APPENDIX II

FINAL TECHNICAL REPORT SUBMITTED BY PARTICIPANTS in 1981 & 1982

TECHNICAL REPORT

PROBLEMS ITH THE HAN RIVER BASIN FLOOD FORECASTING SYSTEM

Submitted by Mr. Han Soo Nam,
KOREA

I. GENERAL DESCHIPTION

As you know well, the Han River Basin is the designated basin for TOPEX in KOREA.

As I mentioned about the Basin in the meeting of the country reports presentation, it is located in the central part of Korean peninsula and also has Seoul Special City with 8.6 millions of population, the capital of Korea, in its downstream.

The catchment area of the basin is about 26,200 square Kilometers and population in its area is about 15 millions in present.

In there, we had already installed telemetering system in order to forecast floods and to control discharge of dams adequately by assistance of Typhoon Committee Program in the early 1970's.

The system is consist of 38 rainfall stations, 6 water level station, 0 stream flow stations and 3 relay stations.

It means that, from the view point of meteorological data collection, one station has to cover almost 690 seuare kilometers, otherwise we have more data from other source such as Central Meteorological Observatory and Provincial Governments.

In addition to this telemetering system, we have 5 warning stations in its basin.

But it is so widely scattered, even if warning is issued to the inhabitants who live in the valnerable area, they can't hear even the sounds.

So, we can hand over the warning to the inhabitants only by means of mass-media.

Also we have a broad communication system for the disaster prevention activities, besides a facsimile system which was installed between the

Ministry of Construction and Provineial Governments, all the information exchange of disasters is performed by ordinary telephones.

II. PROBLEMS AND SUGGESTIONS

As you can know from the above mentioned matters. Ournproblem for disaster prevention activities is we almost don't take any necessary action in prior the disasters in spite of having the telemetering system except rough discharge control of dams.

Speaking of the reasons, those are insufficient meteorological data collection, lack of direct warning systems and inadequate communication systems for disaster prevention.

Furthermore, we have also problems in the technical aspect; that is lack of competent hydrologists and technicians for the disasters prevention activities.

Therefore, I will make some suggestions to the officials in charge in my country and I will do my best to improve our telemetering system and to rearrange hydrological observation facilities which is not connected with telemetering system in adeuate manner.

The suggestions which I plan to make for the disaster prevention activities are;

The first- in relation with the shoojoo dam Project, to strengthen the existing telemetering system in order to predict floods more accurately.

The second- to develop the non-structural measures which can reduce fragility against disasters and dispress prevention.

The third- to facilitate wireless communication systems to some extent which can manage essential information exchange for disaster prevention activities, if possible.

The fourth- to prepare the vulnerable areas map which can give proper informations for disaster prevention activities.

The fifth- to educate the inhabitants who live in vulnerable areas about the disaster prevention activities through mass-media and the neighborhood meeting which is held once a month periodically under the supervision of the Ministry of Home Affairs.

The sixth- to introduce disaster prevention exercise among the organizations concerned to improve their abilities of coping with disasters.

This is my suggestions that I am thinking of applying what I have learned through this seminar and I hope that these suggestions can be realized in my country.

Thank you.

FINAL REPORT

FOR TOPEX TRAINING COURSE ON HYDROLOGY AND WARNING DISSEMINATION/ INFORMATION EXCHANGE COMPONENT

(23-7-1981 to 21-8-1981)

Jiang Yi-yuem

CHINA

I. INTRODUCTION

From April to October every year is the main rainy season of South East CHINA. The flood period divided two season, the mold rainy season and the typhoon rainy season. Typhoons land only in Guangdong Province average 0.3 times per year, but time of affection by typhoon are more offen. The maximum velocity of strong typhoon is more than 40 m/s at landing. Precipitation; The annual rainfall is from 1,700 to 2,300 mm. in general. (based on 20 years of records). Heaviest recorded one-hour rainfall is above 92 mm., 137 mm. in two-hour, 273 mm. in six-hour, 670 mm. in 24-hour, 1,000 mm. in three-day, and 1,157 mm. in one-month. So disaster of typhoons, floods and typhoon surges take places frequently.

In CHINA, two river basins have been designated for TOPEX. It will be carried out the planning of TOPEX for the hydrological Component. A meeting at a national level was held in Hangzou in May 1981 with a view to improve the measuring and transmission system of real-time hydrological data for whole country. In the two river basins, there are plans to upgrade the present system for full automation whereby Puyang River Basin and the Xizhi River Basin will be established with the telemetering systems for flood forecasting.

II. FOR THE EXPERIMENT

For the Puyang River Basin and the Xizhi River Basin the experiment is on the following three aspects;

(i) The evaluation of the established systems for forecasting and warning of hydrological effects of floods by the comparison of its output with actual observed data in the field;

(ii) The identification of forecasting models, the selection of specific models for application to the Puyang River Basin and the Xizhi River Basin, and comparison of the models results in real-time forecasting operations;

(iii) The evaluation of the combined hydrological effects of typhoons, particularly river and storm surge flooding, and thus the determination of associated flood risk.

In addition to the above three aspects, the two river basins' flood forecasting systems are composed of following five sub-systems;

(i) A data-collection sub-system for precipitation, stream-flow and other data;

(ii) A data transmission sub-system for transmitting the data to the forecasting centre;

(iii) A data processing sub-system for shecking and processing the incoming data as imputs to the forecasting model;

(iv) A forecasting model yielding forecasts of discharge and water level at specific locations;

(v) A sub-system which meteorological forecasts are incorporated as inputs to the flood forecasting model;

In this case, improvements can be made in the integrated control of the main reserviors and in keeping watch on the situation of the reserviors and rivers at any times. Thereby, the system of hydrologic forecasting and warning have been established to provide valuable informations about the further development of flood, so that the leading and mass organization will be better informed and assured in the struggle against floods.

FINAL REPORT

ON "TOPEX TRAINING COURSE/SEMINAR" FOR HYDROLOGICAL AND WARNING DISSEMINATION/INFORMATION EXCHANGE COMPONENTS

Held in; Tokyo, Japan

Duration; 23rd July, 1981 ∿ 21st August, 1981

Submitted by; Mr. Chong Sun Fatt
Drainage and Irrigation Department, MALAYSIA

I. INTRODUCTION

The above training course/seminar has been conducted with a view to promote the implementation of the TOPEX Project pertaining to the Hydrological Component as well as the Warning Dissemination/Information Exchange Component via transfer of knowledge. I wish to comment that the aim of the training course has been well achieved.

Through this training source, I have acquired an overview of the efficient disasters counter measures currently practised in Japan to my country will certainly procure great benefits. Nevertheless, such measures can only be introduced progressively in correspondence to the social and economic constraints.

In line with the objectives of the TOPEX Project for Hydrological and Warning Dissemination/Information Exchange Components. I would like to make the following recommendations in the designated river basin;

II. RECOMMENDATIONS

II-1. HYDROLOGICAL COMPONENT

(i) Telemetric data collection network

The density of the existing telemetric raingauge network should be improved by establishing more stations. Such will give a more representative areal rainfall value for forecast preparation.

Assessment on the existing telemetric network performance should be conducted with a view to improve reliability in data transmission.

(ii) Data Transmission system to flood forecasting centre

Kelantan River Forecast is carried out by the flood forecasting centre in Kuala Lumpur. Field data are transmitted from Kelantan office to the flood forecasting centre via teleprinter (land line), with lanline telephone as back up. But the teleprinter are the telephone link experienced frequent breakdown especially during flood events. Therefore, it is essential to establish a communication link using microwave.

(iii) Improvement to present forecasting model

The Sacramento conceptual model is currently used for the forecasting of Kelanton River at Guillemard Bridge. Evaluation of the model should be carried out by comparing the forecast and observed values using standard statistical method and improvements made where necessary.

(iv) Selection of other forecasting models

The Sacramento model is highly dependent on computer. In the event of computer breakdown, a simple forecasting model with reasonable forecast accuracy will be very useful. Hence, calibration of simple models should be carried out.

(v) Extension of flood forecasting services to more areas

Presently flood forecasting is only carried out at Guillemard Bridge of Kelantan River where population concentrates. It would be beneficial to extend flood forecasting services to the upstream areas. In this connection, it is necessary to develop a system for data collection and model calibration.

(vi) Flood Risk Mapping

Detail flood risk study and mapping should be carried out. The flood risk maps could be used effectively as an operational flood forecasting tool and land use planning.

(vii) Flood damage assessment

Comprehensive flood damage assessment should be carried out in the Kelantan River Basin. Assessment should be based on standard rates to privide a rational basis for comparison.

II-2. <u>WD/IE Component</u>

(i) Communication facilities

Establishment of an adequate network of operational communication facilities connecting all the agencies involved in the disaster country measures. A back up system should be maintained.

(ii) Warning devices at community levels

Installation of flood warning sirens, and boards and provision of more publicity cars should be made.

(iii) Greater use of mass-media

Greater use of mass-media such as radio, T.V., and press should be en-ploited in the dissemination of disaster information.

(iv) Training leaders in disasters counter measures activities.

(v) Education of the public

Education should be imparted to the general public to increase theor awarenes to disaster prevention. Besides, the people should be encouraged to participate more actively and be more selfdependent.

(vi) Test exercise

At normal times, the public and the people involved in disaster prevention and relief activities should perform driving exercises periodically so as to improve the operational efficiency.

III. CONCLUSION

It should be recognized that when TOPEX is accomplished. The subsequent evaluation of result in 1984 will decidedly lead to the identification of areas of improvement or effective measures/techniques in mitigating disaster damage. Such measures/techniques will then be applied to other tiver basins in my country in a ster-by-step manner.

Finally, on behalf of the Malaysian Government, especially Jica, for have provided me the opportunity to participate in this informative training course.

TECHNICAL REPORT

HYDROLOGICAL AND WARNING DISSEMINATION/INFORMATION EXCHANGE COMPONENTS OF TOPEX

Submitted by
Mr. AMORN CHANTANAVIVATE
THAILAND

I. HYDROLOGICAL COMPONENT

With a view to supporting the activities of TOPEX under the hydrological component during the testing period from 1981-1983, some improvement of the Pasak river basin which had been designated for this purpose should be carried out on a national basis as follows;

(1) Flood forecasting system in the Pasak river basin should be further extended downstream to cover the whole basin because at present only the upper and middle reaches have been operated.

(2) Real-time flood forecasting operation by utilizing the existing slood forecasting system should be done and comparisons of the observed and computed values based on statistical error functions should be undertaken.

(3) New conceptional models whether simple or complex should be selected and introduced based on topographical and climatological conditions of the basin since the current methods employed are linear hydrological model applied in the Muskingum method and simple stage correlation method.

(4) Rainfall patterns in the Pasak river basin should be studied and quantitative rainfall should be introduced as a new parameter in flood forecasting method.

(5) Flood risk mapping and evaluation of the established system in the Pasak river basin should be studied and investigated in compliance with the TOPEX's work plans.

(6) More advanced flood forecasting systems such as telemetering system, etc., should be taken into account and introduced in later phase with possible technical assistance from Japan.

II. WARNING DISSEMINATION AND INFORMATION EXCHANGE COMPONENT

The recommendations and improvements of this component of TOPEX under national level should be undertaken as follows;

(1) Additional hydrometeorological stations in the lower reaches of the Pasak river basin should be equipped with SSB radio for wides telecommunication network system.

(2) Telecommunication facilities for the data collection and retransmission in the basin should be updated and modernized since most of the existing equipment are out dated, which can, more or less, hamper the real time flood forecasting system.

(3) For more efficient counter-disaster response in Thailand, the government agencies concerned should have closer cooperation and should understand their functions and areas of responsibility very well during disaster.

(4) Test exercises for flood fighting and preparedness should be cared for and held whenever circumstances permit in the areas threathened by flood prior to the typhoon season.

(5) Education programmes for school and community levels about flood and related disasters, the risk involved, warning services and the protection measures to be taken should be disigned and planed.

III. PROBLEM IN FLOOD FORECASTING SYSTEM

The existing problem arising in flood forecasting system in the Pasak river basin is that the forecast real time is quite short because only two hydrometeorological stations in the upstream and downstream points at Wichion Buri and Bua Chum with only about 40 Km. apart have been taken into account and the methods employed are simple stage correlation and linear hydrological model applied in the Muskingum method. At present there are only 3 stations equipped with SSB radio, one at Lorn Sak in the uppermost of the river basin and 2 others at Wichian Buri and Bua Chum in the middle reaches.

Only daily stage and discharge are used in flood forecasting. These two flood forecasting methods have their limitation because of insufficient telecommunication network system and lateral flow effect. So, in order to make longer forecast lead time for the benefit of reducing flood risk and loss of life, it is necessary to install more SSB radio stations in the lower reaches as well as in the upper reaches and new conceptual model, simple or complex, utilizing quantitation rainfall as a new parameter is required for this purpose. However, to achieve this goal, it needs some implementation from the Thai Government and related agencies concerned. If implemented, this kind of non-structural measures will bring great benefit to all people suffered by flood and finally TOPEX's work plans will be fully achieved.

FINAL REPORT

on

TOPEX PRE-EXPERIMENT PERIOD SEMINAR FOR HYDROLOGY AND WARNING DISSEMINATION AND INFORMATION EXCHANGE COMPONENTS

by

Rolu P. Encarnacion

(Philippines)

I. INTRODUCTION AND SEMINAR/TRAINING CONTEXT

The Pre-Experiment Phase of the Typhoon Operational Experiment (TOPEX) was conducted in Japan in the form of a seminar/training course prepared by the Japan International Cooperation Agency for the Hydrology, Warning Dissemination/Information Exchange components. This is in consonance with the agreement arrived at during the Third Meeting of the TOPEX Management Board which was held in Bangkok, Thailand, last June of this year.

In this seminar/training course, various governmental agencies and institutions of the Japanese government involved in warnings and advisories preparation and disseminations, disaster prevention and preparedness, rescue and rehabilitation activities have imparted on us (participants) their existing and modern techniques and methodologies. This was done through classroom lectures and discussions and sometimes illustrations and demonstration especially during our study trips and observation tours. The components which I have participated in have more emphases on hydrology and disaster prevention and preparedness. For the hydrology course, a close study of the Yodo River basin flood forecasting network was done, since Yodo River is Japan's selected river basin for TOPEX. Meanwhile, the National Land Agency and the Science and Technology Agency spearheaded the different national agencies of Japan in sharing with us their techniques and systems in disaster prevention and preparedness, warning dissemination and information exchange. It is most interesting to note that almost all of the agencies involved utilized electronic systems (computerized as possible) in almost all aspects of flood forecasting including that of the rainfall measurement which is done by radar rainguage. Likewise, in the warning dissemination and information exchange, they also utilize sophisticated equipments, e.g. from wireless set-up to mobile communication systems.

II. Philippines' Participation

The Philippines have selected the Pampanga River basin for the Typhoon Operational Experiment (TOPEX). Pampanga river basin is located in the central part of Luzon Island, which is the largest island of the archipelago, and mainly covers a part or whole of the provinces of Pampanga, Bulacan, Tarlac and Nueva Ecija. The entire basin's drainage area is 10,540 square kilometers.

Mainly, the climate of the basin is characterized into two (2) distinct monsoon periods causing pronounced wet and dry seasons. The wet season begin normally on the month of June and ends on August, but sometimes extends up to the end of October. Heavy precipitation brought about by typhoon and the southwest monsoon are typical occurence during the wet season. These tropical systems are the main causes of floods in the area. On the contrary, dry period extends from December to April. Hence, the two transistional months are November and May. This river basin also acts as a sink for the naturally eroded materials derived from the mountain ranges that surrounds it.

The Pampanga River Basin Telemetering System was established and subsequently inaugurated on September 13, 1973, under the auspices of the ECAFE/WMO Typhoon Secretariat with technical and financial assistance from the government of Japan. Since than, The Pampanga River Basin Flood Forecasting Center had been issuing flood bulletins. Although no bulletins were issued on a number or occasions where there was less probability of flooding, continuous flood watch was maintained especially during the occurence of strong cyclones.

For the warning dissemination/information exchange component, the plan of action of the Philippines have been drawn up as early as June this year for TOPEX participation. In context, the plan calls for the monitoring of typhoon and flooding situations. Consequently, a format for this purpose has been prepared. Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) has been designated as the focal point for the three components (meteorology, hydrology, WD/IE), while the Office of Civil Defense, being the primary agency tasked to prepare the communities for disaster, is responsible for carrying out the monitoring scheme.

The disaster preparedness programs of the country, which in effect call for the organization of Regional Disaster Co-ordinating Councils (RDCC) down to the barangay level, hade been established since 1966. Spreading knowledge of disaster preparedness is being undertaken through literatures, press and broadcast media. Training in this discipline have started and to date, about 50 percent of the country's barangay captains have been trained on disaster preparedness and allied aspects.

III. PROBLEMS AND RECOMMENDATIONS

A. Hydrology component

It is noticeable in the foregoing section that the Pampanga river basin telemetering system network had been inaugurated in 1973. At present, the system is now old and besieged with frequent breakdowns and malfunctions. Its operation and maintenance suffer considerably due to unavailability of spare parts. The condition of the system at present, it can only obtain water level data from 4 stations out of 7 and rainfall data from 7 out of the 10 rainfall stations. For this matter then, I strongly recommend that:

1. The rehabilitation project of the PRB Telemetering System Network be implemented as soon as possible, so as to have it completed before the TOPEX first experiment, which will be conducted on August to October next year, is carried out.
2. Studies on Flood Risk Mapping should be enhanced in order to delineate properly the areas in and around the basin, which are vulnerable to disasters caused by flooding.
3. Full support should be given to the plan of testing a QPF model which is based on the probable correlation between the 500-mb vorticity advection and large-scale precipitation, over the PRB.
4. Full support should also be given to project of establishing additional storm surge monitoring stations in strategic locations in the Philippines where strom surge flooding potentials are indicated.

B. Warning Dissemination/Information Exchange Component

The Operation Plan "PAGMAMASID" which is a plan regarding the Philippine participation in the WD/IE component of TOPEX, is very comprehensive in its entirely. Nevertheless, I recommend that:

1. Public information drive and training of Barangay Leaders on disaster prevention and preparedness on areas which have high potentials and vulnerability to natural disasters should have top priority.

2. Standardize the system of assessing the damages inflicted on properties, infrastructures, crops, etc., to facilitate a basis of comparison at least for the TOPEX participating countries.

SOME SUGGESTIONS ON IMPROVEMENT OF WD/IE IN THAILAND

A report submitted to TOPEX
by Mr. THANADDY CHOKESUWATTANASKUL
THAILAND

I. INTRODUCTION

Thailand may be a country among the Typhoon Committee member countries which is less sevier affected by typhoon every year. However, damages cause by typhoon in the country to human life and property is great if compare with those are caused by other disasters such as fire. We belief that some improvement on WD/IE system may help to mitigate the effect of typhoon.

II. PROBLEMS EXISTING IN WD/IE SYSTEM OF THAILAND

1. Means of communication, i.e. tranceivers, are not sufficient and effective in transmitting the warning from district to tambal (sub-district) and villages.

2. Dissemination of timely storm warning from the Local Administration Department to various proviness cannot be effectively made in case of a sudden developments of a tropical storm in the vicinity of the Gulf of Thailand because a storm occurred in this area can hit the coast in a short period of time.

3. Most people in Thailand, except for those in the south, still have no experiences on typhoons and their effects. Therefore, they often take the warning indifferently.

III. DAMAGE CAUSED BY DISASTER IN RURAL AREA IN 1980 & 1981

The above table shows that out of there kinds of major disasters occurred in Thailand, except Bangkok two were caused by typhoon, i.e. storm and flood.

YEAR	DISASTER		DAMAGE		
	KIND	TIME	BAHT	DEAD	INJURE
1980	FIRE	579	464,200,715	18	78
	STORM	458	33,871,503	14	29
	FLOOD	37	1,549,085,487	61	7
1981	FIRE	684	412,221,135	35	20
	STORM	438	14,226,957	18	12
	FLOOD	44	314,351,038	73	7
TOTAL		2,240	2,787,956,835	219	153

IV. SUGGESTION

The government of Thailand is trying to improve its civil defence system. As we can see, a new and fundamental law was enacted and being enforced now-the Civil Defence Act B.E. 2522. However, some improvements should be made on WD/IE.

As stated in the above (II. & III.), problems still exist and the rate of damage seems not to be minimised. The following suggestions many help to improve WD/IE system and rate of damage;

1. A programe to educate general public, especially people who live in flood prone area, about the nature of storm, depression etc., government plan and policy concerning the disasters and now and what is the duty of the people.

2. Initiate the knowledge of civil defense to be included in school circliculum.

3. The Thai Volunteers for National Defence and Civil Defence Volunteers are useful in WD/IE especially in village level. We should find way to use them in disaster prevention and preparedness effectively-especially in time of emergency or in the event of disaster.

4. A project to improve civil defence textbook and quality of lecturer of trainer/instructor of civil defence subject.

5. A project to survey and evaluate the communication network system of WD/IE is recommended to find way and means to improve the system.

V. <u>CONCLUSION</u>

We see from the above discussion that damages cause by typhoon to property and life is big in each year as compare with damages cause by other disasters. The rate of damage should be better if WD/IE is improved because the warning would reach the people in good time, and that the reaction of the people to the warning will be positive. This is also the effects of spreading the civil defence knowledge to them. On the government side, there should be some improvement too, on personels and facilities and equipments.

A PROPOSAL ON THE IMPROVEMENT OF THE FLOOD FORECASTING METHOD IN THE PAMPANGA RIVER BASIN, PHILIPPINES

by Mr. Nestor L. Canuel-
PHILIPPINES

Weather Specialist

I. INTRODUCTION

Flood forecasting was introduced in the Philippines with the establishment of the Pilot Flood Forecasting and Warning System in the Pampanga River Basin.

Large losses to life and property are experienced by the country which results from the destructive floods caused by meteorological phenomena such as monsoon, infense intertropical convergence zone, and an annual average occurrence of about 19 tropical cyclones.

For this reason, the Philippines Government, with the assistance of the Government of Japan and United Nations organization agencies, decided to put up this pilot system.

In the past years that it has been in operation, it has demonstrated its effectiveness in a number of floods, most particularly in the October, 1973, August 1974 and May 1976 floods.

Its effectiveness was recognized by the government and this led to the subsequent planning and establishment of other Flood Forecasting and Warning Systems in three basins in Luzon Island.

While the pilot system has shown its usefulness, there are several aspects in the flood forecasting and warning system which have still much room for improvement for better performance. This is not surprising since the field of flood forecasting is relatively new in the country.

This paper therefore will present a proposal of a forecasting model which is basically a storage function method of runoff calculation using the sub-basin approach.

II. THE PAMPANGA RIVER BASIN FLOOD FORECASTING SYSTEM

A. The Basin/Network

The Pampanga River basin has a drainage area of more than 8,000 Km^2 (see Attachment A +. The basin is generally flat with mountain ranges on the eastern and northern upper reaches draining into two swamps. Two major dams arelocated in the northern and southeastern portion of the basin. Except for some river improvement works in some rivers, the rest of the rivers are in their natural atate. The wet or equivalently the flood season is from June to October generally with 1,800 to 3,000 mm rainfall distribution.

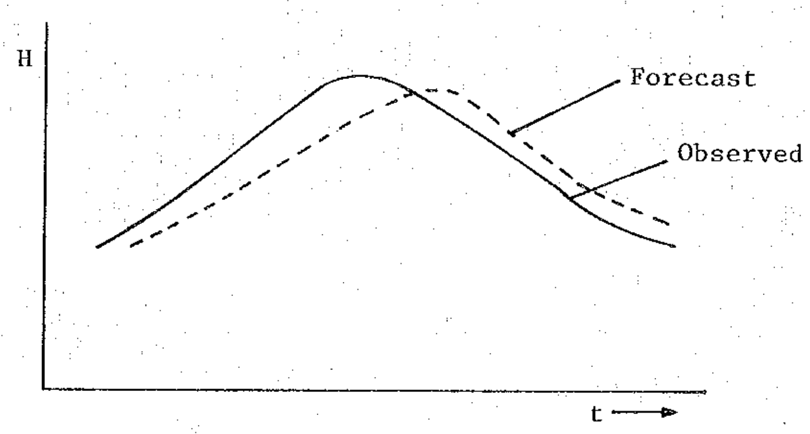
The network system is telemeterized with six water level stations and 10 rainfall stations.

B. The Forecasting Method-Operational

At station 64, the Key Forecast station, a two series storage type tank model is being used using 24 hrs rainfall amounts as input to the model. Calculation issued twice a day normally during flood occurrences. Other forecast points use the stage correlation method.

During the rising stage of the hydrograph at the Key Forecast Station (64, the model forecast is under forecasting and there is a need for manual and subjective and adjustment on the part of the forecaster to arrive at the forecast for issuance. Since flood forecasters have different abilities and skills, the application of such adjustment to the model putput is not always the same.

In order to reduce if not totally eliminate this subjective and manual adjustment there is a need to have a model which will better approximate or simulate the observed hydrograph.



III. THE PROPOSED MODEL

The proposed model is best illustrated in Figure: 1. In this model there are seven basin models, five channel models and two swamp models to represen-tithe whole basin. The basin and channel models will be of the storage function type.

Two branches of computation are carried out from the upstream of station 61. One branch include the swamp model for San Antonio Swamp which drains to station 61.

At station 64, the outflows contribution comes from the Candaba Swamp, from Station 61 and a minor tributary. This minor tributary affected to a great extent the hydrograph at station 64, a catastrophic flood in the area.

Basically the storage function method, which will not be discussed here, is expressed in the following experimental function of runoff Q.

$$S = K Q^{p}$$

where K and p are constants for the basin or channel.

It will be noted that there is a dotted connection between station 59 and Candaba Swamp. This is due to the presence of a floodway between Stations 59 and 61 which directs the discharge dirlectly to the swamp when a certain water level is reach at the flood way entrance.

The proposed model is to have a time of calculation of every 3 hours ($\Delta t = 3$ hrs.) to suit the Networks limited capability of observing at shorter intervals owing to power lack because of possible long absence of solar power.

The development of the proposal model may take quite some time and amendments may be made depending on other factors which may come in or affect it during development. Also, further refinements of the model will be made as more reliable data are obtained.

The advantage of this proposed model is that the basin is devided into smaller segments which sontributes to the total hydrograph at the primary target Station (64).

In a member of flood time using the present model, the effects of a not so big tributary were not predicted because of lumping nature of the model over the whole basin.

IV. OTHER RECOMMENDATION

A. Adoption of the Malaysia Experience-or Setting up of water stage Ilevel warning posts in the flood prone areas which has a corresponding relationship with forecast points in the basin.

B. Education and Information drive on the flood prone areas on Flood sis-aster preparedness as part of the arning dissemination and information exchange.

C. Improvement of cooperation/coordination among agencies concerns.

Submitted by Mr. NESTOR L. CANUEL
04, Aug. 1982.

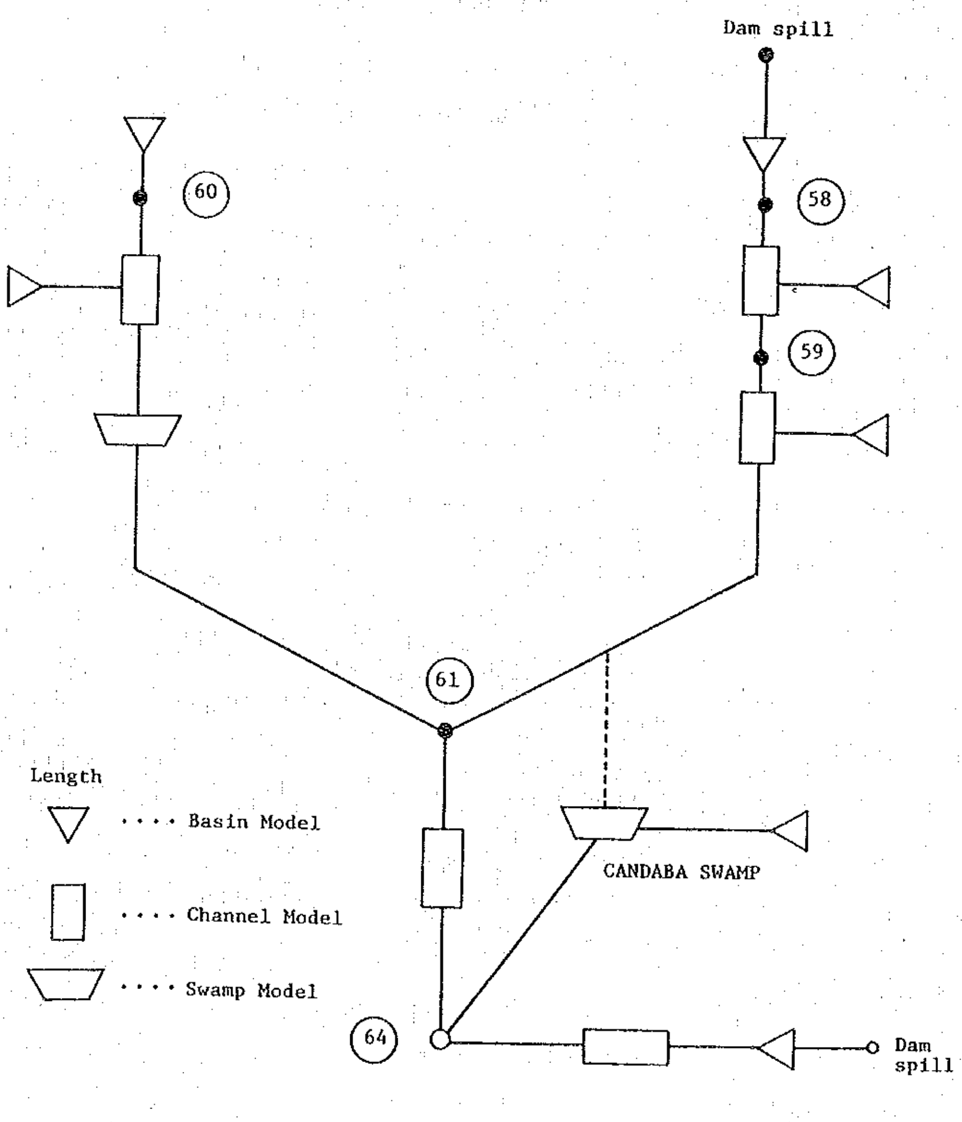


Figure-1. PROPOSED MODEL FOR THE PAMPANGA RIVER BASIN

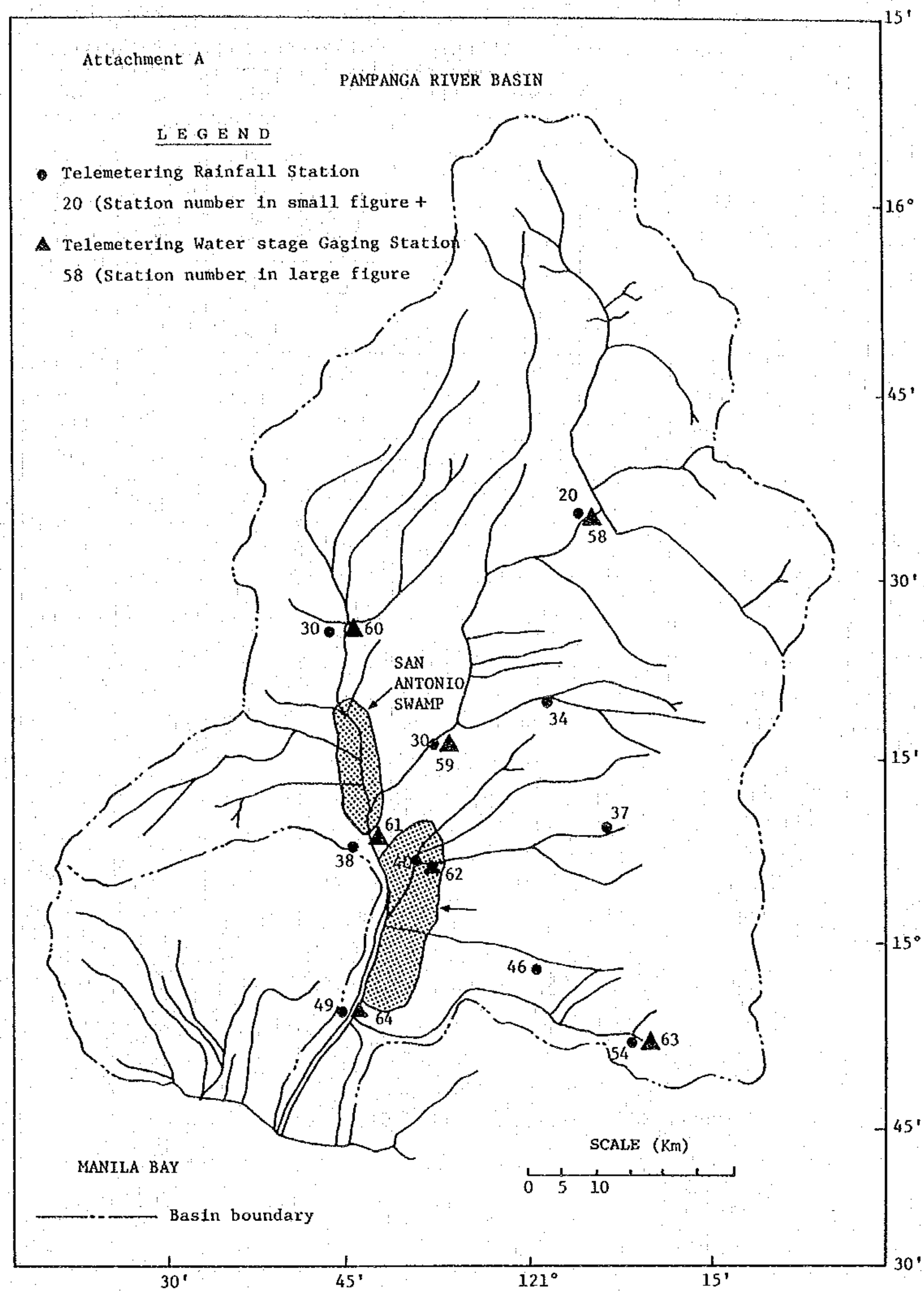


Fig. A-4.4 Location of Telemetering Stations

Table B 7.1 Hourly Rainfall

May 19, 1976

Daily summary of hourly rainfall (mm) at different stations

No.	20	34	36	30	38	37	41	54	46	49
Time \ Gaging Station	Sapang Buho	Papaya	San Isidro	Zaragaza	Arayat	Sibul Spring	Candaba	Ipo	San Rafael	Sulipan
0-1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3	0.1	0.	0.	0.	0.	0.	0.	0.	0.	0.
4	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
6	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
7	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
8	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
9	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
11	0.	1.	0.	0.	0.	2.	0.	0.	0.	0.
12	0.	0.	0.	0.	2.	4.	0.	0.	0.	0.
13	0.	0.	0.	0.	0.	1.	0.	20.	0.	0.
14	0.	0.	0.	0.	0.	0.	0.	11.	7.	0.
15	1.	0.	0.	0.	0.	0.	0.	0.	8.	0.
16	24.	2.	0.	0.	0.	0.	1.	51.	0.	1.
17	0.	1.	0.	0.	0.	2.	0.	27.	1.	2.
18	1.	0.	0.	0.	0.	0.	0.	24.	4.	1.
19	0.	0.	0.	0.	0.	0.	0.	25.	4.	1.
20	0.	0.	0.	0.	0.	0.	0.	49.	0.	0.
21	0.	0.	0.	0.	0.	0.	0.	20.	1.	0.
22	1.	0.	0.	0.	0.	0.	0.	3.	3.	0.
23	1.	0.	0.	0.	1.	0.	0.	43.	8.	0.
23-24	0.	0.	1.	0.	0.	0.	1.	6.	6.	1.
Total	28.	4.	1.	0.	3.	9.	2.	289.	42.	6.
(8-8)	28.	13.	5.	4.	10.	22.	4.	345.	66.	24.

FINAL REPORT

on TOPEX Seminar in Hydrology and Warning Dissemination/ Information Exchange Component

(1-7-1982 to 7-8-1982)

Place: Tokyo, Japan
Name : Chu Yongan
Nationality: The People's Republic of China

I. INTRODUCTION

I'm very glad to take part in the seminar of TOPEX, I wish to comment that the aim of the Seminar has been well achieved. In this Seminar, through the lectures, discussion and observation tours, I have learned a lot of knowledge on Component of Hydrology and arning Dissemination/Information Exchange-particular in the advanced technology. I have acquired an overview of the efficient disaster countermeasures system of Japan. It is recognized that adoption of the various disasters countermeasures, currently practised in Japan to my country will certainly give great benefits.

II. IMPRESSIONS

Our country is frequently hit by the typhoon rain seriously, especially along coastal region of Eastern China. It happens every year, and frequently cause rather serious waterlogging, resulting in the decreasing of industrial and agricultural production the breaking-off of communication and transportation and the sufferring of heavy losses on the life and property of the people. Zhejiang Province is my native place. For the Puyang River Basin the experiment is on the following three aspects;

i) the evaluation of the established system for forecasting and warning of hydrological effects of flood by the comparison of its outputs with actual observed data in the field;

ii) the identification of forecasting models, the selection of specific models for application to the Puyang River Basin and comparison of the model's results in real-time forecasting operations;

iii) the evaluation of the combined hydrological effectsoof typhoon, particularly river and storm surge flooding, and thus the determination of associated flood risk;

In addition to the above three aspects, the Puyang River Basin is composed of following sub-system:

1. a data-collection sub-system for precipitation stremflow and other data;
2. a data transmission sub-system for transmitting the data to the flood forecasting sentre;
3. a data processing sub-system for checking and processing the incoming data as inputs to the forecasting model;
4. a forecasting model yielding forecast of discharge and water level at specific location;
5. a sub-system which meteorological forecasts are incorporated as inputs to the flood forecasting model;

This system is very important, but it sometimes doesn't work so well, so I think that it must be strengthened and improved.

The existing flood forecasting system insludes collection and transmission of data; data processing; warning dissemination; information exchange; flood forecasting operation/issue and so on. At present, as Puyang River Basin is poor in this way, I think as follows:

First, the hydrology law will be studied especially on rainfall-runoff relationship. We want to improve experiment on runoff, then to obtaining experimental data of the hydrology. Thus we will study and analyse this data by the mathematical and physical method. We wish to want open the black box of rainfall-runoff relationship.

Second, we will want improvement of communication system. It includes main warning dissemination/information exchange. At present the improvement of delivering informations via many places by telegraph and computing the data by hands has been in planning. A forecasting center will be established to compute, to analyse, to predict and to control the flood by informations gathering by telemetering instruments, and to submit warning and predictions of flood to the authorities and to go on the controlling. For this purpose, a somplete set of automation device should be adopted.

III. CONCLUSION

I have learned beneficial knowledge in this seminar. After having gone back to my country, I shall make full use of the latest achievements in science and technology on the hydrological forecasting and warning dissemination/information exchange and upgrade the hydrology and warning dissemination/information exchange.

It should be recognized that when TOPEX was accomplished the subsequent evaluation of results in 1984 will decidedly lead to the identification of areas of improvement of effective measures or techniques will then be applied to other river basin in my province in a step-by step manner.

This seminar has substantial content. Often I was obtained by specialists to giving me guidance and was helped by colleguas. Here, I wish to express my sincere thanks to the Japanese Government, especially JICA has done a lot of this seminar. At the same time, it had taken a very good care to me. I would like to express my heartfelt thanks.

Thank you.

FINAL REPORT

The Pasak River

A Pilot Basin for Flood Forecasting and Warning

in THAILAND

NAME: Mr. Prasong Jitseri

COUNTRY: Thailand

ORGANIZATION: Hydrology Division, Royal Irrigation Department, Ministry of Agriculture and Cooperatives.

Thailand has selected the Pasak River Basin for establishing a pilot basin for flood forecasting and warning system since 1980. But few of hydrological and meteorological networks are available in the river basin and the transmission of data during flood season are still outdated

Therefore, in order to enhance flood forecasting efficiency, the following items should be proposed as guidelines for the imprementation of a flood forecasting and warning system as follows.

1. The observation equipments and transmission data in the river basin should be modernized in order to get a reliable informations.

2. Due to the Pasak River Basin has a longshape, the catchment area above the forecasting station is 9,500 Km^2. So the river basin should be divided into sub-basin and each basin have to select a specific model for forecasting.

3. The existing flood forecasting model should be improved by introducing meteorological data into the model.

4. The characteristics of rainfall pattern should also be studied.

5. As a resulting of the flood forecasting model will be improved by introducing meteorological data into the model as a new parameters. The network of meteorological stations have to be taken into consideration to increase them in the river basin as much as possible.

6. Some of methematical models should be recommended, such as, Tank Model, and so on, to provide a new model for flood forecasting and warning system in the new future.

FLOOD FORECASTING AND WARNING SYSTEM

Mr. Mohd. Fadhzliah
Drainage & Irrigation Dept.
MALAYSIA

I. INTRODUCTION

Flood more often than not is a menace when it occurs and the TOPEX member countries suffer from it perennially. The phenomena causing these floods is not too difficult to understand. However to counteract floodings and the effect may involve a lot of resources, for beyond the limit of most nations. Measures are of two kinds, structural and non structural.

This paper would concentrates on the non structural measures with particular reference to Kelanton Basin, MALAYSIA. The auther would like to stress kere that this may not be the official view of his Department and his own

II. FLOOD FORECASTING

II-1. Present System

The present set up consist of 5 telemetering rainfall stations and of water level stations also telemetric for the Kelanton River. The catchment area involved is excess of 12,000 sq. inch. These collected data are transmitted to the State D.I.D. of Kelanton. From here, the datais sent by telex to the D.I.D. headquaters in Kuala Lumpur. The data is then processed, run on the Computer using the Sacremento Model. Based on a certain predetermine amount of rainfall a forecast is made for the next 6 hr, 12 hr, 18 hr, and 24 hrs. These went D.I.D. of Kelanton and of necessary disseminate it to the public and various agencies concerned.

Now consider the set up under two broad headings, forecasting system design and forecasting methods.

II-2. Fordcasting System Design

The disign of the system is very much controlled by the amount of expenditure available and the human resources need to operate and maintain it in operation. The set up cost for the whole country would be enormously high if it were to cover all the catchments flooding.

Therefore there is a limit to say the number of rainfall and water level telemetric stations. The set up would normally be the minimum required to detect the worst case. On the assumption that monsoons are usually extensive and the worst condition arises when the whole catchment receives a heavy downpour then it may be justified to have a minimum of 5 rainfall telemetric stations for Kelanton. Also this number of stations, the forecaster could easily grasp these figures and have a feel of what is going on in the basin.

However the choice of the location of these stations is vital so as to be trully representative of the basin. Also storms sometimes behave very producing unever rainfall distribution in small concentrated location etc. and the rainfall gradient gets steeper on the inland region consistent with the rise in altitude. Thus the probability of only one not catching the rainfall is registering an amount not of the area is very very high. Thus 5 stations will produce unreliable data. this is the error introduced when one station break down

Lastly there is the general problems of one of the components of the system breaking down due to old age.

One further comment is that in the network of hydrological stations, thought must be given to the posibility of expansion in the future.

II-3. Forecasting Methods

The prime objective of the forecasting methods to deliver accurate and effective forecast to meet the public's requirement. For Kelanton it involves the input of catchment precipitation and turning it into runoff and discharge of the forecasting point, Sacrement Bridge.

Ex. Sacremento Model

This entails the simulation of runoff with particular consideration given to the soil moisture characteristics. Proper use of this Model requires interpretation of the primary of the hydrological cycle, precipitation, evapotransporation and also soil moisture in a physically reasonable manner. Calibration would result in producing an effective stream flow simulation only during the fitting period which is casually during the peak flooding period. The December of 1981 flood yields a poor performance of this model which partly may be due to this phenomenon.

Beside having the necessary facilities and the required skill to operate, there are two other factors of importance namely 1) availably of for calibration 2+ data collection network. The second factor and its deficiencies have been discussed earlier. The first factor warrant some comments. Data's are not only few but in some cases unreliable and this rely on subjective . Thus again it any lead to errors in the model output. Therefore one may conclude that other model of simpler natuere may be used such as tank model but there again errors are inherent errors of the component of the system as discussed earlier.

III. WARNING SYSTEMS

In mitigating the effect of flood the warning system is as important as the forecasting system. It is pointless having a good and reliable forecasting system when it can be disseminated and acted promptly by those concerned.

The Japanese people have come a long way in gearing themselves to face disasters but it is rather a affair with much being done by the authorities rapter than the victim. But it is not difficult to understand thus state of affair which is mainly due to the social structure of the present day society. The response of the public to the method of dissemination and also the effectiveness of the method need to be fully put to test and throughly understood.

IV. CONCLUSION

Most systems suffers from defects but in forecasting and warning systems, unlike most other systems, errors shown up fast and may cause untold damages. Therefore learning from our own mistakes and passing on the experience and technological know-how of others is one method of improving the system. In this respect TOPEX seminar is a good example which could result in the better method of forecasting and warning systems of the member countries.