Flood Management in Myanmar

By

Mrs. Tin Yi
Staff Officer
Dept. of Meteorology & Hydrology , Myanmar

1. Introduction

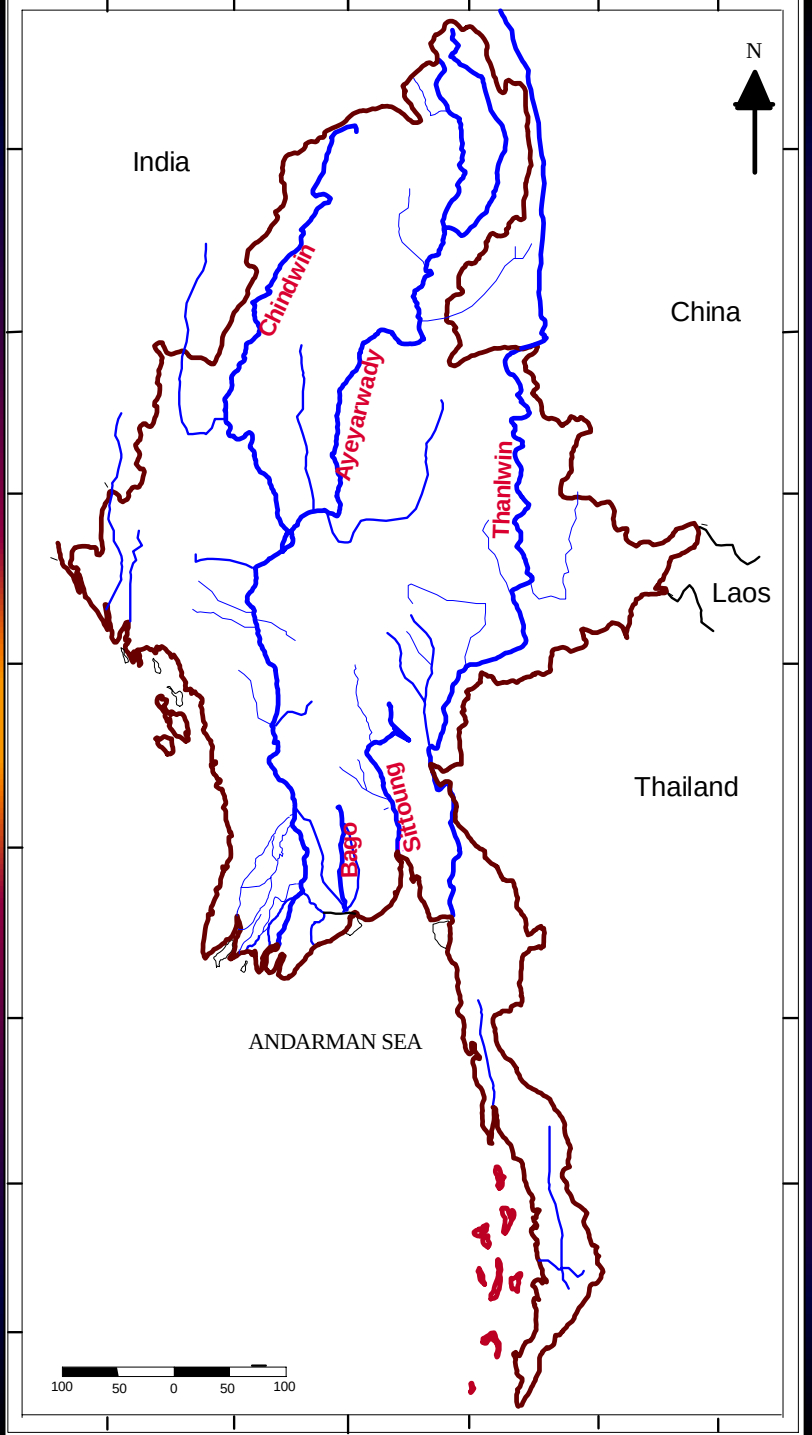
- Flood occurs in Myanmar every year
- during the Southwest Monsoon period (June – Oct)
- % of occurrence of flood in medium and large river

June	July	Aug	Sept	Oct
6 %	23%	49%	14%	8%

- Dept. of Meteorology and Hydrology (DMH)
- Dept. of Irrigation (DI)
- Directorate of Water Resources and Improvement of River System (DWIR)
- Dept. of Relief and Resettlement (DRR)

are mostly responsible for flood mitigation and preparedness in Myanmar

2. Major Rivers in Myanmar



3. Flood in Myanmar

★ Widespread flood

- ⇨ mostly occur in the large and medium rivers
- ⇨ caused by the heaving rainfall striking at the head water region for considerable period (1- 3 days), the flood wave forming at the head water started to move downward and causing flood along the river up to the deltaic area

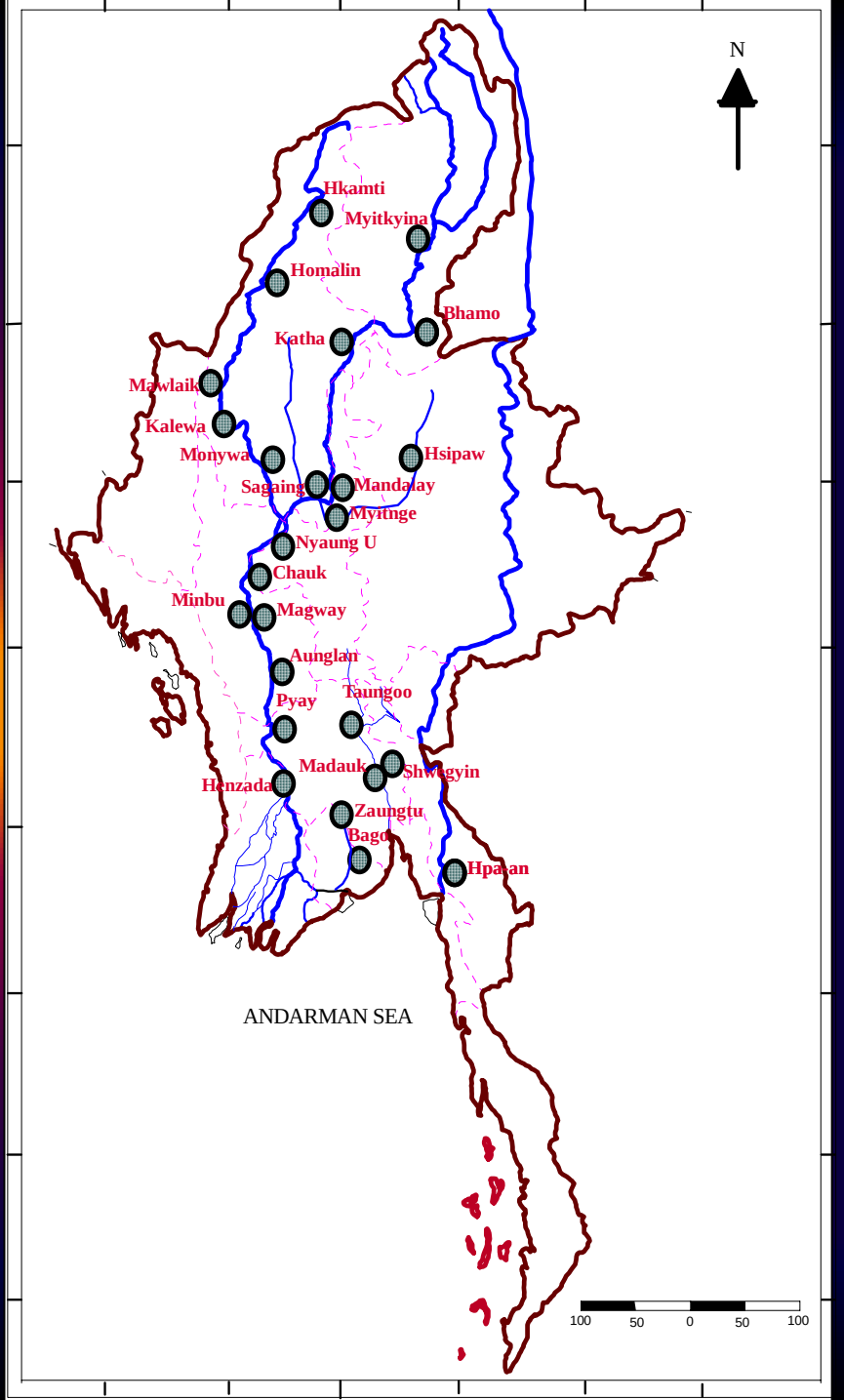
★ Flash Flood

- ⇨ usually occur in the small rivers and streams
- ⇨ caused by heavy rainfall on the source and the flood wave move downward swiftly

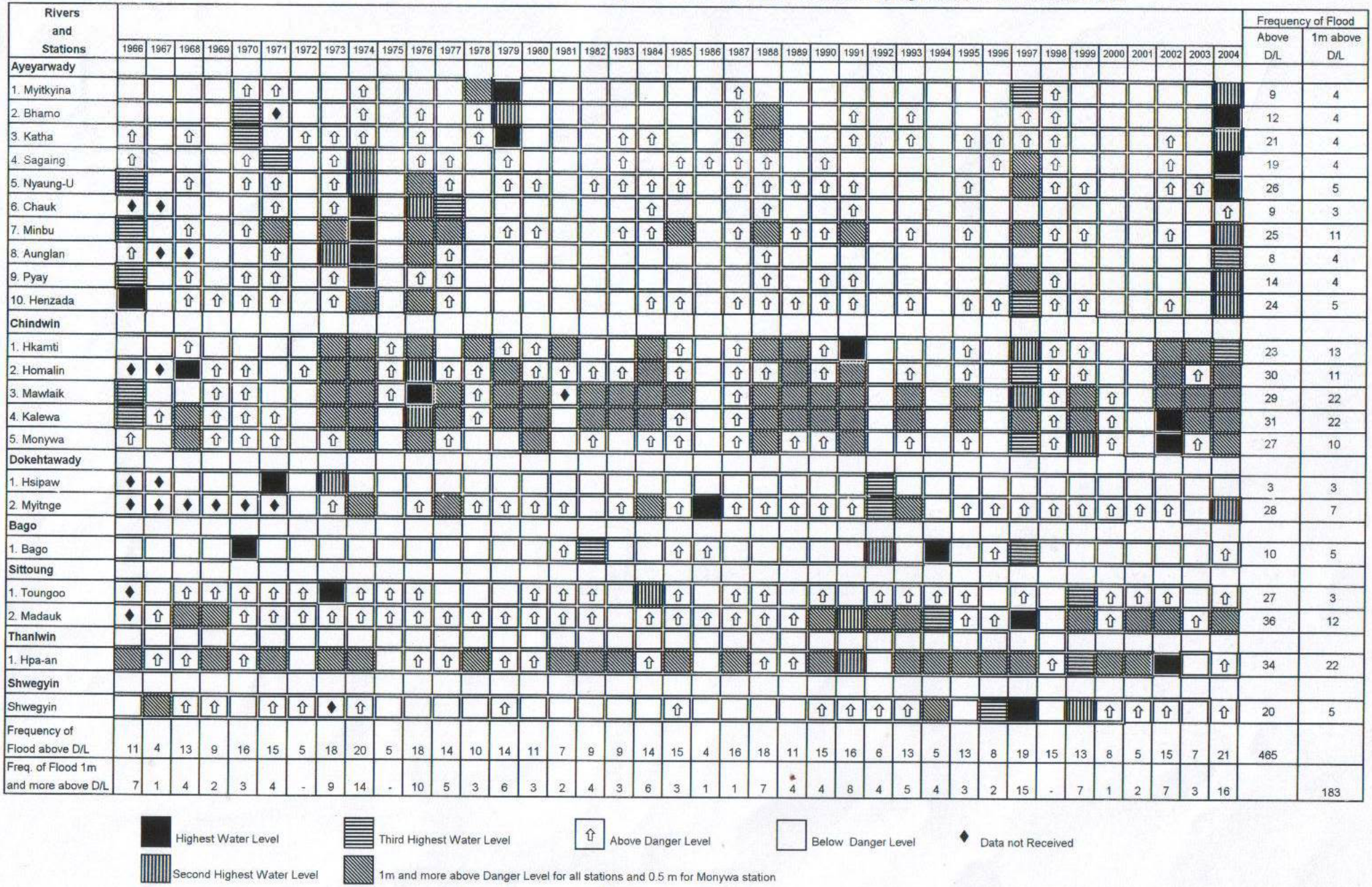
River forecasting stations

in

Myanmar



Annual Maximum Water level for Major Rivers at Different Stations in Myanmar From 1966 to 2004



Maximum Flood Peaks of Forecasting stations in Myanmar rivers during 1966 to 2004

Severe flood had occurred in 2004, 1974, 1997, 1976, 1973, 1988 and order of the years are arranged w.r.t their intensities

No	River Systems Station	Town Danger	Flood Peak Level (cm)	Date of Occurrence	Flood Duration above D.L (Days)	Remark
	Ayeyarwady					
1	Myitkyina	1200	1410	8.10.1979	4 days	+210
2	Bhamo	1150	1338	22. 7.2004	8 days 2 hours	+188
3	Katha	1040	1154	12.10.1979	7 days 6 hours	+114
4	Mandalay	1260	1382	27. 7.2004	16 days 9 hours	+122
5	Sagaing	1150	1274	27. 7.2004	17 days 17 hours	+124
6	NyaungU	2120	2263	29. 7.2004	17 days 2 hours	+143
7	Chauk	1450	1532	15. 8.1974	12 days 12 hours	+ 82
8	Minbu	1700	1982	15. 8.1974	17 days 12 hours	+282
9	Magway	1700	1894	31. 7.2004	15 days 23 hours	+194
10	Aunglan	2550	2737	15. 8.1974	11 days	+187
11	Pyay	2900	3025	15. 8.1974	13 days	+125
12	Hinthada	1342	1461	7. 10.1997	13 days 6 hours	+119
	Chindwin					
1	Khamti	1360	1771	13. 7.1991	18 days 6 hours	+411
2	Homalin	2900	3107	12. 7.1968	18 days 6 hours	+207
3	Mawlaik	1230	1608	20. 7.1976	15 days 12 hours	+378
4	Kalawa	1550	1920	17. 8.2002	10 days 12 hours	+370
5	Monywa	1000	1099	19. 8.2002	9 days 12 hours	+ 99
	Dokehtawady					
1	Hsipaw	600	618	19. 8.1971	5 days	+ 18
2	Myitnge	870	1081	16. 9.2004	14 days 14 hours	+211
	Sittoung					
1	Tounggu	600	725	27. 8.1973	16 days 18 hours	+125
2	Madauk	1070	1244	2. 8.1997	31 days	+174
	Shwegyin					
1	Shwegyin	700	927	3. 8.1997	4 days 12 hours	+227
	Bago					
1	Bago	910	950	26. 8.1970	4 days	+ 40
	Thanlwin					
1	Hpa-an	750	936	18. 8.2002	38 days	+186

Flood Frequency Along Major Rivers in Myanmar

No	Returns Period	2	10	25	100	1000	10000
	Station	Flood Level (cm)	Flood Level (cm)	Flood Level (cm)	Flood Level (cm)	Flood Level (cm)	Flood Level (cm)
	Ayeyarwady						
1	Myitkyina	1099	1267	1334	1422	1548	1660
2	Bhamo	1120	1239	1286	1345	1429	1501
3	Katha	1059	1117	1138	1165	1202	1234
4	Sagaing	1147	1213	1238	1269	1313	1349
5	Mandalay	1153	1242	1275	1320	1380	1431
6	Nyaung U	1154	1235	1266	1305	1359	1405
7	Chauk	1432	1501	1527	1560	1604	1642
8	Minbu	1749	1892	1947	2017	2113	2196
9	Aunglan	2346	2736	2894	3101	3398	2664
10	Pyay	2879	2964	2996	3035	3086	3133
11	Seiktha	2276	2368	2402	2446	2504	2553
12	Henzada	1368	1435	1460	1491	1535	1571
	Chindwin						
1	Hkamti	1431	1597	1663	1747	1865	1969
2	Homalin	2977	3067	3101	3143	3199	3247
3	Mawlaik	1358	1504	1561	1633	1735	1824
4	Kalewa	1675	1849	1916	2003	2124	2229
5	Monywa	1012	1065	1085	1100	1141	1173
	Thanlwin						
1	Hpa-an	812	907	945	993	1061	1121
	Sittoung						
1	Toungoo	620	682	707	739	782	820
2	Madauk	1111	1198	1231	1273	1331	1381
	Bago						
1	Bago	890	927	940	957	980	999
	Myitnge						
1	Myitnge	920	990	1017	1057	1098	1139

Damages due to floods during 1966 to 2004

No.	Year	Flood Affected (Acres)	Crops (million of Kyats)	Roads and Bridges (million of kyats)	Houses (million of kyats)
1	1966	870000	140.0	1.46	-
2	1967	171686	3.9	1.20	-
3	1968	1199423	194.0	1.10	-
4	1969	722935	125.0	4.27	-
5	1970	621687	100.0	2.31	-
6	1971	657578	220.0	2.03	-
7	1972	85592	28.0	0.63	-
8	1973	1209278	405.0	2.10	-
9	1974	1295334	426.0	1.47	-
10	1975	488786	87.0	1.12	-
11	1976	486674	287.0	3.85	-
12	1977	266917	1.0	2.87	-
13	1978	599440	-	1.19	-
14	1979	396900	-	1.65	-
15	1980	595417	-	0.66	-
16	1987	1013268	-	-	-

No.	Year	Flood Affected (Acres)	Crops (million of Kyats)	Roads and Bridges (million of kyats)	Houses (million of kyats)
17	1988	-	-	-	0.53
18	1989	-	-	-	19.0
19	1990	1398489	-	-	0.51
20	1991	461347	-	21.27	-
21	1992	407353	-	-	44.25
22	1993	-	-	71.5	19.46
23	1994	-	-	98.1	253.0
24	1995	-	-	74.89	75.37
25	1996	-	-	83.79	222.5
26	1997	1136175	-	113.64	760.95
27	1998	97015	-	-	72.6
28	1999	-	-	66.08	185.00
29	2000	-	-	-	3.28
30	2001	-	-	-	23.0
31	2002	347761	-	36.15	147.41
32	2003	35734	-	17.84	6.84
33	2004	-	-	-	2.62

4. Flood mitigation and preparedness measures

4.1. Forecasting and Warning

- Non-structural flood control measure
- System started since 1966 at DMH of Myanmar
- Reliable forecasting and easily understandable warning information with sufficient lead-time are of vital importance for flood forecasting system

Issues

Daily Water Level Forecast

Dekad and Monthly Water Level Forecast (including Pre, Moderate and Post monsoon period)

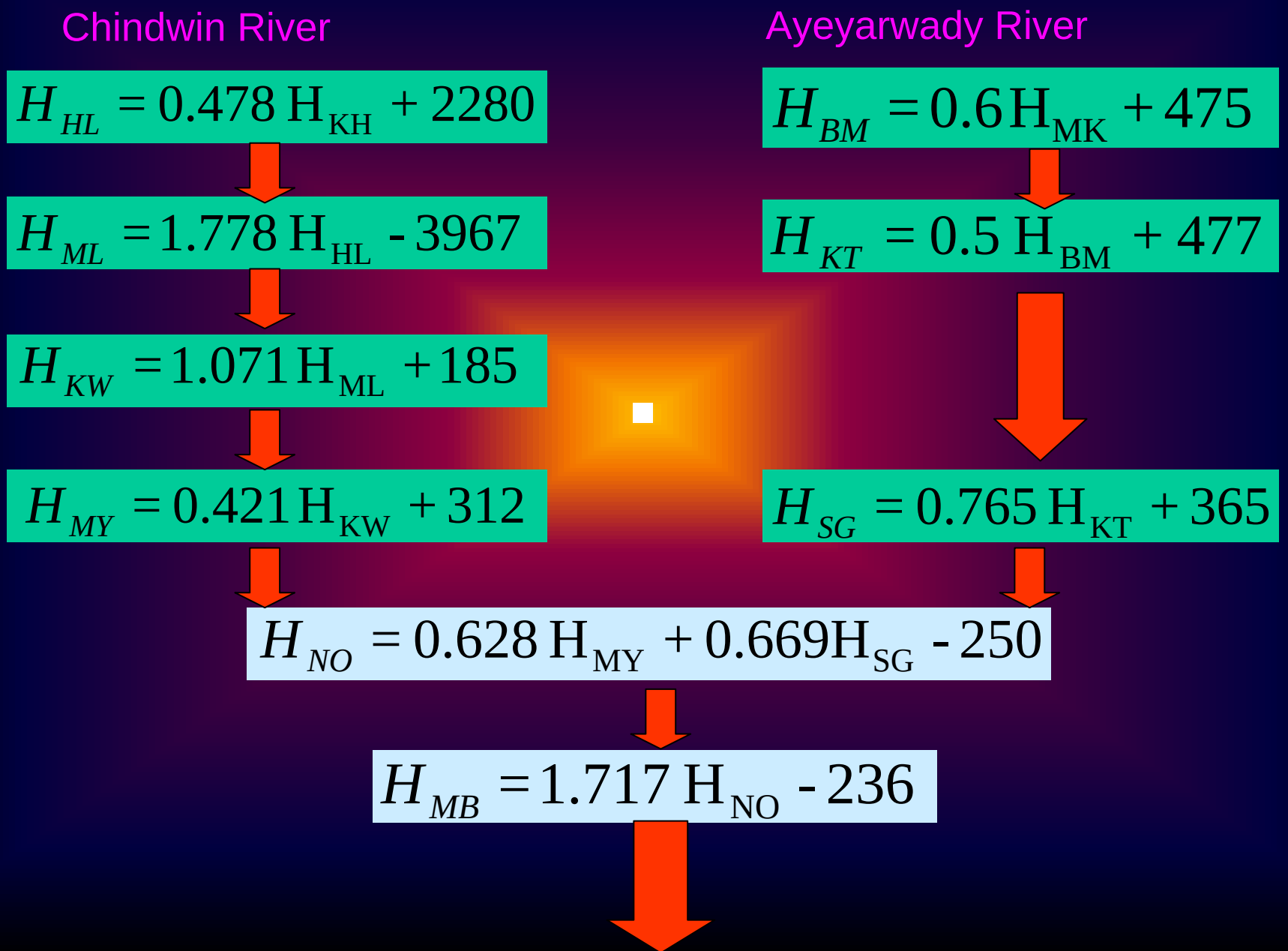
Flood warning, Flood bulletin and Significant bulletin during monsoon period

Methods

Empirical model (based on single and multiple regression analysis)

Lead-time
- about 1 – 2 days for short range forecast
- about 7 – 12 days for the long range forecast

The Empirical Model used for Forecasting Peak Flood Level



$$H_P = 0.6818\,\mathrm{H}_{\mathrm{MB}} + 1670$$

$$H_P = 0.3955 \times \mathrm{H}_{\mathrm{BM}} + 0.5777 \times \mathrm{H}_{\mathrm{ML}} + 1628$$

$$H_P = 0.287\,\mathrm{H}_{\mathrm{BM}} + 0.585\,\mathrm{H}_{\mathrm{ML}} + 0.113\mathrm{H}_{\mathrm{PI}} + 0.191\,\mathrm{H}_{\mathrm{SY}} + 1290$$

$$H_{HZ} = 0.542 H_P - 155$$

$$H_{HZ} = 0.0528 \times H_{BM} + 0.175 \times H_{ML} + 1112$$

$$H_{HZ} = 0..2836 \times H_{BM} + 0.356 \times H_{ML} + 604$$

$$H_{HZ} = 0.61 \times H_{BM} + 0.175 H_{ML} + 0.27 H_{HZI} + 0.19 H_{SY} - 462$$

- Flood frequency analysis
- Conceptual models (such as Sacramento, SSARR, HBV and Tank models) also calibrated and tested for operational used

Flood forecasting and warning system

- adequate for large river
- still exists problem of flash flood at the smaller catchment

Dissemination

- Through the radio, television, telephone, SSB transceiver and other communication (means for concerned government Dept. and Agencies)

4.2. Flood preparedness Plan

- DWIR → River Training using Bed Regulation Method

- DI

→ Special repairs to be done on embankment system using machine and manpower to fill up where the embankment is low and strengthening weak portions of the embankment by resectioning them

→ before the time of flood, usually make arrangements with administrative officers and local people through flood meetings so that Emergency materials may be collected and stored in predetermined places, the nature of expected failures in particular places (such as overtopping, pot holes, slips and sand boils, etc) and organize various kind of ad-hoc working groups such as night-patrols, transportation etc.

- arrangements to evacuate man and cattle to save places, preparations to organize patrolling parties to work day and night for the assessment of flood and embankment condition and send the situation reports during flood
- Meteorological and Hydrological reports and warning regularly collect and send to important places daily
- DI collect the prediction of river level after danger level has been reached
- It is to collect the river level at the station (deltaic area) at the time of breach of embankments

- DI try to close breach in temporary measure but in permanent nature later on, to send the refugees to predetermines places if danger is imminent for the people after the breach of embankment has been occurred

Frequency analysis in the delta

Sr. No.	Station	Water Level (ft) with probable occurrence in years					Previous Authorised crest level (ft)	Revised Authorised crest level (ft)
		50	100	200	500	1000		
1.	Henzada	49.30	50.32	51.33	52.65	53.65	50.10	51.81
2.	Nyaungdon	28.54	29.60	30.65	32.04	33.09	28.90	31.54
3.	Maubin	17.58	18.09	18.59	19.26	19.79	17.30	19.58
4.	Nhathaingyaung	32.35	33.30	30.26	35.52	36.48	34.30	35.85

4.3. Long-term Programs for Flood Prevention

If the flow of the rivers and release of discharge are under controlled, the deltaic areas which has to take the brunt of these disastrous floods will be relieved to a great extent. Government of Myanmar has planned to implement on the tributaries of the rivers the following reservoir schemes. They are;

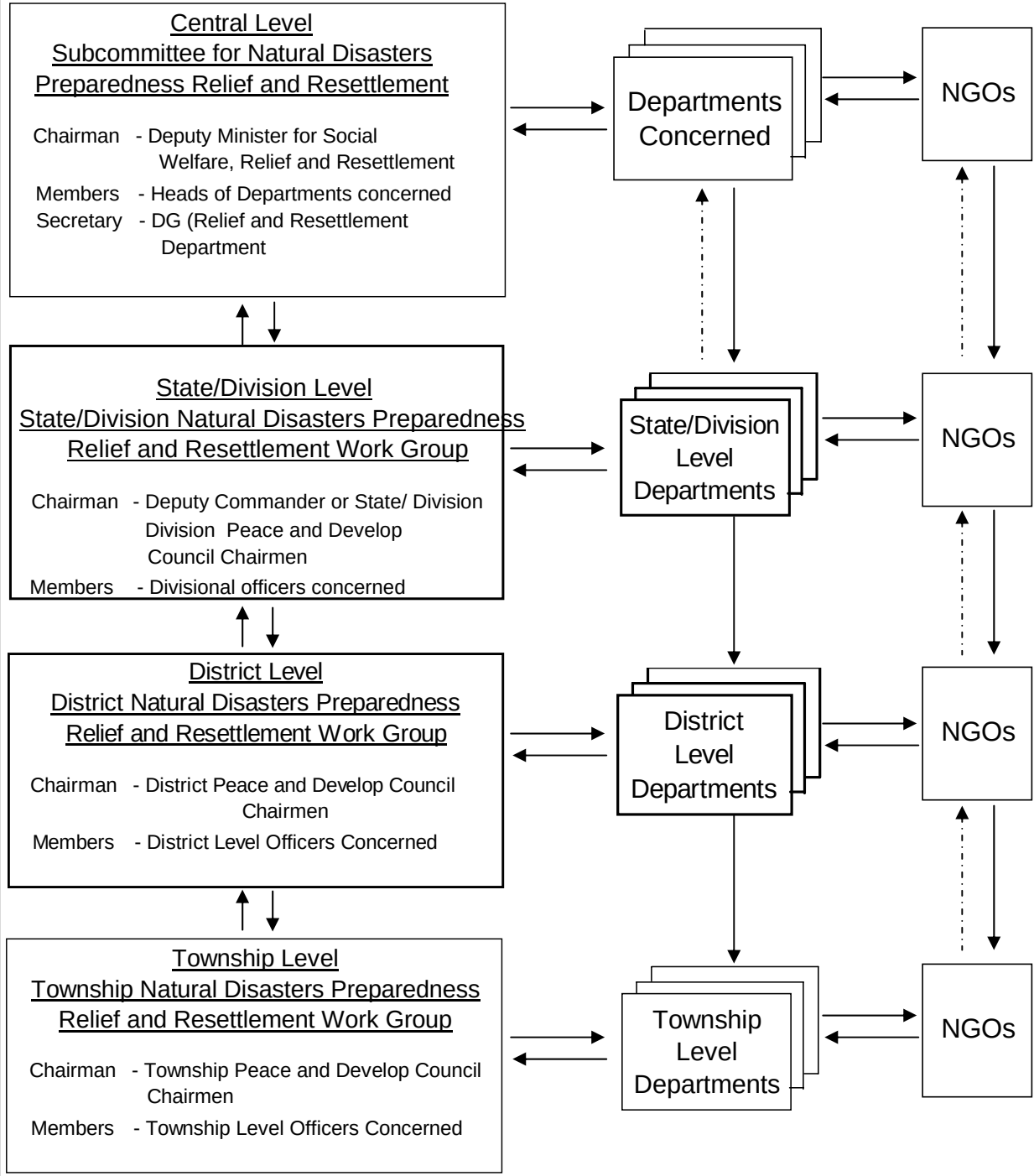
- Kinda Reservoir Project on Panlaung River (tributary of the Ayeyarwady River)
- Thapanseik Reservoir Project on Mu River (tributary of the Ayeyarwady River)
- Paunglaung Reservoir Project on the Sittoung River
- Yeywa Hydroelectric Power Project on Myitnge River (tributary of the Ayeyarwady River)

After completion of these projects the effects of disastrous flood mitigate to a greater extent

- **Control Basin Erosion**
  - **by reforestation in the basin , training the farmers in the hilly region to adopt terrace and contour ploughing**
  - **Using systematic methods of logging in lumber Industry**

5. Measures for Natural Disaster preparedness

(a) Formation of Natural Disaster preparedness, Relief and Resettlement Committee



5. (b) National Disaster education courses

- Management training courses on natural disaster preparedness were opened yearly by rotation in states and divisions in cooperation with other related departments.

6. Mekong River Basin in Myanmar


0 100 200 300 mi
0 100 200 300 400 500 km
INDIA
CHINA
MYANMAR
THAILAND
LAOS
VIETNAM
CAMBODIA
Mt. Hkakabo 5,881
Mt. Victoria 3,053
Parasau Pass
Brahmaputra
PĀTKAI RANGE
KUMON RANGE
KACHIN
Mali
Nmai
Salween
NAO-LI-KUNG MTS.
CH'ING-SHUI-LANG MTS.
Yangtze
Lake Erh
K'un-ming
Lake Tien Ch'ih
Lake Fu-hsien
BARAIL RA.
NĀGA HILLS
Tamanthi
Myitkyina
IRRAWADDY
Homalin
Chindwin
Manipur
MIZO HILLS
Katha
Bhamo
LAO-PIEH MTS.
WU-LIANG MTS.
MANGIN RANGE
CHIN HILLS
Mu
SAGAING
Kabwet
Kyaukmyaung
Sagaing
Ava Bridge
Mandalay
Myingyan
Myittha
Mon
Chauk
Yenangyaung
Minbu
Magwe
ARAKAN
Sittang
Thayetmyo
Prome
PEGU MTS.
Sandoway
RAMREE I.
CHEDUBA I.
BORONGA ISLANDS
Bay of Bengal
Pathein
Pegu
Yandoon
Pathein
Yangon
Gulf of Martaban
SHAN PLATEAU
Salween
MEKONG
PANG-MA MTS.
AI-LAO MTS.
FAN SI MTS.
Red
Black
Tay Chang Pass
Hanoi
Haiphong
HAINAN
Gulf of Tonkin
Louangphrabang
PLATEAU OF XIANGKHOANG
Ky Son
TANEN RANGE
Wang
Ping
Yom
Nan
DAWNA RANGE
Nam Ngum Reservoir
Ngum
Kading
Vientiane
Nam Phong Dam
Nam Phong
Pao
Phong
PHETCHABUN RANGE
Chi
Mun
KHORAT PLATEAU
Basăk
Chao Phraya
DANGREK RANGE
Bangkok
BILAUKTAUNG RANGE
Hue
Da Nang
Banghiang
CORDILLERA ANNAMESE
BOLOVEN PLATEAU
Pakxe
Kông
San
South China Sea
Khone Falls
Srêpôk
Barrage
DAC LAC PLATEAU
Krong
Tonle Sap
Pôrŭng
Sên
Sâmbor
Krâchéh
Kâmpóng Cham
Cam Ranh
KRÂVANH MTS.
Sabl
Phnom Penh
Pa Sac
DÂMRET MTS.
Châu Đôc
Ho Chih Minh City
CA MAU PENINSULA
MEKONG DELTA
Ca Mau
SON ISLANDS
Andaman Sea
ANDAMAN ISLANDS (INDIA)
MERGUI ARCHIPELAGO
Gulf of Thailand
Elevation
metres feet
3,000 9,843
1,000 3,281
500 1,640
100 328
0 0
Spot elevation in metres
Dams
Canals
Railroads
Areas subject to flooding
Swamps and marshes
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- River Length - 350 km (8.3% of total Length 4,200 km)
- Drainage Area - 28,600 sq km

  (3.6 % of total area 795,000 sq km)
- Ave. Annual Flow - 17.634 km^3

- DI has undertaken construction of some diversion weirs under the Border Area Development Programme for the objective of encouraging production of crop for self-suufficiency

- DI is investigating to construct two dams on the tributaries of Mekong River

- Electric Power Enterprise has constructed feasibility studies and constructed small-scale hydroelectric power stations in this region

- Meteorological Stations

Station	Start Date
(a) Kengtung	11.3.1951
(b) Monghsat	20.9.1966
(c) Mongyaung	16.1.1994

- Remote area

- Difficulties to install new

Met. & Hydrological Stations in the basins

7. Conclusion

- For flood prevention in Myanmar, two steps to be followed;
  - Flood warning system
  - Public education on flood fighting for the awareness of the local populace

- In organizing various committee to tackle the flood, they form permanently but not as ad-hoc committees from state and division level to village level

- From the experiences gained in the past years, drills can be organized and practiced

- so that all the parties who will participate in this activity when the flood come

- Flood Management in Myanmar mostly cover for the rivers existing Forecasting Stations and there should be contribute in the remaining rivers


Thank you