

Myanmar Department of
Meteorology and Hydrology



Regional Integrated Multi-
Hazard Early Warning System

Activity Report

9th Monsoon Forum

26 October 2012

Nay Pyi Taw, Myanmar

Convened by Myanmar's Department of Meteorology and Hydrology (DMH), the 9th Monsoon Forum was part of the programme "*Reducing risks of tsunamis, storm surges, large waves, and other natural hazards in low- elevation coastal zones*" with support from the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) and the Regional Integrated Multi-Hazard Early Warning System (RIMES).

SECTION 1

INTRODUCTION

1.1 Background

Hazards – both hydro-meteorological and geological - are prevalent in Myanmar. Though most hazards can be predicted and forecasts are available from the Department of Meteorology and Hydrology (DMH), the country's official provider of forecasts/warning information, gaps in the application of such information in sectoral decision-making abound.

The Monsoon Forum, geared at promoting the application of forecasts/warning information for enhanced management of risks, is a regular interface between DMH and forecast stakeholders from various hazard-sensitive sectors in the country, with the end-in-view of enhanced understanding, by forecast user institutions, of forecast products including their limitations and uncertainties, and better appreciation by DMH of user information needs. This facilitates a cycle of constant refinement of forecast products to suit users' needs/requirements and development of more robust information sharing system, hence facilitating better application forecasts/warning information.

Introduced in Myanmar in 2007, the Monsoon Forum offered an opportunity for dialogue between hydro-meteorological scientists who generate climate forecasts and information, and a range of potential users such as agricultural producers, traders, extension agents, disaster risk managers, government planners and development partners. Built on the monsoon, a regular phenomena in the country, the Monsoon Forum has taken a multi-hazard approach by May 2012, integrating issues on forecasts/warning information and other concerns regarding geological hazards like earthquakes and tsunamis.

In Myanmar, the 9th Monsoon Forum is organized by DMH with support from the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) and the Regional Integrated Multi-Hazard Early Warning System (RIMES) through the project "Reducing risks of tsunamis, storm surges, large waves, and other natural hazards in low elevation coastal zones".

1.2 Objectives

The 9th Monsoon Forum, scheduled on 26 October 2012, from 9:00 AM onwards at Myat Taw Win Hotel, Nay Pyi Taw, Myanmar, is convened with the following objectives:

- a) review the 2012 Southwest Monsoon in terms of patterns of climate and performance of the seasonal climate and water level forecasts
- b) draw feedback from user institutions on the relevance/usability of the seasonal forecast for the Monsoon Season and recommendations for enhancement of forecast products
- c) present the seasonal forecast for the winter season
- d) present sectoral potential impacts outlook and response options for application by stakeholders
- e) present/discuss recent issues/concerns/developments in earthquake monitoring and tsunami early warning and response
- f) draw recommendations from stakeholder institutions on improving the conduct of subsequent Monsoon Forums

1.3 Process

In response to stakeholders' recommendations during the 8th Monsoon Forum of convening meetings prior to the Monsoon Forum, to provide more time for the user sectors to analyze the forecast and develop impacts outlook and response options, a preparatory meeting was convened on 22 October involving key decision

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makers in different sectors in the country. During the preparatory meeting, DMH provided the climate and water level outlook for the winter season (November 2012 to February 2013), for analysis by the sectoral representatives. Sectoral discussion was facilitated by RIMES and DMH. Outputs of discussions fed into Session 5 (Sectoral Impacts Outlook and Response Options) of the Monsoon Forum Agenda.

1.4. Agenda

1.4.1 Preparatory Meeting

The agenda for the preparatory meeting, on 22 October 2012, is shown below.

Agenda Monsoon Forum Preparatory Meeting 22 October 2012 Nay Pyi Taw, Myanmar		
Time	Session	Resource Person/Facilitator
8.30-9.00	Arrival and Registration of Participants	DMH
Opening Session		
9.00-9.15	Opening Remarks/Welcoming Address	DMH
9.15-9.25	Introduction of Participants	DMH
Monsoon Forum Process		
9.25-9.45	Overview of the Monsoon Forum and its Preparatory Meeting and Proposed Innovations in the Monsoon Forum Process in Myanmar	RIMES
9.45-10.00	Discussion	
10.00-10.20	Coffee/Tea Break	
Seasonal Forecast		
10.20-10.40	Presentation of the Long-Range Climate Forecast for the Winter Season	DMH
10.40-11.00	Presentation of the Long-Range Water Level Forecast for the Winter Season	DMH
11.00-11.30	Discussion	
Group Discussion on Impacts Outlook and Response Options Development		
11.30-12.00	Group Discussion: Development of Potential Impacts Outlook and Response Options	
12.00-13.00	Lunch	
13.00-14.00	Continuation - Group Discussion: Development of Potential Impacts Outlook and Response Options	
14.00-14.30	Presentation of Preliminary Outputs from Group Discussion	
14.30-15.00	Discussion and Agreements	

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Wrap up and Closing Session

15.00-15.10	Synthesis of Discussions	RIMES
15.10-15.30	Way Forward and Closing Remarks	DMH
15.30-15.45	Coffee/Tea	

1.4.2 Monsoon Forum

The 9th Monsoon Forum agenda follows.

Indicative Agenda		
8.30 – 9.00	Arrival and registration of participants	DMH
Session 1: Opening/Inaugural Session		
9.00-9.15	Welcome/Opening Remarks	DMH
9.15-9.30	Inaugural Address	DMH/Ministry of Transport
09.30 -09.45	Introduction of participants	
9.45 – 10.00	Coffee/Tea Break	
Session 2: Overview		
10.00 -10.20	Monsoon Forum Overview and Report on the Outcomes of the Monsoon Forum Preparatory Meeting	RIMES/DMH
Session 3: Verification of the Long Range Forecast for the Southwest Monsoon Season		
10.20-10.35	Verification of Long Range Climate Forecast for the Southwest Monsoon Season	DMH
10.35-10.50	Verification of Long Range Water Level Forecast for the Southwest Monsoon Season	DMH
10.50-11.05	Review of the agro-climatic condition for the Southwest Monsoon Season	DMH
11.05-11.40	Discussion/Feedback from User Institutions on Relevance/Usability of Forecast for the Monsoon Season and Recommendations for Enhancement of Forecast Products	
Session 4: Seasonal Climate Outlook for the Winter Season		
11.40-12.00	Presentation of Seasonal Climate Outlook for the Winter Season	DMH
12.00-13.00	Lunch	
13.00-13.20	Presentation of General Long-Range Water Level Forecast for the Winter Season	DMH
13.20-13.35	Presentation of agro-climatic bulletin	DMH
13.35-14.00	Discussion	
Session 5: Panel Discussion: Sectoral Impacts Outlook and Response Options		
14.00-14.30	Presentation of Impacts Outlook and Response Options: Sectors on Agriculture, Irrigation, and Water Resources	Sectoral representative
14.30-15.00	Presentation of Impacts Outlook and Response Options: Sectors on Fisheries and Forestry	Sectoral representative
15.00-15.15	Coffee/Tea Break	
15.15-16.00	Question and Answer/Discussion	
Session 6: Tsunami Arrival Time and Maximum Wave Amplitude Estimation in Myanmar Coastal Areas		
16.00-16.30	Presentation of outputs: Estimation of Tsunami Arrival Time and Maximum Tsunami Wave Amplitude for	DMH

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	Myanmar Coastal Areas by TUNAMI F1 Model	
16.30-16.40	Discussion	
Session 7: Way Forward and Closing Session		
16.40-16.45	Synthesis of Discussions	RIMES
16.45-17.00	Way Forward and Closing Remarks	DMH

1.5 Participants

1.5.1 Preparatory Meeting

25 key decision-makers from DMH and hazard-sensitive sectors. The user institutions represented were the following:

- Department of Agriculture
- Department of Fisheries
- Department of Forecast
- Department of Irrigation
- Directorate of Water Resources and Improvement of River Systems
- General Administration Department
- Ministry of Livestock Breeding And Fisheries
- Myanma Radio and Television
- Relief and Resettlement Department

1.5.2 Monsoon Forum

40 participants from government institutions, academe/research center, mass-based organization and media institution. These include:

Government Institutions

- Ministry of Agriculture and Irrigation
- Ministry of Social Welfare, Relief and Resettlement
- Ministry of Transport
- Department of Agriculture
- Department of Agricultural Research
- Department of Civil Aviation
- Department of Fisheries
- Department of Forest
- Department of Irrigation
- Department of Livestock Breeding and Fisheries
- Department of Meteorology and Hydrology
- Department of Transport
- Department of Water Resources and Improvement of River Systems
- General Administration Department
- Relief and Resettlement Department

Academe/Research Center

- Yezin Agricultural University

Mass-based organization

- Myanmar Red Cross Society

Media

- Myanma Radio and Television

SECTION 2

OPENING SESSION

2.1 Welcome and Opening Remarks

Dr. Hrin Nei Thiam, Director General, DMH, welcomed the participants to the 9th Monsoon Forum. She conveyed her thanks to UNESCAP and RIMES for providing assistance to DMH in conducting the Monsoon Forum, among other undertakings.

She explained that prior to the Monsoon Forum, a preparatory meeting was convened by DMH, on 22 October 2012, so that stakeholder institutions would have more time to analyze the seasonal forecast for the winter season and initially provide comments to DMH on how to improve the seasonal forecast for presentation during the Monsoon Forum.

She then proceeded to provide a summary of the manifestation of the Southwest Monsoon Season in Myanmar. According to Dr. Hrin, late onset and early withdrawal was registered for the Southwest Monsoon hence, low rainfall was recorded – only 55% of the normal rainfall for the season.

She provided an update of the El Nino condition in the Northern Hemisphere which remained weak.

2.2 Remarks

Ms. Ruby Rose Policarpio, Institutional Development Specialist, RIMES, thanked DMH for taking the lead in the conduct of Monsoon Forums and other RIMES-initiated activities in the country. She also thanked the participants for their presence in the 9th Monsoon Forum and conveyed her optimism for interesting discussion and valuable inputs from the different sectors on the possible impacts and potential responses for the upcoming season, as well as on recommendations on enhancing the generation, communication and application of forecast/warning information.

2.3 Introduction of participants

DMH facilitated the introduction of participants.

2.4 Monsoon Forum Overview and Report on the Outcomes of the Monsoon Forum Preparatory Meeting

Ms. Policarpio discussed that the Monsoon Forum process was introduced in Myanmar in 2007 and currently undertaken as part of the UNESCAP-supported programme “Reducing risks of tsunamis, storm surges, large waves, and other natural hazards in low-elevation coastal zones. She discussed the Monsoon Forum objectives followed by target outputs, which included:

- preparedness plan for every season
- short and medium-term recommendations on improving inter-agency coordination and collaboration towards greater uptake of forecast/warning information for various purposes (e.g. disaster risk reduction, planning, etc.)
- recommendations on tailoring forecast/warning information products to support decision-making
- long-term policy recommendations on improving climate risk management

She then elaborated on the Monsoon Forum process and examples of the Monsoon Forums facilitated by RIMES in different countries in Asia, and zeroed-in on the institutional collaboration between the Indonesian Meteorological and Geophysical Agency and the Ministry of Agriculture in Indonesia as an example.

She explained that in the 9th Monsoon Forum, a slight amendment to the Monsoon Forum process is introduced, with the inclusion of a Monsoon Forum preparatory meeting to provide more time to key user institutions to develop/refine impacts

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outlook and response options, based on DMH's seasonal forecast, for sharing to sectoral stakeholders. She provided a brief report on the Monsoon Forum Preparatory Meeting, as follows:

- Participants
 - the preparatory meeting was attended by 25 participants coming from DMH, user institutions like the agriculture, irrigation, disaster management, information management, water resources, forestry and fisheries, among others
- Structure
 - DMH shared the Long Range Climate and Water Level Forecasts
 - Participants were grouped, according to sectors, to prepare impacts outlook and response options.
 - Groups reported their initial outputs and provided feedback to DMH on the generation and delivery of forecasts
- Impacts outlook and response options
 - The impacts outlook and response options developed by key stakeholder institutions fed into Session 5 of the Monsoon Forum
- Feedback and recommendations from participants
 - ***Delivery of forecasts, by DMH, should be improved to enable all stakeholders to have access to the forecast.***

DMH, as of that moment, has a wide range of forecast products of different time-scales but one of the prevalent concerns of the participants is how to make the forecasts more accessible to the decision makers and the public. Participants indicated that DMH explore enhanced mechanisms of sharing forecast information.

- ***Development of easy-to-understand forecasts***

Participants recommended that presentation of forecasts should not be very technical as many terminologies could not be understood by stakeholders.

- ***Development of location-specific climate change projections***

Climate change projections, for different regions and states, should be developed by DMH so that sectors in the different areas would be able to better anticipate future (long-term) climate scenarios.

According to Dr. Thiam, the said capacity to develop location-specific climate change scenarios has to be built in the institution. She related the initiatives undertaken by RIMES in developing this capacity in DMH in the past through the training of Mr. Sein Maw Oo, but unfortunately Mr. Oo passed away.

Dr. Thiam continued that RIMES will be hosting the next batch of DHM scientists for training in Thailand and she hopes that DMH would be able to respond to this recommendation from the participants soon.

- ***Access to DMH's historical data***

The participants requested DMH to provide historical data to institutions for free. According to DMH, however, the fees

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obtained by DMH from the sale of its historical data supports part of the operational cost of the institution.

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VERIFICATION OF THE SOUTHWEST MONSOON SEASON

3.1 Verification of the Long Range Climate Forecast for the Southwest Monsoon Season

DMH recapped that the Southwest Monsoon Season is segmented into the following:

- Early Monsoon – onset date to end of June
- Peak Monsoon – 1 July to 31 August
- Late Monsoon – 1 September to monsoon withdrawal

Subsequently, DMH discussed the Southwest Monsoon onset: normal onset, forecasted and observed, illustrated in Figure 1.

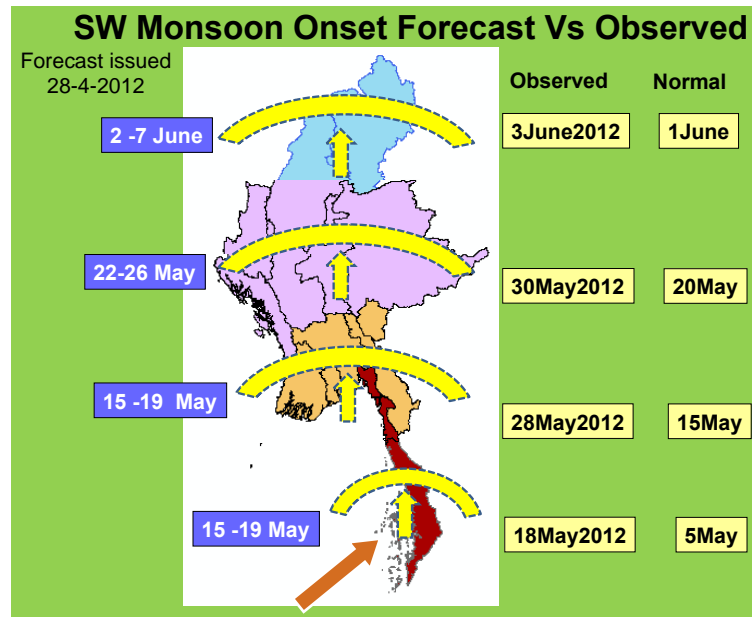


Figure 1. Normal monsoon onset vis-à-vis forecasted and observed monsoon onset for the 2012 Southwest Monsoon period (DMH, as presented during the 9th Monsoon Forum, 26 October 2012, Nay Pyi Taw, Myanmar)

Delay of monsoon onset was recorded in all climatic zones. DMH explained that monsoon onset in Southern Myanmar fell within the forecasted dates of 15 to 19 May; and in Northern Myanmar within the forecasted period of 2-7 June. DMH continued that monsoon onset, however, in Deltaic Areas and Central Myanmar was later than the forecasted onset dates.

According to DMH, only 127 monsoon days were recorded for the 2012 Southwest Monsoon Season, in comparison to the normal monsoon duration of 144 days. Figure 2 indicates the normal monsoon withdrawal in different areas and the forecasted and observed monsoon withdrawal dates.

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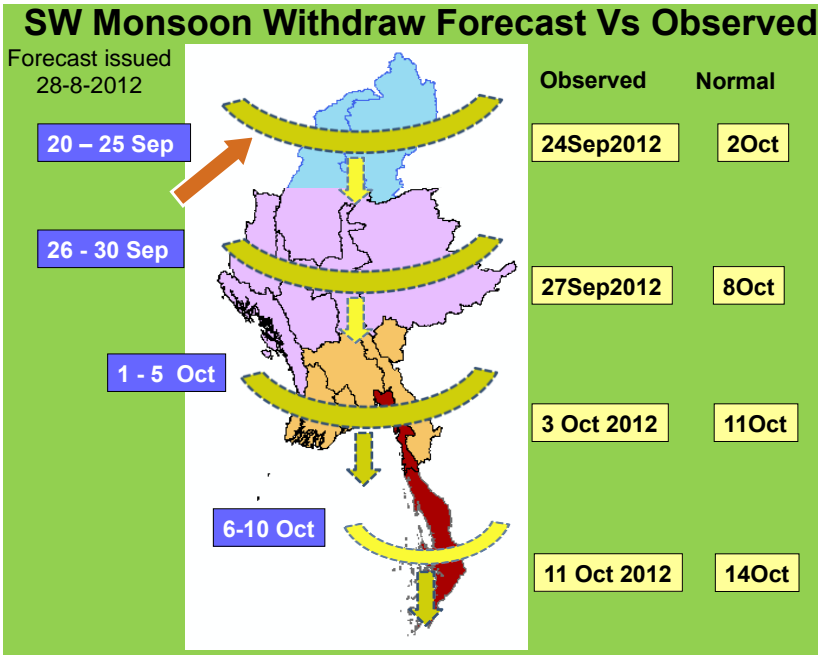


Figure 2. Normal monsoon withdrawal dates and forecasted and observed monsoon withdrawal for the Southern Myanmar, Deltaic Areas, Central and Northern Myanmar (DMH, as presented during the 9th Monsoon Forum, 26 October 2012, Nay Pyi Tan, Myanmar).

Moreover, normal and observed rainfall during the early monsoon period is illustrated in Figure 3 followed by forecasted and observed rainfall values in Figure 4.

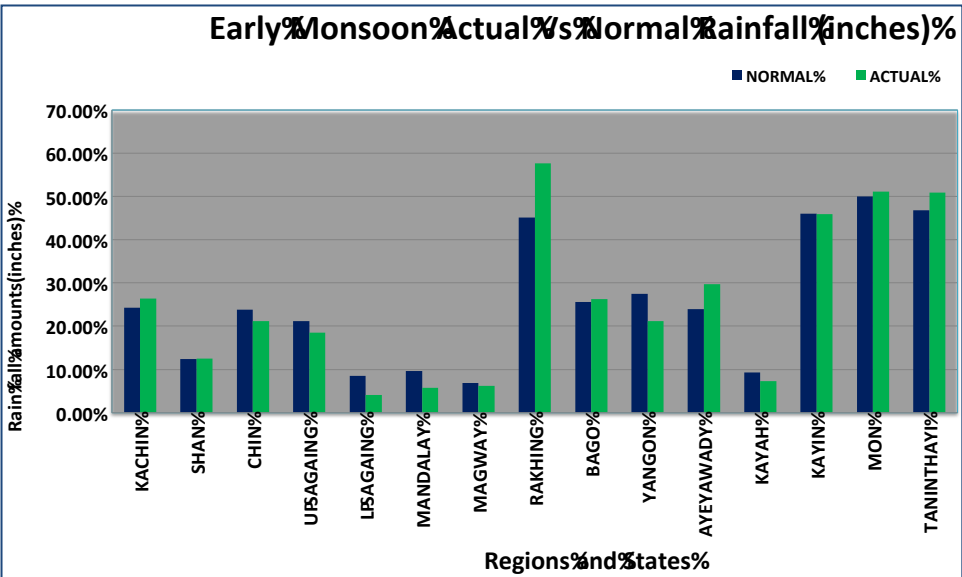


Figure 3. Forecasted and observed rainfall in different stations in the country during the early monsoon period (DMH, as presented during the 9th Monsoon Forum, 26 October 2012, Nay Pyi Tan, Myanmar)

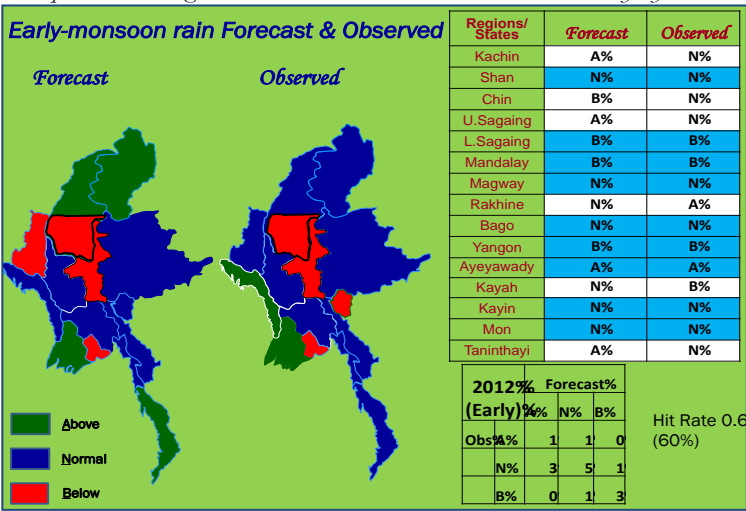


Figure 4. Forecasted and observed rainfall values for the early monsoon season in different areas in the country (DMH, as presented during the 9th Monsoon Forum, 26 October 2012, Nay Pyi Tan, Myanmar)

Following that, DMH presented the normal and observed rainfall in the different stations in the county during the peak monsoon season, in Figure 5; and forecasted and observed rainfall values for the same period, in Figure 6.

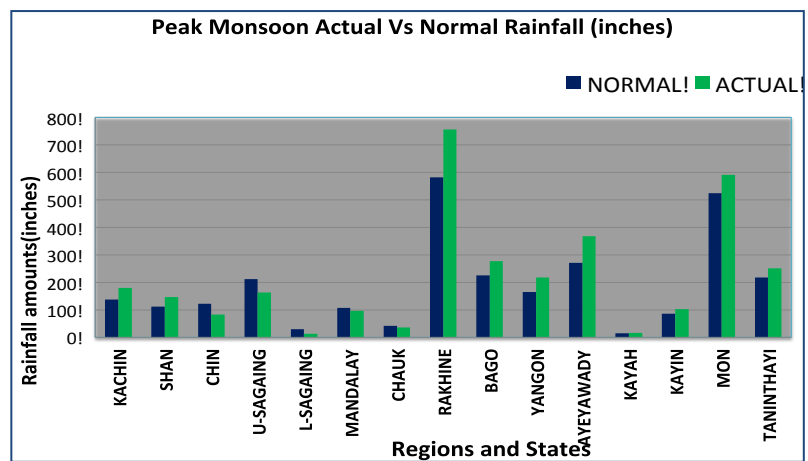


Figure 5. Normal and observed rainfall values for different stations in Myanmar during the peak monsoon season (DMH, as presented during the 9th Monsoon Forum, 26 October 2012, Nay Pyi Tan, Myanmar)

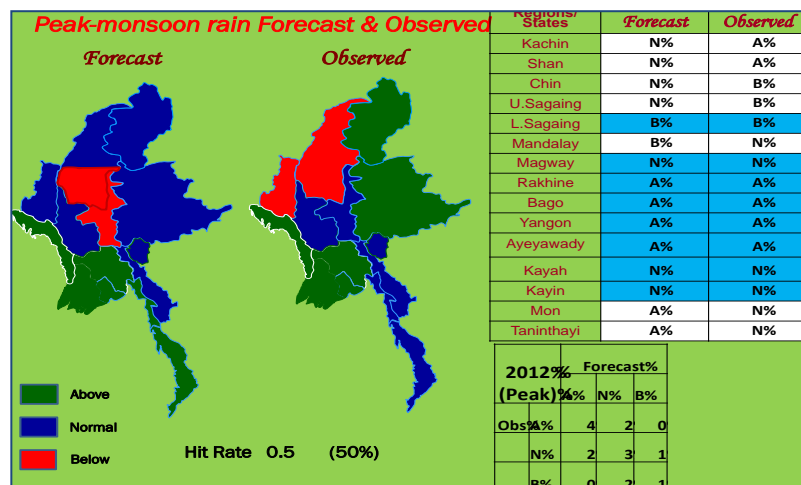


Figure 6. Forecasted and observed rainfall values in different stations in the country for the peak monsoon period (DMH, as presented during the 9th Monsoon Forum, 26 October 2012, Nay Pyi Tan, Myanmar)

For the late monsoon period, DMH presented the normal and observed rainfall values (Figure 7), and the forecasted and observed rainfall values (Figure 8).

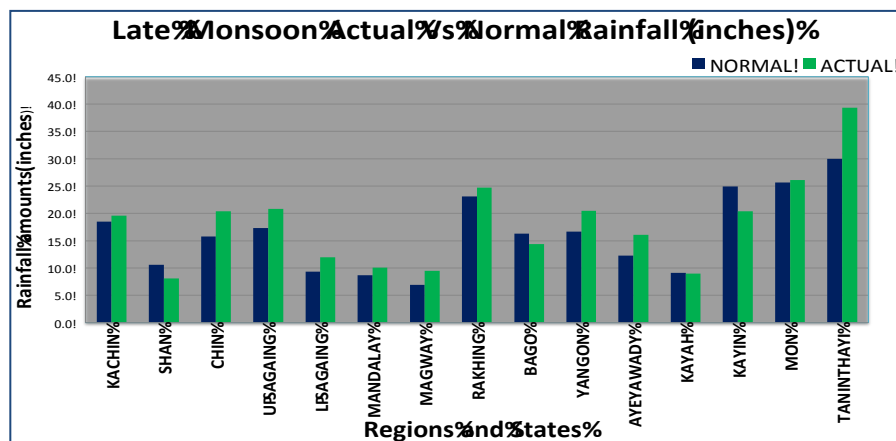


Figure 7. Normal and observed rainfall values in Myanmar during the 2012 late monsoon period (DMH, as presented during the 9th Monsoon Forum, 26 October 2012, Nay Pyi Tan, Myanmar)

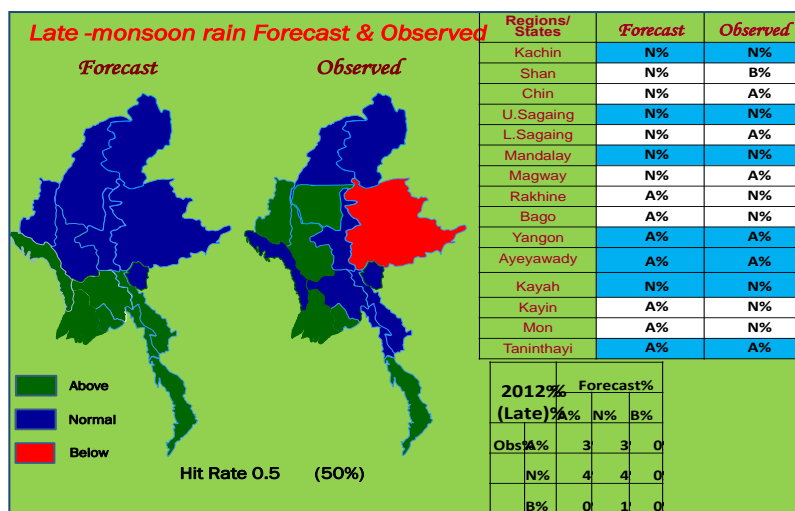


Figure 8. Forecasted and observed rainfall values for the country during the late monsoon period (DMH, as presented during the 9th Monsoon Forum, 26 October 2012, Nay Pyi Tan, Myanmar)

Forecasted and observed cyclone frequency for the 2012 monsoon season is presented in Figure 9.

Cyclone Frequency Forecast Vs Observed for 2012 Monsoon season		
Monsoon	Forecast	Observed
Early Monsoon	2 ILPA, 1 IDEP	Nil
Peak Monsoon	2 LPA, 1 IDEP	4 ILPA
Late Monsoon	3 ILPA, 2 IDEP	2 LPA, 1 IDEP

Figure 9. Forecasted and observed frequency of cyclones for the monsoon season (DMH, as presented during the 9th Monsoon Forum, 26 October 2012, Nay Pyi Tan, Myanmar)

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According to DMH, a new record for temperature, at 46.4°C, was established in Chauk, on 18 May 2012, breaking the 28-year year record for the highest temperature in the country for the Early Monsoon period.

Heaviest 24-hour rainfall events were recorded by DMH for July and August 2012, as shown in Table 1.

Rg/St%	City%	Inches%	Date%
! Kayin!	! Hpa,an!	7.28!	25.7.2012!
!		5.43!	10.8.2012!
! Bago!	Nyaunglaybin!	6.54!	27.7.2012!
!	Bago!	9.29!	10.8.2012!
! Rakhine!	Thandwe!	8.50!	19.7.2012!
!	Si_we!	13.58%	8.8.2012!
! Ayeyawady!	Ngathaingchaung!	5.39!	25.7.2012!
!	Pathein!	6.62!	15.8.2012!
! Mon!	! Thaton!	10.87%	25.7.2012!
!		8.15!	10.8.2012!
! Taninthayi!	Dawei!	10.16%	29.7.2012!
!	Kawthong!	7.28!	22.8.2012!

Table 1. Heaviest rainfall events for July and August 2012 (DMH, as presented during the 9th Monsoon Forum, 26 October 2012, Nay Pyi Taw, Myanmar)

Further, DMH presented Figure 10 which indicates the over-all rainfall deviation from normal rainfall values in different areas.

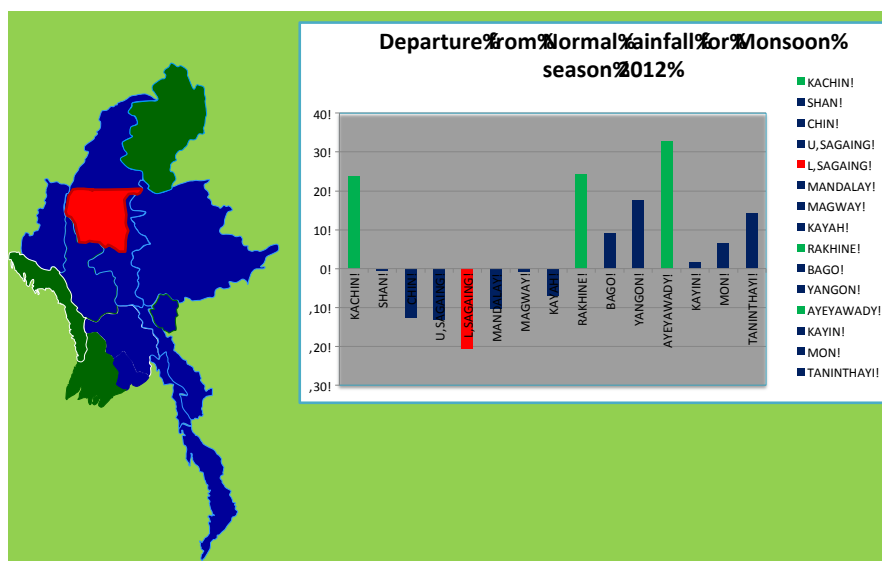


Figure 10. Over-all rainfall deviance from normal rainfall values (DMH, as presented during the 9th Monsoon Forum, 26 October 2012, Nay Pyi Taw, Myanmar)

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Subsequently, DMH presented the following summary of the behavior of the 2012 Southwest Monsoon:

- onset of Southwest Monsoon into Southern Myanmar and Deltaic areas was late by about 13 days; in Central Myanmar by about 10 days; and in Northern Myanmar by about 2 days
- monsoon withdrawal from Northern Myanmar was earlier than normal by about 6 days; from Central Myanmar by about 9 days; from Deltaic areas by about 8 days; and from Southern Myanmar by about 3 days
- Southwest Monsoon duration was 17 days shorter than normal, due to its late onset and early withdrawal
- No storm formed during the early monsoon period; 4 LPAs formed during the peak monsoon period; and 2 LPAs and 1 depression formed during the late monsoon period
- Monsoon intensity was strong during the early and peak monsoon period and moderate to weak during the late monsoon period
- Even though monsoon duration was short, rainfall distribution was nearly normal for the over-all monsoon period

3.2 Verification of the Long range Water Level Forecast for the Southwest Monsoon Season.

This was presented by Ms. Kyu Kyu Sein, Deputy Superintendent, DMH. She indicated that DMH issues flood warning and bulletins on the following conditions:

- Flood warning
 - Water level rises up to one (1) meter below danger level
 - Issued 24 hours in advance for upstream areas of small river systems and two (2) to five (5) days in advance for middle and downstream areas of major rivers
- Flood bulletin
 - Issued when the water level reaches or exceeds the danger level
- Significant water level bulletin is issued from three (3) to seven (7) days in advance for the Ayeyarwady and Chindwin Rivers
 - Issued during the pre-monsoon period (April and May)
 - Issued 3 to 7 days in advance for downstream stations along the Ayeyarwady and Chindwin Rivers, in case of sharp rise of water in upstream stations

She then reviewed the water level observations in the country from May to October 2012:

- Pre-Monsoon Period (May)
 - Widespread rain received in Northern Myanmar as a result of western disturbance
 - Water level rose in all rivers while the southwest monsoon rain was led to central Myanmar towards the end of May
 - Water levels did not reach danger level
- Early Monsoon Period (June)
 - Southwest monsoon intensity was strong to vigorous during the first week of June and water level rose up in all rivers
 - Significant Water level Bulletin was issued for Ayeyarwady and Chindwin Rivers
 - Bamaw and Katha stations, in Ayeyarwady River, exceeded Danger Level
- Mid-Monsoon period (July)
 - Moderate to strong intensity of the Southwest Monsoon, widespread monsoon rain in the whole country, and low pressure

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area in the Bay of Bengal contributed to the rising of water level in all rivers

- The stations of Homalin, Madauk, Ngathaingchaung, Hpaan and Shwegin exceeded their respective danger levels
- Mid-Monsoon period (August)
 - strong to vigorous monsoon intensity, three (3) Low Pressure Areas in the Bay of Bengal, and remnants of the typhoon in the South China Sea contributed to the rise of water level in all rivers. Some stations exceeded danger level
- Late Monsoon Period (September)
 - Water levels rose but did not reach danger level
- Late Monsoon Period (October)
 - Convective clouds, western disturbances, easterly wave, remnants of typhoon and depression from South China Sea, contributed to the widespread rain occurring in Myanmar while the Southwest Monsoon was withdrawing by 2nd week of October.
 - Ngathaingchaung station at Ngawun River exceeded danger level

The flood frequency for the 2012 Monsoon season is indicated in Figure 11.

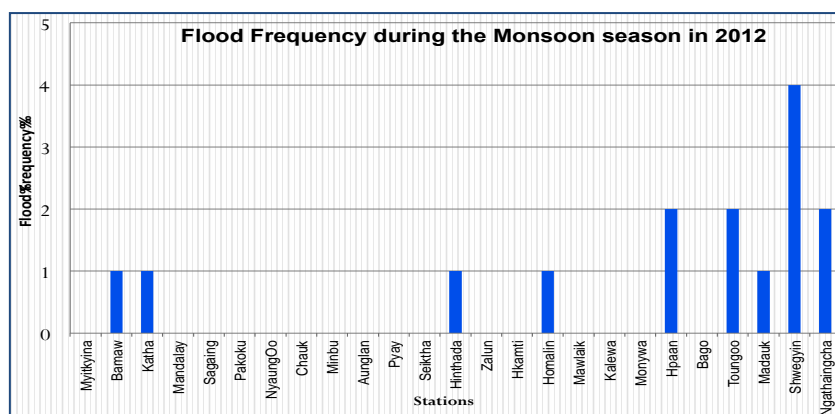


Figure 11. Flood frequency during the 2012 monsoon season in different water level stations in Myanmar (DMH, as presented during the 9th Monsoon Forum, 26 October 2012, Nay Pyi Taw, Myanmar)

DMH presented the verification of its flood forecast for the Monsoon Season in Figures 12 and 13 .

River/Station	D.L. (cm)	Observed Frequency			Forecast Frequency			Score		
		Early Monsoon (M-J)	Peak Monsoon (J-A)	Late Monsoon (S-O)	Early Monsoon (M-J)	Peak Monsoon (J-A)	Late Monsoon (S-O)	Early Monsoon (M-J)	Peak Monsoon (J-A)	Late Monsoon (S)
AYEYARWADY MYITKYNIA		1	1	1	1	1	1	0	0	0
BHAMO	1150	1	1	1	1	1	1	-1	0	0
KATHA	1040	1	1	1	1	1	1	-1	+1	0
MANDALAY	1260	1	1	1	1	1	1	0	+1	0
SAGAING	1150	1	1	1		1	1	0	+1	0
PAKOKKU	2150				1	1		0	+1	0
NYAUNGU	2120	1	1	1	1	1	1	0	+1	0
CHAUK	1450	1	1	1	1	1	1	0	0	0
MINBU	1700	1	1	1	1	1	1	0	+1	0
MAGWAY	1700	1	1	1	1	1	1	0	+1	0
AUNGLAN	2550	1	1	1	1	1	1	0	0	0
PYAY	2900	1	1	1		1	1	0	0	0
SEIKTHA	1200	1	1	1	1	1	1	0	+1	0
HINTHADA	1342	1	1	1		1	1	0	0	0
ZALUN	1160	1	1	1	1	1	1	0	+1	+1

Figure 12. Forecasted and observed frequencies of flood in different stations in Ayeeyarwady River for the monsoon season (DMH, as presented during the 9th Monsoon Forum, 26 October 2012, Nay Pyi Taw, Myanmar)

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River/Station!	D.L. (cm)!	Observed Frequency!			Forecast Frequency!			Score!		
		Early Monsoon (M-J)	Peak Monsoon (J-A)	Late Monsoon (S-O)	Early Monsoon (M-J)	Peak Monsoon (J-A)	Late Monsoon (S-O)	Early Monsoon (M-J)	Peak Monsoon (J-A)	Late Monsoon (S-O)
<u>CHINDWIN</u> HKAMTI!	1360	-	-	-	-	1	-	0	+1	0
HOMALIN!	2900	-	1	-	-	1	1	0	0	+1
MAWLAIK!	1230	-	-	-	-	1	1	0	+1	+1
KALEWA!	1550	-	-	-	-	1	1	0	+1	+1
MONYWA!	1000	-	-	-	-	1	1	0	+1	+1
<u>DOKEHTAWADY</u> HSIPAW!	600	-	-	-	-	-	-	0	0	0
MYITNGE!	870	-	-	-	-	1	1	0	+1	+1
<u>SITTOUNG</u> TOUNGGO!	600	-	2	-	-	2	1	0	0	+1
MADAUK!	1070	-	1	-	-	2	1	0	+1	+1
<u>THANLWIN</u> HPA-AN!	750	-	2	-	-	2	1	0	0	-1
<u>SHWEGYIN</u> SHWEGYIN!	700	-	4	-	-	1	-	0	-3	0
<u>BAGO</u> ZANGTU!	900	-	-	-	-	-	-	0	0	0
BAGO!	910	-	-	-	-	1	-	0	+1	0
<u>NGAWUN</u> NTG!	1130	-	2	1	-	1	-	0	-1	-1

Figure 13. Forecasted and observed frequencies of flood in different stations along different river systems in Myanmar (DMH, as presented during the 9th Monsoon Forum, 26 October 2012, Nay Pyi Taw, Myanmar)

Using statistical tools, DMH assessed that its Long Range Water Level Forecast for the pre-monsoon period is excellent; for the peak monsoon period poor; and for the late monsoon period good.

Observed water levels during the 2012 Monsoon Season are summarized as follows:

- Water level at Bhamo, Katha and Hinthada stations at the Ayeyarwaddy River exceeded their respective danger levels and inundated some low-lying areas
- Along the Chindwin River, the water level at Homalin station exceeded its danger level
- Bago station, along Bago River, nearly reached the danger level
- The second-highest water level was recorded at Madauk Station of Sittoung River, with flood duration of about 37 days
- The third-highest water level was recorded at Shwegyin station of Shwegyin River
- Among the 8 major rivers, water levels in Dokehtawady and Bago rose but water levels did not reach their respective danger levels

3.3. Review of the Agro-Climatic Condition for the 2012 Monsoon Season

This session was presented by Ms. May Khin Chaw, Assistant Director, Agro-Meteorological Division, DMH.

Ms. May Khin Chaw emphasized that the purpose of DMH's Agro-Meteorological Division is to support and provide advisories to support agricultural production and food security activities in the country. She indicated that Decadal Agro-Meteorological Bulletin is distributed by the Agro-Meteorological Division three (3) times a month containing a) weather summary of the previous dekad ; b) review of the agro-meteorological elements to include rainfall, temperature, humidity, evapotranspiration, and water balance; and c) forecast for the next dekad.

Other publications and issuances were elaborated.

Maximum and minimum temperature, and soil water balance conditions for the 2012 Monsoon Season are provided in Figures 14, 15 and 16.

SECTION 3

VERIFICATION OF THE SOUTHWEST MONSOON SEASON

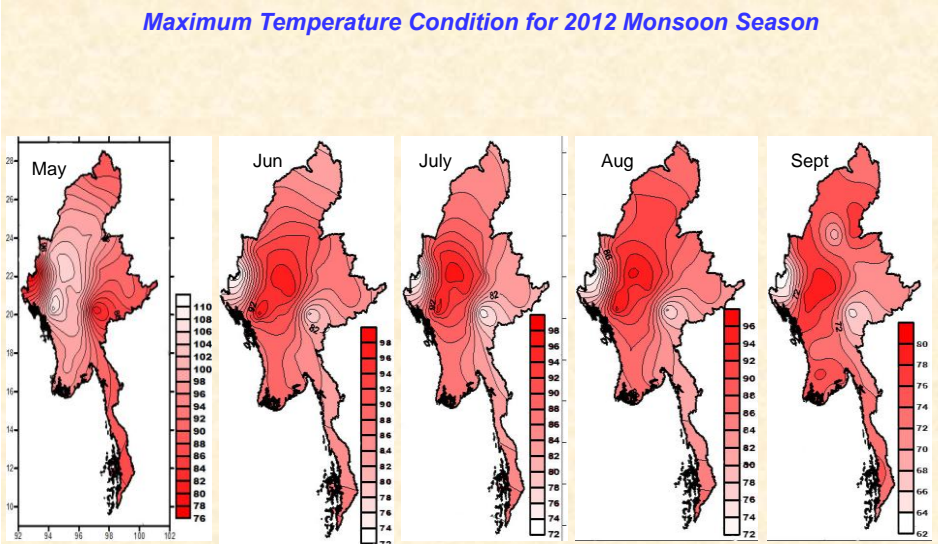


Figure 14. Maximum temperature values for different parts of the country during from May to September 2012 (DMH, as presented during the 9th Monsoon Forum, 26 October 2012, Nay Pyi Taw, Myanmar)

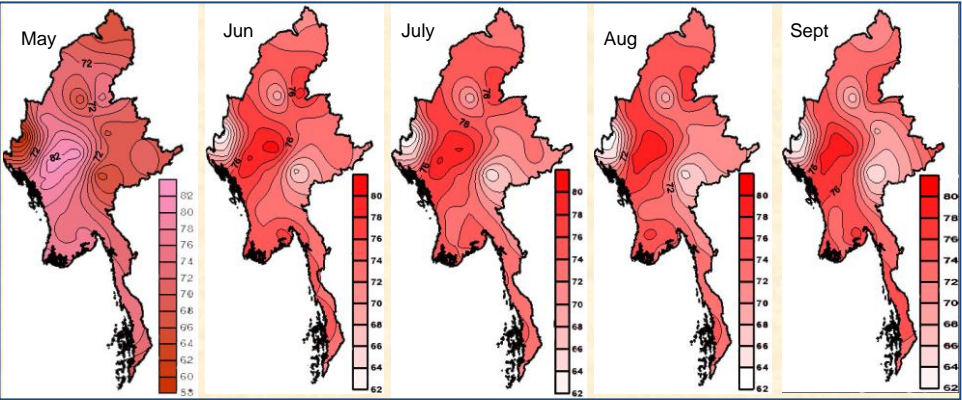


Figure 15. Minimum temperature values for different parts of the country during from May to September 2012 (DMH, as presented during the 9th Monsoon Forum, 26 October 2012, Nay Pyi Taw, Myanmar)

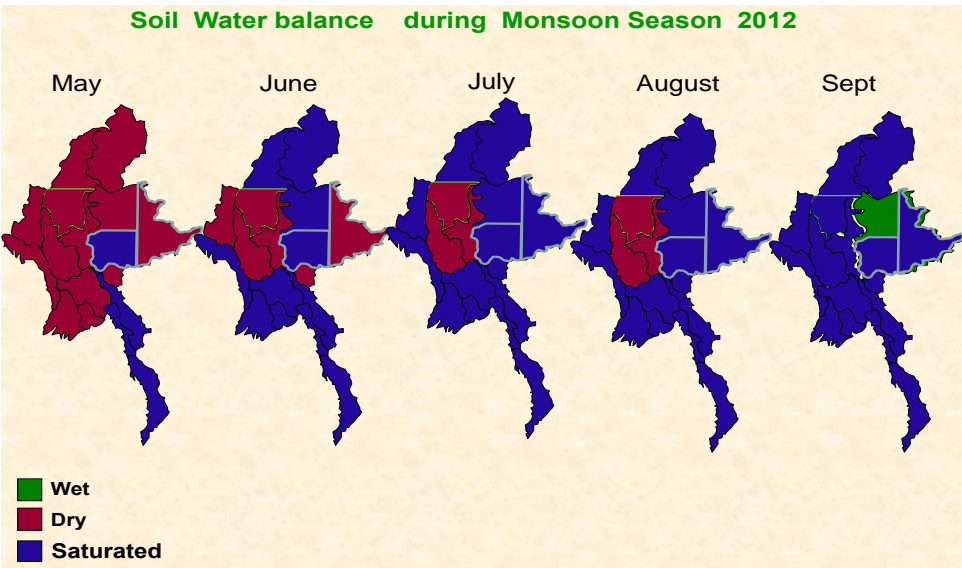


Figure 16. Soil water balance for different parts of Myanmar from May to September 2012 (DMH, as presented during the 9th Monsoon Forum, 26 October 2012, Nay Pyi Taw, Myanmar)

SECTION 3

VERIFICATION OF THE SOUTHWEST MONSOON SEASON

The summary of the behavior of the 2012 Monsoon Season, in the agro-meteorological context, were provided by DMH, as follows:

- Maximum temperature was generally high (nearly 100°F) in Central Myanmar during the Monsoon Season
- Minimum temperature pattern in the whole monsoon season were similar; Upper Sagaing, Southern Shan State and Chin States recorded lowest minimum temperature of about 60°F
- Sharp decrease in monthly PET value from 200mm (May) to 150mm (June) was recorded. The value remained until August and decreased sharply again to 100mm in September
- Except in September, soil water balance condition was deficit in Central Myanmar during the Monsoon Season

To improve the agro-meteorological services in DMH, Ms. Chaw espoused the following needs:

- Modification of cropping calendars to adapt to recent climate trends; DMH need more phenological and agronomic data, partnership with the Ministry of Agriculture and Irrigation is necessary
- Upgrading from conventional/manual observation systems to automated observation systems (i.e. digital sensors, portable agricultural environment detector; and AWOS)
- Modernization of techniques and further research in agro-meteorological forecasting; requirements include training, guidance on the application of crop modeling/crop simulation
- Installation of and capacity building in GIS for utilization in spatial analysis of agro-meteorological databases/ agro-ecological zoning
- Capacity building for agro-meteorologists through trainings, higher education, and participation in regional and/or international platforms in agro-meteorology

3.4 Discussion

The following summarizes the discussions subsequent to the presentations of DMH on the verification of different forecasts for the 2012 Southwest Monsoon season:

- **Definition of terminologies used in forecast products**

Participants recommended that during the next Monsoon Forum, a session on definition of forecast terminologies should be included in the agenda, preferably before the main sessions begin. Although DMH already provided guidance on forecast terminologies through publications distributed to the different institutions, it would be helpful, according to the participants, to include the same in the agenda as it will facilitate better understanding, among the stakeholders, of the discussions.

- **Updating of agro-ecological zonation maps**

Agro-ecological maps should be updated to provide better guidance to agro-meteorological forecasts. Update should at least incorporate 2010 conditions. Soil types and rainfall conditions should also be incorporated in the zonation maps.

- **Capacity building of DMH's Agro-Meteorological Division**

Dr. Thiam recommended to RIMES that the priority areas identified in the presentation of Ms. Chaw should be considered by RIMES in its subsequent programmes in the country.

SECTION 3

VERIFICATION OF THE SOUTHWEST MONSOON SEASON

In case of crop modeling, Dr. Hom from Yezin Agricultural University said that crop modeling is difficult in Myanmar due to paucity of data.

- **Experiences in the application of seasonal forecast for the Southwest Monsoon Season**

According to Dr. Tin Ohnmar Win of the Department of Agriculture, DMH's seasonal forecast for the Southwest Monsoon Season was very useful for the agriculture sector. She cited that in Labutta, many farmers were able to save reserved seeds and other assets as DMH's forecast of probability of normal to above-rainfall condition in Ayeyarwady region coincided with the cultivation/harvest seasons. In anticipation of the normal to above-normal rainfall condition, farmers moved their reserved seeds and other assets to safe places. Dr. Win espoused though that not 100% of the farmers responded to the forecast but still a good percentage was able to save resources because of forecast utility.

RIMES requested detailed information from the Department of Agriculture regarding this recent experience of forecast application in Ayeyarwady region for documentation.

SECTION 4

SEASONAL OUTLOOK FOR THE WINTER SEASON

4.1 Presentation of the Seasonal Climate Outlook for the Winter Season

Delivered by Dr. Tin Mar Htay, Assistant Forecaster, DMH, the seasonal forecast was based on the following:

- Model outputs and outlook from global and regional climate centers
- Selected analogue years
- Prevailing regional conditions
- Outputs from the Climate Predictability Tool (CPT)

Dr. Tin Mar Htay indicated that the International Research Institute for Climate Prediction (IRI) predicted weak El Nino condition to prevail over Nino 3.4 Region from November 2012 to February 2013. She explained that the weak El Nino condition is not likely going to generate significant impact on rainfall in Myanmar.

She then proceeded to discuss the European Center for Medium-Range Weather Forecast (ECMWF), Japan Meteorological Agency (JMA) and IRI Sea Surface Temperature (SST) and Seasonal Outlook for November 2012 to February 2013. Australia's Bureau of Meteorology (BOM)'s probabilistic outlook for Nino 3.4 and Indian Ocean Dipole (IOD) were likewise presented. Temperature and rainfall forecasts from different centers were then provided.

She indicated that in Myanmar, November registers the highest incidence of tropical storm and severe cyclonic storm occurrences per a 134-year record (1877-2011), shown in Figure 17.

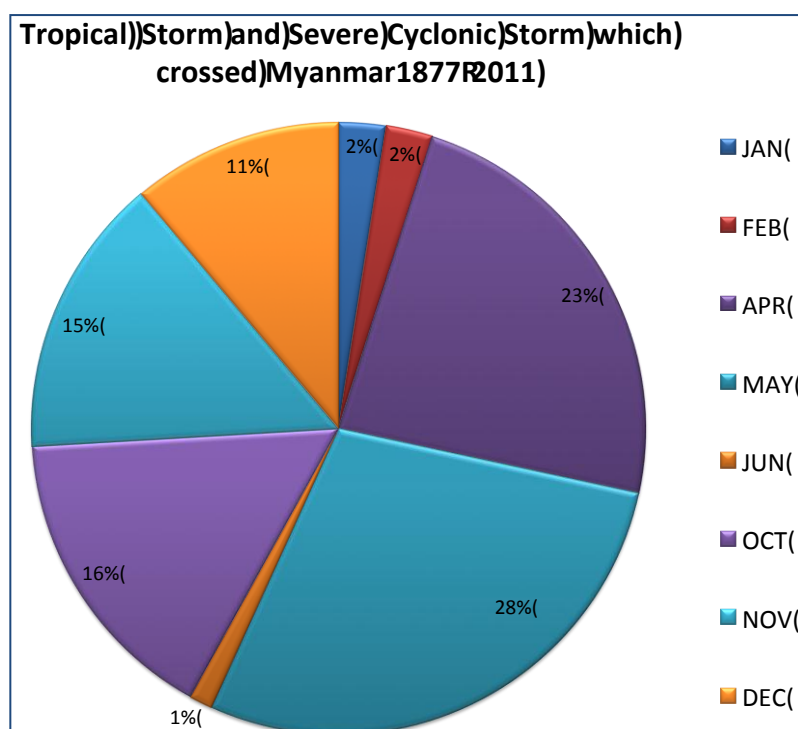


Figure 17. Occurrence of tropical storms and severe cyclonic storms in Myanmar, from 1877 to 2011 (DMH, as presented during the 9th Monsoon Forum, 26 October 2012, Nay Pyi Taw, Myanmar)

She then discussed the tracks of cyclones and depressions which crossed Myanmar in November, from 1891 to 2007, indicated below in Figure 18.

SECTION 4

SEASONAL OUTLOOK FOR THE WINTER SEASON

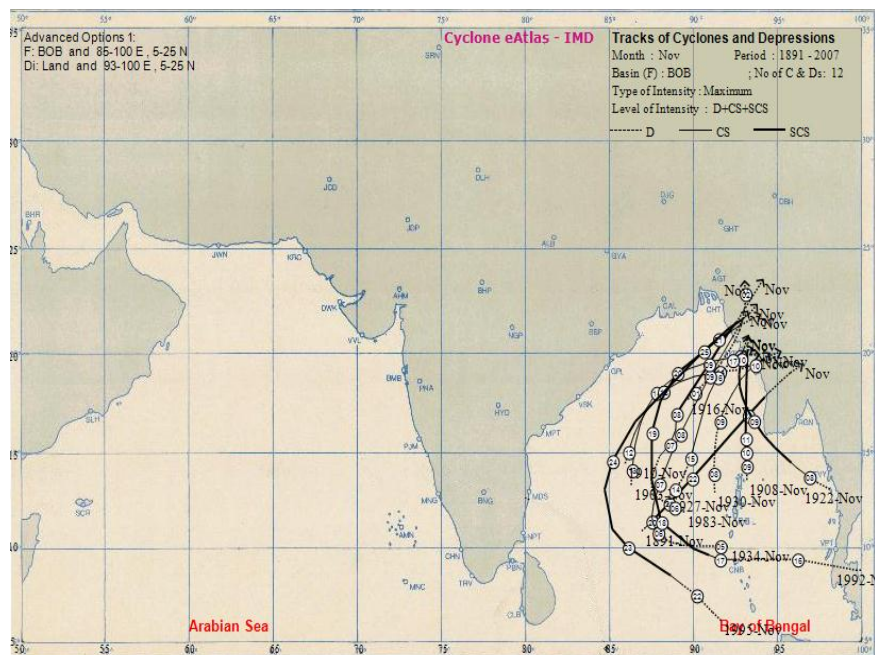


Figure 18. Track of cyclones and depressions which crossed Myanmar from 1891 to 2011 (DMH, as presented during the 9th Monsoon Forum, 26 October 2012, Nay Pyi Taw, Myanmar)

She recalled the tropical storms that crossed Myanmar coast in the recent years:

- Mala: April 2006
- Nargis: May 2008
- Giri: October 2010

Observing the cyclone occurrence every two (2) years from 2006, DMH espoused that many stakeholders were asking whether a cyclone is likely to cross Myanmar in 2012.

Moreover, Dr. Htay proceeded to provide the normal values for rainfall, for the winter season, for different parts of the country, shown in Figure 19.

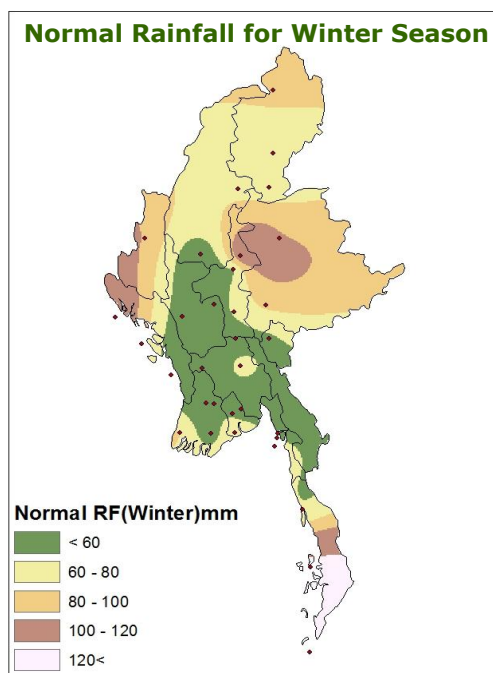


Figure 19. Normal rainfall values for different parts of Myanmar during the winter season (DMH, as presented during the 9th Monsoon Forum, 26 October 2012, Nay Pyi Taw, Myanmar)

SECTION 4

SEASONAL OUTLOOK FOR THE WINTER SEASON

Dr. Htay subsequently espoused the rainfall characteristics in different areas in Myanmar:

- Different climatic conditions are manifested in different locations, based on location, altitude and geography
- The Dry Zone show bi-modal rainfall pattern, characterized by two rainfall peaks
- The number of cyclones formed in the Bay of Bengal, frequency of passages of western disturbances from Northeast India, frequency of Easterly waves and activity of typhoon remnants from South China Sea towards Myanmar, are some of the drivers of Myanmar rainfall
- As of the moment, there are observed abnormalities in cyclone landfall, monsoon patterns/manifestation and extreme temperature and rainfall
- Myanmar's climate is closely linked to El Nino Southern Oscillation (ENSO)

Dr. Htay explained the weather outlook for the Winter Season (November 2012 to February 2013). She elaborated that anchored on prevailing conditions, the forecast is based on analogue method where DMH selects the best possible analogue year as model for the season. She said that per DMH's analysis, 2004 was selected as the analogue year for the seasonal climate outlook for November 2012 to February 2013, as like the current year, weak El Nino condition was experienced in 2004. Hence the current season is most likely going to behave similar to the Southwest Monsoon Season in 2004.

The seasonal forecast for rainfall, temperature and bay inference is provided below in ensuing figures.

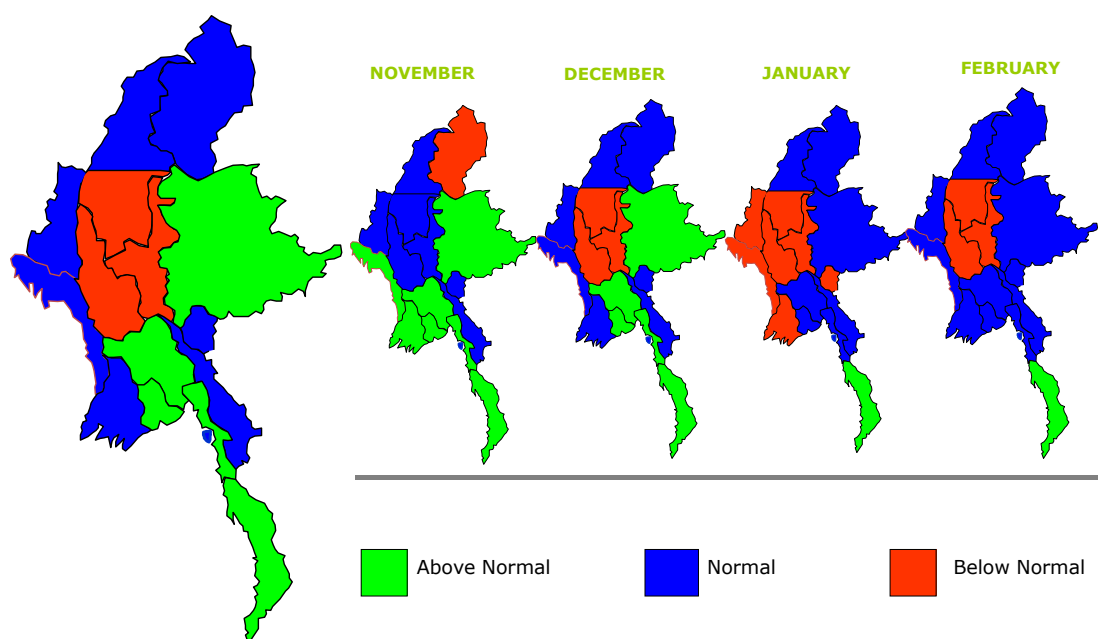


Figure 20. Rainfall map for Myanmar for the winter season (left) and for the months of November 2012 to February 2013 (DMH, as presented during the 9th Monsoon Forum, 26 October 2012, Nay Pyi Taw, Myanmar)

According to DMH, it is possible for three (3) Low Pressure Areas (LPAs) to form over the South Bay of Bengal from November 2012 to February 2013. Of these LPAs, two (2) may intensify into depressions.

SECTION 4

SEASONAL OUTLOOK FOR THE WINTER SEASON

Figure 21 shows the night temperature outlook for the forecast period.

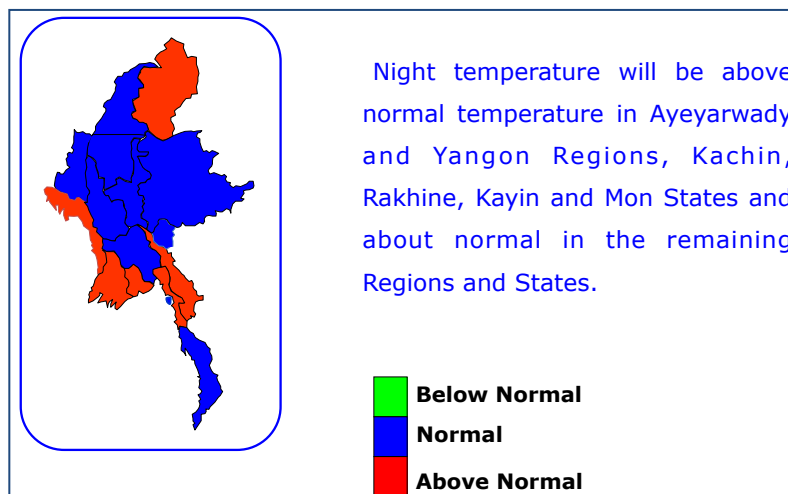


Figure 21. Night temperature outlook for the winter season (DMH, as presented during the 9th Monsoon Forum, 26 October 2012, Nay Pyi Taw, Myanmar)

Figure 22 illustrates DMH's foggy days outlook for the winter season.

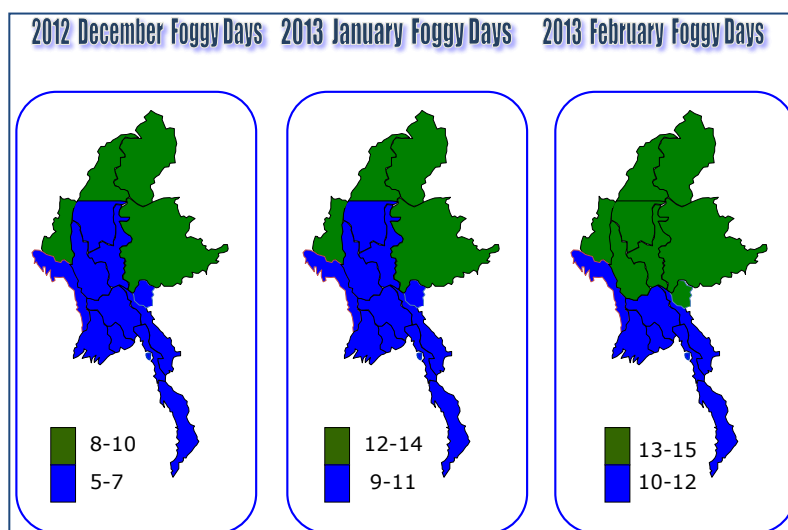


Figure 22. Foggy days outlook from December 2012 to February 2013 (DMH, as presented during the 9th Monsoon Forum, 26 October 2012, Nay Pyi Taw, Myanmar)

The long-range water level forecast is provided in Figure 23.

SECTION 4

SEASONAL OUTLOOK FOR THE WINTER SEASON

Table 4. Long-Range Water Level Forecast					
Stations	Possible decrease of water level from October 2012 water level (in ft)				
	Nov 2012	Dec 2012	Jan 2013	Feb 2013	Total Nov 2012 to Feb 2013
Ayeyarwady River					
Myitkyina	2.5	1.5	1.0	0.5	5.5
Bhamo	2.5	1.5	1.0	0.5	5.5
Katha	4.0	2.0	1.5	1.0	8.5
Mandalay	6.0	2.0	1.5	1.0	10.5
Sagaing	6.0	2.0	1.5	1.0	10.5
Pakokku	7.0	2.5	2.0	1.0	12.5
Nyaung-U	7.0	2.5	2.0	1.0	12.5
Chauk	8.0	3.0	2.0	1.0	14.0
Minbu	8.0	3.0	2.0	1.0	14.0
Magway	8.0	3.0	2.0	1.0	14.0
Aungmye	8.0	3.0	2.0	1.0	14.0
Pyaw	9.0	4.0	2.0	1.0	16.0
Seiktha	9.0	4.0	2.0	1.0	16.0
Hinthada	9.0	4.0	2.0	1.0	16.0
Zalun	9.0	4.0	2.0	1.0	16.0
Chindwin River					
Hkamti	4.0	2.0	1.0	0.5	7.5
Homalin	4.0	2.0	1.0	0.5	7.5
Mawlaik	5.0	2.0	1.0	0.5	8.5
Kalewa	6.0	2.5	1.5	1.0	11.0
Monywa	6.0	2.5	1.5	1.0	11.0

Figure 23. Long Range Water Level Forecast for the different water level stations in Ayeyarwady and Chindwin Rivers for the winter season (DMH, as presented during the 9th Monsoon Forum, 26 October 2012, Nay Pyi Taw, Myanmar)

SECTION 5

IMPACTS OUTLOOK AND RESPONSE OPTIONS

5.1 Sectoral Impacts Outlook and Response Options

Presentations from the different sectors, are summarized in the table below:

Agriculture, Irrigation, and Water Resources	
Potential Impacts	Response Options
Dry Zone	
<ul style="list-style-type: none"> o Lesser inflow into dams and reservoirs; irrigation inflow in Sagaing is likely going to be low; water shortage problems are likely to rise o Insufficient water supply to farmlands for summer paddy/sesame o Shortage of drinking and irrigation water for rural communities and draught animals o Winter season cropping time might be delayed due to insufficient rainfall in some areas, especially in the dry zone o Decrease in crop production especially on upland crop areas o Reduction of daily income of farmers and landless population o Low water level will affect pumping station operation 	<ul style="list-style-type: none"> o Preparation of water harvesting facilities (water pond/ water collecting equipment) o Farmers can immediately prepare for summer plowing, to make use of residual moisture o Adjust cropping pattern based on crop water requirement/available water
Coastal Areas	
<ul style="list-style-type: none"> o In November and December, paddy harvesting seasons coincide with above normal rainfall in many areas. There is probability that harvested paddy will be damaged and post-harvest losses will increase o Winter season cropping time might be delayed due to insufficient rainfall in some areas o Flood can occur due to unusual rainfall intensity; flood protection embankments and polders could be damaged o Salt water intrusion could be possible in cultivable areas 	<ul style="list-style-type: none"> o Farmers can prepare reserved seeds, inputs, family assets, etc. and move them to safe place once they receive DMH shorter-term forecasts ahead of time o Rural families can prepare sea water protection dikes and other protective measures o Mangrove nursery could be prepared in coastal and delta areas to help mitigate adverse conditions
Mountain/Hilly Regions	
<ul style="list-style-type: none"> o Rural communities could experience crop failure if foggy period is prolonged 	<ul style="list-style-type: none"> o Orchard owners could adjust their cropping techniques to reduce damage

Fisheries and Forestry	
Potential Impacts	Response Options
<ul style="list-style-type: none"> o Reduced water level in fishponds could result to high pollution and saline concentration, hence production rate could be lower o Migration of marine species due to higher water temperature o Higher temperature would result to decrease in the rate of oxygen dissolution in water hence production, especially for shrimp, would likely go down o Rise of diseases among fish species o In the forestry sector, above normal and untimely rainfall would be beneficial 	<ul style="list-style-type: none"> o Water supplementation could be done in fishponds

SECTION 6

ISSUES/ CONCERNS/ DEVELOPMENTS IN EARTHQUAKE MONITORING AND TSUNAMI EARLY WARNING

6.1 Presentation of Outputs: Estimation of Tsunami Arrival Time and Maximum Tsunami Wave Amplitude for Myanmar Coastal Areas by TUNAMI F1 Model

Dr. Yin Myo Min Htwe, Staff Officer, DMH and seconded scientist, RIMES, presented the session.

Dr. Yin explained that estimating tsunami arrival time and maximum wave amplitude can enhance preparedness and reduce the damages and losses from tsunami. He proceeded to recall historical tsunamis in Myanmar, and their origins, as indicated in Figure 24.

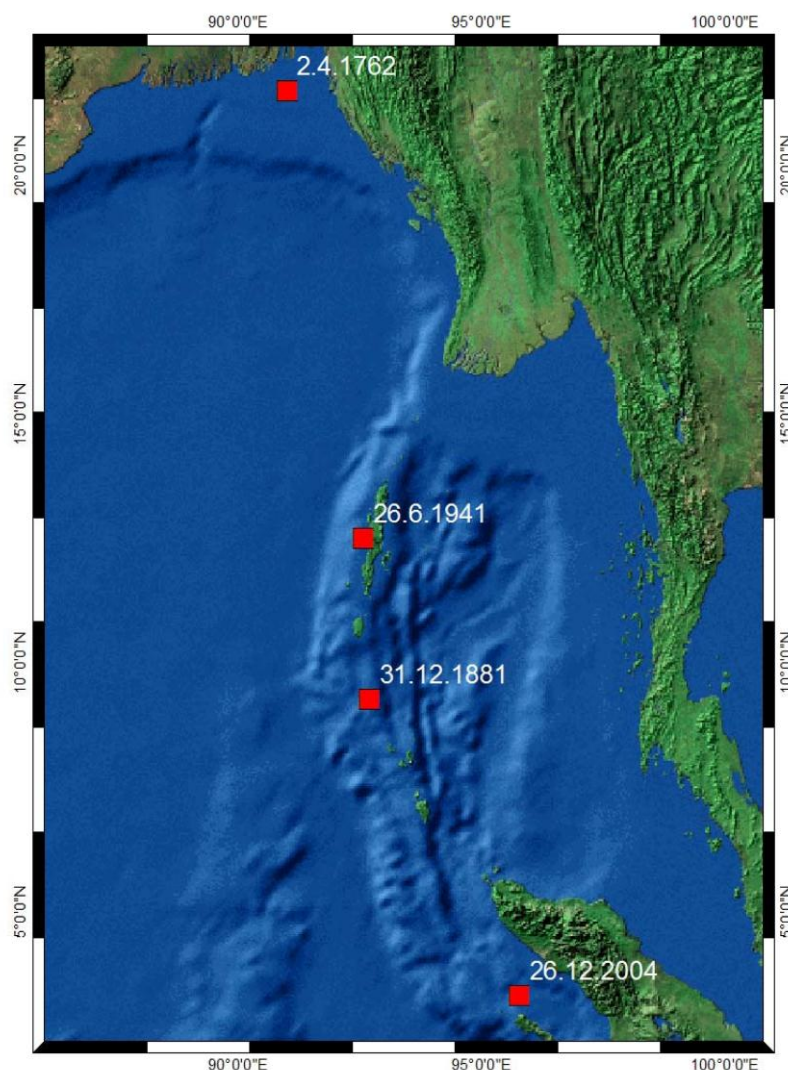


Figure 24. Historical earthquake events which generated tsunami that affected the coastal areas of Myanmar (DMH, as presented during the 9th Monsoon Forum, 26 October 2012, Nay Pyi Taw, Myanmar)

He then explained the process of generation of tsunami arrival time and wave amplitude which included:

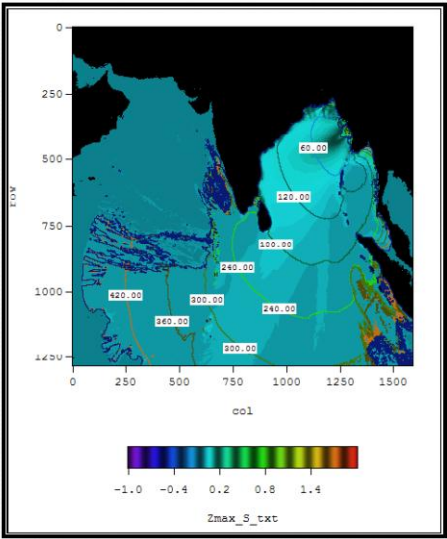
- Using, as inputs, the bathymetric data in coastal areas
- Tsunami generation using TUNAMI model
- Tsunami propagation
- Inclusion of fault parameters

He then presented the model outputs, as presented in the following figures.

SECTION 6

ISSUES/ CONCERNS/ DEVELOPMENTS IN EARTHQUAKE MONITORING AND TSUNAMI EARLY WARNING

**Tsunami Arrival Time by
M=8 of Arakan**



**Tsunami Arrival Time by
M=8.5 of Arakan**

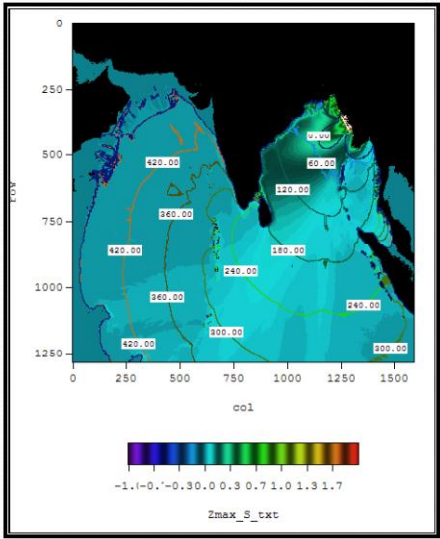


Figure 25. Tsunami arrival time generated by TUNAMI F1 model, for Magnitudes 8 and 8.5 at Arakan (Htwe, 2012)

**Tsunami Arrival Time and Maximum Tsunami Wave Amplitude
of Five regions of Myanmar Coastal Areas with M=8 at Arakan**

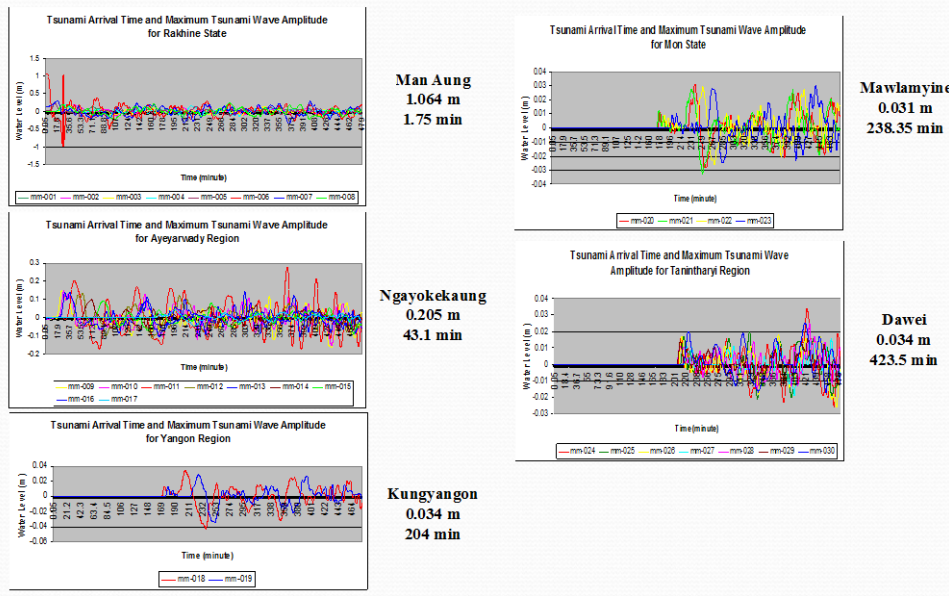


Figure 26. Tsunami arrival time and maximum tsunami wave amplitude in coastal areas in Myanmar estimated by TUNAMI F1 model for Magnitude 8 earthquake at Arakan (Htwe, 2012)

SECTION 6

ISSUES/ CONCERNS/ DEVELOPMENTS IN EARTHQUAKE MONITORING AND TSUNAMI EARLY WARNING

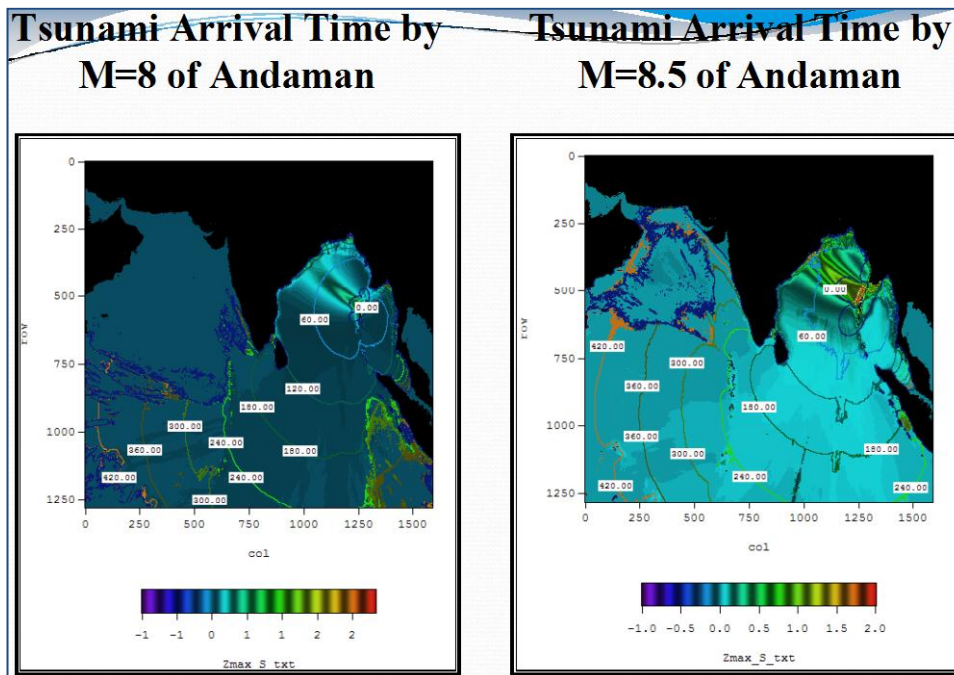


Figure 27. Tsunami arrival time generated by TUNAMI F1 model for magnitudes 8 and 8.5 earthquakes at Andaman (Htwe, 2012)

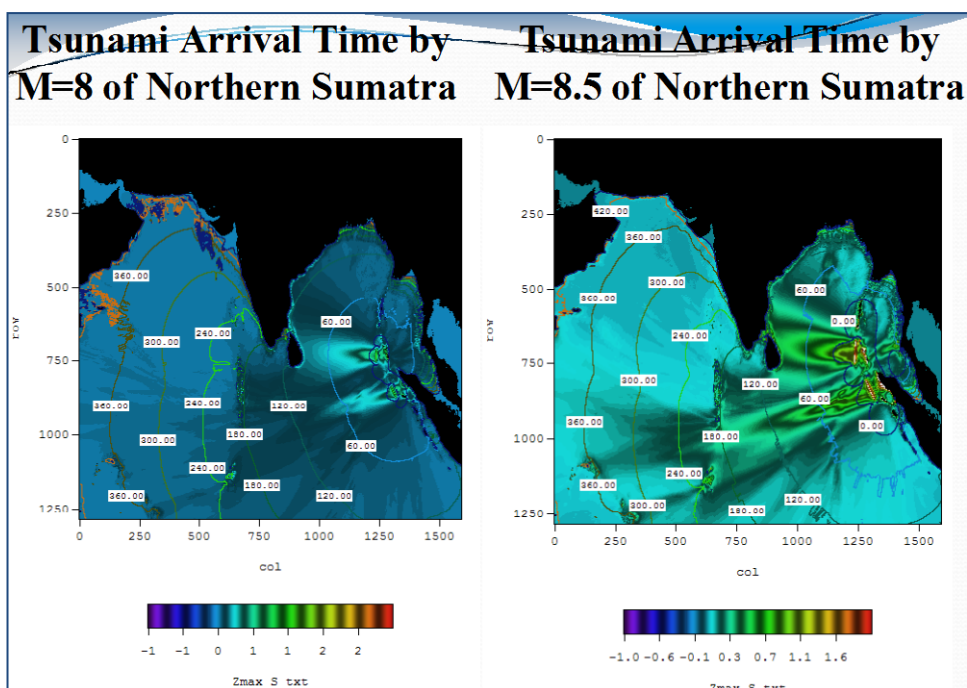


Figure 28. Tsunami arrival time in coastal areas in Myanmar for Magnitudes 8 and 8.5 earthquakes at Northern Sumatra (Htwe, 2012)

Dr. Htwe subsequently presented the following summary:

- **Magnitude 8, Arakan**

- Earliest arrival of tsunami wave at Man Aung and Kyeintali Cities, Rakhine State is estimated at 0.05 minutes after tsunami generation; wave height is estimated at of 1.06m at Man Aung and 0.12 m at Kyeintali

SECTION 6

ISSUES/ CONCERNS/ DEVELOPMENTS IN EARTHQUAKE MONITORING AND TSUNAMI EARLY WARNING

- Maximum wave height of 1.064 m can arrive to Man Aung at 1.75 minutes after the generation of tsunami

- **Magnitude 8.5, Arakan**

- Earliest arrival of tsunami wave, in 0.05 minutes after tsunami generation, is estimated for Sittwe (at 0.83m), Pauktaw (2.01m), Myebon (2.34m), Kyaukpyu (2.37m), Man Aung (2.22m), Kyeintali (0.32m)
- Maximum wave height of 2.37m is estimated to arrive in Kyaukpyu at 0.05 minutes after tsunami generation

- **Magnitude 8, Andaman**

- Earliest arrival of tsunami wave, in 33 minutes after tsunami generation, is estimated for Labutta at 0.001m
- Maximum wave height of 0.176m is estimated to arrive at Ngayokekang in Ayeyarwady Region at 464 min after tsunami generation

- **Magnitude 8.5, Andaman**

- Earliest arrival of tsunami wave in Labutta, is estimated at 20.25 min after tsunami generation, with wave height at 0.001m
- Maximum wave height of 1.136m is estimated to reach Ama in Ayeyarwady Region in 108.60 min after tsunami generation

- **Magnitude 8, Northern Sumatra**

- Earliest arrival of tsunami wave is estimated at 117.15 minutes, with wave height of 0.001m, after tsunami generation
- Maximum wave height of 0.19 m can arrive in Kawthoung in Thanintharyi Division in about 382.65 minutes after tsunami generation

- **Magnitude 8.5, Sumatra**

- Earliest tsunami wave arrival is estimated at 105.25 min in Haingyi Kyun in Ayeyarwady Region, with estimated wave height of 0.001m.
- Maximum wave height, of 0.99m, is estimated to arrive in Kawthoung in Tanintharyi Division in 463 min after tsunami generation

6.2 Discussion

- ***Provision of information on the active faults in Myanmar***

The participants requested DMH to provide information on the active faults in Myanmar.

- ***Earthquake prediction***

The participants asked DMH of the date and time of the next earthquake occurrence. DMH explained that as of the time being, global, regional, and national centers do not have the technology for earthquake forecasting/early

SECTION 6

ISSUES/ CONCERNS/ DEVELOPMENTS IN EARTHQUAKE MONITORING AND TSUNAMI EARLY WARNING

warning, and the technology available currently is only for earthquake monitoring.

SECTION 7

KEY RECOMMEN- DATIONS

7.1 Key Recommendations

Synthesis of the recommendations from stakeholders, during the Preparatory Meeting and the Monsoon Forum, are provided below:

- ***Enhanced generation of forecast/warning information***
 - Upgrading and expansion of weather observation and seismic monitoring stations
 - Building of capacity of DMH scientists in forecasting and other concerns, especially in the Agro-Meteorology Division
 - Application of modern/ latest technologies in DMH research and forecasting
 - Building the capacity of DMH scientists in the application of tools (i.e. GIS) for enhanced spatial analyses of agro-meteorological databases
 - Improving the spatial and temporal resolutions of forecast products
 - Strengthening the collaboration between DMH and international/ regional forecasting/ development organizations
 - Enhancing the capacity of DMH scientists in analyzing earthquake events and generation of tsunami warning
 - Development of location-specific climate change projections (region-, state-, or division-wise)
- ***Development of user-friendly forecast/warning information***
 - Usage of simple terminologies in forecast products
- ***Building stakeholders capacity in understanding, translating, and applying forecast/warning information***
 - Strengthening the capacity of user institutions in projecting impacts and responses, based on forecast information
 - Updating of agro-ecological maps by the agriculture sector
 - Publication of monthly journal discussing different topics of interest to the stakeholders by DMH
 - Provision of educational materials, e.g. posters, pamphlets, etc., to communities to increase people's awareness on disaster risks and risk management options
 - DMH to develop an awareness program on weather and seismic hazards, warnings, and general precautionary measures which can be shown in different radio and television stations (i.e. MRTV). MRTV indicated that it can give time-slots for DMH to air such programs over radio and/or television
- ***Communication/dissemination of forecast/warning information***
 - Development, by DMH, of directory of institutional focal points in the media and other user institutions. The directory should include mobile phone numbers of focal points to ensure communication pathways in cases when landline and fax connections are down. Directory shall be provided to all concerned institutions
 - A mechanism to ensure receipt of warning information by stakeholders should be put in place. In the aviation sector, for example, problems on plane landing have been encountered because of the fog
 - Dissemination, by DMH, of relative humidity forecast to farmers on a regular basis
 - Strengthening of collaboration between DMH and mass-based organizations, like the Myanmar Red Cross Society, to ensure speedy dissemination of forecasts, especially for hazards with short-lead time, like tsunami

SECTION 7

KEY RECOMMEN- DATIONS

- Establish a mechanism to ensure receipt of forecasts in local areas
- ***Access to DMH's historical data***
 - The participants recommended that historical data, from DMH, be provided to user-institutions for free
- ***Strengthening the Monsoon Forum Process***
 - Participants recommended that during the next Monsoon Forum, a session on definition of forecast terminologies should be included in the agenda, preferably before the main sessions begin to facilitate better understanding, among the stakeholders, of the discussions.
 - Presentation of forecasts should not be very technical

SECTION 8

CLOSING SESSION

8.1 Synthesis

Ms. Policarpio of RIMES provided a summary of the key discussion points during the Preparatory Meeting and Monsoon Forum.

8.2 Way Forward and Closing Remarks

Mr. Kyaw Moe Oo, Deputy Director General, DMH, conveyed his hope that the forecasts provided for the Southwest Monsoon Season would be helpful to the participants. He indicated that DMH is looking forward to hearing feedback on the usability of the forecast during the next Monsoon Forum. He thanked the participants for the active participation and their inputs to the discussions. He likewise conveyed thanks to UNESCAP and RIMES for the support extended to DMH.