



ESCAP/WMO
Typhoon Committee



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53rd Session Typhoon Committee

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VIDEO CONFERENCE
REPORT OF THE FIFTY-THIRD SESSION
OF TYPHOON COMMITTEE

Hosted by Japan
23-25 February 2021

PART I – DECISIONS OF THE COMMITTEE

1. The Committee decided to:
 - a. Elect Mr. HASEGAWA Naoyuki, Director-General of Japan Meteorological Agency (JMA) as Chairperson; Ms. Outhone PHETLUANGSY, Director-General of Department of Meteorology and Hydrology (DMH), Ministry of Natural Resources and Environment of Lao PDR as Vice-Chairperson and Mr. Christopher BRENCHLEY, Director, Weather Forecast Office, Regional Specialized Meteorological Center (RSMC) Honolulu as Chairperson of the Drafting Committee.
 - b. Consider the key tropical cyclone impacts on Members in 2020 and review the initiatives and activities to be pursued in support of the 21 TC Priorities to mitigate future impacts. Members should follow a consistent format in member reports, and keep in mind the Typhoon Committee strategic plan in developing priorities and plans.
 - c. Adopt Section 2 of the Summary of Members' Reports 2020 as an "Executive Summary" to be distributed to Members' governments for information and reference.
 - d. Approve the Typhoon Committee Operational Manual (TOM) with the amendments provided in **Appendix IX** and request WMO to publish and upload the 2021 edition of TOM on the Tropical Cyclone Programme (TCP) Website.
 - e. Approve the recommendations submitted by Working Group on Meteorology (WGM) as expressed in paragraph 55.
 - f. Approve the recommendations submitted by Working Group on Hydrology (WGH) as expressed in paragraph 75.
 - g. Approve the recommendations submitted by Working Group on Disaster Risk Reduction (WGDRR) as expressed in paragraph 85.
 - h. Approve the recommendations submitted by Training and Research Coordination Group (TRCG) as expressed in paragraph 93.
 - i. Approve the recommendations submitted by Advisory Working Group (AWG) as expressed in paragraph 100.
 - j. Support the establishment of the Asia-Pacific Typhoon Collaborative Research Center (CRC) in Shanghai contributing to the TC research activities.
 - k. Establish a joint task team composed of China and interested TC Members to develop a pilot project under TRCG and an agreement on technical cooperation between the TC and the CRC, in line with the considerations expressed in paragraph 104.

- l. Request the joint task team to provide a report of their efforts, and invite China to report on the progress with the establishment of the research center at the 54th Annual Session.
- m. Approve Dr. T. C. LEE from Hong Kong, China as the Chairperson of AWG; Mr. Tom EVANS from USA to serve as the Vice-Chairperson of AWG.
- n. Approve YINXING, KOTO, NONGFA, NOKAEN, RAGASA and CO-MAY as replacement names for YUTU, KAMMURI, FAXAI, PHANFONE, HAGIBIS and LEKIMA, respectively, in the list of the names of tropical cyclones.
- o. Approve the retirement of the names of tropical cyclones LINFA, VONGFONG, MOLAVE, GONI and VAMCO, and request TCS to issue letters to the relevant Members (Macao, China; Philippines; Republic of Korea; and Vietnam) to provide replacement names in accordance with the Committee's procedure.
- p. Approve the effective period of the new Typhoon Committee Strategic Plan 2022-2026 and request USA to present the final draft for approval and endorsement at TC54 in 2022.
- q. Approve the Procedures for new Membership in the Typhoon Committee presented in **Appendix XX**.
- r. Approve the Updated Rules and Procedures for Meetings/Sessions arrangements under special or emergency situations for the Typhoon Committee and Methods of Work for the Online Sessions presented in **Appendix XXI**.
- s. Approve the 2021/2022 Budget as presented below (see **Appendix XXVI** for detail):

By Group	Apr-Dec2021/ Jan-Mar2022
	Proposed
TCS	34,000.00
ALL WGS (IWS ONLY)	68,000.00
TRCG	11,000.00
WGM	44,000.00
WGH	30,000.00
WGDRR	30,000.00
TOTAL	217,000.00
Plus	
Special Request Budget for WGs	12,000.00
Total	12,000.00
Total Proposed Budget plus Special Request Budget in 2021/2022	229,000.00

- t. Accept the venue for the host of the 16th IWS in 2021 at the ESCAP facility in Bangkok, Thailand. The final date and arrangements would be confirmed in due course by TCS and ESCAP.

- u. Accept the kind offer of Lao PDR to host the 54th Session in 2022. The final date and place would be confirmed in due course by Lao PDR and later communicated to TCS.
- v. Accept the venue for the host of the 17th IWS in 2022 at the ESCAP facility in Bangkok, Thailand. The final date and arrangements would be confirmed in due course by TCS and ESCAP.
- w. Accept the kind offer of Macao, China to host the 55th Session in 2023. The final date and place would be confirmed in due course by Macao, China and later communicated to TCS.

PART II – PROCEEDINGS OF THE COMMITTEE

I. ORGANIZATION OF THE VIDEO CONFERENCE (VC) (agenda 1)

2. Originally, planned to be conducted face to face in Okinawa, Japan, the 53rd Session of the ESCAP/WMO Typhoon Committee (TC53), was proposed to be held virtually by the AWG in consultation with Japan, due to the travel restriction and quarantine measures associated with the still ongoing COVID-19 pandemic. After consultation with the Chairpersons of the Committee and the host Japan, the Committee decided to conduct the TC53 by video conference (VC) instead.
3. A VC hosted by Japan was then scheduled from 23-25 February 2021.
4. The VC was attended by 123 participants from 13 out of 14 Members of the Typhoon Committee, namely: China; Democratic Republic of Korea (DPRK); Hong Kong, China; Japan; Laos People's Democratic Republic (Laos PDR); Macao, China; Malaysia; the Philippines; Republic of Korea; Singapore; Thailand; United States of America (USA); and the Socialist Republic of Viet Nam. Representatives of United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), World Meteorological Organization (WMO) and Typhoon Committee Secretariat (TCS) also attended the VC.
5. The VC was also attended by observers from the following organizations: Asian Disaster Reduction Center (ADRC); International Federation of Red Cross and Red Crescent Societies (IFRC); International Research Institute of Disaster Science, Tohoku University of Japan; and Infrastructure Development Institute of Japan (IDI). The list of participants can be consulted in **Appendix I**.

Opening of the Session

6. The opening ceremony of the Session began at 10:00 am on Tuesday, 23 February 2021 (Japan Time). Ms. Denise LAU from the TCS conducted the opening ceremony.
7. The following speeches were delivered at the opening ceremony and are provided in **Appendix II**:
 - a) **Dr. Cho-ming CHENG**, Director of the Hong Kong Observatory and Chairperson of the 52nd Session of the Typhoon Committee
 - b) **Dr. Wenjian ZHANG**, Assistant Secretary General of WMO
 - c) **Mr. Sanjay SRIVASTAVA**, Chief, Information and Communications Technology, Disaster Risk Reduction, ESCAP
 - d) **Dr. Johan STANDER**, Director, Service Department, WMO
 - e) **Mr. YU Jixin**, Secretary of the Typhoon Committee
 - f) **Mr. HASEGAWA Naoyuki**, Director General of JMA, who declared the opening of the VC Session
8. Dr. Roman L. KINTANAR AWARD for typhoon related disaster mitigation was presented for the years 2019 and 2020. The winner of Dr. KINTANAR AWARD 2019 was awarded to the Drainage Services Department (DSD) of the Government of the Hong Kong SAR, China, in recognition of their continuous and outstanding contributions towards flood prevention and mitigation due to tropical cyclones and extreme weather, including long-term planning

of drainage facilities, construction of storm water storage tanks and interception tunnels, and in particular, the timely efforts in minimizing flood risk due to Super Typhoons Hato and Mangkhut in Hong Kong, China.

9. The winner of Dr. Roman L. KINTANAR AWARD 2020 was awarded to the Joint Team (International Centre for Water Hazard and Risk Management, Infrastructure Development Institute and Japan Aerospace Exploration Agency) in Enhancing Flood Forecasting Management Capacity, Japan, in recognition of their outstanding contribution and joint efforts in enhancing flood forecasting and management capacity in the Typhoon Committee Region.
10. The Committee took note that the Dr. Roman L. Kintanar Award Plaque Ceremony would be held when the Session is able to meet face-to-face.

II. REPORT ON CREDENTIAL COMMITTEE (agenda item 2)

11. Mr. YU Jixin, TC Secretary, presented the Credential Letters submitted by TC Members and presented the Summary Report of the Credential Committee, which can be consulted at **Appendix III**.

III. ELECTION OF OFFICERS (agenda item 3)

12. Mr. HASEGAWA Naoyuki, Director General of JMA, was elected Chairperson and Ms. Outhone PHETLUANGSY, Director-General of Department of Meteorology and Hydrology (DMH), Ministry of Natural Resources and Environment of Lao PDR was elected Vice-Chairperson of the Committee.
13. Mr. Christopher BRENCHLEY, Director, Weather Forecast Office RSMC Honolulu, was elected Chairperson of the Drafting Committee.

IV. ADOPTION OF THE AGENDA FOR THE VC (agenda item 4)

14. The Committee adopted the agenda for the VC. (**Appendix IV**)

V. TECHNICAL PRESENTATIONS (agenda item 5)

5.1 Summary of the 2020 typhoon season

15. The Committee noted with appreciation the review of the 2020 typhoon season provided by the RSMC Tokyo as provided in **Appendix V**, whose summary is presented in paragraph 16 – 26.

16. In the western North Pacific and the South China Sea, 23 named tropical cyclones (TCs) formed in 2020, which was below the 30-year average, and 10 out of them reached typhoon (TY) intensity, which was also below the 30-year average.
17. The 2020 typhoon season started in May with Vongfong (2001), which originally formed as a TD around the Palau Islands and hit the Philippines with TY intensity early on 14 May. Notably, two named TCs had formed by July, which is far below the 30-year normal of 7.7. The third named TC formed at 00 UTC on 1 August, which is the second latest since related statistics began in 1951. This is attributed to high sea surface temperatures over the Indian Ocean and related convective activity in the region until July, which led to convective inactivity over the South China Sea and seas east of the Philippines, where TCs generally form.
18. The total of six named TCs forming in October was the second highest since statistics began. Analysis shows significantly enhanced convective activity from the South China Sea to the area east of the Philippines, which created favorable atmospheric and oceanic conditions for local TC formation. This is attributed to an active Madden-Julian Oscillation (MJO) phase in the area in addition to the emergence of the La Niña event.
19. The mean genesis point of named TCs was 17.5°N and 126.3°E, which showed a west-northward deviation from that of the 30-year average (16.2°N and 136.7°E) (see Figure 2). The mean genesis point of named TCs formed in summer (June to August) was 19.9°N and 124.1°E, with a west-northwestward deviation from that of the 30-year summer average (18.4°N and 134.9°E), and that of named TCs formed in autumn (September to November) was 16.8°N and 128.6°E, which was a west-northwestward deviation from that of the 30-year autumn average (15.9°N and 137.4°E).
20. The mean duration of TCs sustaining TS intensity or higher was 3.8 days, shorter than that of the 30-year average (5.3 days). The mean duration of TCs sustaining TS intensity or higher formed in summer was 3.5 days, shorter than that of the 30-year average (5.1 days), and the mean duration of TCs sustaining TS intensity or higher formed in autumn was 4.1 days, shorter than that of the 30-year average (5.6 days).
21. The first and second named TCs of 2020 formed in May and June, respectively. Vongfong (2001) formed as a TD around the Palau Islands and hit the Philippines with TY intensity early on 14 May (hereafter, a location with a named TC corresponds to the location of its formation as a TD, unless otherwise noted.), and Nuri (2002) formed over the sea east of the Philippines.
22. Eight named TCs formed in August, exceeding the 5.9 climatological normal for the month. Sinlaku (2003) formed over the South China Sea and crossed the coast of Viet Nam. Hagupit (2004) formed east of the Philippines and affected several countries along its path. Jangmi (2005) formed east of the Philippines and hit the Korean Peninsula. Mekkhala (2006) and Higos (2007) formed west and east of Luzon Island, respectively, and hit the coast of southern to southeastern China. Bavi (2008) and Maysak (2009) formed north and east of the Philippines, respectively. Haishen (2010) formed east of Iwoto Island and moved northward off the west of Kyushu Island over the East China Sea, reaching peak intensity with maximum sustained winds of 105 kt (the second highest of the season). Bavi, Maysak and Haishen hit the Korean Peninsula with TY intensity, bringing torrential rains, strong winds and other extreme conditions to several countries in their paths.

23. Three named TCs formed in September. Noul (2011) formed over the Philippines, moved westward and hit Viet Nam. Dolphin (2012) formed north of Japan's Okinotorishima Island, and Kujira (2013) formed over the sea west of Wake Island.
24. Six named TCs formed in October. Chan-Hom (2014) formed south of Japan, moved northward and reinforced the seasonal rain-front system, bringing heavy rains over wide areas from eastern to western Japan. Linfa (2015) formed east of the Philippines, moved westward and hit Viet Nam with TS intensity. The duration of the TC sustaining TS intensity or higher was the shortest in the year. Nangka (2016) formed west of the Philippines, moved westward, passed over Hainan Island and hit Viet Nam. Saudel (2017) formed east of the Philippines, and Molave (2018) formed over the sea west of Yap Island. Goni (2019) formed over the sea west of Guam Island and reached peak intensity with maximum sustained winds of 120 kt just before hitting the Philippines, marking a record for the typhoon season. Three tropical cyclones (Saudel, Molave and Goni) passed over the Philippines and moved westward over the South China Sea toward Viet Nam.
25. Three named TCs formed in November. Atsani (2020) formed southwest of Guam Island and moved northwestward. Etau (2021) formed east of the Philippines, moved westward, crossed the Philippines and hit Viet Nam. Vamco (2022) formed over the western part of the Caroline Islands, moved westward, passed over the Philippines and hit Viet Nam. From August to November, seven named TCs hit Viet Nam with TS intensity or higher, causing heavy rain and flooding in the country.
26. The last-named TC, Krovanh (2023) formed off the east coast of Mindanao Island and moved westward. It crossed longitude 100 degree east at 00 UTC on 25 December.

VI. REPORT ON TC'S KEY ACTIVITIES AND OVERVIEW SUMMARY OF MEMBERS' REPORTS (agenda item 6)

6.1 Report on TC's Key Activities and Main Events in the Region

27. The Committee took note of the report of the Typhoon Committee Chairperson on the TC's Key Activities and Main Events in the Region in 2020. **(Appendix VI)**
28. The Committee expressed sincere appreciation to the contributions of Dr. CHENG Choming as the Chairperson of the Committee, and of Mr. SEKITA Yasuo and Mr. HASEGAWA Naoyuki in succession as the Vice Chairperson of the Committee.

6.2 Overview Summary of Members' Reports

29. The Committee took note of the Summary of Members' Reports 2020 highlighting the key tropical cyclone impacts on Members in 2020 and the major activities undertaken by Members under the TC Priorities and components during the year. **(Appendix VII)**
30. The Committee expressed its sincere appreciation to AWG Chairperson for preparing the Summary of Members' Reports and the observations made with respect to the progress of Members' activities in support of the 21 Priorities identified in the TC Strategic Plan 2017-2021.

RECOMMENDATIONS OF AWG

31. Consider the key tropical cyclone impacts on Members in 2020 and review the initiatives and activities to be pursued in support of the 21 TC Priorities to mitigate future impacts. Members should follow a consistent format in Member's reports, and keep in mind the Typhoon Committee strategic plan in developing priorities and plans.
32. Adopt Section 2 of the Summary of Members' Reports 2020 as an "Executive Summary" to be distributed to Members' governments for information and reference.

VII. REVIEW OF ACTIVITIES OF RSMC TOKYO AND AMENDMENTS OF TOM (agenda item 7)

7.1 Review of the activities of the Regional Specialized Meteorological Center (RSMC) Tokyo 2020 (Appendix VIII)

33. The Committee noted with appreciation the review of RSMC advisories, products and operational activities and changes made in 2020. It noted the forecast verification results for 23 TCs that reached TS intensity or higher formed in 2020 as follows;

- The forecast track errors of the year

	24-hour	48-hour	72-hour	96-hour	120-hour
2020	74 km	119 km	176 km	214 km	267 km
2019*	80 km	127 km	190 km	263 km	374 km

- The annual mean RMSEs for central pressure forecasts

	24-hour	48-hour	72-hour	96-hour	120-hour
2020	11.6 hPa	15.0 hPa	14.6 hPa	13.9 hPa	13.0 hPa
2019*	11.2 hPa	15.1 hPa	17.6 hPa	18.2 hPa	20.3 hPa

- The annual mean RMSEs for maximum wind speed forecasts

	24-hour	48-hour	72-hour	96-hour	120-hour
2020	5.8 m/s	7.0 m/s	7.3 m/s	7.2 m/s	6.8 m/s
2019*	5.1 m/s	7.1 m/s	8.0 m/s	8.4 m/s	9.3 m/s

*as a reference

34. The Committee noted with appreciation the changes in RSMC advisories, products and operational/coordination activities in 2020, especially the commencement of five-day forecasts for tropical depressions (TDs) expected to reach tropical storm (TS) intensity within 24 hours.
35. The Committee noted with appreciation RSMC Tokyo's development and maintenance of a dedicated platform for enhanced communication between operational forecasters and RSMC-Tokyo, as well as the sharing of advance-notice updates. In light of the active discussions conducted on the system, as demonstrated by the hundreds of user logins observed during the last typhoon season, and the platform's core role in maintaining Member interaction, the Committee also acknowledged with appreciation RSMC Tokyo's decision to migrate its current trial phase to full operation and further enhancement of the platform's communication functionality.

36. The Committee noted with appreciation the operation of RSMC Tokyo's Numerical Typhoon Prediction (NTP) website and the remarkable enhancements made in 2020, such as the commencement of TIFS Monitor (TC intensity forecast guidance), real-time verification results and more accurate TC activity prediction, along with the introduction of additional points for time-series charts representing ocean wave prediction and NOAA-20 data to microwave TC intensity estimation.
37. The Committee noted with appreciation the contribution of RSMC Tokyo (which also serves as an ICAO TCAC (TCAC Tokyo)) to compliance with ICAO Standards and Recommended Practices (SARPs), addressing the new provision of the IWXXM GML format (Annex 3, Amendment 78, Appendix 2, para. 5.1.3) and certain element changes (Amendments 78 and 79, Table A2-2), along with the commencement of tropical cyclone advisory messages in IWXXM 3.0 format on the TCAC Tokyo website.
38. The Committee noted with appreciation the ongoing contribution of RSMC Tokyo to the regional Storm Surge Watch Scheme (SSWS), especially the provision of various products including storm surge forecast distribution maps, time-series charts for selected stations and multi-scenario storm surge predictions, as well as week-range probabilistic wave forecasts for significant wave heights and peak wave periods. The Committee again encouraged Members to make their sea level observation data available in order to support verification activity.
39. The Committee noted with appreciation the continuous efforts and progress of RSMC Tokyo's development of tropical cyclone genesis guidance using early Dvorak Analysis and global ensemble.
40. The Committee was pleased to note the progress of the regional radar network development project, whose experimental exchange of radar composite data among RSMC Tokyo, the Thai Meteorological Department (TMD) and the Malaysia Meteorological Department (MMD) started in 2016. The project has been expanded and three more Members, Lao P.D.R., the Philippines and Viet Nam joined in 2018. The Committee noted with appreciation the progress made on regional radar data exchanges toward the formulation of sample composite maps and on the Users Guide on Introduction and Utilization of Quantitative Precipitation Estimation (QPE) drafted by Thailand, Malaysia and Japan.
41. The Committee was pleased to note the activities of the project on enhancing the utilization of Himawari-8/9 products, in which technical support for developing Rapidly Developing Cumulus Area (RDCA) identification using Himawari-8/9 data has been conducted. The Committee noted with appreciation that continuous discussion and support were held between experts of MMD and JMA. It also appreciated that a technical web-meeting was held among experts of the Meteorological Service Singapore (MSS), TMD and the Viet Nam Meteorological and Hydrological Administration (VNMHA) on 4 February 2020 to share the outline of RDCA, including the technique for development, wide range of usage and verification methods, and to discuss activities planned in 2020. Singapore, Thailand and Viet Nam are considering potential RDCA applications and data suitable for verification. The Committee also noted the December 2019 temporal resolution upgrade of HCAI (High-resolution Cloud Analysis Information) from hourly to every 10 minutes.

42. The Committee noted with appreciation RSMC Tokyo's publication of its Technical Review No. 22 and the Annual Report on the Activities of the RSMC Tokyo Typhoon Center 2019 in April and December 2020, respectively.
43. The Committee was informed that RSMC Tokyo had started tropical cyclone satellite re-analysis in 2012 for the period from 1981 in order to confirm and improve the quality of the Current Intensity (CI) number in the satellite TC analysis, and that the Center has completed the re-analysis for the period from 1987 to present. It was also announced that the Center had conducted basic quality checking of the dataset. Based on these achievements, the Committee noted with appreciation that RSMC Tokyo will share the whole dataset for the period from 1987 to present with Members in 2021 via a URL to be provided in due course.
44. The Committee noted with appreciation that the operation of Himawari-8/9 geostationary meteorological satellites and further welcome the intention of RSMC Tokyo to continue providing Himawari products as well as technical support for using them.
45. The Committee noted with appreciation that RSMC Tokyo would conduct the 20th Attachment Training virtually from 9 to 11 March 2021 to support a solid understanding of monitoring, analysis and forecasting for tropical cyclones based on the use of RSMC Tokyo products. The course would also provide content on up-to-date public weather services and information design echoing the 10-year Vision to Protect Life and Property from Tropical Cyclones declared at the high-level dialogues on tropical cyclones held in Tokyo in 2019.
46. The Committee noted RSMC-Tokyo's regular monitoring of observation data exchanges in 2020 as per the Typhoon Committee Operational Manual's Meteorological Components (TOM), with results to be provided by March 2021. The Committee expressed appreciation to all Members providing special observation data to Committee Members in 2020, and further encouraged all Members to provide additional observations as requested by TOM.

7.2 Typhoon Committee Operational Manual (TOM)

47. The Committee noted that the Typhoon Committee Operational Manual (TOM) rapporteur requests WMO to publish and upload the 2021 edition of TOM on the Tropical Cyclone Programme (TCP) Website as submitted by the Rapporteur, with the amendments given in **Appendix IX**.
48. The Committee expressed its appreciation to the rapporteur for update of TOM.

VIII. REPORTS OF TC WORKING GROUPS AND TRCG (agenda item 8)

49. Parallel sessions of the Working Groups on Meteorology, Hydrology and Disaster Risk Reduction were convened during the WG's individual online meetings and during the online 15th IWS to review progress of work during the past year, identify priorities for cooperation and make recommendations to the Committee.
50. The outcomes of the parallel sessions of the three Working Groups were reported to the plenary session as given in the following sections.

8.1. Meteorological Component

51. The Committee took note of the Member's activities and major progress and issues in Meteorological Component in 2020 as reported by Members at the 15th IWS.
52. The Committee reviewed the activities of Members in implementing the TC Strategic Plan and its annual operating plan in relation to Meteorological Component during the past year, details of which are presented in **Appendix X**.
53. The Committee took note of the outcomes of the WGM Parallel Session at the 15th IWS on 1-2 December 2020. With the assistances of TCP/WMO and TCS and the strong support from all Members, WGM has successfully completed the tasks in 2020 with significant outcomes as follows:
 - a. WGM has fulfilled all the action plans (5 POPs, 9 AOPs and 1 PP) in 2020, which were endorsed at the 52nd TC Session.
 - b. Since the outbreak of COVID-19 in early 2020, the impacts of the COVID-19 pandemic have been deep and wide. Some activities in WGM such as research fellowships, technical transfer and meetings have been either cancelled or postponed due to global travel restrictions and border closure as well as strict social distancing measures in many countries/places.
 - c. After the 52nd TC Session in 2020, WGM has been carrying out the following activities that involve the cooperation among Members as well as other TC WGs and international organizations:
 - i. Coordinated with the Shanghai Typhoon Institute (STI) to organize the third WGM Annual Meeting by video conferencing on 27 October 2020.
 - ii. Coordinated with China Meteorological Administration (CMA) for the online International Training Course on Typhoon Monitoring and Forecast from 9 to 11 December 2020. There were 59 local participants and 42 overseas participants, including 16 from Typhoon Committee (TC) Members and 26 from Panel on Tropical Cyclones (PTC) Members.
 - iii. Coordinated with TRCG to host the 2020 research fellowship by the Hong Kong Observatory (HKO) on a topic entitled "Verification of tropical cyclone wind structure forecasts from global NWP models and ensemble prediction system" in Q1 of 2021.

CONCLUSIONS OF WGM

54. On the basis of the information provided by Members and the respective coordinator of the action plans and based on the discussion during the 15th IWS, the following conclusions were reached:
 - a. Members have made important progress in the implementation of the TC Strategic Plan during the year 2020.
 - b. Members made significant progress during 2020 in tropical cyclone monitoring and communication systems, data assimilation and numerical weather prediction systems, tropical cyclone forecast-aiding systems, and scientific understanding of tropical cyclone activities.

- c. With the help of the Tropical Cyclone Programme (TCP) of WMO and Typhoon Committee Secretariat (TCS), and the absolute sincere cooperation of all Members and the effective efforts of the WGM focal points, WGM has successfully completed the tasks in 2020.
- d. The 3rd WGM Annual Meeting was held online on 27 October 2020. Major results of the meeting were reported during the WGM parallel session in the 15th IWS.
- e. Based on the discussion on the operating plans for 2020 during the 15th IWS, it was concluded to adopt the operating plans as follows:
 - i. The POP item 1-5 will be continued in 2021.
 - ii. The AOP item 1-9 will be continued in 2021.
 - iii. The PP item 1 will be continued in 2021.
 - iv. Establish a new PP item 2 in 2021.
- f. The total budget proposed by WGM, which was concurred at the AWG meeting during the 15th IWS, for undertaking the operating plans (AOPs, POPs and PPs) in 2021 is USD44,000. In addition, the budget of USD12,000 will be allocated for the cross-cutting project (PP1) between WGM and TRCG.
- g. The complete WGM 2021 operating plans (AOPs, POPs and PPs) including the actions, the success indicators, coordinators and budget are listed in **Appendix X**.

RECOMMENDATIONS OF WGM

55. On the basis of the conclusion of discussion and deliberations, the WGM made the following recommendations:
- a) To request KMA to improve typhoon summer prediction techniques and provide information via e-mail for TC Members in late May.
 - b) To request CMA to encourage TC Members to join the Collaborative Discussion (CoDi) Forum for real-time typhoon discussion and information exchange.
 - c) To request STI to publish the TCRR Journal on a quarterly basis in 2021, and to improve the editorial procedure and Journal's influence.
 - d) To request KMA to continue provide technology transfer of the TOS for interested Members, and to package the modules for transfer in steps.
 - e) To request STI to continue the evaluation of performance of tropical cyclone forecast in western North Pacific in 2021, and plan for verification for other basins.
 - f) To request STI to strengthen international cooperation and promote the exchange of TC data and verification techniques through WMO-TLFTP.
 - g) To request JMA to further develop tropical cyclone genesis guidance using early Dvorak Analysis (EDA) and global ensemble.
 - h) To request CMA to continue improving the TRAMS-V3.0 (Tropical Region Atmospheric Model System) including model techniques, 4DVar data assimilation and typhoon ensemble forecasting.

- i) To request JMA to further refine quality control techniques applied to the participants' radar networks to improve their quality of radar composites, and to implement and refine Malaysian Meteorological Department (Met Malaysia) and Thailand Meteorological Department (TMD)'s QPE calibration using rain-gauges.
- j) To request JMA to support applicants to join the experimental regional radar data exchange in the future, and to share the progress with RA II/V WIGOS radar project in Southeast Asia.
- k) To request JMA to compose a user's guide among JMA, Met Malaysia and TMD.
- l) To request JMA to hold a follow-up meeting upon receipt of progress report on the project (AOP3) from participants.
- m) To request Met Malaysia and HKO to conduct training for two participants from two TC Members on composite radar reflectivity, blending of radar data and nowcasting.
- n) To request JMA to add storm surge time series predictions upon request from Members.
- o) To request JMA to publish verification results of storm surge predictions.
- p) To request JMA to encourage Members to provide complete hourly sea level data of at least one year to provide accurate astronomical tides at the stations.
- q) To request JMA to encourage Members to provide sea level observations during storm surge events for verification of storm surge predictions.
- r) To request CMA and HKO to implement the field campaign collaboration among participating Members by using aircraft, airship, rocket drop-sondes, etc.
- s) To request CMA and HKO to collect and share their field observation and research data, and to conduct demonstration research (to be included in TC Fellowship Scheme) on tropical cyclone intensity change with WMO-TLFD.
- t) To request JMA to improve Rapidly Developing Cumulus Area (RDCA) algorithm through the joint development by JMA and MMD.
- u) To request JMA to provide support for development of RDCA by Meteorological Service Singapore (MSS), TMD and Viet Nam Meteorological and Hydrological Administration (VNMHA).
- v) To request JMA to hold follow-up meeting(s) upon receipt of progress reports on the project (AOP7) from participants.
- w) To request CMA to hold a special forum on Parallel Analysis of Satellite Data in the Northwest Pacific in 2021, and to invite other agencies to participate in the analysis.

- x) To request JMA to support AOP7 of WGH through providing 1-month and 3-month ensemble NWP model data necessary for the project, if available, to ICHARM, and to request JMA to share knowledge such as characteristics and features related to NWP.
- y) To request JMA to continue sharing knowledge and experience on public awareness raising through lectures for online workshops and meetings of the IFI project.
- z) To request JMA to promote awareness with hydrological authorities to both local government and public, including the appropriate use of products.
- aa) To request Met Malaysia in cooperation with WGM and TRCG to organize a training workshop for younger operational forecasters on the new typhoon forecasting techniques, and to review the progress of WGM projects.
- bb) To request KMA to introduce GK2A upper-level products related to typhoon forecast and share the technique using GK2A data.
- cc) To endorse the proposed action plans in 2021 (including 5 POPs, 9 AOPs and 2 PPs) as listed in Appendix X – Summary Report for the WGM Parallel Meeting at the 15th IWS, which summarizes the above recommendations with additional action items.
- dd) To endorse the WGM budget request included in the budget proposal to be submitted by AWG for TC's approval.
- ee) To endorse the nomination from CMA to appoint Dr. Tang Jie (Deputy Director of STI) from China as the new Chairperson of WGM.
- ff) To re-appoint Mr. Jailan Simon from Malaysia and Dr. Vicente B. Malano from Philippines as the Vice-Chairpersons of WGM.
- gg) To re-appoint Mr. TANAKA Nobuyuki as the rapporteur of TOM.
- hh) To encourage project coordinators of all working groups to submit the outcome (research paper) to the TCRR journal.

8.2. Hydrological Component

- 56. The Committee reviewed the activities of the Members related to the implementation of the TC Strategic Plan and its annual operating plan (AOP) for the hydrological component during the past year. Details can be found in the **Appendix XI**.
- 57. The Session noted the water-related disaster events, including river flood, urban flood, flash flood and debris flow, and drought caused serious damage in most Members of the Committee in the past year. The Members' hydrological departments made great efforts and provided necessary services of flood forecasting and early warnings to the governmental decision-making departments under the situation of COVID-19 pandemic in 2020.

58. The Session noted with pleasure that, the video conference (VC) for WGH 9th Working Meeting with the theme of “Knowledge sharing on Water-related Disaster Risk Reduction under climate change and COVID-19” was successfully held on 22 October 2020. In total, 37 participants from 10 of 14 Members, namely China; Hong Kong, China; Japan; Lao People’s Democratic Republic (Lao PDR); Malaysia; the Philippines; Republic of Korea; Singapore; Thailand; and the Socialist Republic of Viet Nam. Typhoon Committee Secretariat (TCS) and Japan Meteorological Agency (JMA) attended the VC. The Session expressed its appreciation to the Japan government through MLIT with cooperation of ICHARM and IDI of Japan for generously hosting the meeting.
59. The Session was informed with appreciation that Japan was willing to host a face to face conference for WGH 10th Working Meeting in 2021. The participants expressed their highest gratitude to Japan government through MLIT for the generous offer.
60. The Committee was informed that, due to the impact of COVID-19 pandemic, many scheduled activities for the hydrological component in 2020 were still on-going or postponed. However, following the decisions made at TC 52nd Session, WGH tried its best to conduct the activities for implementing its following 7 AOPs in 2020 including domestic research, paper work and virtual meetings:
- a. Knowledge Sharing on Storm Surge Inundation Mapping
 - b. Application of Hydrological Data Quality Control System in TC Members
 - c. Enhancement of Flood Forecasting Reliability with Radar Rainfall Data and Stochastic Technique
 - d. OSUFFIM Phase-II: Extension of OSUFFIM Application in TC Members
 - e. Impact Assessment of Climate Change on Water Resource Variability in TC Members
 - f. Flood Risk Watch Project for Life-saving
 - g. Platform on Water Resilience and Disaster under IFI (International Flood Initiative)
61. The Session noted that, due to limitations put in place to combat COVID-19, the request for taking part in the project of Knowledge Sharing on Storm Surge Inundation Mapping is still awaiting approval from International Affairs of NOAA, USA. The Session also was informed that the implementation plan was scheduled for 2021 as: (1) Summary of interested TC Members and coastal regions to be covered; (2) Determination of availability of LiDAR or other bathymetry data for the interested Members; and (3) Determine necessary expert missions to provide local enhancements to program during final quarter of 2021. It was suggested that the Members which are interested in this cooperation project should submit their requests, which will be forwarded to NOAA International Affairs office, are advised it takes time to receive a response from them.
62. The Session noted that, the leading Members of the project on Application of Hydrological Data Quality Control System in TC Members (Republic of Korea) hosted the virtual pre-meeting for the expert mission (field survey which was conducted in 2019) wrap-up on 27 November 2020 instead of the scheduled face to face meeting in May 2020 due to COVID-19 pandemic. In the past year, ROK finalized the draft version of technical report; drafted the establishment design report; and developed the initial phase of screening criteria for abnormal data for the hydrological data quality control system. The Session also was informed that the implementation plan for 2021 is (1) to host the expert mission wrap-up meeting; (2) to publish the technical report for hydrological data quality control; and (3) to continue developing the hydrological data quality control system.

63. The Session noted that, in conjunction with AOP2, Republic of Korea hosted the virtual pre-meeting for the project on Enhancement of Flood Forecasting Reliability with Radar Rainfall Data and Stochastic Technique. In the past year, ROK side drafted the design report for updating LEVEL 3 of Extreme Flood Forecasting System (EFFS). The implementation was planned for 2021 as: (1) to host the expert mission wrap-up meeting; (2) to modify the LEVEL 3 of the EFFS; and (3) to develop the ensemble stochastic flood forecasting system.
64. The Session noted that, the phase-II of the project on Development and Application of Operational System for Urban Flood Forecasting and Inundation Mapping (OSUFFIM-II) for TC Members, which is led by China, conducted a series of activities in 2020, including: a) based on a field survey, cross-section size and flooded area measurement and hydrological data collection which was conducted in Pinang, Malaysia; Martina catchment, Philippines; and Huong River Basin, Viet Nam in 2019; OSUFFIM flood models have been initially set up in above-mentioned river catchments; (2) a hydrological observation network has been set up in the Buji river basin in southern China, and the OSUFFIM flood model has been set up and tested; and (3) the land use/cover of the Buji river has been estimated by using satellite remote sensing, and the urbanization pattern has been proposed. The implementation plan is scheduled in pilot river basins for 2021 as: (1) to conduct a field survey for data collecting and measuring in selected members, and selecting new pilot studies in Members; (2) to conduct hydrological observation and real-time flood forecasting in Buji river, China; (3) to finalize the hydrological model parameter calibration, operational system development and pilot implementation in the selected members; (4) to conduct the working meeting for 2021 and beyond in Shenzhen, China, and high level delegations from pilot members visiting SYSU; and (4) to organize the technical trainings in pilot studies in the selected members.
65. The Session was informed that, the implementation activities were conducted in 2020 for the project on the project on Impact Assessment of Climate Change on Water Resource Variability in TC Members, including: 1) Two versions of the RCCC-WBM software have been built including standalone version and network version; 2) The RCCC-WBM was used in several typical catchments and denoted acceptable performance for streamflow simulation; and 3) The response of water resources to climate change has been investigated in typical catchments in the Yellow River Basin.
66. The Session was informed that, due to the impact of COVID-19 pandemic, the generation of hypothetical climatic scenarios and the assessment of the impact of CC on water resources has not yet completed in the typical catchments in Laos and Malaysia. Taking the requirement of Malaysia into consideration, China made its decision to extend the project on the project on Impact Assessment of Climate Change on Water Resource Variability in TC Members for two more years till the end of 2022. Based on the discussion and communication with DID Malaysia, the Research Center for Climate Change of MWR proposed the implementation plan for 2021 as: (1) to improve RCCC-WBM model by adding flow duration curve module; (2) organize online/offline training workshops; and (3) to extend the application in interested members or different river basins.
67. The Session was informed that, the progresses of the Japan-led project on Flood Risk Watch Project for Life-saving in 2020 include: (1) Malaysia and Japan visited each other to understand current usage status of WLG; and (2) Malaysia and Japan agreed to conduct test installation in 2021 towards actual introduction. The Session also noted that the implementation plan is scheduled for 2021 as: (1) Malaysia and Japan resumed preparatory activities for test installation in Malaysia during early 2021; and (2) the testing

will be conducted for more than 6 months to confirm observation performance and maintenance performance.

68. The Session noted that, the Project of Platform on Water Resilience and Disasters under IFI (International Flood Initiative), led by Japan, has achieved progress as: (1) disseminating the IFI Platform activities as WGH AOP7 at the several international conferences such as the Policy Dialogue “Water-related Disaster Resilience under Climate Change” jointly held by ADBI (Asian Development Bank Institute) and ICHARM in Tokyo on January 27-28, 2020; (2) based on the discussion and outcomes from the Policy Dialogue, the Policy Brief “Frontiers of Water-Related Disaster Management and the Way Forward” has been jointly published in August 2020 together with ADBI and ICHARM; (3) organizing the webinar “ICHARM’s efforts for addressing flood disasters considering the prevention of COVID-19 infection” on July 3, 2020 under the restriction of the activities due to the unprecedented outbreak of COVID-19 infection by inviting IFI implementing organizations, where the following activities on flood risk reduction were introduced. The Session was informed that the implementation plan for 2021 is scheduled as: (1) to conduct IFI Platform session in the Philippines with the participation from WGM member (Japan Meteorological Agency); (2) to conduct the capacity development training program in the TC Members upon requests; (3) to disseminate the IFI Platform activities as WGH AOP7 at the several international conferences; (4) to organize a thematic session of AOP7 during the 10th WGH meeting in 2021 in Japan; and (5) To make bridges between TC WGH and PTC through implementing the IFI Platform activities in the Philippines, Myanmar, Sri Lanka and Indonesia.
69. The Session noted that, considering all on-going AOPs will be ended in end of 2022, the WGH Members are encouraged to propose new cooperation projects under the updated TC Strategic Plan. The Session also noted that, the representative from Malaysia recommended that WGH should consider the training courses for closed AOPs to make the outcomes and results of the AOPs applied in Members practices to promote capacity building on water related disaster risk reduction.
70. The Session noted the suggestion and consideration from WGH Members on the WG’s Priorities of updating the TC Strategic Plan, including (1) how to conduct WG’s activities online under public emergencies including secure data monitoring, transmission, and warning information dissemination; (2) Application of big-data and AI technology in typhoon-induced water-related disaster risk reduction, including forecasting and early warning; and (3) how to optimize dam operation, and issue inundation mapping.
71. The Session noted that, the TC WGH webpage has continued to be used for sharing information among WGH members, and has been linked with the TC Webpage (<http://www.typhooncommittee.org/wgh-web-page/>). The webpage will be updated and operated by HRFCO continuously in cooperation with KICT and TCS.
72. The Session was informed that, based on the full discussion and communication, the WGH Members got the following consensus on the Chairmanship of WGH: (1) Current structure of WGs' chairmanship is running very well, and it has the most benefit for the Committee on mobilization of resources, cooperation and support. (2) WGH will maintain the current chair/vice-chair system; (3) participants agreed to maintain setting one Chairperson and three Vice-chairpersons for WGH.

73. The Session was informed that, current chair-person Dr. Tetsuya Ikeda from Japan will retire from the position of WGH Chairperson, and since 53rd Session Dr. Mamoru MIYAMOTO from Japan is nominated as his successor. The Session expressed its appreciation to Dr. Tetsuya Ikeda for his efforts and contribution to WGH in the term of past two years.

CONCLUSIONS OF WGH

74. On the basis of the discussion and outcomes at 9th WGH working meeting/parallel session of 15th IWS, participants recognized the importance in following aspects for further direction of WGH:
- It is a consensus on that, the outbreak of COVID-19 in early 2020, as a public emergency, has impacted people's activities deeply and widely in today's society, including the strategies and measures for typhoon-related disaster risk reduction in the Members of Typhoon Committee (TC). Human coexistence with COVID-19 will become a normal situation in a long period. Also, new public emergencies definitely will appear again in future. In this connection, it is necessary to analyze new countermeasures under public emergencies on typhoon-related disaster risk reduction in TC Members in this typhoon season, including monitoring, data collection, forecasting and warning, information sharing and emergency response; summarize the experience and coping strategy on typhoon-related disaster risk reduction in the region of TC and other regions in the world; and provide reference and guidance for TC Members on typhoon-related disaster risk reduction under public emergencies in future.
 - It is a consensus on that, the working meeting of WGH is very important to review and push forward hydrological activities with deep technical discussion of implementation status of WGH AOPs, and is also very necessary to prepare IWS and annual session. The funding support and in-kind contribution from Members have played the vital role in organizing the annual working meeting. WGH appreciated the generous contribution from Republic of Korea and Japan in the past years and encourages the more and wider resources to support the activities to keep its momentum and sustainability. WGH also encourages more Members to host its working meeting.
 - It is a consensus on that, to draw up a plan on considering and proposing a bank of new cooperation projects under the umbrella of the TC Strategic Plan in a linkage with the initiatives and activities of ESCAP and WMO would be an urgent matter at present for WGH. In order to conduct the cooperative projects sustainably in TC Members, WGH discussed and determined the list of potential topics as the priority cooperation activities for long-term direction to develop the Member's Capacity on water-related disaster risk forecasting and warning.
 - WGH agreed to enhance the cooperation with PTC and other regions, under the Cooperation Mechanism between TC and PTC, through involving more participants from outside of Typhoon Committee region in WGH working meeting.

RECOMMENDATIONS OF WGH

75. On the basis of the deep discussion and communication, participants agreed to submit the following recommendations to the Committee at TC 53rd Annual Session to be held in February 2021:

- a) to appoint Dr. Mamoru MIYAMOTO from Japan as Chairperson, and to re-appoint Dr. CHO Hyo Seob from Republic of Korea, Dr. HOU Aizhong from China, and Mr. Kenneth KLEESCHULTE from USA to continue serving as Vice-Chairpersons for WGH in next two years.
- b) to request USD30,000 from TCTF in total for supporting overall WGH activities for 2021 calendar year.
- c) to request China to extend the project of Impact Assessment of Climate Change on Water Resource Variability in TC Members to the end of 2022.
- d) to thank Japan for hosting the video conferences for WGH 9th Working Meeting on 22 October 2020 and the parallel session of 15th IWS on 1 December 2020.
- e) To request Japan to host WGH 10th working meeting in 2021.
- f) to request HRFCO to continue maintaining and operating the WGH webpage for effective sharing information among WGH members with support from KICT and TCS.
- g) to appoint the focal point of WGH in RO Korea, Dr. Hyeongyo JEONG, as the liaison to PTC and WMO RA II for WGH of the Committee for enhancing hydrological cooperation between TC and other regional bodies.
- h) to continue focusing on improving the ability to forecast hydrological phenomena and providing measures for the effectiveness of the improvements.

8.3. Disaster Risk Reduction Component

- 76. The Committee reviewed the activities of WGD RR in implementing the TC Strategic Plan and Annual Operating Plans (AOPs) in relation to DRR component during the past year. Details of which are presented in **Appendix XII**.
- 77. The Committee was informed that the 15th WGD RR Annual Workshop that was originally planned to be held in Ulsan, Republic of Korea was cancelled. A video meeting that was held on 20 December 2020 which substituted for the face to face meeting in ROK to discuss COVID-19 related issues for WGD RR activities in 2020 and the new plan for 2021. AWG, WMO and ESCAP were also invited to join the video meeting to provide the WG with their valuable comments and information from outside DRR Membership.
- 78. The Committee was informed that some of WGD RR projects in 2020 cannot be successfully carried out due to the travel restriction of COVID-19 pandemic such as fellowship and seminar projects.
- 79. The Committee was informed that Dr. Sang Kwon LEE was nominated as the Chairperson of WGD RR by the WGD RR Members since he served as the Director General of NDMI in September 2020.
- 80. The Committee expressed its appreciation to National Disaster Management Institute (NDMI) for their kind contribution and continued support on WGD RR activities.

81. The Committee expressed its appreciation to the Working Group Chair, Dr. Sang Kwon LEE from the Republic of Korea for his contribution as the Chairperson of WGDRR in the past year.
82. The Committee expressed its appreciation to the Working Group Vice Chairs, Mr. Marcus AYDLETT from USA and Dr. Yuntae KIM for their contribution and effort in the past years.
83. The Committee was informed that the projects (AOPs) for 2021 recommended by WGDRR as follows:
- i. AOP1: Capacity Building/Knowledge Sharing in DRR- the project aims to improve the capacity in DRR especially related to typhoon disaster among the Members by capacity building and knowledge sharing. NDMI, ROK will organize the expert team with the selected Members in order to share knowledge and is going to invite other WGs to join the project.
 - ii. AOP2: Setting up early warning and alert systems – The project is funded by NDMI. With installation of the Flood Early Warning System (FEWS) and Automatic Rainfall Warning System (ARWS), it improves the capacities of resilience for typhoon related disaster for participating members. In 2021, NDMI will continue carrying out the project in Laos in order to expand the target areas including Houaphanh and Xaisomboun.
 - iii. AOP3: WGDRR Annual Meeting- NDMI continues planning to host and fund the WGDRR annual workshop in Republic of Korea in 2021 in order to facilitate follow-up on the WGDRR activities and share and exchange information related to DRR, as well as enhance the communication among members.
 - iv. AOP4: Benefit evaluation of typhoon disaster prevention and preparedness project- this project is led by Shanghai Typhoon Institute (STI), China that functions to establish an evaluation index and provide an evaluation report that assists in decision-making basis for the optimization of typhoon disaster behavior. Due to COVID-19 pandemic, with travel restrictions, the planned research fellowship for the project this year was cancelled, but STI, China expressed that they will continue conducting the fellowship program to the interested Members for the project research in 2021. For implementation of the project, Ms. Chen PEIYAN from STI, China will continue serving as the coordinators of the project.
 - v. AOP5: Sharing information related to disaster risk management- In order to improve the capacities of Members' Disaster Risk Reduction, WGDRR will continue promoting information sharing and exchange related to DRR through the established forum on the TC website.
 - vi. AOP6: Making educational videos related to DRR- In past years, WGDRR produced some videos for TC Members to use for DRR public education. In 2021, WGDRR decided to continue producing the DRR videos, especially related to tropical cyclone or severe weather, in order to raise the public awareness on typhoon related disasters. The latest video "Typhoon edging closer. Are you ready?", produced by HKO, was also shared on WMO's YouTube channel.
 - vii. AOP7: Seminar for TC Crowd-sourcing high density non-conventional weather data- The project aims to share experience on concept and methodology of crowd-sourcing high density non-conventional weather data (e.g. pressure data from smart phone/AWS/photo/video) for impact analysis and micro-climate study.

CONCLUSIONS OF WGDRR

84. On the basis of the information provided by the Members, the reports presented by project coordinator/leader and findings of the parallel session on WGDRR, the following conclusions were reached:
- a. Dr. Sang Kwon LEE has served as the Chairperson of WGDRR by the DRR Member's consensus since he was assigned to be the Director General of NDMI to replace the former Chair, Mr. Jaehyun SHIM in September.
 - b. With the special case of the pandemic, this is a difficult year to carry out some projects due to travel restrictions and risk of infection. However, by the Member's effort, some projects such as the educational video, DRR meeting and DRR information sharing were successfully implemented.
 - c. The 15th WGDRR annual workshop was unable to be held in Republic of Korea as practice due to the COVID-19 pandemic. Instead of the face to face workshop, the video meeting was held on 20 November 2020 to discuss the issues related to WGDRR activities. In the meeting, WG reviewed the AOPs implementation with the budget expenditure in 2020 and proposed the plans for 2021. Besides the TC DRR Members, WMO and ESCAP were also invited to join the meeting to give informative and valuable comments for WG.
 - d. WGDRR decided to continue conducting the projects which can improve capacities of disaster management among TC Members through information exchange and sharing such as participation in the important DRR world conferences, organizing the expert team to selected member state and using effective platform to exchange DRR information, as well as holding the WGDRR annual meeting.
 - e. WGDRR decided to continue the projects related to public education on DRR in the coming future which can facilitate raising public awareness on typhoon related disasters among TC Members such as producing educational videos and social media use on DRR.
 - f. At the WGDRR parallel meeting of 15th IWS, HKO expressed that they can continue providing videos, especially related to tropical cyclone or severe weather for TC DRR public education use. As in past years, the selected video would be translated into English with subtitles and voiceover for sharing with TC Members. The project will be led by HKO.
 - g. With HKO's suggestion, WGDRR agreed postponing the project of Seminar for TC Crowd-sourcing high density non-conventional weather data tentatively until Q4 2021, subject to travel restriction due to the pandemic of Covid-19.
 - h. The project of Capacity Building/Knowledge Sharing in DRR. Due to the travel restriction by the pandemic, it has been cancelled for implementation in 2020 and postponed until 2021, subject to the situation related to travel restriction and the pandemic.
 - i. For implementation of the proposed projects in 2021, WGDRR proposed the request of USD30,000 to be allocated TCTF for the following items:
 - i. To allocate USD10,000 budget of TCTF in 2021 for Capacity Building/Knowledge Sharing in DRR.
 - ii. To allocate USD6,000 budget of TCTF in 2021 for supporting the research fellowship, which will be held in STI, CHINA, related to benefit evaluation of Typhoon disaster prevention and preparedness.
 - iii. To allocate USD2,000 budget of TCTF in 2021 for Making Educational Videos related to DRR.

- iv. To allocate USD12,000 budget of TCTF in 2021 to the Seminar for TC Crowd-sourcing high density non-conventional weather data.

RECOMMENDATION OF WGDRR

85. On the basis of the conclusion of discussion and deliberations, the WGDRR made the following recommendations:
- a) To request HKO to conduct the Seminar for TC crowd-sourcing high density non-conventional weather data.
 - b) To request NDMI to organize the team with the selected member for the project of capacity building and knowledge sharing in DRR.
 - c) To request STI, China to continue conducting the research fellowship of the project of benefit evaluation of typhoon disaster prevention and preparedness for the interested TC Members.
 - d) To request Hong Kong, China to continue providing a video related to typhoon disaster or severe weather and translate it into English version (with voiceover and subtitle) for Members' usage on DRR public education.
 - e) To request NDMI, Republic of Korea to continue supporting and hosting the WGDRR Annual Workshop in 2021 in ROK.
 - f) To request NDMI to continue supporting the development and improvement of the early warning and alert systems related to typhoon disasters with the participating Members
 - g) To encourage the Members to share information related to DRR on the established forum on the TC Website.
 - h) To request the Committee to approve the proposed projects and related budget in 2021.

8.4. Training and Research Coordination Group (TRCG)

86. The Committee took note of the progress made in training and research activities as presented in the TRCG Report 2020 (**Appendix XIII**).
87. The Committee took note of the successful completion of the Typhoon Forecaster Training which was hosted by CMA and conducted online, and expressed its appreciation to China for offering the Training programme for 59 local forecasters and 42 forecasters from other TC and PTC Members.
88. The Committee thanked Hong Kong, China for hosting a research fellowship program in 2020/2021.
89. The Committee noted the RSMC Tokyo Training Attachment will be held in March 2021 and thanked Japan and WMO TCP for continuously supporting this capacity-building initiative.

The committee was also informed about the plan of scheduling the Training Attachment in the first quarter of the year in the future.

90. The Committee was informed about the proposed plan of the 4th TRCG Forum and TRCG Planning Meeting to be held in Q4 of 2021 in conjunction with the 16th IWS.
91. The Committee appreciated TRCG's inputs in support of training and research activities in connection with TC's cross-cutting projects.
92. The Committee noted Dr. LEE Tsz-cheung of Hong Kong, China would step down from the Chairperson of TRCG and the nomination of Mr. WONG Wai-kin of Hong Kong, China as the new Chairperson of the TRCG for the remainder of the term as well as the nomination of Dr. CHA Eun-Jeong of the Republic of Korea as the new Vice-Chairperson of the TRCG.

RECOMMENDATIONS of TRCG:

93. On the basis of the conclusions reached by the deliberation of Members, the TRCG made the following recommendations:
 - a) To request Members to confirm their respective focal points as members of TRCG and update the list of resource persons as appropriate.
 - b) To endorse the priority training and research areas as proposed in TRCG Report 2020.
 - c) To endorse the TRCG Work Plan for 2021-2022 and AOP 2021(with Q1 of 2022) including the hosting of the 4th TRCG Forum and TRCG Planning Meeting under the support of TCTF and other budget requests which are incorporated into the budget proposal to be submitted by AWG.
 - d) To appoint Mr. WONG Wai-kin of Hong Kong, China as the new Chairperson of the TRCG, replacing Dr. LEE Tsz-cheung for the remainder of the term.
 - e) To appoint Dr. CHA Eun Jeong of the Republic of Korea as the new Vice-Chairperson of the TRCG.

IX. REPORTS OF THE TCS AND AWG (agenda item 9)

9.1 Activities of TCS

94. The Committee took note of the report of the Typhoon Committee Secretariat, which can be consulted in **Appendix XIV**.
95. The Committee noted with appreciation the TCS's activities in 2020 in order to enhance coordination and support to Members and coordinate Working Group activities during the ongoing COVID-19 situation.
96. The Committee noted with high appreciation the Macao Government for the strong support to TCS in the past years and cooperating to renew and implement the Agreement between the Government of the Macao Special Administrative Region of the People's Republic of

China and the ESCAP/WMO Typhoon Committee regarding Administrative, Financial and Related Arrangements for the Typhoon Committee Secretariat.

97. The Committee expressed appreciation to Members for their contribution for the Typhoon Committee Trust Fund and in-kind contributions and encouraged Members to continue support activities of the Committee.

9.2 Activities of AWG

98. The Committee was informed of the activities and major issues discussed at the AWG meetings in 2020 and prior to the 53rd Session of the Typhoon Committee. **(Appendix XV)**
99. The Committee was informed of the proposed budget for 2021, including items in support of non-recurring items for special funding consideration.

RECOMMENDATIONS OF AWG

100. The AWG made the following recommendations:
 - a) Recognize and thank Hong Kong, China for their leadership in accommodating and organizing the first Typhoon Committee Annual Session held virtually.
 - b) Recognize and thank Viet Nam for their leadership in accommodating and organizing the first Typhoon Committee Integrated Workshop held virtually.
 - c) Take note of the progress and recommendations made in the planning and implementation of TC activities, including the preparation of the budget for 2021/2022.

X. UPDATE ON THE PROPOSAL FOR TC COLLABORATIVE RESEARCH CENTER AND DISCUSSION ON WAY FORWARD (agenda item 10)

101. The Committee took note of the revised proposal **(Appendix XVI)** by China regarding the establishment of a research center to enhance research activities in the area of tropical cyclones contributing to the Committee.
102. The Committee supported the establishment of the Asia-Pacific Typhoon Collaborative Research Center (CRC) in Shanghai contributing to the TC research activities, as an entity for which the Committee does not have any administrative responsibilities.
103. The Committee decided to promote close collaboration with CRC, through establishment of an agreement between the Committee and CRC. The agreement shall be developed by a Joint Task Team under the guidance of the AWG and signed by the Secretary of the Committee on approval by the Chairperson of the Committee. The Committee also agreed to start a time-bound pilot project under TRCG in collaboration with Working Groups of the Committee to enhance the research activities in collaboration with CRC.
104. The Committee decided to establish a joint task team composed of China and interested TC Members, to develop a plan for the pilot project and an agreement on technical cooperation

between the Committee and the CRC in terms of collaboration in line with the basic consideration as follows:

- 1) The Committee and the CRC will make close collaboration in terms of research activities in the area of typhoon to contribute to TC Members in accordance with the descriptions of the agreement;
 - 2) The Committee will support the CRC through participation in the International Scientific Steering Committee (ISSC) in terms of the technical advice on the research activities of CRC;
 - 3) The Committee will have no responsibility for governance, management and funding mechanism of the CRC;
 - 4) The CRC will be research-centric and avoid involving operational activities including real-time advisory and information services provided by TC Members' NMHSs and RSMCs.
105. The Committee requested the joint task team to report the results of the discussion by the team, and invited China to report the progress with the establishment of the research center, to the Committee at its 54th Annual Session.

XI. NOMINATION OF AWG CHAIRPERSON AND VICE-CHAIRPERSON (agenda item 11)

106. The Committee was informed Mr. Raymond TANABE (USA) completed a second two-year term as AWG Chairperson. **(Appendix XVII)**
107. The Committee was informed according to the Terms of Reference for the AWG, the term of service for the AWG Chairperson is two years and the limit of service for the Member providing the Chairperson shall be two consecutive terms.
108. The Committee was informed the AWG solicited nominations from Members and the AWG selected Dr. T.C. LEE (Hong Kong, China) as the new AWG Chairperson.
109. The Committee was informed since Dr. Lee's position as AWG Co-Vice Chair will be vacant, the AWG solicited nominations from Members and the AWG selected Mr. Tom EVANS (USA) as the new AWG Co-Vice Chairperson.
110. The Committee was reminded Mr. TANAKA Nobuyuki (Japan) was endorsed as the AWG Co-Vice Chairperson in TC52 and continues in this position.
111. The Committee expressed great appreciation to Mr. Raymond TANABE from USA, for his excellent contributions when he served as the Chairperson of AWG since the 49th Session of the Committee in 2017.

RECOMMENDATIONS OF THE AWG

112. The AWG made the following recommendations:
- a) To endorse Dr. T.C. LEE (Hong Kong, China) as the new AWG Chairperson for the two-year term from TC53 to TC55.

- b) To endorse Mr. Tom EVANS (USA) as the new AWG Co-Vice Chairperson for the two-year term from TC53 to TC55.

XII. PUBLICATIONS (agenda item 12)

113. The Committee took note of the publications of the Typhoon Committee in 2020.
114. The Committee noted with appreciation all Member's contributions to the publications of the Typhoon Committee which have promoted TC visibility and transparency. Also the Committee further urged Members to take measures and actions for continuing their support of the TC publications and making contributions to the TCRR Journal especially.

XIII. PROGRAMME FOR 2021 AND BEYOND (agenda item 13)

13.1. Replacement of tropical cyclone names (Appendix XVIII)

115. The Committee noted China provided YINXING, BAILONGMA and ZIWEI as replacement names for YUTU and decided to accept YINXING.
116. The Committee noted Japan provided RYU, KOTO and TOKEI as replacement names for KAMMURI and decided to accept KOTO.
117. The Committee noted Lao PDR provided PHOUBIA, NONGFA and XEKATAM as replacement names for FAXAI, and NOKAEN, DOKCHAMPA and SEUAKHONG as replacement names for PHANFONE, and decided to accept NONGFA and NOKAEN, respectively.
118. The Committee noted Philippines provided TAMARAW, KUSOG and RAGASA as replacement names for HAGIBIS and decided to accept RAGASA.
119. The Committee noted Viet Nam provided CO-MAY, BANG-LANG and HOA-SIM as replacement names for LEKIMA and decided to accept CO-MAY.
120. The Committee noted the request from Viet Nam to retire the name of tropical cyclone LINFA and request Macao, China to provide replacement names.
121. The Committee noted the request from Philippines to retire the names of tropical cyclone VONGFONG, MOLAVE, GONI and VAMCO and request Macao, China; Philippines, Republic of Korea and Viet Nam to provide replacement names.

13.2. Procedures for new Membership of Typhoon Committee

122. The Committee took note of the Article 2 of the Statutes of the Committee "The Committee shall be composed of a representative from each of the participating Governments desiring to participate in co-operative efforts to minimize typhoon damage in the ECAFE region. The Executive Secretary of ECAFE and the Secretary-General of WMO or their representatives shall be ex-officio members of the Committee."
123. The Committee further took note of the Procedures for new Membership of Typhoon Committee, as stated in **Appendix XIX**.

124. The Committee was informed that until now there's no further developments from Indonesia in joining the Typhoon Committee as a new Member.

13.3. Preparation for the update of the Strategic Plan 2022-2026

125. The Committee was informed there was an error in the effective period and timeline for the new Typhoon Committee Strategic Plan which was endorsed in the TC52 second video-teleconference. The Strategic Plan 2022-2026 would be prepared in consultation with TC Members with a draft in **Appendix XX**.
126. The Committee was informed the correct effective period should be 2022-2026 and endorsement will take place at TC54 in 2022.

RECOMMENDATIONS OF THE AWG

127. The AWG made the following recommendations:
- a) To endorse the effective period of the new Typhoon Committee Strategic Plan 2022-2026
 - b) To endorse the final draft of the Strategic Plan 2022-2026 which will be presented for approval and endorsement at TC54 in 2022.
 - c) To endorse the USA to continue to Chair the Drafting Committee for the Strategic Plan 2022-2026.

13.4. Updating the Rules and Procedures for Meetings/Sessions arrangements under special or emergency situations

128. The Committee took note of the review and the update of the Rules and Procedures of the Committee for Special or Emergency Situations and the Methods of Work for the Online Sessions. **(Appendix XXI)**
129. The Committee also noted that the updated documents on (a) Rules and Procedures and (b) Methods of Work for the Online Sessions would give flexibility in adopting alternative approaches for the annual Sessions.
130. The Committee expressed appreciation to TCS and to the AWG, for the contribution on updating the Rules and Procedures and providing the Methods of Work document.

XIV. COORDINATION WITH OTHER ACTIVITIES OF THE WMO TROPICAL CYCLONE PROGRAMME (agenda item14)

131. The Committee was presented information about activities under, and those requiring coordination through, the TCP. It appreciated the comprehensive presentation, and thanked WMO support to the Committee. **(Appendix XXII)**
132. The Committee was informed that the Eighteenth WMO Congress (Cg-18) decided to restructure WMO governance, and made many resolutions on WMO reform and core businesses. It noted decisions/resolutions of highly relevance to TCP including the resolutions 13 on GMAS, 14 on Development WMO Coordination Mechanism, and 16 on

Guide for Members to develop their national DRR protocols and mechanisms. These resolutions will fundamentally shape the future development of the TCP. There is a dedicated Expert Team to support implementation of resolution 16 with the first draft focused on tropical cyclones.

133. The Committee noted with appreciation the major development from the WMO Commission for Observation, Infrastructure and Information Systems (INFCOM) that had organized a data conference which gathered ideas and opinions about establishing new WMO data policies for data sharing and exchanges. The new WMO data policies, once established, will dramatically change the landscape of WMO data availability to Members, and have significant long-term impacts on and benefits to Members. The Committee is encouraged to take some initiative to contribute to the broader sharing and exchange of data which were previously not systematically exchanged, like Radar data, AWS data, etc.
134. The Committee was informed that a technical meeting with a focus in tropical cyclones was organized during 2020 Humanitarian Networks and Partnerships Week (HNPW), to strengthen relations between the meteorology community and the humanitarian and disasters management agencies. To align with the outcome of the HNPW, the first Mini-forum addressing the seasonal forecast of tropical cyclone activity in the South West Indian Ocean has been organized, gathering meteorology and humanitarian communities. A request from the humanitarian agencies is for WMO to consider organizing some similar preseason mini-fora in other regions of the world prone to seasonal severe-weather events.
135. The Committee was informed that WMO is promoting Regional Climate Outlook Forum (RCOF) in all regions. There has been an established network of RCOFs and RCCs. PICO and a network of RCCs in South Pacific were looking after the seasonal forecasting of tropical cyclones. Furthermore, the WMO/ESCAP Panel on Tropical Cyclones (PTC) at its 47th session made a decision requesting RSMC New Delhi to produce tropical cyclone seasonal forecasting for the Bay of Bengal and the Arabian Sea as soon as possible. In this connection, the Committee is invited to consider playing some proactive roles and contribute to the final availability of typhoon season forecasting in the region.
136. The Committee was informed of a Pilot project and task team of WWRP SSC that will address one of the recommendations from the International Workshop on Tropical Cyclones (IWTC-IX) on TC probabilistic track forecast products. It was further informed that the IWTC-X has initiated preparation and tentatively planned to take place in December 2022.
137. The Committee was informed that WGTMR organized the three projects (EXOTICCA, TLFDP and UPGRAFT) meeting from 23-25 November 2020 with outcomes by a set of recommendations. The Committee Members are encouraged to share and exchange data, conventional and nonconventional, to improve tropical cyclone forecasting and warning services. WMO Secretariat will support and coordinate the sharing and exchange of the data.
138. The Committee noted with appreciation that many training activities on tropical cyclones were organized during the past year to support capacity development of the Members to meet competency and skills that are required for tropical cyclone forecasting and services.
139. The Committee was informed that the Tropical Cyclone Programme is 40 years old. It prepared a review to celebrate its 40th anniversary with many congratulatory messages

from RSMCs, Chairpersons of the regional tropical cyclone bodies and old friends. It will be published soon.

140. The Committee was also informed of the ongoing work of ESCAP on promoting impact-based forecasting as well as upcoming flagship publication, the Asia-Pacific Disaster Report 2021. The Committee Members are also encouraged to participate in and contributed to the ESCAP Resilience Week, which will be organized together with the 7th session of ESCAP Committee on Disaster Risk Reduction, in the last week of August 2021.

XV. SUPPORT REQUIRED FOR THE COMMITTEE'S PROGRAMME (agenda item 15)

15.1. Technical Cooperation

141. The Committee was informed that WMO is promoting an Earth systems approach to further enhance global and regional monitoring, forecasting and services capabilities for the provision of better services to Members.
142. To address the eight long-term ambitions to address the water challenge, identified by the World Meteorological Congress, WMO established the Hydrological Coordination Panel (HCP) and Hydrological Assembly, among others, which may be of interest by WGH of the Committee.
143. With the closer partnership with ESCAP, WMO calls for more impact studies highlighting the societal economic value of effective Typhoon warnings, which is being addressed by WGDRR of the Committee.
144. The Committee took note that WMO is planning its Regional Association Sessions and seeks stronger support of, and synergy with, the Typhoon Committee in the WMO reform Process.

15.2. Typhoon Committee Trust Fund (TCTF)

145. The Committee reviewed the statements of account of TCTF for the period of 1 January to 31 December 2019 and 1 January to 31 December 2020, respectively, submitted by the representative of the WMO Secretariat as shown in **Appendix XXIII**. The statements had gone through auditing by WMO external auditors. The auditing report for 2019 statement had been communicated to TCS. The Committee expressed appreciation to WMO Secretariat for its fine management of the TCTF.
146. The Committee encouraged its Members to continue and possibly enhance Members' contribution to the Fund, although on a voluntary basis, for the purpose of sustainable support of the activities of the Committee. A letter of request for contribution to the trust fund will be sent out from WMO Secretary General to the Committee Members.
147. The Committee was informed by TCS of the summary of income and expenditure from 1 January to 31 December 2018 and 2019, and the provisional summary of income and expenditure for 2020 related to the execution of the Work Plans 2018, 2019 and 2020. In addition, provisional summary of income and expenditure from 1 January to 31 March 2021 and summary of TCTF budget 2018/2019, 2019/2020 and 2020/2021 with

additional three months from January to March 2019 to 2021 was provided as reference. **(Appendix XXIV)**

15.3. In-kind Contributions

148. The Committee expressed appreciation for the in-kind contributions from some Members, namely China, Hong Kong, China; Japan; the Philippines; Republic of Korea; Thailand and Viet Nam. The Committee also invited the other Members to report their in-kind contributions, quantifying the corresponding unit of Man-months that have consumed in actions related to TCTF projects. **(Appendix XV)**
149. The Committee also expressed the importance of having in-kind contributions with correspondence values.

15.4. Approval of Typhoon Committee Trust Fund (TCTF) 2021/2022 Budget

150. The Committee took note that the reallocation from normal and special budgets by WG's has been approved by Chairperson of Typhoon Committee and Secretary of Typhoon Committee.
151. The Committee discussed and approved the budget proposal for 2021/2022. **(Appendix XXVI)**

XVI. DATE AND PLACE OF THE 16TH IWS (agenda 16)

152. The Committee took note, by following the updated sequential list table of Annual Sessions and IWS, that the 16th IWS would be held in ESCAP conference facilities in Q4 2021. The final date and arrangements would be confirmed in due course by TCS and ESCAP.
153. As the pandemic situation was still unclear, the Committee requested TCS to communicate with the TC Chairperson, AWG and ESCAP, if the 16th IWS would be held face-to-face or online format.

XVII. DATE AND PLACE OF THE 54TH TC SESSION (agenda 17)

154. The Committee was informed that Lao PDR would host the 54th Session in Lao PDR. The final date and place will be confirmed in due course by Lao PDR and later communicated to TCS.

XVIII. HOSTING OF THE 17TH IWS AND 55TH TC SESSION (agenda 18)

155. The Committee took note, by following the updated sequential list table of Annual Sessions and IWS, that the 17th IWS will be held in ESCAP conference facilities. ESCAP will communicate with TCS in due time.

156. The Committee was informed that Macao, China is willing to host the 55th Session of Typhoon Committee in 2023. The final date and place will be confirmed in due course by Macao, China and later communicated to TCS.

XIX. OTHER BUSINESS (agenda 19)

157. The Committee was informed by the USA, that the National Environment Satellite, Data, and Information Service (NESDIS) of NOAA, which issues tropical cyclone intensity estimates worldwide and is planning to work with WMO to assess which TC Members are interested in issuing intensity estimates of tropical cyclones and contributing their estimates in real time to the WMO observation data system.

XX. CLOSURE OF THE VC SESSION (agenda 20)

158. The Chairperson of TC53 delivered the closing remarks for the TC53 VC.
159. The delegates from the Members of the Typhoon Committee and TCS expressed their thanks and appreciation to Japan for the successful hosting and organizing the VC of the 53rd Session of the Typhoon Committee in this unprecedented time.
160. The VC Session was closed by the Chairperson at 13:03 am, 25 February 2021 (Japan Time).