



Newsletter

National Taiwan University

Department of Atmospheric Sciences

No. 11 January 2019

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Visitors

Prof. Sobel AM (Columbia U, USA), Dr. Martin Z (Columbia U, USA), Prof. Tsuboki K. (Nagoya U, Japan), Prof. Tao WK(NASA, USA), Prof. Kuwat M (Nanyang T. U, Singapore), Prof. Xu W (Colorado State U, USA), Prof. Kim H (Stony Brook U, USA), Prof. Wang WC (U. at Albany, SUNY, USA), Prof. Nugent AD (Hawaii U, USA), Dr. Lee WC (NCAR/EOL/RSF, USA), Prof. Dong SC (Arizona U, USA), Dr. Maroon E (NCAR, USA), Dr. Lee C (KMA, Korea)

Meeting Highlights

- 2018 Cross-Straits Science Seminar on Atmospheric Sciences
- 6th KU-NTU Atmospheric Science Students/Young Scientists Exchange

Research Highlights

- The environment of aggregated deep convection
- Local and Remote Control on Tropical Circulation and Precipitation under Anthropogenic Climate Change

2018 Doctors' and Masters' Theses

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Awards

Prof. Cheng-Ku Yu's research results was published on the British
ature Series Scientific Reports in 2018.

Prof. Chung-Hsiung Sui received the Performance Academic Staff
Award, College of Science in 2018.

Prof. Chien-Ming Wu received the Ta-Yu Wu Memorial Award,
Ministry of Science and Technology in 2018.

Prof. Min-Hui Lo was promoted to Associate Professor in 2017.

Prof. Chien-Ming Wu was promoted to Associate Professor in 2018.

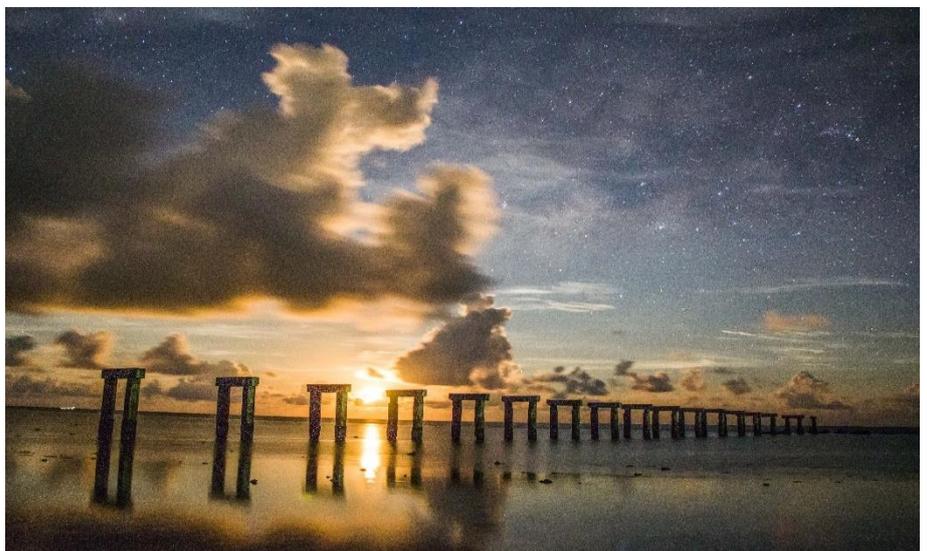
游政谷教授研究成果獲登英國 Nature 系列期刊 Scientific
Reports。

隋中興教授榮獲 106 學年度理學院績優教研人員。

吳健銘副教授獲 2018 年科技部吳大猷獎。

羅敏輝升等副教授。

吳健銘升等副教授。



太平島舊棧道(大氣系研究生黃或珉攝於南海雙島季風觀測實驗)

Personnel Changes

Prof. Mong-Ming Lu was appointed as a Project Professor on August 1, 2018.

Ms. I-Ching Tu left the department on February 1, 2018.

Ms. Shih-Ping Chang started to serve in the department on November 15, 2018.

Mr. Jan-Feng Chang retired from the department on December 31, 2018.

盧孟明老師自 2018 年 8 月 1 日起新聘為本系專案計畫教授。

杜宜靜幹事於 2018 年 2 月 1 日離職。

張詩蘋自 2018 年 11 月 15 日起於本系服務。

張然峰技士於 2018 年 12 月 31 日退休。

The Department Retreat

The Department Retreat was held on September 25, 2018 at NTU Chupei Campus for discussing the future research and teaching directions.

本系教師參加靜修會，針對未來的發展，包含教學、研究各方面進行深入討論。



A group photo of the department retreat on Sep. 25, 2018.

NTU Azalea Festival

The NTU Azalea Festival is held in March every year. It was held on March 10-11 this year, which includes department exhibitions, student club exhibitions and performances attracting high school students from all over Taiwan. NTUAS also set up a booth, providing an introduction of our department courses and information of atmospheric sciences.



臺灣大學每年3月都會舉辦為期兩天的杜鵑花節。今年於3月10日至11日舉行，活動內容包括學系博覽會、社團聯展以及表演活動，吸引臺灣各地高中生前來參，認識臺大各個科系，作為升學時的參考。



Commencement

The Commencement of NTU took place in the morning of June 10, 2018, along with the dean's award ceremony. In the afternoon (Master student on June 16), a hooding ceremony for all new graduates of NTUAS was held in the department, with family and friends sharing this cheerful moment. The students graduating from NTUAS in 2018 include 37 Bachelors, 20 Masters and 3 Ph.Ds.



臺灣大學畢業典禮在6月10日於臺大體育館舉辦。並於當天下午(碩士班於6月16日)，在系上進行畢業典禮，由系主任撥穗，並邀請畢業班導師及畢業生親友共同參與。今年系上共有37名學士，20名碩士及3名博士畢業。

Parents' Day

NTU holds Parents' Day in September every year. NTUAS invited freshmen and their parents to visit the department and attend the department orientation.



臺灣大學於每年9月開學前，舉辦校級新生家長日。大氣系並邀請家長們了解大氣系系況、課程及環境，並進行交流活動。

NTU Anniversary Celebration Sports Day

NTU holds NTU Anniversary Sports Day in November every year. Students of NTUAS won good scores in the contest.



臺灣大學於每年11月舉行校慶運動會，大氣系由系主任林博雄教授帶領學生於賽會中贏得好成績。

2018 Study-Abroad Program

In order to enhance the undergraduate students' knowledge on overseas education program and provide an opportunity with the academic exchange for them, we invited students to join an overseas education exchange program at SUNY Albany in July, 2018. They also shared their experiences and research results at the Department of Atmospheric Science on September 27th, 2018.



之認識並且提供大學部學生學術交流之機會，2018 年 7 月前往美國紐約州立大學歐本尼分校進行海外教育交流，並於 9 月 27 日於大氣科學系舉辦海外教育計畫研究成果分享。

Students	Title
郭毓揚、陳禹安	<ul style="list-style-type: none"> - 海外教育計畫成果發表 - Discussion of the Rapid Intensification Mechanisms of Tropical Cyclone Nepartak (2016)
林蚊殊、唐一平	<ul style="list-style-type: none"> - Mapping the Hotspots of Inter-Basin Interaction in Sea Surface Temperature
陳麒瑞、徐子涵、張玉來、簡睦庭、顏建軒	<ul style="list-style-type: none"> - Is Extreme Snowfall Event the Necessary Condition of its Associate Circulation? - Comparison of Temperature Data between ASOS and NYS Mesonet stations - The experience in SUNY - The Role of Stochastic Exchange Coefficients on Tropical Cyclone Intensity Forecasts - A Case Study of An Extreme Precipitation Event in Northeast U.S. in October, 1996
孔令昀、謝欣璉	<ul style="list-style-type: none"> - 海外教育計畫成果發表 - Radar Innovation Laboratory in Oklahoma University

Progress report on NTUAS's participation in PIRE

The 2018 US-Taiwan PIRE Workshop was held in National Central University on August 13-14, the co-chairmen are Prof. Pay-Liam Lin from Department of Atmosphere of Sciences, National Central University and Prof. Everette Joseph from State University for New York at Albany. The workshop on August 13 began with the report by 10 students from State University at Albany on their internship research during summer days in Taiwan, and in the afternoon, Prof. Jong-Dao Jou of the Department of Atmospheric Studies had a keynote

speech on "afternoon convection and flood observation experiment in bi-Taipei", followed by Prof. Ching-Yuang Huang of National Central University to introduce the general situation of Taiwan Typhoon and Flood Research Institute, and the general situation of C-POL radar and removable team-r radar introduced by Prof. Yu-Chieng Liou of National Central University. On August 14, the workshop began with the round table discussion on the educational aspects of the PIRE program, followed by group discussions in details on the issues of Climate, Ensemble Prediction, Microphysics, Social Impact and Evaluation. In the afternoon, the group reported the conclusions, and the goals that the PIRE program plans to achieve, such as co-publishing academic journal papers and the number of jointly guiding doctoral students.



今年度（2018 年）的 US-Taiwan PIRE Workshop 於 8 月 13-14 日在中央大學大氣系召開，研討會主辦人為中大大氣系林沛練教授與歐本尼大學 ASRC 主任 Everette Joseph 教授。8 月 13 日的研討會先由歐本尼大學的 10 位學生們就他們暑假期間在台灣實習研究進行報告，下午則由大氣系周仲島教授就「雙北市午後對

流及洪水觀測實驗」進行專題報告，接著由中大黃清勇教授介紹颱風中心概況，以及中大廖宇慶老師介紹 C-POL 雷達與可移動式 TEAM-R 雷達概況。8 月 14 日的研討會先就 PIRE 計畫的教育層面進行圓桌會議 (round table discussion)，接著進行分組討論，分別就氣象 (Climate) 議題、系集預報 (Ensemble) 議題、雲物理 (Microphysics) 議題、社會衝擊 (Social Impact) 議題與評估 (Evaluation) 議題等進行細部溝通與分工的討論。下午則由各小組進行分組結論報告，以及 PIRE 計畫預定達到的目標如共同發表學術期刊論文及共同指導碩博士生數目等綜合討論。



A group photo for Taiwan-Philippine VOTE Project Workshop



Prof. Adam H. Sobel of Columbia University visited the department on May 3, 2018, and delivered a seminar titled "Understanding deep convection by parameterizing large-scale dynamics".

Dr. Zane Martin of Columbia University visited the department on August 7, 2018 and delivered a seminar titled "The Influence of the QBO on the MJO in Idealized Cloud-Resolving Simulations".





Prof. Kazuhisa Tsuboki of Nagoya University visited the department on August 16, 2018, and delivered a seminar titled “Aircraft observation of typhoon LAN during the T-PARCII project”.

Prof. Wei-Kuo Tao of NASA visited the department on September 27, 2018, and delivered a seminar titled “Recent Model Improvements for studying Interactions between Clouds, Precipitation and Aerosol”.



Prof. Mikinori Kuwat of Nanyang Technological University visited the department on October 2, 2018, and delivered a seminar titled “Research on wildfire haze in Southeast Asia”.



Prof. Weixin Xu of Colorado State University visited the department on October 16, 2018, and delivered a seminar titled “Boreal Summer Intraseasonal Oscillation and PISTON Field Campaign”.





Prof. Hyemi Kim of Stony Brook University visited the department on October 16, 2018, and delivered a seminar titled “Prediction of the Madden-Julian Oscillation: Current status and challenges”.

Prof. Wei-Chyung Wang of State University of New York at Albany visited the department on October 16, 2018, and delivered a seminar titled “Cloud diurnal cycle in global climate models”.



Prof. Alison Diane Nugent of Hawaii University visited the department on November 22, 2018, and delivered a seminar titled “The Dominica Experiment: Orographic Precipitation in the Tropics”.

Dr. Wen-Chau Lee visited the department on November 22, 2018, and delivered a seminar titled “Radar meteorology research progress exchange and TAHOPE Experiment Planning”.





Prof. Xiquan (She-Chwen) Dong of Arizona University visited the department on November 29, 2018 and delivered a seminar titled “Remote Sensing of Clouds and Precipitation and Their application in Model Evaluation”.

Dr. Elizabeth Maroon of NCAR Project Scientist visited the department on November 16, 2018 and delivered a seminar titled “Influence of the Atlantic meridional overturning circulation on Northern Hemisphere surface temperature trends”.



Dr. Chulkyu Lee of Korea Meteorological Administration National Institute for Materials Science visited the department on December 4, 2018 and delivered a seminar titled “Airborne measurements for atmospheric phenomena investigation over Korea with the KMA/NIMS atmospheric research aircraft”.



2018 Cross-Straits Science Seminar on Atmospheric Sciences

2018 Meteorological Conference for Cross-Taiwan-Strait Young Scientists was held from October 11 to 12. This conference was sponsored by NTUAS. The organizers were Prof. Po Hsiung Lin and Prof. Chun Chien Wu (NTUAS). The two-day conference included oral and poster presentations of invited and contributed papers on mesoscale、typhoon boundary layer gas images、climate and extreme weather and deep convection subjects.



A group photo of “2018 Cross-Straits Science Seminar on Atmospheric Sciences”

2018年「兩岸大氣科學教師科學研討會」

10月11日議程表 主辦單位：氣象學會
台大大氣系
地點：台大大氣系 B105 室

時間	主持人	講者	題目
10:05-10:20			來賓報到
10:20-10:30			開幕 (吳俊傑 / 林博雄)
10:30-12:10			Session I
10:30-10:50		周仲島	Taipei Heavy Rain at Night: A Case Study
10:50-11:10		張慶紅	Realistic Ensemble Perturbation Sensitivity to Idealized Hail Precipitation.
11:10-11:30	張慶紅 林沛鍊	林沛鍊	Diurnal Variation of Regional Circulation and Precipitation During Mei-Yu Season over Taiwan and Surrounding Area
11:30-11:50		傅剛	Characteristics of Atmospheric Rivers Influencing China in Summers from 2001 to 2016
11:50-12:10		饒高陞	The Importance of Assimilating Thermodynamic Fields with Radar Observations in Convective-Scale Weather Systems
12:10-13:50			午餐
13:50-15:30			Session II
13:50-14:10		李青青	Revisiting Asymmetric CAPE in Sheared Tropical Cyclones
14:10-14:30		游政谷	Are Outer Tropical Cyclone Rainbands Similar to Squall Lines?
14:30-14:50	明杰 游政谷	明杰	颱風邊界層觀測分析
14:50-15:10		周昆炫	Characteristics of Size Change of Tropical Cyclones Traversing the Philippines
15:10-15:30		林博雄	The Development of Ultralight Radiosonde and Its Applications in Atmospheric Sciences
15:30-15:50			Coffee Break
15:50-17:30			Session III
15:50-16:10		黃彥婷	On the Temporal Evolution of the Tropical Precipitation Patterns under Anthropogenic Climate Change
16:10-16:30		周文	Interdecadal Variability of Tropical Cyclones in the Western North Pacific
16:30-16:50	周文 陶中興	黃婉如	Impact of Boreal Summer Intra-seasonal Oscillations on Warm Season Diurnal Convection Activity in Taiwan
16:50-17:10		杜宇	Heavy Rainfall Associated with Double Low-level Jets over Southern China
17:10-17:30		陶中興	Cumulus-Radiation Schemes and Simulated MJO during DYNAMO/CINDY

10月12日議程表

主辦單位：氣象學會
台大大氣系
地點：台大大氣系 B105 室

時間	主持人	講者	題目
09:00-11:00			Session IV
09:00-09:20		余嘉裕	A Moist Static Energy Analysis of Super Madden-Julian Oscillation Events
09:20-09:40	蕭績 余嘉裕	劉千義	Characteristics of Deep Convections over the South China Sea and Maritime Continent from CloudSat
09:40-10:00		蕭績	Climatic Responses Of Extreme Precipitation
10:00-10:20		楊舒芝	從對流尺度資料同化與預報探討水氣的重要性
10:20-10:40		吳俊傑	The Role of WISHE in SEF and RI
10:40-11:00			討論與閉幕 (吳俊傑 / 林博雄)

2018 年兩岸大氣科學教師科學研討會由氣象學會在 10 月 11 日至 12 日舉辦於臺灣大學大氣科學系。本次會議參與教師包含周仲島、張慶紅、林沛練、傅剛、鍾高陞、李青青、游政谷、明杰、林博雄、黃彥婷、周文、黃婉如、杜宇、隋中興、余嘉裕、劉千義、聶績、



楊舒芝及吳俊傑共 20 位教師參與，並由氣象學會理事長吳俊傑教授及系主任林博雄教授主持開場，會議為期兩天以中尺度、颱風邊界層氣象、氣候與極端天氣以及深對流等議題進行交流研討。

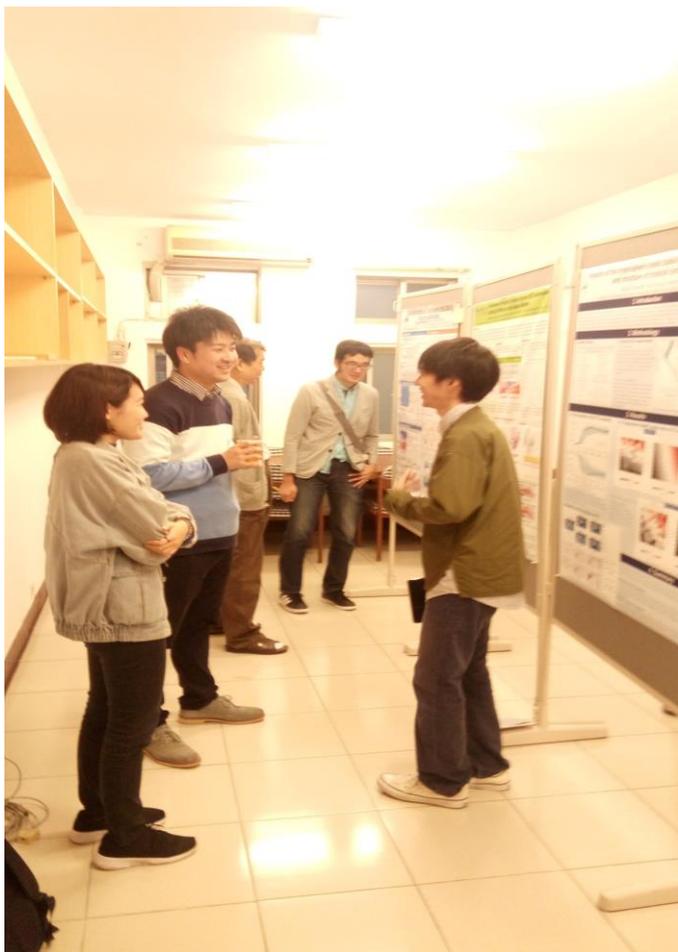
The 6th KU-NTU Atmospheric Science Students/Young Scientists Exchange

The 6th KU-NTU Atmospheric Science Students/Young Scientists Exchange was held by the Department of Atmospheric Sciences of

National Taiwan University on December 12-15, 2018. A total of 30 people attended the conference including 12 teachers and students from Kyoto University and teachers and students from the Department of Atmospheric at the University of Taiwan. The conference topics was including such as convection, deep convection and extreme rainfall etc. For a detailed agenda, please refer to the website <https://goo.gl/CHMjWE>. During this meeting, participants were visiting the History Museum, Nantou Experimental Forest, Fenghuang Broadleaf Ecological Conservation Area, and the Xitou Experimental Forest of National Taiwan University. This exchange meeting not only provides academic ideas exchange between KU and NTU but also the exchange of results in practical observations and forest meteorological research.



Photo with Kyoto University faculty in NTUAS



Poster Presentation in NTUAS

臺灣大學大氣科學系與日本京都大學師生於今年(2018) 12月12-15日於臺大大氣科學系系館舉行第六屆學生與青年研究員交流研討會。本次會議共約30人與會，包括京都大學師生12位以及台灣大學大氣系師生等。會議內容包含對流、深對流探討及極端降雨等議題。

詳細議程請參考網頁 <https://goo.gl/CHMjWE>。

於會期安排與會者參訪臺灣大學校史館、臺灣大

學南投實驗林-鳳凰闊葉生態保護區、溪頭自然教育區及臺灣大學溪頭實驗林。本次交流不僅提供學術上心得交換也在實際觀測與森林氣象研究上有成果交流。



Visiting NTU Experiment Forest

The environment of aggregated deep convection

聚集對流的環境

Wei-Ming Tsai and Chien-Ming Wu*

蔡偉銘，吳健銘*

Using a 3D cloud-resolving model developed in the Department of Atmospheric Sciences at NTU, idealized simulations are performed to explore the environment of aggregated deep convection under various environmental moisture with or without vertical wind shear. Convective aggregation is then evaluated by diagnosing the 3-D size of an individual cloud object from the model output using a six-connected segmentation method. Through connecting cloudy pixel ($q_c + q_i > 10^{-5} \text{ kg kg}^{-1}$), the size of a cloud object can, therefore, be determined as visualized in Fig. 1. The aggregated convection is recognized by a distinct mode with a larger size in the cloud-size distribution. The results suggest that aggregated convection tends to develop when column relative humidity (CRH) is larger than 80% (67%) in nonshear (shear) cases. This aggregation process may be caused by an increasing probability of multicellular cloud structure under a moister environment. The results also suggest that there are at least five convective cores of such system. Analyses of precipitation distribution suggest that the most extreme instantaneous grid point precipitation (sometimes larger than 100 mm hr^{-1}) mainly occurs within the largest convective clusters (Fig. 2).

Tsai and Wu (2017)利用台大大氣科學系研發的3D雲解析模式來進行一系列的深對流的模擬，實驗含蓋了不同濕度的環境以及有無垂直風切，實驗的目的在於利用3D雲的尺度來了解模式中聚集對流發生的情境，一個3D的雲尺度是使用六向連結法來連結有雲的網格(定義為雲水加雲冰大於 10^{-5})，連結後的雲以及對應的尺度如圖一所示。藉由3D雲尺度，可以利用其分布的特徵來決定聚集對流。當雲尺度的分布呈現雙模的時候，可以判定為有明顯聚集對流的發生。實驗的結果顯示，在沒有(有)風切的情形中，垂直積分的環境相對濕度大於80%(67%)時，聚集對流可以發生。其產生的機制主要來在濕的環境中容易有多胞對流的生成，模式的結果顯示，當有5胞以上的時候，容易有聚集對流的發生。研究的結果也指出大的聚集對流可以有極端降水的發生(網格的降水可以大於 100 mm hr^{-1})。

Tsai, W.-M., and C.-M. Wu* (2017), The environment of aggregated deep convection, *J. Adv. Model. Earth Syst.*, 9, doi:10.1002/2017MS000967.

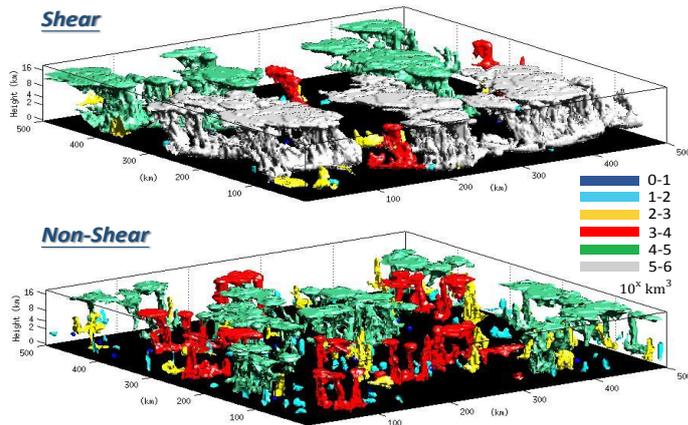


Fig 1. 3-D snapshots of simulated convective systems under shear (top) and non-shear (bottom) environment. Diagnosed cloud sizes of individual clouds are labeled in specific colors.

圖一、對流系統在有風切（上）及無風切（下）時的 3-D 示意圖，顏色代表不同的雲尺度。

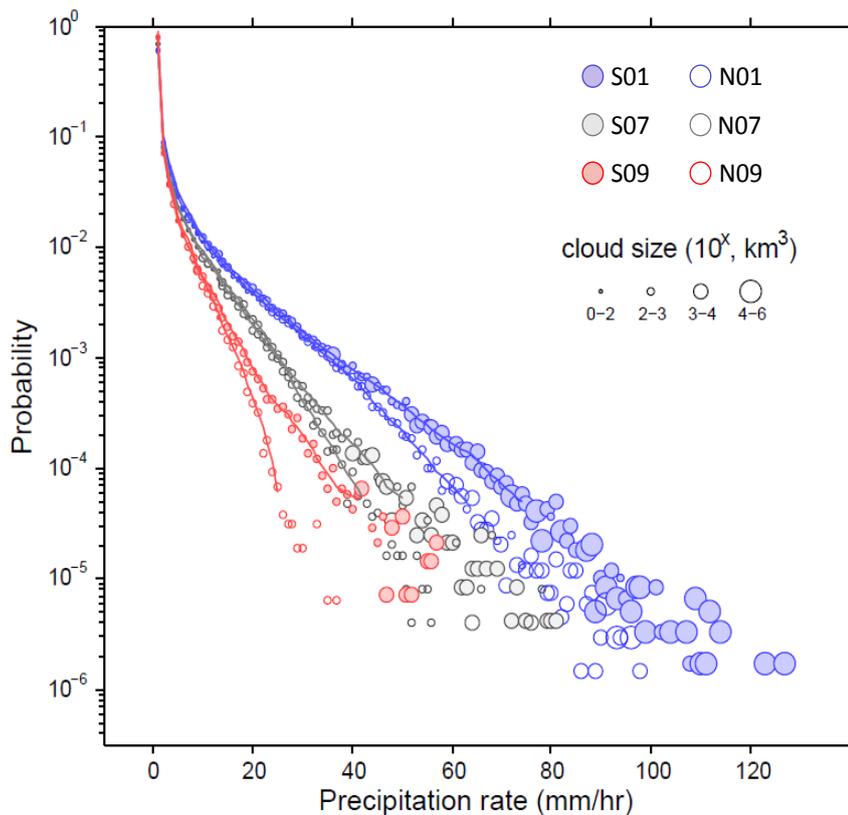


Fig. 2. The probability density function of precipitation rate at each grid point composed with the critical cloud size.

圖二、網格的機率降水分布，圓圈代表產生此降雨率的最小雲尺寸。

Local and Remote Control on Tropical Circulation and Precipitation under Anthropogenic Climate Change

人為氣候變遷下當地與遠程之控制因子對熱帶環流與降雨之影響

黃彥婷*、曾翊涵、林姝殊、Nicole Feldl

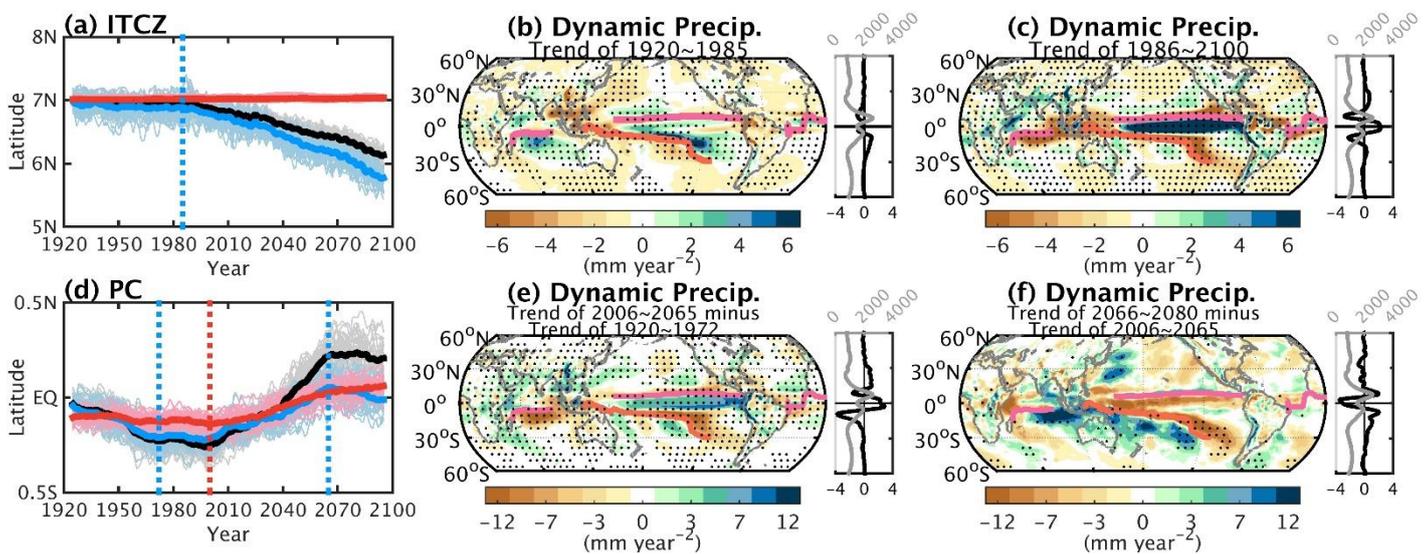
2019 AOGS Kamide Early Career Researcher Award Special Lecture

The local control of sea surface temperature on tropospheric stability and convection in the tropics has long been recognized to play a critical role in determining the position of the tropical rain belt. The newly developed global energetic constraint, on the other hand, has emphasized extratropical influence on tropical precipitation. Confusion arises when constructing a predictive framework for tropical precipitation in global warming scenarios: The local perspective predicts a southward shift of the tropical rain belt toward the equator, caused by an El Niño-like warming pattern in most global climate models; whereas the energetic perspective points to a northward shift of the tropical precipitation due to positive feedbacks over Northern Hemisphere high latitudes and enhanced heat uptake over the Southern Ocean.

Here we point to a structural change in Hadley Circulation when reconciling the two perspectives. Take the Community Earth System Model (CESM) Large Ensemble Project's historical and RCP8.5 simulations as an example. An intertropical convergence zone (ITCZ) index and a precipitation centroid (PC) index are defined to quantify the meridional displacement of the zonal-mean rainfall peak and the overall tropical precipitation pattern, respectively. Throughout the simulations, both indices show complex transient responses but different turning points in their time series. The ITCZ is initially stationary but begins to shift southward toward an enhanced equatorial warming pattern that appears after the 1990s. On the other hand, the PC first shifts southward when aerosols cool the Northern Hemisphere during the 20th century, and then shifts northward after year 2000 when greenhouse gas warming is larger in the Northern than Southern Hemisphere. The structural changes in Hadley Circulation can also be seen in other global climate models participated in CMIP (the Coupled Model Intercomparison Project of the World Climate Research Program). The ITCZ and the PC shift toward the opposite directions as the climate warms. The global energetic framework has a stronger constraint on the subtropical precipitation changes, as the stability changes less in the subtropics comparing with the deep tropics in climate change scenarios. Reconciling the local and remote influences shed new lights on predicting anthropogenic forced tropical precipitation changes.

長久以來，海溫對熱帶當地的對流層穩定度與對流的控制被視為決定熱帶降雨帶位置的重要因子。最新發展的全球能量約束理論則強調了中高緯對熱帶降水的影響。綜合上述機制，建構熱帶降雨在全球暖化情境下的預報系統存在以下疑點：以熱帶當地的觀點，大部分氣候模式中存在的類聖嬰之暖化結構，會造成熱帶雨帶向赤道南移；然而，以能量的觀點來說，北半球中高緯的能量正回饋以及南大洋熱吸收的增加，則會造成熱帶降雨的北移。

在重新檢視以上兩種觀點後，我們提出哈德里胞之結構性改變之說。以美國國家大氣研究中心的系集模式所模擬之過去與未來 100 年的氣候情境為例。熱帶降雨可分別定義為兩種隨時間變化的指數：降雨最大值所在緯度，以及熱帶降雨重心，來量化其南北移動程度。兩項指數在長時間的模擬中，呈現了不同的時間序列。在 1990 年代以前，降雨最大值所在緯度沒有明顯改變，爾後則開始向南往暖化較明顯(穩定度減弱)之赤道移動。然而，熱帶降雨重心在 20 世紀先是受到北半球氣膠冷卻效應的影響而南移。在 21 世紀時，因溫室效應使北半球暖化較南半球更為劇烈，而使降雨重心北移。我們的研究指出，哈德里環流存在複雜的結構變化，同時在世界氣候研究計畫的多個模式中也可以看到類似現象。因此，暖化下熱帶降雨最大值的緯度會與熱帶降雨重心呈現相反的移動變化。而在氣候變遷下，因副熱帶地區之穩定度改變相較於熱帶地區較小，因此，全球能量架構之理論，較可解釋副熱帶地區降雨之改變。釐清當地與遠程因子之影響有助於預測人為氣候變遷下熱帶降雨的變化。



圖說：

(a) 降雨最大值所在緯度隨時間之變化。黑線為總降雨率，紅線為熱力降雨率，藍線為動力降雨率。深色線為模式之平均，淺色線則為各模式。

(d) 降雨重心所在緯度隨時間之變化，可視為南北不對稱降雨之分布變化。顏色描述與(a)相同。

(b), (c), (e), (f) 對特定時間做線性回歸以及緯度平均之動力降雨分布。粉色線為降雨最大緯度之氣候值，紅色線則為南太平洋輻合區所在緯度之氣候值。打點為通過 95%信心區間之線性迴歸。緯度平均圖之黑線為線性迴歸值之緯度平均，灰線則為動力降雨氣候值之緯度平均。

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- Awards
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- Discuss 2017 summer student exchange program
- Chi-Wen Sun RTS Youth Overseas Perspective Foundation

Student Activity

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- Commencement
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