Newsletter 2023

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Events

Honors and Awards

- Prof. I-I Lin was elected as a Fellow of the American Meteorological Society (AMS).
- Prof. I-I Lin received the title of Chair Professor of NTU from 2023.
- Prof. Cheng-Ku Yu received the title of Distinguished Professor from 2023.
- Prof. Min-Hui Lo received the NSTC Outstanding Research Award in 2022.
- Prof. Yu-Chiao Liang received the NSTC Ta-Yu Wu Memorial Award in 2023.
- Prof. Pao-Kuan Wang, a distinguished chair professor of our department, received the Nikolai Dotzek Award 2023.
- Prof. Jen-Ping Chen received the NTU Outstanding Teaching Award for the 2022 Academic Year.
- Our department was awarded as an Excellent Department in the 2023 NTU Azalea Festival Department Exhibition.

- 林依依特聘教授獲選為美國氣象學會會士。
- 林依依教授榮聘臺灣大學講座教授 (自112起)。
- 游政谷教授榮聘臺灣大學特聘教授 (自112起)。
- 羅敏輝教授榮獲111年度國科會傑出研究獎。
- 梁禹喬助理教授榮獲 112 年度吳大猷先生紀念獎。
- 王寶貫特聘研究講座教授榮獲尼可萊鐸切克（Nikolai Dotzek) 獎。
- 陳正平教授獲111學年度教學優良獎。
- 本系榮獲2023年臺大杜鵑花節學系博覽會實體展優秀學系。

Retirement of Prof. Chung-Hsiung Sui

Prof. Chung-Hsiung Sui will retire on February 1, 2024, a retirement party for Prof. Chung-Hsiung Sui was held together with our department year-end banquet on December 28, 2023.

隋中興教授將於明年2月1日退休, 本系於今年12月28日舉辦期末餐會暨退休餐會, 歡送隋老師，會中院長及系主任致贈禮物給老師，並期許老師有個愉快的退休生活。

Students Activities

NTU Azalea Festival

In 2023, our school held the Azalea Festival on March 11th and 12th. Due to the easing of the pandemic, the event was conducted in person. On the first day, the opening ceremony took place in front of the NTU Sports Center. Inside the hall, there were department fairs and also an online exhibition providing comprehensive information on admissions, scholarships, and detailed introductions to various departments and degree programs. Our department also set up an exhibition booth, offering brief explanations about the department and hosting small activities for students interested in atmospheric sciences as a reference for their further studies. As a result, our department was awarded as an Excellent Department in the 2023 NTU Azalea Festival.

本校於今年3月11日及12日舉辦杜鵑花節活動，今年因疫情趨緩採實體方式進行，首先第一天在綜合體育館前舉行開幕典禮，並在綜合體育館內舉行學系博覽會以及線上展覽，提供完整的招生、獎學金資訊及各學系、學位學程的詳盡介紹。本系亦於館內設置展覽攤位，提供系所簡介說明以及舉辦小活動供對大氣系有興趣的同學作為升學之參考。本系更榮獲2023年臺大杜鵑花節學系博覽會實體展優秀學系。

Commencement Ceremony

The NTU Commencement Ceremony was held on the morning of May 23rd for the academic year 111. Following the university ceremony, our department also held a Commencement Ceremony and the undergraduate and graduate ceremonies were held concurrently. Parents were arranged to watch the live stream ceremony in another classroom. The ceremony began with speeches by the Dean of the College of Science, the Department Chair and student advisors, and then a video of a speech given by the teachers of our department to the graduates was played during the ceremony. Next, a representative of the graduating class delivered a graduation speech. The Department Chair turned the tassel from the right to the left for each graduate and gave graduation gifts to them. Everyone was very happy and cherished the opportunity to participate in this graduation ceremony. This year, the department had a total of 28 bachelor's degree graduates, 16 master's degree graduates, and 3 doctoral graduates.

Students Activities

本校於今年5月23日實體舉行111學年畢業典禮，本系亦於同日下午於系館實體舉行撥穗典禮，此次採大學部與研究所同時舉行，並將家長們安排於另一間教室，同步觀賞直播典禮現場。典禮首先由吳俊傑院長、游政谷系主任及學生導師們輪流致詞，並於現場撥放系上老師們預先提供給畢業生的一段話的影片，氣氛溫馨感人。接著請畢業班同學代表分享畢業感言,再由系主任位每個畢業生撥穗並提供畢業小禮物給每一位畢業生。在疫情期間，大家非常開心並珍惜能參與一場實體的畢業典禮。今年系上共有28名學士，16名碩士及3名博士畢業。

Students Awards

- Tsubaki Hosokawa received a student presentation award at ICMCS-XV in 2023.
  Tsubaki Hosokawa 同學獲得第15屆中尺度對流系統國際會議學生論文口頭報告獎。
- Yu-Hsiang Chang received the Bachelor Paper Award for the 2022 academic year.
  張淯翔同學獲得111學年學士論文獎。
- Chih-Hsuan Yu received the NTU Altruism Award for the 2022 academic year.
  俞芷萱同學獲得111學年利他獎。
- Yo-Ting Wu received the MOST College Student Research Creation Award in the 2022 academic year and received helpful guidance from his advisor, Prof. Yu-Chiao Liang.
  吳宥廷同學獲得科技部111年度大專學生研究計畫研究創作獎，其指導教授梁禹喬老師也獲頒指導有方的獎牌。

2023 Undergraduate Summer Research Program Poster Presentation and Awards

To encourage undergraduate students to participate in research activities, the Summer Research Program was held in the department and culminated in a poster session at the end of the summer vacation. There were 15 teachers and 28 students (name list below), including sophomore and junior students, for this activity. These students shared their results from their research and the best 6 poster winners were awarded as judged by their research advisors, research assistants, and graduate students.

為促進大學部學生研究能量，本系於暑假期間推行「大專生暑期研究計畫」，本次活動共計28位二、三年級學生分別接受15位系上教師指導並進行研究，分組名單如下表。另本系於8月31日下午於大氣系系館舉行研究計畫成果發表暨海報競賽活動，大學部學生與研究生踴躍參與討論，感謝系上多位老師蒞臨指導，大家交流學習熱烈。

恭喜參與本屆暑期計畫的學生如期完成研究工作並分享有趣成果，也恭喜本次活動獲獎學生:許米棋、甘祐銓、吳柏慶、周彥廷、陳彥丞、劉詩雅。

	姓名	指導教授	題目
A1	王俊文	洪惠敏	Investigation of Extinction Effect with Different Cloud Condensation Nuclei Properties on Convection Using Simple Parcel Model
A2	王昱文	吳俊傑	Discussion on Ocean Cooling Mechanism Caused by Typhoon Khanun (2023)
A3	甘祐銓	隋中興/曾開治	Convective and Radiative Effects on Tropical Waves
A4	葉柏輝	黃彥婷	Contrasting the Effects of Aerosols and Greenhouse Gases on the Spatial Pattern of Tropical Rainfall Trends: Exploring the Role of Ocean Heat Uptake
A5	蘇煜翔	盧孟明	2023年孟加拉灣及南海夏季季風肇始氣候背景分析
A6	焦俊翔	陳正平	Ozone Effect on the Growth of Leafy Sweetpotato – chamber experiment and model data analysis
A7	邱毓庭	羅敏輝	Exploring the Impact of Climate Change on Amazon Hydroclimate Using the CESM2 Large Ensemble
A8	鍾雅帆	梁禹喬	Comparative analysis of Artic Amplification using a climate model with hierarchical ocean component
A9	俞芷萱	游政谷	2021~2022年大屯山區東北季風降水事件之板橋探空、ERA-5再分析資料與彭佳嶼探空之比較
A10	劉靖傑	游政谷	2011-2022年大屯山區 夏季午後熱對流降雨事件統計
A11	陳芊涵	郭鴻基	Potential Vorticity Invertibility for Boundary Layer in Hadley Circulation & Pangu Simulation and Analysis of Tropical Cyclone
A12	陳彥丞	陳維婷	冬季弱綜觀條件下，東南風引發之背風環流與臺灣西北部麓山帶空氣汙染關係
A13	馮以安	曾開治	Revisiting Lorenz 69 model: the predictability of 2D to 3D turbulence
A14	劉韋杰	吳健銘	Factor Leading Extreme Rainfall in Southern Taiwan under the Convective Precp.

	姓名	指導教授	題目
B1	許博睿	洪惠敏	Analysis of Traffic Pollution Infiltration into Urban Parks: A Case Study in Da'an Park
B2	陳逸鳴	吳俊傑	The Influence of Taiwan Topography on Tropical Cyclone Track – An Intercomparison between Typhoon Wipha (2007) and the terrain-induced mesolow
B3	吳柏慶	黃彥婷	Alterations in Subtropical Circulation Under the Influence of Ozone Depletion
B4	李珵豐	盧孟明	2023年春季華南季內極端降雨事件氣候背景分析
B5	周宥均	陳正平	Tropospheric Ozone Distribution and Potential Effect on Tomato Yield over Primary Crop Fields in Taiwan
B6	周彥廷	羅敏輝	The Effects Of Natural Climate Variation And Anthropogenic Change On The Maritime Continent's Interannual Precipitation Variation
B7	邱聖凱	梁禹喬	Interpreting Deep Learning with SHAP for Identification of Sudden Stratospheric Events
B8	陳柏翔	游政谷	Statistical Analysis of Taiwan Rainbands During 2018-2019
B9	許米棋	林博雄	綠能站風機設計與其效率探討
B10	葉品辰	郭鴻基	Exploring the Pangu pattern through Typhoons and Experimental observations
B11	陳彥葦	楊明仁	Correlation between Precipitation, Precipitable Water, CAPE, and CIN: Precipitation Prediction Model Training with Sounding Data
B12	黃宇維	陳正平	Mini-Chamber Experiments of Ozone Effects on Crops
B13	廖韋翰	吳健銘	透過VVM模擬河口影響台北盆地午後熱對流
B14	劉詩雅	吳健銘	Learning the convective variabilities in VVM using an autoencoder approach

Meeting Highlights

NTU-Tokyo Workshop on Atmospheric Convection

The NTU-UTokyo Workshop on Atmospheric Convection was held on March 2-4, 2023, at the Department of Atmospheric Sciences, National Taiwan University (NTU). The workshop's main objective was to promote scientific exchange and collaboration between researchers from NTU and the University of Tokyo (UTokyo) in the area of atmospheric convection.

The workshop began on March 2, with Prof. Wei-Ting Chen and students introducing the NTU campus to students from UTokyo. This was followed by a series of short talks from researchers at NTU. Then, Prof. Hiroaki Miura, Mr. Kazumasa Ueno, Mr. Kazuya Yamazaki, and Mr. Keiichi Hashimoto from UTokyo shared their studies. The talks covered a range of topics related to atmospheric convection, including modeling framework to understand atmospheric circulations, applying the multigrid method for multiscale representation of fluids, impacts of biogeophysical processes in MIROC-E2SL, and the development of the blockwise-coupled SP-MIROC. There was a demonstration of the Storm Tracker mini radiosonde between these talks.

On March 3rd, the workshop continued with more talks and discussions. Mr. Min-Ken Hsieh and YiChang Chen presented their work on applying machine learning methods to develop frameworks using cloud-resolving model data for understanding convection and local circulations. Ms. Yuka Sato shared analyses of potential instabilities for severe Senjo-Kousuitai precipitation events. Mr. Sosaku Ino presented his work on investigating the Coriolis parameter dependence of tropical cyclone formation in a modeled environment of radiative-convective equilibrium. The workshop concluded on March 4th with a field trip to Maokong, providing a chance for participants to experience the local culture and environment of Taiwan.

NTU-UTokyo大氣對流研討會於2023年3月2日至4日在國立台灣大學(National Taiwan University, NTU)大氣科學系舉行。該研討會的主要目的是促進NTU和東京大學(the University of Tokyo, UTokyo)的老師與同學進行大氣對流領域的交流和合作。

研討會始於3月2日，由陳維婷教授和學生向UTokyo的學生介紹NTU校園。接著，NTU的同學進行了一系列的短講介紹各自的研究主題。Miura Hiroaki教授、Kazumasa Ueno同學、 Kazuya Yamazaki同學、和Keiichi Hashimoto同學依序分享了他們的研究：透過模擬策略來瞭解大氣環流、利用多重網格方法來了解多尺度流體、生物地球物理過程的影響以及區塊耦合SP-MIROC之開發。在報告之間，我們進行了風暴追踪器微型探空氣球的介紹以及討論未來在觀測實驗中可能的合作。

3月3日，研討會繼續進行更多的講座和討論。謝旻耕同學和陳逸昌同學介紹如何應用機器學習於雲解析模型資料的方法以了解對流和局地環流。Yuka Sato同學分享了潛在不穩定性對於線狀降雨帶事件的貢獻之分析。Sosaku Ino同學則介紹了在輻射對流平衡環境中熱帶氣旋形成與科氏參數之關係的研究。研討會於3月4日前往貓空的參訪，讓參與者體驗台灣當地的文化和環境。

在本次的研討會中，NTU和UTokyo的教授與同學互相分享了最新研究發現並討論了未來研究合作的方向。本次研討會提供了一個機會促進NTU和UTokyo的交流，且帶來新的洞見、研究思路和潛在的合作機會。希望透過本次研討會，臺灣大學和東京大學之間合作在未來能夠更加緊密。

Faculty and Students of NTUAS attending the 2023 UAW in Tokyo

A group of 23 faculty members and students from the Department of Atmospheric Sciences, NTU participated in the University Allied Workshop on Climate and Extreme Weather (UAW) held at the Atmosphere and Ocean Research Institute (AORI) of the University of Tokyo's Tsukuba Campus from June 26th to 29th, 2023.

This UAW workshop, which had been interrupted by the pandemic and resumed after a four-year hiatus, brought together professors, graduate students, and researchers from National Taiwan University and the University of Tokyo, as well as invited Professor Xianglei Huang from the University of Michigan. Through oral presentations, poster sessions, and group discussions, participants shared their research results, covering topics such as convection processes, large-scale climate dynamics, extreme precipitation, and the application of machine learning techniques. All students from NTUAS delivered oral presentations in English, receiving high praise and insightful questions and suggestions from Japanese and American scholars in attendance.

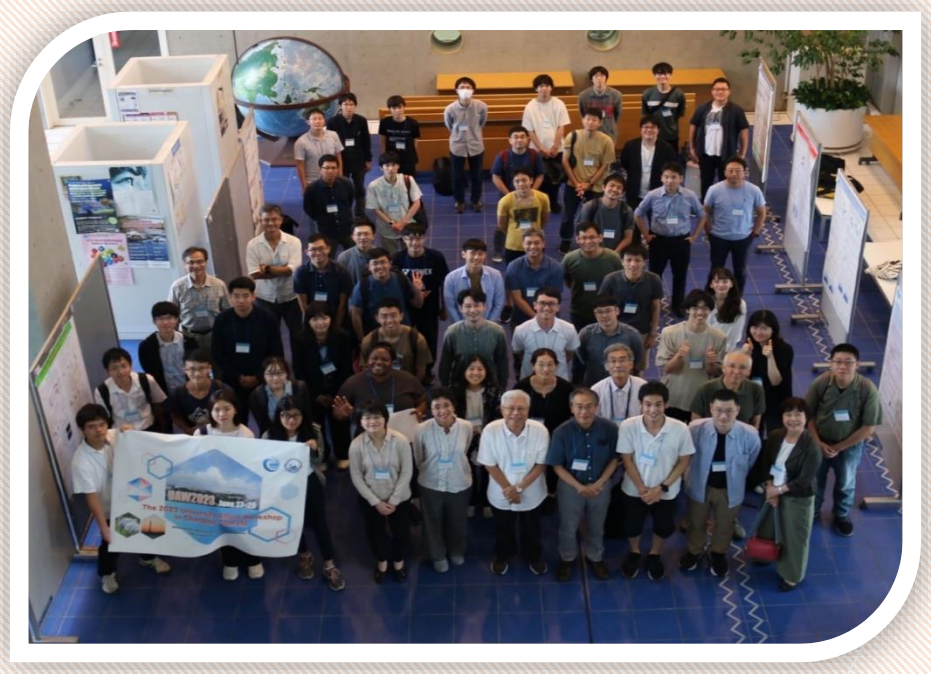
Meeting Highlights

This visit not only deepened the academic cooperation between National Taiwan University and the University of Tokyo but also provided many students with their first experience in international academic exchange activities. It enriched the participants' professional knowledge and provided a rare opportunity for face-to-face communication in the post-pandemic era. At the end of the conference, both parties agreed to hold the next UAW in 2025 at National Taiwan University, aiming to continue the established interactions and collaborate further with the University of Tokyo and other international research teams to advance research in the field of climate and extreme weather.

大氣科學系師生共23人於2023年6月26至29日參訪日本東京大學筑波校區的大氣與海洋研究中心（Atmosphere and Ocean Research Institute, AORI），參加氣候與極端天氣大學聯盟研討會"The University Allied Workshop on Climate and Extreme Weather (UAW)"。

本次UAW研討會是受疫情影響中斷後，睽違四年重新舉辦，匯集了來自台灣大學和東京大學的教師、研究生以及研究人員，也邀請到美國密契根大學黃象磊教授參加。通過口頭報告、海報發表和分組討論，分享了各自的研究成果，內容涵蓋了對流過程、大尺度動力、極端降水和機器學習技術的應用等。所有大氣系同學都上台進行了英文的口頭發表，與會者的日本與美國學者都對同學們的報告給予高度肯定，也提供深入的提問與建議。

這次參訪不僅加深了台灣大學與東京大學之間的學術合作，也是許多同學首度參與國際學術交流活動，除了豐富了與會者們的專業知識。面對面的交流在疫情後更顯難得。會議結束前雙方也約定兩年後在台大舉辦下一次的2025 UAW，期待延續此次參訪建立的互動，與東京大學以及其他國際研究團隊進一步合作，共同推進氣候與極端天氣研究領域的發展。



Parallel Session of the 2023 NTU-UTokyo Joint Conference -“Climate Service”

The 2023 NTU-UTokyo Joint Conference, a university-level exchange event between National Taiwan University (NTU) and the University of Tokyo (UTokyo), took place on December 7th to 8th on the NTU campus. As part of this event, a Parallel Session on “Climate Service” was held on the afternoon of December 7th in the Department of Atmospheric Sciences. This session focused on the theme "Toward the Scientific-Based Climate Service: Developing km-Scale Climate Models for Simulating Future Weather."

Associate Professor Wei-Ting Chen from the NTU Department of Atmospheric Sciences (NTUAS) presided over the Parallel Session on Climate Service. The opening remarks were delivered by Prof. Chun-Chieh Wu, Dean of the NTU College of Science (CoS), and Prof. Cheng-Ku Yu, Chair of NTUAS. Following the opening, Prof. Masaki Satoh from the Atmosphere and Ocean Research Institute (AORI) at UTokyo and Prof. Chien-Ming Wu from NTUAS provided keynote speeches, sharing their research. Prof. Masaki Satoh introduced the development process of the Nonhydrostatic ICosahedral Atmospheric Model (NICAM), currently the global model with the highest horizontal resolution independently developed by Japan. He discussed NICAM’s applications in projects such as EarthCARE satellite and the geoengineering program for typhoon disaster reduction in the MOONSHOT program. Prof. Chien-Ming Wu presented the scientific foundation and achievements of the Taiwan Vector Vorticity Equation Cloud-Resolving Model (TaiwanVVM), developed independently by the team at NTU. He demonstrated TaiwanVVM’s application in simulating the variations of the afternoon thunderstorms under warming scenarios and its potential impacts.

During the subsequent question and discussion session, professors and students exchanged experiences and challenges in developing high-resolution simulations at NTU and UTokyo. They also explored potential ways of utilizing climate models to provide climate service information and brainstormed for future collaboration and exchange between the two institutions.

Meeting Highlights

2023年臺大（NTU）東大（UTokyo）雙邊論壇（NTU-UTokyo Joint Conference）校級交流活動於12月7至8日在臺大校園舉辦，其中Climate Service分場論壇於12月7日下午在大氣科學系舉行，主題為「朝向以科學為基礎的氣候服務：發展公里等級氣候模式以模擬未來天氣（Toward the scientific-based climate service: Developing km-scale climate models for simulating future weather）」。

Climate Service分場論壇由大氣科學系陳維婷副教授主持，首先由理學院院長吳俊傑教授和大氣科學系系主任游政谷致詞，接著由東京大學大氣與海洋研究中心（AORI）的Masaki Satoh教授和台大大氣系吳健銘教授提供專題演講分享他們的研究。Masaki Satoh教授介紹日本自主研發Nonhydrostatic ICosahedral Atmospheric Model（NICAM）全球雲解析模式的歷程，這是目前水平解析度最高的全球模式，他也分享了NICAM在EarthCARE衛星和與MOONSHOT颱風減災地球工程相關計畫之應用。吳健銘教授則介紹台大自主研發Taiwan vector vorticity equation cloud-resolving model（TaiwanVVM）的科學基礎與成果，並應用TaiwanVVM模擬了解暖化情境下台灣午後對流的變化與其潛在衝擊。之後的提問討論時間，現場與會的教授和學生們交換了台大與東大發展高解析模擬的經驗與挑戰，以及運用氣候模式提供氣候服務資訊的可能方式，透過不同的想法與思維的腦力激盪來規劃雙方未來的合作與交流方向。

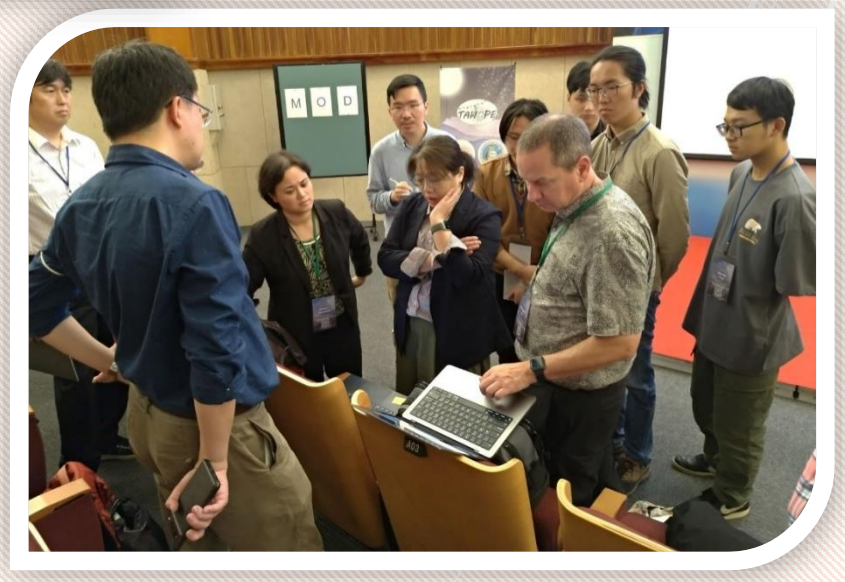
2023 TAHOPE Experimental Data Analysis and Scientific Research Workshop

Researchers in the Taiwan-Area Heavy rain Observation and Prediction Experiment (TAHOPE) campaign conducted intensive observation experiments focused on severe weather phenomena (afternoon convection, Mei-Yu front, and typhoons) in the Taiwan region from May to August 2022, executing a total of 11 Intensive Observation Periods (IOPs) with fruitful results. The "2023 TAHOPE Experimental Data Analysis and Scientific Research Workshop" was jointly organized by the Principal Investigator of the TAHOPE Integrated Project, Professor Yang Ming-Ren from the Department of Atmospheric Sciences at National Taiwan University, and Professor Guo Hong-Ji, Director of the Climate Weather Disasters Research Center at National Taiwan University. The workshop was co-organized by the National Science and Technology Commission and the Central Weather Bureau of the Ministry of Transportation. It was held at the International Conference Hall of the College of Science's Si-Liang Building from 9:00 AM on November 29, 2023, to 5:00 PM on December 1, 2023. The first two days of the workshop focused on academic conferences, including group discussions, the exchange ceremony of TAHOPE observation data among the United States, Japan, and Taiwan, and the signing ceremony of a memorandum of understanding (MOU) between the Taiwan University Disaster Center and Nagoya University and Yokohama National University. The third day included a field trip to Yangmingshan National Park and Chinese Culture University.

The conference emphasized the quality control of TAHOPE observation data and the preliminary scientific research and analysis results of severe weather cases during the observation experiments. In addition to inviting principal investigators from the United States and Japan and scholars who participated in the experiments, a total of 128 domestic and foreign scholars and graduate students attended the workshop, sharing their rich research results with each other.

Meeting Highlights

「臺灣區域豪雨觀測與預報實驗」（Taiwan-Area Heavy rain Observation and Prediction Experiment；TAHOPE）於 2022 年 5–8 月期間進行以臺灣地區為主體之國際聯合劇烈天氣（午後對流、梅雨與颱風）的密集觀測實驗，研究團隊一共執行 11 次 IOPs，成果相當豐碩。此次「2023 年 TAHOPE 實驗資料分析與科學成果研討會」是由 TAHOPE 整合計畫之總計畫主持人臺大大氣系楊明仁教授與臺大氣候天氣災害研究中心主任郭鴻基教授共同主辦，會議協辦單位為國家科學及技術委員會與交通部中央氣象署，舉辦地點為理學院思亮館國際會議廳，自 2023 年 11 月 29 日上午 9 時至 12 月 01 日下午 5 時，研討會前兩天以學術會議為主，還包含分組討論、美日臺三國交換 TAHOPE 觀測資料儀式以及臺大天災中心與名古屋大學、橫濱國立大學的 MOU 簽署儀式，第三天安排陽明山國家公園與文化大學的參訪考察行程。此會議著重於 TAHOPE 觀測資料的品質控制方式及觀測實驗期間劇烈天氣個案的初步科學研究和分析的結果，除了邀請美日兩國的主要計畫主持人及實際參與實驗的學者與會，另有國內外學者及研究生共計128位參加此研討會，彼此分享豐富的研究成果。



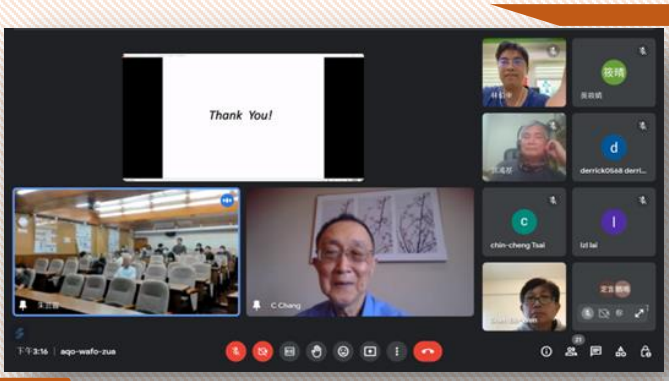
Group photo of Seminar on February 23th, 2023 for the visitor: Dr. Emmanuel Fontaine

Group photo of Seminar on March 8th, 2023 for the visitor: Dr. Shih-How Lo

Group photo of Seminar on March 9th, 2023 for the visitor: Prof. Wei-Chyung Wang and Prof. Soon Il An

Group photo of Seminar on March 10th, 2023 for the visitor: Prof. Fei-Fei Jin

Group photo of Seminar on March 13th, 2023 for the visitor: Prof. Robert Fovell



Group photo of Seminar on March 16th , 2023 for the visitor: Prof. Chih-Pei Chang

Group Photo of Seminar on March 23th, 2023 for the visitor: Prof. Jin-Yi Yu

Group Photo of Seminar on March 30th, 2023 for the visitor: Dr. Ting-Yu Cha

Visitors

Group Photo of Seminar on April 13th, 2023 for the visitor: Prof. Bo-Wen Shen

Group Photo of Seminar on April 18th, 2023 for the visitor: Dr. Yi-Hsuan Chen

Group Photo of Seminar on April 25th, 2023 for the visitor: Dr. Wan-Ling Tseng

Group Photo of Seminar on May 2nd, 2023 for the visitor: Prof. Yueh-Ning Lee

Group Photo of Seminar on May 9th, 2023 for the visitor: Prof. Otto Klemm

Group Photo of Seminar on May 16th, 2023 for the visitor: Prof. Jhih-Hao

Group Photo of Seminar on May 18th, 2023 for the visitor: Prof. Tim Li

Group Photo of Seminar on May 18th, 2023 for the visitor: Prof. Chih-Pei Chang

Group Photo of Seminar on on May 23th, 2023 for the visitor: Dr. Anupam Hazra

Group Photo of Seminar on May 25th, 2023 for the visitor: Prof. Li-Pen Wang

Group Photo of Seminar on May 30th, 2023 for the visitor: Prof. Axel Timmermann

Group Photo of Seminar on June 1st, 2023 for the visitor: Dr. Chun-Yian Su

Group Photo of Seminar on July 21st, 2023 for the visitor: Prof. Ching-Yao Lai

Group Photo of Seminar on July 11st, 2023 for the visitor: Prof. Yuh-Lang Lin and Prof. Yu-Len Chen

Group Photo of Seminar on September 1st, 2023 for the visitor: Dr. Ting-Chen Chen

Group Photo of Seminar on September 12th, 2023 for the visitor: Prof. Haojia Abby Ren

Visitors

Group Photo of Seminar on September 19th, 2023 for the visitor: Prof. Yosuke Sakamoto

Group Photo of Seminar on September 21st, 2023 for the visitor: Dr. Bo-Jun Chung

Group Photo of Seminar on September 26h, 2023 for the visitor: Dr. Shih-Wei Fang

Group Photo of Seminar on October 24th, 2023 for the visitor: Dr. Frank Li

Group Photo of Seminar on November 3th, 20 for the visitor: Prof. Zhaoxia Pu

Group Photo of Seminar on November 16th, 2023 for the visitor: Dr. Yong-Fu Lin

Group Photo of Seminar on November 16th, 2023 for the visitor: Dr. Li-Chung Wang

Group Photo of Seminar on November 20th, 2023 for the visitor: Prof. Xianglei Huang

Group Photo of Seminar on November 23th, 2023 for the visitor: Prof. Song Yang

Group Photo of Seminar on November 28th, 2023 for the visitor: Prof. Michael Bell and Prof. Kristen Rasmussen

Group Photo of Seminar on December 6th, 2023 for the visitor: Dr. Tang Yiping

Group Photo of Seminar on December 12th, 2023 for the visitor: Prof. Timothy Garrett

Group Photo of Seminar on December 19th, 2023 for the visitor: Prof. Qiang

Group Photo of Seminar on December 19th, 2023 for the visitor: Prof. Pao-Shin Chu

Visitors

Group Photo of Seminar on December 20th, 2023 for the visitor: Dr. Josh Wurman

Group Photo of Seminar on December 21th, 2023 for the visitor: Dr. Chiung-Yin (Jenny) Chang

Group Photo of Seminar on December 26th, 2023 for the visitor: Dr. Sam Peng

Group Photo of Seminar on December 26th, 2023 for the visitor: Prof. Chun-Han Lin

Date	Speaker	Unit	Title
112/2/23	Dr. Emmanuel Fontaine	CNRM/Centre d'études en météorologie satellitaire (CEMS)	NWCGEO: Suite of Softwares for Nowcasting with Geostationary Satellites and Research Tools
112/3/9	Prof. Wei-Chyung Wang	ASRC, SUNY-Albany	A Neural Network-based Scale-Adaptive (NSA) Cloud-Fraction Scheme for GCMs
112/3/9	Prof. SOON IL AN	Department of Atmospheric Sciences, Yonsei University, Seoul, South Korea	Hysteresis and Irreversibility of the Climate System in CO2 Removal Experiment
112/3/10	Prof. Fei-Fei Jin	University of Hawaii	On Quantifying Global Warming and an Approach to El Niño-Southern Oscillation Dynamics
112/3/13	Prof. Robert Fovell	Atmospheric & Environmental Sciences, University at Albany SUNY	Windstorms and Fires
112/3/16	Prof. Chih-Pei Chang	(Department of Atmospheric Sciences, National Taiwan University)	Talk 1: Strong Impact of Mesoscale Terrain on Large-Scale Monsoon Rainfall Season Transition Talk 2: Low Predictability of Monsoon Rainfall in Western Continental Regions during ENSO Period
112/3/23	Prof. Jin-Yi Yu	Department of Earth System Science, University of California, Irvine	Multi-Year La Nina Dynamics and Its Distinct Climate Impacts
112/3/30	Dr. Ting-Yu Cha	Department of Atmospheric Science, Colorado State University	Investigation of the Dynamics of Tropical Cyclone Precipitation Structure Using Radar Observations
112/4/13	Prof. Bo-Wen Shen	Department of Mathematics and Statistics, San Diego State University	Attractor Coexistence and Butterfly Effects Within Lorenz Models and a Generalized Lorenz Model
112/5/9	Prof. Otto Klemm	University of Münster, Climatology Research Group, Münster, Germany	Urban Aerosol Pollution as Captured with a Mobile Platform
112/5/18	Prof. Chih-Pei Chang	Special Chair Professor, Department of Atmospheric Sciences, National Taiwan University	Viewing Natural Theology from the Perspective of a Meteorologist: God, Time, and Human Free Will
112/5/18	Prof. Tim Li	University of Hawaii	Moist Baroclinic Instability along the Meiyu Front
112/5/23	Dr. Anupam Hazra	Indian Institute of Tropical Meteorology	Prediction of Deep Convective Clouds (Heavy Rainfall & Lightning) over India: Research on 2M and 3M Microphysical Scheme in WRF Model
112/5/30	Prof. Axel Timmermann	IBS Center for Climate Physics, Pusan National University	Climate Change Effects on Human Evolution

Visitors

112/6/1	Dr. Chun-Yian Su	Postdoctoral Scholar, Department of Meteorology and Atmospheric Science, The Pennsylvania State University	Modulation of Tropical Convection-Circulation Interaction by Aerosol Indirect Effects in a Global Convection-Permitting Model
112/6/8	Yan-Ting Chen	PhD Candidate, Department of Atmospheric and Oceanic Sciences, McGill University, Montreal, Quebec, Canada	A Minimal Recipe of Instantaneous CO2 Forcing
112/6/20	Dr. Hsiang-He Lee	Lawrence Livermore National Laboratory	Resolving Away Stratocumulus Biases in Modern Global Climate Models
112/7/11	Prof. Yuh-Lang Lin	Physics, CoST, NC A&T State University, USA	Formation Mechanisms for Severe Downslope Winds and Their Implications to Wildfires over Lee Slopes
112/7/11	Prof. Yuh-Lang Chen	University of Hawaii	An Overview of Mei-Yu Jet/Front Systems
112/7/21	Prof. Ching-Yao Lai	School of Sustainability, Stanford University	Changing Ice in a Warming Climate
112/9/1	Dr. Ting-Chen Chen	Institute of Meteorology and Climate Research (IMK), Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany	Impacts of Global Warming on the Development of Extratropical Cyclones in Idealized Simulations
112/9/12	Prof. Haojia Abby Ren	Department of Geoscience, National Taiwan University	Centennial Increase of the Western Boundary Transport in the Tropical South Pacific Ocean
112/9/19	Prof. Yosuke Sakamoto	Graduate School of Global Environmental Studies, Kyoto University, Japan	Evaluation of Unquantified Reaction Pathways in Photochemical Oxidant Formation Based on HOx Reactivity Measurements
112/9/21	Dr. Bo-Jun Chung	Department of Earth and Planetary Sciences, University of California, Santa Cruz	Sea Ice Loss, Water Vapor Increases, and Their Interactions with Atmospheric Energy Transport in Driving Seasonal Polar Amplification
112/9/26	Dr. Shih-Wei Fang	Max Planck Institute for Meteorology, Germany	Disentangling Climate Responses to Volcano Eruptions from Intrinsic Variability
112/10/24	Dr. Frank Lin	Department of Earth and Planetary Sciences, Harvard University	Inferring the Linkage of Surface Wind Stress, Sea Surface Temperature and Sea Surface Height Anomalies with the Falling Ice Radiative Effects Using Satellite Measurements and Global Climate Models in CMIP5 and CMIP6: A Highlight

112/11/16	Dr. Li-Chung Wang	Postdoctoral Research Associate, PNNL	Modeling Near-Surface Turbulence and Its Application in Convection-Cloud Chambers via Large-Eddy Simulations, Direct Numerical Simulations, and Machine Learning
112/11/20	Prof. Xianglei Huang	University of Michigan, Department of Climate and Space Sciences and Engineering	Studying Climate through a Spectral Lens
112/11/23	Prof. Song Yang	School of Atmospheric Sciences, Sun Yat-sen University	Atmosphere-Ocean Coupled Processes over the Pacific Involved in Monsoon-ENSO Interactions
112/11/28	Prof. Michael Bell	Colorado State University	The Structure of Rapidly Intensifying Tropical Cyclones
112/11/28	Prof. Kristen Rasmussen	Colorado State University	Extreme Storms in Current and Future Climate: Perspectives from Global and Convection-Permitting Regional Climate Models
112/12/6	Dr. Tang Yi-Ping	Department of Earth and Planetary Sciences, Harvard University	Radiative–Convective Equilibrium (RCE) over Water-Limited Land Surfaces
112/12/12	Prof. Timothy Garrett	Department of Atmospheric Sciences, University of Utah	The Overlooked Impact of Turbulence on the Settling Speed of Precipitation
112/12/19	Prof. Qiang Fu	Department of Atmospheric Sciences University of Washington, Seattle, WA, USA	Response of terrestrial aridity to global warming
112/12/19	Prof. Pao-Shin Chu	Department of Atmospheric Sciences University of Hawaii-Manoa	Seasonal advance of intense tropical cyclones in a warming climate
112/12/19	Prof. Qiang Fu	Department of Atmospheric Sciences University of Washington, Seattle, WA, USA	Optical Properties of Ice Clouds and Tropical Tropopause Layer Cirrus and their Impacts on Temperature and Troposphere-stratosphere Transport
112/12/20	Dr. Josh Wurman	Center for Severe Weather Research	Doppler On Wheels Observations of Tornadoes, Hurricanes, Wildfires, and Other Good Weather
112/12/21	Dr. Chiung-Yin (Jenny) Chang	Postdoctoral Research Associate, Geophysical Fluid Dynamics Laboratory,NOAA	The day after tomorrow: climate model uncertainties and how we deal with them
112/12/25	Prof. Johnny Luo	Professor and Chair, Dept. of Earth & Atmospheric Sciences, City University of New York, City College	Examining satellite observations of convective clouds through the lens of a plume model
112/12/26	Prof. John Lin	Department of Atmospheric Sciences, University of Utah	Greenhouse gases and pollutants in cities: from local to global scales
112/12/26	Dr. Sam Peng	Department of Meteorology and Atmospheric Science The Pennsylvania State University	Afternoon Rainfall, MCS Initiation, and Diurnal Gravity Wave over the Bay of Bengal: Observation and a Linear Theory

Tropical Pacific in a Changing Climate

Why haven't there been any typhoons passing through Taiwan for several years? Why have there been several this year (2023)? The formation and tracks of typhoons are tightly related to the patterns of sea surface temperatures in the Pacific. Specifically, whether the sea surface temperature in the cold tongue region of the eastern equatorial Pacific is higher than average (as in El Niño years) or lower than average (as in La Niña years), and the duration and spatial distribution of these anomalous sea surface temperatures, have significant impacts on large-scale atmospheric circulation and the associated weather phenomena. It's not just the formation and path of typhoons that are affected; many phenomena around the world, such as heatwaves, droughts, forest fires, and floods, are also directly influenced by the changes in the sea surface temperature pattern in the tropical Pacific.

Currently, a challenge in the field of climate science is predicting the trends in sea surface temperature pattern in the tropical Pacific Ocean. Although climate models all capture the essential physics of thermodynamic factors such as global average temperature rise and sea ice melting, there is still considerable uncertainty regarding dynamic factors such as large-scale circulation, as well as the corresponding distribution of sea temperature and precipitation. Predicting sea surface temperature in the eastern Pacific appears to be particularly challenging. Nearly all climate models simulate an enhanced warming in this region in the past few decades, which is consistent with energetic theories in global warming literature. However, it contradicts satellite remote sensing and buoy in situ measurement data since 1979. Even taking into account anthropogenic forcing as greenhouse gases and aerosols, natural factors like volcanic eruptions and solar sunspots, and conducting ensemble members with fifty to a hundred different initial values, most climate models still have not been able to simulate the observed long-term cooling trend in the equatorial and southeastern Pacific over the past forty years.

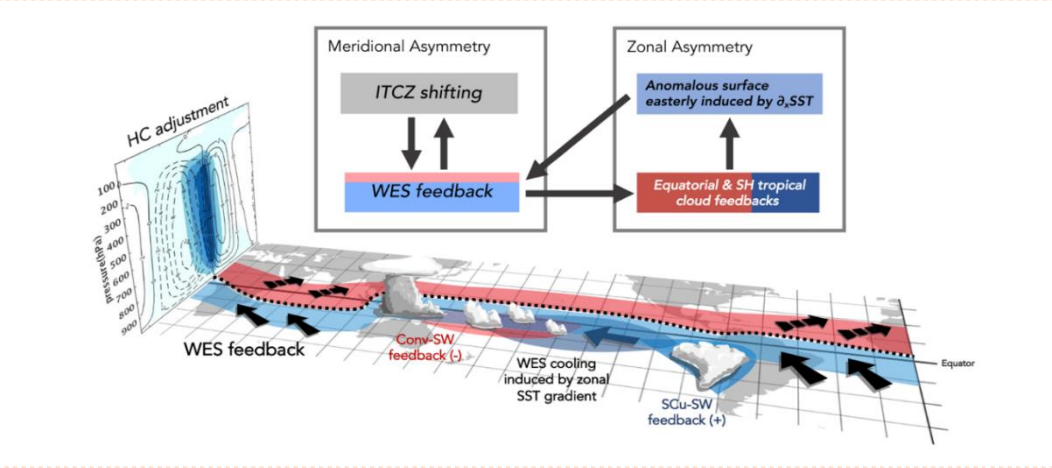
Group led by Associate Professor Yen-Ting Hwang offer a path to understand the model-observation discrepancy. The research team incorporated an ideal step function type radiative forcing into a hierarchy of climate models to systematically clarify the temporal and spatial characteristics of the tropical responses to anthropogenic forcings with three distinct timescales: atmospheric dynamics, air-sea interactions, and ocean circulation adjustments. This research approach, different from traditional studies focusing on atmospheric and oceanic wave characteristics related to Pacific interdecadal oscillation, focuses on the dynamic system's response to radiative changes. For example, when the atmosphere in the Northern Hemisphere rapidly warms due to anthropogenic climate change, the resulting adjustments in atmospheric circulation and the associated air-sea interactions cause a counterintuitive cooling in the southeastern Pacific and the equatorial Pacific, with spatial features consistent with observational data (see the figure below). This simulation of air-sea interaction involves changes in boundary layer cumulus clouds, which are challenging to capture with the resolution and parameterization methods of current climate models. Building upon the theoretical understanding mentioned above, Associate Professor Hwang research team participated this year in the TROPICS (TROpical PacIfiC SST Warming PatternS working group) supported by the World Climate Research Program's Climate and Ocean Variability, Predictability and Change (CLIVAR) initiative. Future plans involve international collaborative projects with interdisciplinary experts to provide more reliable predictions for sea surface temperature patterns.

氣候變遷下的太平洋

為什麼有好幾年沒有颱風登入台灣？為什麼今年一來就來了好幾個？颱風生成和路徑的變化與太平洋海溫分佈的趨勢有關。具體來說：東赤道太平洋冷舌的海溫是偏高（聖嬰年）還是偏低（反聖嬰年），以及此區的異常海溫的持續時間與空間分佈為何，對大尺度大氣環流以及其伴隨的天氣現象有直接影響。不只是颱風的生成和路徑，世界各地許多熱浪、旱災、森林大火、水災等現象也都直接受到熱帶太平洋的海溫分佈變化的影響。

氣候領域當前的挑戰之一即是預測熱帶太平洋海表溫度分佈的趨勢。儘管氣候模式對於全球均溫上升、海冰融化等熱力因素的模擬已經相當成熟，然而對於大尺度環流等動力因素以及相應的海溫和降雨分佈，仍然存在著相當高的不確定性。就東赤道太平洋的海溫而言，幾乎所有的氣候模式的模擬都顯示，相較於附近海域，在過去幾十年間此區的海溫上升特別顯著。這種上升趨勢，與聖嬰年間沃克環流減弱的情境類似，也符合能量平衡理論的預測。然而，這一結果卻與1979年至今的衛星遙測以及浮標在地量測數據相矛盾。即便考量了溫室氣體和氣膠等人為污染物、火山爆發和太陽黑子等自然因子，加上世界上多個大氣候中心分別進行了五十到一百個不同初始值的叢集模擬，大多數的氣候模式仍未能模擬出過去四十多年來赤道太平洋和東南太平洋的長期降溫趨勢。

大氣系黃彥婷副教授領導的氣候動力與全球變遷研究室最近的研究成果對於釐清模式與觀測之間的差異提出了解釋。研究團隊於漸進式複雜度的數值模式中加入理想的階躍函數型（step function）輻射強迫力，有系統的釐清大氣動力、海氣交互作用、以及海洋環流調整等過程的時間和空間特性。這種研究方法不同於傳統專注於與太平洋年代際震盪相關的大氣和海洋波動特性的研究，而是專注於動力系統對輻射變化的響應。舉例來說，當北半球的大氣受到人為氣候變遷影響急遽增暖時，大氣環流的調整所引發的海氣交互作用，導致東南太平洋和赤道太平洋出現逆勢降溫，空間特徵與觀測資料相符(見下圖)。此一海氣交互作用的模擬涉及邊界層層積雲的變化，這是當今氣候模式的解析度和參數化方式難以掌握的。奠基在上述理論機制突破的基礎上，黃副教授的研究團隊在今年參與了世界氣候中心支持的Climate and Ocean Variability, Predictability and Change (CLIVAR) 工作小組TROPICS (TROpical PacIfiC SST Warming PatternS working group)，未來將透過國際合作計畫，與跨領域的專家合作，對未來海溫分佈提出更可靠的預報。



（圖片出處：Hsiao et al. 2022, GRL）

參與計畫成員：台大大氣系暨研究所 曾弘毅、陳永真、陳勇志、羅文新、胡芮嘉、蕭維廷(現就讀於Colorado State University博士班)

Origin of Outer Tropical Cyclone Rainbands

Outer tropical cyclone rainbands (TCRs) are a concentrated region of heavy precipitation and hazardous weather within tropical cyclones (TCs). Outer TCRs pose considerable risk to human societies, but the origin of outer TCRs is a long-standing, unresolved topic in the TC research community. To explore this issue, Prof. Cheng-Ku Yu, postdoctoral researcher Che-Yu Lin and graduate student Chi-Hang Pun perform analyses on a total of 1029 outer TCRs identified during their formative stage by long-term radar observations collected near Taiwan from 2002 to 2019. The observations provide a robust foundation of our knowledge regarding the natural diversity of the outer TCR origin. These important results have been published in the high-impact journal of Nature Communications (https://www.nature.com/articles/s41467-023-42896-x).

One of the striking findings is that current theories of outer TCRs cannot appropriately explain the observed TCR characteristics and statistics. A dominant portion of the identified TCRs (97%) tend to be initiated locally in the outer TC region. This outer-origin dominance is in distinct contrast to numerous theoretical modeling studies of outer TCRs that propose inner-origin scenarios. Moreover, the formative fractions of the identified outer TCRs within and outside the storm radius of TCs (R34) are dramatically different, equal to 29% and 71%, respectively, indicating that outer TCR formation occurs mostly in regions beyond the operational TC alert area. A dominant majority of the identified TCRs possess radial propagation velocities within the range of ±10 m s-1, with evidence for both outward and inward propagation. Compared to the radial propagation, the tangential propagation of outer TCRs is generally much faster and predominantly cyclonic, which is consistent with the influence of TC vortex circulations. Large discrepancies between these observed propagation characteristics and theoretically predicted propagation velocities of both GWs and VRWs are found, suggesting that wave disturbances do not have a direct impact on the origin of the observed outer TCRs. This result contrasts sharply with inner TCRs that have been recognized to be closely related to wave activities triggered near the eyewall.

Analyses from this study provide supportive evidence that squall-line dynamics may play an important role in contributing to the formation of outer TCRs. The observed outer TCRs appear to have a statistical preference for both a squall-line environment and cold pool propagation behavior. In particular, the initiation of faster, squall-line-like outer TCRs preferentially take place immediately adjacent to the outer boundary of prominent precipitation in the outer regions of TCs, and this preexisting outer precipitation may act as an initial, critical provider of cold pools to activate the operation of squall-line dynamics (Fig. 1a). Examining the causes of outer precipitation and clarifying its roles in contributing to the occurrence of cold pools during the preformation stage of rainbands would thus be a necessary task that would help improve our understanding of the initiation of outer TCRs. On the other hand, the formative scenario closely related to squall-line dynamics is expected to occur frequently but not exclusively because a considerable number of the observed outer TCRs do not actually exhibit squall-line environmental and propagation characteristics. These non-squall-line outer TCRs propagate relatively slower and tend to be initiated in the precipitation-free or widely-scattered, weak precipitation area (Fig. 1b). Formative mechanisms other than squall-line dynamics must also exist and deserve future exploration.

Although this study provides important findings and implications, our understanding on the origin of outer TCRs is clearly incomplete. Future efforts and observational programs should pay special attention to the outer-origin processes and the identification of possible cold pool sources by collecting more complete observations of three-dimensional kinematics, thermodynamics and precipitation in the outer environment of TCs during a very early stage of rainband development. Making these datasets available, together with high-resolution numerical simulations, is critical for developing a theoretical model of how squall-line dynamics operates to form outer TCRs and to seek other unidentified processes responsible for the initiation of outer TCRs.

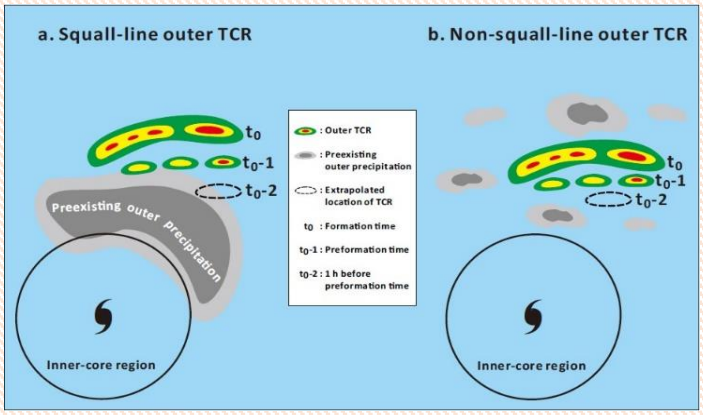


Fig. 1. Schematic diagram illustrating the formative scenario for the squall-line outer TCR (a) and the non-squall-line outer TCR (b), and their embedded precipitation characteristics are particularly highlighted. The solid circle denotes the inner-core boundary of tropical cyclones.

熱帶氣旋外圍雨帶之起源

熱帶氣旋(颱風)是自然界最具破壞力的天氣系統，而熱帶氣旋外圍雨帶(outer tropical cyclone rainbands, TCRs)是其風暴範圍內劇烈降水與危險天氣集中區域之一。儘管過去數十年來氣象界已針對外圍雨帶的各個面向進行探究，但是外圍雨帶的起源仍舊是大氣界未解之謎。導致此狀況主要有兩個原因：首先，長久以來對於熱帶氣旋外圍雨帶生成的了解大多來自於理想化的數值模擬研究，而這些理論研究缺乏實際觀測的驗證，因此所提出的生成機制具高度不確定性。其次，在海上發展的熱帶氣旋主要是依賴飛機或衛星的觀測，飛機觀測的時間較短且範圍較小，而衛星觀測的範圍較廣但其時空解析度較不足，兩者通常皆無法有效捕捉到熱帶氣旋內部降水(雨帶)的實際快速演變；而且當外圍雨帶邁入成熟期後，其降水空間尺度才會變得較大，組織性也變得較好，此時才相對容易被監測與檢視。因此，幾乎所有過去的觀測研究都侷限於探討外圍雨帶成熟期的結構特徵，對於雨帶生成期各種狀態的探索幾乎付之闕如。

本系游政谷教授研究團隊利用2002~2019年長期的台灣全島地面雷達觀測網資料(中央氣象署提供)、大尺度再分析資料及其它熱帶氣旋觀測資訊，從95個侵台颱風中成功辨識出1029個在初生階段的外圍雨帶，並透過此巨大雨帶資料庫進行詳細的統計與診斷分析，嘗試釐清熱帶氣旋外圍雨帶的生成過程，相關研究成果刊登於卓越期刊Nature Communications。

研究顯示，絕大部分的外圍雨帶(約97%)都是在熱帶氣旋外圍區域生成(outer origin)，此觀測結果與理論(模擬)研究強調外圍雨帶是在熱帶氣旋內圍區域生成(inner origin)並向外移行至外圍區域的論點大相逕庭。而絕大多數外圍雨帶的移速與重力波(gravity waves)或渦旋羅士比波(vortex Rossby waves)的理論傳播速度有明顯不一致，據此推斷大氣波動對於外圍雨帶的起源並沒有直接貢獻。此外，論文進一步指出，外圍雨帶生成區域常常具有類似颮線環境的低層垂直風切與內流特性，且移速較快的類颮線(squall-line)外圍雨帶傾向於在熱帶氣旋外圍降水區的邊緣地帶形成，這些原先存在於外圍區域的降水可能為冷池(cold pool)的關鍵初始來源，並透過冷池與低層垂直風切交互作用(即颮線動力，squall-line dynamics)進而促使雨帶的生成。另一方面，並非所有的熱帶氣旋外圍雨帶皆會表現出與颮線類似的環境與移動特徵，統計顯示這些非颮線(non-squall-line)雨帶並不少見，然而其移速相對較慢，且經常在無顯著降水或是在廣泛分散的弱降水區域中形成，這些特性與類颮線外圍雨帶形成強烈對比。很顯然地，原本存在於熱帶氣旋外圍周遭的環境降水特徵是決定類颮線外圍雨帶與非颮線外圍雨帶的重要因子。

雖然本論文對於熱帶氣旋外圍雨帶起源提供了科學上重要的線索和啟示，但也突顯了我們對它瞭解的不足；尤其是熱帶氣旋內部冷池的各種可能來源、局部低層垂直風切的時空變異性、非颮線外圍雨帶生成過程以及outer-origin過程的理論模型建構，仍有待未來更多熱帶氣旋觀測與模擬研究的探索與努力。

發表資訊：Yu, C.- K., C.- Y. Lin and C.- H. Pun, 2023: Origin of outer tropical cyclone rainbands. Nat. Commun., 14, 7061 (2023). doi:10.1038/s41467-023-42896-x. 作者群為游政谷教授，博士後研究員林哲佑及研究生潘知行。論文作者特別感謝臺大與國科會對本研究的支持。

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