UNITED NATIONS ECONOMIC AND SOCIAL COMMISSION

FOR ASIA AND THE PACIFIC

AND

WORLD METEOROLOGICAL ORGANIZATION

REPORT OF THE TYPHOON COMMITTEE

ON ITS TWENTY-FIRST SESSION

Manila, Philippines
22 - 28 November1988

FOR PARTICIPANTS ONLY

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ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC
AND
WORLD METEOROLOGICAL ORGANIZATION

Typhoon Committee
Twenty-first session
22-28 November 1988
Manila

REPORT OF THE TYPHOON COMMITTEE ON ITS TWENTY-FIRST SESSION

I. ORGANIZATION OF THE SESSION

1. The twenty-first session of the Typhoon Committee was held at Manila from 22 to 28 November 1988.

Attendance

2. The session was attended by representatives of China, Hong Kong, Japan, Malaysia, the Philippines, the Republic of Korea, Thailand and Viet Nam. Observers from the Federal Republic of Germany, the Union of Soviet Socialist Republics and the United States of America attended the session. Observers from the United Nations Development Programme (UNDP), the Office of the United Nations Disaster Relief Co-ordinator (UNDRO) and the League of Red Cross and Red Crescent Societies (LRCS) were also present.

3. The Vice-Chairman welcomed the participants to the session. He recounted the circumstances leading to the establishment of the Typhoon Committee 20 years earlier and expressed the hope that it would continue to function for many years to come in the light of its importance to the region.

4. In his message, the Executive Secretary expressed his appreciation to the Government of the Philippines for hosting the session. He pointed out that the Typhoon Committee best exemplified intergovernmental co-operation in natural disaster damage mitigation, earning it the 1988 Sasakawa-UNDRO Disaster Prevention Award. He expressed gratitude to UNDP

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for its support to the Committee as well as to the Members for their contributions to the trust fund. He assured the Committee of the continued support of ESCAP in the framework of its programme of work, and of its determination to play an increasing role in natural disaster reduction in the region.

5. The representative of WMO, on behalf of the Secretary-General, thanked the Philippine Government through Mr. R.L. Kintanar, Co-ordinator of the Typhoon Committee Secretariat and Permanent Representative of the Philippines to WMO, for hosting the session. He congratulated the Committee on its impressive and wide-ranging achievements, leading to its selection as the 1988 recipient of the Sasakawa-UNDRO Disaster Prevention Award. He stressed the need for more collaborative efforts through regional co-operation to further enhance and promote national and regional capabilities in typhoon mitigation. He called upon Members to maintain a close linkage with the international community to obtain better co-ordinated efforts in natural disaster reduction in support of the international decade for natural disaster reduction.

6. The President of WMO congratulated the Typhoon Committee on the occasion of the twentieth year of its existence. He cited the achievements of the Committee since its establishment, making special mention to TOPEX as a fine example of regional co-operation. He emphasized the need for the enhancement of regional co-operation and the continued pursuit of operational and research co-operation in meteorological and hydrological activities in the spirit of TOPEX. He thanked UNDP for its continued support of the activities of the Committee.

7. The Secretary of the Department of Science and Technology of the Philippines welcomed the participants to the session. He congratulated the Typhoon Committee on its twentieth anniversary and for winning the Sasakawa-UNDRO Award, a testimony of its achievements in disaster mitigation. He pointed to the need for co-operation on a wider scale and considered appropriate the involvement of the Committee in the planned experiments by the USSR and the United States in the mid-1990s.

Election of officers

8. The Committee elected Mr. R.L. Kintanar (Philippines) Chairman and Mr. P. Sham (Hong Kong) Vice-Chairman. Mr. Lim Joo Tick (Malaysia) was elected Chairman of the Drafting Committee.

/Agenda

Agenda

9. The Committee adopted the agenda, with a slight change, as follows:

1. Opening of the session.
2. Election of officers.
3. Adoption of the agenda.
4. The Committee's activities during 1988:
   (a) Meteorological component;
   (b) Hydrological component;
   (c) Disaster prevention and preparedness component;
   (d) Training;
   (e) Research.
5. Consideration of the report of the Typhoon Committee Technical Working Group on the Implementation of the Regional Co-operation Programme.
6. Review of the 1987 and 1988 typhoon seasons/annual publication.
7. Co-ordination with other activities of the WMO Tropical Cyclone Programme.
8. Programme for 1989 and beyond.
9. Support required for the Committee's programme.
10. Agenda for the twenty-second session.
11. Date and place of the twenty-second session.
12. Scientific lectures.
13. Adoption of the report.

II. THE COMMITTEE'S ACTIVITIES DURING 1988

(Item 4 of the agenda)

10. The Committee reviewed and evaluated in detail its activities during 1988. It agreed that all its activities should be incorporated in the Regional Co-operation Programme.

A. Meteorological component

(Item 4 (a) of the agenda)

11. The Committee noted with satisfaction the progress made by Members, with the assistance of WMO, ESCAP and the Typhoon Committee Secretariat

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(TCS), in upgrading their computers and telecommunication systems as called for in the Regional Co-operation Programme.

12. The Committee was informed that the WMO Executive Council, at its fortieth session, had approved the designation of the centre at Tokyo as a regional/specialized meteorological centre (RSMC) with activity specialization in tropical cyclone analysis, tracking and forecasting beginning 1 July 1988. It was agreed that the Centre be named "RSMC Tokyo - Typhoon Centre".

13. The Committee was informed by Japan that the implementation phase of Centre was proceeding according to schedule. Some products were ready for dissemination by radio facsimile on high frequency bands (JMH), the choice of which was left to the Members (annex I). Members were requested to indicate their priorities for the products in the long and short term for reception on radio facsimile.

14. The Committee urged Members to procure both hardware and software in preparation for the reception of Grid Point Value (GPV) data and charts through the Geostationary Meteorological Satellite (GMS).

15. The Committee reminded Members to consider the recommendations of the consultant on the regional computer network and to make known their decisions as to requirements for assistance.

16. The Committee expressed appreciation to China for its support of an expert to Thailand to study the possibility of the adaptation of available software to its computer systems within the context of the regional computer network.

17. The Committee approved the changes proposed by the rapporteur, Mr. S. Kadowaki, on the Typhoon Committee Operational Manual (Meteorological Component), and requested WMO to issue amendments to the publication. It expressed appreciation to Mr. Kadowaki for his excellent work. In that connection, the Committee was pleased to know that Japan would continue to provide a rapporteur for that purpose.

18. The Committee also requested Members to provide the rapporteur with updated information on the attachments to the Manual relating to their respective countries under review.

19. The Committee was informed that the Computer System for Meteorological Services (COSMETS) in the Japan Meteorological Agency (JMA)

/had been

had been put into full-scale operation in March 1988. COSMETS made it possible to upgrade four routine models, including the Global Spectral Model (192-hour forecast every day) and the Typhoon Spectral Model (60-hour forecast of typhoon movement).

20. The Committee was pleased to know that most of the Members had either replaced aging radar or put up new ones to attain high-density radar networks. It noted with satisfaction that radar information was being continually exchanged among Members through the Global Telecommunication System (GTS) circuits using the WMO format.

21. The Committee was informed that several Members had procured the necessary hardware to meet the change to Stretched-visible and Infrared Spin Scan Radiometer (S-VISSR) in the GMS transmission system. It was pleased to note that Hong Kong had installed its new equipment and that reception of S-VISSR had become operational since October 1988. China had completed the development of its own Stretched Satellite Image-receiving Facility (SSIRF) and a number of such facilities had been deployed at coastal weather stations.

22. As far as the regional telecommunication circuits were concerned, the Committee was pleased to know that the Bangkok-Hong Kong circuit had been upgraded to 200 bauds and the Seoul-Tokyo link to 9,600 bps. The Bangkok-Kuala Lumpur link, on the other hand, was being upgraded from 75 to 1,200 bauds and should be operational by early 1989. The Committee was also informed that the new Bangkok-Jeddah satellite link, at 75 bauds, had become operational.

23. The Committee noted with satisfaction the continued use of prognostic products of the global numerical models from the European Centre for Medium Range Weather Forecasts (ECMWF). It was also pleased to learn that several Members had already upgraded their computer capabilities to meet the requirements of global/regional numerical prediction models.

24. The Committee urged Members concerned to identify as soon as possible their requirements for support to establish electronic equipment maintenance and repair workshops in accordance with the plan (annex II).

25. The Committee requested Members concerned to seek the co-operation of oil companies to make available meteorological data obtained from their oil platforms for exchange among Members.

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B. Hydrological component

(Item 4 (b) of the agenda)

26. The Committee reviewed the activities implemented under the hydrological component during 1988 on the basis of a document at the session.

27. The Committee noted with satisfaction the continued efforts made by Members to improve their flood forecasting and warning systems and implement comprehensive flood loss prevention measures, thus assisting the reduction of loss of life and property. It also noted the increased fruitful co-operative activities undertaken jointly by the meteorological and the hydrological services at the national and regional levels.

28. The Committee was informed that ESCAP, in co-operation with WMO and TCS, had organized the first mission on comprehensive flood loss prevention and management, which had visited eight Members.

29. The Committee noted with satisfaction that ESCAP, in co-operation with TCS and WMO, had organized the Expert Group Meeting on Comprehensive Flood Loss Prevention and Management at Bangkok from 17 to 21 October 1988. It agreed that Members should be involved to a greater degree in the project on comprehensive flood loss prevention and management through the active participation of the focal points.

30. The Committee was informed that ESCAP, in co-operation with TCS, had completed the project on improvement of flood loss prevention system based on risk analysis and mapping, with financial support from the Government of Japan. The first version of the manual and guidelines for flood risk analysis and mapping had been distributed to Members for their use. It was suggested that Members make use of the manual, and report to TCS any difficulties or problems encountered, including any comments on the manual.

31. The Committee expressed its appreciation of ESCAP activities related to the hydrological component of its work programme, and fully supported further activities to be undertaken in that area.

32. The Committee was informed of the deliberations at the eighth session of the WMO Commission for Hydrology (Geneva, October-November 1988) pertaining to the Tropical Cyclone Programme (TCP). It noted that during the session, the Technical Conference on Hydrology of Disasters had also been held at which papers dealing with disasters caused by floods had been presented, but none by experts from Asia and the South-West Pacific countries. It therefore suggested that Members should encourage their

/experts

experts to participate more actively in similar future events, which were expected to increase with the start of the international decade for natural disaster reduction.

33. The Committee expressed appreciation to TCS, WMO and Members concerned for their co-operation in organizing exchange visits by experts responsible for flood forecasting. It agreed that the usefulness of such exchange visits should be assessed through some kind of feedback from Members who sent the experts and those who received them, in co-operation with the focal points concerned.

34. The Committee was pleased to note that under the auspices of the WMO Commission for Hydrology, a consultant was preparing an analysis and summary of the monitoring reports submitted by Members on their flood forecasting systems for the period 1984-1987. The report was expected to be published in the WMO TCP series as a follow-up to the first report on the subject.

C. Disaster prevention and preparedness component

(Item 4 (c) of the agenda)

35. The Committee reviewed the activities under that component and was pleased to note the implementation by Members of the recommendation made at its twentieth session that their resources be mobilized in mitigating the effects of floods and typhoons.

36. The Committee noted the growing interest of Members in forging closer co-operation and collaboration between agencies concerned with meteorology, hydrology and disaster prevention and preparedness to improve counter-disaster responses.

37. The Committee was informed by some Members of the establishment of national agencies which would orchestrate disaster responses at the national as well as local levels and the decentralization of delivery systems to ensure continuity of assistance at the local levels. Other Members continued upgrading the capabilities of their disaster prevention and preparedness agencies through the conduct of seminars and training courses for their staff and volunteers.

38. The Committee also noted the increasing activities on public awareness, specifically the conduct of information and education campaigns, the distribution of publications on the nature and characteristics of typhoon-induced effects such as landslides and floods, and the dissemination of countermeasures to prevent loss of life and property.

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39. The Committee considered the work being undertaken by ESCAP related to disaster prevention and preparedness. It urged endorsement of flood loss prevention and mitigation as the main issue under the water sector to be considered by the Commission in its next session. The Committee also fully supported the initiative taken by ESCAP to include activities aimed at achieving the goals of the international decade in the programme of work, 1990-1991 and in the medium-term plan (1992-1996).

40. The representative of UNDRO informed the session about UNDRO activities in the region from May 1987 to November 1988 about developments on the Decade. He stressed the importance of the establishment of a national body to act as a focal point for the international decade.

41. A project proposal on public education and information in the Typhoon region was also introduced, and Members were requested to consult their respective authorities on the possibility of its implementation. The representative of UNDRO further asked Members to submit their comments and suggestions, if any, by the end of March 1989. The Committee expressed its appreciation of the UNDRO initiative, and agreed to transmit the consolidated comments of the Members to UNDRO through TCS.

42. The Committee urged Members to initiate other activities to enhance their active participation during the decade. The Committee would endeavor to clarify and develop its role vis-à-vis the decade for the guidance of Members.

43. The Committee urged the expert on disaster prevention and preparedness (part-time) to continue corresponding not only with the respective focal points but also with other national bodies concerned with that component in furtherance of the exchange of information on such matters, including those of a technical nature. In that regard, the Committee suggested that designation of research correspondents be updated regularly by TCS.

44. The Committee took note of the participation of the part-time expert on disaster prevention and preparedness as a resource person in the following events:

(1) Asia-Pacific Regional Workshop on Disaster Preparedness and Relief, 3-9 May 1988, held in Malaysia and jointly sponsored by WMO/LRCS and the Malaysia Red Crescent Society. Representatives of Malaysia, the Philippines and Thailand had attended the Workshop.

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(2) Workshop on Improving Cyclone Warning Response, 31 October-11 November 1988, sponsored by the Asian Disaster Preparedness Centre (ADPC), Asian Institute of Technology (AIT), Bangkok. Representatives of the Philippines and Thailand attended the Workshop.

45. The Committee noted with satisfaction the continued submission by Members of damage survey reports using the standard format.

D. Training component

(Item 4 (d) of the agenda)

46. The Committee reviewed the activities under that component of the programme.

47. The Committee was pleased to note that Members had availed themselves of a number of training opportunities in the fields of meteorology, hydrology and disaster prevention and preparedness.

48. The Committee noted with appreciation the organization of seminars/training courses on the following subjects by the Government of Japan at JMA, in which Members had participated:

(a) Satellite data utilization

(b) Meteorological information service

(c) Meteorological radar

(d) Typhoon forecasting

(e) Typhoon numerical prediction

(f) Probability forecasting

(g) Computer telecommunication

(h) Group training in meteorology

(i) Satellite imagery reception

49. It further appreciated the extension of expert services by Japan to three Members in the following subject areas:

(a) Satellite imagery reception

(b) Satellite data processing

(c) Satellite data utilization

(d) Data processing with personal computer

(e) Meteorological telecommunication

50. The Committee was pleased to note with appreciation that the utilization of the technical co-operation among developing countries (TCDC) concept had become an integral part of the Committee's training programme, of which the following events were examples:

(a) Familiarization with tropical cyclone techniques, provided by the State Meteorological Administration of China to two Philippine meteorologists;

(b) Training courses in meteorology conducted by Hong Kong, in which meteorologists from Malaysia and Thailand participated;

(c) Tropical cyclone forecasting and hydrological modelling, conducted by the Philippines for staff from Viet Nam.

51. In accordance with the practice of the Committee, TCS prepared and transmitted to WMO for possible funding an updated list of the facilities offered, the requirements of Members for training, and the attachments and exchange of experts/scientists, including study tours under TCDC arrangements.

52. The Committee noted with appreciation the conduct of the seminars/workshops organized by WMO and participated in by Members on the routine use of Numerical Weather Prediction (NWP) products (Bangkok) and tropical cyclone storm surges (Calcutta, India).

53. It further appreciated the training courses conducted by the United States in collaboration with WMO on:

(a) Tropical meteorology and tropical cyclone forecasting of 10-week duration at the University of Miami;

(b) Hydrological forecasting of 12-week duration at the University of California.

54. It noted the participation of some Members in the training courses conducted by ADPC and AIT on improving cyclone warning and response and disaster management.

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E. Research component

(Item 4 (e) of the agenda)

55. The Committee was pleased with Members' efforts in research in close co-operation with the corresponding research co-ordinators in the major components of the programme. It expressed its appreciation to Dr. T. Kitade (Japan), Mr. Law Kong Fook (Malaysia) and Col. V. Pagulayan, Jr. (the Philippines), Meteorological, Hydrological and DPP Research Co-ordinators, respectively, and the research correspondents of Members for their progress reports.

56. The disaster prevention and preparedness expert pointed out some difficulties encountered with regard to published research papers. Many of those were published in languages other than English.

57. It expressed the wish that Dr. Kitade, Mr. Law and Col. Pagulayan would continue to serve as Research Co-ordinators in their respective fields. It also expressed gratitude to their Governments for their co-operation.

58. The Committee was informed that Japan had put into operation a 400 MHz wind profiler at Tsukuba Science City capable of measuring wind speed and direction profile from 250 m to 12 km height.

59. The Committee encouraged Members to continue their efforts in the conduct of research activities to further improve their counter-disaster response.

60. The Committee was informed of ongoing tropical cyclone research activities within the WMO Tropical Meteorology Research Programme (TMRP), especially a proposal made by the Chairman of the Commission on Atmospheric Science (CAS) Working Group on Tropical Meteorology and the initiative taken by the WMO secretariat to colocate a tropical-cyclone-research-oriented activity centre for TMRP at the RSMC Tokyo. The proposed centre was expected to act as the centre of communication for the exchange of information on scientific advances in typhoon research by undertaking numerical studies of typhoon formation, development and motion. The representative of Japan indicated the willingness of JMA to establish such a centre.

61. The Committee also took note of action being taken by the International Programme Committee (IPC) to prepare for the Second International Workshop on Tropical Cyclones which would provide a forum for

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discussion between a wide range of experts from research and forecasting communities. In order to facilitate a better linkage between the Typhoon Committee and IPC, it was agreed that Dr. T. Kitade (Japan) and Dr. Chen Lianshou (China), both members of IPC, should serve as focal points for the Typhoon Committee. In that connection, it was noted that IPC was given the expanded responsibilities of assisting in generating global support for tropical-cyclone-related research and forecasting activities in addition to the organization of the Second International Workshop.

62. One of the expected major outcomes of the Second International Workshop was to produce a global manual of tropical cyclone forecasting that could be used at cyclone warning centres throughout the tropics.

III. CONSIDERATION OF THE REPORT OF THE TYPHOON COMMITTEE TECHNICAL WORKING GROUP ON THE IMPLEMENTATION OF THE REGIONAL CO-OPERATION PROGRAMME

(Item 5 of the agenda)

63. The Committee adopted the report of the Technical Working Group, which had met at Kuala Lumpur, Malaysia from 11 to 13 October 1988. The recommendations contained therein were reflected in the appropriate agenda items of the session. Minor changes were incorporated in the implementation plan of the Regional Co-operation Programme (see paragraph 73 below and annex III).

64. The Committee expressed its deep appreciation to the members of the Technical Working Group for the exhaustive review of the Regional Co-operation Programme and for the recommendations made that had greatly facilitated the consideration of the various agenda items. The Committee also recorded its thanks to Malaysia for hosting the meeting of the Group.

IV. REVIEW OF THE 1987 AND 1988 TYPHOON SEASONS/ANNUAL PUBLICATION

(Item 6 of the agenda)

65. The Committee noted with satisfaction the excellent quality of the "ESCAP/WMO Typhoon Committee Annual Review 1987" which had been prepared under the direction of the Chief Editor provided by Hong Kong, with the assistance of national editors. It thanked Hong Kong for its contributions in the production of the publication. The Annual Review was distributed to Members of WMO, the Typhoon Committee and agencies concerned.

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66. The Committee expressed its deep appreciation to the Chief Editor, Mrs. E. Koo, and requested that she continue to serve in the same capacity for another year. The Committee was, however, informed that that might not be possible but that Hong Kong would be prepared to undertake the task for one more year by providing another Chief Editor.

67. The Committee was pleased to note that Members had taken the initiative of widening the readership of the publication by including government departments and national and international agencies. ESCAP had distributed it to participants of relevant workshops/seminars and of its Commission sessions.

68. The Committee agreed that in order to broaden the scope of the Review, articles of an interdisciplinary nature, such as a mariner's account of a tropical cyclone event, or the application of typhoon climatology in coastal development, might be included.

V. CO-ORDINATION WITH OTHER ACTIVITIES OF THE WMO TROPICAL CYCLONE PROGRAMME

(Item 7 of the agenda)

69. The Committee noted with satisfaction the achievements made towards the mitigation of tropical cyclones under the TCP on the basis of its fourteenth status report, as well as additional information presented orally at the session by the representative of WMO.

70. The Committee was informed that steps had been taken by the regional tropical cyclone bodies for the formal designation of the centres at Nadi (Fiji) and Réunion (France) as Regional/Specialized Meteorological Centres (RSMCs) with activity specialization in tropical cyclones for the South Pacific and the South-West Indian Ocean, respectively.

71. At its ninth session Regional Association II (RA II) (Beijing, September 1988) had recommended that a joint session of the Typhoon Committee and the Panel on Tropical Cyclones be held in Thailand to consider matters of common interest, including the use of standard nomenclature for tropical cyclones. The Committee agreed that a joint session of two tropical cyclone bodies would have mutual benefit and requested WMO, in consultation with ESCAP, to explore the possibility of holding a joint session with the Panel. It also requested WMO and ESCAP to address that matter to the Panel at its forthcoming session (New Delhi, February 1989) for its consideration and concurrence.

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72. The Committee considered that it would be useful to have the participation of a representative of the CAS Working Group on Tropical Meteorology in its session as an observer, with a view to promoting the operational use of tropical cyclone research results. It agreed that an invitation to participate in future sessions would be extended to that Group.

VI. PROGRAMME FOR 1989 AND BEYOND

(Item 8 of the agenda)

73. In consideration of its programme for 1989 and beyond, the Committee reviewed and adopted, with minor amendments, the draft implementation plan of the Regional Co-operation Programme submitted by the Technical Working Group (see annex III). It agreed that the implementation plan would be reviewed and updated at each of its subsequent sessions.

74. The United States was currently planning to undertake a field experiment in the Western Pacific in the 1990 typhoon season to study tropical cyclone motion. A national typhoon experiment to study the formation mechanisms of the tropical cyclone anomalous tracks would be conducted in the north-western Pacific from August to November 1990 by the USSR. With regard to those research initiatives, the Committee agreed with the recommendation of the Technical Working Group that a special experiment be established to take place at the same time, and accordingly set up a special working group to formulate plans for the experiment. The following Members would nominate experts to serve in the group: China, Hong Kong, Japan, Malaysia, the Philippines, the Republic of Korea and Thailand. The Committee further agreed on the following working arrangements to be co-ordinated by TCS:

(1) Members to submit names of experts to TCS by January 1989.

(2) The group would conduct its work by correspondence.

(3) Consolidation of ideas by April 1989.

(4) The group would meet in June/July 1989 to finalize recommendations for consideration by the Committee at its twenty-second session.

(5) TCS would keep WMO and ESCAP informed on the work of the group.

To ensure close interaction with the USSR and United States experiments, the Committee agreed that observers from those countries would be invited to attend the meeting in June/July 1989.

75. The Committee was informed of the view expressed at the second session of the RA V Tropical Cyclone Committee (Brisbane, Australia, June-July 1988) on the need for positive measures to establish an aerial reconnaissance facility, financed multilaterally, for operation in both the northern and southern sections of the Western Pacific. The objective was to enhance research initiatives aimed at improving the understanding of the characteristics and mechanisms of tropical cyclones.

VII. SUPPORT REQUIRED FOR THE COMMITTEE'S PROGRAMME

(Item 9 of the agenda)

76. Under that agenda item, the Committee reviewed the need for support to carry out its programme activities, on the basis of a document submitted jointly by WMO and ESCAP.

77. The Committee considered the staffing of TCS, and was pleased to learn that the Philippine Government would continue to facilitate the functioning of TCS in Manila. It also noted with appreciation the Government's offer to continue to make available the services of a co-ordinator, a meteorologist and an expert on disaster prevention and preparedness on a part-time basis.

78. The Committee expressed its thanks and gratitude to Dr. Kintanar for his past contribution and guidance as Co-ordinator of TCS.

79. The Committee welcomed the statement of Japan that it would continue to support a hydrologist in TCS.

80. The Committee noted that the ESCAP/WMO Typhoon Committee Trust Fund (TCTF) had been formally established, in accordance with the decisions made at the twentieth session. It thanked the Governments of China, Japan, Malaysia and the Republic of Korea for their contributions. The Committee stressed the need for promoting annual cash contributions by Members to the Trust Fund with a view to increasing self-reliance in meeting the institutional support to its programme. In that respect, Members that had made pledges were urged to send their contributions to WMO at their earliest convenience.

81. The Committee was informed that, in the interests of equity, the United Nations General Assembly had established a system for reimbursing income tax in respect of salaries on other emoluments received from the United Nations. The Committee reviewed the Rules of the Trust Fund and made a revision to rule 14 as follows:

"Under no circumstances will the Fund be made liable to pay and/or reimburse any taxes or any customs and import duties, value added taxes or similar charges, demurrage and inland transportation costs for goods procured and imported under the Fund except the reimbursement of income taxes if claimed by the staff recruited under the Fund."

82. The Committee agreed to the use of the Trust Fund for the following activities up to the amount indicated against each item. It further agreed that the utilization of the Fund would be reviewed at its annual session:

(a) Travel expenses of the disaster prevention and preparedness expert at TCS (part-time) during 1989 to undertake a mission to countries in the region as the basis for making recommendations to the Committee and to Members on activities under this component. ($US 8,000)

(b) Augmentation of travel funds for TCS staff missions, for example, for participation in selected meetings of international or regional organizations. ($US 4,000)

(c) Support for organizing symposia or technical conferences on a regular basis (for example, every two or three years). ($US 3,000 per event)

(d) Supporting a working group for planning a special typhoon experiment to be organized by TCS ($US 15,000)

(e) Publishing a newsletter by TCS on a periodic basis (for example, initially, annually). ($US 1,000)

(f) Publishing a pamphlet or brochure on the Committee by TCS ($US 1,000)

(g) Representation and emergency expenses of TCS ($US 10,000)

(h) Support to collaboration of research activities among Typhoon Committee Members ($US 2,000)

83. The Co-ordinator of TCS reported that the amount of $US 45,000 had been received under the 1988 Sasakawa-UNDRO Disaster Prevention Award. The Committee supported the proposal that a Typhoon Committee foundation be established, serving to provide income on an ongoing basis which might be used as decided by a Board of Trustees on behalf of the Committee. The Committee agreed that the Board would comprise the Co-ordinator of TCS, the Chairman of the Committee, experts seconded to TCS and a member of the local

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media to be designated by the Co-ordinator. It further agreed that the income derived from the seed capital could be used to generate greater public awareness on disaster prevention and preparedness measures through an annual promotional event in the country hosting a session of the Committee (for example, award for outstanding young scientist, award for distinguished services in disaster prevention and preparedness activities, and so on).

84. A series of activities of the Committee were made possible with assistance from funds provided by the UNDP regional project RAS/86/175, "Programme support to the Typhoon Committee". The Committee reiterated its sincere thanks to UNDP for its strong support, and expressed the hope that that would continue in the future.

85. The Committee was informed that ESCAP would continue to provide substantive support to the Typhoon Committee within the framework of its own work programme. It noted with appreciation that a new Japan-ESCAP Co-operation Fund project on urban flood loss prevention and mitigation had been initiated, in which a number of Typhoon Committee Members, as well as other countries in the ESCAP region, would be involved.

86. It was encouraging to note that participating Governments of the Committee had taken over the responsibilities for institutional support of the intercountry project of the Committee and had recognized that as an important principle in the management of the Regional Co-operation Programme. The Committee emphasized the need for greater efforts by Members to mobilize national resources to the extent possible for the implementation of its Programme.

87. The Committee recognized that much could be achieved in the transfer of technology through TCDC arrangements. Exchange visits of experts and support to trainees were of immense benefit to Members. Members were urged to give strong support to that concept of self-reliance. The Committee was informed that China would organize a study tour on meteorological instruments and equipment for Members in 1989 through TCDC.

88. The Voluntary Co-operation Programme (VCP) of WMO provided enormous potential for support of its activities, and Members were advised to take full advantage of that system of mutual assistance.

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VIII. AGENDA FOR THE TWENTY-SECOND SESSION

(Item 10 of the agenda)

89. The Committee agreed that the following additional items would be included in the agenda of the twenty-second session:

- Report of the Special Working Group on the 1990 field experiment:

  Operational co-operation;

  Research co-operation.

- The Typhoon Committee's role in the international decade for natural disaster reduction

90. The Committee requested TCS, in close consultation with ESCAP and WMO, to prepare the provisional agenda for the twenty-second session. It was agreed that Members might propose to ESCAP, WMO and TCS, by the end of February 1989, additional specific items for inclusion in the agenda of the next session.

IX. DATE AND PLACE OF THE TWENTY-SECOND SESSION

(Item 11 of the agenda)

91. The Committee noted with satisfaction that some Members were considering hosting its future sessions. It requested ESCAP and WMO, in consultation with TCS, to decide on the date and venue of the twenty-second session, by February 1989.

X. SCIENTIFIC LECTURES

(Item 12 of the agenda)

92. The following scientific lectures were presented:

<u>Investigations of tropical cyclones with the use of research vessels and aircraft in the USSR</u>

by P.N. Svirkounov
Senior Scientist
Institute of Experimental Meteorology, USSR

<u>Recent tropical cyclone research</u>

by Russell L. Elsberry
Professor of Meteorology
Naval Post Graduate School
Monterey, California, United States of America

/The hydrology

<u>The hydrology of disastrous floods in Asia - An overview</u>

by Naginder S. Sehmi
Scientific Officer
World Meteorological Organization, Geneva

<u>Comprehensive flood control policies in Japan</u>

by Osamu Arai
Director of River Department
Shikoku Regional Construction Bureau
Ministry of Construction, Japan

<u>Central civil control in a disaster situation</u>

by John A. Fortune
Deputy Commissioner (Ops) and Chief Staff Officer
Civil Aid Services, Hong Kong

The Committee expressed its thanks to the lecturers.

XI. ADOPTION OF THE REPORT

(Item 13 of the agenda)

93. The Committee adopted its report on 28 November 1988.

/Annex I

IMPLEMENTATION PLAN OF THE RSMC

PRODUCT	86	87	88	89	90	91	REMARKS
GMS Observation							
GMS S-VISSR			—				8tms/dy(full),16tms/dy(north hemi)
				—	—	—	24tms/dy(full)
HR-FAX*	—	—	—				
WEFAX **	—	—					7sector:8tms/dy
		—	—	—	—	—	4sector:8tms/dy, Image H:24tms/dy Image I or J:24tms/dy
Cloud motion wind	—	—					2tms/dy
		—	—	—	—	—	4tms/dy
Analysis							
SAREP+(for tropical cyclone)	—	—					4tms/dy
		—	—	—	—	—	4~8tms/dy, Dovorak intensity estimation included.
Sea surface temperture		—	—	—	—	—	10-day mean and its anomaly
Objective analysis							
conventional	—	—	—	—	—	—	FAX (Polar stero.)
conventional				—	—	—	FAX (Mercator)# or GPV#
stream line				—	—	—	FAX#
Cloud distribution					—	—	GPV#
Long-wave radiation					—	—	GPV#
Forecast							
Tropical cyclone advisory	—	—	—	—	—	—	4tms/dy, (On- going Weather and Sea forecast/warning)
				—	—	—	2tms/dy, 24 & 48 hrs
Prognostic reasoning					—	—	
NWP products							
conventional	—	—	—				FAX (Northen Hemisphere Model)
conventional			—	—	—	—	FAX (Global Model, Polar stereo.)
conventional				—	—	—	FAX (Mercator)# or GPV#
stream line				—	—	—	FAX#
Other Best track				—	—	—	

SURPORTING ACTIVITY	86	87	88	89	90	91	REMARKS
Data archive					—	—	
Product dissemination via GMS					—	—	
Typhoon intensity predinction modelling						—	

* HR-FAX - High Resolution Facsimile

** WEFAX - Weather Facsimile

\+ SAREP - Report of synoptic Interpretation of cloud data obtained by a meteorogical satellite

\# Subject to available resources of JMA

Annex II

ESTABLISHMENT OF ELECTRONIC MAINTENANCE WORKSHOPS

LIST OF EQUIPMENT

A set of equipment recommended for each member is shown below:

i)	Oscilloscope	US$ 5,500 each
ii)	SHF Signal Generator	9,000 "
iii)	Digital Frequency Counter	1,300 "
iv)	Frequency Meter	1,900 "
v)	Microwave Power Meter including power sensor	2,500 "
vi)	Digital Equipment test set (including logic kit)	2,500 "
vii)	Pulse Generator	4,500 "
viii)	Digital VOM	1,100 "
ix)	50 ohm Terminators	120 "
x)	Detector Mount	400 "
xi)	Logic State Analyzer and printer	16,000 "
xii)	Co-axial Fixed Attenuator	650 "
	Total Cost for one set of test equipment	US$ 45,470

Project Cost

The estimated cost required for establishing the proposed repair workshops for six members amounts to approximately US$ 273,000.

Annex III

TYPHOON COMMITTEE'S REGIONAL CO-OPERATION PROGRAMME IMPLEMENTATION PLAN

I. METEOROLOGICAL COMPONENT

1.1 SUPPORT TO METEOROLOGICAL OBSERVING SYSTEMS AND FACILITIES

	TASKS	TIMESCALE (88 89 90 91 92 93)	BY WHOM	RESOURCES	COMMENTS
1.1.1	Maintaining services specified in the Operational Manual, including intensified observations (surface, upper-air and radars)	88–93 →	Members	National	Continuous activities
1.1.2	Provision of automated observation facilities and real-time telemetry of meteorological parameters, e.g., winds, rainfall, pressure, etc., by replacing with automatic instruments	88–93	Members	National	
1.1.3	Establishment of AMeDAS, ASDAR, anemometer, tide gauge and wave recorder networks	88–93	Members	National	
1.1.4	Establishment of upper-air stations:				
	- 98645 Cebu (Philippines)	88–89	- Philippines	National and external assistance	
1.1.5	Expansion of observational programme:				
	- 98223 Laoag (Philippines) at 12 GMT Radiosonde/Radiowind	88–90	- Philippines	National and external assistance	
1.1.6	Replacement/Upgrading of old radars (places to be identified)	88–93	- Malaysia, Philippines and Thailand	National and external assistance	

	TASKS	TIMESCALE (88 89 90 91 92 93)	By WHOM	RESOURCES	COMMENTS
1.1.7	Establishment of new weather radars:				
	- Cheju (Republic of Korea)	88–89	- Rep. of Korea	- National	
	Pusan (Republic of Korea)	89–90	-ditto-	-ditto-	
	Kangnung (Republic of Korea)	90–91	-ditto-	-ditto-	
	- Tanay (near Manila, Philippines)	88	- Philippines	- National	
	- Danang (Viet Nam)	88–92	- Viet Nam	- National and external assistance	
	- Vietiane (Lao PDR)	88–92	- Lao PDR	- External assistance	
	- Bangkok (Thailand)	88–90	- Thailand	- National & External assistance	
	- Khon Kaen Thailand)	88–90	-ditto-	-ditto-	
	- Chanthaburi (Thailand)	88–90	-ditto-	-ditto-	
	- Phuket (Thailand)	88–89	-ditto-	- National	
1.1.8	Establishment/Upgrading of satellite equipmetn (GMS/TIROS-N)				
	- Hanoi (Viet Nam)	88–90	- Viet Nam	- External Assistance	
	- Kuala Lumpur (Malaysia)	88	- Malaysia	- National & external assistance	
	- Manila (Philippines)	88	- Philippines	-External assistance (bilateral)	
	- Seoul (Republic of Korea)	88–89	- Rep. of Korea	- National	
	- Bangkok (Thailand)	88–89	- Thailand	- National	APT & HRPT/LR-FAX & HR/FAX (NOAA/GMS)
1.1.9	Establishment of a WWW data user system for the reception of fax & GPV data from the LR Channel of GMS transmissions	89–90	- Members	- National	

NEWSLETTER

I. METEOROLOGICAL COMPONENT

1.2 SUPPORT TO METEOROLOGICAL TELECOMMUNICATION SYSTEMS AND FACILITIES

TASKS	TIMESCALE 88	89	90	91	92	93	BY WHOM	RESOURCES	COMMENTS
1.2.1* Maintaining (a) services and facilities for the real-time exchange of data and products (b) monitoring of data exchange	—	—	—	—	—	—	Members RTHs Bangkok, Beijing and Tokyo	National Members concerned	Continuous activities Continuous activity
1.2.2 Improvement of facilities and their operation as necessary for the rapid and reliable collection and distribution of the required observational and processed information									
1.2.2.1 Establishment of regional telecommunication links									
- Bangkok-Hanoi	—	—	—				-Thailand and Viet Nam	National and external assistance	
- Beijing-Guangzhou-Hong Kong	—	—	—				-China and Hong Kong	National and bilateral support	
1.2.2.2 Strengthening of RTH, Bangkok	—	—					-Thailand	National and external assistance	
1.2.2.3 Improvement of Kuala Lumpur-Bangkok and Singapore links	—	—	—				-Malaysia and Thailand	External assistance	
1.2.2.4 Improvement of data completeness and quality, including use of real-time and non-real-time monitoring results for this purpose	—	—	—	—	—	—	-Members	National	

I. METEOROLOGICAL COMPONENT

1.2 SUPPORT TO METEOROLOGICAL TELECOMMUNICATION SYSTEMS AND FACILITIES (Cont'd.)

TASKS	TIMESCALE 88	89	90	91	92	93	BY WHOM	RESOURCES	COMMENTS
1.2.2.5 Review of existing arrangements for dissemination of typhoon warnings with a view to introducing improvements where necessary	—	—	—	—	—	—	-Members	National	
1.2.2.6 Improvement of national data collection and re-transmission to associated RTHs;									
- Laos PDR	—	—	—	—	—	—	- Laos PDR	National	
- Philippines	—	—	—	—	—	—	- Philippines	National and bilateral support	
- Viet Nam	—	—	—	—	—		- Viet Nam	External assistance	

I. METEOROLOGICAL COMPONENT

1.3 REQUIREMENTS SPECIFICALLY FOR TROPICAL CYCLONE FORECASTING AND WARNING

	TASKS	TIMESCALE 88 | 89 | 90 | 91 | 92 | 93	BY WHOM	RESOURCES	COMMENTS
1.3.1*	Continuing provision and dissemination of processed information, advisories and other products needed by TC Members for their forecasting and warning systems, archival of information on typhoon data in accordance with the TC Operational Manual	88 → 93	RSMC, Tokyo	Japan	Continuous activity
1.3.2	Exchange of forecasts including products of different objective methods in accordance with the TC Operational Manual	88 → 93	Members	National	Continuous activity
1.3.3*	Enhancement of co-operation in typhoon monitoring, forecasting and warning	88 → 93	Members	National	Continuous activity
1.3.4	Establishment of a regional computer network	88–89	Members	National and external assistance	
1.3.5	Installation of a computer processing system with a view to integrating satellite, radar and rainfall data so as to provide a spatial distribution of rainfall amount over a large region	88–92	Members	National and external assistance	TCDC, Technical consultancy and assistance from external sources would be required
1.3.6	Setting up of electronic equipment maintenance and repair workshops	88–93	Members	National and external assistance including TCDC	
1.3.7	Promotion of developments at the interface between the Meteorological warning services and the users of warnings for increasing the impact and effectiveness of these services	88–93	Members	National and external assistance in conjunction with IDNDR	

* During 1988 and 1989 items with an asterisk to be given priority attention

2.1 FLOOD FORECASTING AND WARNING

	TASKS	TIMESCALE 88 | 89 | 90 | 91 | 92 | 93	BY WHOM	RESOURCES	COMMENTS
2.1.1	Installation and operation of networks of observing stations required for flood forecasting systems	88 → 93	Members	National	Continuous activity
	- Installation of telemetering systems complemented by radar-raingauges and satellite systems for important cities and other densely populated areas prone to flash floods.		China	National	
	- Integration and use of data from existing meteorological and hydrological observing stations operated by various agencies	90–91 88–89	China Malaysia Republic of Korea	National National National	
	- Improvement of means of transmission to reduce data collection time		China	National	
	- Development of an on-line systems		China	National	
	- Development of hydrometric stations on the urban drainage		Hong Kong	National	
2.1.2	Establishment and operation of flood forecasting and warning systems:	88 → 93	Members	National	Continuous activity
	- Nam Ngum and Se Bang Hieng basins (Lao PDR)	88–90	Lao PDR	National	Includes real-time data
	- Pasak River basin (Thailand)	91–93	Thailand	National	collection and hydrological modelling
	- One river basin (Viet Nam - to be selected by Viet Nam)	91–93	Viet Nam	National	
	- Application of computer-based mathematical models to study the hydrology of urban zones.		Hong Kong	National	In Co-operation with ESCAP

II. HYDROLOGICAL COMPONENT

2.1 FLOOD FORECASTING AND WARNING (Cont'd)

	TASKS	TIMESCALE 88	89	90	91	92	93	BY WHOM	RESOURCES	COMMENTS
	- Extension of flood forecasting services to other basins subject to flooding especially in medium-scale catchments		—	—	—	—	—	Malaysia	National	
		—	—	—	—			Republic of Korea		
	- Development of forecasting of the location and intensity of rainfall in densely populated areas which are subject to flash floods (e.g. Metro Manila)							Philippines	National JICA	
	- Increased use of existing radar raingauges for providing QPF data							Philippines	National	
2.1.3	Establishment of flood forecasting and warning systems for dam operations	—	—	—	—			Philippines, Malaysia and Interested	Members concerned and external assistance	Faulty dam Operation aggravates flooding downstream
2.1.4	Establishment of flood forecasting and warning systems for inundation from storm surges	—	—	—	—	—	—	Members concerned	Members concerned and external assistance including TCDC	Includes Interaction of river floods and storm surges
2.1.5	Continuation of monitoring of and reporting on performance of existing flood forecasting systems	—	—	—	—	—	—	Members	National and external assistance including TCDC and with support of TCS and WMO	Co-ordinated by WMO. Using standard TOPEX monitoring and forecast accuracy formats, as amended
2.1.6	Further improvement of existing flood forecasting and warning systems, making use, where appropriate, of the results of TOPEX	—	—	—	—	—	—	Members	Members concerned and external assistance including TCDC	Includes catchment modelling
	- Improvement of existing models and their application in catchments subject to flash floods.	—	—	—	—	—	—	Philippines Malaysia	National	

2.1 FLOOD FORECASTING AND WARNING (Cont'd)

	TASKS	TIMESCALE 88	89	90	91	92	93	BY WHOM	RESOURCES	COMMENTS
	- Improvement of currently used model on the Han River basin.	—	—	—	—			Republic of Korea	National	
	- Improvement of existing flood forecasting systems for the rivers Hong and Thai Binh using micro-computers		—	—	—			Viet Nam		
2.1.7	Implementation of recommendations of missions by experts to provide technical guidance on items 2.1.1 to 2.1.6							Members concerned	External assistance. Missions to be organized by WMO and ESCAP	Using, where appropriate, technology available through HOMS
2.1.8	Exchange of technical visits among flood forecasters	—	—	—	—	—	—	Members	National and external assistance	Co-ordinated by WMO
2.1.9	Development and application of guidance on hydrological technology, including hydrological models, for tropical cyclone regions	—	—					Members	External assistance WMO	On the basis of OHP (HOMS)
	- Preparation of a description of flood forecasting and warning systems for one river as an example for submission to TC							China	National and external assistance	
2.1.10	Development and use of improved techniques for Quantitative Precipitation Forecast (QPF), taking advantage of data provided by satellite and radar	—	—	—	—	—	—	Members	Members and external assistance	WMO to assist in development and promulgation of improved techniques

2.1 FLOOD FORECASTING AND WARNING (Cont'd)

TASKS	TIMESCALE 88	89	90	91	92	93	BY WHOM	RESOURCES	COMMENTS
- Development and application of QPF derived from radar raingauges and satellites to issue flash flood warnings in densely populated small river basins			—	—	—	—	Malaysia	National and external assistance	WMO to assist in development and promulgation of the technique.
- Development of QPF and its application to flood forecasting in central region.		—	—	—			Viet Nam	National and external assistance	

II. HYDROLOGICAL COMPONENT

2.2 COMPREHENSIVE FLOOD LOSS PREVENTION AND MANAGEMENT

	TASKS	TIMESCALE 88	89	90	91	92	93	BY WHOM	RESOURCES	COMMENTS
2.2.1	Establishment of pilot area for comprehensive flood loss prevention and management	—	—	—				Members	Bilateral or multilateral support if available	Detailed programme will be established by respective Members
2.2.2	Investigation and survey including: a) Determination of flood-prone areas subject to heavy damage; b) Determination of magnitude and corresponding frequency of floods in each flood-prone area; c) Assessment of potential flood damage in each area for various flood magnitudes; d) Preparation of flood risk maps.	—	—	—				Members	National	ESCAP and WMO to assist in organizing investigations and surveys
2.2.3	Preparation and application of a manual and guidelines for/and dissemination of techniques for comprehensive flood loss prevention and management.	—	—	—				Members	National and external assistance (subcontract under UNDP regional project)	With assistance of ESCAP and WMO
2.2.4	Implementation of selected aspects of comprehensive flood loss prevention and management plans			—	—	—	—	Members	- ditto -	- ditto -

II. HYDROLOGICAL COMPONENT

2.2 COMPREHENSIVE FLOOD LOSS PREVENTION AND MANAGEMENT (Cont'd.)

	TASKS	TIMESCALE 88	89	90	91	92	93	BY WHOM	RESOURCES	COMMENTS
2.2.5	Mission of experts to provide technical guidance to Members on items 2.2.1 to 2.2.4 above	—	—	—				Members	UNDP, TCDC and bilateral or multilateral support, if available	With assistanc of ESCAP and WMO
2.2.6	Flood risk analysis and mapping in demonstration area(s):									As a joint project of TC, one or two demonstration areas for implementatio
	a) Collection of data and information and land survey;	—	—					Hosting Member(s) of project	UNDP, Members and bilateral or multilateral support	
	b) Formulation of an implementation programme for flood risk analysis and mapping;	—	—	—				- ditto -	- ditto -	
	c) Preparation of a manual and guidelines for flood risk analysis and mapping applicable to TC Members;	—	—					- ditto -	- ditto -	
	d) Organization of an expert group meeting and a workshop on flood risk analysis and mapping;			—	—			- ditto -	- ditto -	
	e) Extension to other areas.					—	—	Members	UNDP, Members and bilateral or multilateral support, if available	

III. DISASTER PREVENTION AND PREPAREDNESS COMPONENT

3.1 PUFLIC AWARENESS

	TASKS	TIMESCALE 88	89	90	91	92	93	BY WHOM	RESOURCES	COMMENTS
3.1.1	*Improvement of public awareness on typhoon and flood threat and preparedness, coupled with studies of human response to warnings.	—	—	—	—	—	—	Members	National and external assistance in conjunction with IDNDR	With advice assistance c UNDRO/LRCS/W and other agencies concerned
3.1.2	Production of materials (audio-visual aids, pamphlets and booklets) related to public information and education	—	—	—	—	—	—	Members	National and external assistance	Work under t WMO TCP proj 12 and 14 is also relevar

* During 1988 and 1989 items with an asterisk to be given priority attention

II. DISASTER PREVENTION AND PREPAREDNESS COMPONENT

3.2 DISASTER MANAGEMENT

	TASKS	88	89	90	91	92	93	BY WHOM	RESOURCES +	COMMENTS
3.2.1	Establishment/upgrading of national disaster prevention and preparedness plans	—	—	—	—	—	—	Members	Bilateral or multi-lateral support if available	With advice and if possible support from ESCAP
3.2.2	Strengthening national co-ordination and co-operation between departments and agencies involved in DPP activities	—	—	—	—	—	—	Members	National	
3.2.3	Improvement in the timely dissemination of warnings of typhoons, floods and storm surges, with particular attention to remote areas	—	—	—	—	—	—	Members	National	
3.2.4	Improvement of communication systems for warning dissemination and relief operation	—	—	—	—	—	—	Members	Bilateral or multilateral support if available	
3.2.5	Improvement of damage assessment and reporting	—	—	—	—	—	—	Members	Multilateral support if available	With advice from ESCAP roving missio.
3.2.6	Development and exchange of information and guidance materials on structural and non-structural measures for mitigation of disasters	—	—	—	—	—	—	Members	External assistance	With guidance from inter-national agencies such as UNDRO, LRCS, ESCAP and WMO
3.2.7	Conducting case studies of response to major disasters	—	—	—	—	—	—	Members	External assistance	With advice from UNDRO, LRCS, UNDRO and WMO

III. DISASTER PREVENTION AND PREPAREDNESS COMPONENT

3.2 DISASTER MANAGEMENT (Cont'd.)

	TASKS	88	89	90	91	92	93	BY WHOM	RESOURCES +	COMMENTS
3.2.8	Compilation of annual information on loss of life and damage caused by typhoons, floods and storm surges including damage to houses, public facilities, agricultural products, and so on	—	—	—	—	—	—	Members	External assistance	With advice from UNDRO in co-operation with ESCAP
3.2.9	Where appropriate, implementing the recommendations of joint missions and seminars to evaluate DPP procedures and to provide advice on local problems			—	—	—	—	Members	Bilateral or multilateral support if available	Missions to be organized by UNDRO/LRCS/WMO/ESCAP at the request of Members
3.2.10	Establishment of disaster research and training institutes	—	—	—	—	—	—	Members	Bilateral or multilateral support if available	
3.2.11	Production of material related to public information and education on the Typhoon Committee activities, particularly storm warning and DPP			—	—	—	—	Members	External assistance	With support of ESCAP, WMO and TCS
3.2.12	Establishment of a Philippine training and research centre for disaster prevention and preparedness, through consultancy services, where appropriate	—	—	—	—			Philippines	External assistance	With advice from UNDRO

+ External assistance in conjunction with IDNDR

IV. TRAINING COMPONENT

4.1 METEOROLOGY

	TASKS	TIMESCALE 88 89 90 91 92 93	BY WHOM	RESOURCES	COMMENTS
4.1.1	Training on engineering applications of tropical cyclone climatological data	91–93	Members	External assistance	Conferences, seminars and overseas training programmes, including roving missions and TCDC arrangements
4.1.2	Training on applications of radar and satellite data in tropical cyclone tracking, forecasting and very short-range precipitation forecasts	89–93	Members	External assistance	
4.1.3	Training in calibration, maintenance and repair of electronic meteorological instrumentation	88–93	Members	National and external assistance	Co-ordinated by WMO
4.1.4	Training on utilization of software for integrating satellite/radar/rainfall data	88–93	Members	Short-term fellowships with external support	- ditto -
4.1.5	Training on quantitative precipitation forecast (QPF) models	88–93	Members	- ditto -	- ditto -
4.1.6	Training of personnel through fellowships on tropical cyclone forecasting	88–93	Members	UNDP, WMO and other international organizations concerned	- ditto -

IV. TRAINING COMPONENT

4.1 METEOROLOGY (Cont'd.)

	TASKS	TIMESCALE 88 89 90 91 92 93	BY WHOM	RESOURCES	COMMENTS
4.1.7	Training on: - meteorology; - electronics	88–93	Members	UNDP, WMO and other international organizations concerned	Courses and seminars organized by WMO and Members
4.1.8	Continuation of group training courses	88–93 →	Japan	Japan International co-operation Agency (JICA)	
4.1.9	Exchange of forecaster(s) between tropical cyclone forecasting and warning centres	88–93	Members	External assistance	Through TCDC arrangements
4.1.10	Training on observing technology	88–90	Members	External support	Seminars
4.1.11	Exchange of meteorological experts between Members other than 4.1.9 above	88–91	Members	Bilateral or TCDC arrangements	
4.1.12	Training on storm surge and wave prediction	88–93	Members	Short-term fellowships with external support	
4.1.13	Training in message-switching, wave forecasting, numerical weather prediction and cloud physics, through attachments	88–93	Members	External assistance	TCDC arrangements
4.1.14	*Training of personnel through fellowships on maintenance of electronic equipment	88–93	Members	External assistance	For both meteorological and hydrological equipment

*During 1988 and 1989 items with an asterisk to be given priority attention

IV. TRAINING COMPONENT

4.2 HYDROLOGY

	TASKS	88	89	90	91	92	93	BY WHOM	RESOURCES	COMMENTS
4.2.1	Training on repair and maintenance of electronic equipment used in flood forecasting and warning		—	—				Members	WMO, UNDP and other sources	Roving seminars organized by WMO
4.2.2	Training on advanced techniques for flood forecasting and warning and associated storms, including hardware and software		—	—	—	—	—	Members	WMO, UNDP and other sources	Courses and seminars organized by WMO
4.2.3	Training in hydrology with emphasis on flood forecasting		—	—	—	—		Members	- ditto -	- ditto -
4.2.4	Training of personnel through fellowships on flood loss prevention			—	—			Members	- ditto -	- ditto -
4.2.5	Training on appropriate topics relating to flood loss prevention and management	—	—	—	—	—	—	Members	ESCAP, UNDP and other sources	Seminar organized by ESCAP
4.2.6	Group training courses on river engineering	—	—	—	—	—	—	Japan	Japan International Co-operation Agency (JICA)	At the request of TC
4.2.7	Exchange of flood forecasting experts	—	—	—	—	—	—	Members	WMO, UNDP and other sources	TCDC arrangements

IV. TRAINING COMPONENT

4.3 DISASTER PREVENTION AND PREPAREDNESS

	TASKS	88	89	90	91	92	93	BY WHOM	RESOURCES	COMMENTS
4.3.1	Training of disaster managers and volunteer leaders	—	—	—	—	—	—	Members	National and external assistance	With advice from international agencies
4.3.2	Test exercises	—	—	—	—	—	—	- ditto -	- ditto -	- ditto -
4.3.3	Training in DPP	—	—	—	—	—	—	Members	External assistance	Regional seminars organized by TCS with help of UNDRO, LRCS, ESCAP and WMO
4.3.4	Exchange of information on the socio-economic impact of disasters			—	—			Members	UNDRO, LRCS, ESCAP and other multilateral support if available	Seminars organized by UNDRO, LRCS and ESCAP
4.3.5	Training on disaster vulnerability and risk assessment	—	—	—	—	—	—	- ditto -	- ditto -	Courses and seminars organized by UNDRO, LRCS and ESCAP
4.3.6	Group training courses on technology for disaster prevention	—	—	—	—	—	—	Japan	Japan International Co-operation Agency (JICA)	Continuation.
4.3.7	Exchange of DPP personnel	—	—	—	—	—	—	UNDRO, LRCS, TCS and ESCAP	UNDRO, LRCS, ESCAP and other sources	TCDC arrangements organized by UNDRO, LRCS, TCS and ESCAP

V. RESEARCH COMPONENT

5.1 METEOROLOGY

TASKS	TIMESCALE 88 89 90 91 92 93	BY WHOM	RESOURCES	COMMENTS
5.1.1 General Studies on:				
5.1.1.1 Methods of typhoon location and accuracy		Members or regionally co-ordinated programme	National	
5.1.1.2 Typhoon development mechanism and forecasting		- ditto -	- ditto -	
5.1.1.3 Disastrous weather associated with typhoons		- ditto -	- ditto -	
5.1.1.4 Forecasting of precipitation by use of new approaches or techniques such as interactive techniques for integrating satellite, radar and other information		- ditto -	- ditto -	
5.1.1.5 Influences of meso- and micro-scale systems on typhoon characteristics		- ditto -	- ditto -	
5.1.1.6 Interaction between typhoons and the environmental circulation		- ditto -	- ditto -	
5.1.1.7 Possibility of extended track forecasting methods		- ditto -	- ditto -	
5.1.1.8 Evaluation and improvement of present objective forecasting methods		- ditto -	- ditto -	
5.1.1.9 Sensitivity of objective methods to initial data distribution and quality		- ditto -	- ditto -	
5.1.1.10 Typhoon climatology in relation with anomalies in regional circulation		- ditto -	- ditto -	
5.1.1.11 Forecasting storm surge and heavy rainfall (see also 5.2.6)		- ditto -	- ditto -	

V. RESEARCH COMPONENT

5.1 METEOROLOGY (Cont'd.)

TASKS	TIMESCALE 88 89 90 91 92 93	BY WHOM	RESOURCES	COMMENTS
5.1.2 Post-TOPEX research				
5.1.2.1 Utilization of TOPEX data set (radar, satellite, upper-air soundings, etc.) in tropical cyclone numerical and physical modelling, with the aim of improving existing methods of predicting formation, development and steering		Members or regionally co-ordinated programme	National	Need for short-term attachment of experts to advanced centres in the typhoon region
5.1.2.2 Establishment and operation of a tropical cyclone data bank for the north western Pacific and East Asia with software exchanges between Members		RSMC, Tokyo	Japan	According to the procedure described in TOM.
5.1.2.3 Development of an operational NWP model for typhoon movement and development		Members or regionally co-ordinated programme	National	
5.1.2.4 Irregular tropical cyclone behavior such as sudden turning of tracks, sudden increase/decrease of intensity, rainfall and storm surge		- ditto -	- ditto -	
5.1.2.5 Air-sea interactions associated with the occurrence of typhoons, with emphasis on wave and storm surge generation		- ditto -	- ditto -	

. RESEARCH COMPONENT

.2 HYDROLOGY

TASKS		TIMESCALE 88 89 90 91 92 93	BY WHOM	RESOURCES	COMMENTS
5.2	Studies for developing or improving techniques for:				
5.2.1	Comprehensive flood loss prevention and management		National or regionally co-ordinated programme	National	
5.2.2	Flood risk analysis, including flood risk mapping		- ditto -	- ditto -	
			- ditto -	- ditto -	
5.2.3	Flood run-off models appropriate for the region				
5.2.4	Application of meteorological inputs to flood forecasting		- ditto -	- ditto -	
5.2.5	Comparison of the performance of the different models, using the post-TOPEX data set		- ditto -	- ditto -	
5.2.6	Forecasting floods caused by the combined effects of storm surges, heavy rainfall and stream flow (see also 5.1.1.11)		- ditto -	- ditto -	
5.2.7	Flash flood forecasting		Members	- ditto -	
5.2.8	Study of effects of deforestation, urbanization and changing land use on the hydrology of the catchment and on the intensity of floods.		Philippines China Malaysia	National	In Co-operation with ESCAP

V. RESEARCH COMPONENT

5.3 DISASTER PREVENTION AND PREPAREDNESS

TASKS		TIMESCALE 88 89 90 91 92 93	BY WHOM	RESOURCES	COMMENTS
5.3.1	Studies on socio-economic impact of typhoon and flood disasters		Members	National	With advice and possible support of UNDRO/LRCS/ ESCAP/WMO
5.3.2	Vulnerability and risk assessment of disaster-prone areas		- ditto -	- ditto -	- ditto -
5.3.3	Socio-economic implication of availability and quality of typhoon and flood forecasts and warnings		- ditto -	- ditto -	- ditto -
5.3.4	Disaster impact modelling		- ditto -	- ditto -	- ditto -

. . . . .

ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC
AND
WORLD METEOROLOGICAL ORGANOZATION

WRD/TC.21/4
Doc.
(8 November 1988)

Typhoon Committee
Twenty-first session
22-28 November 1988
Manila

Item;4(a)

Updating of

TYPHOON COMMITTEE OPERATIONAL MANUAL

METEOROLOGICAL COMPONENT

(Submitted by the rapporteur)

SUMMARY of DOCUMENT

This document contains the proposals for the updating of Typhoon Committee Operational Manual Meteorological Component issued in 1987.

ACTION PROPOSED

Typhoon Committee is invited to:

(a) Note the information contained in this report;

(b) Examine and approve the proposed amendments to the Manual;

(c) Request the WMO Secretariate to issue a Supplement to the publication.

Appendices : A. Proposals for the Updating of TYPHOON COMMITTEE OPERATIONAL MANUAL METEOROLOGICAL COMPONENT

B. APPENDIX to the Proposals

DISCUSSION

General

1. The twentieth session of the Typhoon Committee(October 1987,Bankok) requested the Government of Japan to designate a rapporteur for updating the Typhoon Committee Operational Manual(TOM) Meteorological Component(Report No. TCP-23) issued in 1987. The terms of reference of the rapporteur are to submit proposals for updating the TOM to the Typhoon Committee on its twenty-first session in November,1988.

2. The Government of Japan designated Mr.Shunichiro Kadowaki,Telecommunications Counsellor, Forecast Department, Japan Meteorological Agency as the rapporteur. The rapporteur considered it preferable to submit a draft proposal to the Meeting of the Typhoon Committee Technical Working Group on the Implementation of the Regional Cooperation Programme to be held before the twenty-first session of the Typhoon Committee.

3. The rapporteur requested the individual Focal Points of Meteorological Component of the Typhoon Committee Members by correspondence to provide him with comments and suggestions on the updating. Number of comments were received from the Focal Points of China,Malaysia,Hong Kong, Thailand and the Republic of Korea as of the end of last August as well as relevant information from the staff of the Japan Meteorological Agency. Based on those information the rapporteur prepared draft proposals and submitted them to the Meeting of the Technical Working Group, 11-13 October 1988,Kuala Lumpur Malaysia. The draft proposals were examined and supported in general by the Meeting.

4. Following the discussions made in the Meeting,the rapporteur made a few amendments to his draft proposals and prepared the prposals now submitted. Amendments made included are as follows;

(1) Deletion of the word "sustained" from all of the descriptions on the classification of tropical disturbances to keep consistency of definition of relevant wind speed throughout the Manual and also consistency with Tokyo RSMC practice(See blow paraphrases 8 to 14.).

(2) Renaming of GMS cloud imagery dissemination system LR-FAX to WEFAX.

(3) Further correction of editorial error based on the comments received after the preparation of the draft proposals.

Proposals for updating

5. The proposals consist of "Proposals for the updating of the Typhoon committee Operational Manual Meteorological component" and "APPENDIX" to the Proposals.

6. In the "Proposals",suggested amendment items are listed in the page order of current version of the TOM. For your convenience,all of amended pages are given in "APPENDIX". Amended parts are marked with red broad line.

7. The amendments are in the following three cases:
   (1) Addition/Replacement:installation of new observing stations,introducing new observation techniques, upgrade of telecommunication circuits,introducing of new forecast methods,etc;
   (2) Withdrawal : description related to data from U.S.reconnaissance flight that was ceased in early summer of 1987;and
   (3) Correction of editorialerror : In addition of miscellaneous errata,the full text of Appendix 7,Annex,p.5 of the present TOM is prepared(This page is missed in spite of submission of the manuscript).

Terms related to wind speed

8. The term of "maximum sustained wind" in the TOM seems to have different meaning from description to description. The Typhoon Committee is invited to consider consistent uses of the term throughout TOM.

9. In the present TOM cyclonic disturbances are to be classified with "maximum sustained wind speed" (see para 1.3 on pages 4 and 5,and para 2.4 on page 20). The term of "maximum sustained wind speed" in the TOM be "maximum of wind speed averaged for 10 minutes". On the WMO technical regulations the said classification is made with "maximum wind speed".

10. A term "mean wind speed" in the definition of kinds of warning and a term "wind speed"(see para 1.3 on page 4) should be read "wind speed averaged for 10 minutes".

11. In another part of the TOM the term " maximum sustained wind speed" is appeared in the different meaning;"The maximum surface wind in this graph is 1-min.mean value,i.e.,the maximum sustained wind....."(see note on page 6 of Appendix 3-B).

12. In the Atlantic Ocean and the eastern part of the Pacific Ocean,the term "maximum sustained wind" is clearly defined as wind speed averaged for one-minute for the classification of tropical and othe cyclonic storms:e.g.

   Maximum sustained surface wind(1-min. mean)
      cf.NOAA,Tropical Cyclones of the north Atlantic Ocean 1871-1977;

   Maximum average surface wind(one minute mean)
      cf.RA-IV Hurricane Operational Plan,WMO Publication No.524.

13. One-minute mean wind speed is not operationally available from surface synoptic reports. The U.S. reconnaissance flight had been the unique data source of one minute mean wind speed. No more flight is avairable now. Today, the one minute mean wind speed is only estimated from storm intensity derived from features of satellite cloud imagery(Dvorak's method).

14. Japan Meteorological Agency has been using "10 minutes mean wind speed" for warning and classification of tropical disturbances.

RSMC for typhoon forecasts and advisory services

15. The EC-XL(1988,Geneva) adopted the CBS recommendation to designate the RMCs Tokyo ,Miami and New Delhi as the RSMCs for tropical cyclone forecasts and advisory services on an operational basis. Updating of the TOM concerned with the said RSMC in Tokyo should be made in due course after the twenty-first session of the Typhoon Committee in Manila.

Proposals for the updating of

TYPHOON COMMITTEE OPERATIONAL MANUAL

METEOROLOGICAL COMPONENT

Content and Appendices

Page iii

Appendices

Delete "and future" from 2-F.

Delete "2G:Codes of reconnaissance flight observation".

Replace "special" in 2-A,2-B and 2-D with "enhanced.

Page iv

Figures

Delete figures "Fig.2-F.2 to Fig.2-F.7".

Insert following new figures;

Fig.2-F.2	Four-sectorized Cloud Images broadcast three-hourly,
Fig.2-F.3	WEFAX "H" Images of the Polar-stereographic projection,
Fig.2-F.4	Stretched VISSR Scan Format,
Fig.2-F.5	Time Chart of VISSR data.

Insert "(one minute mean)" after "sustained wind" in the title of Fig.3-B.5.

Delete figure Fig.3-B.6 .

Change the number of the present figure Fig.3-B.7 to new number Fig.3-B.6.

Delete figures Fig.3-B.8 and Fig.3-B.9.

Page v

Tables

Delete table "Table 3-B.1".

Chapter 1

Page 4

Section 1.3

23rd line(Maximum sustained wind)
Insert "one minute" between "the" and "average".

26th-28th line(Reconnaissance aircraft centre fix.......)
Delete these three lines.

30th line(Severe tropical storm)
Delete "sustained".

Page 5

9th(Tropical cyclone),13th line(Tropical depression),16th line(Tropical storm) and 17thline(Typhoon)
Delete the "sustained"s in these lines.

Chapter 2

Page 7

Section 2.1

Replace "3-hourly" in (ii) with "hourly".

Subsection 2.1.1 and 2.1.2

All "GMT"(time standard) is to read "UTC".

Page 8 **Section 2.2**

(First paragraph)
Change the call signs "8JNZ" and "JPQX" to "JDWX" and "JCCX" respectively.

(Second paragraph, second line)
Change "and" to ",".
Insert "and JCCX(upper-air)" next to "JGZK"(radar)".

Replace the last sentence of this paragraph with new sentence shown below;
"A newly-built weather ship JDWX from Japan started upper-air observation as from August 1988."

(Third paragraph)
Add following new sentence at the end of the last sentence.

"A new function was installed on the Buoy No.22001 moored in the East China sea to make hourly observation automatically whenever wind speed there exceeds 35knots and became operationally as from June 1988."

"GMT" is to read "UTC".

Page 8 and 11 Section 2.4

Replace all paragraphs in this section excepting the last one with following new paragraphs;

" The current system of providing meteorological satellite information obtained by GMS and related products is operated as follows;
(a)the full disk data will be obtained hourly,
(b)cloud motion wind observation will be performed four times a day,
(c)the stretched VISSR digital data dissemination for all observations will be made in addition to the WEFAX dissemination.
Detailed information is given in Appendix 2-F.

Remarks GMS-4 is scheduled to be launched in 1989, but the GMS products will remain unchanged. "

Page 9 **Fig.2.1**

Add new weather radar station 96413 of Malaysia into the figure.

Amend the positions of the station 48615,48602 and 48672 as shown in the APPENDIX to this proposal.

Page 10 **Table 2.1**

Delete the perpendicular line centre right of the table.

China: Station number 58369(Shanghai) is to read 58367.

Japan: Station number 47430 is to read 47432.

Malaysia:Add new station "96413 Kuching" to the table.

Republic of Korea:Change the station name "47116 Gwanag Mt." to "47116 Kwanaksan".

Page 12 **Fig.2.2**

Add following new satellite cloud imagery receiving stations into the figure.
Hong Kong.....one MDUS
Japan.........five SDUSs
Viet Nam......three SDUSs

Page 13 **Table 2.2**

Amend the table as follows;

Hong Kong(Kowloon):Add "1" to the GMS column of the table.

Japan:Amend the positions of the stations as follows; Tokyo 35.7N 139.8E,Hiroshima 34.4N 132.5E,Fukuoka 33.6N 130.4E

Add following stations to the table.

Kobe	(34.7N,135.2E)	2,3
Nagasaki	(32.7N,129.1E)	2,3
Narita	(35.8N,140.4E)	2,3
Haneda	(35.6N,139.8E)	2,3

Malaysia:Change the station name "Selangor" to "Petaling Jaya"

Viet Nam:Add "2,3" into the GMS column of Hanoi and Ho Chi Minh city respectively.

Add following station into the table;
Da Nang (16.0N,108.2E) 2,3 GMS column.

Page 14 **Section 2.5**

Delete the last two paragraphs("The reconnaissance flight...The details of RECCO and.....in Appendix2-G").

Chapter 3

Page 15 **Section 3.1**

(Second paragraph,second line)
"Streamlined" is to read "streamline".

(Third paragraph,third and fourth lines)
Delete "and aircraft reconnaissance reports".

Page 16 **Table 3.1**

(a)analysis
(First line)
"GMT" is to read "UTC".

(Last line)
Change present last line as follows:
"sea surface temperature 5 days C,G A ".

(Fifth line from the bottom of the page)
"V:Area centred at..." is to read "V:Area around...".

Page 17 **Section 3.2**

(First paraphrase)
Fourth line : "including" is to read "include".
First line of (i) : Replace "(200km)" with "(180km)".
First line of (ii): Replace "...a very fine mesh(50km)NWP model..." with "Typhoon model of 50km horizontal resolution...".

Delete third to fifth lines of (ii)(In the case.... areas.).

Page 18 Table 3.2(a)

(In the midst of the page)
"Truncation Spectral,..." is to read as follows;
"Horizontal representation Spectral,with triangular truncation at wave number 63.".

Page 19 Table 3.2(b)

(In the midst of the page)
"Integration domain", "Grid interval" and "Grid" is to read as follows;

Integration domain	Area around the typhoon eye at the initial time,4000km x 4000km
Horizontal representation	Spectral,with circular truncation at wave number 51
Grid	81 longitudes and 81 latitudes in Mercator projection.The grid interval is about 50km.

Chapter 4

Page 20 Section 4.2

Delete the words "sustained" from the descriptions on the classification of tropical disturvances(2.Tropical depression,3. Tropical storm,4.Severe tropical storm,5.Typhoon).

Page 21 Examples of Advisories

Advisory for analysis EX.1

(sixth line) Delete "RECON AND".

Page 22 Section 4.3

Advisory for Prognostic Reasonning EX.3

Replace whole sentences of the part "A" with following new sentences;
" A. SAT CLOUD IMAGERY OF TY 8526 HOPE SHOW THE EYE DISAPPEARED AND SIGNIFICANT CIRRUS OUTFLOW TO THE NORTHEAST. THESE DATA INDICATE THE STORM HAS REACHED PEAK INTENSITRY AND SUGGEST RECURVATURE.

Replace "RECON" in the part "C" with "SAT".

Page 27 Table 5.1

3. Regional circuits

Update the "present operational status" of the table to reflect recent improvements in the regional telecommunication circuits as follows;

Bankok-Hong Kong	Satellite,200 bit/s,
Tokyo-Seoul	Cable,V.29 9600bit/s,4800bit/s(data)X.25 Level 3 +4800bit/s(NCDF).

APPENDIX

Appendix 1

Page 1-B,p.1 Delete acronyms "GMT"(11th line),HR/LR FAX(14th line) and "RECCO" (33rd line) from the list.

1-B,p.2 Delete acronym "TEMP DROP"(first line) from the list.

Appendix 2

Page 2-A,p.1 Replace "special" in the first line(title) with "enhanced".

Delete following stations of JAPAN(47) from the list:451,599,603 and 748.

Add following stations to Japan(47) in the list; 805, 887,890,891, 892,893,894,895,897,898,899,909,912 and 991.

2-A,p.2 Add following two stations to the Republic of Korea(47) in the list ; 095 and 185.

Page 2-B Replace "special" in the first line(title) with "enhanced".

Delete three stations shown below from Japan(47) of the list.
580,681 and 881

Put "*" mark on the shoulder of two station numbers,971 and 991.

Add following "note" at the end of the list of Japan(47);
"* 06 UTC only."

Delete the second to fourth lines of Notes of Philippines(98)(At present.... ...become available.).

Add new station "185" to the Republic of Korea(47) in the list.

Page 2-C Replace present figure with revised version(See the APPENDIX to this Proposal).(Some errors were found on the position of Buoys.)

Page 2-D Replace "special" in the first line(title) with "enhanced".

Replace the station number of China(58) "369" with "367".

Replace the station number of Hong Kong(45) "005" with "010".

Add new station number " 413" to Malaysia(96) .

age 2-E Update the radar parameters shown belows.

p.1,2 (China-1) and (China-2)

Radar station:Shanghai,Fuzhou,Shantou and Xishadao

Wave length	10.6cm
Peak power of transmitter	500kw
Sensitivity minimum of receiver	-110dBm
Beam width	2.0deg
Detection range	600km

Change the antnna elevation of "Shanghai" to 50m.

Change the "scan mode in operation of "Shanghai" to 2.

Change the "Display" of "Shanghai" to 1.

p.3 (Hong Kong)

Change the operation mode of "Tate's Cairn" to 3.

p.4,5 (Japan-1) and (Japan-2)

Change the modes of three radars,Sapporo(p.4),Sendai(p.4) and Akita(p.5) as follows;

Scan mode in observation	1
MTI Processing	1
Display	1

p.6 (Japan-3)

Change the station name of Fukui/Tojinbo to Fukui/Tojimbo.

Change the pulth length of Fukui/Tojimbo to 1.9.

Update the radar parameters of "Nagoya" as follows;

Pulse length	2.5μs
Sensitivity minimum of receiver	-109dBm
Beam width	1.5(H),1.3(V)deg

Change the pulse length of "Murotomisaki" to 2.7μs.

p.7 (Japan-4)

Change the wave length of Matsue/Misakayama to 5.69 cm.

The location of "Fukuoka/Sefuri" is to read 33° 26'N,130° 22'E.

Change the scan mode in observation and display of two radars, Fukuoka/Sefuri and Tanegashima to 1 .

p.8 (Japan-5)

Update the radar parameters of "Okinawa/Itokazu as follows;

Pulse lengh	2.8μs
Sensitivity minimum of receiver	-113dBm
Beam width	1.3(H),1.4(V)deg
MTI Processing	1
Disply	1

Change the horizontal beam width of Ishigakijima to 1.4(H).

p.11 (Malaysia-3)

Add new radar station "Kuching 96413" and its parameters to the list as follows;

Location	01° 29'N,110° 20'E
Antenna elevation	32m
Wave length	10cm
Peak power of transmitter	370kw
Pulse length	2μs
Sensitivity minimum of receiver	-112dBm
Beam width	1.8 deg
Detection range	400km
Scan mode in observation	1
MTI and Doppler processing	2
Display and peration mode & status	1.

p.12 (Republic of Korea)

Present station name 47116 Gwanag Mt. is to read "47116 Kwanaksan. The radar parameters of this station should be updated as follows;

Wavelength	5.6cm
Peak power of transmitter	250kw
Pulse length	2/0.5μs
Sensitivity minimum of receiver	-108dBm
Beam width	1.2 deg
Detection range	480km
Scan mode in observation	2
MTI and Doppler processing	1
Display	1,2.

Page 2-F

p.1-7 Replace all of present pages 2-F,p.1-p.7 to reflect the progress in "Stretched VISSR dissemination Program" with new pages 2-F,p.1-3 as shown in the "APPENDIX" to this Draft Proposal. Present Annex to 2-F remains unchanged.

Note. The term "LR-FAX" is to read "WEFAX" throughout the Manual due to the renaming of the GMS cloud imagery dissemination system as from October 1988.

Appendix 3

Page 3-A (China)

p.2 Change present name of method "ANALOG" to new name "MARKOV-TYPE ANALOG MODEL" and replace present Description of method with new description as shown in the "APPENDIX" to this Proposal. To do this ,add new page 3-A,p.2-2 next to present 3-A,p.2.

Add new method "Two-level Steering Method" with its description of method shown in the "APPENDIX" to this Proposal into new page 3-A,p.2-2,next to MARKOV-TYPE ANALOG MODEL.

p.5 (Hong Kong)

Add new method "ANALOG" with its description of method shown in the "APPENDIX" of this Proposal next to the"Space-mean method".

Add additional page 3-A,p.5-2 after 3-A,p.5 to do this.

p.13 (Republic of Korea)

Add new type of forecast "24-hr forecast" to each of four methods described in this page .

Page3-B

p.5 Delete the subsection 1.3.2,and accordingly,change the number of subsections 1.3.3,1.3.4,1.3.5 and 1.3.6 to new number 1.3.2,1.3.3 ,1.3.4 and 1.3.5 respectively.

p.6 Insert "(one minute mean)" after "sustained wind of the title of Fig.3-5.B.

Delete Fig.3-B.6 ,Table 3-B.1 and Notes in the midst of this page.

p. Change figure number 3-B.7 to 3-B.6.

p.14 Section 2

Change the title of this section as follows;
"2.The application of radar and satellite observation data in tropical cyclone analysis and forecasting".

p.14-16 Section 2.1

p.14-16 Section 2.1
Delete whole section 2.1.

p.16-17 Section 2.2 and 2.3

Change the number of section and subsection as follows:

(present number)	New number
2.2	2.1
2.2.1	2.1.1
2.2.2	2.1.2
2.2.3	2.1.3
2.3	2.2
2.3.1	2.2.1
2.3.2	2.2.2
2.3.2.1	2.2.2.1
2.3.2.2	2.2.2.2

Page 15-19 Delete entire page p.15 and change page numbers 16-19 to 15-18.

Appendix 5

Page 5-A

p.1 (Hong Kong)

Present telephone number(24 hours) 3-7829471 is to read 3-7829474.
Add new telephone number(24 hours) 3-681944 to the list.
Add new telefax number 3-7215034 to the list.

(Japan)

Change the name of Director to "Y.Yamagishi".
Add "(24 hours)" after the Telex METTOK J.
Add new telephone number 03-211-8303(24 hours but excepting 00-09 UTC on weekdays).

(Malaysia)
Amend present name,adress and telephone numbers as folows:

Main Meteorological Office,Kuala Lumpur International Airport	Kuala Lumpur Inter-national Airport , 47200.Subang,Selangor Dahal Ehsan	03 7461441 03-7465990 03-7463961 (24 hours).

Page 5-C

p.1 Replace "Intensified" in the Type of data with "Enhanced".

Delete "TD" in the NN column Of the heading 'SNPH20 RPMM'.

Change the "Heading" of intensified upper-air observation as follows;

(present)	(new)
USJP1 RJTD	USJP01 RJTD
UKJP1 RJTD	UKJP01 RJTD
ULJP1 RJTD	ULJP01 RJTD
UEJP1 RJTD	UEJP01 RJTD
UEK01 RJTD	UEK01 RKSL

Delete "TD" in the ' NN' column of ULPH1 RPMM.

p.2 Replace "Intensified" in the Type of data with "enhanced".

p.2 Change the "heading" of intensified ship observation as follows:

(present)	(new)
SNVX20	SNVB20 SNVD20 SNVE20 SNVX20
SNVX21	SNVB21 SNVD21 SNVE21 SNVX21

Delete headings etc.of "Aircraft Report(RECCO),Peripheral data and Drop-sonde Report" from the table.

Add following new heading to those of Tropical cyclone forecast.
FXKO RKSL(receiving stations) TD=SL,SL=0.

Delete "TD" from the NN column of WDPA1 PGTW .
Add "TD"s to the SL column of WTPA31 PTWG and WTPA32 PTWG.

p.3 Add following new heading to the Warning.
WWJKO RKSL(receiving stations)TD=SL SL=0

Page 5-D Delete followings from TT Data designater in the table.
UR Air craft report(RECCO)
UZ Drop sonde report

Amend the first line of (ii) in the table shown below.

(present)	(new)
1-19 Global	01-19 Global.

Appendix 6

Page 6-B 1.Items of monitoring
Delete "3-hourly" ahead of "buoy observation" in (ii).
Delete "(v) reconnaissance flight observation".

Appendix 7

Page 7-A Change the number of page Appendix 7-A to 7-A,p.1.

Add new page Appendix 7-A,p.2 next to 7-A,p.1.

(a) Level II-b

Delete "reconnaissance flight observation" from the second line of "Kinds of data".

(b)GMS cloud pictures

Data form is to read as follows;
Data form : Microfilm(Detailed specification is given in the

next page(Appendix 7-A,p.2)).

(c) Level III-a
(the last line of "Element and layer)"

" GMT" is to read "UTC".

Annex,p.3
(II) Level III-a data)
All "GMT" is to read "UTC".
Amend "block length etc. " as follows;
(new)
(6) Block length 2640 bytes,
(7) Number of records in one block 10,
(8) Logical record length 264 bytes,

(9)Structure of record
(a)Logical order of records
＊ 44 cnosecutive records are.....
.....entire A-area data........
..... A group of
45 records(one identification record plus 44 data records) is.........
....
＊ The record sequences..........60° N to 20.625° S at 1.875 degree......(44 records).
(b)Type of logical record
....

264 bytes
| IDbbyymm...............b |.....

Annex,p.4 (At the bottom of the page)

264 bytes
| I 1................................... | I 66 | I 66 | I 66 | I 66 |

Annex,p.5

Amend some numerals as follows;
(6-7th line)
(new) Data sequences proceed from 78.75 degree east longitude .....untill 159.375 degree west longitude(66 grid points).
(d)
(new) 264 bytes
| EEbbb.........................|....

Note. The fifth page of Annex to 7-A was missed from all copies distributed to Japan Meteorological Agency,though the manuscript had submitted.

APPENDIX

to the Proposals for the Updating of

TYPHOON COMMITTEE OPERATIONAL MANUAL

METEOROLOGICAL COMPONENT

Appendices

Figures

Tables

Cyclone: Tropical cyclone

Cyclone warning bulletin: A priority message for exchange of tropical cyclone information and advisories.

Cyclonic disturbance: A non-frontal synoptic scale low pressure area originating over tropical waters with organized convection and definite cyclonic wind circulation.

Direction of movement of the tropical cyclone: The direction towards which the centre of the tropical cyclone is moving.

Eye of the tropical cyclone: The clear area inside the circular cloud mass within the wall of convective clouds, the geometric centre of the cyclone.

Gale warning: Meteorological message intended to warn those concerned of the occurrence or expected occurrence of wind speed in the range of 34 to 47 knots, or wind force 8 or 9 in the Beaufort scale.

Gale: Mean surface wind speed of 34 to 47 knots.

Gust: Instantaneous peak value of surface wind speed.

Low pressure area: An area bounded by a closed isobar with minimum pressure inside when the central pressure cannot be accurately assessed and the maximum sustained wind is less than 34 knots. On the weather map, the low pressure area is denoted with the capital L within the innermost isobar without showing the centre position.

Maximum sustained wind: Maximum value of the one minute average wind speed at the surface.

Mean wind speed: Average wind speed.

Delete ~~Reconnaissance aircraft centre fix of the tropical storm: The location of the centre of a tropical cyclone obtained by reconnaissance aircraft penetration.~~

Severe tropical storm: A cyclonic disturbance in which the maximum Delete ~~sustained~~ wind speed is in the range of 48 to 63 knots.

Speed of movement of the cyclone: Speed of movement of the centre of the tropical cyclone.

Storm surge: The difference between the actual sea (tide) level under the influence of a meteorological disturbance (storm tide) and the lvel which would have been reached in the absence of the meteorological disturbance. Storm surge results mainly from the shoreward movement of water under the action of wind stress. A minor contribution is also made by the hydrostatic rise of water resulting from the lowered barometric pressure.

Storm tide: The actual sea level as influenced by a weather disturbance. The storm tide consists of the normal astronomical tide and the storm surge.

Storm warning: Meteorological message intended to warn those concerned of the occurrence or expected occurrence of average wind speeds in the range of 48 to 63 knots, wind force 10 or 11 in the Beaufort scale.

Tropical cyclone: A cyclonic disturbance with average maximum Delete ~~sustained~~ wind speed of 34 knots or more.

Tropical cyclone advisory: A priority message for exchanging information, internationally, on tropical cyclones.

Tropical depression: A cyclonic disturbance in which central position can be identified and the maximum ~~sustained~~ wind speed is less than 34 knots.

Tropical storm: A cyclonic disturbance in which the maximum Delete ~~sustained~~ wind speed is in the range of 34 to 47 knots.

Typhoon: A cyclonic disturbance in which the maximum ~~sustained~~ wind speed is 64 knots or more.

Typhoon warning: Meteorological message intended to warn those concerned of the occurrence or expected occurrence of the mean wind speed of 64 knots or higher, or wind force 12 in the Beaufort scale.

Uncertainty of the centre position: Degree of uncertainty of the centre position of a tropical storm expressed as the radius of the smallest circle within which the centre is located by the analysis.

Visual storm signals: Visual signals displayed at coastal points to warn ships of squally winds, gales and tropical cyclones.

1.4 Units used for regional exchange

(a) The following units/indicators are used for marine purposes:

(i) Distance in nautical miles, the unit (nm) being stated;

(ii) Location (position) by degrees and where possible tenths of degrees of latitude and longitude preferably expressed by words;

(iii) Direction to the nearest sixteen points of the compass or in degree to the nearest ten, given in words;

(iv) Speed (wind speed and direction of movement of tropical cyclones) in knots, the unit (kt) being stated;

CHAPTER 2

OBSERVING SYSTEM AND OBSERVING PROGRAMME

2.1 Networks of synoptic land stations

The surface and upper-air stations in the regional basic synoptic network are those of the Typhoon Committee Members and are included in Weather Reporting Volume A - Observing stations (WMO Publication No.9).

The RSMC and all Typhoon Committee Members should initiate enhanced observation programmes for their stations in the area within 300 km of the centre of a tropical cyclone. All the observations should be made available to the RSMC and all Members. Enhanced observations should include:

(i) surface observations - hourly,
(ii) buoy observations - hourly ,
(iii) radar observations - hourly,
(iv) upper-air observations - 6-hourly.

2.1.1 Surface observations

All surface stations included in the regional basic synoptic network should make surface observations at the four main standard times of observation, i.e., 0000, 0600, 1200 and 1800 UTC, and at the four intermediate standard times of observation, i.e., 0300, 0900, 1500 and 2100 UTC . Any surface station that cannot carry out the full observational programme should give priority to carrying out the observations at the main standard times. Additional surface observations at hourly intervals may be requested by any Member, whenever a typhoon becomes an imminent threat to the Member, from the stations shown in Appendix 2-A.

2.1.2 Upper-air synoptic observatons

All the upper-air stations included in the regional basic synoptic network should carry out radiosonde and radiowind observations at 0000 and 1200 UTC, and radiowind observations at 0600 and 1800 UTC. The radiosonde/radiowind observations carried out at 0000 and 1200 UTC should reach the 30 hPa level for more than 50 per cent of the ascents. The carrying out of the radiowind observations at 0000 and 1200 UTC should receive priority over the radiowind observations at 0600 and 1800 UTC.

Radiowind stations in the areas affected by tropical cyclones should also make radiowind observations at 0600 and 1800 UTC which should aim at reaching the 70 hPa level.

Additional upper-wind observations given in Appendix 2-B will be made as appropriate whenever a tropical cyclone is centred within 500 km of the station. The minimum required is two observations per day, but for a better understanding of the ambient windfield three or even four ascents on some days should be made when possible. All these additional upper-air observations will be distributed among the Typhoon Committee Members.

2.2 Ship and buoy observations

Additional hourly surface observations are made by the Japanese weather ships (call signs of them are: JBOA, JGZK, JDWX , JPVB, JFDG and JCCX) when they are within 1,000 km of the centre of a tropical cyclone with central pressure of less than 990 hPa.

Additional upper-air and radar observations are also made by the ships JBOA (upper-air and radar) ~~and~~, JGZK (radar) and JCCX(upper-air) when they are in the vicinity of a tropical cyclone. A newly-built weather ship JDWX from Japan started upper-air observations from August 1988.

The observation network of the Japanese moored buoy is shown in Appendix 2-C. Data from buoys on air temperature, air pressure, wind, sea-surface temperature (SST), waves and others are collected by the centre at Tokyo via GMS. A new function was installed on the Buoy No.22001 moored in the East China sea to make hourly observation automatically whenever the wind speed there exceeds 35knots and became operational as from June 1988. Surface observations are made by three oil rigs in Malaysia at 2100 or 2200 UTC during weekdays. These observations are collected by the main Meteorological Office at Subang and transmitted regionally over the GTS.

2.3 Radar observations

It is essential that radar observations continue as long as a tropical cyclone remains within the detection range of the radar. All meteorological centres should co-operate to ensure that the radar observations are transmitted through the GTS to the RSMC and all Members. Reports will be coded in the RADOB code (FM 20-VIII).

In case the report is in plain language, the full range of information available at the radar station should be given. The message will therefore include, where available, the confirmation of the determination of the centre, the shape, definition, size and character tendency of the eye, the distance between the end of the outermost band and the centre of the cyclone and the direction and speed of movement with a statement of the interval of time over which the movement was calculated.

A list of the radar stations and a map of the radar network in the Typhoon Committee region are given in Table 2.1 and Figure 2.1, respectively. Information on meteorological radars of the Typhoon Committee Members is shown in Appendices 2-D and 2-E.

2.4 Meteorological Satellite Observations

The current system of providing meteorological satellite information obtained by GMS and related products is operated as follows:

(a) the full disk data will be obtained hourly,
(b) cloud motion wind observation will be performed four times a day for both hemisphere,
(c) the stretched VISSR digital data dissemination for all observations will be made in addition to the WEFAX dissemination.

Detailed information is given in Appendix 2-F.

Remarks GMS-4 is scheduled to be launched in 1989, but the GMS products will remain unchanged.

Fig. 2.1 Radar network in the Typhoon Committee region

Note * : Station number is being proposed.

Table 2.1 List of radar stations in the Typhoon Committee region

Member	Radar Station		
China	58367 Shanghai 59316 Shantou	58760 Dangtou 59981 Xishadao	58941 Fuzhou
Democratic Kampuchea			
Hong Kong	45010 Tate's Cairn		
Japan	47412 Sapporo 47590 Sendai 47639 Fujisan 47636 Nagoya 47792 Hiroshima 47869 Tanegashima 47927 Miyakojima	47418 Kushiro 47582 Akita 47572 Niigata 47773 Osaka 47899 Murotomisaki 47909 Naze 47918 Ishigakijima	47432 Hakodate 47662 Tokyo 47705 Fukui 47791 Matsue 47806 Fukuoka 47937 Okinawa
ao PDR			
alaysia	48601 Penang 48647 Kuala Lumpur 96471 Kota Kinabalu	48602 Butterworth 48657 Kuantan 96413 Kuching	48615 Kota Bharu 48672 Kluang
hilippines	98126 Basco 98334 Baler* 98525 Busuanga*	98231 Aparri 98440 Daet 98558 Guian	98321 Baguio 98447 Virae 98646 Mactan
epublic of orea	47116 ~~Kwanaksan~~	Delete this line.	
hailand	48455 Bangkok 48568 Sonkhla 48569 Hat Yai	48517 Chupon 48456 Donmuang	48356 Sakonnakon 48327 Chiang Mai
iet Nam			

ote*: Station number is being proposed

Delete

Phase I : March 1987 – February 1988
Phase II : March 1988 – May 1988*
Phase III: After May 1988*

* Subject to change. JMA wishes to ask for the opinion of the users.

Main features of the new system may be summarized as follows:

In Phase I, (a) the full disk data will be obtained three-hourly, (b) in principle, the Northern Hemisphere data will be retrieved hourly except for the time of GMS system check-out, etc., and (c) cloud-motion wind observation will be performed for both hemispheres at 0000 and 1200 GMT and for only the Northern Hemisphere at 0600 and 1800 GMT. If necessary, in (b) the hemispheric observation for the Southern Hemisphere instead of the Northern Hemisphere will be carried out.

Delete

In Phase II, the stretched VISSR digital data dissemination for all observations will be started in addition to the FAX dissemination schedule in Phase I. During this period, the operation of GMS for obtaining satellite information will not be changed. Therefore, all the VISSR observations and the HR/LR FAX dissemination schedule will be carried out without any change from Phase I. The overlapping of stretched digital data with HR-FAX dissemination at this stage is placed for the convenience of M-DUS modification for stretched VISSR digital data reception.

Delete

In Phase III, (a) the full disk data will be obtained three-hourly, (b) the Northern Hemisphere data will be retrieved hourly except for the time of GMS check-out, etc., (c) cloud-motion wind observatin will be performed four times a day for both hemispheres, and (d) the HR-FAX will be replaced by the stretched VISSR digital data. If necessary, in (b) the hemispheric observation for the Southern Hemisphere instead of the Northern Hemisphere will be carried out. Detailed information is given in Appendix 2-F.

Delete

Remarks During the period of Phase III, GMS-4 is scheduled to be launched in 1989, but the GMS products will remain unchanged.

SAREP reports (Part A) will be disseminated eight times a day from RSMC to Typhoon Committee Members through the GTS under the heading TPPW20 RJTD when a tropical cyclone is located in the region north of the equator and between 100°E and 140°E. Information on the intensity of the tropical cyclone at 0000, 0600, 1200 and 1800 UTC will be reported under the heading TPPW21 RJTD.

Details of the SAREP code are to be found in the Manual on Codes, Volume 1, FM 85-VI (WMO Publication No. 306).

2.5 Aircraft observations

Reports from aircraft in flight (AIREPs) in Asia and neighbouring areas are collected and exchanged according to the Regional OPMET Bulletin Exchange (ROBEX) scheme. AIREPs are collected by the centres in the Typhoon Committee Members areas and transmitted to the Main Collection Centres at Bangkok, Beijing, Hong Kong, Kuala Lumpur and Tokyo.

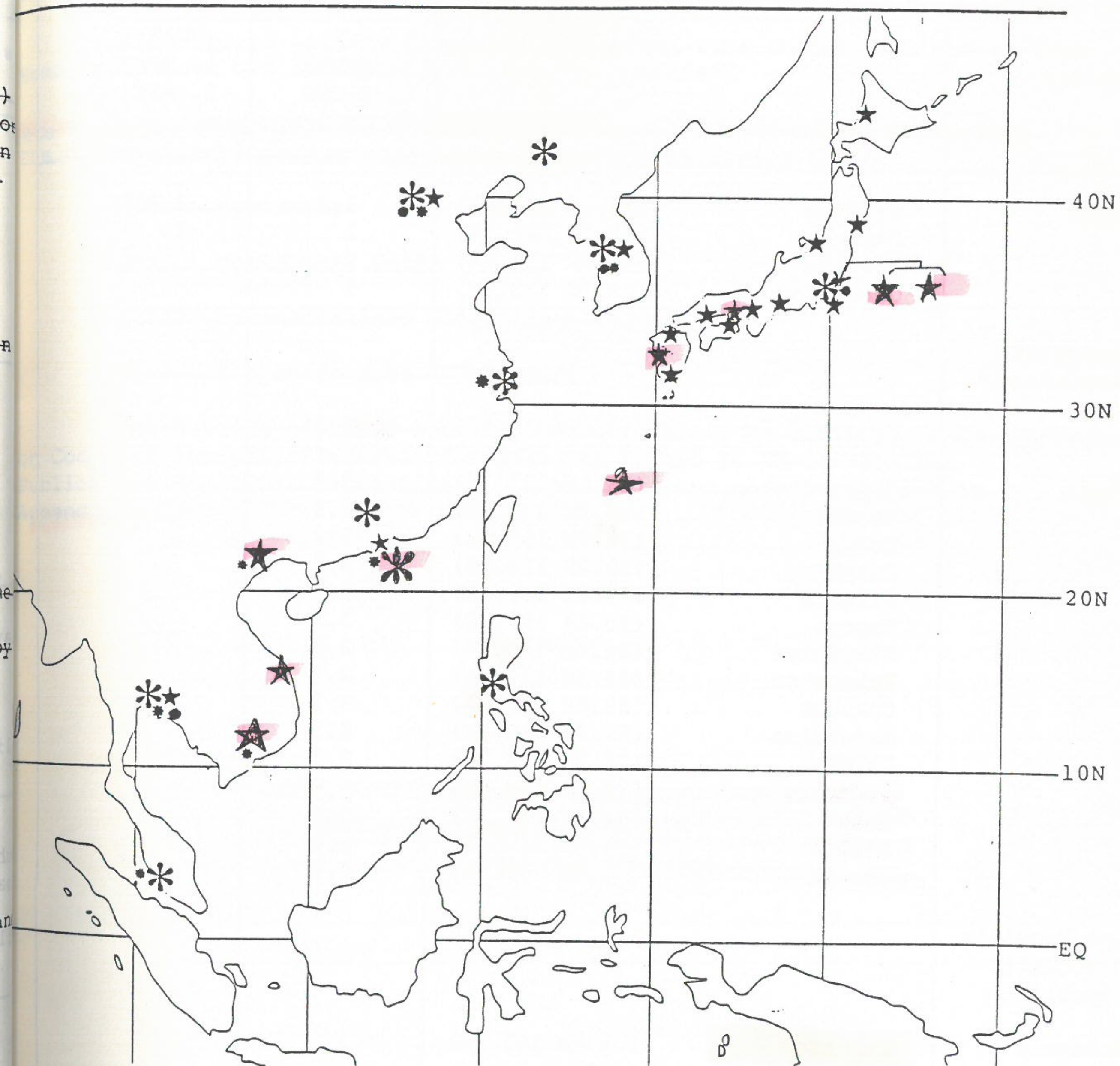


Fig. 2.2 Satellite cloud imagery receiving facilities at meteorological centres in the Typhoon Committee region

✱: M-DUS station ★: S-DUS station

●: NOAA HRPT station ✸: NOAA APT station

Table 2.2: Satellite cloud imagery receiving facilities of the Typhoon Committee Members

Country	Station	GMS 1. M-DUS 2. S-DUS 3. Movie	NOAA 1. HRPT 2. APT
China	Beijing (39.9N 116.4E)	1,2	1,2
	Shanghai (31.1N 121.4E)	1	2
	Shenyan (41.8N 123.6E)	1	
	Guongzhou (23.1N 113.3E)	1	
Democratic Kampuchea			
Hong Kong	Kowloon (22.2N 114.1E)	1,2,3	2
Japan	Sapporo (43.1N 141.3E)	2,3	
	Sendai (38.3N 140.9E)	2,3	
	Tokyo (35.7N 139.8E)	1,2,3	1
	Osaka (34.7N 135.5E)	2,3	
	Niigata (37.9N 139.1E)	2,3	
	Nagoya (35.2N 137.0E)	2,3	
	Hiroshima (34.4N 132.5E)	2,3	
	Takamatsu (34.3N 134.1E)	2,3	
	Fukuoka (33.6N 130.4E)	2,3	
	Kagoshima (31.6N 130.6E)	2,3	
	Okinawa (26.2N 127.7E)	2,3	
	Nagasaki (32.7N 129.9E)	2,3	
	Kobe (34.7N 135.2E)	2,3	
	Narita (35.8N 140.4E)	2,3	
	Haneda (35.6N 139.8E)	2,3	
Lao People's Democratic Republic			
Malaysia	Petaling Jaya (3.1N 101.7E)	1	2
Philippines	Quezon City (14.7N 121.0e)	1	
Republic of Korea	Seoul (37.5N 127.0E)	1,2	1,2
Thailand	Bangkok (13.7N 100.6E)	1,2	1,2
Viet Nam	Hanoi (21.0N 105.5E)	2,3	2
	Ho Chi Minh City (10.5N 106.4E)	2,3	2
	Da Nang (16.0N 108.2E)	2,3	

AIREPs in the north-east Pacific area are also collected by the centres at Honolulu, Washington, etc., and relayed to Tokyo.

ASDAR (Aircraft to Satellite Data Relay) reports are collected by the centre at Tokyo via GMS.

All reports will be disseminated in real-time to the RSMC and to other Members through GTS and AFTN circuits.

lete ~~The reconnaissance flight observations are made by the JTWC, Guam. The observational data are classified into the following types:~~

~~(i) eye data;~~

~~(ii) peripheral data;~~

~~(iii) reconnaissance flight data (RECCO);~~

~~(iv) dropsonde data (TEMP DROP)~~

~~The details of RECCO and TEMP DROP codes are to be found in the Manual on Codes, Volume II, II-4-F-1 II-4-F-12 and Volume I, FM 37-VII (WMO Publication No. 306), respectively. Other relevant codes are shown in Appendix 2-G.~~

CHAPTER 3

TROPICAL CYCLONE ANALYSIS AND FORECAST

3.1 Analysis at RSMC

The RSMC should produce analyses of various meteorological parameters in chart form and/or in grid point value depending on the facilities of NMCs to process these products. These analyses should include pressure distribution at the sea level and temperature, geo-potential height, humidity and wind at selected pressure levels.

The streamline analysis is indispensable over the tropical region for forecasting tropical cyclones. The RSMC should produce streamline analyses of the upper and lower atmospheric levels utilizing cloud motion wind, aircraft reports, as well as upper-air observations. A list of output products is shown in Table 3.1(a).

The RSMC should produce additional analyses of the tropical cyclone when it is in the region north of the equator and between 100°E and 180°E, based on the enhanced observations, additional satellite imagerie~~s and aircraft~~ Delete ~~reconnaissance reports.~~ Such analyses should be disseminated in the form of additional bulletins consisting of information on:

(i) position of the tropical cyclone;

(ii) direction and speed of movement;

(iii) central pressure;

(iv) maximum wind and wind distribution.

Various analyses based on GMS data other than cloud imagery itself should be produced by the RSMC. These analyses include five-day mean cloud amount and that of long-wave radiation. In addition to these, analysis of sea-surface temperature combining satellite data and in-situ measurements should be prepared every five days. These analyses are useful for the better understanding of the tropical atmosphere and medium-range assessment of forecasting tropical cyclones.

Table 3.1: Output products transmitted by RSMC Tokyo for regional purposes

(a) Analysis

Description of product	Observation time (UTC)	Form of transmission	Area
Sea level pressure	00,12	C,G	A
500 hPa height	00,12	C,G	A
850 hPa wind vector	00,12	G	A
850 hPa streamline	00,12	C	A
850 hPa isotach	00,12	C	A
850 hPa vorticity*	00,12	C	A
850 hPa divergence*	00,12	C	A
200 hPa wind vector	00,12	G	A
200 hPa streamline	00,12	C	A
200 hPa isotach	00,12	C	A
200 hPa vorticity*	00,12	C	A
200 hPa divergence*	00,12	C	A
850 hPa temperature	00,12	C,G	A
850 hPa specific humidity	00,12	G	A
850 hPa dew point depression	00,12	C	A
Sea surface temperature	5 days	C,G	A

(b) Forecast

Description of product time (hour)	Forecast transmission	Form of	Area
Sea level pressure	24,48	C,G	A,V
500 hPa height	24,48	C,G	A,V
850 hPa wind vector	24,48	G	A,V
850 hPa streamline	24,48	C	A,V
850 hPa isotach	24,48	C	A,V
200 hPa wind vector	24,48	G	A,V
200 hPa streamline	24,48	C	A,V
200 hPa isotach	24,48	C	A,V
850 hPa temperature*	24,48	C,G	A,V
Rainfall amount	24,48	C	V

Form of transmission:
C: chart form
G: grid point value

Area:
A: 80°E - 160°W, 20°S - 60°N
V: Area around the typhoon eye at the initial time. The size of the area is about 4,000 km x 4,000 km.

* These may be omitted due to limitation of the capacity of the telecommunication line.

Some of them may be superimposed on one chart.

3.2 Forecast at RSMC

The RSMC should prepare relevant numerical weather prediction products based on a global model and a regional model. An outline of the models is depicted in Table 3.2. These products should be made available to Members of the Typhoon Committee in real-time. These products should include the following:

(i) forecast products of a high resolution (180km) synoptic scale NWP model covering the globe for the prediction of the change of large-scale atmospheric circulation patterns in the region;

(ii) forecast products of Typhoon model of 50km horizontal resolution f predicting the 24- and 48-hour movements of a tropical cyclone. In the case wh Delete than one cyclone exists over the area of concern, the NWP model is applied to the tropical cyclone which is expected to affect populated areas. A list of output products is shown in Table 3.1(b).

The RSMC should also prepare several statistical models for predicting the track of the tropical cyclone and apply the Dvorak method for the prediction of the intensity change of the tropical cyclone. Other relevant synoptic methods should also be applied for predicting the tropical cyclone.

The RSMC should summarize in a consolidated form all available information and prepare the final forecasts of the tropical cyclone when it exists in the region north of the equator and between 100°E and 180°E. These forecasts should include:

(i) 24- and 48-hour forecast position;
(ii) forecast intensity and wind distribution;
(iii) prognostic reasoning
(iv) tendency assessment if possible.

3.3 Operational analysis and forecast at centres of Typhoon Committee Members

The national meteorological services of Typhoon Committee Members are using various kinds of operational forecast methods for typhoon track. The ones currently used are shown in Appendix 3-A.

The final responsibility for analysis and forecasting development and movement of tropical cyclones in the region will be with the national meteorological services of each of the Members. In order to promote uniformity in the adoption of proven techniques, a sample of such techniques currently used by Members is given in Appendix 3-B.

Table 3.2: Outline of RSMC Tokyo prediction models

(a) Global prediction model

Basic equation	Primitive equation	
Vertical resolution	16 level σ-co-ordinate	
	0.015 (sigma 16)	0.450 (sigma 8)
	0.045	0.565
	0.075	0.690
	0.110	0.800
	0.160	0.890
	0.210	0.950
	0.280	0.980
	0.360 (sigma 9)	0.995 (sigma 1)
Integration domain	Globe	
Horizontal representation	Spectral, with triangular truncation at wave number 63.	
Grid	96 Gaussian latitudes and 192 longitudes	
Horizontal diffusion	$K\nabla^4$ (linear)	
Time integration	Semi-implicit (Δt depends on maximum V, Δt = 14 min. for Vmax = 100 m/s) with time filter (ν = 0.05)	
Orography	Included. Small scale smoothed	
Physical parameterization	(i) Surface exchanges: Fluxes of momentum, heat and moisture are included both for land and sea areas (ii) Convection: Kuo's scheme (iii) Latent heating: Condensation of water vapour (iv) Radiation: Long-wave cooling and solar heating with effects of cloud. Diurnal variation included	
Earth surface	Daily analysed sea-surface temperature. Monthly averaged albedo, soil moisture, ice cover specified geographically. Soil temperature predicted.	

(b) Typhoon prediction model

Basic equation	Primitive equation
Vertical resolution	8 level σ-co-ordinate
0.050 (sigma 8) 0.125 0.200 0.325 0.500 0.725 0.905 0.980 (sigma 1)	
Integration domain	Area around the typhoon eye at the initial time ,4000km x 4000km
Horizontal representation	Spectral,with circular truncation at wave number 51.
Grid	81 longitudes and 81 latitudes in Mercator projection. The grid interval is about 50km
Horizontal diffusion	$K\nabla^4$ (linear)
Time integration	Semi-implicit (Δt depends on maximum V, Δt = 5 min. for Vmax = 100 m/s) with time filter (ν = 0.05)
Orography	Included. Small-scale smoothed
Physical parameterization	(i) Surface exchanges: Fluxes of momentum, heat and moisture are included for sea area. Flux of momentum is included for land (ii) Convection: Kuo's scheme (iii) Latent heating: Condensation of water vapour but no evaporation (iv) Radiation: Not included
Earth surface	Daily analysed sea-surface temperature
Lateral boundary	Value from the global prediction model

CHAPTER 4

TROPICAL CYCLONE WARNINGS AND ADVISORIES

4.1 General

The responsibility for warning the human settlements on land which are threatened by a tropical cyclone rests in all cases with the National Meteorological Services (NMS). These national responsibilities are not subject to regional agreement. Therefore, only the cyclone warning systems intended for international users and exchanges among the Typhoon Committee Members are described in this chapter.

4.2 Classification of cyclonic disturbances

Classifications of cyclonic disturbances for the typhoon region for the exchange of messages among the Typhoon Committee Members are given below:

1.	Low pressure area	(L)	Central position cannot be accurately assessed.
2.	Tropical depression	(TD)	Central position can be identified, but the maximum ~~su~~ Delete wind speed is less than 34 kt.
3.	Tropical storm	(TS)	Maximum ~~sustained~~ Delete wind speed is between 34 and 47 kt.
4.	Severe tropical storm	(STS)	Maximum ~~sustained~~ Delete wind speed is between 48 and 63 kt.
5.	Typhoon	(TY)	Maximum ~~sustained~~ Delete wind speed is 64 kt or more.

4.3 Tropical cyclone advisories

The RSMC should disseminate six to three-hourly analyses and forecasts of tropical cyclones in the form of bulletins (tropical cyclone advisories - see examples below):

(i) analysis of the central position, intensity and wind distribution;
(ii) 24- and 48-hour forecasts of the central position (72-hour at a later date);
(iii) forecasts of intensity and wind distribution;
(iv) prognostic reasoning if applicable;
(v) tendency assessment if possible.

The issuance times of the advisories will be decided later.

Examples of Advisories

Advisory for analysis

REGION II/V RSMC ADVISORIES 000000Z DEC 21

(EX. 1)

ADVISORY FOR TYPHOON 8526 HOPE ANALYSIS NR 30

TYPHOON 8526 HOPE 965 HPA AT 000000Z DEC 21

AT ONE THREE POINT SEVEN NORTH ONE TWO EIGHT POINT EIGHT EAST SEA

EAST OF PHILIPPINES

MOVING WEST 08 KNOTS WITH DECELERATION

Delete

POSITION GOOD BASED MAINLY ON ~~RECON AND~~ SAT DATA

MAX WINDS 70 KNOTS WITH GUST 100 KNOTS NEAR CENTRE

RADIUS OF OVER 50 KNOT WINDS 150 MILES IN NORTH WEST SEMI-CIRCLE AND

120 MILES ELSEWHERE

RADIUS OF OVER 30 KNOT WINDS 400 MILES IN NORTH WEST SEMI-CIRCLE AND

200 MILES ELSEWHERE

Advisory for forecasts

REGION II/V RSMC ADVISORIES 000000Z DEC 21

(EX. 2)

ADVISORY FOR TYPHOON 8526 HOPE FORECAST No. 25

24-HOUR FORECAST (FOR 220000Z)

POSITION AT 15.0N6 126.0E9 WITH UNCERTAINTY OF 100 MILES RADIUS

CENTRAL PRESSURE 970 HPA

MAX WINDS 65 KT WITH GUST 90 KT

RADIUS OF OVER 50 KT WINDS 100 MILES IN NORTH SEMI-CIRCLE AND 80

MILES ELSEWHERE

RADIUS OF OVER 30 KT WINDS 300 MILES IN NORTH SEMI-CIRCLE AND 200

MILES ELSEWHERE

48-HOUR EXPECTED OUTLOOK (FOR 230000Z)

POSITION AT 19.0N0 128.0E1 WITH UNCERTAINTY OF 250 MILES RADIUS

CENTRAL PRESSURE 975 HPA

MAX WINDS 60 KT WITH GUST 80 KT

Advisory for prognostic reasoning

REGION II/V RSMC ADVISORIES 000000Z DEC 21

(EX. 3)

ADVISORY FOR TYPHOON 8526 HOPE PROGNOSTIC REASONING No. 12

PROGNOSTIC REASONING FOR ANALYSIS AND FORECAST AT 000000Z DEC 21

A. SAT CLOUD IMAGERY OF TY 8526 HOPE SHOW THE EYE DISAPPEARED AND SIGNIFICANT CIRRUS OUT-FLOW TO THE NORTHEAST. THESE DATA INDICATE THAT THE STORM HAS REACHED PEAK INTENSITY AND SUGGEST RECURVATURE. ~~RECON DATA INDICATE THAT TY 8526 HOPE HAS REACHED PEAK INTENSITY. SAT DATA INDICATE THAT THE EYE DISAPPEARED AND SIGNIFICANT CIRRUS OUTFLOW IS SEEN TO THE NORTH EAST SUGGESTING RECURVATURE.~~

B. THE FORECAST TRACK IS BASED ON PERSISTENCE FOR THE FIRST 24 HOURS AND DYNAMIC AIDS AND SYNOPTIC REASONING FOR 24 TO 48 HOURS. DYNAMIC MODELS ARE PREDICTING RECURVATURE IN THE 48 HOURS WITH A TROUGH REACHING THE EAST COAST OF CHINA. SYNOPTICALLY, THIS PREDICTION IS MOST LIKELY.

C. SAT ~~RECON~~ DATA INDICATE THAT TY 8526 HAS STARTED TO WEAKEN. THIS TREND IS EXPECTED TO CONTINUE DUE TO RECURVATURE. THE NORTH EAST MONSOON CONTINUES TO ENHANCE THE WIND FIELD OF NORTH SEMI-CIRCLE.

D. ADDITIONAL COMMENTS. IT IS UNLIKELY FOR TY 8526 TO MISS THE TROUGH AND MOVE ACROSS THE PHILIPPINES BECAUSE OF THE DEEPENING OF THE TROUGH IN CHINA.

Table 5.1: Present operational status of the regional meteorological telecommunication network for the Typhoon Committee region

1. Main Telecommunication Network	Present Operational Status
Beijing - Tokyo	Satellite, V.29, 9,600 bit/s 4,800 bit/s (data) X.25 LAPB + 4,800 bit/s (NCDF)
2. Main regional circuit	
Tokyo - Bangkok	Satellite, 200 bit/s
3. Regional circuits	
Bangkok - Hanoi	(HF radio broadcast)
Bangkok - Hong Kong	Satellite, 200 bit/s
Bangkok - Phnom Penh	(HF radio broadcast)
Bangkok - Vientiane	(HF radio broadcast)
Beijing - Hanoi	-
Beijing - Hong Kong	Cable, 75 bauds
Tokyo - Hong Kong	Cable/satellite, 200 bit/s
Tokyo - Seoul	Cable, V.29 9600 bit/s,4800 bit/s(data) X.25 Level 3 + 4800bit/s(NCDF)
4. Inter-regional circuits	
Bangkok - Kuala Lumpur	Microwave, 75 bauds
Tokyo - Manila	Cable, 200 bit/s
5. RTH radio broadcast	
Bangkok	1 RTT, 1 FAX
Beijing	1 RTT, 1 FAX
Tokyo	1 RTT, 2 FAX
6. Satellite broadcast	
Operated by Japan:	
GMS-III (140°E)	Operational satellite image distribution

List of acronyms used in the TC operational manual - Meteorological Component -

AFTN	Aeronautical Fixed Telecommunication Network
AIREP	Aircraft En-route Report
APT	Automatic Picture Transmission
ASDAR	Aircraft to Satellite Data Relay
DPSK	Differential Phase-Shift Keying
EIR	Enhanced Infrared
ESCAP	Economic and Social Commission for Asia and the Pacific
FAX	Facsimile
GMS	Geostationary Meteorological Satellite
~~GMT~~ Delete	~~Greenwich Mean Time~~
GOES	Geostationary Operational Environmental Satellite
GTS	Global Telecommunication System
~~HR/LR~~ Delete	~~High Resolution/ Low Resolution Facsimile~~
HRPT	High Resolution Picture Transmission
IR	Infrared
JMA	Japan Meteorological Agency
JTWC	Joint Typhoon Warning Centre
LTP	Long Term Plan
MANAM	Manual Amendment
M-DUS	Medium Scale Data Utilization Station
MOS	Model Output Statistics
MSL	Mean Sea Level
MTI	Moving Target Indicator
NESDIS	National Environmental Satellite,Data and Information Service
NMC	National Meteorological Centre
NMS	National Meteorological Service
NOAA	National Oceanic and Atmospheric Administration
NWP	Numerical Weather Prediction
OPMET	Operational Meteorological Data
RADOB	Report of ground radar weather observation
~~RECCO~~ Delete	~~Report from a meteorological reconnaissance flight~~
RMC	Regional Meteorological Centre
ROBEX	Regional OPMET Bulletin Exchange
RSMC	Regional/Specialized Meteorological Centre
RTH	Regional Telecommunication Hub
S-DUS	Small Scale Data Utilization Station
S.VISSR	Stretched VISSR
SAREP	Report of synoptic interpretation of cloud data obtained by a meteorological satellite
SST	Sea Surface Temperature
TC	Typhoon Committee
TCP	Tropical Cyclone Programme
TEMP	Upper-level pressure, temperature, humidity and wind report from a land station

Delete ~~TEMP DROP~~ ~~Upper-level pressure, temperature, humidity and wind report from a sonde released by carrier balloons or aircraft~~

TOPEX	Typhoon Operational Experiment
UNDP	United Nations Development Programme
VIS	Visible
VISSR	Visible and Infrared Spin Scan Radiometer
WMC	World Meteorological Centre
WMO	World Meteorological Organization
WWW	World Weather Watch

List of stations from which enhanced surface observations are available#

The following stations will make hourly surface observations when they are within 300 km of the centre of a tropical cyclone:

China

(54): 662, 753, 776, 836, 843, 857, 863, 938, 945
(58): 040, 150, 238, 251, 265, 345, 367, 445, 457, 472, 477, 556, 569, 646, 653, 659, 666, 754, 834, 847, 853, 911, 921, 927, 944
(59): 096, 117, 134, 278, 287, 293, 316, 431, 456, 493, 501, 632, 644, 658, 663, 673, 758, 838, 845, 855, 948, 981

Democratic Kampuchea

Hong Kong (45)

005

Japan (47) Delete following staions: 451,599,603,748

401, 402, 404, 405, 406, 407, 409, 411, 412, 413, 417, 418,
420, 421, 423, 424, 426, 427, 428, 430, 431, 433, 435, 440,
~~451,~~ 512, 520, 570, 574, 575, 576, 577, 581, 582, 584, 585,
587, 588, 590, 592, 593, 595, 597, 598, ~~599,~~ 600, 601, 602,
~~603,~~ 604, 605, 606, 607, 610, 612, 615, 616, 617, 618, 620,
622, 624, 626, 629, 631, 632, 636, 637, 638, 640, 641, 648,
649, 651, 653, 654, 655, 656, 657, 662, 663, 665, 666, 668,
670, 672, 674, 675, 677, 678, 682, 684, 690, 740, 741, 742,
744, 746, 747, ~~748,~~ 750, 751, 754, 755, 756, 759, 761, 762,
765, 766, 767, 768, 769, 770, 772, 776, 777, 778, 780, 784,
800, 807, 809, 812, 813, 814, 815, 817, 818, 819, 821, 822,
823, 824, 827, 829, 830, 831, 835, 836, 837, 838, 842, 843,
917, 918, 927, 929, 936, 942, 945, 971, ⟸ Add following stations: 805, 887, 890, 891, 892, 893, 894, 895, 897, 898, 899, 909, 912 and 991.

Lao PDR

\# See, Final Report of Regional Association II, eighth session, paragraph 4.2.2.3.

Malaysia

(48): 601, 615, 620, 647, 657, 665
(96): 413, 421, 441, 449, 471, 491

Philippines (98)

132, 133, 135, 222, 223, 232, 233, 324, 325, 328, 329, 333,
336, 425, 427, 428, 429, 430, 431, 432, 434, 435, 437, 440,
444, 446, 526, 531, 536, 538, 543, 546, 548, 550, 553, 558,
602*, 618, 630, 637, 642, 644, 646, 648, 712, 741, 745, 746*,
751, 752, 753, 755, 836, 851

* Index No.	Name	Lat.	Long.	Elev.
602	Pag-asa	11 10'N	114 17'E	3 MTS
746	Cotabato	7 10'N	124 13'E	62 MTS

(These stations are not included in Weather Reporting Volume A, see Note below.)

Republic of Korea (47) Add following stations: 095 and 185.

090, 101, 105, 108, 112, 114, 115, 119, 129, 130, 131, 133,
135, 136, 138, 140, 143, 146, 152, 155, 156, 159, 162, 165,
168, 170, 184, 189, 192

Thailand (48)

300, 303, 327, 328, 331, 353, 354, 356, 375, 378, 379, 381,
400, 407, 431, 432, 456, 462, 465, 477, 480, 500, 517, 532,
551, 565, 567, 568, 569, 583

Viet Nam (48)

820, 826, 839, 845, 848, 855, 870, 877, 900, 914, 917, 918,
920

Note: Name, latitude, longitude and elevation of these stations are included in Weather Reporting Volume A - Observing Stations (WMO Publication No. 9) except for the stations marked *.

List of stations from which enhanced upper-air observations are available

The following stations will make six-hourly upper-air observations when they are within 500 km of the centre of a tropical cyclone:

China

(54): 662, 857
(58): 150, 367, 666, 847
(59): 287, 316, 758, 981

Democratic Kampuchea

Hong Kong (45)

004

Japan (47) Delete following stations: 580, 681 and 881.

401, 412, 420, ~~580,~~ 582, 590, 600, 646, 678, ~~681,~~ 744, 778,
807, 827, ~~881,~~ 909, 918, 936, 945, 971,* 991*
* 06 UTC only.

Lao PDR

Malaysia

(48): 601, 615, 647, 657
(96): 413, 441, 471, 481

Philippines (98)

223, 444*, 618*, 646, 753*, 836

* These stations observe upper winds only.

Delete ~~At present, all upper-air stations have temporarily stopped operations due to non-availability of consumables and spare-parts. They will resume operation sometime in the first quarter of 1987, when the headed supplies become available.~~

Republic of Korea (47)

122, 138, 158, 185

Thailand (48)

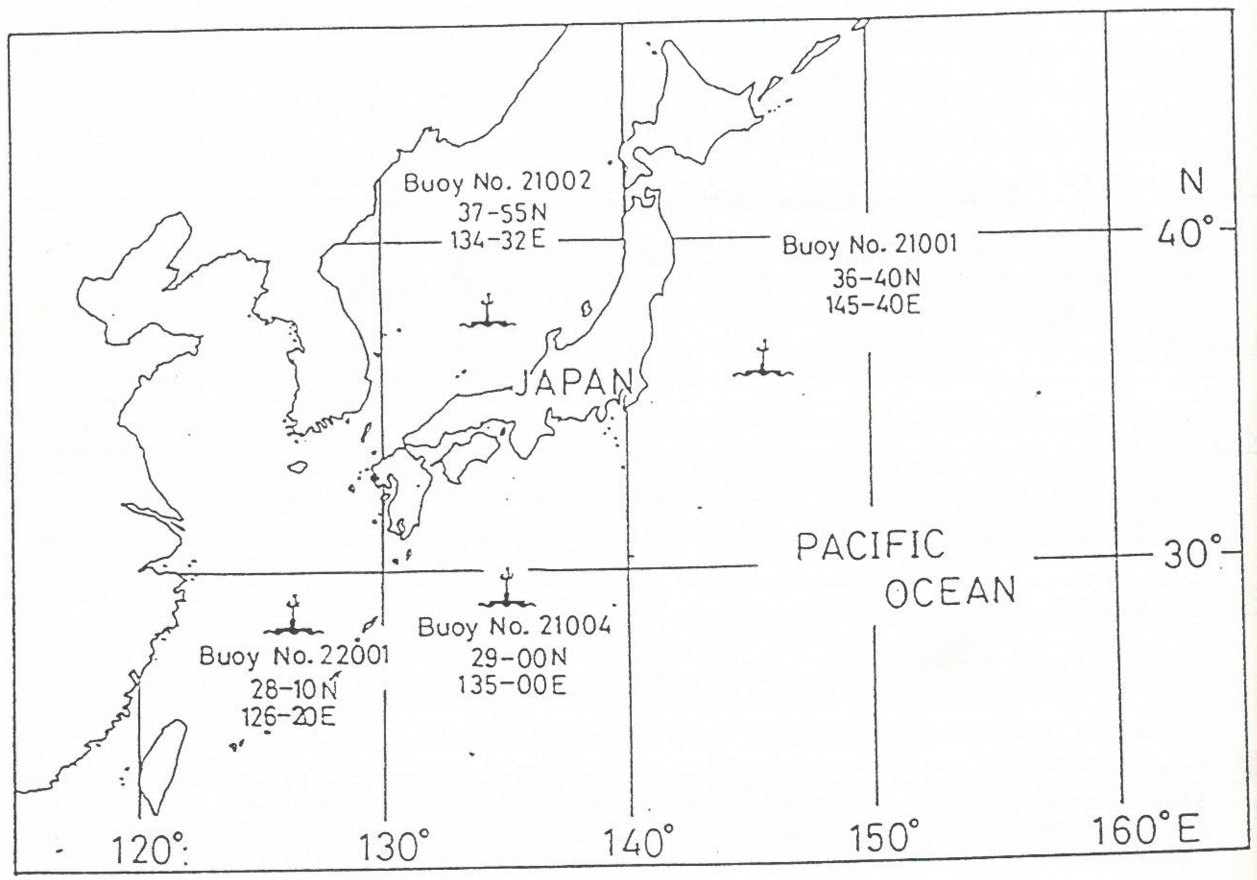
327, 407, 455, 480, 500, 551, 568

Viet Nam (48)

820, 855, 900

Note: Name, latitude, longitude and elevation of these stations are included in Weather Reporting Volume A - Observing Stations (WMO Publication No. 9).

Observation network of the Japanese moored buoys



Buoy No. is defined as WMO identifier.

List of stations from which enhanced radar observations are available

The following stations will make hourly radar observations when the centre of a tropical cyclone is within their respective radar range:

China

(58): 367, 760, 941
(59): 316, 981

Democratic Kampuchea

Hong Kong (45)

010

Japan (47)

412, 418, 432, 572, 582, 590, 636, 639, 662, 705, 773, 791, 792, 806, 869, 899, 909, 918, 927, 937

Lao PDR

Malaysia

(48): 601, 602, 615, 647, 657, 672
(96): 471 , 413

Philippines (98)

126, 231, 321, 334*, 440, 447, 525*, 558, 646

* Index number of the station is being proposed to WMO.

Republic of Korea (47)

116

Thailand (48)

327, 356, 455, 456, 517, 568, 569

Viet Nam

At present, only a 3 cm radar observation is made.

Note: Name, latitude, longitude and elevation of these stations are included in Weather Reporting Volume A - Observing Stations (WMO Publication No. 9) except for the stations marked *.

Technical specification of radars of Typhoon Committee Members

Name of Member China-1

Name of the station	Shanghai		Dongtou		Fuzhou	
Index number	58367		58760		58941	
Location of the station	31° 02′ 121° 57′	N E	27° 50′ 121° 08′	N E	25° 59′ 119° 32′	N E
Antenna elevation	50	m	228.5	m	652.5	m
Wave length	10.6	cm	11.43	cm	10.6	cm
Peak power of transmitter	500	KW	2000	KW	500	KW
Pulse length	3	μs	3	μs	3	μs
Sensitivity minimum of receiver	-110	dBm	-100	dBm	-110	dBm
Beam width (Width of over -3dB antenna gain of maximum)	2.0	deg	1.7(E) 2.4(H)	deg	2.0	deg
Detection range	600	km	500	km	600	km
Scan mode in observation * 1.Constant altitude 2.Cappi 3.Manually controlled altitude	2		1		1	
Data processing in observation *						
MTI processing 1.yes 2.no	2		2		2	
Doppler processing 1.yes 2.no	2		2		2	
Display 1.digital 2.analog	1		2		2	
Operation mode * (when a typhoon is within the detection range) 1.hourly 2.3-hourly 3.other(please specfy)	1		1		1	
Status * 1.operational 2.not operational (for research or other please specify)	1		1		1	

* Note:Select an appropriate figure

Name of Member China-2

Name of the station	Shantou		Xishadao			
Index number	59316		59981			
Location of the station	23° 25′ 116° 38′	N E	16° 50′ 112° 20′	N E	° °	N E
Antenna elevation	262.6	m	8.5	m		m
Wave length	10.6	cm	10.6	cm		cm
Peak power of transmitter	500	KW	500	KW		KW
Pulse length	3	μs	3	μs		μs
Sensitivity minimum of receiver	-110	dBm	-110	dBm		dBm
Beam width (Width of over -3dB antenna gain of maximum)	2.0	deg	2.0	deg		deg
Detection range	600	km	600	km		km
Scan mode in observation * 1.Constant altitude 2.Cappi 3.Manually controlled altitude	1		1			
Data processing in observation *						
MTI processing 1.yes 2.no	2		2			
Doppler processing 1.yes 2.no	2		2			
Display 1.digital 2.analog	2		2			
Operation mode * (when a typhoon is within the detection range) 1.hourly 2.3-hourly 3.other(please specfy)	1		1			
Status * 1.operational 2.not operational (for research or other please specify)	1		1			

* Note:Select an appropriate figure

Name of Member Hong Kong

Name of the station	Tate's Cairn		
Index number	45010		
Location of the station	22° 22′ N 114° 13′ E	° N ° E	° N ° E
Antenna elevation	587 m	m	m
Wave length	10.7 cm	cm	cm
Peak power of transmitter	650 KW	KW	KW
Pulse length	2.0 μs	μs	μs
Sensitivity minimum of receiver	<-109 dBm	dBm	dBm
Beam width (Width of over -3dB antenna gain of maximum)	<2 deg	deg	deg
Detection range	512 km	km	km
Scan mode in observation * 1. Constant altitude 2. Cappi 3. Manually controlled altitude	2		
Data processing in observation *			
MTI processing 1. yes 2. no	2		
Doppler processing 1. yes 2. no	2		
Display 1. digital 2. analog	1		
Operation mode * (when a typhoon is within the detection range) 1. hourly 2. 3-hourly 3. other(please specfy)	3		
Status * 1. operational 2. not operational (for research or other please specify)	1		

* Note: Select an appropriate figure

Name of Member Japan-1

Name of the station	Sapporo	Kushiro	Hakodate/ Hakodatevama	Sendai
Index number	47412	47418	47432	47590
Location of the station	43° 03′ N 141° 20′ E	42° 59′ N 144° 24′ E	41° 45′ N 140° 43′ E	38° 16′ N 140° 54′ E
Antenna elevation	72.1 m	71.8 m	314.8 m	99.4 m
Wave length	5.66 cm	5.66 cm	5.66 cm	5.66 cm
Peak power of transmitter	250 KW	250 KW	250 KW	250 KW
Pulse length	2.0 μs	2.6 μs	1.9 μs	2.0 μs
Sensitivity minimum of receiver	-106 dBm	-108 dBm	-105 dBm	-105 dBm
Beam width (Width of over -3dB antenna gain of maximum)	1.5 (H) 1.3 (V) deg	1.4 (H) 1.4 (V) deg	1.4 (H) 1.4 (V) deg	1.4 (H) 1.4 (V) deg
Detection range	300 km	300 km	300 km	300 km
Scan mode in observation * 1. Constant altitude 2. Cappi 3. Manually controlled altitude	1	3	3	1
Data processing in observation *				
MTI processing 1. yes 2. no	1	1	2	1
Doppler processing 1. yes 2. no	2	2	2	2
Display 1. digital 2. analog	1	2	2	1
Operation mode * (when a typhoon is within the detection range) 1. hourly 2. 3-hourly 3. other (please specify)	1	1	1	1
Status * 1. operational 2. not operational (for research of other please specify)	1	1	1	1

* Note: Select an appropriate figure

Name of Member Japan-2

Name of the station	Akita	Tokyo	Fujisan	Niigata/ Yahikoyama
Index number	47582	47662	47639	47572
Location of the station	39° 43′ N 140° 06′ E	35° 41′ N 139° 46′ E	35° 21′ N 138° 44′ E	37° 43′ N 138° 49′ E
Antenna elevation	34.4 m	85.3 m	3785.5 m	646.5 m
Wave length	5.66 cm	5.66 cm	10.42 cm	5.66 cm
Peak power of transmitter	250 KW	250 KW	1500 KW	250 KW
Pulse length	2.6 μs	2.0 μs	3.3 μs	2.0 μs
Sensitivity minimum of receiver	-108 dBm	-106 dBm	-113 dBm	-106 dBm
Beam width (Width of over -3dB antenna gain of maximum)	1.4 (H) deg 1.4 (V)	1.3 (H) deg 1.5 (V)	1.6 (H) deg 1.7 (V)	1.4 (H) deg 1.4 (V)
Detection range	300 km	300 km	600 km	300 km
Scan mode in observation * 1. Constant altitude 2. Cappi 3. Manually controlled altitude	1	3	1	1
Data processing in observation *				
MTI processing 1. yes 2. no	1	2	1	1
Doppler processing 1. yes 2. no	2	2	2	2
Display 1. digital 2. analog	1	2	1	1
Operation mode * (when a typhoon is within the detection range) 1. hourly 2. 3-hourly 3. other (please specify)	1	1	1	1
Status * 1. operational 2. not operational (for research of other please specify)	1	1	1	1

* Note:Select an appropriate figure

Name of Member Japan-3

Name of the station	Fukui/ Tojimbo	Nagoya	Osaka/ Takayasuyama	Matsue/ Misakayama
Index number	47705	47636	47773	47791
Location of the station	36° 14′ N 136° 09′ E	35° 10′ N 136° 58′ E	34° 37′ N 135° 40′ E	35° 32′ N 133° 06′ E
Antenna elevation	107.0 m	73.7 m	497.6 m	554.2 m
Wave length	5.66 cm	5.66 cm	5.66 cm	5.69 cm
Peak power of transmitter	250 KW	250 KW	250 KW	250 KW
Pulse length	1.9 μs	2.5 μs	2.0 μs	2.0 μs
Sensitivity minimum of receiver	-106 dBm	-109 dBm	-106 dBm	-106 dBm
Beam width (Width of over -3dB antenna gain of maximum)	1.3 (H) deg 1.4 (V)	1.5 (H) deg 1.3 (V)	1.5 (H) deg 1.5 (V)	1.5 (H) deg 1.5 (V)
Detection range	300 km	300 km	300 km	300 km
Scan mode in observation * 1. Constant altitude 2. Cappi 3. Manually controlled altitude	1	1	1	1
Data processing in observation *				
MTI processing 1. yes 2. no	1	1	1	1
Doppler processing 1. yes 2. no	2	2	2	2
Display 1. digital 2. analog	1	1	1	1
Operation mode * (when a typhoon is within the detection range) 1. hourly 2. 3-hourly 3. other (please specify)	1	1	1	1
Status * 1. operational 2. not operational (for research of other please specify)	1	1	1	1

* Note:Select an appropriate figure

Name of Member Japan-4

Name of the station	Hiroshima/ Haigamine	Murotomisaki	Fukuoka/ Sefurisan	Tanegashima/ Nakatane
Index number	47792	47899	47806	47869
Location of the station	34° 16′ N 132° 36′ E	33° 15′ N 134° 11′ E	33° 26′ N 130° 22′ E	30° 38′ N 130° 59′ E
Antenna elevation	746.9 m	198.8 m	984.2 m	292.0 m
Wave length	5.66 cm	5.66 cm	5.66 cm	5.66 cm
Peak power of transmitter	250 KW	250 KW	250 KW	250 KW
Pulse length	2.1 μs	2.7 μs	2.5 μs	2.5 μs
Sensitivity minimum of receiver	-107 dBm	-108 dBm	-108 dBm	-106 dBm
Beam width (Width of over -3dB antenna gain of maximum)	1.3 (H) deg 1.5 (V)	1.4 (H) deg 1.5 (V)	1.5 (H) deg 1.5 (V)	1.5 (H) deg 1.4 (V)
Detection range	300 km	300 km	300 km	300 km
Scan mode in observation * 1. Constant altitude 2. Cappi 3. Manually controlled altitude	1	1	1	1
Data processing in observation *				
MTI processing 1. yes 2. no	1	1	1	1
Doppler processing 1. yes 2. no	2	2	2	2
Display 1. digital 2. analog	1	1	1	1
Operation mode * (when a typhoon is within the detection range) 1. hourly 2. 3-hourly 3. other (please specify)	1	1	1	1
Status * 1. operational 2. not operational (for research of other please specify)	1	1	1	1

* Note: Select an appropriate figure

Name of Member Japan-5

Name of the station	Naze/ Funchatoge	Okinawa/ Itokazu	Miyakojima	Ishigakijima
Index number	47909	47937	47927	47918
Location of the station	28° 23′ N 129° 33′ E	26° 09′ N 127° 46′ E	24° 47′ N 125° 17′ E	24° 20′ N 124° 10′ E
Antenna elevation	316.6 m	208.3 m	54.9 m	30.2 m
Wave length	5.66 cm	5.66 cm	5.66 cm	5.66 cm
Peak power of transmitter	250 KW	250 KW	250 KW	250 KW
Pulse length	2.8 μs	2.8 μs	2.0 μs	2.0 μs
Sensitivity minimum of receiver	-106 dBm	-113 dBm	-105 dBm	-108 dBm
Beam width (Width of over -3dB antenna gain of maximum)	1.4 (H) deg 1.5 (V)	1.3 (H) deg 1.4 (V)	1.3 (H) deg 1.3 (V)	1.4 (H) deg 1.5 (V)
Detection range	300 km	300 km	300 km	300 km
Scan mode in observation * 1. Constant altitude 2. Cappi 3. Manually controlled altitude	3	3	3	3
Data processing in observation *				
MTI processing 1. yes 2. no	1	1	2	2
Doppler processing 1. yes 2. no	2	2	2	2
Display 1. digital 2. analog	2	1	2	2
Operation mode * (when a typhoon is within the detection range) 1. hourly 2. 3-hourly 3. other (please specify)	1	1	1	1
Status * 1. operational 2. not operational (for research of other please specify)	1	1	1	1

* Note: Select an appropriate figure

Name of Member Malaysia-3

Name of the station	Butterworth	Kuching	
Index number	48602	96413	
Location of the station	5° 28′ N 100° 23′ E	01 ° 29′ N 110 ° 20′ E	° ′ N ° ′ E
Antenna elevation	14 m	32 m	m
Wave length	10 cm	10 cm	cm
Peak power of transmitter	650 KW	370 KW	KW
Pulse length	2 μs	2 μs	μs
Sensitivity minimum of receiver	-110 dBm	-112 dBm	dBm
Beam width (Width of over -3dB antenna gain of maximum)	2 deg	1.8 deg	deg
Detection range	400 km	400 km	km
Scan mode in observation * 1.Constant altitude 2.Cappi 3.Manually controlled altitude	1	1	
Data processing in observation *			
MTI processing 1.yes 2.no	2	2	
Doppler processing 1.yes 2.no	2	2	
Display 1.digital 2.analog	1.2	1	
Operation mode * (when a typhoon is within the detection range) 1.hourly 2.3-hourly 3.other(please specfy)	1	1	
Status * 1.operational 2.not operational (for research or other please specify)	1	1	

* Note:Select an appropriate figure

Name of Member Republic of Korea

Name of the station	Kwanaksan		
Index number	47116		
Location of the station	37° 21′ N 126° 58′ E	° ′ N ° ′ E	° ′ N ° ′ E
Antenna elevation	629.1 m	m	m
Wave length	5.6 cm	cm	cm
Peak power of transmitter	250 KW	KW	KW
Pulse length	2/0.5 μs	μs	μs
Sensitivity minimum of receiver	-108 dBm	dBm	dBm
Beam width (Width of over -3dB antenna gain of maximum)	1.2 deg	deg	deg
Detection range	480 km	km	km
Scan mode in observation * 1.Constant altitude 2.Cappi 3.Manually controlled altitude	2		
Data processing in observation *			
MTI processing 1.yes 2.no	1		
Doppler processing 1.yes 2.no	1		
Display 1.digital 2.analog	1,2		
Operation mode * (when a typhoon is within the detection range) 1.hourly 2.3-hourly 3.other(please specfy)	1		
Status * 1.operational 2.not operational (for research or other please specify)	1		

* Note:Select an appropriate figure

Present schedule of GMS VISSR observation and FAX/data dissemination

The current schedule of VISSR observation and FAX dissemination is as follows:

(a) the full disk data will be obtained hourly,
(b) cloud motion wind observation will be performed four times a day for both hemisphere,
(c) the stretched VISSR digital data dissemination for all observations will be made in addition to the WEFAX dissemination.

The detailed time schedule is shown in Fig.2-F1.

1 VISSR observation

The VISSR observation time is as follows:
(the observation starts at about 30 minutes before the respective observation time.)

(1) Regular observation

- Full disk image
  hourly basis
  and for wind derivation (06,12,18 & 00 UTC)
  : 0530,1130,1730 & 2330 UTC

(2) Additional observation for Typhoon wind derivation (WT)

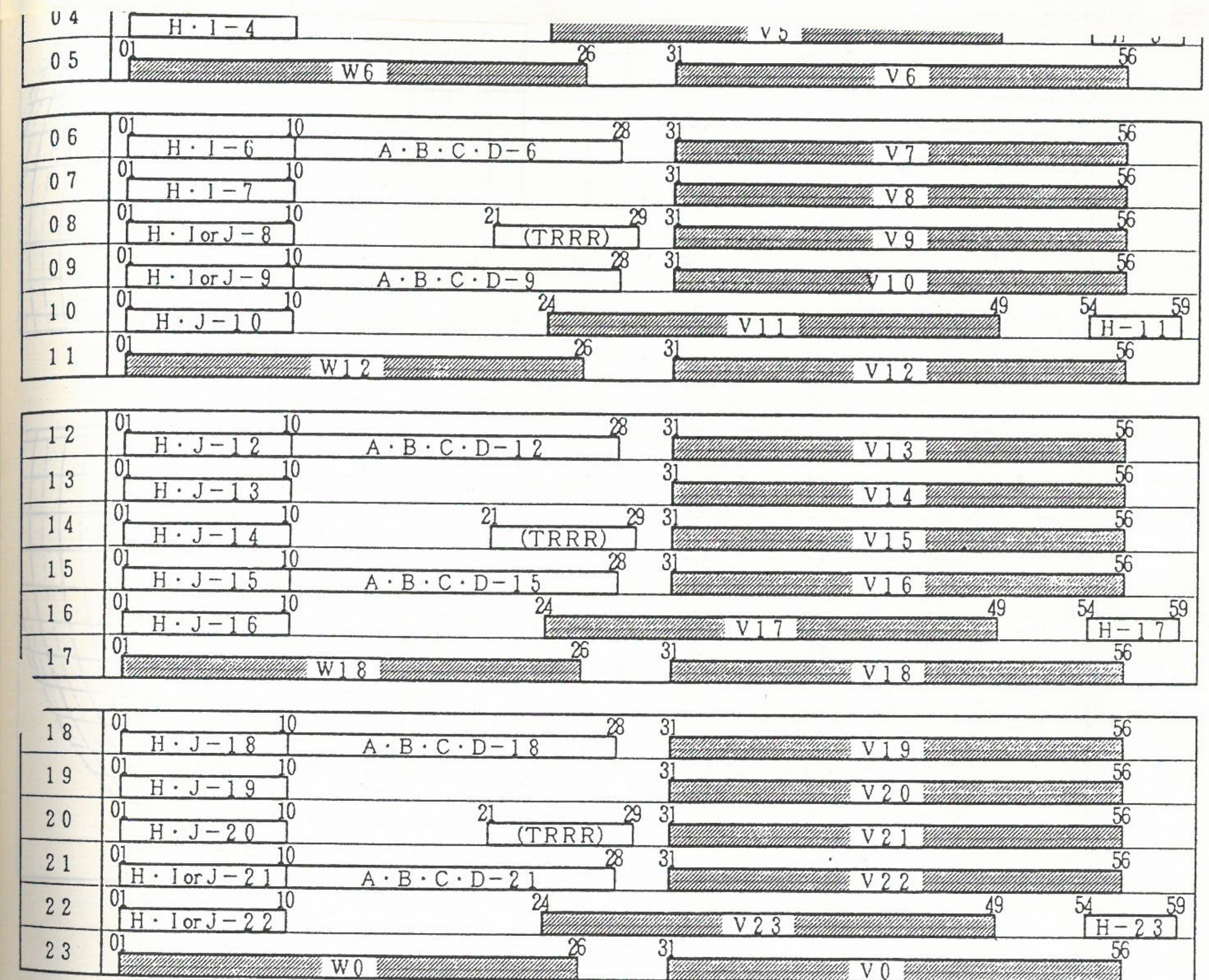
- Half disk image covering the Northern Hemisphere
  15 minutes interval between 0330 and 0415 UTC

2 FAX dissemination via GMS

WEFAX alone is transmitted.

WEFAX

- 4-sectorized full disk (IR) : 00,03, ... & 21 UTC
  (Fig.2-F2)
- Polar stereographic projection
  Image H (IR) : hourly
  Image I (VIS)
  or J (enhanced IR) : hourly except for 05,11,17 & 23 UTC
  (Fig.2-F3)



ABBREVIATIONS

VISSR OBSERVATION
Vnn: VISSR OBSERVATION OF nnZ
Wnn: VISSR WIND OBSERVATION

TRRR: TRILATERATION RANGE AND RANGE RATE

WEFAX DISSEMINATION
A~D: 4-SECTORIZED INFRARED FULL-DISK
H~J: IR, VIS AND ENHANCED IR POLAR-STEREOGRAPHIC COVER THE FAR EAST AREA
MNM: MANUAL AMENDMENT WITH TEST PATTERN

** IN CASE OF 15 MIN. SPECIAL TYPHOON OBSERVATION, SCHEDULE OF 03&04 UTC WILL CHANGE AS FOLLOWS.

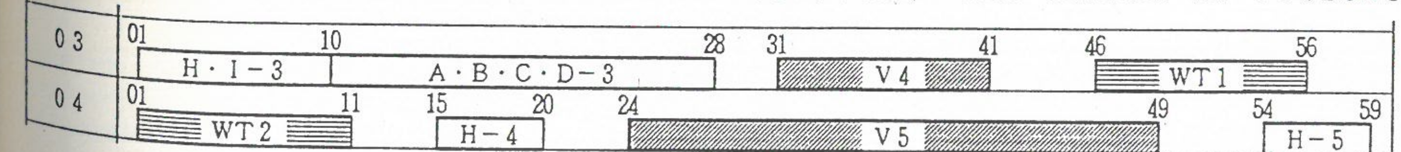


Fig. 2-F1 CURRENT VISSR / FAX SCHEDULE

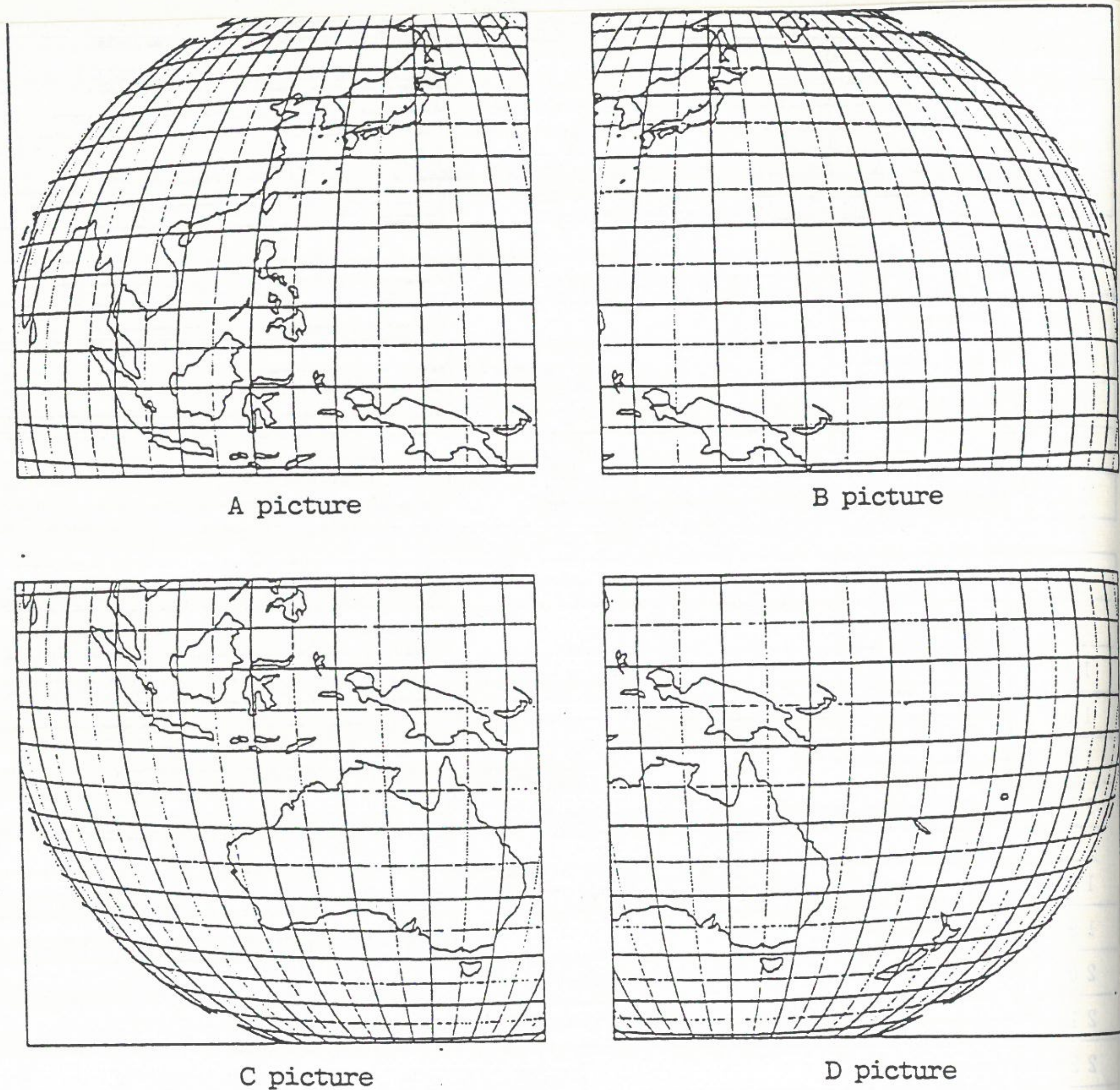


Fig. 2-F.2 Four-sectorized cloud images broadcast three-hourly.

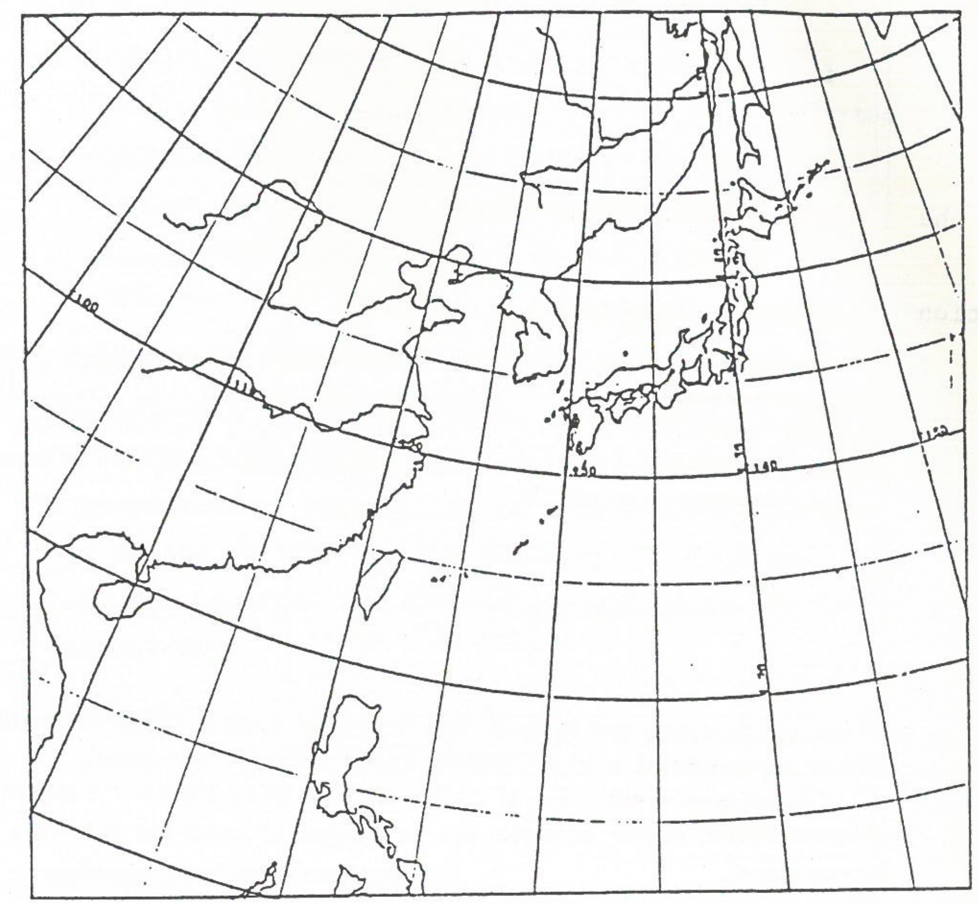


Fig. 2-F.3 WEFAX "H" image of the polar stereographic projection.

NOTE; "I" and "J" images will be of the same projection and size as "H".

ITEM	METHOD	TYPE OF OUTPUT
	e. Time integration (one step): 1 hour for coarse mesh 10 minutes for fine mesh f. Frequency of forecast: Once a day 12Z up to 48-hr	
Name of the method	MARKOV-TYPE ANALOG MODEL	12, 24, 36, 4[8], 60 and 72-hr forecast positions

Description of the method

a. Basic Conception

In Markov process, if all the pr'bable states are $E_1, E_2, E_3, \cdots$, and all the probable transportation times are $t_1, t_2, t_3, \cdots$, the transportation probabilities from states E_i to E_j are expressed by P_{ij}. Then, transportation probabilities can be arrayed like a matrix. The transportation probabilities of higher order can be arrayed by a matrix of a higher order like this[1]:

$$P^{(k)} = \begin{bmatrix} p_{11}^{(k)} & p_{12}^{(k)} & p_{13}^{(k)} \cdots \\ p_{21}^{(k)} & p_{22}^{(k)} & p_{23}^{(k)} \cdots \\ p_{31}^{(k)} & p_{32}^{(k)} & p_{33}^{(k)} \cdots \\ \cdots & \cdots & \cdots \end{bmatrix}, \quad k = 1, 2, 3, \cdots.$$

Then, the forecasts can be made by calculating transportation probabilities and transportation matrix of a higher order.

Because of description of motion state by using Markov "non-post effective" characteristics, analog examples can be studied by renewing data in a new circumstance.

b. Basic Method

Concerning the complex nature of cyclone motion, the storm strike probabilities have been considered as an independent $p(T)$ at $T(T>t)$ and a "transportation" probability related to new circumstance at $T(T>t)$ in this study.

Theory and method of computing probability ellipses at any given condition (such as $T>t$) can also be used. Description of them is as follows.

The bivariate normal probability density function is expressed as: [2]

$$f(x, y) = \frac{1}{2\pi\sigma_x\sigma_y\sqrt{1-\rho_{xy}^2}} e^{-G/2},$$

where G, the locus of which in the x, y plane describes an ellipse, is expressed as

$$G = \frac{1}{1-\rho_{xy}^2}\left[\frac{(x-\mu_x)^2}{\sigma_x^2} - \frac{2\rho_{xy}(x-\mu_x)(y-\mu_y)}{\sigma_x\sigma_y} + \frac{(y-\mu_y)^2}{\sigma_y^2}\right],$$

where the population parameters are: μ_x——mean of x (longitude) coordinates, μ_y——mean of y (latitude) coordinates, σ_x——standard deviation of x coordinates, σ_y——standard deviation of y coordinates, σ_x^2——variation of x coordinates, σ_y^2——variation of y coordinates, and ρ_{xy}——correlation coefficient between x and y coordinates.

The probability that a randomly selected point (x, y) falls into the region S of the x, y plane is the integral of the probability density function:

$$P(s) = \iint f(x, y)\,dx\,dy.$$

c. The Criteria for the Model

In Markov-type analog model, the following two criteria must be satisfied.

1) Distance between current center for a predicted typhoon and that for a historical storm (to be chosen) is less than 1.2 Of latitude.

2) The same situation must be satisfied for 12h before.

Markov model differs from traditional concept in that forecasts out through 72h are made in six 12h increments rather than 0-12h, 0-24h, etc. The "transportation" probability is solved by renewing the analog probability search every 12h in a new circumstance from the optimum probabilities for the current time.

d. Domain

North to Equator, West to 180E.

e. Frequency oc Forecast:

Twice a day, 00z, 12z up to 72hr

Four times a day if necessary.

f. References:

(1) Wang Jizi and C.J.Neuman, A Markov-type Analog Model for the prediction of Typhoon Motion in Northwestern Pacific
Scientia Sinica, May, 1985 Vol.28, No.5

(2) Hope, J.R.& Neuman, C.J., Preprints of 11th Tech. Conf. Hurricanes and Tropical Meteorology, Miami Beach, Amer.Meteor.Soc ., 1977, 367-374

ITEM	METHOD	TYPE OF OUTPUT
Name of the Method	Two-Level Steering method	12,24,36 and 48-h forecast typhoon position
Description of the method	a. Basic equation:	

$$V_T = V_g + \Delta V$$

Where V_T represents the velocity of

	typhoon displacement; V_g, the steering velocity obtained from environmental geostrophic flows at both 500 and 850 hPa levels; ΔV, the correction velocity. b. Domain: All the northwest Pacific typhoon basin for all seasons. c. Frequency of forecast: Twice a day	

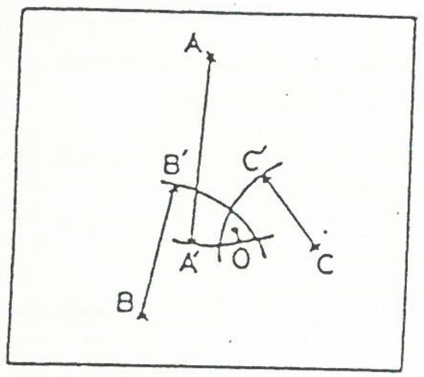
ITEM	METHOD	TYPE OF OUTPU
	References: Chang, S.L. 1959 'Climatological charts of the Far East', Royal Observatory Occasional Papers (printed) No. 4. Chin, P.C. 1970 'The "Control Point" method for the prediction of tropical cyclone movement', Royal Observatory Technical Note No. 30.	
Name of the method	Regression method	24, 48, 72 and 96-hr movement forecasts
Description of the method	The mean 24-hr movement of each tropical cyclone centred in each 5-degree square is correlated with that 24 hours ago to derive regression equations for forecasting. Independent variables: Present and past 24-hr positions. Domain : 5-25N, 105-145E. Frequency of forecast: 4 times a day.	
Name of the method	The space mean method	Space mean charts and 24-hr movement forecast
Description of the method	The space mean technique is based on the concept of steering. Space mean charts are prepared by the computer to depict the smoothed basic flows at various upper levels with the circulation of the tropical cyclone and other small-scale eddies removed. An estimate of the steering current for prediction purposes is derived by statistically combining the basic flows at four different levels. This has been called the 'MUSIC' (MUltilevel Steering by Integrated Current) technique. Input : Surface, 700, 500 and 300 hPa data covering the area 0-65N, 65-165E. Frequency of forecast: Twice a day.	
Name of the method	ANALOG	
Description of the method	The analog method is based on the concept that a storm with certain characteristics (time of year, position, direction and speed) will move in the same way as past storms with similar characteristics. Therefore, the method searches through historical storm tracks and identif those that fall within certain pre-defined "windows" of these characterist These storms are called analog storms. Each analog storm is then shifted to the position of the current storm and then advected along using a weigh average of the movement of the two storms. The weight given to the	

		TYPE OF OUTPU
	movement of the current storm decreases linearly with the forecast period. After 36 hours, no contribution to the advection comes from the current storm. The analog forecast is then the average of all the forecast positions of the analog storms. Input : Position of current storm, past 6-hour direction and speed or position of current storm, radius of acceptance circle. Frequency of forecast : Four times a day Reference : Hope, J.R., and C.J. Neumann, 1970 : An operational technique for relating the movement of existing tropical cyclones to past tracks. Mon. Wea. Rev., 98, 925-933.	Analog forecas positions(ever hours) and mov ment,list of analog storms(to +72 hour po tions).

ITEM	METHOD	TYPE OF OUTPU
Name of the method Description of the method	Statistical methods 1. Persistence and Climatology Method (P+C)/2 method Independent Variables: Present and 12-hour storm positions Historical variables: Climatological modal directions and speed in 2 1/2 degree square Domain: 20-40N, 115-140E Frequency of forecast: Twice a day	12-hr and 24-hr foreca position
Name of the method Description of the method	2. Cook's method This method is similar to the Arakawa's or the Veigas-Miller Method. Independent variables: Present and past 12 and 24-hour positions and present MSL pressure values at selected grid points Grid: Moving 5 degree lat. and long. grids Domain: 20-40N, 110-140E Frequency of forecast: Twice a day	12-hr and 24-hr forecas position
Name of the method Description of the method	Steering Methods 1. Fixed control-point method Input: 700 hPa wind direction at the control-point and climatological wind speed in 2 1/2 degree squares Domain: 20-35N, 120-135E Frequency of forecast: Twice a day	12-hr and 24-hr forecast position
Name of the method Description of the method	2. Space mean method Input: 500 hPa data Domain: 20-40N, 115-140E Frequency of forecast: Twice a day	12-hr and 24-hr forecast position

Fig. 3-B.3

Explanation of the distance intersecting method (1)



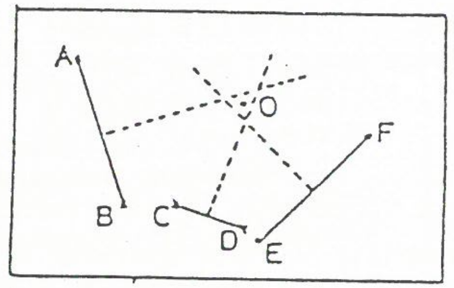


Fig. 3-B.4 Explanation of the distance intersecting method (2)
Dotted lines are perpendicular bisectors of lines AB, CD and EF connecting equal pressure points. A point O is the center of typhoon.

1.3 Assessment of tropical cyclone/typhoon intensity

1.3.1 Preparation of time change curve of central pressure using past eye data
See Chapter 2.1

Delete
~~1.3.2 Reconnaissance flight observation~~
~~See Chapter 2.1~~

1.3.2 Satellite analysis
See Chapter 2.3

1.3.3 Radar observation
See Chapter 2.2

1.3.4 Surface map analysis
See Chapter 1.2.4

1.3.5 Estimation of maximum wind by using the empirical relation between central pressure and maximum wind

The observation of the maximum wind is scarcely made over the sea area. Therefore, the maximum wind speed must be estimated from the central pressure using some formula. As an example, the formula given by Atkinson and Holliday (1977) is shown below.

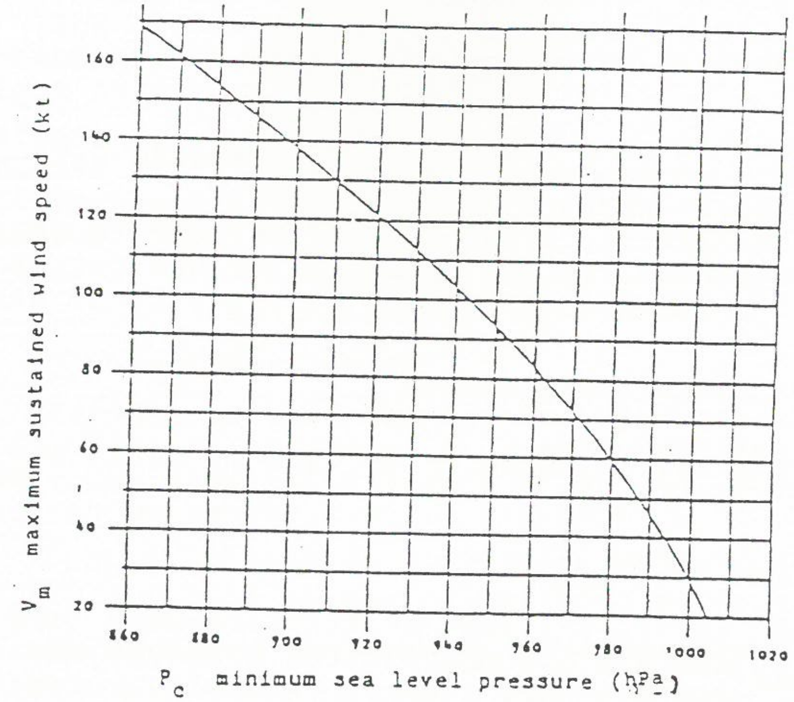
The maximum sustained surface wind speed is obtained by applying the minimum sea level pressure to the following regression equation:

$$V_m = 6.7(1010 - P_c)^{0.644}$$

where V_m is the maximum sustained(1 min) wind speed(kt) and P_c the minimum sea level pressure (hPa). In this study, 28 years of maximum wind measurements made at coastal and island stations in the Western North Pacific were collected and analyzed. (see Fig. 3-B.5)

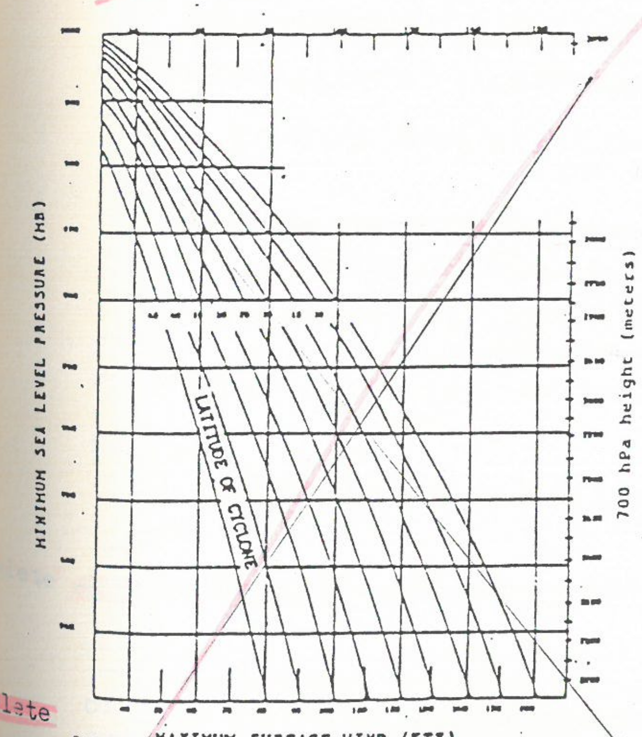
(After G.D.Atkinson and C.R.Holliday, 1977: Mon. Wea

Fig. 3-B.5 The maximum sustained wind (one minute mean) vs the minimum sea level pressure



~~Note:~~

Delete
~~The central pressure-V_{max} graph (Fig. 3-B.6) is developed by JTWC (Annual Typhoon Report 1968) and it is used in JMA. The maximum surface wind in this graph is 1-min. mean value, i.e., the maximum sustained wind. The Table 3-B.1 is used in JMA for 1-min. to 10-min. mean maximum wind conversion.~~



Delete
Table 3-B.1

The empirical conversion table for 10-min. mean value from 1-min. mean maximum wind (kt)

1-min.	10-min.
70	70
80	70
90	80
100	90
110	90
120	100
130	110
140	110
150	120
160	130
170	130
180	140
190	150
200	150

Delete
Fig. 3-B.6
JTWC graph for the maximum surface winds from RECCO data at the 700 hPa level or

In order to estimate the tide, predict

i) the place and the time of landfall,

ii) the minimum central pressure and the maximum wind of the storm at the time of landfall,

iii) the storm trajectory relative to the axis of the bay concerned.

There are two methods, i.e., dynamical method and statistical method. An example of the dynamical method is the SPLASH model. A detailed report about the SPLASH model is found in the reference. It is helpful for operational purpose to calculate the surge beforehand using the dynamical method for storms with various intensity and trajectory.

1.8.2 An example of statistical method

The following regression equation is used in Japan to predict the maximum storm surge.

$$h = A (P_0 - P_c) + B V_{max}^2 \cos \theta$$

here, h is surge (cm) and P_0 the mean monthly pressure (hPa). The terms P_c and V_{max} are the minimum central pressure and the maximum wind of the storm at the time of landfall, respectively. The term θ denotes the angle between the wind and the axis of the bay. The magnitude of constant A is close to unity since the hydrostatic pressure fall by 1 hPa generates a rise of sea level of about 1 cm. The magnitude of costant B is specified for each bay, because the area size, depth and configuration of bays are not the same. The regression coefficients must be determined from tide gauge data over the long period.

Reference:

WMO (1973): Present Techniques of Tropical Storm Surge Prediction.
Report on marine science affairs report No.13.

Delete

2. The application of reconnaissance flight observation Radar and satellite observation data in tropical cyclone analysis and forecasting

Delete 2.1 Reconnaissance Flight Observation Data

2.1.1 General explanation

The reconnaissance flight data are classified into the following four types:

1) Eye data, 2) drop-sonde data, 3) peripheral data, and 4) Flight report.

The reconnaissance flight observation code is shown in Appendix 2-H

Delete

(1) Eye data (center/vortex fix data)

The eye data message includes the central position and the vertical structure near the typhoon center by the reconnaissance flight observation.

(2) Drop-sonde data

The message is reported when the drop-sonde data are obtained near the typhoon center during the penetration flight. Generally, this message is accompanied by the eye data. Thus, these data should be checked by comparing mutually.

(3) Peripheral data

Peripheral data message includes the altitude, temperature, wind direction and speed at the 700 hPa level and wind condition on the sea level at distance of 30, 60, 90 and 120 miles from the typhoon center.

Surface pressure is estimated from the value of height at the 700 hPa level by using the formula.

Some formulas are shown as follows:

$P = 645 + 0.115xZ_{700}$ (JTWC)

$P = 643 + 0.116xZ_{700}$ (JMA)

(Use conversion scale in Fig. 3-B.8)

After the surface pressures are estimated at distance of 30, 60, 90 and 120 miles, construct the pressure profile in accordance with the procedure of 1-2-5

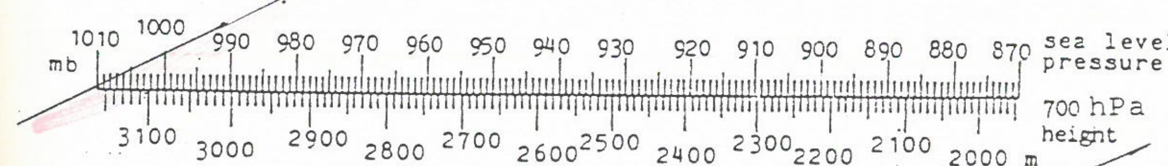


Fig. 3-B.8 Nomogram for sea level pressure from RECCO data at 700 hPa level

(4) Flight report

The flight report includes the weather conditions at the flight level on the way of the penetration flight. The flight report data are used for analysis of upper level weather maps.

Remark:

Check the accuracy of the central pressure in the eye data and drop-sonde data before using them.

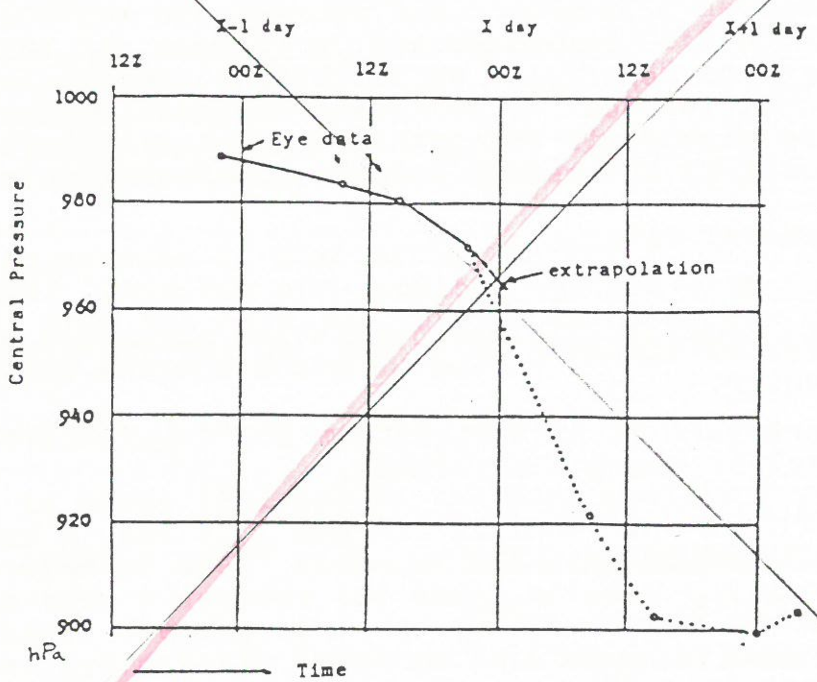
Delete 2.1.2 Estimation of central pressure

Construct a "time change curve" of central pressure based on the eye data. Estimate the current central pressure by extrapolating the curve (Fig. 3-B.9).

Delete

Note: Time change curve using the eye data

Estimation of the central pressure of the typhoon may be made by the extrapolation using the time change curve prepared beforehand.



Delete Fig. 3-B.9 Temporal change curve of central pressure by the eye data

2.1 Radar Observation Data

Radar observation and RADOB report are used for the operation.

2.1.1 Judgement on tropical cyclone formation

The features of the curved echoes, spiral bands and the eye show the stage of the tropical storm.

2.1.2 Identification of typhoon position

When the radar data reported by WMO code are used to fix the central position of the typhoon, the accuracy code in the RADOB must be confirmed. Accuracy code is classified into three categories: 1) good (within 10 km), 2) fair (10-30 km), and 3) poor (30-50 km).

Type of data	Heading		Receiving stations									
			TD	BJ	BB	HH	MM	SL	NN	KK	IV	PP
Warning	WDPA1	PGTW	*	TD	TD	TD	TD	TD	~~TD~~ Delete	BB		
	WHCI28	BCGZ	HH	*	HH	BJ			BJ			
	WHCI40	BABJ	BJ	O	HH	BJ			BJ	BB		
	WSPH	RPMM	MM	TD			O					
	WTPA21	PGTW	*	TD	TD	TD	TD	TD	BB	BB		
	WTPA31	PGTW	*	TD	TD	TD	TD	TD	BB	BB		
	WTPA32	PGTW	*	TD	TD	TD	TD	TD	BB	BB		
	WTPH20	RPMM	MM	TD	TD	TD	O		BB	BB		
	WTPH21	RPMM	MM	TD	TD	TD	O		BB	BB		
	WTPQ20	VHHH	HH	HH	HH	O		TD	BB	BB		
	WTSS20	VHHH	HH	HH	HH	O			BB	BB		
	WTTH20	VTBB	BB	TD	O	BB			BB	BB		
	WTVS20	VNNN							O			
	WWJP20	RJTD	O	TD	TD	TD	TD	TD	TD	BB		
	WWJP21	RJTD	O	TD	TD	TD	TD	TD	TD	BB		
	WWKO30	RKSL	SL					O				

NOTE : Meaning of abbreviation,

- O : Data originating centre
- TD : Data transmitting centre - Tokyo
- BJ : " - Beijing
- BB : " - Bangkok
- HH : " - Hong Kong
- MM : " - Manila
- SL : " - Seoul
- NN : " - Hanoi
- KK : " - Kuala Lumpur
- IV : " - Vientiane
- PP : " - Phnom Penh
- * : " - Places other than described above

Table of abbreviated headings (TTAAii CCCC)

TT	Data designator
FX	Miscellaneous forecasts
SB	Radar reports PART A
SC	Radar reports PART B
SD	Radar reports PART A and PART B
SN	Synoptic reports (non-standard hours)
TP	Satellite guidance
UA	Aircraft reports (AIREP)
UE	Upper-level observation PART D
UK	Upper-level observation PART B
UL	Upper-level observation PART C
Delete ~~UR~~	~~Aircraft reports (RECCO)~~
US	Upper-level observation PART A
Delete ~~UZ~~	~~Drop sonde reports~~
WD	Prognostic reasoning for typhoon
WH	Hurricane warnings
WO	Other warnings
WS	SIGMET
WT	Tropical cyclone warnings
WW	Warning and weather summary

ii	Data distribution area
01-19	Global
20-39	Regional
40-89	National

AA	Geographical designator
CI	China
HK	Hong Kong
JP	Japan
KO	Republic of Korea
KP	Democratic Kampuchea
LA	Lao People's Democratic Republic
MS	Malaysia
PA	Pacific area
PH	Phillipines
PN	North Pacific area
PQ	Western North Pacific
PW	Western Pacific area
SS	South China Sea area
TH	Thailand
VS	Vietnam

CCCC	Location indicator
BABJ	Beijing
BCGZ	Guangzhou
KWBC	Washington
PGFW	Guam (F.W.C)
PGTW	Guam (JTWC)
PGUM	Guam (Agana)
RJTD	Tokyo
RJTY	Yokota
RKSL	Seoul
RKSO	Osan
RODN	Okinawa/Kadena AB
RPMK	Clark AB
RPMM	Manila/Intl.
VDPP	Phnom Penh
VHHH	Hong Kong
VLIV	Vientiane
VNNN	Hanoi
VTBB	Bangkok
WMKK	Kuala Lumpur

Regular monitoring at RSMC

1. Items of monitoring

RSMC monitors the reception time of following observations;

(i) hourly surface observations,
(ii) hourly ship and buoy observations,
(iii) 6-hourly upper-air observations,
(iv) hourly radar observations,
Delete ~~(v) reconnaissance flight observations.~~

2. Output format

Reception time of SYNOP reports

Aug. 24th, 1986

Location	00Z	01Z			24Z
47918	0007	0105			2408
47927	0006	0107			2409
≀	≀	≀			≀
58238	0028	0123			2425

List of data proposed to be archived by RSMC

(a) Level II-b

Kinds of data : surface, ship, buoy, upper-air, RADOB, aircraft, ASDAR, reconn Delete ~~e flight and drop-sonde~~, advisory, warning, SAREP, SATEM, SATOB, TBB grid value and five-day mean sea surface temperature and cloud amount (GMS).

Area coverage : SATEM :90°E-180°E and 0°-45°N. SATOB, TBB grid value and five-day mean sea surface temperature and cloud amount : area covered by GMS. Other data : within the area of 80°E-160°W and 20°S-60°N (hereafter A-area).

(b) GMS cloud pictures

Kinds of data : Either negative or positive imagery.

Data form : Microfilm (Detailed specification is given in the next page(Appendix 7-A,p.2))

Area coverage : Area covered by GMS

(c) Level III-a

Kinds of data : Grid point data of the objective analysis obtained by the global objective analysis system in RSMC

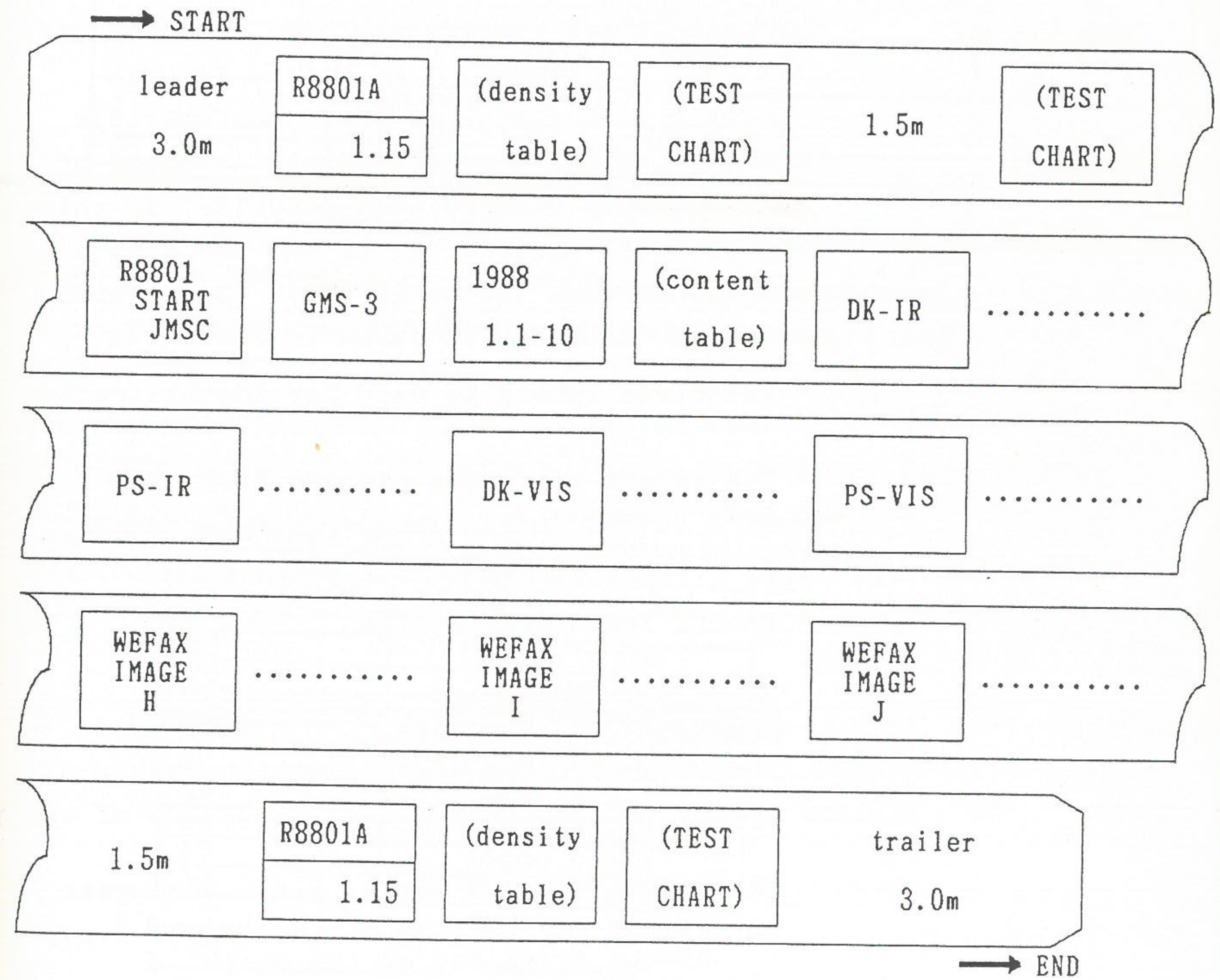
Area coverage : A-area covered by 1.875° x 1.875° latitude-longitude grid system.

Element and layer : Temperature (Ts), dewpoint depression (Ts-Tds), wind (Vs, Vs) at station level, sea surface pressure (Ps) and geopotential height (Z), wind (U,V), temperature (T), dewpoint depression (T-Td) at mandatory pressure levels from 850 mb up to 100 mb at 00 and 12 UTC. Sea surface temperature at 00 UTC.

Note : Specifications of the characteristics of the tapes for level II-b and level III-a are given in Appendix 7-A, Annex

SPECIFICATION OF GMS IMAGE MICROFILM

form	35mm no-perforation			
image	Full Disk (DK)		infrared (IR) visible (VIS)	3-hourly 00,03,06 UTC
	Polar-Stereographic projection of northern hemisphere (PS)		infrared (IR) visible (VIS)	3-hourly 00,03,06 UTC
	WEFAX image	H I/J	infrared visible or enhanced IR	hourly hourly
quantity	10days/volume			
format	below			



II) Level III-a data

(1) Number of tracks : 9

(2) Density of records : 6250 BPI

(3) File format : Single file, single volume

(4) Label : Non label

(5) Character code : EBCDIC

(6) Block length : 2640 bytes

(7) Number of records in one block : 10

(8) Logical record length: 264 bytes

(9) Structure of record

(a) Logical order of records

* 44 consecutive records are used to cover the entire A-area data for one specific time (00 or 12 UTC), one specific element and one specific level. A group of 45 records (one identification record plus 44 data records) is defined as 1 "CLUSTER" in this report. 45 "CLUSTER" cover the whole data at a specific time (00 or 12 UTC). Sequential order of "CLUSTER" is given in Table 7-A.3.

* The first record is used for identification (see (b)).

* The record sequences proceed from 60°N to 20.625°S at 1.875 degree intervals (44 records).

(b) Type of logical record

* Record for identification

← 264 bytes →

IDbbyymmddhhbbeebbllb -----------b

ID: Indicator for identification record

yy: Symbol for tens and units digits of the year i.e., 88=1988

mm: Symbol for the month, i.e., 08=August

dd: symbol for the day of the month, i.e., 01=the first day of the month

hh: Symbol for time (00 or 12(UTC))

ee: Symbol for parameter, reference value and unit (See, Table 7-A.1 and 7-A.2)

$\ell\ell$: Symbol indicating pressure at mandatory pressure levels in units of 10 mb, i.e., 85=850 mb

Note:

The following specifications are used to indicate sea surface pressure and elements at station level.

$\ell\ell$ = 00, ee = 1 for sea surface pressure

$\ell\ell$ = 00, ee ≠ 1 for temperature, wind speed and dewpoint temperature at station level.

Table 7-A.1 Specification of symbol letter "ee"

Code figure	Field parameter	Reference value	unit
01	pressure	900.0 mb	0.1 mb
02	geopotential height	variable according to code figure of $\ell\ell$ (Table 7-A.2)	1.0 gpm
03	west-east comp. of wind	-200.0 m/s	0.1 m/s
04	south-north comp. of wind	-200.0 m/s	0.1 m/s
05	temperature	0.0°K	0.1°K
06	dewpoint depression	0.0°C	0.1°C

Note: When the value of the wind speed obtained by the formula (1) (see below) is positive, wind blows from west or south.

Table 7-A.2 Reference value for geopotential height

Code figure of $\ell\ell$	Reference value
85	0.0 gpm
70	0.0 gpm
50	0.0 gpm
40	0.0 gpm
30	6000.0 gpm
25	7000.0 gpm
20	8000.0 gpm
15	10000.0 gpm
10	12000.0 gpm

* Record of the data

← 264 bytes →

$I_1I_1I_1I_1I_2I_2I_2I_2$-----$I_iI_iI_iI_i$-----$I_{66}I_{66}I_{66}I_{66}$

4 bytes (= 4 digits) are used to represent a value at one grid point.

The value is always positive.

Undefined data is given the value 9999.

Data sequences proceed from 78.75 degree east longitude towards east until 159.375 degree west (66 grid points).

Note:

Actual value at each grid point is obtained by the following formula using reference value and the value of unit (See, Table 7-A.1 and 7-A.2):

Actual value = (reference value) + $I_i I_i I_i I_i$ x(unit) (1)

(c) Sequential order of "CLUSTER" is given in Table 7-A.3.

Table 7-A.3 Sequential order of "CLUSTER"

Parameter / Level	Z/P_s	u	v	T	$T-T_d$
surface	1	11	21	31	41
850 mb	2	12	22	32	42
700 mb	3	13	23	33	43
500 mb	4	14	24	34	44
400 mb	5	15	25	35	45
300 mb	6	16	26	36	
250 mb	7	17	27	37	
200 mb	8	18	28	38	
150 mb	9	19	29	39	
100 mb	10	20	30	40	

(d) Record of the end of file

264 bytes

EEbbb ----------------------------------b

EE: Indicator of the end of the file.

This record appears in the very last block on tape.

2.1.3 Some features indicating the change in typhoon intensity

The following features should be noted in radar observation.

1. The distinct eye and reduction of eye size show the typhoon development. The indistinct shape of the eye and the expansion of the diameter of the eye observed over the sea show the decay of the typhoon.

2. Remarkable echo developing near the center shows the typhoon development. The reduction of area and intensity of convective echo near the center over the sea shows typhoon decay.

3. Typical configuration of the spiral band shows the typhoon development.

4. Increase of stratified echo shows the decay of the typhoon.

5. When the typhoon center reaches the middle latitudes and the echoes are organized into the pattern like ❟ or ⅄ , the typhoon is changing into the extratropical cyclone.

Note:

a) Regular calibration of radar should be carried out. Technical specification of radars of Typhoon Committee members shown in Appendix 2-E should be consulted when reports from these radars are used.

b) When the reports from two or more radar sites are received, the report from the sites using 10-cm radar is used first in the tropics. If the type of the radars are same, the report from the site nearest to the typhoon is used first and the report with better accuracy is used next.

In addition, past radar reports from the same site should be evaluated for accuracy against the past track of the typhoon.

c) Typhoon track fixed by radar should be smoothed. Since the typhoon track fixed by radar reports often shows irregular fluctuation over a short span of time, any small-scale irregularities should be eliminated using the smoothing method.

2.2 Satellite Analysis

2.2.1 Judgement on tropical cyclone formation.
Identification of tropical cyclone/typhoon position,
Assessment of tropical cyclone/typhoon intensity and
Prediction of tropical cyclone/typhoon intensity

After its operational application over a long time in many tropical cyclone forecast centers, it has been found that Dvorak's technique is very useful for the satellite analysis operation of tropical cyclones.

Therefore, the explanation of the satellite data application techniques for the operations in this section is considered to be fulfilled by refering to the material in Dvorak's article which is attached to this Manual as an annex of Appendix 3-B

2.2.2 Prediction of tropical cyclone/typhoon movement

2.2.2.1 Cloud features indicating future storm movement

When cloud features mentioned below are found, change of movement should be noted.

1. Deep convective cloud clusters developing around CSC.

Storm moves toward them. When they are seen in front of (in the rear of) CSC, storm movement accelerates (decelerates). Storm does not move toward the Cb-free secter of the storm.

2. The elongation of storm cloud system.

Storm tends to change its movement direction to the orientation of its long axis.

3. Northward extension of cirrus shield.

This feature indicates northward component of future storm movement. Northeastward extension of cirrus is often seen when the recurvature of westward moving storm takes place.

On the other hand, when cloud features stated above are not seen or when cloud features mentioned below are observed, persistence of the present movement may be expected.

1. Axially symmetric cloud pattern.
2. Multidirectional cirrus outflow.

2.2.2.2 Identification of cloud features indicating environmental situation affecting future storm movement.

Environmental cloud features sometimes indicate large scale situation affecting future storm movement.

1. North-south oriented active convective cloud band moving westward in the subtropical high.

This cloud band indicates westward extension or intensification of the subtropical high.

2. Southward extension of the cloud system associated with midlatitude westerly trough seen to the northwest of the storm.

When this extension is significant, northward movement of the storm is expected.

Remark:

Short-period variation of cloud features associated with the storm and in environmental area often misleads forecast of future storm movement.

List of addresses, telex/cable and telephone numbers of the tropical cyclone warning centres in the region

Centre	Mailing address	Telex/cable and telephone numbers
China		
Central Meteorological Office National Meteorological Centre State Meteorological Administration (Director: Lianshou Chen)	46 Baishiquiaolu, Western Suburb, Beijing	Telex: 22094 FDSMA CN Tel.: 89-0371 Ext. 2615 Ext. 2344 Cable: 2894
Democratic Kampuchea		
Hong Kong		
Meteorological Services Division Royal Observatory Hong Kong (Attn.: H.K. Lam)	134A Nathan Rd. Tsim Sha Tsui, Kowloon, Hong Kong.	Telex: 54777 GEO PH Tel.: 3-7329361 (00-09 UTC on weekdays) 3-7329474 3-681944 (24 hours) Telefax 3-7215034
Japan		
Forecast Division, Forecast Department Japan Meteorological Agency (Director: Y. Yamagishi)	1-3-4 Ote-machi, Chiyoda-ku, Tokyo 100	Telex: 2228080 METTOK J (24 hours) Tel: 03-211-8303 (00-09 UTC on weekdays) 03-211-7617 (24 hours but excepting 00-09 UTC on weekdays)
Lao PDR		
Malaysia		
Main Meteorological Office, Kuala Lumpur International Airport	Kuala Lumpur International Airport, 47200 Subang, Selangor Darul Ehsan	Tel.: 03-7461441 03-7465990 03-7463961 (24 hours)

Collection and distribution of information related to tropical cyclones

Type of data	Heading	Receiving stations: TD	BJ	BB	HH	MM	SL	NN	KK	IV	PP
Enhanced surface observation	SNCI30 BABJ	BJ	O	HH	BJ		TD	BJ	BB		
	SNHK20 VHHH	HH	HH	HH	O			BB	BB		
	SNJP20 RJTD	O	TD				TD				
	SNKO20 RKSL	SL	TD				O				
	SNLA20 VLIV	BB	TD	IV				BB		O	
	SNMS20 WMKK	BB	TD	KK					O		
	SNPH20 RPMM	MM	TD	TD	TD	O	TD	Delete ~~TD~~	BB		
	SNTH20 VTBB	BB	TD	O				BB			
	SNVS20 VNNN	BB	TD	NN		TD	TD	O			
Enhanced upper-air observation	USCI11 BABJ	BJ	O		BJ	TD	TD	BJ			
	UKCI11 BABJ	BJ	O		BJ		TD				
	ULCI11 BABJ	BJ	O		BJ		TD	BJ			
	UECI11 BABJ	BJ	O		BJ						
	USHK1 VHHH	HH	HH	HH	O	TD	TD	BB	BB		
	UKHK1 VHHH	HH	HH	HH	O		TD		BB		
	ULHK1 VHHH	HH	HH	HH	O		TD	BB	BB		
	UEHK1 VHHH	HH	HH	HH	O				BB		
	USJP01 RJTD	O	TD	TD	TD	TD	TD.		BB		
	UKJP01 RJTD	O	TD	TD	TD		TD		BB		
	ULJP01 RJTD	O	TD	TD	TD						
	UEJP01 RJTD	O	TD	TD	TD						
	USKO1 RKSL	SL	TD	TD	TD	TD	O		BB		
	UKKO1 RKSL	SL	TD		TD		O				
	ULKO1 RKSL	SL	TD	TD	TD		O		BB		
	UEKO1 RKSL	SL	TD	TD	TD		O		BB		
	USMS1 WMKK	BB	TD	KK		TD	TD		O		
	UKMS1 WMKK	BB	TD	KK		TD			O		
	ULMS1 WMKK	BB	TD	KK		TD			O		
	UEMS1 WMKK	BB	TD	KK		TD			O		
	USPH1 RPMM	MM	TD	TD	TD	O	TD	TD			
	UKPH1 RPMM	MM	TD	TD	TD	O		Delete ~~TD~~			
	ULPH1 RPMM	MM	TD	TD	TD	O					
	UEPH1 RPMM	MM	TD	TD	TD	O					
	USTH1 VTBB	BB	TD	O		TD	TD				
	UKTH1 VTBB	BB	TD	O							
	ULTH1 VTBB	BB	TD	O							
	UETH1 VTBB	BB	TD	O							
	USVS1 VNNN	BB	HH	NN	BB		TD	O			
	UKVS1 VNNN	BB	HH	NN	BB			O			
	ULVS1 VNNN	BB	HH	NN	BB			O			
	UEVS1 VNNN	BB	HH	NN	BB			O			

Ship observation	~~SNVX20~~ RJTD	O	TD		TD	TD	TD		
	~~SNVX21~~ RJTD	O	TD		TD	TD	TD		
	SNVX20 RPMM	MM	TD	TD	TD	O		BB	
	SNVX20 VHHH	HH	HH	HH	O	TD	TD	BB	
	SNVX20 VNNY	BB	TD	NN	BB	TD		O	
Enhanced radar observation	SBCI30 BABJ	BJ	O	HH	BJ	TD	TD	BJ	BB
	SCCI31 BABJ	BJ	O	HH	BJ				BB
	SBCI60 BCGZ	BJ	O		BJ	TD	TD	BJ	
	SCCI60 BCGZ		O		BJ				
	SBHK20 VHHH	HH	HH	HH	O	TD		BB	BB
	SBJP20 RJTD	O	TD		TD	TD	TD		
	SDKO20 RKSL	SL	TD		TD	TD	O		
	SDMS20 WMKK	BB	TD	KK					O
	SDPH20 RPMM	MM	TD	TD	TD	O	TD	BB	BB
	SDTH20 VTBB	BB	TD	O	BB				
	SDVS20 VNNN	BB	TD	NN	BB	TD		O	
Satellite guidance	TPPA1 PGTW	*	TD						
	TPPA1 RJTY	*	TD	TD	TD				
	TPPA1 RODN	*	TD	TD	TD	TD			
	TPPW20 RJTD	O	TD	TD	TD	TD	TD	BB	
Delete ~~Aircraft report (RECCO)~~	~~URPA10 PGTW~~	~~*~~	~~TD~~	~~TD~~	~~TD~~	~~TD~~	~~TD~~	~~TD~~	
	~~URPA10 RJTY~~	~~*~~	~~TD~~	~~TD~~	~~TD~~	~~TD~~	~~TD~~		~~BB~~
	~~URPA10 RPMK~~	~~*~~	~~TD~~	~~TD~~	~~TD~~				~~BB~~
	~~URPA11 PGTW~~	~~*~~	~~TD~~	~~TD~~	~~TD~~	~~TD~~		~~TD~~	~~BB~~
	~~URPA11 RJTY~~	~~*~~	~~TD~~	~~TD~~	~~TD~~	~~TD~~	~~TD~~		~~BB~~
	~~URPA11 RPMK~~	~~*~~	~~TD~~	~~TD~~	~~TD~~				~~BB~~
	~~URPA12 PGTW~~	~~*~~	~~TD~~	~~TD~~	~~TD~~	~~TD~~	~~TD~~	~~TD~~	~~BB~~
	~~URPA12 RJTY~~	~~*~~	~~TD~~	~~TD~~	~~TD~~	~~TD~~			~~BB~~
	~~URPA12 RPMK~~	~~*~~	~~TD~~	~~TD~~	~~TD~~				
Delete ~~Peripheral data~~	~~URPA14 PGTW~~	~~*~~	~~TD~~	~~TD~~	~~TD~~	~~TD~~		~~TD~~	
	~~URPA14 RPMK~~	~~*~~	~~TD~~	~~TD~~	~~TD~~	~~TD~~			
Delete ~~Drop sonde report~~	~~UZPA13 PGTW~~	~~*~~	~~TD~~	~~TD~~	~~TD~~	~~TD~~	~~TD~~		~~BB~~
	~~UZPA13 RJTY~~	~~*~~	~~TD~~	~~TD~~	~~TD~~	~~TD~~			
	~~UZPA13 RPMK~~	~~*~~	~~TD~~	~~TD~~	~~TD~~	~~TD~~	~~TD~~		~~BB~~
Tropical cyclone forecast	FXPH20 RPMM	MM	TD	TD	TD	O	TD	BB	BB
	FXPQ20 BABJ	BJ	O	HH	BJ	TD	TD	BJ	BB
	FXPQ20 VHHH	HH	HH	HH	O	TD	TD	BB	BB
	FXPQ21 VHHH	HH	HH	HH	O	TD	TD	BB	BB
	FXPQ29 VTBB			O					
	FXSS20 BABJ	BJ	O	HH	BJ	TD	TD	BJ	
	FXSS20 VHHH	HH	HH	HH	O	TD	TD	BB	BB
	FXSS21 VHHH	HH	HH	HH	O	TD	TD	BB	BB
	FXKO20 RKSL	SL					O		

ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC AND
WORLD METEOROLOGICAL ORGANOZATION

WRD/TC.21/4
Doc.
(8 November 1988)

Typhoon Committee
Twenty-first session
22-28 November 1988
Manila

Item;4(a)

Updating of

TYPHOON COMMITTEE OPERATIONAL MANUAL

METEOROLOGICAL COMPONENT

(Submitted by the rapporteur)

SUMMARY of DOCUMENT

This document contains the proposals for the updating of Typhoon Committee Operational Manual Meteorological Component issued in 1987.

ACTION PROPOSED

Typhoon Committee is invited to:

(a) Note the information contained in this report;

(b) Examine and approve the proposed amendments to the Manual;

(c) Request the WMO Secretariate to issue a Supplement to the publication.

Appendices : A. Proposals for the Updating of TYPHOON COMMITTEE OPERATIONAL MANUAL METEOROLOGICAL COMPONENT

B. APPENDIX to the Proposals

DISCUSSION

General

1. The twentieth session of the Typhoon Committee(October 1987,Bankok) requested the Government of Japan to designate a rapporteur for updating the Typhoon Committee Operational Manual(TOM) Meteorological Component(Report No. TCP-23) issued in 1987. The terms of reference of the rapporteur are to submit proposals for updating the TOM to the Typhoon Committee on its twenty-first session in November,1988.

2. The Government of Japan designated Mr.Shunichiro Kadowaki,Telecommunications Counsellor, Forecast Department, Japan Meteorological Agency as the rapporteur. The rapporteur considered it preferable to submit a draft proposal to the Meeting of the Typhoon Committee Technical Working Group on the Implementation of the Regional Cooperation Programme to be held before the twenty-first session of the Typhoon Committee.

3. The rapporteur requested the individual Focal Points of Meteorological Component of the Typhoon Committee Members by correspondence to provide him with comments and suggestions on the updating. Number of comments were received from the Focal Points of China,Malaysia,Hong Kong, Thailand and the Republic of Korea as of the end of last August as well as relevant information from the staff of the Japan Meteorological Agency. Based on those information the rapporteur prepared draft proposals and submitted them to the Meeting of the Technical Working Group, 11-13 October 1988,Kuala Lumpur Malaysia. The draft proposals were examined and supported in general by the Meeting.

4. Following the discussions made in the Meeting,the rapporteur made a few amendments to his draft proposals and prepared the prposals now submitted. Amendments made included are as follows;

(1) Deletion of the word "sustained" from all of the descriptions on the classification of tropical disturbances to keep consistency of definition of relevant wind speed throughout the Manual and also consistency with Tokyo RSMC practice(See blow paraphrases 8 to 14.).

(2) Renaming of GMS cloud imagery dissemination system LR-FAX to WEFAX.

(3) Further correction of editorial error based on the comments received after the preparation of the draft proposals.

Proposals for updating

5. The proposals consist of "Proposals for the updating of the Typhoon committee Operational Manual Meteorological component" and "APPENDIX" to the Proposals.

6. In the "Proposals",suggested amendment items are listed in the page order of current version of the TOM. For your convenience,all of amended pages are given in "APPENDIX". Amended parts are marked with red broad line.

7. The amendments are in the following three cases:

(1) Addition/Replacement:installation of new observing stations,introducing new observation techniques, upgrade of telecommunication circuits,introducing of new forecast methods,etc;

(2) Withdrawal : description related to data from U.S.reconnaissance flight that was ceased in early summer of 1987;and

(3) Correction of editorialerror : In addition of miscellaneous errata,the full text of Appendix 7,Annex,p.5 of the present TOM is prepared(This page is missed in spite of submission of the manuscript).

Terms related to wind speed

8. The term of "maximum sustained wind" in the TOM seems to have different meaning from description to description. The Typhoon Committee is invited to consider consistent uses of the term throughout TOM.

9. In the present TOM cyclonic disturbances are to be classified with "maximum sustained wind speed" (see para 1.3 on pages 4 and 5,and para 2.4 on page 20). The term of "maximum sustained wind speed" in the TOM be "maximum of wind speed averaged for 10 minutes". On the WMO technical regulations the said classification is made with "maximum wind speed".

10. A term "mean wind speed" in the definition of kinds of warning and a term "wind speed"(see para 1.3 on page 4) should be read "wind speed averaged for 10 minutes".

11. In another part of the TOM the term " maximum sustained wind speed"

is appeared in the different meaning;"The maximum surface wind in this graph is 1-min.mean value,i.e.,the maximum sustained wind....."(see note on page 6 of Appendix 3-B).

12. In the Atlantic Ocean and the eastern part of the Pacific Ocean,the term "maximum sustained wind" is clearly defined as wind speed averaged for one-minute for the classification of tropical and othe cyclonic storms:e.g.

Maximum sustained surface wind(1-min. mean)
cf.NOAA,Tropical Cyclones of the north Atlantic Ocean 1871-1977;

Maximum average surface wind(one minute mean)
cf.RA-IV Hurricane Operational Plan,WMO Publication No.524.

13. One-minute mean wind speed is not operationally available from surface synoptic reports. The U.S. reconnaissance flight had been the unique data source of one minute mean wind speed. No more flight is avairable now. Today, the one minute mean wind speed is only estimated from storm intensity derived from features of satellite cloud imagery(Dvorak's method).

14. Japan Meteorological Agency has been using "10 minutes mean wind speed" for warning and classification of tropical disturbances.

RSMC for typhoon forecasts and advisory services

15. The EC-XL(1988,Geneva) adopted the CBS recommendation to designate the RMCs Tokyo ,Miami and New Delhi as the RSMCs for tropical cyclone forecasts and advisory services on an operational basis. Updating of the TOM concerned with the said RSMC in Tokyo should be made in due course after the twenty-first session of the Typhoon Committee in Manila.

Appendix A

WRD/TC.21/4
Doc.

Proposals for the updating of
TYPHOON COMMITTEE OPERATIONAL MANUAL
METEOROLOGICAL COMPONENT

Content and Appendices

Page iii

Appendices

Delete "and future" from 2-F.

Delete "2G:Codes of reconnaissance flight observation".

Replace "special" in 2-A,2-B and 2-D with "enhanced.

Page iv

Figures

Delete figures "Fig.2-F.2 to Fig.2-F.7".

Insert following new figures;

Fig.2-F.2 Four-sectorized Cloud Images broadcast three-hourly,
Fig.2-F.3 WEFAX "H" Images of the Polar-stereographic projection,
Fig.2-F.4 Stretched VISSR Scan Format,
Fig.2-F.5 Time Chart of VISSR data.

Insert "(one minute mean)" after "sustained wind" in the title of Fig.3-B.5.

Delete figure Fig.3-B.6 .

Change the number of the present figure Fig.3-B.7 to new number Fig.3-B.6.

Delete figures Fig.3-B.8 and Fig.3-B.9.

Page v

Tables

Delete table "Table 3-B.1".

Chapter 1

Page 4

Section 1.3

23rd line(Maximum sustained wind)
Insert "one minute" between "the" and "average".

26th-28th line(Reconnaissance aircraft centre fix.......)
Delete these three lines.

30th line(Severe tropical storm)
Delete "sustained".

Page 5

9th(Tropical cyclone),13th line(Tropical depression),16th line(Tropical storm) and 17thline(Typhoon)
Delete the "sustained"s in these lines.

Chapter 2

Page 7

Section 2.1

Replace "3-hourly" in (ii) with "hourly".

Subsection 2.1.1 and 2.1.2

All "GMT"(time standard) is to read "UTC".

Page 8 — Section 2.2

(First paragraph)
Change the call signs "8JNZ" and "JPQX" to "JDWX" and "JCCX" respectively.

(Second paragraph, second line)
Change "and" to ",".
Insert "and JCCX(upper-air)" next to "JGZK"(radar)".

Replace the last sentence of this paragraph with new sentence shown below;
"A newly-built weather ship JDWX from Japan started upper-air observation as from August 1988."

(Third paragraph)
Add following new sentence at the end of the last sentence.

"A new function was installed on the Buoy No.22001 moored in the East China sea to make hourly observation automatically whenever wind speed there exceeds 35knots and became operationally as from June 1988."

"GMT" is to read "UTC".

Page 8 and 11 — Section 2.4

Replace all paragraphs in this section excepting the last one with following new paragraphs;

" The current system of providing meteorological satellite information obtained by GMS and related products is operated as follows;
(a) the full disk data will be obtained hourly,
(b) cloud motion wind observation will be performed four times a day,
(c) the stretched VISSR digital data dissemination for all observations will be made in addition to the WEFAX dissemination.
Detailed information is given in Appendix 2-F.

Remarks GMS-4 is scheduled to be launched in 1989, but the GMS products will remain unchanged. "

Page 9 — Fig.2.1

Add new weather radar station 96413 of Malaysia into the figure.

Amend the positions of the station 48615,48602 and 48672 as shown in the APPENDIX to this proposal.

Page 10 — Table 2.1

Delete the perpendicular line centre right of the table.

China: Station number 58369(Shanghai) is to read 58367.

Japan: Station number 47430 is to read 47432.

Malaysia: Add new station "96413 Kuching" to the table.

Republic of Korea: Change the station name "47116 Gwanag Mt." to "47116 Kwanaksan".

Page 12 — Fig.2.2

Add following new satellite cloud imagery receiving stations into the figure.
Hong Kong.....one MDUS
Japan.........five SDUSs
Viet Nam......three SDUSs

Page 13 — Table 2.2

Amend the table as follows;

Hong Kong(Kowloon): Add "1" to the GMS column of the table.

Japan: Amend the positions of the stations as follows; Tokyo 35.7N 139.8E, Hiroshima 34.4N 132.5E, Fukuoka 33.6N 130.4E

Add following stations to the table.

Kobe	(34.7N,135.2E)	2,3
Nagasaki	(32.7N,129.1E)	2,3
Narita	(35.8N,140.4E)	2,3
Haneda	(35.6N,139.8E)	2,3

Malaysia: Change the station name "Selangor" to "Petaling Jaya"

Viet Nam: Add "2,3" into the GMS column of Hanoi and Ho Chi Minh city respectively.

Add following station into the table;
Da Nang (16.0N,108.2E) 2,3 GMS column.

Page 14 — Section 2.5

Delete the last two paragraphs("The reconnaissance flight...The details of RECCO and.....in Appendix2-G").

Chapter 3

Page 15 — Section 3.1

(Second paragraph, second line)
"Streamlined" is to read "streamline".

(Third paragraph, third and fourth lines)
Delete "and aircraft reconnaissance reports".

Page 16 — Table 3.1

(a) analysis
(First line)
"GMT" is to read "UTC".

(Last line)
Change present last line as follows:
"sea surface temperature 5 days C,G A ".

(Fifth line from the bottom of the page)
"V:Area centred at..." is to read "V:Area around...".

Page 17 — Section 3.2

(First paraphrase)
Fourth line : "including" is to read "include".
First line of (i) : Replace "(200km)" with "(180km)".
First line of (ii): Replace "...a very fine mesh(50km)NWP model..." with "Typhoon model of 50km horizontal resolution...".

Delete third to fifth lines of (ii)(In the case.... areas.).

Page 18 Table 3.2(a)

(In the midst of the page)
"Truncation Spectral,..." is to read as follows;
"Horizontal representation Spectral,with triangular truncation at wave number 63.".

Page 19 Table 3.2(b)

(In the midst of the page)
"Integration domain", "Grid interval" and "Grid" is to read as follows;

Integration domain	Area around the typhoon eye at the initial time,4000km x 4000km
Horizontal representation	Spectral,with circular truncation at wave number 51
Grid	81 longitudes and 81 latitudes in Mercator projection.The grid interval is about 50km.

Chapter 4

Page 20 Section 4.2

Delete the words "sustained" from the descriptions on the classification of tropical disturvances(2.Tropical depression,3. Tropical storm,4.Severe tropical storm,5.Typhoon).

Page 21 Examples of Advisories

Advisory for analysis EX.1

(sixth line) Delete "RECON AND".

Page 22 Section 4.3

Advisory for Prognostic Reasonning EX.3

Replace whole sentences of the part "A" with following new sentences;
" A. SAT CLOUD IMAGERY OF TY 8526 HOPE SHOW THE EYE DISAPPEARED AND SIGNIFICANT CIRRUS OUTFLOW TO THE NORTHEAST. THESE DATA INDICATE THE STORM HAS REACHED PEAK INTENSITRY AND SUGGEST RECURVATURE.

Replace "RECON" in the part "C" with "SAT".

Page 27 Table 5.1

3. Regional circuits

Update the "present operational status" of the table to reflect recent improvements in the regional telecommunication circuits as follows;

Bankok-Hong Kong	Satellite,200 bit/s,
Tokyo-Seoul	Cable,V.29 9600bit/s,4800bit/s(data)X.25 Level 3 +4800bit/s(NCDF).

APPENDIX

Appendix 1

Page 1-B,p.1 Delete acronyms "GMT"(11th line),HR/LR FAX(14th line) and "RECCO"(33rd line) from the list.

1-B,p.2 Delete acronym "TEMP DROP"(first line) from the list.

Appendix 2

Page 2-A,p.1 Replace "special" in the first line(title) with "enhanced".

Delete following stations of JAPAN(47) from the list:451,599,603 and 748.

Add following stations to Japan(47) in the list; 805, 887,890,891, 892,893,894,895,897,898,899,909,912 and 991.

2-A,p.2 Add following two stations to the Republic of Korea(47) in the list ; 095 and 185.

Page 2-B Replace "special" in the first line(title) with "enhanced".

Delete three stations shown below from Japan(47) of the list.
580,681 and 881

Put "*" mark on the shoulder of two station numbers,971 and 991.

Add following "note" at the end of the list of Japan(47);
"* 06 UTC only."

Delete the second to fourth lines of Notes of Philippines(98)(At present.... ...become available.).

Add new station "185" to the Republic of Korea(47) in the list.

Page 2-C Replace present figure with revised version(See the APPENDIX to this Proposal).(Some errors were found on the position of Buoys.)

Page 2-D Replace "special" in the first line(title) with "enhanced".

Replace the station number of China(58) "369" with "367".

Replace the station number of Hong Kong(45) "005" with "010".

Add new station number " 413" to Malaysia(96) .

age 2-E Update the radar parameters shown belows.

p.1,2 (China-1) and (China-2)

Radar station:Shanghai,Fuzhou,Shantou and Xishadao

Wave length	10.6cm
Peak power of transmitter	500kw
Sensitivity minimum of receiver	-110dBm
Beam width	2.0deg
Detection range	600km

Change the antnna elevation of "Shanghai" to 50m.

Change the "scan mode in operation of "Shanghai" to 2.

Change the "Display" of "Shanghai" to 1.

p.3 (Hong Kong)

Change the operation mode of "Tate's Cairn" to 3.

p.4,5 (Japan-1) and (Japan-2)

Change the modes of three radars,Sapporo(p.4),Sendai(p.4) and Akita(p.5) as follows;

Scan mode in observation	1
MTI Processing	1
Display	1

p.6 (Japan-3)

Change the station name of Fukui/Tojinbo to Fukui/Tojimbo.

Change the pulth length of Fukui/Tojimbo to 1.9.

Update the radar parameters of "Nagoya" as follows;

Pulse length	2.5μs
Sensitivity minimum of receiver	-109dBm
Beam width	1.5(H),1.3(V)deg

Change the pulse length of "Murotomisaki" to 2.7μs.

p.7 (Japan-4)

Change the wave length of Matsue/Misakayama to 5.69 cm.

The location of "Fukuoka/Sefuri" is to read 33° 26'N,130° 22'E.

Change the scan mode in observation and display of two radars, Fukuoka/Sefuri and Tanegashima to 1 .

p.8 (Japan-5)

Update the radar parameters of "Okinawa/Itokazu as follows;

Pulse lengh	2.8μs
Sensitivity minimum of receiver	-113dBm
Beam width	1.3(H),1.4(V)deg
MTI Processing	1
Disply	1

Change the horizontal beam width of Ishigakijima to 1.4(H).

p.11 (Malaysia-3)

Add new radar station "Kuching 96413" and its parameters to the list as follows;

Location	01° 29'N,110° 20'E
Antenna elevation	32m
Wave length	10cm
Peak power of transmitter	370kw
Pulse length	2μs
Sensitivity minimum of receiver	-112dBm
Beam width	1.8 deg
Detection range	400km
Scan mode in observation	1
MTI and Doppler processing	2
Display and peration mode & status	1.

p.12 (Republic of Korea)

Present station name 47116 Gwanag Mt. is to read "47116 Kwanaksan. The radar parameters of this station should be updated as follows;

Wavelength	5.6cm
Peak power of transmitter	250kw
Pulse length	2/0.5μs
Sensitivity minimum of receiver	-108dBm
Beam width	1.2 deg
Detection range	480km
Scan mode in observation	2
MTI and Doppler processing	1
Display	1,2.

Page 2-F

p.1-7 Replace all of present pages 2-F,p.1-p.7 to reflect the progress in "Stretched VISSR dissemination Program" with new pages 2-F,p.1-3 as shown in the "APPENDIX" to this Draft Proposal. Present Annex to 2-F remains unchanged.

Note. The term "LR-FAX" is to read "WEFAX" throughout the Manual due to the renaming of the GMS cloud imagery dissemination system as from October 1988.

Appendix 3

Page 3-A (China)

p.2 Change present name of method "ANALOG" to new name "MARKOV-TYPE ANALOG MODEL" and replace present Description of method with new description as shown in the "APPENDIX" to this Proposal. To do this ,add new page 3-A,p.2-2 next to present 3-A,p.2.

Add new method "Two-level Steering Method" with its description of method shown in the "APPENDIX" to this Proposal into new page 3-A,p.2-2,next to MARKOV-TYPE ANALOG MODEL.

p.5 (Hong Kong)

Add new method "ANALOG" with its description of method shown in the "APPENDIX" of this Proposal next to the"Space-mean method".

Add additional page 3-A,p.5-2 after 3-A,p.5 to do this.

p.13 (Republic of Korea)

Add new type of forecast "24-hr forecast" to each of four methods described in this page .

Page3-B

p.5 Delete the subsection 1.3.2,and accordingly,change the number of subsections 1.3.3,1.3.4,1.3.5 and 1.3.6 to new number 1.3.2,1.3.3,1.3.4 and 1.3.5 respectively.

p.6 Insert "(one minute mean)" after "sustained wind of the title of Fig.3-5.B.

Delete Fig.3-B.6 ,Table 3-B.1 and Notes in the midst of this page.

p. Change figure number 3-B.7 to 3-B.6.

p.14 Section 2

Change the title of this section as follows;
"2.The application of radar and satellite observation data in tropical cyclone analysis and forecasting".

p.14-16 Section 2.1

p.14-16 Section 2.1
Delete whole section 2.1.

p.16-17 Section 2.2 and 2.3

Change the number of section and subsection as follows:

(present number)	New number
2.2	2.1
2.2.1	2.1.1
2.2.2	2.1.2
2.2.3	2.1.3
2.3	2.2
2.3.1	2.2.1
2.3.2	2.2.2
2.3.2.1	2.2.2.1
2.3.2.2	2.2.2.2

Page 15-19 Delete entire page p.15 and change page numbers 16-19 to 15-18.

Appendix 5

Page 5-A

p.1 (Hong Kong)

Present telephone number(24 hours) 3-7829471 is to read 3-7829474.
Add new telephone number(24 hours) 3-681944 to the list.
Add new telefax number 3-7215034 to the list.

(Japan)

Change the name of Director to "Y.Yamagishi".
Add "(24 hours)" after the Telex METTOK J.
Add new telephone number 03-211-8303(24 hours but excepting 00-09 UTC on weekdays).

(Malaysia)
Amend present name,adress and telephone numbers as folows:

Main Meteorological Office,Kuala Lumpur International Airport	Kuala Lumpur International Airport , 47200.Subang,Selangor Dahal Ehsan	03 7461441 03-7465990 03-7463961 (24 hours).

Page 5-C

p.1 Replace "Intensified" in the Type of data with "Enhanced".

Delete "TD" in the NN column Of the heading 'SNPH20 RPMM'.

Change the "Heading" of intensified upper-air observation as follows;

(present)	(new)
USJP1 RJTD	USJP01 RJTD
UKJP1 RJTD	UKJP01 RJTD
ULJP1 RJTD	ULJP01 RJTD
UEJP1 RJTD	UEJP01 RJTD
UEK01 RJTD	UEK01 RKSL

Delete "TD" in the ' NN' column of ULPH1 RPMM.

p.2 Replace "Intensified" in the Type of data with "enhanced".

p.2 Change the "heading" of intensified ship observation as follows:

(present)	(new)
SNVX20	SNVB20 SNVD20 SNVE20 SNVX20
SNVX21	SNVB21 SNVD21 SNVE21 SNVX21

Delete headings etc.of "Aircraft Report(RECCO),Peripheral data and Drop-sonde Report" from the table.

Add following new heading to those of Tropical cyclone forecast.
FXKO RKSL(receiving stations) TD=SL,SL=0.

Delete "TD" from the NN column of WDPA1 PGTW .
Add "TD"s to the SL column of WTPA31 PTWG and WTPA32 PTWG.

p.3 Add following new heading to the Warning.
WWJKO RKSL(receiving stations)TD=SL SL=0

Page 5-D Delete followings from TT Data designater in the table.
UR Air craft report(RECCO)
UZ Drop sonde report

Amend the first line of (ii) in the table shown below.

(present)	(new)
1-19 Global	01-19 Global.

Appendix 6

Page 6-B 1.Items of monitoring
Delete "3-hourly" ahead of "buoy observation" in (ii).
Delete "(v) reconnaissance flight observation".

Appendix 7

Page 7-A Change the number of page Appendix 7-A to 7-A,p.1.

Add new page Appendix 7-A,p.2 next to 7-A,p.1.

(a) Level II-b

Delete "reconnaissance flight observation" from the second line of "Kinds of data".

(b)GMS cloud pictures

Data form is to read as follows;
Data form : Microfilm(Detailed specification is given in the next page(Appendix 7-A,p.2)).

(c) Level III-a
(the last line of "Element and layer)"

" GMT" is to read "UTC".

Annex,p.3
(II) Level III-a data)
All "GMT" is to read "UTC".
Amend "block length etc. " as follows;
(new)
(6) Block length 2640 bytes,
(7) Number of records in one block 10,
(8) Logical record length 264 bytes,

(9)Structure of record
(a)Logical order of records
* 44 cnosecutive records are.....
.....entire A-area data........
..... A group of
45 records(one identification record plus 44 data records) is.........
....
* The record sequences..........60° N to 20.625° S at 1.875 degree......(44 records).
(b)Type of logical record
....

264 bytes
| IDbbyymm...............b |.....

Annex,p.4 (At the bottom of the page)

264 bytes

I 1...................................	I 66	I 66	I 66	I 66

Annex,p.5

Amend some numerals as follows;
(6-7th line)
(new) Data sequences proceed from 78.75 degree east longitude .....untill 159.375 degree west longitude(66 grid points).
(d)
(new) 264 bytes
| EEbbb.......................... |....

Note. The fifth page of Annex to 7-A was missed from all copies distributed to Japan Meteorological Agency,though the manuscript had submitted.

APPENDIX

to the Proposals for the Updating of
TYPHOON COMMITTEE OPERATIONAL MANUAL
METEOROLOGICAL COMPONENT

Appendices

Figures

Tables

Cyclone: Tropical cyclone

Cyclone warning bulletin: A priority message for exchange of tropical cyclone information and advisories.

Cyclonic disturbance: A non-frontal synoptic scale low pressure area originating over tropical waters with organized convection and definite cyclonic wind circulation.

Direction of movement of the tropical cyclone: The direction towards which the centre of the tropical cyclone is moving.

Eye of the tropical cyclone: The clear area inside the circular cloud mass within the wall of convective clouds, the geometric centre of the cyclone.

Gale warning: Meteorological message intended to warn those concerned of the occurrence or expected occurrence of wind speed in the range of 34 to 47 knots, or wind force 8 or 9 in the Beaufort scale.

Gale: Mean surface wind speed of 34 to 47 knots.

Gust: Instantaneous peak value of surface wind speed.

Low pressure area: An area bounded by a closed isobar with minimum pressure inside when the central pressure cannot be accurately assessed and the maximum sustained wind is less than 34 knots. On the weather map, the low pressure area is denoted with the capital L within the innermost isobar without showing the centre position.

Maximum sustained wind: Maximum value of the one minute average wind speed at the surface.

Mean wind speed: Average wind speed.

Delete ~~Reconnaissance aircraft centre fix of the tropical storm: The location of the centre of a tropical cyclone obtained by reconnaissance aircraft penetration.~~

Severe tropical storm: A cyclonic disturbance in which the maximum Delete ~~sustained~~ wind speed is in the range of 48 to 63 knots.

Speed of movement of the cyclone: Speed of movement of the centre of the tropical cyclone.

Storm surge: The difference between the actual sea (tide) level under the influence of a meteorological disturbance (storm tide) and the lvel which would have been reached in the absence of the meteorological disturbance. Storm surge results mainly from the shoreward movement of water under the action of wind stress. A minor contribution is also made by the hydrostatic rise of water resulting from the lowered barometric pressure.

Storm tide: The actual sea level as influenced by a weather disturbance. The storm tide consists of the normal astronomical tide and the storm surge.

Storm warning: Meteorological message intended to warn those concerned of the occurrence or expected occurrence of average wind speeds in the range of 48 to 63 knots, wind force 10 or 11 in the Beaufort scale.

Tropical cyclone: A cyclonic disturbance with average maximum Delete ~~sustained~~ wind speed of 34 knots or more.

Tropical cyclone advisory: A priority message for exchanging information, internationally, on tropical cyclones.

Tropical depression: A cyclonic disturbance in which central position can be identified and the maximum ~~sustained~~ wind speed is less than 34 knots.

Tropical storm: A cyclonic disturbance in which the maximum Delete ~~sustained~~ wind speed is in the range of 34 to 47 knots.

Typhoon: A cyclonic disturbance in which the maximum ~~sustained~~ wind speed is 64 knots or more.

Typhoon warning: Meteorological message intended to warn those concerned of the occurrence or expected occurrence of the mean wind speed of 64 knots or higher, or wind force 12 in the Beaufort scale.

Uncertainty of the centre position: Degree of uncertainty of the centre position of a tropical storm expressed as the radius of the smallest circle within which the centre is located by the analysis.

Visual storm signals: Visual signals displayed at coastal points to warn ships of squally winds, gales and tropical cyclones.

1.4 Units used for regional exchange

(a) The following units/indicators are used for marine purposes:

(i) Distance in nautical miles, the unit (nm) being stated;

(ii) Location (position) by degrees and where possible tenths of degrees of latitude and longitude preferably expressed by words;

(iii) Direction to the nearest sixteen points of the compass or in degree to the nearest ten, given in words;

(iv) Speed (wind speed and direction of movement of tropical cyclones) in knots, the unit (kt) being stated;

CHAPTER 2

OBSERVING SYSTEM AND OBSERVING PROGRAMME

2.1 Networks of synoptic land stations

The surface and upper-air stations in the regional basic synoptic network are those of the Typhoon Committee Members and are included in Weather Reporting Volume A – Observing stations (WMO Publication No.9).

The RSMC and all Typhoon Committee Members should initiate enhanced observation programmes for their stations in the area within 300 km of the centre of a tropical cyclone. All the observations should be made available to the RSMC and all Members. Enhanced observations should include:

(i) surface observations – hourly,
(ii) buoy observations – hourly,
(iii) radar observations – hourly,
(iv) upper-air observations – 6-hourly.

2.1.1 Surface observations

All surface stations included in the regional basic synoptic network should make surface observations at the four main standard times of observation, i.e., 0000, 0600, 1200 and 1800 UTC, and at the four intermediate standard times of observation, i.e., 0300, 0900, 1500 and 2100 UTC. Any surface station that cannot carry out the full observational programme should give priority to carrying out the observations at the main standard times. Additional surface observations at hourly intervals may be requested by any Member, whenever a typhoon becomes an imminent threat to the Member, from the stations shown in Appendix 2-A.

2.1.2 Upper-air synoptic observatons

All the upper-air stations included in the regional basic synoptic network should carry out radiosonde and radiowind observations at 0000 and 1200 UTC, and radiowind observations at 0600 and 1800 UTC. The radiosonde/radiowind observations carried out at 0000 and 1200 UTC should reach the 30 hPa level for more than 50 per cent of the ascents. The carrying out of the radiowind observations at 0000 and 1200 UTC should receive priority over the radiowind observations at 0600 and 1800 UTC.

Radiowind stations in the areas affected by tropical cyclones should also make radiowind observations at 0600 and 1800 UTC which should aim at reaching the 70 hPa level.

Additional upper-wind observations given in Appendix 2-B will be made as appropriate whenever a tropical cyclone is centred within 500 km of the station. The minimum required is two observations per day, but for a better understanding of the ambient windfield three or even four ascents on some days should be made when possible. All these additional upper-air observations will be distributed among the Typhoon Committee Members.

2.2 Ship and buoy observations

Additional hourly surface observations are made by the Japanese weather ships (call signs of them are: JBOA, JGZK, JDWX, JPVB, JFDG and JCCX) when they are within 1,000 km of the centre of a tropical cyclone with central pressure of less than 990 hPa.

Additional upper-air and radar observations are also made by the ships JBOA (upper-air and radar) ~~and~~, JGZK (radar) and JCCX(upper-air) when they are in the vicinity of a tropical cyclone. A newly-built weather ship JDWX from Japan started upper-air observations from August 1988.

The observation network of the Japanese moored buoy is shown in Appendix 2-C. Data from buoys on air temperature, air pressure, wind, sea-surface temperature (SST), waves and others are collected by the centre at Tokyo via GMS. A new function was installed on the Buoy No.22001 moored in the East China sea to make hourly observation automatically whenever the wind speed there exceeds 25knots and became operational as from June 1988. Surface observations are made by three oil rigs in Malaysia at 2100 or 2200 UTC during weekdays. These observations are collected by the main Meteorological Office at Subang and transmitted regionally over the GTS.

2.3 Radar observations

It is essential that radar observations continue as long as a tropical cyclone remains within the detection range of the radar. All meteorological centres should co-operate to ensure that the radar observations are transmitted through the GTS to the RSMC and all Members. Reports will be coded in the RADOB code (FM 20-VIII).

In case the report is in plain language, the full range of information available at the radar station should be given. The message will therefore include, where available, the confirmation of the determination of the centre, the shape, definition, size and character tendency of the eye, the distance between the end of the outermost band and the centre of the cyclone and the direction and speed of movement with a statement of the interval of time over which the movement was calculated.

A list of the radar stations and a map of the radar network in the Typhoon Committee region are given in Table 2.1 and Figure 2.1, respectively. Information on meteorological radars of the Typhoon Committee Members is shown in Appendices 2-D and 2-E.

2.4 Meteorological Satellite Observations

The current system of providing meteorological satellite information obtained by GMS and related products is operated as follows:

(a) the full disk data will be obtained hourly,
(b) cloud motion wind observation will be performed four times a day for both hemisphere,
(c) the stretched VISSR digital data dissemination for all observations will be made in addition to the WEFAX dissemination.

Detailed information is given in Appendix 2-F.

Remarks GMS-4 is scheduled to be launched in 1989, but the GMS products will remain unchanged.

Fig. 2.1 Radar network in the Typhoon Committee region

Note * : Station number is being proposed.

Table 2.1 List of radar stations in the Typhoon Committee region

Member	Radar Station		
China	58367 Shanghai 59316 Shantou	58760 Dangtou 59981 Xishadao	58941 Fuzhou
Democratic Kampuchea			
Hong Kong	45010 Tate's Cairn		
Japan	47412 Sapporo 47590 Sendai 47639 Fujisan 47636 Nagoya 47792 Hiroshima 47869 Tanegashima 47927 Miyakojima	47418 Kushiro 47582 Akita 47572 Niigata 47773 Osaka 47899 Murotomisaki 47909 Naze 47918 Ishigakijima	47432 Hakodate 47662 Tokyo 47705 Fukui 47791 Matsue 47806 Fukuoka 47937 Okinawa
Lao PDR			
Malaysia	48601 Penang 48647 Kuala Lumpur 96471 Kota Kinabalu	48602 Butterworth 48657 Kuantan 96413 Kuching	48615 Kota Bharu 48672 Kluang
Philippines	98126 Basco 98334 Baler* 98525 Busuanga*	98231 Aparri 98440 Daet 98558 Guian	98321 Baguio 98447 Virae 98646 Mactan
Republic of Korea	47116 Kwanaksan	Delete this line.	
Thailand	48455 Bangkok 48568 Sonkhla 48569 Hat Yai	48517 Chupon 48456 Donmuang	48356 Sakonnakon 48327 Chiang Mai
Viet Nam			

Note*: Station number is being proposed

Delete Phase I : March 1987 - February 1988
Phase II : March 1988 - May 1988*
Phase III: After May 1988*

* Subject to change. JMA wishes to ask for the opinion of the users.

Main features of the new system may be summarized as follows:

In Phase I, (a) the full disk data will be obtained three-hourly, (b) in principle, the Northern Hemisphere data will be retrieved hourly except for the time of GMS system check-out, etc., and (c) cloud-motion wind observation will be performed for both hemispheres at 0000 and 1200 GMT and for only the Northern Hemisphere at 0600 and 1800 GMT. If necessary, in (b) the hemispheric observation for the Southern Hemisphere instead of the Northern Hemisphere will be carried out.

Delete In Phase II, the stretched VISSR digital data dissemination for all observations will be started in addition to the FAX dissemination schedule in Phase I. During this period, the operation of GMS for obtaining satellite information will not be changed. Therefore, all the VISSR observations and the HR/LR FAX dissemination schedule will be carried out without any change from Phase I. The overlapping of stretched digital data with HR-FAX dissemination at this stage is placed for the convenience of M-DUS modification for stretched VISSR digital data reception.

In Phase III, (a) the full disk data will be obtained three-hourly, Delete (b) the Northern Hemisphere data will be retrieved hourly except for the time of GMS check-out, etc., (c) cloud-motion wind observatin will be performed four times a day for both hemispheres, and (d) the HR-FAX will be replaced by the stretched VISSR digital data. If necessary, in (b) the hemispheric observation for the Southern Hemisphere instead of the Northern Hemisphere will be carried out. Detailed information is given in Appendix 2-F.

Delete Remarks During the period of Phase III, GMS-4 is scheduled to be launched in 1989, but the GMS products will remain unchanged.

SAREP reports (Part A) will be disseminated eight times a day from RSMC to Typhoon Committee Members through the GTS under the heading TPPW20 RJTD when a tropical cyclone is located in the region north of the equator and between 100°E and 140°E. Information on the intensity of the tropical cyclone at 0000, 0600, 1200 and 1800 UTC will be reported under the heading TPPW21 RJTD.

Details of the SAREP code are to be found in the Manual on Codes, Volume 1, FM 85-VI (WMO Publication No. 306).

2.5 Aircraft observations

Reports from aircraft in flight (AIREPs) in Asia and neighbouring areas are collected and exchanged according to the Regional OPMET Bulletin Exchange (ROBEX) scheme. AIREPs are collected by the centres in the Typhoon Committee Members areas and transmitted to the Main Collection Centres at Bangkok, Beijing, Hong Kong, Kuala Lumpur and Tokyo.

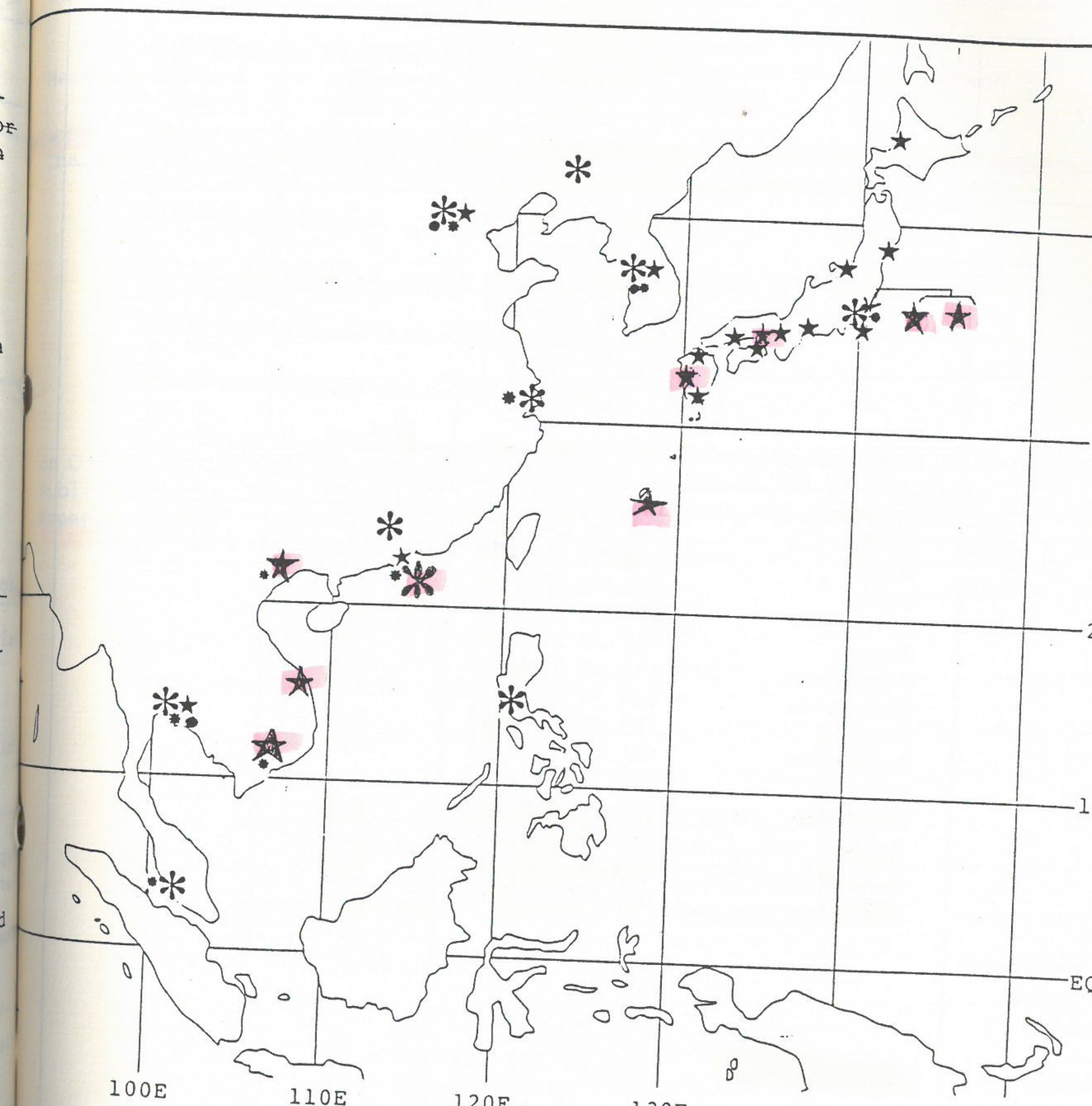


Fig. 2.2 Satellite cloud imagery receiving facilities at meteorological centres in the Typhoon Committee region

✱: M-DUS station ★: S-DUS station

●: NOAA HRPT station ✸: NOAA APT station

Table 2.2: Satellite cloud imagery receiving facilities of the Typhoon Committee Members

Country	Station		GMS 1. M-DUS 2. S-DUS 3. Movie	NOAA 1. HRPT 2. APT
China	Beijing	(39.9N 116.4E)	1,2	1,2
	Shanghai	(31.1N 121.4E)	1	2
	Shenyan	(41.8N 123.6E)	1	
	Guongzhou	(23.1N 113.3E)	1	
Democratic Kampuchea				
Hong Kong	Kowloon	(22.2N 114.1E)	1,2,3	2
Japan	Sapporo	(43.1N 141.3E)	2,3	
	Sendai	(38.3N 140.9E)	2,3	
	Tokyo	(35.7N 139.8E)	1,2,3	1
	Osaka	(34.7N 135.5E)	2,3	
	Niigata	(37.9N 139.1E)	2,3	
	Nagoya	(35.2N 137.0E)	2,3	
	Hiroshima	(34.4N 132.5E)	2,3	
	Takamatsu	(34.3N 134.1E)	2,3	
	Fukuoka	(33.6N 130.4E)	2,3	
	Kagoshima	(31.6N 130.6E)	2,3	
	Okinawa	(26.2N 127.7E)	2,3	
	Nagasaki	(32.7N 129.9E)	2,3	
	Kobe	(34.7N 135.2E)	2,3	
	Narita	(35.8N 140.4E)	2,3	
	Haneda	(35.6N 139.8E)	2,3	
Lao People's Democratic Republic				
Malaysia	Petaling Jaya	(3.1N 101.7E)	1	2
Philippines	Quezon City	(14.7N 121.0e)	1	
Republic of Korea	Seoul	(37.5N 127.0E)	1,2	1,2
Thailand	Bangkok	(13.7N 100.6E)	1,2	1,2
Viet Nam	Hanoi	(21.0N 105.5E)	2,3	2
	Ho Chi Minh City	(10.5N 106.4E)	2,3	2
	Da Nang	(16.0N 108.2E)	2,3	

AIREPs in the north-east Pacific area are also collected by the centres at Honolulu, Washington, etc., and relayed to Tokyo.

ASDAR (Aircraft to Satellite Data Relay) reports are collected by the centre at Tokyo via GMS.

All reports will be disseminated in real-time to the RSMC and to other Members through GTS and AFTN circuits.

Delete ~~The reconnaissance flight observations are made by the JTWC, Guam. The observational data are classified into the following types:~~

~~(i) eye data;~~

~~(ii) peripheral data;~~

~~(iii) reconnaissance flight data (RECCO);~~

~~(iv) dropsonde data (TEMP DROP)~~

~~The details of RECCO and TEMP DROP codes are to be found in the Manual on Codes, Volume II, II-4-F-1 II-4-F-12 and Volume I, FM 37-VII (WMO Publication No. 306), respectively. Other relevant codes are shown in Appendix 2-G.~~

CHAPTER 3

TROPICAL CYCLONE ANALYSIS AND FORECAST

3.1 Analysis at RSMC

The RSMC should produce analyses of various meteorological parameters in chart form and/or in grid point value depending on the facilities of NMCs to process these products. These analyses should include pressure distribution at the sea level and temperature, geo-potential height, humidity and wind at selected pressure levels.

The streamline analysis is indispensable over the tropical region for forecasting tropical cyclones. The RSMC should produce streamline analyses of the upper and lower atmospheric levels utilizing cloud motion wind, aircraft reports, as well as upper-air observations. A list of output products is shown in Table 3.1(a).

The RSMC should produce additional analyses of the tropical cyclone when it is in the region north of the equator and between 100°E and 180°E, based on the enhanced observations, additional satellite imageries~~-and aircraft~~ Delete ~~reconnaissance reports.~~ Such analyses should be disseminated in the form of additional bulletins consisting of information on:

(i) position of the tropical cyclone;

(ii) direction and speed of movement;

(iii) central pressure;

(iv) maximum wind and wind distribution.

Various analyses based on GMS data other than cloud imagery itself should be produced by the RSMC. These analyses include five-day mean cloud amount and that of long-wave radiation. In addition to these, analysis of sea-surface temperature combining satellite data and in-situ measurements should be prepared every five days. These analyses are useful for the better understanding of the tropical atmosphere and medium-range assessment of forecasting tropical cyclones.

Table 3.1: Output products transmitted by RSMC Tokyo for regional purposes

(a) Analysis

Description of product	Observation time (UTC)	Form of transmission	Area
Sea level pressure	00,12	C,G	A
500 hPa height	00,12	C,G	A
850 hPa wind vector	00,12	G	A
850 hPa streamline	00,12	C	A
850 hPa isotach	00,12	C	A
850 hPa vorticity*	00,12	C	A
850 hPa divergence*	00,12	C	A
200 hPa wind vector	00,12	G	A
200 hPa streamline	00,12	C	A
200 hPa isotach	00,12	C	A
200 hPa vorticity*	00,12	C	A
200 hPa divergence*	00,12	C	A
850 hPa temperature	00,12	C,G	A
850 hPa specific humidity	00,12	G	A
850 hPa dew point depression	00,12	C	A
Sea surface temperature	5 days	C,G	A

(b) Forecast

Description of product time (hour)	Forecast transmission	Form of	Area
Sea level pressure	24,48	C,G	A,V
500 hPa height	24,48	C,G	A,V
850 hPa wind vector	24,48	G	A,V
850 hPa streamline	24,48	C	A,V
850 hPa isotach	24,48	C	A,V
200 hPa wind vector	24,48	G	A,V
200 hPa streamline	24,48	C	A,V
200 hPa isotach	24,48	C	A,V
850 hPa temperature*	24,48	C,G	A,V
Rainfall amount	24,48	C	V

Form of transmission:
C: chart form
G: grid point value

Area:
A: 80°E - 160°W, 20°S - 60°N
V: Area around the typhoon eye at the initial time. The size of the area is about 4,000 km x 4,000 km.

* These may be omitted due to limitation of the capacity of the telecommunication line.

Some of them may be superimposed on one chart.

3.2 Forecast at RSMC

The RSMC should prepare relevant numerical weather prediction products based on a global model and a regional model. An outline of the models is depicted in Table 3.2. These products should be made available to Members of the Typhoon Committee in real-time. These products should include the following:

(i) forecast products of a high resolution (180km) synoptic scale NWP model covering the globe for the prediction of the change of large-scale atmospheric circulation patterns in the region;

(ii) forecast products of Typhoon model of 50km horizontal resolution for predicting the 24- and 48-hour movements of a tropical cyclone. ~~In the case wh~~ Delete ~~than one cyclone exists over the area of concern, the NWP model is applied to the tropical cyclone which is expected to affect populated areas.~~ A list of output products is shown in Table 3.1(b).

The RSMC should also prepare several statistical models for predicting the track of the tropical cyclone and apply the Dvorak method for the prediction of the intensity change of the tropical cyclone. Other relevant synoptic methods should also be applied for predicting the tropical cyclone.

The RSMC should summarize in a consolidated form all available information and prepare the final forecasts of the tropical cyclone when it exists in the region north of the equator and between 100°E and 180°E. These forecasts should include:

(i) 24- and 48-hour forecast position;
(ii) forecast intensity and wind distribution;
(iii) prognostic reasoning
(iv) tendency assessment if possible.

3.3 Operational analysis and forecast at centres of Typhoon Committee Members

The national meteorological services of Typhoon Committee Members are using various kinds of operational forecast methods for typhoon track. The ones currently used are shown in Appendix 3-A.

The final responsibility for analysis and forecasting development and movement of tropical cyclones in the region will be with the national meteorological services of each of the Members. In order to promote uniformity in the adoption of proven techniques, a sample of such techniques currently used by Members is given in Appendix 3-B.

Table 3.2: Outline of RSMC Tokyo prediction models

(a) Global prediction model

Basic equation	Primitive equation
Vertical resolution	16 level σ-co-ordinate
0.015 (sigma 16) 0.045 0.075 0.110 0.160 0.210 0.280 0.360 (sigma 9)	0.450 (sigma 8) 0.565 0.690 0.800 0.890 0.950 0.980 0.995 (sigma 1)
Integration domain	Globe
Horizontal representation	Spectral, with triangular truncation at wave number 63.
Grid	96 Gaussian latitudes and 192 longitudes
Horizontal diffusion	$K\nabla^4$ (linear)
Time integration	Semi-implicit (Δt depends on maximum V, Δt = 14 min. for Vmax = 100 m/s) with time filter (ν = 0.05)
Orography	Included. Small scale smoothed
Physical parameterization	(i) Surface exchanges: Fluxes of momentum, heat and moisture are included both for land and sea areas (ii) Convection: Kuo's scheme (iii) Latent heating: Condensation of water vapour (iv) Radiation: Long-wave cooling and solar heating with effects of cloud. Diurnal variation included
Earth surface	Daily analysed sea-surface temperature. Monthly averaged albedo, soil moisture, ice cover specified geographically. Soil temperature predicted.

(b) Typhoon prediction model

Basic equation	Primitive equation
Vertical resolution	8 level σ-co-ordinate
0.050 (sigma 8) 0.125 0.200 0.325 0.500 0.725 0.905 0.980 (sigma 1)	
Integration domain	Area around the typhoon eye at the initial time ,4000km x 4000km
Horizontal representation	Spectral,with circular truncation at wave number 51.
Grid	81 longitudes and 81 latitudes in Mercator projection. The grid interval is about 50km.
Horizontal diffusion	$K\nabla^4$ (linear)
Time integration	Semi-implicit (Δt depends on maximum V, Δt = 5 min. for Vmax = 100 m/s) with time filter (ν = 0.05)
Orography	Included. Small-scale smoothed
Physical parameterization	(i) Surface exchanges: Fluxes of momentum, heat and moisture are included for sea area. Flux of momentum is included for land (ii) Convection: Kuo's scheme (iii) Latent heating: Condensation of water vapour but no evaporation (iv) Radiation: Not included
Earth surface	Daily analysed sea-surface temperature
Lateral boundary	Value from the global prediction model

CHAPTER 4

TROPICAL CYCLONE WARNINGS AND ADVISORIES

4.1 General

The responsibility for warning the human settlements on land which are threatened by a tropical cyclone rests in all cases with the National Meteorological Services (NMS). These national responsibilities are not subject to regional agreement. Therefore, only the cyclone warning systems intended for international users and exchanges among the Typhoon Committee Members are described in this chapter.

4.2 Classification of cyclonic disturbances

Classifications of cyclonic disturbances for the typhoon region for the exchange of messages among the Typhoon Committee Members are given below:

1.	Low pressure area	(L)	Central position cannot be accurately assessed.
2.	Tropical depression	(TD)	Central position can be identified, but the maximum ~~si~~ Delete wind speed is less than 34 kt.
3.	Tropical storm	(TS)	Maximum ~~sustained~~ Delete wind speed is between 34 and 47 kt.
4.	Severe tropical storm	(STS)	Maximum ~~sustained~~ Delete wind speed is between 48 and 63 kt.
5.	Typhoon	(TY)	Maximum ~~sustained~~ Delete wind speed is 64 kt or more.

4.3 Tropical cyclone advisories

The RSMC should disseminate six to three-hourly analyses and forecasts of tropical cyclones in the form of bulletins (tropical cyclone advisories - see examples below):

(i) analysis of the central position, intensity and wind distribution;
(ii) 24- and 48-hour forecasts of the central position (72-hour at a later date);
(iii) forecasts of intensity and wind distribution;
(iv) prognostic reasoning if applicable;
(v) tendency assessment if possible.

The issuance times of the advisories will be decided later.

Examples of Advisories

Advisory for analysis

REGION II/V RSMC ADVISORIES 000000Z DEC 21

(EX. 1)

ADVISORY FOR TYPHOON 8526 HOPE ANALYSIS NR 30

TYPHOON 8526 HOPE 965 HPA AT 000000Z DEC 21

AT ONE THREE POINT SEVEN NORTH ONE TWO EIGHT POINT EIGHT EAST SEA

EAST OF PHILIPPINES

MOVING WEST 08 KNOTS WITH DECELERATION

POSITION GOOD BASED MAINLY ON ~~RECON AND~~ (Delete) SAT DATA

MAX WINDS 70 KNOTS WITH GUST 100 KNOTS NEAR CENTRE

RADIUS OF OVER 50 KNOT WINDS 150 MILES IN NORTH WEST SEMI-CIRCLE AND

120 MILES ELSEWHERE

RADIUS OF OVER 30 KNOT WINDS 400 MILES IN NORTH WEST SEMI-CIRCLE AND

200 MILES ELSEWHERE

Advisory for forecasts

REGION II/V RSMC ADVISORIES 000000Z DEC 21

(EX. 2)

ADVISORY FOR TYPHOON 8526 HOPE FORECAST No. 25

24-HOUR FORECAST (FOR 220000Z)

POSITION AT 15.0N6 126.0E9 WITH UNCERTAINTY OF 100 MILES RADIUS

CENTRAL PRESSURE 970 HPA

MAX WINDS 65 KT WITH GUST 90 KT

RADIUS OF OVER 50 KT WINDS 100 MILES IN NORTH SEMI-CIRCLE AND 80

MILES ELSEWHERE

RADIUS OF OVER 30 KT WINDS 300 MILES IN NORTH SEMI-CIRCLE AND 200

MILES ELSEWHERE

48-HOUR EXPECTED OUTLOOK (FOR 230000Z)

POSITION AT 19.0N0 128.0E1 WITH UNCERTAINTY OF 250 MILES RADIUS

CENTRAL PRESSURE 975 HPA

MAX WINDS 60 KT WITH GUST 80 KT

Advisory for prognostic reasoning

REGION II/V RSMC ADVISORIES 000000Z DEC 21

(EX. 3)

ADVISORY FOR TYPHOON 8526 HOPE PROGNOSTIC REASONING No. 12

PROGNOSTIC REASONING FOR ANALYSIS AND FORECAST AT 000000Z DEC 21

A. SAT CLOUD IMAGERY OF TY 8526 HOPE SHOW THE EYE DISAPPEARED AND ~~RECON DATA INDICATE THAT TY 8526 HOPE HAS REACHED PEAK INTENSITY.~~ SIGNIFICANT CIRRUS OUT-FLOW TO THE NORTHEAST. THESE DATA INDICATE ~~SAT DATA INDICATE THAT THE EYE DISAPPEARED AND SIGNIFICANT CIRRUS~~ THAT THE STORM HAS REACHED PEAK INTENSITY AND SUGGEST RECURVATURE. ~~OUTFLOW IS SEEN TO THE NORTH EAST SUGGESTING RECURVATURE.~~

B. THE FORECAST TRACK IS BASED ON PERSISTENCE FOR THE FIRST 24 HOURS AND DYNAMIC AIDS AND SYNOPTIC REASONING FOR 24 TO 48 HOURS. DYNAMIC MODELS ARE PREDICTING RECURVATURE IN THE 48 HOURS WITH A TROUGH REACHING THE EAST COAST OF CHINA. SYNOPTICALLY, THIS PREDICTION IS MOST LIKELY.

C. ~~RECON~~ SAT DATA INDICATE THAT TY 8526 HAS STARTED TO WEAKEN. THIS TREND IS EXPECTED TO CONTINUE DUE TO RECURVATURE. THE NORTH EAST MONSOON CONTINUES TO ENHANCE THE WIND FIELD OF NORTH SEMI-CIRCLE.

D. ADDITIONAL COMMENTS. IT IS UNLIKELY FOR TY 8526 TO MISS THE TROUGH AND MOVE ACROSS THE PHILIPPINES BECAUSE OF THE DEEPENING OF THE TROUGH IN CHINA.

Table 5.1: Present operational status of the regional meteorological telecommunication network for the Typhoon Committee region

1. Main Telecommunication Network	Present Operational Status
Beijing - Tokyo	Satellite, V.29, 9,600 bit/s 4,800 bit/s (data) X.25 LAPB + 4,800 bit/s (NCDF)
2. Main regional circuit	
Tokyo - Bangkok	Satellite, 200 bit/s
3. Regional circuits	
Bangkok - Hanoi	(HF radio broadcast)
Bangkok - Hong Kong	Satellite, 200 bit/s
Bangkok - Phnom Penh	(HF radio broadcast)
Bangkok - Vientiane	(HF radio broadcast)
Beijing - Hanoi	-
Beijing - Hong Kong	Cable, 75 bauds
Tokyo - Hong Kong	Cable/satellite, 200 bit/s
Tokyo - Seoul	Cable, V.29 9600 bit/s, 4800 bit/s(data) X.25 Level 3 + 4800bit/s(NCDF)
4. Inter-regional circuits	
Bangkok - Kuala Lumpur	Microwave, 75 bauds
Tokyo - Manila	Cable, 200 bit/s
5. RTH radio broadcast	
Bangkok	1 RTT, 1 FAX
Beijing	1 RTT, 1 FAX
Tokyo	1 RTT, 2 FAX
6. Satellite broadcast	
Operated by Japan:	
GMS-III (140°E)	Operational satellite image distribution

List of acronyms used in the TC operational manual
- Meteorological Component -

AFTN	Aeronautical Fixed Telecommunication Network
AIREP	Aircraft En-route Report
APT	Automatic Picture Transmission
ASDAR	Aircraft to Satellite Data Relay
DPSK	Differential Phase-Shift Keying
EIR	Enhanced Infrared
ESCAP	Economic and Social Commission for Asia and the Pacific
FAX	Facsimile
GMS	Geostationary Meteorological Satellite
~~GMT~~ Delete	~~Greenwich Mean Time~~
GOES	Geostationary Operational Environmental Satellite
GTS	Global Telecommunication System
~~HR/LR~~ Delete	~~High Resolution/ Low Resolution Facsimile~~
HRPT	High Resolution Picture Transmission
IR	Infrared
JMA	Japan Meteorological Agency
JTWC	Joint Typhoon Warning Centre
LTP	Long Term Plan
MANAM	Manual Amendment
M-DUS	Medium Scale Data Utilization Station
MOS	Model Output Statistics
MSL	Mean Sea Level
MTI	Moving Target Indicator
NESDIS	National Environmental Satellite, Data and Information Service
NMC	National Meteorological Centre
NMS	National Meteorological Service
NOAA	National Oceanic and Atmospheric Administration
NWP	Numerical Weather Prediction
OPMET	Operational Meteorological Data
RADOB	Report of ground radar weather observation
~~RECCO~~ Delete	~~Report from a meteorological reconnaissance flight~~
RMC	Regional Meteorological Centre
ROBEX	Regional OPMET Bulletin Exchange
RSMC	Regional/Specialized Meteorological Centre
RTH	Regional Telecommunication Hub
S-DUS	Small Scale Data Utilization Station
S.VISSR	Stretched VISSR
SAREP	Report of synoptic interpretation of cloud data obtained by a meteorological satellite
SST	Sea Surface Temperature
TC	Typhoon Committee
TCP	Tropical Cyclone Programme
TEMP	Upper-level pressure, temperature, humidity and wind report from a land station

Delete ~~TEMP DROP~~ ~~Upper-level pressure, temperature, humidity and wind report from a sonde released by carrier balloons or aircraft~~

TOPEX	Typhoon Operational Experiment
UNDP	United Nations Development Programme
VIS	Visible
VISSR	Visible and Infrared Spin Scan Radiometer
WMC	World Meteorological Centre
WMO	World Meteorological Organization
WWW	World Weather Watch

List of stations from which enhanced surface observations are available#

The following stations will make hourly surface observations when they are within 300 km of the centre of a tropical cyclone:

China

(54): 662, 753, 776, 836, 843, 857, 863, 938, 945
(58): 040, 150, 238, 251, 265, 345, 367, 445, 457, 472, 477, 556, 569, 646, 653, 659, 666, 754, 834, 847, 853, 911, 921, 927, 944
(59): 096, 117, 134, 278, 287, 293, 316, 431, 456, 493, 501, 632, 644, 658, 663, 673, 758, 838, 845, 855, 948, 981

Democratic Kampuchea

Hong Kong (45)

005

Japan (47)

Delete following staions: 451,599,603,748

401, 402, 404, 405, 406, 407, 409, 411, 412, 413, 417, 418,
420, 421, 423, 424, 426, 427, 428, 430, 431, 433, 435, 440,
~~451,~~ 512, 520, 570, 574, 575, 576, 577, 581, 582, 584, 585,
587, 588, 590, 592, 593, 595, 597, 598, ~~599,~~ 600, 601, 602,
~~603,~~ 604, 605, 606, 607, 610, 612, 615, 616, 617, 618, 620,
622, 624, 626, 629, 631, 632, 636, 637, 638, 640, 641, 648,
649, 651, 653, 654, 655, 656, 657, 662, 663, 665, 666, 668,
670, 672, 674, 675, 677, 678, 682, 684, 690, 740, 741, 742,
744, 746, 747, ~~748,~~ 750, 751, 754, 755, 756, 759, 761, 762,
765, 766, 767, 768, 769, 770, 772, 776, 777, 778, 780, 784,
800, 807, 809, 812, 813, 814, 815, 817, 818, 819, 821, 822,
823, 824, 827, 829, 830, 831, 835, 836, 837, 838, 842, 843,
917, 918, 927, 929, 936, 942, 945, 971,

Add following stations: 805,887, 890,891,892,893,894,895,897, 898,899,909,912 and 991.

Lao PDR

See, Final Report of Regional Association II, eighth session, paragraph 4.2.2.3.

Malaysia

(48): 601, 615, 620, 647, 657, 665
(96): 413, 421, 441, 449, 471, 491

Philippines (98)

132, 133, 135, 222, 223, 232, 233, 324, 325, 328, 329, 333,
336, 425, 427, 428, 429, 430, 431, 432, 434, 435, 437, 440,
444, 446, 526, 531, 536, 538, 543, 546, 548, 550, 553, 558,
602*, 618, 630, 637, 642, 644, 646, 648, 712, 741, 745, 746*,
751, 752, 753, 755, 836, 851

* Index No.	Name	Lat.	Long.	Elev.
602	Pag-asa	11 10'N	114 17'E	3 MTS
746	Cotabato	7 10'N	124 13'E	62 MTS

(These stations are not included in Weather Reporting Volume A, see Note below.)

Republic of Korea (47) Add following stations: 095 and 185.

090, 101, 105, 108, 112, 114, 115, 119, 129, 130, 131, 133,
135, 136, 138, 140, 143, 146, 152, 155, 156, 159, 162, 165,
168, 170, 184, 189, 192

Thailand (48)

300, 303, 327, 328, 331, 353, 354, 356, 375, 378, 379, 381,
400, 407, 431, 432, 456, 462, 465, 477, 480, 500, 517, 532,
551, 565, 567, 568, 569, 583

Viet Nam (48)

820, 826, 839, 845, 848, 855, 870, 877, 900, 914, 917, 918,
920

Note: Name, latitude, longitude and elevation of these stations are included in Weather Reporting Volume A - Observing Stations (WMO Publication No. 9) except for the stations marked *.

List of stations from which enhanced upper-air observations are available

The following stations will make six-hourly upper-air observations when they are within 500 km of the centre of a tropical cyclone:

China

(54): 662, 857
(58): 150, 367, 666, 847
(59): 287, 316, 758, 981

Democratic Kampuchea

Hong Kong (45)

004

Japan (47) Delete following stations: 580, 681 and 881.

401, 412, 420, ~~580,~~ 582, 590, 600, 646, 678, ~~681,~~ 744, 778,
807, 827, ~~881,~~ 909, 918, 936, 945, 971,* 991*
* 06 UTC only.

Lao PDR

Malaysia

(48): 601, 615, 647, 657
(96): 413, 441, 471, 481

Philippines (98)

223, 444*, 618*, 646, 753*, 836

* These stations observe upper winds only.

Delete ~~At present, all upper-air stations have temporarily stopped operations due to non-availability of consumables and spare parts. They will resume operation sometime in the first quarter of 1987, when the headed supplies become available.~~

Republic of Korea (47)

122, 138, 158, 185

Thailand (48)

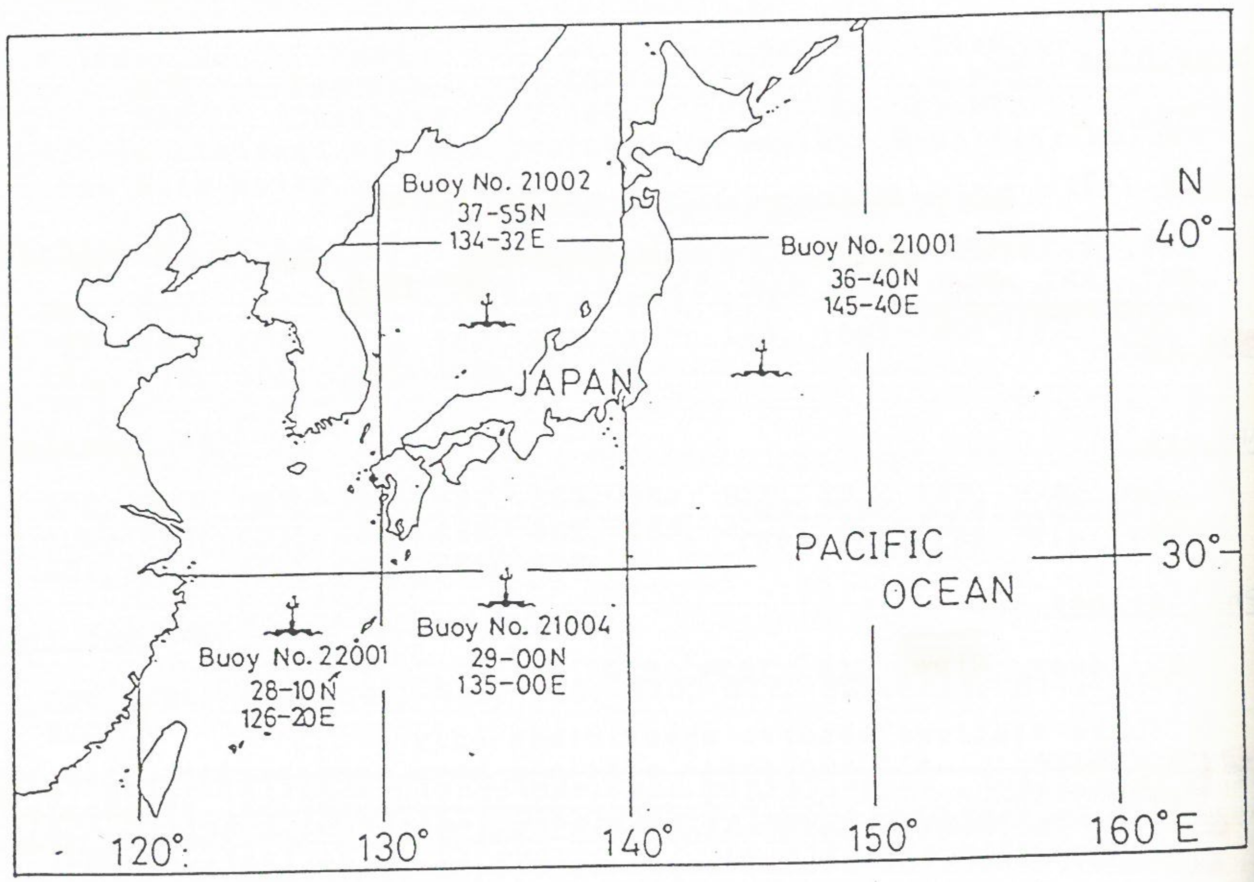
327, 407, 455, 480, 500, 551, 568

Viet Nam (48)

820, 855, 900

Note: Name, latitude, longitude and elevation of these stations are included in Weather Reporting Volume A - Observing Stations (WMO Publication No. 9).

Observation network of the Japanese moored buoys



Buoy No. is defined as WMO identifier.

List of stations from which enhanced radar observations are available

The following stations will make hourly radar observations when the centre of a tropical cyclone is within their respective radar range:

China

(58): 367, 760, 941
(59): 316, 981

Democratic Kampuchea

Hong Kong (45)

010

Japan (47)

412, 418, 432, 572, 582, 590, 636, 639, 662, 705, 773, 791, 792, 806, 869, 899, 909, 918, 927, 937

Lao PDR

Malaysia

(48): 601, 602, 615, 647, 657, 672
(96): 471, 413

Philippines (98)

126, 231, 321, 334*, 440, 447, 525*, 558, 646

* Index number of the station is being proposed to WMO.

Republic of Korea (47)

116

Thailand (48)

327, 356, 455, 456, 517, 568, 569

Viet Nam

At present, only a 3 cm radar observation is made.

Note: Name, latitude, longitude and elevation of these stations are included in Weather Reporting Volume A - Observing Stations (WMO Publication No. 9) except for the stations marked *.

Technical specification of radars of Typhoon Committee Members

Name of Member China-1

Name of the station	Shanghai	Dongtou	Fuzhou
Index number	58367	58760	58941
Location of the station	31° 02′ N 121° 57′ E	27° 50′ N 121° 08′ E	25° 59′ N 119° 32′ E
Antenna elevation	50 m	228.5 m	652.5 m
Wave length	10.6 cm	11.43 cm	10.6 cm
Peak power of transmitter	500 KW	2000 KW	500 KW
Pulse length	3 μs	3 μs	3 μs
Sensitivity minimum of receiver	-110 dBm	-100 dBm	-110 dBm
Beam width (Width of over -3dB antenna gain of maximum)	2.0 deg	1.7(E) 2.4(H) deg	2.0 deg
Detection range	600 km	500 km	600 km
Scan mode in observation * 1.Constant altitude 2.Cappi 3.Manually controlled altitude	2	1	1
Data processing in observation *			
MTI processing 1.yes 2.no	2	2	2
Doppler processing 1.yes 2.no	2	2	2
Display 1.digital 2.analog	1	2	2
Operation mode * (when a typhoon is within the detection range) 1.hourly 2.3-hourly 3.other(please specfy)	1	1	1
Status * 1.operational 2.not operational (for research or other please specify)	1	1	1

Name of Member China-2

Name of the station	Shantou	Xishadao	
Index number	59316	59981	
Location of the station	23° 25′ N 116° 38′ E	16° 50′ N 112° 20′ E	° N ° E
Antenna elevation	262.6 m	8.5 m	m
Wave length	10.6 cm	10.6 cm	cm
Peak power of transmitter	500 KW	500 KW	KW
Pulse length	3 μs	3 μs	μs
Sensitivity minimum of receiver	-110 dBm	-110 dBm	dBm
Beam width (Width of over -3dB antenna gain of maximum)	2.0 deg	2.0 deg	deg
Detection range	600 km	600 km	km
Scan mode in observation * 1.Constant altitude 2.Cappi 3.Manually controlled altitude	1	1	
Data processing in observation *			
MTI processing 1.yes 2.no	2	2	
Doppler processing 1.yes 2.no	2	2	
Display 1.digital 2.analog	2	2	
Operation mode * (when a typhoon is within the detection range) 1.hourly 2.3-hourly 3.other(please specfy)	1	1	
Status * 1.operational 2.not operational (for research or other please specify)	1	1	

* Note:Select an appropriate figure

Name of Member Hong Kong

Name of the station	Tate's Cairn		
Index number	45010		
Location of the station	22° 22′ N 114° 13′ E	° N ° E	° N ° E
Antenna elevation	587 m	m	m
Wave length	10.7 cm	cm	cm
Peak power of transmitter	650 KW	KW	KW
Pulse length	2.0 μs	μs	μs
Sensitivity minimum of receiver	<-109 dBm	dBm	dBm
Beam width (Width of over -3dB antenna gain of maximum)	<2 deg	deg	deg
Detection range	512 km	km	km
Scan mode in observation * 1.Constant altitude 2.Cappi 3.Manually controlled altitude	2		
Data processing in observation *			
MTI processing 1.yes 2.no	2		
Doppler processing 1.yes 2.no	2		
Display 1.digital 2.analog	1		
Operation mode * (when a typhoon is within the detection range) 1.hourly 2.3-hourly 3.other(please specfy)	3		
Status * 1.operational 2.not operational (for research or other please specify)	1		

* Note:Select an appropriate figure

Name of Member Japan-1

Name of the station	Sapporo	Kushiro	Hakodate/ Hakodateyama	Sendai
Index number	47412	47418	47432	47590
Location of the station	43° 03′ N 141° 20′ E	42° 59′ N 144° 24′ E	41° 45′ N 140° 43′ E	38° 16′ N 140° 54′ E
Antenna elevation	72.1 m	71.8 m	314.8 m	99.4 m
Wave length	5.66 cm	5.66 cm	5.66 cm	5.66 cm
Peak power of transmitter	250 KW	250 KW	250 KW	250 KW
Pulse length	2.0 μs	2.6 μs	1.9 μs	2.0 μs
Sensitivity minimum of receiver	-106 dBm	-108 dBm	-105 dBm	-105 dBm
Beam width (Width of over -3dB antenna gain of maximum)	1.5 (H) 1.3 (V) deg	1.4 (H) 1.4 (V) deg	1.4 (H) 1.4 (V) deg	1.4 (H) 1.4 (V) deg
Detection range	300 km	300 km	300 km	300 km
Scan mode in observation * 1. Constant altitude 2. Cappi 3. Manually controlled altitude	1	3	3	1
Data processing in observation *				
MTI processing 1. yes 2. no	1	1	2	1
Doppler processing 1. yes 2. no	2	2	2	2
Display 1. digital 2. analog	1	2	2	1
Operation mode * (when a typhoon is within the detection range) 1. hourly 2. 3-hourly 3. other(please specify)	1	1	1	1
Status * 1. operational 2. not operational (for research of other please specify)	1	1	1	1

* Note:Select an appropriate figure

Name of Member Japan-2

Name of the station	Akita	Tokyo	Fujisan	Niigata/ Yahikoyama
Index number	47582	47662	47639	47572
Location of the station	39° 43′ N 140° 06′ E	35° 41′ N 139° 46′ E	35° 21′ N 138° 44′ E	37° 43′ N 138° 49′ E
Antenna elevation	34.4 m	85.3 m	3785.5 m	646.5 m
Wave length	5.66 cm	5.66 cm	10.42 cm	5.66 cm
Peak power of transmitter	250 KW	250 KW	1500 KW	250 KW
Pulse length	2.6 μs	2.0 μs	3.3 μs	2.0 μs
Sensitivity minimum of receiver	-108 dBm	-106 dBm	-113 dBm	-106 dBm
Beam width (Width of over -3dB antenna gain of maximum)	1.4 (H) 1.4 (V) deg	1.3 (H) 1.5 (V) deg	1.6 (H) 1.7 (V) deg	1.4 (H) 1.4 (V) deg
Detection range	300 km	300 km	600 km	300 km
Scan mode in observation * 1. Constant altitude 2. Cappi 3. Manually controlled altitude	1	3	1	1
Data processing in observation *				
MTI processing 1. yes 2. no	1	2	1	1
Doppler processing 1. yes 2. no	2	2	2	2
Display 1. digital 2. analog	1	2	1	1
Operation mode * (when a typhoon is within the detection range) 1. hourly 2. 3-hourly 3. other (please specify)	1	1	1	1
Status * 1. operational 2. not operational (for research of other please specify)	1	1	1	1

Name of Member Japan-3

Name of the station	Fukui/ Tojimbo	Nagoya	Osaka/ Takayasuyama	Matsue/ Misakayama
Index number	47705	47636	47773	47791
Location of the station	36° 14′ N 136° 09′ E	35° 10′ N 136° 58′ E	34° 37′ N 135° 40′ E	35° 32′ N 133° 06′ E
Antenna elevation	107.0 m	73.7 m	497.6 m	554.2 m
Wave length	5.66 cm	5.66 cm	5.66 cm	5.69 cm
Peak power of transmitter	250 KW	250 KW	250 KW	250 KW
Pulse length	1.9 μs	2.5 μs	2.0 μs	2.0 μs
Sensitivity minimum of receiver	-106 dBm	-109 dBm	-106 dBm	-106 dBm
Beam width (Width of over -3dB antenna gain of maximum)	1.3 (H) 1.4 (V) deg	1.5 (H) 1.3 (V) deg	1.5 (H) 1.5 (V) deg	1.5 (H) 1.5 (V) deg
Detection range	300 km	300 km	300 km	300 km
Scan mode in observation * 1. Constant altitude 2. Cappi 3. Manually controlled altitude	1	1	1	1
Data processing in observation *				
MTI processing 1. yes 2. no	1	1	1	1
Doppler processing 1. yes 2. no	2	2	2	2
Display 1. digital 2. analog	1	1	1	1
Operation mode * (when a typhoon is within the detection range) 1. hourly 2. 3-hourly 3. other (please specify)	1	1	1	1
Status * 1. operational 2. not operational (for research of other please specify)	1	1	1	1

* Note: Select an appropriate figure

Name of Member Japan-4

Name of the station	Hiroshima/ Haigamine	Murotomisaki	Fukuoka/ Sefurisan	Tanegashima/ Nakatane
Index number	47792	47899	47806	47869
Location of the station	34° 16′ N 132° 36′ E	33° 15′ N 134° 11′ E	33° 26′ N 130° 22′ E	30° 38′ N 130° 59′ E
Antenna elevation	746.9 m	198.8 m	984.2 m	292.0 m
Wave length	5.66 cm	5.66 cm	5.66 cm	5.66 cm
Peak power of transmitter	250 KW	250 KW	250 KW	250 KW
Pulse length	2.1 μs	2.7 μs	2.5 μs	2.5 μs
Sensitivity minimum of receiver	-107 dBm	-108 dBm	-108 dBm	-106 dBm
Beam width (Width of over -3dB antenna gain of maximum)	1.3 (H) 1.5 (V) deg	1.4 (H) 1.5 (V) deg	1.5 (H) 1.5 (V) deg	1.5 (H) 1.4 (V) deg
Detection range	300 km	300 km	300 km	300 km
Scan mode in observation * 1. Constant altitude 2. Cappi 3. Manually controlled altitude	1	1	1	1
Data processing in observation *				
MTI processing 1. yes 2. no	1	1	1	1
Doppler processing 1. yes 2. no	2	2	2	2
Display 1. digital 2. analog	1	1	1	1
Operation mode * (when a typhoon is within the detection range) 1. hourly 2. 3-hourly 3. other (please specify)	1	1	1	1
Status * 1. operational 2. not operational (for research of other please specify)	1	1	1	1

* Note: Select an appropriate figure

Name of Member Japan-5

Name of the station	Naze/ Funchatoge	Okinawa/ Itokazu	Miyakojima	Ishigakijima
Index number	47909	47937	47927	47918
Location of the station	28° 23′ N 129° 33′ E	26° 09′ N 127° 46′ E	24° 47′ N 125° 17′ E	24° 20′ N 124° 10′ E
Antenna elevation	316.6 m	208.3 m	54.9 m	30.2 m
Wave length	5.66 cm	5.66 cm	5.66 cm	5.66 cm
Peak power of transmitter	250 KW	250 KW	250 KW	250 KW
Pulse length	2.8 μs	2.8 μs	2.0 μs	2.0 μs
Sensitivity minimum of receiver	-106 dBm	-113 dBm	-105 dBm	-108 dBm
Beam width (Width of over -3dB antenna gain of maximum)	1.4 (H) 1.5 (V) deg	1.3 (H) 1.4 (V) deg	1.3 (H) 1.3 (V) deg	1.4 (H) 1.5 (V) deg
Detection range	300 km	300 km	300 km	300 km
Scan mode in observation * 1. Constant altitude 2. Cappi 3. Manually controlled altitude	3	3	3	3
Data processing in observation *				
MTI processing 1. yes 2. no	1	1	2	2
Doppler processing 1. yes 2. no	2	2	2	2
Display 1. digital 2. analog	2	1	2	2
Operation mode * (when a typhoon is within the detection range) 1. hourly 2. 3-hourly 3. other (please specify)	1	1	1	1
Status * 1. operational 2. not operational (for research of other please specify)	1	1	1	1

* Note: Select an appropriate figure

Name of Member Malaysia-3

Name of the station	Butterworth	Kuching	
Index number	48602	96413	
Location of the station	5° 28′ N 100° 23′ E	01 ° 29′ N 110 ° 20′ E	° ′ N ° ′ E
Antenna elevation	14 m	32 m	m
Wave length	10 cm	10 cm	cm
Peak power of transmitter	650 KW	370 KW	KW
Pulse length	2 μs	2 μs	μs
Sensitivity minimum of receiver	-110 dBm	-112 dBm	dBm
Beam width (Width of over -3dB antenna gain of maximum)	2 deg	1.8 deg	deg
Detection range	400 km	400 km	km
Scan mode in observation * 1.Constant altitude 2.Cappi 3.Manually controlled altitude	1	1	
Data processing in observation *			
MTI processing 1.yes 2.no	2	2	
Doppler processing 1.yes 2.no	2	2	
Display 1.digital 2.analog	1.2	1	
Operation mode * (when a typhoon is within the detection range) 1.hourly 2.3-hourly 3.other(please specfy)	1	1	
Status * 1.operational 2.not operational (for research or other please specify)	1	1	

* Note:Select an appropriate figure

Name of Member Republic of Korea

Name of the station	Kwanaksan		
Index number	47116		
Location of the station	37° 21′ N 126° 58′ E	° ′ N ° ′ E	° ′ N ° ′ E
Antenna elevation	629.1 m	m	m
Wave length	5.6 cm	cm	cm
Peak power of transmitter	250 KW	KW	KW
Pulse length	2/0.5 μs	μs	μs
Sensitivity minimum of receiver	-108 dBm	dBm	dBm
Beam width (Width of over -3dB antenna gain of maximum)	1.2 deg	deg	deg
Detection range	480 km	km	km
Scan mode in observation * 1.Constant altitude 2.Cappi 3.Manually controlled altitude	2		
Data processing in observation *			
MTI processing 1.yes 2.no	1		
Doppler processing 1.yes 2.no	1		
Display 1.digital 2.analog	1,2		
Operation mode * (when a typhoon is within the detection range) 1.hourly 2.3-hourly 3.other(please specfy)	1		
Status * 1.operational 2.not operational (for research or other please specify)	1		

* Note:Select an appropriate figure

Present schedule of GMS VISSR observation and FAX/data dissemination

The current schedule of VISSR observation and FAX dissemination is as follows:

(a) the full disk data will be obtained hourly,
(b) cloud motion wind observation will be performed four times a day for both hemisphere,
(c) the stretched VISSR digital data dissemination for all observations will be made in addition to the WEFAX dissemination.

The detailed time schedule is shown in Fig.2-F1.

1 VISSR observation

The VISSR observation time is as follows:
(the observation starts at about 30 minutes before the respective observation time.)

(1) Regular observation

- Full disk image
  hourly basis
  and for wind derivation (06,12,18 & 00 UTC)
  : 0530,1130,1730 & 2330 UTC

(2) Additional observation for Typhoon wind derivation (WT)

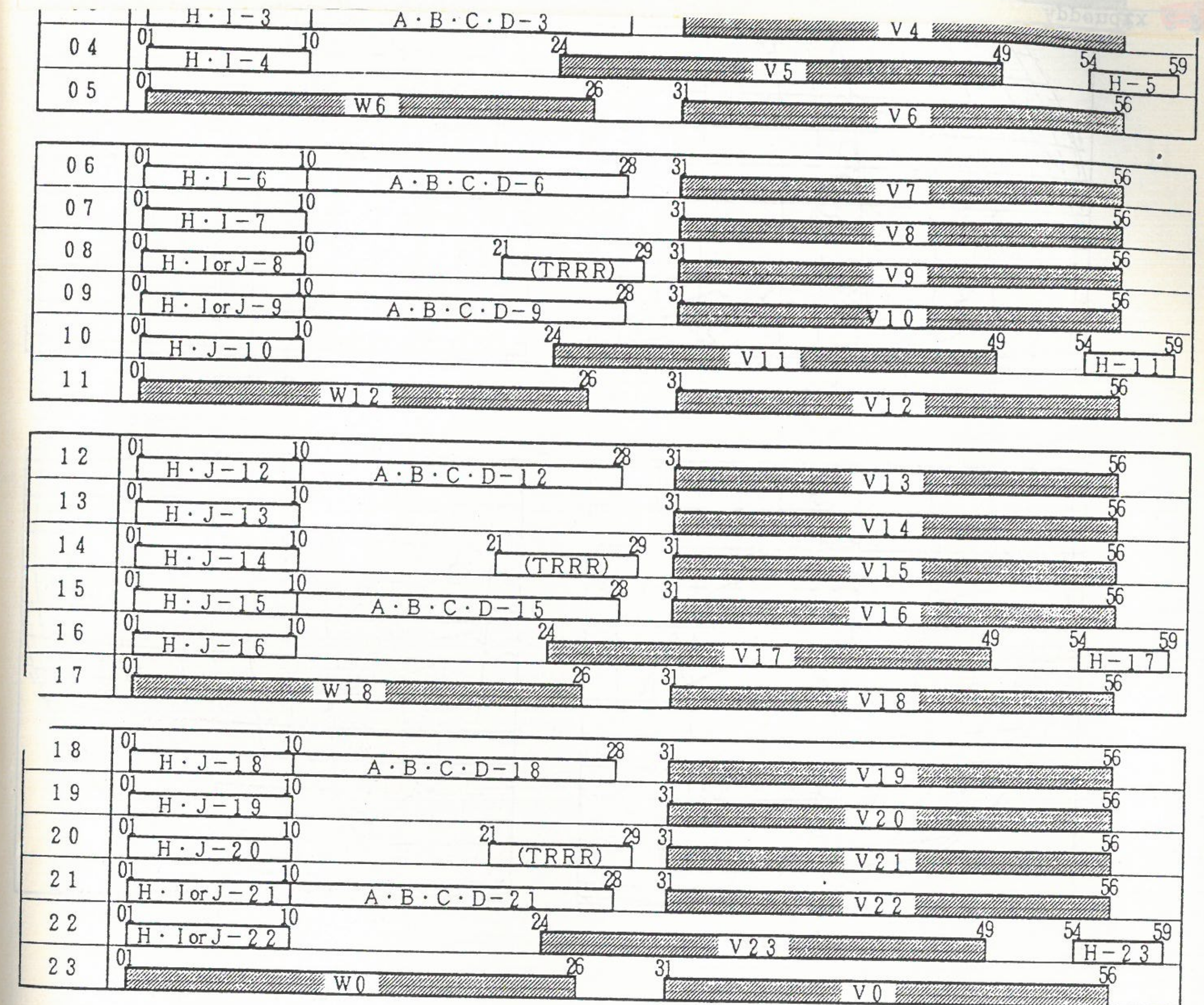
- Half disk image covering the Northern Hemisphere
  15 minutes interval between 0330 and 0415 UTC

2 FAX dissemination via GMS

WEFAX alone is transmitted.

WEFAX

- 4-sectorized full disk (IR) : 00,03, ... & 21 UTC
  (Fig.2-F2)
- Polar stereographic projection
  Image H (IR) : hourly
  Image I (VIS)
  or J (enhanced IR) : hourly except for 05,11,17 & 23 UTC
  (Fig.2-F3)



ABBREVIATIONS

VISSR OBSERVATION
Vnn: VISSR OBSERVATION OF nnZ
Wnn: VISSR WIND OBSERVATION

TRRR: TRILATERATION RANGE AND RANGE RATE

WEFAX DISSEMINATION
A~D: 4-SECTORIZED INFRARED FULL-DISK
H~J: IR, VIS AND ENHANCED IR POLAR-STEREOGRAPHIC COVER THE FAR EAST AREA
MNM: MANUAL AMENDMENT WITH TEST PATTERN

** IN CASE OF 15 MIN. SPECIAL TYPHOON OBSERVATION, SCHEDULE OF 03&04 UTC WILL CHANGE AS FOLLOWS.

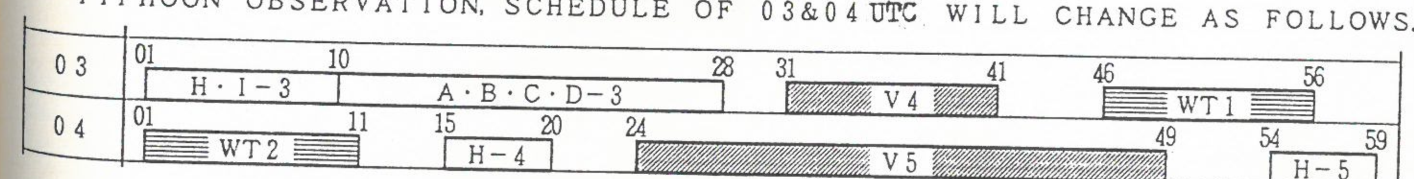


Fig. 2-F1 CURRENT VISSR / FAX SCHEDULE

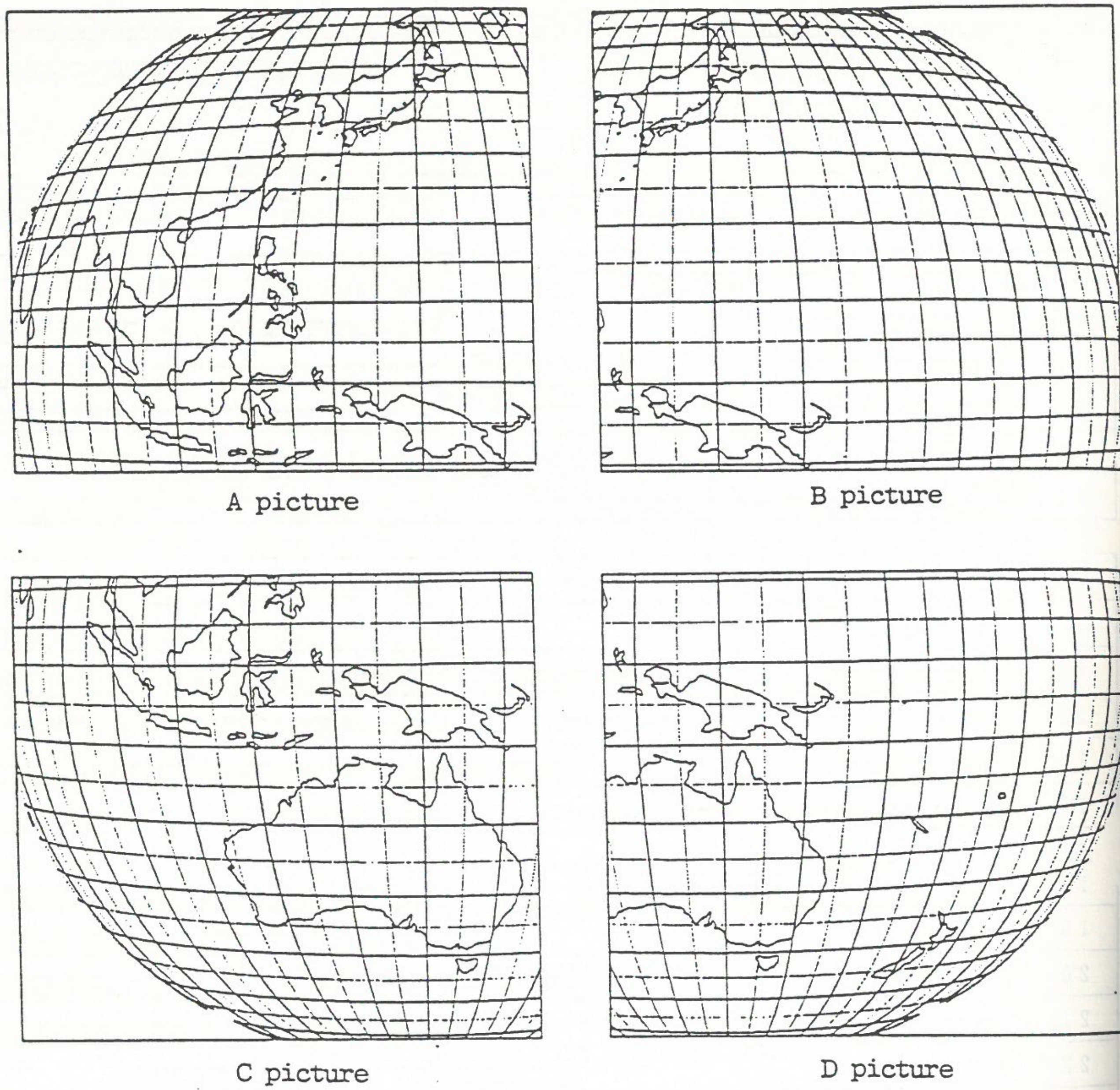


Fig. 2-F.2 Four-sectorized cloud images broadcast three-hourly.

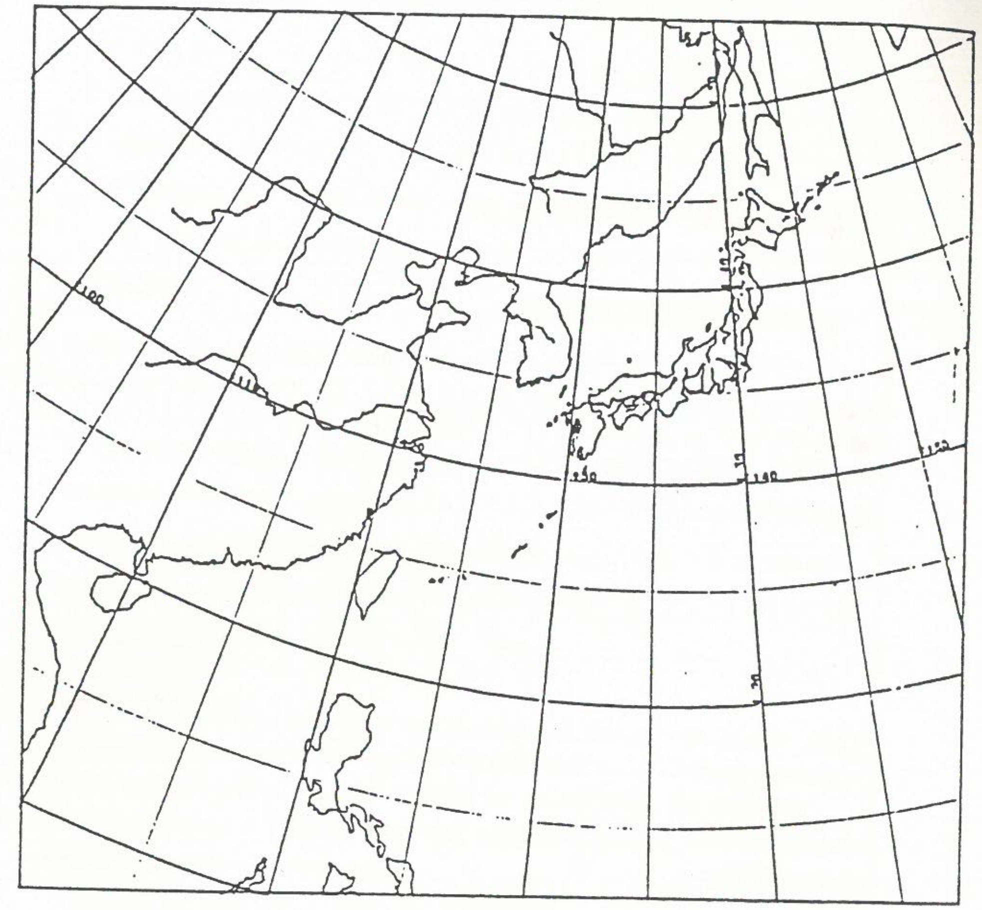


Fig. 2-F.3 WEFAX "H" image of the polar stereographic projection.

NOTE; "I" and "J" images will be of the same projection and size as "H".

ITEM	METHOD	TYPE OF OUTPUT
	e. Time integration (one step): 1 hour for coarse mesh 10 minutes for fine mesh f. Frequency of forecast: Once a day 12Z up to 48-hr	
Name of the method	MARKOV-TYPE ANALOG MODEL	12, 24, 36, 48, 60 and 72-hr forecast positions

Description of the method

a. Basic Conception

In Markov process, if all the probable states are $E_1, E_2, E_3, \cdots$, and all the probable transportation times are $t_1, t_2, t_3, \cdots$, the transportation probabilities from states E_i to E_j are expressed by P_{ij}. Then, transportation probabilities can be arrayed like a matrix. The transportation probabilities of higher order can be arrayed by a matrix of a higher order like this[1]:

$$p^{(k)} = \begin{bmatrix} p_{11}^{(k)} & p_{12}^{(k)} & p_{13}^{(k)} \cdots \\ p_{21}^{(k)} & p_{22}^{(k)} & p_{23}^{(k)} \cdots \\ p_{31}^{(k)} & p_{32}^{(k)} & p_{33}^{(k)} \cdots \\ \cdots & \cdots & \cdots \end{bmatrix}, \quad k = 1, 2, 3, \cdots.$$

Then, the forecasts can be made by calculating transportation probabilities and transportation matrix of a higher order.

Because of description of motion state by using Markov "non-post effective" characteristics, analog examples can be studied by renewing data in a new circumstance.

b. Basic Method

Concerning the complex nature of cyclone motion, the storm strike probabilities have been considered as an independent $p(T)$ at $T(T>t)$ and a "transportation" probability related to new circumstance at $T(T>t)$ in this study.

Theory and method of computing probability ellipses at any given condition (such as $T>t$) can also be used. Description of them is as follows.

The bivariate normal probability density function is expressed as: [2]

$$f(x, y) = \frac{1}{2\pi\sigma_x\sigma_y\sqrt{1-\rho_{xy}^2}} e^{-G/2},$$

where G, the locus of which in the x, y plane describes an ellipse, is expressed as:

$$G = \frac{1}{1-\rho_{xy}^2}\left[\frac{(x-\mu_x)^2}{\sigma_x^2} - \frac{2\rho_{xy}(x-\mu_x)(y-\mu_y)}{\sigma_x\sigma_y} + \frac{(y-\mu_y)^2}{\sigma_y^2}\right],$$

where the population parameters are: μ_x——mean of x (longitude) coordinates, μ_y——mean of y (latitude) coordinates, σ_x——standard deviation of x coordinates, σ_y——standard deviation of y coordinates, σ_x^2——variation of x coordinates, σ_y^2——variation of y coordinates, and ρ_{xy}——correlation coefficient between x and y coordinates.

The probability that a randomly selected point (x, y) falls into the region S of the x, y plane is the integral of the probability density function:

$$P(s) = \iint f(x, y)dxdy.$$

c. The Criteria for the Model

In Markov-type analog model, the following two criteria must be satisfied.

1) Distance between current center for a predicted typhoon and that for a historical storm (to be chosen) is less than 1.2 Of latitude.

2) The same situation must be satisfied for 12h before.

Markov model differs from traditional concept in that forecasts out through 72h are made in six 12h increments rather than 0-12h, 0-24h, etc. The "transportation" probability is solved by renewing the analog probability search every 12h in a new circumstance from the optimum probabilities for the current time.

d. Domain

North to Equator, West to 180E.

e. Frequency oc Forecast:

Twice a day, 00z, 12z up to 72hr

Four times a day if necessary.

f. References:

(1) Wang Jizi and C.J.Neuman, A Markov-type Analog Model for the prediction of Typhoon Motion in Northwestern Pacific
Scientia Sinica, May, 1985 Vol.28, No.5

(2) Hope, J.R.& Neuman, C.J., Preprints of 11th Tech. Conf. Hurricanes and Tropical Meteorology, Miami Beach, Amer. Meteor. Soc ., 1977, 367-374

Name of the Method Description of the method	Two-Level Steering method a. Basic equation: $V_T = V_g + \Delta V$ Where V_T represents the velocity of	12,24,36 and 48-hr forecast typhoon position

	typhoon displacement; V_g, the steering velocity obtained from environmental geostrophic flows at both 500 and 850 hPa levels; ΔV, the correction velocity. b. Domain: All the northwest Pacific typhoon basin for all seasons. c. Frequency of forecast: Twice a day	

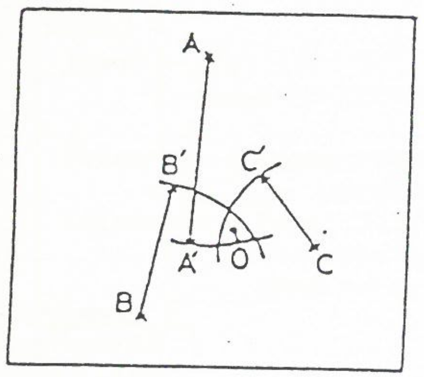
ITEM	METHOD	TYPE OF OUTP
	References: Chang, S.L. 1959 'Climatological charts of the Far East', Royal Observatory Occastional Papers (printed) No. 4. Chin, P.C. 1970 'The "Control Point" method for the prediction of tropical cyclone movement', Royal Observatory Technical Note No. 30.	
Name of the method	Regression method	24, 48, 72 an 96-hr movement forecasts
Description of the method	The mean 24-hr movement of each tropical cyclone centred in each 5-degree square is correlated with that 24 hours ago to derive regression equations for forecasting. Independent variables: Present and past 24-hr positions. Domain : 5-25N, 105-145E. Frequency of forecast: 4 times a day.	
Name of the method	The space mean method	Space mean charts and 24-hr movement forecast
Description of the method	The space mean technique is based on the concept of steering. Space mean charts are prepared by the computer to depict the smoothed basic flows at various upper levels with the circulation of the tropical cyclone and other small-scale eddies removed. An estimate of the steering current for prediction purposes is derived by statistically combining the basic flows at four different levels. This has been called the 'MUSIC' (MUltilevel Steering by Integrated Current) technique. Input : Surface, 700, 500 and 300 hPa data covering the area 0-65N, 65-165E. Frequency of forecast: Twice a day.	
Name of the method	ANALOG	
Description of the method	The analog method is based on the concept that a storm with certain characteristics (time of year, position, direction and speed) will move in the same way as past storms with similar characteristics. Therefore, the method searches through historical storm tracks and identi those that fall within certain pre-defined "windows" of these characteris These storms are called analog storms. Each analog storm is then shifted to the position of the current storm and then advected along using a weigh average of the movement of the two storms. The weight given to the	

	TYPE OF OUTPUT
movement of the current storm decreases linearly with the forecast period. After 36 hours, no contribution to the advection comes from the current storm. The analog forecast is then the average of all the forecast positions of the analog storms. Input : Position of current storm, past 6-hour direction and speed or position of current storm, radius of acceptance circle. Frequency of forecast : Four times a day Reference : Hope, J.R., and C.J. Neumann, 1970 : An operational technique for relating the movement of existing tropical cyclones to past tracks. Mon. Wea. Rev., 98, 925-933.	Analog forecast positions(every 6 hours) and movement,list of analog storms(-48 to +72 hour positions).

ITEM	METHOD	TYPE OF OUTP
Name of the method	Statistical methods 1. Persistence and Climatology Method	12-hr and 24-hr forecast position
Description of the method	(P+C)/2 method Independent Variables: Present and 12-hour storm positions Historical variables: Climatological modal directions and speed in 2 1/2 degree square Domain: 20-40N, 115-140E Frequency of forecast: Twice a day	
Name of the method	2. Cook's method	12-hr and 24-hr forecast position
Description of the method	This method is similar to the Arakawa's or the Veigas-Miller Method. Independent variables: Present and past 12 and 24-hour positions and present MSL pressure values at selected grid points Grid: Moving 5 degree lat. and long. grids Domain: 20-40N, 110-140E Frequency of forecast: Twice a day	
Name of the method	Steering Methods 1. Fixed control-point method	12-hr and 24-hr forecast position
Description of the method	Input: 700 hPa wind direction at the control-point and climatological wind speed in 2 1/2 degree squares Domain: 20-35N, 120-135E Frequency of forecast: Twice a day	
Name of the method	2. Space mean method	12-hr and 24-hr forecast position
Description of the method	Input: 500 hPa data Domain: 20-40N, 115-140E Frequency of forecast: Twice a day	

Fig. 3-B.3

Explanation of the distance intersecting method (1)



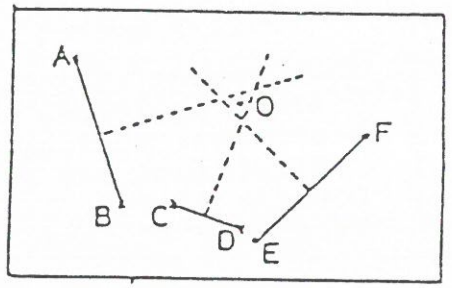


Fig. 3-B.4 Explanation of the distance intersecting method (2)
Dotted lines are perpendicular bisectors of lines AB, CD and EF connecting equal pressure points. A point O is the center of typhoon.

1.3 Assessment of tropical cyclone/typhoon intensity

1.3.1 Preparation of time change curve of central pressure using past eye data
See Chapter 2.1

Delete
~~1.3.2 Reconnaissance flight observation~~
~~See Chapter 2.1~~

1.3.2 Satellite analysis
See Chapter 2.3

1.3.3 Radar observation
See Chapter 2.2

1.3.4 Surface map analysis
See Chapter 1.2.4

1.3.5 Estimation of maximum wind by using the empirical relation between central pressure and maximum wind

The observation of the maximum wind is scarcely made over the sea area. Therefore, the maximum wind speed must be estimated from the central pressure using some formula. As an example, the formula given by Atkinson and Holliday (1977) is shown below.

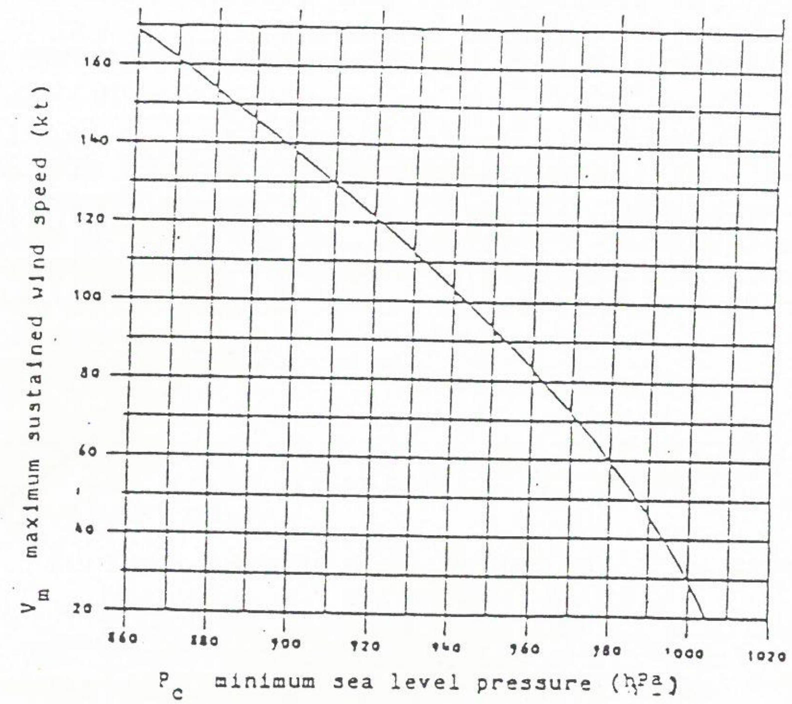
The maximum sustained surface wind speed is obtained by applying the minimum sea level pressure to the following regression equation:

$$V_m = 6.7(1010 - P_c)^{0.644}$$

where V_m is the maximum sustained(1 min) wind speed(kt) and P_c the minimum sea level pressure (hPa). In this study, 28 years of maximum wind measurements made at coastal and island stations in the Western North Pacific were collected and analyzed. (see Fig. 3-B.5)

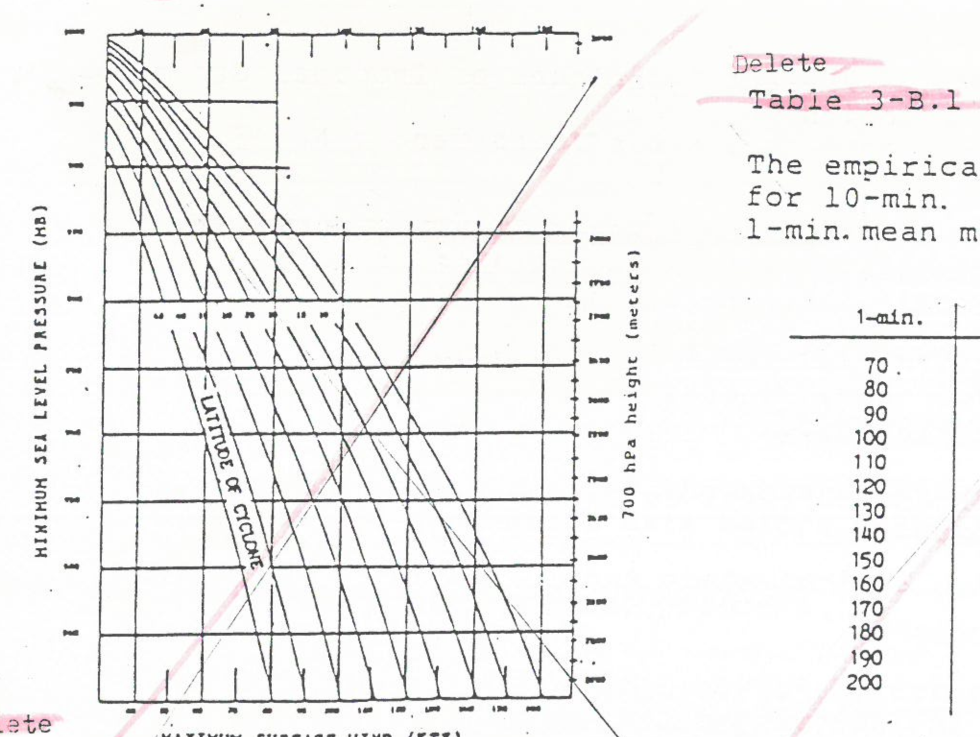
(After G.D.Atkinson and C.R.Holliday, 1977: Mon. Wea.

Fig. 3-B.5 The maximum sustained wind (one minute mean) vs the minimum sea level pressure



~~Note:~~

Delete ~~The central pressure-V_{max} graph (Fig. 3-B.6) is developed by JTWC (Annual Typhoon Report 1968) and it is used in JMA. The maximum surface wind in this graph is 1-min. mean value, i.e., the maximum sustained wind. The Table 3-B.1 is used in JMA for 1-min. to 10-min. mean maximum wind conversion.~~



Delete
Fig. 3-B.6
JTWC graph for the maximum surface winds from RECCO data at the 700 hPa level or

Delete
Table 3-B.1

The empirical conversion table for 10-min. mean value from 1-min. mean maximum wind (kt)

1-min.	10-min.
70	70
80	70
90	80
100	90
110	90
120	100
130	110
140	110
150	120
160	130
170	130
180	140
190	150
200	150

In order to estimate the tide, predict

i) the place and the time of landfall,

ii) the minimum central pressure and the maximum wind of the storm at the time of landfall,

iii) the storm trajectory relative to the axis of the bay concerned.

There are two methods, i.e., dynamical method and statistical method. An example of the dynamical method is the SPLASH model. A detailed report about the SPLASH model is found in the reference. It is helpful for operational purpose to calculate the surge beforehand using the dynamical method for storms with various intensity and trajectory.

1.8.2 An example of statistical method

The following regression equation is used in Japan to predict the maximum storm surge.

$$h = A (P_0 - P_c) + B V_{max}^2 \cos \theta$$

here, h is surge (cm) and P_0 the mean monthly pressure (hPa). The terms P_c and V_{max} are the minimum central pressure and the maximum wind of the storm at the time of landfall, respectively. The term θ denotes the angle between the wind and the axis of the bay. The magnitude of constant A is close to unity since the hydrostatic pressure fall by 1 hPa generates a rise of sea level of about 1 cm. The magnitude of costant B is specified for each bay, because the area size, depth and configuration of bays are not the same. The regression coefficients must be determined from tide gauge data over the long period.

Reference:

WMO (1973): Present Techniques of Tropical Storm Surge Prediction. Report on marine science affairs report No.13.

Delete

2. ~~The application of reconnaissance flight observation~~ Radar and satellite observation data in tropical cyclone analysis and forecasting

Delete ~~2.1 Reconnaissance Flight Observation Data~~

~~2.1.1 General explanation~~

~~The reconnaissance~~ flight data are ~~classified into the following four types:~~

~~1) Eye data, 2) drop-sonde data, 3) peripheral data,~~ and ~~4) Flight report.~~

Delete

The reconnaissance flight observation code is shown in Appendix 2-H

(1) Eye data (center/vortex fix data)

The eye data message includes the central position and the vertical structure near the typhoon center by the reconnaissance flight observation.

(2) Drop-sonde data

The message is reported when the drop-sonde data are obtained near the typhoon center during the penetration flight. Generally, this message is accompanied by the eye data. Thus, these data should be checked by comparing mutually.

(3) Peripheral data

Peripheral data message includes the altitude, temperature, wind direction and speed at the 700 hPa level and wind condition on the sea level at distance of 30, 60, 90 and 120 miles from the typhoon center.

Surface pressure is estimated from the value of height at the 700 hPa level by using the formula.

Some formulas are shown as follows:

$P = 645 + 0.115 x Z_{700}$ (JTWC)

$P = 643 + 0.116 x Z_{700}$ (JMA)

(Use conversion scale in Fig. 3-B.8)

After the surface pressures are estimated at distance of 30, 60, 90 and 120 miles, construct the pressure profile in accordance with the procedure of 1-2-5

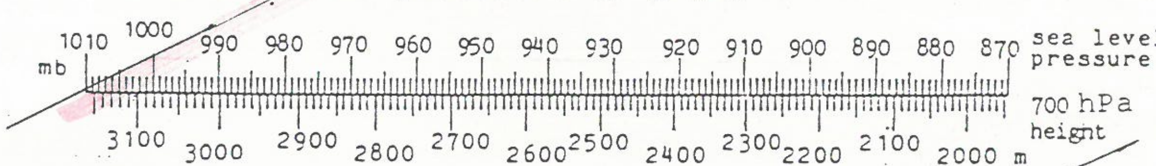


Fig. 3-B.8 Nomogram for sea level pressure from RECCO data at 700 hPa level

(4) Flight report

The flight report includes the weather conditions at the flight level on the way of the penetration flight. The flight report data are used for analysis of upper level weather maps.

Remark:

Check the accuracy of the central pressure in the eye data and drop-sonde data before using them.

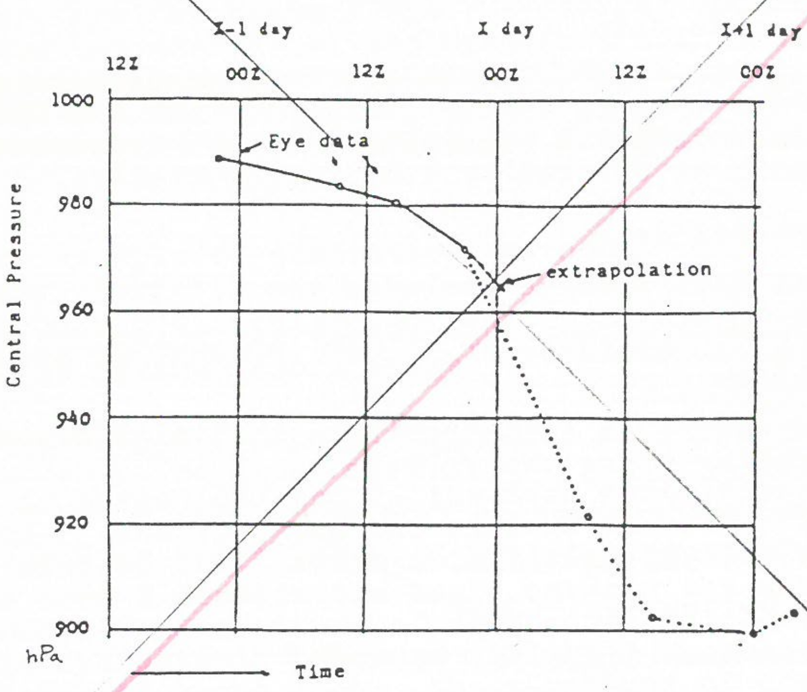
Delete ~~2.1.2 Estimation of central pressure~~

~~Construct a "time change curve" of central pressure based on the eye data. Estimate the current central pressure by extrapolating the curve (Fig. 3-B.9).~~

Delete

Note: Time change curve using the eye data

Estimation of the central pressure of the typhoon may be made by the extrapolation using the time change curve prepared beforehand.



Delete Fig. 3-B.9 Temporal change curve of central pressure by the eye data

2.1 Radar Observation Data

Radar observation and RADOB report are used for the operation.

2.1.1 Judgement on tropical cyclone formation

The features of the curved echoes, spiral bands and the eye show the stage of the tropical storm.

2.1.2 Identification of typhoon position

When the radar data reported by WMO code are used to fix the central position of the typhoon, the accuracy code in the RADOB must be confirmed. Accuracy code is classified into three categories: 1) good (within 10 km), 2) fair (10-30 km), and 3) poor (30-50 km).

2.1.3 Some features indicating the change in typhoon intensity

The following features should be noted in radar observation.

1. The distinct eye and reduction of eye size show the typhoon development. The indistinct shape of the eye and the expansion of the diameter of the eye observed over the sea show the decay of the typhoon.

2. Remarkable echo developing near the center shows the typhoon development. The reduction of area and intensity of convective echo near the center over the sea shows typhoon decay.

3. Typical configuration of the spiral band shows the typhoon development.

4. Increase of stratified echo shows the decay of the typhoon.

5. When the typhoon center reaches the middle latitudes and the echoes are organized into the pattern like **9** or λ , the typhoon is changing into the extratropical cyclone.

Note:

a) Regular calibration of radar should be carried out. Technical specification of radars of Typhoon Committee members shown in Appendix 2-E should be consulted when reports from these radars are used.

b) When the reports from two or more radar sites are received, the report from the sites using 10-cm radar is used first in the tropics. If the type of the radars are same, the report from the site nearest to the typhoon is used first and the report with better accuracy is used next.

In addition, past radar reports from the same site should be evaluated for accuracy against the past track of the typhoon.

c) Typhoon track fixed by radar should be smoothed. Since the typhoon track fixed by radar reports often shows irregular fluctuation over a short span of time, any small-scale irregularities should be eliminated using the smoothing method.

2.2 Satellite Analysis

2.2.1 Judgement on tropical cyclone formation.
Identification of tropical cyclone/typhoon position,
Assessment of tropical cyclone/typhoon intensity and
Prediction of tropical cyclone/typhoon intensity

After its operational application over a long time in many tropical cyclone forecast centers, it has been found that Dvorak's technique is very useful for the satellite analysis operation of tropical cyclones.

Therefore, the explanation of the satellite data application techniques for the operations in this section is considered to be fulfilled by refering to the material in Dvorak's article which is attached to this Manual as an annex of Appendix 3-B

2.2.2 Prediction of tropical cyclone/typhoon movement

2.2.2.1 Cloud features indicating future storm movement

When cloud features mentioned below are found, change of movement should be noted.

1. Deep convective cloud clusters developing around CSC.

Storm moves toward them. When they are seen in front of (in the rear of) CSC, storm movement accelerates (decelerates). Storm does not move toward the Cb-free secter of the storm.

2. The elongation of storm cloud system.

Storm tends to change its movement direction to the orientation of its long axis.

3. Northward extension of cirrus shield.

This feature indicates northward component of future storm movement. Northeastward extension of cirrus is often seen when the recurvature of westward moving storm takes place.

On the other hand, when cloud features stated above are not seen or when cloud features mentioned below are observed, persistence of the present movement may be expected.

1. Axially symmetric cloud pattern.
2. Multidirectional cirrus outflow.

2.2.2.2 Identification of cloud features indicating environmental situation affecting future storm movement.

Environmental cloud features sometimes indicate large scale situation affecting future storm movement.

1. North-south oriented active convective cloud band moving westward in the subtropical high.

This cloud band indicates westward extension or intensification of the subtropical high.

2. Southward extension of the cloud system associated with midlatitude westerly trough seen to the northwest of the storm.

When this extension is significant, northward movement of the storm is expected.

Remark:

Short-period variation of cloud features associated with the storm and in environmental area often misleads forecast of future storm movement.

List of addresses, telex/cable and telephone numbers of the tropical cyclone warning centres in the region

Centre	Mailing address	Telex/cable and telephone numbers
China		
Central Meteorological Office National Meteorological Centre State Meteorological Administration (Director: Lianshou Chen)	46 Baishiquiaolu, Western Suburb, Beijing	Telex: 22094 FDSMA CN Tel.: 89-0371 Ext. 2615 Ext. 2344 Cable: 2894
Democratic Kampuchea		
Hong Kong		
Meteorological Services Division Royal Observatory Hong Kong (Attn.: H.K. Lam)	134A Nathan Rd. Tsim Sha Tsui, Kowloon, Hong Kong.	Telex: 54777 GEO PH Tel.: 3-7329361 (00-09 UTC on weekdays) 3-7329474 3-681944 (24 hours) Telefax 3-7215034
Japan		
Forecast Division, Forecast Department Japan Meteorological Agency (Director: Y. Yamagishi)	1-3-4 Ote-machi, Chiyoda-ku, Tokyo 100	Telex: 2228080 METTOK J (24 hours) Tel: 03-211-8303 (00-09UTC on weekdays) 03-211-7617 (24 hours but excepting 00-09 UTC on weekdays)
Lao PDR		
Malaysia		
Main Meteorological Office, Kuala Lumpur International Airport	Kuala Lumpur International Airport, 47200 Subang, Selangor Darul Ehsan	Tel.: 03-7461441 03-7465990 03-7463961 (24 hours)

Collection and distribution of information related to tropical cyclones

Type of data	Heading	TD	BJ	BB	HH	MM	SL	NN	KK	IV	PP
		Receiving stations									
Enhanced surface observation	SNCI30 BABJ	BJ	O	HH	BJ		TD	BJ	BB		
	SNHK20 VHHH	HH	HH	HH	O			BB	BB		
	SNJP20 RJTD	O	TD				TD				
	SNKO20 RKSL	SL	TD				O				
	SNLA20 VLIV	BB	TD	IV				BB		O	
	SNMS20 WMKK	BB	TD	KK					O		
	SNPH20 RPMM	MM	TD	TD	TD	O	TD	Delete ~~TD~~	BB		
	SNTH20 VTBB	BB	TD	O				BB			
	SNVS20 VNNN	BB	TD	NN		TD	TD	O			
Enhanced upper-air observation	USCI11 BABJ	BJ	O		BJ	TD	TD	BJ			
	UKCI11 BABJ	BJ	O		BJ		TD				
	ULCI11 BABJ	BJ	O		BJ		TD	BJ			
	UECI11 BABJ	BJ	O		BJ						
	USHK1 VHHH	HH	HH	HH	O	TD	TD	BB	BB		
	UKHK1 VHHH	HH	HH	HH	O		TD		BB		
	ULHK1 VHHH	HH	HH	HH	O		TD	BB	BB		
	UEHK1 VHHH	HH	HH	HH	O				BB		
	USJP01 RJTD	O	TD	TD	TD	TD	TD.		BB		
	UKJP01 RJTD	O	TD	TD	TD		TD		BB		
	ULJP01 RJTD	O	TD	TD	TD						
	UEJP01 RJTD	O	TD	TD	TD						
	USKO1 RKSL	SL	TD	TD	TD	TD	O		BB		
	UKKO1 RKSL	SL	TD		TD		O				
	ULKO1 RKSL	SL	TD	TD	TD		O		BB		
	UEKO1 RKSL	SL	TD	TD	TD		O		BB		
	USMS1 WMKK	BB	TD	KK		TD	TD		O		
	UKMS1 WMKK	BB	TD	KK		TD			O		
	ULMS1 WMKK	BB	TD	KK		TD			O		
	UEMS1 WMKK	BB	TD	KK		TD			O		
	USPH1 RPMM	MM	TD	TD	TD	O	TD	TD			
	UKPH1 RPMM	MM	TD	TD	TD	O					
	ULPH1 RPMM	MM	TD	TD	TD	O		Delete ~~TD~~			
	UEPH1 RPMM	MM	TD	TD	TD	O					
	USTH1 VTBB	BB	TD	O		TD	TD				
	UKTH1 VTBB	BB	TD	O							
	ULTH1 VTBB	BB	TD	O							
	UETH1 VTBB	BB	TD	O							
	USVS1 VNNN	BB	HH	NN	BB		TD	O			
	UKVS1 VNNN	BB	HH	NN	BB			O			
	ULVS1 VNNN	BB	HH	NN	BB			O			
	UEVS1 VNNN	BB	HH	NN	BB			O			

Type of data	Heading	TD	BJ	BB	HH	MM	SL	NN	KK	IV	PP
observation	[illegible]	O	TD		TD	TD	TD				
	~~SNVX21~~ RJTD	O	TD		TD	TD	TD				
	SNVX20 RPMM	MM	TD	TD	TD	O		BB			
	SNVX20 VHHH	HH	HH	HH	O	TD	TD	BB			
	SNVX20 VNNY	BB	TD	NN	BB	TD		O			
Enhanced radar observation	SBCI30 BABJ	BJ	O	HH	BJ	TD	TD	BJ	BB		
	SCCI31 BABJ	BJ	O	HH	BJ				BB		
	SBCI60 BCGZ	BJ	O		BJ	TD	TD	BJ			
	SCCI60 BCGZ		O		BJ						
	SBHK20 VHHH	HH	HH	HH	O	TD		BB	BB		
	SBJP20 RJTD	O	TD		TD	TD	TD				
	SDK020 RKSL	SL	TD		TD	TD	O				
	SDMS20 WMKK	BB	TD	KK					O		
	SDPH20 RPMM	MM	TD	TD	TD	O	TD	BB	BB		
	SDTH20 VTBB	BB	TD	O	BB						
	SDVS20 VNNN	BB	TD	NN	BB	TD		O			
Satellite guidance	TPPA1 PGTW	*	TD								
	TPPA1 RJTY	*	TD	TD	TD						
	TPPA1 RODN	*	TD	TD	TD	TD					
	TPPW20 RJTD	O	TD	TD	TD	TD	TD	BB			
Delete ~~Aircraft report (RECCO)~~	URPA10 PGTW	*	TD	TD	TD	TD	TD	TD			
	URPA10 RJTY	*	TD	TD	TD	TD	TD		BB		
	URPA10 RPMK	*	TD	TD	TD				BB		
	URPA11 PGTW	*	TD	TD	TD	TD		TD	BB		
	URPA11 RJTY	*	TD	TD	TD	TD	TD		BB		
	URPA11 RPMK	*	TD	TD	TD				BB		
	URPA12 PGTW	*	TD	TD	TD	TD	TD	TD	BB		
	URPA12 RJTY	*	TD	TD	TD	TD			BB		
	URPA12 RPMK	*	TD	TD	TD						
Delete ~~Peripheral data~~	~~URPA14 PGTW~~	~~*~~	~~TD~~	~~TD~~	~~TD~~	~~TD~~		~~TD~~			
	~~URPA14 RPMK~~	~~*~~	~~TD~~	~~TD~~	~~TD~~	~~TD~~					
Delete ~~Drop-sonde report~~	~~UZPA13 PGTW~~	~~*~~	~~TD~~	~~TD~~	~~TD~~	~~TD~~	~~TD~~		~~BB~~		
	~~UZPA13 RJTY~~	~~*~~	~~TD~~	~~TD~~	~~TD~~	~~TD~~					
	~~UZPA13 RPMK~~	~~*~~	~~TD~~	~~TD~~	~~TD~~	~~TD~~	~~TD~~		~~BB~~		
Tropical cyclone forecast	FXPH20 RPMM	MM	TD	TD	TD	O	TD	BB	BB		
	FXPQ20 BABJ	BJ	O	HH	BJ	TD	TD	BJ	BB		
	FXPQ20 VHHH	HH	HH	HH	O	TD	TD	BB	BB		
	FXPQ21 VHHH	HH	HH	HH	O	TD	TD	BB	BB		
	FXPQ29 VTBB			O							
	FXSS20 BABJ	BJ	O	HH	BJ	TD	TD	BJ			
	FXSS20 VHHH	HH	HH	HH	O	TD	TD	BB	BB		
	FXSS21 VHHH	HH	HH	HH	O	TD	TD	BB	BB		
	FXK020 RKSL	SL					O				

Type of data	Heading	Receiving stations TD	BJ	BB	HH	MM	SL	NN	KK	IV	PP
Warning	WDPA1 PGTW	*	TD	TD	TD	TD	TD	Delete ~~TD~~	BB		
	WHCI28 BCGZ	HH	*	HH	BJ			BJ			
	WHCI40 BABJ	BJ	O	HH	BJ			BJ	BB		
	WSPH RPMM	MM	TD			O					
	WTPA21 PGTW	*	TD	TD	TD	TD	TD	BB	BB		
	WTPA31 PGTW	*	TD	TD	TD	TD	TD	BB	BB		
	WTPA32 PGTW	*	TD	TD	TD	TD	TD	BB	BB		
	WTPH20 RPMM	MM	TD	TD	TD	O		BB	BB		
	WTPH21 RPMM	MM	TD	TD	TD	O		BB	BB		
	WTPQ20 VHHH	HH	HH	HH	O		TD	BB	BB		
	WTSS20 VHHH	HH	HH	HH	O			BB	BB		
	WTTH20 VTBB	BB	TD	O	BB			BB	BB		
	WTVS20 VNNN							O			
	WWJP20 RJTD	O	TD	TD	TD	TD	TD	TD	BB		
	WWJP21 RJTD	O	TD	TD	TD	TD	TD	TD	BB		
	WWK030 RKSL	SL					O				

NOTE : Meaning of abbreviation,

- O : Data originating centre
- TD : Data transmitting centre – Tokyo
- BJ : " – Beijing
- BB : " – Bangkok
- HH : " – Hong Kong
- MM : " – Manila
- SL : " – Seoul
- NN : " – Hanoi
- KK : " – Kuala Lumpur
- IV : " – Vientiane
- PP : " – Phnom Penh
- * : " – Places other than described above

Table of abbreviated headings (TTAAii CCCC)

TT	Data designator
FX	Miscellaneous forecasts
SB	Radar reports PART A
SC	Radar reports PART B
SD	Radar reports PART A and PART B
SN	Synoptic reports (non-standard hours)
TP	Satellite guidance
UA	Aircraft reports (AIREP)
UE	Upper-level observation PART D
UK	Upper-level observation PART B
UL	Upper-level observation PART C
Delete ~~UR~~	~~Aircraft reports (RECCO)~~
US	Upper-level observation PART A
Delete ~~UZ~~	~~Drop sonde reports~~
WD	Prognostic reasoning for typhoon
WH	Hurricane warnings
WO	Other warnings
WS	SIGMET
WT	Tropical cyclone warnings
WW	Warning and weather summary

ii	Data distribution area
01-19	Global
20-39	Regional
40-89	National

AA	Geographical designator
CI	China
HK	Hong Kong
JP	Japan
KO	Republic of Korea
KP	Democratic Kampuchea
LA	Lao People's Democratic Republic
MS	Malaysia
PA	Pacific area
PH	Phillipines
PN	North Pacific area
PQ	Western North Pacific
PW	Western Pacific area
SS	South China Sea area
TH	Thailand
VS	Vietnam

CCCC	Location indicator
BABJ	Beijing
BCGZ	Guangzhou
KWBC	Washington
PGFW	Guam (F.W.C)
PGTW	Guam (JTWC)
PGUM	Guam (Agana)
RJTD	Tokyo
RJTY	Yokota
RKSL	Seoul
RKSO	Osan
RODN	Okinawa/Kadena AB
RPMK	Clark AB
RPMM	Manila/Intl.
VDPP	Phnom Penh
VHHH	Hong Kong
VLIV	Vientiane
VNNN	Hanoi
VTBB	Bangkok
WMKK	Kuala Lumpur

Regular monitoring at RSMC

1. Items of monitoring

RSMC monitors the reception time of following observations;

(i) hourly surface observations,
(ii) hourly ship and buoy observations,
(iii) 6-hourly upper-air observations,
(iv) hourly radar observations,
Delete ~~(v) reconnaissance flight observations.~~

2. Output format

Reception time of SYNOP reports

Aug. 24th, 1986

Location	00Z	01Z			24Z
47918	0007	0105			2408
47927	0006	0107			2409
≀	≀	≀			≀
58238	0028	0123			2425

List of data proposed to be archived by RSMC

(a) Level II-b

Kinds of data : surface, ship, buoy, upper-air, RADOB, aircraft, ASDAR, reconn Delete ~~e flight and drop-sonde~~, advisory, warning, SAREP, SATEM, SATOB, TBB grid value and five-day mean sea surface temperature and cloud amount (GMS).

Area coverage : SATEM :90°E-180°E and 0°-45°N. SATOB, TBB grid value and five-day mean sea surface temperature and cloud amount : area covered by GMS. Other data : within the area of 80°E-160°W and 20°S-60°N (hereafter A-area).

(b) GMS cloud pictures

Kinds of data : Either negative or positive imagery.

Data form : Microfilm (Detailed specification is given in the next page(Appendix 7-A,p.2))

Area coverage : Area covered by GMS

(c) Level III-a

Kinds of data : Grid point data of the objective analysis obtained by the global objective analysis system in RSMC.

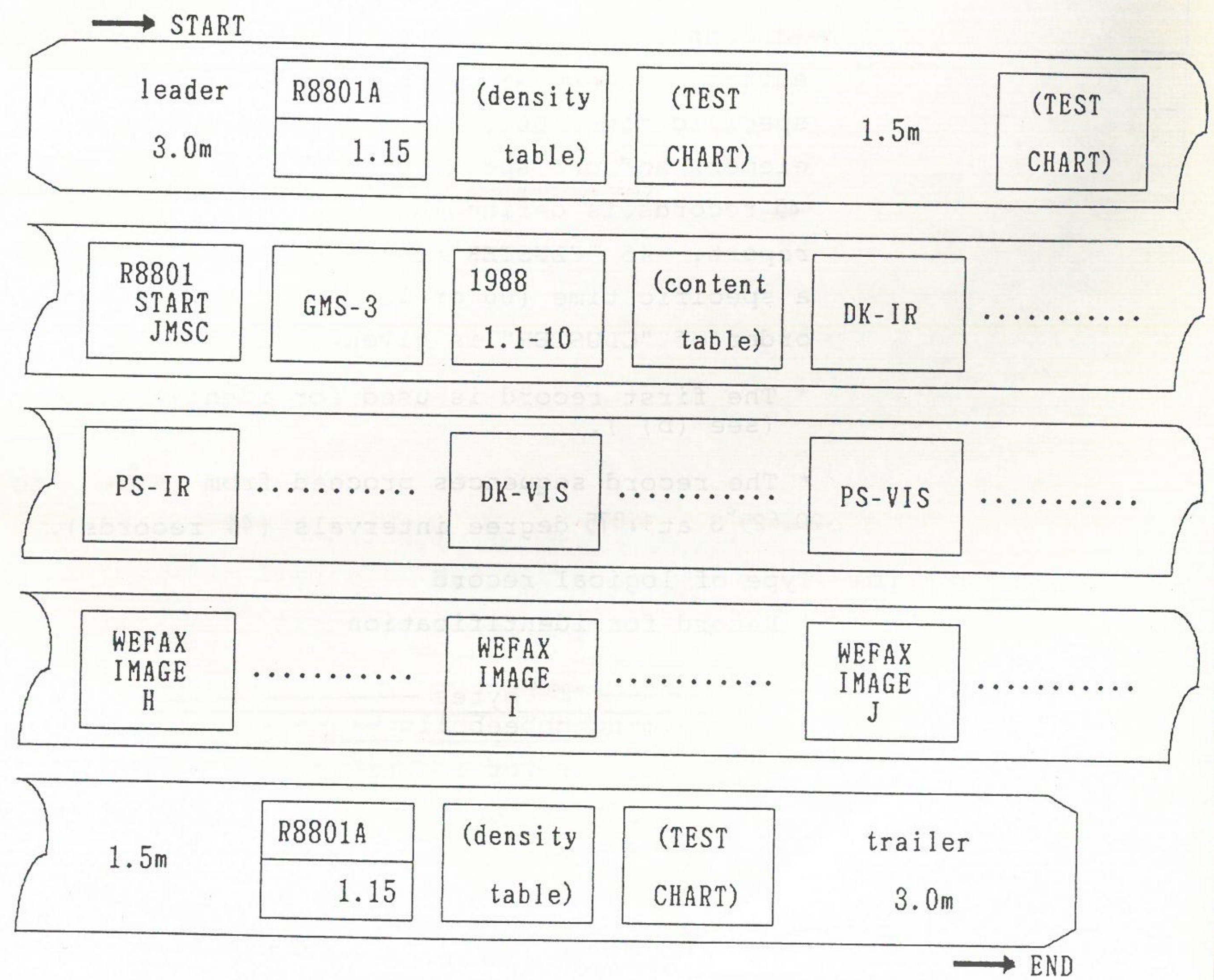
Area coverage : A-area covered by 1.875° x 1.875° latitude-longitude grid system.

Element and layer : Temperature (Ts), dewpoint depression (Ts-Tds), wind (Vs, Vs) at station level, sea surface pressure (Ps) and geopotential height (Z), wind (U,V), temperature (T), dewpoint depression (T-Td) at mandatory pressure levels from 850 mb up to 100 mb at 00 and 12 UTC. Sea surface temperature at 00 UTC.

Note : Specifications of the characteristics of the tapes for level II-b and level III-a are given in Appendix 7-A, Annex.

SPECIFICATION OF GMS IMAGE MICROFILM

form	35mm no-perforation		
image	Full Disk (DK)	infrared (IR) visible (VIS)	3-hourly 00,03,06 UTC
	Polar-Stereographic projection of northern hemisphere (PS)	infrared (IR) visible (VIS)	3-hourly 00,03,06 UTC
	WEFAX image H I/J	infrared visible or enhanced IR	hourly hourly
quantity	10days/volume		
format	below		



II) Level III-a data

(1) Number of tracks : 9

(2) Density of records : 6250 BPI

(3) File format : Single file, single volume

(4) Label : Non label

(5) Character code : EBCDIC

(6) Block length : 2640 bytes

(7) Number of records in one block : 10

(8) Logical record length: 264 bytes

(9) Structure of record

(a) Logical order of records

*44 consecutive records are used to cover the entire A-area data for one specific time (00 or 12 UTC), one specific element and one specific level. A group of 45 records (one identification record plus 44 data records) is defined as 1 "CLUSTER" in this report. 45 "CLUSTER" cover the whole data at a specific time (00 or 12 UTC). Sequential order of "CLUSTER" is given in Table 7-A.3.

* The first record is used for identification (see (b)).

* The record sequences proceed from 60°N to 20.625°S at 1.875 degree intervals (44 records).

(b) Type of logical record

* Record for identification

← 264 bytes →

IDbbyymmddhhbbeebbllb ------------b

ID: Indicator for identification record

yy: Symbol for tens and units digits of the year, i.e., 88=1988

mm: Symbol for the month, i.e., 08=August

dd: symbol for the day of the month, i.e., 01=the first day of the month

hh: Symbol for time (00 or 12 (UTC))

ee: Symbol for parameter, reference value and unit (See, Table 7-A.1 and 7-A.2)

$\ell\ell$: Symbol indicating pressure at mandatory pressure levels in units of 10 mb, i.e., 85=850 mb

Note:

The following specifications are used to indicate sea surface pressure and elements at station level.

$\ell\ell$ = 00, ee = 1 for sea surface pressure

$\ell\ell$ = 00, ee ≠ 1 for temperature, wind speed and dewpoint temperature at station level.

Table 7-A.1 Specification of symbol letter "ee"

Code figure	Field parameter	Reference value	unit
01	pressure	900.0 mb	0.1 mb
02	geopotential height	variable according to code figure of $\ell\ell$ (Table 7-A.2)	1.0 gpm
03	west-east comp. of wind	-200.0 m/s	0.1 m/s
04	south-north comp. of wind	-200.0 m/s	0.1 m/s
05	temperature	0.0°K	0.1°K
06	dewpoint depression	0.0°C	0.1°C

Note: When the value of the wind speed obtained by the formula (1) (see below) is positive, wind blows from west or south.

Table 7-A.2 Reference value for geopotential height

Code figure of $\ell\ell$	Reference value
85	0.0 gpm
70	0.0 gpm
50	0.0 gpm
40	0.0 gpm
30	0.0 gpm
25	6000.0 gpm
20	7000.0 gpm
15	8000.0 gpm
10	10000.0 gpm
	12000.0 gpm

* Record of the data

← 264 bytes →

$I_1 I_1 I_1 I_1 I_2 I_2 I_2 I_2$ -----$I_i I_i I_i I_i$ -----$I_{66} I_{66} I_{66} I_{66}$

4 bytes (= 4 digits) are used to represent a value at one grid point.

The value is always positive.

Undefined data is given the value 9999.

Data sequences proceed from 78.75 degree east longitude towards east until 159.375 degree west (66 grid points).

Note:

Actual value at each grid point is obtained by the following formula using reference value and the value of unit (See, Table 7-A.1 and 7-A.2):

Actual value = (reference value) + $I_i I_i I_i I_i$ x(unit) (1)

(c) Sequential order of "CLUSTER" is given in Table 7-A.3.

Table 7-A.3 Sequential order of "CLUSTER"

Parameter / Level	Z/P_s	u	v	T	$T-T_d$
surface	1	11	21	31	41
850 mb	2	12	22	32	42
700 mb	3	13	23	33	43
500 mb	4	14	24	34	44
400 mb	5	15	25	35	45
300 mb	6	16	26	36	
250 mb	7	17	27	37	
200 mb	8	18	28	38	
150 mb	9	19	29	39	
100 mb	10	20	30	40	

(d) Record of the end of file

264 bytes

EEbbb ---------------------------------b

EE: Indicator of the end of the file.

This record appears in the very last block on tape.