4 October 1971

ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

WORLD METEOROLOGICAL ORGANIZATION

Fourth session of the Typhoon Committee
4-11 October 1971
Tokyo, Japan

MESSAGE FROM U NYUN, EXECUTIVE SECRETARY OF THE UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

Your Excellencies, Ladies and Gentlemen,

On behalf of the Secretary-General of the United Nations and on my own behalf, I have great pleasure in conveying this message to the participants of the fourth session of the Typhoon Committee. I deeply regret that the pressure of urgent official duties elsewhere has precluded my presence on this important occasion. I should like to take this opportunity of conveying, through Mr. Alan D. Benham, Chief of the Water Resources Development Division of the ECAFE secretariat, a warm welcome to you all.

First of all, I wish to express our deep gratitude to the Government of Japan for kindly making the necessary arrangements for the session and post-session study tour; and for having placed these excellent facilities at our disposal.

The choice of Tokyo as the venue of the fourth session is particularly appropriate in view of the Government of Japan's considerable experience in flood forecasting and warning; and on account of its wholehearted support of the Typhoon Committee.

We are all conscious of the recurrent damage inflicted by typhoons and tropical cyclones, without being fully aware of the significance of the

/damage incurred.

damage incurred. According to recent estimates made by the ECAFE secretariat, twenty-two countries in the region sustained damage to the extent of $9,300 million during the period covered by the first United Nations Development Decade (1961-70). This sum is almost as much as the cumulative financing of the World Bank to the countries concerned during that period ($9,416 million): in other words, virtually all the assistance given by the Bank was erased by the destructive impact of flood, storm surge and wind!

The seven countries comprising the Typhoon Committee sustained damage at the rate of $676 million annually. This is equivalent to an annual per capita loss of $2.9 and a total loss of 0.5 per cent in gross national product. On the average, 1.4 million people were affected annually; 1,216 lives were lost; 761,000 ha of arable land were inundated or otherwise damaged; and 41,300 buildings were wholly or partially destroyed.

Some 60 per cent of this damage was sustained by public works; 15 per cent by private property; 11 per cent by agriculture, 8 per cent by industry; and 2 per cent by public utilities.

The unprecedented tropical cyclones that ravaged East Pakistan last year, following the occurrence of several typhoons of exceptional severity in the Philippines, aroused the conscience of the world. Submissions made by the Typhoon Committee and Member States of the United Nations induced the General Assembly to adopt resolution 2717 (XXV) - Assistance in Cases of Natural Disaster - and resolution 2733 (XXV) - International Co-operation in the Peaceful Uses of Outer Space.

Resolution 2717 (XXV) appeals to all countries to offer assistance in cases of natural disaster on a much wider scale than hitherto and calls

/upon the

upon the Secretary-General to submit a comprehensive report on the ways and means of rendering assistance through the United Nations and other bodies. Resolution 2733 (XXV) recommends that the World Meteorological Organization take appropriate action to mobilize scientists, technologists and other pertinent resources with the object of obtaining the necessary basic meteorological data and discovering means of mitigating the harmful effects of tropical cyclones and typhoons.

The Typhoon Committee, in the forefront of these activities, has set about strengthening the forecasting and warning facilities in the typhoon area with the advice and assistance of developed countries who have generously contributed to the supply of equipment and to the training of personnel. In this connexion, I should like to acknowledge the assistance rendered by the Governments of Australia, France, the Federal Republic of Germany, Japan, the Soviet Union and the United States of America. The Soviet Union's action in stationing weather ships in the typhoon-breeding area with the object of giving advance warning of typhoons, has been of considerable value to meteorological agencies operating in the typhoon area. I welcome this collaboration and trust it will continue.

At its twenty-seventh session, the Commission noted with satisfaction an offer by the Government of the United States of America to transfer its Stormfury Project from the Caribbean to the western Pacific for a limited period during 1972, and the accompanying invitation to countries to participate in weather modification experiments designed to reduce the destructive impact of typhoons. I need not stress the potential benefit of this bold and costly research to all countries in the region.

/Throughout the

Throughout the ECAFE region, the need for concerted action by national and international bodies such as the Typhoon Committee is urgent. One of the primary purposes of the present session is to formulate a request to the United Nations Development Programme for financial assistance in accelerating and extending the Committee's activities. I appeal to the countries represented here to-day to support this request in all its phases; for without financial assistance of the order sought, material progress will be slow and inadequate.

Before I conclude I should like to express my deep appreciation of the continued active support of the World Meteorological Organization and the valuable contributions of developed and developing countries alike, in particular the generous offer of the Republic of the Philippines to provide the facilities required for the accommodation of the Typhoon Committee secretariat. To the secretariat, I offer my warmest congratulations on having completed another fruitful year.

I am confident that this session will have a profound influence on the lives of the peoples of the region in the years ahead. We are as yet at the beginning of our co-operative efforts; a good deal has been accomplish but much more needs to be done to reduce the tragic loss of life and enormous wastage of resources suffered by the inhabitants of places exposed to the menace of typhoon disasters.

Knowing that you will bear this in mind when considering the action programme of the Committee and the other substantive matters for considerati I wish you every success in your deliberations.

Statement on the occasion of the
Opening Ceremony of the Fourth Typhoon Committee
by Mr. Ryoko Ishikawa, Acting Director-General
of the United Nations Bureau,
Ministry for Foreign Affairs

Mr. Chairman, Distinguished Delegates and participants,

It is my honour and privilege to say a few words on behalf of the Ministry of Foreign Affairs on the occasion of the Fourth Session of Typhoon Committee.

I should like to extend my most hearty welcome to all distinguished delegates and participants who have come to Tokyo to attend this meeting.

This is the time of the year when our country falls a victim of typhoons, which cause us a considerable damage. There is a saying in Japan that natural disaster comes at a time when people forget about it. I must say memory of Typhoon in Japan at this time of the year is still vivid. Therefore, it is most opportune for us that delegates together with observers for this Committee have assembled here to exchange ideas to find ways and means for mitigating the harmful effects of typhoon.

As we all know, various co-operative efforts have been made by ECAFE in economic and social development

of

of the region, and among these activities of ECAFE, the Typhoon Committee has conducted substantial and productive work.

The Government of Japan has always attached a great importance to the unique role of the Typhoon Committee in the economic and social development of Asia, and I should like to take this opportunity to express my deep appreciation of the strenuous efforts exerted by ECAFE, WMO and Typhoon Committee Secretariat in this field and in particular, the endeavour to prepare for this meeting.

I sincerely hope that this meeting will be a success in providing a valuable guideline for further efforts of the Typhoon Committee and that all of you will have a most enjoyable stay in our country.

Thank you.

Address by the Parliamentary Vice-Minister of Construction

at the Fourth Session of the Typhoon Committee

Mr. Chairman, Distinguished Delegates and Observers and Ladies and Gentlemen:

It is indeed a great pleasure for me to have this opportunity to say a few words of welcome at the fourth session of the Typhoon Committee.

From the time the first meeting of experts on typhoons was held in 1965 the various interested countries and organs concerned worked cooperatively to lay the foundation for the establishment of the Typhoon Committee, and in 1968 the first session of the Committee was held. Since then, through the efforts of the countries concerned and of ECAFE, WMO and the Typhoon Committee Secretariat, fruitful results have been steadily obtained by the Typhoon Committee as an organ for cooperation in mitigating the typhoon damage in the ECAFE region. For this I wish to pay a high tribute to the Typhoon Committee, and, at the same time, wish to say we are most happy that the Committee accepted our invitation to have the fourth session of the Committee held in Japan and that we now have the pleasure of welcoming the distinguished participants.

As you know, typhoons frequently attack our country, taking a toll of precious lives and causing enormous amounts of property damage. However, we must not overlook the fact that they provide us with precious water resources. In Japan, in order to minimize flood damage and to make effective use of water resources, efforts are being made for construction and improvement of flood control facilities including riparian works and dam construction, and for

strengthening the systems of flood forecasting and flood fighting. This year, the country has already been attacked by two or three typhoons, but the damage caused has not been so serious as that caused twenty years ago. I believe the smaller damage is due to our continuous efforts. We Japanese intend to continue making the best use of our experience and knowledge on minimizing typhoon damage through the Typhoon Committee for the development of the ECAFE region.

It is my sincere wish that this conference will be a success producing fruitful results.

Here in Japan, autumn is the best season of the year. When the conference is over, I hope that you will enjoy the natural beauty of the country by participating in the study tour etc. which we have planned for you all.

Thank you.

Wednesday 6, October 1971

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

AND

WORLD METEOROLOGICAL ORGANIZATION

Fourth session of the Typhoon Committee
4-11 October 1971
Tokyo, Japan

ORDER OF THE DAY

Wednesday, 6 October 1971

09.30-12.30 hours (A2 ROOM, INTERNATIONAL CONFERENCE HALL, SEVENTH FLOOR, MINISTRY OF FOREIGN AFFAIRS)

1. Continuation of discussion of agenda item 6

   Outline of a tentative request to UNDP for assistance as institutional support to the Typhoon Committee

14.30-17.00 hours

2. Discussion of agenda item 7 (WRD/TC4/8)

   Action related to United Nations General Assembly resolution 2733 (XXV)

Social events

18.30-20.30 hours

Dr. Koichiro Takahashi, Director General of Japan Meteorological Agency and Mrs. Takahashi will give a reception at the Takara Hotel.

FOR PARTICIPANTS ONLY

4 October 1971

ORIGIANL : ENGLISH

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

AND

WORLD METEOROLOGICAL ORGANIZATION

Fourth session of the Typhoon Committee
4-11 October 1971
Tokyo, Japan

Conference Bulletin No. 1

Venue

The Typhoon Committee will meet in the International Conference Hall on the seventh Floor of the Ministry of Foreign Affairs, Kasumigaseki, Chiyodaku, Tokyo. Participants will be directed to the Hall on arrival at the Ministry.

Inauguration

The meeting will be inaugurated by His Excellency Mr. Masayuki Fujio, Partiamentary Vice-Minister of Construction at 10.00 hours on Monday 4 October 1971. Participants are requested to be seated five minutes before the inauguration. Transport will be provided for participants staying at the Tokyo Prince and Daiichi Hotels, leaving there at 08.30 and 08.45 hours respectively. Participants staying elsewhere are requested to make their own transport arrangements.

Registration

Registration will be at the desks provided in the lobby on the seventh floor of the Ministry of Foreign Affairs, between 09.15 and 09.45 hours. Name cads will be issued on registration. Participants are requested to wear these at all

sessions of the Committee and all official social engagements.

Transport

Transport will be provided free of charge to participants staying at the Tokyo Prince and Daiichi Hotels. Buses will depart daily (EXCEPT on Sunday 10 October) on the following schedule:

Leave Tokyo Prince Hotel	08.40
Leave Daiichi Hotel	09.00
Arrive Ministry of Foreign Affairs	09.20
Leave Ministry of Foreign Affairs	12.40
Arrive Daiichi Hotel	13.00
Arrive Tokyo Prince Hotel	13.20
Leave Daiichi Hotel	13.40
Leave Tokyo Prince Hotel	14.00
Arrive Ministry of Foreign Affairs	14.20
Leave Ministry of Foreign Affiars	17.10
Arrive Daiichi Hotel	17.30
Arrive Tokyo Prince Hotel	17.50

Conference Offices

	Room	Telephone
(1) Typhoon Committee		
Chairman	663	3040 (ex)
Vice-Chairman	663	3041 (ex)
(2) ECAFE Secretariat		
Mr. A.D. Henham	661	581-1905 (direct)
Mr. M. Kawamura		3028 (ex)
(3) WMO Secretariat		
Dr. A. Glases	659	504-3047 (direct)
Mr. D.H. Nijhoff		3027 (ex)
Mr. P. Rogers		

(4) Typhoon Committee Secretariat		
Dr. S.N.Sen	657	504-3046 (direct)
Mr. C.H. Tang		3026 (ex)
Mr. A. Hamamori		
Mr. J. Hickey		
(5) Government of Japan		581-1064 (direct)
Conference Officer	665	3031(ex) 3042 (ex)
Typing Pool and Documentation	658	3029 (ex)
Information Desk	lobby	3043 (ex) 3044 (ex)
(6) Interpreters		
Mr. C. Massaux	655	3025 (ex)
Mr. J. Roland		
Mrs. F. Sala		

Working hours

The working hours of the ECAFE, WMO and Typhoon Committee Secretariats and the Government of Japan will be as follows:

Monday to Saturday	09.00 hours - 13.00 hours
	14.00 hours - 18.00 hours
Sunday	As required by the Conference agenda

Documents Distribution

Documents and other papers, including mail and invitation cards, will be placed in the pigeon-holes allotted to delegations in the lobby of the Conference Hall. Participants wishing to distribute papers, pamphlets, invitation cards, etc., are requested to consult to Mr. Kawamura, if possible 24 hours in advance of circulation.

Earphones and Microphones

The working languages will be English and French, Participants may use channel 1 for the original language, channel 2 for English, and channel 3 for French.

Delegates are requested to push the button of the microphone before speaking and to speak only after the light has come on.

Refreshments

Arrangements have been made by the Government of Japan for refreshments to be served in the lobby during coffee breaks, both in the morning and in the afternoon.

Exhibition

Some modern meteorological and hydrological instruments and telemeterin equipment manufactured by Japanese firms will be on display in the lobby during the Conference.

First Aid

First aid will be available at the Ministry of Foreign Affairs' clinic on the eighth floor of the Ministry.

Study Tour

Participants are requested to register for the study tour at the special desk provided in the lobby, from 12.00 to 17.00 hours latest by Wednesday 6 October. Participants will be required to pay US$50 at the time of registration.

4 October 1971

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

AND

WORLD METEOROLOGICAL ORGANIZATION

Fouth session of the Typhoon Committee
4-11 October 1971
Tokyo, Japan

CONFERENCE BULLETIN NO. 2

Social Events

A reception will be held by Mr. Ryoko Ishikawa, Acting Director-General of the United Nations Bureau, Ministry of Foreign Affairs on Monday, 4 October 1971, from 18.30 to 20.00 hours at the Akasaka Prince Hotel. Individual invitations will be issued. Transport will be provided from the Tokyo Prince Hotel and Dai-ichi Hotel as follows:

18.00	Leave	Tokyo Prince
18.15	Leave	Dai-ichi Hotel
18.30	Arrive	Akasaka Prince Hotel
20.00	Leave	Akasaka Prince Hotel
20.15	Arrive	Dai-ichi Hotel
20.30	Arrive	Tokyo Prince Hotel

Monday, 4 October 1971

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

AND

WORLD METEOROLOGICAL ORGANIZATION

Fourth session of the Typhoon Committee
4-11 October 1971
Tokyo, Japan

CONFERENCE BULLETIN NO. 4

Social events

In honour of the delegates attending the fourth session of the Typhoon Committee, the following social functions have been arranged. Individual invitations will be issued. Transport will be provided from the Tokyo Prince Hotel and Dai-ichi Hotel for each reception, returning to the hotels at the end of the reception.

1. Tuesday, 5 October 1971, 6.00 to 8.00 p.m.

Reception by Dr. Shigenobu Sakano, the Chairman, Engineer General, Ministry of Construction at the Chinzanso.

2. Wednesday, 6 October 1971, 6.30 to 8.30 p.m.

Reception by Dr. Koichiro Takahashi, Director General of Japan Meteorological Agency at the Takara Hotel.

3. Thursday,7 October 1971, 6.30 to 8.30 p.m.

Reception by Mr. Alan D. Benham, Chief of Division of Water Resources Development, ECAFE, Dr. Arnold Glaser, Special Assistant for World Weather Watch Management and Coordination and Dr. S.N. Sen, Chief of the Typhoon Committee secretariat at the Kayu Kaikan.

4. Friday, 8 October 1971, 5.30 to 7.00 p.m.

Reception by H.E. the Chinese Ambassador to Japan, at his residence.

4 October 1971

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

AND

WORLD METEOROLOGICAL ORGANIZATION

Fourth session of the Typhoon Committee
4-11 October 1971
Tokyo, Japan

CONFERENCE BULLETIN NO. 5

Social Events

A reception will be held by Dr. S. Sakano, Chairman of the Committee and Mrs. Sakano on 5 October 1971, from 18.00 to 20.00 hours at Chinzanso.

Individual invitations are issued. Bus will be provided ffom the Ministry of Foreign Affairs to Chinzanso.

Bus will leave the front of the building of the Ministry at 5.30.

Tuesday, 5 October 1971

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

AND

WORLD METEOROLOGICAL ORGANIZATION

Fourth session of the Typhoon Committee
4-11 October 1971
Tokyo, Japan

CONFERENCE BULLETIN NO. 6

Film shows

A film titled "A LDAY CALLED CAMILLE" will be shown by courtesy of the United States Delegation at 5.00 p.m.,on Wednesday 6 October 1971 in the Conference Hall.

A film titled "TYPHOON ROSE AT HONG KONG (AUG 1971)" will be shown by courtesy of the Hong Kong Government, at 5.00 p.m., on Thursday 7 October 1971 in the Hall.

A film titled "THE YODO RIVER - MOTHER OF THE HUMAN LIFE" will be shown by courtesy of the Government of Japan at 5.00 p.m., on Friday 8 October 1971 in the Hall.

5 October 1971

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

AND

WORLD METEOROLOGICAL ORGANIZATION

Fourth session of the Typhoon Committee
4-11 October 1971
Tokyo, Japan

CONFERENCE BULLETIN NO. 7

Social Events

A reception will be held by Dr. Koichiro Takahashi, Director-General of JMA and Mrs.Takahashi on 6 October 1971, from 18.30 to 20.30 at Takara Hotel.

Individual invitation will be issued. Bus will be provided from the Ministry of Foreign Affairs to Takara Hotel.

Bus will leave the front of the building of the Ministry at 18.00.

TED NATIONS
ONOMIC
O
CIAL COUNCIL

GENERAL

E/CN.11/1005
15 November 1971

ORIGINAL : ENGLISH

ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

Twenty-eighth session
15-27 March 1972
Bangkok, Thailand

REPORT OF THE TYPHOON COMMITTEE (FOURTH SESSION)

CONTENTS

I. INTRODUCTION

1. The fourth session of the Typhoon Committee, held at Tokyo from 4 to 10 October 1971, was attended by representatives of the Republic of China, Hong Kong, Japan, the Republic of Korea, Laos, the Philippines and Thailand; and by observers from Australia, the Khmer Republic, the Federal Republic of Germany, the Union of Soviet Socialist Republics, the United States of America, the United Nations Development Programme (UNDP), the International Civil Aviation Organization (ICAO), the International Telecommunication Union (ITU), the League of Red Cross Societies (LRCS) and the Committee for Co-ordination of Investigations of the Lower Mekong Basin. Participants are listed in annex I.

2. The session was inaugurated by His Excellency Mr. Masayuki Fujio, Parliamentary Vice-Minister for Construction, who extended a cordial welcome to all participants. After referring to the steps that had led to the formation of the Typhoon Committee and to the subsequent action taken by the Committee he pointed out that, although typhoons frequently attacked Japan, taking a toll of precious lives and causing considerable property damage, the Government could not overlook the fact that typhoons were the source of the country's precious water resources. Through efforts made in the construction and improvements of flood control facilities, and in the strengthening of flood forecasting and flood fighting systems, the damage that had been sustained during the past year had not been so serious as that sustained twenty years before. The experience and knowledge of the Government of Japan in regard to the mitigation of the harmful effects of typhoons would be placed at the disposal of the Committee for the benefit of the whole ECAFE region.

3. Dr. Koichiro Takahashi, Director-General of the Japan Meteorological Agency, in a message of welcome delivered on behalf of the Agency, noted the steady and successful progress made by the Committee since its establishment in 1968. He stressed the need for international co-operation in typhoon forecasting and warning. The setting up of the Committee had been a significant step in that direction.

4. In welcoming participants on behalf of the Ministry of Foreign Affairs, Mr. Ryoko Ishikawa, Acting Director-General of the United Nations Bureau,

/stated that

stated that the Government of Japan attached great importance to the Committee's role in the economic and social development of Asia and expressed his appreciation of the efforts made by the ECAFE, WMO and Typhoon Committee secretariats to ensure the success of the meeting.

5. Dr. Charoen Charoen-rajapak, Chairman of the Typhoon Committee, thanked His Excellency Mr. Masayuki Fujio, Dr. K. Takahashi and Mr. R. Ishikawa for having spared time, amidst their pressing duties of state, to address the participants. He noted the deep interest of the Government of Japan in the welfare of the ECAFE region, and, in particular, in the activities of the Typhoon Committee, and expressed the hope that, with the help of Japan and other countries, those activities would grow and eventually bear fruit.

6. In a message read on his behalf by Mr. Alan D. Benham, Chief of the Division of Water Resources Development, U Nyun, Executive Secretary of the United Nations Economic Commission for Asia and the Far East (ECAFE), thanked the Government of Japan for the arrangements made for the session and for the post-session study tour. Citing recent estimates of flood damage in the ECAFE region, he said that twenty-two countries had sustained damage to the extent of $9,300 million during the period covered by the First United Nations Development Decade (1961-1970), a sum which was almost as large as the world-wide financing of the World Bank during that period. The seven countries composing the Typhoon Committee alone had sustained damage at the rate of $676 million annually, equivalent to an annual per capita loss of $2.9 and a total loss of 0.5 per cent in gross national product. On the average, 1.4 million people had been affected annually; 1,216 lives had been lost; 761,000 hectares of arable land had been inundated or otherwise damaged; and 41,300 buildings had been wholly or partially destroyed.

7. Referring to General Assembly resolutions 2717 (XXV), Assistance in Cases of National Disaster, and 2733 (XXV), International Co-operation in the Peaceful Uses of Outer Space, the proposed transfer of the United

/States

States stormfury project to the western Pacific and the proposed request for UNDP assistance to the Typhoon Committee, he enjoined all concerned to support the Committee in expanding and accelerating its activities. He thanked the World Meteorological Organization for its full co-operation, developed countries for their valuable contributions, and the Government of the Philippines for its generous provision of facilities for the Typhoon Committee secretariat.

8. The representative of the Secretary-General of WMO, Dr. Arnold Glaser, conveyed the Secretary-General's greetings and best wishes for success. He expressed WMO's gratitude to the Government of Japan for hosting the session and for the fine facilities provided. He noted that Japan was the crossroads for Pacific typhoons, and thus a most suitable place for the meeting. He informed the meeting of the steps taken following the United Nations Resolution 2733 (XXV) calling upon the World Meteorological Organization to mobilize all resources to mitigate the effects of tropical cyclones. The WMO Congress had created a Tropical Cyclone Project, and the Executive Committee had named a panel of experts to draw up a plan of action for the project. The panel had met in Tokyo the week before, and had drawn up a plan emphasizing the need to co-operate with regional organizations such as the Typhoon Committee. The plan covered such elements as making available advanced techniques of typhoon, storm surge and flood forecasting to all national services and the preparation of risk estimates of damage by wind, storm surge or flood. Finally, Dr. Glaser thanked the Government of the Philippines for providing facilities for the Typhoon Committee secretariat, and thanked ECAFE for their continuing collaboration. He wished the meeting every success.

9. A vote of thanks was accorded to the Government of Japan for its hospitality and to the ECAFE, WMO and Typhoon Committee secretariats for having arranged the meeting.

10. Before proceeding to the discussion of technical matters, Mr. Alan D. Benham, on behalf of the Executive Secretary, paid a tribute to Mr. P.T. Tan, until lately Chief of the Division of Water Resources Development, who

/had passed

had passed away after a brief illness on 10 September 1971. Mr. Tan had been in the forefront of activities in water resources in the ECAFE region during the past twenty years. His lasting monuments would be the Mekong River basin project and the Typhoon Committee project, to which two projects he had given unsparingly of his time and effort in the closing years of his working life. Participants stood in silence to mark their respect for one who had dedicated his whole life to others.

11. Referring to a resolution of the third session to invite the Khmer Republic and the Republic of Viet-Nam to become members of the Typhoon Committee, the Chairman informed participants that no formal replies had been received by the ECAFE secretariat to an invitation extended to the Governments of those two countries. In response to an invitation to attend the fourth session of the Committee, Mr. D.N. Kimsan, Counsellor of the Khmer Republic to Japan, represented the Khmer Republic at the session as an observer.

12. Dr. S. Sakano (Japan) was elected Chairman of the Committee for 1971/72; Mr. G.J. Bell (Hong Kong) was elected Vice-Chairman. Mr. P.C. Chin (Hong Kong) was elected Chairman of the Drafting Committee.

13. A vote of thanks was extended to the outgoing Chairman and Vice-Chairman.

14. The Committee adopted the provisional agenda for the meeting prepared by the ECAFE, WMO and Typhoon Committee secretariats (annex II).

II. THE COMMITTEE'S ACTIVITIES DURING 1971
(Agenda item 4)

15. The Typhoon Committee examined document WRD/TC4/5 prepared by the Typhoon Committee secretariat (TCS) and the WMO secretariat, reviewing the action which had been taken by member countries, the TCS and the secretariats of ECAFE and WMO in response to the decisions adopted by the Committee at its third session. The Committee noted with satisfaction the progress made

/in member

in member countries since the third session and then considered in detail the following four components of the programme : meteorological, hydrological, complementary protective measures, and training and research.

A. METEOROLOGICAL COMPONENT

16. The Committee studied the progress made in observing and telecommunication facilities in 1971, as shown in the document submitted to it, and heard reports from a number of members on national activities related to the Global Observing System (GOS) and the Global Telecommunication System (GTS) of the World Weather Watch which also form part of the Typhoon Committee's programme.

Global Observing System (GOS)

17. It was noted that, in China (Taiwan), further steps had been taken towards the installation of the new radiosonde/radiowind station at Pratas. The station was being set up as the result of the decision of the United States to provide the equipment required as part of its contribution to the WMO Voluntary Assistance Programme. It was also learned that the Republic of China had earmarked the sum of US$130,000 in the budgetary year beginning in July 1971 for its contribution to the project. Staff to operate the station would be trained in the United States and it was hoped that observations could begin not later than mid-1972. The Committee again stressed the importance of that station for typhoon forecasting and expressed the hope that it would be brought into operation as soon as possible. Although there had been some delays in the installation of the new radiosonde/radiowind station at Taipei, it was expected that the buildings would be completed in 1971. The Committee also took note of China's request for a radar station in the north of the island to assist in flood-forecasting over the Tan-shui river basin. It decided to add that requirement to the priority list.

18. The action of Japan in stationing the ship "Keifu Maru" at 20°N, 130°E for several periods during the 1971 typhoon season was recognized by the Committee. It noted with satisfaction that plans had been made to continue and extend the activities of that vessel in future typhoon seasons.

/19.

19. In the Republic of Korea, an APT station had been installed at Seou in January 1971, thereby fulfilling the priority request made at the third session of the Committee.

20. Although some delay had occurred in the arrangements under which the radiosonde/radiowind station at Vientiane in Laos was being set up under a VAP project, the Committee was informed that the equipment had been ordered and would be dispatched as soon as possible. The staff trained in Bangkok had returned to Laos and would be available to assist in implementi the programme of observations. An APT station was expected to be installed at Vientiane in early 1972 through a bilateral project under which France was supplying the equipment. The Committee recorded its appreciation of that offer, which would satisfy another priority requirement.

21. In the Philippines, it was noted with satisfaction that new radioso radiowind equipment had been installed at Cebu and the 00 GMT observations initiated. It was planned to install new equipment at Davao in December 1971 and at Puerto Princesa in March 1972. A 10 cm radar had recently been installed at Guian and was expected to be in operation shortly. Five other new radars were being procured through a loan from the United States Import-Export Bank and were expected to arrive by the end of 1971. The Committee was of the opinion that the bringing into service of those radars would materially assist the Philippines in combating the serious effects of typhoons. The intention of the Philippines to re-locate the radar intended for Puerto Princesa at Cuyo Palawan was notified to the Committee. The arrival of equipment for the radar station at Basco was also announced. It was hoped that that station, to which priority was being given, would become operational in the first half of 1972.

22. Under a bilateral arrangement with the United States, Thailand planned and hoped to install a 10 cm radar at Bangkok, following which the existing 5.7 cm radar would be transferred to a location in the south of the country.

23. The other main development in 1971 in the observational system at disposal of the Typhoon Committee countries had been the provision by the USSR of two weather ships for a period of three to four months. These

/vessels had

vessels had been stationed at approximately 16°N, 135°E from 19 June to the end of September and had carried out invaluable surface and upper-air observations. The Committee wished once again to record its gratitude to the USSR authorities for the positive response they had made to the request of the Committee at its third session. It also noted with pleasure that two member countries, Japan and the Philippines, had contributed to the success of this operation by providing port and other facilities for the weather ships, as well as by ensuring the transmission of the observations from the vessels.

24. It further noted that the USSR had provided the TCS with the upper-air observational data resulting from its weather ship's operations in the same area in 1970. It felt that those data, which were being distributed to all member countries, would be of considerable interest for research purposes. The Committee again expressed the hope that the USSR would give favourable consideration to continuing and, if possible, extending the support it was providing through its ocean weather ships in the typhoon area.

25. The Committee was advised that the Agency Prakla Seismos (Federal Republic of Germany) had stationed the research vessel "Jason" in the area southwest of Korea and that all vessels of the Federal Republic in the area had been instructed to undertake observations to assist the Typhoon Committee countries. The Committee expressed its gratitude for that practical contribution to its programme. It was hoped that research vessels from the Federal Republic of Germany would continue to co-operate in that way.

Global Telecommunication System (GTS)

26. Although further progress had been made in 1971 in implementing the telecommunication facilities required under the GTS, the Committee was of the opinion that more rapid implementation was desirable, especially for some of the regional telecommunication links. It noted that plans already established provided for the implementation during 1971-1972 of most of those links required as a matter of priority, and expressed the hope that the time schedules set up would be respected.

/27.

27. As a complement to the project for the installation of the upper-air station on Pratas, the Republic of China had set aside US$90,000 for telecommunication equipment to improve the transmission of meteorological data to Tai

28. The information that the link from Tokyo to Seoul had been implemented on 1 July 1971 was warmly received by the Typhoon Committee. It was noted tha the Republic of China and Japan had plans to bring the Taipei-Tokyo link into operation in January 1972.

29. In Laos, some difficulties had delayed the project for the RTT link between Vientiane and Bangkok. It was noted that the USSR equipment had reach Vientiane and that a USSR telecommunication expert would arrive in late Octobe to determine what further steps were required to make the link operational.

30. Following the destruction caused by typhoons in the Philippines in 197 the Australian Government had offered bilateral assistance in providing telecommunication equipment worth about US$300,000. It would consist of SSB trans ceivers, power generators, antennae, etc. and was expected to be delivered in 1972. The Typhoon Committee recorded its appreciation of that practical contr bution to the improvement of the typhoon-warning services in the Philippines.

31. Further studies in connexion with the strengthening of the RTH in Ban were conducted in 1971 and a revised request for assistance under VAP was bei made. The need for the early completion of that VAP project was stressed by the Committee. It was reported that the link to New Delhi had been tested an could be considered operational, while the Bangkok-Rangoon and the Bangkok-Vientiane links should become operational before the end of 1971. The target date of 1972 had been set for the link between Bangkok and Kuala Lumpur.

Exchange of radar fixes

32. The Committee reiterated the usefulness of the system of exchange of radar-fix messages and expressed satisfaction with the arrangements made for such exchanges during 1971. However, the representative of one country repor that the total number of radar observations received during the 1971 typhoon season had been much less than the number expected. The Committee urged memb to ensure the transmission of all relevant radar fixes in accordance with the agreed procedure and schedule. It requested the TCS to collect statistics

/pertain

pertaining to radar-fix messages exchanged during 1971 with a view to initiating any further action required to ensure greater frequency of exchanges.

33. Since the new WMO code for the exchange of radar observations, which would become mandatory on 1 January 1972 was very detailed, the Committee agreed to use Part A of the new code during 1972. It was recalled that that part of the code had been developed by WMO in response to a request from the Committee for a simple code for the exchange of typhoon radar fixes.

Priorities for the implementation of observing and telecommunication facilities

34. As at its third session, the Committee reviewed the list of observing and telecommunication facilities to which it had assigned priority. Although only a relatively small number of the facillties listed had been implemented during 1971, the Committee felt that the information available showed that there were good prospects of further progress in the following year or two. It felt that it was important, therefore, to maintain a list of priorities which would serve to focus attention on the most serious deficiencies in the current systems.

35. The Committee accordingly decided to revise the list of priorities to bring it up to date. At previous sessions, it had pointed out the need for a concerted effort on behalf of all concerned to secure the early implementation of the facilities listed; attention was again directed to the importance of planning for the speedy introduction of the facilities in the interest of saving human lives and reducing the adverse economic impact of damage. The Committee recalled that increased importance was being given to projects of that type as a result of the adoption by the Sixth World Meteorological Congress of a WMO Tropical Cyclone Project. It felt that further aid from countries outside the typhoon area would be essential in carrying out the programme it had decided upon and hoped that those countries able to do so would assist the Committee in performing its humanitarian task.

36. The list of priorities adopted by the Committee is given below:

Observing facilities

(a) Upper-air stations

/No plans

No plans

46902 Nansha (China)

98836 Zamboanga (Philippines)

Already planned

46810 Pratas (China) - Installation expected in 1971 under VA

48940 Vientiane (Laos) - Installation expected in 1971 under VA

98223 Laoag (Philippines) - 12 GMT radiosonde/radiowind. Partial implementation expected in 1971 from national resources

(b) Weather radar

No plans

Taipei (China)

Kwangju (Korea) (or other selected site)

Vientiane (Laos)

Already planned

Basco (Philippines) - National project 1972

Bangkok (Thailand) - Bilateral project

(c) APT stations

No plans

Taipei (China)

Already planned

Vientiane (Laos) - Bilateral project 1972

(d) Ocean weather station

No plans (after 1971)

Ship at 16°N, 135°E

/Telecommunicati

Telecommunication facilities

(a) National collection facilities

No plans

China - Nansha

Already planned

China - National project for Pratas

Laos - National project

Philippines - National/bilateral project

(b) Regional telecommunication

Establishment of the following point-to-point links:

Already planned

Bangkok - Saigon	National project 1972
Bangkok - Vientiane	National/VAP project 1971
Taipei - Tokyo	National project 1972

(c) Other telecommunication facilities

Partial implementation planned

Thailand - strengthening of RTH, Bangkok	Will be partially implemented with help of VAP project and national resources

37. The Committee requested the TCS to maintain close contact with those member countries in which the facilities were required and to provide them with advice and assistance in seeking aid through VAP or from other appropriate sources.

Other meteorological questions

38. In addition to the questions dealt with above, the Committee recorded its views on a number of other matters under that component of its programme. Those points are dealt with below.

/Denser

Denser network of special observations from land stations

39. The Committee was informed that the WMO Executive Committee Panel of Experts on Tropical Cyclones, which had held its first session in Tokyo the previous week, had drawn attention to the need for a denser network of special observations from land stations, especially in coastal areas. Those stations should be simple, observing only wind and pressure. In considering the need for those stations in the typhoon area, the Committee was conscious that the choice of new stations would depend to a large extent upon the availability of staff to man them and adequate telecommunication arrangements. It requested each member country, therefore, to consider where those stations should be set up and by what means; and to communicate its findings to the TCS.

Observations from mobile ships

40. Attention was drawn to the inadequacy of ship reports from some typhoon areas. It noted that the EC Panel had already called for action on that questi and stressed the urgency of improvement. It requested each member country to renew its efforts to ensure that arrangements for the collection and dissemination of reports were closely followed.

Aircraft reports

41. The Committee was informed of the action taken by ICAO to ensure that the procedures for the making and distributing of aircraft reports were followe As little progress had been achieved so far, it requested the Secretary-General of WMO to take the matter up with IATA and IFALPA with a view to ensuring full compliance with the agreed procedures.

Role of the Typhoon Committee

42. It was noted that, as a consequence of the progress made in the implementation of World Weather Watch requirements, the role of the Committee was changing. It was agreed that the Committee should proceed to look beyond WWW requirements in order to identify other deficiencies in the basic systems need for typhoon prediction and warning. The Committee decided that member countri should examine their additional needs and convey their views thereon to the TC

B. HYDROLOGICAL COMPONENT

43. The Committee noted with interest the progress made in developing comprehensive plans for the establishment of pilot flood forecasting and warning systems in selected river basins. Significant developments included:

China (Taiwan)

44. In 1971, the inter-agency group established to provide flood warnings in the Tan-shui River basin had compiled a list of the data needed for the selection of forecasting stations and the study of rainfall-runoff characteristics. On the basis of the work undertaken, the group had developed a technique for quantitative precipitation forecasting and attempted to make flood forecasts during July and September on the basis of incomplete information.

45. In complying with a request from the Government of the Republic of China for technical assistance, four Japanese hydrologists and three telecommunication experts had visited Taiwan during May and June 1971 to ascertain the feasibility of the proposed flood forecasting system; and, in the event of its proving feasible, to prepare a comprehensive forecasting and warning plan. The TCS hydrologist and flood forecasting expert had joined the Japanese survey team for one week. The expert group had recommended that forecasting be undertaken in two stages the first stage requiring only minimum facilities, the second stage additional facilities. The final report was expected to be presented to the Government of the Republic of China not later than 31 December 1971. The Committee noted with appreciation the assistance rendered by the Government of Japan.

Japan

46. The Committee was informed that flood forecasts were currently being issued jointly by the Ministry of Construction and the Japan Meteorological Agency for eighteen major river basins; the Ministry of Construction issued flood fighting warnings for eighty-seven river basins. By the end of 1970, the Ministry had installed 252 rainfall telemeters and 254 water-level telemeters. Forty-one rainfall telemeters and fifty-six water level telemeters were due to be installed in 1971. In addition, JMA monitored 276 robot rainfall gauges.

47. Under the Government's technical assistance programme, the third training course on flood forecasting and warning had been begun on 16 Septemb 1971 and was being attended by participants from China (Taiwan), the Republic of Korea, the Philippines and Thailand. The leader of the team that had conducted the feasibility survey of the Tan-shui River basin flood forecasting scheme reported his team's findings to the committee which noted with interes that the Government of Japan was considering further technical assistance in the implementation of a flood forecasting and warning system for the Pampanga River basin in the Philippines.

Republic of Korea

48. In the light of the four-year programme for water resources developme to commence in 1972, the Government of Korea had reviewed the requirements fo the implementation of a flood forecasting and warning system in the Han River basin.

Laos

49. During August 1971, Laos had experienced the fourth major flood in th Mekong River in six years; more than 90 per cent of the land under rice culti vation was affected. Flood forecasts were made by the Mekong Committee. In the Nam Ngum River, one of the main tributaries of the Mekong, regulating ga would shortly be installed on the hydro-electric dam currently under construc tion. It was recognized that it had not been possible to make adequate progr in the development of a pilot flood forecasting system in the Se Bang Hieng River basin during the past year, because of the insecure situation and for want of meteorological and hydrological data. The Committee was informed by the representative of Laos that the Se Bang Hieng was accessible in the lowe reaches though it was difficult to establish new stations in some parts of t basin. The installation of new rain-gauge and water-gauging stations could started without delay. External assistance was thus requested for the purch of flood forecasting facilities and equipment.

Philippines

50. In connexion with the establishment of a flood forecasting and warni system in the Pampanga River basin, the Government of the Philippines submit

/a forma

a formal request to the Government of Japan for the necessary equipment and training facilities. As it was a project of considerable importance, the Committee welcomed the offer of the Government of Japan to consider the provision of technical assistance and flood-forecasting equipment from 1972 onwards. The Weather Bureau and the Bureau of Public Works had agreed on the joint establishment and operation of the requisite flood-forecasting unit in the Weather Bureau. The Committee noted with satisfaction that the TCS was assisting the flood forecasting unit in carrying out case studies of floods in the light of the Japanese survey team's recommendations. It considered that studies would facilitate implementation of flood forecasting and warning on an operational basis when the recommended additional equipment had been installed.

Thailand

51. A tentative plan for the forecasting of floods in the Maeklong River basin through the medium of streamflow simulation had been developed and tried out experimentally during the flood season of 1971. The Royal Irrigation Department had established an SSB communication system in the upper Maeklong River basin. The Meteorological Department had made arrangements for the daily collection of rainfall data from three stations thrcugh existing and new communication links. Flood forecasts had not always been satisfactory, however, owing to insufficient data collection. Attempts to obtain better collection of data for such experiments would be expedited.

Mekong River

52. The representative of the Mekong Committee presented information on the establishment of an interim basin-wide flood-forecasting system for the lower Mekong River basin in 1970 and 1971.

Assessments of typhoon damage

53. The Committee was informed that, in consequence of a circular sent to all countries in the ECAFE region, information had been obtained which made it possible to estimate flood damage more accurately than hitherto. During the period 1961-1970, twenty-two countries had sustained damage to extent of $9,300 million. The seven countries of the Typhoon Committee had sustained damage at the rate of $676 million annually: a total loss of 0.5 per cent in gross national product and an annual *per capita* loss of $2.9.

/54.

54. Some 60 per cent of the damage had been incurred by public works; 15 per cent by private property; 11 per cent by agriculture; 8 per cent by industry; and 2 per cent by public utilities. On the average, 1.4 million people had been affected annually during the ten-year period; 1,216 lives had been lost; 761,000 hectares of arable land had been inundated or otherwi damaged; and 41,300 buildings had been wholly or partially destroyed.

C. COMPLEMENTARY PROTECTIVE MEASURES

55. The Committee noted with satisfaction that the TCS had prepared a summary of the information so far collected on the existing disaster prevention organization against typhoons and floods in member countries, copies of which were distributed at the session. The Committee considered that the summary would be particularly useful to countries which had not yet prepared national plans for disaster prevention. It requested members to furnish supplementary information to the TCS so that a revised summary could be prepared in due course.

56. The Committee noted that, as a result of negotiations conducted between WMO and the League of Red Cross Societies (LRCS), the services of a community preparedness/disaster relief expert had been made available to the TCS for a period of four months from 1 September 1971. The Committee expressed its appreciation of the valuable assistance provided to the Commit by the LRCS in arranging for that expert and supporting in principle the co tinued services of an expert in the TCS on a part-time basis.

57. The Committee endorsed the following broad functions proposed for t community preparedness/disaster relief expert:

/(a)

(a) to carry out surveys of community preparedness arrangements in selected member countries of the Typhoon Committee;

(b) to advise national authorities on the improvements desirable under the arrangements;

(c) to assist in the drawing up of plans to mitigate natural disasters where no such plans exist;

(d) to assist in the implementation of plans to mitigate natural disasters by organizing exercises to test the efficiency of preparations;

(e) to establish a programme of work as part of TCS activities to ensure that adequate attention is devoted to complementary protective measures in the next few years.

58. The role of the community preparedness/disaster relief expert during his current assignment was discussed in the light of the action programme approved by the Committee. The Committee agreed that the first step would be to conduct a survey of member countries analysing the status of disaster preparedness planning. Such a survey was essential as an initial step in order to provide appropriate information upon which to base constructive suggestions for the improvement of national readiness and response efforts. It was recognized, however, that a follow-up evaluation of performance would be required when a major disaster occurred. It was agreed that the expert should visit member countries as early as possible to meet officials concerned with disaster planning.

59. At its third session, the Committee had discussed the possibility of a regional action programme for natural disaster relief (paragraph 78 of the third session's report). As no further information had been received by ECAFE, WMO or TCS, and, in the absence of any comment at the session, the Committee considered that further action was not called for at that stage.

D. TRAINING AND RESEARCH

60. The Typhoon Committee reviewed the training facilities provided for countries of the region in the fields of meteorology and hydrology. It noted with satisfaction that a number of long-term fellowships had been

/provided

provided under WMO's Voluntary Assistance Programme (VAP) and several other fellowships under bilateral aid schemes.

61. In pursuance of an offer made at the third session of the Committee, the Government of Japan had organized three training courses in flood forecasting and warning for the benefit of the member countries of the Typhoon Committee. Course A in hydrology and course B in meteorology, each for a period of six months, had commenced in September 1971; course C in meteorolog telecommunication, of four months' duration, was due to commence in November 1971. The Committee recorded its deep appreciation of the Government's acti in organizing those training courses. The Committee welcomed a statement mad by the representative of Japan to the effect that Japan would consider organi another similar training course in flood forecasting and warning in 1972. The Committee was informed that seven trainees would be accepted for the sub-course in hydrology and five trainees for the sub-course in meteorology.

62. With reference to the offer of assistance made by France at the third session to meet the entire training requirements of Laos in meteorology and hydrology for a period of five years, the Committee was informed that Laos would soon submit formal proposals and nominations for training to the French Government.

63. The Committee welcomed the information given by the observer from Australia regarding the excellent training facilities that were available in various disciplines in his country to meet requirements common to the World Weather Watch and the Typhoon Committee's programme. He drew attention to th availability of training awards under bilateral aid programmes. Training awards, scholarships and fellowships sponsored by Australia under the Colombo Plan and other aid schemes covered travel and living expenses and the cost of books and equipment, and included a clothing allowance. Twelve courses were currently being offered in meteorology, hydrometeorology, cloud physics, telecommunication and electronics.

64. The representative of WMO informed the Committee that UNDP was ready to support the proposed training seminar on tropical cyclone forecasting techniques and warning services in Asia and the southwest Pacific, and that efforts were being made to find a country willing to offer host facilities fo the seminar. The Committee reiterated its views as to the importance and u urgency of the proposed seminar and urged all member countries to participate

actively in it. It expressed the hope that the seminar would be held in the early part of 1972.

65. The Committee reviewed the present arrangements for the exchange of information on the results of studies of typhoons. It noted that the Japan Meteorological Agency had distributed a second list of its research papers on typhoons to all member countries.

66. A member of the Committee drew attention to the need for strengthening existing methods for the exchange of research information. He suggested that, since there might be several research institutes or centres in each member country, the TCS should ascertain how many copies of research papers were needed for distribution to ensure that each agency concerned received one. It was suggested that, in order to facilitate the exchange of views and promote interest in research, member countries might wish to invite specialists of other countries whose work was of particular importance to provide their services for lectures and discussions. Arrangements for co-ordinating such requests and the possibility of procuring funds for visits of that kind might be explored by the TCS in consultation with the WMO and ECAFE secretariats.

67. The Committee noted with interest that Hong Kong's plan for producing typhoon movement forecasts by various objective techniques on an operational basis, with the help of a computer, was being given further consideration. Computer requirements for that purpose had been examined and alternative schemes were under consideration. The Committee was informed that research relating to typhoons and floods was being undertaken under the auspices of a UNDP/WMO Special Fund project in the Philippines.

68. The TCS had consulted member countries actively engaged in typhoon research activities on the possibility of joint collaboration in studying storm surges, typhoon-resistant structures, and precipitation patterns associated with typhoons. The Committee considered that the suggestions offered in that connexion by the Meteorological Research Institute of the Japan Meteorological Agency which had been circulated to member countries, might be pursued in consultation with other interested countries. The recommendations made at the first session of the WMO Panel of Experts on Tropical Cyclones should be taken into account to avoid duplication of effort.

III. PROGRAMME FOR 1972 AND BEYOND
(Agenda item 5)

69. After reviewing its activities during 1971, the Committee gave consideration to its anticipated work programme for 1972 and beyond on the basis of document WRD/TC4/6 presented by the TCS. The tentative action programme approved by the Committee at its first session continued to provide general guidelines for its future activities. The Committee decided to concentrate on the following specific items of work during 1972 within the framework of the broad programmes:

(a) to take further steps to speed up implementation of the meteorological and telecommunication facilities included in the priority list as revised during the session;

(b) with the assistance of the telecommunication and electronics expert of TCS, to organize on-the-job training on operation and maintenance of radar and FAX equipment at Seoul and telecommunication equipment at Vientiane;

(c) to assist the Philippine Weather Bureau in studying the present difficulties in national data collection and in improving it;

(d) to assist the Philippine Weather Bureau in repairing the existing radar at Virac and in the installation of new radars

(e) to continue experimental flood forecasting in the Maeklong River basin (Thailand) on the basis of the tentative plan already developed and to consider further improvement of the plan;

(f) to assist the Philippines in the implementation of flood forecasting for the Pampanga River basin with the further assistance which the Government of Japan was considering providing in 1972;

(g) to assist in the implementation of the first stage of the flood forecasting system in the Tan-shui River basin and assist in the development of a comprehensive plan for the second stage;

/(h)

(h) to assist the Republic of Korea in the analysis of hydrological data for development of a comprehensive plan for pilot flood forecasting in the Han River basin;

(i) to continue the study for first-stage flood forecasting in the Se Cham Phone River and lower reaches of the Se Bang Hieng River in close collaboration with the Mekong Committee secretariat.

(j) to continue the study of disaster preparedness organizations and to assist some countries in improving existing plans and in drawing up new national disaster relief plans, assuming that an expert on community preparedness is available to TCS for part of 1972;

(k) to co-ordinate appropriate supporting facilities to be provided by member countries in case the United States decides to transfer its Stormfury Project to the Pacific in 1972 for typhoon modification experiments;

(l) to expedite the procurement of assistance from external sources in the light of offers made; and

(m) to prepare a request to UNDP for assistance to the Typhoon Committee and to take the necessary steps in the submission of that request to UNDP.

IV. OUTLINE OF A TENTATIVE REQUEST TO UNDP FOR ASSISTANCE AS INSTITUTIONAL SUPPORT TO THE TYPHOON COMMITTEE
(Agenda item 6)

70. Following the proposal made at the third session of the Typhoon Committee to seek assistance from UNDP (Special Fund) at the earliest appropriate date, the Committee examined the outline of a tentative request to UNDP. It was informed that a project divided into two or more phases with a relatively modest Phase I was likely to receive more favourable consideration by UNDP than a single large request. If Phase I was successful, a larger Phase II project could then be submitted with good prospects of its acceptance.

/71.

71. In the light of that information, the Committee decided to re-exami in detail the proposals presented in document WRD/TC.4/7 in order to select those items of highest priority that could be included in Phase I. In doin so, the Committee decided to confine its attention to items for which it fe there were good prospects of early and successful implementation.

72. To facilitate consideration of the elements for inclusion in the re outline of a request to UNDP, the Committee established a small sub-committe composed of representatives of the Republic of China, the Republic of Korea Laos, the Philippines and Thailand. The recommendations of the sub-committe were based upon the following considerations relative to each part of the request.

Experts

It was decided to maintain the provision for expert staff at the present level and not to enlarge the Typhoon Committee secretariat. On the other hand, provision for consultants was increased to allow more flexibili in obtaining the services of highly-qualified experts for short periods of services in specialized subjects.

Training

A small reduction was made in the total sum requested in document WRD/TC4/7 for fellowships. This was achieved by reducing the number of 12-month specialization fellowships and increasing the amount provided for short-period (3-month) fellowships to meet emergency requirements.

Equipment

Large reductions were made in the proposed request for equipment. Because of their very high cost, it was decided to delete the request for two 10 cm storm-warning radars. The representative of Laos expressed the view that a storm-warning radar in Vientiane was vital to the development of efficient precipitation and flood-forecasting systems in his country an hence, to the safety of life and property. Although the Committee was ful conscious that its prime objective was to save life and reduce damage, it reluctantly felt that, in the interest of reducing the total sum requested it would not be possible to include that item in Phase I of the request.

/It felt

It felt that it was more appropriate to Phase II. It was suggested that, in the meanwhile, efforts to obtain storm-warning radars from other sources be redoubled and the attention of the Secretary-General of WMO be drawn to that requirement. The TCS was requested to undertake new initiatives in order to secure additional radar sets for the Typhoon Committee area.

73. The Committee recognized that a few pilot flood forecasting projects in selected river basins with different flood characteristics might qualify for support under a regional project. On the basis of that consideration, provision for telemetering instruments for pilot flood forecasting projects in selected river basins in the Republic of Korea, Laos and Thailand was maintained, although reduced in amount.

74. The Committee emphasized its belief that increased UNDP support would be essential if more rapid progress was to be made in accomplishing the programme it had set itself. It decided, therefore, that the TCS be requested to prepare a final draft request to UNDP on the basis of the following list, and that, after consultation with the ECAFE and WMO secretariats, the request be circulated to the member countries of the Typhoon Committee for their concurrence prior to submission to UNDP.

/CONTENT

CONTENT OF REQUEST TO UNDP
(PHASE I / DURATION 3 YEARS)

(Expenditure in US$)

SECRETARIAT		UNDP contribution	Counterpart contribution
Chief/Synoptic meteorologist	36 m/m	90,000	
Hydrologist	36 m/m	90,000	
Telecommunication/Electronics expert	36 m/m	90,000	
Consultant services	24 m/m	60,000	
Supporting staff (provided by host Government)			
1 Administrative officer	36 m/m		
3 Secretaries	108 m/m		
2 Drivers	72 m/m		
	216 m/m		25,000
Secretariat building and office equipment			300,000
Sub-total for secretariat		330,000	325,000
TRAINING			
12 specialization fellowships of 12 months each on the average (international fellowships at $6,400)	144 m/m	76,800	
20 fellowships of 3 months each for emergency cases (area fellowships at $1,550)	60 m/m	31,000	
Salaries of fellowship-holders	204 m/m		40,800
Sub-total for training		107,800	40,800

/EQUIPM

EQUIPMENT		UNDP contribution	Counterpart contribution
-- RS/RW Station at Nansha (China) plus supplies for one year		85,000	
Building			30,000
Spare parts, supplies and staff for 2 years			40,000
-- Radar test equipment (1 set for Republic of Korea, 3 sets for Philippines)		40,000	
-- Power generator for 3 radar stations (Philippines)		45,000	
-- APT Station for Taipei (China)		35,000	
Spare parts and operation for 2 years			10,000
-- SSB equipment for meteorological stations			
	(a) 4 sets 1.5 kW for Nansha (China)	40,000	
Spare parts and operation for 2 years			8,000
	(b) 30 sets of 100 W (10 for Laos and 20 for Korea)	45,000	
Spare parts and operation for 2 years			5,000
-- Fax scanner and 1.5 kW SSB transceivers with antenna for transmission of radar pictures and for collection and relay of meteorological data (for 3 radars to Manila)		115,000	
Spare parts and operation for 2 years			38,000

/-- Electronic

	UNDP contribution	Counterpart contribution
EQUIPMENT		
-- Electronic spare parts for emergency cases to be put at the disposal of the telecommunication/electronics expert	25,000	
-- Equipment for pilot flood forecasting projects in Republic of Korea, Laos, and Thailand	300,000	
Building, spare parts and operation for 2 years		210,000
Sub-total for equipment	730,000	341,000
MISCELLANEOUS		
Vehicle, postage, clerical assistance (6% of secretariat costs)	19,800	
Petrol, vehicle, stationery		20,000
	19,800	20,000
Grand total	1,187,600	726,800

/V.

V. ACTION RELATED TO UNITED NATIONS GENERAL ASSEMBLY RESOLUTION 2733 (XXV) (Agenda item 7)

75. It was recalled by the Typhoon Committee that the appeal it had made to the United Nations at its third session had led the General Assembly to adopt resolution 2733 (XXV). This resolution was addressed to WMO and recommended "that it take, if necessary, further appropriate action for mobilizing capable scientists, technologists and other pertinent resources from any or all nations towards obtaining basic meteorological data and discovering ways and means to mitigate the harmful effects of these storms and remove or minimize their destructive potentials". In addition, the resolution calls upon Member States "to exert efforts within their means to implement fully the World Weather Watch of the World Meteorological Organization".

76. The steps that WMO had taken to meet that request were explained to the Committee. Early in 1971, WMO had drawn up a tentative plan and submitted it to the Secretary-General of the United Nations in February 1971 as an interim statement. A similar document, containing more precise proposals, had been submitted to the Sixth World Meteorological Congress in April 1971. Because of the need for WMO to make increased efforts in that sphere, Congress requested the WMO Executive Committee, as a matter of urgency, to provide for the planning and implementation of a WMO Tropical Cyclone Project.

77. Immediately following the Sixth Congress, the twenty-third session of the Executive Committee established a panel of experts to draw up a comprehensive plan of action for the project and to keep its progress under review. It empowered the President of WMO to take the necessary action to ensure the rapid progress of the project and requested the Secretary-General to support the panel and to carry out various functions aimed at ensuring co-ordination of those activities with other international organizations.

78. Arrangements were accordingly made for the panel to hold its first session in Tokyo from 28 September to 1 October 1971. The panel concentrated its attention on the preparation of a Basic Plan which will later be developed into the Comprehensive Plan called for by the WMO Executive Committee. The Basic Plan outlines those elements amenable to immediate implementation and includes tropical cyclone detection and forecasting, storm-surge and flood forecasting, warning systems, disaster prevention and community preparedness and risk evaluation.

/79.

79. The Committee noted that the panel had stated its belief that regio programmes such as that carried out by the Typhoon Committee were of critic importance to the Tropical Cyclone Project. It had further stated that the best hope for an early reduction in the loss of life and damage caused by tropical cyclones lay in the vigorous prosecution of all parts of the programmes being carried out or planned. The Committee gave its full and enthusiastic support to the Tropical Cyclone Project and urged its members t spare no efforts in contributing in every way possible to the execution of t plan drawn up by the panel. It recognized that the Basic Plan would need t be further developed and then adopted by the WMO Executive Committee. Howe it noted that the Tropical Cyclone Project itself had been adopted by the W Congress and that there were accordingly a number of ways in which the membe countries of the Typhoon Committee could actively support the Project in the immediate future.

80. The following items, drawn from the Plan, appeared to lend themselve to implementation or support by the members of the Typhoon Committee:

(a) World Weather Watch

The Typhoon Committee could assist by identifying those elements of the WWW plan, not yet implemented, which had priority for typhoon purposes. It had to be understood that such demands might be different from the over- priorities established by the WMO Regional Associations.

(b) Dense surface network

Surveys of national requirements and possibilities would guide the Project in giving priority to the development of instruments suitable for widespread use. Once it nad been ascertained that a large potential market existed, inexpensive equipment might be made available.

(c) Ship and aircraft observations

Members of the Committee could co-operate in making sure that ships and aircraft of their nations filed observations regularly, not only in the typhoon areas, but in other tropical cyclone regions as well.

/(d)

(d) Forecast verification

The Panel of Experts recommended that a tropical cyclone forecast verification programme be instituted. The members of the Committee could co-operate by making their ideas known through the TCS, and by adopting the system proposed once it had been established.

(e) Time of warning and accuracy of forecast

The Tropical Cyclone Project should look into the relationship between the time of warning and the probable accuracy of a forecast based upon established warning and forecasting procedures. The Committee would be asked to make its ideas on that subject known to the Project.

(f) Storm surge forecasting

In the area of storm surge forecasting, Japan had developed advanced techniques for dealing with the estimation of storm surges, particularly in nearly enclosed bays. The Project hoped to formulate a unified technique for storm surge forecasting, based on advanced concepts, but sufficiently simple in application to be used by all meteorological services. Japan would be called upon to assist by providing detailed information for and aid in the formulation of an integrated storm surge forecasting system suitable for application in forecast centres not equipped with large computers.

(g) Flood forecasting

Flood forecasting had been split for convenience into two components: a hydrologic component, which had been referred to the WMO Commission for Hydrology for definition; and a meteorological component dealing with the problem of flash flooding. Members of the Typhoon Committee currently undertaking advanced work in the prediction of typhoon rainfall would be requested to redouble their efforts and to make their results available for use in flood estimation elsewhere.

(h) Risk of death or destruction

The Project included the development of techniques to evaluate the risk of death or destruction by cyclone winds, storm surges, and floods. Guidance might be sought from Committee members as to the uses to which such information might be put.

/(i)

(i) Geostationary satellite

The importance and usefulness of the data obtained from the United States geostationary satellites ATS-1 and ATS-3 in operation over the Caribb and the central and eastern Pacific was emphasized by the Committee. It fel that the placing in orbit of a geostationary satellite over the western Paci would greatly assist the Typhoon Committee's programme as well as the operat of other meteorological services in the ECAFE region.

VI. PROPOSED TRANSFER OF PROJECT STORMFURY TO THE PACIFIC (Agenda item 8)

81. The Committee had before it document WRD/TC4/9 which traced the events leading up to the proposed transfer of the project Stormfury to the Pacific. Reference was made to earlier considerations within the ECAFE/WMO typhoon project of the possibility of typhoon modification experiments in th Pacific. The results obtained in the latest experiment in the Carribean on hurricane Debbie in 1969 and the recent studies carried out in the United States and Japan on frequencies of typhoons likely to be eligible for modifi tion experiments were mentioned. It was recalled that, at the twenty-sevent session of the Economic Commission for Asia and the Far East, held at Manila in April 1971, the representative of the United States had announced the intention of his Government, subject to the availability of funds and the favourable response of interested nations, to transfer the Stormfury project to the Pacific for a limited period in 1972.

82. Document WRD/TC4/14 on that item was introduced by the United States representative who explained the project's theoretical basis and its histori development. As regards justification for moving the project to the Pacific the representative mentioned that recent studies had revealed that six typho would probably be eligible for seeding in the western Pacific during 1972 as against only two in the Atlantic. The expected increase in the number of eligible storms justified a shift in operation to the western Pacific.

83. In explaining the conduct of the experiment, the United States representative stated that a combined task force of aircraft and supporting personnel would be assembled for a three-month period during the 1972 typho season. The aircraft would be equipped for dispersing cloud-seeding materi and collecting environmental data. Missions would be flown as appropriate.

/on Completion

On completion of the experimental period, a comprehensive data analysis and research programme would be undertaken with a view to assessing the results of the experiments conducted. In regard to the co-operation needed from other nations, the representative stated that special radiosonde flights, additional ship reports, extra in-flight reports from commercial aircraft and other data would be helpful in the analysis of the weather conditions associated with each seeded typhoon. Help would be needed from various countries in obtaining this information, including the establishment of special observing stations in areas where it was at present lacking. The representative expressed the hope that each member country would depute a scientist to act as an observer in the experiments and to participate in the research programme. There were in addition a number of research tasks that could be undertaken by the countries concerned. The representative of the United States informed the Committee that the results of climatological studies on the speed of movement and the deepening and filling of typhoons for the months and areas concerned would be useful for the project.

84. It was stated that a decision had yet to be taken as to whether the project should be transfered to the Pacific; and, if so, when the transfer should take place. Before reaching a decision, the United States would have bilateral diplomatic consultations with all the countries concerned regarding the broad range of issues involved; and thereafter, if a consensus were reached, would hold multilateral technical discussions to develop criteria, procedures and cautionary measures which the United States would want to be at least as restrictive as those applied in the Atlantic.

85. The Committee discussed the subject at great length and all its members participated fully in expressing their views. All members welcomed the proposed transfer of the Stormfury project to the Pacific in 1972 in principle, provided that agreement were reached on appr iate criteria and restrictive conditions for seeding experiments. It was stated that, in experiments so far conducted, some reduction of wind speed had been reported. That was a most welcome result from the standpoint of damage mitigation, but the probable effect of the experiment on rainfall or on the track of the storm was unknown. Those uncertainties might lead to social repercussions, and, therefore, technical standards and restrictive criteria for seeding individual typhoons were indispensable. Some countries expressed the view that, if the project were to be implemented, they should be kept fully informed of the plans made both before and during the course of the experiments.

/86.

86. The Committee noted with satisfaction that the United States would take the initiative in approaching each of the countries concerned with a vie to seeking bilateral agreement regarding criteria and restrictive conditions for carrying out seeding operations on typhoons. One member suggested that the United States be requested to provide additional informative material concerning the Stormfury project to facilitate consultations within the varic government agencies concerned.

87. The Committee considered to what extent member countries could suppor the project by undertaking to provide additional observational data and other facilities. It urged each of its members to make special efforts to carry ou increased programmes of surface and upper-air observations at existing statio and, where necessary, to set up additional facilities on a temporary basis. facilitate necessary preparations at national levels, it was agreed that the United States would arrange to supply member countries, through the TCS, with detailed particulars of the observations (location, frequency etc.) that woul be required.

88. The Committee was of the opinion that further efforts would be requir to ensure that the maximum number of reports from ships and aircraft were ava able from the area of the experiment. The Committee agreed that the collabor tion of aircraft and ships' crews might be obtained by impressing upon them t special significance and requirement of the additional observations during th periods of seeding experiments. A suggestion was also made that the Secretar General of WMO could be requested to notify ICAO, IATA and IFALPA to ensure maximum co-operation by airlines during those periods. The Committee further recommended that the possibility of setting up buoys for additional data migh be explored.

VII. CO-ORDINATION WITH OTHER REGIONAL TROPICAL STORM PROJECTS (Agenda item 9)

89. Under that heading, the Committee discussed the various activities which were being undertaken on a regional basis in efforts to reduce loss of life and damage caused by tropical storms. It noted that the awakening of interest created by recent natural disasters had led to new initiatives in a number of areas. The activities of the Typhoon Committee since its formation in 1968 had served as an example of the benefits of co-operation between nati

/on a

on a regional basis and similar arrangements were being made by the countries affected by tropical storms in several other regions of the world. The Committee therefore felt that it was desirable to consider the extent to which co-ordination of the activities between different projects was necessary and desirable. It dealt with that question under two main headings.

WMO/ECAFE Panel on Tropical Cyclones

90. The Committee noted that a Meeting of Experts on Tropical Cyclones in the Bay of Bengal and the Arabian Sea, held in October 1970, had requested WMO and ECAFE to establish a joint Panel on Tropical Cyclones. In agreement with ECAFE, WMO had accordingly invited five countries (Burma, Ceylon, India, Pakistan and Thailand) to be represented on the Panel. So far, only Pakistan and Thailand had signified their acceptance of the invitation, and, therefore, the Panel had not yet been established.

91. The Committee examined a proposal that its activities be merged with those of the proposed Panel, thus forming a single intergovernmental body with responsibility for those two adjacent areas of southeast Asia. It recognized that the phenomena being dealt with in both areas were the same and that many of the associated problems were, therefore, also the same. There was a clear need for co-ordination between the two areas if effective progress was to be made in tackling those problems. In addition, the Committee was aware that amalgamation could result in economies both for the participating Governments and for the secretariats of the organizations supporting the project.

92. The Committee recorded its full support for the Panel and hoped that it would soon prove possible for it to begin its important activities. However, it was of the opinion that, as its own activities had been in operation for three years, it had reached a stage of close regional collaboration, and that enlarging the membership of the Committee at that time might have the effect of slowing down progress on some important aspects of the programme upon which it had agreed. It also noted that the recent first session of the WMO Executive Committee Panel of Experts on Tropical Cyclones had urged the creation of bodies similar to the Typhoon Committee in other tropical cyclone areas. In view of the fact that several such regional bodies were likely to come into being, the Committee considered that it would be inadvisable to merge only two

/of them.

of them. It agreed, however, that close co-operation was essential and that the matter might usefully be reconsidered at its fifth session. To ensure co-ordination in the meanwhile, it decided to appoint the representative of Thailand to serve as a rapporteur to the Typhoon Committee.

Projects in other areas

93. The Committee then turned its attention to the ways in which it might collaborate effectively with the projects in other areas. There was unanimous agreement that close liaison with the other regional cyclone bodies was essential, both for the benefit of the regional projects and within the general framework of the WMO Tropical Cyclone Project. It accordingly decided to empower the TCS to perform those functions on behalf of the Typhoon Committee, with the assistance of the WMO secretariat whenever required.

VIII. DATE AND PLACE OF THE FIFTH SESSION (Agenda item 10)

94. The representative of the Republic of China extended a cordial invitation to the Committee to hold the fifth session of the Committee in Taiwan. The Committee accepted the representative's offer with appreciation. Subject to the conclusion of mutually satisfactory arrangements between the ECAFE and WMO secretariats and the Government of the Republic of China, it was decided to hold the next session at Taipei in November 1972.

IX. CLOSURE OF THE SESSION

95. At its concluding meeting, held on 11 October 1971, the Committee considered and adopted, with minor amendments, the report of the session prepared by the Drafting Committee. Participants thanked the ECAFE, WMO and Typhoon Committee secretariats, and, in particular, the secretarial staff furnished by the Government of Japan, for their unremitting efforts to ensure the success of the session.

/Annex I

Annex I

LIST OF PARTICIPANTS

MEMBERS OF THE TYPHOON COMMITTEE

CHINA

Representative: Mr. Tsun-Hsien Lin,
First Secretary,
Chinese Embassy, Tokyo

Alternates: Mr. Shih-Chong Lu,
Chief, Observation Division,
Central Weather Bureau, Taipei

Mr. Yung-Ting Hu,
Deputy Chief Engineer,
Taiwan Provincial Water Conservancy Bureau,
Taipei

HONG KONG

Representative: Mr. G.J. Bell,
Director, Royal Observatory,
Hong Kong

Alternate: Mr. P.C. Chin,
Senior Scientific Officer,
Royal Observatory, Hong Kong

JAPAN

Representative: Mr. Shigenobu Sakano,
Engineer-General,
Ministry of Construction, Tokyo

Alternates: Mr. Ren'iti Saito,
Director of Forecast Department,
Japan Meteorology Agency, Tokyo

Mr. Ken Suda,
Telecommunication Counsellor,
Forecast Department,
Japan Meteorology Agency, Tokyo

Mr. Keiichiro Masumura,
Chief of First Research Division,
National Research Centre for Disaster Prevention,
Science and Technology Agency, Tokyo

/Mr. Akira

JAPAN (Cont.)

Mr. Akira Miyazaki,
Director of River Planning Division,
River Bureau, Ministry of Construction,
Tokyo

Mr. Hiroaki Fujii,
Head, Economic Affairs Division,
United Nations Bureau,
Ministry of Foreign Affairs, Tokyo

Mr. Tatsuo Kawagoe,
Director of Planning Bureau,
Public Works Research Institute,
Ministry of Construction, Tokyo

Mr. Yutaka Inada,
Special Grade Engineer,
River Planning Division,
River Bureau, Ministry of Construction,
Tokyo

Mr. Akira Mizuno,
Head, International Cooperation Division,
Planning Bureau, Ministry of Construction,
Tokyo

Mr. Takeo Kinoshita,
Head, Hydrology Section,
River Bureau, Public Works Research Institute,
Ministry of Construction, Tokyo

/Experts:

JAPAN (Continued)

Experts:

Mr. Kazuo Watanabe,
Chief Researcher,
Typhoon Research Laboratory,
Meteorological Research Institute,
Japan Meteorology Agency, Tokyo

Mr. Shigenori Maruyama,
Economic Affairs Division,
United Nations Bureau,
Ministry of Foreign Affairs, Tokyo

Mr. Yukio Omoto,
Head, Climatological Anomaly Laboratory,
First Research Division,
National Research Centre for Disaster Prevention,
Science and Technology Agency, Tokyo

Mr. Hiroomi Sakai,
Economic Affairs Division,
United Nations Bureau,
Ministry of Foreign Affairs, Tokyo

Mr. Koichi Matsumoto,
Economic Affairs Division,
United Nations Bureau,
Ministry of Foreign Affairs, Tokyo

REPUBLIC OF KOREA

Representative:

Mr. In Ki Yang,
Director-General,
Central Meteorological Office,
Seoul

Alternates:

Mr. Yeong Keun Kim,
Chief of Water Control Division,
Ministry of Construction, Seoul

Mr. Yong Dai Park,
Chief of Observation Division,
Central Meteorological Office,
Ministry of Science and Technology, Seoul

/LAOS

LAOS

Representative: Mr. Khamtanh Kanhalikham,
Directeur du Service Nationale de la
Météorologie et de l'Hydrométéorologie,
Vientiane

Alternates: Mr. Issara Sasorith,
Directeur du Service de l'Hydraulique
et de la Navigation,
Ministére des Travaux Publics et des Transport
Vientiane

PHILIPPINES

Representative: Mr. Roman L. Kintanar,
Director, Philippine Weather Bureau,
Quezon City

Alternates: Mr. Alejandro B. Delena,
Director, Bureau of Public Works,
Department of Public Works and Communictions,
Manila

Col. Ramon A. Makabuhay,
Office of the Executive Secretary,
Manila

THAILAND

Representative: Mr. Charoen Charoen-rajapark,
Director-General, Meteorological Department,
Office of the Prime Minister, Bangkok

Alternate: Mr. Damrong Jaraswathana,
Special Grade Engineer,
Chief of Hydrology Division,
Royal Irrigation Department,
Ministry of National Development, Bangkok

OTHER ECAFE MEMBER COUNTRIES

AUSTRALIA

Representative: Mr. R.L. Southern,
Regional Director,
Commonwealth Bureau of Meteorology,
Department of the Interior, Perth

/KHMER REPU

KHMER REPUBLIC

Representative: Mr. Doeur Nouth Kimsan,
Counsellor, Embassy of the Khmer Republic,
Tokyo

UNION OF SOVIET SOCIALIST REPUBLICS

Representative: Mr. A. T. Tolcachev,
Chief, Division of Central Department,
USSR Hydrometeorological Services Office,
Moscow

UNITED STATES OF AMERICA

Representative: Mr. Grover D. Hughes,
Assistant to the Director of International
Affairs, National Oceanic and Atmospheric
Administration (NOAA), Department of Commerce,
Washington D.C.

Alternates: Mr. Eugene Bollay,
Program Director,
Weather Modification, NOAA,
Department of Commerce,
Boulder, Colorado

Mr. Paul Moore,
Chief, Scientific Services Division,
National Weather Service,
Southern Region, NOAA,
Department of Commerce, Fort Worth, Texas

Mr. William J. Tonesk,
First Secretary and Deputy Permanent
Representative of the United States to ECAFE,
United States Embassy, Bangkok

Mr. Cooke H. Leutwyler
USAF Weather Center
Fuchu Airstation, Tokyo.

/OTHER STATE

OTHER STATE

FEDERAL REPUBLIC OF GERMANY[a/]

Representative:	Mr. Ernst Lingelbach, Ministerial Counsellor, Ministry of Transport, Bonn
Alternate:	Mr. Gunter Blaurock, Second Secretary, German Embassy, Tokyo

UNITED NATIONS BODIES

United Nations Development Programme (UNDP)	Mr. William L. Magistretti, UNDP Representative in Japan

SPECIALIZED AGENCIES

International Civil Aviation Organization (ICAO)	Mr. F. Oliveira, Technical Officer (Meteorology), Far East and Pacific Office, Bangkok
International Telecommunication Union (ITU)	Mr. Shigenori Horiguchi, Vice-Counsellor of Telecommunications, Ministry of Post and Telecommunication of Japan

NON-GOVERNMENTAL ORGANIZATION

Category I

League of Red Cross Societies (LRCS)	Mr. Risaburo Kikuchi, Director, Foreign Affairs Department, Japanese Red Cross Society, Tokyo

/SECRETAR

---

a/ Participating in a consultative capacity under Economic and Social C
resolution 617 (XXII) of 20 July 1956.

SECRETARIAT

ECAFE

Mr. Alan D. Benham	Chief, Division of Water Resources Development
Mr. M. Kawamura	Economic Affairs Officer, Division of Water Resources Development

WMO

Mr. Arnold Glaser	Special Assistant for World Weather Watch Management and Coordination, Geneva
Mr. D.H. Nijhoff	Chief, Section for Asia Southwest Pacific and Europe, Technical Co-operation Department, Geneva
Mr. P. Rogers	Technical Officer, Networks and Telecommunication Division, Geneva

TYPHOON COMMITTEE SECRETARIAT

Mr. S.N. Sen	Chief
Mr. C.H. Tang	Telecommunication and Electronic Expert
Mr. A. Hamamori	Hydrologist and Flood Forecasting and Warning Expert
Mr. J. Hickey	Community Preparedness/Disaster Relief Expert

COMMITTEE FOR CO-ORDINATION OF INVESTIGATIONS OF THE LOWER MEKONG BASIN

Mr. S. Sangsnit	Chief Hydrometeorologist

Annex II

AGENDA

1. Opening of the session
2. Election of the chairman and the vice-chairman
3. Adoption of the agenda
4. The Committee's activities during 1971
   - (a) Meteorological component
   - (b) Hydrological component
   - (c) Complementary protective measures
   - (d) Training and research
5. Programme for 1972 and beyond
6. Outline of a tentative request to UNDP for assistance as institutional support to the Typhoon Committee
7. Action related to United Nations General Assembly resolution 2733 (XXV)
8. Proposed transfer of project Stormfury to the Pacific
9. Co-ordination with other regional tropical storm projects
10. Date and place of the fifth session
11. Closure of the session

/Annex III

Annex III

LIST OF DOCUMENTS

No.	Title
WRD/TC4/1	Provisional list of documents
WRD/TC4/2	Provisional agenda
WRD/TC4/3	Annotated provisional agenda
WRD/TC4/4	Note on the session
WRD/TC4/5	Activities of the Typhoon Committee in 1971
WRD/TC4/6	Programme for 1972 and beyond
WRD/TC4/7	Outline of a tentative request to UNDP for institutional support to the Typhoon Committee
WRD/TC4/8	Action related to United Nations General Assembly Resolution 2733 (XXV)
WRD/TC4/9	Proposed transfer of project Stormfury to the Pacific
WRD/TC4/10	Co-ordination with other regional tropical storm projects
WRD/TC4/11	Tentative programme
WRD/TC4/12 Rev.1	Corrigenda
WRD/TC4/13	Report on basin-wide flood forecasting in the Lower Mekong Basin (Mekong Committee)
WRD/TC4/14	Proposed transfer of project Stormfury to the Pacific (United States)

. . . . .

FOR PARTICIPANTS ONLY

WRD/TC4/1
October 1971

ORIGINAL : ENGLISH

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

AND

WORLD METEOROLOGICAL ORGANIZATION

Fourth Session of the Typhoon Committee
4-11 October 1971
Tokyo, Japan

PROVISIONAL LIST OF DOCUMENTS

No.	Title
WRD/TC4/1	Provisional list of documents
WRD/TC4/2	Provisional agenda
WRD/TC4/3	Annotated provisional agenda
WRD/TC4/4	Note on the session
WRD/TC4/5	Activities of the Typhoon Committee in 1971
WRD/TC4/6	Programme for 1972 and beyond
WRD/TC4/7	Outline of a tentative request to UNDP for institutional support to the Typhoon Committee
WRD/TC4/8	Action related to UN General Assembly Resolution 2733(XXV)
WRD/TC4/9	Proposed transfer of project Stormfury to Pacific
WRD/TC4/10	Co-ordination with other regional tropical storm projects
WRD/TC4/11	Tentative Programme
WRD/TC4/12 Corr.1	CORRIGENDUM
WRD/TC4/13	Report on basin-wide flood forecasting in the Lower Mekong Basin (Mekong Committee)
WRD/TC4/14	Proposed transfer of project Stormfury to the Pacific (United States)

FOR PARTICIPANTS ONLY

WRD/TC.4/2
22 July 1971

ORIGINAL : ENGLISH

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

AND

WORLD METEOROLOGICAL ORGANIZATION

Fourth session of the Typhoon Committee
4-11 October 1971
Tokyo, Japan

PROVISIONAL AGENDA

1. Opening of the session
2. Election of the chairman and the vice-chairman
3. Adoption of the agenda
4. The Committee's activities during 1971
   (a) Meteorological component
   (b) Hydrological component
   (c) Complementary protective measures
   (d) Training and research
5. Programme for 1972 and beyond
6. Outline of a tentative request to UNDP for assistance as institutional support to the Typhoon Committee
7. Action related to United Nations General Assembly resolution 2733 (XXV)
8. Proposed transfer of project "Stormfury" to the Pacific
9. Co-ordination with other regional tropical storm projects
0. Date and place of the fifth session
1. Closure of the session.

. . . . .

FOR PARTICIPANTS ONLY

WRD/TC.4/3
23 July 1971

ORIGINAL : ENGLISH

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

AND

WORLD METEOROLOGICAL ORGANIZATION

Fourth session of the Typhoon Committee
4-11 October 1971
Tokyo, Japan

ANNOTATED PROVISIONAL AGENDA

1. Opening of the session

The inaugural session will be held at the International Conference Hall, Ministry of Foreign Affairs, Kasumigaseki, Tokyo.

2. Election of the chairman and the vice-chairman

Rule of procedure 6 of the Typhoon Committee states, "The Committee shall, at its first meeting of the year, elect from its representatives a chairman and a vice-chairman, who shall hold office until their successors are elected. They shall be eligible for re-election". Accordingly, the Committee will elect its chairman and vice-chairman after the opening of the session.

3. Adoption of the agenda

The provisional agenda was prepared after consultation between ECAFE and WMO, with due consideration being given to the advice of the Committee secretariat and the views of the participating Governments. Representatives of participating Governments may propose additions or changes, if they wish, before the adoption of the agenda.

4. The Committee's activities during 1971

A tentative action programme on typhoon-damage control was endorsed by the Typhoon Committee at its first session, held in December 1968. The

/programme

programme included improvements of meteorological, hydrological and other facilities urgently required to mitigate typhoon damage in the region. The task of assisting the members of the Committee in the implementation of this programme was assigned to the Committee secretariat. The activities of the Committee and its secretariat during 1969 and 1970 were reviewed at the second and third sessions. A similar review for 1971 will be made under this item on the basis of the report contained in document WRD/TC.4/5.

The Committee may wish to consider to what extent its decisions have been fulfilled and, where necessary, to make new proposals designed to complete or accelerate the desired action.

Participants may wish to exchange views on the latest research activities relating to typhoons and also to give information on plans for strengthening research activities in their respective countries. The Committee may wish to consider whether joint efforts by member countries in undertaking research on selected subjects could assist in accelerating research programmes towards mitigating typhoon damage.

Arrangements made for exchange of information on the latest research studies on typhoons, flood forecasting and so on, may also be reviewed under this item.

In reviewing each component of the action programme separately, the Committee will be in a position to assess the progress made since its third session. The representatives may wish to comment on the report of the activities during 1971, offer suggestions to accelerate the work and draw attention to special items which call for priority action. They may also report on the establishment in their respective countries during 1971 of any additional facilities not covered in the document presented under this item.

5. Programme for 1972 and beyond

After reviewing the current year's activities it would be useful to consider the anticipated work programme for 1972 and beyond. While the tentative action programme approved at the first session continues to provide the general guide-lines for future activities, the Committee may wish to concentrate on specific items of work during 1972. To facilitate consideration of this matter, a tentative list of such items is presented in document WRD/TC.4/6.

6. Outline of a tentative request to UNDP for assistance as institutional support to the Typhoon Committee

The Committee's third session considered a proposal to seek assistance from UNDP (Special Fund) for those parts of the Committee's programmes which would qualify for such assistance. The Committee desired that action required for the preparation of a request for assistance from UNDP be studied by the Typhoon Committee secretariat in consultation with the member countries and that a plan of action be presented to the fourth session for consideration. The matter was accordingly studied by the secretariat and the result of its study was circulated among the member countries. The Chief of the secretariat also discussed the matter personally with officials of the member countries and with the ECAFE and WMO secretariats. Based on these consultations, an outline draft of a tentative request to UNDP for assistance as institutional support to the Typhoon Committee is presented in document WRD/TC.4/7.

It is proposed that the assistance from UNDP be composed of two components, viz: (1) provision of selected equipment and training fellowships to permit accelerated implementation of the Committee's programmes and (2) financial assistance for maintaining the Typhoon Committee secretariat. The proposed budget for five years, showing estimated financial assistance from UNDP and corresponding counterpart expenditure, is included in document WRD/TC.4/7.

The representatives of the member countries may consider the proposals contained in the tentative request and suggest such changes as may be considered appropriate. On the basis of opinions expressed at the session, the Committee may wish to advise the secretariat to prepare a complete draft request for further action.

7. Action related to United Nations General Assembly resolution 2733 (XXV)

The appeal made to the United Nations by the third session of the Typhoon Committee resulted in the General Assembly's adopting resolution 2733 (XXV). This resolution calls upon WMO to take further appropriate action by mobilizing scientists and resources to discover ways and means of mitigating the harmful effects of tropical storms, and of removing or minimizing their

/destructive

destructive potential. It also calls upon member States to exert efforts to implement fully the World Weather Watch Plan. Document WRD/TC.4/8 describes the response to the resolution.

As part of the response, the Sixth World Meteorological Congress decided to establish the WMO Tropical Cyclone project. Subsequently, the WMO Executive Committee set up a panel of experts to prepare a comprehensive plan of action for the project. Document WRD/TC.4/8 describes further development under this heading.

8. Proposed transfer of project "Stormfury" to the Pacific

At the twenty-seventh session of ECAFE, in April last, the representative of the United States made a statement concerning the prospect of typhoon modification experiments in the Pacific. The Commission was informed that the United States was considering moving project "Stormfury" to the Pacific area for a limited period in 1972. It was mentioned that the proposed move was subject to the availability of funds, facilities and operating bases and to favourable responses from interested nations. In planning for the operation of project "Stormfury" in the Pacific, the United States intended to invite the countries concerned to assist in providing additional meteorological data needed for the required analysis and also to send representatives to observe and work with the project. The representative of the United States expressed the hope that they could consult the interested Governments at the time of the fourth session of the Typhoon Committee.

Background information on the "Stormfury" project and any additional information available concerning the proposed transfer of the project is presented in document WRD/TC.4/9. It is hoped that detailed plans for the proposed typhoon modification experiments will be presented by the representative of the United States at the session. The member countries of the Typhoon Committee may wish to express their views and the manner in which they could assist and participate in the proposed experiments.

9. Co-ordination with other regional tropical storm projects

Since the third session of the Typhoon Committee, there have been a number of developments concerning tropical storm projects that merit discussion at the fourth session.

/The

The first of these concerns the joint WMO/ECAFE Panel on Tropical Cyclones which is now being established to carry out, for the Bay of Bengal and the Arabian Sea, functions similar to those performed by the Typhoon Committee for the area affected by typhoons. Because these two areas are adjacent and both projects are being sponsored by ECAFE and WMO, a proposal has been made to merge the Committee and the Panel into a single body. The Committee will therefore be called upon to record its views on this proposal.

WMO is also assisting activities assigned to limit tropical storm damage in some other parts of the world, notably in the southwest Indian Ocean. The Committee may wish to consider what measures, if any, are desirable to co-ordinate these activities in different areas and to avoid duplication of effort.

Document WRD/TC.4/10 prepared by the WMO secretariat provides full background information on the above development to facilitate consideration by the Committee.

10. Date and place of the fifth session

Rule of Procedure 1 of the Typhoon Committee states, "The Committee shall hold at least one session annually. The venues and dates of its session shall be decided by the Committee". The Committee should therefore decide the venue and date of its fifth session.

11. Closure of the session.

. . . . .

FOR PARTICIPANTS ONLY

WRD/TC.4/4
26 July 1971

ORIGINAL : ENGLISH

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

AND

WORLD METEOROLOGICAL ORGANIZATION

Fourth session of the Typhoon Committee
4-11 October 1971
Tokyo, Japan

NOTE ON THE SESSION

Background

1. At its twentieth session, in March 1964, the Economic Commission for Asia and the Far East (ECAFE) recommended that the secretariat, in co-operation with the World Meteorological Organization (WMO), look into practical means of initiating a joint programme for investigating typhoons in the ECAFE region. A subsequent study by the ECAFE secretariat showed that the average annual typhoon damage in the region was about US$500 million and was a retarding factor in the economic development of the region. The ECAFE and WMO secretariats organized the first meeting of Experts on Typhoons at Manila in December 1965 and, as a result of the recommendations of that meeting, a preparatory mission on typhoons was organized jointly by ECAFE and WMO, with financial assistance from UNDP.

2. After visiting the various countries in the ECAFE region affected by typhoons, this mission prepared a report containing a number of recommendations to minimize typhoon damage in the region. The report was examined by the second meeting of Experts on Typhoons, which met at Bangkok from 5 to 10 October 1967. Besides endorsing the recommendations contained in it, the meeting recommended the establishment of a typhoon committee to co-ordinate their implementation.

3. Thereafter, ECAFE and WMO drafted jointly the statute and rules of procedure for the Typhoon Committee and convened an ad hoc meeting of

/government

government representatives at Bangkok from 29 February to 2 March 1968. The ad hoc meeting unanimously adopted the statute. The establishment of the intergovernmental Typhoon Committee was endorsed by ECAFE at its twenty-fourth session, in April 1968, and by the Executive Committee of WMO at its twentieth session in 1968. Before long, the ECAFE/WMO Joint Unit on Typhoons was established in the ECAFE secretariat, with financial assistance from UNDP.

4. After seven countries, namely China, Hong Kong, Japan, the Republic of Korea, Laos, the Philippines and Thailand, had signified their intention of joining the Typhoon Committee, the inaugural session was convened at Bangkok from 17 to 20 December 1968. At this session, the Committee discussed an action programme to secure the establishment of the additional facilities required to minimize typhoon damage in the region. At its second session, convened in Manila in December 1969, the Committee reviewed the implementation of its programme during the first year and decided to transfer its secretariat from Bangkok to Manila.

5. At the third session, convened in Bangkok in November 1970, the Committee reviewed the activities of the Typhoon Committee during 1970 and recommended an action programme for 1971 and beyond. The Committee also unanimously passed a resolution on international action for the mitigation of typhoon damage.

6. In March 1971, the Typhoon Committee secretariat was transferred from Bangkok to Manila.

Venue and date

7. The fourth session of the Typhoon Committee, in response to an invitation by the Government of Japan, will take place at Tokyo from 4 to 11 October 1971. The inaugural meeting will begin at 10 a.m. on Monday, 4 October, at the International Conference Hall, Ministry of Foreign Affairs, Kasumigaseki, Chiyoda-ku, Tokyo. The other meetings will be held at the same place.

Registration and credentials

8. The registration counter will be set up in front of the Conference Hall, and will be open at 9.30 a.m. on Monday, 4 October. Participants are requested to register at the counter prior to the inaugural meeting.

/They are

They are also requested to bring their official credentials, duly signed by the appropriate authority of their home country, and to present them to the Conference Officer when registering.

Programme

9. After electing a chairman and a vice-chairman, the Committee will review the progress of the work undertaken by member countries with the assistance of the Typhoon Committee secretariat. It will also discuss measures required to accelerate the implementation of the Committee's work programme.

Study tour

10. There will be a study tour from the afternoon of 11 to 14 October 1971 to visit the Yodo River and Takayasuyama radar site and some cultural and historical sites in Kyoto and Nara. The cost of the study tour, including transport and hotel accommodation, is estimated at US$ 50 (maximum). The tentative itinerary is as follows;

October 11	(Monday)	-	leave Tokyo for Kyoto by train; stay at Kyoto
12	(Tuesday)	-	visit Mt Hiei, Lake Biwa, Seta Weir, Amagase Dam and Yodo River Overall Control Office; stay at Nara
13	(Wednesday)	-	sightseeing of Nara City, and visit to Takayasuyama radar site and lower reach of the Yodo River; stay at Kyoto
14	(Thursday)	-	sightseeing of Kyoto City; leave Kyoto for Tokyo by train.

11. Those who wish to participate in the study tour are requested to fill in the attached form (annex I) and to send it, not later than 1 September 1971, to Mr. Hiroaki Fujii, Head of Economic Affairs Division, United Nations Bureau, Kasumigaseki, Chiyoda-ku, Tokyo, Japan, with a copy to the Chief, Division of Water Resources Development, ECAFE, Sala Santitham, Bangkok, Thailand. Because of the tight situation in transport and hotel accommodation, those who intend to participate are requested to comply strictly with this requirement.

/Participation

Participation

12. Invitations have been sent to the following Governments participat in the Typhoon Committee: the Republic of China, Hong Kong, Japan, the Republic of Korea, Laos, the Philippines and Thailand. In pursuance of the recommendation of the third session of the Committee, invitations have also been sent to the Khmer Republic and the Republic of Viet-Nam. In addition, Australia, France, the Federal Republic of Germany, the Netherlands, the Union of Soviet Socialist Republics, the United Kingdom and the United Sta of America have been invited to send observers in view of their interest in the Committee's programme. The International Civil Aviation Organization (ICAO), the International Telecommunication Union (ITU) and the League of Red Cross Societies have been invited to send observers.

Climate

13. The climate of Tokyo during October is usually mild with some rain. The mean monthly temperature is 16.9°C (62°F). The mean monthly minimum temperature is 13.5°C (56.3°F). The average monthly relative humidity is 74 per cent. The mean monthly rainfall is 203.3 mm.

Passport and visas

14. Each participant is required to possess a valid passport and an entr visa for Japan, obtainable from a Japanese diplomatic or consular mission abroad. Where there is no such mission, the participants are advised to ma a brief stop-over en route at a convenient place to obtain the required vis

Health requirements

15. Every participant must have a valid certificate of vaccination against smallpox and those who are coming from or through areas infected wit cholera are required to have inoculation against cholera. Participants are advised to consult travel agencies at least two weeks in advance of departu in order to obtain the latest information in regard to health requirements.

Foreign exchange

16. Participants may bring with them travellers' cheques or drafts in United States dollars or pounds sterling. There is no restriction on the amount of cash which may be carried. Travellers' cheques in US dollars and

/pounds

pounds sterling may be exchanged for Japanese currency at around US$1 = ¥360 and £1 = ¥864. These rates fluctuate slightly from time to time. Upon departure, reconversion from yen to other currencies will be permitted, within the amount exchanged, upon submission of a "Record of purchase of foreign means of payment". The cashing of personal cheques in Japan is not recommended, as collection procedures may take several weeks.

Communications

17. Correspondence for participants should be addressed as follows:

c/o ECAFE/WMO Typhoon Committee,
Economic Affairs Division,
United Nations Bureau,
Ministry of Foreign Affairs,
Kasumigaseki, Chiyoda-ku,
Tokyo,
Japan.

18. The cable address of the Typhoon Committee is "ECAFE Tokyo".

Hotel accommodation

19. Accommodation will be reserved, on request, at one of the two under-mentioned hotels. Both are in close proximity to the international conference site. The room rates are:

Tokyo Prince Hotel

Single bedroom	¥4,500 (plus 10% tax and 10% service)
Twin bedroom (double occupancy)	¥5,500 (plus 10% tax and 10% service)
(single occupancy)	¥5,000 (plus 10% tax and 10% service)

Daiichi Hotel

Single bedroom	¥3,400 (plus 10% tad and 10% service)
Twin bedroom	¥5,000 (plus 10% tax and 10% service)

(no single occupancy admitted)

20. Participants who wish to have rooms reserved for them at either of the above hotels are requested to fill in the attached schedule of arrival and hotel accommodation form (annex II) and to send it, not later than 1 September 1971, to Mr. Hiroaki Fujii, Head of Economic Affairs Division,

/United Nations

United Nations Bureau, Ministry of Foreign Affairs, Kasumigaseki, Chiyoda-ku, Tokyo, Japan, with a copy to the Chief, Division of Water Resources Development, ECAFE, Sala Santitham, Bangkok. Because of the acute shortage of hotel accommodation, it is requested that this requirement be strictly complied with.

Reception on arrival

21. Provided sufficient notice is given, participants will be met on arrival at the Tokyo International Airport by officials of the Japanese Government who will assist them in complying with customs and immigration formalities and arrange for transport to their hotels.

22. Participants are requested to cable ECAFE TOKYO their airline flight number and date and time of arrival at Tokyo.

Local transport

23. As far as possible, transport will be provided to take participants from the above-mentioned hotels to the conference site and to bring them back after the end of the daily meeting as well as to and from all official functions.

Working languages

24. The working languages of the meeting will be English and French. However, simultaneous interpretation may not be available.

Documents

25. As the number of copies of documents available for distribution at the session is limited, participants are requested to bring a complete set of the working documents sent to them through official channels. Other documents will be distributed as issued at the documents desk located in the conference hall.

/Annex I

Annex I

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST
AND
WORLD METEOROLOGICAL ORGANIZATION
FOURTH SESSION OF THE TYPHOON COMMITTEE

Study Tour

Name _____
(surname first)

and _____
(name(s) of accompanying person(s)

altogether _____ persons wish to participate in the study tour

(_____ October 1971).

_____ _____
(date) (signature)

This form must be completed in duplicate; one copy should be sent to reach Mr. Hiroaki Fujii, Head of Economic Affairs Division, United Nations Bureau, Ministry of Foreign Affairs, Kasumigaseki, Chiyoda-ku, Tokyo, Japan, and the other to reach the Chief, Division of Water Resources Development, ECAFE, Sala Santitham, Bangkok, Thailand, not later than 1 September 1971.

Annex II

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

AND

WORLD METEOROLOGICAL ORGANIZATION

FOURTH SESSION OF THE TYPHOON COMMITTEE

4-11 October 1971

Tokyo, Japan

1. Schedule of arrival

Name _____
(surname first)

accompanied by Mr., Mrs., Miss _____

will arrive at the Tokyo International Airport at _____ hours, on _____
(date)

on board _____
(Flight No.)

_____ _____
(date) (signature)

2. Hotel accommodation

Name _____
(surname first)

accompanied by Mr., Mrs., Miss _____

wishes to reserve a single/twin* room at _____ Hotel

from _____ to _____
(date) (date)

_____ _____
(date) (signature)

* Please cross out the word not required

This form must be completed in duplicate; one copy should be sent to reach Mr. Hiroaki Fujii, Head of Economic Affairs Division, United Nations Bureau, Ministry of Foreign Affairs, Kasumigaseki, Chiyoda-ku, Tokyo, Japan, and the other to reach the Chief, Division of Water Resources Development, ECAFE, Sala Santitham, Bangkok, Thailand", not later than 1 September 1971.

FOR PARTICIPANTS ONLY

WRD/TC.4/5
20 August 1971

ORIGINAL : ENGLISH

ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

AND

WORLD METEOROLOGICAL ORGANIZATION

Fourth session of the Typhoon Committee
4-11 October 1971
Tokyo, Japan

ACTIVITIES OF THE TYPHOON COMMITTEE IN 1971

(Agenda item 4)

Note by the Typhoon Committee secretariat

Contents

Summary

Document WRD/TC.4/5 describes the activities of the Typhoon Committee and the TCS during 1971, including action taken in response to the decisions reached at the third session of the Committee and proposals for further steps. It contains four sections as follows:

A. Meteorological component

Report on the progress made in improving meteorological network and telecommunication facilities which form the basis of the typhoon forecasting and warning system; special attention being paid to the priority list of facilities drawn up at the third session.

B. Hydrological component

The objective under this head is to establish a pilot flood forecasting and warning system in a key river basin in each of the following countries: China (Taiwan), the Republic of Korea, Laos, the Philippines and Thailand. Progress is reported.

C. Complementary protective measures

The limited work of the secretariat in compiling information on national organizations in this field is described, together with proposals for a more active approach to the many problems involved. Efforts to secure the services of an expert on community preparedness are described.

D. Training and research

An account is given of progress made in meteorological and hydrological training and of further action taken in securing fellowships. The current position regarding arrangements to exchange information on the results of typhoon studies and on recent research activities are reported.

/1.

I. THIRD SESSION OF THE TYPHOON COMMITTEE

The third session of the Typhoon Committee was held at Bangkok, Thailand from 18 to 24 November 1970. The meeting was attended by representatives of China, Hong Kong, Japan, the Republic of Korea, the Philippines and Thailand as well as by the Executive Secretary of the Economic Commission for Asia and the Far East (ECAFE) and the representative of the Secretary-General of the World Meterological Organization (WMO) as ex officio members. Representatives of Australia, France, the Federal Republic of Germany, the United States of America and the Union of Soviet Socialist Republics (USSR) attended as observers. A representative of the United Nations Development Programme (UNDP) and observers from the International Civil Aviation Organization (ICAO) and the League of Red Cross Societies (LRCS) were also present.

The meeting reviewed the activities of the Typhoon Committee and the ECAFE/WMO Joint Unit during 1970 and took stock of the current state of implementation of the meteorological, telecommunication, hydrological and complementary facilities required for an efficient system for the mitigation of typhoon damage. The list of priorities drawn up at its second session was revised by the Committee in the light of the progress made, and a programme of action for 1971 was established.

The Committee discussed the sources of assistance for new facilities. The representative of the USSR indicated the possibility of future operation of the Ocean weather ship in the West Pacific. Encouraging offers of assistance were also made by the representatives of Australia, France, the Federal Republic of Germany, Japan and the United States, particularly in the field of training. The Committee welcomed the readiness of the Government of Japan to consider extending assistance for implementation of flood forecasting and warning systems in the Philippines and in China (Taiwan).

The unprecedented severe cyclone which devastated East Pakistan only a few days before the session and the news that typhoon "Patsy" had struck Manila during the session created a sense of urgency for an all-out effort to mitigate typhoon damage. One of the significant results of deliberations was the decision to adopt a resolution calling for international

/action for

action for the mitigation of typhoon damage, which led to United Nations General Assembly resolution 2733 (XXV) adopted at the end of 1970. In addition, a proposal to draw up a special regional action programme for disaster relief was discussed by the Committee.

II. ACTIVITIES DURING 1971

INTRODUCTION

The second session of the Typhoon Committee decided to transfer the ECAFE/WMO Joint Unit on typhoons from Bangkok to Manila in response to an invitation by the Government of the Philippines. Accordingly all arrangements for the transfer were completed by early 1971 and the staff of the Joint Unit (Mr. S.N. Sen, Chief, and Mr. C.H. Tang, Telecommunication and Electronics Expert) were assigned to Manila on 25 March 1971. In accordance with the amendment of article 3 of the Statute, the ECAFE/WMO Joint Unit was re-designated "Typhoon Committee secretariat (TCS)". TCS has since been located in the Philippines Weather Bureau in Quezon City. Supporting staff has been provided by the Government of the Philippines.

The twenty-seventh session of ECAFE, held at Manila in April 1971, considered the annual report of the Typhoon Committee for 1970, and commended the Typhoon Committee on its activities. It welcomed a statement of the representative of the United States to the effect that his Government was considering the possibility of moving its Stormfury project from the Atlantic to the Pacific area in 1972 with the object of conducting typhoon modification experiments. The proposed transfer will be discussed under agenda item 8 and a separate document (WRD/TC.4/9) provides relevant background information on the subject.

Mr. A. Hamamori, Hydrologist and Flood-forecasting Expert, joined TCS on 29 April 1971. This post had been vacant since 8 December 1970 when Mr. A. Mizuno's two-year assignment expired.

The experts of TCS made the following visits to member countries and to the ECAFE and WMO secretariats:

/(a)

(a) Mr. Sen: Taipei, Seoul, Tokyo, Hong Kong, Bangkok, Vientiane and Geneva, 2 May - 17 June 1971.

(b) Mr. Tang: Tokyo, Seoul and Taipei, 1-28 January 1971; Seoul and Taipei, 20 May - 16 June 1971.

(c) Mr. Hamamori: Taipei and Bangkok, 6-17 June 1971

As recommended by the third session, TCS made a preliminary study of the components that might be included in a request to UNDP (Special Fund) for institutional support to the Typhoon Committee. The Chief of TCS, during his visits to member countries, discussed these proposals with the officials concerned. The ECAFE and WMO secretariats were also consulted. An outline of a tentative request to UNDP was then prepared by TCS (see WRD/TC.4/7, for consideration under agenda item 6).

Details of the progress made or action taken since the third session of the Committee are reported in sections A-D, below, together with action taken and further action proposed.

A. METEOROLOGICAL COMPONENT

1. Status of meteorological observing and telecommunication systems

It is customary at each session of the Typhoon Committee to examine the degree to which the meteorological and telecommunication facilities essential to an efficient typhoon warning service have been implemented in the member countries. This service is based essentially on facilities forming part of the World Weather Watch (WWW) plan, the requirements of which are already well-known.

The information presented here is intended to assist the Committee in reviewing this part of its programme. As in the past, it consists mainly of lists of those facilities which are not yet in operation in the member countries together with brief remarks on the outlook for their implementation over the next few years. The information, condensed as far as possible, is presented in annexes I - IV.

No listing of the deficiencies in surface observations is given. The network of surface observation is fully implemented in four of the seven

/Typhoon

Typhoon Committee countries and there are deficiencies at the main standard times in only one country. As the Committee has not assigned priority to any of these deficiencies it has not been felt necessary to tabulate them. Further information can be provided at the session if required.

Annex IV summarizes the state of implementation and further plans for those facilities assigned priority at the third session. It will be noted that progress is slow in some cases, and the Committee may wish to give further attention to means of spending up action.

Notification of any corrections, additions or changes at the session would be appreciated.

2. Other meteorological activities

The latest position regarding radiosonde/radiowind (RS/RW) and radar stations in the Philippines are as follows:

(a) RS/RW equipment was installed at Cebu in March 1971 and the station has commenced recording 00Z observations. New Vaisala type RW equipment is scheduled to be installed at Davao in December 1971 and at Puerto Princess in March 1972. RW equipment will be transferred from Zamboanga to Virac in September 1971. Decca-type RW equipment at Manila was destroyed by typhoon in November 1970 and arrangements are being made to purchase the spare parts needed for its repair.

(b) A 10cm JRC radar is being installed at Guian and is expected to be operational in the near future. Five new radars are being procured through loan from the United States Import-Export Bank; these are expected by the end of 1971. Some parts of the 5.6 cm radar at Manila have been defective, the repair and calibration of which is being assisted by the telecommunication and electronics expert of TCS.

The telecommunication and electronics expert of TCS has visited Seoul twice this year to repair the 10cm radar there. He also gave on-the-job training in the tasting and maintenance of radar to local technicians. This assistance was much appreciated by the Director of the Korean Meteorological Service.

/APT equipment

APT equipment was installed at Seoul in January 1971. It is understood from the French Aid Mission at Vientiane that APT equipment to be at Vientiane under bilateral aid was expected in early 1972. It is understood that, although it was planned to include funds in the national budget for 1971-1972 to purchase APT equipment for Taipei, the Government has recently considered requesting help from the WMO Voluntary Assistance Programme (VAP).

TCS has studied the various requirements for strengthening the RTT at Bangkok in consultation with officials of the Meteorological Department and a detailed report, together with specific proposals, has been sent to WMO for consideration in connexion with the pending request for assistance under VAP.

The latest position regarding installation of some of the regional point-to-point circuits are as follows:

(a) Bangkok-Saigon circuit: Equipment for this circuit is available at both ends, but the cable between the RTT station and the Meteorological Office at Saigon needs to be repaired. The circuit is expected to be established by the end of 1971.

(b) Seoul-Tokyo circuit is expected to be operational from July

(c) Taipei-Tokyo circuit is expected to be operational in 1972.

In view of the difficulties experienced in collecting national meteorological data at Manila and their retransmission, TCS undertook a s of the associated problems in consultation with the officials of the Phil Weather Bureau and of Clark Field USAF Communication Center.

Following typhoon destruction at Manila in November 1970, the Gov ment of Australia offered bilateral assistance to the Philippines to prov telecommunication equipment (SSB transceivers, power generators, antenna at an estimated cost of over US$300,000. This equipment, which will impr the collection of meteorological data needed for typhoon-warning services is now being manufactured and is expected to be delivered in 1972.

/To improve

To improve the communication facilities for transmission of meteorological observations from Pratas to Taipei (an item included in the priority list), the Government of the Republic of China made a budgetary provision of US$90,000 for telecommunication equipment to be installed at Pratas as part of the counterpart contribution in connexion with the VAP project for establishment of RS/RW there.

3. Action on decisions of the third session

RS/RW station at Pratas (paragraph 20)[1/]

The Committee was informed at its third session that the United States had offered to provide equipment required to establish this station under VAP. In March 1971 the formal procedure for the mentation of the project was agreed by the two Governments concerned. The authorities of the Republic of China have set aside the sum of US$130,000 in the budgetary year beginning July 1971, for their contribution to the project, and the equipment is expected to be installed in the second half of this year. Chinese staff to operate the station will be trained in the United States.

RS/RW station at Vientiane (paragraphs 23, 61)

Preparations to establish this station continued in the early months of 1971, and the staff required for its operation and maintenance has been trained in Thailand. Installation should take place later in the year.

Installation of an ocean weather ship in the Southwest Pacific (paragraphs 26, 70, 71)

In response to the Committee's request, the USSR authorities are again providing support, by stationing in the Pacific two research vessels from 10 June to about the end of September 1971. Final arrangements to receive the observations and for port and other facilities in Japan and the Philippines are being made. At present, observations are being received in Japan and retransmitted through JMA broadcast.

In addition, the USSR has recently provided the Typhoon Committee Secretariat with the upper-air observational data for the period of operation of its vessel in the Pacific in 1970. Copies have been made available to all members of the Typhoon Committee.

/Bangkok-

1/ This and subsequent references to paragraphs relate to the report of the third session.

Bangkok-Vientiane point-to-point link (paragraph 27)

The equipment provided by the USSR to Laos for establishment of Vientiane-Bangkok point-to-point circuit was received at Vientiane in May 1971. The TCS telecommunication and electronics expert prepared a design of the antenna system required for transmission and reception at Vientiane, sketches for which were forwarded to the Director of the Meteorological Service under intimation to WMO. Procurement of the antenna is under consideration. The circuit is expected to be operational towards the end of the year.

Priorities for the implementation of observing and telecommunication facilities (Paragraph 30, 31 and 32)

A revised priority list was distributed to all members of WMO. In the accompanying letter, particular attention was drawn to the importance of the facilities mentioned and the hope was expressed that members would give serious consideration to assisting in their early implementation.

The Typhoon Committee secretariat maintained close contacts with member countries, both by correspondence and by visits, with a view to expediting implementation of the facilities recommended. Wherever bilateral or VAP assistance was offered or fresh assistance needed, representatives of the prospective donor countries, local aid mission, UNDP representative or WMO secretariat were consulted and the receiving country advised on further action to be taken.

Exchange for radar fixes of typhoons and code for exchanges (paragraphs 74 and 75)

Arrangements were made to exchange radar fix messages during the typhoon season of 1971. TCS consulted member countries on the question of introducing the new WMO code. Member countries were advised to use the same code in 1971 as in 1969 and 1970, since consultation showed that some wished to introduce the new code only as from 1 January 1972.

Assessment of typhoon damage (paragraphs 85, 86)

Both WMO and ECAFE have initiated inquiries aimed at collecting information on the economic consequences of tropical storm and flood damage. The following thirteen countries of the region have responded to ECAFE's inquiry: Australia, Ceylon, the Republic of China, Hong Kong, India, Indonesia, Japan,

/the Republic

the Republic of Korea, Malaysia, New Zealand, Thailand, Singapore and the Republic of Viet-Nam. Limited interim information indicates that the seven member countries of the Typhoon Committee sustained damage to the extent of $676 million annually during the period 1961-1970; 1,216 lives were lost; 1.4 million people were affected; 761,000 ha of land were inundated or otherwise damaged; and 413,000 houses and buildings were damaged on the average each year during that period. The average annual damage was equivalent to a loss of 0.5 per cent in the gross national product of the countries affected.

Appeal to the United Nations General Assembly (paragraphs 88, 89)

The views of the third session of the Typhoon Committee on the need for further urgent measures to relieve human suffering from tropical storm disaster were conveyed to the General Assembly. The Committee's appeal was discussed soon after and resulted in the adoption of two resolutions (2717 and 2733 (XXV)). The action taken by WMO in response to these resolutions is fully described in document WRD/TC.4/8 on agenda item 7.

The proposed transfer of the Stormfury project to the Pacific, to be discussed under agenda item 8, has a direct bearing on the Committee's appeal and resolution 2733 (XXV).

4. Further actions proposed

It is suggested that the Typhoon Committee may wish:

(a) to examine the factual material contained in the annexes, especially the progress made in implementing the facilities to which priority was assigned by the third session;

(b) to revise the list of priorities as may be necessary;

(c) to recommend further measures to speed up the implementation of the meteorological and telecommunication facilities forming part of the Committee's programme;

(d) to record its appreciation to the USSR for its valuable contribution to the observing facilities in the Pacific through the operation of its research vessels, and to express the hope that these observations may be continued;

(e) to record its appreciation to the Government of Australia for its generous offer of telecommunication equipment to the Philippines.

(f) To recommend exchange of radar fix messages during 1972 and beyond, in accordance with the agreed schedule, using the new WMO code and the most direct communication channel available for such exchanges.

B. HYDROLOGICAL COMPONENT

1. General activities

Further progress has been made in developing comprehensive plans and establishment of pilot flood forecasting and warning systems in the key river basins selected for this purpose in China (Taiwan), the Republic of Korea, Laos, the Philippines and Thailand. TCS helped the departments concerned to take further necessary action in this regard. New developments during 1971 are summarized below:

China (Taiwan)

As reported at the third session, plans for a flood forecasting system on Tan-shui river basin would form part of the Government's comprehensive flood control plan for Taipei, which includes evacuation and flood-fighting measures. The Government approved an estimated expenditure of US$1 million, to be shared by the Taipei municipal provincial and central governments. It has been proposed to implement the entire plan gradually, over a period of three to four years starting in 1971.

A tentative improvement project for flood forecasting in the Tanshui river basin was proposed by PWCB on the basis of recommendation by an inter-agency Working Group. The tentative plan was discussed with the experts of TCS and revised by PWCB in 1970. It was recognized that hydrological analysis of the existing data must be carried out in order to develop appropriate quantitative flood forecasting procedures before the exact number and location of additional rainfall and river stage stations were finally decided. For this purpose technical assistance of external experts was considered necessary. A request for assistance was submitted to the Government of Japan for the services of two hydrologists and an electronic engineer.

/Meanwhile

Meanwhile, the interagency group for flood warnings commenced full-time activities from the beginning of 1971 with the assistance of the UNDP/WMO project at Taipei. The group, comprising five hydrologists and five meteorologists, started compiling basic data for the selection of forecast stations in the Tan-shui basin and study of rainfall-runoff characteristics. The meteorological side of the group continued to develop the quantitative precipitation forecasting techniques. It is understood that the interagency group will attempt trial flood warning this year, on the basis of the work already completed.

In response to the request for assistance, submitted to the Government of Japan, a team of four Japanese hydrologists visited Taipei during May and June 1971, for a period of one month, for field survey and analysis of data as a part of the technical assistance for the Tan-shui river flood forecasting project. Another team of three telecommunication experts also visited Taipei during June. The TCS hydrologist and flood-forecasting expert joined the Japanese survey teams for one week, to participate in the survey. According to the survey team's interim report, two stages of flood-forecasting have been recommended, the first starting soon with the minimum facilities necessary and the second with additional facilities. The final report is expected to be prepared by the end of the year, after further study of the data in Japan.

Republic of Korea

Flood forecasting for the Seoul area (Indo-Gyo) is being continued by stage correlations between Cheongpyeong and Koan for the North Han river, between Yeo-Ju and Koan for the South Han river and between Koan and Indo Gyo for the main Han river. There is an urgent need for analysis of available data with a view to improving the flood forecasting technique which is now based on simple stage correlation. However, owing to a shortage of trained personnel, possible approaches for data analysis suggested by the TCS hydrologist in 1970 could not be undertaken. The equipment at present used (SSB and VHF) for the collection of data is old; in fact the system needs improvement and modernization.

/Average

Average annual flood damage in this country has been estimated as 3,200 million won (over US$ 25 million). To mitigate such recurring damage, the Government has planned a four-year development programme starting from 1972, which aims at improving the flood forecasting and warning techniques, modernizing the system of data collection and constructing reservoirs and levees to control floods and prevent inundations.

The requirements for implementation of improved flood forecasting and warning system for Han river has been reviewed recently in the light of the development programme planned by the Government. TCS consulted the Ministry of Construction at Seoul about their need for technical assistance and it was considered that expert assistance for analysis of hydrological data and fellowships for training of a few engineers in hydrology and telecommunications would be urgently required. The possibility of obtaining assistance from the Government of Japan was subsequently explored in consultation with the River Bureau officials of the Ministry of Construction at Tokyo, and the Director of the Hydrological Service at Seoul was advised on the procedure for requesting such help.

Laos

The Se Bang Hieng river basin was selected by the Government of Laos for the establishment of pilot flood forecasting. However, more than two-thirds of the basin area is not accessible at present and meteorological or hydrological data are not available. Consequently, it may not be feasible to develop a comprehensive plan and a reliable technique for flood forecasting until the situation permits of obtaining data from a larger part of the basin area.

The two raingauge stations at Dong Henh and Kengkok, on the western tributary (Se Cham Phone), are the only ones in the Se Bang Hieng river basin at present. They have water-stage data for the last few years, but no discharge measurements. There are two water-gauge stations at Bang Keng Done and Keng Thangone in the lower reach. Following a survey of the western part of the

/basin

basin up to the farthest accessible spot in 1970, the TCS hydrologist analysed the limited data available. He suggested that a beginning could be made by introducing flood forecasting for the Se Cham Phone river and lower reaches of the Se Bang Hieng, using the rainfall at Dong Henh and Kengkok as indicator for the basin and finding a correlation with the discharge at Bang Keng Don. A note on this analysis is expected soon.

The practical difficulties in developing a comprehensive plan of flood forecasting for Se Bang Hieng river basin have recently been reviewed in consultation with the Director of the Hydrological Services in Laos, who is considering the desirability of selecting another key river basin in Laos for development of pilot flood forecasting, such as the Nam Ngum river which was originally recommended by the Preparatory mission, in order to enable more useful work to be accomplished within a reasonable time. It is understood that the accessible area on the western part of the basin is now more restricted than in 1970.

Philippines

It will be recalled that the final feasibility report on plans for a flood-forecasting and warning system on the Pampanga river basin, prepared by Japanese experts, was submitted to the Government of the Philippines in July 1970 and that the third session of the Typhoon Committee noted with appreciation that the Government of Japan was considering extending further technical assistance for implementation of the project.

TCS contacted the departments concerned in the Philippines in this connexion and, in April 1971, the Government submitted a formal request for equipment and training facilities to the Government of Japan. It is hoped to reap the benefits of these measures in 1972.

Meanwhile the Philippine Weather Bureau and the Bureau of Public Works have agreed on their respective roles. A flood-forecasting unit has been established in the former which will eventually be responsible for operational flood forecasting.

/Pending

Pending assistance from Japan, preparatory work including case studies of past floods has been discussed with the Weather Bureau and the Bureau of Public Works, and the TCS hydrologist and flood forecasting expert is helping the flood-forecasting unit to assemble the requisite data.

Thailand

A tentative plan for flood forecasting in the Maeklong river basin has been developed by TCS in consultation with the Royal Irrigation Department and the Meteorological Department at Bangkok. Simulation methods for obtaining streamflow at K10 station on the Kwae Noi river and K6 station on the Kwae Yai river, on the basis of available daily rainfall data at selected stations in the upper basin and discharge correlation between K10/K6 and Kanchanaburi, have been developed. A detailed note describing the tentative plan was supplied to the departments concerned at Bangkok for study and comments. Following further discussions with their representatives in joint meetings, the tentative plan was accepted for trial implementation in 1971.

It was agreed that the Royal Irrigation Department would establish an SSB communication system at K6 and K10 stations and, if possible, at K22 and that the Meteorological Department would make arrangement for collection of daily rainfall data from three stations (Songkhlaburi, Umphang and Siswat either through existing communication links maintained by other agencies or by establishing a separate telecommunication system. It was expected that these facilities would be provided by July 1971 and trial flood forecasting could be undertaken during the flood season of 1971. TCS now awaits confirmation from Bangkok on the implementation of these facilities. It is planned to consider further improvement of the tentative plan based on experience gained by trial flood forecasting. The need for an additional rainfall/water gauging station and for telemetering equipment would then be assessed for a comprehensive plan.

2. Action on decisions of the third session

The action taken on the decisions contained in paragraphs 38, 41 and 68 (assistance for establishment of flood forecasting in Pampanga river basin in the Philippines), paragraph 38 /assistance for flood forecasting in China (Taiwan)/ and paragraph 69 (Financing of flood-forecasting and warning systems) has been described under the respective country headings in the preceding section.

3. Further action proposed

It is suggested that the Typhoon Committee may wish:

(a) to record its appreciation for the valuable assistance provided by the Government of Japan in sending a team of experts to Taipei in connexion with the development of flood-forecasting in Tan-shui river basin and for considering favourably further technical assistance for the implementation of flood forecasting in Pampanga river basin;

(b) to consider the steps so far taken towards implementation of pilot flood forecasting in each of the countries and to offer suggestions, where appropriate, with a view to expedite action;

(c) to consider whether, in view of the difficulties experienced in developing comprehensive plan for pilot flood forecasting in Se Bang Hieng river basin (Laos), an additional key river should be selected for pilot flood forecasting in Laos.

C. COMPLEMENTARY PROTECTIVE MEASURES

1. General activities

Provision of an expert in community preparedness

Immediately after the Committee's third session LRCS was further approached for help in providing TCS with the services of an expert in community preparedness. Arrangements were concluded in June 1971 whereby such services would be available for four months or so from about 1 September 1971.

The following broad functions have been suggested for the expert:

(a) to carry out surveys of community preparedness arrangements in selected countries members of the Typhoon Committee;

(b) to advise national authorities on the improvements desirable in these arrangements;

(c) to assist in the drawing up of plans to mitigate natural disasters where no such plans;

(d) to assist in the implementation of plans to mitigate natural disasters by organizing exercises to test the efficiency of preparations;

(e) to establish a programme of work as part of TCS activities to ensure that adequate attention is devoted to complementary protective measures in the next few years.

Further, it has been agreed with LRCS that the initial efforts described above will be evaluated at the end of 1971 prior to any decision on similar assistance in the years ahead. The League has announced its support in principle for the continued services of an expert in the secretar on a part-time basis. Additional information should be available for the forthcoming session.

Collection of information on current national organization for protective measures

TCS continued to collect material from member countries on this subject. Copies of a summary of the information so far obtained will be distributed before the session, together with a request that any supplementa material be sent to TCS.

Regional action programme for natural disaster relief

When the Typhoon Committee discussed its programme for 1971 and beyo proposals were made for a special regional action programme for natural disaster relief (paragraph 78) and it was decided that the lines of action suggested would be conveyed to the respective Governments for careful study As no further information has yet been notified to ECAFE or WMO, it is sugge

/that

that every member country will wish to ensure that its representatives come to the session fully prepared for further discussion the proposals put forward at the previous session.

2. Action on decisions of the third session

The action taken on the decisions contained in paragraphs 45 and 65 (community preparedness expert), paragraph 44 (country summary on protective measures) and paragraphs 78 and 79 (Regional action programme for natural disaster relief) has been recorded in the preceding section. No further comment is required under this heading.

3. Further action proposed

It is suggested that the Typhoon Committee may wish:

(a) to record its appreciation of the valuable assistance provided to the Committee by LRCS in arranging for a community preparedness expert to join TCS for four months in 1971;

(b) to express its views on the functions assigned to the expert, recommending whatever changes it feels to be necessary in pursuing a vigorous programme of community preparedness in the next few years;

(c) to decide whether precedence should be given to particular aspects of that programme;

(d) to reconsider the views it recorded on the need for a regional action programme for natural disaster relief on the basis of any new information contributed by its member countries, recommending how such a programme could best be initiated and under what auspices it should be considered.

/D.

D. TRAINING AND RESEARCH

1. Training of personnel

In pursuance of the offer made by its representative at the third session, the Government of Japan decided to organize during 1971 three training courses in flood forecasting and warning, for the benefit of the Typhoon Committee's member countries. The courses will form part of Japan's technical operation schemes for developing countries. Course A on hydrology and course B on meteorology will last six months commencing in mid-September 1971, and course C on meteorological telecommunication will be for four months commencing in mid-November 1971. Courses A and C will be conducted in English and course B in Japanese. Invitations for the nomination of trainees have been sent to Governments of the Republic of China, the Republic of Korea, Laos, the Philippines and Thailand, and the directors of the meteorological and hydrological services of these countries have also been informed.

With reference to the assistance offered by France to meet the entire training requirements of Laos in meteorology and hydrology, TCS has suggested Laos submit its formal request together with proposals for training in 1971-1972. Following recent discussions at Vientiane, TCS has sent a further communication to the Commissioner of Planning under intimation to the Resident Representative of UNDP.

Two persons from Laos are at present in the USSR, being trained in basic meteorology and hydrometeorology, with long-term fellowships under VAP and another is receiving training in electronics in Australia, under bilateral aid. The Meteorological Service has also planned to depute one candidate to France in October 1971 for a year's training in instrument maintenance. In connexion with the establishment of a Bangkok-Vientiane point-to-point link, five technicians from Laos are expected to be trained at Bangkok, in operation and maintenance of telecommunication equipment, with a UNDP fellowship of 3 months.

The TCS telecommunication and electronics expert provided on-the-job training in radar maintenance to seven technicians at Seoul for a period of three weeks. It is proposed to organize on-the-job training at Vientiane towards the end of 1971 in operation and maintenance of telecommunication equipment used for national data collection and for international exchange.

2. Co-ordination of research activities

In July 1971, the Japan Meteorological Agency distributed to all member countries of the Typhoon Committee a second list of its research papers on typhoons.

The present arrangement for exchange of information on the results of studies on typhoons was reviewed in consultation with the member countries, in suggesting that the present method of exchange might need strengthening, one country mentioned the following points among others:

(a) Since there might be several research institutes or centres in a country, TCS could ascertain how many copies of research papers needed to be distributed in each case to ensure wider publicity.

(b) TCS could prepare an annual review of research activities on typhoons.

(c) To facilitate the exchange of views and to promote interest in research, countries might wish to invite authors whose work was of particular relevance to them to visit their services for lectures and discussions. TCS could co-ordinate the requests and arrange for necessary funds to be made available.

At the previous session, Hong Kong reported its plans for producing typhoon movement forecasts by various objective techniques on an operational basis with the help of computer. Computer requirement for this purpose have been examined and estimates for two schemes are under consideration, one using an IBM 1130 computer to be set up at the Royal Observatory and the other involving time-sharing of an ICL 1904 A computer installed at a commercial centre.

The Royal Observatory has continued to co-operate with the University of Hong Kong in a research project on evaluating the effect of typhoon winds on tall building.

Research relating to typhoons and floods was undertaken within the UNDP/WMO Special Fund project on meteorological training and research in the Philippines, and a preliminary report prepared on objective techniques for forecasting typhoon movement.

The Philippines Weather Bureau has recently drawn up a 5-year integra typhoon research project (estimated total cost P30 million or roughly US$5 mi including proposed financial assistance from the National Science Development

The Government of the Republic of Korea has submitted a request for U (Special Fund) assistance in connexion with a 5-year project, a meteorologica research and training institute, with WMO as executing agency. The subjects which research under this project include typhoon forecasting and hydrometeor with particular emphasis on flood-forecasting and warning. The project is ex to be established in 1972.

TCS has consulted some of the member countries actively engaged in ty research activities, on the possibility of joint collaboration with a view to celerating research directed towards mitigating the effects of typhoons. The following areas were considered as examples where joint collaboration might b useful: (a) storm surges (b) typhoon-resistant structures (c) climatological studies of typhoons in different areas (d) precipitation patterns associated with different typhoon tracks and their use in flood forecasting. Specific suggestions in this regard are awaited from the Meteorological Research Insti of the Japan Meteorological Agency.

It is to be noted that one of the terms of reference of WMO Executive Committee Panel of experts on tropical cyclones is "to recommend research activities that can be expected to have reasonably prompt benefits, and to suggest the means by which these may be carried out". Result of discussions at the first session of the Executive Committee Panel on this question may be of special significance to the Typhoon Committee's deliberation under this component.

3. Action on decisions of the third session

Seminar on tropical cyclone forecasting techniques and warning syste in Asia and the South-west Pacific (paragraph 49)

At its third session the Typhoon Committee requested the Secretary-General of WMO to organize the above-mentioned seminar as soon as possible, and in early 1971 a formal submission for a regional technical assistance project was made to UNDP. It is understood that UNDP is, in principle, ready to support the project. Efforts are being made to find a country will to offer host facilities for the seminar which it is hoped can be held in th early part of 1972.

/Informati

Information on training facilities in hydrology (paragraph 50)

Information on training facilities currently available in the field of drology, with special reference to flood-forecasting, has been assembled by WMO secretariat and sent to TCS in order to help member countries meet their aining requirements.

Offers of assistance by France and Japan (paragraph 52 and 53)

Follow-up action has been recorded in the preceding section.

Distribution of synopses of scientific lectures (paragraph 57)

Synopses of lectures on "Disaster relief planning and preparedness' by . M.F. Beltran and on 'Typhoon researches in Hong Kong' by Mr. G.J. Bell and r. P.C. Chin have been distributed to the member countries.

4. Further action proposed

It is suggested that Typhoon Committee may wish:

(a) to record its appreciation of the valuable assistance provided by the Government of Japan in organizing three training courses during 1971 for the benefit of the member countries;

(b) to reiterate the importance it attaches to the proposed seminar on tropical cyclone forecasting techniques and warning services in Asia and the Southwest Pacific, and the desirability of its being held as soon as possible; and to urge all member countries of the Typhoon Committee to participate fully in the seminar.

(c) to express its views on the present arrangement for exchange of international on the results of studies on typhoons and to suggest further steps for improvement if considered appropriate.

(d) to comment on the possibility of collaboration and co-ordinated efforts in studying selected typhoon problems with a view to accelerating research directed towards mitigating the effects of typhoons.

/Annex I

Annex I

WWW GLOBAL OBSERVING SYSTEM - UPPER-AIR STATIONS

(a) Level of implementation (1 July 1971)

Country	Number of observations requested	Number of observations made					
		Radiowind(W)				Radiosonde(R)	
		00	06	12	18	00	12
China (Taiwan)	4	1	0	1	0	2	2
Hong Kong	1	1	1	1	1	1	1
Japan	17	17	15	17	15	17	17
Korea, Republic of	3	3	1	3	1	3	3
Laos	1	0	0	0	0	0	0
Philippines	6(W) 4(R)	1	1	1	1	3	1
Thailand	4	4	1	4	1	4	4
Total	36(W) 34(R)	27	19	27	19	30	28

/(b)

(b) Deficiencies and further plans

ntry/station	Radiowind(W) 00	06	12	18	Radiosonde(R) 00	12	Plans/remarks
aiwan)							
ipei	0	0	0	0			Installation end 1971
ngkong		0		0			
atas a/ b/	v 1971	0	v 1971	0	v 1971	v 1971	Equipment provided by United States under VAP. Installation in 1971.
nsha a/ b/	v	0	v	0	v	v	VAP request circulated, no offer to date.
ichijima		0		0			
namitorishima		0		0			
epublic of							
hang		0		0			Budgetary and staff problems
sulpo AB		0		0			
entiane b/	v 1971	0	v 1971	0	v 1971	v 1971	
nes							
oag b/		0	0	0		1971	
erto Princesa	0	0	0	0			
bu		0	0	0		1971	
vao	0	0	0	0			Installation end 1971
mboanga b/	0	0	0	0		1971	
iangmai		0		0			
ngkok		0		0			
ngkhla		0		0			

v = VAP request; year is shown if implementation approved.
A year alone indicates implementation from national resources.
l priority station.
oon Committee priority station.

/Annex II

Annex II

WWW GLOBAL OBSERVING SYSTEM - OTHER FACILITIES NOT YET IMPLEMENTED

(a) Storm-warning radar stations

Korea, Republic of	Kwangju	No plans
Laos	Vientiane	No plans
Philippines	Basco	Implementation from national resources is planned
	Puerto Princesa	
	Manila	
Thailand	Bangkok	No plans

(b) Automatic picture transmission (APT) stations

China (Taiwan)	Taipei	National project 1
Laos	Vientiane	Bilateral project

/Annex II

Annex III

WWW GLOBAL TELECOMMUNICATION SYSTEM (GTS)

(a) National collection facilities

It is understood that some shortcomings subsist in the national lection facilities of China (Taiwan), Laos and the Philippines. See ion A, 2, of the present paper.

(b) Regional telecommunication links not yet implemented

Country	Link		Remarks
a (Taiwan)	Taipei	- Tokyo	National project 1972-1973 (Satellite)
n	Tokyo	- Khabarovak	National project 1972 (50 bauds) - 1974 (1,200 bps)
	Tokyo	- Seoul	National project 1971
	Tokyo	- Taipei	National project 1972 (satellite)
a, Republic of	Seoul	- Tokyo	No recent information
	Vientiane	- Bangkok	VAP project - implementation in 1971
land	Bangkok	- Dacca	National project 1971
	Bangkok	- Kuala Lumpur	No recent information
	Bangkok	- New Delhi	VAP project 1971
	Bangkok	- Phnom-Penh	National project 1971-1972
	Bangkok	- Rangoon	National project 1971
	Bangkok	- Saigon	National project 1971
	Bangkok	- Vientiane	National project 1971

/Annex IV

Annex IV

PRIORITIES ASSIGNED BY THE THIRD SESSION OF THE TYPHOON COMMITTEE

Summary of state of implementation and further plans

Observing facilities

(i) Upper-air stations

Pratas (China (Taiwan))	Installation in 1971 under VAP
Nansha (China (Taiwan))	VAP request circulated; no offers to date
Vientiane (Laos)	Installation late 1971 under VAP
Laoag (Philippines)	12 GMT RS/RW. Implementation of RS obser planned from national resources in 1971.
Zamboanga (Philippines)	00 and 12 GMT RW. No known plans

(ii) Weather radar

Kwangju (Korea, Rep. of)	No known plans
Vientiane (Laos)	No known plans
Bangkok (Thailand)	No known plans
Basco (Philippines)	National project, date unknown

(iii) APT stations

Taipei (China (Taiwan))	National project 1971-1972
Seoul (Korea, Rep. of)	Implemented 1971
Vientiane (Laos)	Bilateral project 1971

(iv) Ocean weather station

Ship at 16°N, 135°N	USSR vessels will provide this support fo 2-3 months in 1971

Telecommunication facilities

(i) National collection facilities

See (a) under Appendix A/3.

(ii) Regional telecommunications (point-to-point links)

Bangkok - Saigon	National project 1971
Bangkok - Vientiane	National/VAP project 1971
Taipei - Tokyo	National project 1972-1973
Seoul - Tokyo	National project 1971

(iii) Other telecommunication facilities

Thailand - strengthening of RTH, Bangkok	Partly planned with help of the project and national resources

. . . . .

FOR PARTICIPANTS ONLY

WRD/TC.4/6
13 August 1971

ORIGINAL : ENGLISH

TED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

LD METEOROLOGICAL ORGANIZATION

rth session of the Typhoon Committee
l October 1971
yo, Japan

PROGRAMME FOR 1972 AND BEYOND

(Agenda item 6)

Note by the Typhoon Committee secretariat

The tentative action programme approved by the Typhoon Committee at first session continues to provide the general guidelines for its future ivities. The second and third sessions of the Committee reviewed its activis during 1969 and 1970. Those during 1971 will be similarly reviewed under nda item 4 of this session. Actions taken on decisions at the third session proposals for further action will also be considered under the same item. h a view to speeding up the more urgent programmes, the Committee will sider under agenda item 6 a tentative request for UNDP (Special Fund) assisce covering a period of five years.

Document WRD/TC4/5 on agenda item 4 and WRD/TC.4/7 on agenda item 6 l thus provide useful material for consideration of the anticipated programme work during 1972 and beyond. Work will be continued in the light of the ion programme originally approved by the Committee and in accordance with functions assigned to the Typhoon Committee secretariat. However, it may useful to draw up a list of specific items of work on which the Committee ht wish to concentrate during 1972. Taking into account the progress so made and items on which work has already begun, the following items are gested for special attention during 1972:

/(a)

(a) to take further steps to speed up implementation of the meteorological and telecommunication facilities included in the priority list as revised during the session;

(b) with the assistance of the telecommunication and electro expert of TCS, to organize on-the-job training on operat and maintenance of radar and FAX equipment at Seoul (Kor and of telecommunication equipment at Vientiane (Laos);

(c) to assist the Philippine Weather Bureau in studying the difficulties in national data collection and in improvin the present data collection system;

(d) to assist the Philippine Weather Bureau in repairing ex radar and in installation of new radar;

(e) to continue experimental flood forecasting in the Meklon river basin (Thailand) on the basis of the tentative pla already developed and, after further improvement of the to initiate action for procurement of additional equipme

(f) to assist the Philippines in the implementation of flood forecasting for the Pampanga river basin with further assistance expected from Japan in 1972;

(g) to implement first stage flood forecasting in Tan-shui r basin (China) and assist in the development of comprehen plan for the second stage;

(h) to assist the Republic of Korea in the analysis of hydr data for development of comprehensive plan for pilot flo forecasting in the Han river basin;

(i) with the assistance of the expert on community preparedn to carry out a survey of community preparedness arrange in one or two selected countries and to assist them in drawing up a national disaster plan;

(j) to organize appropriate supporting facilities in case th United States decides to transfer the Stormfury Project the Pacific in 1972 for conducting typhoon modification experiments;

(k) to take appropriate follow-up action to expedite procurement of assistance from external sources in the light of offers already made and of further offers of assistance and suggestions tendered during the session;

(l) to prepare the final draft of the request to UNDP for institutional support to the Typhoon Committee, incorporating the suggestions made at the session and to take further steps for submission of that request to UNDP.

tion proposed

It is suggested that the Committee may wish:

(a) to consider the anticipated work programme during 1972 and beyond and to urge member countries to take all possible measures with the assistance of the secretariat to speed up the implementation of the action programme;

(b) to approve or suggest amendments to the proposed items of work on which it may wish to concentrate during 1972.

. . . . .

FOR PARTICIPANTS ONLY

WRD/TC.4/7
17 August 1971

ORIGINAL : ENGLISH

ITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

D

RLD METEOROLOGICAL ORGANIZATION

urth session of the Typhoon Committee
11 October 1971
kyo, Japan

OUTLINE OF A TENTATIVE REQUEST TO UNDP FOR ASSISTANCE AS INSTITUTIONAL SUPPORT TO THE TYPHOON COMMITTEE

(Agenda item 6)

Note by the Typhoon Committee secretariat

At the third session of the Typhoon Committee, a proposal was made seek assistance from UNDP (Special Fund) at the earliest appropriate te for those parts of the Committee's programmes which would qualify for ch assistance. After consideration of this proposal, the Committee sired that action required for the preparation of a request for assistance om UNDP should be studied by the Typhoon Committee secretariat (TCS) in nsultation with the member countries, and, on the basis of those nsultations, a plan of action should be presented to the fourth session the Committee for further consideration.

A preliminary study of this matter was accordingly made by the TCS. note indicating possible components that might be included in the request r assistance, together with rough estimates of the budget, was circulated ong the member countries for comments and suggestions. During his sub- quent visits to the member countries, the Chief of the TCS discussed ese proposals further with the officials concerned. The ECAFE and WMO cretariats were also consulted. Based on these consultations, an outline

/draft of

draft of a tentative request to UNDP for assistance as institutional supp to the Typhoon Committee has been prepared and is presented in the annex this document for consideration by the Committee.

3. The outline draft provides relevant background information and br explains the need for approaching UNDP for assistance. The expected fina contribution from UNDP and counterpart contributions by the participating Governments for the different components of the proposed project are sho in tables 1 and 2 appended to the outline draft.

Action proposed

4. The Typhoon Committee is invited to examine the outline draft re to UNDP for institutional support and to suggest in what ways the propose components and the estimated budget need be modified.

5. If the Committee should decide to submit a request to UNDP for assistance at an early date, it may wish to ask the TCS to prepare the fi draft request, in further consultation with the ECAFE and WMO secretariat incorporating therein the amendments suggested by the Committee, and the to circulate the final draft to member countries for their concurrence.

/Annex

Annex

Request to UNDP for Institutional Support to the Typhoon Committee

SUMMARY

equested from UNDP	$ 2,557,000
ounterpart contribution of the participating overnments, est.ated at equivalent of	$ 2,344,250
uration:	Five years
urpose:	To provide the necessary support to the activities of the Typhoon Committee which was established in December 1968 to co-ordinate measures aimed at reducing typhoon damage. This support will be composed of two components: (a) the provision of selected equipment and training fellowships to permit accelerated implementation of the Committee's programme and (b) financial assistance for the upkeep of the Typhoon Committee secretariat.
articipating and xecuting agency:	The World Meteorological Organization (WMO) in association with the Economic Commission for Asia and the Far East (ECAFE)

/I. Background

I. Background

1. The Typhoon Committee was established in 1968 to assist the participating countries in taking co-ordinated measures which would contribute to a reduction of the damage caused by typhoons. The average annual damage in these countries is of the order of $700 million, which seriously impedes economic development in the typhoon area. The action programme adopted by the Committee is separated into four components - (1) meteorological, (2) hydrological, (3) complementary protective measures and (4) training and research. Progress in effecting this programme is reviewed annually by the Committee and priorities assigned for the year ahead.

2. The Committee is assisted by a small secretariat (Typhoon Committee secretariat) which serves as its executive arm by carrying out its day-to-day activities. It was established by ECAFE and WMO with financial assistance from UNDP. It comprised two experts initially and a third expert was added in 1970. The TCS provides advisory services and assists the participating countries in the implementation of the recommended facilities, as well as in procuring financial assistance through bilateral and international sources. The secretariat was initially based in Bangkok but moved to Manila in March 1971 upon the invitation of the Government of the Philippines.

3. The recent United Nations General Assembly Resolution 2733(XXV) on tropical cyclones was a direct result of an appeal for help in mitigating the harmful effects of typhoons and cyclones made by the Typhoon Committee at its third session (Bangkok, November 1970).

4. Although a number of the facilities needed for the typhoon warning system have been installed during the last two to three years, either nationally or with external aid, there remain other facilities which are urgently needed and cannot be set up without financial assistance from bilateral or international sources. Thus, the programme of the Typhoon Committee, including those parts of it to which priority has been assigned, is not advancing with the necessary rapidity.

5. In addition, some increased technical support may be requested by the Typhoon Committee if the United States decides to carry out experiments on typhoons in the Pacific area similar to those it now pursues on Atlantic hurricanes. This would also result in increased secretarial work for the TCS.

/6.

6. Acceleration of the implementation of the action programme is therefore highly desirable and assistance from UNDP (Special Fund) would be an effective way of achieving this aim. The assistance sought would provide for selected equipment, consultants' services, and training fellowships urgently needed by member countries, and would also finance a slightly enlarged Typhoon Committee secretariat.

II. The Project

7. The main purpose of the project would accordingly be to hasten the carrying out of those parts of the Typhoon Committee programme most to contribute towards mitigation of damage caused by typhoons. It would finance the equipment most urgently needed for this purpose and provide training facilities and expert advice when required. Some strengthening of the TCS is also considered necessary in order to render more effective help in expediting implementation of the programme. Some explanation of the proposed expansion of activities is given below:

(a) Equipment

The equipment included in the project would be mostly that which was given the highest priority by the Typhoon Committee at its third session, whose installation might well be delayed indefinitely because of difficulty in meeting the cost from national resources and for which no bilateral, VAP or other assistance is likely to be forthcoming. As may be seen from table 1 appended to this outline request, one radiosonde/radiowind station at an island location in the South China Sea, two storm-warning radars and an APT station for the reception of satellite pictures are included in the project as additions to the observing system. Although the Typhoon Committee has assigned priority to three locations for new radar stations for which there are no national plans, only two are included in the project. Telecommunication equipment is also a vital part of the system and proposals for transceivers and facsimile transmitters appear in the list of equipment. The Typhoon Committee's programme in the hydrological component is also in urgent need of acceleration and the request accordingly contains provision for equipment required for implementation of pilot flood-forecasting systems in three member countries. A small amount of equipment for one country as part of the "complementary protective measures" component of the programme is also proposed. The facsimile equipment proposed under this item is required for prompt collection of damage statistics from district centres at the disaster Control Committee Headquarters.

/(b)

(b) Training

During its third session, the Typhoon Committee accepted a study on the additional trained staff needed in each country to carry out the recommended programme. The report recommends the provision of 84 fellowships for the staff of those five participating countries who normally receive technical assistance. The fellowships are in the fields of meteorology, telecommunication, hydrology and flood forecasting, with durations ranging from six to twelve months. It is estimated that some of these fellowships will be requested under the UNDP of the country concerned. However, it might not be possible to accommodate all these fellowships in this way, and, therefore, in order to accelerate the more urgent training programme, a provision of 20 fellowships constituting only 25 per cent of the total need is included in the project. In addition, some 10 fellowships of very short duration are also included in order to enable the TCS to cope with certain emergency cases, such as when a member country needs a short-duration fellowship to study operation or maintenance of equipment.

(c) Experts (including the Typhoon Committee secretariat)

Some strengthening of the TCS is considered necessary so as to render more effective assistance in expediting implementation of the following aspects of the programme:

(i) Advice on acquisition and installation of equipment through UNDP and other sources.

(ii) Development of comprehensive plans for pilot flood-forecasting and implementation: to accelerate this activity, TCS may undertake data analysis in collaboration with national services.

(iii) Provision of advice regarding training matters, including procedures to obtain fellowships.

(iv) Rendering advisory services, including on-the-job training where appropriate.

(v) Assist member countries in disaster relief activities, community preparedness, development of national plans, etc.

(vi) Reviews of typhoon research activities. Under specific instructions from the Typhoon Committee, the TCS may conduct studies on problems concerning typhoons with a view to assisting the Committee in performing its advisory functions in support of the action programme more effectively.

(vii) Liaison with similar activities in other areas, such as the WMO tropical cyclone project.

/The proposal

The proposal includes an increase of the present staff of the Typhoon Committee secretariat from three to five permanent staff plus consultant services amounting to six man/months per year. The present staff consists of three permanent experts (one Chief/synoptic meteorologist, one hydrologist and one expert in electronics/telecommunications). It is envisaged that one additional hydrologist will be needed to cope with the rapidly increasing demand for advice and assistance on hydrological data analysis in the participating countries /see (ii) above/. An additional meteorologist specialized in tropical meteorology and able to advise on the application to the typhoon area of the results of research carried out under various projects by developed countries, /see (vi) above/ will be needed as from the second year of the project. The consultant services will be used partly for community preparedness advice /see (v) above/ and partly for specialized assistance in emergency cases.

III. Budget

8. The proposed budget for provision of equipment and training fellowships is given in table 1. This table also shows the contributions expected from UNDP and the corresponding counterpart contributions by the participating Governments during the project period of five years. Table 2 contains a similar budget for maintaining the Typhoon Committee secretariat for the same period. The total budget is summarized in table 3.

9. The counterpart contributions by the participating Governments would mainly cover expenditure on buildings and cost of operation and maintenance of the new stations. It is envisaged, however, that, in some cases, counterpart contributions might include assistance obtained bilaterally, such as in the case of pilot flood-forecasting in China (Taiwan) and the Philippines for which assistance is expected from Japan.

/Table 1.

Table 1. Equipment and training

A. EQUIPMENT	United Nations (in US dollars)	Counterpart (in US dollars)
RS/RW station at Nansha /China (Taiwan)/		
Ground equipment and supplies for 1 year	85,000	
Building and operation for 4 years		50,000
Spare parts and supplies for 4 years		60,000
Two radars (location to be decided by TC)		
Cost of radars, spare parts and installation	500,000	
Buildings, spare parts, costs of operation for 3-4 years		300,000
Radar test equipment (1 set for the Republic of Korea and 5 sets for the Philippines)	60,000	
Power generators (Philippines)		
5 power generators 50 kVA for radar station	75,000	
APT at Taipei /China (Taiwan)/		
Cost of equipment	35,000	
Spare parts, operation for 4 years		16,000
SSB equipment /China (Taiwan), the Republic of Korea and Laos/		
4 sets 1.5 kW for Nansha /China (Taiwan)/	40,000	
30 sets 100 W (10 for Laos and 20 for the Republic of Korea)	45,000	
Spare parts, operation for 4 years ($16,000 + $9,000)		25,000
Fax transmitters (Philippines)		
Fax scanner and 1.5 kW SSB transceivers with antenna for transmission of radar pictures and for collection and relay of meteorological data (from 5 radar stations to Manila)	160,000	
Spare parts and operation for 4 years		75,000
Fax transmitters (the Republic of Korea)		
(1) Fax transceivers for transmission of flood damage statistics from eleven districts to Seoul	70,000	
(2) Fax scanner for transmission of weather charts from Seoul	10,000	
Spare parts and operation for 4 years		70,000

/Pilot flood

Table 1. (con'd)

	United Nations (in US dollars)	Counterpart (in US dollars)
Pilot flood forecasting (the Republic of Korea, Laos and Thailand)		
Equipment and installation	450,000	
Building, spare parts and operation for 4 years		360,000
Pilot flood forecasting /China (Taiwan) and the Philippines)		800,000
Spare parts for emergency cases	50,000	
	1,580,000	1,756,000
B. TRAINING		
20 specialization fellowships (average duration 12 months)	100,000	50,000
10 fellowships of 2 months each for emergency cases	12,000	6,000
TOTAL B	112,000	56,000
TOTAL (A + B)	1,692,000	1,812,000

Table 2. Typhoon Committee secretariat

			United Nations (in US dollars)	Counterpart (in US dollars)
BUILDING				300,000
VEHICLES, OFFICE EQUIPMENT			20,000	25,000
EXPERTS TO STAFF THE TCS				
Chief/synoptic meteorologist	5m/y	150,000		
Hydrologist (two)	10m/y	300,000		
Telecom/electronics expert	5m/y	150,000		
Tropical meteorologist	4m/y	120,000		
Consultant	$2\frac{1}{2}$m/y	75,000		
		795,000	795,000	
15% local cost				119,250
SUPPORTING STAFF FOR TCS				
1 Administrative officer 4 Secretary/typist 1 Technical assistant 2 Drivers	for 5 years 40m/y			48,000
Miscellaneous				
Petrol, stationery, postage, clerical assistance			50,000	40,000
TOTAL			865,000	532,250

Table 3. Total budget (5 years)

	United Nations (in US dollars)	Counterpart (in US dollars)
EQUIPMENT AND TRAINING	1,692,000	1,812,000
TYPHOON COMMITTEE SECRETARIAT	865,000	532,250
TOTAL	2,557,000	2,344,250

. . . .

FOR PARTICIPANTS ONLY

WRD/TC.4/8
30 July 1971

ORIGINAL : ENGLISH

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

AND

WORLD METEOROLOGICAL ORGANIZATION

Fourth Session of the Typhoon Committee
4-11 October 1971
Tokyo, Japan

ACTION RELATED TO UNITED NATIONS GENERAL ASSEMBLY RESOLUTION 2733 (XXV)

(Agenda item 7)

Note by the WMO secretariat

Introduction

1. At its third session, the Typhoon Committee adopted a resolution appealing to the United Nations General Assembly for help in reducing the harmful effects of tropical cyclones. This appeal was discussed at the twenty-fifth session of the General Assembly and led, in turn, to the adoption of resolution 2733 (XXV)[1/] recommending to WMO "that it take, if necessary, further appropriate action for mobilizing capable scientists, technologists and other pertinent resources from any or all nations towards obtaining basic meteorological data and discovering ways and means to mitigate the harmful effects of these storms and remove or minimize their destructive potentials;". In addition, the resolution calls upon Member States "to exert efforts within their means to implement fully the World Weather Watch Plan of the World Meteorological Organization".

/2.

1/ The text of this resolution is given in annex III.

2. The main purpose of this document, which is primarily for information, is to describe briefly the measures that have been taken by WMO in response to resolution 2733 (XXV).

Action on resolution 2733 (XXV)

3. Early in 1971, WMO drew up a tentative plan of action for the implementation of resolution 2733 (XXV). This tentative plan was forwarded to the United Nations in February 1971 as an interim statement to the Secretary-General. It should be mentioned at this point that the WMO response to resolution 2733 (XXV) was considered also to cover the necessary WMO action on another closely related resolution of the General Assembly: 2717 (XXV) - Assistance in cases of national disaster.[2/] WMO is not specifically mentioned in that resolution, which is of a general nature covering many aspects of natural disasters, though the Secretary-General of the United Nations invited WMO to assist him in meeting the request addressed to him in that resolution. The document containing the tentative plan further indicated that the Sixth World Meteorological Congress in April 1971 would undoubtedly wish to decide on the main lines of WMO's future activities in this important task.

4. A similar document, but containing more precise proposals for future WMO action, was therefore submitted to Sixth Congress. Congress agreed that increased efforts by WMO towards the mitigation of tropical cyclone disasters were indeed desirable and requested the Executive Committee, as a matter of urgency, to provide for the planning and implementation of a WMO Tropical Cyclone Project. It set forth guidance for the Executive Committee in performing this task.

5. Immediately following Sixth Congress, the twenty-third session of the Executive Committee took up this question. In order that the Tropical Cyclone Project might proceed as quickly as possible, the Committee established a panel of experts to draw up a comprehensive plan of action for the project and to keep its progress under review. The detailed terms of reference of the panel are given in annex I to this document. In addition, the Executive Committee authorized the President of WMO to take the necessary action to ensure the

/rapid

2/ The text of this resolution is given in annex II.

rapid progress of the project and requested the Secretary-General to support the panel and to carry out various other functions aimed at ensuring co-ordination of these activities with other international organizations.

6. At the time of preparing this document, the necessary steps to set up the panel had been taken. Arrangements were also in hand for the panel to hold its first session in Tokyo from 28 September to 1 October 1971, immediately before the fourth session of the Typhoon Committee. It is expected that, at its first session, the panel will devote a large part of its time to items (1) and (2) of its terms of reference. As far as item (2) is concerned, it will evidently be impossible for the panel to draw up a comprehensive plan during a four-day meeting; attention will therefore be focused on preparing a basic plan which can later be developed further.

7. A number of other measures will be taken in the period before the panel meets with the purpose of following up the directives of Congress and the Executive Committee on the Tropical Cyclone Project. Action will also proceed on the various regional projects already in hand (see document WRD/TC.4/10).

8. As the brief review of the present situation given above shows, WMO is now embarking on a broadened and accelerated action programme which aims at reducing loss of life and damage caused by tropical cyclones. It is not yet possible to give any detailed information on the form the action may take. Obviously, a great deal will depend on the response of WMO members and the extent to which they are prepared to contribute to the project in one way or another.

9. By the time the Typhoon Committee meets in October, it will be possible to report more fully on the developments that have taken place in the WMO Tropical Cyclone Project since its adoption by Sixth Congress, and, especially, on the discussions at the first session of the Executive Committee Panel of Experts on Tropical Cyclones.

/Action

Action proposed

10. As previously mentioned, this document is of an informative nature and does not, in itself, call for any specific action. However, the fact that the first session of the Executive Committee Panel of Experts on Tropical Cyclones will take place immediately before the Typhoon Committee session provides a welcome opportunity for close liaison with the new panel. The Committee will no doubt wish to consider the report of the Panel session and to take any action it feels to be desirable to follow up those of the panel's recommendations which might further the objectives of the Committee.

/Annex I

Annex I

WMO EXECUTIVE COMMITTEE PANEL OF EXPERTS
ON TROPICAL CYCLONES

Terms of reference

(1) To assess the present state of tropical cyclone warning services, with special reference to the Bay of Bengal, the Arabian Sea, the Indian Ocean, the western Pacific and the South China Sea, making full use of the information already available from the existing projects in this field being carried out by WMO and other international organizations;

(2) To draw up a comprehensive plan of action for the WMO Tropical Cyclone Project, taking into account the specific needs of the areas concerned, national responsibilities and sovereignties and the present activities of WMO and of other international organizations and paying special attention to the following topics:

(a) Facilities for and methods of cyclone detection, tracking, and measurement of intensity;

(b) Forecasting cyclone intensity and movement;

(c) Forecasting the storm surge;

(d) Hydrological data collection and flood forecasting;

(e) Telecommunication systems for collection of data and relay of forecasts and warnings;

(f) Dissemination of forecasts and warnings through radio, television, and other mass communication media;

(g) Education of the exposed population with respect to the nature of tropical cyclones and procedures for protection of life and property before and after the onset of the storm;

(h) Preparation and presentation of data on wind, storm surge, and flood risk to guide the provision of protective works and aid in the design of cyclone-resistance structure;

(3) To recommend specific practical measures for international action;

(4) To recommend research activities that can be expected to have reasonably prompt benefits, and to suggest the means by which these may be carried out;

(5) To submit a preliminary report to the President by the end of 1971;

(6) To advise the Executive Committee on measures to ensure any necessary co-ordination of regional programmes, such as that of the WMO/ECAFE Typhoon Committee, both between regions and with the WMO project;

(7) To review the progress of the project, submitting as necessary reports and recommendations to the Executive Committee.

/Annex II

Annex II

UN RESOLUTION 2717 (XXV) - ASSISTANCE IN CASE OF NATURAL DISASTER

TEXT OF RESOLUTION

The General Assembly,

Concerned about the grave human and material losses suffered by countries which have recently been stricken by natural disasters,

Aware also of the serious consequences of such disasters on the economic and social development of countries, particularly the developing countries,

Expressing its appreciation of the assistance rendered by the Red Cross and other voluntary organizations, the United Nations system and bilateral aid and once again emphasizing the necessity of strengthening the international machinery for providing adequate assistance in cases of natural disaster,

Mindful of the principles laid down in the Declaration for International Humanitarian Relief to the Civilian Population in Disaster Situations adopted by resolution XXVI of the twenty-first International Conference of the Red Cross at Istanbul in 1969,

Recalling its resolutions 2034 (XX) of 7 December 1965, 2435 (XXIII) of 19 December 1968, 2608 (XXIV) of 16 December 1969 and 2643 (XXV) of 20 November 1970 and Economic and Social Council resolutions 1533 (XLIV) of 28 July 1970 and 1546 (XLIX) of 30 July 1970 concerning assistance in cases of natural disaster,

Aware that the assistance envisaged in cases of natural disaster in its resolution 2435 (XXIII) is inadequate for relief in calamities of major magnitude,

Having considered with interest and appreciation the interim report of the Secretary-General on assistance in cases of natural disaster (1) and the report of the Secretary-General's personal representative on United Nations assistance to Peru, (2)

Noting the request made by the Economic and Social Council at its forty-ninth session (3) to the Secretary-General to give early consideration to the strengthening of staff arrangements within the United Nations Secretariat to deal with natural disasters, and the steps already taken towards the implementation of this request, including the designation of a focal point in the United Nations Secretariat,

/Bearing

(1) E/4853 and Corr. 1.

(2) E/L. 1356.

(3) See Economic and Social Council resolution 1546 (XLIX).

Bearing in mind the need to strengthen and co-ordinate effectively the efforts of the United Nations family of organizations in disaster relief as well as other assistance directed through the United Nations system,

Considering that additional measures are necessary to enable the United Nations system to play an effective and more significant role in meeting the needs of States, especially the developing countries, in relation to natural disasters, epidemics, famines and similar emergency situations,

Also bearing in mind that immediate relief assistance on the international level should be followed by concerted action for the reconstruction, rehabilitation and development of the disaster areas,

Recalling the request made to the Secretary-General in its resolution 2435 (XXIII) to submit a comprehensive report on the implementation of that resolution to the Economic and Social Council at its fifty-first session and to the General Assembly at its twenty-sixth session,

1. Renews its appeals to States Members of the United Nations and members of specialized agencies to consider and to continue offering on a wider basis, through the United Nations, bilateral arrangements or other appropriate organizations, emergency assistance to meet natural disasters, including stand-by disaster relief units or the earmarking of similar units for service in foreign countries;

2. Invites State Members of the United Nations and members of specialized agencies to communicate information to the Secretary-General on the kind of facilities and services they might be in a position to provide immediately, if they so decided, in response to a request from him to participate in emergency relief operations, including, where possible, the number and type of vehicles or other means of delivering supplies to disaster areas by air, sea and land;

3. Urges the Secretary-General to submit in his comprehensive report the study called for in paragraph 6 of its resolution 2455 (XXIII) concerning the legal status of disaster relief units made available through the United Nations;

4. Invites the Secretary-General to study and include in his comprehensive report in addition to those studies and reports he has been invited to submit by the General Assembly in resolution 2435 (XXIII) and the Economic and Social Council in resolution 1546 (XLIX), paragraphs 10 and 11, his conclusions and recommendations on the following:

(a) The capacity of the different organizations of the United Nations system to contribute assistance in connexion with natural disasters;

(b) The areas where this assistance might be increased or made more effective;

/(c)

(c) The most appropriate means to further strengthen the capacity of the United Nations relating to natural disasters, including organizational arrangements for the permanent office in the United Nations responsible for co-ordination of action relating to natural disasters, epidemics, famines and similar emergency situations and the resources required therefore;

5. Further invites the Secretary-General, in pursuance of paragraphs 1, 2 and 4 above, to submit recommendations in particular on:

(a) Ways and means of ensuring better mobilization and co-ordination of the assistance to be provided through the United Nations and the organizations of the United Nations system, as well as the League of Red Cross Societies and other non-governmental organizations;

(b) Pre-disaster planning at the national and international levels, including the definition of machinery and contingency arrangements capable of coping immediately with disaster situations;

(c) The stockpiling of emergency supplies, including medicines, non-perishable food-stuffs, blankets, tents and clothing, and the earmarking of other facilities, such as logistical equipment and helicopters;

(d) The application of technology to and scientific research for the prevention and control of natural disasters, or a mitigation of the effects of such disasters, including arrangements to disseminate effectively to all countries the fruits of research from satellites and other sophisticated technology with a view to strengthening international co-operation to determine the causes and early manifestation of impending disasters, including the development and improvement of early warning systems;

(e) National and international programmes designed to train relief personnel;

(f) Measures to be taken in the initial emergency or post disaster phase directed at immediate relief operations and short-term low-cost rehabilitation measures, including the deployment of mobile transportation units and the means to assess the extent of damage and the amount of assistance needed in this first phase;

(g) Studying long-term plans for the reconstruction and development of disaster areas, and the affected countries as a whole, bearing in mind the principle that the problems of reconstruction are inseparable from the problems of economic development;

6. Requests the Secretary-General, in co-operation with the organization of the United Nations system and the League of Red Cross Societies, where appropriate, to study and recommend in his comprehensive report, taking into account past practices, the most effective measures and means to meet requests for technical assistance by States Members of the United Nations system in

/elaboration

elaboration of their planning of national preparations to meet natural disasters, epidemics, famines and similar emergency situations;

7. Urges that requests submitted by Governments for assistance under its resolutions 2435 (XXIII) and 2608 (XXIV) be given a prompt and appropriate response, in regard to the amount and type of assistance requested;

8. Also invites the United Nations Development Programme to give serious consideration to the possibility of meeting requests for assistance which countries stricken by natural disasters may submit for the express purpose of the rehabilitation and development of the stricken areas, without prejudice to the utilization of funds already earmarked for projects of the United Nations Development Programme;

9. Further invites the International Bank for Reconstruction and Development and other international credit organizations and development agencies to give serious consideration to requests for assistance from the Governments of countries affected by natural disasters relating to their programmes for reconstruction and development and without prejudice to the requests submitted by them prior to the natural disaster that are still under consideration.

/Annex III

Annex III

UN RESOLUTION 2733 (XXV) D

INTERNATIONAL CO-OPERATION IN THE PEACEFUL USES OF OUTER SPACE

The General Assembly,

Concerned over the devastating harmful effects of typhoons and storms in various parts of the world, particularly in Asia,

Believing that man's present scientific and technical capabilities that have conquered space could help conquer this environmental scourge,

Recalling its resolutions 1721 (XVI) of 20 December 1961 and 1802 (XVII) of 14 December 1962, and noting work being undertaken and progress achieved in response to them, as reported by the World Meteorological Organization in its annual reports to the Committee on the Peaceful Uses of Outer Space,

Noting further the co-ordinating role in this field of the joint World Meteorological Organization-Economic Commission for Asia and the Far East Typhoon Committee, the discussions on this subject held in that forum and the recent decision to transfer the Typhoon Committee secretariat to Manila,

1. Recommends to the World Meteorological Organization that it take, if necessary, further appropriate action for mobilizing capable scientists, technologists and other pertinent resources from any or all nations towards obtaining basic meteorological data and discovering ways and means to mitigate the harmful effects of these storms and remove or minimize their destructive potentials;

2. Calls upon Member States to exert efforts within their means to implement fully the World Weather Watch Plan of the World Meteorological Organization;

3. Requests the World Meteorological Organization to submit a report through the Secretary-General to the Committee on the Peaceful Uses of Outer Space at its next session, and to such other United Nations bodies as may be appropriate, on the steps taken pursuant to this and other resolutions.

. . . . .

10/ Official Records of the General Assembly, Twenty-fifth Session, Supplement No. 20 (A/8020), para. 55.

FOR PARTICIPANTS ONLY

WRD/TC.4/9
17 August 1971

ORIGINAL : ENGLISH

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

AND

WORLD METEOROLOGICAL ORGANIZATION

Fourth session of the Typhoon Committee
4-11 October 1971
Tokyo, Japan

PROPOSED TRANSFER OF STORMFURY PROJECT TO PACIFIC

(Agenda item 8)

Note by the Typhoon Committee secretariat

Introduction

1. Project STORMFURY is a co-operative venture of the United States Department of Commerce (NOAA) and the United States Department of Defense. Its objective is to determine to what extent man can beneficially modify tropical cyclones. The project was formally organized in 1962 after modification of hurricane Esther was attempted in 1961 with encouraging but inconclusive results. Modification experiments on hurricane Beulah were conducted in 1963 with similar results. The results of both experiments were published in a paper by R.H. Simpson and J.S. Maulkus in 1964.

2. The Project Stormfury experiment is designed to alter cloud conditions in the eye wall by seeding with silver iodide and thus upsetting the balance of forces near the eye, causing a redistribution of the energy concentrated there. Hurricane clouds contain large quantities of super-cooled water and, by seeding with silver iodide, the latent heat of fusion is released in the eye wall, whereupon the site of maximum pressure falls towards the centre. The effect of this additional heat in the eye wall should reduce atmospheric pressure adjacent to the low pressure centre of the storm, thereby reducing

/and

and displacing outwards the maximum radial pressure gradient. Thus seeding induces an outward migration of the wall cloud, a reduction of the pressure gradient and a consequent decrease in maximum windspeed.

3. Project Stormfury had a fruitful year in 1969 when it conducted modification experiments on hurricane Debbie on August 18 and 20. These were the first experiments since 1961 and 1963. Meanwhile, research work greatly expanded the knowledge of the structure and energy processes of hurricanes and of the convective processes operating in tropical clouds. Better instrumentation and techniques for counting freezing nuclei and measuring the liquid and solid water content of clouds and other parameters have since become available. Theoretical models of hurricanes have also been greatly improved. These developments obviously influenced the experimental design in the modification experiments conducted in 1969.

4. In a paper on Project Stormfury by Dr. Gentry, the Director of the project, published in 1969 two general considerations justifying Project Stormfury were stated as follows: "(1) recent improvements in our understanding of the physical processes fundamental to the maintenance of hurricanes suggest promising avenues of experimentation; and (2) enormous rewards can be derived from even a slight degree of beneficial modification." The second consideration was illustrated by means of the following rough "cost-benefit" analysis:

> "Hurricanes caused an average annual damage in the United States of 13 million dollars between 1915 and 1924. By the period 1959 to 1968, this figure had jumped to 295 million dollars. Even after considering the inflated cost of construction in more recent years, a 475 per cent increase in the average annual cost of hurricane damage has occurred in less than 50 years. The current practice of constructing valuable buildings in vulnerable areas indicates that hurricane damage costs will continue to rise. Hurricane Betsy of 1965 alone caused more than 1.4 billion dollars in damage. If the United States continues supporting hurricane modification research at the present rate for the next 10 years and if by that time we modify just one severe hurricane, such as Betsy, sufficiently to reduce its damage by only 10 per cent, the nation will obtain more than 1,000 per cent return on its investment. Similarly, if within 10 years

/we can

> we can reduce the damage caused by such a storm by only 1 per cent, the nation will have 100 per cent return on its investment. The benefits in terms of prevention of human suffering are, of course, incalculable."

Hurricane modification experiments in 1969

5. In the experiments conducted on hurricane Debbie in August 1969, thirteen aircraft were available and fifteen flights were made. Of these fifteen flights, five carried pyrotechnic generators and the other ten monitored the storm for changes in structure and intensity. The seeder aircraft entered the wall cloud and dropped the pyrotechnic generators near the expected radius of maximum winds. Each aircraft carried 208 generators and dropped them along a line leading radially away from the centre in the north-northeast quadrant. Each generator contained over 120 grammes of silver iodide, each gramme of which was capable of producing more than 10^{12} nuclei. The wind speed decreased from shortly after the second seeding until at least five hours after the fifth seeding. The decrease was most marked on 18 August. The observed reduction of wind speed was as follows:

> "Before the first seeding, maximum winds at 12,000 feet were 98 knots. Five hours after the fifth seeding, they were 68 knots, or 31 per cent less than before the first. On August 20 the maximum wind speed before the first seeding was 99 knots. Within 6 hours after the final seeding the maximum had dropped to 84 knots, a decrease of 15 per cent."

6. In presenting the results of the 1969 experiments at the Sixth Technical Conference on Hurricanes (2-4 December 1969, Miami, Florida), Dr. Gentry expressed the following view:

> "That hurricane Debbie decreased in intensity following multiple seedings on 18 and 20 August is reasonably well established. What we do not know for certain is whether the decrease was caused by the seeding, or whether it resulted from natural changes in the hurricane.** The thing which seems obvious is that since the 1969 experiments suggest so strongly that hurricane modification was accomplished they must be repeated on one or more additional storms as soon as practical to seek further confirmation".

/7.

7. In 1970 no hurricanes occurred in the Atlantic that were suitable for experimentation. However, further study of the data collected during 1969 experiments was continued.

Consideration within the ECAFE/WMO Typhoon Project of possibilities for typhoon modification experiments

8. In view of the experiments conducted in the Atlantic in 1961 and 1963, ECAFE initiated consideration in 1964 of possibilities for typhoon modification experiments in the Pacific. A paper on "Hurricane modification: Progress and prospects, 1964" prepared by Dr. R.H. Simpson and Dr. J.S. Maulkus as Consultants to ECAFE was presented at the Sixth Regional Conference on Water Resources Development held at Bangkok in November 1964. One year later, ECAFE and WMO jointly convened the first Meeting of Experts on Typhoons (Manila, December 1965). The meeting considered the possibilities of typhoon modification as a means of preventing or minimizing typhoon damage in the ECAFE region (paragraphs 42-64 of the report of this meeting).

9. In accordance with the recommendation of the Manila Meeting of Experts on Typhoons, a survey mission was organized by ECAFE and WMO during 1966-67. The mission visited the countries in the ECAFE region affected by typhoons and submitted a report on existing and proposed measures for minimizing typhoon damage. Some of the countries evinced keen interest in possibilities of typhoon modification experiments. However, on account of the high cost involved, the consensus of opinion was that the results of experiments conducted by the United States in the Atlantic should be awaited. The view was expressed that if the United States planned to carry out typhoon modification experiments in the Pacific, the countries in the Far East should extend all possible technical collaboration. The survey mission's report was endorsed by the Second Meeting of Experts on Typhoons held in October 1967.

10. The third session of the Typhoon Committee held in November 1970 adopted a resolution appealing to the United Nations General Assembly for help in reducing the harmful effects of tropical cyclones. The resolution stressed the urgency of "discovering ways and means of mitigating the harmful effects of these storms and of modifying typhoons or hurricanes or cyclones to remove or minimize their destructive potential, while retaining their beneficial effects". The resolution appealed to nations "to make all possible

/effort

effort including the direction of men and resources in support of this endeavour." This resolution of the Committee led to the adoption of General Assembly Resolution 2733 (XXV). Action related to the General Assembly Resolution will be discussed under agenda item 7.

Recent studies in the United States and Japan concerning Project Stormfury experiments in the Western North Pacific

11. A study concerning Project Stormfury experiments in the Western North Pacific, completed at the National Hurricane Research Laboratory, NOAA, in December 1970, study points out the scientific desirability of conducting experiments in that area during August through October which should increase experimental opportunities by a factor of three over those available climatologically in the Atlantic Stormfury area.

12. A recent meeting sponsored by the United States-Japan Co-operative Science Programme held in February 1971 at Miami, Florida, discussed the present "state of the art" of cumulus cloud and tropical cyclone modification as well as future co-operation in this field. The meeting proposed that Project Stormfury move its operation to the Pacific during some part of the 1972 season. Reference was made to the following studies:

(1) Dr. T. Kitaoka, Director, Meteorological Research Institute, presented a climatological study of killer typhoons in the Western Pacific that would have been suitable for seeding during the period 1965-1969. Dr. Kitaoka imposed stricter seeding regulations in his study than those currently in use in the Carribean area in order to avoid any possibility of a political problem. He eliminated from his study all storms that struck land during their lifetime. With this criteria, he concluded that Stormfury experiments could be carried out on one to three typhoons between mid-September and the end of October, using Guam as a staging base and Wake and Yokota (or Atsugi) as secondary bases.

(2) The results of a similar study made by W.D. Mallinger of the National Hurricane Research Laboratory were presented by Dr. Gentry. This study, using less stringent rules, eliminated any storm that (1) would have been within 50 nautical miles of land 24 hours after seeding had ended, and (2) any that would have become extratropical. Guam and Okinawa were suggested

/as the

as the primary operating, experiments being conducted primarily over the ocean between these two islands. Using typhoon data from 1961 to 1969 it was concluded that on the average 5.3 individually eligible typhoons would be available for seeding during the three month period from August to October.

Statement by the representative of United States at the twenty-seventh session of ECAFE (April 1971) and subsequent developments

13. The twenty-seventh session of ECAFE, held at Manila during 20-30 April 1971, was informed by the representative of the United States that his Government was considering the transfer of the Stormfury Project to the Pacific for a limited period in 1972. The relevant portion of the representative's statement is reproduced below:

"In addition to other significant developments in the ECAFE region, my government attaches high importance to the deliberations of the Typhoon Committee and the resultant action taken by the UN General Assembly in its Resolution 2733 (XXV). The effects of the tropical storms which devasted areas of Pakistan and the Philippines last year are still fresh in our minds. At the same time, we considered the discussions on the mitigation of the harmful effects of tropical storms at the third session of the Typhoon Committee held in Bangkok last November to have almost unparalleled timeliness. Also, President Marcos took the lead as early as 1966, during his State visit to the United States, in urging that a programme of tropical storm moderation be set up in the Pacific. We have, in addition, co-operated with the Government of Japan in the research aspects of this problem for some time. However, in seeking to develop an appropriate, scientifically-proved technology in storm modification, my Government has up to this time centered its attention on storms arising in the Atlantic.

"The first recorded account of Atlantic hurricanes dates back to the time of Columbus and we in the United States have felt the effect of many severe hurricanes in recent times, Perhaps the most devastating being that of Hurricane Camille which struck the United States with destructive force along the coastlines of Mississippi, Alabama and Louisiana on the evening of Sunday, 17 August 1969. Because of

/previous storms,

previous storms, the United States has mounted a research project to alter conditions in the clouds around the hurricane eye, and by upsetting the balance of forces there, to cause a redistribution of the energy concentrated around the storm centre. Preliminary tests were conducted in Hurricane Ester of 1961 and as a result project Stormfury was established by an agreement between the Department of Commerce and the Department of Navy in 1962. In 1963 the project seeded Hurricane Beulah. The seeding of these two storms produced encouraging results although the sample is too small to permit definite conclusions. In August of 1969, Hurricane Debbie was seeded and it is believed its force may have been weakened. Continued efforts have been made to verify these results.

"In 1970 no hurricanes were available in the Atlantic suitable for experimentation. In order to find sufficient cases to test the theories and to provide conclusive evidence, I am pleased to inform you that consideration is being given to moving Project Stormfury to the Pacific area for a limited period in 1972, where it would be possible to take advantage of the larger number of typhoons present. This proposed move is, of course, subject to the availability of funds, facilities and operating bases and favourable responses from interested nations. In planning for the operation of Project Stormfury in the Pacific, we would be in contact with countries likely to be affected and would invite participation in the experiment by asking countries to make ground-based or shipboard observations to assist in providing the additional meteorological data needed for use in the required analysis. Subject to space limitations these co-operating countries would be invited to send representatives to observe and work with the Stormfury Project. The proposed move will enable us also to meet the long-standing request of President Marcos and the interest shown by other governments of the region that we conduct research leading to the development of methods for typhoon moderation in the Pacific in view of the very great annual losses suffered in the Philippines and elsewhere due to typhoon damage. To further the interest of international co-operation in this endeavour, my government, subject to the approval of plans for this research project, hopes to consult with other interested governments at the time of the next session of the WMO/ECAFE Typhoon Committee, now scheduled for late 1971."

/14.

14. The Commission noted with satisfaction that the United States was considering the possibility of moving the Stormfury Project from the Atlantic to the Pacific in 1972 with the object of conducting typhoon modification experiments. It also noted with interest that interested countries would be invited to participate in the project and that further consultations would be held with them at the fourth session of the Typhoon Committee. The delegations of the Republic of Korea and the Philippines assured the Commission of their full support.

15. The Chief of the TCS visited the member countries of the Typhoon Committee in May-June 1971 and informed them of the encouraging statement made by the United States representative at the ECAFE session. They were informed that, in pursuance of this statement, the subject would be discussed at the fourth session of the Typhoon Committee and that detailed plans of the United States were expected to be known by that time.

16. The United States agencies involved in the shift of Stormfury activities to the Pacific are preparing information on this subject for presentation to the fourth session of the Typhoon Committee. It is expected that detailed plans will be presented to interested Governments in the region either shortly before or at the fourth session.

Action proposed

17. The Typhoon Committee is invited to express its views on the proposed transfer of **Stormfury** Project to Pacific in the light of the detailed plans presented by the United States delegation.

18. If the Stormfury Project is certain to be transferred to the Pacific in 1972, the Committee may wish to consider in what manner the member countries can assist and participate in the proposed modification experiments.

. . . . . .

FOR PARTICIPANTS ONLY

WRD/TC.4/10
30 July 1971

ORIGINAL : ENGLISH

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

AND

WORLD METEOROLOGICAL ORGANIZATION

Fourth Session of the Typhoon Committee
4-11 October 1971
Tokyo, Japan

CO-ORDINATION WITH OTHER REGIONAL TROPICAL STORM PROJECTS

(Agenda item 9)

Note by the WMO secretariat

Introduction

1. During the past year there has been a sharp upsurge in the interest evoked by tropical storm disasters in different parts of the world and their impact upon human affairs. This awakening of interest has led to new initiatives taken to reduce the loss of life caused by these storms and to promote measures to limit damage.

2. A logical consequence of the regional nature of tropical storms has been the development of new regional projects, or proposals for action on a regional basis. The Typhoon Committee itself was established three years ago in 1968 in response to a call for regional action to combat the serious consequences of tropical storms in the typhoon area of the western Pacific. In that period, the Typhoon Committee has performed a pioneering role in showing how an intergovernmental body made up of the countries affected can prosecute an action programme designed for the benefit of all its members.

/3.

3. In the light of the example set by the Typhoon Committee countries, the countries in other tropical storm areas have sought some similar co-operative arrangement as the basis for an attack on the tropical storm problem in their area. Thus the countries around the Bay of Bengal and the Arabian Sea have already taken action to set up a joint WMO/ECAFE Panel on Tropical Cyclones, and there are already indications that similar action may be taken by other groups of countries.

4. The purpose of this document is to inform the Typhoon Committee of these developments and to seek its views on the extent to which co-ordination of the activities in different areas is necessary and desirable. The main part of the document is divided into two portions; one dealing with the WMO/ECAFE Panel on Tropical Cyclones and the other with the expected developments in other areas affected by tropical storms.

WMO/ECAFE Panel on Tropical Cyclones

5. A Meeting of Experts on Tropical Cyclones in the Bay of Bengal and the Arabian Sea, organized jointly by WMO and ECAFE, was held at Dacca, Pakistan, in October 1970. The meeting made proposals for a programme to reduce the serious loss of human life and the damage to national economies caused by cyclones each year. It requested WMO and ECAFE to establish a joint Panel on Tropical Cyclones consisting of representatives of all the countries participating in the programme to co-ordinate its progress and to plan its further development.

6. In agreement with ECAFE, WMO has therefore invited five countries (Burma, Ceylon, India, Pakistan and Thailand) to be represented on the Panel. At the time of preparing this document, only one country (Thailand) had signified its acceptance of the invitation. Further information on the progress made in establishing the Panel will be given at the session.

7. In the meanwhile a suggestion has been made that the Typhoon Committee and the Panel on Tropical Cyclones could advantageously be merged into a single intergovernmental body with responsibility for these two adjacent areas of southeast Asia. It is clear that such a course of action could only be taken with the full assent of all the countries now represented on the Typhoon Committee and the Panel. It is accordingly intended to place

/this proposal

this proposal before these bodies on the first possible occasion. The views of the Typhoon Committee member countries are accordingly sought at its fourth session. No arrangements have been made for the Panel to meet, pending its full establishment.

8. There are a number of considerations which the Committee will doubtless wish to examine before it is able to record its views on the proposed merger. It is suggested that the following points will be among those considerations:

(a) the phenomenon being dealt with is the same in both areas, hence many of the associated problems are the same. There are occasions when both areas are affected by the same storm;

(b) there is accordingly a need for co-ordination between the countries of both areas in tackling the problems;

(c) the majority of the countries which are members of the Typhoon Committee (six out of seven) and all the proposed members of the Panel are situated in WMO Region II (Asia). The observing and telecommunication networks therefore form part of the same regional plan;

(d) it would be more economical for the participating countries and for the secretariats (travel, documentation, interpreters, etc) if there were only one body to provide services for, and if, as would then be likely, only one annual meeting instead of two were held;

(e) amalgamation of the Typhoon Committee and the Panel into a joint body would involve reconsideration of the role of the present Typhoon Committee secretariat if it were to be enlarged to support programmes in the Bay of Bengal and the Arabian Sea in addition to its existing functions;

(f) the Typhoon Committee is a formally constituted intergovernmental body. The Panel was expected to be a less formal association of countries under the aegis of WMO and ECAFE;

/(g)

(g) both the Typhoon Committee and the Panel are pursuing their functions under projects sponsored by WMO and ECAFE;

(h) if the Committee is to be enlarged, how should its statute be changed and its method of operation adjusted to meet the new demands to be placed upon it?

9. There are, no doubt, other considerations the Committee will also wish to take into account in recording its views. It is hoped that all members of the Typhoon Committee will be able to come to the fourth session prepared to discuss fully the proposed amalgamation of the two bodies and ready to indicate clearly whether they consider such an enlargement of present activities to be desirable.

Projects in other areas

10. The activities in other areas of the world affected by tropical storms where countries have shown a desire for co-operative action are, at present, less advanced than in the areas covered by the Typhoon Committee and the Panel on Tropical Cyclones.

11. However, progress is now being made in the southwest Indian Ocean and it seems probable that action for the formation of another "cyclone committee" will be undertaken before the end of 1971. The activities in this area began in 1969 when the WMO Regional Association I (Africa) set up a Working Group on Tropical Cyclones to examine the existing storm-warning system and to make recommendations to improve the system and on the desirability of a regional project for the reduction of tropical cyclone damage. The report of the working group was submitted to the WMO Executive Committee which requested the Secretary-General to organize a meeting of the WMO members concerned with the following broad objectives:

(a) to discuss the working group report and to formulate an outline of a technical plan for action to reduce tropical cyclone damage in the southwest Indian Ocean;

(b) to decide on the need for a regional project and the form any co-ordinating or planning body should take.

/12.

12. This meeting is now scheduled to take place in Mauritius in December 1971. There is accordingly a strong possibility that the meeting will decide that a regional project be initiated in the area and that it will propose the creation of a suitable body to supervise the execution of the project.

13. At its fifth session at Kuala Lumpur in August 1970, the WMO Regional Association V (South-West Pacific) appointed a rapporteur on tropical cyclone damage mitigation. His task is to investigate the adequacy of the total system for warnings of tropical cyclones in the affected areas of Region V, to formulate any necessary recommendations for improvements and to collect information on the cost of damage and the action taken by countries to mitigate damage. At the time of preparing this document, no specific information on the progress achieved by the rapporteur to date was available. Here again, it is hoped that further details can be provided at the fourth session.

14. Both the areas considered in this part of the document are located in the southern hemisphere and of less immediate concern to the Typhoon Committee than the activities in the Bay of Bengal and the Arabian Sea. Nevertheless, there is an obvious need for, at least, an exchange of ideas and information on these activities, if only to ensure that limited resources are not disbursed needlessly by duplication or overlapping of work. The main problem for the Typhoon Committee would therefore seem to be to decide how best such an exchange of information can be achieved. It might also wish to go one step further in considering whether there is a need for closer co-operation with these other activities in certain fields, such as, for example, research and training. Other possible subjects of collaboration, such as community preparedness, disaster prevention and relief, may also be worthy of consideration. In this context, the Committee should take into account the functions of the Executive Committee Panel of Experts on Tropical Cyclones established as part of the action taken under the WMO Tropical Cyclone Project. Further information on the Panel and its activities is given in document WRD/TC.4/8 under agenda item 7.

15. There are a number of ways in which the Committee could effect liaison with the work carried out in areas such as the southwest Indian Ocean

/and the

and the south Pacific. One of these would be to request its secretariat to assume this responsibility. Alternatively, the Committee may feel that this task would be more easily effected within the scope of the WMO Tropical Cyclone Project adopted at Sixth Congress. Yet another possibility would be for the Typhoon Committee to appoint rapporteurs for this purpose. These and other methods by which effective liaison can be established should be discussed at the fourth session.

Action proposed

16. The Typhoon Committee is invited to examine the proposals presented in this document and to decide whether it considers that:

(a) the amalgamation of its activities with the WMO/ECAFE Panel on Tropical Cyclones is desirable and, if so, the means by which this should be achieved (see paragraphs 5 to 9);

(b) more specific arrangements for liaison with other tropical storm projects are necessary and, if so, suggest how this liaison might most effectively be carried out (see paragraphs 10 to 15).

17. If the Committee should decide that merging its activities with the Panel would not be desirable, consideration should then be given to the need for liaison with it in the same way as for other tropical storm projects.

FOR PARTICIPANTS ONLY

WRD/TC4/11
1 September 1971

ORIGINAL: ENGLISH

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

AND

WORLD METEOROLOGICAL ORGANIZATION

Fourth session of the Typhoon Committee
4-11 October 1971
Tokyo, Japan

TENTATIVE PROGRAMME

4 October - Monday

09.00 - 09.45 hours	Registration
10.00 - 10.40 hours	Opening session (1) Inaugural address (2) Statement by the Executive Secretary of ECAFE (3) Statement by the Secretary-General of WMO (4) Vote of thanks
	Recess 20 minutes
11.00 - 12.30	Technical session (5) Election of the Chairman and Vice-Chairman (6) Adoption of the provisional agenda (WRD/TC4/2) (7) Agenda item 4: The Committee's activities during 1971 (WRD/TC4/5)
12.30 - 14.30	Lunch
14.30 - 17.00	Continuation of discussion of agenda item 4: (a) Meteorological component (b) Hydrological component

5 October - Tuesday

09.30 - 12.30 hours	Continuation of discussion on agenda item 4: (c) complementary protective measures (d) Training and research
14.30 - 17.00 hours	Agenda item 5: Programme for 1972 and beyond (WRD/TC4/6)

/6 October

6 October - Wednesday	
09.30 - 12.30 hours	Agenda item 6: Outline of tentative request to UNDP for assistance as institutional support to the Typhoon Committee (WRD/TC4/7)
14.30 - 17.00 hours	Continuation of discussion on agenda item 6 Agenda item 7: Action related to United Nations General Assembly Resolution 2733(XXV) (WRD/TC4/8)
7 October - Thursday	
09.30 - 12:30	Continuation of discussion on agenda item 7 Agenda item 8: Proposed transfer of project "Stormfury" to the Pacific (WRD/TC4/9)
14.30 - 17.00	Continuation of discussion on agenda item 8
8 October - Friday	
09.30 - 12.30	Agenda item 9: Coordination with other regional storm projects (WRD/TC4/10)
14.30 - 17.00	Agenda item 10: Date and place of the fifth session
9 October - Saturday	
9.30 - 12.30	Meeting of the Drafting Committee
Afternoon	**Free**
10 October - Sunday	**Free**
11 October - Monday	
09.30 - 12.30	Agenda item 11: Consideration of the draft report and closure of the session.

Tc 4/13

Limited
WRD/MKG/INF/L.467
28 September 1971
Original: English

UNITED NATIONS

ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

Committee for Co-ordination of Investigations
of the Lower Mekong Basin (Khmer Republic,
Laos, Thailand and the Republic of Viet-Nam)

Fourth Session of the Typhoon Committee
Monday 4 October - Monday 11 October 1971
Tokyo, Japan

REPORT ON BASIN-WIDE FLOOD FORECASTING IN THE LOWER MEKONG BASIN

Note by the Mekong Secretariat

FOR PARTICIPANTS ONLY

WRD/TC4/13
4 October 1971

ORIGINAL : ENGLISH

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

AND

WORLD METEOROLOGICAL ORGANIZATION

Fourth Session of the Typhoon Committee
4-11 October 1971
Tokyo, Japan

REPORT ON BASIN-WIDE FLOOD FORECASTING IN THE LOWER MEKONG BASIN

Note by the Mekong Secretariat

REPORT ON BASIN-WIDE FLOOD FORECASTING IN THE LOWER MEKONG BASIN

Introduction

The Mekong Project

The Mekong Project seeks the comprehensive development of the water resources of the Lower Mekong Basin, including mainstream and tributaries, in terms of hydroelectric power, irrigation, flood control, navigation improvement and related developments for the benefit of all the people of the Basin, without distinction as to nationality, religion or politics.

The Mekong Project is directed by the Committee for Co-ordination of Investigations of the Lower Mekong Basin, established in 1957 by the Governments of the Khmer Republic, Laos, Thailand and the Republic of Viet-Nam as an autonomous intergovernmental agency under the aegis of the United Nations Economic Commission for Asia and the Far East (ECAFE). The Committee consists of a plenopotentiary representative from each of the four riparian countries, and is authorized to promote, co-ordinate, supervise, and control the planning and investigation of water resources projects in the Basin.

In 1959, the Committee appointed an Executive Agent for the day-to-day management of the Project. The Office of the Executive Agent (the Mekong Secretariat) is supported in part by the UNDP, in part by ECAFE, and in part by the riparian governments and by co-operating governments and agencies. At the end of June 1971, resources of more than US$ 211 million equivalent had been pledged by 26 countries, 16 UN agencies, 4 foundations and several private firms to finance the Secretariat, pre-investment investigations and planning, and investment for construction.

In 1966, the Committee and its co-operating entities received the Ramon Magsaysay Award for International Understanding.

/Flood

Flood Forecasting

At its Forty-fifth Session, held in Phnom Penh, Khmer Republic, in February 1970, the Mekong Committee requested the Mekong Secretariat to establish an interim programme for Basinwide Flood Forecasting to utilize the great quantity of hydrometeorological data so far accumulated, to draw upon the expertise in meteorology, hydrology, and computer systems available in the existing organizational structure of the Mekong Secretariat, and to provide the four riparian governments with a reliable system of flood warning along the Mekong.

The interim programme based on the United Nations ECAFE report entitled "Proposed Implementation of a Basinwide Flood Forecasting System for the Lower Mekong Basin" dated December 1969, with advisory help from the U.S. Corps of Engineers, North Pacific Division and the Portland River Forecast Center, U.S. National Weather Service, NOAA in Portland, Oregon, was started during the 1970 flood season on a trial basis. The forecasts were made by applying a modification of the SSARR (Streamflow Synthesis And Reservoir Regulation) computer model developed for forecasting operations on the Columbia River. The IBM 360/40 computer at the National Statistical Organization (NSO) in Bangkok is used to run the programme.

1971 Flood Forecasting Programme

Introduction

The 1970 experience was evaluated by the Mekong Secretariat, the American advisory experts, and the Mekong Committee's Advisory Board. The Mekong Committee at its Fiftieth Session, held in Vientiane, Laos, in February 1971 authorized a continuation of the Basinwide Flood Forecasting Programme for 1971 with an extension of the forecast to the Mekong Delta in the Republic of Viet-Nam, refinement of the computer programme, and greater use of weather satellite and radar data.

/Flood Situation

Flood Situation

During the 1971 flood period, streamflows at all stream gaging stations in the Mekong from Chiang Saen, Thailand, to Pakse, Laos, were consistently above the computed mean flows from July through September. There are several periods during which the streamflows exceeded the maximum of record for the particular time of year. The above normal streamflows are related to the generally above normal rainfall associated with the tropical disturbances that was experienced in the headwater areas of the Mekong.

Figure I shows the storm tracks which affected the Lower Mekong Basin in July and September 1971.

The above normal streamflows described above resulted in major floods in certain critical areas. The major flood damage area was that associated with overbank flows in the vicinity of Pakse and Vientiane in Laos, and Nongkhai in Thailand. The peak at Pakse was recorded at 12.10 m (98.61 m above M.S L.) with the corresponding discharge of 40,200 m^3/sec on 18 July. The maximum water level at Vientiane was 12.51 m (170.55 m above M.S.L.) on 22 August. The corresponding discharge is 23,100 m^3/sec. This is the third highest flood at Vientiane since 1913. The water level is only 20 cm less than the 1966 peak which is the highest. Significant overbank flow and flooding in the vicinity of Vientiane occurs when the water level exceeds 11.50 m. In 1971 it exceeded 11.50 m for 23 days from 17 August through 8 September.

In the Mekong Delta, the flood levels were not excessive because of the timing of the runoff. The water level at Phnom Penh, Khmer Republic, was 9.91 m (8.83 m above M.S.L.) on 28 September. This level is near the mean level of the annual flood peaks for the period of record since 1930.

/Input Data

Input Data

Figure II shows the sub-basin areas, the location of the reporting hydrologic and precipitation stations. Figures III & IV show the schematic diagram of the computer programme used in the flood forecasting operation.

Input data necessary to operate the SSARR model are as follows:

(1) Interpretation of all available precipitation data from reporting precipitation stations and weather radar for the periods preceding the initial time of forecast to represent the sub-basin precipitation amounts, expressed in percent of normal annual value.

(2) Conversion of all water stages from reporting hydrologic stations to discharge amounts by applying appropriate discharge rating tables.

(3) Computation of local inflows between main stem gaging stations, and adjusting local inflows and observed main stem discharge to provide values that are consistent with respect to time continuity at all reporting stations.

(4) Analysis of synoptic weather situation together with APT (Automatic Picture Transmission) mosaics from the U.S. ESSA 8 weather satellite, data and forecasts, from which quantitative precipitation forecasts and outlooks are made for each contributing sub-basin.

(5) Preparation of data forms necessary for each of the above items to be inserted as input to the SSARR model; key-punching these values; and assembling the data deck for computer operation.

Period Covered by Forecasts

River stage forecasts were prepared and issued on a regular basis, seven days a week, beginning on 5 August. Forecasts were issued for one, two, three, four and five days ahead for the selected key stations on the Mekong as follows :

/ (1) Chiang Saen,

(1) Chiang Saen, Thailand
(2) Luang Prabang, Laos
(3) Vientiane, Laos
(4) Nongkhai, Thailand
(5) Nakorn Phanom, Thailand
(6) Mukdahan, Thailand
(7) Pakse, Laos
(8) Phnom Penh, Khmer Republic
(9) Chau Doc, Republic of Viet-Nam, and
(10) Tan Chau, Republic of Viet-Nam.

Dissemination of Forecasts

Forecasts were released to the National Mekong Committees of the Khmer Republic, Laos, and the Republic of Viet-Nam by radio at noon, to the National Energy Authority and the Meteorological Department of Thailand by hand-carry at the same time.

The NEA and the Meteorological Department of Thailand, and the National Mekong Committees of the other three riparian governments then provide forecast information to concerned government offices, the press and the radio for general distribution to the public.

The dissemination of forecasts on weekends and holidays was carried out in a routine manner, just as was done on weekdays.

Forecast Results

Figures V & VI show the forecast deviations (absolute value of deviation, observed minus forecast water stage) in cm for two representative key stations, namely, Vientiane in Laos and Phnom Penh in the Khmer Republic.

Summary

There is definite improving of forecasts in 1971 operation, as compared with those of 1970. The Mekong Secretariat will make continued effort in carrying on and improving river forecasts in the future.

****

FIGURE I

STORM TRACKS IN Jul. and Sept. 1971

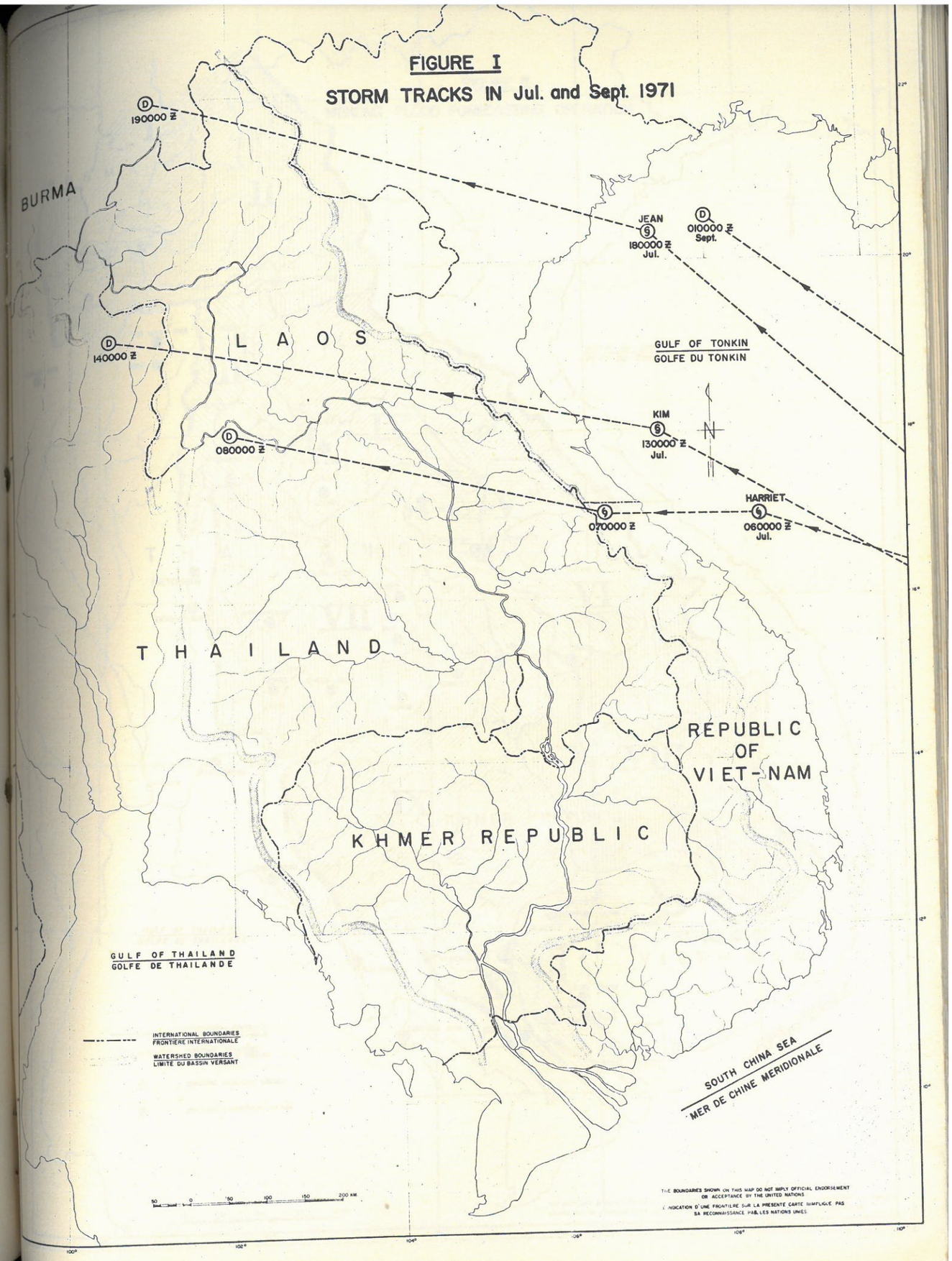


FIGURE II

MEKONG FLOOD FORECASTING OPERATION

THE BOUNDARIES SHOWN ON THIS MAP DO NOT IMPLY OFFICIAL ENDORSEMENT OR ACCEPTANCE BY THE UNITED NATIONS.

L'INDICATION D'UNE FRONTIERE SUR LA PRESENTE CARTE N'IMPLIQUE PAS SA RECONNAISSANCE PAR LES NATIONS UNIES.

FIGURE III

FORECAST RUN I

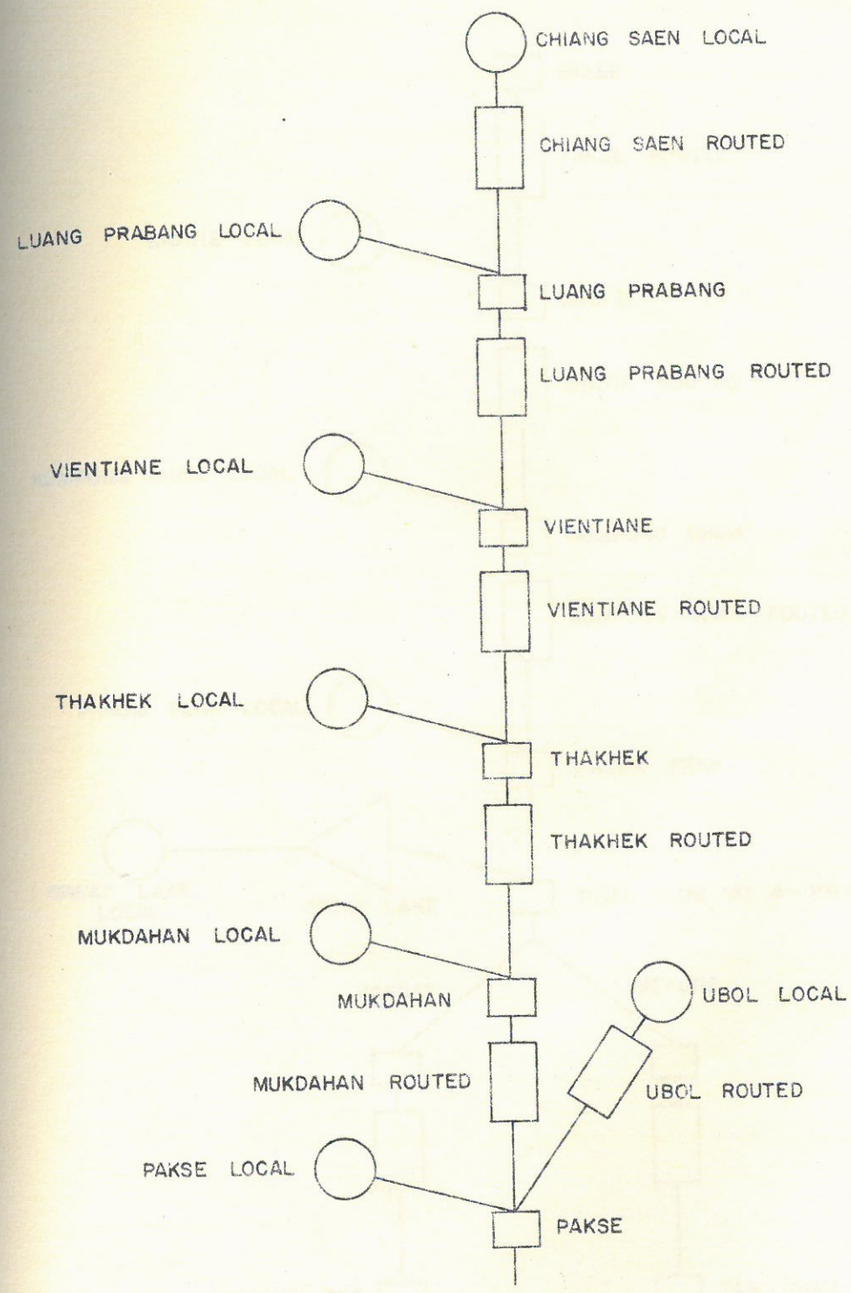
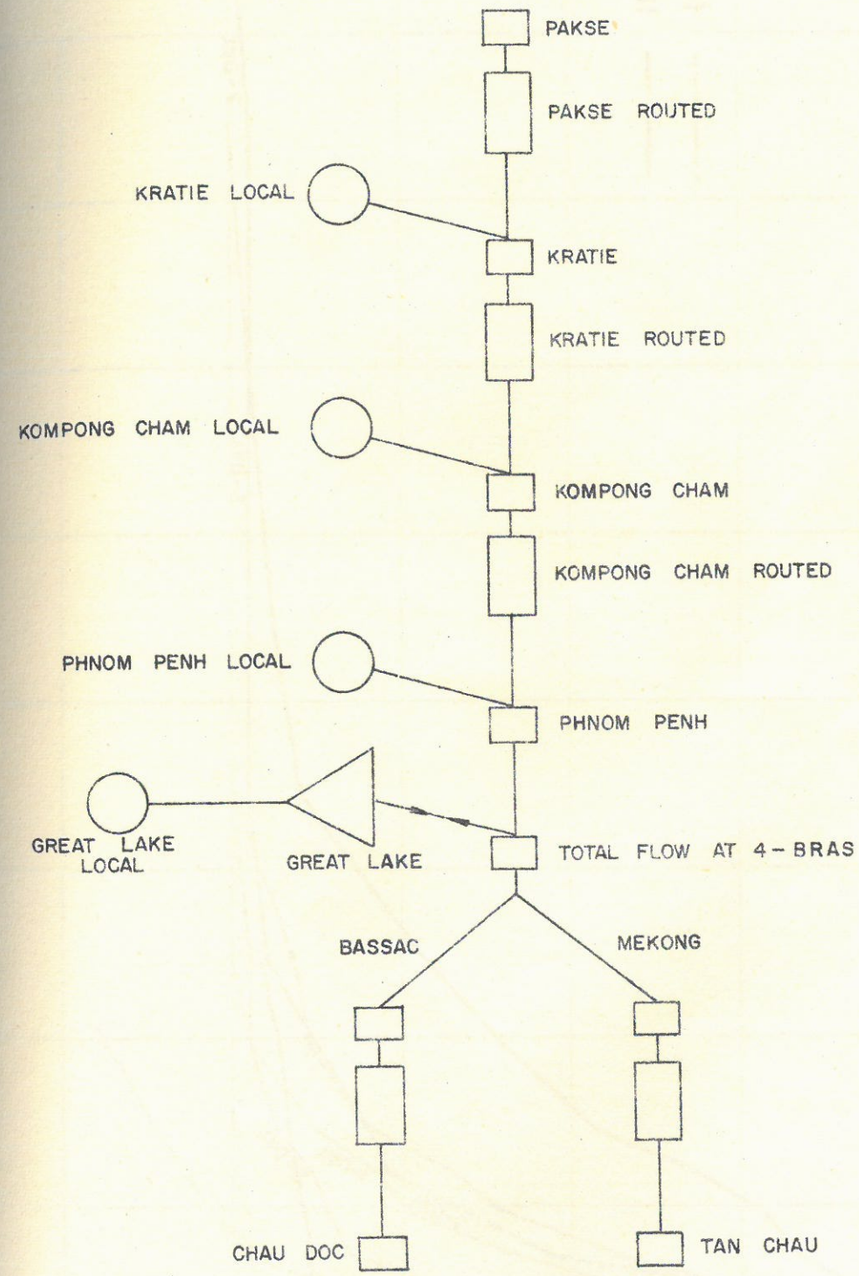
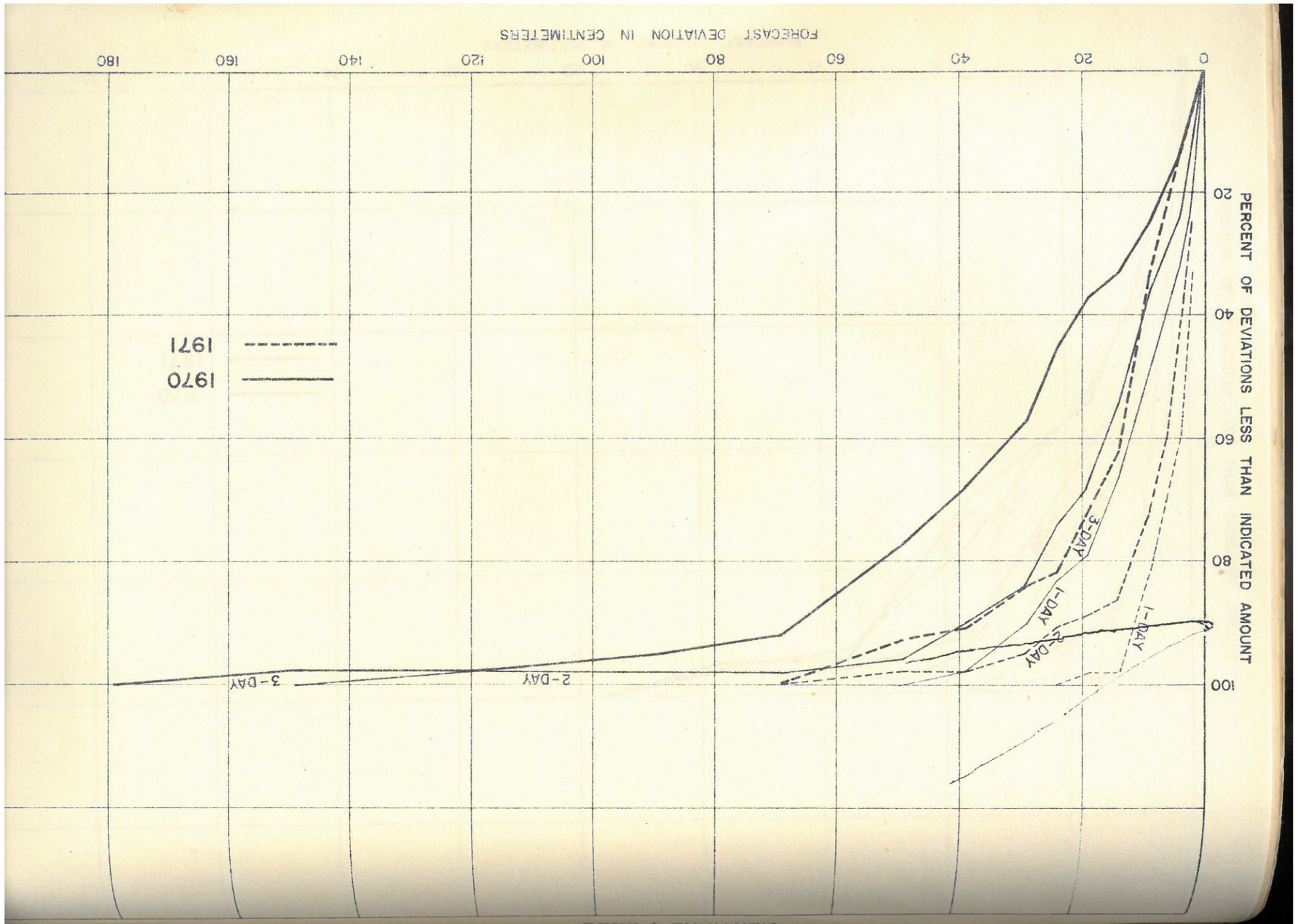
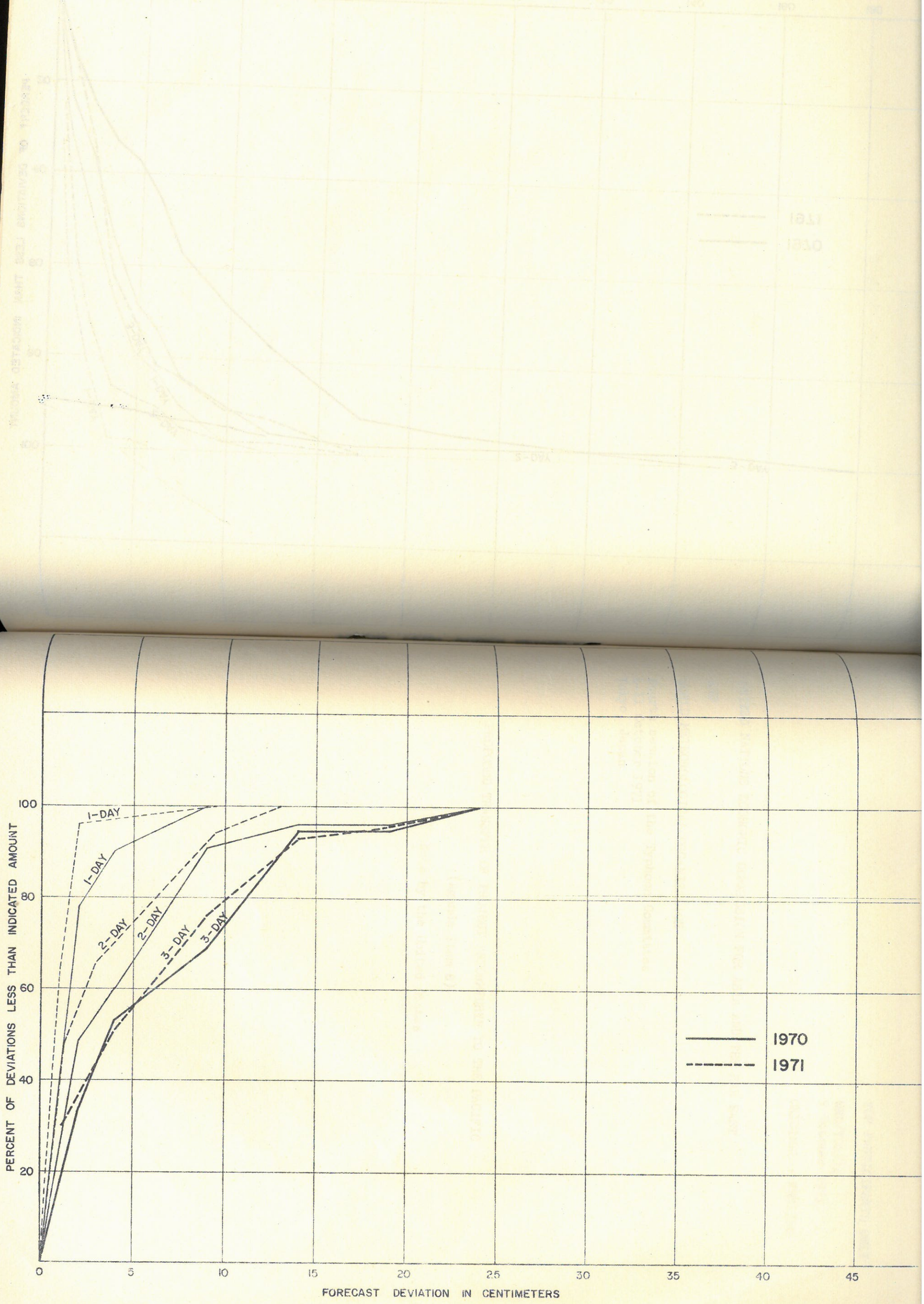


FIGURE IV

FORECAST RUN 2




PERCENT OF DEVIATIONS LESS THAN INDICATED AMOUNT
FORECAST DEVIATION IN CENTIMETERS
0
20
40
60
80
100
120
140
160
180
1970
1971
3-DAY
2-DAY
1-DAY


PERCENT OF DEVIATIONS LESS THAN INDICATED AMOUNT
100
80
60
40
20
0
5
10
15
20
25
30
35
40
45
FORECAST DEVIATION IN CENTIMETERS
1-DAY
1-DAY
2-DAY
2-DAY
3-DAY
3-DAY
1970
1971

FOR PARTICIPANTS ONLY

WRD/TC4/14
5 October 1971

ORIGINAL : ENGLISH

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

AND

WORLD METEOROLOGICAL ORGANIZATION

Fourth session of the Typhoon Committee
4-11 October 1971
Tokyo, Japan

PROPOSED TRANSFER OF PROJECT "STORMFURY" TO THE PACIFIC

(Agenda item 8)

Note by the United States

STORMFURY PACIFIC

1. THE PROJECT'S THEORETICAL BASIS

A tropical cyclone draws its energy from the convective overturning of the atmosphere. Warm, moist air spirals over the tropical seas toward the storm center and flows upward in a bans of clouds ringing the calm eye. The inflowing air, already turning slowly with the rotation of the earth, gathers speed as it draws toward the storm center, producing winds of estructive violence before moving upward and away from the storm's core.

Project Stormfury experiments are designed to upset the balance of forces in the clouds around the eye of the tropical cyclone causing the redistribution of energy concentrated around the storm center. Theoretically, injection of silver iodide particles into the clouds outside the eyewall should transform super-cooled water droplets to ice crystals, releasing the latent heat of fusion. The release of heat into the ascending air increases cloud buoyancy, causing a more vigorous ascending motion. As the cloud rises, it expands, cools, and is no longer able to retain all of its water vapor. As the water vapor condenses or sublimates, additional heat energy is released. The processes just described are more likely to occur in the area just outside the eyewall clouds. In this area the clouds do not all reach great heights naturally, and some way grow explosively when appropriately seeded. The growth of these clouds, and the addition of large amounts of heat in the area outside the eyewall, reduces the temperature gradient along a radius from the center of the storm, and reduces the steep pressure gradient producing the strongest winds. All of these changes encourage the development of a new eyewall radially outward from the old one. From angular momentum considerations, the farther from the storm's center that the inflow ceases, the less the tangential wind will be. Therefore, the development of the new eyewall, where the principal ascent occurs, and the reduced pressure gradient, will cause a reduction in the maximum wind, and a dispersion of the energy concentrated about the center over a larger area.

Research in the numerical modelling of hurricanes at the National Hurricane Research Laboratory holds particular significance to the evaluation of experimental modification efforts. Since changes occurring in seeded tropical cyclones are rarely beyond the range of changes which may occur naturally in unmodified storms, the process of evaluating a field modification experiment is particularly difficult. A theoretical model that can isolate changes occurring in a modified storm from those occurring in an unmodified storm can be a valuable tool. Such a model can also indicate which data need to be collected in field experiments for the subsequent improvement of modification concepts.

Rosenthal has developed a circularly-symmetrical, seven-level, primitive equation model of hurricanes which simulates convective precipitation (and the macroscale heating due to the latent heat release) as well as the enrichment of macroscale humidity due to the presence of cumuli. Nonconvective precipitation is also simulated. Explicit predictions of the air-sea exchanges of sensible and latent heat are included. Despite the fact that this model is one of the more sophisticated of the circularly-symmetric models in existence, and despite the fact that it has provided extremely realistic results, it does suffer from two major deficiencies. The first is the highly pragmatic parameterization of cumulus convection. The second deficiency results from the assumption of circular symmetry, precluding direct comparison between model calculations and actual tropical cyclones. The model results must, therefore, be considered as only representative of an "average" cyclone.

The model has been used to simulate some of the features of the modification experiment on Hurricane Debbie.* Prior to the time of Debbie an earlier version of this model was used to investigate the radii at which a storm should be seeded. In qualitative reasoning, it would appear that the storm clouds should be seeded at radii greater than the radius of maximum winds. Model experiments provided the same answer.

Through the use of a numerical model, controlled experiments can be conducted. The results of a "modified" run can be compared with those from an "unmodified" run to identify changes resulting from the modification experiment. The results from several experiments with the model suggest that heat should be added at radii greater than that of either the maximum vertical motion or maximum winds.

Seeding with silver iodide crystals will freeze super-cooled water drop-lets and release the latent heat of fusion. In an earlier modification concept, this was the main reaction expected. In a newer explanation, release of the latent heat of fusion is the factor initiating a larger reaction. The latent heat of fusion is expected to increase cloud buoyancy, to cause greater growth in the ascending plumes, and ultimately to result in condensation or sublimation of extra water vapor at the radii of seeding. Either of the latter two processes can release many times as much heat as would be released by merely freezing existing super-cooled water in the cloud.

Eyewall clouds naturally reach great heights and seeding will probably not make them grow taller. But beginning five miles radially outward from the inner edge of the eyewall, it may be possible to stimulate sufficient cloud growth to cause further water vapor condensation, thus, releasing larger amounts of heat. Modelling would indicate this to be the region where additional heat input would result in the greatest reduction in the storm's maximum winds. A reanalysis of data collected from Hurricane Debbie supports this new interpretation. While in Debbie

---

*1969

most of the seeding runs were begun from the center of the eyewall, the somewhat limited data collected regarding cloud structures and super-cooled liquid water content suggest that the principal heat release occurred outside the principal eyewall clouds.

Other experiments run with the symmetrical model suggest that changes following application of enhanced heating vary according to the wind and pressure distribution in the "model" storm when the simulated modification experiment is initiated. These results are still being evaluated and may in time lead to further improvements in the design of field experiments.

2. HISTORY

Preliminary tests of hurricane modification concepts were conducted on Hurricane Esther in 1961 by the U.S. Weather Bureau and the U.S. Navy. The results were encouraging but inconclusive. It was agreed that additional experiments were needed and Project Stormfury was established by the Department of Commerce and the Department of the Navy on July 30, 1962. Stormfury operations were initially limited to those storms which did not have a climatological expectancy of striking land within 36 hours after seeding. Large-scale seeding operations were further restricted by the range of project aircraft from the operating base, Rossevelt Roads, Puerto Rico. In 1962 only one hurricane passed through the experimental area, but it had neither an identifiable eye nor a spiral band structure and was not seeded.

In the 1963 season, the seeding area remained the same, and operations were scheduled during the period August 1 through November 1. On August 23 and 24, two large-scale single-seeding experiments were carried out on Hurricane Beulah. Results obtained on August 23 were inconclusive because monitoring could not be sufficiently extended to determine the effect on the hurricane after the silver iodide entered the storm's major convective cells. There was even some doubt that the seeding material had entered the cells at all. Wind reductions observed following a single seeding on August 24 were not of sufficient magnitude to represent a real reduction in storm hazard. The analysis of control data from an unseeded hurricane, Flora, revealed the existence of natural changes of the order of magnitude observed following the August 24 operation involving Beulah. The changes in Flora may not have been entirely random, however, due to the progressive influence of terrain during the monitoring period. The 1963 season thus produced too little information to support substantial conclusions concerning the effect of seeding.

In 1964 and 1965, the operational season was shifted to the period July 15 to October 15, however hurricane seeding operations were not accomplished due to the shortage of certain key aircraft and the lack of suitable hurricanes meeting established operating guidelines.

In 1966 the operating period was shortened to August 1 through October 15. Several hurricanes approached but did not enter the prescribed seeding area.

In 1967, the seeding area was enlarged in an effort to increase the number of hurricanes available to the project. Under a new guideline, hurricanes would be eligible for seeding as long as there was a probability of 10% or less of the hurricane center coming within 50 miles of a populated land area within 24 hours after seeding. Hurricane movement predictions were now based on U.S. Weather Bureau forecasts rather than area climatology. However, even with new criteria and expanded operating area, no hurricane eligible for seeding entered the area.

In 1968, the prescribed seeding area was further enlarged to include regions within the Gulf of Mexico and Caribbean Sea, but again nature failed to provide a storm suitable for large-scale experiments.

At long last, in 1969, two hurricanes occurred which were found to be eligible for seeding. Hurricane Debbie was the first hurricane to be multiple seeded on August 18 and 20, 1969. Hurricane Inga, technically eligible when near Bermuda, was not seeded because of poorly formed eyewall clouds, general weakness and erratic movement. Appreciable changes in maximum wind speed and other parameters related to the structure of Hurricane Debbie were found following seeding. Analyses of past storms indicate that the rate of decrease in wind speed observed on August 18 would be very rare in an unseeded hurricane. Decreases in wind speed observed on August 20 could be expected to occur naturally in fewer than half of a sample of unmodified storms. The fact that the storm's winds diminished on both seeding days strongly suggests that the modification experiment was effective.

In 1970, no hurricanes were available for experimentation, even though the operating season was extended to July 23 through October 31, and the eligibility criterion changed from 24 to 18 hours to landfall.

3. JUSTIFICATION FOR MOVE TO THE PACIFIC

Since the inception of Project Stormfury, the record shows a disconcerting absence of eligible hurricanes in the Atlantic operating areas, even though seeding restrictions have been progressively relaxed and operating areas expanded. A thorough study has been conducted to determine the frequency of Atlantic hurricanes eligible for seeding under various restrictions. This study, based on historical data for the period 1954 to 1969, indicates that an average of <u>two</u> eligible storms can be expected for a three month period using the 24-hour "time to landfall" criterion. A maximum of three candidate storms per year could be expected if the operating season were extended from June 1 through November 30, and the "time to landfall" criterion were changed from 24 to 12 hours following seeding.

A similar study was conducted for the Western Pacific based on staging primarily from Guam. An operating season of August 1 to October 31

was assumed and the "24-hour" criterion for eligibility was used. The results of this study, using data from 1961 through 1969, show that an average of six typhoons eligible for seeding should occur each season.

It is this expected increase in the number of eligible storms from <u>2</u> to <u>6</u> per season that urges a shift in operations to the Western Pacific, with the assumption that a typhoon would be eligible for seeding as long as there was a probability of 10% or less of the typhoon center coming within 50 miles of a populated land area within 24 hours after seeding.

4. TYPES OF MISSION EXPERIMENTS

During the three months period it is anticipated that the following missions would be flown:

<u>Multiple Seeding Experiment</u> -- The multiple seeding experiment is the primary technique designed to produce wind reduction. An A/C A, the seeding aircraft, will make five seeding runs along a radial from the eye of the typhoon beginning at a designated point outside the eyewall. The five runs will be made at two hour intervals. An A/C B will enter the typhoon for six hours beginning four hours prior to the first seeding. This aircraft will criss-cross and circle the storm at about 29,000 feet to monitor outflow and release dropsondes in the eye, on the perimeter, and within the storm itself. This aircraft will return to repeat the pattern after the second seeding. About 2 hours before the first seeding three more aircraft will arrive: A/C C to monitor outflow by flying across the around the typhoon at about 37,000 feet for two hours; A/C D to fly an X-pattern across the eye at an altitude of 5,000 feet for approximately four hours;and A/C E to circle the storm at 1,000 feet for about eight hours, monitoring inflow. Each of these flights will be repeated later during the experiment -- A/C C returning about an hour before the final seeding; an aircraft F arriving just before the third seeding, and A/C D returning about two hours after the last seeding to monitor the storm. An aircraft G will relieve A/C E at about the time of the fourth seeding and continue low level inflow monitoring for another eight hours.

Before seeding begins, two aircraft (H & I) approach the storm at 7,000 and 10,000 feet. These are the command and control aircraft and alternate. Both remain in or near the storm for more than eight hours.

A/C J will participate as a cloud physics monitor, flying between 22,000 and 25,000 feet for five hours beginning one hour before the first seeding. Just before the seeding, an A/C K will begin flying back and forth above the typhoon, photographing its cloud patterns from 49,000 feet or higher and return later after the seeding. An A/C L will be used for data collection and possibly additional seeding. About an hour after the first seeding, an A/C M will enter the storm to monitor outflow at about 41,000 feet for seven hours, until the time of the fifth and final seeding.

Rain-sector Experiment -- The rain-sector experiment has been designed to test whether some of the energy flowing toward the center of the tropical cyclone can be intercepted while it is still between 50 and 100 miles from the center. If successful, this experiment should result in the dispersal of the energy over a larger area than is usually the case in an unmodified storm. In the experiment clouds in a 45 degree sector between 50 miles and 75 miles radius are seeded in an effort to stimulate growth. The sector will be selected in an area where low level winds are carrying warm moist tropical air toward clouds around the center of the storm. If cloud growth in this sector causes moist air to ascend to the outlow layer at a relatively large radius, some of the energy normally released near the center of the storm would be released at greater radii. It is hypothesized that this would cause dispersion of energy over a larger area, and thus result in a reduction in the maximum winds of the storm. A seedable cloud in the designated sector will be treated, while monitoring aircraft continue to collect data to document changes in storm structure or intensity. The seedings will occur during four periods of 50 minutes each, separated by non-seeding periods of 50 minutes each.

Rainband Experiment -- This experiment has the same objectives as the rain-sector experiment, and in addition should provide an opportunity to study the interaction of seeded clouds with other clouds in the same and nearby rainbands. In the experiment, clouds will be seeded along a rainband (a line of clouds spiralling around and toward the center of the storm) at 50 to 150 nautical miles from the storm center. If the rainband selected is in a proper location, this should result in a dispersion of the hurricane energy over a larger area. Information gathered about interactions of individual clouds with the general cloud system of the storm should provide some of the information needed to improve the design of other modification experiments. The rainband experiment will provide better opportunities for studying certain features of this interaction because a rainband can be selected away from the central vortex area where it is not obscured by the main cloud system of the hurricane.

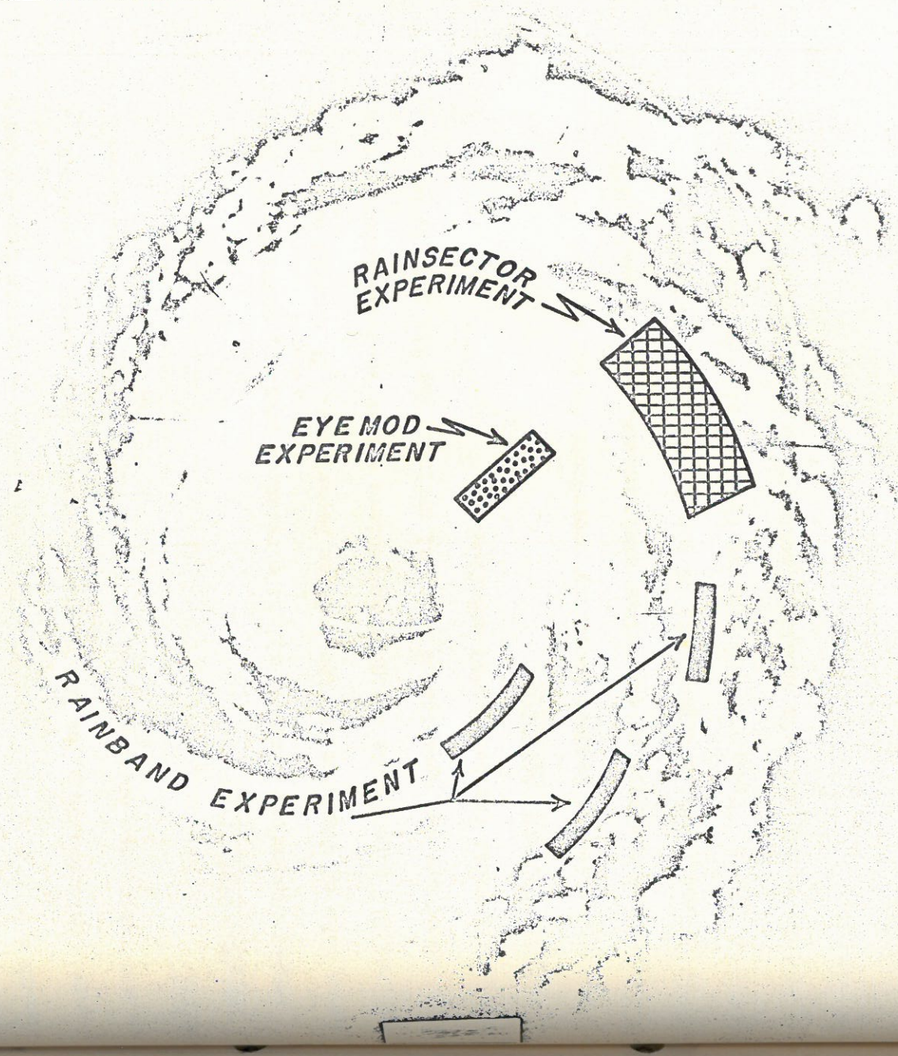
Typhoon Monitoring Missions -- It is anticipated that two or more typhoon monitoring missions will be conducted during the operational period. The purpose of these missions is to add to present knowledge of the natural variations within a typhoon and to compare these results with the variations noted in the experimental storms after seeding has been conducted. These missions will most ptobably be conducted when, for some reason, typhoons in the operational area are not suitable for seeding or the entire complement of aircraft needed for seeding missions is not available. Aircraft requisites for these missions will be the same as for multiple seeding missions except that seeder aircraft will not be needed.

5. COOPERATION FROM OTHER NATIONS

In the experimental work the most difficult task is evaluating the results to determine if the change observed in the storm were caused by the seeding or whether they occurred naturally. For each experiment, therefore, it is necessary to study the environmental circulations and conditions to learn if they might have been responsible for the changes. Some of the questions which must be answered are: 1) Did cold or dry air get into the typhoon circulation at low levels, 2) Was anticyclonic vorticity advected into the storm circulation, and 3) Did a trough or any other unfavorable circulation in the upper troposphere approach closely to the typhoon during the experimental period. To prepare detailed weather maps needed to answer these and other similar questions, additional data are required. Special rawinsonde flights, additional ship reports, extra inflight reports from commercial aircraft and other data would all be helpful in defining the circulations and weather conditions in the environment of the typhoon experiment. Help is needed from the various countries in obtaining these data including the establishment of special observing stations in data void areas.

It is hoped that as a minimum each conerned ECAFE member would have at least one scientist to act as an observer of some of the experiments and to participate in the research program for evaluating the results. This is very desirable. If the Project learns how to modify tropical cyclones, the information should be made available to all interested countries. Having a competent informed scientist from each country would be the first step for accomplishing this.

In addition there are several research tasks that could be undertaken by interested countries. For example, much more needs to be known about the natural variability of typhoons. These data are needed to compare with the magnitude and character of changes that occur in the experimental storms. If researchers in the Pacific have or can develop objective forecast rules for predicting changes in the intensity of unseeded storms, it would be very helpful. If none can be developed that show significant skill statistically, it would be useful to have good guidelines for identifying storms that are not expected to change intensity for the next 12 to 24 hours unless they are seeded. As a minimum a reliable climatology of typhoon deepening and filling for the months and areas concerned should be developed. There are many projects of this type that could furnish background and basic information needed by the modification project. Such projects vary greatly in difficulty so each participating country could select a problem suitable for the talent and resources they can devote to the effort.


RAINSECTOR EXPERIMENT
EYE MOD EXPERIMENT
RAINBAND EXPERIMENT

176)

Correction to WRD/TC4/14

Agenda Item 8

INTRODUCTION

Mr. Secretary and Delegates:

I am pleased to be here and comment on Project Stormfury. Our principal research director of this program - Dr. Cecil Gentry - regrets that he can't be here. Unfortunately, he had to stay at home - supervising "Stormfury Atlantic" which has another month to run during the 1971 hurricane season.

SUMMARY

1. PROJECT OBJECTIVES

Project Stormfury first of all is a research program, carried out jointly between NOAA of Commerce and the Defense Department in the U.S. It consits of a series of scientific experiments designed to achieve a more thorough understanding of the structure and dynamics of tropical cyclones for the purpose of identifying means for beneficial modification.

2. PACIFIC PROGRAM OBJECTIVE

The objective of Project Stormfury operations in the Pacific is the collection and analysis of sufficient environmental data to evaluate the effects of modification experiments on the dynamics and structure of Pacific typhoons. Presuming the present theoretical modification hypothesis is correct, sufficient data should be gathered in one season to confirm the concept.

3. APPROACH

A combined NOAA/Navy/Air Force task force of aircraft and supporting personnel will be assembled on Guam for a three-month period during the 1972 Pacific typhoon season. The aircraft will be equipped for dispersing cloud seeding materials and collecting environmental data. Within specific

scientific and operational guidelines as to the eligibility and suitability of typhoons for seeding experiments, experimental missions will be flown as directed by the Project Director. Missions will be flown from both Guam and Okinawa as appropriate. At the termination of each mission, quick-look data will be processed and analyzed, and modifications to subsequent experiments made as deemed appropriate by the Project Director. If, in the opinion of the Project Director and Assistant Project Director, sufficient experiments have been conducted prior to the end of the three month operational period, operations may be terminated and the forces released. On completion of the experimental period, a comprehensive data analysis and research program will be conducted to determine the effect of the experiments on typhoons and to improve numerical models of tropical storms. Recommendations will then be made as to the most promising avenues for future experimentation.

October 1971

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

AND

WORLD METEOROLOGICAL ORGANIZATION

Fourth session of the Typhoon Committee
4-11 October 1971
Tokyo, Japan

SUMMARY OF STATISTICAL SURVEY ON FLOOD DAMAGE IN JAPAN, 1970

Ministry of Construction, Japan

A. INTRODUCTION

1. Purpose

The object of this statistical survey shall be to grasp the flood and its associated damage in monetary terms, classifying into the causes of the floods, the river basins and the administration units, in order to clarify the economic effects of flood control projects undertaken in the country.

2. Flood damage to be surveyed

(1) Floods caused by:

a) the river flow, inland inundation, high tide and storm wave

b) high tide and storm wave along sea-coast

c) sediment flow

d) land-slide and collapse due to heavy rainfall

(2) All flood damage in above shall be surveyed in spite of its size.

3. Items to be surveyed

(1) General damage

a) casualities -------killed, missing and injured

b) flooding area ------agricultural land and housinglot, etc.

(2) General properties

a) houses and buildings

b) household articles

c) capital goods and stored goods of establishments

d) capital goods and stored goods of farm and fishermen's households

e) loss due to stopping the business

(3) Agricultural products

a) damaged areas by damaged crops

(4) Public works structures

a) Public works ---- river training, flood control, multiple purpose dam, sabo-works, coastal embankment, road and bridge

b) Agricultural land and facilities --- paddy and crop fields, irrigation and drainage facilities, reclamation works

c) Urban facilities --- street, highway, public parks, sewerage system

(5) Transport, Communication and Power facilities

a) Transportation facilities ---Japan National Railway, private railway and highway

transport industries

b) Tele-Communication facilities

c) Power industries facilities

(6) Unit price for estimating general properties damage and agricultural products

a) Houses and buildings

b) Household articles

c) Establishments (capital goods and stored goods)

d) Farm and fishermen's household (capital goods and stored goods)

e) Agricultural crops

(7) Percentage of damage to general properties

same items in above mentioned.

4. Estimation of flood damage

(1) Damage to general properties shall be calculated by multiplying damaged quantity (in 3. (2)) to unit price (in 3. (6)) and percentage of damage (in 3. (7)).

(2) Damage to public works structures and transport, communication and power facilities shall be estimated and summed up by each administrators.

(3) Damage to non-operational loss shall be calculated by multiplying damage of general properties (in 4. (1)) to some assumed percentage.

(4) Damage to agricultural products shall be calculated by multiplying damaged acreage (in 3. (1) - b)) to damaged cost per hectar (in 3. (6) - e)).

5. Surveying Organizations

(1) Damage to general properties (excluding non-operational loss) shall be investigated by the municipality, town and village offices under the guidance of the prefectural government.

(2) Damage to public works structures and transport, communication and power facilities shall be investigated by the prefectural governments.

(3) Unit price for general properties (in 3. (6)) shall be investigated by the River Bureau, Ministry of Construction.

(4) Percentage of damage to general properties shall be investigated by a part of the municipality, town and village offices, which have been damaged by big floods, under the guidance of the prefectural government.

(5) Flood damage investigators can be installed in the field, whenever the municipality, town and village offices may need to undertake the flood damage survey.

Recognizing the necessity, the prefectural governors will request the Director General of River Bureau, Ministry of Construction, to issue the identification cards for appointed flood damage investigators, stating the name of the surveyor, present address, status of the official or present occupation in otherwise.

6. Time for the survey

(1) Damage to general properties --- on all occasions of the flood

(2) Damage to agricultural products --- on all occasions of the flood

(3) Damage to public works structures --- after the official assessment of damage

(4) Damage to transport, communication and power facilities --- next January following the flood-happening year

(5) Unit price of general properties --- in the flood-happening year or next March

(6) Percentage of damage to general properties --- in the occurrence of big flood

7. Submission of the survey reports

The prefectural government and the municipality, town and village officies shall submit their survey reports to River Bureau, Ministry of Construction as follows:

(1) Damage to general properties ---within 45 days after the occurrence of flood

(2) Damage to public works structure ---end of next March following the flood-happening year

(3) Damage to transport, communication and power facilities--- end of next March following the flood-happening year

(4) Percentage of damage to general properties --- within four months after the occurrence of flood

8. Expenses for the survey

Expenses for the survey shall be defrayed from the appropriated national budget in the Ministry of Construction. (In 1970, the expense is allocated to ¥19,000,000)

B. DAMAGE TO GENERAL PROPERTIES

9. Damage to general properties shall be investigated by the municipality, town and village offices (hereinafter referred to as the public authorities), which were suffered from the floods already mentioned in 2. 1 of introduction.

Each items in annexed Form-1 shall be investigated by using the maps of flood damaged areas and officially prepared list of casualities or annexed Form-2 within the administrative units of the public authorities.

10. Preparations of Form-1, inquiring out the damage to general properties

(1) Causes of flood, location, casualities etc.

Rivers and coasts suffered from the flood, legal status of rivers and coasts, causes of flood, casualities of human lives and average ground surface gradient of flooding area shall be investigated.

(2) Flood damaged area

a) Flood damaged areas shall be measured by referring to the maps of flood damaged areas, which would be prepared by the public authorities, and other available informations.

b) Agricultural land area damaged by the flood shall be estimated from basic data of Ministry of Agriculture and Forestry and Agricultural Committee in the public authorities.

(3) Damage to general properties

a) Items to be investigated are as follows:

(i) Number of houses and buildings damaged, families damaged, farm and fishermen's households damaged, establishments such as manufacturing factories and work shops damaged, and persons engaged in the establishments, in accordance with flooded below the floor, flooded above the floor (1 - 49 cm, 50 - 99 cm, 100 cm over) and completely destroyed (including washed away).

The survey shall be undertaken by the officials of public authorities and newly-appointed flood damage investigators, with checking the casualities list officially prepared and direct interviews to the casualities in order to fulfill the items listed in Form-2, on preparatory inquires to general properties damage.

(ii) Floor area of damaged houses, excluding large buildings such as schools and factories, shall be estimated by multiplying the numbers of damaged

houses to an average floor area per unit which has been calculated by dividing whole floor areas by all houses within the municipality, town and village, based on Housing Survey Report.

(iii) In the case of houses flooded below the floor, number of houses shall be investigated.

11. Preparation of the maps of flood damaged areas

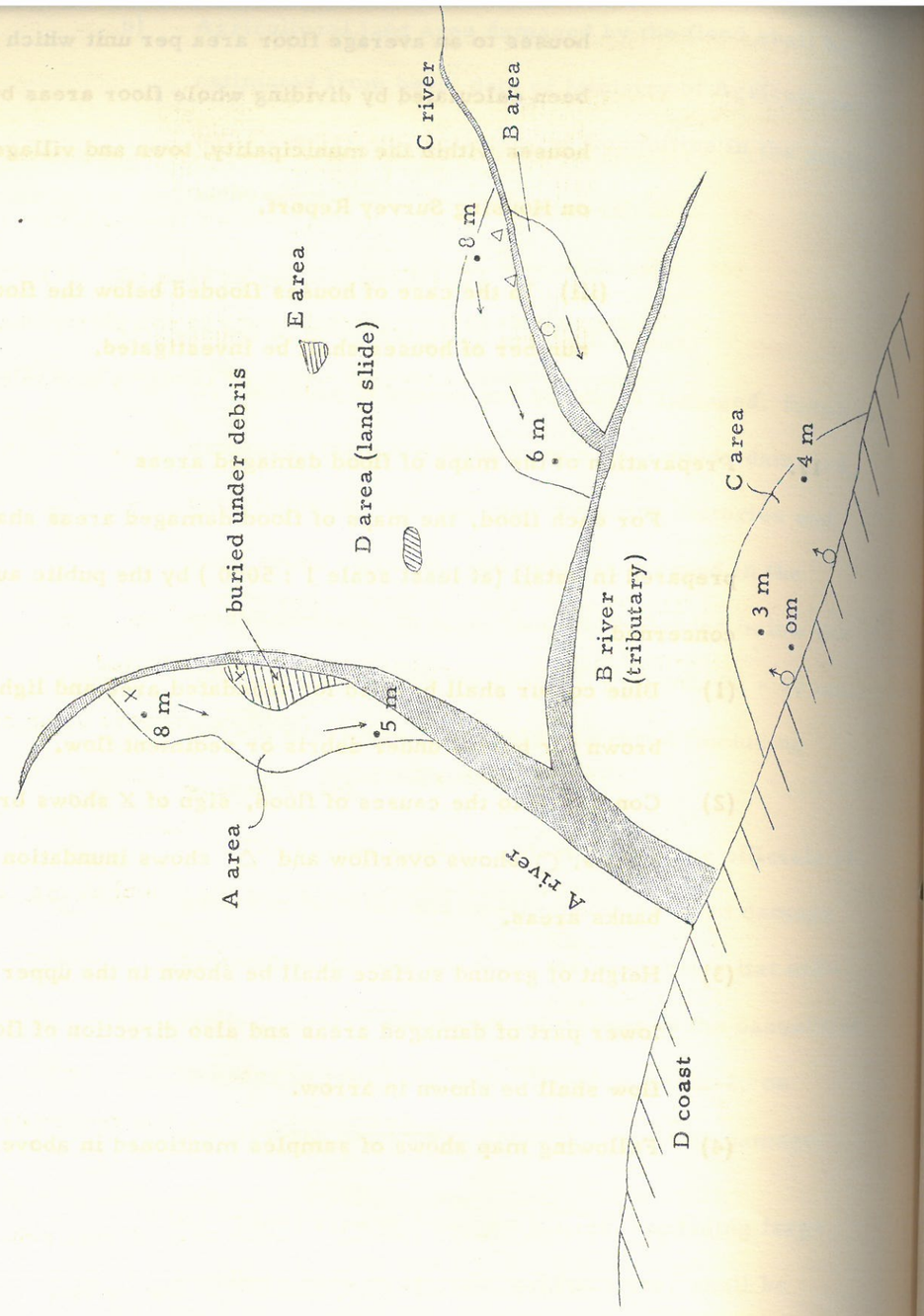
For each flood, the maps of flood damaged areas shall be prepared in detail (at least scale 1 : 5000) by the public authorities concerned.

(1) Blue colour shall be used for inundated area and light brown for buried under debris or sediment flow.

(2) Concerned to the causes of flood, sign of X shows breach of levees, ○ shows overflow and △ shows inundation in no banks areas.

(3) Height of ground surface shall be shown in the upper and lower part of damaged areas and also direction of flooding flow shall be shown in arrow.

(4) Following map shows of samples mentioned in above:



C. DAMAGE TO AGRICULTURAL PRODUCTS

12. (1) Damaged agricultural land area

Damaged area of agricultural land shall be estimated in the former chapters.

(2) Damaged cost per hectar

Damaged cost to agricultural products per hectar shall be estimated from of official report of Ministry of Agriculture and Forestry.

D. DAMAGE TO PUBLIC WORKS STRUCTURES

13. (1) The following structures shall be investigated

a) River training works, multiple purpose dams and other flood control facilities

b) Coastal protection works

c) Sabo (debris control and conservation) works, land slide protection works

d) Highway, road and bridges

e) Agricultural land

f) Irrigation and drainage facilities and reclamation structures

g) Public works facilities in the city, street, public parks, water supply, sewerage system etc.

h) Above-mentioned facilities which will be rehabilitated by the public authorities and prefectural governments alone.

(2) After the official assessment were made for rehabilitation expenses of those public works structures listed in above, the amount shall be rewritten to Form 3-1 and summed up in Form 3-2, from the informations available of the authorities concerned, by the prefectural government.

E. DAMAGE TO TRANSPORT, COMMUNICATIONS, POWER FACILITIES

14. Damage to the fixed assets (excluding land and building) and decreased sales amount due to stopping the activity in the following enterprises shall be estimated by sending the Form 4 to each president of damaged enterprises:

(1) Japan National Railway

(2) Private Railway Companies

(3) Highway transportation companies (regular service only)

(4) Japan Telegraph & Telephone Public Corporation

(5) Nine Power Companies

f. UNIT PRICE

15. This investigation shall be taken by River Bureau, Ministry of Construction, to fix the unit price which will be used to estimate the damages concerning to houses and buildings, household articles, assets of establishments (capital goods and stored goods) and assets of farm and fishermen's households (capital goods and stored goods).

Reference 1, 2 and 3 are attached to indicate the unit price in 1970.

G. PERCENTAGE OF DAMAGE

16. This investigation shall be undertaken by the public authorities which were affected seriously from big flood and also selected by River Bureau, for the same items in above.

17. Ten samples (twenty samples for houses and buildings) shall be investigated by a random sampling from the officially prepared list of casualities or annexed Form 2, according to classifying into the inundation depth.

18. Form 5 on percentage of damage to houses and buildings,

Form 6 - 1 on percentage of damage to household articles,

Form 6 - 2 on summary of percentage of damage to household articles,

Form 7 on percentage of damage to properties of establishments, and

Form 8 on percentage of damage to properties of form and fishermen's household shall be distributed to sampled houses, families and establishments

(Form 5 - 8 are not attached here with).

Form 1. Damage to general properties (classified by meteorological causes, municipalities and towns, river systems)

(1) Prefecture : municipalities, town or village

Date of flood occurrence: from (time date month) to (time date month)

Meteorological causes:

Average ground gradient:

(2) River or sea-coast damaged by flood

(a) River system (b) (c) river or coastal region

(d) Legal status (check applicable box)

☐ 1st class river ☐ 2nd class river ☐ low applied river

☐ normal river ☐ coast conservaning area ☐ other's coast

☐ land slide area ☐ low-grade mineral deposit ☐ steep slope area

(3) Causes of flood (check applicable box)

☐ overflow from bank ☐ breach ☐ inundation from no-bank area

☐ inland flooding ☐ high tide ☐ tsunami

☐ sediment flow ☐ land slide ☐ collapse of low grade mineral deposit

☐ collapse of steep slope area

(4) Casualities

Dead	missing	injured	Total

(5) Flooding area

agricultural land	others	Total	damaged cost per hectar of agricultural land
ha	ha	ha	¥

(6) Damage to general properties

	Flooded below the floor		Water depth of inundation above the floor						Completely destroyed (including washed away)	
			1 - 49 cm		50 - 99 cm		over 100 cm			
	Number	Amount of assets	Number	Amount of assets	Number	Amount of assets	Number	Amount of assets	Number	Amount of assets
(a) Houses and buildings	m^2		number m^2		number m^2		number m^2		number m^2	
(b) Household articles			family		family		family		family	
(c) Farmers & Fishermen's household	capital goods stored goods		number		number		number		number	
(d) *Establishment*										
Mining	capital goods		number		number		number		number	
	stored goods		person		person		person		person	
Construction	capital goods		number		number		number		number	
	stored goods		person		person		person		person	
Manufacturing	capital goods		number		number		number		number	
	stored goods		person		person		person		person	
Wholesale & retail	capital goods		"		"		"		"	
	stored goods		"		"		"		"	
Finance & insurance	capital goods		"		"		"		"	
	stored goods		"		"		"		"	
Sub-total of all Industries	capital goods		number		number		number		number	
	stored goods		person		person		person		person	

(7) Calculation of general property damage

	Water depth of Inundation	Amount of Assets	Percentage of Damage	Damaged Amount
(a) House and building	Flooded below the floor		0.03	
	Flooded above the floor			
	1 - 49 cm			
	50 - 99 cm			
	over 100 cm			
	Completely destroyed		1.00	
	sub-total			
(b) House hold articles	Flooded above the floor			
	1 - 49 cm		0.86	
	50 - 99 cm		0.191	
	over 100 cm		0.366	
	Completely destroyed		1.000	
	sub-total			
(c) Farmer and Fishermen's household	Flooded above the floor			
	1 - 49 cm (c)		0.156	
	(s)		0.199	
	50 - 99 cm (c)		0.237	
	(s)		0.370	
	over 100cm (c)		0.311	
	(s)		0.510	
	Completely destroyed (c)		1.000	
	(s)		1.000	
	sub-total			
(d) Establishments	Flooded above the floor			
	1 - 49 cm (c)		0.180	
	(s)		0.127	
	50 - 99 cm (c)		0.314	
	(s)		0.276	
	over 100 cm (c)		0.443	
	(s)		0.398	
	Completely destroyed (c)		1.000	
	(s)		1.000	
(e) Total (a)+(b)+(c)+(d) = (T)				
(f) Non-operational loss		(T) x 0.06		
(g) Agricultural products				
(h) Grand total (T)+(f)+(g)				

Form 2. Preparatory Note to General Property Damage Survey

Number	Name of street	Name of House-holder	Occupation	Damage to House & Building		Workshop, Shop or Business in the Damaged Houses and Buildings, if any	
				Number	Depth of Inundation (cm)	Name of Workshop	Number of Workers Engaged

From 3-1. Public Works Facilities

Data of Flood : Data Month Year 1970

Causes or Name of Flood :

	River system					
	1st tributary					
	River					
	Legal status of river					
	City, village					
(1) Rehabilitation project by national expences		No. of project	Assessed amount	No. of project	Assessed amount	No. of project	Assessed amount
(a) Ministry of Construction	1. River, flood control						
	2. Sabo works						
	3. Coast						
	4. Road						
	5. Bridge						
	Sub-total						
(b) Ministry of Agriculture & Forestry	6. Agricultural land						
	7. Agricultural facilities						

	(c) Ministry of Construction	8. Urban facilities										
	(d) Ministry of Health & Welfare	9. Water supply										
	Total											
(2)	Rehabilitation project by local government expences alone											
		1. River										
		2.										
		3.										
		4.										
		5.										
		6.										
		7.										
		8.										
		9.										
	Total											
	Grand Total											

From 3-2. Summary of Public Works Facilities Damage (Prefecture)

Causes of flood	Date of flood	River system	First tributary	River or coast	Legal status of river	City, town, village	River & Sabo works	Coastal structure	Road & bridge	Agricultural land & facilities	Urban facilities	Total

Form 4. Transport, Communication and Power Industry

Prefecture: Address of enterprise :

Name of enterprise: Enterprise (check applicable box)

☐ National Rail Way ☐ Public or Private rail way

☐ Passenger traffic ☐ Cargo traffic

☐ Telegraph and Telephone ☐ Power industries

Data of flood	Damaged places or lines	City, town, village	River system	Causes of flood	Non-Operational days	Estimated Damage Cost					
						(1) Structures	(2) Machinery Rolling stocks	(3) Stored goods	(4) Sub-total (1)+(2)+(3)	(5) Loss due to non-operation	(6) Total (4)+(5)

Reference 1. Percentage of Damage to General Properties by Flooding

	Flooded below the floor	Flooded above the floor			Sediment deposited above the floor		Completely destroyed or washed away
		less than 50 cm	50-99cm	over 100cm	less than 50cm	over 100 cm	
Houses and building : A group [1]	3	5.3	7.2	11.7	43	57	100
B group		8.3	12.6	19.2			
C group		12.4	21.0	33.0			
Household articles		8.6	19.1	36.6	50	69	100
Farm and Fishermen's household :							
Capital goods		15.6	23.7	31.1	37	45	100
Stored goods		19.9	37.0	51.0	58	69	
Industries : Capital goods		18.0	31.4	44.3	54	53	100
Stored goods		12.7	27.6	39.8	48	56	

Note: 1 A, B and C group is classified as ground surface gradient, that is, A for less than 1/1000, B for 1/1000 - 1/500 and C for over 1/500.

Reference 2. Evaluated Value of General Properties

(1) Houses and buildings

average unit cost in 1969 for all country — ¥25,300 per square meter

average unit cost in 1970 for all country — ¥28,200 per square meter

(2) Household articles

average properties in 1969 — ¥1,135,000 per household

average properties in 1970 — ¥1,249,000 per household

(3) Capital goods and stored goods of a farm and fishermen's household on 1969

capital goods — ¥477,000 per household

stored goods — ¥123,000 per household

on 1970

¥525,000 per household

¥128,000 per household

Reference 3. Capital Goods and Stored Goods per a Worker Engaged by Industries in 1970

Classified Industries		Amount of Capital Goods	Amount of Stored Goods
Mining excluding coal mining		1,810	963
Mining (coal only)		1,438	138
Construction		292	925
Manufacturing			
18 19	Food and kindred products	911	411
20	Textile mill products	513	361
21	Apparel and other finished products made from fabrics	218	194
22	Lumber and wood products	488	290
23	Furniture and fixtures	424	188
24	Pulp, paper and paper worked products	1,456	443
25	Publishing, printing and allied industry	581	165
26	Chemicals and allied industry	2,281	974
27	Petroleum and coal products	6,977	2,655
28	Rubber products	574	305
29	Leather and leather products	355	249
30	Ceramic, stone and clay products	1,070	314
31	Iron and steel	2,606	1,395
32	Nonferrous metals and products	1,825	1,511
33	Fabricated metal products	589	339
34	Machinery, excluding the next	664	827
35	Electrical machinery, equipment and supplies	507	702
36	Transportation equipment	898	1,005
37	Precision instruments	388	462

	Classified Industries	Amount of Capital Goods	Amount of Stored Goods
	38 Ordnance and accessaries	664	757
	39 Miscellaneous	595	277
	Average in manufacturing industry	941	572
G	Wholesale and retail trade		
	40 41 Wholesale trade	435	1,216
	42 Agents and brokers		-
	43 General merchandise retailers		739
	44 Retail trade dry goods, apparel and accessaries		661
	45 Food and beverage retailers		172
	46 Eating and drinking places	364	-
	47 Retail trade--cars, bycicles and carts		525
	48 Retail trade--furniture, fixture and household utensils		550
	49 Miscellaneous retail trade		441
	Average in wholesale and retail trade	404	697
H	Finance and insurance	(733)	-
I	Real estate	(733)	-
J	Transport and communication *	751	142
K	Gas	5,782	668
L	Services	733	73
M	Government Services	(733)	
	Average in whole industries	905	697

* Excluding National Railway, Big private railways and Japan Telephon and Telegraph Public Corporation.

erence 4. Unit price for agricultural product in 1970 (in ¥1,000 per ton)

rice	140	chinese cabbage	15
barley	59	cabbage	17
naked barley	63	spinach	50
wheat	62	welsh onions	45
oats	38	onions	25
buck wheat	78	Japanese radish	20
maize, dried	37	carrots	27
soybeans, dried	72	burdocks	80
red beans	144	taroes	84
broad beans, dried	59	apples	44
kidney beans, dried	110	mandarin orange	58
peanuts	294	summer orange	57
sweet potatoes	42	grapes	124
potatoes	14	peaches	74
cucumbers	60	pears	47
tomatoes	53	persimmons	71
eggplant	51	rape seed	65
pumpkins and squashes	32	konnyaku-imo	76
water melons	23	tea	644
straw berries	277	mat rush	172
peas, green	188	hemp	1,584
soybeans, green	70	japanese paper bush	268
kidney beans, green	82	japanese paper mulberry	277
		pyrethrum	327
		japanese peppermint	69
		cocoons	1,020
		barnyard millet	63

FOR PARTICIPANTS ONLY

4 October 1971

ORIGINAL : ENGLISH

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

AND

WORLD METEOROLOGICAL ORGANIZATION

Fourth session of the Typhoon Committee
4-11 October 1971
Tokyo, Japan

PROVISIONAL LIST OF PARTICIPANTS

MEMBERS OF THE TYPHOON COMMITTEE

CHINA

Representative: Mr. Tsun-Hsien Lin,
First Secretary,
Chinese Embassy, Tokyo

Alternates: Mr. Shih-Chong Lu,
Chief, Observation Division,
Central Weather Bureau, Taipei

Mr. Yung-Ting Hu,
Deputy Chief Engineer,
Taiwan Provincial Water Conservancy Bureau,
Taipei

HONG KONG

Representative: Mr. G.J. Bell,
Director, Royal Observatory,
Government of Hong Kong

Alternate: Mr. P.C. Chin,
Senior Scientific Officer,
Royal Observatory, Hong Kong

JAPAN

Representative: Dr. Shigenobu Sakano,
Engineer-General,
Ministry of Construction, Tokyo

Alternates: Dr. Ren'iti Saito,
Director of Forecast Department,
Japan Meteorology Agency, Tokyo

Dr. Ken Suda,
Telecommunication Counsellor,
Forecast Department,
Japan Meteorology Agency, Tokyo

Mr. Keiichiro Masumura,
Chief of First Research Division,
National Research Centre for Disaster Prevention,
Science and Technology Agency, Tokyo

Mr. Akira Miyazaki,
Director of River Planning Division,
River Bureau, Ministry of Construction,
Tokyo

Mr. Hiroaki Fujii,
Head, Economic Affairs Division,
United Nations Bureau,
Ministry of Foreign Affairs, Tokyo

Mr. Tatsuo Kawagoe,
Director of Planning Bureau,
Public Works Research Institute,
Ministry of Construction, Tokyo

Mr. Yutaka Inada,
Special Grade Engineer,
River Planning Division,
River Bureau, Ministry of Construction,
Tokyo

Mr. Akira Mizuno,
Head, International Cooperation Division,
Planning Bureau, Ministry of Construction,
Tokyo

Dr. Takeo Kinoshita,
Head, Hydrology Section,
River Bureau, Public Works Research Institute,
Ministry of Construction, Tokyo

JAPAN (Continued)

Experts: Dr. Kazuo Watanabe,
Chief Researcher,
Typhoon Research Laboratory,
Meteorological Research Institute,
Japan Meteorology Agency, Tokyo

Mr. Shigenori Maruyama,
Economic Affairs Division,
United Nations Bureau,
Ministry of Foreign Affairs, Tokyo

Dr. Yukio Omoto,
Head, Climatological Anomaly Laboratory,
First Research Division,
National Research Centre for Disaster Prevention,
Science and Technology Agency, Tokyo

Mr. Hiroomi Sakai,
Economic Affairs Division,
United Nations Bureau,
Ministry of Foreign Affairs, Tokyo

Mr. Koichi Matsumoto,
Economic Affairs Division,
United Nations Bureau,
Ministry of Foreign Affairs, Tokyo

REPUBLIC OF KOREA

Representative: Dr. In Ki Yang,
Director-General,
Central Meteorological Office,
Seoul

Alternates: Mr. Yeong Keun Kim,
Chief of Water Control Division,
Ministry of Construction, Seoul

Mr. Yong Dai Park,
Chief of Observation Division,
Central Meteorological Office,
Ministry of Science and Technology, Seoul

KHMER REPUBLIC

Representative: Ambassador in Tokyo

Alternate: Mr. Tang Lette,
Chief, National Meteorology Service,
Phnom Penh

LAOS

Representative: Monsieur Khamsing Xosanavongsa,
Deuxième Secretaire à l'Ambassade Royale du Laos,
Tokyo

Alternates: Monsieur Khamtanh Kanhalikham,
Directeur du Service Nationale de la
Météorologie et de l'Hydrométéorologie,
Vientiane

Monsieur Issara Sasorith,
Le Directeur du Service de l'Hydraulique
et de la Navigation,
Ministere des Travaux Publics et des Transports,
Vientiane

PHILIPPINES

Representative: Dr. Roman L. Kintanar,
Director, Philippine Weather Bureau,
Quezon City

Alternates: Mr. Alejandro B. Delena,
Director, Bureau of Public Works,
Department of Public Works and Communications,
Manila

Col. Ramon A. Makabuhay,
Office of the Executive Secretary,
Manila

THAILAND

Representative: Dr. Charoen Charoen-rajapak,
Director-General, Meteorological Department,
Office of the Prime Minister, Bangkok

Alternate: Mr. Damrong Jaraswathana,
Special Grade Engineer,
Chief of Hydrology Division,
Royal Irrigation Department,
Ministry of National Development, Bangkok

OTHER ECAFE MEMBER COUNTRIES

AUSTRALIA

Representative: Mr. R.L. Southern,
Regional Director,
Commonwealth Bureau of Meteorology,
Department of the Interior, Perth

FRANCE

Representative:

Alternates:

UNION OF SOVIET SOCIALIST REPUBLICS

Representative: Mr. A.Y. Tolkachev,
Chief, Division of Central Department,
USSR Hydrometeorological Services Office,
Moscow

UNITED STATES OF AMERICA

Representative: Mr. Grover D. Hughes,
Assistant to the Director of International Affairs, National Oceanic and Atmospheric Administration (NOAA), Department of Commerce,
Washington D.C.

Alternates: Mr. Eugene Bollay,
Program Director,
Weather Modification, NOAA,
Department of Commerce,
Boulder, Colorado

Mr. Richard A. Johnston,
Chief Asian Weather Center,
Air Weather Station,
Fuchu Air Station; Japan

Mr. Paul Moore,
Chief, Scientific Services Division,
National Weather Service,
Southern Region, NOAA,
Department of Commerce, Fort Worth, Texas

Mr. William J. Tonesk,
First Secretary and Deputy Permanent Representative of the U.S. to ECAFE,
Embassy of the United States, Bangkok

OTHER STATE

FEDERAL REPUBLIC OF GERMANY a/

Representative: Prof. Dr. Ernst Lingelbach,
Ministerial Counsellor,
Ministry of Transport, Bonn

Alternates:

UNITED NATIONS DEVELOPMENT PROGRAMME (UNDP)

SPECIALIZED AGENCIES

International Civil Aviation	Mr. F. Oliveira, Technical Officer (Meteorology), Far East and Pacific Office, Bangkok
International Telecommunication Union (ITU)	

---

a/ Participating in a consultative capacity under ECOSOC resolution 617 (XXII) of 20 July 1956.

NON-GOVERNMENTAL ORGANIZATION

Category I

League of Red Cross Societies (LRCS)	Mr. Risaburo Kiuchi, Director, Foreign Affairs Department, Tokyo, Japan

SECRETARIAT

ECAFE

Mr. Alan D. Benham	Chief, Division of Water Resources Development
Mr. M. Kawamura	Economic Affairs Officer, Division of Water Resources Development
Mr. C. Massaux	Interpreter
Mr.J. Roland	Interpreter
Mrs. F. Sala	Interpreter

WMO

Mr. Arnold Glaser	Special Assistant for World Weather Watch Management and Coordination, Geneva
Mr. D.H. Nijhoff	Chief, Section for Asia Southwest Pacific and Europe, Technical Co-operation Department, Geneva
Mr. P. Rogers	Technical Officer, Networks and Telecommunications Division, Geneva

TYPHOON COMMITTEE SECRETARIAT

Dr. S.N. Sen	Chief
Mr. C.H. Tang	Telecommunication and Electronic Expert
Mr. A. Hamamori	Hydrologist and Flood Forecasting and Warning Expert
Mr. J. Hickey	Community Preparedness/Disaster Relief Expert

COMMITTEE FOR CO-ORDINATION OF INVESTIGATION OF THE LOWER MEKONG BASIN

Mr. Surin Sangsnit	Chief Hydrometeorologist, Bangkok