**APPENDIX XIII**

**TRAINING & RESEARCH COORDINATION GROUP (TRCG)**

**Annual Report 2021**

Wai-Kin WONG (TRCG Chair)

Hong Kong, China

**1. Introduction**

* 1. According to the Terms of Reference, TRCG is to promote research and training activities on various aspects of tropical cyclone analysis and forecasting, including assessment of tropical cyclones’ impacts on Members’ socio-economic development processes, and to encourage cooperation of efforts among Members. Towards this end, TRCG is expected to assist in:

(a) identifying scientific and technical problems in the analysis and forecasting of tropical cyclones and their impacts on water resources and measures for disaster prevention and preparedness;

(b) facilitating the exchange of experience and knowledge on the latest development and techniques related to the above problems;

(c) coordinating training and research programmes, including activities in support of cross-cutting initiatives and other collaboration programmes among Members such as twinning and mentoring arrangement, aimed at improving the technical capacity and capability of Members to better serve the people in the region;

(d) evaluating the effectiveness of training and research activities undertaken by TRCG, and providing support to other working groups in performing such evaluation; and

(e) recommending to the Committee priority areas and long-term plans for cooperation in research and training in support of the targets and various KRAs of the Committee’s Strategic Plan.

**2. Membership**

2.1 The composition and members list of TRCG in 2021 are:

Chair: Mr WONG Wai-Kin (Hong Kong, China)

Vice Chair: Dr CHA Eun Jeong (Republic of Korea)

Members: Mr So Im Monichoth (Cambodia)

Mr QIAN Chuanhai (China)

Mr Kang Bom Jin (DPR Korea)

Mr HOSOMI Takuya (Japan)

Dr Mayphou Mahachaleun (Lao PDR)

Mr Ho Kuok Hou (Macao, China)

Mr Hamray bin Muhammad Yazit (Malaysia)

Dr Bonifacio G. Pajuelas (Philippines)

Ms LEE Kyungho (Republic of Korea)

Mr Eugene Chong (Singapore)

Ms Patchara Petvirojchai (Thailand)

Mr Eric Lau (USA)

Dr Do Tien Anh (Viet Nam)

**3. Major TRCG Activities in 2021**

***COVID-19***

3.1 COVID-19 together with the outbreaks of successive coronavirus variants continue to affect the activities of various sectors extensively around the world. Travel restrictions, stringent quarantine, social distancing measures and border closures prevail in many countries/places. The planned activities of TRCG for 2021/22 have been further postponed or cancelled. Information about the impact of COVID-19 on each TRCG related programme are described in the subsequent paragraphs where appropriate.

***TRCG Online Meeting***

3.2 With new Members, Chair and vice-Chair, an online meeting was conducted on 14 July 2021 to review and update the planned activities of TRCG. The developments of draft agreement between the Committee and the Asia-Pacific Typhoon Collaborative Research Centre (AP-TCRC) under the Joint Task Team (JTT) were discussed.

***The Fourth TRCG Forum***

3.3 According to the TRCG’s 4-year plan (2018-2021), the 4th TRCG Forum and TRCG Planning Meeting have been scheduled to late 2021 in conjunction with the 16th IWS. Due to COVID-19 situation, the 4th TRCG Forum would be postponed to the Q4 of 2022, in conjunction with the 17th IWS in ESCAP Conference Center, Bangkok, Thailand. The proposed theme remained as before, namely “Towards a typhoon resilient society”. The plan of provisional budget and tentative schedule would be unchanged. TRCG Members have been requested to consider the keynote speakers and topics of technical presentation for the TRCG Forum. A physical TRCG Planning Meeting would also be held during the TRCG Forum.

***Roving Seminar / Visiting Lecturers Programme***

3.4 Roving seminars have been arranged for capacity building purposes on both research and operational aspects. Knowledgeable experts travel to Members’ countries and deliver lectures focused on subjects of current interest to operational centers. A record of all roving seminars previously organized can be found in Annex I.

3.5 With the prevailing of COVID-19 and after consulting the hosting Member, the Typhoon Committee Roving Seminar 2020 originally planned to conduct in Vietnam in October/November 2020 has been postponed with the same theme on “Impact based forecasting”. The latest tentative plan will be discussed in Section 6.

***Forecasters’ Training Attachment***

3.6 The RSMC Forecaster’s Training Attachment originally for 2020 was successfully conducted online from 9 to 11 March 2021. There were 44 international participants from Hong Kong, China, Macao, China, Malaysia, the Philippines, Republic of Korea, Singapore and Thailand attended the training and delivered presentations to share their experience on tropical cyclone related services. RSMC New Delhi senior forecaster Ms Sunitha Devi attended as an invited presenter to deliver knowledge on Asian monsoon affecting tropical cyclones.

3.7 CMA’s Typhoon Forecaster Training Programme, namely the Sixth International Distance Training Course on Tropical Cyclone Monitoring and Forecasting, has been scheduled to conduct online from 25 November to 3 December 2021 due to COVID-19 situation. The training focused on knowledge and skills of TC monitoring and forecasting, and enhancement of trainees’ application of meteorological satellite data and ensemble forecast products. There were 133 international participants from 30 NMHSs and 64 local trainees that joined the training course.

3.8 In view of persisting COVID-19 pandemic, the RSMC Tokyo continued to organize the Attachment Training course remotely on 11 – 13 January 2022. Besides presentations on tropical cyclone analysis / forecasting and practical sessions, invited lectures were delivered by: (a) Dr SHIMADA Udai of the Meteorological Research Institute, JMA on improvement of rapid intensification prediction, and (b) Professor FUDEYASU Hironori of Yokohama National University on multiscale interactions of tropical cyclone formation. A total of 55 participants from China, Hong Kong, China, Republic of Korea, Macao, China, Malaysia, Thailand, the United States of America, and Vietnam attended the Training.

***Research Fellowship Scheme***

3.9 The Research Fellowships are awarded to Members to promote joint research through the exchange of visiting scientists on a short-term basis with voluntary funding and logistic support by host Members. One of the merits of the scheme is that the visiting fellow has a chance to work closely with forecasters, experienced scientists or forecast system developers at the host centre, providing an opportunity to transfer knowledge and latest research findings to operational applications. The scheme has worked well on the basis of bilateral cooperation mutually agreed between the host and the applicant.

3.10 Due to COVID-19, there was only one fellowship research project conducted in Q1 of 2021 that hosted by Hong Kong, China on the topic entitled “Verification of tropical cyclone wind structure forecasts from global NWP models and ensemble prediction system” via a remote approach to discuss and implement the research studies. This HKO fellowship offer demonstrated a feasible approach or as a new option for carrying out the project remotely at participant’s country / place, and to reduce substantial overheads in arranging administrative and logistical matters on physical travel, vaccination, and quarantine measures.

3.11 In 2021, the fellowship by Republic of Korea and China were cancelled again due to difficulties arisen from physical attachments under COVID-19. A fellowship was offered by Hong Kong, China entitled “Study on characteristics of rapid intensification (RI) in coastal tropical cyclones”. The project was awarded to Mr Nawin SERMSOOK of Thai Meteorological Department and it was being conducted remotely in Q1 of 2022. Information of the latest project under the scheme and a summary of previous fellowships awarded can be found in Annex II. Publications and papers published in connection with the scheme are listed in Annex III.

***Asia-Pacific Typhoon Collaborative Research Centre (AP-TCRC)***

3.12 Following to the decision of 53rd Session of the Committee (TC53), the Joint Task Team (JTT) was established to develop: (a) draft agreement on technical cooperation between the Committee and AP-TCRC, and (b) a proposal of time-bound Pilot Project under TRCG as stipulated in paragraph 104 of the TC53 Final Report. Several members of TRCG including Chair and Vice-chair were nominated to join JTT and develop the two aforementioned documents. A tentative theme of the time-bound Pilot Project, namely “*Advances in application of new observations and technologies for improving tropical cyclone prediction in various time scales and related disaster prevention activities*” with three potential research topics have been identified. Further information can refer to the Session document WRD/TC.54/11 - “Report on Draft Agreement and Time-bound Pilot Project on Technical Cooperation between TC and AP-TCRC”. Opportunities would also be taken to synergize TRCG activities with AP-TCRC to benefit the Members in capacity building and research areas identified in TRCG annual report, as well as prioritized training and research areas under the new Typhoon Committee Strategic Plan (2022-2026).

**4. Resource Support for Research and Training**

4.1 The available resource persons on specialized research subjects provided by Members are tabulated for reference in Annex IV.

4.2 The Pacific International Training Desk (PITD), funded by the USA's National Weather Service as part of the US contribution to the WMO Voluntary Cooperation Programme (VCP) is currently managed by the Telecommunications and Social Informatics (TASI) Research Programme at the University of Hawaii. PITD provides one‐on‐one basic weather forecast training with an emphasis on the tropics. The training programme is focused on operational forecasting to enable its participants to prepare and disseminate locally‐produced meteorological, hydrologic and climate products for their home countries. There are four components to the training, including: (a) eLearning Prerequisite Course, (b) On-Site Training Programme, (c) Communication Training, and (d) Advanced In-Island workshops on severe weather event topics. In 2021, several webinars were organized by PITD including the subjects on wave modelling, aviation forecasting, and effective communication in meteorology. Further information on the activities of PITD are available from http://pacificdesk.org/.

**5. Prioritization of Training and Research Areas**

5.1 Based on the discussion during the 3rd TRCG Meeting held in conjunction with the 12th Integrated Workshop (IWS) in Jeju on 31 October – 1 November 2017, the priority and need for training and research activities have been reviewed by TRCG Members and updated as follows:

***(A) Meteorology***

*Monitoring*

1. application of Dvorak and microwave satellite image analysis techniques;
2. application of radar-based analysis/products for landfalling tropical cyclones and monsoon depressions; and
3. application of new observation technologies (such as aircraft reconnaissance, weather buoys, automatic weather network and mobile observations) in tropical cyclone monitoring and forecasting.

*Forecasting and warning*

1. development and enhancement of tropical cyclone analysis and forecast techniques from nowcast to medium range, and seasonal to long-range predictions.
2. development of tropical cyclone structure and intensity forecasting techniques such as rapid intensification and wind structure;
3. application of ensembles of guidance from global and regional dynamical models, ensemble prediction systems, conceptual models, statistical models and systematic knowledge-based approach;
4. use of high-resolution numerical models with advanced data assimilation techniques;
5. rainfall forecasting: development of nowcasting and very short-range forecasting techniques, and understanding of interaction between tropical cyclones and monsoon;
6. development of probability forecasting and extended outlook;
7. development of impact-based forecast and risk-based warnings; and
8. better understanding of wave, storm surge and marine forecasting.

***(B) Meteorology and Hydrology***

1. application of meteorological and hydrological information for forecasting of river flooding and urban flash flood; and
2. geological hazards associated with heavy rain and tropical cyclones such as flash flood, mudslides and landslides.

***(C) Meteorology and DRR***

1. development of technical procedures to quantify forecast uncertainties and to convert probabilistic information into effective warnings;
2. development of decision-making tools for DRR purpose, including the integration of forecast information with GIS and the use of automated information processing systems;
3. making use of new communication technology; and
4. community response and outreach effort for mitigation of the societal impact caused by disasters.

***(D) Other Cross Cutting Topics***

1. better understanding of tropical cyclone related issues, such as rapid intensification, and impacts across different spatial and time scales, from mesoscale and synoptic analysis arising from El Nino / La Nina and global warming / climate change;
2. forecasting and warning systems for better coastal protection from multi-hazards such as storm surge, high winds, heavy rain, river delta inundation and urban flooding;
3. effective communication of warning messages to stakeholders, DRR users and communities at risk; and
4. utilization of big data, social media, crowdsourcing and artificial intelligence in tropical cyclone and weather monitoring, impact assessment, DRR and public education.

**6. Future Directions and Strategies**

6.1 The 4-year cycle of TRCG work plan from 2018 to 2021 has reached its final stages and plans for the new cycle (2022-2025/2026) were being consolidated. Research projects and training opportunities arising from the time-bound Pilot Project under the collaboration of the Committee with the Asia-Pacific Typhoon Collaborative Research Centre (AP-TCRC) would be incorporated in the TRCG’s work plan and Annual Operating Plan.

6.2 According to TRCG 4-year plan (2018-2021), the 4th TRCG Forum and TRCG Planning Meeting was originally planned to conduct in late 2021 with the 16th IWS. However, due to COVID-19, the 4th TRCG Forum would be postponed to late 2022 in conjunction with the 17th IWS. A proposed plan can be found in Annex V. TRCG will follow up closely with AWG and TCS to work out the details of the programme and activities (e.g. invited lectures and break-out discussion sessions) for the proposed theme “Towards a typhoon resilient society”.

6.3 Furthermore, in view of situation of COVID-19 pandemic, the next Roving Seminar hosted by Vietnam would be scheduled to Q2 2023 with a proposed theme on “Impact based forecasting”.

6.4 TRCG will continue to support plans to have more cross-cutting training and research initiatives in consultation with the meteorology, hydrology and DRR components. Members are in turn encouraged to promote such initiatives through proactive involvement of the appropriate meteorological, hydrological and DRR personnel in their countries/places.

6.5 The current arrangements in RSMC Forecasters’ Training Attachment operated smoothly in the past few years and will generally be maintained. Starting from 2019, the self-funded participation by Members will be considered. The RSMC Attachment Training will continue to be conducted during the first quarter of the year for better allocation of manpower.

6.6 The possibility of involving hydrologists and DRR experts in RSMC Attachment Training, CMA Typhoon Forecaster Training, and TC Research Fellowship Schemes could be explored by corresponding Members. Moreover, training and research opportunities will be explored in collaboration with WGM, WGH, WGDRR, and WMO Training Centre in Nanjing, as well as various interested Members (and AP-TCRC in future when cooperation with the Committee would be established).

6.7 Review of the TRCG AOP 2021 (including the Q1 of 2022) can be found in Annex VI. A provisional work plan and the proposed AOP 2022 (including Q1 of 2023) are provided in Annex VII and Annex VIII respectively.

6.8 Given the large uncertainty in the COVID-19 pandemic, the planned TRCG activities in 2022 and early 2023 may still be subject to changes. TRCG will work closely with TCS and relevant Members to monitor the development of COVID-19 and develop feasible options or contingency plan for major events such as the TRCG Forum.

***Annex I***

**Summary of Roving Seminars**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Year** | **Dates** | **Venue** | **Topic** | **Lecturers** |
| 2003 | 20 – 21 Oct | Seoul | Interpretation of Typhoon Forecasts and Analyses | Dr. H-J Kwon  Mr. MANNOJI Nobutaka |
| 22 – 24 Oct | Hong Kong | Interpretation of Satellite Data and Use of Radar Data in Operational Tropical Cyclone Forecasting | Dr. Mark Lander  Dr. P.W. Li  Dr. B.-J. Sohn |
| 27 – 29 Oct | Shanghai | Interpretation of Satellite Data and Use of Radar Data in Operational Tropical Cyclone Forecasting | Dr. Mark Lander  Dr. P.W. Li |
| 2004 | 22 – 24 Nov | Beijing | Operational Application of Multi-model Ensemble Typhoon Forecasts | Prof. Johnny C.L. Chan  Mr. MANNOJI Nobutaka |
| 25 – 27 Nov | Kuala Lumpur | Operational Application of Multi-Model Ensemble Typhoon Forecasts | Prof. Johnny C.L. Chan  Mr. MANNOJI Nobutaka |
| 2006 | 4 – 7 Sep | Ha Noi | Tropical Cyclone Motion and Intensity, and Principles of Dvorak Method | Prof. Johnny C.L. Chan  Mr. Joe Courtney  Dr. B.-J. Kim |
| 2007 | 5 – 8 Sep | Manila | Satellite and Radar Analysis Techniques, and Tropical Cyclone Interaction with Monsoon Systems | Mr. Roger Edson  Mr. Bart Hagemeyer  Dr. NAKAZAWA Tetsuo |
| 2009 | 16 – 19 Nov | Nanjing | Forecasting of High-impact Weather associated with Tropical Cyclones,  and Formulation and Communication of Warning Messages | Mr. S.T. Chan  Mr. Chip Guard  Mr. Sam Muchemi |
| 2010 | 30 Nov – 3 Dec | Ubon Ratchathani | Tropical Cyclone Genesis and Large Scale Interaction | Mr. S.M. Lee  Prof. Zhang Qinghong  Dr. Mark Lander |
| 2011 | 20 – 23 Sep | Petaling Jaya | Heavy Rain and Flood Hazards associated with Landfalling Tropical  Cyclones | Dr. Siriluk Chumchean  Mr. H.Y. Yeung  Prof. Chen Charng-Ning |
| 2012 | 30 Oct – 1 Nov | Seoul | Tropical Cyclone Damage Assessment and Impact Forecast | DRR experts from NDMI  Ms. Xu Jing  Mr. W.K. Wong |
| 2014 | 3-5 Nov | Hong Kong | Warning communication | Mr. Chip Guard  Mr. Ahmed Nadeem  Ms. Sandy, M.K. Song  Mr. K.L. Lee |
| 2015 | 4-6 Nov | Lao PDR | Flash flood and landslides | Mr NAGAI Yoshiki  Prof. Xu-dong Fu  Dr. Dong-ryul Lee |
| 2016 | 15-17 Nov | Viet Nam | Storm Surge | Mr. KOHNO Nadao  Mr. Author Taylor  Mr. Dickson Lau |
| 2018 | 20-22 Nov | Singapore | Application of Remote Sensing Technologies | Mr. YAMASHITA Koji  Dr. Xiang Fang  Mr. Ray Kong |
| 2019 | 11-13 Nov | China | Quantitative precipitation estimation and forecasting (QPE/QPF) | Mr. W C Woo  Mr. Erik Becker  Prof. NAKAKITA Eiichi |

***Annex II***

**Summary of Awarded Research Fellowships**

|  |  |  |  |
| --- | --- | --- | --- |
| **Subject** | **Fellow** | **Host** | **Period** |
| Analysis of evolution of landfalling tropical cyclones with a view to developing forecast guidance for wind and rain | Mr. XUE, Jianjun  (China) | Hong Kong Observatory | 1 Feb – 31 Mar. 2001 |
| TC track forecasting with use of super-ensemble | Dr. PENG, Taoyong  (China) | Korea Meteorological Administration | 15 Jun – 15 Nov 2001 |
| Near real-time analysis of the wind structure of tropical cyclones | Dr. Nathaniel T. SERVANDO  (Philippines) | Hong Kong Observatory | 5 May – 4 Jul 2002 |
| Numerical modelling on typhoon intensity change | Ms. YU, Hui  (China) | Kongju National University and Korea Meteorological Administration | 15 Jul –15 Sep 2002 |
| Tropical cyclone track forecasting method | Dr. KANG, Bom Jin  Dr. KIM, Tae Jin  (DPR Korea) | Shanghai Typhoon Institute | Feb – Mar 2001  Oct – Nov 2002 |
| Analyses on the responses of extratropical transition of tropical cyclone to its environment | Dr. Vicente B. MALANO (Philippines) | Korea Meteorological Administration | Jun – Aug 2004 |
| Effect of tropical cyclone bogussing on model analysis and forecasts | Ms. WANG, Dongliang  (China) | Hong Kong Observatory | 11 Oct – 10 Dec 2004 |
| Evaluation of the model performance in typhoon prediction in the high-resolution global model (T426L40) | Ms. Sugunyanee YAVINCHAN  (Thailand) | Kongju National University and Korea Meteorological Administration | 1 Aug – 30 Oct 2005 |
| Impact study of Moisture Data on TC forecasting in South China Sea and Western North Pacific | Dr. Vicente B. MALANO (Philippines) | Hong Kong Observatory | 20 Sep – 19 Nov 2005 |
| Using ensemble prediction system (EPS) information in tropical cyclone forecasting | Ms. CHEN, Peiyan  (China) | Hong Kong Observatory | 13 Oct – 12 Dec 2006 |
| Numerical simulation of Typhoon RUSA with a very high resolution mesoscale model, and calibration of intensity of typhoon with Kalman filtering | Mr. HOA, Vo Van  (Viet Nam) | Korea Meteorological Administration | Jun – Aug 2006 |
| Use of EPS information in TC forecasting | Mr. NGUYEN, Dang Quang  (Viet Nam) | Hong Kong Observatory | 15 Sep – 14 Nov 2007 |
| Seasonality of Tropical Cyclone Activities over the Western North Pacific | Ms. YING, Ming | Korea Meteorological Administration | 22 Sep – 20 Dec 2008 |
| Study of high resolution non-hydrostatic model in prediction of landfalling tropical cyclones | Mr. Santi SUMDIN  (Thailand) | Hong Kong Observatory | 20 Oct – 19 Dec 2008 |
| Tropical cyclone bogus in NHM and its impact on forecast track and intensity | Mr. QU, Anxiang  (China) | Hong Kong Observatory | 29 Oct – 28 Dec 2009 |
| Typhoon Vortex Initialization Scheme and typhoon Ensemble Forecast Techniques | Ms. NGUYEN Thi Minh Phuong  (Viet Nam) and Mr. Chatchai CHAIYASAEN (Thailand) | National Meteorological Center,  China Meteorological Administration | Early Dec 2009 – Early Feb 2010 |
| Improvement of typhoon analysis and forecast with KMA's TAPS | Mr. TRAN Quang Nang  (Viet Nam) | Korea Meteorological Administration | 1 Sep – 27 Nov 2010 |
| Study on the tropical cyclone genesis in the northwestern Pacific | Mr. Kamol Promasakha Na SAKOLNAKHON (Thailand) | Korea Meteorological Administration | 1 Sep – 27 Nov 2010 |
| Typhoon Information Processing System | Mr. NGUYEN Manh Linh (Viet Nam) and Ms. Kamolrat SARINGKARNPHASIT (Thailand) | National Meteorological Center,  China Meteorological Administration | 8 Oct – 8 Dec 2010 |
| Can the extreme rainfall associated with Typhoon Morakot (0908) happen in Hong Kong? | Mr. HUANG, Yiwu (China) | Hong Kong Observatory | 29 Oct – 28 Dec 2010 |
| Improvement of typhoon analysis and forecast with KMA's TAPS | Mr. Jori J. LOIZ  (Philippines) | Korea Meteorological Administration | Sep – Nov 2011 |
| Improvement of typhoon analysis and forecast with KMA's TAPS | Mr. Chukiat THAIJARATSATIAN  (Thailand) | Korea Meteorological Administration | Sep 2011 |
| Implementation of Tropical Cyclone Intensity Forecast in the Tropical Cyclone Information Processing System (TIPS) of the Hong Kong Observatory | Mr. Nursalleh K. CHANG (Malaysia) | Hong Kong Observatory | 24 Oct – 23 Dec 2011 |
| Improvement of Prediction Method for the Rapid Intensification of Tropical Cyclones in the South China Sea | Dr. Sukrit KIRTSAENG (Thailand) | National Meteorological Center,  China Meteorological Administration | 2 Nov – 29 Dec 2011 |
| Application of Numerical Ensemble Prediction in the Forecasting of Typhoon Sharp Turning Tracks | Mr. Raymond C. ORDINARIO (Philippines) | National Meteorological Center,  China Meteorological Administration | 14Nov 2011 –  13 Jan 2012 |
| Typhoon Analysis and Prediction System (TAPS), genesis and dissipation of tropical cyclones, and change of typhoon characteristics due to climate change | Mr. Renito B. PACIENTE (Philippines), Ms. Plaidao KHUMCHAIYAPHUM  (Thailand) and Mr. Bounteum SYSOUPHANTHAVONG (Lao PDR) | Korea Meteorological Administration | May – June 2012 |
| Enhancement of rainfall nowcast in tropical cyclone situation | Mr. Maqrun Fadzli Mohd Fahmi (Malaysia) and Mr. Michael S. Bala (Philippines) | Hong Kong Observatory | 22 Oct – 21 Dec 2012 |
| Optimizing typhoon forecast  using Typhoon Analysis and Prediction System (TAPS), and research on intensity and track forecasts using model ensemble, correction of track forecast bias according to synoptic patterns, and analysis of synoptic features and typhoon model forecast errors in anomalous typhoon tracks. | Dr. Bonifacio Galt Pajulelas (Philippine) ,  Mr. Nguyen Huu Thanh (Vietnam),  and Ms. Prapaporn Wongsaming  (Thailand) | Korea Meteorological Administration | 1 May – 30 June 2013 |
| Development of location-specific severe weather nowcasting techniques. | Dr. Sukrit KIRTSAENG (Thailand) | Hong Kong Observatory | 21 Oct – 20 Dec 2013 |
| Optimizing typhoon forecast  using Typhoon Analysis and Prediction System (TAPS) and separate researches (typhoon-mid latitude pressure system interaction, study on the typhoon recurvature and moving speed, and study on the relationship between the central pressure and maximum sustained winds for typhoon) | Ms. Bai Lina (China)  Mr. Nguyen Tung Thanh (Vietnam)  Mr. Juanito S. Galang (The Philippines) | Korea Meteorological Administration | 1 May – 30 June 2014 |
| Tropical Cyclone Genesis Forecast Technique | Mr. Boonthum Tanglumlead (Thailand) | Shanghai Typhoon Institute | 1 Jul – 31 Aug 2014 |
| The utilization of ECMWF products in detecting storm tracks over the North Western Pacific | Mr. Pak Sang Il and Mr Song Yong Chol (DPR Korea) | Shanghai Typhoon Institute | 1-30 Sept 2014 |
| Nationwide Nowcast of Tropical Cyclone Rainfall | Mr. Evan James K. Carlos (The Philippines) | Hong Kong Observatory | 6 Oct – 5 Dec 2014 |
| Optimizing typhoon forecast  using Typhoon Analysis and Prediction System (TAPS), and research on typhoon monitoring, interpretation of satellite-based and radar images, typhoon track and intensity forecast and tropical depression or extra-tropical transition | Ms. Akhom THAMALANGSY (Lao PDR)  Mr. Aldczar D. Aurelio (The Philippines),  Mr. Jose Frivaldo, JR. (The Philippines),  Mr. Somprat Srithagon (Thailand), and Ms. DO Thi Thanh Thuy (Viet Nam) | Korea Meteorological Administration | 19 April - 2 May 2015 |
| Tropical cyclone genesis forecast technique | Mr. Pak Sang Il (DPR Korea)  Mr. Ri Hak Il (DPR Korea) | Shanghai Typhoon Institute | 26 Oct - 25 Nov 2015 |
| Visiting editor for Tropical Cyclone Research and Review (TCRR) | Dr. Jason Sippel (USA)  Dr. Nguyen Dang Quang (Viet Nam) | Shanghai Typhoon Institute | 6-13 Dec 2015  20-26 Dec 2015 |
| Development of objective guidance on tropical cyclone genesis forecast using global models | Mr. Wen FENG (China) | Hong Kong Observatory | Mid Nov 2015 – mid Jan 2016 |
| Training for typhoon forecast  - Typhoon genesis and analysis  - Typhoon track and intensity forecast  - TAPS\* operations and products | Benison Jay N. Estareja(The Philippines)  Boonthum Tanglumlead(Thailand)  Narongpon Thongsang(Thailand) | Korea Meteorological Administration | 1 May to 14 May 2016 |
| Tropical cyclone genesis forecast technique | Mr. Pak Sang Il and Mr. Kim Kum Song (DPR Korea) | Shanghai Typhoon Institute | 24 October to 23 November 2016 |
| Visiting editor for Tropical Cyclone  Research and Review (TCRR) | Mr. Kamol Promasakha na Sakolnakhon (Thailand)  Dr. Chen Yi-Leng (USA) | Shanghai Typhoon Institute | 17-21 October 2016 |
| Tropical Cyclone Size Climatology | Mr. Wei HONG (China) | Hong Kong Observatory | mid-Dec 2016 – 31 Jan 2017 |
| Training for typhoon forecast  - Typhoon genesis and analysis  - Typhoon track and intensity forecast  - TAPS\* operations and products | Ms. Pensiri Trisataya and Ms. Chuanpit Ngernchalad (Thailand)  Mr. Robert B. Badrina (The Philippines)  Ms. Hoang Thi Mai (Viet Nam) | Korea Meteorological Administration | 16-29 April 2017 |
| Observational Study on Intensity and Structure of Offshore Typhoon for EXOTICCA | Mr. Jaral Yiemwech (Thailand)  Ms. Khanh Hoa Bui Thi (Viet Nam) | Shanghai Typhoon Institute | September 2017 |
| Benefit evaluation of Typhoon disaster prevention and preparedness | Mr. Nursalleh Chang (Malaysia) | Shanghai Typhoon Institute | September 2017 |
| Visiting Editor for Tropical Cyclone Research and Review | Mr. Somkuan Tonjan (Thailand)  Dr. Doan Quang Tri from (Viet Nam) | Shanghai Typhoon Institute | February 2018 |
| Tropical Cyclone Precipitation Verification | No nomination was received | Shanghai Typhoon Institute | NA |
| Short-term Rainfall Forecast for Tropical Cyclone Using Himawari-8 Data and NWP Model Products | Applicant who was accepted for the fellowship withdrew from the offer | Hong Kong Observatory | NA |
| Benefit evaluation of Typhoon disaster prevention and preparedness | Mr. Nursalleh K Chang (Malaysia) | Shanghai Typhoon Institute | 2 May – 1 June 2018 |
| Training for forecasters:  - Tropical meteorology & climatology  - Processing observed meteorological variables  - Typhoon analysis and monitoring-  - Producing typhoon information using TAPS and TOS  - Seasonal typhoon prediction | Mr. Nuthakit Singhaphet, (Thailand)  Mr. Tran Quang Nang, Typhoon (Viet Nam)  Dr. Guanbo Zhou (China)  Mr. Robb Prieto Gile (the Philippines) Mr. Wan Muhammad Hafiz Bin Husin, (Malaysia) | Korea Meteorological Administration | 23 April to 4 May 2018 |
| Short-term Rainfall Forecast for Tropical Cyclone Using Himawari-8 Data and NWP Model Products | Ms. Nguyen Thu Hang (Viet Nam) | Hong Kong Observatory | January – March 2019 |
| Training for forecasters:  - Tropical meteorology & climatology  - Processing observed meteorological variables  - Typhoon analysis and monitoring-  - Producing typhoon information using TAPS and TOS  - Seasonal typhoon prediction | Ms. Reyes Sheilla Mae R. (the Philippines)  Mr. Tran Van Vu (Viet Nam) | Korea Meteorological Administration | 20 May to 14 June 2019 |
| Visiting Editor for Tropical Cyclone Research and Review | Prof. Kimberly Wood (USA)  Prof. Shishir Dube (India) | Shanghai Typhoon Institute | 24-29 March 2019  13-19 October 2019 |
| Integrated Precipitation Estimator using Radar and Satellite (IPERS) for Tropical Cyclone Rainfall (TC) Analysis and Nowcasting | Mr. Benison Jay N Estareja (the Philippines) | Hong Kong Observatory | January – February 2020 |
| Verification of tropical cyclone wind structure forecasts from global NWP models and ensemble prediction system | Ms LU Xiaoqin (China) | Hong Kong Observatory | Q1 2021 |
| Study on the characteristics and model forecast performance of rapid intensification (RI) of near-landfall tropical cyclones (TCs) | Mr Nawin Sermsook (Thailand) | Hong Kong Observatory | Q1 2022 |

***Annex III***

**TRCG Publications / Papers**

Xue, J.J., 2002: Structural and Diagnostic Analyses of Landfalling Tropical Cyclones near Hong Kong in 1999 and 2000. Typhoon Committee Annual Review 2001, pp. 153-161

Servando, N.T., P.W. Li and E.S.T. Lai, 2003: Near Real-time Analysis of the Wind Structure of Tropical Cyclones. Typhoon Committee Annual Review 2002 (in CD form)

Peng, T.-Y., H.-J. Kwon, W.-J. Lee, and J.-H. Lim, 2005: A systematic approach to tropical cyclone track. *The International Journal of Systems & Cybernetics.* **34**, 681-693.

Wang, D.L., W.K. Wong and E.S.T. Lai, 2005: A Study on Tropical Cyclone Bogussing Strategies in NWP Model Analysis and Forecast. Typhoon Committee Annual Review 2004.

Yu, Hui and H. Joe Kwon, 2005: Effect of TC–Trough Interaction on the Intensity Change of Two Typhoons. *Weather and Forecasting.* **20**, 199–211.

Malano, V.B., W.K. Wong and E.S.T. Lai 2006: Effect of Moisture Data to the Numerical Simulation of Tropical Cyclone in the Western North Pacific. Typhoon Committee Annual Review 2005, pp. 242 – 251.

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***Annex IV***

**List of Resource Persons**

| **Member** | **Specialties** | **Name** | **E-mail** | **Affiliation** |
| --- | --- | --- | --- | --- |
| ***(A) Data Assimilation*** | | | | |
| China | TC vortex initialization | LIANG, Xudong | Liangxd@mail.typhoon.gov.cn | Shanghai Typhoon Institute |
| TC intensity estimation  by radar, satellite, SSMI and QuikScat | GAO, Shuanzhu  ZHOU, Bing | [gaosz1129@sina.com](mailto:gaosz1129@sina.com)  [bingz@cma.gov.cn](mailto:bingz@cma.gov.cn) | National Meteorological Center |
| Radar data quality control and assimilation scheme | GONG, Jiandong | gongjd@cma.gov.cn | National Meteorological Center |
| Hong Kong, China | TC data assimilation, ensemble radar assimilation | K. K. Hon | kkhon@hko.gov.hk | Hong Kong Observatory |
| Japan | Satellite data assimilation | OKAMOTO Kozo | kokamoto@mri-jma.go.jp | Meteorological Research Institute |
| Data assimilation | ISHIBASHI Toshiyuki | [ishibasi@mri-jma.go.jp](mailto:ishibasi@mri-jma.go.jp) | Meteorological Research Institute |
| Republic of  Korea | Typhoon bogussing | HA, Ji-Hyun | jhha80@korea.kr | Korea Meteorological Administration |
| Satellite data analysis | CHUN, Hyoung-Wook | chunhw@korea.kr | Korea Meteorological Administration |
| Radar data analysis | HA, Jong-Chul | bellfe@korea.kr | Korea Meteorological Administration |
| USA (western North Pacific) | TC analysis, satellite interpretation, use of microwave imagery and scatterometer data | Tom LEE  Peter BLACK  Paul CHANG | [Lee@nrlmry.navy.mil](mailto:Lee@nrlmry.navy.mil)  [Peter.Black.ctr@nrlmry.navy.mil](mailto:Peter.Black.ctr@nrlmry.navy.mil)  [Paul.S.Chang@noaa.gov](mailto:Paul.S.Chang@noaa.gov) | NRL, Monterey, CA  NRL, Monterey CA  NOAA/NESDIS, Suitland MD |
| ***(B) Modelling*** | | | | |
| China | Numerical schemes  of TC model | DUAN, Yihong | [duanyh@mail.typhoon.gov.cn](mailto:duanyh@mail.typhoon.gov.cn) | Shanghai Typhoon Institute |
| TC model physics and bogussing schemes | MA, Suhong | [mash@cma.gov.cn](mailto:mash@cma.gov.cn) | National Meteorological Center |
| Ensemble track forecasting | ZHOU, Xiaqiong | [zhouxq@mail.typhoon.gov.cn](mailto:zhouxq@mail.typhoon.gov.cn) | Shanghai Typhoon Institute |
| Typhoon modelling | LIANG, Xudong | [Liangxd@mail.typhoon.gov.cn](mailto:Liangxd@mail.typhoon.gov.cn) | Shanghai Typhoon Institute |
| Hong Kong, China | Mesoscale and ensemble TC modelling | K.K. HON | kkhon@hko.gov.hk | Hong Kong Observatory |
| Japan | Ensemble track  forecasting | KAWABATA Yasuhiro | kawabata@mri-jma.go.jp | Meteorological Research Institute |
| TC-ocean interaction  (incl. mixed-layer  ocean and ocean surface wave modelling) | WADA Akiyoshi | awada@mri-jma.go.jp | Meteorological Research Institute |
| TC modelling | TSUJINO Satoki | satoki@mri-jma.go.jp | Meteorological Research Institute |
| Storm surge / wave modelling | KOHNO Nadao | nkohno@mri-jma.go.jp | Meteorological Research Institute |
| Republic of  Korea | Global NWP model | CHOI, Hyun-Joo | hjchoi81@korea.kr | Korea Meteorological Administration |
| Ensemble track  forecasting | SHIN, Hyun Cheol | sinhyo@korea.kr | Korea Meteorological Administration |
| Storm surge / wave modelling | CHANG, Pil-Hun | phchang@korea.kr | Korea Meteorological Administration |
| USA (western North Pacific) | TC Modeling  Extratropical Transition  TC Genesis  Sub-Tropical Systems Structure | Jim DOYLE  Pat HARR  Jenni EVANS | [James.Doyle@nrlmry.navy.mil](mailto:James.Doyle@nrlmry.navy.mil)  [paharr@nps.edu](mailto:paharr@nps.edu)  evans@meteo.psu.edu | NRL, Monterey CA  Naval Postgraduate School, Monterey CA  Pennsylvania State Univ |
| Viet Nam | Computational fluid dynamics and modelling | LE, Duc | leducvn@yahoo.com | National Hydro-Meteorological Service  of Viet Nam |
| ***(C) Forecasting*** | | | | |
| China | Track and intensity  forecasting | LEI, Xiaotu | Leixt@mail.typhoon.gov.cn | Shanghai Typhoon Institute |
| Long-range prediction  of typhoon | XU, Ming | Xum@mail.typhoon.gov.cn | Shanghai Typhoon Institute |
| Hong Kong, China | TC climatology and best track analysis | C.W. CHOY | cwchoy@hko.gov.hk | Hong Kong Observatory |
| Radar and satellite nowcasting in TC | W.K. WONG | wkwong@hko.gov.hk | Hong Kong Observatory |
| TC intensity, structure and landfall impact | S.T. CHAN | stchan@hko.gov.hk | Hong Kong Observatory |
| Long-range forecasting  of TCs | S.M. LEE | smlee@hko.gov.hk | Hong Kong Observatory |
| TC motion, intensity,  size, modelling and seasonal prediction | Johnny C.L. CHAN | Johnny.Chan@cityu.edu.hk | City University of Hong Kong. |
| Japan | Satellite data analysis, use of microwave imagery, AMSU | OYAMA Ryo | [oyama@met.kishou.go.jp](mailto:oyama@met.kishou.go.jp) | Japan Meteorological Agency |
| Doppler radar data analysis | SHIMADA Udai | [ushimada@mri-jma.go.jp](mailto:ushimada@mri-jma.go.jp) | Meteorological Research Institute |
| Republic of Korea | Track and intensity forecasting | LEE, Kyung-Ho | khlove1119@korea.kr | Korea Meteorological Administration |
| Long-range prediction  of typhoon |
| Singapore | Seasonal prediction  of typhoon | CHOW Kwok Wah | CHOW\_Kwok\_Wah@nea.gov.sg | Meteorological Service Singapore  National Environment Agency |
| USA (western North Pacific)  USA (western North Pacific) | TC analysis and forecasting, seasonal prediction,  use of microwave imagery  and scatterometer data, Dvorak technique | Mark LANDER  Roger EDSON | [mlander@uguam.uog.edu](mailto:mlander@uguam.uog.edu)  [Roger.Edson@noaa.gov](mailto:Roger.Edson@noaa.gov) | University of Guam (WERI)  National Weather Service, Forecast Office Guam |
| Satellite data analysis,  use of microwave imagery | Jorel TORRES  Dan LINDSEY | [Jorel.Torres@colostate.edu](mailto:Jorel.Torres@colostate.edu)  [Dan.Lindsey@colostate.edu](mailto:Dan.Lindsey@colostate.edu) | NOAA/NESDIS at CIRA,  Colorado State University |
| Satellite data analysis,  use of microwave imagery, automated Dvorak Technique, AMSU | Chris VELDEN  Derrick HERNDON | [chris.velden@ssec.wisc.edu](mailto:chris.velden@ssec.wisc.edu)  [dherndon@ssec.wisc.edu](mailto:dherndon@ssec.wisc.edu) | CIMSS,  University of Wisconsin-Madison |
| Satellite data analysis,  use of microwave imagery, AMSU | John KNAFF | john.knaff@noaa.gov | NOAA/NESDIS at CIRA,  Colorado State University |
| Satellite-based rainfall estimates in TCs (eTRaP) | Bob KULIGOWSKI Shelden KUSSELSON | bob.kuligowski@noaa.gov [sheldon.kusselson@noaa.gov](mailto:sheldon.kusselson@noaa.gov) | NOAA/NESDIS  Suitland, Maryland |
| ***(D) Application*** | | | | |
| Hong Kong, China | TC warning systems  and operations | H.Y. YEUNG | hyyeung@hko.gov.hk | Hong Kong Observatory |
| TC information visualization and display systems | C.K. PAN | ckpan@hko.gov.hk | Hong Kong Observatory |
| USA (western North Pacific) | TC warning and disaster preparedness, seasonal prediction, Dvorak technique | Chip GUARD | chip.guard@noaa.gov | NOAA National Weather Service  Guam |

***Annex V***

**Proposed plan for the 4th TRCG Forum/Planning Meeting in 2022 in conjunction with the 17th IWS of the Typhoon Committee**

**1. Date/location**

Q4 of 2022, in conjunction with the 17th IWS to be held in ESCAP Conference Center, Bangkok, Thailand.

**2. Proposed theme :**

The proposed theme for the 4th TRCG Forum will be “***Towards a typhoon resilient society***” which echoes the vision of the Tokyo Statement announced in 2019.

**3. Draft programme**

It is proposed that the 4th TRCG Forum and 16th IWS will be a 4 to 5-day event (2 days Forum + 2 to 2.5 days IWS (including the post-IWS AWG Meeting)).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Time** | **Day 1** | **Day 2** | **Day 3** | **Day 4** | **Day 5** |
| AM | Opening Ceremony | Technical presentations  (7-8 presentations, 20-min each) | WGM, WGH, WGDRR and TRCG Meetings  (parallel sessions) | WGM, WGH, WGDRR and TRCG Meetings - Cont’d  (parallel sessions, if required) | Reserved half day for Plenary Session  (if required)  Post-IWS AWG Meeting  (AWG Members only) |
| Keynote presentations  (3-4 presentations, 30-min each) | **Plenary Session**  (1) Reports of WGM and WGH |
| PM | Keynote presentations  (3-4 presentations, 30-min each) | Topical discussions  (3-4 Breakout groups) | WGM, WGH, WGDRR and TRCG Meetings - Cont’d  (parallel sessions) | **Plenary Session**  (2) Reports of WGDRR and TRCG  (3) Discussion of AOPs and Strategic Plan  (4) Other business  (5) Closing |
| Technical presentations  (3-4 presentations, 20-min each) | Wrap up discussions (Plenary) |

**4. Presentation/discussion arrangements:**

The Forum is expected to include Keynote/Technical Presentations. About 6-8 Keynote Presentations will be delivered by invited speakers (nominated by WG Chairs). Other Technical Presentations (around 10-12) will be contributed by IWS participants / WG representatives (nominated by TC Members, similar to the technical presentations of IWS). Similar to previous Forums, “topical discussions” in breakout group approach will also be arranged for participants to discuss concerned topics with the invited speakers.

**5. TRCG Planning Meeting (Day 3)**

The TRCG Planning Meeting is a quadrennial gathering of the TRCG Members to discuss the new 4-year plan and priority areas of TRCG during 2022 - 2025/2026.

**6. Budget:**

Additional funding to support the participation of up to 8 invited speakers and about 9 TRCG Members (others will be supported by IWS budget) is estimated to be about USD 26,000.

**7. Contingency arrangements**

To be discussed and confirmed with AWG and TCS based on the development of the COVID-19 pandemic.

***Annex VI***

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Review of Training and Research Coordination Group (TRCG) Annual Operating Plan 2021 (including Q1 of 2022)** | | | | | | | | | | | |
| **Objective Number** | **KRA** | **Objective** | **Action** | **Other WGs Involved** | **TCS Responsibility** | **Expected Quarter Completed** | **Other Organizations Involved** | **Success Indicators** | **Funding Required** | **Funding Sources** | **Review and Target Met (Yes/No)** |
| 1 | KRA 1-3 | To enhance TC Members' capacity and knowledge in operational tropical cyclone forecasting. | Attachment of forecasters from TC Members to RSMC Tokyo | nil | Provision of administrative and logistic support. | Q1 | RSMC Tokyo, WMO | Assessment as given in RSMC Tokyo report. | USD 11,000\* | TCTF  and Member self-funded | Yes |
| 2 | KRA 1-3 | To facilitate technology transfer among TC Members through research and development initiatives. | Research Fellowship | WGM, WGH and WGDRR | Provision of administrative and logistic support. | Q1 of 2022 | TC Members | Publication of research findings and development output in TCRR or other journals. | Fellowship offered by voluntary hosts. | TC Members | To be conducted online |
| 3 | KRA1-3 | To enhance TC Members' capacity and knowledge in operational tropical cyclone forecasting. | Up to 4 forecasters from TC to CMA Forecaster Training | nil | Provision of administrative and logistic support. | Q3-Q4 | CMA | Assessment as given in CMA report. | Participation will be supported by CMA | CMA | To be conducted online |
| 4 | KRA 1-3 | To: (a) implement training initiatives in the priority operational and research areas as identified in the TRCG annual report; and (b) enhance Members' capability and capacity in the assessment of damage and pre-assessment of potential impact caused by landfalling TCs | 4th TRCG Forum and Planning Meeting  (in conjunction with the 16th IWS) | WGM, WGH and WGDRR | Provision of administrative and logistic support. | Q4 | - | Feedback from evaluation forms to be completed by a target audience of about 30 people. | USD 26,000 | TCTF | Postponed to Q4/2022 with the 17th IWS |
| 5 | KRA 1-3 | To enhance TC Members' capacity and knowledge in operational tropical cyclone forecasting. | Attachment of forecasters from TC Members to RSMC Tokyo | nil | Provision of administrative and logistic support. | *Q1 of 2022* | RSMC Tokyo, WMO | Assessment as given in RSMC Tokyo report. | USD 11,000 | TCTF  and Member self-funded | To be conducted online |

***Annex VII***

**TRCG Work Plan for 2021 – 2022 (including Q1 of 2023)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Year** | **Quarter** | **Typhoon Committee Activity** | **Training and Research Activities (\*activities organized by parties other than TRCG)** | **Themes (if any) / Remarks** |
| **2021** | **Q1** | TC-53  (Video conferencing) | RSMC Tokyo Attachment Training | 9-11 March (Online) |
| Research Fellowship | HKO fellowship in Jan-Mar |
| **Q2** |  | Research Fellowship | KMA and STI fellowships were cancelled |
| **Q3** |  |
| **Q4** | 16th IWS  (Video conferencing) | TRCG Forum / 4th TRCG Meeting | Postponed to Q4 2022 in conjunction with 17th IWS |
| Roving Seminar | Postponed to Q4 2022 in Vietnam |
| CMA Training Programme | 25 November – 3 December (Online) |
| **2022** | **Q1** | TC-54  (Video conferencing) | RSMC Tokyo Attachment Training | 11 – 13 January (Online) |
| Research Fellowship | HKO fellowship in Jan-Mar |
| **Q2** |  | Research Fellowship | KMA fellowship in April-May  \* will be subjected to COVID-19 situation |
| **Q3** |  |
| **Q4** | 17th IWS  (TBC) | *\*\* Typhoon Forecasting Techniques Workshop in collaboration with WGM* | *\*\* tentatively in October 2022* |
| TRCG Forum / 4th TRCG Meeting | Proposed theme: “Towards a typhoon resilient society” |
| Roving Seminar | *Postponed to Q2 2023* in Vietnam.  Proposed theme: “Impact based Forecasting” |
| CMA Training Programme | TBC |
| **2023** | **Q1** | TC-55 | RSMC Tokyo Attachment Training | TBC |

\*\* to be hosted by Malaysia under PP1 of WGM AOP 2022

***Annex VIII***

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Training and Research Coordination Group (TRCG) Annual Operating Plan 2022 (including Q1 of 2023)** | | | | | | | | | | |
| **Objective Number** | **KRAs** | **Objective** | **Action** | **Other WGs Involved** | **TCS Responsibility** | **Expected Quarter Completed** | **Other Organizations Involved** | **Success Indicators** | **Funding Required** | **Funding Sources** |
| 1 | KRA 1-3 | To enhance TC Members' capacity and knowledge in operational tropical cyclone forecasting. | Attachment of forecasters from TC Members to RSMC Tokyo | nil | Provision of administrative and logistic support. | Q1 | RSMC Tokyo, WMO | Assessment as given in RSMC Tokyo report. | USD 11,000\* | TCTF  and Member self-funded |
| 2 | KRA 1-3 | To facilitate technology transfer among TC Members through research and development initiatives. | Research Fellowship | WGM, WGH and WGDRR | Provision of administrative and logistic support. | Q1 of 2022 | TC Members | Publication of research findings and development output in TCRR or other journals. | Fellowship offered by voluntary hosts. | TC Members |
| 3 | KRA1-3 | To enhance TC Members' capacity and knowledge in operational tropical cyclone forecasting. | Up to 4 forecasters from TC to CMA Forecaster Training | nil | Provision of administrative and logistic support. | Q3-Q4 | CMA | Assessment as given in CMA report. | Participation will be supported by CMA | CMA |
| 4 | KRA 1-3 | To: (a) implement training initiatives in the priority operational and research areas as identified in the TRCG annual report; and (b) enhance Members' capability and capacity in the assessment of damage and pre-assessment of potential impact caused by landfalling TCs | 4th TRCG Forum  [Towards a typhoon resilient society]  TRCG Planning Meeting  (in conjunction with the 17th IWS) | WGM, WGH and WGDRR | Provision of administrative and logistic support. | Q4 | - | Feedback from evaluation forms to be completed by a target audience of about 30 people. | USD 26,000 | TCTF |
| 5 | KRA 1-3 | To: (a) implement training initiatives in the priority operational and research areas as identified in the TRCG annual report; and (b) enhance Members' capability and capacity in the assessment of damage and pre-assessment of potential impact caused by landfalling TCs | Roving Seminar  [Impact based forecasting] | WGM, WGH and WGDRR | Provision of administrative and logistic support. | *Postponed to Q2 of 2023* | - | Feedback from evaluation forms to be completed by a target audience of about 30 people. | *USD 16,000*  *(Q2 of 2023)* | TCTF |
| 6 | KRA 1-3 | To enhance TC Members' capacity and knowledge in operational tropical cyclone forecasting. | Attachment of forecasters from TC Members to RSMC Tokyo | nil | Provision of administrative and logistic support. | *Q1 of 2023* | RSMC Tokyo, WMO | Assessment as given in RSMC Tokyo report. | USD 11,000 | TCTF  and Member self-funded |