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**Proposal for ESCAP/WMO Typhoon Committee  
Collaborative Research Center**

Feb 2021

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## 1. Background

Since its establishment in 1968, the ESCAP/WMO Typhoon Committee (TC) has been devoting its efforts to strengthen technical cooperation among its Members on tropical cyclones disaster prevention and preparedness. Technical exchanges on disaster risk reduction, regional cooperation and coordination, joint research and capacity development activities have been organized through workshops, seminars and research fellowship programs to share the experiences and best practices in disaster prevention.

Tropical cyclone in the Western North Pacific (WNP) basin is commonly referred to as "typhoon" to the public and communities. The WNP is the most active region for tropical cyclones among the five ocean basins prone to tropical cyclones worldwide. In recent years, many unusual tropical cyclones have been observed with sudden changes in track, rapid intensification, record-breaking intensity, and associated extreme rainfall, etc. These pose significant challenges to the operational forecasting and warning services of the National Meteorological and Hydrological Services (NMHSs), as well as the disaster prevention and mitigation efforts of the TC Members.

Over the past few decades, the NMHSs of TC Members have been devoting their efforts to research and development capable of improving typhoon analysis and forecasting techniques. In addition, significant progress has been made by different research units specialized in tropical cyclones, contributing to significant improvement in tropical cyclone tracks and intensity forecast. However, many challenges remain in the operational forecast, especially those associated with the tropical cyclone landfall processes that directly affect coastal regions. The levels of

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capacity and technical competencies of tropical cyclone operational services vary among the TC Members.

To bridge the gaps among the TC members in applying the latest available technologies to tropical cyclone operational services, the TC has established several international cooperation projects and plans funded by TC members, such as Annual Operating Plan (AOP) established by the respective Working Groups, Research Fellowship Scheme offered by TC members and the cross-cutting projects among TC Working Groups. Nevertheless, it has been noted that most of the projects and plans have not been provided with sufficient resources and funds for typhoon specialists or scientists, such as supports in the respects of high-performance computing, journal publications, academic conferences, etc. Consequently, the opportunities for research topics that require joint efforts with shared interests and operational challenges have not been widely available in the current tropical cyclone community, especially in North-West Pacific TC Members. As a result, there are some limitations to the progress of capacities for operational typhoon forecast in the Asia-Pacific region to cope with severe typhoons.

On the other hand, forecasters and young scientists from TC Members may wish to have opportunities to update their skills and competencies as well as their knowledge on new operational services products. There remains room to provide such opportunities sustainably to engage them in the research development of advanced technologies promoted or shared by international communities on tropical cyclones. Without such supports, enhancement and new development of tropical cyclone operational capacities and competencies among the TC Members would be inevitably under constraint.

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Based on the above, it is essential to establish a joint tropical cyclone research unit to provide a sustainable platform for conducting collaborative research on sciences, new techniques and methodologies in tropical cyclone monitoring, forecasting, warnings of multi-hazard impacts and risk information.

In this connection, China proposes to establish the Typhoon Committee Collaborative Research Center (referred to as "the Center" hereinafter) in Shanghai as a specialized research body under ESCAP/WMO Typhoon Committee. The Center will focus on the key technologies and important theories in typhoon forecast and warning research in collaboration with the existing operational and research institutions of the TC Members. In addition, the Center will provide a sustainable platform for scientists from TC Members to work together for years to resolve the problems faced by TC Members. Financial support will also be provided to support joint research among the TC Members on common scientific and technical issues. In addition, the Center will coordinate with all Working Groups to organize training courses and workshops to promote technical exchanges among Members and provide technical support for Members' capacity building in the region.

This proposal was discussed at the 51<sup>st</sup> TC Session and has been supported by the Shanghai Municipal Government and the China Meteorological Administration. The establishment of the Center has been one of the major outcomes of the 7<sup>th</sup> cooperation meeting between the China Meteorological Administration and the Shanghai Municipal Government. The proposed Center was identified as a key project in the Municipal Government's "Work Plan for the International Organization Settlement in Shanghai". The office space and other miscellaneous supporting utilities/facilities of the Center have been reserved in Zhangjiang Science Park, Pudong District of Shanghai.

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## 2. Objectives and Scope

The objectives of the proposed Center are:

- 1) To set up projects to support long-term/sustaining joint research on typhoon related problems and associated high-impact typhoon events and to address common scientific challenges with domestic needs among the TC Members;
- 2) To strengthen cooperation among the TC Members in the areas of meteorological observations from operational platforms, new instruments in the regional and international field campaign, forecast technology, data collection and sharing, disaster impact assessment, etc. for tropical cyclones landfall;
- 3) To enhance capacity building through training courses, establish connections among researchers, and accelerate the techniques transfer among TC Members in the Asia-Pacific region through forums, journals, and training courses;
- 4) To raise the visibility of tropical cyclone community and expand its influences on the economic and social development of Asia-Pacific countries;
- 5) The research scope of the proposed Center covers the followings areas, which would be reviewed and updated according to the needs of TC Members through an International Scientific Steering Committee (ISSC) and TRCG of the Committee;
- 6) Operational techniques and methodologies for tropical cyclone forecast and early warning in the Asia-Pacific Region;
- 7) Analysis and research on physical/dynamic mechanisms of tropical cyclones with high impact typhoon events related with TC Region;

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- 8) Risk analysis and assessment as well as the impact-based forecast of landfall tropical cyclones.

### 3. Organizational Structure

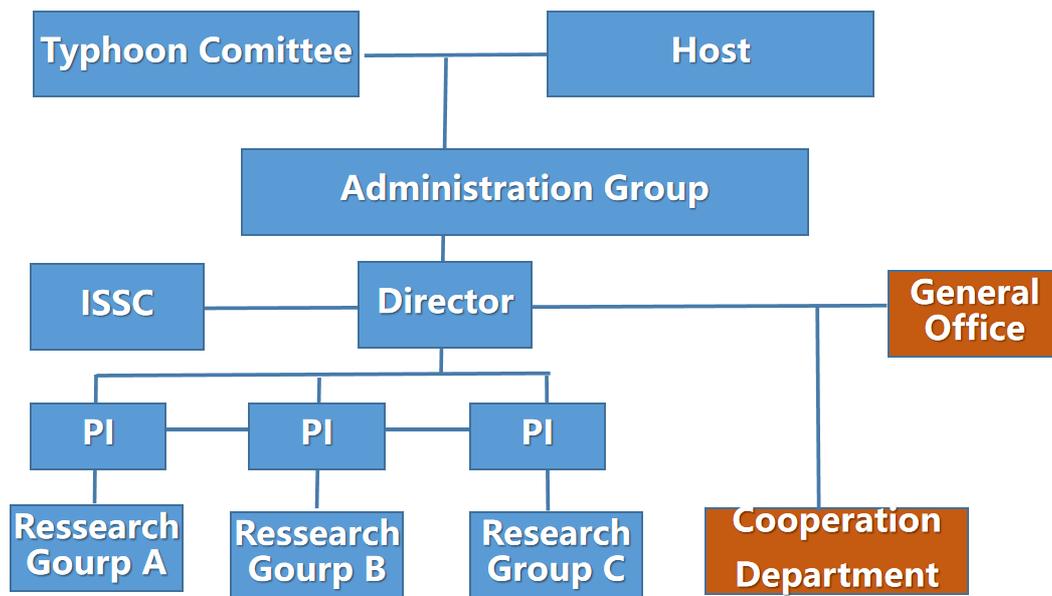


Fig 1. Organization chart of the Center

#### 3.1 Administration group

The leader of the administration group is nominated by the HOST and then appointed by the TC. The members of administration group consist of the Secretary of the TCS, the chairperson of the AWG and persons designated by the HOST.

Terms of reference for the administration group:

- 1) Appoint the director of CRC according to the recommendation of the HOST;
- 2) Evaluate the performance of the director and the operation of the CRC every year;
- 3) Discuss and decide on major issues of the Center.

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### ***3.2 International Scientific Steering Committee (ISSC)***

The International Scientific Steering Committee (ISSC) will be established under the ESCAP/WMO Typhoon Committee auspices and appointed by the Committee. The ISSC shall include representatives from TRCG and Working Groups of the Typhoon Committee. ISSC members will also include experts from tropical cyclone communities around the world nominated by the TC Members to provide advice on the direction and identification of priorities and implementation of research projects.

The members of the ISSC are drawn from leaders of the Working Groups, experts nominated by TC Members, and other internationally renowned typhoon experts may be invited by ISSC.

Terms of reference for the ISSC:

- 1) Advise on the strategic plan with the long-term goals of the Center;
- 2) Advise on the annual work plan and implementation strategy of the Center;
- 3) Solicit and consolidate integrates the TC Members' the needs and requirements of TC Members ;
- 4) Advise on and approve the strategic plan with the long-term goals of the Center;
- 5) Approve the annual work plan and implementation strategy of the Center;
- 6) Evaluate and advise on the achievements of the international cooperation projects of the Center.

### ***3.3 Directorship of the Center***

The Director shall carry out the work of the Center under the leadership of the administration group and the guidance of the ISSC. The Director shall be nominated by the HOST and then appointed by the Administration Group on behalf of the TC.

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The Director of the Center is the chief executive responsible for the Center's administration. The director shall perform duties and responsibilities with the following terms of reference :

- 1) To formulate and develop the strategic plan, annual budget, and annual work plan of the Center;
- 2) To lead the formulation of the cooperation research Project guidelines and decide the proposal;
- 3) To decide the appointment of PI and the related Research Group, and oversee the progress of the research projects;
- 4) To lead the organization of academic workshops and training activities;
- 5) To promote the application of the research achievements;
- 6) To report the work progress of the Center to the administration group;

### ***3.4 Research Groups and Principal Investigators***

Research groups will be established for the relevant project research guided by the Principal investigator (PI) is responsible for organizing the corresponding research group to conduct the relevant research.

Terms of reference for the research groups and PI:

- 1) Research groups will be supervised by the PI;
- 2) PI is supposed to manage this project;
- 3) The performance of PI is assessed annually by the director of the Center;

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- 4) Generally, each group will be established for generally 2-4 years, with the possibility of extension on satisfactory performance and approval by ISSC and the Director of the Center;

### ***3.5 General office and cooperation department***

The general office and cooperation department are permanent units of CRC and are managed by the Director of CRC. The general office is responsible for providing logistical and financial services to CRC and visiting scientists.

The director will lead the cooperation department to improve the international cooperation among TC Members.

Terms of reference:

- 1) Publication of the typhoon journal: Tropical Cyclone Research and Review (TCRR);
- 2) Enhance the prevention and mitigation capabilities of TC Members by organizing technical training to promote the achievements of the Center through strengthening cooperation with TRCG and other institutions;
- 3) Organize the international typhoon forum and young scientists form.

## **4. Operating Mechanism**

The Center will establish collaboration with relevant professional institutions, training centers, and other scientific research resources in this region. The Center will organize regular training courses or workshops to promote knowledge transfer in the application of products and new technologies. It is expected that the projects will also complement the annual work programs and TC Research fellowship programs of the Working Groups of TC.

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#### ***4.1 The Research Projects***

The research projects will be established to support the needs of TC Members in the broad range of technical area that will ultimately enable TC Members to prevent and mitigate disasters related tropical cyclone. The projects shall be reviewed, assessed, and endorsed by the director of the center based on comprehensive requirements formulated by the ISSC.

#### ***4.2 Technical training and promotion of the achievements***

The training courses/seminar/workshop on the new operational technology and products will be organized in collaboration with the TRCG, TC Training Center (WMO Regional Training Center (Nanjing)) and all Working Groups of the TC. The lecturers and training materials for various training courses held by the TC Working Groups and training centers will be made available to TC Members.

#### ***4.3 Academic exchange programme***

The Center will organize academic exchanges on scientific research and operational technology regularly and on annual basis. In tandem with the TC's annual meeting, the Asia-Pacific international forum on disaster prevention and mitigation will be held. The objectives of the exchange programme will focus on identifying key technologies in operational tropical cyclone forecast and research directions in the future. In combination with the Working Groups' annual work plan, young talented researchers academia in the TC Members will be invited as visiting scholars in the Center under this program. Research deliverables will be publicized through TCRR, international workshops, and other peer-reviewed journals, along with other scientific achievements of the Center. In this connection, the TC is expected to gain visibility in the international scientific community.

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#### ***4.4 Reporting and endorsement mechanisms***

As an academic unit, the Center should have its operation mechanism.

- 1) The Director should report CRC's job to the Administration Group annually and submit the report to the TC in the TC Session. In addition, the performance of the director should be assessed by the Administration Group on annual basis.
- 2) The PI of each research group should report to the director of the Center. The director of the Center shall decide whether the program shall go on or suspend under the suggestions of ISSC in writing.
- 3) The group member should report to and be evaluated by the PI of the group.

### **5. Financial Arrangement**

The Shanghai Typhoon Collaborative Research Fund (STCRF) will be established to support the research projects and activities as well as the operation of the CRC. This fund will be solely funded and managed by China.

Members may submit their research project proposal with budget consideration to the Center.

### **6. Collaboration with other institutes and centers**

Proposed approaches and plans to collaborate or establish a partnership with other institutes and centers.

- 1) Scientists can work together to eliminate some current operation differences (e.g. typhoon intensity difference among different members) for a more comprehensive and coordinated communication procedure;

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- 2) Larger program (e.g. the international typhoon experiment) require institutes and centers from all the members to work together and launch the campaign since so many countries and regions are affected by typhoons;
  - 3) Different institutes may cooperate to call more attention to the typhoon community from the society and the government by launching International Typhoon Forum and getting more technical help from other industries (e.g. artificial intelligence, remote sensing) to improve the ability of the typhoon community.

## **7. Benefits to the Typhoon Committee Members**

- 1) Members may submit their research project proposal with budget consideration to the Center, thus solving difficult and important bottleneck which they cannot solve themselves;
- 2) Through the long-term collaborative research in the Center, TC members may improve the operational capacity for disaster prevention and mitigation. Through studying and working, a multilateral cooperative mechanism that research to operation (R2O) among TC Members may be formed;
- 3) As an international platform, the Center may help TC Members to attract more resources domestically (e.g. government funding, society focus, enterprise support);
- 4) Through the long-term cooperation among scientists from different TC Members, the mutual understanding in common operation problems (e.g. typhoon intensity identification) and coordinated typhoon operation among TC Members will be strengthened;

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- 5) More and larger international programs will be carried out through the Center's international cooperation (e.g. typhoon experiment that may cover the whole Asia-Pacific region);
  - 6) Help TC Members to apply for the international program (United Nation, WMO, ESCAP, etc) to promote their research and operation

## **8. Roadmap of CRC**

### ***(i) The tentative plan of development in the first year***

- 1) On Feb 2021, the 53<sup>th</sup> TC approve the proposal of CRC;
- 2) In Apr 2021, ISSC of CRC will be organized;
- 3) In Jun 2021, CRC will be claimed and in a pilot run;
- 4) In Sep 2021, the guideline for research project application will be published after collecting the request of members;
- 5) In April 2022, the first group will be set up and work in CRC.

### ***(ii) Tentative plan of development in the first 5 years***

- 1) Establish at least two international research groups and two international scientists will be invited to join CRC as PI;
- 2) Organize 2-3 international typhoon forums and 2-3 international courses;
- 3) At least two bottleneck problems are studied and two techniques are transferred between TC Members by the Center;
- 4) Train at least 4-5 young scientists from TC Members.

### ***(iii) List of targeted or potential research areas and potential deliverables for consideration by the TC (or its task force) and TC Members***

- 1) Typhoon intensity identification technique;

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- 2) Geostationary and orbit satellite in typhoon operation;
  - 3) Typhoon model development;
  - 4) International typhoon experiment.

## **9. The review of establishment progress**

- 1) The proposal for the establishment of the Center was initially put forward to the Advisory Working Group meeting during the 13th Integrated Workshop of TC (Chiang Mai, Thailand, Nov 5-9, 2018);
- 2) The draft proposal for the establishment of the Center was submitted and reported to the 51<sup>st</sup> TC Session (Guangzhou, China, Feb 26-Mar 1, 2019). The TC Session requested the Advisory Working Group to submit the proposal again during the 52<sup>nd</sup> TC Session after revision by the Members and Working Groups;
- 3) The draft proposal for the establishment of the Center was sent to all members of the Advisory Working Group for comments in April 2020. As of 30 April 2020, Hong Kong, China had sent feedback in writing. The proposal was modified at the end of May and submitted to the Advisory Working Group on June 9 by China, and resubmitted to the 2nd TC video conference of 2020 held on June 10, 2020;
- 4) As a key project, the establishment of the Center has been prioritized in the next Five-Year Plan of Shanghai Municipal Government and China Meteorological Administration;
- 5) The establishment of the Center has been included in the "Work Plan for the International Organization Settlement in Shanghai" by the Shanghai Municipal Government. In the early stage, the Shanghai Municipal Government supported Shanghai Typhoon Institute (STI) to carry out a project on "the development of

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fine-scale typhoon forecast system" approved in 2019. In 2020, the Shanghai Municipal Government will support the establishment of the Center through its "international science and technology partnership project";

- 6) The site investigation and selection have been carried out in Zhangjiang Science Town, the Pudong District of Shanghai. With the support of the Pudong District Government, the Center will be settled in Zhangjiang Science Town, and the location of the office has been preliminarily determined. This town also accommodates industries of artificial intelligence, information communication, and bio-medicine. The perfect facilities in the Town will play an important role in promoting the development of the Center in the future;
- 7) On February 1, 2020, the proposal was discussed by the AWG after all comments had been received. In addition, the proposal was included in the agenda of the 53<sup>rd</sup> session.
- 8) Under the request of the AWG, the CMA made a final revision to the proposal and submitted it to the TCS before the Chinese New Year in 2020.

# APPENDIX

## Layout and photos of Zhangjiang Science Town

