UNITED NATIONS ECONOMIC AND SOCIAL COMMISSION

FOR ASIA AND THE PACIFIC

AND

WORLD METEOROLOGICAL ORGANIZATION

REPORT OF THE TYPHOON COMMITTEE

ON ITS THIRD SESSION

Bangkok, Thailand
18 - 24 November 1970

18 November 1970

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

WORLD METEOROLOGICAL ORGANIZATION

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

Your Excellencies, Ladies and Gentlemen,

It is with great pleasure that I welcome you all to this third session of the Typhoon Committee. First of all, I wish to express on behalf of all of us our deep gratitude to the Royal Government of Thailand for its generous hospitality and the excellent facilities and arrangements provided for this session. I also wish to express our deep and sincere thanks to His Excellency Lieutenant General Sawaeng Senanarong, Minister of the Prime Minister's Office, Royal Government of Thailand, for his warm words of welcome and inspiring address.

The constant threat posed by typhoons in this region is a grim reminder that man's survival is a process of constant interaction between him and nature. He must learn how to adjust and react to the forces of nature if he is to survive. To his credit, man has not only survived but has also secured a comfortable existence by means of technical and social mechanisms which have enabled him to extract from nature what he needs. But man has not completely succeeded in eliminating or taming these harmful forces which try to reduce him to his primitive state by destroying or damaging what he has painstakingly built up. Earthquakes, tornadoes, tidal waves,

/landslides,

landslides, floods, cyclones and typhoons continue to exact their heavy toll in life and property all over the world. In this region typhoons and floods steadily erode and undermine the economic progress of the countries by reducing their income by $500 million every year. All of us are now familiar with this figure, which will not remain constant but can be expected to increase with the development of the countries conce if no active measures are taken to curb such losses.

As a defence reaction to the typhoon menace, the countries concerned have organized the Typhoon Committee, which may be considered a techno-social mechanism to minimize the detrimental effects of this natural hazard. At its first session, the Typhoon Committee drew up and adopted the programme of work which it is now implementing. Understandably, this programme is technologically oriented, having been formulated by engineers and meteorologists. There is no doubt that this approach is correct. However, in the light of the most recent studies on the range of possible adjustments to natural disasters, the social or behavioural approach has been suggested as a useful, and perhaps even necessary, complement to the techno-logical approach. In contrast to the latter which attempts to manipulate nature, the behavioural approach seeks to alter human behaviour by making society spread, plan or bear the losses. Perhaps a few years from now, some other types of adjustment may be needed to meet the new requirements of the future environment.

So far, the development of human response to natural hazards may be classified in three distinct stages. They are: (1) folk or pre-industrial, (2) modern technological or industrial, and (3) comprehensive or post-industrial. Each stage comprises a distinct set of adjustments and characteristic patterns of damage occurrence.

/The accent

The accent on folk or pre-industrial adjustments is on the modification of human behaviour to place it in harmony with nature. The adjustments are often mystical and irrational, flexible and easily abandoned, but they do not need much capital and require action only by individuals or small groups so that they can be varied drastically over short distances. This is the type of response to natural disasters of people living in a primitive setting where industry and technology have not established a foothold.

Next we have the modern technological or industrial adjustments involving a limited range of technological actions which emphasize the control of nature. These adjustments are not very flexible, are difficult to change and involve a large amount of capital. They also tend to be uniform and require the co-operation of interlocking and interdependent organizations. The construction of flood control reservoirs or levees and the establishment of typhoon and flood forecasting and warning systems belong to this type of adjustment.

Finally, we have the comprehensive or post-industrial adjustments which combine features of both earlier stages so as to provide a larger range of adjustments with greater variety and flexibility as well as capital and organizational requirements.

Of course the type of adjustment which should be adopted depends on the stage of development of the country concerned, the comprehensive one being probably suitable only for highly developed countries where the losses incurred from one disaster are likely to be much higher than those which would occur in a less developed country from the same disaster.

I want to take this opportunity to mention the increasing work being done in the field of natural hazard research, which is of interest and use to the Typhoon

/Committee,

Committee, because I realize that the Committee's programme of work is a dynamic one and amenable to any new ideas which may facilitate its accomplishment. I am convinced that there are other ideas in the field of typhoon damage control which will be developed in the next few years. In the search for such ideas and developments, I am confident that the staff of the ECAFE secretariat will remain in the forefront and continue to call the attention of the Committee to the new ones as they are evolved. Being deeply involved in the economic and social development activities of the ECAFE region, I have always advocated that conservatism must be infused with pragmatism as well as with the courage to adopt enterprising and forward-looking ideas, because I believe that rapid progress can be achieved not by anchoring our minds and efforts to the traditional methods of the past but by emancipating them so as to be able to apply the innovations of to-day and anticipate the developments of the future.

I should like to take this opportunity to thank the World Meteorological Organization for its continuing co-operation and valuable contributions to the implementation of this important project. I also wish to thank the members of the ECAFE/WMO Joint Unit on Typhoons for their important collaboration in the work of the Typhoon Committee. I have been informed that the facilities for the Typhoon Committee's secretariat in the Philippines are now ready and that the ECAFE/WMO Joint Unit on Typhoons will soon transfer to its new office in that country. I should like to thank the Philippine Government for its generosity in providing those facilities.

I assure you that the transfer of the ECAFE/WMO Joint Unit on Typhoons from the ECAFE secretariat to the Philippines will not in any way affect the support and assistance which ECAFE will continue to extend to the Typhoon Committee.

I wish you every success in your deliberations.

I thank you.

UNITED NATIONS
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ANNUAL REPORT OF THE TYPHOON COMMITTEE (9 December 1969 - 24 November 1970)

INTRODUCTION

1. In accordance with article 10 of its statute, the Typhoon Committee is required to submit annual reports to participating Governments, ECAFE and WMO. This is the second annual report.

2. The second session of the Typhoon Committee was held at Quezon City, Philippines, from 2 to 8 December 1969. A brief report on this session was included in the first annual report of the Committee.

WORK OF THE TYPHOON COMMITTEE SINCE THE SECOND SESSION

3. The ECAFE/WMO Joint Unit on Typhoons, consisting of two experts (Mr. S.N. Sen, Chief of the Unit and Mr. A. Mizuno, Hydrologist and Flood Control expert), continued to function at the ECAFE secretariat as the executive body of the Typhoon Committee. An expert on Telecommunication and Electronics was appointed by WMO during the year to serve in the Joint Unit. Mr. C.H. Tang took up this post on 10 August 1970.

4. In accordance with the decision of the second session to transfer the Joint Unit from Bangkok to Manila and that it should be re-designated as the Typhoon Committee secretariat, details of facilities required at Manila have been under negotiation with the Government of the Philippines. As the third session of the Committee is to be held at Bangkok in November 1970, it

/has been

been decided to transfer the Joint Unit to Manila in early 1971.

Consequent on the decision to re-designate the Joint Unit as the Typhoon mittee secretariat, article 3 of the Statute of the Typhoon Committee had to amended. The Executive Secretary of ECAFE and the Secretary-General of took up this matter with the Governments concerned and the proposed amendment duly approved.

The first annual report of the Typhoon Committee for the year, 1969 s presented to the twenty-sixth session of ECAFE held at Bangkok from 14 to April 1970. The Commission commended the Typhoon Committee for its activities d expressed satisfaction that the secretariats of ECAFE and WMO had collaborated d co-operated in this sub-regional undertaking. The Commission also noted th appreciation the continued interest of some of the developed countries and e support they had provided.

The experts of the Joint Unit visited each of the member countries once twice during the year and had detailed discussions with the officials of the teorological and hydrological services. The current facilities for typhoon mage control were reviewed and actions were initiated for implementation of e programmes recommended by the Typhoon Committee. Progress made or actions itiated during the year under review are summarized below under the respective mponents of the Action Programme.

METEOROLOGICAL COMPONENT

. Continuing efforts were made to implement the recommendations regarding bservational and telecommunication facilities. Special attention was given o those facilities which were included in the priority list drawn up by the econd session of the Typhoon Committee. Attention was also given to the need or ensuring regular and efficient operation of the existing facilities. evelopments and actions initiated since the second session of the Committee re briefly reported below.

Observational facilities (RS/RW, radar and APT)

). The proposed RS/RW stations at Pratas and Nansha (China) were included n the priority list by both the second session of the Typhoon Committee and he last session of the Regional Association II of WMO. The Republic of China's

/request for

request for assistance under WMO VAP for establishment of these two stations was circulated by WMO and an offer to provide the equipment needed to establish the stations at Pratas was received in October 1970. At the time of preparing this document the necessary steps for the implementation of this VAP project were being taken with the donor and recipient countries. No offer has yet been received in response to the VAP request for Nansha.

10. The RS/RW station at Pohang (Republic of Korea), which had observation at 00 GMT only, introduced the recommended additional observation at 12 GMT with effect from January 1970. Both observations are now included in broadcasts from Seoul.

11. For the establishment of an RS/RW station at Vientiane (Laos), ground equipment has been offered by Finland under VAP and accepted by Laos, It was decided to provide consumable equipment for the first year of operation from WMO VAP(F). Training of two Laotian operators in operation and maintenance of Vaisata equipment was arranged at Bangkok, the cost of travel and stipend being met by WMO through its UNDP regional programme. The training commenced in July and is expected to be completed by March 1971.

12. In the Philippines, the full programme of RS/RW observations at Laoag and Zamboanga could not be introduced for want of sufficient personnel and consumable articles. RS/RW equipment for Cebu and RW equipment for Davao could not be installed and wind-finding radar at Manila could not be made operational for the same reason. A minimum network which would be more realistic was therefore considered, and a full programme of observations at Laoag, regular reception of observations from the existing United States station at Clark Air Base (near Manila) and priority establishment of RS/RW at Cebu were suggested for the Weather Bureau's consideration.

13. A weather radar was installed at Kaohsiung (China) under the UNDP Special Fund and has been operational since January 1970. SSB communication between the radar station and Taipei was established in June 1970.

/14. A 10 cm

4. A 10 cm weather radar was established at Seoul in early 1970. It was rought into regular operation with effect from 1 August 1970.

5. The construction of the radar building at Guian (Philippines) was completed nd the installation of the radar was expected to be completed by the end of 1970. t was understood from the Weather Bureau that the purchase of five additional eather radars by means of loans from the United States Import-Export Bank as under negotiation. Since the Typhoon Committee attached high priority to he establishment of radar at Basco, the USAID mission in Manila was contacted ith a view to exploring the possibility of procuring a radar through bilateral id from the United States.

6. One set of Alden APT equipment was installed at Manila and has been in egular operation since March 1970. The APT equipment installed at Bangkok was rovided by the United States under VAP assistance and has been in operation ince July 1970. APT equipment to be installed at Seoul was expected to be eceived from Japan by the end of 1970. It was noted that France had offered o provide Laos with APT equipment for Vientiane on a bilateral basis.

Ocean weather ship at 16°N, 135°E

17. In pursuance of the offer made by the USSR to station a weather ship n the Southwest Pacific, the Secretary-General of WMO took up the various recommendations made by the second session of the Committee with the USSR authorities. The Hydrometeorological Service of the USSR agreed to arrange for the weather ship to be in position from June to August 1970 and suggested that operation of a weather ship for a longer period would be possible only with support from other developed countries. The Soviet views were communicated to the member countries of the Typhoon Committee for further consideration.

18. Information was received that the Soviet weather ship had reached the recommended location and commenced its programme of observations with effect from 16 June 1970. This information was notified to the members of the Committee. The ship was in operation for a period of two months. Surface meteorological observations recorded by the ship were transmitted to Tokyo through Nagasaki and were re-broadcast from Tokyo. It was understood that since the ship had been in operation for the first time it was not possible to transmit the upper air observations.

/Exchange of

Exchange of radar fixed of typhoons

19. Arrangements were made for the continuance of the exchange programme of radar-fix messages during the typhoon season of 1970. Recommendations of the second session of the Committee concerning distribution of these messages, units used and communication arrangements were implemented. With the establishment of two additional radar at Kaohsiung (China) and at Seoul (Republic of Korea), radar-fix messages exchanged during 1970 provided a better coverage.

Telecommunication facilities

20. Thailand submitted a request for VAP assistance for telecommunication equipment worth US$578,000 for the establishment of the Regional Telecommunication Hub (RTH) at Bangkok. This request was approved by WMO for circulation to countries. Australia offered assistance equivalent to US$20,000 to provide some telecommunication equipment and WMO recently agreed to contribute up to US$50,000, out of the VAP Fund, to the cost of providing a set of HF radio transmitting and peripheral equipment. The balance of the equipment would cost about 0.5 million dollars and assistance was still needed for this.

21. The Bangkok-Hong Kong point-to-point circuit was established in June 1970 and brought into regular operation on 18 July 1970. With the establishment of this circuit, the gap in the circuit Guam-Manila-Bangkok-Hong Kong-Tokyo has been bridged, thus providing an additional facility for exchange of meteorological data among these centres. The current programme of exchanges and need for changes of schedules etc. were under review.

22. Regarding the establishment of the Bangkok-Vientiane point-to-point link, the USSR agreed to provide the terminal equipment at Vientiane as VAP assistance to Laos. The frequencies to be used for transmissions from either side have been settled and communicated to the USSR through WMO. The Soviet authorities agreed to give three months' training at Moscow to the officer in charge of the Telecommunication Section as part of the VAP assistance.

23. China (Taiwan) and Japan have planned to operate a Taipei-Tokyo point-to-point circuit through a communication satellite. It was understood that the Taiwan Provincial Weather Bureau would make necessary provision for this

/purpose in

purpose in their budget for 1972. As regards the Seoul-Tokyo point-to-point link, the Republic of Korea and Japan have agreed to use a leased circuit of the existing cable communication. The circuit is expected to be in operation from April 1971.

24. The improvement needed in the collection of observations from Pratas and Nansha was reviewed. The unsatisfactory reception at Taipei is due to low transmitter power, severe interference and poor operation. It was gathered that China would try to instal more powerful transmitting equipment at Pratas and Nansha and, if this cannot be done from national resources, it might request assistance from external sources.

HYDROLOGICAL COMPONENT

Pilot flood forecasting and warning systems

25. Further progress was made in developing comprehensive plans for pilot flood forecasting and warning systems in the key river basins selected for this purpose. The ECAFE/WMO Joint Unit assisted the countries concerned in reviewing the latest position and in initiating further action. Fresh developments under this component during the year under review are reported below:

China (Taiwan)

26. The weather radars at Kaohsiung and Hualien provide very good coverage for China (Taiwan) and the surrounding ocean areas and have been most useful in typhoon tracking and precipitation studies. The larger part of the Tan-Shui river basin, however, is located on the lee-side of the high mountains in relation to the radar beams from both the radars, and it is considered that installation of a third radar at Taipei would ensure complete coverage of the basin for flood forecasting.

27. The experts working on the UNDP/WMO project at Taipei have developed objective techniques for precipitation forecasting in relation to typhoon tracks. They intend to develop procedures for the conversion of precipitation forecasts into river flow for qualitative flood warning purposes.

28. A tentative improvement project for flood forecasting was proposed by the Provincial Water Conservancy Bureau (PWCB) in consultation with other agencies. Following discussions with the experts of the Joint Unit, PWCB

/revised this

revised this plan during 1970. The revised plan includes one additional radar at Taipei, ten telemetering rain-gauge stations, seven telemetering river-stage stations and other telecommunication facilities. It is recognized that hydrological analysis of the existing data must be carried out for developing quantitative flood forecasting procedures and for determining the exact number and locations of the additional stations. It has been decided that, for data analysis, PWCB will need technical assistance by one or two experts. The possibility of Japanese assistance in this matter has been under consideration.

Republic of Korea

29. At present, flood forecasting in the Han river basin is based solely on stage correlations. The correlations have been progressively influenced by the recent completion of dams on the north Han river and will be further affected in future by the completion of the Paldang and Soyang dams. Construction of the latter two dams was in progress during 1970.

30. There is an urgent need for the establishment of a new comprehensive plan for the flood forecasting system or for the improvement and expansion of the existing system. The provision of an expert on hydrological data analysis will be necessary to assist the Hydrology Division in analysing the available data. The training of a few Korean engineers in Hydrology and Flood Forecasting in a foreign country, such as Japan, is also urgently needed. These requirements and possible sources of assistance are under consideration.

Laos

31. The Se Bang Hieng river basin was selected for the establishment of pilot flood forecasting, but more than two-thirds of the basin area is not accessible at present. A preliminary reconnaissance of the western part of the basin was made by the Hydrologist of the Joint Unit, along with Laotian officials concerned. The Se Bang Hieng river basin has two rain-gauge stations at present, both situated on the western tributary (Se Cham Phone). River stage data at these two stations covering the last few years are available, but there are no records of discharge measurements. There are two other stream-gauging stations in the lower reach below the confluence of the Se Cham Phone and the Se Bang Hieng. The Hydrologist of the Joint Unit has made some

/hydrological

hydrological analysis with the limited data available. Preliminary computations made so far suggest that a beginning could be made by introducing flood forecasting for the Se Cham Phone and the lower reach of the Se Bang Hieng and that the system could later be expanded when implementation of facilities for the entire Se Bang Hieng basin becomes feasible.

Philippines

32. A team of nine Japanese experts carried out a comprehensive survey and study of the Pampanga river basin with a view to preparing plans for flood forecasting. The Hydrologist of the Joint Unit participated in this survey. The final feasibility report was submitted by the Japanese team to the Government of the Philippines in July 1970. For implementation of the first stage of the pilot flood forecasting system, the installation of seven telemetering rainfall and stage-gauging stations, three telemetering rainfall stations, two relay stations, one monitor and one master station has been recommended. The estimated total cost of US$225,000 includes housing facilities, equipment, installation, transportation and training. The training of two engineers in flood forecasting and three in telecommunication for three months was suggested in the survey report.

33. The possibility of further technical assistance for implementation of the project, as recommended by the survey team, has been under consideration by the Government of Japan.

Thailand

34. Further progress was made in developing a plan for establishing a pilot flood-forecasting system in the Maeklong river basin. A reconnaissance trip to the Maeklong was organized and communication by portable SSB equipment was tried out. Simulation methods for stream flow at the K10 station on the Kwae Noi river and K6 station on the Kwae Yai river have been developed by the Joint Unit on the basis of available daily rainfall data in the upper basin. Discharge correlation between the K10/K6 stations and Kanchanaburi is also being developed. The Joint Unit also assisted the Meteorological Department official concerned in studying synoptic situations and precipitation patterns associated with past floods in the Maeklong basin.

35. On the basis of the above studies, a plan incorporating minimum requirements for flood forecasting has been drawn up. According to this plan, data will be required from nine rainfall stations and three (preferably five) stage-gauging stations. Only two of these stations are equipped with telecommunication facilities; the remaining stations will have to be provided with similar facilities. The proposals are being examined by the departments concerned. The Royal Irrigation Department considered that it might be possible to meet the expenditure on equipment from national resources and that a part of the equipment could be provided from the stock already available in that department.

Complementary protective measures

36. The Typhoon Committee has not yet been able to give sufficient attention to community preparedness and disaster prevention questions. Further negotiations took place during 1970 with the League of Red Cross Societies regarding the possible provision of an expert on community preparedness to serve in the Joint Unit. It has been suggested to the LRCS that it would be valuable if the expert could be made available for short periods of one to two months from time to time to carry out surveys in countries affected by typhoons. An encouraging reply has been received from the Secretary-General of the League, who is investigating means of meeting the request of the Typhoon Committee.

37. The informative material concerning national organization for protective measures so far collected by the Joint Unit from member countries was examined, and a summary prepared for circulation to member countries. Since Japan has an elaborate organization for disaster prevention, the River Bureau of the Ministry of Construction, Tokyo, was again requested to provide a note in English summarizing the large volume of material available in the Japanese language.

TRAINING AND RESEARCH

Training of personnel

38. In connexion with the implementation of the action programmes recommended by Typhoon Committee, the need for additional trained personnel in the meteorological and hydrological services of the member countries was reviewed by the Joint Unit. China (Taiwan), the Republic of Korea, Laos, the Philippines and

Thailand need training fellowships for the training of their personnel in foreign countries. A tentative five-year plan for the training of personnel was prepared by the Joint Unit in consultation with the officials of the national services. This plan was endorsed by the third session of the Committee for further necessary action.

Training seminar on flood forecasting and warning services

39. In pursuance of the offer made by the representative of Japan at the second session of the Committee, the Government of Japan organized the second training seminar on flood forecasting and warning services at Tokyo from 15 August to 14 October 1970, entirely at its own expense. The arrangements for conducting this seminar were made by the Overseas Technical Co-operation Agency (OTCA) of the Government of Japan in collaboration with the ECAFE/WMO Joint Unit. Eight trainees from the Republic of China, the Republic of Korea, Laos, the Philippines and Thailand participated in the seminar which was designed to give greater emphasis to the practical aspects of flood forecasting and proved to be a great success.

Co-ordination of research activities

40. Information was received from the University of Hong Kong that research work connected with the experimental building at Cape D'Aguilar had been taken up by the Department of Civil Engineering.

41. A proposal submitted by the Korean Meteorological Department to WMO for assistance under the UNDP Special Fund for the establishment of a meteorological research institute at Seoul is under consideration. The project will include research related to the improvement of flood warning techniques, water conservation schemes and typhoon forecasting.

42. In a paper on "Project Stormfury, 1969", Dr. R.C. Gentry reported the results of the hurricane modification experiment conducted on hurricane Debbie on 18 and 20 August 1969. The conclusions reached in these experiments seem to be very encouraging. It is understood from the Director, National Research Centre for Disaster Prevention, Tokyo, that some thought is being given to the possibility of future experiments on typhoon modification, in connexion with activities under United States-Japan Science Co-operation.

/THIRD SESSION

THIRD SESSION OF THE TYPHOON COMMITTEE

43. 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 the Republic of China, Hong Kong, Japan, the Republic of Korea, the Philippines and Thailand as well as by the Executive Secretary of ECAFE and the representative of the Secretary-General of WMO as ex-officio members. Representatives of Australia, France, the Federal Republic of Germany, the United States and the USSR attended as observers. A representative of UNDP and observers from the International Civil Aviation Organization (ICAO) and the League of Red Cross Societies (LRCS) were also present.

44. The meeting reviewed the activities of the Typhoon Committee and the Joint Unit during 1970 and took stock of the present state of implementation of the meteorological, telecommunication, hydrological and complementary facilities required for an efficient system for the mitigation of typhoon damage. In particular, the Committee reviewed the priority list drawn up at its second session and drew up a new list taking account of the changes which had taken place in the past year.

45. The Committee reviewed the progress and significant developments in developing comprehensive plans for the establishment of pilot flood-forecasting and warning systems in key river basins of some of the member countries and discussed further action required for this purpose.

46. It also reviewed the action taken by the secretariats of ECAFE and WMO, and by the Joint Unit, on the decisions reached at the second session, including recommendations for further action where necessary.

47. The other main features of the meeting, details of which are given in the report of the session, were the decision to adopt a resolution calling for international action for the mitigation of typhoon damage and the drawing up of a programme of action for 1971. In addition, a proposal to draw up a special regional action programme for natural disaster relief was discussed.

CONCLUDING REMARKS

48. In conclusion the Committee would like to thank the Executive Secretary of ECAFE and the Secretary-General of WMO for their continued support.

49. The report of the third session of the Committee is attached as an annex to this report.

/Annex

Annex

REPORT OF THE THIRD SESSION OF THE TYPHOON COMMITTEE

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I. SUMMARY

1. The Typhoon Committee was organized at its first session at Bangkok in December 1968 by the Governments of the Republic of China, Hong Kong, Japan, the Republic of Korea, Laos, the Philippines and Thailand, with the Executive Secretary of the Economic Commission for Asia and the Far East (ECAFE) and the Secretary-General of the World Meteorological Organization (WMO) as ex officio members. The second session was held at Quezon City, Philippines, in December 1969.

2. The third session of the Committee was held at Bangkok, Thailand, from 18 to 24 November 1970 and was attended by representatives of the Republic of China, Hong Kong, Japan, the Republic of Korea, the Philippines, Thailand and observers from Australia, France, 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) and the League of Red Cross Societies (LRCS). The list of representatives is shown in appendix I of this report.

3. The session was inaugurated with the observance of one minute's silence in memory of those who had perished in the catastrophic cyclone that had devastated East Pakistan on 12 November 1970, inflicting a heavy toll in human lives and intensive damage, and in the severe typhoons that had similarly ravaged the Philippines only a few days later. The Executive Secretary of ECAFE, on behalf of the Secretary-General of the United Nations and himself, expressed his deep sympathy for the Governments and people of Pakistan and the Philippines. The members of the Committee present at the session, the representative of the Secretary-General of WMO and observers of those countries and agencies participating in the session associated themselves with that expression of sympathy.

4. H.E. Lt. Gen. Sawaeng Senanarong, Minister of the Prime Minister's Office, Government of Thailand, extended a cordial welcome to the participants. He pointed out that the solution of problems which were regional in character, such as the mitigation of typhoon damage, required regional or sub-regional action as well as imaginative innovation in developing forms of concerted action. He also stressed the need for identifying ways in which assistance from various sources could be made most effective in strengthening such

/regional

regional co-operation. He was gratified to note that the members of the Typhoon Committee were pooling their efforts and resources under the auspices of ECAFE and WMO and he assured the meeting of Thailand's readiness to co-operate in that regional undertaking.

5. U Nyun, Executive Secretary of ECAFE, welcomed the participants and thanked the Government of Thailand for its warm hospitality and the generous facilities it had provided for the session. Commenting on the programme of work of the Typhoon Committee, he suggested that its technological approach could be complemented by the behavioural approach and was convinced that new ideas in the field of typhoon damage control would likely be conceived in the next few years. He stated that conservatism must be infused with pragmatism as well as the courage to adopt enterprising and forward-looking ideas because he believed that rapid progress could be achieved, not by anchoring minds and efforts to the traditional methods of the past, but by emancipating them to apply the innovations of to-day and anticipate the developments of the future. He appealed to scientists of the world and members of the Committee to inject a sense of urgency into their endeavours to mitigate typhoon damage, and he suggested that some co-operative efforts for providing efficient relief to disaster-stricken areas in the region be arranged at suitable localities and made available at short notice. In concluding, he expressed his keen personal support for any action which might be proposed by the Committee.

6. On behalf of the Secretary-General of WMO, Dr. H. Sebastian, Director of the Technical Co-operation Department in the WMO secretariat, welcomed the participants to the third session of the Typhoon Committee and wished the meeting every success. He stressed the need for the Committee to look to the future and to determine how the programme could be further promoted over the following twelve months. In addition to the meteorological, telecommunication and hydrological facilities, he suggested that the time had come to devote more effort to the vital question of community preparedness and disaster prevention, reminding the committee that the most efficient forecasting and warning services were of little value on their own. The recent disaster in Pakistan had been an unfortunate demonstration of the need for the Committee to prosecute that part of its programme with all speed.

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7. Dr. Sebastian also spoke of the importance of training and research. An adequate typhoon-warning service could only be achieved if there were sufficient qualified staff to man the different components of the system. He hoped that the session would result in offers of help from developed countries and that full use would be made of fellowships available through UNDP and the WMO VAP. On the question of research activities, Dr. Sebastian expressed the view that the Committee's activities in that field should be expanded. He cited, in particular, the need for a co-ordinated research programme between the different centres and further proposed that the Committee might wish to suggest research topics deserving early investigation. The exchange of research scientists between different centres was also desirable. He concluded his address by emphasizing the essentially collaborative nature of the typhoon damage reduction programme.

8. The participants passed a vote of thanks to the Government of Thailand for its hospitality.

9. Dr. Charoen Charoen-rajapark (Thailand) was elected Chairman and Dr. Roman L. Kintanar (Philippines) was elected Vice-Chairman.

10. After adopting the agenda (appendix II) the activities of the Typhoon Committee during 1970 were reviewed.[a/] The present status of implementation of plans for establishing the recommended facilities were discussed and views were exchanged on ways and means of expediting the establishment of these facilities.

11. The meeting also reviewed the action taken by ECAFE, WMO and the Joint Unit on Typhoons on the decisions of the second session and provided guidance for further action where needed.[b/]

12. One half day was devoted to scientific lectures by experts from Hong Kong, Japan, the United States of America and the League of Red Cross Societies.

13. The meeting finalized the Typhoon Committee's second annual report (9 December 1969 - 24 November 1970) to be submitted to the participating Governments, ECAFE and WMO.

/14.

a/ See documents WRD/TC3/6, WRD/TC3/7 and WRD/TC3/8 as listed in appendix III.

b/ See document WRD/TC3/9 as listed in appendix III.

14. In considering other business, the members of the Committee unanimously passed a resolution on international action for the mitigation of typhoon damage proposed by the Philippine representative, discussed the need for the proper assessment of typhoon damage and expressed interest in the participation of the Khmer Republic and the Republic of Viet-Nam in its work.

15. The Committee noted with appreciation that the Government of Japan was considering the possibility of inviting the Committee to hold the fourth session in Japan in 1971.

16. The Drafting Committee, with Dr. Charoen Charoen-rajapark as its Chairman, on 23 November to finalize the draft report of the third session.

17. After the report of the session was adopted, the participants offered a vote of thanks to Thailand, ECAFE and WMO and the meeting closed on 24 November 1970.

II. ACTIVITIES OF THE TYPHOON COMMITTEE DURING 1970

(Agenda item 4)

18. The Typhoon Committee had before it detailed documents,[a/] prepared by the ECAFE/WMO Joint Unit on Typhoons and the WMO secretariat, reviewing the action which had been taken by member countries, the Joint Unit and the secretariats of ECAFE and WMO in response to the decisions adopted by the Committee at its second session. The Committee noted with satisfaction the progress made during the year in member countries and then considered in detail the following four components of the programme: meteorological, hydrological, complementary protective measures, and training and research.

A. METEOROLOGICAL COMPONENT

19. The Committee studied the progress made in observing and telecommunication facilities during 1970, as shown in the documents 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.

/20.

a/ Documents WRD/TC3/6 and WRD/TC3/7 as listed in appendix III.

20. It was noted that, in China, arrangements were proceeding for the implementation of the radiosonde/radiowind station at 46810 Pratas as the result of an offer made by the United States under the WMO Voluntary Assistance Programme. The Committee considered that the station was of special importance for typhoon forecasting and recorded its appreciation to the United States for the valuable aid it was providing. The Committee further noted that the 00 GMT radiosonde/radiowind observations at 46747 Tungkong were now being made regularly and that a newly equipped station at Taipei was expected to be completed by June 1971. The information that the weather radar at Kaohsiung, to which the Committee had assigned priority at its second session, had been brought into operation in January 1970 was also welcomed by the Committee.

21. In Japan, the JMA weather ship "Keifu-maru" (ship's call sign JBOA), stationed at 20°N and 130°E, had carried out weather and upper air observations from 20 August to 20 October 1970 and broadcast the observed data through Tokyo Sub-regional Broadcast (JMG). The recent progress in the establishment of the landline facsimile network for radar stations was also reported.

22. In the Republic of Korea, the second daily radiosonde/radiowind observation at 12 GMT had been introduced in January 1970 at 47138 Pohang. The observations were included in the broadcasts from Seoul. The 10 cm radar established at Seoul early in 1970 had been brought into regular operation with effect from 1 August 1970. It was expected that APT equipment would be installed at Seoul before the end of 1970.

23. Further progress had been made during the year in the setting up of the radiosonde/radiowind station required at 48940 Vientiane in Laos under VAP. It was noted by the Committee that the difficulties regarding the provision of expendable equipment for the operation of the station during its first year had been overcome by covering the cost from the VAP(F) contingency fund. The training of two Laotian staff in the operation

/and maintenance

and maintenance of Vaisala equipment was being carried out in Bangkok and would be completed in March 1971. The Committee expressed its satisfaction that the station at Vientiane was expected to begin its observations before mid-1971. During the discussion, the observer from France announced that the APT equipment required at Vientiane would be provided by France as bilateral aid to Laos. The Committee recorded its appreciation of that offer which would satisfy the priority requirement for that station.

24. In the Philippines, the construction of the building for the radar at Guian had been completed during the year. The Committee noted that it was expected that the installation of the radar would be completed by the end of 1970. The bringing into operation of an APT station in Manila in March 1970 fulfilled the priority request made for that station at the Committee's second session.

25. Another APT station on the priority list had been implemented at Bangkok, Thailand when the equipment provided by the United States under VAP was brought into regular operation on 1 July 1970.

26. The Committee also wished to record its deep appreciation of the assistance given by the USSR in stationing an ocean weather ship at approximately 16°N, 135°E for a period of about two months in 1970 during the main typhoon season. It expressed the hope that consideration would be given by the USSR to stationing the ship in the same area, during future typhoon seasons and stressed that the observations were of benefit not only in the typhoon area but to meteorology in general. For that reason it considered that the regular dissemination of the reports from that ship (or any other ship that might operate in the region) to all countries through the GTS was essential and, consequently, that appropriate measures should be taken to that end. The matter was given further consideration under agenda item 5.

/27.

27. The year 1970 had also seen the introduction of a number of telecommunication facilities, including some of those contained in the priority list. One important development had been the establishment of the Bangkok-Hong Kong RTT circuit which had come into regular operation in July 1970. The Committee considered that the completion of the circuit Guam-Manila-Bangkok-Hong Kong-Tokyo would greatly facilitate exchanges of data between those centres. It was also informed that considerable progress had been made towards the implementation of the Bangkok-Vientiane link with equipment to be provided by the USSR through VAP. It was expected that the circuit would become operational before mig-1971. The aid provided bilaterally by Australia and from VAP(F) for the strengthening of the RTH in Bangkok was also noted with satisfaction. Further plans were announced for the setting up of the circuits between Taipei and Tokyo in 1972, and between Seoul and Tokyo in 1971.

28. The Committee was also informed of steps taken to improve the collection of national data in the Philippines by the installation of five SSB transceivers during 1970, and that further improvements were planned from national resources in the near future.

29. Reviewing the general progress made in 1970, the Committee was of the opinion that there remained a number of facilities requiring urgent implementation. It recognized that some important improvements had taken place since its second session and that active plans had been made to introduce further facilities in the following year or two. It considered that the decision made at its previous session to draw attention to the most obvious deficiencies in the system had proved useful in securing external assistance in some cases and in procuring additional national resources in others. It was pointed out that a further concerted effort was needed to ensure the early implementation of the most important facilities.

30. The Committee accordingly decided to revise the list of priorities established at its second session in the light of the changes that had since taken place. It drew up the following list of facilities which it considered should receive first attention in the period between its third and fourth sessions.

Observing facilities

(i) Upper-air stations

No plans

46902 Nansha (China)

Already planned

46810 Pratas (China) VAP project approved for implementation

48940 Vientiane (Laos) VAP project approved for implementation

98223 Laoag (Philippines) - 12 GMT radiosonde/radiowind) } National resources

98836 Zamboanga (Philippines) - 00 and 12 GMT radiowind) }

(ii) Weather radar

No plans

Kwangju (Korea)

Vientiane (Laos)

Bangkok (Thailand)

Already planned

Basco (Philippines) National project

(iii) APT stations

No plans

Taipei (China)

Already planned

Seoul (Korea) National project

Vientiane (Laos) Bilateral project

(iv) Ocean weather station

No plans

Ship at 16°N, 135°E

Telecommunication facilities

(i) National collection facilities

Already planned

China - Improvement needed for collection of observations from Pratas and Nansha (National project)

Laos, Philippines - Improvement needed for prompt collection of national data (National project)

(ii) Regional telecommunications

Establishment of the following point-to-point links:

Already planned

Bangkok - Saigon (National/VAP project)

Bangkok - Vientiane (National/VAP project)

Taipei - Tokyo, Seoul - Tokyo (National project)

(iii) Other telecommunication facilities

Only partially planned

Thailand - Strengthening of RTH, Bangkok (National/VAP for part already planned)

31. In adopting those priorities, the Typhoon Committee wished to stress yet again the need for the full implementation of those observing programmes and telecommunications forming part of the WWW Plan. Noting with appreciation the growing contribution being made to the implementation of WWW through projects under VAP, the Committee expressed the hope that prospective donor countries would consider favourably those facilities in the priority list which, in addition to being part of the WWW Plan, could also make a major contribution to the programme for the reduction of typhoon damage.

32. Finally, the Committee requested the Joint Unit to keep in close contact with the member countries with regard to the items in the priority list and to provide them with advice and assistance in seeking aid through VAP or from other appropriate sources.

/B. HYDROLOGICAL

B. HYDROLOGICAL COMPONENT

33. The Committee learned with interest that some progress had been made in developing comprehensive plans for the establishment of pilot flood forecasting and warning systems in the key river basins selected for that purpose. Significant developments in the member countries are described below.

34. The weather radar at Kaohsiung in China (Taiwan) was made operational in January 1970. It was expected that four more telemetering rain-gauge stations in the Choshui River basin would be completed by the end of 1970 under the UNDP/WMO project. Experts of that project had developed an objective technique for qualitative and quantitative precipitation forecasting on the basis of typhoon tracks and resulting precipitation and tested it on typhoons during 1970. However, procedures for converting the precipitation forecasts into runoff for qualitative forecasting had not yet been evolved. The hydrologist of the Joint Unit had assisted the Project Manager in reviewing the requirements for developing the hydrological procedure and in preparing the terms of reference of the proposed hydrologist.

35. The Joint Unit had also sent suggestions to the Taiwan Provincial Water Conservancy Bureau (PWCB) to remedy difficulties experienced in the operation and maintenance of the telemetering rain-gauges at Hsia-liao and Ta-pao.

36. Preparation of a plan for the flood forecasting system on the Tanshui River Basin would form part of the comprehensive flood control plan for Taipei. It was envisaged that the comprehensive plan would also include evacuation and flood-fighting measures. The proposal had been approved by the Central Government and would be carried out in a period of three to four years, starting in 1971. In addition to the nine rainfall and four stage gauges already installed, ten telemetering rain-gauges, seven telemetering stage gauges, two radio-phone reporting stage gauges, two relay stations, two terminal stations and one weather radar would be installed. The estimated total cost of US$1,075,000 would be shared by the Taipei municipal, the provincial and the central governments. The preparation of the detailed plan would require the services of two hydrologists and an electronic

/engineer.

engineer. A request for the assistance of such experts had been submitted to Japan through the Japanese Embassy at Taipei and it was hoped that their services would be available in 1971. In the meantime, the necessary hydrological data were being collected and analysed so that a preliminary plan could be developed before the experts arrived. As the damage caused by typhoons in Taiwan during 1969 had been more than US$175 million (NT$7 billion) or about 4.2 per cent of the gross domestic product (GDP), the project was considered of great importance to the country.

37. The flood forecasting techniques in Japan continued to be developed progressively, with the introduction of electronic computers to speed up data analysis. Expansion of the services was being continued with improvement of facilities and further development of techniques. Flood forecasts were issued jointly by the Minister of Construction and the Director General of the Meteorological Agency, while flood-fighting warnings were issued by the Minister of Construction for rivers which he selected. In April 1970, there were eighteen rivers for which joint flood forecasts were made and eighty-seven rivers for which flood-fighting warnings were given. At the end of 1969, systems for flood forcasting and flood fighting managed by the Ministry of Construction had 219 rainfall telemeters and 207 water-level telemeters. Thirty-three rainfall telemeters and forty water-level telemeters were to be installed in 1970. In addition, the Meteorological Agency managed 247 robot gauges for meteorological observations and to render services to flood-forecasting activities. Moreover, the prefectural governors managed 107 robot rainfall gauges and 111 robot water-level gauges for flood control. Thus, flood forecasting and flood-fighting warning systems were being built up for each river, along with the appropriate legislation and organization as well as the development of electronic support systems. To improve warning techniques, the development of computer software for various kinds of runoff models for the Yodo and other rivers was being carried out.

38. Other activities in Japan under the hydrological component of the Typhoon Committee programme during 1970 had included the organization of the Second Training Seminar on Flood Forecasting and Warning from 15 August to 14 October 1970. That seminar had been attended by participants from China,

/the Republic

the Republic of Korea, Laos, the Philippines and Thailand. The team which had conducted a survey of the Pampanga River basin in the Philippines in 1969 had completed its report and recommendations for a flood forecasting and warning system on the Pampanga River basin had been submitted to the Philippine Government. The Committee noted with interest that the Government of Japan was ready to consider further technical assistance to the project, including the provision of equipment, when the necessary preparations had been made in the Philippines and a formal request had been received from the Philippine Government. Considering the urgency of the matter, the Committee welcomed the efforts of all concerned to investigate the possibility of earlier implementation of the project. It further welcomed the readiness of the Government of Japan to consider extending technical assistance, on a bilateral basis under the Colombo Plan, for the flood-forecasting and warning system for the Tanshui River in Taiwan.

39. There was a tentative plan in the Republic of Korea for telemeterizing the existing observation stations in the Han River basin. However, it was considered necessary that flood analyses be made so that key stations to be telemeterized could be selected and better procedures of flood forecasting could be developed.

40. A preliminary reconnaissance survey of the western part of the Se Bang Hieng River basin in Laos had been undertaken in March 1970 by the hydrologist of the Join Unit together with the Laotian officials concerned, and information on past floods had been collected at Savannakhet, Kengkok and Lahanam. Preliminary analyses made by the hydrologist of the Joint Unit indicated that a flood forecasting procedure could be introduced for the Se Cham Phone River and the lower reaches of the Se Bang Hieng below its confluence with the Se Cham Phone. That procedure could be expanded later when the establishment of facilities for the entire basin became feasible.

41. The final feasibility report on plans for a flood forecasting and warning system on the Pampanga River basin in the Philippines prepared by Japanese experts had been received by the Philippine Government in July 1970. Some aspects of that report, which was being studied by the Philippine Government had been explained to the officials concerned by the hydrologist

/of the

of the Joint Unit who had participated in the survey. Implementation of that project was considered to be one of the top priority projects of the Weather Bureau and the Bureau of Public Works in the Philippines. Those two agencies had agreed to establish and operate jointly the flood forecasting and warning centre in the Weather Bureau in 1971. The Philippine Government was grateful for the assistance which the Government of Japan had provided and for its favourable consideration of further assistance. However, considering the urgency of the problem, the hope was expressed that assistance could be provided for earlier implementation of the project.

42. The Thai Meteorological Department had initiated a study of the meteorological conditions and rainfall patterns associated with selected flood events in the Maeklong basin. Seven rainfall stations had been established on the upper Maeklong basin during 1970 to supplement the four hydrometeorological and four rainfall stations which had been set up before 1970. The preliminary study indicated that the highest flood frequency and the larger floods occurred in the month of August. The orographic rains during the strong southwest monsoon prevailing periods, the heavy rainfall associated with the existing equatorial trough and the heavy rainfall produced by the invading tropical storms and depressions were the three main causes producing floods over the lower Maeklong basin. The Joint Unit had made some progress in developing a comprehensive plan for the establishment of a pilot flood-forecasting system for the basin. Simulation methods for streamflow at the K10 station on the Khwae Noi River and at the K6 station on the Khwae Yai River had been developed by the Joint Unit from available daily rainfall data at several stations in the upper basin. On the basis of those studies, a plan incorporating minimum proposals for flood forecasting in the Maeklong River basin had been drawn up. Those proposals were being examined by the Royal Irrigation and the Meteorological Departments.

43. The Committee listened with interest to a report on the activities of the Mekong Committee concerning the establishment of an interim basin-wide flood-forecasting system for the high-water period of 1970 in the lower Mekong basin.

/C. COMPLEMENTARY

C. COMPLEMENTARY PROTECTIVE MEASURES

44. The Committee was informed of the activities under the above heading that had been carried out by the ECAFE/WMO Joint Unit on Typhoons during the previous year. It noted with interest that the Unit had prepared a summary of the material collected from member countries of the Typhoon Committee and that the distribution of that summary would be made to all concerned in the near future. The Committee felt that the summary would be of considerable value, particularly in those countries which had not yet prepared national disaster prevention plans. It therefore requested the Joint Unit to keep the summary under review and to supplement it as necessary in the light of any future information it might obtain.

45. Noting that negotiations with the League of Read Cross Societies for the provision of an expert in community preparedness were being pursued, the Committee appealed to the League to spare the expert services requested as soon as possible. It felt that the effects of recent typhoons in the Philippines, together with the calamitous cyclone which had struck East Pakistan only a few days before it had met, had once again underlined the vital need for effective community preparedness and disaster relief measures if human lives were to be saved and damage restricted. It further requested ECAFE and WMO to follow the matter closely in order that an early solution could be found. In that context, the Committee was informed of the plans of the Philippines for a number of pilot projects in those areas most affected by typhoons and of the need for an expert in community preparedness to advise in the setting up of those projects. It considered that, if an expert was made available by the LRCS, early attention should be given to assisting the Philippines in that way.

46. The Committee heard with interest reports from several member countries of steps they had taken in 1970 to improve the community preparedness element of the Typhoon Committee programme. Nevertheless, it was of the opinion that insufficient attention had so far been devoted to the problem. It considered that a new system of regional disaster relief was urgently needed. The measures proposed by the Committee to that end are fully reported in chapter III B of this report.

/D.

D. TRAINING AND RESEARCH

47. The Typhoon Committee reviewed the requirements of training in the fields of Meteorology and Hydrology on the basis of a tentative five-year plan[b/] submitted to the session by the ECAFE/WMO Joint Unit. The proposed plan covers training requirements in the Republic of China, the Republic of Korea, Laos, the Philippines and Thailand. The Committee recognized that the proposed training programme would be useful in submitting requests for training fellowships and also in planning recruitment of additional staff where necessary.

48. The Government of Japan had organized the second training seminar on flood forecasting and warning services at Tokyo from 15 August to 14 October 1970, mainly for the benefit of the member countries of the Tyhpoon Committee. The Committee recorded its deep appreciation to the Government of Japan for organizing that useful and successful seminar. The Committee noted with satisfaction that the hydrologist of the Joint Unit had taken an active part in the seminar.

49. The representative of WMO drew the Committee's attention to the WMO training seminar on "Tropical Analysis and Forecasting in the Tropics of Asia and the Pacific", which was to be held at Singapore in December 1970. The Committee also noted that some of the other seminars recommended by WMO Regional Associations II and V were of direct interest to the Committee. The seminar on "Tropical Cyclones and Warning Systems" was given high priority and the Committee requested the Secretary-General of WMO to organize that training seminar as soon as possible.

50. In regard to the need for collecting information on training facilities currently available in the field of hydrology, with special reference to flood forecasting (training courses, duration etc.), the representative of WMO informed the Committee that the WMO secretariat could arrange collection of the required information from the various countries.

/51.

b/ See document WRD/TC3/8 as listed in appendix III.

51. The Committee noted with interest the progress of activities under the UNDP/WMO Special Fund project "Meteorological Training and Research" in the Philippines. The representative of the Philippines informed the Committee that graduate and under-graduate courses in meteorology had been undertaken and that the Government of the Philippines had already offered a number of fellowships to students from abroad.

52. The Committee noted with appreciation a statement made by the observer from France offering assistance to Laos in meeting its entire training requirements. With reference to the proposed programme of training in meteorology to meet the most urgent requirements, the observer from France informed the Committee that, in particular, the training of one senior forecaster (three to six months) and one other professional meteorologist of under-graduate level (one year plus six months' practical training) could be taken up in 1971.

53. The Committee welcomed the statement by the representative of Japan who stated that his country would consider organizing a group training course in flood forecasting and warning during 1971. The period of training would be six months and it would cover theory and operational flood forecasting. About five trainees could be accepted for the course. Japan also offered another group training course on telecommunication, for about six months in 1971, for which a few trainees could be accepted. One or two additional fellowships might also be provided for training in meteorology provided that the trainees understood the Japanese language. Fellowships for all those trainees would be provided under the Overseas Technical Co-operation programme of Japan.

54. The Committee also welcomed the statements made by the observers from Australia, the Federal Republic of Germany and the United States who expressed their readiness to assist the member countries of the Typhoon Committee in the field of training.

/55.

55. The Committee noted with satisfaction the arrangement made for exchange of information on the results of studies on typhoons. Reference was made to the annual reports in tropical meteorology compiled by the WMO secretariat and distributed to all meteorological services. Those annual reports contained all references to research work under way or completed in that field.

56. Scientific lectures were organized during the session. Four of these lectures related to certain aspects of research activities on hurricanes and typhoons carried out in the United States, Japan and Hong Kong. The following lectures were:

(a) Disaster relief planning and preparedness, by Dr. M.F. Beltran (LRCS)

(b) Hurricane preparations, by Mr. Nels E. Johnson (United States)

(c) Typhoon forecasting in Japan, by Dr. Eizo Maruyama (Japan)

(d) Flood damage and its counter measures in Japan, by Mr. Yutaku Inada (Japan)

(e) Typhoon researches in Hong Kong, by Mr. G.J. Bell and Mr. P.C. Chin (Hong Kong).

57. The Committee directed its secretariat to arrange for the distribution of the synopsis of those lectures to all member countries.

58. The representative of Hong Kong reported on the Hong Kong Royal Observatory's plans for producing typhoon movement forecasts by various objective techniques on an operational basis with the help of a new computer to be installed in 1971. The Committee welcomed his offer to transmit typhoon forecasts obtained by different methods on an operational basis to other member countries through existing communication channels. He also stated that Hong Kong would consider providing one or two fellowships for training in objective techniques of forecasting.

59. The Committee noted with appreciation that research was being continued by the United States on hurricane modification. Encouraging scientific results had been obtained from "Project Stormfury, 1969", as reported by Dr. R.C. Gentry in a paper on the subject.

/III.

III. ACTION TAKEN ON DECISIONS OF THE SECOND SESSION AND FURTHER ACTION REQUIRED

(Agenda item 5)

A. ACTION ON DECISIONS OF THE SECOND SESSION OF THE TYPHOON COMMITTEE

60. The Committee considered the action taken by the secretariats of ECAFE and WMO and by the Joint Unit in following up the decisions made at its second session. Its study was based on a detailed document[a/] which was examined under a number of different headings. The paragraph numbers given in parentheses after the headings relate to the report of the second session.

Radiosonde/radiowind Station at Vientiane (paragraph 21)

61. Full information on the progress made in 1970 towards the implementation of the radiosonde/radiowind station at Vientiane is recorded in paragraph 23 of this report. The Committee felt that no further action was needed on that point.

Sources of assistance for new facilities (paragraphs 26, 54, 55)

62. The Committee discussed this question on the basis of a document[b/] submitted to the session. The representative of France confirmed that his Government would provide APT equipment for Vientiane as bilateral aid to Laos. The Committee also learned with interest and appreciation that the Federal Republic of Germany had increased its annual contribution to the WMO VAP(F) from US$34,648 to US$63,500. As regards requirements in the field of training, offers of assistance made by the representatives of developed countries have been reported in paragraphs 52 to 54.

63. The Committee urged once again that full use of all possible sources of assistance including UNDP and WMO VAP should be made for speedy implementation of the recommended facilities.

Priorities for implementation of observing and telecommunication facilities (paragraphs 27, 29)

64. The Committee was informed of the action taken by WMO following the drawing up of a priority list at its second session. In addition it noted the

/action taken

a/ Document WRD/TC3/9 as listed in appendix III.

b/ Document WRD/TC3/11 as listed in appendix III.

action taken by the twenty-second session of the WMO Executive Committee with appreciation. Its proposals for the revised priority list adopted at its third session are incorporated in paragraph 30 of this report.

Community preparedness expert for Joint Unit (paragraph 42)

65. The Committee's views on the early need for an expert in community preparedness, including the request made by the Philippines, are recorded in paragraph 45 of this report. In order that a solution to the problem might be found as soon as possible, it expressed the hope that WMO would bring to the notice of the LRCS immediately after its third session that the Joint Unit would be transferred to Manila in early 1971.

Training requirements of the Typhoon Committee (paragraph 48)

66. The item was considered in detail by the Committee under agenda item 4d, and the results of its discussion are recorded in paragraphs 47 to 54.

Second Training Seminar on Flood Forecasting and Warning Services (paragraph 46)

67. The Committee expressed its deep appreciation to the Government of Japan for having organized that useful seminar and for providing financial assistance towards the cost of travel and subsistence for the participants from the members of the Typhoon Committee. It also commended the ECAFE/WMO Joint Unit on Typhoons for having collaborated with the Government of Japan in organizing the seminar.

Assistance for the establishment of a flood forecasting and warning system in the Pampanga River basin in the Philippines (paragraph 53)

68. The Committee thanked the Government of Japan for the generous assistance it had extended to the Philippine Government in the survey of the Pampanga River basin and the preparation of a final feasibility report for a pilot flood forecasting and warning system. It also expressed its appreciation to Japan for considering the extension of further technical assistance for the implementation of the project.

Financing of flood forecasting and warning systems (paragraph 55)

69. As mentioned in the previous session, the initial step required under this item would be the preparation of comprehensive detailed plans for pilot

/flood forecasting

flood forecasting and warning systems for key river basins in China (Taiwan), the Republic of Korea, Laos, the Philippines and Thailand. Chapter II of this report indicates the progress made in the preparation of such plans for these five countries and the corresponding further assistance required by them.

Installation of an ocean weather ship in the Southwest Pacific (paragraphs 56-58)

70. The observer from the USSR explained to the Committee the operations that had been carried out by the USSR ocean weather ship 'Priliv' between 16 June and 16 August 1970. The ship had regularly transmitted its surface meteorological observations to coastal stations in Hong Kong and Japan. As the ship had been in operation for the first time, however, it had not been possible to transmit the upper-air observations carried out on board. In view of their value for research purposes, the Committee suggested that the USSR might kindly arrange for those observations to be made available to the Typhoon Committee secretariat for onward transmission to its members.

71. Having been informed that, in response to the wish expressed by the Committee, consideration might be given by the USSR Government to the possibility of future operation of the ship in accordance with Resolution 17 (Congress V) of WMO under decision(2), the Committee requested WMO to take the question up with the USSR with a view to finding a suitable arrangement for the continuation of those valuable observations. The USSR observer also reiterated his view that other developed countries should share in carrying out oceanic meteorological observations in that area during other periods of the year.

72. The Committee also learned with interest from a statement made by the observer from the Federal Republic of Germany that his Government would investigate the possibility of research vessels operating occasionally in the area making meteorological observations for the benefit of the Typhoon Committee countries.

Strengthening of the Joint Unit (paragraph 63)

73. The recruitment of the telecommunication/electronics expert in August 1970 was noted by the Committee with satisfaction.

/Exchange of

Exchange of radar fixes of typhoons (paragraph 66)

74. The members of the Committee expressed satisfaction with the arrangements made for exchange of radar-fix messages during the typhoon season of 1970 and decided that such exchanges should be continued. A proposal was made by one member that exchange of radar-fix messages should commence whenever a tropical storm was within the range of radar even though its eye might not be detectable. That proposal was accepted by the Committee.

Code for exchange of radar observations (paragraph 67)

75. The Committee was informed of the adoption by the twenty-second session of the WMO Executive Committee of the code for the exchange of radar observations. It considered that the question of introducing the code in Typhoon Committee countries before it became mandatory on 1 January 1972 could best be decided by the countries themselves when they had had further opportunity to study the question. The Committee requested its secretariat to consult each country on its intention in that respect before the 1971 typhoon season began.

Amendment of article 3 of Statute (paragraph 72)

76. As all the Governments of the members of the Typhoon Committee had approved the amendment of article 3 of the Statute, the article as amended and approved would read as follows:

Article 3

"The Committee shall have a technical secretary and a secretariat which will serve as its executive body. The functions and duties of the Typhoon Committee secretariat shall be determined by the Committee".

The Committee agreed that the chief of the Typhoon Committee secretariat would also serve as technical secretary to the Typhoon Committee.

Transfer of Joint Unit from Bangkok to Manila (paragraph 77)

77. In view of the steps already taken for the Unit to move to Manila in early 1971, the Committee felt that no further action was needed.

/B. ACTION

B. ACTION PROGRAMME OF THE COMMITTEE FOR 1971 AND BEYOND

78. Before discussing proposals for the action programme of the Committee for 1971, the Committee listened with interest to U Nyun, ECAFE Executive Secretary, who, in referring to the appeal which he had made at the inaugural session, suggested that the Committee consider the adoption of a special regional action programme for natural disaster relief. A possible approach would be (a) to institute appropriate machinery for advance organization of funds on the basis of voluntary contributions by all interested countries to meet the emergency requirements which would arise during disasters and (b) to set up stand-by mobile regional disaster relief units with pools of materials, equipment, experts, and other requisites to be dispatched at short notice to disaster-stricken areas under appropriate international auspices and in close co-operation with the League of Red Cross Societies. The meeting was requested to give careful thought and serious consideration to those suggestions as it was evident from recent occurrences of typhoons and cyclones that much more action than was being taken at present was needed to alleviate the suffering of victims of those calamities.

79. The Committee members supported in principle the central idea that a special regional action programme for natural disaster relief was needed and stated that the lines of action which had been suggested to carry out the idea would be conveyed to their respective Governments for careful study.

80. The Committee was grateful to the observers from Australia, France, Germany, the United States and the USSR who, while noting that the suggestions needed careful study, expressed support for the main idea behind them and stated that they would convey them to their respective Governments.

81. The Committee then gave consideration to the anticipated work programme during 1971. It was recognized that the tentative action programme approved by the Committee at its first session continued to provide the general guidelines for its future activities, but the Committee wished to concentrate on the following specific items of work during 1971:

(1) To take further measures to speed up implementation of the meteorological and telecommunication facilities included in the revised priority list adopted by the session.

/(2)

(2) To consider remedial measures for observed irregularities and delays in exchange of meteorological data through existing telecommunication circuits.

(3) With the assistance of the expert on telecommunication and electronics, to organize on-the-job training, where appropriate in the operation and maintenance of weather radar, APT, telemetering and SSB equipment.

(4) To undertake a review of current systems of dissemination of typhoon warnings within the countries and suggest improvements where necessary.

(5) To implement experimental flood forecasting in the Maeklong River basin (Thailand) on the basis of the plan already developed by the Joint Unit and also consider further refinement of the plan.

(6) To assist the Philippines in implementing the pilot flood-forecasting plan for the Pampanga River basin on the basis of the comprehensive plan recommended by the team of Japanese experts. Further assistance from Japan was expected for this project.

(7) In connexion with the proposed pilot flood-forecasting in China, analysis of hydrological data to be expedited with the assistance of an expert. An expert on electronics will also be needed to assist in the establishment of additional stations.

(8) For pilot flood-forecasting in the Han River basin in the Republic of Korea, analysis of hydrological data to be expedited with the assistance of a consultant.

(9) To continue study for first-stage flood-forecasting in the Se Cham Phone River and lower reaches of the Se Bang Hieng River (Laos) and initiate action for procurement of required equipment.

(10) To continue efforts for obtaining the services of an expert on community preparedness, and, when such an expert is available, to arrange surveys in one or two countries; the Philippines in the first instance.

(11) To assist countries in the implementation of the training programme envisaged for the first year of the five-year plan.

/(12)

(12) To take appropriate follow-up action to expedite procurement of assistance from external sources in the light of offers and suggestions made at the session.

(13) To organize, with the assistance of the member countries actively engaged in typhoon research, a review of typhoon research currently in progress and to initiate co-ordination in research plans.

(14) To keep abreast of the activities carried out or envisaged in other areas by similar bodies and to organize the exchange of information with those bodies.

82. In view of the amount of work to be accomplished that requires external assistance, the representative of China felt that a request to the UNDP (Special Fund) might be made at the earliest appropriate date for the purpose of seeking assistance for those parts of the Typhoon Committee programme which would qualify for assistance from that source under existing UNDP policies. The action required for the preparation of a request for assistance from UNDP for the implementation of the Typhoon Committee programme should be studied by the Typhoon Committee secretariat in consultation with the member countries of the Committee. On the basis of such consultations, a plan of action should be presented to the fourth session for the consideration of the Committee.

IV. ANNUAL REPORT OF THE TYPHOON COMMITTEE

(Agenda item 6)

83. As article 10 of the Statute of the Typhoon Committee stipulates that an annual report should be submitted to the participating Governments, ECAFE and WMO, the Committee finalized and adopted its annual report covering the period 9 December 1969 to 24 November 1970.

/V. ANY

V. ANY OTHER BUSINESS
(Agenda item 7)

Invitation to the Khmer Republic and the Republic of Viet-Nam to participate in the work of the Typhoon Committee

84. Several participants suggested that it would be appropriate to make a new approach to the Khmer Republic and the Republic of Viet-Nam to take part in the activities of the Typhoon Committee. The members of the Committee expressed the hope that those two countries, which are also affected by typhoons, would now be interested in participating in the work of the Typhoon Committee. It accordingly requested ECAFE and WMO to raise the matter with those two countries.

Assessments of typhoon damage

85. The Committee's attention was called to the decision of the twenty-second session of the WMO Executive Committee stressing the need for WMO members to make systematic assessments of the cost of tropical storm damage to national economies. The Executive Committee had recognized that such storms had serious economic consequences, particularly in developing countries, and that detailed information on the cost of the damage was frequently lacking. It had therefore suggested that such assessments be made and that they include, wherever possible, information on the cost to the various sectors of the economy, such as agriculture, industry and transport. Noting that studies of that kind had already been, and were being carried out for some areas of the world, the Executive Committee requested the Secretary-General to collect from members concerned copies of official surveys of the cost of tropical storm damage and, upon request, to make that information available to interested members.

86. The Typhoon Committee was informed that a request for such information would soon be sent to its members. It decided to request its members to take any appropriate action possible in the meanwhile and to collaborate fully in providing that important information.

/Appeal to

Appeal to the United Nations General Assembly

87. The representative of the Philippines, deeply grieved over the devastation and suffering caused by the recent cyclone in Pakistan, and typhoon PATSY which struck the Philippines during the second day of the Committee's meeting, appealed to the members to pass a resolution which he proposed for international action to mitigate typhoon and cyclone damage. Every participant in the meeting expressed his deepest sympathy for the victims of those disasters.

88. During the discussion on the draft resolution, attention was drawn to resolution 1721 (XVI) of the United Nations General Assembly which called upon all Member States, the World Meteorological Organization and other agencies to advance the state of atmospheric sciences, including the possibility of weather modification. Reference was also made to resolution 1802 (XVII) in which the United Nations noted the initial response of the World Meteorological Organization and further invited the International Council of Scientific Unions (ICSU) to expand a programme of atmospheric science research.

89. It was noted that the above resolutions had resulted in WMO adopting a World Weather Watch programme and in a Global Atmospheric Research Programme being organized jointly by WMO and ICSU. The Typhoon Committee was of the opinion that the recent disasters in Pakistan and the Philippines had underlined the need for urgent action on some aspects of those programmes. That action should not only consist of accelerated research into typhoons and the possibility of modifying them to reduce destructive potential; there was also an urgent need to obtain basic data and to take those protective measures which would enable many lives to be saved while the research was being undertaken.

90. The resolution, unanimously approved by the Committee, is given in appendix IV.

VI. DATE AND PLACE OF THE FOURTH SESSION
(Agenda item 8)

92. The representative of Japan informed the Committee that his Government was considering the possibility of inviting the Committee to hold its fourth session in Japan in 1971. The Committee expressed its appreciation to the Government of Japan for its kind gesture.

/Appendix I

Appendix I

LIST OF PARTICIPANTS

MEMBERS OF THE TYPHOON COMMITTEE

CHINA

Representative: Mr. Chu-Hsun Ling, Counsellor, Embassy of the Republic of China, Bangkok

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

Mr. Ke-Hsun Chi, Supervising Meteorologist, Taiwan Provincial Weather Bureau, Taipei, Taiwan

Mr. Andrew J.P. Shen, Second Secretary and Deputy Permanent Representative to ECAFE, Embassy of the Republic of China, Bangkok

HONG KONG

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

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

JAPAN

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

Alternates: Mr. Hiroaki Tamamitsu, First Secretary, Embassy of Japan, Bangkok

Mr. Hiromoto Seki, Second Secretary and Alternative Permanent Representative to ECAFE

Dr. Eizo Maruyama, Senior Technical Staff, Shipping Operation Division, Marine Department, Japan Meteorological Agency, Tokyo

REPUBLIC OF KOREA

Representative: Mr. Hyeong Jin Son, Research Officer, Research and Development Department, Central Meteorological Office, Seoul

/PHILIPPINES

PHILIPPINES

Representative: Dr. Roman L. Kintanar, Director, Weather Bureau, Manila

Adviser: Dr. Ian E.M. Watts, Project Manager of the UNDP-assisted Training and Research Project in the Philippines

THAILAND

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

Alternates: Captain Prasert Soontarotok, R.T.N., Deputy Director-General, Meteorological Department, Office of the Prime Minister, Bangkok

Mr. Damrong Jaraswathana, Special Grade Engineer, Head of Hydrology Section, Survey Division, Royal Irrigation Department, Ministry of National Development, Bangkok

Commander Dumrong Chareonsook, R.T.N., Chief of Hydro-meteorological Division, Meteorological Department, Office of the Prime Minister, Bangkok

Mr. Thongterm Yuktanuntana, First Grade Engineer, Hydrology Section, Survey Division, Royal Irrigation Department, Ministry of National Development, Bangkok

Dr. Wiroj Sangvaree, Second Grade Engineer, Hydrometeoro-logical Division, Meteorological Department, Office of the Prime Minister, Bangkok

OTHER ECAFE MEMBER COUNTRIES

AUSTRALIA

Representative: Mr. Rex Falls, Meteorologist (Northern Territory Regional Office), Commonwealth Bureau of Meteorology, Darwin

FRANCE

Representative: Mr. R. du Chaxel, Chief Meteorological Engineer, Paris

Alternate: Mr. Michel Auchère, Permanent Representative to ECAFE, French Embassy, Bangkok

/UNION OF

UNION OF SOVIET SOCIALIST REPUBLICS

Representative: Mr. A.Y. Tolkachev, Chief, Division of Research Missions and Hydrometeorological Regime, Central Department of the USSR Hydrometeorological Services Office, Moscow

Alternate: Mr. V.N. Voronin, Attaché, Assistant Permanent Representative to ECAFE, USSR Embassy, Bangkok

UNITED STATES OF AMERICA

Representative: Mr. Nels E. Johnson, Director, International Affairs, National Oceanic and Atmospheric Administration, Department of Commerce, Washington, D.C.

Alternates: Mr. John Kinney, Director, Joint Typhoon Warning Center, Fleet Weather Center, Guam

Mr. William J. Tonesk, First Secretary and Deputy Permanent Representative to ECAFE, American Embassy, Bangkok

OTHER STATE

FEDERAL REPUBLIC OF GERMANY[a/]

Representative: Prof. Dr. Ernst Lingelbach, Ministerial Counsellor, Ministry of Transport, Bonn

Alternate: Mr. Ingo von Ruckteschell, Counsellor (Economics), Embassy of the Federal Republic of Germany, Bangkok

UNITED NATIONS DEVELOPMENT PROGRAMME (UNDP)

Mr. Wali-Shah Wali, Regional Representative, Bangkok

SPECIALIZED AGENCY

International Civil Aviation Organization (ICAO)	Mr. F.A.L. Oliveira, Technical Officer (Meteorology), Far East and Pacific Office, Bangkok

NON-GOVERNMENTAL ORGANIZATION

Category I

League of Red Cross Societies (LRCS)	Dr. Mariano F. Beltran, Director of Disaster Preparedness and Relief Service of the Philippines National Red Cross, Manila

/ECAFE

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a/ Participating in a consultative capacity under ECOSOC resolution 617 (XXII) of 20 July 1956.

SECRETARIAT

ECAFE

U Nyun	Executive Secretary
Mr. P.T. Tan	Chief, Division of Water Resources Development
Mr. A.D. Benham	Senior Economic Affairs Officer, Division of Water Resources Development
Mr. A.S. Manalac	Economic Affairs Officer, Division of Water Resources Development

WMO

Dr. H. Sebastian	Director, Technical Co-operation Department, Geneva
Mr. P. Rogers	Technical Officer, Networks and Telecommunications Division, Geneva

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ECAFE/WMO Joint Unit on Typhoons

Dr. S.N. Sen	Chief
Mr. A. Mizuno	Hydrologist and Flood Forecasting and Warning Expert
Mr. C.H. Tang	Telecommunication and Electronic Expert

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

Mr. Surin Sangsnit	Chief Hydrometeorologist, Bangkok

Appendix II

AGENDA

1. Opening of the session
2. Election of the chairman and vice-chairman
3. Adoption of the agenda
4. Activities of the Typhoon Committee during 1970
   - (a) Meteorological component
   - (b) Hydrological component
   - (c) Complementary protective measures
   - (d) Co-ordination of training and research activities
5. Action taken on decisions of the second session and further action required
6. Annual report of the Typhoon Committee
7. Any other business
8. Date and place of the fourth session
9. Closure of the session

/Appendix III

Appendix III

LIST OF DOCUMENTS

No.	Title
WRD/TC3/1	Provisional agenda
WRD/TC3/2	Annotated provisional agenda
WRD/TC3/3	Note on the session
WRD/TC3/4	Tentative programme of the meeting
WRD/TC3/5	Provisional list of documents
WRD/TC3/6	Activities of the Typhoon Committee during 1970 (agenda item 4)
WRD/TC3/7	Status of meteorological network and telecommunication systems (agenda item 4a)
WRD/TC3/8	Training requirements of the Typhoon Committee (agenda item 4d)
WRD/TC3/9	Actions on decisions of second session of the Typhoon Committee (agenda item 5)
WRD/TC3/10 & Corr. & Add.1	Draft annual report of the Typhoon Committee (agenda item 6)
WRD/TC3/11	Assistance required for implementation of Typhoon Committee's programmes (agenda item 5)
WRD/TC3/12	Report on feasibility survey for the establishment of comprehensive plan of the flood forecasting and warning system in the Pampanga River basin in the Philippines
WRD/TC3/13	Flood forecasting warning and flood fighting
WRD/TC3/14	Flood forecasting, warning and flood defence in the Yodo
WRD/TC3/15	Flood damage and its counter-measures in Japan
WRD/TC3/16	Studies on wind damages by typhoon in Japan
WRD/TC3/17	Typhoon forecasting and warning in Japan

/Appendix IV

Appendix IV

RESOLUTION ON INTERNATIONAL ACTION FOR
THE MITIGATION OF TYPHOON DAMAGE

The Typhoon Committee,

Considering the uncounted millions of human lives that have fallen victims to the natural calamity called typhoon or hurricane or cyclone,

Further considering the millions bereaved of their loved ones or who have suffered from this scourge in all ages in human history,

Knowing that this suffering will continue undiminished until man himself will choose to reduce it,

Believing that man's present scientific and technological capability that has conquered space could well conquer this environmental scourge, if dedicatedly applied towards this end,

Further believing that man, after all, is expending much of his resources and energies to less humanitarian activities,

Noting General Assembly Resolutions 1721 (XVI) and 1802 (XVII) as well as the work being undertaken in response to them,

Appeal to the United Nations General Assembly to consider setting up, as a matter of urgency, of appropriate mechanism and seeking contributions for the specific purpose of mobilizing capable scientists, technologists and pertinent resources from any or all nations towards obtaining basic data, construction of protective measures and 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;

Appeal also to nations to make all possible efforts including direction of men and resources in support of this endeavour.

. . . . .

FOR PARTICIPANTS ONLY
WRD/TC3/1
24 August 1970
ORIGINAL : ENGLISH

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

AND

WORLD METEOROLOGICAL ORGANIZATION

Third session of the Typhoon Committee
18-24 November 1970
Bangkok, Thailand

PROVISIONAL AGENDA

1. Opening of the session
2. Election of the chairman and vice-chairman
3. Adoption of the agenda
4. Activities of the Typhoon Committee during 1970
   (a) Meteorological component
   (b) Hydrological component
   (c) Complementary protective measures
   (d) Co-ordination of training and research activities
5. Action taken on decisions of the second session and further action required
6. Annual report of the Typhoon Committee
7. Any other business
8. Date and place of the fourth session
9. Closure of the session

FOR PARTICIPANTS ONLY
WRD/TC3/2
24 August 1970
ORIGINAL : ENGLISH

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST
AND
WORLD METEOROLOGICAL ORGANIZATION

Third session of the Typhoon Committee
18-24 November 1970
Bangkok, Thailand

ANNOTATED PROVISIONAL AGENDA

1. Opening of the session

The third session of the Typhoon Committee will be held from 18 to 24 November 1970 at Sala Santitham, headquarters of the Economic Commission for Asia and the Far East, Bangkok.

2. Election of the chairman and the vice-chairman

Rule 6 of the Rules of Procedure 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 opening of the session.

3. Adoption of the agenda

The provisional agenda was prepared after consultation between ECAFE and WMO giving due consideration to the advice of the ECAFE/WMO Joint Unit on Typhoons 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. Activities

4. Activities of the Typhoon Committee during 1970

A tentative action programme on typhoon-damage control was endorsed by the Typhoon Committee at its first session held in December 1968. The programme included improvements of meteorological, hydrological and other facilities urgently required to mitigate typhoon damage in the region. The task of following up and assisting the members of the Typhoon Committee in the implementation of this programme was assigned to the ECAFE/WMO Joint Unit on Typhoons. The activities of the Typhoon Committee and the ECAFE/WMO Joint Unit during 1969 were reviewed at the second session of the committee held in December 1969. A similar review of the activities during 1970 will be made under this item on the basis of a report prepared by the Joint Unit.

Document (WRD/TC3/6) describes the activities of the Typhoon Committee and the ECAFE/WMO Joint Unit during 1970. The document contains separate sections dealing with different components of the action programme, viz (1) the meteorological component, (2) hydrological component, (3) complementary protective measures and (4) co-ordination of training and research activities.

(a) Meteorological component

The document on activities during 1970 will provide information on further progress made towards improvement of meteorological network and telecommunication facilities with special reference to those facilities which were included in the priority list drawn up at the second session of the Committee.

An up-to-date statement WRD/TC3/7 on the establishment of meteorological network and telecommunication systems forming part of the World Weather Watch and the plans already drawn up for further implementation in the near future will be presented by the WMO secretariat as at the previous sessions of the Committee. This will facilitate a review of the present status of implementation of plans for establishing the recommended facilities.

(b) Hydrological component

The objective of this component of the action programme was 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,

Laos, the Philippines and Thailand. Progress made towards development of a comprehensive plan for pilot flood forecasting and warning in each of the countries and steps taken for data analysis are reported in the document on activities during 1970 (WRD/TC3/6). The representatives of the member countries concerned may wish to supplement the information and exchange views on ways and means for expediting the establishment of pilot flood forecasting and warning systems.

(c) Complementary protective measures

Efforts made by the Joint Unit in collecting information from member countries on national plans relating to protective measures and steps taken for obtaining the services of an expert on community preparedness may be reviewed. The participants may wish to give information on latest disaster prevention activities in their respective countries.

(d) Co-ordination of training and research

In a separate document (WRD/TC3/8), an estimate of the training requirements in the fields of meteorology and financial assistance (fellowships) needed for this purpose during the next five years will be presented. This will facilitate a review of the present inadequacy of trained personnel in some of the member countries and of the additional training facilities required in connexion with the implementation of the Typhoon Committee's programmes. Arrangements made for exchange of information on latest research studies on typhoons, flood forecasting, etc., may also be discussed under this item. Participants may wish to give information on plans for strengthening research activities in their respective countries.

In reviewing each component of the action programme separately, the Committee will be in a position to assess the progress made since its second session. The representatives of the participating Governments may wish to comment on the report of the activities during 1970, offer suggestions to accelerate the work and draw attention to special items which call for priority action. They may also report on the establishment of any additional facilities in their respective countries during 1970, if not covered in the documents presented under this item.

5. Action

5. Action taken on decisions of the second session of the Typhoon Committee and further action required

The Typhoon Committee made a member of recommendations at its previous sessions for action to be taken either by ECAFE or WMO, or by the Joint Unit on Typhoons. The action taken to follow up some of these recommendations is reported under agenda items 4 and 6, but not all the recommendations are covered by specific items of the agenda. The purpose of this item is to provide the Committee with a review of the action taken in response to the decisions reached at its second session. Suitable cross-reference to other items on the agenda will be made where appropriate. The review will also include information on assistance (financial or technical) provided or offered to the member countries of the Typhoon Committee. Listing of the recommendations in a separate document (WRD/TC3/9) together with information on action so far taken will enable the Committee to review the latest position in regard to each recommendation.

This item will also provide an opportunity for consideration of a number of activities which, though not undertaken in direct response to decisions of the Committee, have made or will make valuable contributions to its objectives.

It is thought that the committee will wish to consider to what extent its decisions have been fulfilled and, where necessary, make new proposals designed to complete or accelerate the desired action.

6. Annual report of the Typhoon Committee

Article 10 of the Statute of the Typhoon Committee states, "The Committee will submit annual reports to participating governments, the Commission and the World Meteorological Organization". The draft annual report of the Typhoon Committee for the period December 1969 to November 1970 (document WRD/TC3/10) will be prepared by the ECAFE/WMO Joint Unit on Typhoons and presented at the session for completion and approval.

7. Any other business

Any matters not included in the agenda which the Committee may wish to consider will be discussed under this item.

/8. Date and

8. Date and place of the fourth session

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

9. Closure of the session

FOR PARTICIPANTS ONLY
WRD/TC3/3
24 August 1970
ORIGINAL:ENGLISH

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

WORLD METEOROLOGICAL ORGANIZATION

Third session of the Typhoon Committee
18-24 November 1970
Bangkok, Thailand

NOTE ON THE SESSION

Background

1. At its twentieth session in March 1964, the Economic Commission for Asia and the Far East, recommended that the secretariat, in co-operation with 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 secretariats of ECAFE and WMO 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,

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 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 the Economic Commission for Asia and the Far East at its twenty-fourth session held at Canberra in April 1968 and by the Executive Committee of the World Meteorological Organization at its twentieth session at Geneva in June 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, e.g. China, (Taiwan) Kong 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 first-year implementation of its programme and decided to establish its secretariat in the Philippines. This third session is being convened in accordance with the rules of procedure of the Committee which state that the Committee shall hold at least one session annually.

Programme

5. After electing a chairman and vice-chairman, the meeting will review the progress of the work undertaken by the member countries with the assistance of the ECAFE/WMO Joint Unit on Typhoons. It will also discuss measures required to accelerate the implementation of the work programme of the Committee.

Participation

6. Invitations have been sent to the following Governments participating in the Typhoon Committee: China (Taiwan) Hong Kong, Japan, the Republic of Korea, Laos, the Philippines and Thailand. In addition, Australia,

/France,

France, the Federal Republic of Germany, the Netherlands, the USSR, the United Kingdom and the United States of America have been invited to send observers in view of their interest in the programme of the Committee. ICAO, ITU and the League of Red Cross Societies have also been invited to send observers.

Climate

7. The climate of Bangkok during November is usually humid and warm with occasional showers. The mean daily temperature is 26.9°C (80.4°F) with an average daily maximum of 31°C (87.8°F) and average daily minimum of 23°C (73°F) . The mean monthly rainfall is 46 mm (about 1.9 inches)

Passports and visas

8. Each participant is required to possess a valid passport and visa for entry to Thailand. Visas are obtainable at any Thai diplomatic or consular mission abroad. Where there is no Thai diplomatic representation at the point of departure, a request for a visa may be made through the ECAFE secretariat, provided application is made well in advance of the meeting and the application is accompanied by information as to flight number and arrival date. In such cases arrangement will be made with the Ministry of Foreign Affairs to furnish visas on arrival at Bangkok Airport.

Health requirements

9. Vaccination against smallpox (within the last three years but not less than two weeks before departure) and inoculation against cholera (two injections six days apart within the last six months) are required. Participants are advised to consult travel agencies in their home towns at least two weeks in advance of departure, in order to obtain the latest information in regard to health requirements.

Foreign exchange

10. Participants are advised to bring with them pound sterling or US dollar travellers cheques or bank drafts exchangeable for Thai currency at the rates prevailing during their visit. Rates fluctuate slightly from time to time,

/the

the current rates being approximately 20 baht to the US dollar and 49 baht to the pound sterling.

11. Exchange facilities are available at hotels as well as the Sala Santitham Branch of the Siam Commercial Bank which is open from 0900 to 1200 and from 1300 to 1500 hours from Monday to Friday, with the exception of official holidays.

Hotel accommodation

12. Accommodation will be reserved on request at one or other of the under-mentioned hotels, all of which are in close proximity to Sala Santitham and for that reason recommended. Special tariffs available to participants are as follows:

Royal Hotel

Single room .....Baht 120
Double room .....Baht 190

Viengtai Hotel

Single room .....Baht 100
Double room .....Baht 140

Majestic Hotel

Single room .....Baht 100
Double room .....Baht 200

Thai Hotel

Single room .....Baht 120
Double room .....Baht 160

RS Hotel

Single room .....Baht 120
Double room .....Baht 180

13. The rates quoted are for air-conditioned rooms. Charges for meals are additional and may amount to 100 baht a day or more. Room rents and meal charges are subject to a 10 per cent service charge, except at the Viengtai and Thai hotels where the rates quoted are inclusive of service. Room rents are subject to alteration without notice.

/14. Participants

14. Participants wishing the secretariat to reserve rooms for them at any of the above hotels are requested to fill in the attached schedule of arrival and hotel accommodation form and send it as soon as possible to the Division of Water Resources Development, ECAFE, Sala Santitham, Bangkok.

Reception on arrival

15. Provided sufficient notice is given, participants will be met on arrival at Bangkok Airport by a member of the secretariat who will assist them in complying with customs and immigration formalities and arrange for transport to their hotels.

Transport

16. Cars will be provided to transport participants from their hotels to Sala Santitham and to return them at the conclusion of each meeting. As there are sometimes heavy demands on transport in the evening, participants are requested not to rely entirely on official transport on returning to their hotels. The usual taxi fare from Sala Santitham to any of the hotels mentioned above is 5-7 baht.

Credentials

17. Participants are requested to bring their official credentials, duly signed by the appropriate authority of their home country, and present them to the Conference Officer when registering prior to the inaugural meeting.

Working languages

18. The working languages of the meeting will be English and French.

Documents

19. As the number of copies available for distribution at the Conference 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.

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

AND

WORLD METEOROLOGICAL ORGANIZATION

THIRD SESSION OF THE TYPHOON COMMITTEE

18-24 November 1970

Bangkok, Thailand

1. Schedule of arrival

Name _____
(surname first)

accompanied by Mr., Mrs., Miss _____

will arrive Bangkok Airport at _____hours, on _____1970
(date)

on board _____
(Flight No.)

_____ _____
(Date) (Signature)

---

2. Hotel accommodation

Name _____
(Surname first)

accompanied by Mr., Mrs., Miss _____

wishes to reserve a single/double room at _____Hotel

from _____to _____
(date (date)

_____ _____
(Date) (Signature)

FOR PARTICIPANTS ONLY

WRD/TC3/4
6 November 1970

ORIGINAL : ENGLISH

ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

WORLD METEOROLOGICAL ORGANIZATION

Third session of the Typhoon Committee
18-24 November 1970
Bangkok, Thailand

TENTATIVE PROGRAMME OF THE MEETING

18 November - Wednesday: Registration.

10.00-12.30: Opening of the session

1. The Executive Secretary of ECAFE invites His Excellency Lt. General Sawaeng Senanarong, Minister of the Prime Minister Office to deliver the opening address.

2. Opening address by H.E. Lt. General Sawaeng Senanarong.

3. Statement by U Nyun, Executive Secretary of ECAFE.

4. Statement by Dr. H. Sebastian, Representative of the Secretary-General of WMO.

5. Vote of thanks.

6. Participants are requested to remain in their places while U Nyun introduces them to H.E. Lt. General Sawaeng Senanarong.

Recess - 30 minutes

/Technical

Technical Session

1. Election of the chairman and vice-chairman.

2. Adoption of the agenda (WRD/TC3/1).

3. Discussion of agenda item 4:
Activities of the Typhoon Committee during 1970 (WRD/TC3/7).

14.30-17.00: Discussion of agenda item 4 (continued):

4(a) Meteorological component (WRD/TC3/6 and WRD/TC3/7)

4(b) Hydrological component (WRD/TC3/6).

19 November - Thursday

09.30-12.30: Discussion of agenda item 4(b) (continued):

4(c) Complementary protective measures

4(d) Co-ordination of training and research activity (WRD/TC3/8).

14.30-17.00: Discussion of agenda item 4(d) (continued).

Discussion of agenda item 5:

Action taken on decisions of the second session and further action required (WRD/TC3/9 and WRD/TC3/11).

20 November - Friday

09.30-12.00: Discussion of agenda item 6:

Annual report of the Typhoon Committee (WRD/TC3/10).

Discussion of agenda item 7:

Any other business.

Discussion of agenda item 8:

Date and place of fourth session.

14.00-17.00: Scientific session.

/21 November

21 November - Saturday

09.30-12.00: Closed session (to be attended only by members of Typhoon Committee).

Afternoon: Free

22 November - Sunday: Free

23 November - Monday

09.30-12.30: Consideration of the draft report.

14.30-17.00: Consideration of the draft report (continued).

24 November - Tuesday

10.00-12.00: Adoption of the Committee's report.

Closing of the session.

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FOR PARTICIPANTS ONLY

WRD/TC3/5
6 November 1970

ORIGINAL : ENGLISH

ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

AND

WORLD METEOROLOGICAL ORGANIZATION

Third session of the Typhoon Committee
18-24 November 1970
Bangkok, Thailand

PROVISIONAL LIST OF DOCUMENTS

	Title	No.
1.	Provisional agenda	WRD/TC3/1
2.	Annotated provisional agenda	WRD/TC3/2
3.	Note on the session	WRD/TC3/3
4.	Tentative programme of the meeting	WRD/TC3/4
5.	Provisional list of documents	WRD/TC3/5
6.	Activities of the Typhoon Committee during 1970 (agenda item 4)	WRD/TC3/6
7.	Status of meteorological network and telecommunication systems (agenda item 4a)	WRD/TC3/7
8.	Training requirements of the Typhoon Committee (agenda item 4d)	WRD/TC3/8
9.	Actions on decisions of second session of the Typhoon Committee (agenda item 5)	WRD/TC3/9
10.	Draft Annual Report of the Typhoon Committee (agenda item 6)	WRD/TC3/10
11.	Assistance required for implementation of Typhoon Committee's programmes (agenda item 5)	WRD/TC3/11
12.	Draft Annual Report of the Typhoon Committee (agenda item 6)	WRD/TC3/10 Corr. & Add.1

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FOR PARTICIPANT ONLY

WRD/TC3/6
9 October 1970

ORIGINAL : ENGLISH

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

WORLD METEOROLOGICAL ORGANIZATION

Third Session of the Typhoon Committee
18-24 November 1970
Bangkok, Thailand

ACTIVITIES OF THE TYPHOON COMMITTEE DURING 1970

(Agenda item 4)

Note by the ECAFE/WMO Joint Unit on Typhoons

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I. SECOND SESSION OF THE TYPHOON COMMITTEE

The second session of the Typhoon Committee was held at Quezon City, Philippines, from 2 to 8 December 1969. It was attended by representatives of all the seven members countries. Representatives of Australia, France, the Federal Republic of Germany and the United States of America attended as observers, as well as a representative of the United Nations Development Programme (UNDP) and observers from the International Telecommunication Union (ITU) and League of Red Cross Societies (LRCS).

The Committee reviewed the activities of the Typhoon Committee and the ECAFE/WMO Joint Unit during 1969 and took stock of the present status regarding the installation of facilities required for an efficient system of mitigating of typhoon damage. It examined the deficiencies in the meteorological and telecommunication systems and drew up a list for priority consideration. Emphasizing the urgent need for pilot flood forecasting and warning systems in the countries concerned, it reviewed the action taken by the secretariats of ECAFE and WMO and the Joint Unit on the decisions reached at the first session of the Committee and made recommendations for further action.

In regard to the expansion of the existing Joint Unit, the Committee felt that there was no need as yet for a large increase in the staff and that institutional support from UNDP (Special Fund component) need not be sought for the present. It agreed that a gradual growth of the Unit, supported as hitherto by the secretariats of ECAFE and WMO and by the UNDP through its regional programmes and other resources, would suffice. It was noted that the Joint Unit would soon be strengthened by an expert on telecommunication/electronics. The Committee felt that one or two additional professional staff, such as an expert on community preparedness, might become necessary in the near future.

The Committee, reviewing the terms of reference for the proposed "Regional Typhoon Centre", concluded that its designation should be changed to "Typhoon Committee secretariat", the functions and duties of which it proceeded to define. The Committee accepted with warm appreciation the invitation of the Government of Philippines to locate the Typhoon/Committee

/secretariat

secretariat in that country. In conclusion, the Committee requested ECAFE and WMO to strengthen their support and guidance to the Typhoon Committee and its secretariat and to seek assistance from UNDP and other sources as required.

II. ACTIVITIES DURING 1970

Introduction

The ECAFE/WMO Joint Unit on Typhoons, comprised of two experts, namely Mr. S.N. Sen, Chief of the Unit, and Mr. A. Mizuno, hydrologist and flood control expert, continued to function at the ECAFE secretariat, Bangkok. As in the previous year, secretarial help was provided by the staff of the Division of Water Resources Development. An expert on telecommunication and electronics was appointed by WMO to serve in the Joint Unit. Mr. C.H. Tang of China (Taiwan) took up this post on 10 August 1970.

The first task of the Joint Unit was to make a thorough study of the report of the second session of the Typhoon Committee and to initiate action in accordance with its recommendations. This was done partly by correspondence with the appropriate departments in member countries and partly by personal discussions with officials during visits of the experts from the Joint Unit. The second session of the Typhoon Committee had emphasized the continuing need to ensure that the facilities already available were used regularly and and efficiently. Observed deficiencies or difficulties experienced in operation and maintenance of equipment, collection of national data, or as a result of non-receipt of data from other countries, etc., were discussed by the experts during their visits and remedial measures were suggested where appropriate.

/Two experts

Two experts of the Joint Unit visited the following places during 1970:

Station (country)	Mr. S.N. Sen	Mr. A. Mizuno
Hong Kong (Hong Kong)	2-4 June	12-14 August
Manila (Philippines)	14-20 May	26-30 July
Seoul (Republic of Korea)	23-27 May	14-21 April
Taipei /China (Taiwan)/	20-23 May	6-12 August
Tokyo (Japan)	27-31 May	7-14 and 21-25 April 30 July - 6 August 29 September - 13 October
Vientiane (Laos)	23-27 February	23-28 March
Geneva (Switzerland)	6-10 July	-
Phnom-Penh (Cambodia)	8-13 February	

During visits to the member countries and also at Bangkok, the members of the Joint Unit held detailed discussions with the officials of the meteorological and hydrological services. Relevant subjects were also discussed with the project managers of the UNDP/WMO projects at Manila and Taipei. The embassies at Bangkok of the developed countries which took a sustained interest in the activities of the Typhoon Committee were contacted with a view to exploring possibilities of bilateral aid. Typhoon Committee's programmes and assistance needed were discussed with the permanent representatives of these countries to ECAFE.

In accordance with the decision of the second session to transfer the Joint Unit from Bangkok to Manila where it will be re-designated the Typhoon Committee secretariat, details of facilities required at Manila are under negotiation with the Government of the Philippines. It is expected that office accommodation, furniture, supporting staff, etc., will be available by November 1970. Since the third session of the Committee is to be held at Bangkok in November 1970, it has been decided to transfer the Joint Unit to Manila early in 1971.

/The Joint Unit's

The Joint Unit's re-designation as the Typhoon Committee secretariat requires amendment to Article 3 of its Statute. The Executive Secretary of ECAFE and the Secretary-General of WMO have taken this matter up with the Governments concerned and approval from six member countries has so far been received.

The Committee continued to receive active support from the secretariats of ECAFE and WMO. Acting on behalf of the Typhoon Committee, the Joint Unit maintained close liaison with both of them. Its Chief visited the WMO secretariat at Geneva during July 1970 and discussed various matters, including the preparations for the third session.

The annual report of the Typhoon Committee for the year 1969 was presented to the twenty-sixth session of ECAFE held at Bangkok from 14 to 27 April 1970. The Commission commended the Typhoon Committee on its activities and expressed satisfaction that the secretariats of ECAFE and WMO had collaborated in this sub-regional undertaking. It noted with appreciation the continued interest of some of the developed countries and the support they had provided.

Details of the progress made or action taken since the second session of the Committee are reported below under the respective components of the programme, namely (A) meteorological component, (B) hydrological component, (C) complementary protective measures and (D) training and research.

(A) METEOROLOGICAL COMPONENT

Continued efforts were made to implement the recommended observational network and telecommunication facilities. Special attention was given to the facilities included in the priority list drawn up by the second session of the Committee. Attention was also given to the need for ensuring regular and efficient operation of the existing facilities. Fresh developments and action initiated since the second session of the Typhoon Committee are briefly reported below:

Observational facilities

China (Taiwan)

The possibility of establishing RS/RW stations at Pratas and Nansha islands was further explored. The Republic of China's request for assistance under VAP for establishing these two RS/RW stations had been circulated by

/WMO,

WMO, but no offer of assistance had yet been received. The possibility of bilateral assistance from the United States was discussed with its Embassy at Bangkok. Information was received from the ESSA Administrator that, since all available resources of ESSA had been committed, it was not possible to furnish required equipment despite the fact that the need for the stations was recognized. The Regional Association for Asia of WMO at its last session, held in July 1970, attached high priority to establishing RS/RW stations at Pratas and Nansha. On receipt of a communication from Hong Kong emphasizing the pressing need for these two stations, the Joint Unit requested WMO that the matter be given special consideration at the next session of E.C. Panel of VAP. During recent discussions with permanent representatives to ECAFE of some of the developed countries on possible bilateral assistance to the Typhoon Committee, the need for assistance in establishing the RS/RW stations at Pratas and Nansha was again highlighted. The Republic of China was requested to review whether its request for assistance needed to be modified in any way and to consider whether any contribution could be made from that country's national resources.

The weather radar provided under a UNDP (Special Fund) component was installed at Kaohsiung and became operational on 29 January 1970. The SSB communication arrangement between Kaohsiung radar station and Taipei was completed by June 1970.

As regard APT equipment for Taipei, which is included in the priority list, the Taiwan Weather Bureau was advised by the Joint Unit to submit an application for VAP assistance.

Republic of Korea

The RS/RW station at Pohang which was making observations at 00 GMT only introduced the recommended additional observation at 12 GMT from January 1970. Both observations are now included in broadcasts from Seoul.

A 10 cm weather radar established at Seoul early in 1970 was brought into regular operation with effect from 1 August that year.

APT equipment to be installed at Seoul was expected from Japan by the end of this year.

/Laos

Laos

For the establishment of an RS/RW station at Vientiane, ground equipment was offered by the Government of Finland under VAP and accepted by Laos. As regards the consumable equipment needed to operate the station during its first year, it was decided to provide it from the WMO VAP(F) contingency fund. The training of two Laotian operators in the operation and maintenance of Vaisala equipment was arranged at Bangkok, the cost of travel and stipend being met by WMO through its UNDP regional programme. The training commenced in July and was expected to be completed by March 1971. All arrangements for the establishment of the RS/RW station at Vientiane were thus complete.

Laos had earlier expected that a weather radar would be obtained through Japanese assistance as a part of the project for the extension of the runway at Vientiane. It was ascertained, however, during discussions at Vientiane and Tokyo that weather radar was not included in this project. Since the weather radar at Vientiane was included in the priority list and there was as yet no indication of any bilateral assistance, Laos was advised by the Joint Unit to apply for VAP assistance.

With regard to APT equipment for Vientiane, the French Technical and Economic Mission to Laos had expressed its readiness to consider providing it as bilateral aid to Laos. It was expected that the equipment would be available in 1971.

Philippines

The RS/RW stations at Laoag and Zamboanga continued to record only 00 GMT RS/RW and 00 GMT RS observations respectively. It was apparent that additional observations at these stations might not be possible in the near future for want of sufficient personnel and consumable articles. RS/RW equipment for Cebu and RW equipment for Davao were available at Manila, but could not be installed for want of facilities (personnel and consumable articles). Nor could the wind-finding radar at Manila be made operational.

The need for RS/RW stations in the Philippines was reviewed in detail in consultation with the Weather Bureau officials. In view of the lack of facilities, a minimum network which would be more realistic in the present

/circumstances

circumstances was considered. The Chief of the Joint Unit suggested that Laoag, Clark Air Base and Cebu could provide a reasonable network in the Philippines for the present. A full programme of observations at Laoag, regular reception of observations from the existing United States station at Clark Air Base and priority establishment of RS/RW at Cebu were suggested for the Weather Bureau's consideration.

The construction of the radar building at Guian was completed and arrangements were made for it to receive the 10 cm JRC radar from Manila. It was expected that installation of the radar at Guian would be completed by the end of 1970.

It was understood from the Weather Bureau in May 1970 that the possibility of obtaining five additional sets of radar equipment through loans from the United States Import-Export Bank was under negotiation. Since the Typhoon Committee attached high priority for establishment of radar at Basco, the Chief of the Joint Unit during his visit to Manila in May contacted the USAID mission there with a view to exploring the possibility of procuring radar equipment through bilateral assistance. The discussion led to the understanding that it might be possible to procure a reconditioned radar through the USAID mission, if the Government of Philippines were to submit a formal request for such assistance. The position was to be reviewed by the Director of the Weather Bureau in the light of further developments regarding the procurement of radar equipment through a loan from Import-Export Bank which was then under negotiation.

One set of Alden APT equipment installed at Manila came into regular operation in March 1970.

Thailand

APT equipment provided by the United States with VAP assistance and installed at Bangkok was brought into regular operation on 1 July 1970.

Ocean weather ship at 16°N, 135°E

In pursuance of the offer made by the USSR to station a weather ship in the South-west Pacific, the Secretary-General of WMO took up with the USSR authorities the various recommendations made by the second session of the Committee. The Hydrometeorological Service of the USSR agreed to

/establish

establish the weather ship during the typhoon season, namely the period from June to August and suggested that operation of a weather ship for a longer period would be possible with international support from other developed countries. The Soviet Union's views were communicated to the Typhoon Committee for further consideration.

Information was received that the Soviet Ocean Weather Ship had reached the recommended location and commenced its programme of observations with effect from 20 June 1970. Members of the Typhoon Committee were immediately notified. It was expected that the coastal radio stations in Japan and/or the Philippines would receive the observations from the Soviet ship. While full particulars of the observations and mode of transmission were still being awaited, the Joint Unit requested the member countries to keep close watch on the receipt of observations from the ship at coastal radio stations or through rebroadcasts from Tokyo.

Exchange of radar fixes of typhoons

Arrangements were made for continuance of the exchange programme of radar fix messages during the typhoon season of 1970. The recommendations of the second session of the Typhoon Committee concerning the distribution of these messages, units used and communication arrangements had been implemented. With the establishment of two additional radars at Kaohsiung (China) and at Seoul (Korea), exchang of radar fix messages was expected to be more useful this year.

In pursuance of the proposal made by Laos, arrangements were made for the transmission of radar fix messages from Bangkok to Vientiane through the Mekong Committee's existing RTT circuit, pending the establishment of a meteorological channel between Bangkok and Vientiane. The Mekong secretariat's concurrence with this proposal was communicated to the meteorological services concerned.

Telecommunication facilities

Strengthening of Bangkok RTH

Thailand had requested for VAP assistance for the provision of telecommunication equipment worth $139,000 in connexion with the improvement of the RTT broadcasts from Bangkok. With reference to this request, an

/offer

offer of assistance equivalent to $20,000 was received from Australia. Thailand also submitted a separate request for VAP assistance for telecommunication equipment worth $578,000 for the establishment of RTH at Bangkok. This request was approved by WMO for circulation among member countries. The second session of the Typhoon Committee attached high priority to the strengthening of RTH, Bangkok. WMO recently agreed to contribute to the cost of providing HF radio transmitting and peripheral equipment upto an amount of $50,000 out of the VAP fund. The exact types of equipment to be obtained from Australia and also from WMO under VAP-F were under negotiation. The telecommunication/electronics expert of the Joint Unit discussed this matter with the Meteorological Department at Bangkok. The balance of equipment was classified into three groups in order of priority.

Bangkok-Vientiane RTT circuit

Following a survey made at Vientiane by a Soviet telecommunication expert last year, the USSR agreed to provide terminal equipment at Vientiane as VAP assistance to Laos for the establishment of the Bangkok-Vientiane circuit. The Chief of the Joint Unit reviewed the situation during his visit to Vientiane in February 1970 and sent detailed reports to WMO. Particulars of the Soviet Union equipment were collected from Vientiane and given to the Meteorological Department at Bangkok. The frequencies to be used for transmissions from either end have been settled and communicated to the USSR through WMO. The Soviet Union authority agreed to give three months' training at Moscow to the officer in charge of the Telecommunication Section, as a part of the VAP assistance. All arrangements have thus been completed for establishment of the RTT circuit.

Bangkok-Hong Kong RTT circuit

The Bangkok-Hong Kong RTT circuit was established in June 1970. After trial transmissions, it was brought into regular operation on 18 July 1970, so the gap in the circuit Guam-Manila-Bangkok-Hong Kong-Tokyo has now been bridged. This should greatly facilitate exchanges of meteorological data among these centres. A review of the current programme of exchanges and need for changes in schedules, etc., was undertaken with a view to ensuring maximum utilization.

/Bangkok-Saigon

Bangkok-Saigon RTT circuit

Necessary terminal equipment is available at Bangkok for establishing this circuit, provided Saigon is ready to do so. Informal enquiries indicated that Saigon also requires terminal equipment for this purpose. The Joint Unit sent a communication to the Director of the Meteorological Service, Saigon, to ascertain their plans in this regard.

Taipei-Tokyo RTT circuit

In the revised regional telecommunication plan of WMO RA II, a Taipei-Tokyo RTT circuit was recommended instead of the Taipei-Hong Kong link. China (Taiwan) and Japan have planned to operate a Taipei-Tokyo circuit through a communication satellite. The Taiwan Weather Bureau informed the Joint Unit that necessary funds would be available in their national budget for 1972.

Seoul-Tokyo circuit

As a result of negotiations between Japan and the Republic of Korea, it has been agreed that Seoul-Tokyo point-to-point link will be established by using a leased circuit of the existing cable communication. The circuit will be tested early in 1971 and put into regular operation in April that year.

Improvements needed for collection of observations from Pratas and Nansha (China)

This item was included in the priority list drawn up by the second session of the Committee. The matter has since been reviewed by the Joint Unit in consultation with the Taiwan Weather Bureau. It was understood that poor reception or non-reception of observations from Pratas and Nansha at Taipei was due to weak transmitter power, severe interference and poor operation. The stations are under control of the Chinese Navy and Chinese Aeronautical Administration (CAA). As a result of discussions between the agencies concerned, it was decided that the Navy and CAA will try to replace the present equipment by more powerful transmitting equipment. In case this cannot be done from national resources within a reasonable period, the Taiwan Weather Bureau will consider requesting assistance from external sources.

/Manila

Manila RTT broadcasts

The reception of Philippine data in other countries through the Manila RTT broadcasts was reported to be still irregular. Some of the countries receive Philippine data through Tokyo broadcasts, but it was reported that these broadcasts often do not contain sufficient data from the Philippines. In response to a request by the Joint Unit, JMA agreed to scrutinize the statistics of recent receptions of Manila RTT broadcasts at Tokyo and their inclusion in Tokyo broadcasts. The possibility of better reception of Philippine data through Manila-Bangkok-Hong Kong-Tokyo circuits will be examined.

(B) HYDROLOGICAL COMPONENT

Further progress was made in developing comprehensive plans for establishment of pilot flood forecasting and warning systems in the key river basins selected for this purpose. The ECAFE/WMO Joint Unit assisted the concerned Departments in China (Taiwan), the Republic of Korea, Laos, the Philippines and Thailand in reviewing the latest position and in initiating further actions. Fresh developments under this component during 1970 are summarized below:

China (Taiwan)

Two telemetering rainguage stations established under a UNDP/WMO project at Pinlin in the Tan-shui river basin and at Kuei Shan island near the basin continued to operate. The establishment of four more telemetering rainguage stations in the Choshui river basin under the same project will be completed by the end of 1970. The weather radar at Kaohsiung was made operational in January 1970. The two sets of radar equipment at Kaohsiung and Hualien provide very good coverage for China (Taiwan) and the surrounding ocean area and have been most useful for typhoon tracking and precipitation studies. However, most of the Tan-shui river basin is located on the lee-side of the high mountains in relation to the radar beam from both sets. It is therefore considered that installation of a third set at Taipei that could cover the basin would be useful for precipitation studies and flood forecasting.

/The experts

The experts of the UNDP/WMO project have developed an objective technique for qualitative and quantitative precipitation forecasting on the basis of case studies of typhoon tracks and resulting precipitation. Typhoon tracks are classified in several groups, and, taking into account other meteorological indicators and radar observations, the objective technique provides figures regarding the expected total rainfall under the influence of the approaching storm, the average intensity of rainfall in mm/hr during the storm, the approximate occurrence time and the amount of maximum two-hour rainfall (within an error of 40 per cent) twelve to twenty-four hours in advance at selected points in Taiwan. Trails with these procedures were being carried out for typhoons in 1970. Hydrological procedures for conversion of the derived precipitation forecasts into hydrological terms for qualitative flood warning in the target area have not yet been evolved. For this purpose, extension of the project for one year and assignment of an expert in hydrology or hydrometeorology to develop it has been under consideration by WMO. Mr. A. Mizuno, hydrologist and flood forecasting expert of the Joint Unit, assisted the Project Manager in reviewing the requirements for developing the hydrological procedure and in preparing the terms of reference for the proposed hydrologist.

The Taiwan Provincial Water Conservancy Bureau (PWCB), in co-operation with the Shih-men Reservoir Operation Office and the Taiwan Power Company, continued to maintain rainfall and river stage observation facilities in the Tan-shui river basin. Two telemetering rainguage stations at Hsio-liao and Ta-pao continued to operate and river stage observations from six selected stations were collected by radio telephone during typhoon periods. Difficulties were experienced by PWCB in operation and maintenance of the telemetering rainguages. Mr. Mizuno looked into these problems during his visit to Taipei. In response to a questionnaire from PWCB, the Joint Unit communicated suggestions for remedial measures after consulting Japanese experts on the subject.

Because of the hydrological and hydrometeorological complexity of the basin, the available facilities are still inadequate for flood forecasting and warning purposes. Therefore, a tentative improvement project for flood forecasting was proposed by PWCB on the basis of recommendations

/made

made by a working group comprised of representatives of PWCB, TWB, the Shih-men Reservoir Administration Bureau and the Taiwan Power Company in 1969. Following discussion of this tentative project with the experts of the Joint Unit, PWCB revised the plan during 1970. The revised plan includes one additional radar at Taipei, ten telemetering rainguage stations, seven telemetering river stage stations and other telecommunication facilities. The tentative plan has been approved in principle by the administrations concerned, viz (1) Taipei city (2) the Taiwan provincial government and (3) the Central Government. These three administrations have also agreed to share an estimated expenditure of 40 million NT dollars for completion of the project. It is proposed to install the equipment in two stages; complete implementation of the scheme is expected to take from three to five years.

While the estimate of additional equipment included in the tentative plan is considered satisfactory for budgetary provisions, it is 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 locations of additional rainfall and river stage stations are finally decided. Some hydrological analysis is being carried out by the staff of PWCB, but for systematic and detailed analysis of the available data the technical assistance of external experts would be necessary. PWCB has plans to request Japan for such assistance in 1971. These questions were discussed by the staff of the Joint Unit with PWCB officials and the possibility of Japanese assistance was being explored in consultation with the concerned officials in Tokyo.

Hong Kong

Hong Kong has a good network of precipitation stations with well distributed radio links. Storm surges and flash floods are its main hydrological problems. Studies for forecasting storm surges and also for precipitation forecasting have been progressively carried out by the Royal Observatory. The Public Works Department, which is responsible for the drainage facilities, has carried out some hydrological studies on inflow to the reservoirs for the city water supply to facilitate regulation of gate operation of the reservoir.

/Japan

Japan

Flood forecasting in Japan is carried out on eighteen important rivers at present. The responsibilities of the Ministry of Construction and the Japan Meteorological Agency in regard to flood forecasting are prescribed in the flood fighting law. A good network of rainfall telemeters and water-gauging stations in each of the basins and modernized telecomunication networks using micro-wave and VHF systems have been provided for the purpose. The techniques used for flood forecasting have been progressively developed. Electronic computers are used to speed up data analysis and in the application of sophisticated flood forecasting techniques. Expansion of the services is being continued with improvement of facilities and further development of techniques.

The latest developments in flood forecasting in Japan were explained and demonstrated during the Second Training Seminar on Flood Forecasting and Warning Services, sponsored by the Government of Japan, which was held at Tokyo from August to October 1970 (see section D).

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. The time difference in reaching the confluence and the magnitude of the flood judged by the observed hydrographs at the two stations on the North and South Han rivers are taken into account to use the stage correlations. There are many recording and ordinary raingauge and water stage gauging stations in the basin and the data collected from these stations are available in the annual reports published by the Ministry of Construction. It is considered necessary that the available data be analyzed with a view to improving the flood forecasting technique now based on simple stage correlation. Possible approaches for such an analysis were discussed by Mr. Mizuno of the Joint Unit with the officials concerned in the Ministry of Construction. However, due to shortage of trained personnel in the Division, it has not yet been possible to undertake these studies.

/Since the

Since the present flood forecasting is solely dependent on stage correlations, it may have been progressively influenced by the recent completion of dams on the north Han river and will be further affected in future by the completion of the Paldang and Soyang dams. Construction of these two dams was in progress during 1970.

There is an urgent need to establish a new comprehensive flood forecasting system or to improve and expand the existing system. There is a tentative plan for telemeterizing the existing observation stations in the basin on the basis of a feasibility report made by Nihon Densen Company (a Japanese firm) in 1968. Financial provision has not yet been made for implementation of this plan. However, it is considered most important that a sufficient number of case studies on floods be undertaken for selecting the key stations to be telemeterized and for developing more sophisticated procedures of flood forecasting.

The Central Meteorological Office has promised to provide observations and forecasts of rainfall and to make studies of the quantitative precipitation forecasting for the basin area. A 10 cm weather radar recently installed at Seoul should be of assistance in assessing the actual precipitation over the basin and for quantitative precipitation forecasting.

In view of these considerations, it is considered that the following urgent steps should be taken during 1971:

(1) An expert on hydrological and hydrometeorological data analysis with practical experience on flood forecasting is needed as a consultant for a period of six months to assist the Hydrology Section of the Ministry of Construction at Seoul in analyzing the available data.

(2) At least three engineers with the necessary basic education and/or experience, two in the field of hydrology and one in telecommunication, should be given six months' training in the respective fields with special emphasis on practical flood forecasting. Since such training facilities exist in Japan, assistance from that country in the form of training fellowship would be most welcome.

/Laos

Laos

Forecasts of flood level at Vientiane have been issued since 1967 by the Meteorological Department in co-operation with the Hydraulic and Navigation Department on the basis of stage correlation between Luang Prabang and Vientiane. The synoptic situation and expected precipitation are also taken into account. Forecasts for Vientiane are now provided about thirty-six hours in advance. It is expected that the forecast period will be extended to forty-eight hours if sufficient data on rainfall and stage in the upper stream of the basin can be speedily collected. Flood forecasting for the lower Mekong river basin, which includes Vientiane, has been started this year by the Mekong Committee secretariat as an experimental measure on the basis of the SSARR programme.

The Se Bang Hieng river basin was selected for the establishment of a pilot flood forecasting by the Government of Laos, because of river improvement works and high population density in the lower reaches and considering that a solution of the flood problem would encourage economic development of the country's southern region. However, more than two-thirds of the basin area is not accessible at present. In the circumstances, a preliminary reconnaissance of the western part of the basin upto the farthest accessible place was undertaken by the hydrologist of the Joint Unit together with the Laotian officials concerned in March 1970. Information in regard to past floods was collected at Savannakhet, Kengkok and Lahanam and a review was made of the available data.

Except for two raingauge stations at Dong Henh and Kengkok on the western tributary (Se Cham Phone), Se Bang Hieng river basin has no rainguage station at present. These two stations have also provided water stage data for the last few years, but no discharge measurements. There are two water gauge stations at Bang Keng Done (recording) and Keng Thangone in the lower reach below the confluence of Se Cham Phone and Se Bang Hieng. However, there is some doubt about the datum level used for the Keng Thangone station and fresh level checking is considered necessary. None of the above stations has telecommunication facilities.

/With

With a view to evolving a flood forecasting procedure with the limited data available, some hydrological analysis has been made by the hydrologist of the Joint Unit, using the rainfall at Dong Henh and Kengkok as indicator rainfall for the basin with a view to finding a correlation with the discharge at Bang Keng Don. The preliminary computations made so far suggest that a beginning could be made by introducing flood forecasting for the Se Cham Phone river and lower reaches of the Se Bang Hieng below its confluence with Se Cham Phone; and also that the system could later be expanded when the establishment of facilities for the entire Se Bang Hieng basin becomes feasible.

According to this preliminary study, the first stage of flood forecasting can be started after the rainfall and water-gauging stations at Dong Henh, Kengkok and Bang Kong Done, and if possible one additional station, have been provided with a telemetry or other telecommunication system for transmission of daily data to a master station at Savannakhet. The number of rainfall/water-gauge stations will have to be increased at least to four rainfall and water-gauging stations, four rainfall stations and one relay station (in case of using telemetering system) when the remaining part of Se Bang Hieng river basin become accessible. Financial assistance from external sources would be necessary for implementation of the programme.

Philippines

A comprehensive survey and study of the Pampanga river basin with a view to preparing detailed plans for a flood forecasting and warning system has been carried out by a team of nine Japanese experts in consultation with the Bureau of Public Works and the Weather Bureau. The survey was made at Manila during November/December 1969 in response to the request of the Philippine Government. After further study in Japan of the data collected, the team submitted its final feasibility report to the Government in July 1970. The hydrologist of the Joint Unit participated in this survey and study.

The survey team made an analysis of major floods and recommended that the flood forecasting and warning system in the first stage should include the following three areas: (1) the Candaba area, (2) the right

/bank

bank of the main Pampanga river below Arayat and (3) the delta below Apalit. The other areas of the basin are recommended to be covered gradually by expansion of the system during the second stage.

For implementation of the first stage pilot flood forecasting and warning system, the establishment of seven telemetering rainfall and stage gauging stations, three telemetering rainfall gauging stations, two relay stations, one monitor station and one master station has been recommended. The estimated total cost of $225,000 includes cost of housing facilities, equipment, installation, transportation cost, etc., and the cost of training two engineers in flood forecasting and three in telecommunication for three months each in Japan. The survey team has recommended the establishment of a flood forecasting centre at Manila, to receive data on rainfall and water level directly from the telemetering stations to be newly established, as well as other relevant meteorological and hydrological data procured by the Weather Bureau and Bureau of Public Works. Utilization of the weather radar equipment at Manila for qualitative measurement of rainfall intensity has been recommended.

The survey repost has since been under examination by the Philippine Government. The hydrologist of the Joint Unit, during his recent visit to Manila, explained some aspects of the survey report to the official concerned. The possibility of further financial and technical assistance for implementation of the project has been under consideration by the Government of Japan. Full implementation of the project may take several years.

Thailand

Further progress has been made in developing a comprehensive plan for the establishment of a pilot flood forecasting system for the Meklong river basin in Thailand. The staff of the Joint Unit held several joint meetings with officials of Royal Irrigation and Meteorological Departments to discuss the results of various studies made for the development of a comprehensive plan. These officials participated in a reconnaissance trip to the Meklong river along with three Japanese experts of the Pampanga survey team. Trial communication by portable SSB equipment was arranged during the trip.

/Simulation

Simulation methods for streamflow at the K10 station on the Kwae Noi river and at the K6 station on the Kwae Yai river have been developed by the Joint Unit on the basis of available daily rainfall data at several stations in the upper basin. Discharge correlation between K10/K6 and Kanchanaburi was also being developed. A note on the subject is being prepared. The Joint Unit also assisted officials of the Meteorological Department in studying the synoptic situation and precipitation patterns associated with past flood cases along the Meklong. A separate note on the subject is under preparation.

On the basis of these studies, a plan incorporating minimum requirement for flood forecasting in the Meklong river basin has been drawn up. According to this plan, data from nine rainfall stations, and three (preferably five) stage gauging stations are to be received at the flood forecasting centre at Bangkok. All but two of these stations still require radio telecommunication facilities. The proposals are being examined by the Royal Irrigation Meteorological Departments. The Director-General of the RID considered that it might be possible to meet the expenditure on equipment from national resources, for which budget provision could be made for 1972 and that a part of the equipment could be spared in 1970-1971 out of that available in the Department. The need for financial assistance, if any, from external sources will be considered in due course.

C. COMPLEMENTARY PROTECTIVE MEASURES

The informative material concerning national organization for protective measures so far collected by the Joint Unit, either in response to the questionnaire or gathered by the experts during visits to the member countries, were examined. Since Japan has an elaborate national plan for disaster prevention, the Ministry of Construction, Tokyo was requested to provide a summary in English of the large volume of material available in the Japanese language. The Joint Unit undertook preparation of a country-wise summary of the material for circulation to all concerned. It is hoped that this summary, when completed, will be useful to those countries in which national plans for protective measures have yet to be developed. In this connexion, a pamphlet entitled "A Guide to a National Disaster Relief Plan" prepared by League of Red Cross Societies and the "Red Cross Disaster Relief Handbook" under preparation by the LRCS will be useful as reference documents.

/The efforts

The efforts made last year to procure the services of an expert on community preparedness from the League of Red Cross Societies was reported at the second session of the Committee, which again stressed the importance of community preparedness in any programme of protective measures against typhoon damage and requested ECAFE and WMO to pursue this matter with LRCS. The Secretary-General of WMO, in consultation with the Executive Secretary of ECAFE, sent a fresh proposal to the Secretary-General of LRCS in May 1970. It was made clear that the full-time services of an expert may not be required and that such services provided from time to time for one or two months at a time might suffice for the present. The Chief of the Joint Unit, during his visit to Geneva in July 1970, visited the Headquarters of LRCS accompanied by a staff member of the WMO secretariat and discussed with a representative of LRCS the possible secondment of an expert on community preparedness. It was understood that the matter was still under consideration by the League. The representative of LRCS was however hopeful that LRCS might be able to help.

It was felt that the Typhoon Committee has not yet been able to give sufficient attention to community preparedness and disaster prevention. Following consultations between ECAFE and WMO, it was decided that one half day during the third session could be devoted to lectures. The subjects are to be disaster prevention organization and recent developments in storm warning services. LRCS was requested to present a lecture on the former. One of the purposes of the lecture session is to initiate a more active approach to this vital part of the Committee's programme.

D. TRAINING AND RESEARCH

Training of personnel

In connexion with the implementation and maintenance of the programmes recommended by the Typhoon Committee, the need for additional trained personnel in the meteorological and hydrological services of the member countries was reviewed by the Joint Unit. China (Taiwan), the Republic of Korea, the Philippines, Laos and Thailand are in need of financial assistance (training fellowships) for having their personnel trained in meteorology

/and hydrology.

and hydrology. A tentative five-year plan for training personnel in these countries was prepared in consultation with the officials of the national services. The present inadequacy of trained personnel, need for recruitment of additional staff, nature of training courses required, need for training fellowship, etc., have been assessed. The tentative plan is briefly presented in a separate document for the third session (WRD/TC3/8).

In view of the acute shortage of trained personnel and technicians in the Meteorological and Hydrological Departments of Laos, a separate detailed note on training requirements there was prepared. Copies of this note were forwarded to the Directors of those departments asking for the Government's concurrence in principle and for it to take steps for the gradual implementation of the plan.

WMO publication No.240 T.P.131 entitled "Report on Meteorological Training Facilities" provides detailed information on existing training facilities in various countries in the field of meteorology. Similar information on existing training facilities in hydrology is not readily available. The Typhoon Committee may wish to consider how best these details could be collected, particularly from those developed countries which might offer assistance for training in hydrology and flood forecasting.

Training Seminar on Flood Forecasting and Warning Services

In pursuance of the offer made by the representative of Japan at the second session of the Committee, the Government of Japan organized the Second Training Seminar on Flood Forecasting and Warning Services at Tokyo from 15 August to 14 October 1970. The joint Unit conveyed to the Government of Japan the deep appreciation of the Typhoon Committee, ECAFE and WMO of its generosity in organizing another training seminar. Arrangements for conducting the Seminar were made by the Overseas Technical Co-operation Agency (OTCA) of the Government of Japan in collaboration with the ECAFE/WMO Joint Unit. Mr. A. Mizuno of the Joint Unit delivered lectures and assisted in the conduct of practical exercises on flood forecasting for two weeks during the Seminar.

/Nine

Nine trainees from China (Taiwan), the Republic of Korea, Laos, the Philippines and Thailand participated. Financial assistance towards cost of travel and subsistence was provided by the Government of Japan.

The Seminar was designed to give greater emphasis to practical aspects of flood forecasting. It provided an excellent opportunity for the participants to familiarize themselves with practical flood forecasting and the latest developments of equipment and techniques in Japan, as well as to discuss with the Japanese experts problems of flood forecasting in their individual countries.

Co-ordination of research activities

The need for distribution of the results of studies on typhoons and associated floods and the arrangements made for exchange of such information were discussed at the second session of the Committee. On request by the Joint Unit, the Secretary-General of WMO requested the Permanent Representative of the United States to send a list of selected research papers related to hurricanes and hurricane warning services. The United States Weather Bureau's representative drew attention to the annual reports of research work in tropical meteorology compiled by the WMO secretariat and distributed to all meteorological services, stating that they contained all the references to research under way or completed. However, the Bureau agreed to send copies of recent ESSA publications to the Joint Unit. The ninth annual report of research work in tropical meteorology was distributed by WMO in May 1970. Progress reports prepared by countries engaged in numerical weather predication are also distributed regularly by WMO to all members.

The Director of the Royal Observatory, Hong Kong, plans to produce typhoon movement forecasts by various objective techniques with the help of a computer and to transmit the results to other member countries. It was thought that such an arrangement would facilitate comparison of the results obtained by different objective techniques and thereby promote further studies on the subject. It was understood that the Joint Universities Computer Centre at Hong Kong would be used for this purpose.

/Information

Information was received from the University of Hong Kong that research work connected with the experimental building at Cape D'Aguilar was being taken up by the Department of Civil Engineering.

A proposal submitted by the Korean Meteorological Department to WMO for assistance under the UNDP Special Fund in establishing a meteorological research institute at Seoul was under consideration during the year.

A paper entitled "Project Stormfury, 1969" by Dr. R.C. Gentry, Director, Project Stormfury, Miami, was received by the Joint Unit in March 1970. Hurricane modification experiments had been conducted on hurricane Debbie on August 18 and 20, 1969 and the conclusions reached in these experiments as reported by Dr. Gentry appeared very encouraging. Dr. Gentry writes in his article: "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".

A letter was received from Dr. Terada, Director, National Research Centre for Disaster Prevention, Tokyo, giving information on the centre's recent views on typhoon modification and possible activities under US-Japan Science Co-operation in this direction. In response to Dr. Terada's letter, the Joint Unit sent a reply summarizing earlier considerations of the subject at ECAFE/WMO meetings. The Chief of the Joint Unit later discussed this matter with Dr. Terada and JMA officials at Tokyo in June 1970. The concensus of opinion seems to be that Japan is much interested in the subject but, in the first stage, would like to concentrate on studies to obtain more knowledge about typhoons, experiments on cloud modification, hail suppression, etc., before becoming actively engaged in typhoon modification experiments.

III. CONCLUDING REMARKS

The members of the Typhoon Committee continued to make efforts at the national level to establish the additional facilities recommended by the Committee. The ECAFE/WMO Joint Unit, acting as the secretariat of the Typhoon Committee, assisted the members in formulating plans for implementation and initiated action on the various recommendations made by the Committee.

/The action

The action programme approved by the Committee at its first session has provided the guidelines for activities during 1970.

A few facilities were established during 1970 either with the help of national resources or with assistance from external sources. Preparations were also made for the establishment of certain other facilities for which assistance had already been offered bilaterally or under WMO VAP. The placing by the USSR of an ocean weather ship in the southwest Pacific during June-August 1970 and Japan's organization of the Second Training Seminar on Flood Forecasting are of particular significance to all members of the Typhoon Committee.

It is evident that, for full implementation of the action programme envisaged by the Committee, most of the countries in the region will need assistance under bilateral or multilateral aid schemes or from international sources. Increased efforts will have to be made to secure such assistance in order to ensure speedy establishment of the more urgently needed facilities. The reviews made so far have brought out clearly the nature of assistance needed under each component of the action programme. The Joint Unit contacted the permanent representatives to ECAFE of prospective donor countries and explained the situation to them. The Secretary-General of WMO has written to the permanent representatives of countries with WMO drawing attention to the meteorological facilities allotted high priority by the Typhoon Committee. It is hoped that representatives of the developed countries present at the third session will be in a position to make specific offers of assistance, which would greatly facilitate follow-up action during 1971.

The Joint Unit continued to function with only two experts upto August 1970 when an expert on telecommunication and electronics was added to the staff. With his help, the Joint Unit will hereafter be in a position to provide technical advice on the installation, operation and maintenance of telecommunication and electronic equipment. The expert can also provide on-the-job training in operation and maintenance of equipment to the national staff in the countries concerned.

The transfer of the Unit from Bangkok to Manila is likely to be effected by early 1971.

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FOR PARTICIPANTS ONLY

WRD/TC3/7
1 October 1970

ORIGINAL : ENGLISH

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST
AND
WORLD METEOROLOGICAL ORGANIZATION

Third session of the Typhoon Committee
18-24 November 1970
Bangkok, Thailand

STATUS OF METEOROLOGICAL OBSERVING AND TELECOMMUNICATION SYSTEMS

(Agenda item No. 4)

Note by WMO Secretariat

Introduction

1. The purpose of this document is to provide the Typhoon Committee, at its third session, with an up-to-date statement of the degree to which the meteorological and telecommunication facilities essential to an efficient typhoon warning system have been implemented in the countries affected by typhoons.

2. It will be recalled that most of these facilities also form part of the World Weather Watch plan. The requirements of that plan are already well-known and are set forth in detail in other publications. There is, consequently, no need to list them in the present document which is accordingly confined to a consideration of the meteorological and telecommunication facilities required in the typhoon area which it has not yet been possible to implement.

Information on deficiencies

3. In preparing the material the objective has been to give a straightforward summary of the deficiencies, avoiding the inclusion of too much detail. In general the material is restricted to lists of the facilities not implemented, accompanied by brief remarks on the outlook for implementation over the next few years. Considerable use has been made of material received in the WMO Secretariat for inclusion in the third status report on the implementation of the World Weather Watch, as well as information obtained by the ECAFE/WMO Joint Unit on Typhoons.

4. The information is arranged in the appendices to this document as shown below :

Appendix A - World Weather Watch - Global Observing System (GOS)

- A/1 - Surface and upper-air observing stations
- A/2 - Automatic Picture Transmission (APT) Stations
- A/3 - Storm Warning Radar Stations

Appendix B - World Weather Watch - Global Telecommunication System (GTS)

- B/1 - National collection facilities
- B/2 - Regional telecommunications
- B/3 - Main Trunk Circuit (MTC)
- B/4 - Other telecommunication facilities

5. In listing these deficiencies an appropriate note has been added whenever the facility required has been assigned priority for implementation by the WMO Congress, the Regional Association for Asia or the Typhoon Committee itself. For ease of reference, a summary of the facilities which the Committee selected for priority treatment at its second session is given in Appendix C, together with an indication of those already implemented and existing plans for the others. Further information on the progress achieved in advancing the Committee's programme in other respects may be found in the documents WRD/TC3/6 (Agenda item 4) and WRD/TC3/9 (Agenda item 5).

6. Although every effort has been made to incorporate the latest information in the appendices, changes may have taken place since they were compiled. Notification at the third session of corrections, additions or changes would be appreciated.

Further action proposed

7. It is suggested that the Typhoon Committee will wish :

(i) to examine the lists of deficiencies given in the appendices to this document and to assess thereby the progress being made in providing the additional facilities most needed for typhoon damage reduction;

(ii) to revise the list of priorities adopted at its second session in the light of the changes that have since taken place;

(iii) to recommend to its member countries any further measures they may take to speed up the implementation of the meteorological and telecommunication facilities forming part of the Committee's programme.

APPENDIX A/1

WORLD WEATHER WATCH - GLOBAL OBSERVING SYSTEM (GOS)

Level of implementation of surface and upper-air observations (%)

COUNTRY	SURFACE								RADIOWIND				RADIO-SONDE	
	00	03	06	09	12	15	18	21	00	06	12	18	00	12
CAMBODIA	71	71	71	71	71	71	71	71	100	0	100	0	0	0
CHINA	100	100	100	100	100	100	100	100	0	0	25	0	25	50
HONG KONG	100	100	100	100	100	100	100	100	100	100	100	100	100	100
JAPAN	100	98	100	98	100	98	100	98	100	88	100	88	100	100
KOREA	100	100	100	100	100	100	100	100	100	33	100	33	100	100
LAOS	60	60	60	60	60	40	60	40	0	0	0	0	0	0
PHILIPPINES	100	100	100	100	100	100	100	100	33	17	33	17	75	25
THAILAND	100	100	100	100	100	48	96	48	100	25	100	25	100	100
VIET-NAM	100	100	100	100	86	64	64	86	60	0	40	0	100	100

WORLD WEATHER WATCH-GLOBAL OBSERVING SYSTEM (GOS)

FACILITIES NOT YET IMPLEMENTED

Surface and upper-air observing stations

Country/Station	Surface (s)								Radiowind (W)				Radio-sonde(R)		Plans and Remarks
	00	03	06	09	12	15	18	21	00	06	12	18	00	12	
CAMBODIA															
48978 Sen Monorom	70-72	70-72	70-72	70-72	70-72	70-72	70-72	70-72							(Shortage of staff
982 Kaf Moul	70-72	70-72	70-72	70-72	70-72	70-72	70-72	70-72							
991 Phnom-Penh/ Pochentong									0	0	0	0	0	0	W-obs. irregular. Financial difficulties.
CHINA															
46692 Taipei									V70-71	V70-71	V70-71	0	70-71	V70-71	00 GMT RW-obs. temporarily suspended.
747 Tungkong									0	0	0	0	0	0	VAP project approved for circulation. Equipment for Pratas offered by USA. No offer yet received for Nansha. Typhoon Committee and RA II priority stations.
810 Pratas									V70-71	V70-71	V70-71	0	70-71	V70-71	
902 Nansha															
JAPAN															
47971 Chichijima										0		0			
991 Minamitorishima		0		0		0		0		0		0			

Surface and upper-air observing stations (continued)

Country/Station	Surface (s)								Radiowind (W)				Radio-sonde (R)		Plans and Remarks
	00	03	06	09	12	15	18	21	00	06	12	18	00	12	
KOREA															
47138 Pohang										0		0			
187 Mosulpo AB										0		0			
LAOS															
48924 Muong-Sing	0	0	0	0	0	0	0	0							
928 Sam-Neua						0		0							
Plaine des Jarres (Xiengkhouang)						0		0							
940 Vientiane									V70-71	0	V70-71	0	V70-71	V70-71	VAP project approved for implementation with equipment from Finland and VAP(F) Typhoon Committee priority station.
9-- Houei Sai (20°N, 101°E)	0	0	0	0	0	0	0	0							
9-- Attapu(17°N 107°E)	0	0	0	0	0	0	0	0							
9-- Saravane (16°N, 107°E)	0	0	0	0	0	0	0	0							

Surface and upper-air observing stations (continued)

Country/Station	Surface (s)								Radiowind (W)				Radio-sonde(R)		Plans and Remarks
	00	03	06	09	12	15	18	21	00	06	12	18	00	12	
PHILIPPINES															
98223 Laoag										70	70	70		70	Typhoon Committee priority station.
618 Puerto Princesa									71	71	71	71			
645 Cebu									71	71	71	71	71	71	
754 Davao									71	71	71	71			
836 Zamboanga									70	70	70	70		70	Cg-V and Typhoon Committee priority station.
THAILAND															
48327 Chiengmai										0		0			
331 Nan						70-71		70-71							
353 Loei						70-71		70-71							
356 Sakon Nakhon						70-71		70-71							
375 Mae Sot						70-71		70-71							
400 Nakhon Sawan						70-71		70-71							

Surface and upper-air observing stations (continued)

Country/Station	Surface (s)								Radiowind (W)				Radio-sonde (R)		Plans and Remarks
	00	03	06	09	12	15	18	21	00	06	12	18	00	12	
THAILAND (continued)															
432 Surin						70-71		70-71							
455 Bangkok										0		0			
462 Aranyaprathet						70-71		70-71							
500 Prachuap Khirikhan						70-71		70-71							
517 Chumphon						70-71		70-71							
565 Phuket Airport						0	0	0							
567 Trang						70-71		70-71							
568 Songkhla										0		0			
583 Narathiwat						70-71		70-71							
VIET-NAM															
48855 Da-Nang/Tourane										0		0			
860 Hoang-Sa (Pattle)									B70-71	0	B70-71	B70-71			
863 Quang-Ngai						70	70								
870 Qui-Nhon										0	70	0			

Surface and upper-air observing stations (continued)

Country/Station	Surface (s)								Radiowind (W)				Radio-sonde(R)		Plans and Remarks
	00	03	06	09	12	15	18	21	00	06	12	18	00	12	
VIET-NAM (continued)															
875 Banmethuot					70	70	70	70							
887 Phan-Thiet						70	70								
900 Saigon/Tanso'-nnhu't										0		0			
914 An-Xuyen (Camau)						70	70		0	0	0	0			
917 Phu-Quoc					70	70	70	70							

APPENDIX A/2

WORLD WEATHER WATCH - GLOBAL OBSERVING SYSTEM (GOS)

FACILITITES NOT YET IMPLEMENTED

Automatic Picture Transmission (APT) Stations

Country	Station	Remarks
CAMBODIA	Phnom-Penh/Pochentong	Bilateral project for 1971.
CHINA	Taipei	National project 1971-1972. Typhoon Committee priority station.
KOREA	Seoul	National project 1970.
LAOS	Vientiane	Bilateral project 1970-1971. Typhoon Committee priority station.
THAILAND	Bangkok	Equipment offered by USA under VAP project. Installation to be completed in 1970. Typhoon Committee priority station.
VIET-NAM	Saigon	Bilateral project 1970.

APPENDIX A/3

WORLD WEATHER WATCH - GLOBAL OBSERVING SYSTEM (GOS)

FACILITIES NOT YET IMPLEMENTED

Storm Warning Radar Stations

Country	Station	Remarks
CAMBODIA	Sihanoukville	Planned but no recent information available.
KOREA	Seoul	Installed. Expected to be operational by July 1970.
	Kwangju	No known plans. Typhoon Committee priority stations.
LAOS	Vientiane	No known plans. Typhoon Committee priority station.
PHILIPPINES	Guian	10 cm radar to be installed in 1970.
	Basco	No definite plans but action being taken to meet Typhoon Committee priority request for this station.
	Puerto Princesa	No recent information available.
	Manila	A 5.7 cm radar is in operation at Manila but a 10 cm radar has been recommended.

APPENDIX B/1

WORLD WEATHER WATCH - GLOBAL TELECOMMUNICATION SYSTEM (GTS)

FACILITIES NOT YET IMPLEMENTED

National collection facilities

Country	Plans or remarks
CAMBODIA	Collection satisfactory from stations making required observations. National plans 1971-1972 for both observations and telecommunication facilities at remaining two stations.
CHINA	Improvements for collection of observations from Pratas and Nansha under consideration. Typhoon Committee priority list.
LAOS	Some observations do not reach collecting centre in time. No recent information on planned improvements.
PHILIPPINES	Some improvement realised in 1970 by purchase of 5 additional SSB sets. Further gradual improvement planned from national resources. Typhoon Committee priority list.
VIET-NAM	Delays still occur in the collection of many observations. Some improvements have been made and further action will be taken from national resources in 1970-1971 with the aid of SSB equipment.

APPENDIX B/2

WORLD WEATHER WATCH - GLOBAL TELECOMMUNICATION SYSTEM (GTS)

FACILITIES NOT YET IMPLEMENTATED

Regional telecommunications

Country	Link	Plans and remarks
CAMBODIA	Phnom-Penh - Bangkok	National project 1970.
CHINA	Taipei - Tokyo	National project 1972-1973 (Satellite). Typhoon Committee priority.
JAPAN	Tokyo - Khabarovsk	National project 1973
	Tokyo - Seoul	National project 1971) Typhoon Committee priority.
	Tokyo - Taipei	National project 1972 (Satellite))
KOREA	Seoul - Tokyo	National project 1971. No recent information. Typhoon Committee priority.
LAOS	Vientiane - Bangkok	VAP project 1970-1971 approved for implementation. Typhoon Committee priority.
THAILAND	Bangkok - Dacca	National project 1970-1971
	Bangkok - Kuala Lumpur	National project 1971
	Bangkok - New Delhi	National project 1971
	Bangkok - Phnom-Penh	National project 1972
	Bangkok - Rangoon	National project 1972
	Bangkok - Saigon	National project 1971) Typhoon Committee priority.
	Bangkok - Vientiane	National project 1971)
VIET-NAM	Saigon - Bangkok	Bilateral project 1970. Typhoon Committee priority

APPENDIX B/3

WORLD WEATHER WATCH - GLOBAL TELECOMMUNICATION SYSTEM (GTS)

FACILITIES NOT YET IMPLEMENTED

Main Trunk Circuit (MTC)

Country	Segment	Plans or remarks
JAPAN	Tokyo - Melbourne	75 baud cable circuit established. Upgrading of transmission speed to 2400 bits/sec. planned as national project for 1972.
	Tokyo - Washington	75 baud circuit established. Upgrading of transmission speed to 2400 bits/sec. planned as national project for 1971.

APPENDIX B/4

WORLD WEATHER WATCH - GLOBAL TELECOMMUNICATION SYSTEM (GTS)

FACILITIES NOT YET IMPLEMENTED

Other telecommunication facilities

Country	Facility	Plans and remarks
JAPAN	Facsimile broadcast-Tokyo second channel	National project 1972.
	Strengthening of RTH, Tokyo	Considerable progress made in past year, especially with automatic data editing and switching system. Completion of most remaining facilities planned for 1970 from national resources.
LAOS	RTT and facsimile equipment at NMC, Vientiane.	VAP project approved for implementation with equipment provided by USSR. Completion planned for 1971
THAILAND	Strengthening of RTH, Bangkok.	Partial implementation in progress through bilateral aid from Australia and contribution from VAP (F).

APPENDIX C

PRIORITIES ASSIGNED BY SECOND SESSION OF TYPHOON COMMITTEE

Summary of State of implementation and further plans

Observing facilities

(i) Upper-air Stations

Pratas (China) } Nansha (China) }	VAP project approved for circulation. Equipment for Pratas offered by USA. No offer yet received for Nansha.
Vientiane (Laos)	VAP project approved for implementation. Completion planned for 1971.
Laoag (Philippines) - 12 GMT radiowind. Zamboanga (Philippines) - 00 and 12 GMT radiowind	Implementation from national resources planned for 1970.

(ii) Weather radar

Kaohsiung (China)	Implemented
Kwangju (Korea)	No known plans
Vientiane (Laos)	No known plans
Basco (Philippines)	No definite plans but consideration being given to ways of meeting priority requirement.

(iii) APT stations

Taipei (China)	National project 1971-1972
Vientiane (Laos)	Bilateral project 1970-1971
Manila (Philippines)	Implemented
Bangkok (Thailand)	VAP project approved for implementation. Completion planned for 1970.

Telecommunication facilities

(i) National collection facilities

China	- Improvement needed for collection of observations from Pratas and Nansha.	Under consideration
Philippines	- Improvement needed for prompt collection of national data.	5 SSB sets purchased in 1970. Further improvement planned from national resources.

(ii) Regional telecommunications

Establishment of the following point-to-point links :

Bangkok - Hongkong	Implemented
Bangkok - Vientiane	National project 1971
Bangkok - Saigon	National project 1971
Taipei - Tokyo	National project 1972-1973 (Satellite)
Seoul - Tokyo	National project 1971

(iii) Other telecommunication facilities

Thailand	- Strengthening of RTH, Bangkok	Partial implementation in progress through bilateral aid and VAP (F).

FOR PARTICIPANTS ONLY

WRD/TC3/8
8 October 1970

ORIGINAL : ENGLISH

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

WORLD METEOROLOGICAL ORGANIZATION

Third session of the Typhoon Committee
18-24 November 1970
Bangkok, Thailand

TRAINING REQUIREMENTS OF THE TYPHOON COMMITTEE

(Agenda item 4d)

Note by the ECAFE/WMO Joint Unit on Typhoons

INTRODUCTION

Training of personnel in the fields of meteorology and hydrology has been considered to be an essential component in the implementation of the Typhoon Committee's programmes. From the responses to a questionnaire and discussions with officials of the national services, the Joint Unit has made an assessment of the training requirements for the next five years (1971-1975). It has been concluded that China (Taiwan), the Republic of Korea, Laos and Thailand will need financial assistance for training outside the home country. The Philippines will mainly need training facilities in the field of hydrology as the UNDP/WMO project on meteorological training and research, which is currently in operation at Manila, is expected to meet most of the Philippines' requirements for training in meteorology.

When the item dealing with financial and technical support for new facilities required in Typhoon Committee countries was considered at the previous sessions of the Committee, representatives of a number of developed countries referred to the possibility of aid in the field of training of personnel. Among the member countries of the Typhoon Committee, Japan has already provided valuable

/assistance by

assistance by organizing two training seminars on "Flood Forecasting and Warning Services" during 1969 and 1970 and more assistance from Japan can be expected under its technical co-operation schemes for developing countries. In addition to bilateral assistance from developed countries, assistance may be obtained from international sources such as UNDP or WMO VAP.

Estimates have been made of the training in meteorology and hydrology that will be required for the implementation of the new facilities recommended by the Typhoon Committee and also for the efficient operation of the existing facilities. For this purpose, the factors taken into consideration included the number and category of personnel already available, their qualifications and training, the need for additional trained staff, recruitment difficulties (if any), the nature and duration of training courses required, and the training facilities available in other countries. For the sake of convenience, only two broad categories of personnel, namely professional staff and assistants/operators, have been considered. In most cases, the training of assistants/operators can be arranged within the national services. Estimates of training requirements for professional staff for which financial assistance is necessary are briefly presented below for each of the countries concerned.

TRAINING IN METEOROLOGY

Reference was made to the classification of meteorological personnel and standards of training prescribed in WMO Technical Note No. 50. The minimum educational qualification prescribed for Class I personnel is a University degree in Mathematics or Physics and those for Classes II, III and IV correspond to undergraduates with varying levels of education. In our assessment, Classes I and II are treated as professional staff and Classes III and IV as assistants/operators, etc.

The WMO publication on "Meteorological Training Facilities" provides up-to-date (1969) information about training facilities available in different countries of the world, including details of formal and informal training courses. It is recognized, however, that special training courses may have to be arranged for some of the trainees of the Typhoon Committee countries, depending on their educational qualifications and special requirements.

/The divisions

The divisions in the Meteorological Services which are directly concerned with the Typhoon Committee's programmes are Forecasting, Telecommunication, Instruments, Observations and Hydrometeorology. The training requirements for personnel of these divisions have been assessed. As regards the establishment or strengthening of a Research Division, it is recognized that highly qualified personnel will be required and research potential will have to be increased gradually. Financial assistance in the form of long-term fellowships for training in advanced meteorology leading to a Doctorate degree may be necessary. Some countries have already applied for a few such long-term fellowships under WMO VAP. Requirements for such training have not been included in the estimate presented here.

China (Taiwan)

In the Taiwan Weather Bureau, there are twenty-four professional staff and seventy assistants/operators in the Forecasting, Telecommunication and Instruments/Observations Sections. Most of the professional staff are graduates from the National Taiwan University with meteorology as their main subject. It is understood that the University's annual output of such graduates is about fifty, so that there is no difficulty in recruiting professional staff for the Meteorological Service. Out of the twenty-four professional staff now employed, six officers received additional training in meteorology in foreign countries for periods of six months to two years.

New facilities or improvements that are to be implemented in the Taiwan Weather Bureau in the light of the Typhoon Committee's recommendations include (1) two RS/RW stations (2) a weather radar (3) a set of APT equipment (4) a point-to-point link between Taipei and Tokyo (5) the establishment of a Hydrometeorological Section to assist flood forecasting and (6) improvement in weather analysis, forecasting and research activities.

It is estimated that at least fourteen training fellowships will be needed for the training of professional staff during the next five years, as detailed below:

A. Senior Forecasters' Course: Two senior forecasters (with at least five years' experience in forecasting) to be given special training in modern techniques of forecasting with particular reference to hurricane or typhoon forecasting (e.g. in the United States or Japan). (Duration six months).

/B.

B. General Meteorology and Weather Forecasting: Four junior forecasters or fresh recruits (graduates) to be given one year's training in higher meteorology (e.g. M.S. degree course) plus six months' practical training in weather forecasting with special reference to hurricane or typhoon forecasting. (Duration eighteen months).

C. Hydrometeorology: Two officers - one year's course with special reference to flood forecasting.

D. Telecommunication: Two officers for operation and maintenance of equipment. (Duration six months).

E. Radar and APT (Operation and maintenance): Two officers. (Duration six months).

F. Radar and Satellite Meteorology: One officer. (Duration six months or one year).

G. Rawinsonde (Operation and maintenance): One officer. (Duration six months).

A schedule for the training of the above-mentioned personnel and the corresponding distribution of training fellowships over a period of five years is suggested below:

	A	B	C	D	E	F	G	Total
1971:	1	1	1	1	-	-	-	4
1972:	1	-	-	-	1	-	1	3
1973:	-	1	1	1	-	-	-	3
1974:	-	1	-	-	1	-	-	2
1975:	-	1	-	-	-	1	-	2

Republic of Korea

At present, there are twenty professional staff and 100 assistants/operators working in the Forecasting, Telecommunication, Instruments/Observations and Hydrometeorology Sections of the Meteorological Department. Out of the twenty professional staff, seven are graduates and ten officers have received some training in meteorology in foreign countries (Australia, Japan, Thailand and the United States).

/The Typhoon

The Typhoon Committee's recommendations for new facilities and improvements include (1) one weather radar in addition to the one recently installed at Seoul, (2) a set of APT equipment (3) a point-to-point link between Seoul and Tokyo (4) strengthening of the Hydrometeorological Section (5) improvement in weather analysis and forecasting and (6) introduction of research activity.

The requirements for the training of professional staff are practically the same as those proposed for China (Taiwan). The recommended distribution of training fellowships during the next five years (1971-1975) is as follows:

	A	B	C	D	E	F	G	Total
1971:	1	-	-	1	1	-	-	3
1972:	1	1	1	-	1	-	-	4
1973:	-	1	-	1	-	1	-	3
1974:	-	1	1	-	-	-	1	3
1975:	-	1	-	-	-	-	-	1

The Meteorological Department of Korea has submitted an application to WMO for assistance under the UNDP Special Fund for the establishment of an Institute of Meteorological Research at Seoul. If this project is approved and it includes some training facilities, the training requirements proposed above may have to be modified.

Laos

There are thirteen professional staff and about ninety assistants/operators in the Laotian Meteorological Service. The professional staff, whose basic educational qualification is of high school standard, were all trained in meteorology in foreign countries, as follows: six officers received two years' training in General Meteorology in France, four officers underwent a one-year course for meteorologists in Thailand and three officers received training in climatology and agrometeorology in the USSR. The assistants/operators (mostly of middle school standard) were trained locally after recruitment. Some training has also been given to them by WMO experts stationed at Vientiane during recent years.

/As there

As there is no university in Laos, personnel with university education are not available for direct recruitment. Personnel with high school education (lycée) could be given long-term training in foreign university. This would involve a training period of at least four years. Alternatively, they could be trained in special undergraduate courses in Meteorology for one to two years. The four-year undergraduate Meteorology courses leading to a university degree in Canada and the United States; the two-year course for "Ingénieur des travaux de la Météorologie" (assistant meteorological engineer) in France and the one-year training course for meteorologists in Thailand may be cited as examples. Since the main language taught in high school in Laos is French and the second language is English, it is desirable to arrange training of the Laotian staff in countries where the medium of instruction is French or English, preferably French.

As recommended by the Typhoon Committee, a number of new facilities, e.g. Rawinsonde, radar, APT, and an improved telecommunication system, are to be implemented in Laos during the next few years. The Forecasting Division will have to handle a much larger volume of data and introduce weather analysis and forecasting on modern lines. The Meteorological office will also have to cater for the needs of flood forecasting. All these duties will necessitate the provision of additional trained staff in the divisions concerned. It has been estimated that the present strength of ten professional staff in the Forecasting, Telecommunication, Observations and Hydrometeorology Sections should be increased to at least twenty within a period of five years. Ten additional officers, therefore, will have to be provided and trained in five years.

All new recruits with high school education (lycée) must be trained in undergraduate courses in Meteorology and then given specialized training in appropriate branches. Professional staff earmarked for instrumentation, Rawinsonde, radar and telecommunication may be given undergraduate courses of a shorter duration, such as the one-year course in Thailand. A number of forecasters also have to be trained as quickly as possible. A few officers, however, should be given long-term training leading to a university degree, plus some practical training in weather forecasting.

/In addition

In addition to the above, at least two of the present professional staff with experience in Forecasting should be given a three to six months' familiarization course in methods of weather analysis and forecasting. This training should be arranged as soon as possible.

The need for training, then, has been estimated as follows:

Two Senior Forecasters (During 1971 and 1972) — Three to six months' training

Ten professional staff (Basic education - lycée):

- 3 (1971, 1973, 1975): Long-term training (four years) + Practical training in forecasting (six months)
- 7 (1971-one, 1972-two, 1973-one, 1974-two, 1975-one): Shorter undergraduate course (one year) + Practical* training (six months)

* 1971 - Forecasting, 1972 - Telecommunication, Hydrometeorology, 1973 - Forecasting, 1974 - Radiosonde, Radar/APT, 1975 - Forecasting.

As regards assistants/operators, it is estimated that about thirty additional staff will be needed during the next five years. The assistants/operators may be given initial training in elementary Meteorology. This can be organized locally by the professional staff. On completion of training in elementary Meteorology, some of the assistants/operators, say 50 per cent (preferably those with a diploma from the Collège de Technique), should receive operational training for three months or so in Rawinsonde, telecommunication, radar, APT etc. Such training may be initially arranged in neighbouring countries such as Thailand. When trained professional staff are available in Laos, operational training of assistants/operators can be arranged locally.

Philippines

As stated in the introduction to this paper, the requirements for training in Meteorology will be mostly met by the UNDP/WMO Special Fund project currently in operation in Manila. It is desirable, however, to arrange for three professional staff to be trained abroad in the operation and maintenance of (1) Rawinsonde (2) radar/APT and (3) telecommunication equipment. As recommended by the

/Typhoon

Typhoon Committee, additional RS/RW and radar stations are to be established in the Philippines. The proposed training, for which three fellowships would be required, may be distributed during the first three years as follows:

1971:	Radar/APT	)
		)
1972:	Telecommunication	) each for six months
		)
1973:	Rawinsonde	)

Thailand

Fifty professional staff and 370 assistants/operators work at present in the divisions of the Meteorological Department which are concerned with the Typhoon Committee's activities. Most of the professional staff are graduates in Science and 50 per cent of them received training in Meteorology, mostly in the United States. Some of the latter obtained a university degree.

The Meteorological Department at Bangkok provides training for new professional staff (a one-year course for meteorologists) and also for assistants (a one-year course for observers). The P.T.T. and the Civil Aviation Department have some training courses in Telecommunication.

Additional training facilities will be needed in General Meteorology and Forecasting to strengthen the weather forecasting organization and to build up research potential. The recommended establishment of a Regional Telecommunication Hub (RTH) at Bangkok will require additional trained personnel for the efficient operation and maintenance of telecommunication equipment. Training will also be necessary for the maintenance of existing weather radars and the recently installed APT equipment. The Hydrometeorology Section also needs to be strengthened to render effective assistance in flood forecasting activities.

The professional staff (graduates) to be trained abroad, and for whom training fellowships would be required, are estimated as follows (A, B, C, etc. as under China):

	A	B	C	D	E	F	Total
1971:	1	-	-	1	1	-	3
1972:	-	1	1	-	-	1	3
1973:	1	-	-	1	1	-	3
1974:	-	1	1	-	-	-	2
1975:	-	1	-	-	-	-	1

/TRAINING IN

TRAINING IN HYDROLOGY

As recommended by the Typhoon Committee, a pilot flood forecasting and warning system is to be implemented in a key river basin in China (Taiwan), the Republic of Korea, Laos, Philippines and Thailand. There is an acute shortage of trained personnel in the Hydrological Services of these countries. For the effective implementation of the flood forecasting and warning system, it is essential that some personnel be trained in hydrology and flood forecasting as quickly as possible. The training should preferably be in countries actively engaged in flood forecasting, e.g. Japan and the United States.

Except for some information on training facilities in Japan and the United States, details of training courses in Hydrology and Flood Forecasting in other countries are not readily available. These details will be collected particularly from those developed countries who might offer assistance or training fellowships in this field.

The minimum requirements for training which would make the early implementation of pilot flood forecasting possible have been estimated for each of the countries recommended by the Typhoon Committee. It is considered that graduates in Science or Engineering (with Hydrology) and even undergraduate professional staff with some earlier training and/or good experience of work in a Hydrology Division might be selected for six months' training in practical flood forecasting. Where graduates or such experienced professional staff are not available, undergraduate training courses leading to a university degree in Hydrology or Engineering (with Hydrology) followed by six months' practical training in flood forecasting have been recommended.

In some of the countries, there is an urgent need for hydrological data analysis to facilitate development of a comprehensive plan for flood forecasting. In such cases, the services of a foreign expert who could assist the Hydrological Service in data analysis for a period of six months would be most advantageous.

China (Taiwan)

The Hydrology Section of the Provincial Water Conservancy Bureau (PWCB) has about 100 members of staff of whom seventeen are graduates in Science or Engineering and fifty have had senior high school education. Three officers were trained in hydrology in the United States for one to two years. One

/officer was

officer was also trained in Japan for several months in applied hydrology. At least four more officers (graduates or with good experience in the Division) should be given six months' training in practical flood forecasting in, say, Japan or the United States. In view of the urgent need for trained officers, two officers should be trained in 1971 and one each in 1972 and 1973. In addition, two officers with appropriate basic knowledge should be trained in the operation and maintenance of the telecommunication system related to flood forecasting. The training of these two officers should be arranged during the first two years, each for a period of six months. The training fellowships required are therefore as follows:

	Flood forecasting	Telecommunication	Total
1971:	2	1	3
1972:	1	1	2
1973:	1	-	1

It is also recommended that one or two foreign experts on hydrological data analysis be made available for several months in 1971 to assist PWCB in the development of a comprehensive plan for flood forecasting in the Tan-Shui river basin. It is understood that PWCB has plans to request Japan for this assistance.

Republic of Korea

The Flood Control Division and the Disaster Prevention Division of the Water Resources Bureau are concerned with flood forecasting and warning services. These two divisions have many engineers in hydrology and water resources development. Several engineers were trained in hydrology in the United States and the United Kingdom for one to two years. One or two engineers were also trained for several months in applied hydrology in Japan. The Bureau, therefore, has a sufficient number of personnel with the necessary basic education. It is necessary, however, for a few selected officers to be trained immediately in practical flood forecasting and the maintenance of telecommunication equipment in order to implement the pilot flood forecasting and warning system in the Han river basin.

/The training

The training fellowships should be for six months each and may be distributed over 1971-1973 in the same way as recommended under China (Taiwan).

An expert on hydrological and hydrometeorological data analysis should be made available as early as possible to work as a consultant for a period of six months and assist the division concerned in analysing the available data.

Laos

The Hydrology Division at Vientiane is concerned with flood forecasting activity and has, at present, seven professional staff and nine assistants/operators. About half of the staff is stationed at Vientiane and the remainder at various other places in the country. Most of the present professional staff had some training in Hydrology for six months or one year in foreign countries (the Netherlands, Italy, Japan). None of the staff, however, has had any specialized training in flood forecasting.

As there is no university in Laos, personnel with university education are not available for direct recruitment. Personnel who have completed high school education (lycée) or those educated in the School of Technicians for Public Works at Vientiane have to be recruited as professional staff. The School of Technicians provides a two-year training course on public works engineering, plus six months' practical training.

The Typhoon Committee recommended the establishment of pilot flood forecasting in the Se Ban Hieng river basin and the Mekong Committee has been considering the implementation of basin-wide flood forecasting for the main stream of the lower Mekong river. It is considered, therefore, that the Hydrology Division will have to assume increasing responsibility in the field of flood forecasting.

It is estimated that, within a period of five years, the Hydrology Division will need an additional five professional staff and ten assistants/operators in connexion with flood forecasting activities.

Undergraduate training courses in Hydrology or Civil Engineering (including Hydrology), leading to a university degree in foreign countries, will require a period of at least four years. Since it is most desirable to provide

/three trained

three trained professional staff in the Flood Forecasting Section within the next two years or so, it is proposed that three selected candidates from the present professional staff of the Division, who have had the requisite basic education and also had some training in Hydrology in foreign countries, be given special training in Hydrology and Flood Forecasting for a period of six months or one year. The first one to complete the training should be put in charge of the Flood Forecasting Section. Two members of staff will also have to be given six months' training in the operation and maintenance of the telecommunication system. At a later stage, say after two years, two professional staff (one each year) may be sent for training abroad in long-term undergraduate courses in Hydrology followed by practical training in flood forecasting.

In the light of the above comments, the requirement of training fellowships may be summed up as follows:

	Flood forecasting (six months or one year)	Telecommunication (six months)	Undergraduate course in hydrology (four years)	plus	Flood forecasting (six months)
1971:	2	1	-		
1972:	1	-	-		
1973:	-	1	1		
1974:	-	-	1		

Philippines

The Water Resources Division and the Flood Control and Drainage Division of the Bureau of Public Works have seventy-five engineering staff. Some of these officers are graduates in Civil Engineering. Personnel trained in flood forecasting are not available, however, although a few officers received limited training in a flood forecasting seminar.

According to recommendations made by the Japanese survey team, the Flood Forecasting Centre for the Pampanga river basin should have two senior hydrologists or river engineers, one hydrologist and three assistant engineers. Three additional engineers in charge of telecommunication have also been recommended. It is proposed that six engineers be given six months' training (four in flood forecasting

/and two

and two in maintenance of telecommunication system) during the first three years, that is during 1971-1973. Suitable candicates may be selected from the present engineering staff for the proposed training (to be given in foreign countries, e.g. Japan or the United States).

It is accordingly estimated that training fellowships (each for six months) will be required as follows:

	Flood forecasting	Telecommunication	Total
1971:	2	1	3
1972:	1	-	1
1973:	1	1	2

Thailand

The Hydrology Division in the Royal Irrigation Department (RID) has ten engineers in hydrology, three mathematicians, six senior technicians with more than ten years' experience and many other junior technicians. The engineers and mathematicians have a basic knowledge of hydrology and hydrological operation and some of them are university graduates.

The preliminary plan for pilot flood forecasting in the Mekong river basin includes several additional radio-linked rainfall and water-gauge stations. It is estimated that for the implementation of the pilot flood forecasting scheme, at least six officers should be trained (four in flood forecasting and two in telecommunication) during the first three years (1971-1973). The six training fellowships (each for six months) that are required for this purpose may be distributed in the same way as shown under the Philippines.

CONCLUSION

The total number of training fellowships proposed may be summed up as follows:

	China		Korea		Laos		Philippines		Thailand	
	Met.	Hydro.	Met.	Hydro.	Met.	Hydro.	Met.	Hydro.	Met.	Hydro.
1971:	4	3	3	3	3	3	1	3	3	3
1972:	3	2	4	2	3	1	1	1	3	1
1973:	3	1	3	1	2	2	1	2	3	2
1974:	2	-	3	-	2	1	-	-	2	-
1975:	2	-	1	-	2	-	-	-	1	-

/The proposed

The proposed training programme covers a period of five years (1971-1975). The schedule for training in different years takes into account the priority for each type of training, the availability of suitable trainees and the need to stagger the procurement of training fellowships. In view of the urgency for the implementation of pilot flood forecasting schemes, the required training in hydrology and flood forecasting has been proposed for the first three years (1971-1973). It is recognized that some of the proposed training in Meteorology and Hydrology may have to be postponed if the required assistance or training fellowships are not available in time, and the schedule would then have to be adjusted.

It is hoped that the formulation of training requirements in this way will be helpful to the departments concerned in submitting requests for training fellowships and also in recruitment of additional staff where necessary. It is also hoped that the material presented in this paper will facilitate further consideration by prospective donor countries. Representatives of developed countries present at the third session of the Typhoon Committee may be in a position to make specific offers of assistance in this field. The Typhoon Committee may also wish to consider to what extent assistance for training could be obtained from UNDP or WMO VAP.

The Committee is invited to express views on the proposed plan and to make recommendations in the light of discussions at the session.

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FOR PARTICIPANTS ONLY

WRD/TC3/9
8 October 1970

ORIGINAL : ENGLISH

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

WORLD METEOROLOGICAL ORGANIZATION

Third Session of the Typhoon Committee
18-24 November 1970
Bangkok, Thailand

ACTIONS ON DECISIONS OF SECOND SESSION OF THE TYPHOON COMMITTEE

(Agenda item 5)

Note by the ECAFE and WMO secretariats and the ECAFE/WMO Joint Unit on Typhoons.

Introduction

As indicated in the annotated agenda, the purpose of this document is to provide the Typhoon Committee with a review of the action taken in following up the decisions it made at its second session. The paragraph numbers given in parentheses after the sub-headings are those of the relevant portions of the final report of the second session of the Typhoon Committee.

The Committee is invited to consider to what extent the action reported meets its wishes as expressed in the various decisions and, where necessary, to make new proposals designed to complete or accelerate the action needed.

Radiosonde/ratiowind station at Vientiane (paragraph 21)

In response to the request made by the Committee at its second session, the President of WMO has authorized the financing of the consumable equipment required for the first year of operation of this station from the WMO Voluntary Assistance Programme (Fund). Ground equipment is being provided by Finland and

/the training

the training of two Laotian observers in Bangkok began in July 1970 and is scheduled to last nine months. It is therefore expected that the station will come into operation before mid-1971.

Sources of assistance for new facilities (paragraphs 26, 54, 55)

The Joint Unit made an assessment of the requirements of assistance for the implementation of new facilities under the meteorological and hydrological components of the action programme and also for the training of personnel. A note on these requirements, based on information so far collected by the Joint Unit, is presented in a separate document (WRD/TC3/11). It is hoped that the information presented in that document will facilitate review of the possible sources of assistance and further consideration by prospective donor countries.

The Joint Unit advised the member countries concerned to apply for assistance under WMO VAP for the implementation of certain new facilities and, in some other cases, assisted them in exploring the possibilities of assistance through bilateral aid.

Priorities for implementation of observing and telecommunication facilities (paragraph 27-29)

The list of observing and telecommunication facilities which the Committee felt should receive priority in implementation was brought to the attention of all members of WMO by means of a circular letter distributed in May 1970. It was suggested that members providing aid bilaterally or under VAP would wish to take full account of these priorities when selecting projects to further implementation of the World Weather Watch.

This decision of the Typhoon Committee was also referred to the twenty-second session of the WMO Executive Committee in October 1970. The WMO representative at the third session of the Typhoon Committee will report on the views of the Executive Committee regarding this question.

Progress made since the second session in implementing these facilities is reported in document WRD/TC3/7 under agenda item 4.

/Information

Information on protective measures (paragraph 41)

The informative material so far collected by the Joint Unit concerning national organization for protective measures has been examined and a country-wise summary has been prepared for circulation to member countries. Since Japan has an elaborate organization for disaster prevention for which there is a large volume of material available in the Japanese language, the River Bureau of the Ministry of Construction, Tokyo, has been requested to provide a summary of that material in English. Additional information collected in this way will be incorporated in the consolidated summary prepared by the Joint Unit.

Community preparedness expert for Joint Unit (paragraph 42)

Further negotiations have taken place during 1970 with the League of Red Cross Societies (LRCS) regarding the possible provision of an expert in community preparedness to serve in the Joint Unit. It has been suggested to the LRCS that it would be valuable if the expert could be made available for periods of one to two months, from time to time, to carry out surveys in countries affected by typhoons.

An encouraging reply has been received from the Secretary-General of the LRCS who is investigating means of meeting the request of the Typhoon Committee. Contact is being maintained with the LRCS on this subject and any further progress will be reported to the Committee.

Second Training Seminar on Flood Forecasting and Warning Services (paragraph 46)

The second training seminar on Flood Forecasting and Warning Services was held in Tokyo from 15 August to 14 October 1970. The seminar was organized by the Government of Japan in collaboration with the ECAFE/WMO Joint Unit. Nine trainees from China (Taiwan), the Republic of Korea, Laos, the Philippines and Thailand participated in the seminar. Financial assistance towards the cost of travel and subsistence was provided by the Government of Japan.

Training requirements of the Typhoon Committee (paragraph 48)

Requirements of training in Meteorology and Hydrology and financial assistance (training fellowships) needed have been assessed in consultation with the member countries concerned. A tentative five-year plan for such training has been presented by the Joint Unit in a separate document (WRD/TC3/9) for consideration by the third session.

/Assistance

Assistance for the establishment of a flood forecasting and warning system in the Pampanga river basin in the Philippines (paragraph 53)

The survey of the Pampanga river basin was carried out by a team of Japanese experts in November/December 1969 and the team's final feasibility report was submitted to the Government of the Philippines in July 1970. The total cost of implementing the first stage of the pilot flood forecasting and warning system was estimated to be US$225,000. While the survey report is being studied by the Philippines Government, further financial and technical assistance for the implementation of the project is being considered by the Government of Japan.

Financing of flood forecasting and warning systems (paragraph 55)

It is necessary to prepare comprehensive detailed plans for pilot flood forecasting and warning systems for key river basins in China (Taiwan), the Republic of Korea, Laos, the Philippines and Thailand. So far, assistance had been obtained from Japan in preparing a comprehensive plan for a pilot flood forecasting and warning system for the Pampanga river basin in the Philippines (see note on paragraph 53 above).

A tentative plan for flood forecasting in the Meklong river basin in Thailand has been developed and it is expected that the implementation of the initial stage of this plan will be financed from national resources. As regards pilot flood forecasting for the Tan-Shui river basin in China (Taiwan) and the Han river basin in the Republic of Korea, it is considered that the assistance of one or two experts will be needed for data analysis. The possibility of obtaining such assistance from Japan is under consideration.

Installation of an ocean weather ship in the Southwest Pacific (paragraph 56-58)

As requested by the Committee, the Secretary-General of WMO conveyed to the Government of the USSR its acceptance of the offer to station an ocean weather ship at approximately 16°N 135°E in the Southwest Pacific for a period of two months. In accordance with the desire of the Typhoon Committee, the Government of the USSR changed the planned period of operation to fit into the main typhoon season and the vessel began its programme of observations on 20 June 1970. It is understood that the observations were passed four times a day to Tokyo, through Nagasaki, although bad propagation conditions sometimes prevented successful transmissions.

/The Committee's

The Committee's request that the vessel operate for a longer period and during future typhoon seasons was also conveyed to the Government of the USSR. In reply, that Government stated that the operation of a weather ship in the area over an extended period could only be accomplished through international support from other countries. This information was circulated to member countries of the Typhoon Committee in May 1970.

Strenthening of the Joint Unit (paragraph 63)

The Committee was informed at its second session of the steps taken to obtain the services of a telecommunications/electronics expert to serve in the Joint Unit through UNDP funds under the WMO regional programme. Early in 1970 Mr. Chieh-hsi Tang (China) was selected to fill this post and he took up his duties in Bangkok in August 1970.

Exchange of radar fixes of typhoons (paragraph 66)

As in the previous year, arrangements were made for the exchange of radar fix messages during the typhoon season of 1970. Recommendations of the second session concerning distribution of these messages, units used and communication arrangements were implemented. The Committee may wish to review how the arrangements for the exchange for radar messages actually worked this year.

Code for exchange of radar observations (paragraph 67)

The code drawn up for this purpose by the CSM Working Group on Data Needs and Codes was considered at the fifth session of the WMO Commission for Synoptic Meteorology held at Geneva in June 1970; the Commission recommended its adoption for reporting ground radar observations. This recommendation is to be submitted to the twenty-second session of the WMO Executive Committee (October 1970) and, if approved, will come into force on 1 January 1972. This date has been chosen to allow members adequate time to prepare national instructions.

Members are free, however, to use the code before this date if they so wish. The Typhoon Committee, therefore, may wish to urge its members to use the code as soon as possible, with a view to uniformity during the 1971 typhoon season.

/Amendment

Amendment of Article 3 of Statute (paragraph 72)

ECAFE and WMO sent a joint note to the Governments of the member countries of the Typhoon Committee concerning the amendment of Article 3 of the Statute in accordance with the request of the Typhoon Committee. According to Article 11 of the Statute, amendments shall take effect when approved by all participating Governments. At the time of the preparation of this document, approval had been received from the Governments of Hong Kong, the Republic of Korea, Laos, the Philippines and Thailand. Replies to the reminders sent to China and Japan were still awaited.

Transfer of Joint Unit from Bangkok to Manila. (paragraph 77)

Details of facilities required at Manila for locating the Typhoon Committee secretariat have been under negotiation with the Government of Philippines. It is understood that office accomodation, furniture, supporting staff etc. will be available by November 1970. As the third session of the Typhoon Committee is to be held at Bangkok in November, it has been decided to transfer the Joint Unit to Manila in early 1971.

Date and place of third session (paragraph 79)

At the second session of the Typhoon Committee, the representative of Hong Kong expressed interest in the possibility of holding the third session in Hong Kong. Shortly thereafter, ECAFE was informed that it would not be convenient to hold the session in Hong Kong and, consequently, it was decided to convene it in Bangkok.

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FOR PARTICIPANTS ONLY

WRD/TC3/10
8 October 1970

ORIGINAL : ENGLISH

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

WORLD METEOROLOGICAL ORGANIZATION

Third session of the Typhoon Committee
18-24 November 1970
Bangkok, Thailand

DRAFT ANNUAL REPORT OF THE TYPHOON COMMITTEE

(9 December - 24 November 1970)

(Agenda item 6)

INTRODUCTION

1. In accordance with article 10 of its statute, the Typhoon Committee is required to submit annual reports to participating Governments, ECAFE and WMO. This is the second annual report; it describes the activities of the Committee during the period 9 December 1969 to 24 November 1970.

2. The second session of the Typhoon Committee was held at Quezon City, Philippines, from 2 to 8 December 1969. A brief report on this session was included in the first annual report of the Committee.

WORK OF THE TYPHOON COMMITTEE SINCE THE SECOND SESSION

3. The ECAFE/WMO Joint Unit on Typhoons, consisting of two experts (Mr. S.N. Sen, Chief of the Unit and Mr. A. Mizuno, Hydrologist and Flood Control expert), continued to function at the ECAFE secretariat as the executive body of the Typhoon Committee. An expert on Telecommunication and Electronics was appointed by WMO during the year to serve in the Joint Unit. Mr. C.H. Tang assumed charge of this post on 10 August 1970.

/4. In

4. In accordance with the decision of the second session to transfer the Joint Unit from Bangkok to Manila where it will be re-designated as the Typhoon Committee secretariat, details of facilities required at Manila have been under negotiation with the Government of the Philippines. It is expected that office accommodation, furniture, supporting staff, etc. will be available by November 1970. As the third session of the Committee is to be held at Bangkok in November 1970, it has been decided to transfer the Joint Unit to Manila in early 1971.

5. Consequent on the decision to re-designate the Joint Unit as the Typhoon Committee secretariat, Article 3 of the Statute of the Typhoon Committee had to be amended. The Executive Secretary of ECAFE and the Secretary-General of WMO took up this matter with the Governments concerned and the proposed amendment was duly approved.

6. The first annual report of the Typhoon Committee for the year 1969 was presented to the twenty-sixth session of ECAFE held at Bangkok from 14 to 27 April 1970. The Commission commended the Typhoon Committee for its activities and expressed satisfaction that the secretariats of ECAFE and WMO had collaborated and co-operated in this sub-regional undertaking. The Commission also noted with appreciation the continued interest of some of the developed countries and the support they had provided.

7. The experts of the Joint Unit visited each of the member countries once or twice during the year and had detailed discussions with the officials of the meteorological and hydrological services. The current facilities for typhoon damage control were reviewed and actions were initiated for implementation of the programmes recommended by the Typhoon Committee. Progress made or actions initiated during the year under review are summarized below under the respective components of the Action Programme.

METEOROLOGICAL COMPONENT

8. Continuing efforts were made to implement the recommendations regarding observational and telecommunication facilities. Special attention was given to those facilities which were included in the priority list drawn up by the second session of the Typhoon Committee. Attention was also given to the need for ensuring regular and efficient operation of the existing

/facilities.

facilities. Developments and actions initiated since the second session of the Committee are briefly reported below.

Observational facilities (RS/RW, radar and APT)

9. The proposed RS/RW stations at Pratas and Nansha (China) were included in the priority list by both the second session of the Typhoon Committee and the last session of the Regional Association II of WMO. The Republic of China's request for assistance under WMO VAP for establishment of these two stations has been circulated by WMO, but no offer of assistance has yet been received. Following exploratory discussion last year with the American Embassy at Bangkok, information was received from the ESSA Administrator that all available resources of ESSA were committed and it was not possible, therefore, to supply the equipment required, although the need for these stations was recognized. On receipt of a communication from a member of the Committee again emphasizing the urgency for these two RS/RW stations, the Joint Unit sent a request to WMO for this matter to be given special consideration at the next session of the E.C. Panel of VAP. The possibility of obtaining assistance from bilateral sources was also discussed with the Permanent Representatives to ECAFE of a number of developed countries.

10. The RS/RW station at Pohand (Republic of Korea), which had observation at 00 GMT only, introduced the recommended additional observation at 12 GMT with effect from January 1970. Both observations are now included in broadcasts from Seoul.

11. For the establishment of an RS/RW station at Vientiane (Laos), ground equipment has been offered by Finland under VAP and accepted by Laos. It was decided to provide consumable equipment for the first year of operation from WMO VAP (F) Contingency Fund. Training of two Laotian operators in operation and maintenance of Vaisata equipment was arranged at Bangkok, the cost of travel and stipend being met by WMO through its UNDP regional programme. The training commenced in July and is expected to be completed by March 1971.

12. In the Philippines, the full programme of RS/RW observations at Laoag and Zamboanga could not be introduced for want of sufficient personnel and consumable articles. RS/RW equipment for Cebu and RW equipment for Davao could not be installed and wind-finding radar at Manila could not be made

/operational for

operational for the same reason. A minimum network which would be more realistic was therefore considered, and a full programme of observations at Laoag, regular reception of observations from the existing United States station at Clark Air Base (near Manila) and priority establishment of RS/RW at Cebu were suggested for the Weather Bureau's consideration.

13. A weather radar was installed at Kaohsiung (China) under the UNDP Special Fund and has been operational since January 1970. SSB communication between the radar station and Taipei was established in June 1970.

14. A 10 cm weather radar was established at Seoul in early 1970. It was brought into regular operation with effect from 1 August 1970.

15. The construction of the radar building at Guian (Philippines) was completed and the installation of the radar was expected to be completed by the end of 1970. It was understood from the Weather Bureau that the purchase of five additional weather radars by means of loans from the United States Import-Export Bank was under negotiation. Since the Typhoon Committee attached high priority to the establishment of radar at Basco, the USAID mission in Manila was contacted with a view to exploring the possibility of procuring a radar through bilateral aid from the United States.

16. One set of Alden APT equipment was installed at Manila and has been in regular operation since March 1970. The APT equipment installed at Bangkok was provided by the United States under VAP assistance and has been in operation since July 1970. APT equipment to be installed at Seoul was expected to be received from Japan by the end of 1970. With regard to APT equipment for Vientiane, the French Technical and Economic Mission to Laos expressed its readiness to consider providing the equipment as bilateral aid.

Ocean weather ship at 16°N, 135°E

17. In pursuance of the offer made by the USSR to station a weather ship in the Southwest Pacific, the Secretary-General of WMO took up the various recommendations made by the second session of the Committee with the USSR authorities. The Hydrometeorological Service of the USSR agreed to arrange for the weather ship to be in position from June to August 1970 and suggested that operation of a weather ship for a longer period would be possible only with support from other developed countries. The Soviet views were communicated to the member countries of the Typhoon Committee for further consideration.

18. Information was received that the Soviet weather ship had reached the recommended location and commenced its programme of observations with effect from 20 June 1970. This information was notified to the members of the Committee. It was expected that the coastal radio station in Japan and/or the Philippines would receive the observations from the weather ship for further dissemination. Full particulars of observations recorded and transmitted by the weather ship were being awaited.

Exchange of radar fixes of typhoons

19. Arrangements were made for the continuance of the exchange programme of radar fix messages during the typhoon season of 1970. Recommendations of the second session of the Committee concerning distribution of these messages, units used and communication arrangements were implemented. With the establishment of two additional radars at Kaohsiung (China) and at Seoul (Republic of Korea), the exchange of radar fix messages was expected to be more useful during 1970.

Telecommunication facilities

20. Thailand submitted a request for VAP assistance for telecommunication equipment worth US$578,000 for the establishment of the Regional Telecommunication Hub (RTH) at Bangkok. This request was approved by WMO for circulation to countries. Australia offered assistance equivalent to US$20,000 to provide some telecommunication equipment and WMO recently agreed to contribute up to US$50,000, out of the VAP Fund, to the cost of providing a set of HF radio transmitting and peripheral equipment. The Joint Unit reviewed the latest position, in consultation with the Meteorological Department at Bangkok, and the balance of equipment needed for the RTH was classified into three groups in order of priority.

21. The Bangkok-Hong Kong point-to-point circuit was established in June 1970 and brought into regular operation on 18 July 1970. With the establishment of this circuit, the gap in the circuit Guam-Manila-Bangkok-Hong Kong-Tokyo has now been bridged, thus providing an additional facility for exchange of meteorological data among these centres. The current programme of exchanges and need for changes of schedules etc. were under review.

22. Regarding the establishment of the Bangkok-Vientiane point-to-point link, the USSR agreed to provide the terminal equipment at Vientiane as VAP assistance to Laos. The frequencies to be used for transmissions from either

side have been settled and communicated to the USSR through WMO. The Soviet authorities agreed to give three months' training at Moscow to the officer in charge of the Telecommunication Section as part of the VAP assistance.

23. China (Taiwan) and Japan have planned to operate a Taipei-Tokyo point-circuit through a communication satellite. It was understood that the Taiwan Provincial Weather Bureau would make necessary provision for this purpose in their budget for 1972. As regards the Seoul-Tokyo point-to-point link, the Republic of Korea and Japan have agreed to use a leased circuit of the existing cable communication. The circuit is expected to be in operation from April 1971.

24. The improvement needed in the collection of observations from Pratas and Nansha was reviewed. The unsatisfactory reception at Taipei is due to low transmitter power, severe interference and poor operation. It was gathered that China would try to install more powerful transmitting equipment at Pratas and Nansha and, if this cannot be done from national resources, it might request assistance from external sources.

HYDROLOGICAL COMPONENT

Pilot flood forecasting and warning systems

25. Further progress was made in developing comprehensive plans for pilot flood forecasting and warning systems in the key river basins selected for this purpose. The ECAFE/WMO Joint Unit assisted the countries concerned in reviewing the latest position and in initiating further action. Fresh developments under this component during the year under review are reported below:

China (Taiwan)

26. The weather radars at Kaohsiung and Hualien provide very good coverage for China (Taiwan) and the surrounding ocean areas and have been most useful in typhoon tracking and precipitation studies. The larger part of the Tan-Shui river basin, however, is located on the lee-side of the high mountains in relation to the radar beams from both the radars, and it is considered that the installation of a third radar at Taipei would be useful for flood forecasting in the Tan-Shui river basin.

27. The experts of the UNDP/WMO project at Taipei have developed objective techniques for precipitation forecasting in relation to typhoon tracks.

/They intend

They intend to develop procedures for the conversion of precipitation forecasts into riverflow for qualitative flood warning purposes.

28. A tentative improvement project for flood forecasting was proposed by the Provincial Water Conservancy Bureau (PWCB) in consultation with other agencies. Following discussions with the experts of the Joint Unit, PWCB revised this plan during 1970. The revised plan includes one additional radar at Taipei, ten telemetering rain-gauge stations, seven telemetering river-stage stations and other telecommunication facilities. It is recognized that hydrological analysis of the existing data must be carried out for developing quantitative flood forecasting procedures and for determining the exact number and locations of the additional stations. It has been decided that, for data analysis, PWCB will need technical assistance by one or two experts. The possibility of Japanese assistance in this matter is under consideration.

Republic of Korea

29. At present, flood forecasting in the Han river basin is based solely on stage correlations. The correlations have been progressively influenced by the recent completion of dams on the north Han river and will be further affected in future by the completion of the Paldang and Soyang dams. Construction of the latter two dams was in progress during 1970.

30. There is an urgent need for the establishment of a new comprehensive plan for the flood forecasting system or for the improvement and expansion of the existing system. The provision of an expert on hydrological data analysis will be necessary to assist the Hydrology Division in analysing the available data. The training of a few Korean engineers in Hydrology and Flood Forecasting in a foreign country, such as Japan, is also urgently needed. These requirements and possible sources of assistance are under consideration.

Laos

31. The Se Bang Hieng river basin was selected for the establishment of pilot flood forecasting, but more than two thirds of the basin area is not accessible at present. A preliminary reconnaissance of the western part of

/the basin

the basin was made by the Hydrologist of the Joint Unit, along with Laotian officials concerned. The Se Bang Hieng river basin has only two rain-gauge stations at present, both situated on the western tributary (Se Cham Phone). River stage data at these two stations covering the last few years are available, but there are no records of discharge measurements. There are two other stream-gauging stations in the lower reach below the confluence of the Se Cham Phone and the Se Bang Hieng. The Hydrologist of the Joint Unit has made some hydrological analysis with the limited data available. Preliminary computations made so far suggest that a beginning could be made by introducing flood forecasting for the Se Cham Phone and the lower reach of the Se Bang Hieng and that the system could later be expanded when implementation of facilities for the entire Se Bang Hieng basin become feasible.

Philippines

32. A team of nine Japanese experts carried out a comprehensive survey and study of the Pampanga river basin with a view to preparing plans for flood forecasting. The Hydrologist of the Joint Unit participated in this survey. The final feasibility report was submitted by the Japanese team to the Government of Philippines in July 1970. For implementation of the first stage of the pilot flood forecasting system, the installation of seven telemetering rainfall and stage-gauging stations, three telemetering rainfall stations, two relay stations, one monitor and one master stations has been recommended. The estimated total cost of US$225,000 includes housing facilities, equipment, installation, transportation and training. The training of two engineers in flood forecasting and three in telecommunication for three months in Japan has been envisaged.

33. The possibility of further financial and technical assistance for implementation of the project, as recommended by the survey team, has been under consideration by the Government of Japan.

Thailand

34. Further progress was made in developing a plan for establishing a pilot flood forecasting system in the Meklong river basin. A reconnaissance trip to the Meklong was organized and communication by portable SSB equipment was tried out. Simulation methods for stream flow at the K10 station on the

/Kwae Noi

Kwae Noi river and the K6 station on the Kwae Yai river have been developed by the Joint Unit on the basis of available daily rainfall data in the upper basin. Discharge correlation between the K10/K6 stations and Kanchanaburi is also being developed. The Joint Unit also assisted the Meteorological Department official concerned in studying synoptic situations and precipitation patterns associated with past floods in the Meklong basin.

35. On the basis of the above studies, a plan incorporating minimum requirements for flood forecasting has been drawn up. According to this plan, data will be required from nine rainfall stations and three (preferably five) stage-gauging stations. Only two of these stations are equipped with telecommunication facilities; the remaining stations will have to be provided with similar facilities. The proposals are being examined by the departments concerned. The Royal Irrigation Department considered that it might be possible to meet the expenditure on equipment from national resources and that a part of the equipment could be provided from the stock already available in the Department.

TRAINING AND RESEARCH

Training of personnel

36. In connexion with the implementation of the action programmes recommended by the Typhoon Committee, the need for additional trained personnel in the meteorological and hydrological services of the member countries was reviewed by the Joint Unit. China (Taiwan), the Republic of Korea, Laos, the Philippines and Thailand need financial assistance (training fellowships) for the training of their personnel in foreign countries. A tentative five-year plan for the training of personnel was prepared by the Joint Unit in consultation with the officials of the national services. This plan (document WRD/TC3/8) is presented to the third session of the Committee for further consideration.

Training seminar on flood forecasting and warning services

37. In pursuance of the offer made by the representative of Japan at the second session of the Committee, the Government of Japan organized, the second training seminar on flood forecasting and warning services at Tokyo

/from 15 August

from 15 August to 14 October 1970, entirely at its own expense. The arrangements for conducting this seminar were made by the Overseas Technical Co-operation Agency (OTCA) of the Government of Japan in collaboration with the ECAFE/WMO Joint Unit. Nine trainees from the Republic of China, the Republic of Korea, Laos, the Philippines and Thailand participated in the seminar which was designed to give greater emphasis to the practical aspects of flood forecasting and proved to be a great success.

Co-ordination of research activities

38. Information was received from the University of Hong Kong that research work connected with the experimental building at Cape D'Aguilar had been taken up by the Department of Civil Engineering.

39. A proposal submitted by the Korean Meteorological Department to WMO for assistance under the UNDP Special Fund for the establishment of a meteorological research institute at Seoul is under consideration.

40. In a paper on "Project Stormfury, 1969", Dr. R.C. Gentry reported the results of the hurricane modification experiment conducted on hurricane Debbie on 18 and 20 August 1969. The conclusions reached in these experiments seem to be very encouraging. It is understood from the Director, National Research Centre for Disaster Prevention, Tokyo, that some thought is being given to the possibility of future experiments on typhoon modification, linked with activities under United States-Japan Science Co-operation.

THIRD SESSION OF THE TYPHOON COMMITTEE

(To be completed at the third session).

CONCLUSION

(To be completed at the third session).

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FOR PARTICIPANTS ONLY

WRD/TC3/10 Corr. & Add.1
26 October 1970

ORIGINAL : ENGLISH

ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

WORLD METEOROLOGICAL ORGANIZATION

Third session of the Typhoon Committee
18-24 November 1970
Bangkok, Thailand

CORRIGENDUM AND ADDENDUM
DRAFT ANNUAL REPORT OF THE TYPHOON COMMITTEE

(9 December - 24 November 1970)

(Agenda item 6)

Page	Para	Line	Corrections and additions
1	3	last	Replace "assumed charge of" by "took up".
2	4	2	Replace "where it will" by "and that it should".
3	9	5	After "WMO" delete remainder of para. Add "... and an offer to provide the equipment needed to establish the stations at Pratas was received in October 1970. At the time of preparing this document the necessary steps for the implementation of this VAP project were being taken with the donor and recipient countries. No offer has yet been received in response to the VAP request for Nansha."
3	11	4	Delete "Contingency Fund".
4	16		Add at end "It is understood that no decision has yet been made on this matter".
6	26	6 & 7	Amend lines 6 and 7 to read "that installation of a third radar at Taipei would ensure complete coverage of the basin for flood forecasting."
6	27	1 & 2	Amend to read "The UNDP/WMO project at Taipei has developed an objective technique ....."
8	31	2	Delete "only".

/9

Page	Para	Line	Corrections and additions
9			Add two paragraphs after para 35 under the heading "COMPLEMENTARY PROTECTIVE MEASURES" to read as follows:
			"36. The Typhoon Committee has not yet been able to give sufficient attention to community preparedness and disaster prevention questions. Further negotiations took place during 1970 with the League of Red Cross Societies regarding the possible provision of an expert on community preparedness to serve in the Joint Unit. It has been suggested to the LRCS that it would be valuable if the expert could be made available for short periods of one to two months from time to time to carry out surveys in countries affected by typhoons. An encouraging reply has been received from the Secretary-General of the League, who is investigating means of meeting the request of the Typhoon Committee.
			37. The informative material concerning national organization for protective measures so far collected by the Joint Unit from member countries was examined, and a summary prepared for circulation to member countries. Since Japan has an elaborate organization for disaster prevention, the River Bureau of the Ministry of Construction, Tokyo, was again requested to provide a note in English summarizing the large volume of material available in the Japanese language.
9,10			Renumber present paragraphs 36 to 40 to read 38 to 42.
10	41 (revised number)		Add at end "The project will include research related to the improvement of flood warning techniques, water conservation schemes and typhoon forecasting."

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FOR PARTICIPANTS ONLY

WRD/TC3/11
23 October 1970

ORIGINAL : ENGLISH

ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

WORLD METEOROLOGICAL ORGANIZATION

Third session of the Typhoon Committee
18-24 November 1970
Bangkok, Thailand

ASSISTANCE REQUIRED FOR IMPLEMENTATION OF THE TYPHOON COMMITTEE'S PROGRAMMES

(Agenda item 5)

Note by ECAFE/WMO Joint Unit

INTRODUCTION

The first session of the Typhoon Committee, held in December 1968, approved a tentative action programme for the mitigation of damage caused by typhoons. The programme comprised four distinct components: (a) meteorological component, (b) hydrological component, (c) complementary protective measures and (d) training and research. It was agreed that member countries of the Typhoon Committee should make every possible effort to implement the recommended facilities as far as possible from available national resources and to provide necessary local support to external aid programmes. It was recognized that most of the countries in the region would need assistances under bilateral aid schemes or from international sources for implementation of the required facilities.

The activities of the Typhoon Committee during 1969 towards implementation of the recommended programmes were reviewed at the second session of the Committee held in December 1969. Further progress during 1970 will be reported at the third session of the Committee. Although some facilities have been implemented during this period, either from national resources or with assistance from external sources, the countries concerned are in need of assistance for many of the recommended facilities yet to be implemented. The purpose

/of this

of this paper is to present an assessment of the assistance still required, as far as can be ascertained, for implementation of the more urgent facilities.

ASSISTANCE ALREADY PROVIDED OR OFFERED

Those facilities recommended by the Typhoon Committee which have been implemented fully or partially with assistance from external sources, or for which offer of assistance has been received, are listed below:

(1) Ocean weather ship: A Soviet weather ship was stationed at the recommended location (16°N, 135°E) and commenced meteorological observations on 20 June 1970. It was proposed by the USSR that the OWS would be operated during the months June-August 1970. In regard to the Typhoon Committee's request for a longer period of operation during 1970 and in subsequent typhoon seasons, the USSR has suggested the pooling of the material - technical facilities and financial resources of countries with highly-developed hydrometeorological services.

(2) RS/RW station at Vientiane (Laos): Ground equipment has been offered by Finland under WMO VAP. Consumable equipment for the first year's operation will be provided from the WMO VAP (F) contingency fund. The training of two Laotian operators at Bangkok was arranged, the cost being met by WMO through its UNDP regional programme.

(3) RS/RW station at Pratas (China): Ground equipment and consumables for the first year's operation have been offered by the United States under VAP (ES). An agreement between the donor and recipient countries is being negotiated.

(4) Weather radar at Kaohsiung (China): Already established with assistance from the UNDP/WMO Special Fund.

(5) APT station at Bangkok (Thailand): Equipment provided by the United States under WMO VAP has been installed at Bangkok.

(6) Bangkok-Vientiane RTT point-to-point link: The USSR has offered assistance to Laos under WMO VAP for the establishment of terminal equipment at Vientiane. The training of one Laotian officer at Moscow on maintenance of telecommunication equipment has also been agreed as part of the VAP assistance.

(7) Pilot flood forecasting for Pampanga River basin (Philippines): A comprehensive survey of the Pampanga River basin has been made by a team of nine Japanese experts. After further study in Japan, the team submitted a comprehensive plan for flood forecasting.

/(8)

(8) Training Seminar on Flood Forecasting and Warning Services: The Government of Japan organized, entirely at its expense, two training seminars at Tokyo in 1969 and in 1970, mainly for the benefit of Typhoon Committee countries.

ASSISTANCE REQUIRED FROM EXTERNAL SOURCES

(a) Meteorological component

The second session of the Typhoon Committee considered that, within the area affected by typhoons, there are some gaps in the observing networks and telecommunication arrangements which are, for typhoon warning purposes, of more importance than others. The Committee therefore drew up a priority list of those facilities which it considered to be of prime importance and which should receive priority attention (see pages 7 and 8 of the second session's report). As a result of consultations with the countries concerned, it is concluded that at least some of the facilities included in the priority list cannot be implemented without assistance from external sources. These facilities for which a definite need for assistance is already known are listed below:

Observing facilities

(i) Ocean weather ship: during typhoon season of 1971 and in subsequent years.

(ii) Upper-air stations:

Nansha (China)) Republic of China's application to WMO for VAP assistance for supply of equipment was circulated but no offer has yet been received.

(iii) Weather radar:

Kwangju (Korea))
Vientiane (Laos)) Countries concerned may apply for VAP assistance.
Basco (Philippines))

(iv) APT stations:

Taipei (China)

Vientiane (Laos): French technical and economic mission to Laos considering bilateral aid.

/Telecommunication

Telecommunication facilities

Strengthening of RTH, Bangkok (Thailand): Thailand submitted an application for VAP assistance for terminal equipment worth $578,000, and this was circulated to member countries of WMO. So far, an offer of bilateral aid from Australia to provide equipment worth $20,000 and an offer of $50,000 from the VAP Fund have been received. The balance of telecommunication equipment worth about $500,000 is still needed by Thailand through assistance from external sources. The telecommunication equipment needed includes that required for the transmitting station, receiving station and communication centre, details of which were given in the original application already circulated to WMO members.

The remaining observational and telecommunication facilities included in the priority list have either been implemented or are proposed to be implemented from national resources. The need for assistance from external sources for any of the facilities in the latter category could be considered at a later stage if it proves that they cannot be implemented nationally. A complete summary of the priorities established by the Typhoon Committee and the prospects for their implementation is given in annex III to document WRD/TC3/7.

(b) Hydrological component

The Typhoon Committee decided to establish a pilot flood forecasting and warning system in a key river basin in each of the countries - China (Taiwan), Republic of Korea, Laos, the Philippines and Thailand. Comprehensive plans for pilot flood forecasting systems in these river basins are in varying stages of development. A comprehensive plan has been prepared for the Pampanga River basin in the Philippines. Tentative plans for the Tan-Shui River basin (China) and for the Mekong River basin (Thailand) have been under consideration. Although it is not yet possible to give a final estimate of the required facilities, except for the Pampanga River basin, it is evident that, in order to implement

/the pilot

the pilot flood forecasting system, each of the countries would need some assistance from external sources and that assistance would be required for the provision of some of the following facilities:

(1) Telemetering rainfall and river stage equipment; SSB transreceivers or VHF telemetering systems.

(2) Radar for precipitation measurement.

(3) Consultants' services to assist in the analysis of data.

(4) Training of personnel /see section (d) below/.

As a result of the survey of the Pampanga River basin in the Philippines carried out by a team of Japanese experts, it has been estimated that additional equipment consisting of seven telemetering rainfall and river stage gauges, three telemetering rainfall gauges, and one master station and one or two relay stations will be necessary. The cost of this equipment has been estimated to be about $145,000.

Tentative estimates have been made of the additional equipment required for pilot flood forecasting for the Tan-Shui river (China) and the Meklong River (Thailand). It is not yet known, however, how much of this equipment could be provided from national resources and what portion would be required through assistance from external sources.

For the development of comprehensive plans for pilot flood forecasting for the Tan-Shui River basin in China (Taiwan) and the Han River basin in the Republic of Korea, it has been considered that assistance for data analysis by one or two foreign experts would be needed.

(c) Complementary protective measures

The Typhoon Committee has not yet been able to give sufficient attention to community preparedness and disaster prevention organization. It was considered necessary that an expert on community preparedness should be provided for the ECAFE/WMO Joint Unit and the League of Red Cross Societies (LRCS) was approached for this purpose. At its second session, the Typhoon Committee requested ECAFE and WMO to pursue the matter with LRCS and also to explore the possibility of obtaining the services of such an expert, even as a short-period consultant, from other sources. The matter has since been under negotiation with LRCS.

/(d)

(d) Training of personnel

Training of meteorologists and hydrologists has been considered to be one of the essential requirements for the effective implementation of the Typhoon Committee's programmes. Apart from Hong Kong and Japan, the member countries, namely China (Taiwan), the Republic of Korea, Laos, the Philippines and Thailand, need assistance from external sources in the form of training fellowships. A survey has been carried out of the training requirements for the next five years in these countries in connexion with the implementation of the Typhoon Committee's programmes.

A tentative five-year plan for training of personnel, proposed on the basis of the above survey, has been presented in document WRD/TC3/8 for the consideration of the Committee. The following table extracted from that document shows the allocation of the proposed training fellowships for each of the countries concerned.

	China		Republic of Korea		Laos		Philippines		Thailand	
	Met.	Hydro.	Met.	Hydro.	Met.	Hydro.	Met.	Hydro.	Met.	Hydro.
1971	4	3	3	3	3	3	1	3	3	3
1972	3	2	4	2	3	1	1	1	3	1
1973	3	1	3	1	2	2	1	2	3	2
1974	2	-	3	-	2	1	-	-	2	-
1975	2	-	1	-	2	-	-	-	1	-

CONCLUSION

It is evident that, for full implementation of the action programme envisaged by the Typhoon Committee, most of the member countries would need assistance under bilateral or multilateral aid schemes or from international sources. The requirements of assistance under each component of the action programme as assessed so far have been indicated in this paper. The Committee may wish to examine these requirements and suggest any modification or provide supplementary information in the light of latest national plans.

/The

The Secretary-General of WMO has written to all member countries of WMO drawing attention to the list of the observing and telecommunication facilities to which the Typhoon Committee attached high priority for implementation. It was suggested that members providing aid bilaterally or under VAP would wish to take full account of these priorities. The Permanent Representatives to ECAFE of prospective donor countries were also contacted and the requirements of assistance were explained to them. The Committee may wish to consider further steps that may be taken to expedite procurement of the required assistance. It is hoped that representatives of the developed countries present at the third session will be in a position to make specific offers of assistance. Such considerations and expressions of opinions would greatly facilitate follow-up action during the next year.

. . . . .

Mr. MIZUNO

No TC 3/12

INTERIM REPORT

On

Feasibility Survey for the Establishment of Comprehensive Plan of the Flood Forecasting and Warning System in the Pampanga River Basin in the Philippines

Reported to Dr. S.N. Sen, Mr. A. Mizuno of ~~ECAFE/WMO~~ Joint Unit on Typhoons, Mr. Damrong, Mr ~~Tongtem~~ Thongtem from RID, Cap. Prasert, Mr. Damrong,

THE JAPANESE GOVERNMENT SURVEY TEAM
for
Flood Forecasting and Warning
under
The Colombo Plan
16 December 1969

The Japanese Survey Team consisting of nine experts has implemented their feasibility survey for establishment of comprehensive plan of the flood forecasting system on the Pampanga River Basin in the Philippines. The team arrived at Manila on 19 November 1969 and has finished their works in the Philippines on 18 December 1969 along the line of a plan of operation which was agreed by the Government of the Philippines and the Government of Japan.

This is the interim report resuming the results of the survey and study up to the end of their terms. It is understood that the final feasibility report will be submitted to the government of the Philippines by the end of March 1970.

II. Works Implimented

1. Field Works

During the period, the survey team has conducted field reconnaissance survey of whole Pampanga river basin, middle and lower basin, upper basin and Angat area respectively to observe the features of the basin, river channel system, existing observation facilities, river improvement works, proposed places for telemetering system and telecommunication facilities etc.

2. Collection and study of data

All available data of the following items are collected and studied by the experts.

a. Meteorological, Hydrological and Hydraulic observed data.

b. Facilities for flood protection and river improvement.

c. Population, properties and other important factors in frequently inundated areas.

d. Existing related river improvement projects and water resources development projects and hydraulic analysis of floods.

3. Preliminary selection of location for proposed flood forecasting and warning system and preliminary design and cost estimation for necessary facilities.

III. Target area and basic places for flood forecasting and warning services.

It is considered that the target areas for flood forecasting and warning services are to be focused on the following three blocks of the middle and lower river basin.

1. Candaba Area
2. Right bank area of the main Pampanga river below . Arayat Mountain.
3. Delta area below Apalit.

Most important factors which have to be taken into account for flood forecast are over toping or collapse of Cabiao-Gapan dike and Cabiao-Candaba ring levee for the upper stream side of block No. 1, water elevation and its duration time of inudation in the Candaba Swamp and densely populated area around Arayat-Apalit Arnedo Dike for entire block No. 1,

conditions of Candaba fuse dike for block No. 2 and Calumpit-Plaridel dike and Apalit-Bagbag discharge for block No. 3 respectively.

IV. Measures and facilities for flood forecasting and warning services.

To approach to the above mentioned purpose the survey team considered so far at the end of their field survey the following measures are and recommended (or recommendable) as the first stage of the project.

1. For Upper Pampanga River Basin, the flood run-off is to be forecast and observed at Sapang Buho from observed data on the proposed telemetering rainfall and river stage station at Sapang Buho. The flood discharge is routed to San Vicente with modification by intervening flow computed from the rainfall at Papaya.
2. Contribution from Rio Chico is to be estimated and observed at La Paz and routed to the joining point to the Pampanga river.
3. Arayat and Candaba stations are considered necessary for giving indication of hydraulic behaviour of the main river channel and Candaba Swamp.
4. Contribution to Candaba Swamp from east bank side is to be computed from rainfall at Biak-Na-Bato and San Rafael stations.

5. Computing method to trace the hydraulic behaviour for middle and lower reaches will be introduced.
6. Sulipan station is required for flood forecasting to the lower delta area.

The comparison of SSB system and VHF telemetary system has been conducted carefully by the telecommunication experts and it (with consultation of the philippine officials. is concluded that the adoption of VHF telemetary system is the most reasonable and practicable.

The attached figure shows two alternative proposed systems. Although these two systems are preliminary proposal and may be changed after further study, ~~One~~ one of which will be finalized without much change by the time of submission of the report.

Both proposed systems include seven telemetering rainfall and river stage gauges, ~~Three~~ three telemetering rainfall gauges and one master station.

The difference between two alternative systems is whether ~~having~~ having installation of one relay station at the side of Mt. Arayat or two relay stations in case of difficulty of accessibility to the side of the mountain.

By use of this system it is considered to procure the fairly (possible to procure ~~procurable~~) good flood forecast to the target area about one day in advance. procurable

It was also noticed the deficiency of observed data on the hill and mountainous areas for extending the forecasting period.

Continuation of observation and establishment of new rain gauge stations on these areas are desired, although the existing weather radar at Manila can be utilized for estimating the rainfall in the basin qualitatively. Telemeterization of these stations are recommended as for second stage of this project.

V. Cost Estimation

The rough cost estimation is shown as follows:

	Case I	Case II
Telecommunication Equipments and Instrument (F.O.B.)	$100,000	$115,000
Housing Facilities	$22,000	$ 55,000
Transportation, Installation and others	$68,000	70,000
T O T A L - -	$ 190,000	$240,000



Philippines

1970 3月末 Report. …… 在比大使館 3部 ~4. [Emb. BPW. WP. 外務] [1部 1部 (Bangkok)

予算要求 態度 4~6月

1971. 4月以降 … [centre 支渉]

Seminar.

1970 集団研究会. 経過しか. 気象庁. 正式文書をおいてよいかどうか.

そのようなのよう

メガロン. ハン. 泥水. アバンヒエン

[様子]

1 調査団

秋. 70 [土木 西方 吉木]

4~5人 2ヶ月

FORECASTING SYSTEM

Target Area for Flood Forecasting and Warning Service	Marked Site	Forecasting Station	Telemetering Station
1. Candaba Area	Cabiao-Gapan Dike Cabiao-Candaba Ring Levee Candaba Swamp Apalit-Arayat Arnedo Dike	(San Antonio Swamp) Arayat Candaba	H. R. La Paz H. R. Sapang Buho H. R. San Vicente R. Papaya H. R. Arayat R. Biak-Na-Bato
2. Right Bank Area of the Main Pampanga River below Mt. Arayat	Candaba Fuse Dike	Apalit	H.R. Candaba R. San Rafael
3. Delta Area below Apalit	Calumpit-Plaridel Dike Apalit-Bagbag Discharge		H. R. Ipo H. R. Apalit
			H: Water stage R: Rainfall

FOR PARTICIPANTS ONLY

WRD/TC3/14
18 November 1970

ORIGINAL : ENGLISH

UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

WORLD METEOROLOGICAL ORGANIZATION

Third session of the Typhoon Committee
18-24 November 1970
Bangkok, Thailand.

FLOOD FORECASTING, WARNING AND FLOOD DEFENCE[1/] IN THE YODO

by

Ministry of Construction
Japan

1/ This paper is circulated as submitted by the delegation of Japan.

FLOOD FORECASTING, WARNING

AND FLOOD DEFENCE

IN THE YODO

November, 1970

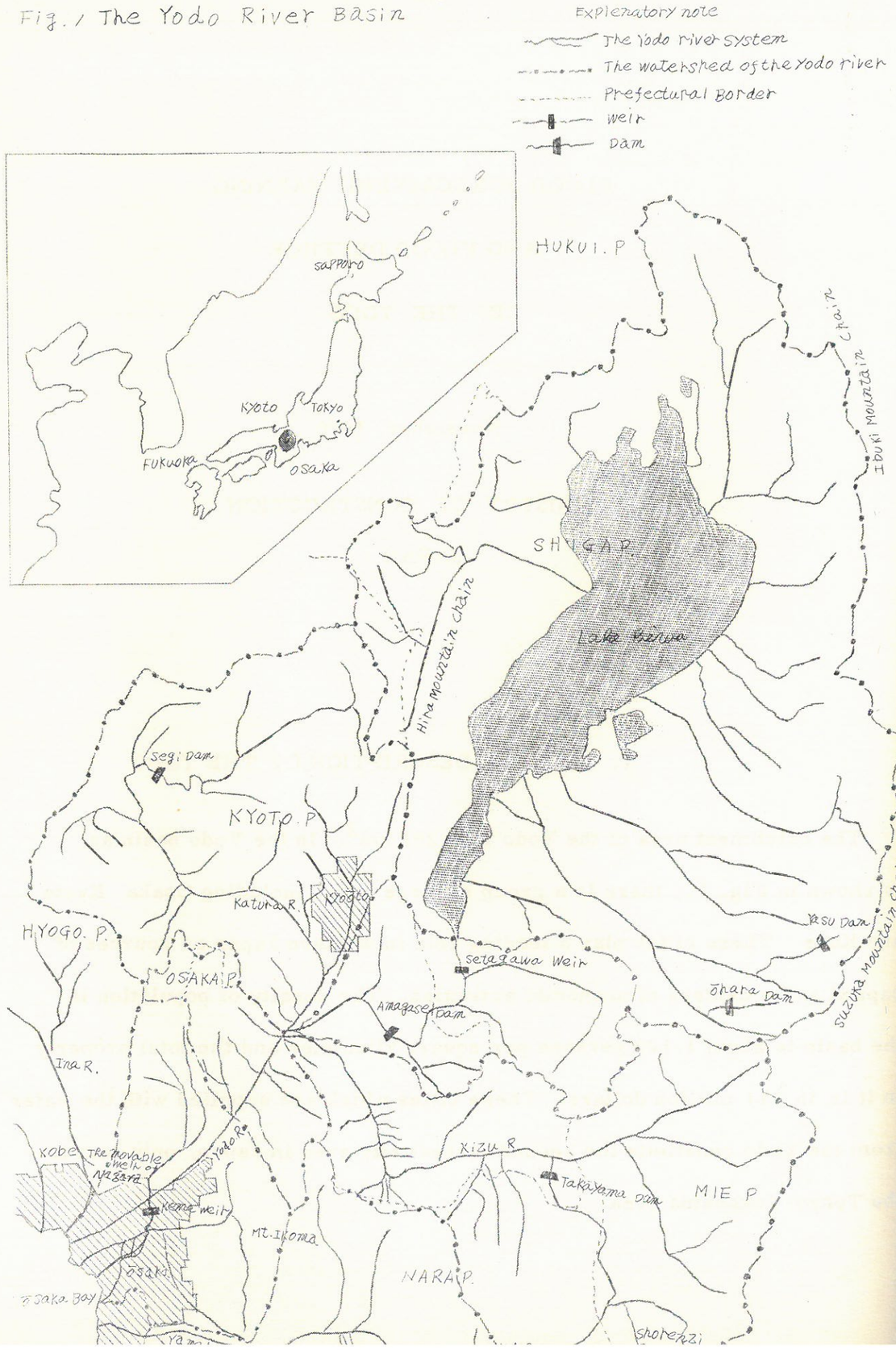
MINISTRY OF CONSTRUCTION

JAPAN

1. GENERAL DESCRIPTION OF THE YODO

The catchment area of the Yodo is 7,281 km^2. In the Yodo basin as is shown in Fig. 1., there is a group of large cities including Osaka, Kyoto and Kobe. These cities play a leading role in western Japan as sources of capital and a centers of economic activities. The density of population in the basin is about 1,100 persons per square kilometer and the total property in it is 36,111 million dollars. These cities which are supplied with the water from the Yodo constitute the second largest city area in Japan, only next to the Tokyo-Yokohama area.

Fig. 1 The Yodo River Basin



So, a trouble in the flow of the Yodo (for example, flood, drought, etc.) would immediately cause serious damage to a great number of people and a large amount of property.

Lake Biwa, the water source of the Yodo river, is the largest lake in Japan, its total catchment area being 3,848 km^2, which is nearly the half of the Yodo basin. The lake area is 717 km^2. Lake Biwa with its capacity of about 25.5 billion m^3 has been playing an important role in regulating the stream flow of the Yodo ever since ancient times.

If Lake Biwa had not existed, any flood of the Yodo would have been double as large in its extent. On the other hand, the discharge of the Yodo must have been halved in the dry season.

Water flows out from the Seta which exists on the south end of the south lake (Biwa Lake consists of the north lake and the south lake). The outlet of the lake is controlled by a sluice which was constructed in 1904 and improved in 1961.

The Seta joins the Kizu and the Katsura, thereby constituting the main stem of the Yodo.

Although the catchment area of the Kizu occupies only a 22% of the total, since it forms a so-called "radial basin", the shapes of flood hydrographs are very steep and the max. flood discharge (6,200 m^3/s by Typhoon No. 15 in 1959) and the specific discharge (4.25 $m^3/s.$ km2) take the largest value in 3 tributaries of the Yodo.

Katsura has a uniformly narrow basin, therefore, the shapes of flood hydrographs are flatter than that in the Kizu, and the max. flood discharge

(2,400 m^3/s by Typhoon No. 13 in 1953) and the specific discharge (2.7 $m^3/s.$ km^2) are smaller than 2/3 of these values in the Kizu.

The lower Yodo, downstream the confluence of 3 tributaries, is a meandering river through an alluvial plain. The training works of this river started in 1873 with the low water works for the improvement of ship navigation. The improvement works for the flood prevention started in 1910 and continued for 15 years. By this scheme, the Yodo was put to offer the present appearance, (1) the Seta sluice was constructed, (2) the Uji was changed a part of its water course and (3) a new channel of the Yodo was opened and several locks were constructed.

After these works were completed, supplimentary works and the finishing works were executed, and the design discharge of each river was raised to 6,950 $m^3/s.$ in the main Yodo, 835 m^3/s in the Uji, 4,650 m^3/s in the Kizu and 2,870 m^3/s in the Katsura.

The design discharge of the main Yodo was raised to 8,650 m^3/s after the disaster caused by Typhoon No. 13 in 1953. The amount increased was allocated to 3 flood control dams and the design discharge of the channel was left unchanged.

The Yodo experienced 25 floods from the era of Meiji (from 1868). Among those floods, those in 1885, 1917, 1953 must be mentioned.

By the flood in 1885, the left embankment of the main Yodo was broken in Hirakata city, and almost all of the city area of Osaka was inundated.

31 bridges including Temma bridge and Tenjin bridge were washed away. It is said that the depth of inundation reached up to 3m.

By the flood in 1917, the right embankment of the main Yodo was broken at Otsuka in Takatsuki city, and towns and villages in Mishima county and the west side of the river of Nishinari county were inundated. At this time, the Seta sluice, which was completed in 1904, was closed to shut out the water from Lake Biwa. It is reported that some of people living around the lake rushed to the office and asked to open it in vain.

By the flood in 1953, the left embankment of the Uji was broken at recalaimed land of Oguragaike pond. The highest water stage at Hirakata was 6.97 m and the water surface came to only 1 meter below the bank top.

After that, various works for flood prevention, such as embankment, multipurpose dams shown in Table -1 and improvement of Seta sluice etc. were completed.

The flood caused by Typhoon No. 24 in 1965 was one of the largest floods, but the embankment was not broken. This was due to the exact forecasting and the effective operation of dams.

In 1969, an office was opened to transact the integrated operation of several dams in the basin. This office is called OPERATION CONTROL OFFICE FOR THE YODO RIVER DAMS.

Table-1 Elements of Multi-purpose Dams in the Yodo

Element \ Dam	Amagase	Takayama	Shorenji	Muro
Catchment area Km^2	352	615	100	136 33
Total Volume of Storage m^3	26, 800, 000	56, 800, 000	27, 200, 000	16, 900, 000
Volume for Flood Control m^3	20, 000, 000	35, 400, 000	8, 400, 000	7, 750, 000
Volume for Water Supply m^3	600, 000	17, 500, 000	15, 400, 000	8, 150, 000
Highest Water Level m	78. 5	135. 00	282. 00	296. 50
Height of Dam m	73. 0	67	82	62. 5
Design flood Discharge m^3/s	1, 360	(4, 000) 3, 175	1, 100	850
Amount of Control m^3/s	520	1, 375	500	350
Newly Developed Water m^3/s	0. 3	5. 0	2. 49	1. 6

2. HISTORY OF FLOOD FORECASTING AND WARNING

It is said that flood forecasting based on science was begun by "Study of floods and their forecasting in Yodo River" written by Dr. S. Sakamoto. He worked as an engineer in the Ministry of Interior on the improvement works of this river. During this time, he gathered and analysed meteorological and hydrological data, publishing that book in 1931. This study deals also with relations between depressions and floods.

Dr. Sakamoto discussed the relation between rainfall and water stage after deciding duration of rainfall, which was supposed to affect the relation, after investigating 104 rainfalls.

He derived equations deviding the rainfalls into 4 classes.

Take the equation for 6 - 12 mm/hr rainfall, it is

$$H = 0.4287 + 0.0930\,R$$

where

H : Rise at Kamo water gauge (Shaku *)

R : Rainfall (mm)

* 1 Shaku = 30.3 cm

In deriving these equations, the following factors were considered.

(1) The quantity allocated to the ground surface storage and to the seepage was assumed to be 5 mm, because rainfalls up to 5 mm had no effect on water stage.

(2) When the Kamo water gauge showed values lower than the mean low water, 5 - 15 mm of rainfall was subtracted from the observed

value. This amount was changed according to the water stage and the season.

(3) Out of the antecedent rainfall, 2.5 - 10 mm of it was added to the main rainfall. This amount was also changed according to the amount of antecedent rainfall.

It was reported that only 6 floods out of 88 floods, had the difference of estimated and observed values larger than 1 Shaku (30.3 cm).

Analysing the relation between water stage at Hirakata and those at Tenryuji and Kamo, he tried to get a formula to estimate water stage at Hirakata from others. To derive the equation, 69 sets of observed values were used.

In applying data, Tenryuji stage at the time that Kamo gauge showed the highest were used for floods for which the Kizu took the largest part, and for floods the Katsura had greater effect, Kamo stage at the time that Katsura gauge showed the highest were used.

$$H = -0.5304 + 0.4902\, h_1 + 1.0666\, h_2$$

where

H : water stage at Hirakata (Shaku)

h_1 " Kamo "

h_2 " Tenryuji "

Difference between observed and estimated values were smaller than 1 Shaku.

It was said that if these 2 sets of equations were used connectedly, water stage at Hirakata could be predicted 16 hours in advance from rainfall in the

upper reaches of the Yodo, though it was not so accurate.

After the study by Dr. Sakamoto many engineers tried to develop better method. As mentioned before, the time from the peak of a storm rainfall (the center of the mass of rainfall) to that of flood discharge at the datum point Hirakata is 10 - 20 hours at the most.

Therefore, methods used in large continental rivers, namely the forecasting of water stages at a point in the lower reach from water stages at a point in the upper reach is not applicable in this river. Therefore, the method must take the following 2 steps just as adopted by Dr. Sakamoto.

(1) Estimating the storm runoff in the upper reach from rainfall and giving this to the outlet of the upper reach as an input to the lower reach, and

(2) the water stage of a datum point in the lower reach is calculated by stream flow routing.

For the above 2 stages a number of methods, from coarse to minute, were presented. Among these, what first applied actually for the flood forecasting was a kind of statistical method, namely a method based on a empirical relations developed through statistical analysis of rainfall and runoff. Fig. 2 shows an example, here the length of rainfall which is supposed to influence the storm runoff was taken as 12 hours. Because it resulted in the best correlation.

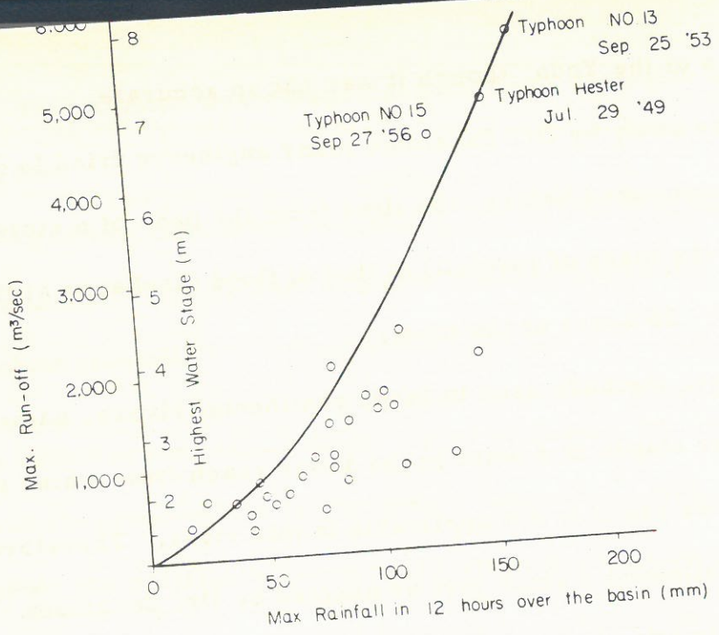
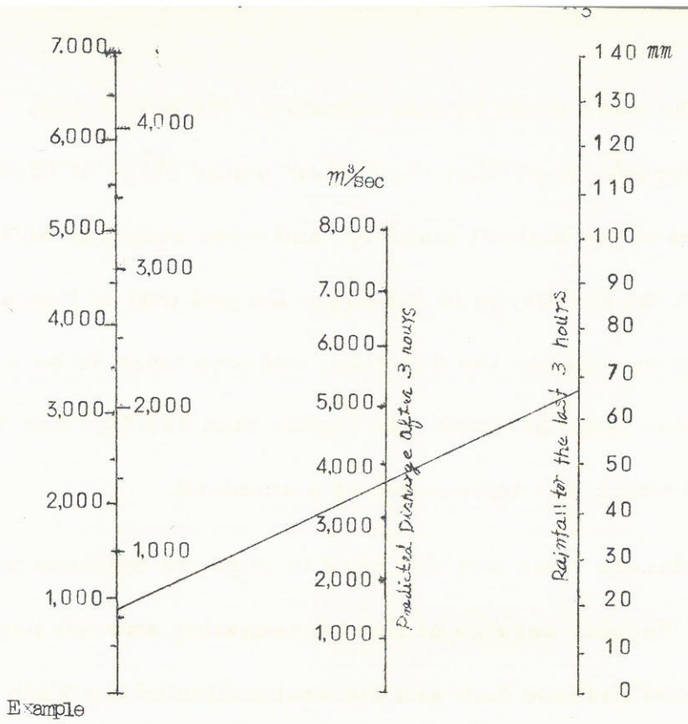


Fig. 2 Relation between Rainfall and Max. Run-off (Kamo, Kizu River)

After the World War II, a method based on a well known "linear storage" formula was adopted. By this method, the flood discharge at Kamo in 3 hours later was forecasted using the discharge at Kamo at present and the estimate of rainfall for coming 3 hours. Fig. 3 shows the nomograph that was actually used in those days.



Example

① Discharge at Kamo 9 a.m 880m³/sec
Average rainfall from 6~9 a.m 66 mm
Predicted Discharge 12 a.m 3,700m³/sec

② After the cease rainfall using (1-μ)Q₀ scale
Discharge at 3 p.m 3,710m³/sec
Predicted Discharge at 6 p.m 2,400m³/sec

Fig. 3 Nomograph for Prediction of Discharge at Kamo (Kizu River)

These methods were for estimation of storm runoff from rainfall. So, there must be methods for stream flow routing to couple with the above.

What first used for this purpose was also a statistical method, and it gave a fairly good estimate.

Early in 1950's, we developed ~~an~~ electronic flood simulater. This was a kind of analogue computer based on a general theory for flood flow developed by Dr. Hayami.

Nomographs were made by this simulater for actual use. Fig. 4 and Fig. 5 are nomographs to predict the highest water stage at Hirakata Hm and the time of travel of the highest stage tg, and were constructed by changing the summation of the discharge in Uji River Qu and that of Katsura River Qo.

T in the figures means the duration, and was taken to be a half of time for which the water stage at Kamo was higher than 1/2 H_k, and To is T for the flood in 1953 which was introduced as a standard.

Though engineers were working hard to improve methods for flood forecasting, the regular service of flood forecasting was not begun until the legislation of Flood Defense Law and the designation of the Yodo as a flood forecasting river in 1949. Since then, the flood forecasting was done for every flood occurred in the river.

As regards the flood caused by Typhoon No. 24 in 1965, it is said that the forecasting was exact enough to serve much for the operation of dams and reservoirs, and also to help activities of flood defense brigades. Therefore, announced statements of flood forecasting and warning, the time of announcement and flood defense activities were shown as an example in Table - 2 and Fig. 6.

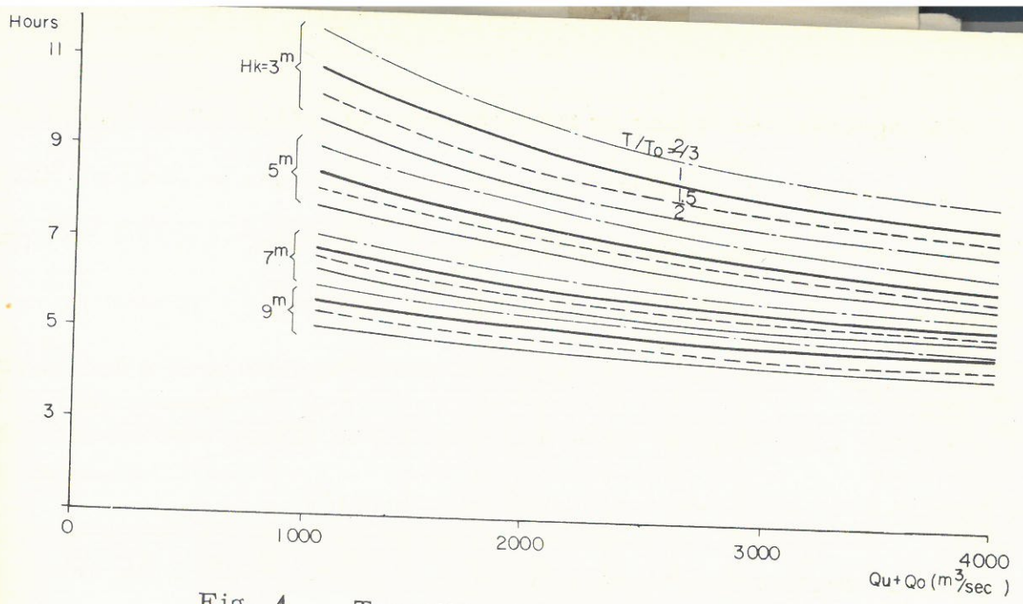


Fig. 4 Trevelling Time of the Highest Stage from Kamo to Hirakata

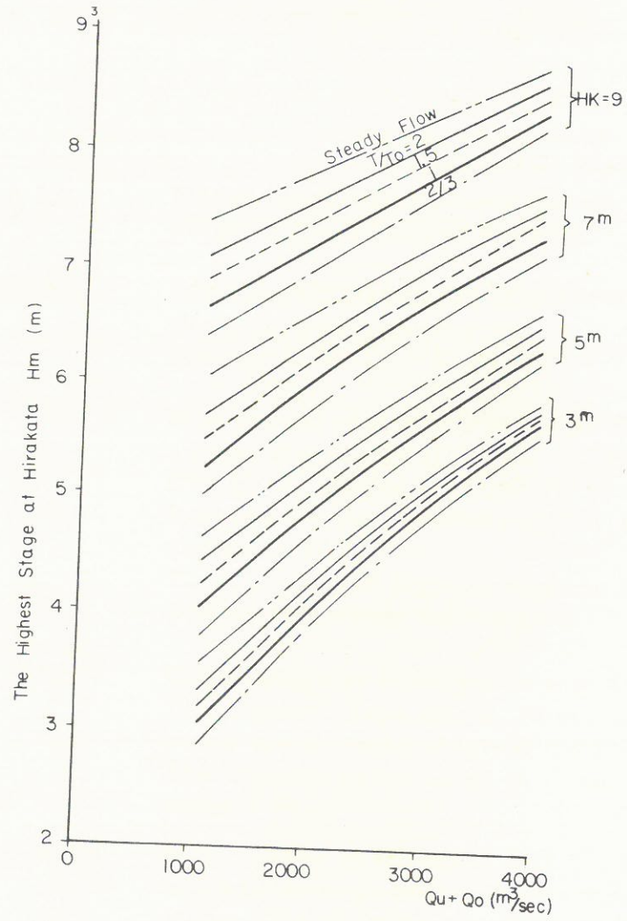
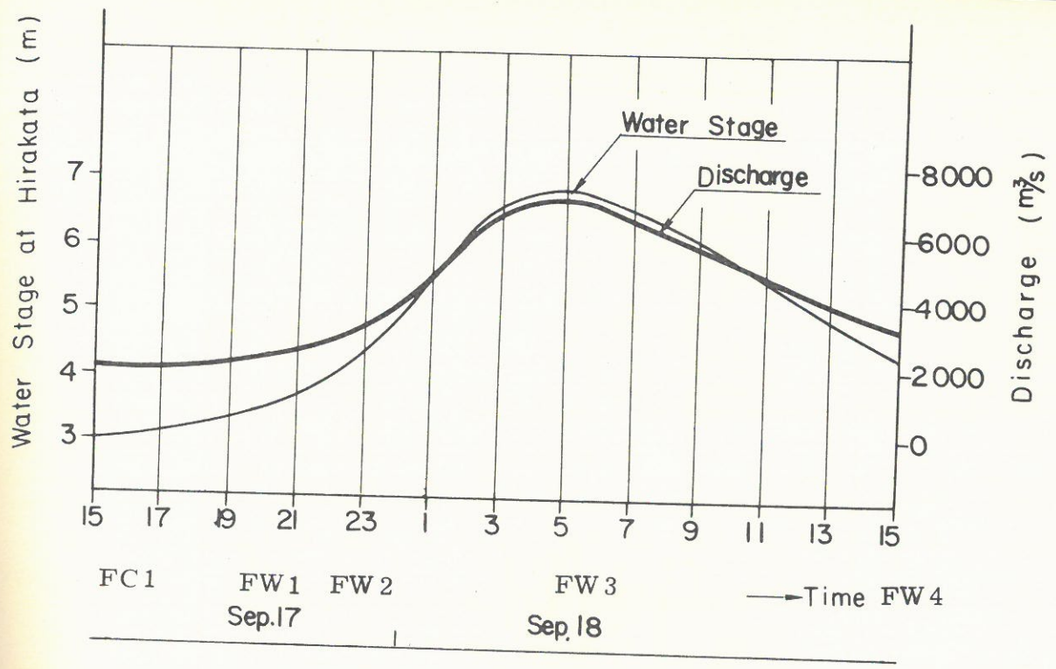


Fig. 5 The Highest Stage at Hirakata

Fig. 6 Hydrograph at Hirakata



Warning	Contents of warning
Flood caution No. 1	Water stage will be over the warning water stage in the Yodo and the Kizu.
Flood warning No. 1	It is feared that water stage at Hirakata in the Yodo will exceed 6 m. (Design H.W.L. = 6.36 m)
" No. 2	It is feared that water stage at Hirakata will exceed the design H.W.L. and reach nearly 7 m. The water stages at Kamo (in the Kizu) and Katsura (in the Katsura) will be as high as the design H.W.L. The time of the highest stage in both gauges will be tomorrow morning.
" No. 3	Water stage at Hirakata is now descending. The highest stage was 6.70 m. It will go below the warning stage in the evening. The highest water stage in Biwa Lake will be about 1 m.
" No. 4	Water stage at Hirakata was 4.53 m at 14.30 and will soon go below the warning water stage. (the warning water stage is 4.50 m).

Table - 2 Flood Defense Activities

(Typhoon No. 24, 1965)

Time		Place	Cause	Kind of Works	Main Material	Number of Members **		Effect
from	to					Marched	Worked	
6. 10 Sep. 18	8.00 Sep. 18	Nishi-Imoarai Kumiyama T. Left bank of Uji r. 40 km Length 50 m	Seepage from the slope toe of the back side of bank	Piling, Kamadan*	Wooden pile 40 Jute bag 100	Member of flood defense brigade 25	Member of flood defense brigade 20	Collapse of the bank due to seepage from the toe was prevented.
5.40 Sep. 18	8.00 Sep. 18	Mukojima-Shimosakata Fushimi-ku Kyoto city Left bank of Uji r. 41.4km Length 200 m	"	"	Wooden pile 120 Jute bag 400	" 37	" 37	"
6.00 Sep. 18	7.00 Sep. 18	" 42 km Length 100 m	"	"	Wooden pile 20 Jute bag 60	" 20	" 17	"
5.00 Sep. 18	8.00 Sep. 18	Yodo Kawase-cho Fushimi-ku Kyoto city Right bank of Uji r. 39 km Length 100 m	"	Piling, heaping bags	Wooden 100 Jute bag 600	" 40 Fire officer 20	" 40 Fire officer 10	"
20.00 Sep. 17	6.00 Sep. 19	Yodo-mizura Fushimi-ku Kyoto city Left bank of Katsura r. 1.2 km Length 50 m	Due to the seepage from the bank, the surface of the high-way was inundated Depth 50 cm	Watching				

* Kamadan is a kind of flood defense works consisted of rings made of heaped jute bags.

** 211 soldiers of the Self Defense Force helped the work.

3. System for Flood Forecasting

Three multi-purpose dams as well as the improvement of Seta Sluice have already been completed in the Yodo. In addition, there are plans for construction of several more dams.

Operation Control Office for the Yodo River Dams has been conducting the flow management on the Yodo throughout the year. The flow management covers all conditions of flow from floods to droughts.

The setup for flood observation (e.g. observation of water stage, discharge, rainfall, etc.) has been reinforced and telemeters are in use for transmitting observation data. Digital computers are used for data processing and flood computation (e.g. runoff from rainfall, stream flow routing, flood control, etc.). Organizations which receive flood informations (including directions, flood cautions and flood warnings) have been organized over an extensive area. (These organizations comprise prefectural and city authorities, police stations, power supply stations, railways, dams, etc.). Further details will be given below.

3.1. Collection of Flood Data

The location of observation stations in the Yodo basin is given in Fig. 7, and items of flood data to be collected are listed in Table 3.

Rainfall observation stations are designated to obtain enough information on rainfall. These stations are equipped with rainfall gauges and some of them which has not telemeter are instructed to send out information by telephone when values of rainfall observed have exceeded a certain limit. Each gauge covers some 140 km^2 of the basin area and each telemetered gauge covers some 240 km^2.

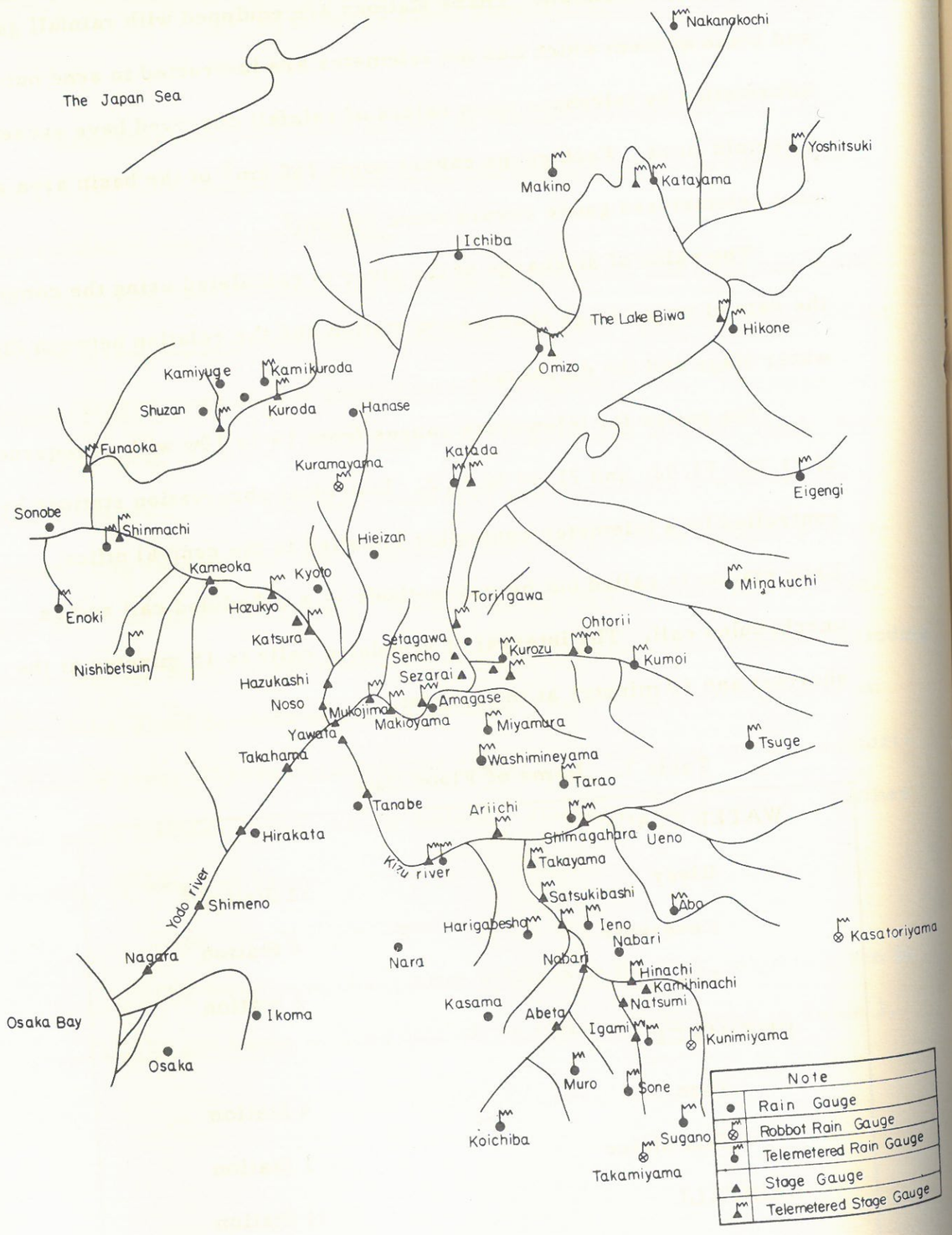
The value of discharge of the river is calculated using the computer, the data of water stage observation station and the relation between the water stage and the discharge.

The power for telemeters ranges from 1w to 10w with a frequency of 71.82, 71.92, and 71.94 M.H.Z. Individual observation stations are controlled by a telemeter controller installed in the central office. Each station is called out by two methods -- a scheduled call and an unscheduled call. The interval of scheduled calls is 15 minutes at the shortest and 60 minutes at the longest.

Table 3. Items of Flood Data

WATER STAGE	
River	32 Station
Reservoir	4 Station
Lake	2 Station
DISCHARGE	
Dam	4 Station
Seta Sluice	1 Station
RAINFALL	31 Station
FLOOD FORECASTING POINT	25 Station

Fig. 7 Designated Observation Stations for Flood Forecasting in Yodo River



3.2. Transaction of Flood Data

The transaction of flood data can roughly be divided into the two following processes:

(1) Inspection, arrangement, filing and temporary memory of collected data.

(2) Computation of runoff, flood controll, etc.

A telemeter data controller (T. D. C.) is used for (1) and a digital computer is used for (2). The two units effectively receive and send out data, one of the features of this system. This is named Central Processing Unit (C. P. U.).

3.2.1. Outline of Central Processing Unit (C. P. U.)

The C. P. U. is a Japanese-made medium unit. For constitution of the unit, see Fig. 8.

The telemeter data controller (T. D. C.) controls indicator, printers, telemeters, etc., while feeding data to and receiving them from the C. P. U.

3.2.2. Process of Flood Data Transaction

The process of flood data transaction by this system is normally an inquiry process, but when a trial computation of runoff or flood control by reservoirs is necessary, batch operation can be carried out. Fig. 9 shows a flow chart of processing informations.

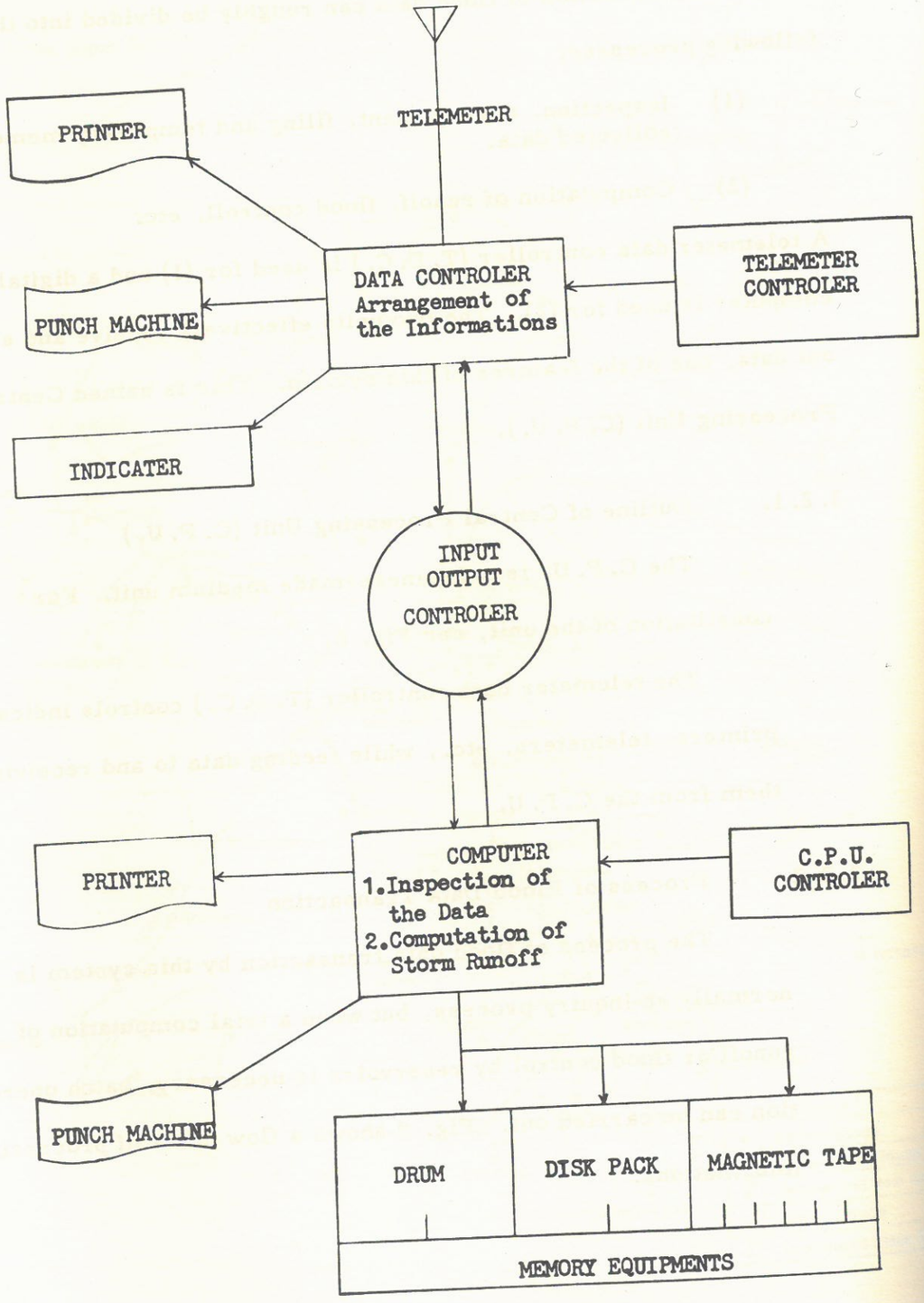
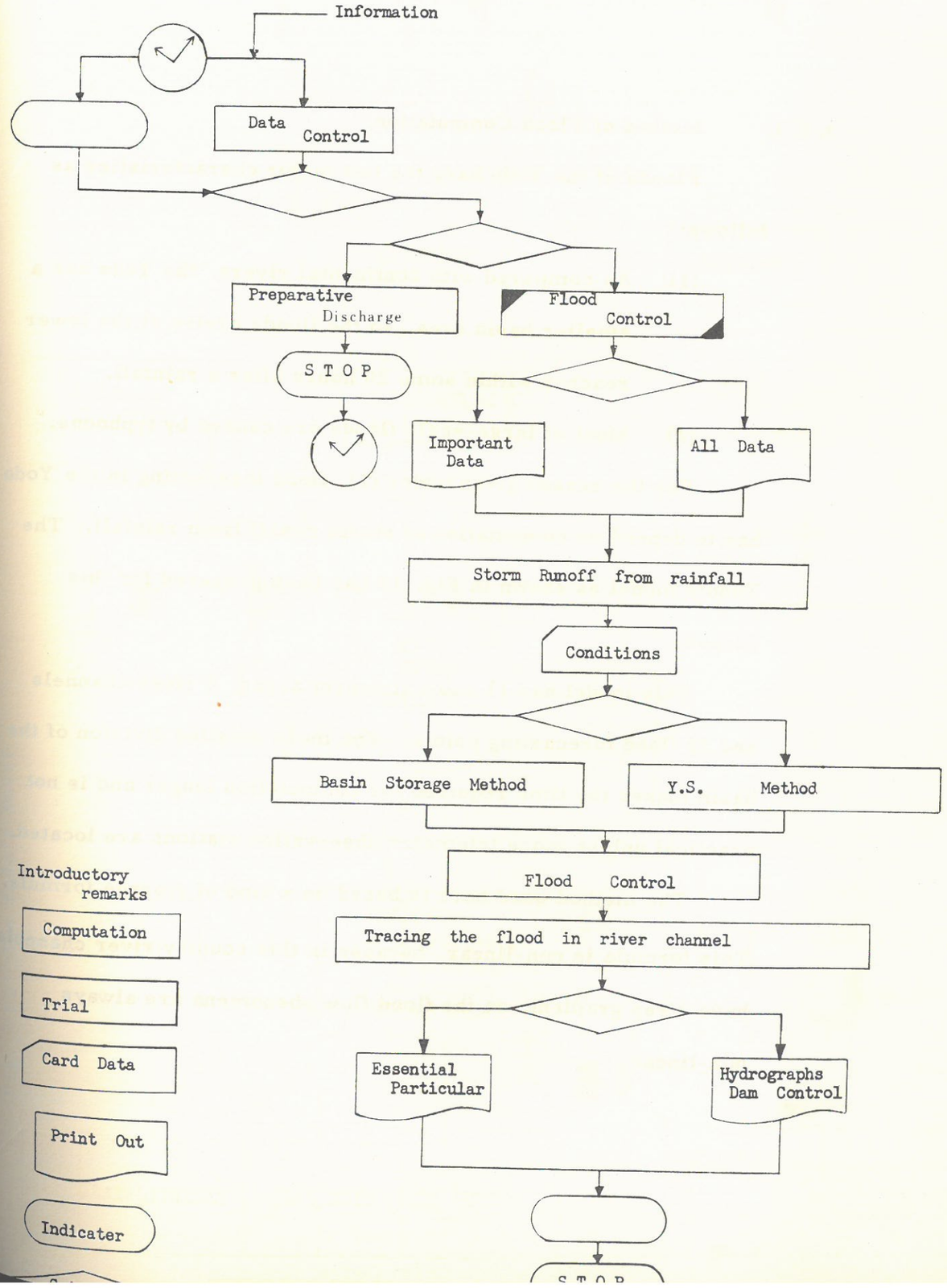


Fig. 9 Flow Chart of Processing Information



3.2.3. Method of Flood Computation

Floods of the Yodo have the two major characteristics as follows:

(1) As compared with continental rivers, the Yodo has a smaller basin area,. so the floods arrive at the lower reaches within some 20 hours after a rainfall.

(2) Most of large-scale floods are caused by typhoons.

For the reason given under (1), flood forecasting in the Yodo has to depend on computation of storm runoff from rainfall. The Yodo's model as shown in Fig. 10 has been prepared for this purpose.

This model has 11 sub-catchment areas, 6 river channels and 25 flood forecasting points. The more detailed division of the basin makes the time required for computation longer and is not practical unless more telemeter observation stations are located.

The method used here is based on a kind of storage formula. This formula is non-linear, because in this country river channels have steep gradient, so the flood flow phenomena are always non-linear.

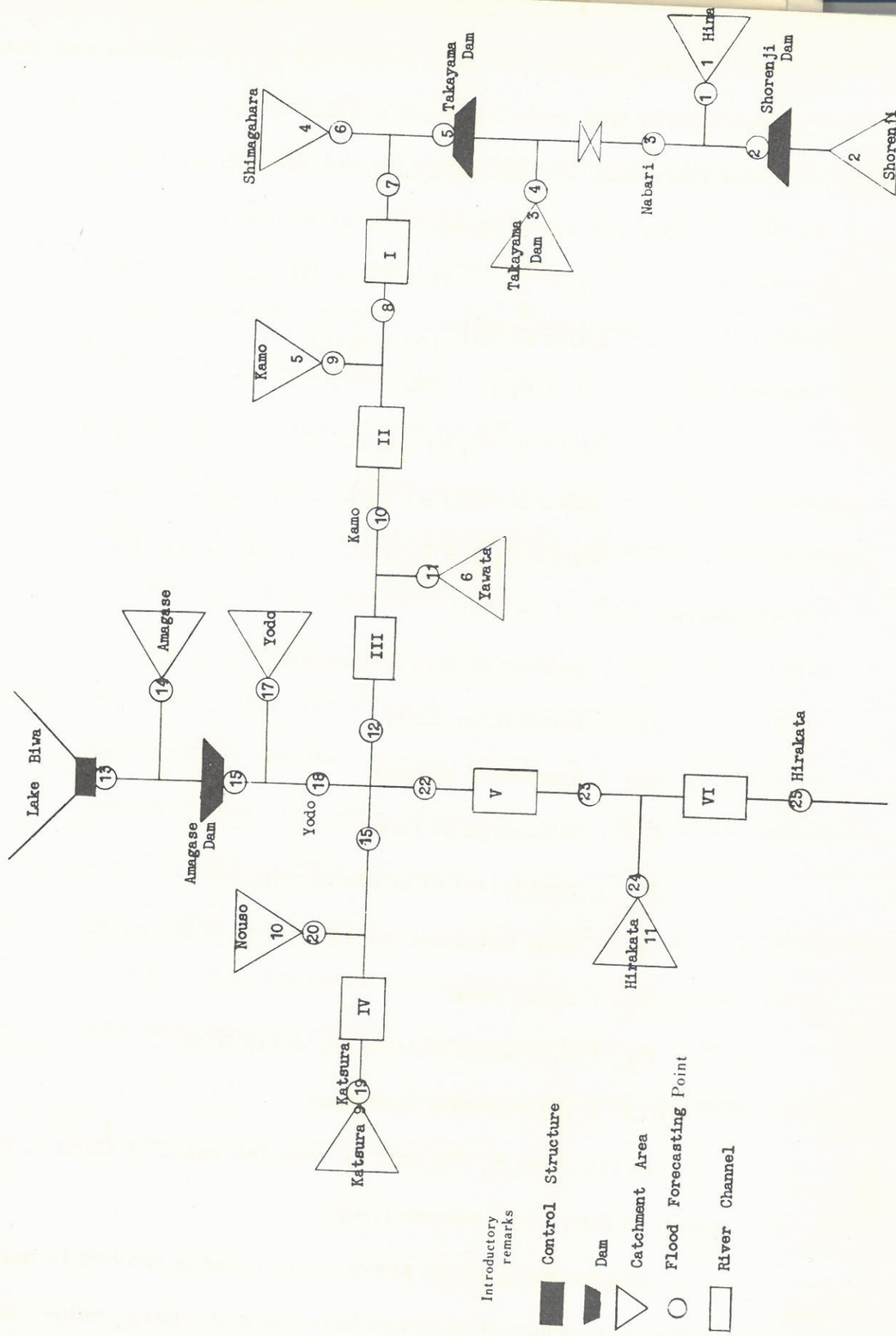


Fig. 10 The Yodo's Model

This method was first developed by Dr. Kimura and was refined to give more accurate results by the engineers in the Operation Control Office for the Yodo River Dams.

Dr. Kimura's equations is as follows:

$$R_L = \sum_{t}^{t_L} (1 - F) \cdot R(t) \quad \text{..... Eq. 1}$$

$$I(t) = F \cdot R(t) \quad (0 \leqq t \leqq t_L) \quad \text{..... Eq. 2}$$

$$= R(t) \quad (t_L < t)$$

$$S(t) = K \cdot Q_L(t)^P \quad \text{..... Eq. 3}$$

$$dS(t)/dt = I(t) - Q_L(t) \quad \text{..... Eq. 4}$$

$$Q(t) = Q_L(t - T_L) \quad \text{..... Eq. 5}$$

where

R_L : amount of loss of rainfall

$R(t)$: rainfall intensity

$S(t)$: amount of storage

$Q(t)$: discharge of river

F : coefficient of effective rainfall

t_L : time required for saturation of the basin

T_L : delay time

Q_L : discharge considered delay time

K, P : experiential constants

In the Yodo F, R_L and T_L take the value of about 0.5, 50 mm and less than 5 hrs respectively.

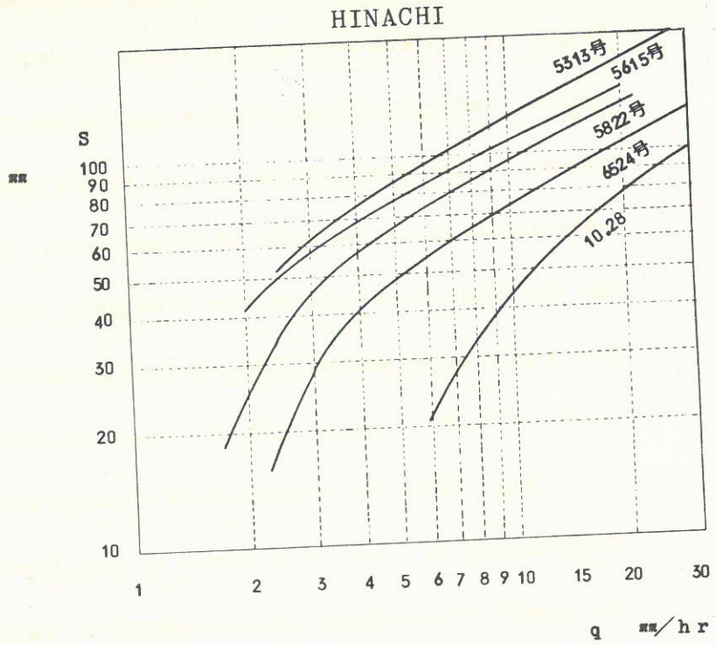
Shortcoming of the above basin storage method is that it is difficult to adjust differences between a discharge value obtained

by calculation and that obtained by observation in the midst of flood. A system was needed which, using ever-changing observation readings of flood discharge, keeps on adjusting calculated values to observed discharge and furthermore starts fresh calculation from the point of adjustment. Operation Control Office for the Yodo River Dams has developed such a system and already put it into application. The system is named S. Y. System. Major points of S. Y. System will be described below.

Fig. 11 is the examples of storage curves and shows the relationship of storage to runoff in the Hinachi and the Katsura. As readily known from these examples, each flood gives a different storage curve. However, all curves are similar in pattern. Particularly, as the storage increases, all curves tend to be in parallel, in other words, K in Eq. (3) varies in each flood but P is almost constant. S. Y. System has been developed by noticing this tendency.

When a flood occurs, the value of K is so determined by the computer that the result of calculation accords with the flood discharge observed by the telemetered stations.

Consequently, since error is constantly corrected, highly accurate results can be obtained.



After the calculation of runoff, the central processing unit further conducts computation on flood control by dams. Conditions for computation are as follows:

(1) to minimize a peak of flood

(2) to use the pocket of reservoir to the full

Each control office of the dam is provided with a sub-system of the C. P. U. which constantly keeps the data of the flood in order and feeds new data to the C. P. U. Therefore, the state of flood control can be inspected at all time by means of the C. P. U.

3.2.4. Examples of Computation

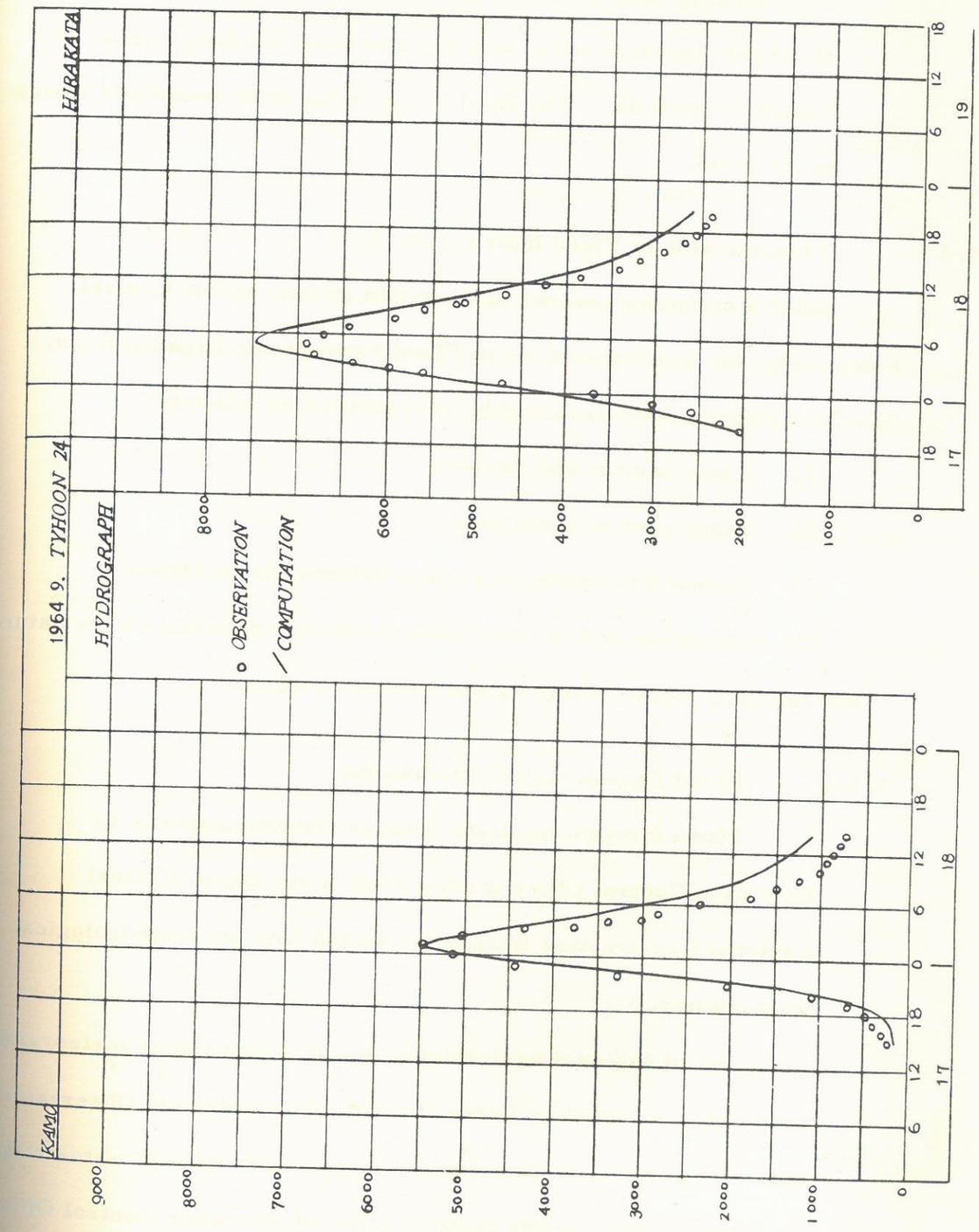


Fig. 12 Examples obtained by computer and observation

Hydrographs given in Fig. 12 are a comparision of the observed discharge value with the computed discharge value by Kimura's formula. The flood is one of the most enormous floods in the Yodo.

3.3 Transmission of Flood Information

After a complete review, computation results by the Central Processing Unit are transmitted to Flood Forecasting Organizations. The flood informations can roughly be classified as follows:

(1) Flood caution and warning

(2) Flood control directions

(3) Detailed computation results offered for reference

The destination of flood information differs depending on the nature of information. Some of this will be discussed below.

3.3.1 Flood Forecasting Organizations

Flood forecasting in the Yodo is conducted jointly by Operation Control Office for the Yodo River Dams of Kinki Regional Construction Bureau and Osaka District Meteorological Observatory.

Out of forecasting services, the part concerning meteorology is mainly conducted by Osaka District Meteorological Observatory, while the part which concerns the river itself, namely water stages, discharges, etc., is the responsibility of Operation Control Office for the Yodo River Dams.

The announcement of a forecast is made after a thorough discussion between the two agencies.

The exchange of data between the two agencies is ensured by mutual agreement, thereby enabling engineers to make full technical investigations.

For the method of transmitting forecasts and warnings, a multi-stage transmitting system has been developed in cooperation with the "Association for Transmission of Flood Forecasting and Warning in the Yodo."

Agencies that use the informations for flood defense and some other purposes are listed in Fig. 13.

Forecasts and warnings to the general public are announced through the mass media such as TV and radio stations.

The association, as shown in Fig. 13, consists of 46 organizations including Osaka and Kyoto prefectural governments, the Self-Defense Forces, police departments, national and private railways, Kansai Electric Company, information media, etc.

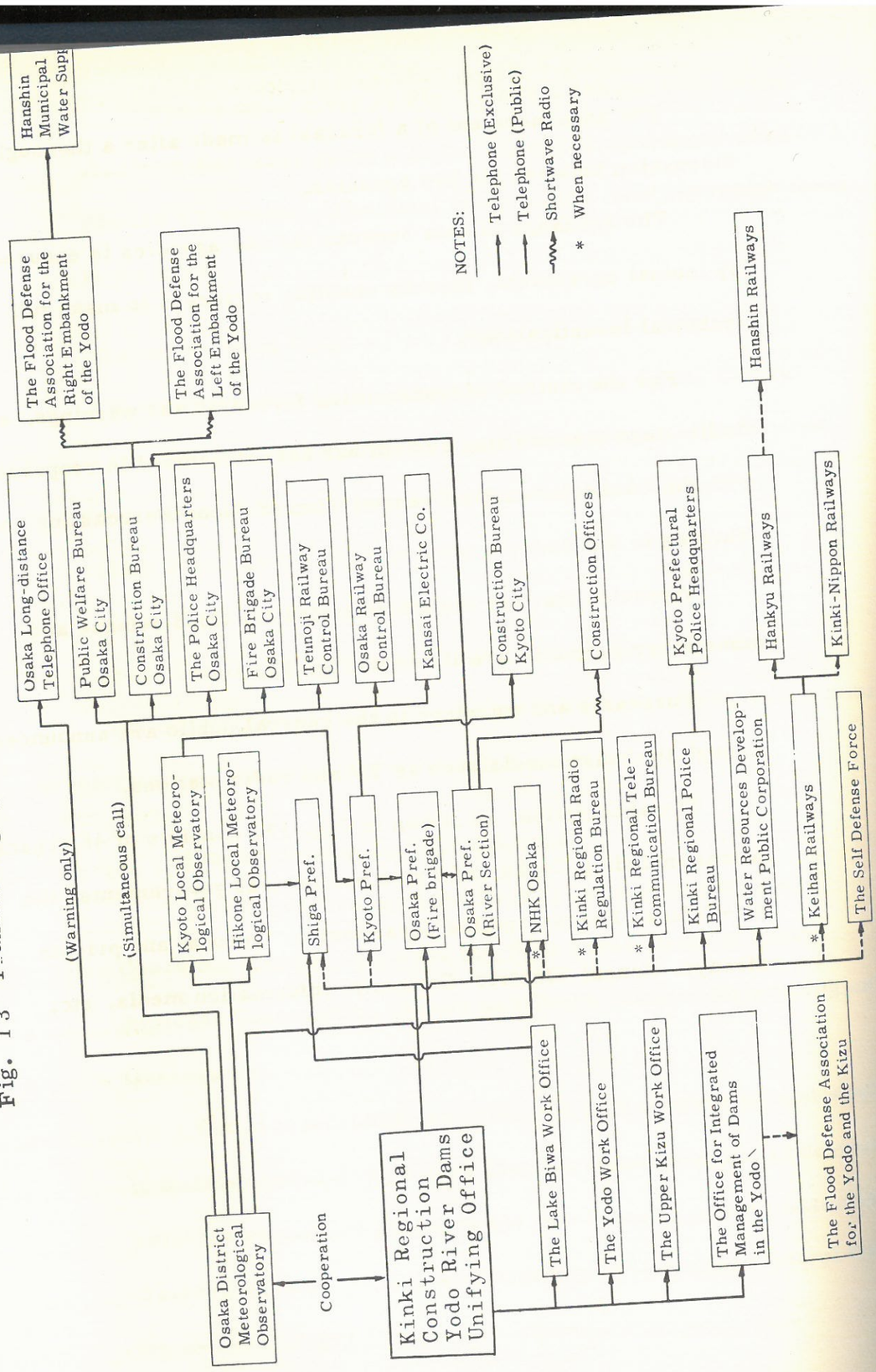


Fig. 13 Transmitting Systems for Flood Forecasting and Warning in Yodo River

4. Flood Defense Activities

The flood defense in Yodo River is entrusted to 3 designated flood defense associations and the municipal governments.

After the break of the left embankment at Hirakata city in 1885, the municipalities in this area recognized the need of establishing a flood defense organization, and worked hard to realize the plan.

However, a greater disaster of break at Otsuka (in Takatsuki city, right embankment) in 1917 had been necessary before this plan was materialized.

On Nov. 8th, 1919, the Left Bank Flood Defense Association was founded. The president was the president of Kita Kawachi county (now the mayor of Osaka).

In Yodo River, there are two more designated flood defense organizations: The Right Bank Flood Defense Association (founded: June, 1926, President: the mayor of Osaka), and the Flood Defense Association for Yodo and Kizu River (founded: 1967, President: the mayor of Uji). They are eagerly working for the flood defense of each allocated area.

A Flood Defense Association is composed of a Flood Defense Assembly (members are those who are elected in the city or town assemblies concerned or those who are recommended by mayors and have the approval of the proper assembly), a Flood Defense Conference (the members of which investigate and consider the flood defense plan and other important matters under the article 26 of Flood Defense Law) and a flood defense brigade.

The number of officers of a flood defense brigade is, take the Left Bank Flood Defense Association for instance, 2347 and its covering length is

about 41 km. According to the publications from the Left Bank Flood Defense Association, the number of floods for which defense activities were done are 21 as of 1970.

The main works were prevention of collapse of embankment and of leakage of water. In the typhoon No. 13, 1953, the Left Bank Flood Defense Association issued mobilization orders to 1,150 officers.

FOR PARTICIPANTS ONLY

WRD/TC3/15
18 November 1970

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UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

WORLD METEOROLOGICAL ORGANIZATION

Third session of the Typhoon Committee
18-24 November 1970
Bangkok, Thailand.

FLOOD DAMAGE AND ITS COUNTERMEASURES IN JAPAN[1/]

by

Ministry of Construction

Japan

1/ This paper is circulated as submitted by the delegation of Japan.

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UNITED NATIONS ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

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FLOOD DAMAGE AND ITS COUNTERMEASURES IN JAPAN

Ministry of Construction, Japan.

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1. Changes in Flood Damage

The rivers in Japan are characterized by their steep gradient and short river cource due to the topographical conditions of the country. As a result, in spite of being blessed with an abundance of rainfall twice as much as the world's average, the country is losing every year a major part of this precious natural resource as the rivers flow rapidly and wastefully into the sea in the form of destructive floods when there are heavy rainfalls. Consequently, these rivers have a great difference in their discharge volumes between rainy days and dry seasons.

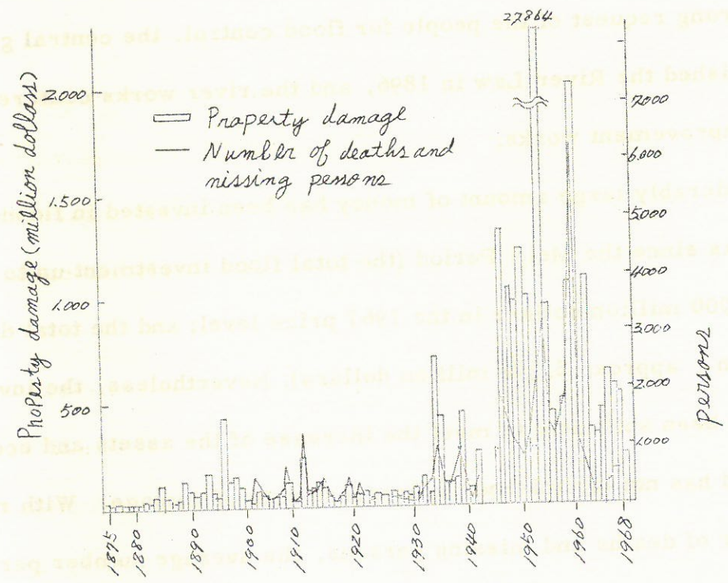
In view of the natural conditions of the rivers in Japan, flood prevention was the first requisite for the development of the country. In order to meet the strong request of the people for flood control, the central government established the River Law in 1896, and the river works centered on the river improvement works.

A considerably large amount of money has been invested in flood control works since the Meiji Period (the total flood investment up to 1969 : approx. 10,000 million dollars in the 1967 price level; and the total damage rehabilitation : approx. 5,278 million dollars). Nevertheless, the investment has not been sufficient to meet the increase of the assets and economic activities and has not diminished the increase rate of damage. With regard to the number of deaths and missing persons, the average number per year which was 280 persons during the period from the beginning of the Meiji era to the prewar years has increased in the postwar years to 1,340 persons or 4.7 times. As for the amount of flood damage, the annual damage which

was about 92 million dollars in the 1967 price level has increased to 839 million dollars or 9.2 times. In term of the rate of flood damage to the national income, the percentage of the flood damage increased from 1.4% to 3.0% or 2.2 times.

Fig. 1

Human Loss and Property Loss Caused by Floods in the Yeas 1875~1968 (1967 Price level)



2. Flood Damage Countermeasures

1) Erosion Control and Flood Control Measures

The Law Concerning Forestry and River Conservation Emergency Measures was enacted in March, 1960 (Law No. 21, 1960) with aims to carry out forestry and river conservation projects speedily and in a systematic manner for conservation and exploitation of national land.

Under the law, five-year projects have been formulated for reforestation (Juridiction of the Ministry of Agriculture and Forestry) and river conservation beginning in 1960. River Conservation work was started in 1960, with a total outlay of 1,111 million dollars.

It was in 1961 that the second Muroto Typhoon ravaged the Osaka district, causing great damage and then in the same year another natural calamity in the form of torrential rains hit Nagano Prefecture centering in the Inatani regions causing floods and numerous landslides.

On the other hand, Tokyo and other larger urban areas perennially suffer from overall acute shortages of water and require emergency measures to alleviate the situation. To cope with such situations the Law Concerning Forestry and River Conservation Emergency Measures was revised at the junction of enactment of the New River Law. In addition, the second five-year program was started in 1965 to accelerate the river conservation projects. The budget for the

projects totals 3,056 million dollars, a drastic increase over the fund for the previous program.

But in recent years, the damage by floods and debris avalanches has been aggravated owing to the conspicuous change of the social conditions such as the industrial and economic development in the river basins, rising in the living standard, special concentration of population and industries in cities and their environs as well as the meteorological irregularity including occurrences of abnormally heavy concentrated rains. In order to meet this situation and to relieve the serious water famine aiming at conservation of the land and at the promotion of its exploitation and utilization, Third Flood Control Five Year Program starting in 1968 has been established. This program will be a great help to the promotion of the improvement and construction of flood control facilities and to the positive development of water resources.

An outline of the Program is given below:

a. Size of Investment

against disasters, the law establishes the necessary structure involving the national government, local public bodies, etc., clarifying the responsibilities of the respective organs, and, at the same time, provides for the fundamental matters concerning preparation of disaster prevention plans, protection against disasters, emergency measures for disasters, disaster rehabilitation, financial measures for disaster prevention and other disaster countermeasures.

In view of the fact that the national government has the mission of protecting the country's land and the people's life and property against disasters, the law stipulates that it is the responsibility of the government to take prudent measures for disaster prevention, utilizing all the organs concerned and fully exercising its functions. It also prescribes that the national government shall, through the Central Disaster Prevention Committee headed by the Prime Minister, prepare a disaster prevention basic plan to make it serve as the basis of disaster prevention, emergency measures for disasters and disaster rehabilitation and carry out such plan. With regard to the prefectures, cities, towns and villages, the law makes it their responsibility to prepare disaster prevention plans for their respective areas through local disaster prevention committees, and to implement the plans.

The provisions of this law cover the whole field of disaster countermeasures. The fundamental matters such as the respective responsibilities of the national government, prefectures, and cities, towns and villages, disaster prevention plans and disaster prevention committees are provided

for in detail by this Law, while the disposal of other matters such as actual prevention of disasters, emergency disaster measures, disaster rehabilitation, financial measures, etc. is conducted according to the respective laws concerned as well as this Law.

As regards the prevention of disasters and the emergency measures on the occurrence of a disaster, the Flood Fighting Law, the Fire Fighting Law, the Diaster Relief Law, the Police Law, the Self-Defense Force Law, etc. apply to them. As for the disaster rehabilitation, the River Law, the Road Law, the Harbor Law and the Seacoast Law apply. With respect to the national government's subsidization of the prefectures and cities, towns and villages when they carry out disaster rehabilitation projects, the Law concerning National Treasury Share of Expenses for Rehabilitation of Damage to Public Civil Engineering Facilities, the Law concerning Temporary Measures for National Treasury Subsidies for Rehabilitation Expenses of Damage to Agricultural, Forestry and Fishery Facilities, the Law for National Treasury Share of Expenses for Rehabilitation of Damage to Public School Facilities, etc. apply, and high rate national subsidies are given. For the rehabilitation of the disaster-stricken industries, housing, schools, etc. the necessary funds are loaned out. These matters are disposed of according to the Law concerning Temporary Measures for Extending Loans to Natural-Disaster Afflicted People Engaged in Agriculture, Forestry, Fishery, etc., the Private School Promotion Law, the Housing Loan Corporation Law, etc.

As the basic law of disaster countermeasures including the disaster prevention, emergency measures, loaning out of funds, etc., we have the Disaster Countermeasures Basic Law. The enforcement of this Law as well as that of the other laws concerned is intended for double ensuring of satisfactory carrying out of disaster measures.

3. Development of Flood Forecasting in Japan in Recent Years

1) History of Flood Forecasting in Japan

The research works on flood forecasting started in the early 1920's. Experimental formulas for estimating downstream crest stage from upstream rainfall intensity were developed on serveral river basins.

In 1924, a flood forecasting formula for estimating downstream crest stage about 8 hours in advance by using upstream stage was proposed on the Tone River basin for the emergency removal of equipment and facilities at the place where a bridge construction work was going on. In 1930, flood forecasting service was started on the Yodo River basin for giving accurate information on the flood to the flood fighters. Forecast was obtained 16 hours in advance when it was made on the basis of upstream rainfall and 9 hours in advance on the basis of upstream river stage. A semi-theoretical formula was published on a certain river basin in 1925. The formula taking account of the channel storage and the concept of unit hydrograph was used successfully for practical purposes.

An observation network consisting of 11 self-recording raingauges was established on the Tone River basin in 1936 after a big flood in the previous year. It was an epoch making matter as in those days to install such a number of self-recording instruments on a river basin.

In 1947, a historical big flood occurred on the Tone River basin. In consideration of this catastrophic flood, an urgent need of establishing

flood forecasting systems on an important river basins was strongly recognized and improvement programmes of the equipments and facilities were remarkably promoted. Forecasting offices carry out collection of data and dissemination of information during the flood time in cooperation with the agencies concerned.

Observers reported data to the forecasting office through telegraph or telephone. Then SSB radio-telephone sets were introduced for sending the data. Now the observed data are sent in digital form through telecommunication system on a regular time or occasional time basis.

Dissemination system of flood forecasting from the forecasting office to local offices has the same history as above mentioned. Radio and television play an important role as a tool of transmission.

2) Flood Forecasting and Warning System

It is the function of the Meteorological Agency to provide forecasts and issue warnings on weather, land conditions (excluding earthquakes and volcanic activities), tidal waves, high tides, billows and floods for use by the general public and those on weather, high tides and floods for use in flood-defense activities. When a flood forecast or warning is issued for flood-defense purposes, the Director of the Meteorological Agency must so notify the Minister of Construction and the prefectural governors concerned and so inform, with the cooperation of the press if necessary, the general public. Also, whenever flooding is likely on those rivers designated for flood forecasting, the Minister of Construction and the

Director of the Meteorological Agency must jointly notify the prefectural governors concerned and inform, with the cooperation of the press if necessary, the general public of such a danger along with an indication of the water level or the current rate. The rivers designated for flood forecasting are either those passing through two or more prefectures or those whose basin area is so wide that its flooding is likely to cause grave damages to the national economy and so designated jointly by the Minister of Construction and the Minister of Transportation. At present, there are 18 rivers so designated including the Tone and the Yodo rivers.

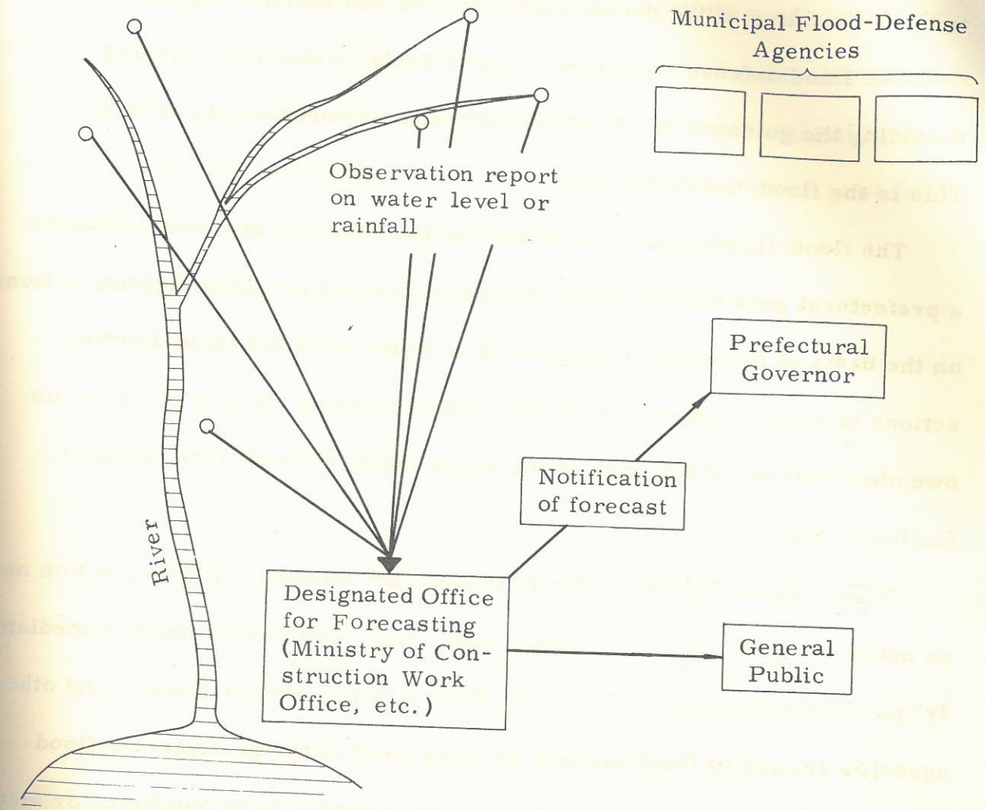
Table 2. Rivers Designated for Flood Forecasting and Flood-Fighting Operations

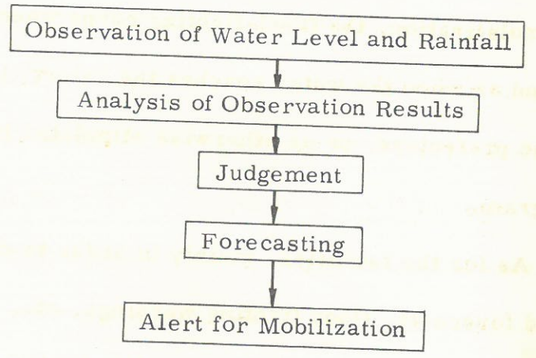
As of Apr. 1, 1970.

Rivers designated for Flood Forecasting	Rivers designated for Flood-Fighting Operations
18 rivers	87 rivers

The governor of the prefecture, when notified of the flood forecast or warning, must immediately convey the information to the flood-defense administrators and the keepers of the water gauges designated in the flood-defense program of the said prefecture. The flood-defense administrator or the keeper of the water gauges, when so notified or found for himself the danger of flooding or high tide and when the water gauge in fact shows the figure exceeding the "report" level designated by the governor of the prefecture, must report the state of the water level to those persons or agencies concerned as designated in the prefecture's flood-defense program.

Fig. 2 System of Flood Forecasting





Thus, while flood forecasting is a system by which notifications and warnings are made about possible flood disasters, its function is limited to the forecasting of the phenomenon and does not include judgements on concrete flood defense measures. Accordingly, a separate warning providing the guidance for flood-fighting actions becomes necessary. This is the flood-fighting order.

The flood-fighting order is issued by the Minister of Construction or a prefectural governor for those rivers designated for flood-fighting actions on the basis of the issuer's judgement as to the need for flood-fighting actions in view of either a flood forecast or warning already given or his own observations of the state of the water level, current rate, control facilities, etc.

When a flood-fighting order is issued, the Minister of Construction must so notify the prefectural governors concerned, who in turn must immediately pass the information over to the flood-defense administrators and other agencies related to flood defense as designated in the prefecture's flood-defense program. The flood-defense administrator is to mobilize, or alert for mobilization, the flood-fighting corps when a flood-fighting order is issued or when the water reaches the "alert" level designated by the governor of the prefecture, or as otherwise stipulated in the prefecture's flood-defense program.

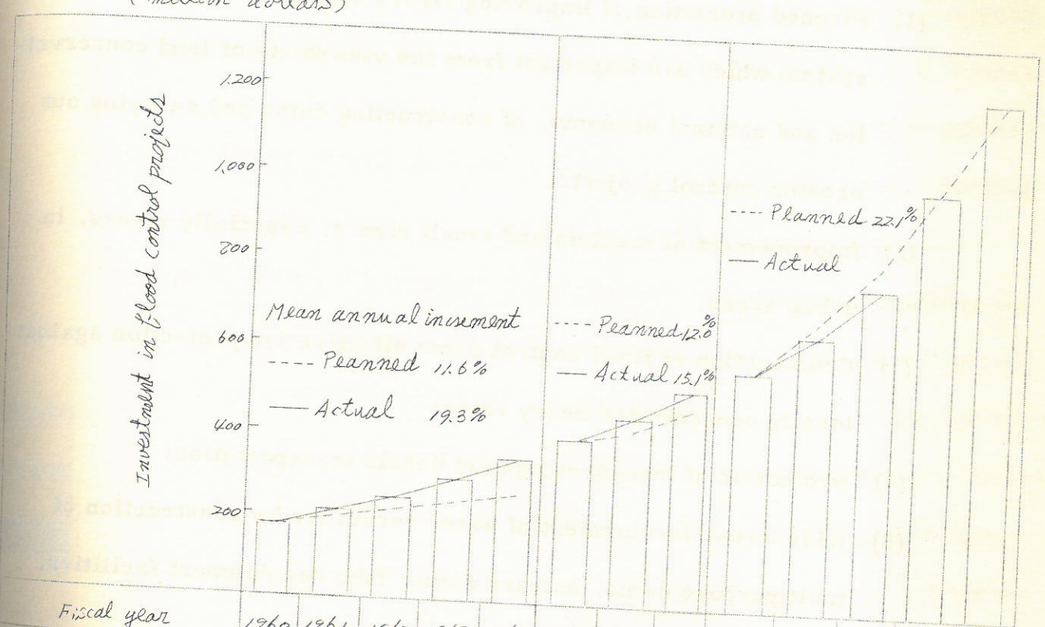
As for the facilities, mainly in order to control floods and give out flood forecasts, flood fighting warnings, etc. by foreseeing flooding, 219 rainfall telemeters and 207 water level telemeters were installed up to the

end of 1969, and in 1970 there are to be set up 33 rainfall telemeters and 40 water level telemeters. These telemeters are managed by the Ministry of Construction. Besides these telemeters, 247 robot rainfall gauges managed by the Meteorological Agency for meteorological observations render services to flood forecasting. Also, 107 robot rainfall gauges and 111 robot water level gauges are operating for flood control purpose under the management of the prefectural governors concerned.

Table 1

Size of Investment of 5-Year Program

(Unit: million dollars)



Fiscal year		1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Investment in flood control Projects	Actual	163	197	229	278	329	379	434	504	546	632	747		
	Planned	161	180	200	224	249	372	416	466	537	656	801	978	1,195
Accumulated investment in flood control projects	Actual	163	360	589	867	1,196	379	813	1,317	546	1,178	1,925		
	Planned	161	341	541	765	1,014	372	788	1,254	537	1,193	1,994	2,972	4,167
Total budget	Flood control Projects	1,014					2,361			4,167				
	Projects connected with disasters and projects executed by local authorities without subsidy	97					417			833				
	Reserve Emergency fund						278			833				
	Total						3,056			5,694				
Program	Name	First Five-Year Program					Second Five-Year Program			Third Five-Year Program				
	Term Actual	1960~1964					1965~1967			1968~				
	Planned	1960~1964					1965~1969			1968~1972				

b. The aims and targets of the projects are:

(1) Planned promotion of improving rivers belonging to the water system which are important from the viewpoints of land conservation and national economy, of constructing dams and carrying out erosion control projects;

(2) Improvement of medium and small rivers, especially rivers, in urban areas;

(3) Construction of flood control dams effective for protection against locally concentrated heavy rains;

(4) Promotion of measures against debris transportation;

(5) Wide-areal development of water resources by construction of multipurpose dams, estuary dams, lake development facilities, etc.;

(6) Strengthening of high-tide measures and river water pollution measures.

c. Benefits of the program

In and after 1972, the execution of the New Plan will annually reduce the damage by floods by 1,722 million dollars on an average and allow additional supply of 14,600,000 cubic meters of water per day.

2) Disaster Countermeasures Basic Law

For the purpose of fixing fundamental matters concerning disast measures, the Disaster Countermeasures Basic Law was enacted in 19

Fig 3

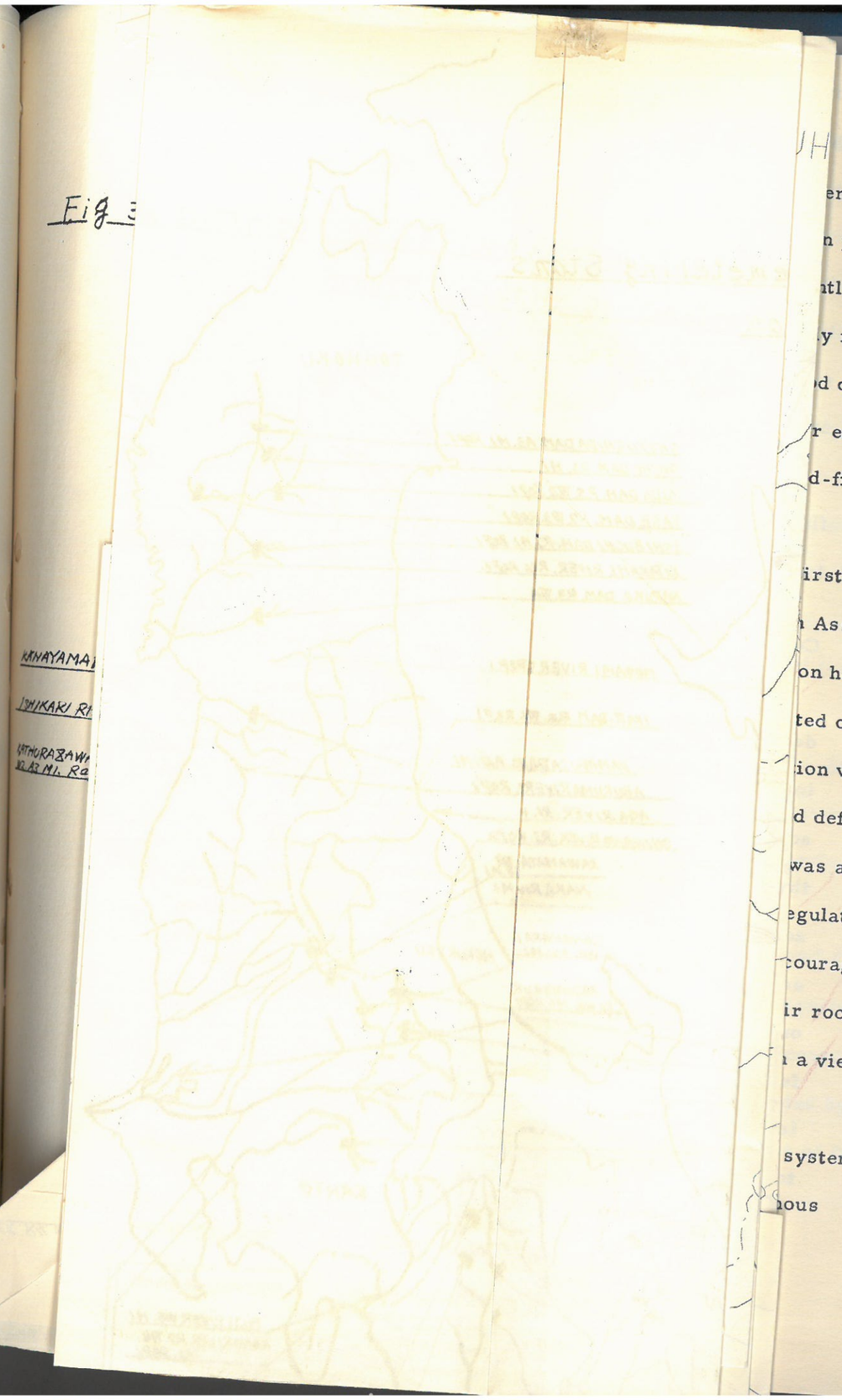


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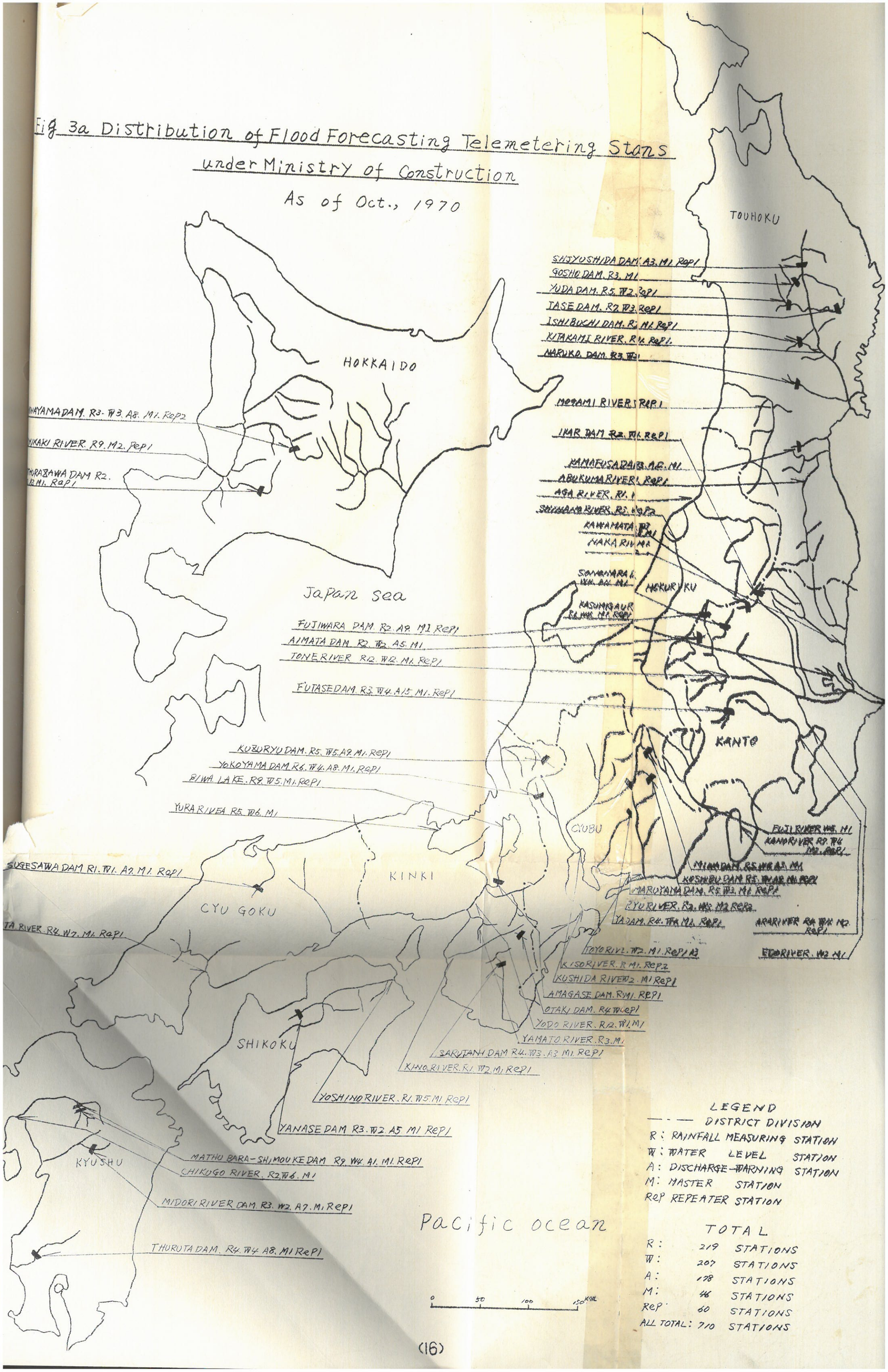
Fig 3a Distribution of Flood Forecasting Telemetering Stns under Ministry of Construction

As of Oct., 1970



LEGEND

—·—·— DISTRICT DIVISION
R : RAINFALL MEASURING STATION
W : WATER LEVEL STATION
A : DISCHARGE WARNING STATION
M : MASTER STATION
Rep REPEATER STATION

TOTAL

R :	219	STATIONS
W :	207	STATIONS
A :	128	STATIONS
M :	46	STATIONS
Rep :	60	STATIONS
ALL TOTAL :	710	STATIONS

Fig. 3d KANTO

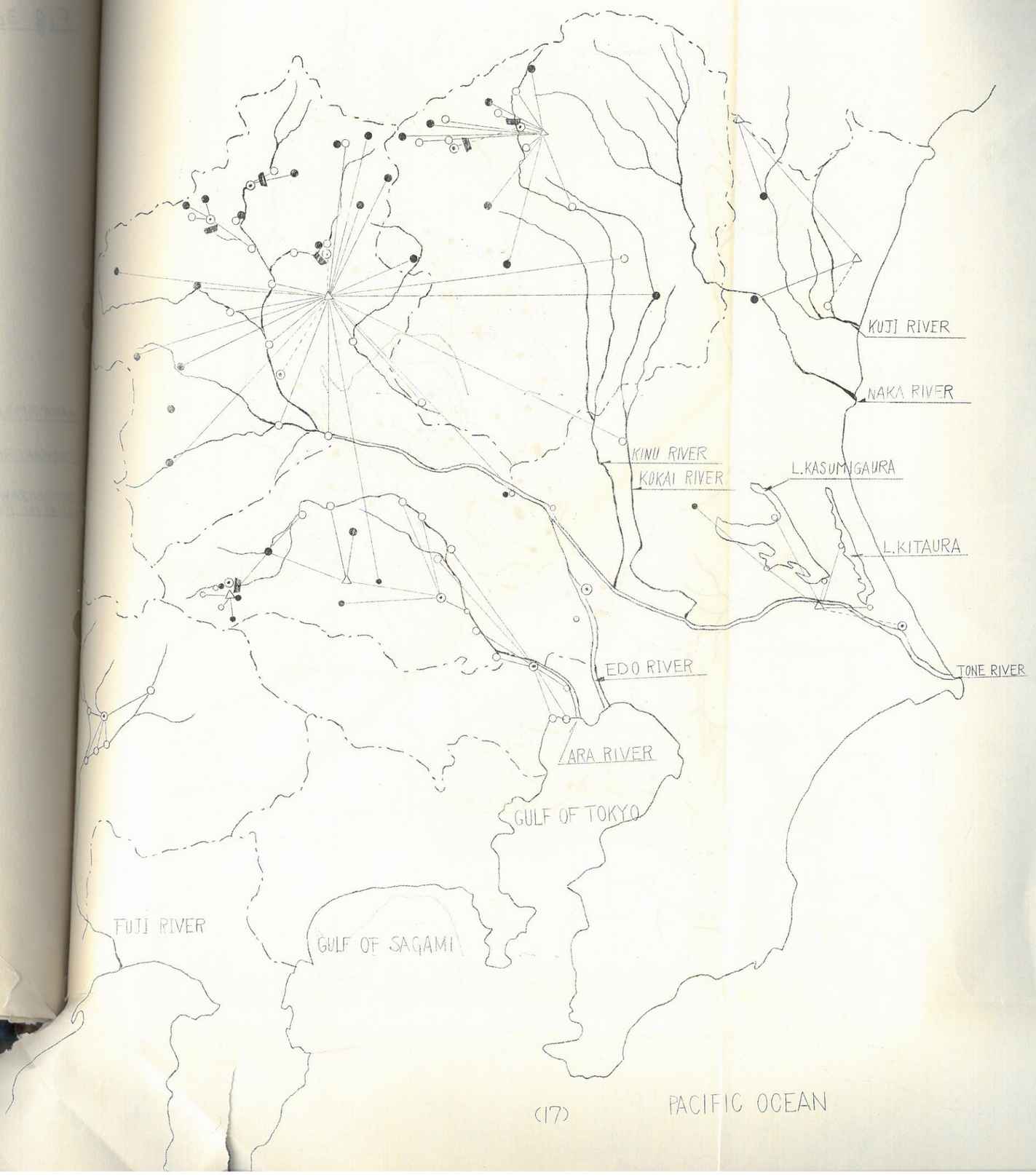

KUJI RIVER
NAKA RIVER
KINU RIVER
KOKAI RIVER
L.KASUMIGAURA
L.KITAURA
EDO RIVER
TONE RIVER
ARA RIVER
GULF OF TOKYO
FUJI RIVER
GULF OF SAGAMI
PACIFIC OCEAN

Fig. 3c

TOUHOKU

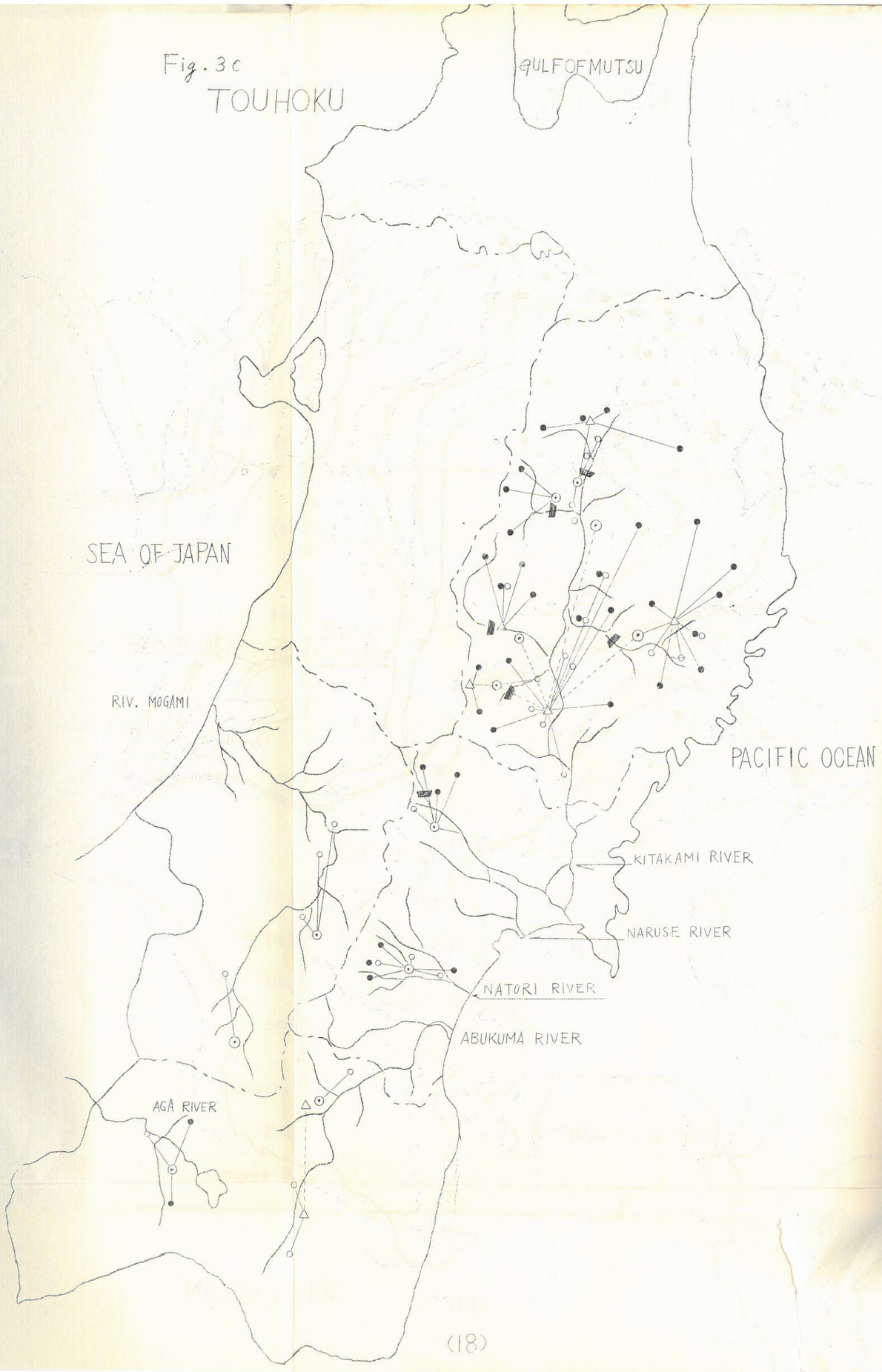


Fig. 3b

HOKKAIDO

SEA OF OKHOTSK

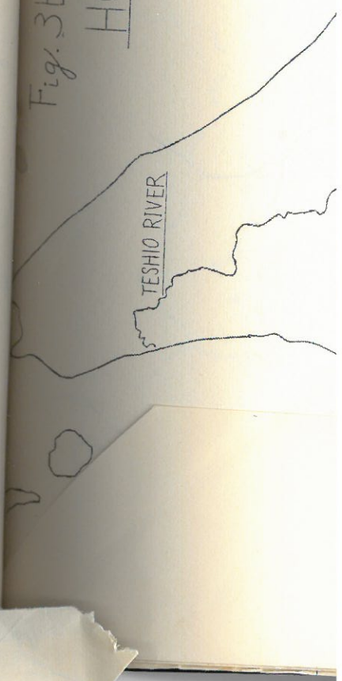


Fig. 5b

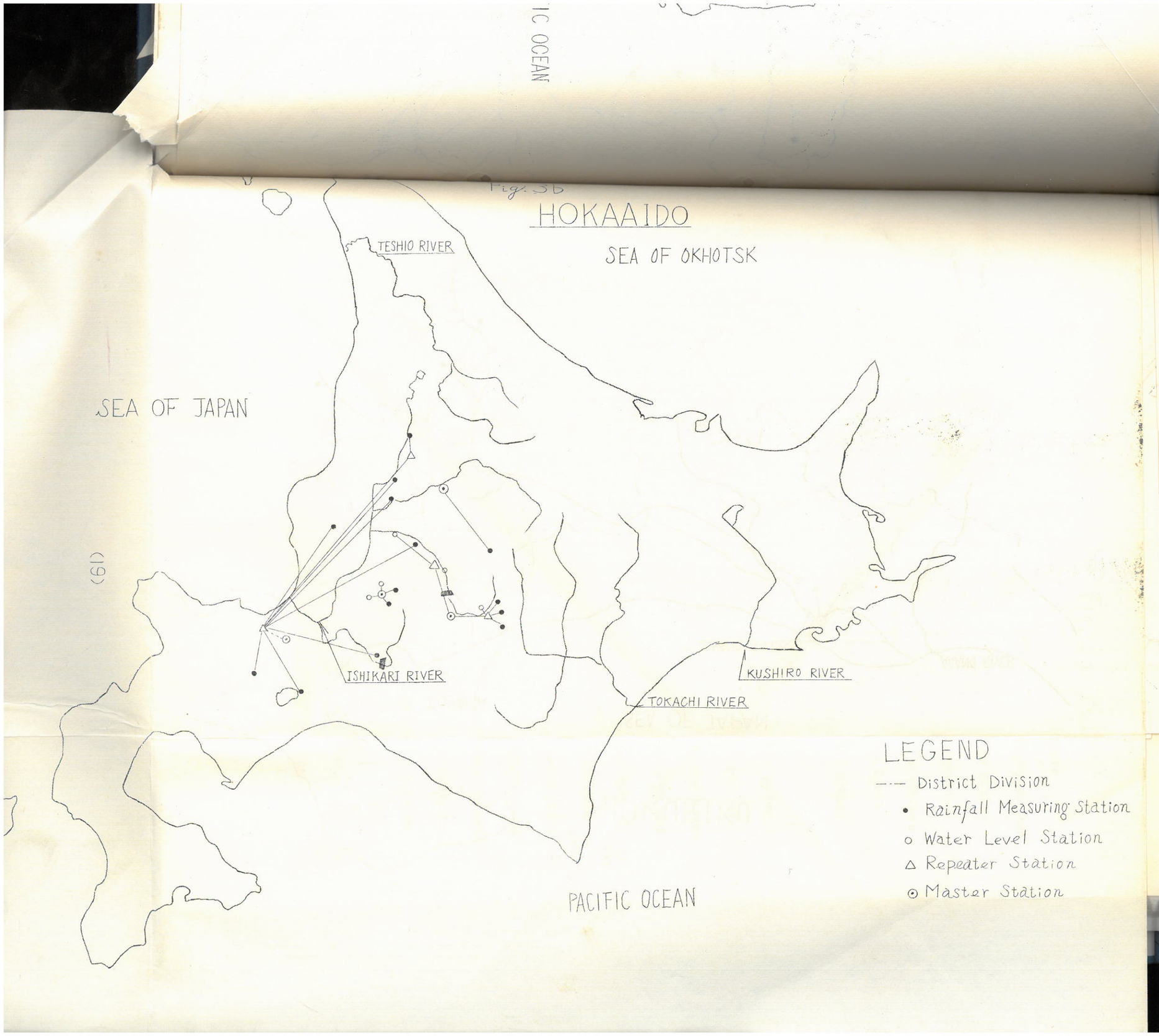

HOKAAIDO
SEA OF OKHOTSK
SEA OF JAPAN
TESHIO RIVER
ISHIKARI RIVER
KUSHIRO RIVER
TOKACHI RIVER
PACIFIC OCEAN
LEGEND
District Division
Rainfall Measuring Station
Water Level Station
Repeater Station
Master Station

Fig. 3e

HOKURIKU



Fig. 3f

CYUBU



Fig. 3f

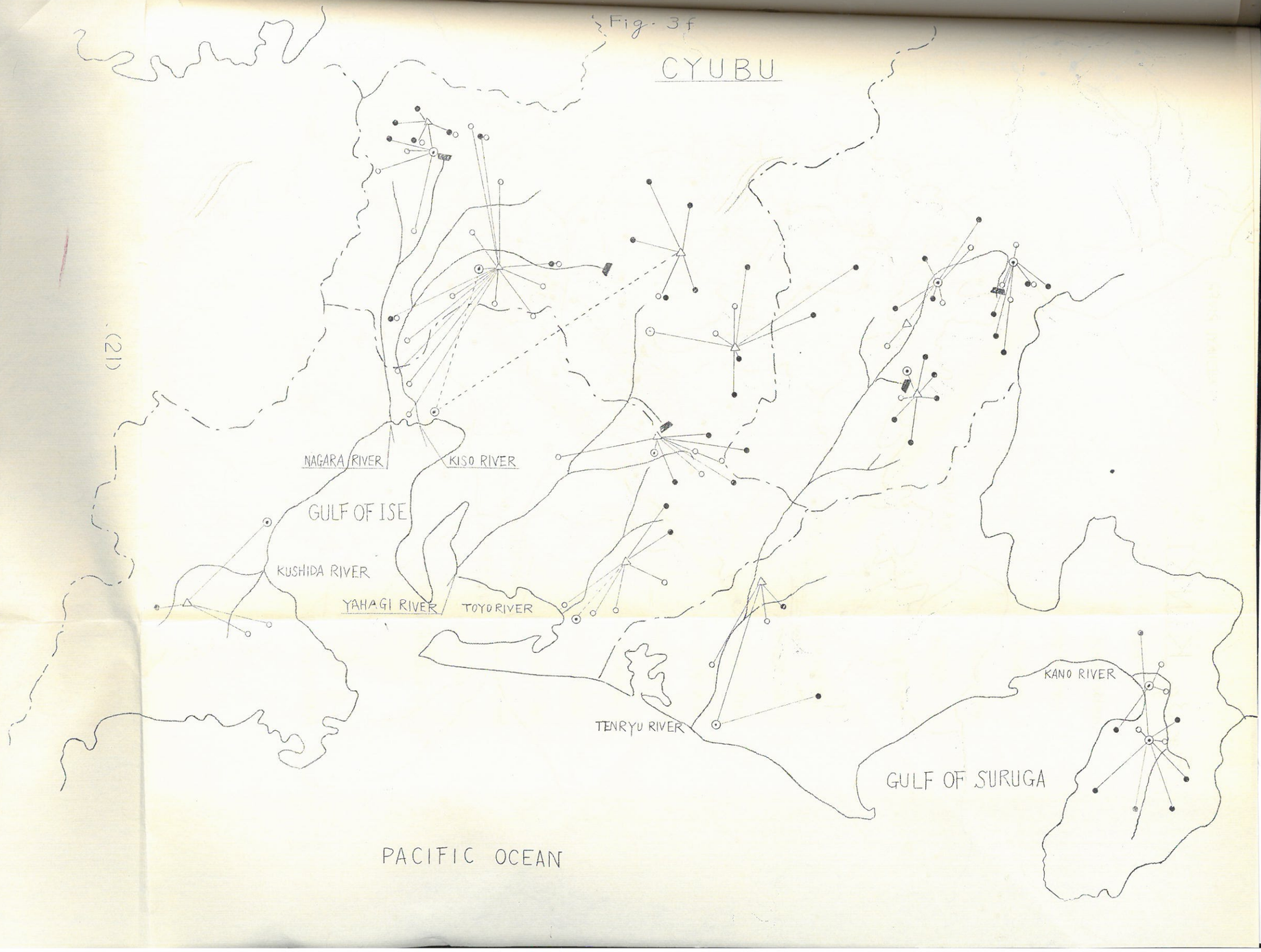

CYUBU
NAGARA RIVER
KISO RIVER
GULF OF ISE
KUSHIDA RIVER
YAHAGI RIVER
TOYO RIVER
TENRYU RIVER
KANO RIVER
GULF OF SURUGA
PACIFIC OCEAN

Fig. 3g KINKI

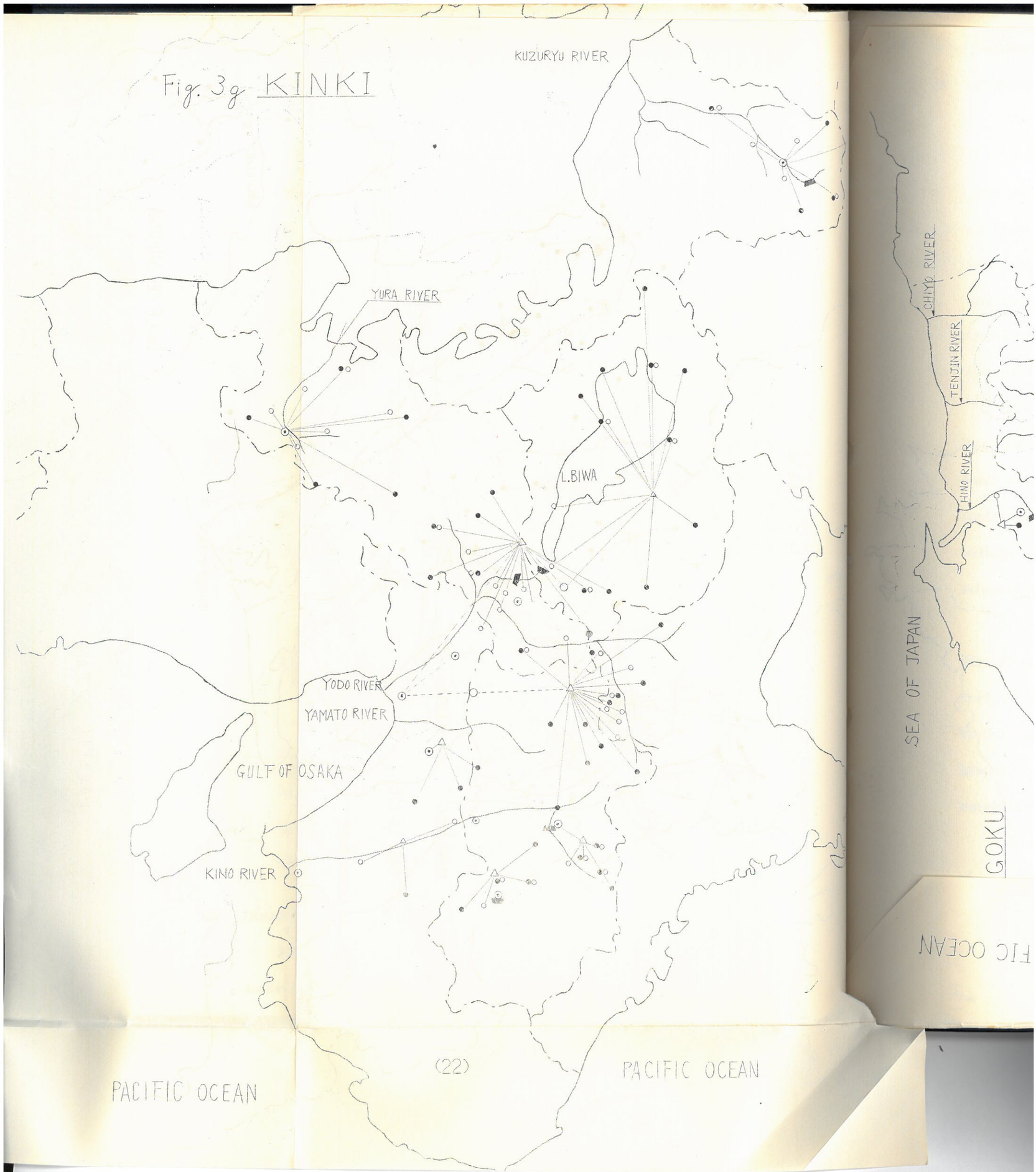

KUZURYU RIVER
YURA RIVER
L.BIWA
YODO RIVER
YAMATO RIVER
GULF OF OSAKA
KINO RIVER
PACIFIC OCEAN
CHIYU RIVER
TENJIN RIVER
HINO RIVER
SEA OF JAPAN
GOKU
FIC OCEAN

Fig. 3h

CHUGOKU

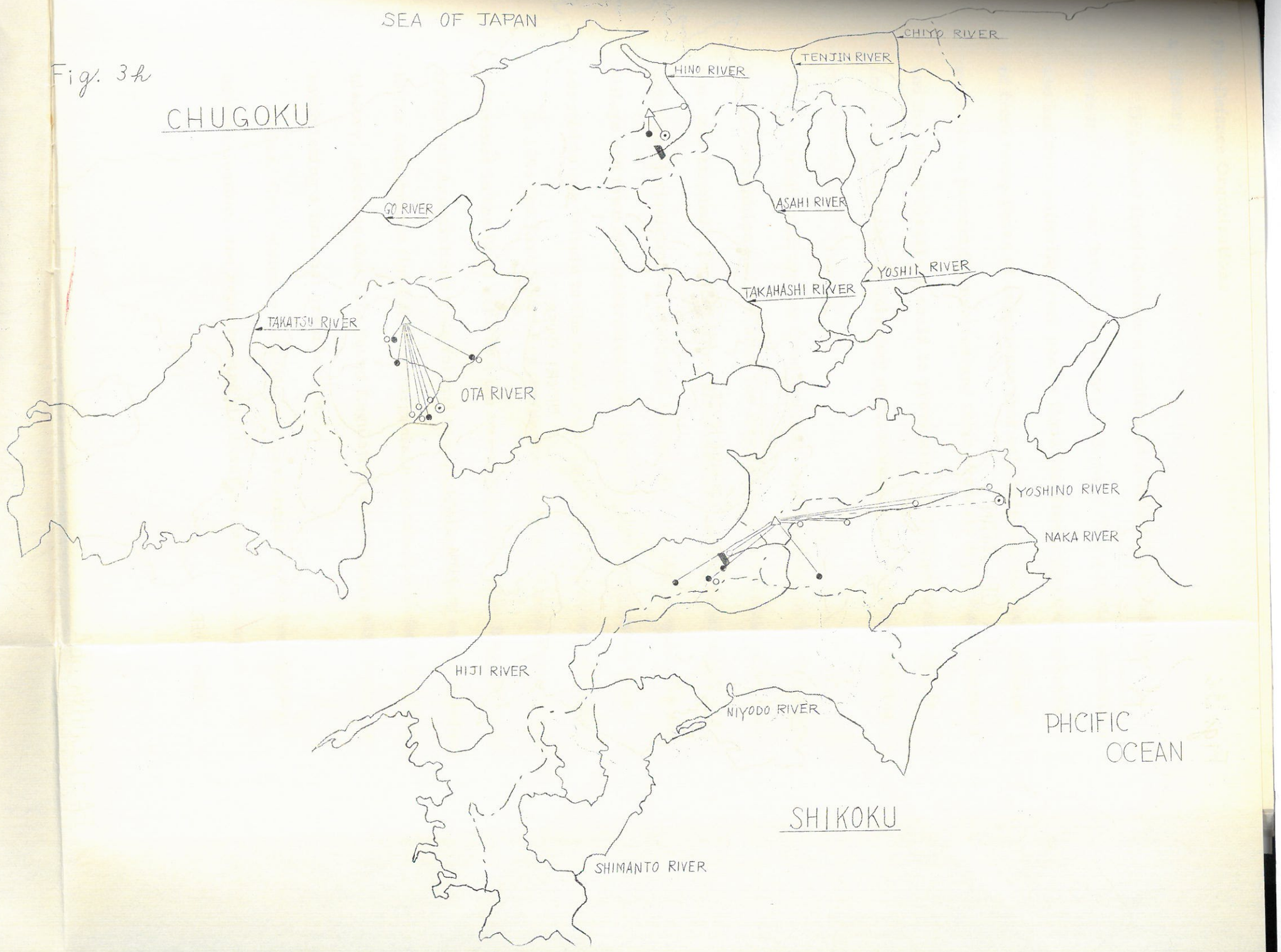
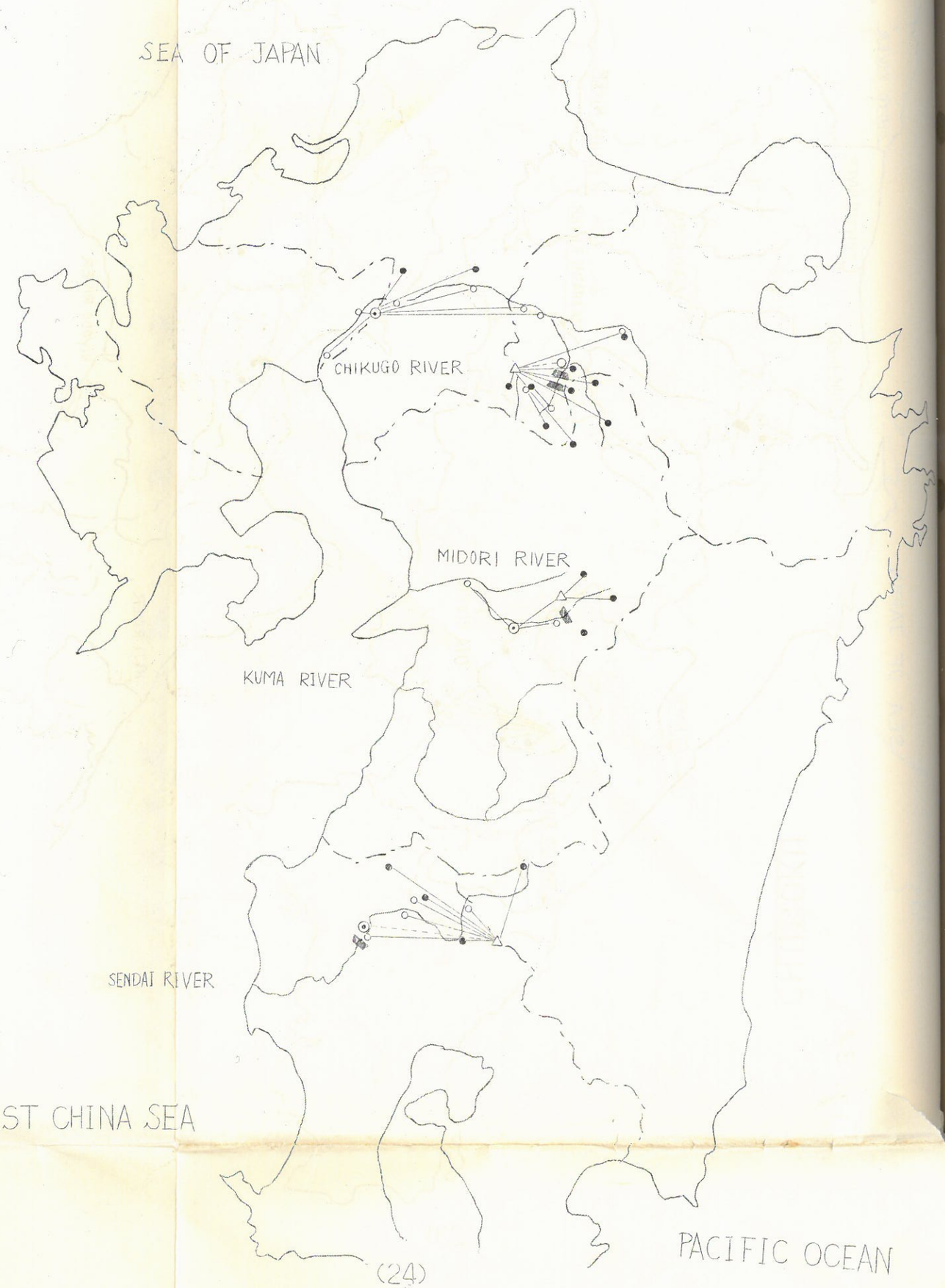
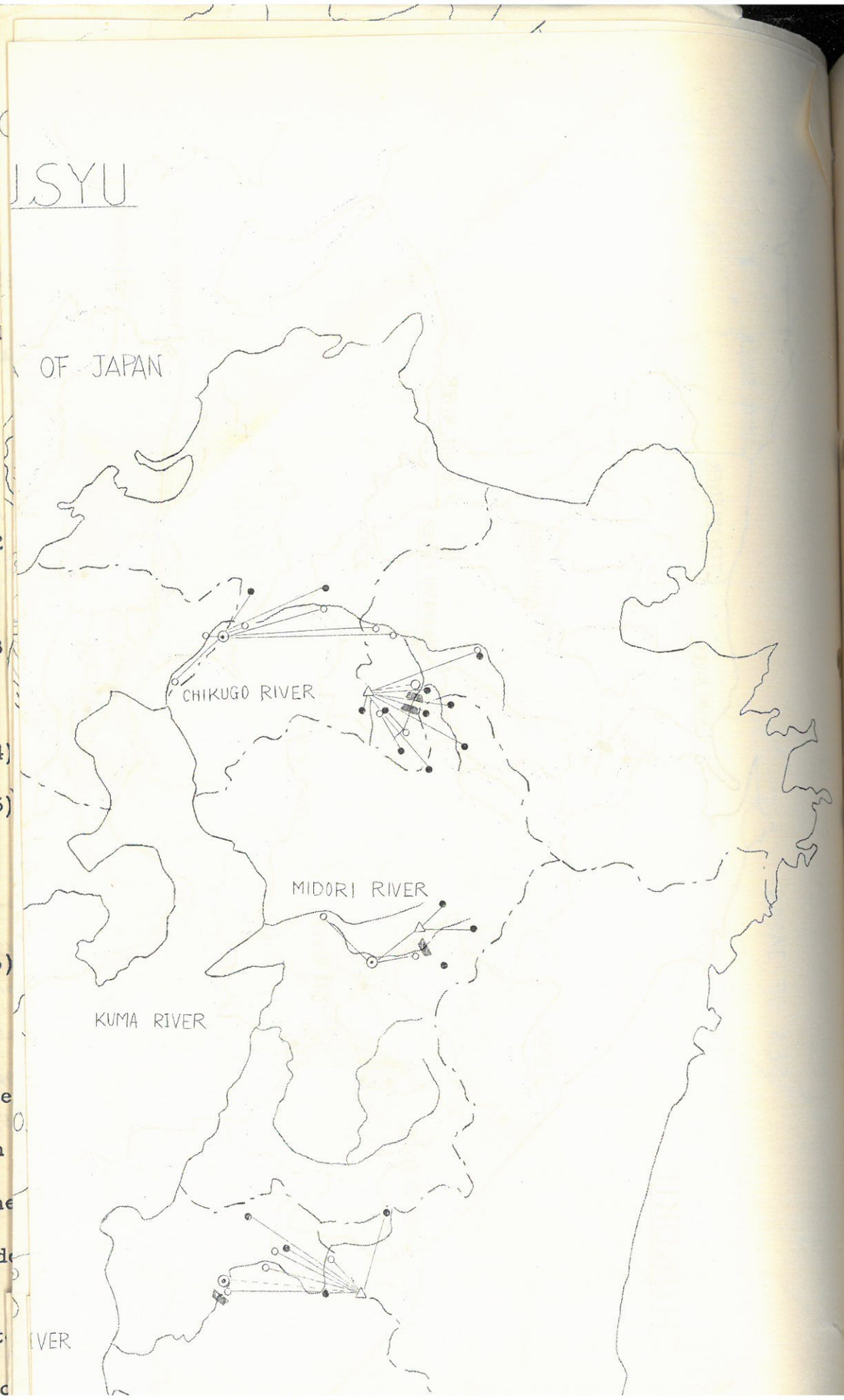


Fig. 3i

KYUSYU





3) Flood-Defence Organizations

a. History

Organized flood-defense activities as a village self-defense measure have long been in existence in Japan. The riparian population, who had been suffering from yearly flood disasters, apparently learned from many years of experience that self-help was the only method available to protect themselves and their property from flood disasters and that these disasters could be prevented, or at least their effects could be minimized, if only they spent several hours in flood-fighting operations.

The traditional type of flood-defense organization was first given formal recognition in 1890 when the Regulation on Irrigation Associations was enacted. By that time, flood-defense administration had come under the jurisdiction of municipal bodies by the newly adopted city and village and town administrative unit system, but the Regulation was adopted to pay tribute to the traditional organization for flood defense.

In 1894 the Fire Squad Regulation was adopted. There was a basic difference in the legal nature of the two Regulations: The Regulation on Irrigation Associations gave formal recognition and even encouragement to the autonomous flood-defense organizations which had their roots in history, whereas the Fire Squad Regulation was enacted with a view to establishing a national organization.

Thus, flood-defense functions are performed by the two systems of organization, one representing the land-oriented, autonomous

organization and the other the officially established, and it is to the joint efforts of these two lines of organizations that Japan's flood defense owes for its effectiveness and development.

In 1896 the old River Law was enacted, which included provisions for flood defense and empowered the local administrative bodies at time of flood emergency to impose public cost-sharing duties and to mobilize lower rank public bodies through stand-by and turnout orders and material requisitions.

In 1949 the Flood Defense Law was enacted, which unified the flood-defense organization hitherto developed in two parallel lines of legislative actions.

Current Flood Defence Organizations

The Flood Defense Law states that the responsibility for flood defense rests primarily with the municipal bodies, municipal associations, and the Flood Damage Prevention Associations as flood-defense administrative units, and secondarily with the prefectural authority, thus classifying it as an autonomous function. Each flood-defense administrative unit is thus empowered to deal with all flood-defense activities of the area under its jurisdiction. Each prefectural body, on the other hand, is to draw up the flood-defense program of the prefecture, which provides the basis for adequate flood-defense activities by the flood-defense administrative units under its jurisdiction, to issue flood-fighting orders, and to provide other necessary services

such as issuing the evacuation order at time of emergency, etc.

The governor of the prefecture can designate those flood-defense administrative units which, for flood-defense purposes, have serious bearings upon public safety as designated flood-defense administrative units. Special duties are imposed on designated flood-defense administrative units such as drawing up the flood-defense program, establishing the Flood-Defense Council, etc.

The Flood-Defense Council, established jointly by the prefecture and the designated flood-defense administrative units, is composed of representatives of the administrative agencies concerned, men of learning and experience and others, and considers the prefecture's flood-defense program and other important items connected with flood defense. The organ of flood defense is the flood-fighting corps set up jointly by the municipal fire-defense agencies and the flood-defense administrative units.

Municipal bodies are required to set up all or part of the fire-defense agencies which consist of the fire-defense headquarters, fire stations and fire brigades. These fire-defense agencies are responsible not only for fire defense but also for flood defense.

The flood-defense administrative unit can freely organize flood-fighting corps in order to perform its flood-defense services and the designated flood-defense administrative unit must organize a flood-fighting corps separate from the fire-defense agencies when the services provided by the latter in the area are deemed inadequate to perform the duties of flood defense.

The fire-defense agencies, as well as the flood-fighting corps, take orders from the flood-defense administrator for actions connected with flood defense.

Table 3. Changes in Flood-Defense Administrative Units and Membership in Flood-Fighting Corps

As of Jan. 1, 1969

Date of report	Flood-Defense Administrative Units			Membership in Flood-Fighting Corps			Reference
	Designated	Non-designated	Total	Full-time	Part-time	Total	
Nov. 1954	1,860	3,921	5,781		-	1,442,517	Based on reports from prefectures
Mar. 31, 1960	1,496	1,712	3,208	106,356	1,502,603	1,608,959	
Apr. 1, 1962	1,546	1,782	3,328	82,701	1,399,117	1,481,818	
Apr. 1, 1965	1,415	1,769	3,184	32,707	1,276,647	1,309,354	
Jan. 1, 1967	1,567	1,658	3,225	26,500	1,331,855	1,358,355	
Jan. 1, 1968	1,516	1,566	3,082	23,675	1,212,482	1,236,157	
Jan. 1, 1969	1,556	1,599	3,155	27,300	1,219,624	1,246,924	

gress of Flood Forecasting in Recent Years

The operational model to establish the run-off forecasting system is ded into the following three directions.

Methods based on the estimation of water storage in river channels. These methods are widely used in Japan.

Principle : The amount of run-off is closely related with the storage volume in river channel and basin slopes upstream of the location where we are considering for the run-off.

The main problem for these methods is to find out the relation between run-off and storage volume, that is, so-called "storage function".

Dr. Kimura found out the synthetic storage function with consideration of lag time, which gives a satisfactory result in Japan.

Dr. Sugawara's "Tank Model" method, the hydrological simulation model of the run-off phenomena in the actual basin, is also considered as one of these methods.

2) Methods based on the calculation of water in the channel.

Former methods are based on the continuity condition of water mass, and run-off-storage volume relationship, ie, Horton's Principle. However, these methods are treated hydrodynamically rather than hydrologically, that is, rainfall and run-off relation in the basin is found out by calculating the equations of motion and of continuity of the flow. Run-off phenomena are considered as the hydrodynamic

phenomena of the flow on the surface of slopes and in the stream channels caused by the rainfall or snow-melts. In order to solve the run-off problems, the equation of motion should be taken as the unsteady one from the actual phenomena, but the analytical treatment is rather difficult, so for the practical purpose, the equation of motion used in these methods is the equation for the uniform flow condition, in Japan Manning's formula is mostly used. In some cases, the storage-discharge relationship is used instead of mean velocity formula. This relation is considered as one form of the equation of motion.

The method calculated with a help of characteristics curves is used successfully to solve the equation of motion with the equation of continuity. Digital computer is also applied for the practical prediction and forecasting in the cases of the method of characteristics curves and the direct numerical calculation of the equations. The main problems concerning with this method are :

1. How to subdivide the total basin into a number of sloping area and stream channels.
2. To estimate the value of the parameters included in the dynamic equation. This value is corelated with the degree of the subdivision of the basin, geomorphological conditions, surface cover, etc.

Muskingum method is considered as one of these methods, but is not so commonly used in Japan, because the relation between storage volume and discharges at the inlet and outlet can not be established difinitly in the basin of this country as experienced in the foreign countries.

rical solution of the exact equations of unsteady flow was undertaken
any years as the method of flood routing, and the experiences of
lation methods and techniques have been accumulated. As the results,
ractical method was developed and was applied successfully especially
e cases of the storage or detention reservoirs located in the basin or
e flood routing in the tidal reach.

similar method to solve the equations of unsteady flow directly is
ied for the flood routing in Chikugo River basin by using the analog
puter. Analog computer is developed intensively for the purpose of
d routing by the Public Works Research Institute, Ministry of Construct-

The idea of analog computer is to solve the dynamic equations of
teady flow for the complicated actual boundary conditions as acculately
possible by assistance of the modern electronical knowledge.

ong these methods mentioned before, it is felt concurrently that one of
most important problems is the lack of knowledge concerning the rainfall
ess or loss of input rainfall.

formulate the amount of rainfall excess related with the rainfall intensity
geomorphological conditions or surface cover, many researchers have
devoured by theoretical or experimental works. However, at present we
uld have only the very rough relationship, and the very acculate and
ysically sound relation could not be obtained.

ethods based on the calculation of stochastic model.

un-off phenomenon caused by rainfall is considered as a very complicated
stem combined with the various elements and each one of them will be

controlled by the definit physical laws from the view point of the micro-scale sense. Therefore, it is possible to solve the run-off problem by applying the principal physical laws for the appropriate basin model which is the representative boundary conditions of the actual river basin.

On the other hand, from the view point of micro-scale, the run-off phenomenon is considered as one of the stochastic phenomenon. Due to the development of the imformation theory, we may solve the run-off problems as the combined system of stochastic process. Along the line, many efforts have been done in the field of run-off prediction, for instance, the correlation and sprectrum of hydrological quantities were studied by Dr. Sugawara, Prof. Hino, Prof. Ishihara and Prof. Yamaoka. Generally, it is recognized that the run-off phenomenon is the non-linear system from the study of unit graph method. It is now under investigation to test the applicability of the Wiener's theory on non-linear stochastic process or Marcov Chain theory for the run-off problems and it is found in a certain degree that these methods are applicable for the run-off problems with success.

Up to now, (1) & (2) methods are applicable for flood forecasting and the third one is considered a suitable method for ordinary flow forecasting and that is not applicable for the flood run-off.

STUDIES ON WIND DAMAGES BY TYPHOON IN JAPAN

M. Okuta,

Abstract

Since greater part of buildings in Japan are made of wood, the object of investigation is for the most part the damage of wooden house. The wind damage of steel tower, chimney and steel-framed or ferro-concrete building is treated separately. In this paper, we give an outline of investigation in Japan about the wind damage of houses caused by typhoon historically.

1. Introduction

Our country, Japan, lies at the edge of east side of the Eurasian Continent and is attacked by typhoon almost every year. So, she has been badly damaged by typhoon almost every year from old time. Damage by the typhoon is caused by strong wind, heavy rainfall, storm surge and raging waves. At the area damaged by storm surge, raging waves or flood, it was scarcely possible to separate the damage caused solely by wind. Investigation on the damage caused to houses by strong wind of typhoon started at first stage of Showa Era (1930), at that time the scientific study on architecture began to develop in Japan. Now, let us give an outline of investigation in Japan about the wind damage of houses by typhoon historically.

Since greater part of buildings in Japan are made of wood, the object of investigation is for the most part the damage of wooden houses. The wind damage of steel tower, chimney and steel-framed or ferroconcrete building is treated separately.

2. Investigation of wind damage by Muroto Typhoon (1934)

At 0510 L.M.T. on 23rd September 1934, the Muroto Typhoon landed Murotomisaki in the Shikoku District, with recordbreaking minimum pressure 911.9mb. After landing it moved northeastward and passed near to the north of Osaka City at about 0800 L.M.T.. Severe storm raged especially in Osaka City and Osaka Prefecture, and peak gust recorded by Dines anemometer at Osaka Observatory was more than 60m/sec.. Osaka suffered most from the Typhoon.

Japan Architecture Society investigated to the best of its ability the house damage by this typhoon in connection with the actual condition in process and cause of destruction.

The foundation for the investigation on wind damage by the Muroto Typhoon was established by H. Tanabe and his collabolators, who had investigated the wind damage of wooden houses in northern Kyushu District caused by typhoon on August 1930. From their investigation of wooden houses mainly in Nagasaki, Saga and Fukuoka Prefectures, they pointed out that the greater part of destroyed houses lacked wind proof such as the diagonal bracing and knee bracing. As shown in Fig. 1, they showed that for the case of several houses arraged in line, not only the house which stood at the windward edge but also that which stood at the lee of the line were prone to destruction. And they mentioned that houses were prone to be destroyed by wind when several houses stood in such arragement as to brake the wind. The Muroto Typhoon is a super large one which attacked Osaka and surroundings, and the damage caused by it was enormous as shown in Table 1. Japan Architecture Society asked its members living in suffering districts to investigate the

actual condition of wind damages, and then sent there many authorities of wind load to make clear the factors which may cause wind damage to various kind of construction such as wooden house, steel tower etc. Since the report of this investigation is massive, we cannot introduce its detail, and we will introduce in this paper the main results which gave foundation to the development of the research activities for protection of wind damage.

2.1 Wooden houses

Among the wind damages of wooden houses caused by the Muroto Typhoon, special mention should be made that primary and middle school houses were destroyed and many students were killed and injured in Osaka District. Fig.2 & 3 show the distribution of damage of school houses in Osaka City and Osaka Prefecture respectively. Every school house which had not been reinforced by steel was greatly damaged, while the damge of reinforced houses was few except breakdown of roofs and window-panes.

Actual condition of those damages as investigated after classifying school houses according to their disposition, and its results are shown in Fig. 4 after Toyoda. Tanabe and Katsuta classified the disposition of school houses to 8 types, and they derived the relation between main wind direction and the damaged part of houses of each type as shown in Fig. 5. And then, they analyzed the damage of wooden house by classifying the wind effects for wooden houses into five: For are direct effect, the external pressure, the internal pressure, the attraction and the blowing up, and the other one is indirect effect by objects which were blown away by strong wind. H. Tanabe had already pointed out in 1930 that wooden houses which had not protecting construction for strong wind were damaged seriously. And he emphasized that, for the protection of houses

against strong wind, not only the diagonal bracing and knee bracing, but also the shore are very important. These protecting constructions had been suggested by H. Tanabe in 1931 for counter measure of earthquake damage.

2.2 Steel tower and other tower construction

Serious damages were caused on steel tower of the transmission line, steel pole chimney and advertisement tower. At that time, there were no firm standard of design wind load for the high building. From the experience of this Typhoon, the study for establishment of wind load (rapidly) developed.

The distribution of collapsed or inclined steel towers and poles in Osaka Prefecture is shown in Fig. 6. Direction of collapse and inclination coincides with the direction of high speed wind. There were two cases in damage of steel tower: one was structural damage, and the other was uprooting. Damage of steel framed tower was classified according to the kind of direct damage effect and shown in Table 2.

Next, the distribution of (the) damage of chimneys (of) public bathhouses in Osaka City is shown in Fig.7. Short lines at every point indicate the direction of collapse, and they almost coincide with the direction of high speed wind. From those damaged chimneys, the broken selfstanding ferroconcrete ones were seperated and their distribution is shown in Fig. 8.

Saka, Tanabashi and Utsugi investigated the damage of steel towers from the point of construction dynamics, and pointed out the cause of it as follows: the greater part of damaged tower was insufficient in design wind load, and the metal fittings which fixed the foot to tower closely with base were used brittle cast iron.

After that days, study on wind load for the construction by wind tunnel was started earnestly and the motion for the establishment of design wind load became concrete in Japan Architecture Society by introducing the result of research in vertical distribution of wind by meteorologist.

2.3 Windowpane

Damage of windowpane of high building also began to attract attention from the experience of this Typhoon. Distribution of the number of damages of high building in Osaka classified by floor and orientation is in Table 3 and the total damage for each floor is shown in Table 4. High rate of damage of windowpane is concentrated at around the 7th floor. Because we cannot infer the terrain roughness around high buildings, we cannot indicate clearly the cause of that phenomenon, probably the 7th floor and neighboring floors may be hit most frequently by wind-blown matters.

3. Post 2nd World War

3.1 Before Ise Bay Typhoon

According to the results of studies on the factor of wind damage and design wind load, the law regulating wind load was changed in 1938. But, owing to intensification of War, the research of wind damage and wind proof construction was oppressed, to be resumed in about 1948 when our country began to regain its footing.

On 16-17th, September 1948, the Ione Typhoon went past by the Boso Peninsula to the south of Tokyo, and moved northeastward. At that time, the group of wooden houses built on a hill in Choshi City in Chiba

Prefecture were destroyed by high speed wind. Fig. 9 indicates the distribution of damaged houses in that group, and we can see there are many in windward and lee side of main wind direction. Rather high damage rate in the western part of the group can be explained by the fact that the building site is higher than else-where.

After 1945, main typhoons which brought about damage in Japan are as follows: Makurazaki Typhoon in 1945 (with min. pressure next to record), Ione Typhoon in '48, Jane Typhoon in '50, Ruth Typhoon in '51, No. 13 in '53, Toyamaru Typhoon in '54, No. 11 in '57, and Ise Bay Typhoon in '59. The Ise Bay Typhoon caused the greatest damage ever recorded in the history of meteorological observation in our country.

Before 2nd World War, after experience of the great damage by Muroto Typhoon, the study of wind load on every part of house had been started by using the experiment of wind tunnel, and after the War it was rapidly developed by I. Kamei and others in Building Research Institute. The results obtained by them were introduced in architectural technique.

On 13-15th October 1951, by the Ruth Typhoon, which landed the Kyushu District and passed through toward the Japan Sea, several steel towers of power transmission line in the Shikoku District were destroyed, although they were constructed according to the design wind load 60m/sec., According to meteorological obsrvation in the Shikoku District, maximum ten-minute-mean wind speed is 31.4m/sec. in land level, 39.0m/sec. in mountain. For lack of observation of peak gust at stations where the maximum mean wind speed was observed,

we estimate peak gust by using the (relation-ship) between peak gust and maximum mean wind speed obtained from data of the Shikoku District. The peak gust thus determined for that district is about 45m/sec. in land level and about 58m/sec. in mountain. Destroyed steel towers had been designed to stand the wind speed as high as 60m/sec., so the wind speed must be more than that at the places damaged due to the local effect of mountainous topography.

3.2 Ise Bay Typhoon (no. 5915)

Ise Bay Typhoon landed the southern edge of the Kii Peninsula on 26th September 1959, with recorded min. pressure of 929.5mb (the 3rd rank in Japan) at Shionomisaki near the place of landing. Then it passed about 40km to the north of Nagoya City, and caused serious damage in Aichi, Gifu and Mie Prefectures, especially around Nagoya City.

Most of damage was caused by storm surge and flood, and totals of death and missing were more than 5,000 men. As house damages due solely to high speed wind were relatively slight, it is difficult to express the wind damge seperately. However, a few studies have been made on wind damage due to this Typhoon and their results may be summarized as follows:

(1) Wooden house

K. Takahashi shows the areal distribution of the rate of wooden house damage as shown in Fig. 10. The rate was obtained by following process: the number of completely destroyed houses multipied by 0.9 and the number of badly destroyed houses multiplied by 0.6 are added and the sum is devided by total number of houses in respective city

in Aichi Prefecture. In coastal region attacked by storm surge, the rate of house damage was naturally high, and the pattern of its value that gradually decays from the coast toward inland indicates good agreement with the distribution of the peak gust as shown in Fig. 11. The area more than 10% of the rate coincide with the area more than 50m/sec. of peak gust.

H. Sugiyama and others investigated the relation between the construction of wooden house and the wind damage. Their investigation is summarized as follows:

(a) Breakthrough of windows and doors by wind caused a fatal blow for construction.

(b) The roof covered by plates seems to safe for high speed wind of typhoon as compared with the roof covered by Japanese tiles, but the light roof, with gentle slope and long eaves is vulnerable to typhoons, and if it had a fault in construction, it is in danger of fatal blow not oly in roof truss but also in construction of the lower part. Especially the roofs covered by long iron plate or by aluminum tiles are stripped widely in the time of damage.

(c) Recently, detailed measure for wind proof wooden house have been kept in actual construction, so that wooden house would be almost safe for the wind speed comparable to this Typhoon except that it possesses important defect.

(2) Steel tower

There were many damges in the steel towers of power transmission line operated by the Chubu Electric Power Co. as shown in Table 5.

Many of steel towers lower than 50m were uprooted from the base, and many of higher than 50m were collapsed. As the design wind speed of those towers was 40m/sec., the collapse of those towers was inevitable in view of the areal distribution of the peak gust as shown in Fig. 12.

(3) Windowpane

Japan Housing Public Co-operation investigated the situation of the damage of windowpane in the group of two-storied houses made of ferro-concrete. And the number of damaged windowpane of the first floor is overwhemingly more than that of ground floor. And as the main wind direction of high speed wind was SE-SSE, the damage rate of windowpane is overwhemingly much in southern side of houses, and we can see from this the damage was great in the region where the strong wind blows hard against houses.

3.3 2nd Muroto Typhoon (No. 6118)

On 16th September 1961, 2nd Muroto Typhoon (min. pressure is 930.9mb at Murotomisaki) landed near Murotomisaki and moved along the course almost the same as the Muroto Typhoon in 1934, and brought about great damage in the Kinki District especially around Osaka City. In spite of that the maximum high speed wind brought by this Typhoon in and around Osaka City was comparable to its predecessor, amount of damage was considerably few compared with the case of the latter. (see Table 1)

Fig. 12 indicates the areal distribution of the rate of damage of wooden houses which was obtained by dividing the total number of completely and badly destroyed houses by the number of all houses in respective cities. The areal distribution of that rate more than 10%

almost coincides with the areal distribution of peak gust more than 50m/sec. as shown in Fig. 13.

In Kyoto Prefecture, more than 10 steel towers of the power transmission line of Kansai Electric Power Co. which had been constructed across Kitsu River were collapsed. In Fig. 13 we we can see that peak gust near Kitsu River is about 50-60m/sec, and the design wind speed was 60m/sec.. So, it is our judgement that considerably strong wind blew along Kitsu River by topographic effect.

4. Method of picking out (the) wind damage from typhoon disasters

As previously described, it is difficult to pick out from multiple disaster the damage due solely to wind. M. Okuta(1965) proposed a method to seperate the amount of the wind damge from that of typhoon disaster in general. In simple (flood) damage caused solely by heavy rainfall, there is a good relation between the number of flooded houses and the number of destroyed (completely and badly) houses, and the regression equation of the relationship is as follows,

$$D = e^{\log_e 10\,(1.175 \log_{10} F - 2.663)}$$

D : estimated number of destroyed houses

F : number of flooded houses

He applied this equation for the estimation of wind damage of wooden house caused by the Ise Bay Typhoon, and subtracted D from the actual (m) nuber of destroyed houses of every city with the observation of peak gust. Fig. 14 indicates the relation between actual number of destroyed houses and peak gust of respective city, and Fig. 15 indicates the relation between estimated amount of wind damage of

of houses and peak gust at respective city. We can see by those Figs. that the interrelatioship is closer for the estimated number than for actual number of houses.

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Table 1. The total damages of maintyphoons in Japan

	Muroto	Makurazaki	Ise Bay	2nd Muroto
landed year	1934	1945	1959	1961
min. pressure	911.9mb	916.6	929.5	930.9
peak gust	S 65m/sec	ESE 63	S >60	S >60
death and missing	3,036	4,229	5,177	202
copletely destroyed	38,771	55,934	35,125	14,681
badly destroyed	49,275	51,385	105,371	46,662
washed away	4,277	2,394	4,480	557

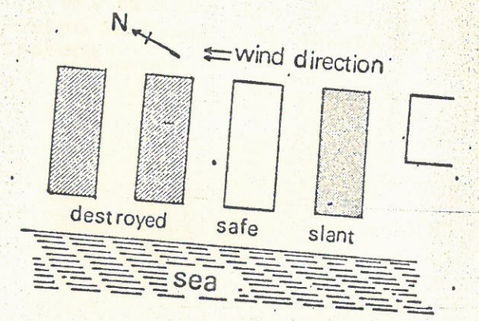

Fig. 1 Relation between strong wind direction and the damage of houses due to their disposition

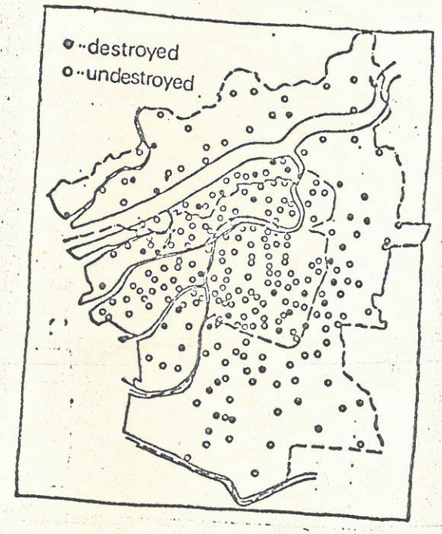

Fig. 2 Areal distribution of damaged school houses in Osaka City caused by Muroto typhoon

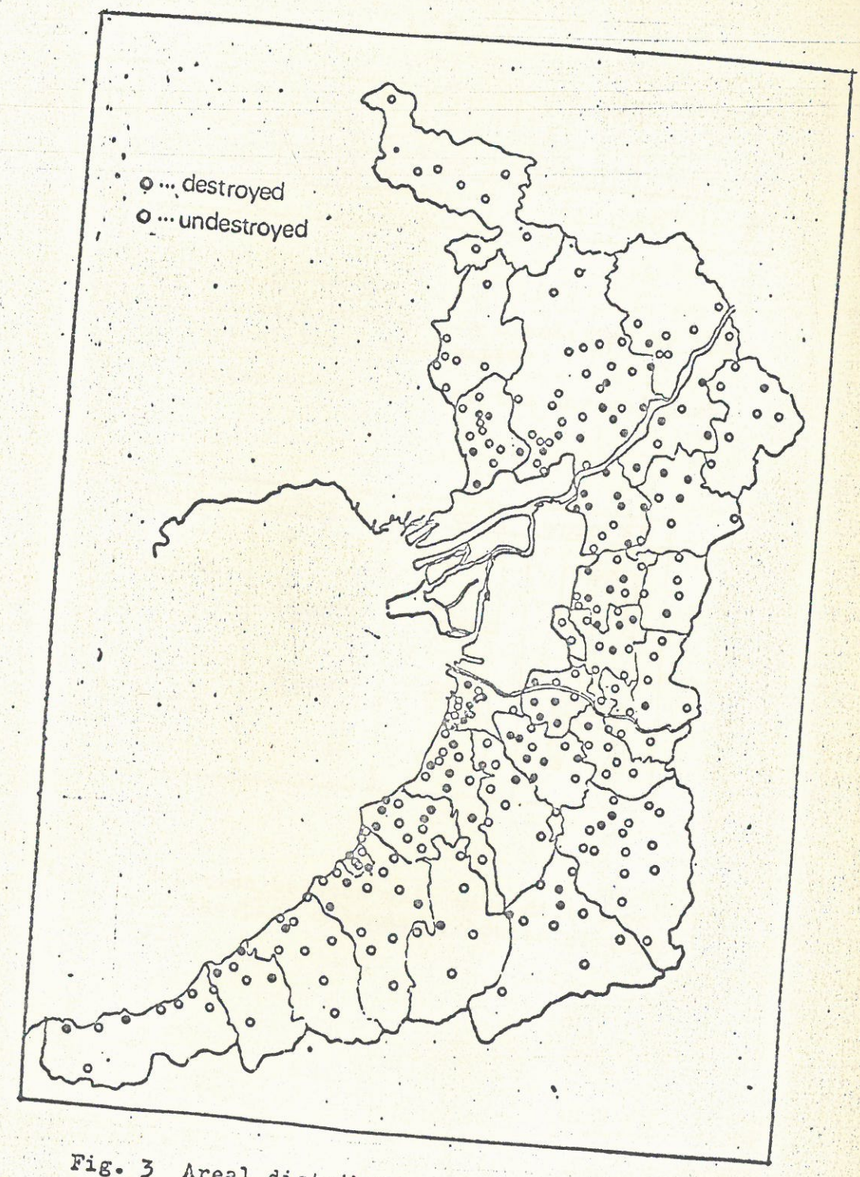

Fig. 3 Areal distribution of damaged school houses in Osaka Prefecture caused by Muroto Typhoon

type										
sum	9	2	5	2	2	10	3	1		
%	82	18	56	22	22	72	21	7	1	1
sum	11		9			14			1	
total	10		57%			40%			3%	

damaged

Fig. 4 Sum of school houses classified by their type of their disposition

Broken lines indicate the damaged part.

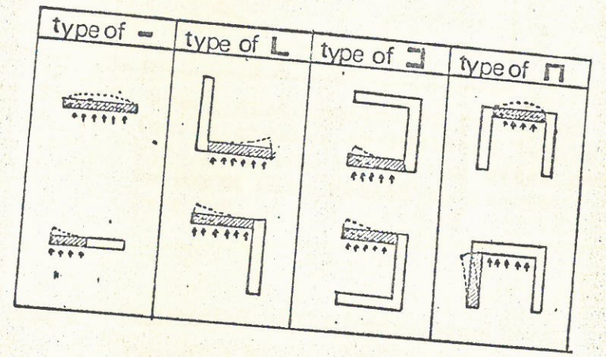

Fig. 5 Relation between main wind direction and the part of damaged houses of each type

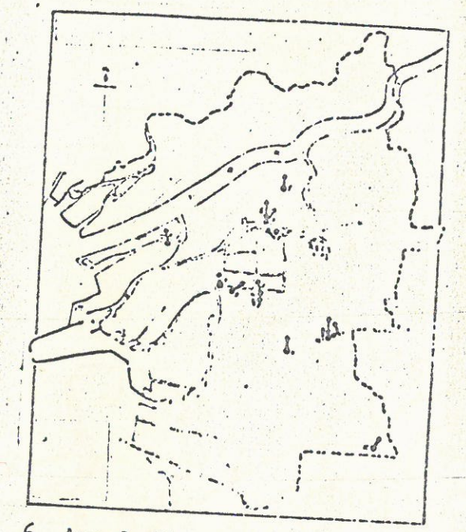

Fig. 6 Areal distribution of collapsed (black circle) or inclined (white circle) steel towers and steel pole in Osaka City caused by Muroto Typhoon

Table 2. Distrbution of the framed steel tower classified direct damage effect

kind of tower / damage effect	advertisement	antenna	others	total
uproot	5	—	1	6
structural damage	2	2	2	6
destroy in fastening	1	1	—	2
total	8	3	3	14

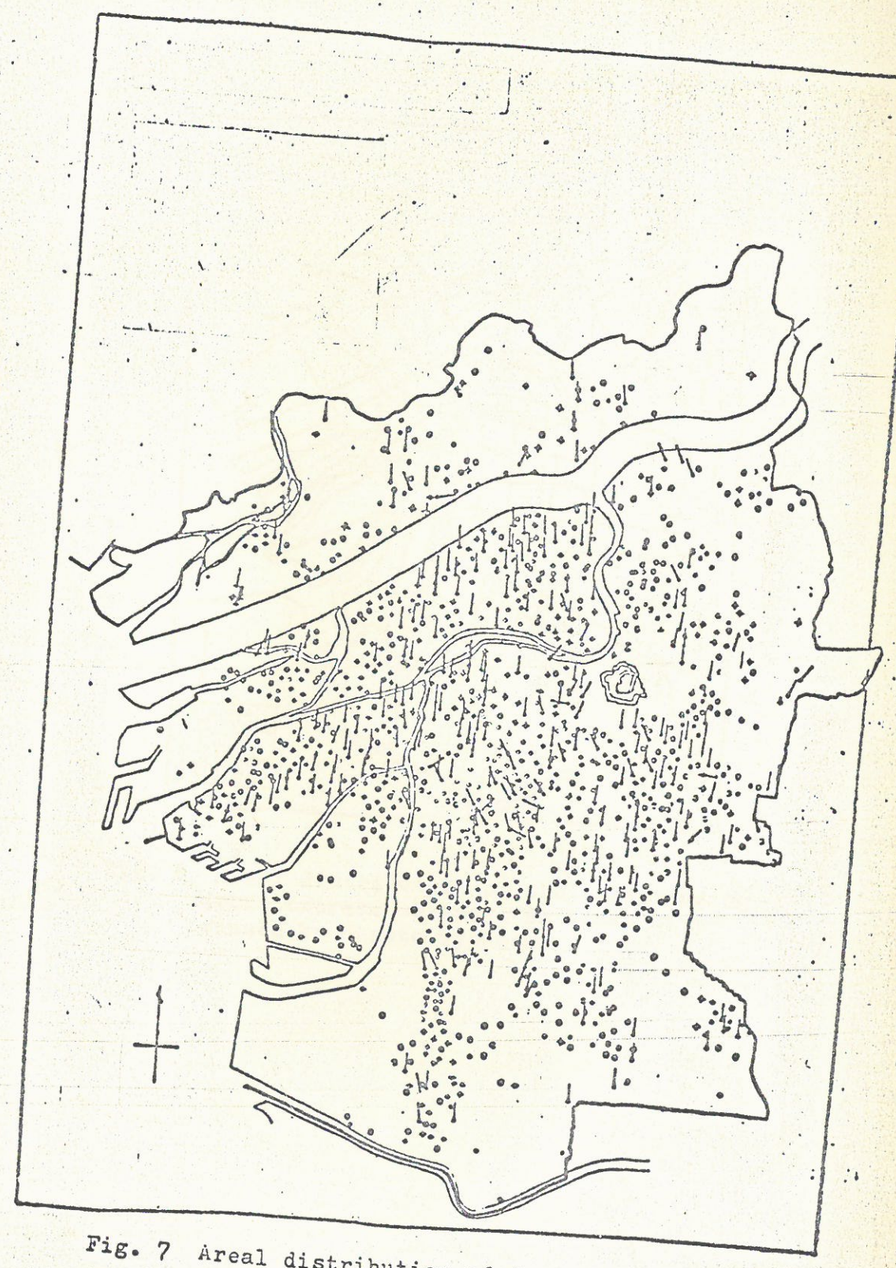

Fig. 7 Areal distribution of damaged chimneys of public bathhouses in Osaka City caused by Muroto Typhoon

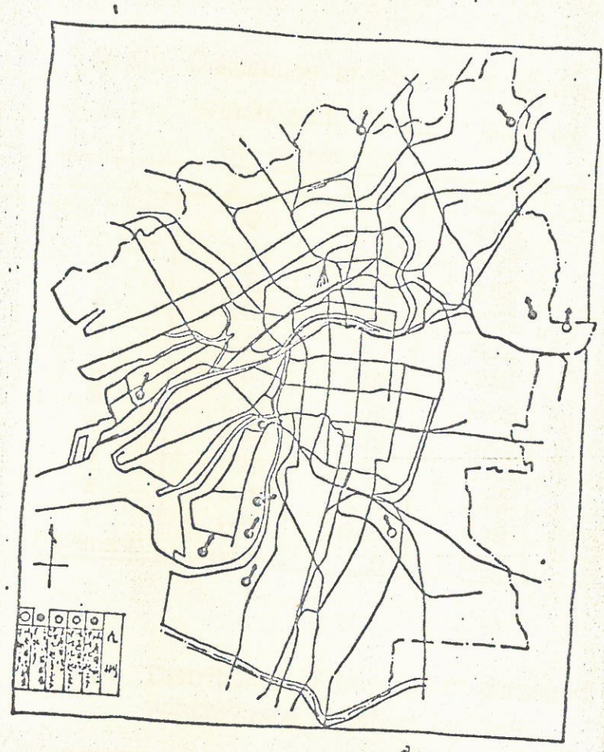

Fig. 8 Areal distribution of the selfstanding ferroconcrete chimneys in Osaka City caused by Muroto Typhoon

Table3. Distribution of the rate of damaged windowpane (×1000) classified by orientation

	E	W	S	N
pent house	1.03	0.16	1.98	4.00
10 floor	1.12	2.42	4.30	0
9	1.96	2.42	2.58	0
8	1.68	3.06	5.34	0.32
7	2.43	7.17	6.72	0.45
6	4.67	6.69	3.10	0.26
5	1.31	2.74	6.03	0.19
4	1.68	4.19	3.45	0.52
3	1.78	3.87	3.45	0.32
2	1.49	3.79	3.62	0.06
1	1.03	0.48	1.29	0.19
basement	0.56	0	0.52	0.19

Table 4. Distribution of the rate of damaged windowpane classfied by floor

	number of damaged windowpane	rate of damage (1/1000)
pent house	98	1.95
10 floor	92	1.83
9	81	1.61
8	123	2.45
7	200	3.99
6	173	3.45
5	121	2.41
4	118	2.36
3	112	2.24
2	106	2.12
1	35	0.69
basement	15	0.30
total	1,274	

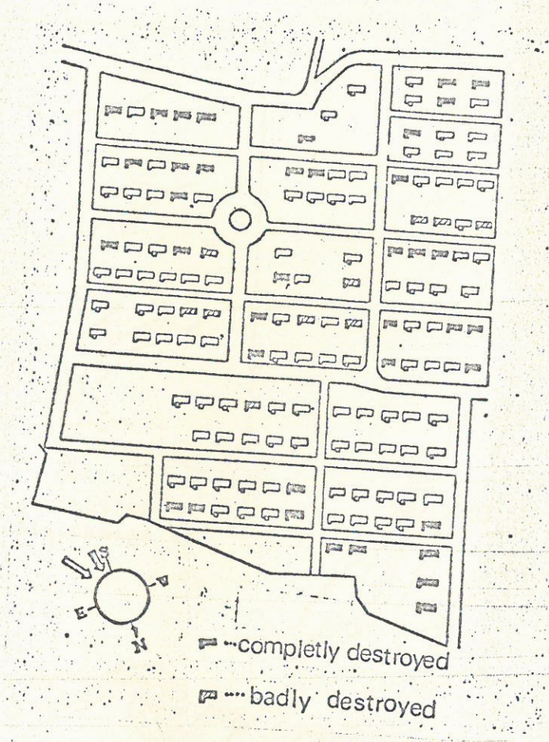

Fig. 9 Distribution of damaged houses in the group of wooden houses caused by Ione Typhoon

Table 5. Damage of steel tower

kind of damage / height	uprooted	collapsed	break	total
15m≧	7	0	1	8
16～30	35	1	5	41
31～50	6	1	1	8
51～70	1	0	0	1
71m≦	0	5	0	5
total	49	7	7	63

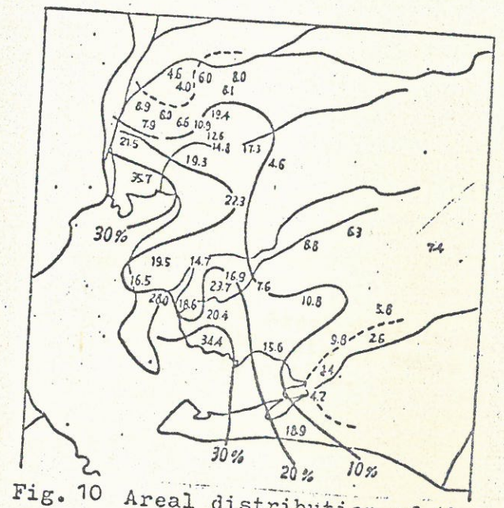

Fig. 10 Areal distribution of the rate of house damage by cities

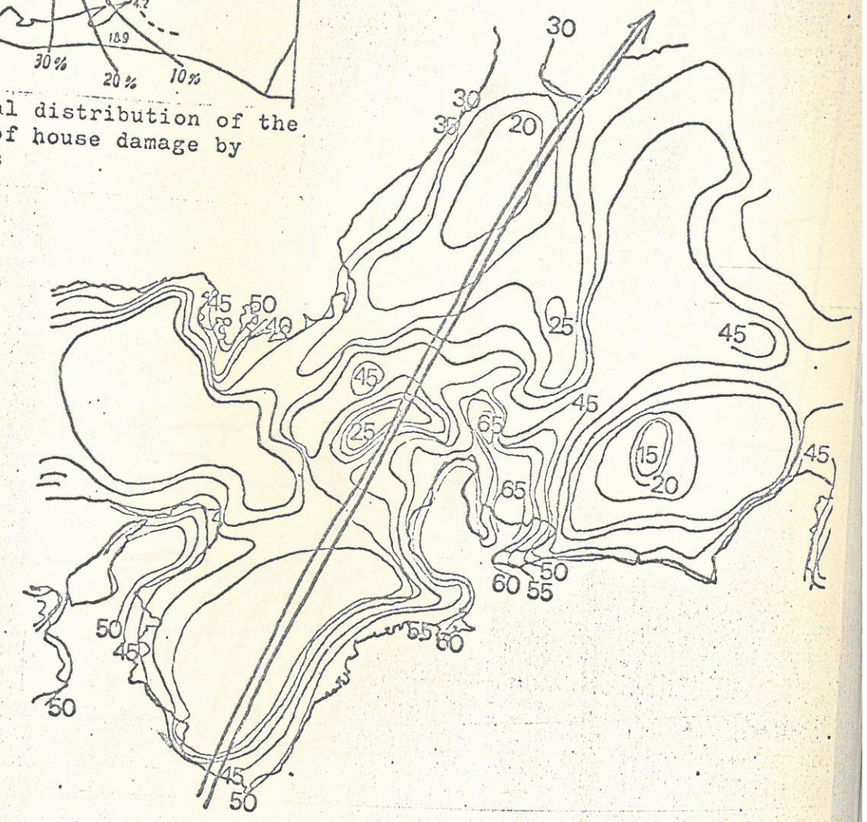

Fig. 11 Areal distribution of peak gust (m/sec.) Caused by the Ise Bay Typhoon

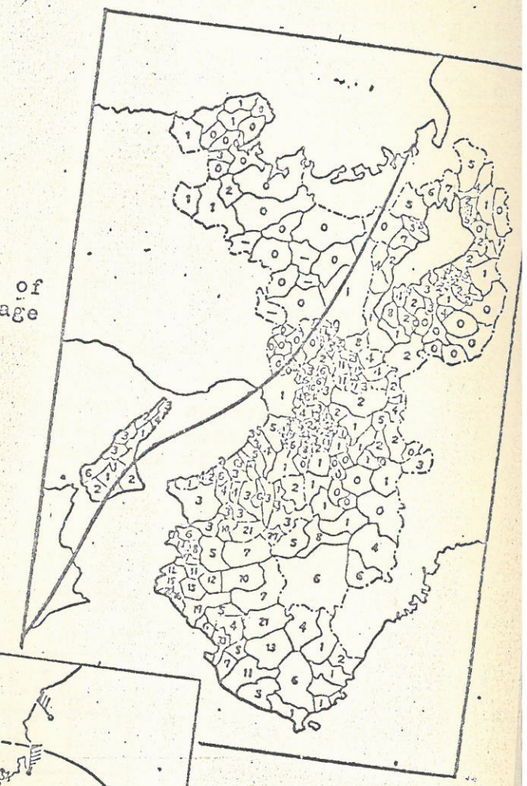

Fig. 12 Areal distribution of the rate of house damage by cities.

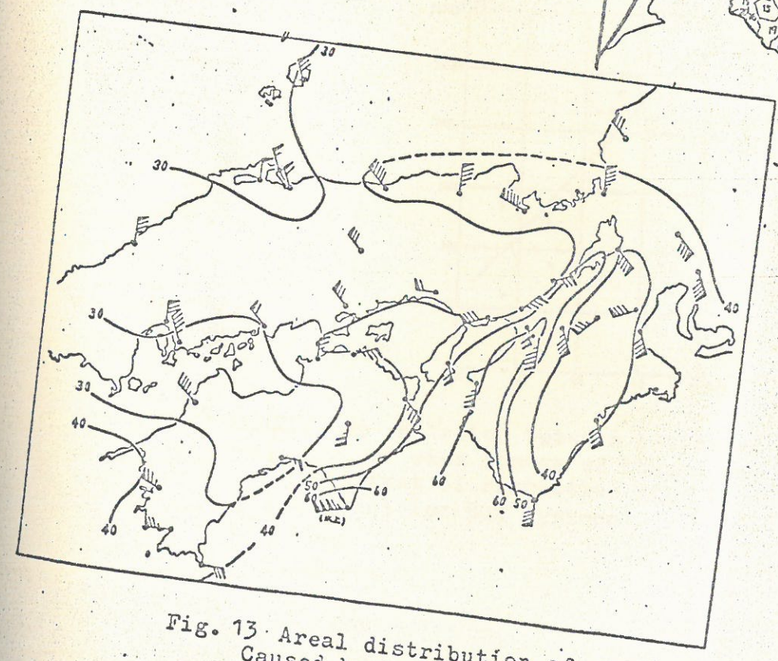

Fig. 13 Areal distribution of peak gust (m/sec.) Caused by the 2nd Muroto Typhoon

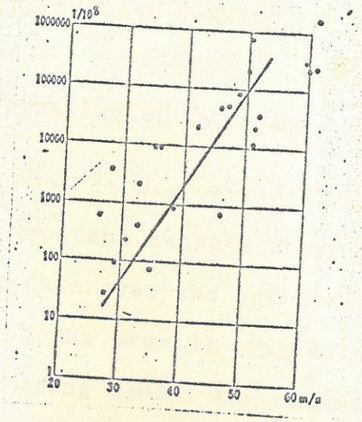

Fig. 14 Relation between actual number of destroyed houses and peak gust of respective city (the case of Ise Bay Typhoon)

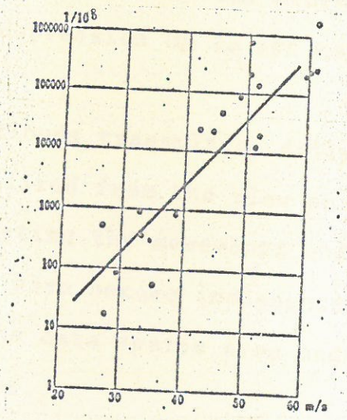

Fig. 15 Relation between estimated number of wind damage of houses and peak gust of respective city (the case of Ise Bay Typhoor)

Lecture by Maruyama in TC3

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TYPHOON FORECASTING AND WARNING IN JAPAN

1. Surveillance and Forecasting of Typhoons

Until several years ago, it was very difficult to detect quickly the formation of typhoons because there were very few surface and upper air data over the sea area of low latitude regions where typhoons usually originate. However, ever since photographs covering almost the entire western North Pacific Ocean taken and sent from the US weather satellite "ESSA" became available for analysis of the clouds in this region, it has become possible to grasp with considerable accuracy the development of tropical storm from the early stage of tropical depression up to its maturity as a typhoon.

The photographs of clouds transmitted daily from the weather satellite are utilized from the view point of macro-scale analysis for forecasting the movements and developments of typhoons. They have become indispensable information for analysis for the data sparse area and are being utilized for these purposes.

Whenever a typhoon is generated, the US air forces fly meteorological reconnaissance planes to conduct observations several times a day. These aerial reconnaissance provide accurate and detailed information on the center position,

sea level pressure at the center, shape of the storm eye, the distribution of the winds, etc. of the typhoon. These weather reconnaissance data sent via teletype constitute the most valuable source of information during some number of days while the typhoon is still over the tropical waters until radar observations from land stations become possible. The data are used for tracking the course of the typhoon.

After the fix is discontinued by the observation plane, the center position of the typhoon is decided every three hours or every hour on the surface maps by analyzing data received from ship and island stations along the course of the typhoon. When observation data are available from ship or island stations relatively close to the typhoon, any changes in its course, the state of its development, etc. can be forecasted with better results in this way than from simple extrapolation analysis.

When the typhoon approaches Japan, the radar on top of Mt. Fuji which has a range of 800 kilometers commences special observation along with a network of radars located at 19 different sites, and the position of the typhoon is tracked accurately. In most instances, two or three radars follow the typhoon simultaneously, and the data obtained is reported at 30 to 60 minute intervals to the headquarters of Japan Meteorological Agency in Tokyo.

The radar echo picked up by the radar sites at Mt. Fuji and in Tokyo can be observed on scopes in Forecast Section in Tokyo for direct observation by the forecasters. These radar echo provide information on movements of the typhoon as well as effective data on meso-scale heavy rainfalls which create large damage.

The observational data obtained at each radar site is transmitted in coded message or in plain language at present. Plans have been introduced from 1970 with completion date set several years ahead to establish a landline facsimile network connecting radar sites with relative local forecast centers and weather stations.

Considerable number of typhoons hitting Japan in decay stage were found not to possess a clear eye even though they maintained their typhoon intensity. Even strong typhoons that possess a clear eye while traveling over the ocean suddenly begin to lose clearness of their eye when they strike land. For typhoons which do not possess a clear eye, it is very difficult to detect their center position accurately with radars.

Weather station without any instruction from headquarters commence hourly surface observation whenever the center of the typhoon comes within a distance of 300 kilometers from each station. Based on these observations, the analysis of the sectional surface maps is conducted

every hour. The RECON fix and radar fix are also taken into consideration and the center position of the typhoon is determined hourly within 60 minutes from the time of surface observations. This work is continued until the typhoon downgrades or leaves Japan.

Typhoons that approach Japan after recurvature, other than those originating in mid-summer, gradually dissipitate into a tropical depression. Particularly, the speed of the typhoon becomes very fast. It reaches a speed four or five times greater than the speed maintained in the low latitude regions prior to its recurvature. The average speed in the vicinity of Japan and its easterly ocean is ordinarily about 25 knots. However, it is not unusual for the speed to reach 40 knots. These waters are crossed by shipping lanes and many ships are exposed to the typhoon which will have expanded its area of gust and rain. At this stage, the fix on the center of the typhoon can be determined from aerial reconnaissance as well as from relatively abundant data supplied from ships in the area. Therefore, the center position can be determined every 3 or 6 hours from analysis of the surface map. The course and development of the typhoon is forecasted in a manner similar to tropical depressions.

2. Typhoon Warning System

The typhoon warning system enforced by Japan includes warning provided primarily to ships in accordance with international standard and an extensive system for alerting the entire nation.

2. 1. Typhoon Warning System on the International Level

a. Warning System for All Ocean Going Vessels

JMA prepares four times daily, at each map time, a typhoon alert report for all ships sailing in the area enclosed by the equator to north latitude 60 degrees and east longitude 100 degrees to 180 degrees. The alert reports are broadcasted over the semi-regional broadcast(JMG) and shipping broadcastJMC). Particularly, in the area covered by 40 degrees N and 120 degrees E, 20 degrees N and 120 degrees E, 20 degrees N and 150 degrees E, 50 degrees N and 150 degrees E, and 50 degrees N and 140 degrees E emergency broadcasts of the alert reports will also be made at hours 0300, 0900, 1500 and 2100 besides the usual hours when it is forecasted that velocity of the winds will exceed 50 KTS within the next 24 hours in those areas. Also, in the facsimile broadcast(JMI) conducted every 6 hours on surface

analysis, the principal sections of the typhoon alert report will be recorded. In the overall alert report to all vessels, the course of the typhoon is not expressed with dots or lines but indicated with fan shaped direction signs showing the estimated position of the typhoon 12 hours and 24 hours later.

b. Regional Sea Alert System

In the ocean area within 300 ~~knots~~ nautical Mile from the Japanese shores, 11 separate regional sea forecasting sections have been set up. The center forecasting office of each section prepares its respective alert report for ships which is broadcasted over the facilities of the local Maritime Defense Agency stations at random or several times per day on a fixed schedule.

The above mentioned alert report for all ocean going vessels and regional sea sections are broadcasted in English.

2. 2. The Typhoon Warning System for Domestic Purposes

a. Organization

The central forecasting organ is JMA which coordinates all activities in this field. The entire nation is divided into 10 regional forecasting blocks with local forecast centers. These blocks are further divided into Prefectural forecasting districts with 4 to 8

weather stations each. In principle, all forecasts and warnings on typhoons are prepared and issued by JMA to the local forecast centers and then to the weather stations.

These institutions are all equipped with facsimile and teletype equipment. JMA and each local forecast center is connected with an exclusive weather telephone system.

The local forecast centers are connected to their respective weather stations by VHF telephones for mutual communication.

* JMA is responsible for watching the movements and forecasting the course of the typhoon. It prepares the necessary forecasts, conduct technological analysis, provides information on how to prevent damages from the typhoon which are all compiled into a typhoon report and relayed to the local forecast centers via teletype or telephone. Technical guidance is also provided to the centers.
* The local forecast centers conducts analysis of the effect of the typhoon in its district based on the information provided by JMA. It maintains surveillance over the typhoon with its radar system and conveys the typhoon report prepared by JMA to its relative weather stations. If necessary,

it will conduct explanation of this report as well as provide additional data as local typhoon report to give technical guidance to weather stations.

b. Types of Warnings and Alerts

Alerts are issued when it is decided that damage may be incurred from the typhoon while warnings are sent out when serious and heavy damage are expected. The warnings are issued on the Prefectural level by respective weather stations.

These warnings and alerts are divided into the following according to the phenomena leading to damage. When necessary, several different types of warnings and alerts are listed side by side.

Alerts: Includes preliminary warning on wind and rain, strong winds, heavy rain, flood tide, storm waves, floods, and innudations.

Warnings: Storm accompanied by heavy rain and wind, heavy rain, flood tide, storm waves, and floods.

Examples: Combination storm, flood tide, and storm waves warning and flood alert. Combination heavy rain and flood warning and strong wind alert.

As per foregoing, the necessary warnings and alerts are issued as required.

The weather stations that issue the storm warnings and alerts are required to conduct preliminary surveys on the relationship between outbreak of damages and weather conditions in their respective Prefecture. Based on these surveys, the necessary criteria for issue of warnings and alerts are decided. As an example, the following are the principal criteria applicable to metropolitan Tokyo.

Storm (with wind and rain) Warning: When velocity of the wind reaches an average 25 meter/second over a 10 minute period.

Heavy Rain Warning: When rainfall is forecasted to exceed 100mm in 24 hours. When rainfall is forecasted to exceed 60mm in 6 hours. When rainfall is forecasted to exceed 40mm in 3 hours.

Flood Tide Warning: Depending on the position of the coastline, whenever the tide level rises 2.0 meters to 3.0 meters above the Tokyo point.

The criteria for issue of respective alerts are set at a lower level than warnings.

Besides the above, the Ministry of Construction and the Meteorological Agency cooperate with each other

to check the water level and flow of principal rivers in Japan including the Tone River and issue flood forecasts to promote flood prevention activities.

c. Reporting of Storm Alerts and Warnings

Whenever a storm warning is issued, it is reported over the radio and television as special announcements at the earliest opportunity and also carried in the press. Also, the Meteorological Agency informs the Prefectural Offices, Ministry of Construction, Police Agency, Fire Agency, Maritime Safety Agency and other public institutions connected with prevention of natural disaster. With the cooperation of the Japan Telephone and Telegraph Corporation, the Meteorological Agency also conveys necessary storm warnings instantly to all governors of Prefectures, mayors of cities and towns, etc. by means of telegram or telephone.

As to storm alerts, there are no legal commitment calling for mandatory announcements. However, they are usually conveyed to the public and damage prevention organizations via radio/TV broadcasts, press and other mass communication media.

When the occasion arrives for issue of storm warnings

or when the time for enforcement of such actions draws near, the Damage Prevention Liaison Committee is usually set up within the offices of Meteorological Agency. This Committee is comprised of liaison personnel despatched from respective Prefectures, Municipalities, Ministry of Construction, Police Department, Fire Department, Japan National Railways, Power companies, etc. for this purpose. The Committee receives full and latest information about the typhoon regarding its movement, rainfalls, strength of winds, etc. The data are carefully analysed and provided to the public with emphasis laid on conducting damage prevention activities swiftly and effectively.

d. Typhoon Information

Besides the above mentioned typhoon warnings and alerts, typhoon information are announced whenever a typhoon originates in the tropical waters and is expected to head for Japan. This information is to alert the people in advance on future movements of the typhoon and reporting of same is commenced several days prior to its approach to Japanese waters. The frequency of the reports increase as the typhoon comes closer. The information is announced every hour from several hours prior to landing of the typhoon on Japan and during its passage. The public

as well as the necessary damage prevention organizations are informed immediately about the moves of the typhoon. As the typhoon draws nearer, the report becomes more detailed covering fine data on the movement, estimate course, existence of heavy rain or wind which may lead to damage, forecasts of districts subject to flood tide and heavy rains including the approximate positions, time, extent of damage expected, etc. Also, measures to reduce damage are announced. When the typhoon comes close to Japan, it is customary for meteorologists from the Meteorological Agency to appear on radio and television programs held every hour to conduct direct explanation of the typhoon. Radar and APT (automatic picture transmission) photographs are usually employed to conduct explanations over these programs. In many cities, the typhoon warnings and alerts are available over the telephone weather information service. That is by dialing 177, the latest typhoon information is always available.

The Japanese newspapers usually carry detailed weather maps in their morning and evening editions and many readers are capable of reading these maps. Therefore, it can be said that the individual is on the watch against the approach of the typhoon while it is still

far from Japan. Also, as mentioned in the foregoing, damage prevention activities go into operation from the time the first typhoon information is announced and are intensified as the alert and warning reports are issued.

TYPHOON RESEARCHES IN HONGKONG

Mr. G. J. Bell & Mr. P. C. Chin
(Hongkong)

The Royal Observatory devotes considerable effort to the study of tropical cyclones in the western Pacific and China Seas area and recent investigations have been mainly concerned with the improvement of existing forecasting techniques and the development of new methods for predicting tropical cyclone movement.

Since 1961, the Royal Observatory has been testing the operational value of many objective forecasting techniques which have proved useful in other regions. These include the methods due to Veigas-Miller, Miller-Moore and Arakawa and those developed by the U.S. Fleet Weather Central/Joint Typhoon Warning Centre and the Royal Observatory. Attempts have also been made to improve the simple $\frac{1}{2}$ persistence + $\frac{1}{2}$ climatology technique by deriving regression equations which incorporate different weighting factors for persistence and climatology.

Many early statistical analyses of tropical cyclones have been revised and up-dated and tracks of all tropical depressions, tropical storms and typhoons which occurred in the region from 1884 - 1969 have been compiled and re-analysed for each standard pentad. Studies of the structure of tropical cyclones have been carried out using data from reconnaissance aircraft and more than 3500 reports have been transferred onto magnetic tape for analysis by computer. Special radiosonde ascents have also been made on several occasions when tropical cyclones passed over Hong Kong for the purpose of examining the core characteristics of these systems.

The Royal Observatory co-operates with the University of Hong Kong in a research project on evaluating the effect of typhoon winds

on tall buildings. The department has also undertaken to install and operate a pressure sensitive wave recorder off Waglan Island to make direct measurements of sea waves during typhoon conditions.

A new computer centre will soon be established by the University of Hongkong and the Chinese University of Hongkong and plans are being made to use this computer for the production of tropical cyclone forecasts under operational conditions. Simple empirical methods will be used at the initial stage but it is expected that more sophisticated numerical models will be attempted in a few years time when assistance from visiting research fellows becomes available.

DISASTER RELIEF PLANNING AND PREPAREDNESS

Dr. M. F. Beltran
(League of Red Cross Societies)

Mr. Chairman and Distinguished Delegates:

Since the start of the sessions last Wednesday and up to this morning, the importance of community preparedness has been focused in our discussions. And, as if to emphasize the urgency of this undertaking, typhoon Patsy visited again the Philippines yesterday leaving death and destruction in its wake.

Incidentally, I have also chosen to speak on the subject of community preparedness for natural disasters. This subject covers a vast area and I am quite certain we do not have the time this afternoon to discuss in full its various aspects. Permit me therefore to confine myself only to the initial phase of community preparedness which is "Planning" and to the actions being undertaken by the League of Red Cross Societies towards the realization of this objective.

No one can fortell with certainty when or where a disaster will strike, leaving a terrible toll of human tragedy; death; illness, crippling injuries, destruction of homes and loss of sources of livelihood. Disaster cuts across the familiar provisions of the stricken community for meeting the normal welfare needs of its people and instantly creates a new group in urgent need of immediate personal services and material assistance. Few communities that have not experienced disaster realize the many problems created of personal suffering, dislocations of family and community life, and potential dependency. No community can be sure it is safe from disaster.

Relief measures undertaken hurriedly under the pressures of an actual disaster cannot be fully effective and ecnonomical unless there

is good pre-disaster planning. Each person or group near the scene instinctively applies the skill or resources they happen to have. But too frequently, all these helpful activities operate independently. Confusion, waste and duplication result. These can be avoided only when there is complete pre-disaster knowledge of resources available among all community individuals and groups and how these resources can best be applied in a disaster emergency.

The United Nations and the League of Red Cross Societies, having disaster relief as one of the main parts of their program, have given particular attention to the problem of how to diminish the effects of natural disasters. As a result of the deliberations on this matter, the General Assembly passed a resolution (2034-XX-1965) inviting member states to consider the advisability of setting-up appropriate National Planning and operating machinery most suited to the conditions of each member country. The United Nations also offered both guidance and technical assistance in formulating disaster plans to countries requesting it.

In line with the studies being made within the United Nations, the League itself presented the matter to the International Conference of the Red Cross which subsequently passed resolution No. 27.

This resolution emphasized the importance of National Pre-disaster planning and coordination in the field. This resolution also entrusted to the League- pre-disaster planning in government and non-government organizations. The League Secretariat has accepted these responsibilities and among its actions in this direction was the preparation of a handbook entitled "A Guide to a National Disaster Relief Plan".

B. PLANNING

In preparing a plan for community preparedness the following points should be considered:

1. Prevention of disasters, assistance to victims and reconstruction are first and foremost the responsibility of the public authories.

2. In order to cope with the effects of disasters, each country should have a national plan outlining an effective organization of relief.
3. The National plan shall assign to all sections of the community-public services, Red Cross Voluntary agencies, Social Welfare Organizations and qualified persons - precise tasks in the fields of disaster prevention, relief and reconstruction.
4. To ensure rapid mobilization as well as complete and effective use of material and personnel resources, the national plan should envisage coordination through the establishment of a centralized direction. Such direction should be able to provide precise and official information on the effects of a disaster, its evolution and the needs.

The plan should as far as possible make use of and coordinate the services of already existing departments, organizations and institutions.

It should cover all eventualities during a disaster and be so flexible that it can be put into force in whole or in part as circumstances require.

The plan s ould also consider the following:

a. Size of country and density of population
b. Traditions
c. Political and Social Structure
d. State of development
e. Resources
f. Transportation network
g. Type of disaster most frequent

PLANNING FOR LEGISLATION

The basis of a national disaster relief plan should be a national assembly or government act or statute determining the following:

1. A central authority for the coordination of the planning and the conduct of any disaster relief action and the authority vested in one of the following to carry out this task.
    a. Chief of state or,
    b. Government or,
    c. Prime Minister or,
    d. Another number of the government or
    e. a disaster relief committee
2. A central body to be the secretariat which will have the responsibility of:
    a. Preparing and continuously reviewing the plan
    b. Preparing administrative orders
    c. Preparing and presenting budgets
3. A <u>regional body</u> or person responsible for the coordination of the planning and the conduct of any relief action on the regional level and its or his authority:
    a. Chief of regional administration or
    b. Chief of police etc. or
    c. A regional disaster relief committee
4. A <u>body or a person</u> within a community to be responsible for the coordination of the planning and the conduct of any relief action in case of a natural disaster within its boundaries and its or his authority:
    a. the mayor or
    b. the chairman of the community council
    c. the chief of police or
    d. a local disaster relief committee
5. Financial arrangements should also be determined regarding:
    a. funds ordinary and extraordinary budgets to cover government and community expenses
    b. aid to victims during the emergency phases:
        1. loans or grants

2. extraordinary credits
3. extensions of terms of payments
4. postponement of collection of taxes
5. government supported insurance plans
6. aid to victims for rehabilitation and reconstruction
7. regulation of prices in disaster areas

The Plan should establish

6. Procedure for information service during disasters
7. Procedure for declaring missing persons presumably dead
8. Procedure for the requisitioning of services, supplies, labor, equipment, use of real estate etc.
9. Regulation for tax and customs exemption and free transportation of relief materials.

PLANNING FOR ORGANIZATION

Large countries will normally organize disaster relief on at least three levels; local, regional and national.

1. Local Organization:

The local organization will consist of persons in charge of planning and coordinating disaster relief action and of teams carrying out the relief work in the field. A Committee or a person should be made responsible and given authority to act in times of disaster. If it be a person he should appoint a local advisory committee of representatives of the local:

a. police
b. civil defense
c. telecommunication services
d. health authorities
e. Red Cross/Red Crescent and other voluntary organizations
f. public works authority
g. Finance Department, etc.

Sub-Committees should be appointed to take care of those services which exceed the capacity of the ordinary community offices such as:

a. Mass care of the victims
   1. temporary shelters
   2. feeding centers, distribution of food
   3. distribution of clothing, blankets, etc.
   4. nursing and first-aid shelters
   5. first aid in disaster areas

b. Tracing services
   1. registration of missing persons
   2. identification of the dead
   3. information to relatives

c. Special care of aged, disabled and handicapped

d. Evacuation of victims

e. survey of damages and needs

f. case recording

g. review of case record and

2. Regional Organization:

The government regional administration differs very much from one country to another, and this will affect the build-up of a regional relief organization. The main responsibility of such an organization should be coordination and direction of local relief operations in cases of natural disasters affecting more than one community and upon request, to help communities out of its resources or requisition them from the central authority if necessary.

As mentioned earlier, a regional authority should have been appointed. If it be one person, he should appoint an advisory relief committee consisting of persons with whom it would be normal to cooperate such as:

a. regional commander or armed forces

b. chief of police

c. Regional chief of Civil Defense
d. Regional medical officer
e. Chief Engineer (roads, electricity, water)
f. a transpportation or logistics
g. a supply expert
h. chairman of regional Red Cross
i. Chief of public information
j. regional veterinarian
k. Scientist specifically seismologists and meteorologists)

3. National Organization:

As already mentioned earlier, a central authority with a secretariat should be made responsible for the planning, coordination and direction of all disaster relief operations. Depending upon the central authority being one person and the size and composition of this secretariat, the setting-up of an advisory relief committee should be considered consisting of ministers and head of services which are likely to be used in disaster relief operations, chairman of National Red Cross/ Red Crescent Societies and other National Voluntary Organizations.

OPERATIONAL PLANS

As mentioned earlier, there are several ways of preparing for disaster relief. In the following plan the various elements are shown:

1. Local Plans:
   a. Already existing community services should prepare emergency relief
      1. law, order and protection
      2. firefighting
      3. medical and nursing care of sick and injured
      4. Veterinarian control and service
      5. repair of public utilities

6. Telecommunications
7. Warning system of appraoching dangers
8. Mass evacuation
9. Health and hygiene service in camps and disaster areas
10. Over-all transport or logistics plan
11. Emergency burial service
12. Information and reporting system

b. Sub-committee should be made responsible for planning
   1. mass care-shelter-feeding-clothing-fuel and other necessities
   2. supply service
   3. First aid and rescue in disaster areas
   4. tracing services

c. Plans for special services which are not covered in the preceeding enumerations:
   1. during forest fires
   2. rescue in disasters at sea
   3. rescue in train accident
   4. rescue in aircraft accidents
   5. demolition and removal of debris
   6. building passages agains floods and
   7. industrial (mining accidents)

2. Any plan should at least define
   a. plan of action
   b. responsibility (job description) of key personnel
   c. list of key personnel, addresses & telephone numbers
   d. roster of other personnel
   e. system of alerting relief personnel
   f. training of personnel
   g. technical equipments
   h. regulations for requisitioning
   i. regulations for requesting aid from outside of community

j. reporting system and
k. location of relief headquarters and telephone numbers

3. The local authority (and his advisory committee) should be responsible for the coordination of all planning and for giving directives in intercommittee cooperation on such problems which are common to two or more plans.
4. Regional plans should be prepared in order to meet emergency needs not covered by local relief plans and resources. Most probably they will differ considerably even inside a country and items might be recommended for considerations:
   a. special mobile medical units
   b. special mobile technician
   c. plans for reception or evacuees from disaster areas
   d. plans for survey by air
   e. medical and nursing care of the sick and wounded exceeding local medical capacity
   f. special demolition units
   g. plans for reinforcements to maintain law and order
   h. list of services, supplies etc. available in the region
   i. stockpiling of reserve supplies
   j. regulations for requesting aid from outside the region
   k. regulations for requesting (authorization by legislators)
   l. reporting system
5. Central planning:

   The central authority will be obliged to issue directives and regulations of different kinds such as:
   a. model plans for local and regional levels to insure inform planning
   b. service to information media
   c. reporting system
   d. authorization of requisitioning

e. financial matters
f. reviewing of plans
g. regularly testing of plans by practical and staff exercises

6. Different plans must also be prepared for the central activities
   a. bilateral and multi-lateral agreements with neighboring countries for mutual aid and for regulations for relief action in disasters affecting frontier areas.
   b. coordination of substantial foreign aid (including personnel)
   c. units more specialized than the regional ones
   d. stages of alertness and systems of alerting
   e. national stockpiling of reserve supplies
   f. dissemination of information to the public on plans, alertness alarm systems and
   g. rehabilitation and reconstruction.

When planning is completed and the necessary legeslative or government acts are already enacted the central authority should immediately start the organization of the committees on all levels. When the membership of the committees are completed training of the committee members should immediately follow.

Disaster prone areas should be given priority in the organization of committees.

A pamphlet or a manual incorporating the authority, basic policies, organizations, operational procedures, Disaster Preparedness and disaster action should be prepared for reference of those concerned.

With further regard to Community preparedness, may I be permitted to inform you of the:

Resolutions passed by the United Nations and the League Regarding Disaster Relief Planning

1. UN General Assembly Resolution (A/Res/2034(XX) 9/12/1965)

"Assistance in Case of Natural Disasters"

This resolution invites member states "to consider the advisability of setting-up appropriate and national planning and operating machinery most suited to their conditions, and designed to determine the degree and character of the relief required and to give unified direction to relief operations." It further indicates that "in cooperation with the League of Red Cross Societies, the United Nations can offer both guidance and technical assistance in formulating pre-disaster plans to countries requesting it."

2. International Conference of the Red Cross, Vienne 1965, passed a resolution on

"International Relief Actions-Planning and Co-ordinating"

Deals with the problems of National Planning and coordination along very similar lines.

3. Resolution adopted by the General Assembly

"Assistance in Cases of Natural Disaster"

Authorizing the Secretary General to draw on the Working Capital Fund in the amount of $100,000 for emergency aid in any one year, with a normal ceiling of $20,000 per country in case of any one disaster.

Actions Undertaken by the League in Following up these Resolution

1. Publishing the "International Disaster Relief Manual" which should serve as a guide to the National Societies in this matter.
2. Encouraging the Societies to make an arrangement with their governments, which will define the specific tasks develving on them in times of disaster, if this role has not been assigned by the National Disaster Relief Plan.
3. Forwarding to them the numerous instructions concerning the establishment of their relief reserves and encouraging them to train their relief personnel.

4. Encouraging and helping them to obtain the customs and other facilities provided for in Resolution X of the XIXth International Conference of the Red Cross.
5. Forwarding to National Societies the "Oslo" principles accompanied by detailed comments as to how these principles should be followed up.
6. Providing them with "Simple Disaster Relief Guide for the constitution of a well-defined Disaster Relief Service."
7. Assisting them through conferences, seminars and meetings (regional and national) in planning and organizing disaster relief services.
8. Helping National Societies in this matter through its numerous delegates, desk officers, etc.
9. Being in direct contact with a great number of National Societies and their governments, urging them to follow-up United Nations and Vienna Resolutions concerning disaster preparedness.
10. Encouraging them to cooperate with amateur radio associations in their countries.
11. Advising them of the guiding priciples for obtaining assistance from United Nations (funds, Norwegian and Swedish units)
12. Establishing and providing them with standard forms for survey of needs.
13. Publishing and distributing a "Guide to a National Disaster Relief Plan" for use by governments and National Societies.
14. Revising the "Oslo" principles; in the new edition, all information, advise and recommendations are given concerning organization and preparedness for relief actions.
15. Publishing and disseminating the "Disaster Relief Handbook" meant for National Societies, which also includes organizations, preparedness and training of relief personnel.

Thank you.