHSs in fulfilling the requirements of DMCPAs and other users. During the field phase it will be particularly important for participating NMHSs to keep regular contacts with disaster management authorities and the media to ensure smooth flow of information with a view to measuring the level of user satisfaction. The information in this continuous evaluation should be consolidated into regular quarterly progress reports.

Regular quarterly progress reports should be prepared according to the schedule in Section 10 using the format in Annex G. These progress reports should not require significant effort if the evaluation of individual events is maintained.

9.3 Spot evaluation of the specified severe weather event during the field phase

To achieve the ongoing evaluation of the Regional guidance, a form will be filled in by the NMHS and transmitted to the RFSC Hanoi. A draft template of such an evaluation bulletin is given in Annex E. It is intended that the participating NMHSs will complete the evaluation bulletin for each severe weather event (whether forecast or not). These should be completed within a week of the event and passed to the RFSC Hanoi.

The evaluation bulletin will need to be formatted in a convenient form (Excel file) in order to simplify the processing and archiving of the data. The products that have been used in the production of severe weather forecasts must also be archived for use in future case studies.

9.4 Complete evaluation after the end of the field phase

A final evaluation of the regional subproject will be carried out by the RSMT to identify gaps and areas for improvement to ensure future sustainability of the demonstrated procedures and for other similar subprojects.

In the final evaluation of the regional subproject, a qualitative assessment will be made of the success of the SWFDP related to the specific benefits of the Project and in particular the measurable improvements that have been noted in the warning services that are provided to the National Disaster Management Offices (NDMOs).

9.5 Feedback from users from the viewpoint of PWS

The feedbacks from users are quite useful to improve the severe weather forecasting services. The NMCs/NMHSs regularly obtain these feedbacks using the user assessment questionnaire in ANNEX H. This should be included in regular quarterly progress report.

10. Timetable of implementation of the field phase

When	What Task	Who RSMT Member
Feb. 10 – Feb. 11	Preparatory Work	All
Jan. 11	SWFDP-SeA RSMT meeting to review the RSIP	All
Mar.. 11	Preparatory training workshop (GDPFS/PWS)	A. Soares, WMO H. Kootval, WMO L.-S. LEE, HKO
Feb. 11 – Apr. 11	Development of NWP products	Z. Xioling, CMA Y. Honda, JMA H.-C. Shin, KMA L.-S. LEE, HKO N. Dai Khanh, VN ??, RSMC-New Delhi M. Kunitsugu, RSMC-Tokyo ??, GIFS-FDP ??, PP on Satellite
Feb. 11 – Apr. 11	Development of PWS products	H. Kootval, WMO L.-S. LEE, HKO
Feb. 11 – Apr. 11	Development of web portal (lead RC)	N. Dai Khanh, Hanoi
Apr./May 11	Set up feed to all NWP products (global and regional centres)	N. Dai Khanh, Hanoi Global and Regional Centres
Apr./May 11	Preliminary assessment of trial products and web portal	NMHSs: Cambodia, Lao P.D.R., Thailand, Viet Nam. N. Dai Khanh, Hanoi
May 11	Finalize the RSIP and start the field phase	All
Aug. 11	First quarterly report (May 11 – Jul. 11)	NMHSs: Cambodia, Lao P.D.R., Thailand, Viet Nam.
Aug. 11	First progress report (May 11 – Jul. 11)	All
Nov. 11	Second quarterly report (Aug. 11 – Oct. 11)	NMHSs: Cambodia, Lao P.D.R., Thailand, Viet Nam.
Nov. 11	Second progress report (Aug. 11 – Oct. 11)	All
Dec. 11	Mid-term meeting (adjust and discuss the expand phase) Mid-term review (May 11 – Nov. 11) and submit the interim report to WG-D SD (RA II) and the SG-	All

	SWFDP (WMO/CBS)	
Mar. 12	Third quarterly report (Dec. 11 – Feb. 12)	NMHSs: Cambodia, Lao P.D.R., Thailand, Viet Nam.
Mar. 12	Third progress report (Dec. 11 – Feb. 12)	All
Mar-Apr. 12	Training workshop	Chair
May 12	End the field phase	All
Jun. 12	Final quarterly report (Mar. 12 – May 12)	NMHSs: Cambodia, Lao P.D.R., Thailand, Viet Nam.
Jun. 12	Final progress report (Mar. 12 – May 12)	all
Q4. 12	Complete evaluation of field phase; Final Evaluation report and submit it to WG-DSD (RA II) and SG-SWFDP (WMO/CBS)	all

11. Costs

For the purpose of evaluating the total cost of the regional subproject, participating centres are required to estimate all additional costs associated with the SWFDP. This should include human costs (equivalent person-months) as well as expenditures of funds if any directly related to the project.

Financial assistance from a variety of sources will be needed to complete the project. There is potential for additional assistance as part of ongoing projects and activitiesin the region. The potential impact of field phase project-related activities on operational staffing should be considered by all participating centres.

The WMO DPFS, PWS, DRR, Regional and ETR (Education and Training), TCP programmes and RMO may be able to source funding to assist with conducting RSMT meetings and training. CBS-XIV commended the efforts of the Secretariat in supporting the SWFDP through optimising activities across WMO programmes and in seeking support from aid donors. Following the recommendations of CBS, Members are urged to seek funds from potential development partners and other agencies who stand to benefit from the important results of the SWFDP.

12. Communication and publicity of the project (Stakeholder engagement)

Informing stakeholders about the Project is an important ongoing task. There should be publicity about the initiation of the Project as well regular progress reports.

Stakeholders include:

- NMHSs in the region, including spreading information within the NMHS of the participants;
- RA II President and Management Group;
- Relevant RA II Working Groups and Theme Leaders;
- Executive Council;
- Aid agencies and development partners : Asian Development Bank, World Bank;
- ASEAN Sub-committee on meteorology and geophysics
- UNESCAP/WMO Typhoon Committee
  Mekong River Commission

- WMO Secretariat

Communication could be through newsletters, information pamphlets, presentations (e.g., at the TC sessions, regular session of RA II and other regional meetings)

This Regional Subproject Implementation Plan should be passed to stakeholders for information and feedback. Responsibility for communicating the Project and publicity is a task for all participants, but with overall coordination by the Chairman.

13. List of the Annexes

- ANNEX A: Availability of Minimum Required NWP Products from Global Centres
- ANNEX B: List of the Stations of EPSgrams provided by Global Centres
- ANNEX C: Data and Products List issued from Regional Centres
- ANNEX D: Data and Products delivered from other Programmes / Initiatives
- ANNEX E: EXAMPLE OF A SEVERE WEATHER EVENT EVALUATION FORM
- ANNEX F: EXAMPLE OF THE INFORMATION TO BE INCLUDED IN THE QUATERLY REPORT OF THE SEVERE WEATHER REGIONAL SUBPROJECT
- ANNEX G: Quarterly Evaluation Table
- ANNEX H: User Assessment Questionnaire

References

ANNEX A: Availability of Minimum Required NWP Products from Global Centres				
For the SWFDP in Southeast Asia (product list from SWFDP RAV subproject for discussion) Note that tbd means: to be determined				
Deterministic Forecasts:	Availability			
6-hourly out to 72 hours, then 12-hourly up to 144 hours	CMA	JMA	KMA	ECMWF
Parameters: wind (streamlines and speed/direction), temperature, geopotential height, humidity Levels: sfc, 925mb, 850mb, 700mb, 500mb, 300mb, 200mb Purpose: General forecasting parameters to gain a perspective on the overall atmosphere. For determination of frontal system and pressure maxima locations.				
Parameter: vorticity Level: 500mb, 300mb Purpose: Determination of frontal and low pressure system locations. Crucial in locating potential severe weather outbreak locations. Can be used in determination of severe weather type				
Parameter: vertical velocity Level: 850mb, 700mb, 300mb Purpose: Determination of mesoscale patterns of rising and sinking air masses (convective updrafts)				
Parameter: 850mb wet bulb potential temperature Level: 850mb Purpose: Frontal position diagnosis and change in airmass				
Parameters: instantaneous and accumulated precipitation, minimum temperature, maximum temperature, sea level pressure, relative humidity Level: sfc Purpose: General forecasting parameters				
Parameter: 1000-500mb thickness Level: partial atmospheric column Purpose: Freezing level determination and air mass distinguishing				
Parameter: precipitable water Level: atmospheric column Purpose: Determination of total liquid water in the atmosphere and thus potential rainfall				
Parameter: convective available potential energy (CAPE), Theta-E Level: atmospheric column Purpose: Amount of energy available in the atmosphere for storm production				
Parameter: lifted index, K index, total totals index Level: stability index Purpose: Pre-calculated indices to generalize severe weather potential				
Parameter: convective inhibition (CIN) Level: stability index Purpose: Strength of force preventing convective initiation. The amount of energy (frontal forcing or daytime heating) that is				

needed to begin convection.				
Ensemble Forecasts:	Availability			
12-hourly out to 144 hours	CMA	JMA	KMA	ECMWF
Probability of 6-hour accumulated precipitation exceeding 50mm and 100mm threshold value				
Probability of 24-hour accumulated precipitation exceeding 100mm threshold value				
Probability of 10-meter wind speed exceeding 20kt and 30kt threshold value				
Probability of significant wave height exceeding 2 m, 4 m and 6 m threshold value				
Probability of significant wave period exceeding 10 s and 15 s threshold value				
Ensemble Prediction System meteograms for specified locations				
Spaghetti diagrams for 500mb geopotential height				
Thumbnails of probability of precipitation in excess of threshold of 50mm/6h at 6 hours intervals				
ECMWF Extreme Forecast Index for precipitation and wind				
Tropical cyclone occurrence and genesis probability maps				
Tropical cyclone strike probability maps				
Tropical cyclone forecast tracks from ensemble members, including ensemble mean, deterministic and control tracks				
Tropical Cyclone Lagrangian meteograms (ECMWF)				
Other REQUESTED Products:	Availability			
	CMA	KMA	JMA	ECMWF
SKEW-T logarithmic forecast plots for selected grid points based on NWP output (out to 144 hours, 12-hourly)				

ANNEX B: List of the Stations of EPSgrams provided by Global Centres

B.1 Cambodia

B.1.1 List of stations for EPSgrams from JMA

N°	WMO id.	Station Name	Latitude	Longitude	Altitude

B.2 Lao P.D.R.

B.2.1- List of stations for EPSgrams from JMA

N°	WMO id.	Station Name	Latitude	Longitude	Altitude

B.3 Thailand

B.3.1 List of stations for EPSgrams from JMA

N°	WMO id.	Station Name	Latitude	Longitude	Altitude

B.4 Viet Nam

B.4.1 List of stations for EPSgrams from JMA

N°	WMO id.	Station Name	Latitude	Longitude	Altitude

ANNEX C: Data and Products List issued from Regional Centres

C.1 Regional Forecasting Support Centre Hanoi

C.3 RSMC Tokyo – Typhoon Centre

C.4 RSMC New Delhi – Tropical Cyclone Centre

ANNEX D: Data and Products delivered from other Programmes / Initiatives

D.1 RA-II Pilot Project on the Provision of City-Specific NWP products

D.2 JMA Pilot Project on EPS products

D.3 WIS Pilot Project on Internet Virtual Private Network (VPN) in RA-II

D.4 GIFS-Forecast Demonstration Project (FDP) (THORPEX/TIGGE/GIFS)

D.5 RAII Pilot Project to Develop Support for NMHSs in Satellite Data, Products and Training

D.6 Landfall Typhoon Forecast Demonstration Project (WMO-Project, ESCAP/WMO? TC)

D.7 North Western Pacific Tropical Cyclone (Track) Ensemble Forecast Research Project (WWRP Research Development Project)

ANNEX E: EXAMPLE OF A SEVERE WEATHER EVENT EVALUATION FORM

The proposed evaluation form should allow to evaluate the performance of the RSMC Severe Weather Forecasting Guidance and as well as the efficiency of the NMHS warning system.

It must be completed by the NMHS in both of the following cases:

- **a severe weather event has been observed; and**
- **a severe weather event has been forecast.**

The evaluation form should document the characteristics of the severe weather event (whether observed or forecast) and allow to evaluate the efficiency of the forecasts given by the RSMC Severe Weather Forecasting Daily Guidance as well as the performance of the warnings issued by the NMHS. Therefore it should include the three following sections.

Section A – Identification of the severe weather event:

- NMHS concerned;
- number of the event;
- type of event;
- region affected.

Section B – Information about the observed weather event:

- start and end times of the severe weather event;
- maximum observed value of the characteristic parameter;
- assessment about the efficiency of the warning given the DMCPA;
- information from the end-users (number of interventions, casualties, damages, usefulness of the warning).

Section C – Information about the forecast and warning issued from the NMHS:

- lead-time of the warning;
  start and end time of the severe weather event according to the forecaster's assessment;
  level of risk as indicated in the RSMC Severe Weather Forecasting Daily Guidance;
- probabilities of medium-range in the RSMC Severe Weather ForecastingDaily Guidance;
- usefulness of the various products (RSMC Guidance, various models);
- comments including information on usefulness and applicability of used tools.

How to use this evaluation form to evaluate the performance of warnings ?

The common way to evaluate the performance of a warning system is based on the 2 x 2 contingency table matrix including the number of justified warnings ("hits") "a", the number of missed severe events "b" and the number of false alarms "c". The POD index (Probability of Detection) is defined as the ratio of the number of hits by the total number of severe events, i.e., a/(a+b) ; the FAR (False Alarm Ratio) is defined as the ratio of the number of false alarms by the number warnings issued, i.e., c/(a+c).The information contained in the proposed evaluation form enables to computes the performance indicators of the warning issued by the NMHS as long as the assessment of the DMCPA (in section C) is correctly taken into consideration.

A template of an evaluation form is provided in the following pages. The evaluation form is to be filled by the NMHSs (preferably by a forecaster or manager of the forecasting unit) participating to the SWFDP regional subproject. This template can be modified with respect to the products selected for preparing the severe weather forecasts and warnings.

It is important that the design of the evaluation form be adapted to allow the data and information to be easily gathered and transformed into a tabular form. Avoid unnecessary and repetitive typing, and as much as possible to encourage and allow reliable creation and maintenance of the dataset that is needed to analyze and evaluate the performance indicators.

SEVERE WEATHER EVALUATION FORM
(Page 1)

INSTRUCTIONS: :

1. This form must be filled in whenever: (1) Severe weather is observed (Sections A and B)
   (2) A warning has been issued to DM/CPA (Sections A and C)

2. Email the completed document to RSMC Pretoria, WMO and other agreed recipients
   To standardize please put the title "SWFDP Evaluation Form" in the title list of the email

A. IDENTIFICATION OF THE SEVERE EVENT

NMHS:		Alphabetic	
Region affected:		Alphabetic	
Event Number:		Numeric	
Type of event:		Numeric	(put the right number in the cell)

1: Heavy Precipitation (indicate the most significant phenomenon,
2: Strong wind either heavy precipitation or strong wind)

Severe convection		Numeric	(put 1 if extreme phenomena are the consequence of severe convection or 0 otherwise)

B. SEVERE WEATHER OBSERVED (to be completed even if no severe weather has been forecast)

	JJ	MM	DD		HH	MM	
Start of the event:				at			UTC
End of the event:				at			UTC

Max. observed value: _____ _____ Unit
Numeric Alphabetic
(According to the event: accumulated precipitation, gusts, other significant parameter)

Information from the end-users
short text explaining the consequences and possibly some figures
(number of interventions, casualties, damages, usefulness of the warning)

SEVERE WEATHER EVALUATION FORM
(Page 2)

C. SEVERE WEATHER FORECAST (to be completed even if severe weather did not occur)

		JJ	MM	DD		HH	MM	
Time of the warning	toward DMCPA				at			UTC
Start of the event;	forecaster assessment				at			UTC
End of the event;	forecaster assessment				at			UTC

Usefulness of the warning (feedback from the DMCPA)

check in the chosen cell	
Lack of warning	
False alarm warning	
Late warning	
Useful warning	

Level of risk as appreciated by RSMC (put 1 in the chosen cell)

		No	Low	Med.	High
Level of risk	1 day before:				
Level of risk	2 days before:				

Probabilities of medium range outlooks as appreciated by RSMC

Probability	3 days before:		%
Probability	4 days before:		%
Probability	5 days before:		%

Mark for usefulness of products (put 1 in the chosen cell)

	Guidance	
	RSMC	

KEY
A = Very useful (basis of the warning)
B = Useful (aided warning confidence)
C = Neutral (not useful)
D = Negative (misleading)
X = Not used

	NWP	EPS
ECMWF		
NCEP		
Met Office		
RSMC LAM		

Comments including information on usefulness and applicability of used tools

ANNEX F: EXAMPLE OF THE INFORMATION TO BE INCLUDED IN THE QUATERLY REPORT OF THE SEVERE WEATHER REGIONAL SUBPROJECT

NMC : - - - - - - - -
PERIOD: (Start date to end date)

1. HIGHLIGHTS OVER THE PERIOD

2. OVERVIEW OF PRODUCTS

   a. Usefulness of RSMC-Devere Weather Daily Guidance
   b. Usefulness of SWFDP NWP/EPS Products received from each global centre and RSMC Limited Area Model (if available)

3. PROJECT EVALUATION AGAINST SWFDP GOALS

SWFDP GOAL	**PROGRESS AGAINST GOALS**
To improve the ability of NMCs to forecast severe weather events	
To improve the lead time of alerting these events	
To improve the interaction of NMCs with Disaster Management and Civil Protection authorities before, during and after severe weather events	
To identify gaps and areas for improvements	
To improve the skill of products from Global Centres through feedback from NMCs	

4. EVALUATION OF WEATHER WARNINGS

   A) Feedback from the public
   B) Feedback from the DMCPA to include comments of the timeliness and usefulness of the warnings
   C) Feedback from the media
   D) Warning verification by the NMCs

5. SUMMARY (general comments, challenges, etc)

6. CASE STUDY (PowerPoint presentation to include guidance products (RSMC and NWP), satellite imagery, warnings issued, impact evidence etc)

ANNEX G: Quarterly Evaluation Table

(to be fulfilled based on the Severe Weather Event Evaluation Form)

An row has to be filled in this table whenever a severe weather event is observed or a warning is issued toward DMCPA.

Starting date of the event	**SWFDP Evaluation Form Event Number**	**Type of event**	**Region affected**	**Highest observed value**	**RSMC Guidance**		**Which NWP/EPS forecast product(s) used by NMC**		**Local warnings issued?**	**Impact of the event**	**Impact of the warning**
dd/mm/yy		Indicate if extreme phenomena are the consequence of severe convection	Indicate the region of the country hit by the severe weather	specify units, according to the phenomenon	Amount predicted (same unit as in the preceding column)	Usefulness from 1 to 4 1- Misleading 2 - Not useful 3 - Useful 4 - Very useful	Indicate the model(s) used	Usefulness from 1 to 4 1- Misleading 2 - Not useful 3 - Useful 4 - Very useful	Yes or No	Damages, Casualties	According to the DMCPA assessment

ANNEX H: USER ASSESSMENT QUESTIONNAIRE

NMHS ------- (Country)

Q1. From where do you obtain weather information of your country?

1. Radio
2. Television
3. Newspaper
4. Directly from the Meteorological Service
5. Meteorological service Website
6. Other Websites
7. Mobile phones
8. Other sources (please specify)

Q2. Do you consider the warnings of severe weather of your country over the past several months accurate or inaccurate?

1. Very accurate
2. Somewhat accurate
3. Average
4. Somewhat inaccurate
5. Very inaccurate
6. Don't know / no comment(s)

Q3. How easy is it for you to understand the format and the language used in the severe weather warnings?

1. Very easy
2. Easy
3. Neutral
4. Difficult
5. Very difficult
6. Don't know / no comment(s)

Q4. How do compare the current severe weather warnings with those from the first two (2) years?

1. More accurate
2. About the same
3. Less accurate
4. Don't know / no comment(s)

Q5. Are the severe weather warnings useful in helping you decide on appropriate response action (e.g., stay at home, do not take the car out of the house, keep children indoors, etc.)?

1. yes
2. No

Q6. On the whole, how satisfied are you with the severe weather warnings provided by your country?

1. Very satisfied
2. Satisfied
3. Neutral
4. Dissatisfied
5. Very dissatisfied
6. Don't know / no comment(s)

Annex IV

LIST OF ACTIONS

The meeting agreed that the following tasks should be conducted before the next RSMT meeting:

NMC/NMHS

- Develop a Service Delivery Plan to improve PWS till the next RSMT meeting
  - WMO PWS secretariat will help to develop a implementation plan.
  - The draft will be reviewed at the meeting and will be included in the RSIP.

Regional Forecasting Support Centre Hanoi (RFSC Hanoi)

- Develop a plan to train four people of the forecasting support team in RFSC Hanoi
  - Representative of RFSC Ha Noi will consult with representatives of JMA and HKO
    - Possible action is an attachment training at JMA and/or HKO
- Review the NWP products and EPS output and update the list of products of Global Centres (ANNEX A).
- Create the format of the Regional Severe Weather Forecasting Daily Guidance
  - Representative of RFSC Ha Noi will consult with representatives of participating NMCs and representatives of Global Centres and RSMC Typhoon / Tropical Cyclone
  - Decide the common threshold value for precipitation and wind

RSMT

- All
  - Provide the information of data and products that are available for the subproject.
- PWS representative
  - Develop the ToRs of PWS representative.
  - Refine the assessment form attached as ANNEX H.

WMO Secretariat

- PWS training to high-level people at the side meeting of ASEAN committee and RAII TECO
- Gather the information of data and products of Global and Regional Centres
  - The updated ANNEX A should be used for this purpose.
- Arrange the next RSMT meeting in consultation of RSMT members.
- Arrange the training workshop in consultation of RSMT members.