

*Current Limitations and Challenges
in Myanmar
on Flood Forecasting in General and on the use
of Remote Sensing*

Hydrological Division

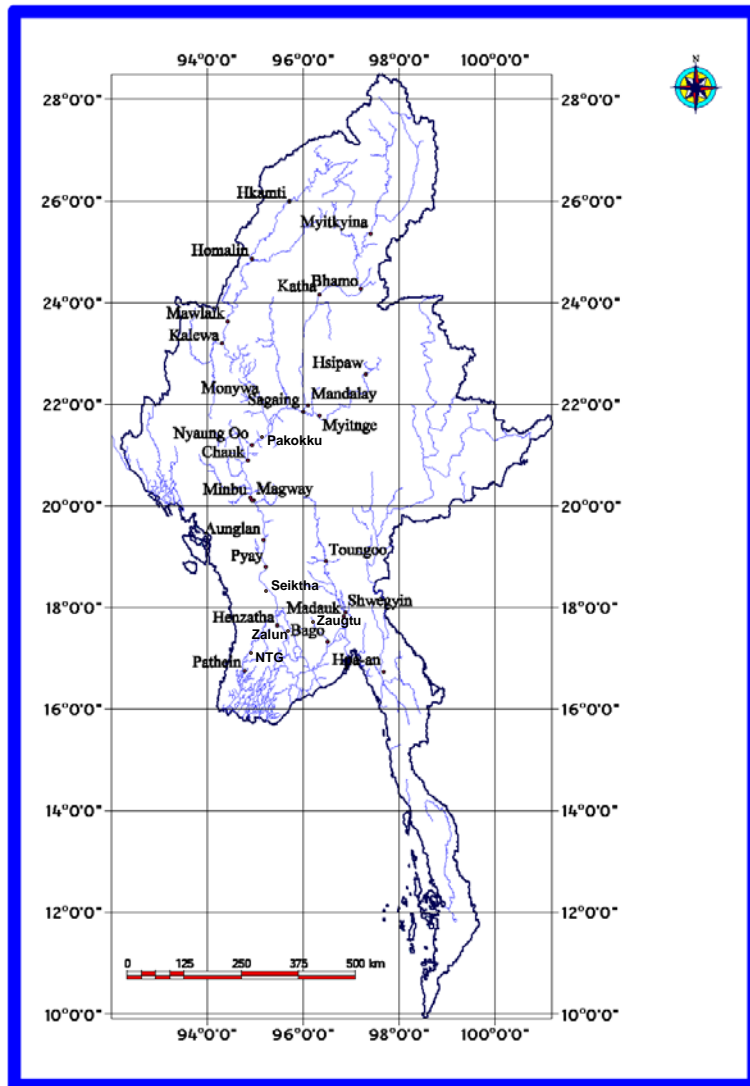
Department of Meteorology and Hydrology

Ministry of Transport

20 November 2014

Yangon

Hydrological Forecasting Stations



Myanmar has eight major rivers which generally flow from North to South.

Ayeyarwady - 1789 km

Chindwin - 901 km

Thanlwin - 1223 km

Sittoung - 407 km

Bago River - 331 km

Ayeyarwady

- 15 stations

Chindwin

- 5 stations

Sittaung

- 2 stations

Thanlwin

- 1 station

Dokehtawady

- 2 stations

Bago

- 2 stations

Shwegyin

- 1 station

Ngawun

- 2 stations

Different Type of Issues and Warnings

- Daily water level forecast
- Dekad Forecast (10 days advance FC)
- Monthly Forecast
- Significant Water level Bulletin
- Flood warning and Bulletin
- Minimum Alert Water Level and Bulletin (for low flow)
- Seasonal water level forecast
 - General Long Range flood Forecast
 - Flood Forecast for early monsoon
 - Flood Forecast for Peak-monsoon
 - Flood Forecast for Late-monsoon



Types of Forecast and Warning (Hydrological Division)

Type of Forecast	Date of Issue	Forecast Validity	Forecast Area
Daily water level forecast	Daily	1 day	30 Stations(8 Major Rivers)
Dekad Forecast	8 th , 18 th , 28 th of Every Month	10 days	20 Stations (Ayeyarwady and Chindwin River)
Monthly Forecast	28 th of Every Month	1 Month	20 Stations (Ayeyarwady and Chindwin River-Low Flow Period)
			30 Stations(8 Major Rivers-Monsoon Season)
Significant Water Level Bulletin	Pre Monsoon Period	Depend on WL rising	20 Stations (Ayeyarwady and Chindwin Rivers)
Flood Warning and Bulletin	Monsoon Season	Depend on WL rising/falling	30 Stations(8 Major Rivers)
Minimum Alert Water Level and Bulletin (for low flow)	Low Flow Season	Depend on WL falling	7 Stations (Ayeyarwady and Chindwin Rivers)
Seasonal water level forecast			
- General Long Range Flood Forecast	28 th April	The whole monsoon season	30 Stations(8 Major Rivers)
- Flood Forecast for Early monsoon period	28 th April	2 Month	
- Flood Forecast for Mid-monsoon period	28 th June	2 Month	
- Flood Forecast for Late-monsoon period	28 th Aug	2 Month	

Flood Forecasting Methods

Daily Water Level Forecast

- ☐ River Stage Correlation Method
- ☐ Empirical model (based on single and multiple regression analysis)

Seasonal water level forecast

- ☐ Based on flood characteristic occurred in Analogue years
- ☐ Based on seasonal weather forecast
- ☐ Based on comparison of current flow with the individual hydrograph for the last (10) years
- ☐ Based on the average flow of the last (10) years
- ☐ Based on Flood frequency analysis

✓ Based on Satellite rainfall from Many different website

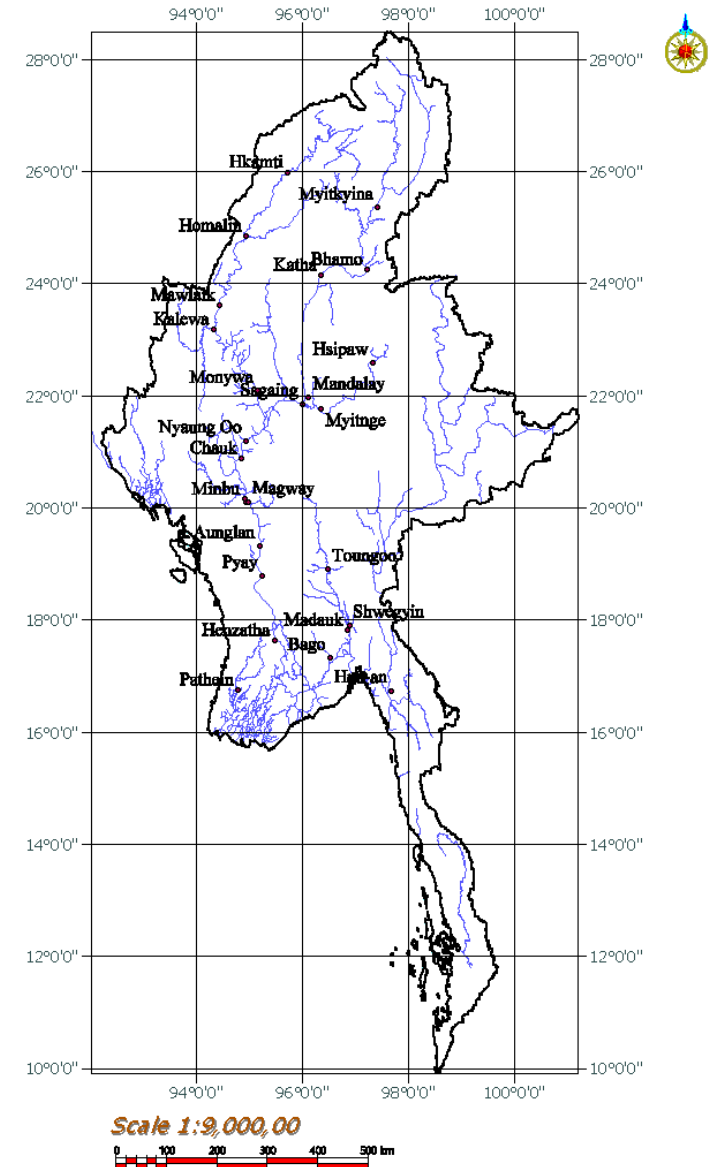
Lag Time for Ayeyarwady River

Stations	Lag Time
Myitkyina to Bhamo	1 day and 12 hrs
Bhamo to Katha	1 day and 12 hr
Katha to Mandalay/Sagaing	3 days and 12 hrs
Mandalay/Sagaing to Nyaung Oo	1 day and 18 hrs
Nyaung to Chauk	1 day
Chauk to Minbu/Magway	1 day
Minbu/Magway to Aunglan	1 day
Aunglan to Pyay	1 day
Pyay to Hinthada	1 day
















Lag Time for Chindwin River

Stations	Lag Time
Hkamti to Homalin	1 day and 12 hrs
Homalin to Mawlaik	1 day and 18 hr
Mawlaik to Kalewa	1 day
Kalewa to Monywa	1 day and 18 hrs

Hydrological Forecasting Stations



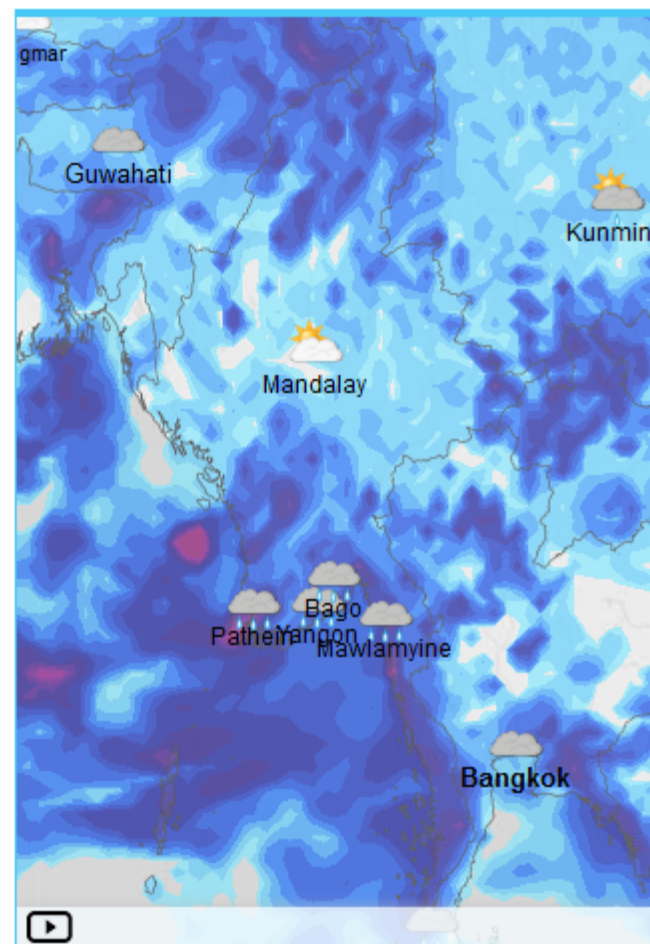
Weather forecast for Myanmar

Places	Tuesday	Wednesday	Thursday	Shortcuts
Bago	 26°	 27°	 29°	Hour by hour Long term
Mandalay	 32°	 32°	 32°	Hour by hour Long term
Mawlamyine	 27°	 25°	 28°	Hour by hour Long term
Patheingyi	 25°	 29°	 27°	Hour by hour Long term
Yangon	 28°	 28°	 29°	Hour by hour Long term

Regions

[Ayeyarwady](#)
[Bago](#)
[Chin](#)
[Kachin](#)
[Kayah](#)
[Kayin](#)
[Magway](#)
[Mandalay](#)

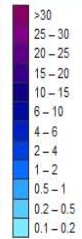
[Mon](#)
[Other](#)
[Rakhine](#)
[Sagaing](#)
[Shan](#)
[Tanintharyi](#)
[Yangon](#)



N-Europe

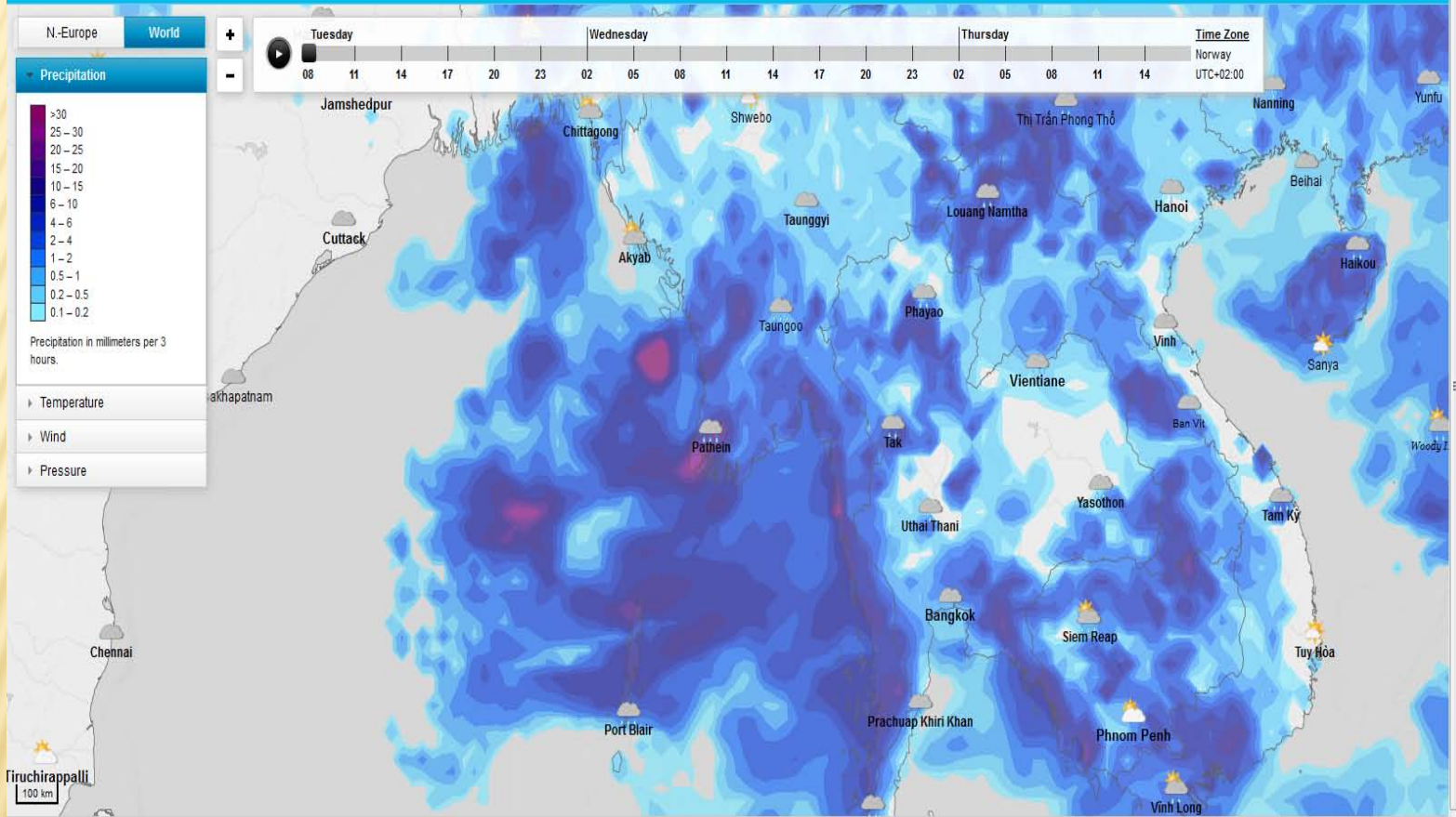
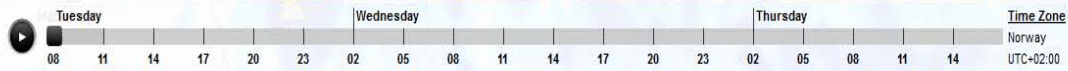
World

Precipitation



Precipitation in millimeters per 3 hours.

- Temperature
- Wind
- Pressure



Multiple Linear Regression Approach for 1 day ahead for Chindwin River

FC for Hkamti

$$H_{HTt+1} = 0.95H_{HTt} + 0.38RF_{HTt} + 0.26RF_{PTt} + 0.51H_{HTt(change)} + 24.6$$

Used
parameters



WL and RF of Forecasting Station, 24 hr Change
WLs

FC for Homalin

$$H_{HMT+1} = 0.95H_{HMT} + 0.02H_{HTt-1} + 0.35H_{HTt(change)} + 114.57$$

Used
parameters



WL of Forecasting Station, WL of upstream station, 24
hr Change WL

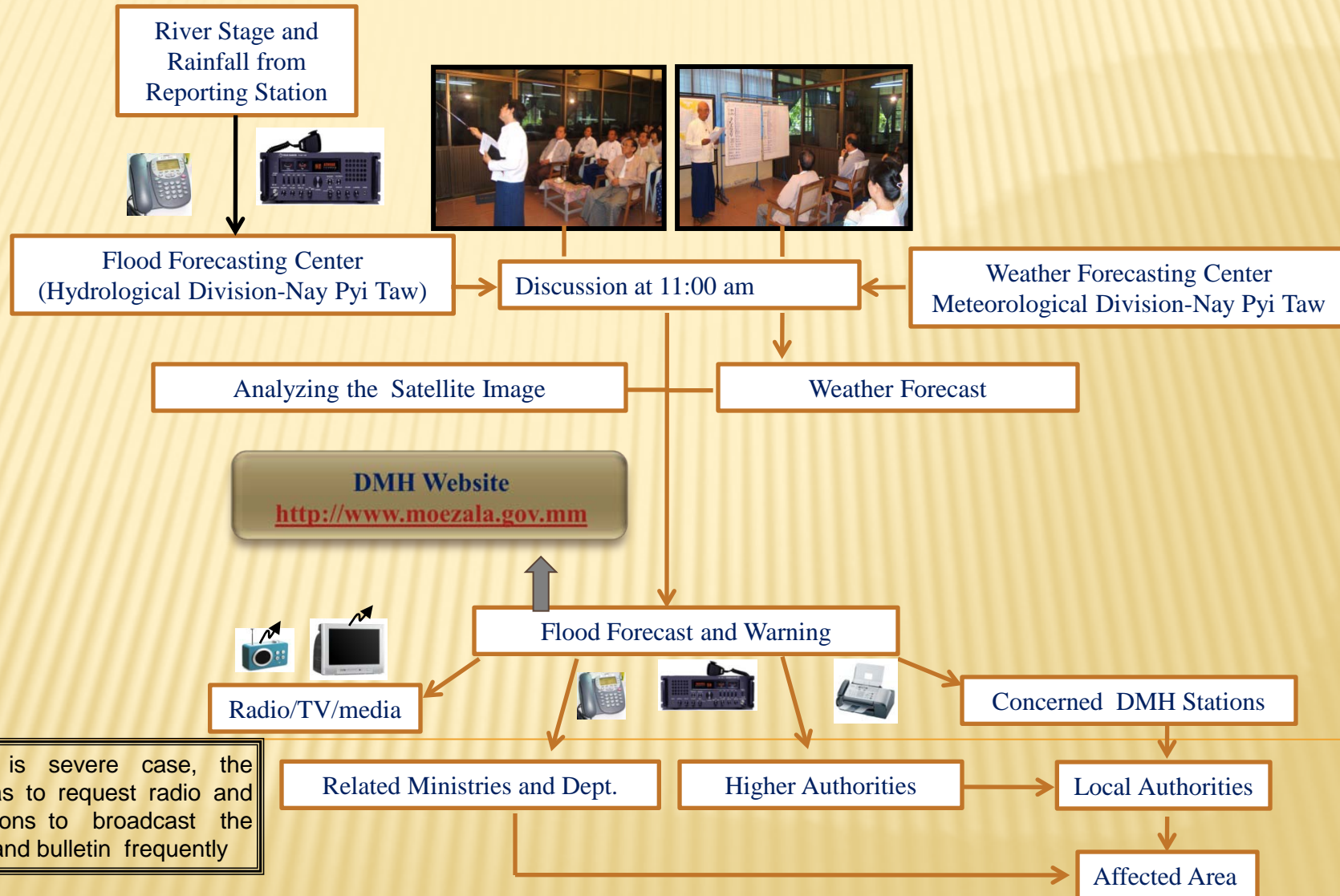
Issuing of Forecast and Warning

- ☐ **River Water Level Forecasting has being issued 24 hours in advance**
- ☐ **Flood Warning is issued when the water level rise up to 1 meter below danger level**
- ☐ **Flood warning can be issued from 1 to 2 days in advance for upper part of river and 2 to 5 days in advance for middle and lower reach of major rivers**
- ☐ **Flood Bulletin is issued when the water level reach or exceed the danger level and till reach below the danger level.**
- ☐ **Significant WL bulletin is issued from 3 to 7 days in advance for the Ayeyarwady and Chindwin Rivers**

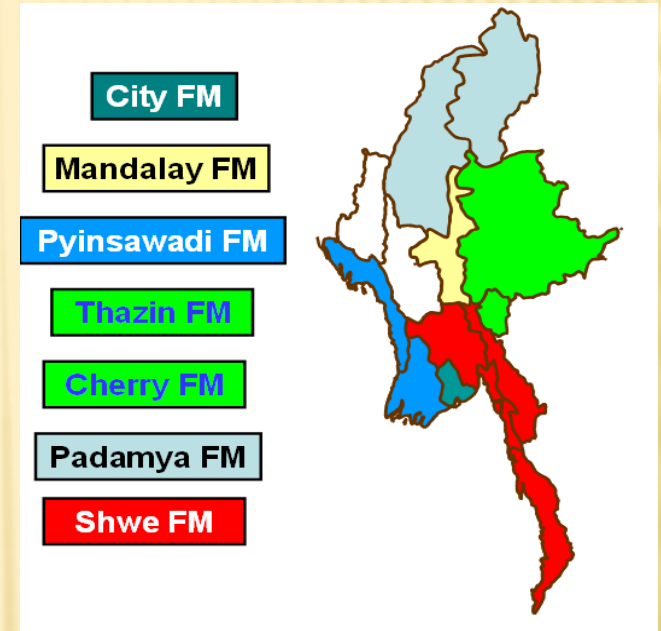
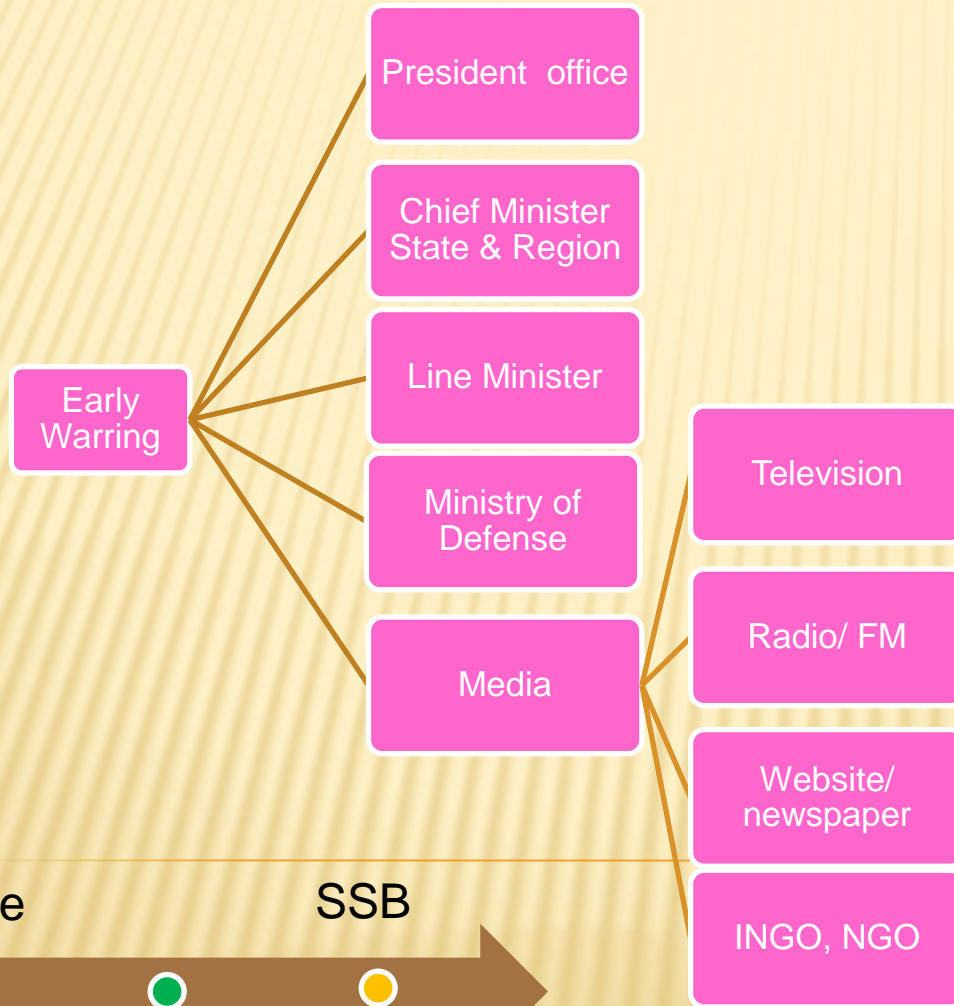
Significant Water level Bulletin

- ❑ Significant water level bulletin is issued at the pre-monsoon period (April and May) for the people from the low lying area, fisher-men and farmers near the river bank have to be noticed the rising of water level.**
 - ❑ When the water level is sharply risen at the most upstream station, the significant water level bulletin is issued 3 to 7 days in advance for the downstream station along the Ayeyarwaddy and Chindwin Rivers**
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Flood Forecasting and Warning System



Early Warning Dissemination



Phone

SSB

Fax

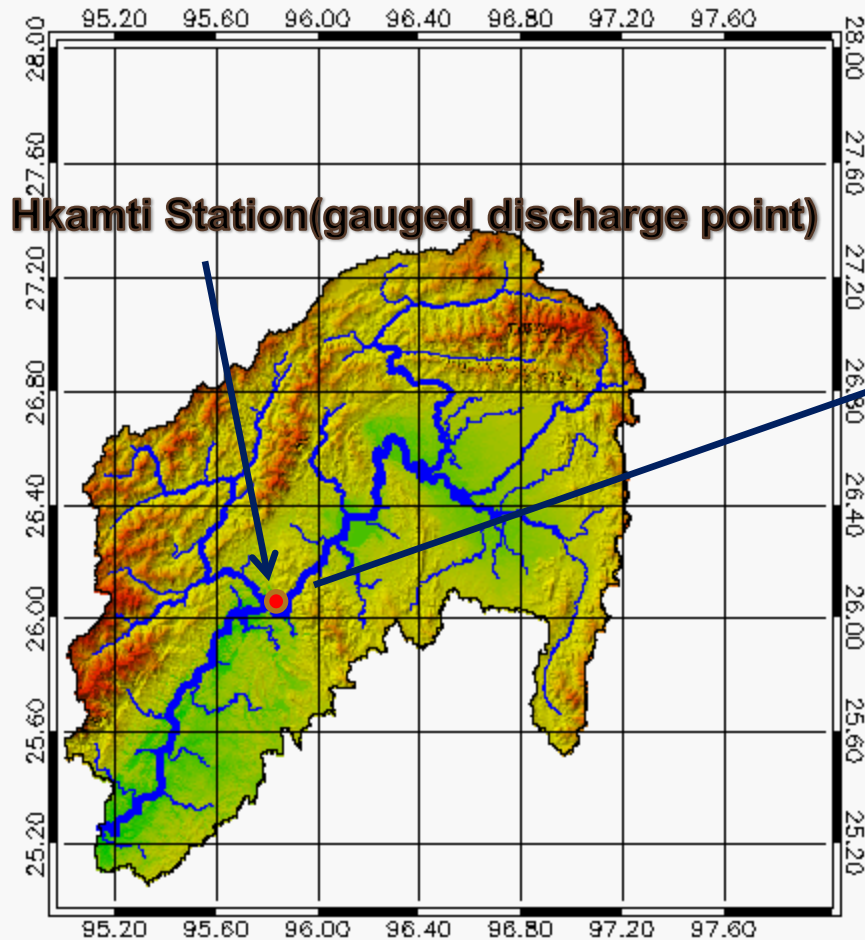
Training Workshop on Installation of Integrated Flood Analysis System (IFAS)

Supported by JAXA

22 -24 June 2010
Nay Pyi Taw, Myanmar



Target Basin



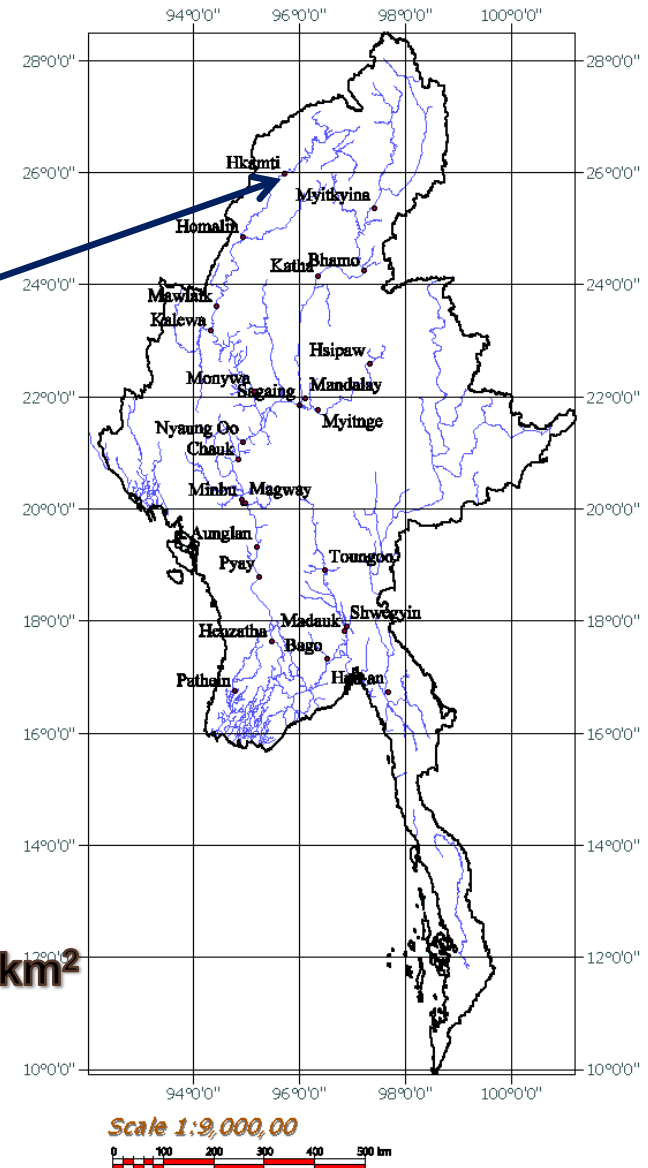
Catchment Area above Hkamti Station is 27420 km²

Outlet Elevation - 139 m above mean sea level

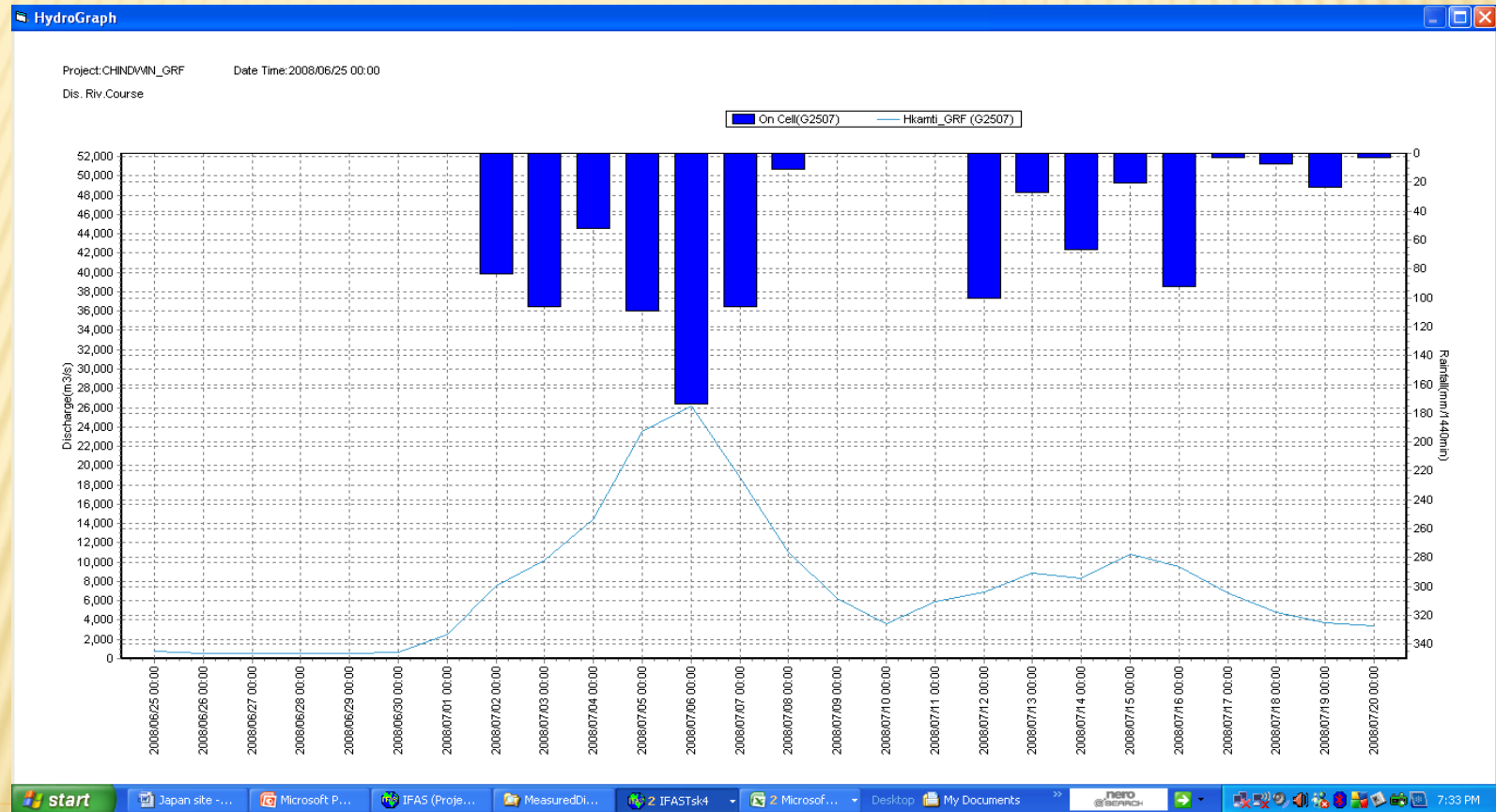
Basin relief - 3.252 km

Drainage density - 2.17 m⁻¹

Hydrological Forecasting Stations

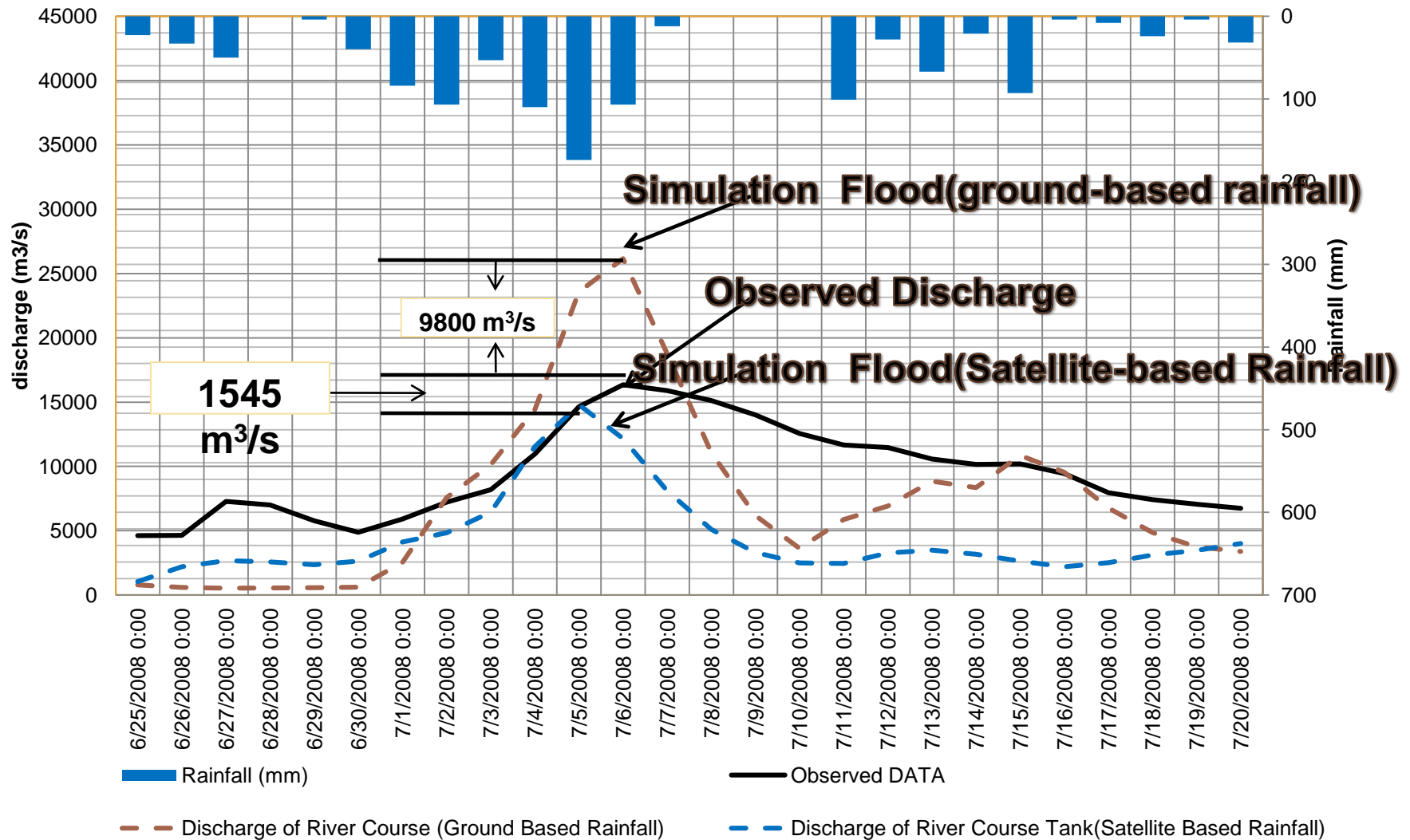


Simulation result using by satellite-based rainfall



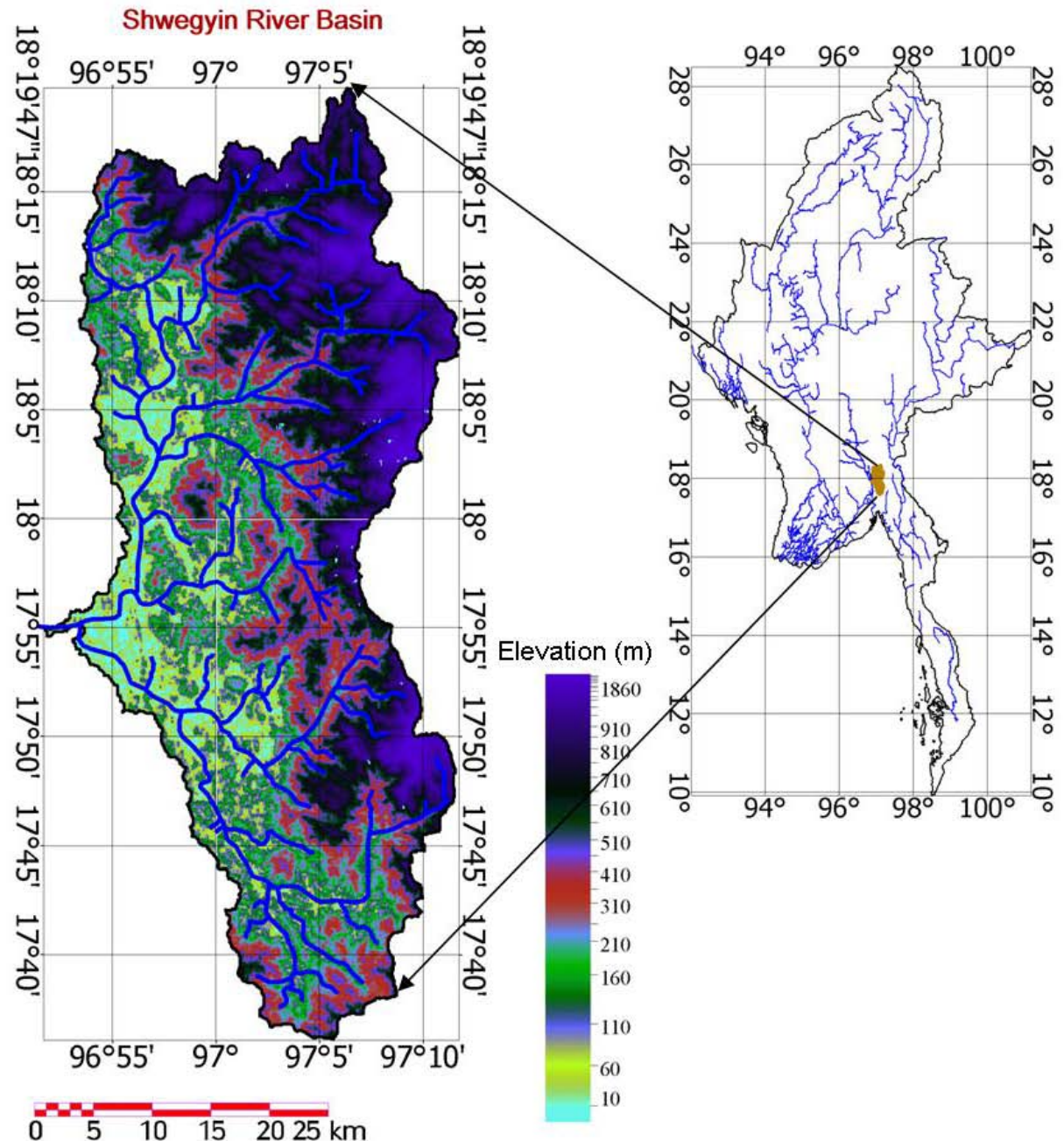
Comparing between Observed and Simulation Flood

Comparison between Observed and Simulated Flood



Study Area

- It stretches for about 42 miles from north to south and 19 miles from east to west,
- It is situated on the mouth of Shwegyin River
- Shwegyin River catchment is about 1747 km²
- Topography of the basin is varying from 40 ft to 6200 ft above Mean Sea Level



***Utilization of satellite-based
rainfall as an input data***

Product Name	3B42RT	CMORPH	QMORPH	GSMaP
Builder	NASA/GSFC	NOAA/CPC	NOAA/CPC	JAXAEORC
Coverage	60° N – 60° S			
Spatial Resolution	0.25° (25 km)	0.25° (25 km)	0.25° (25 km)	0.1° (10 km)
Temporal Resolution	3 hr	3 hr	30 min	1 hr
Delivery delay	10 hr	15 hr	2.5 hr	4 hr
Data Archive	Since Dec. 1997	Since Dec. 2002	-	Since Dec 2007

***.bin**

***.dat**

Get Area

Lower Left Latitude: Longitude:

Upper Right Latitude: Longitude:

Timing Conditions

Cell Size: km

Start Date,Time: h End Date,Time: h

Time Interval: minute

View	Data	Transpare	Legend Color
<input checked="" type="checkbox"/>	Pseud. River	0% ▼	Move Top
<input checked="" type="checkbox"/>	Basin Boundary	0% ▼	Move Up
<input checked="" type="checkbox"/>	Basin Elevation Data	0% ▼	Move Down
<input checked="" type="checkbox"/>	Sub-Basin	0% ▼	

Download

Data Name

Source

Period

Original Data Location

Date

Saved Data Location

Date

Description :

Data Import

Rainfall Data

Source: 3B42RT(V5) ▼

Import Folder: 3B42RT(V5)
3B42RT(V6)

Start Date,Time: **GSMaP_NRT** h
GSMaP_MVK+
Qmorph
Cmorph
CSV(Ground-based Rainfall)
GPV

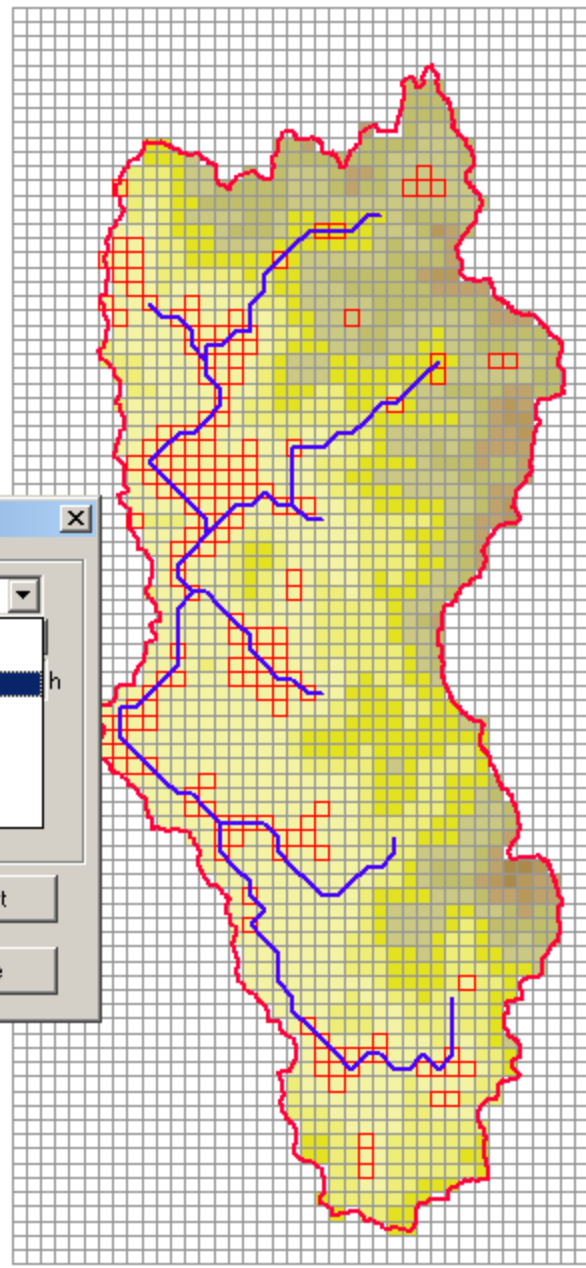
Imported Date: Acquirer:

Data Name:

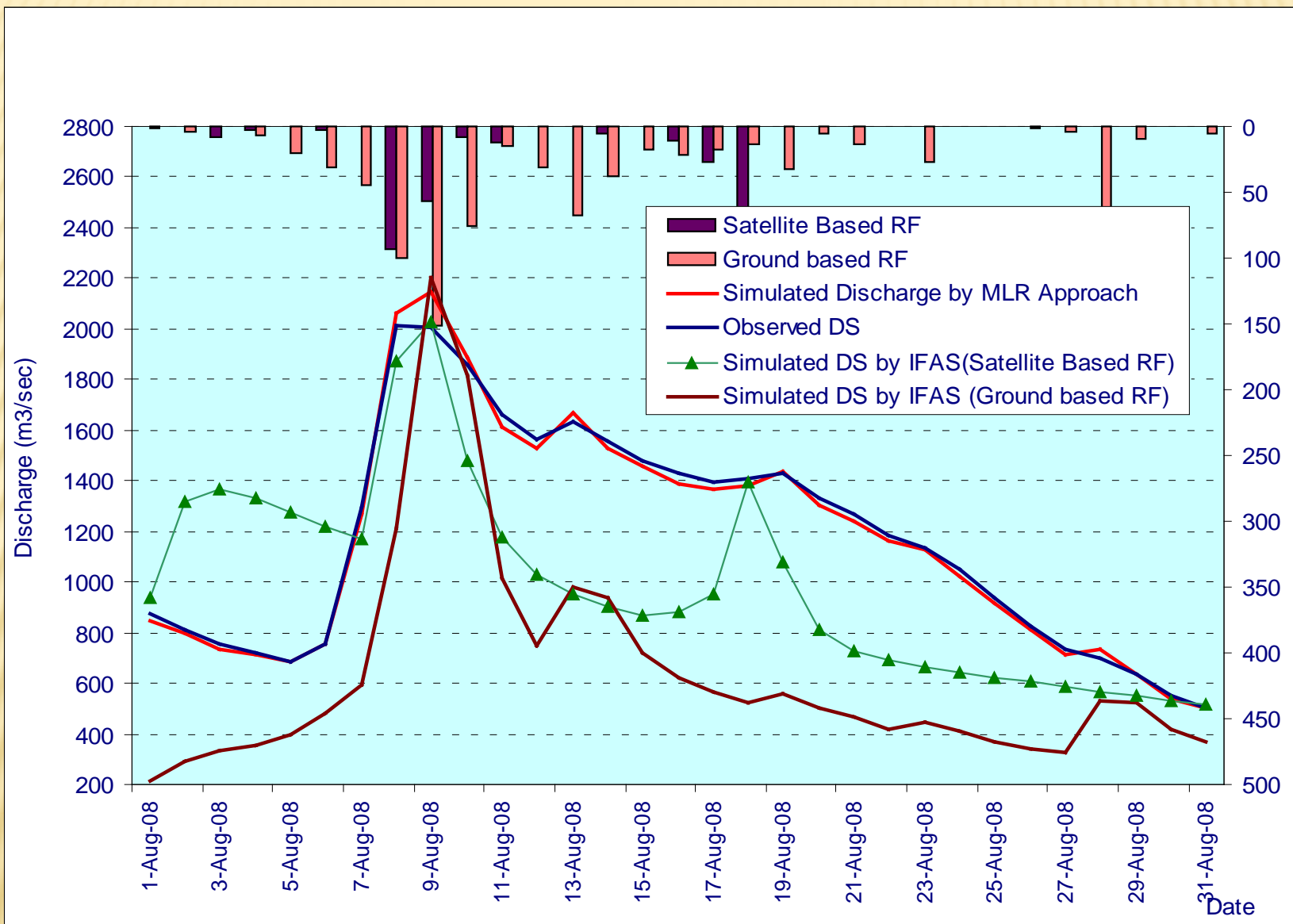
Save Path:

Import

Close



Close





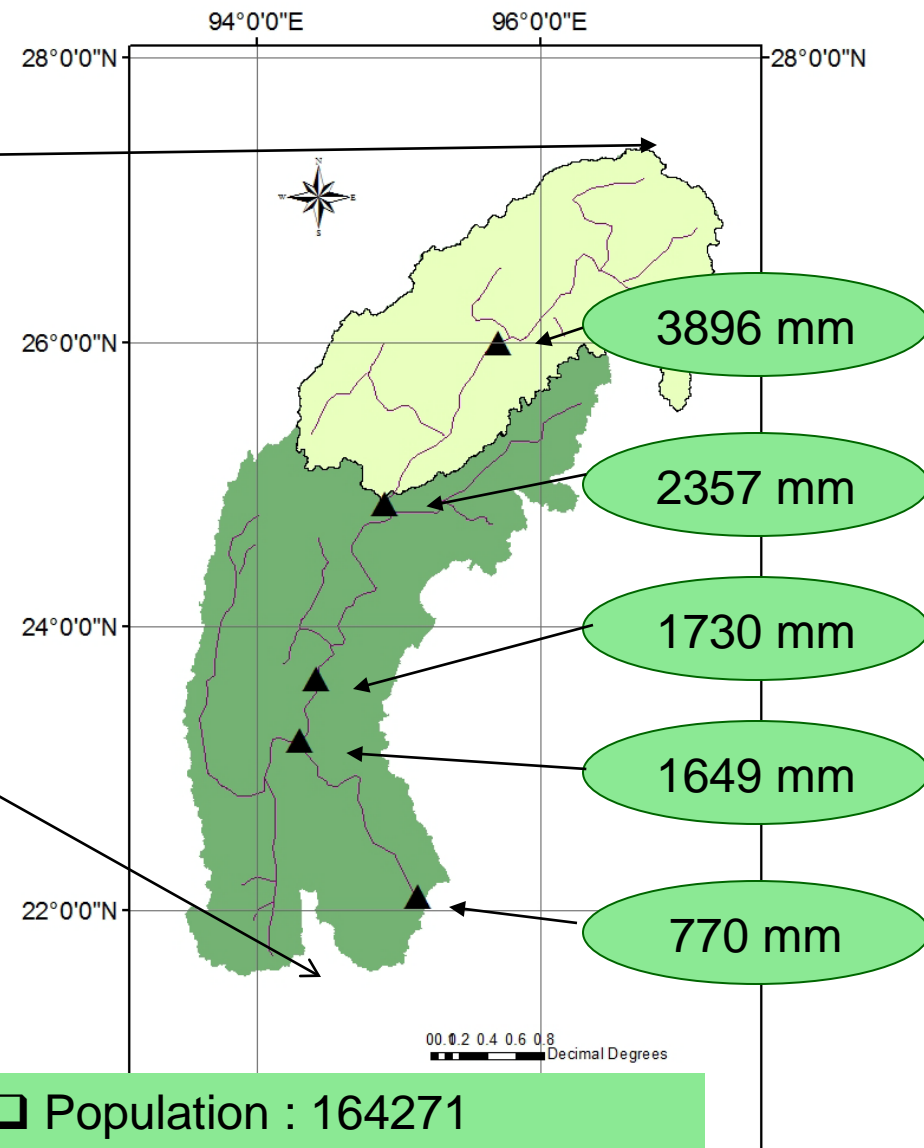
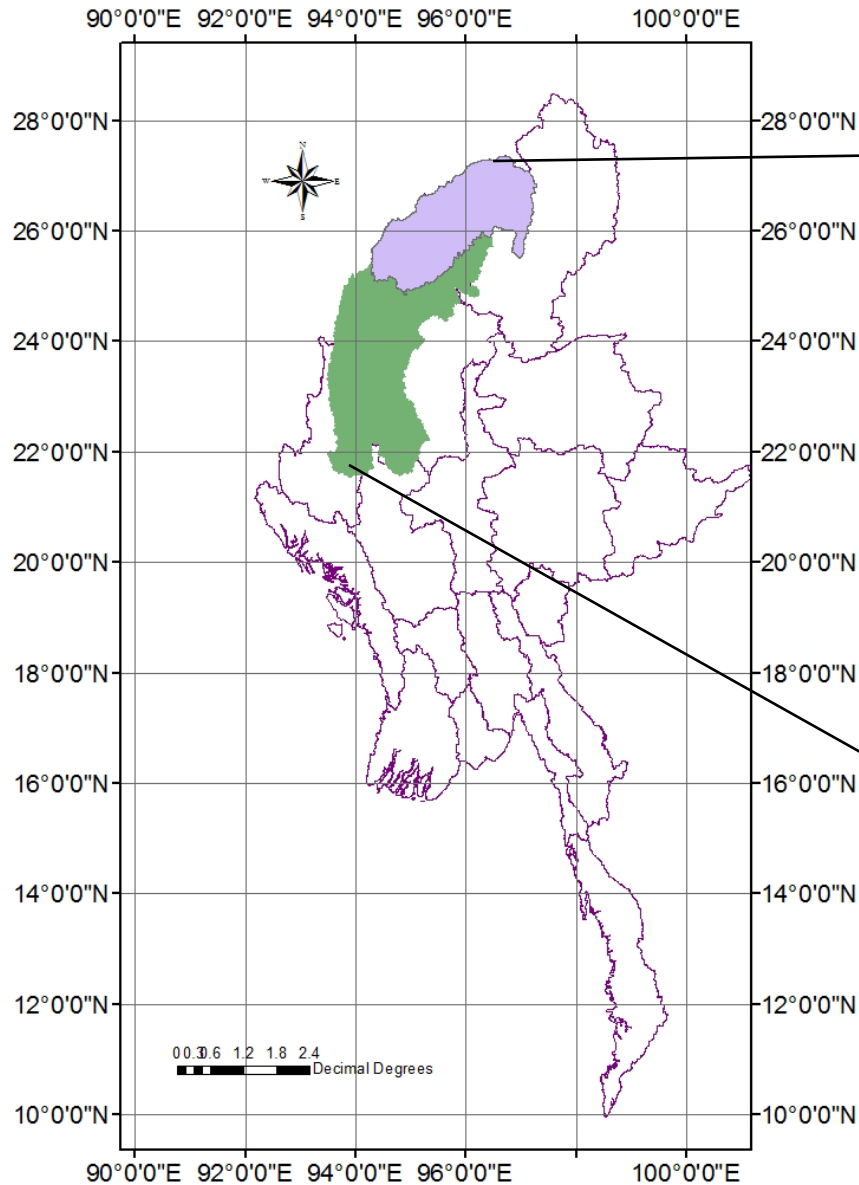
Flood Hazard Mapping in Homalin City in the Chindwin River Basin

(10-28 September 2012)

1st Phase



Introduction (Study Area)



Objective

S

- To develop the flood hazard map for Homalin city for different return periods
 - To verify the flood depth and flood duration in village level
 - To identify an appropriate disaster-preparedness plan and mitigation activities for Homalin city
-

Requirements to improve existing flood warning system

- To upgrade the use of the new advance technologies for Flood Forecasting in future.
- IFAS is applicable for large catchment or not.
- High performance computer
- Real time satellite rainfall data (it is easy to download the data from the different websites.
- How to modify the simulation result, if the error between simulation hydrograph and observed hydrograph is more and more.
- Long term and Short term training on IFAS and RRI
- Technical knowledge about the GIS and Remote Sensing application on flood forecasting

Thank you for your kind attention!

Website - <http://www.moezala.gov.mm>