



Newsletter

National Taiwan University
Department of Atmospheric Sciences

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Contents

Department 60th Anniversary

- Department Alumni Reunion
- Research and Perspective of Extreme Weather and Climate Events and Climate Change Conference

Event

- Awards
- Personnel Changes
- Prof. Ming-Jen Yan joins the Department Faculty
- Prof. Cheng-Ku Yu joins the Department Faculty
- Prof. Yen-Ting Hwang joins the Department Faculty
- Retirement of Prof. Lin Ho
- Dual Degree
- Class of "Dynamics of El Nino and Southern Oscillation"
- The Department Retreat
- Department Review
- NTU 1984 30th Reunion

Student Activity

- The NTU Azalea Festival
- Parent-Teacher Conference
- Commencement
- 31st Conference on Hurricanes and Tropical Meteorology
- Ocean Science Meeting 2014
- The 9th Workshop of the Virtual Laboratory for the Earth's Climate Diagnostics Program, and the University Allayed Workshop
- 2014 Study-Abroad Program
- 2015 Study-Abroad Program

Visitors

Research Highlights

- Change in Ocean Subsurface Environment to Suppress Tropical Cyclone Intensification Under Global Warming
- Recent Decrease in Typhoon Destructive Potential and Global Warming Implications
- A Long Neglected Damper in the El Niño-Typhoon Relationship: a 'Gaia-Like' Process

2014 Doctors' & Masters' Theses

2015 Doctors' & Masters' Theses

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Department Alumni Reunion

On 16th May 2015, the NTUAS organized a large reunion as many overseas alumni returned to Taiwan to attend the Research and Perspectives of Extreme Weather and Climate Events and Climate Change conference. It was also a celebration of the department's 60th anniversary. The opening speeches were delivered by Academician Kuo-Nan Liou and followed by talks given by Prof. Ching-Yen Tsai (Chairman of Industrial Technology Research Institute of Taiwan), Chair Prof. Chih-Pei Chang, Prof. Tai-Jen George Chen, Dr. Wei-Cheng Chang (NRL), Dr. Ying-Hwa Kuo (NCAR) and Dr. Wen-Chau Lee (NCAR) who shared their research and life experiences. After the talks, sixty colorful balloons were released by the alumni members to celebrate the department's 60th anniversary.

2015年5月16日下午臺大大氣科學系舉辦60週年系慶系列活動「系友大團圓」。開場貴賓由廖國男院士擔任，隨後登場分享生涯規劃座，有蔡清彥董事(工研院)、張智北講座教授、陳泰然教授、張偉正博士(美國海軍研究實驗室)、郭英華博士(美國國家大氣研究中心)、李文兆博士(美國國家大氣研究中心)及陳淑華教授(加州大學)，多位海外系友共襄盛舉。之後並向天空施放60顆紅氣球，象徵臺大大氣系成立60週年。也於5月15日及16日上午舉辦「氣候變遷、極端氣候與天氣事件之研究與展望」國際研討會。



Research and Perspective of Extreme Weather and Climate Events and Climate Change Conference

Research and Perspective of Extreme Weather and Climate Events and Climate Change was held from May 15th to 16th morning. This conference was sponsored by NTUAS and Meteorological Society of the Republic of China.

A number of distinguished scientists and the delegates of international partner institutions were invited to attend this conference. The conference, including oral and poster presentations of invited and contributed papers, focused on extreme weather and climate change.

由臺灣大學大氣科學系主辦及中華民國氣象學會協辦「氣候變遷、極端氣候與天氣事件之研究與展望」國際研討會，於2015年5月15日及16日上午在集思會議中心國際廳舉行。

適逢今年(2015年)為臺大大氣系成立60週年，藉此邀請國內外傑出系友回來介紹其近年來的研究成果及分享人生經驗。會議同時邀請著名專家學者及國際(美、中、日、韓)姐妹系代表與會，透過專題演講與學術海報討論有關氣候變遷及極端氣候的重大科學議題，並與國內外學者及學生進行廣泛交流。此次研討會相當圓滿，與會人員持有熱烈的討論與互動，成果豐碩。



A group photo at the Research and Perspective of Extreme Weather and Climate Events and Climate Change.



Associate Dean Chun-Chieh Wu (吳俊傑) of college science delivered the opening speeches.



Dr. Ching-Ray Chang (張慶瑞), vice president for administrative affairs of NTU (first photo) and Shiuh-Tzung Liu (劉緒宗), dean, College of Science (second photo) delivered the opening speeches.



Dr. Ching-Yen Tsay (蔡清彥) of Industrial Technology Research Institute (ITRI) (工研院董事長) delivered a speech entitled “Past, Present, and Future”.



Dr. Kuo-Nan Liou (廖國男) of Department of Atmospheric and Oceanic Sciences, UCLA delivered a speech entitled “Regional Climate Change: Impacts of 3D Mountain/Snow and BC deposition”.



Prof. Min-Hui Lo (羅敏輝) (left) hosted banquet activity with Ms. Chun-Lan Kao (高春蘭).



Prof. Ming-Jen Yang (楊明仁) had a guitar performance during banquet.



A group photo of the NTU F4. From left to right: Dr. Wen-Chau Lee (李文兆), Mr. Tien-Chin Chang(張天欽), Mr. So-Ling Chai(翟所領), Ms. Yen-Shu Lin (林燕淑), Prof. Chung-Hsiung Sui (隋中興), Prof. Jong-Dao Jou(周仲島), Dr. Ying-Hua Kuo(郭英華), Prof. Cheng-Shang Lee (李清勝).



Prof. Tai-Jen Chen sang a song “往事就是我的安慰” with Mr. Yueh-Hsin Chu (朱約信) during banquet.

Research and perspective of extreme weather and climate events and climate change

氣候變遷、極端氣候與天氣事件之研究與展望

Date: 15-16 May

Venue: GIS NTU Convention Center, Taipei

Time	15 May (Fri) morning	Room: The Forum (國際會議廳)
08:20-	Registration	
09:00-09:30	Opening & Picture-taking	
09:30-10:00	Atmospheric Sciences and my Career beyond 30 years (Past, Present, and Future) 我與大氣科學 30 年 (Past, Present, and Future) <i>Ching-Yen Tsay (蔡清彥), Industrial Technology Research Institute (ITRI) (工業技術研究院)</i>	
10:00-10:20	Coffee Break	
Keynote I; Chair: Chih-Pei Chang (張智北)		
10:20-10:50	Regional Climate Change: Impacts of 3D Mountain/Snow and BC deposition <i>Kuo-Nan Liou (廖國男), Department of Atmospheric and Oceanic Sciences, UCLA</i>	
10:50-11:20	Research and Perspective of Mei-Yu in Taiwan <i>Tai-Jen George Chen (陳泰然), Department of Atmospheric Sciences, National Taiwan University</i>	
Session 1; Chair: Chun-Chieh Wu (吳俊傑)		
11:20-11:35	Is the Tropical Circulation Weakened or Strengthened Under Global Warming <i>William K. M. Lau (劉家銘), Earth System Science Interdisciplinary Center, University of Maryland</i>	
11:35-11:50	Predicting Tropical Cyclones and Global Weather in 2100 <i>Simon W. Chang (張偉正), Marine Meteorology Division, Naval Research Laboratory</i>	
Session 2 (Poster)		
Theme I: Climate; Chair: Chung-Hsiung Sui & William K. M. Lau		
11:50-12:02	I-1 Moistening Processes for Intraseasonal Oscillations <i>Chung-Hsiung Sui (隋中興), Department of Atmospheric Sciences, National Taiwan University</i>	
	I-2 Transition of Clouds and Convection Associated with MJO: Investigations using Satellite Observations and Numerical Simulations <i>Wei-Ting Chen (陳維婷), Department of Atmospheric Sciences, National Taiwan University</i>	
	I-3 Intraseasonal Oscillation and the Taiwan Climate <i>Chih-Wen Hung (洪致文), Department of Geography, National Taiwan Normal University</i>	
	I-4 Interannual Variability of Tropical Cyclone Activity in the South China Sea during Fall <i>Jau-Ming Chen (陳昭銘), Department of Maritime Information and Technology, National Kaohsiung Marine University</i>	
	I-5 Influence of Climate Regime Shift on The Interdecadal Change of Tropical Cyclone Activity over Pacific Basin during middle -late 1990s <i>Chi-Cherng Hong (洪志誠), Department of Earth and Life, University of Taipei</i>	
	I-6 SSTa, SICa, and Extreme Circulation in the Winter 2013-2014 <i>Huang-Hsiung Hsu (許冕雄), Research Center for Environmental Changes, Academia Sinica</i>	
Theme II: Weather and Precipitation; Chair: Ming-Jen Yang & Ying-Hwa Kuo		
12:02-12:12	II-1 Water Budget and Precipitation Efficiency of Typhoon and Squall Line <i>Ming-Jen Yang (楊明仁), Department of Atmospheric Sciences, National Taiwan University</i>	
	II-2 Multiple Mechanisms of Orographic Precipitation Associated with Typhoons <i>Cheng-Ku Yu (游政谷), Department of Atmospheric Sciences, National Taiwan University</i>	

	<p>II-3 Development of a Taiwan unified cloud-resolving model with a partial step surface topography <i>Chien-Ming Wu (吳健銘), Department of Atmospheric Sciences, National Taiwan University</i></p> <p>II-4 Radar data retrieval and assimilation over complex terrain and the applications on model QPN <i>Yu-Chieng Liou (廖宇慶), Department of Atmospheric Sciences, National Central University</i></p> <p>II-5 On the Upstream Track Deflection of Tropical Cyclones past Mountain Ranges: Idealized Experiments <i>Ching-Yuang Huang (黃清勇), Department of Atmospheric Sciences, National Central University</i></p>	
Theme III: Aerosol, Land Process and Related Climate Issue; Chair: Wei-Ting Chen & Tzung-May Fu		
12:12-12:22	<p>III-1 Impacts of Agricultural Irrigation on local, regional, and remote climate <i>Min-Hui Lo (羅敏輝), Department of Atmospheric Sciences, National Taiwan University</i></p> <p>III-2 Estimation of foreign versus domestic contributions to Taiwan's air pollution <i>Jen-Ping Chen (陳正平), Department of Atmospheric Sciences, National Taiwan University</i></p> <p>III-3 Positive but variable sensitivity of August surface ozone to large-scale warming in the southeast United States <i>Tzung-May Fu (傅宗政), Department of Atmospheric and Oceanic Sciences, Peking University</i></p> <p>III-4 Transport and Scavenging of Biomass Burning Aerosols in the Maritime Continent <i>Hsiang-He Lee (李湘鶴), Center for Environmental Sensing and Modeling (CENSAM), Singapore-MIT Alliance for Research and Technology (SMART)</i></p> <p>III-5 Numerical investigation of the coagulation mixing between dust and hygroscopic aerosol particles and its impacts <i>I-Chun Tsai (蔡宜君), Research Center for Environmental Changes, Academia Sinica</i></p>	
Time	15 May (Fri) afternoon	Room: The Socrates (蘇格拉底廳)
12:22-14:00	<u>Lunch + Poster viewing</u>	
Session 3; Chair: Ming-Dah Chou (周明達)		
14:00-14:15	Impact of GPS RO Data on the Prediction of Tropical Cyclogenesis <i>Ying-Hwa Kuo (郭英華), University Corporation for Atmospheric Research</i>	
14:15-14:30	From Line Echo Wave Pattern (LEWP) to Bow Echo <i>Wen-Chau Lee (李文兆), National Center for Atmospheric Research</i>	
14:30-14:45	Study the Effect of Aerosol Mixing State on Fog Formation in the Central Valley of California Using a Source-Oriented WRF/Chem Model <i>Shu-Hua Chen (陳淑華), Department of Land, Air & Water Resources, University of California, Davis</i>	
14:45-15:00	Natural and Anthropogenic sources of atmospheric iron deposition in the Northwestern Pacific Ocean <i>Jen-Ping Chen (陳正平), Department of Atmospheric Sciences, National Taiwan University</i>	
15:00-15:15	From 1987 TAMEX to 2017 SC-YMC __ the development of instrumentation and measurement program in the department <i>Po-Hsiung Lin (林博雄), Department of Atmospheric Sciences, National Taiwan University</i>	
15:15-15:30	Two stories on clouds and large-scale circulation in global climate models: clouds and polar jet, clouds and Pacific Decadal Variability <i>Yen-Ting Hwang (黃彥婷), Department of Atmospheric Sciences, National Taiwan University</i>	
15:30-15:45	<u>Coffee Break</u>	

Session 4; Chair: Hung-Chi Kuo (郭鴻基)	
15:45-16:00	Deep convective cross-tropopause transport of water vapor <i>Pao-Kuan Wang (王寶貴), Research Center for Environmental Changes, Academia Sinica</i>
16:00-16:15	Typhoon Rainfall Potential with Satellite Remote Sensing in Taiwan <i>Gin-Rong Liu (劉振榮), Center for Space and Remote Sensing Research, National Central University</i>
16:15-16:30	CWB's monthly and seasonal forecast development in relation to extreme climate events and climate change <i>Mong-Ming Lu (盧孟明), Research and Development Center, Central Weather Bureau</i>
16:30-16:45	Changes of precipitation patterns in Monsoon Asia associated with global warming <i>Jia-Yuh Yu (余嘉裕), Department of Atmospheric Sciences, Chinese Culture University</i>
16:45-17:00	How much rainfall extremes associated with Typhoon Morakot (2009) can be attributable to anthropogenic influences? <i>Cheng-Ta Chen (陳正達), Department of Earth Sciences, National Taiwan Normal University</i>
Time	16 May (Sat) morning Room: The Socrates (蘇格拉底廳)
Keynote II; Chair: Jen-Ping Chen (陳正平)	
09:00-09:30	Trends of regional precipitation and their control mechanisms during the 1979 -2013 global warming <i>Shaw-Chen Liu (劉紹臣), Research Center for Environmental Changes, Academia Sinica</i>
Session 5; Chair: Chung-Hsiung Sui (隋中興)	
09:30-09:45	Influences of stratospheric ozone changes on Antarctic sea ice <i>Yongyun Hu (胡永云), Department of Atmospheric Oceanic Sciences, Peking University</i>
09:45-10:00	What causes divergent projections of ENSO amplitude change under global warming in CMIP5 models? <i>Tim Li (李天明), IPRC and Department of Atmospheric Sciences, SOEST, University of Hawaii</i>
10:00-10:15	Typhoon researches at HyARC and future collaboration with the NTU atmospheric science group <i>Kazuhisa Tsuboki, Hydrospheric-Atmospheric Research Center (HyARC), Nagoya University</i>
10:15-10:30	Aerosol-cloud microphysics-radiation interactions: A case study of stratocumulus clouds over Southeast Pacific <i>Wei-Chyung Wang (王維強), Atmospheric Sciences Research Center, State University of New York at Albany.</i>
10:30-10:45	International Research Collaborations on Extreme Weather in Changing Climate in the Maritime Continent <i>Shigeo Yoden, Department of Geophysics, Kyoto University</i>
10:45-11:00	Coffee break
Session 6; Chair: Cheng-Shang Lee (李清勝)	
11:00-11:15	Regional Climate Change in CORDEX-East Asia <i>Dong-Kyou Lee, School of Earth and Environmental Sciences, Seoul National University</i>
11:15-11:30	A Study of Typhoon Rainfall in Taiwan <i>Cheng-Shang Lee (李清勝), Department of Atmospheric Sciences, National Taiwan University</i>
11:30-11:45	Quantitative Precipitation Estimation using S-Band Polarimetric Radars in Taiwan Meiyu Season <i>Ben Jong-Dao Jou (周仲島), Department of Atmospheric Sciences, National Taiwan University</i>
11:45-12:00	Wavenumber-2 Deep Convection in the Tropical Cyclone <i>Hung-Chi Kuo (郭鴻基), Department of Atmospheric Sciences, National Taiwan University</i>
12:00-12:15	From Targeted Observation to Eyewall Dynamics: Progress from 2005 to 2015 <i>Chun-Chieh Wu (吳俊傑), Department of Atmospheric Sciences, National Taiwan University</i>

Time	16 May (Sat) afternoon	To be held in the Department of Atmospheric Sciences, NTU
12:30-13:30	<u>Lunch</u>	
13:30-15:30	My Story__系友成長故事分享 (系館 B105 教室)	
15:30-16:00	系友老少大合照 + 彩色氣球施放 (系館外庭) 拍照:陳至凡	
16:00-17:00	A 館歷史巡禮與解密 (洪致文系友覽導)	
<u>Banquet (at Hung Kan Restaurant)</u>		
18:00-18:30	晚宴-報到入場領取依依特製蛋糕及發送時光膠囊信紙	
18:30-21:00	晚宴-節目:系友會會長,系主任,貴賓致詞 專輯影片播放/舉杯合照 系友才藝表演 時光膠囊活動 系友會長改選 KTV 歡唱	



Academician Kuo-Nan Liou (廖國男) shared his story on the road to success..



Chair Prof. Chih-Pei Chang (張智北) shared his story on the road to success..



Dr. Ying-Hwa Kuo (郭英華) shared his story on the road to success.



Dr. Ching-Yen Tsay (蔡清彥) shared his story on the road to success.

Awards

Prof. I-I Lin received the Outstanding Research Award from the Ministry of Science and Technology in 2014.

Prof. Hung-Chi Kuo received the Merit Ministry of Science and Technology Research Fellow Award in 2014.

Prof. Tai-Jen Chen received the Outstanding Award of 40-year teaching of Ministry of Education in 2015.

林依依教授獲 103 年度科技部傑出研究獎。

郭鴻基教授獲科技部 103 年度傑出特約研究員獎。

陳泰然教授榮獲 2015(104)年教育部服務 40 年資深優良教師獎。

Personnel Changes

Prof. Chun-Chieh Wu completed his six-year term of the department chairman. Prof. I-I Lin assumed the responsibility starting August 1st, 2014.

Prof. Ming-Jen Yang, Prof. Cheng-Ku Yu and Prof. Yen-Ting Hwang joined the Department Faculty in August 2014.

Prof. Ming-Jen Yang was appointed as the next Commissioner of the Alumni Association of the Department in 2015.

吳俊傑教授 6 年系主任的任期已於 2014 年 7 月 31 日屆滿，自 2014 年 8 月 1 日起由林依依教授繼擔本系系主任。

楊明仁教授、游政谷教授和黃彥婷教授於 2014 年 8 月到系服務。

2015 年隋中興教授系友會主任委員任期屆滿卸任，由楊明仁教授接任職務。

Prof. Ming-Jen Yan joins the Department Faculty



我是楊明仁，很高興有機會回到母校台灣大學服務。28年前（1986年）我從台大大氣系畢業，服完兩年兵役後曾在母校理學院大氣系擔任一年的助教工作，所以大氣系是我踏入社會

後的第一個工作崗位。如今我能回到母校擔任教授一職，倍感榮幸，個人必當竭盡所能，回饋孕育我成長茁壯的母校。個人有難得機緣在台灣許多行政及教育機構服務過，其中包括中央氣象局、私立中國文化大學、及中央大學，現在回到母校任教。也由於個人的教學經歷，使我瞭解不同學校學生的人格特質，深刻體會到孔子提倡「因材施教」的意義。

台灣大學擁有全台灣最優秀的學生及最充沛的教育資源，雖在華人大學中列為首位，但在全世界大學排名中，僅在百名之內，尚未在前二十名中。雖然大學排名方式仍為爭議，但這也表示台大尚有進步空間，而且台灣社會各界對台大有更高期許，希望台大除了在學術追求卓越外，更能善盡社會責任。「大氣科學」領域是個非常「入世」的學術專業，大氣科學的發展可以增進對氣候變遷的瞭解，減少氣象災害損失，是門可以直接貢獻所學、服務社會的自然科學領域。個人到理學院大氣系任職教授後，必當貢獻所學，積極教育及培養學生，為台灣之大氣科學領域善盡個人一份棉薄心力！

Prof. Cheng-Ku Yu joins the Department Faculty



在大學及研究所階段為主修大氣科學，研究內容主要是利用飛機都卜勒雷達資料及氣象傳統觀測資料來分析探討台灣梅雨季的對流降水系統。畢業後，受聘於美國華盛頓大學大氣科學系，擔任博士後研究員(Research

Associate)一職，利用外場實驗計畫所收集的飛機觀測來檢視海岸地形與鋒面系統的交互作用，此研究經驗顯著增加了我對中緯度天氣與降水特性的了解。在國內外從事多年博士後研究之後，於2003年8月開始全職投入教研工作。除了研究工作與指導研究生之外，預備講課內容與授課經驗，使我有機會拓展自己的專業領域，學習如何教育年輕世代，這中間也深刻體會到自己所學的很有限。

我時常與學生分享一些作研究的基本理念，例如：要專注工作與責任、態度比程度重要、要耐心研讀與思考等等。未來仍需要努力地充實自己，好好培養學生的專業素養與積極培育未來研究人才，並期待對台灣的大氣科學研究與發展盡微薄之力。

學歷	國立臺灣大學大氣科學博士 國立臺灣大學大氣科學碩士 中國文化大學大氣科學學士
經歷	國立臺灣大學大氣科學系教授 中國文化大學大氣科學系助理教授、副教授、教授 國立臺灣大學大氣科學系國科會特約博士後研究學者 國立臺灣大學大氣科學系博士後研究員

	美國華盛頓大學大氣科學系博士後研究員 傑雲科技公司應用系統工程師暨行政院青輔會博士後研究員
專長	地形降水 劇烈天氣與中小尺度天氣現象 颱風(鋒面)雨帶結構與動力

Prof. Yen-Ting Hwang joins the Department Faculty



很高興有機會回到台大這個大家庭，和許多提拔栽培我的老師們共事。校園裡的系館跟樹木比印象中更密，建築裡頭的人情味和記憶中一樣濃。

我的研究興趣主要是大尺度大氣動力學，以及大氣環流跟海洋、陸地、雲、以及冰山等因子的交互作用。透過觀測資料、模式模擬和理論分析，希望了解哪些機制影響了地球上各個氣候區的分部(包含熱帶降雨帶、季風區、副熱帶沙漠區、中緯度風暴路徑和高緯度極地等)，以及這些氣候區的分界在未來將如何改變。

從物理系畢業後到華盛頓大學西雅圖分校念大氣科學，很多朋友都問我為什麼轉行？其實這個彎轉得不大，還是用數學和物理來歸納了解各種自然現象。記得高中時學了彩虹的原理以後，我跑到圖書館借了本雲物理學，當時完全看不懂，只覺得用一堆方程式來描述天空中的雲很酷。現在的我依然覺得可以用物理、化學定律跟流體力學方程式來解釋自然界的各種變化，是很奇妙的一件事情。比起高中大學時期，我心中少了些走科學研究這條路會不會離人群很遙遠的擔憂，多了些和同學同事切磋分享自然奧妙的期待，以及評估氣候變遷對農作物、水資源以及生態環境的衝擊的使命感。

Dual Degree

Department of Atmospheric Sciences of National Taiwan University inaugurated a Dual Degree with the Department of Atmospheric and Environmental Sciences of the State University of New York at Albany on December 15th, 2014.

為實施國立臺灣大學大氣科學系和美國紐約州立大學大氣環境科學系阿爾伯尼校區聯合設立的雙學位計畫，確保參加並完成該計畫之兩校學生畢業時可以獲得兩校學位，雙方校長於12月15日於臺灣大學校史館簽訂國立臺灣大學與美國紐約州立大學阿爾伯尼校區大氣科學雙聯學位計畫協議書。



Both presidents sign the Dual and Joint Degree Agreements in the gallery of NTU history.

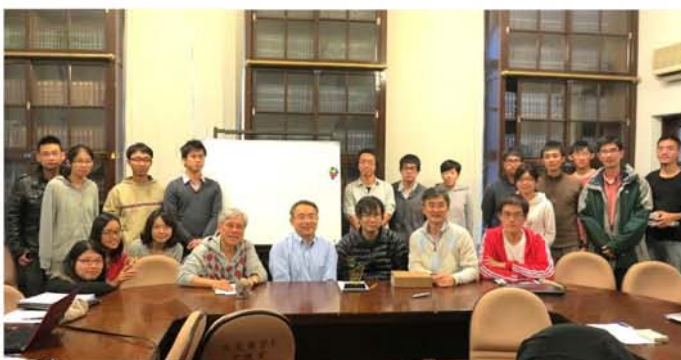


A group photo in front of the Fu Bell.

Class of “Dynamics of El Nino and Southern Oscillation”

In fall semester of 102nd academic year, Professor Fei-Fei Jin, from the University of Hawaii, was invited as Chair Professor of Department of Atmospheric Sciences at National Taiwan University to give a series course of ENSO and climate dynamics. Prof. Jin has been dedicated in large-scale circulation, oceanic dynamics, large-scale air-sea interaction and meteorological dynamics for a long time. Many of his distinct researches about ENSO dynamics are well recognized by scientific community as a whole. In the class, Professor Jin encouraged students to think, to ask, and he reminded them of a lot of fundamental but important questions. Additionally, he had some great discussions with students and designed different types of projects for students to sharpen their thinking and their ability of doing research independently.

台灣大學大氣科學系於102-1學期聘請美國夏威夷大學金飛飛教授為講座教授，並且開授「聖嬰氣候震盪動力學」。金教授長期從事大尺度大氣環流和海洋動力學、大尺度海氣交互作用、氣象動力等方面的研究，在「聖嬰現象」的研究成果斐然國際。課堂中，老師鼓勵學生思考發問，也會提出許多看似基本但是相當重要的問題。課餘時間，也和學生充分討論，且根據學生特質而設計了許多實作讓學生動手分析，思考這些問題的核心價值。



Prof. Jin with students at the class.

The Department Retreat

All faculty members attended the Retreat to discuss the future direction of the department, including issues on both research and education. In 2014, the Retreat was held on February 10th.

靜修會為全系教授共同參加，針對本系未來的發展，包含教學、研究各方面的討論。



A group photo of the department retreat on Feb. 10th, 2014.

Department Review

The review of the Department of Atmospheric Sciences took place during May 21st – 23rd 2014. The committee comprised of Prof. Kuo-Nan Liou (UCLA), Prof. Pan-Kuan Wang (Academia Sinica), Dr. Simon Chang (NRL), Prof. Ngar-Cheung Lau (The Chinese University of Hong Kong) and Prof. William K. M. Lau (NASA).

2014年5月21-23日為五年一度的系教學研究評鑑。此次評鑑邀請5位國內外著名學者擔任委員，包括廖國男教授、王寶貫教授、張偉正教授、劉雅章教授、劉家銘教授。在三天的行程中，委員分別和系上教師、職員、研究人員和學生代表進行座談，並深入了解系上教學及研究的運作及規畫。



A group photo of the department review.

NTU 1984 30th Reunion

The 30th reunion celebrations of the Class of 1984 took place on June 7th, 2014. Prof. Po-Hsiung Lin and Shiu-Wen Lin invited 20 alumni to attend this ceremony. Some overseas alumni, even those in the United States, returned to NTUAS to join this meaningful reunion. Before the banquet held by NTU, Prof. Po-Hsiung Li guided all alumnus to have brief tour in NTUAS and it was followed by a greeting Acapella, Formosa, directed by Prof. Chun-Chieh Wu. All alumnus had high appreciation to NTUAS' progress.

2014年6月7日，臺灣大學舉辦三十周年(畢業於1984年)重聚。擔任本次系上召集人的林博雄教授與林秀雯女士(中央氣象局前預報中心副主任)，力邀20位系友及同班同學參與本次活動，並有多位從美國專程返台參加。在全校性晚宴之前，林博雄教授安排系友們參觀系館，重溫舊夢。

隨後吳俊傑主任安排由系上大學部學生組成的Acapella獻唱"美麗島"，歡迎學長姐返母系，會場和樂融融，一起談笑話家常。全體學長姐對於臺大校園及大氣系環境之進展，給予相當肯定的讚譽。



A group photo of the 30th reunion celebrations.

The NTU Azalea Festival

The NTU Azalea Festival is held in March every 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。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觀，認識臺大各個科系，作為升學時的參考。



The NTU Azalea Festival was held on March 15th to 16th, 2014.



The NTU Azalea Festival was held on March 14th to 15th, 2015.

Parent-Teacher Conference

NTU holds the Parent-Teacher Conference in August 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。



Prof. I-I Lin (林依依) made a presentation on Parent-Teacher Conference Day on August 23rd, 2014.



Acting director Prof. Chun-Chieh Wu (吳俊傑) made a presentation on Parent-Teacher Conference Day on August 30th, 2015.

Commencement

The Commencement of NTU took place in the morning of June 7th 2014, along with the dean's award ceremony. In the afternoon, a hooding ceremony for all new graduates of NTUAS was held in the department, with family and friends sharing this cheerful moment.

臺灣大學畢業典禮在6月於臺大體育館舉辦。當天下午，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。



The students graduating from NTUAS in 2014 include 28 Bachelors, 17 Masters and 3 Ph.Ds.



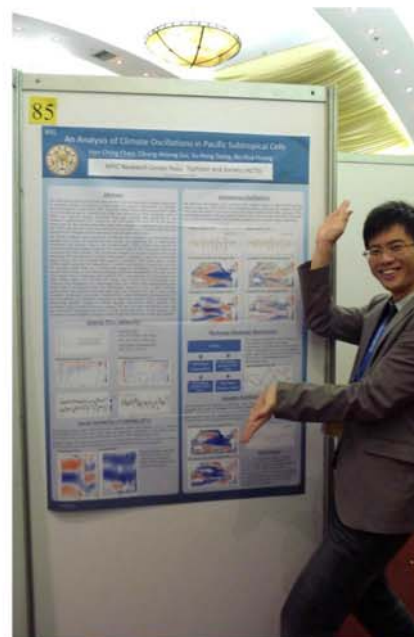
The students graduating from NTUAS in 2015 include 17 Bachelors, 13 Masters and 1 Ph.D.

31st Conference on Hurricanes and Tropical Meteorology



The 31st Conference on Hurricanes and Tropical Meteorology of the American Meteorological Society was held from March 31st to April 4th, 2014, in San Diego. One of NTUAS' master students, Chuan-Chieh Chang (張傳杰) attended this conference and had an oral presentation titled "What Caused the Rapid Intensification of Typhoon Megi (2010)?".

Ocean Science Meeting 2014



The Ocean Science Meeting 2014 was held from February 23rd to 28th, 2014, in Hawaii. One of NTUAS' doctoral students, Han-Ching Chen (陳漢卿) attended this conference and had an oral presentation titled "An Analysis of the Linkage of Pacific Subtropical Cells".

The 9th Workshop of the Virtual Laboratory for the Earth's Climate Diagnostics Program, and the University Allayed Workshop



The 9th Workshop of the Virtual Laboratory for the Earth's Climate Diagnostics Program, and the University Allayed Workshop was held from September 29th to October 1st, 2015, in Japan. Two of our doctoral students, Chia-Wei Lan (藍嘉偉) and Po-Shun Hsu (許博舜) attended this workshop and reported about "Contrast Responses of Seasonal Precipitation Changes over the Land and the Ocean" and "Modeling Study of the Multi-Scale Nature of Tropical Disturbances with MPAS".

2014 Study-Abroad Program

Through the study-abroad program of the College of Science at NTU, the department encourages undergraduate students to participate in collaborating activities with overseas academic institutions.

Junior students Chu-Chun Chen and Chin-Chieh Chou visited the Department of Earth System Science, School of Physical Sciences, at UC-Irvine from July 9th to September 19th, 2014. They studied with Prof. Yu learning data analysis, statistical methods, and using climate model simulations. This program gave them a chance to explore their research interests, and these special experiences could also broaden their horizons.

Furthermore, undergraduate student Wen-Chien Lee had been doing atmospheric physical chemistry research about haze in Southeast Asia with Assistant Prof. Mikinori Kuwata from July 28th to September 6th, 2014 at Nanyang Technological University, Singapore. Haze in Southeast Asia mainly comes from forest fires due to the slash-and-burn agriculture practices in Indonesia. People open the new agriculture areas to plant palm trees and acacias for its high economic value. Different from other woodlands, the lands in the forest of Indonesia are peat land, which is composed of accumulated partially decayed vegetation or organic matters. One special phenomenon for peat is its combustion type: smouldering. Unlike flaming, there is no flame during the smouldering, so it is difficult to detect. Furthermore, this kind of incomplete burning will generate carbon monoxide, which is toxic to human beings. Also, compared to typical forest burning, peat burning produces more fine particles and PAHs (Polycyclic aromatic hydrocarbon). During the dry season (i.e. May to August), prevailing winds could transport these particles to the other regions, raising

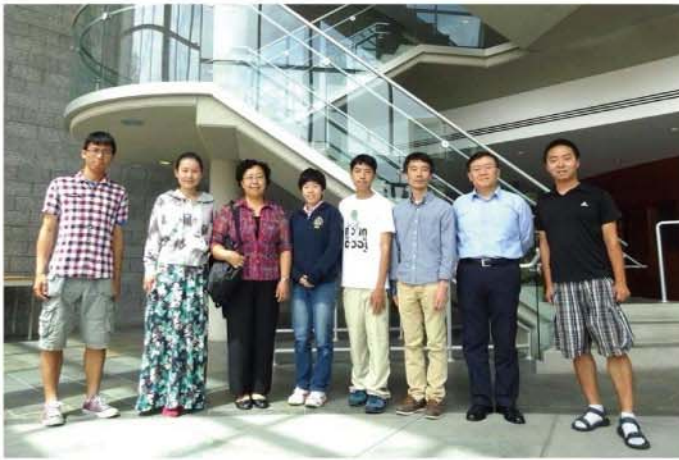
harmful air pollution and health issues.

Five other students, Ying-Ju Chen, Ting-Yu Chang, Wei-Lin Wu, An-Chi Ho and Chih-Chi Hu visited the division of Earth and Planetary Sciences, Kyoto University on August 28th to September 8th, 2014. During this period, Prof. Yoden, Prof. Takemi, Prof. Ishikawa introduced some of the latest concepts and studies during the program in Kyoto University. Prof. Yoden introduced the challenges and difficulties while using the numerical model to simulate the multiscale phenomena in atmosphere. He also shared his experience about working with a small team to deal with some small scale phenomena and their structure by designing the appropriate numerical simulation. Prof. Takemi gave some great lectures to discuss the issues of the mesoscale meteorology, such as the relation between tropical cyclone and climate change, and elaborated some possible mechanisms of rapid intensification with typhoon Haiyan as an example. Prof. Ishikawa talked about the topics on the air pollution and the transport mechanisms in the atmosphere, mentioning some notorious historical disasters caused by air pollution.

在理學院海外教育計畫，本系積極鼓勵學士班學生參加海外教育研究。2014年有陳竹君及周晉傑同學於7月9日~9月19日前往美國加州大學爾灣分校物理科學學院地球系統科學系(Department of Earth System Science, School of Physical Sciences, UC Irvine)進行短期研究。在這期間中，跟隨 Prof. Jin-Yi Yu 學習資料處理、統計分析及氣候模式模擬(CESM)。

新加坡南洋理工大學(Nanyang Technological University, Singapore)學習大氣物理化學實驗設計及執行計畫於2014年7月28日~9月6日由大學部李玟苒同學與 Mikinori Kuwata 教授進行南亞地區霾害問題的相關研究。

京都大學(Kyoto Uni.)交換計畫於 2014 年 8 月 28 日 ~ 9 月 8 日，由陳映如、吳蔚琳、胡志祺、張丁瑀和何安琪等同學拜訪京都大學 Prof. Yoden, Prof. Takemi and Prof. Ishikawa。



A group photo of Yu-Chiao Liang (梁禹喬) (first from left)、Chu-Chun Chen (陳竹君) (fourth from left)、Chin-Chieh Chou (周晉傑) (fourth from right) and Prof. Jin-Yi Yu (余進義) (second from right).



A group photo of the conference. First row (from left to right): Prof. Yoden and Prof. Chun-Chieh Wu (吳俊傑). Second row (from left to right): Ting-Yu Chang (張丁瑀), An-Chi Ho (何安琪), Ying-Ju Chen (陳映如), Wei-Lin Wu (吳蔚琳) and Chih-Chi Hu (胡志祺).



A group photo of Dr. Jing Chen (陳靜)(first from left)、Wen-Chien Lee (李玟芊) (middle) and Prof. Mikinori Kuwata (first from right) in Nanyang Technological University.



A group photo of the Natural Hazards and Global Change Conference.

2015 Study-Aboard Program

Our undergraduate students Ting-Yu Cha, Shiu-Jung Chu, Li-Chih Shen and Jih-Hsuan Tan visited the National Center for Atmospheric Research from May 28th to July 17th.

Another student, Chi-Jung Tsai, visited the State University of New York at Albany for 22 days in July as a visiting student. During this period, she used the programming language Python to make figures out of the experiment and discussed them with Prof. Rose. This experiment is to turn off the horizontal ocean transportation in the Earth system. In other words, we got an Earth without ocean circulation. By analyzing the global temperature, precipitation, ice covered area, energy transportation etc., we tried to realize the role of ocean in energy transportation.

Furthermore, student Po-Chun Chung visited the Colorado State University (CSU) for summer intern from July 13th to August 23rd. He worked with Prof. Elithabeth A. Barnes and did research about how air mass propagates in the atmosphere to find out whether jet acts as a barrier to block air from transporting meridionally. He did his research by GFDL dynamical core, which is a pure atmospheric model (without ocean, radiation etc.).

2015年，大學部朱琇榕同學、沈里治同學、查亭宇同學、譚日軒同學到美國海斯(Hays)進行2個月夜間平原舉升對流觀測實驗。

7月10日至31日，由蔡其融同學前往紐約州立大學阿爾巴尼分校(the State University of New York at Albany)，跟隨 Brian Rose 教授進行短期研究探討海洋輸送對全球能量傳輸的影響。

7月13日至8月24日，由鐘柏鈞同學拜訪美國科羅拉多州立大學(Colorado State University)，由Barnes教授指導進行中緯度暴風路徑與氣膠傳送之關係的短期研究。

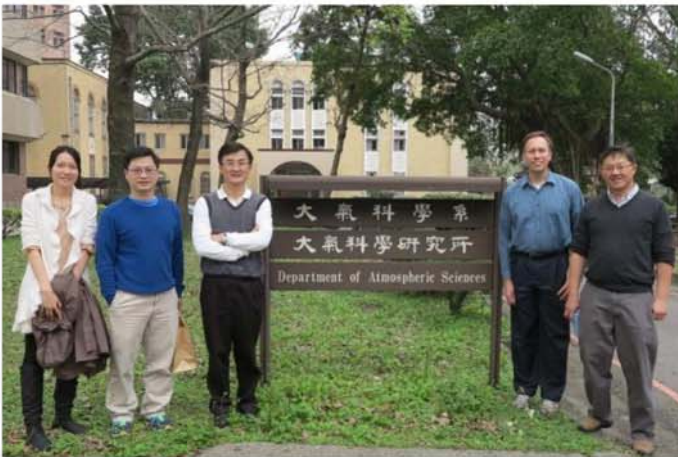


Prof. Brian Rose (right) and Chyi-Rong Tsai (蔡其融) (left) at the State University of New York at Albany.



Prof. Barnes (left) and Po-Chun Chung (鐘柏鈞) (right) at Colorado State University.

Visitors



Dr. Jonathan Vigh (second of right) of NCAR and Prof. John Chiang of Berkeley (first of right) visited the department on February 13th, 2014. Dr. Jonathan Vigh delivered a seminar titled “Tropical cyclone eye formation: observations of intensity and structure change”.



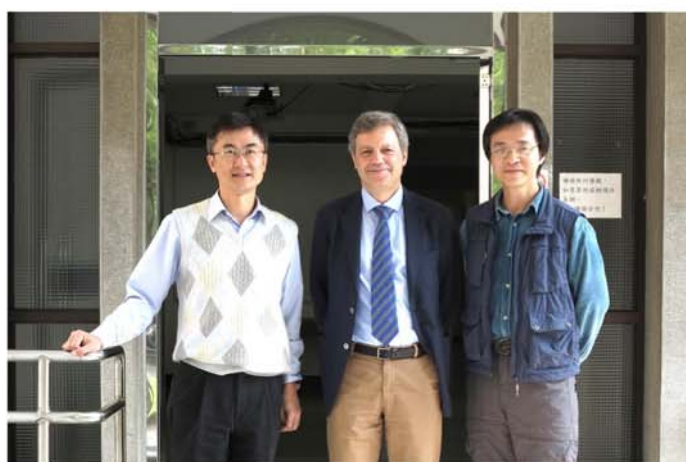
Dr. Shian-Jiann Lin (林先建) (fifth from left) of NOAA visited the department on February 25th, 2014 and delivered a seminar titled “Simulations of tornadoes, tropical cyclones, MJOs, and QBOs, using GFDL's multi-scale global climate modeling system”.

The Kyoto University visited the department on March 5th to 11th, 2014. The 13-member group included Prof. Keiichi Ishioka, Prof. Tetsuya Takemi, Prof. Shoichi Shige, Prof. Takeshi Enomoto, Dr. E. Nishimoto and 6 students were headed by Prof. Shigeo Yoden.



Group photo of the visitors from Taipei Fuhsing Private School who visited the department on March 9th, 2014.

Dr. Sachie Kanada \ Mr. Satoki Tsujino \ Mr. Masaya Kato \ Mr. Keishi Kubo and Dr. Taro Shinoda of the Nagoya University visited the department on March 13th, 2014.



Prof. Jose Luis Sanchez (middle) of University of Leon at Spain visited the department on March 18th, 2014 and delivered a seminar titled “The scientific publication from the point of view of the Editor in Chief of the Journal of Atmospheric Research”.



Dr. Kwo-Sen Kuo (郭國森) (second of left) of NASA visited the department on August 13th, 2014 and delivered a seminar titled “Highly productive research and collaboration in earth science during the era of big data:

1. Toward highly productive earth science research ecosystem.
2. Identifying episodes of earth science phenomena using a big data technology.
3. Collaborative workbench for precipitation retrieval algorithm development.



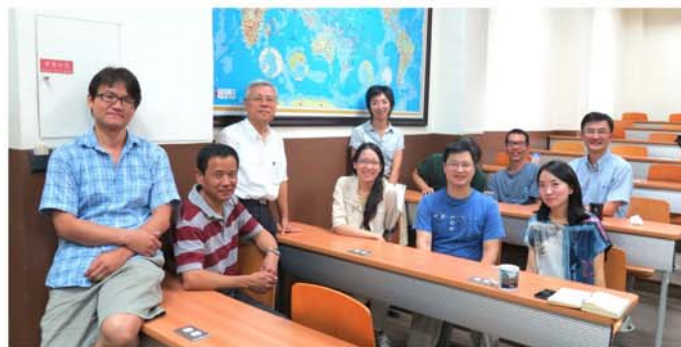
Prof. Po-Hsiung Lin (林博雄) met Prof. Otto Klemm (University of Munster) through the MOST's project, "Studies of Cloud/Fog physical characteristics at Xitou, western Taiwan plan". The 16-member group was headed by Prof. Otto Klemm to conduct field experiment and hold the International Student Conference on Atmospheric Research conference on Sep. 16th to 25th, 2014.

On September 23rd, 2014, the Nanjing University of Information Science & Technology made a brief visit to the department.



Prof. David S. Nolan of University of Miami visited the department on September 30th, 2014 and delivered a seminar titled "Development, validation, and applications of the JONR/WRF hurricane nature runs".

Prof. Sarah Kang (second of left) of Ulsan National Institute of Science and technology and Dr. Zhian Sun (second of right) of Australian Bureau of Meteorology visited the department on October 2nd, 2014. Prof. Sarah Kang delivered a seminar titled “Sensitivity of climate response to latitudinal position of thermal forcing”. Dr. Zhian Sun delivered a seminar titled “Modifications of atmospheric physics for improving ACCESS model simulations for the IPCC AR5 experiments”.



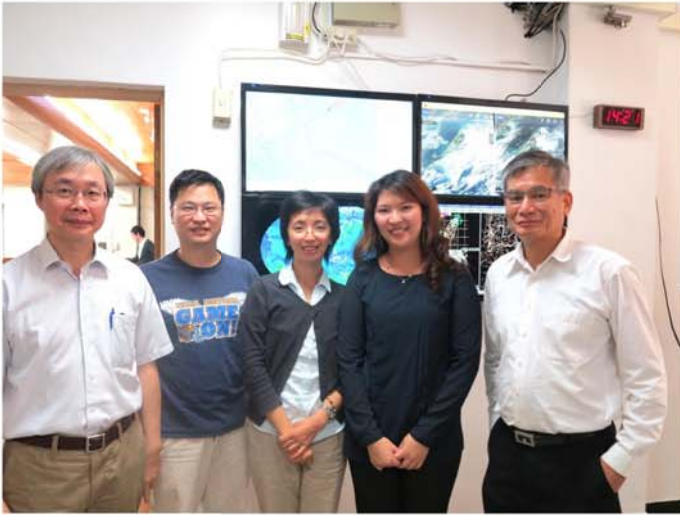
On 3rd October, 2014, four students studying in fifth grade and two of their parents in Morrison Academy Bethany visited the department. Ph.D student Rong-Guang Hsiu (修榮光) welcomed the group and gave some introduction of atmospheric science.



Dr. Sergio F. Abarca (middle) of Naval Postgraduate School visited the department on October 10th, 2014 and delivered a seminar titled “Secondary eyewall formation dynamics”.

Dr. Wen-Chau Lee (李文兆) (first from left) of NCAR visited the department on October 23rd, 2014 and delivered a seminar titled “PECAN (Plains Elevated Convection at Night) and Airborne Phased Array Radar (APAR)”.





Dr. Li Hsiang-Ho (李湘鶴) of Naval Postgraduate School visited the department on October 28th, 2014 and delivered a seminar titled “Release of carbonaceous aerosols from cloud drop evaporation: impacts on aerosol radiative forcing”.

Prof. Pao-Shin Chu (朱寶信) of University of Hawaii at Manoa visited the department on November 4th, 2014 and delivered a seminar titled “Bayesian analysis in climate research”.



Prof. Daryl Kleist of University of Maryland visited the department on November 6th, 2014 and delivered a seminar titled “Initialization, nonlinearity, and non-Gaussianity in hybrid EnVar data assimilation: Time filtering, outer loops, and variable transforms”.

Prof. Haojia Abby Ren (任昊佳) of National Taiwan University visited the department on November 18th, 2014 and delivered a seminar titled “Climate and polar ocean stratification”.



Mr. Yuejian Zhu (朱躍建) (first of left) of NCEP EMC and Prof. Wei - Chyung Wang of University of New York at Albany visited the department on November 20th, 2014. Mr. Yuejian Zhu delivered a seminar titled "Optimum representation of model physics for forecast uncertainty". Prof. Wei-Chyung Wang delivered a seminar titled "Effects of anthropogenic aerosols on marine stratocumuli over Southeast Pacific".



Dr. Yi Jin (first from right in first-row) of Naval Research Laboratory, Monterey visited the department on December 17th, 2014 and delivered a seminar titled "Evaluation of microphysical parameterizations for tropical cyclone prediction".



Prof. Zhenyu Liu of University of Wisconsin visited the department on December 30th, 2014 and delivered a seminar titled "AMOC evolution in the last deglaciation: Forcing mechanism, thermohaline instability and implications".



Distinguished Prof. Lance F. Bosart (fourth from left in first row) of the State University of New York at Albany visited the department on March 17th, 2015. Prof. Lance F. Bosart is Prof. Tai-Jen George Chen's teacher. This photo symbolizes "6 Generations of the Atmospheric Science Family Tree".



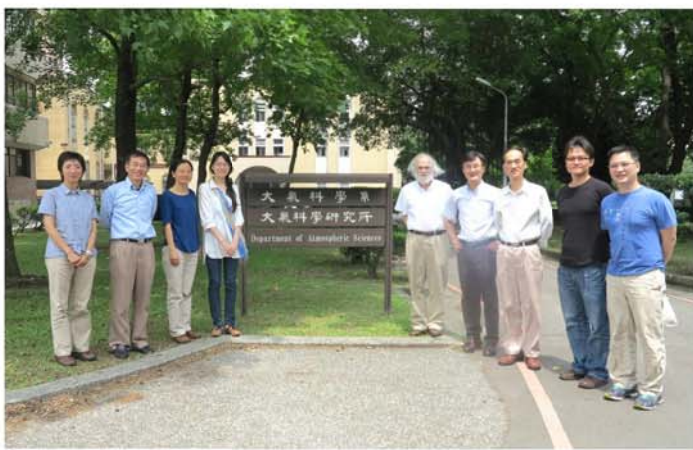
Mr. David A. Unger of Climate Prediction Center visited the department on March 26th, 2015 and delivered a seminar titled “A review of Extended Range Weather and Seasonal Climate Forecasting Techniques at CPC”.



Prof. Gudrun Magnusdottir of University of California at Irvine visited the department on March 27th, 2015 and delivered a seminar titled “Experience sharing to encourage female scientists in Taiwan”.



Prof. Edmund Chang of Stony Brook University visited the department on April 23th, 2015 and delivered a seminar titled “Wavepackets and weather forecasting”.



Prof. Isaac Held (fourth from right) of NOAA visited the department on April 28th, 2015 and delivered a seminar titled “Some problems in large-scale atmospheric dynamics”.



Dr. Guo-Yuan Lien (連國淵) (first from right) of RIKEN Advanced Institute for Computational Science visited the department on April 30th, 2015 and delivered a seminar titled “Assimilation of precipitation-related variables with the local ensemble transform Kalman filter (LETKF)”.



The Hong Kong Meteorological Society visited the department on May 22nd, 2015.



Nanjing University of Information Science & Technology visited the department on July 6th, 2015.



Prof. Tsann-wang Yu (余燦旺) (third from left) of Howard University and his wife visited the department on September 23rd, 2015.



Dr. Yoshiaki Miyamoto (second from left) of RIKEN Advanced Institute for Computational Science Computational Climate Science Research team visited the department on October 6th, 2015 and delivered a seminar titled “Convection on the globe in the subkilometer global simulation”.



Prof. Tim Li (李天明) (middle) of University of Hawaii visited the department on October 10th, 2015 and delivered a seminar entitled “Recent progress in understanding MJO dynamics and extended-range forecast”.

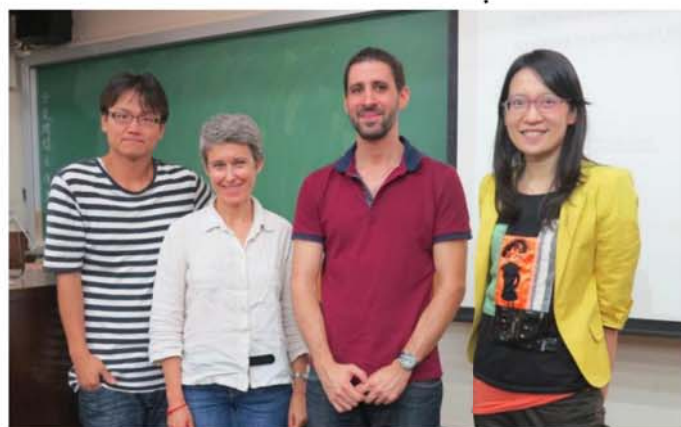


Prof. Ni-Bin Chang (張乃斌) (second from left) of University of Central Florida visited the department on October 15th, 2015 and delivered a seminar titled “How can the climate change assessment framework be reshaped by the advances of climate informatics technologies? ”.



Dr. Ma, Hsi-Yen (馬席研) (second from right in first row) of Lawrence Livermore National Laboratory visited the department on October 29th, 2015 and delivered a seminar titled “A multi-year hindcast”.

Dr. Nicolas Freychet (second from right) of Research Center for Environment Changes of Academia Sinica visited the department on November 5th, 2015 and delivered a seminar titled “Extreme weather events: Observations / Models”.



Prof. Ching-Yen Tsai (蔡清彥) (fourth from left in first row), incumbent Chairman of Industrial Technology Research Institute of Taiwan, delivered a talk about “The Journey of My Study and Thought Development” (我的學思歷程) on November 18th, 2015.



Participants from “2015 Meteorological Conference for crossing - Taiwan-Strait Youngman” visited the department on November 27th, 2015.

Change in Ocean Subsurface Environment to Suppress Tropical Cyclone Intensification Under Global Warming

全球暖化不利熱帶氣旋發展

本篇擷取自臺大校訊第 1221 期

【全球暖化不利熱帶氣旋發展 臺大與中國大陸中國科學院、臺灣中央研究院合作成果榮登《Nature Communications》】

Tropical cyclones (TCs) are hazardous natural disasters. Because TC intensification is significantly controlled by atmosphere and ocean environments, changes in these environments may cause changes in TC intensity. Changes in surface and subsurface ocean conditions can both influence a TC's intensification. Regarding global warming, minimal exploration of the subsurface ocean has been undertaken. Here we investigate future subsurface ocean environment changes projected by 22 state-of-the-art climate models and suggest a suppressive effect of subsurface oceans on the intensification of future TCs. Under global warming, the subsurface vertical temperature profile can be sharpened in important TC regions, which may contribute to a stronger ocean coupling (cooling) effect during the intensification of future TCs. Regarding a TC, future subsurface ocean environments may be more suppressive than the existing subsurface ocean environments. This suppressive effect is not spatially uniform and may be weak in certain local areas.

全球暖化之下海洋水下環境改變不利熱帶氣旋發展，臺大大氣系林依依主任與中國大陸中國科學院、臺灣中央研究院合作成果榮登《自然通訊期刊》(Nature Communications)。

熱帶氣旋，在北大西洋稱之颶風，在西北太平洋地稱之颱風，為最大的自然災害之一，並且是相當重要的天然災害。由於這些熱帶氣旋的發

展受其所處的大氣和海洋環境有極大的影響，在全球暖化下，地球環境的改變亦有可能影響其發展。一篇最新的研究由臺灣大學、中國大陸中國科學院、台灣中央研究院合作共同發表在自然通訊期刊上，發現在未來全球暖化情況下，海洋的水下環境可能變得不利熱帶氣旋發展。主要原因是雖然當全球暖化發生時海表面的水溫變得較暖，但是海表下淺水層水溫增加速率不如海表面一樣快速。換言之，即海洋表水溫度變暖較快，水下溫度變暖較慢，如此的水溫變化差異造成海洋淺水層溫度垂直梯度變得更大，即溫度垂直分佈斜率變陡，此梯度增加的現象將會增強熱帶氣旋和海洋之間的耦合作用，該耦合作用的增強造成海洋下層溫度較低的海水更容易被帶到海表面，因而抑制熱帶氣旋的形成。而文章指出這樣的結果同時存在於世界上最重要的兩熱帶氣旋好發區；西北太平洋颱風好發區，及西北大西洋颶風好發區。因此雖然過去普遍認為全球暖化之下，只考慮海洋表面溫度增暖，將有利熱帶氣旋發展，但若一併考慮海洋水下環境的改變，水下溫度梯度增大的情形將會抑制熱帶氣旋發展。總的來說，文章指出熱帶氣旋在全球暖化下的增強程度，不僅要考慮海洋表層海水溫度變化而產生的增強作用，還必須要考慮一新的控制因子，即考慮水下溫度梯度變化對熱帶氣旋發展的抑制作用。

引用:Ping Huang, I-I Lin* Chia Chou, and Rong-Hui Huang, Change in Ocean Subsurface Environment to Suppress Tropical Cyclone Intensification under Global Warming, Nature Communications, accepted, 2015* corresponding email: iilin@as.ntu.edu.tw

Recent Decrease in Typhoon Destructive Potential and Global Warming Implications

海洋變暖不一定導致颱風破壞

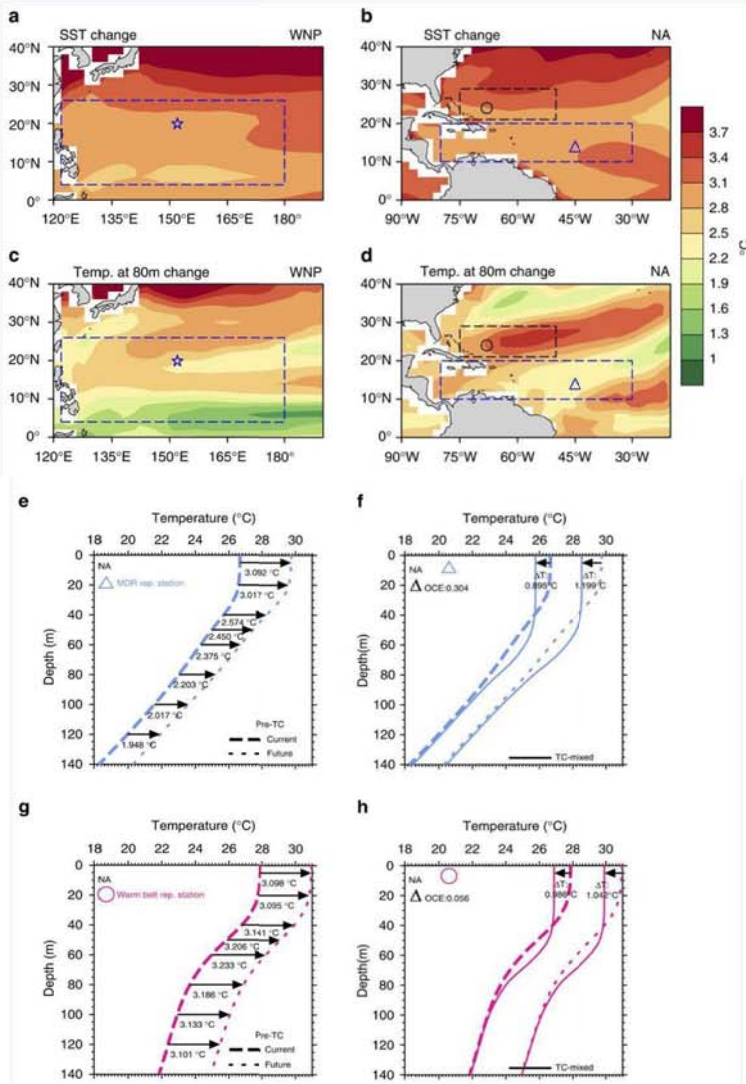
潛力增加

本篇擷取自臺大校訊第 1221 期

【海洋變暖不一定導致颱風破壞潛力增加
臺大及香港城市大學合作成果榮登
《Nature Communications》】

Typhoons (tropical cyclones) severely impact the half-billion population of the Asian Pacific. Intriguingly, during the recent decade, typhoon destructive potential (Power Dissipation Index, PDI) has decreased considerably (by ~35%). This decrease, paradoxically, has occurred despite the increase in typhoon intensity and ocean warming. Using the method proposed by Emanuel (in 2007), we show that the stronger negative contributions from typhoon frequency and duration, decrease to cancel the positive contribution from the increasing intensity, controlling the PDI. Examining the typhoons' environmental conditions, we find that although the ocean condition became more favourable (warming) in the recent decade, the atmospheric condition 'worsened' at the same time. The 'worsened' atmospheric condition appears to effectively overpower the 'better' ocean conditions to suppress PDI. This stronger negative contribution from reduced typhoon frequency over the increased intensity is also present under the global warming scenario, based on analysis of the simulated typhoon data from high-resolution modelling.

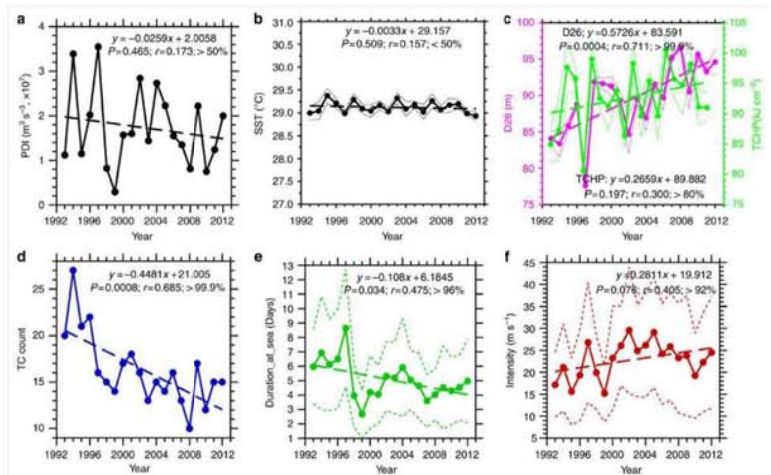
在一般的認知裡，人們常常認為海洋變暖會導致颱風破壞潛力增加，但是在最近 20 年中，西北太平洋觀測的結果卻與此恰恰相反，雖然近年海洋變暖，但颱風破壞潛力卻逐年下降。此篇



(a,b) SST warming over the WNP and the NA. (c,d) Similar to a,b, but for the ocean subsurface temperature at 80 m. The change is defined as the difference between the 2091–2100 mean and the 2006–2015 mean. The two large boxes denote the MDRs over the WNP and the NA. The NA warm belt region is denoted by a smaller box (northern box) in b,d. The star, triangle and circle denote the positions of the selected representative stations for the three regions. (e,f) Initial (e) and TC-mixed (f, output from the 3DPWP for scenario 8) ocean temperature profiles for the representative station of the NA MDR, comparing current and future conditions. (g,h) Similar to e,f, but for the NA warm belt. In e,g, the arrows and numbers denote the initial temperature increases under global warming at various ocean depths. Rep., representative; Temp., temperature.

由臺灣大學大氣科學系林依依教授及香港城市大學陳仲良教授發表在自然通訊期刊的最新研究，深入探索其原因。由於颱風的破壞潛力並不是只受到海洋的影響，雖然近年海洋變暖，颱風強度略為增加，但是影響颱風破壞潛力還有另外兩個重要因子，即颱風個數及颱風生命期。林與陳的研究發現，近 20 年來颱風形成個數顯著下降，同時生命期顯著縮短。由於颱風破壞潛力是由三個因素共同影響，而颱風個數下降及生命期變短產生的負貢獻遠超過颱風強度變強的正貢獻，因此造成近 20 年來的颱風破壞潛力逐年降低，至於為何颱風生命期變短和颱風個數下降，研究發現該現象與不利的大氣環境有關，雖然海洋條件變得較有利颱風強度增強，但是大氣環境變得不利颱風的生命期及個數增加，所以近 20 年來的颱風破壞潛力逐年降低。同時，在全球暖化的情境下，他們也發現類似的現象。透過分析 NOAA 高解析度氣候模式所模擬 simulate 出的全球暖化情境下之颱風資料，他們發現在全球暖化之下，西北太平洋的颱風破壞潛力降低了 15%，其主要原因也與近 20 年來的分析結果類似，即雖然在全球暖化之下，颱風強度略為增加，但是颱風個數更顯著的減少，使其負貢獻遠大於颱風強度增加的正貢獻，因此在西北太平洋的破壞潛力於全球暖化情境下降低了 15%。

引用: I-I Lin* and Johnny Chan, Recent Decrease in Typhoon Destructive Potential and Global Warming Implications, Nature Communications, in press, 2015* corresponding email: iilin@as.ntu.edu.tw



Time evolution of the observed PDI and other parameters over the western North Pacific MDR in the past two decades. The trend line for each time series, based on linear regression is also depicted. Standard deviations are depicted by dotted curves. (a) PDI, (b) SST, (c) the depth of the 26°C isotherm (D26) and TCHP (Tropical Cyclone Heat Potential or upper ocean heat content (UOHC)). (d) Typhoon case number in the typhoon season (July– October) of a year, (e) as in d, but for the averaged typhoon duration, (f) as in d, but for the averaged typhoon intensity.

A Long Neglected Damper in the El Niño-Typhoon Relationship: a 'Gaia-Like' Process

聖嬰年颱風強度「踩煞車」刊載

《Nature Scientific Reports》

本篇擷取自臺大校訊第 1230 期

【聖嬰年颱風強度「踩煞車」刊載《Nature Scientific Reports》】

Proposed in the early 1970's, the Gaia hypothesis suggests that our planet earth has a self-regulating ability to maintain a stable condition for life. Tropical cyclone (TC) is one of the earth's most hazardous disasters; it is intriguing to explore whether 'Gaia-like' processes may exist in nature to regulate TC activities. El Niño can shift the forming position of the Western Pacific typhoons away from land. This shift enables typhoons to travel longer distances over ocean and is known to be a positive process to promote TCs to achieve higher intensity. What is neglected, however, is that there co-exists a negative process. Here we show that during El Niño, typhoons intensify over region undergoing strong ocean subsurface shoaling where upper ocean heat content can drop by 20 - 50%. This 'worsen' ocean pre-condition can effectively reduce ocean's energy supply for typhoon intensification during typhoon-ocean interaction. We find this an elegant, 'Gaia-like' process demonstrating nature's self-regulating ability. Though during El Niño, typhoons can take advantage of the longer travelling distance over ocean to achieve higher intensity, nature is also providing a damper to partially cancel this positive impact. Without the damper, the situation could be even worse.

臺大跨國研究聖嬰年颱風強度「踩煞車」刊載《Nature Scientific Reports》。過去研究顯示，聖嬰發展時西太平洋颱風生成位置偏東，偏暖的

海水有利颱風發展，加上颱風生成地點距離陸地較遠，照理而言會出現較平常年更為強勁之颱風，可是統計分析結果顯示，聖嬰年期間颱風卻沒有特別顯著增強之趨勢。過去學界對此沒有定論，但現在科學家發現了聖嬰期間颱風強大的負向回饋機制，此機制順利解開聖嬰年颱風強度演變之謎，而這項研究成果也已於今年 7 月刊登在國際知名期刊《自然-科學報導》中。

7 月到 9 月是傳統臺灣颱風熱季，今年適逢中等強度聖嬰現象持續作用，有利於颱風發展，近日襲臺的蘇迪勒颱風，短短 24 小時從輕颱成為強颱，更被美國聯合颱風警報中心偵測，瞬間最大風速達每小時 354 公里，成為今年全球最強的颱風。

蘇迪勒為典型發生於聖嬰年期間之強烈颱風，若在其生成與成長期間，沒有研究中顯示的負向回饋機制作用，蘇迪勒對臺灣帶來的災害與威脅將更嚴峻。

由臺師大海洋環境科技研究所副教授鄭志文與臺大大氣科學系系主任林依依特聘教授研究團隊主導，與夏威夷大學王斌教授進行跨國研究合作，歷經 3 年多努力分析近 50 餘年颱風資料，進一步解開聖嬰年期間颱風強度演化之謎，並引進大地之母蓋亞假說的概念，順利解釋先前世界各團隊研究間的落差(missing-link)。

長久以來，熱帶氣旋(颱風)一直是地球上最具破壞性的天然災害之一。聖嬰年期間，在赤道太平洋特殊背景環境底下，颱風生成位置往東南偏移，此偏移讓颱風得以從溫暖海洋獲取發展能量的時空範圍皆擴大，對颱風強度的發展為一正向回饋(positive feedback)機制。因此，長久以來，聖嬰年期間的颱風強度，被認為應該會較平常年颱風強勁許多。

然而，弔詭的是，長期統計資料顯示，事實上卻非如此。根據過去研究統計颱風累積能量綜合指標 (Accumulated Cyclone Energy, ACE) 並指出，聖嬰年期間，颱風強度其實並未若預期般強大，此事實與理論上的落差，已存在颱風研究領域長達十年，並成為科學家待解開的謎團。

研究團隊利用衛星觀測資料、歐洲中期天氣預報中心(ECMWF)海洋再分析資料，配合海洋數

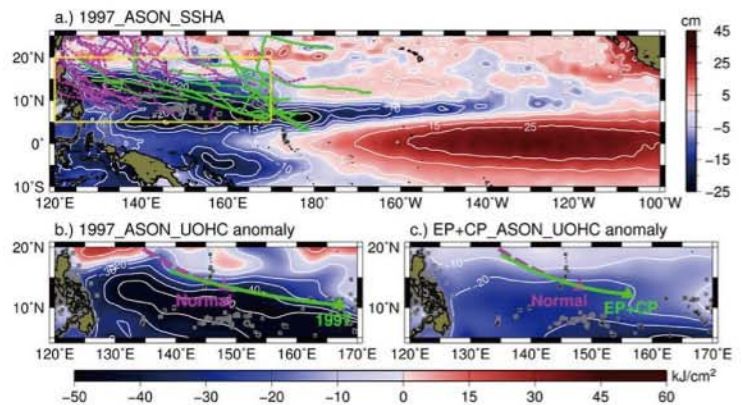
值模式之執行，計算海表溫降，並透過熱動力方程式計算海氣熱通量變化，乘上颱風行進距離，藉此估算在不同情境下颱風強度變化情形，研究發現聖嬰年期間，雖然因颱風生成位置朝東南移進而允許颱風有更長的發展期 (development length)，幾乎同一時間，卻有另一個強大的負向回饋機制(聖嬰年西赤道太平洋海域次層冷海水淺化)在幫忙「踩煞車」。

研究指出，如果少了這項機制的影響(或幫忙!?)，聖嬰年期間的颱風恐將增強為平常年的149%，而且該現象適用於兩種不同種類之聖嬰年(標準聖嬰 Canonical El Niño & 非典型聖嬰 El Niño Modoki)之上。

也就是說，這個重要機制可控制颱風於聖嬰年期間，不至於造成更可怕災害，作者並引進蓋亞(Gaia-hypothesis,大地之母)的概念，認為此過程可被視為一 Gaia-like 的過程，在聖嬰年提供颱風「適宜」發展環境的同時，同時也有一個默默作用之機制，保護整個平衡不致於失衡甚至失控。研究團隊指出，這與希臘神話中所描述的蓋亞大地之母相似，她促使地球系統萬物相互作用，使得地球適宜生命持續生成與發展。此作用過程的發現與提出，順利解釋了先前相關重要研究成果間的落差。

最後，過去研究指出，在全球暖化 (Global Warming)的情境底下，太平洋未來很有可能呈現持續偏向聖嬰年的狀態(El Niño-like scenario)，因此，此研究所提出的物理過程 (A Long Neglected Damper in the El Niño-Typhoon Relationship)之重要性，在全球暖化趨勢下將更趨強烈。

此研究於7月21日在國際頂尖的自然出版集團 (Nature Publishing Group) 著名的期刊《自然-科學報導》(Nature-Scientific Reports) 發表。詳細的研究成果請參閱2015年7月21日正式發表於 Scientific Reports 的全文及補充資料，“A Long Neglected Damper in the El Niño-Typhoon Relationship: a ‘Gaia-Like’ Process. Sci. Rep. 5, 11103; doi: 10.1038/srep11103 (2015)”。



(a) During-El Niño Sea Surface Height Anomaly (SSHA) map of the tropical Pacific Ocean, as observed by satellite altimetry in August–November (ASON) 1997. The corresponding TC intensification tracks [from the genesis position to the life-time intensity peak] are depicted in green. For comparison, the non-El Niño TC intensification tracks (ASON of 1998–2001) are depicted in pink. The south-eastward shift of TC tracks during El Niño is evident. The study region is shown by yellow box. (b) Upper ocean heat content (UOHC) anomaly [with respect to the 1980–2009 mean] of the study region in the 1997 TC season (ASON). Data source: ECMWF ORAS4 reanalysis data. The corresponding mean TC intensification track and the genesis position (in triangle) are illustrated in green. For comparison, the normal (long-term) TC intensification mean track and genesis position (triangle) are depicted in pink. (c) As in (b), but for the UOHC anomaly based on composites of 8 El Niño events. Figures are generated using the GMT (<https://www.soest.hawaii.edu/gmt/>) and IDL softwares (<http://www.exelisvis.com/ProductsServices/IDL.aspx>).

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曾開治*	DYNAMO 期間，季內震盪之濕化過程診斷
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- Chih-Hang Wei Diagnostic study of a morning convection event over southwestern coast of Taiwan during MeiYu season under weak synoptic condition
- Wen-Lin Lin Asymmetric Responses of Precipitation over the Maritime Continent in the ENSO events
- Chin-An Lin The Influence of Boundary Layer Processes on Advection Fog
- Wen-Ying Wu* Annual Range of Water Storage and its Application on Land-Atmosphere Interactions
- Tien-Yao Hsu Dynamic Efficiency of Heat and Momentum in Balanced Vortex Model

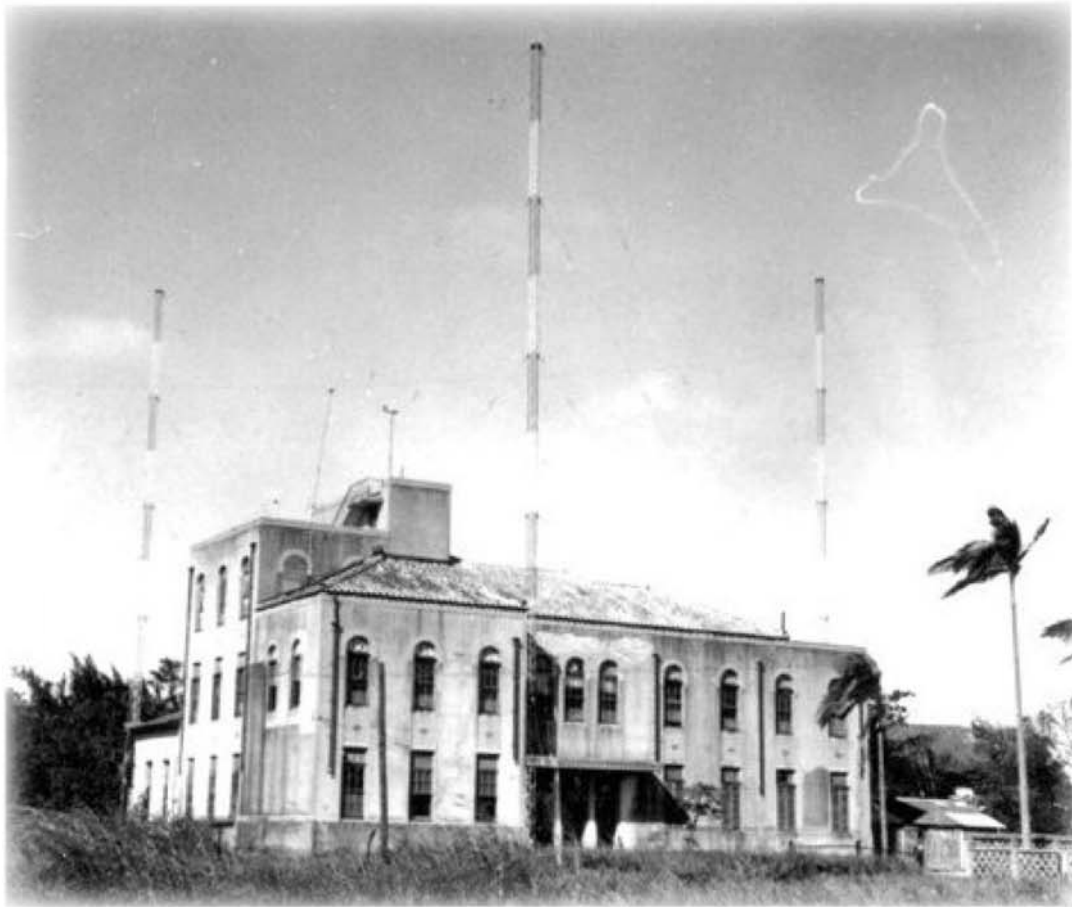
2015 博士論文

- 陳柏孚 颱風與環境交互作用下之長生命期雨帶
- 林宜菽* 以區域數值模式探討沙塵與雲的交互作用

2015 碩士論文

- 謝璨筑 雲微物理參數法對模擬颱風的影響
- 蔡佳穎* 層積雲動力系統之分歧現象
- 蘇俊彥 以雙矩量雲微物理機制探討雲凝結核對極端降水之影響:西南氣流實驗個案分析
- 呂佳穎 台灣環島之大氣邊界層特性
- 徐世裴 探討西北太平洋暖季赤道羅士比波的特性
- 林佑宇 重力波動對層積雲系統垂直結構及雲量之影響
- 黃冠慈 人為氣膠排放與灌溉活動對北印度度乾季氣候之影響
- 郭冠廷 台北盆地午後熱對流降水集中區形成機制之探討
- 魏豪緯 農業灌溉於低緯度地區造成之冬季時期高土壤濕度對區域與全球氣候之可能影響
- 何國豪 梅雨鋒面北退與相關之南海低壓發展之個案診斷分析研究
- 徐嘉鴻 高雄都會區氣膠吸濕特性之探討
- 魏智航 梅雨季弱綜觀強迫下臺灣西南部沿海清晨對流發展之個案診斷分析研究
- 林文琳 海洋大陸於聖嬰期間的海陸空間降水不對稱
- 林晉安 邊界層物理過程對平流霧之影響
- 吳文瑛* 全球暖化下陸地水含量的季節變化與陸氣交互作用
- 許天耀 平衡渦旋模型之熱與動量動力效率

*Recipients of the Dean's Award; *院長獎得主



Meteorology Class of Science and Agriculture Taihoku Imperial University in 1933.

No.7 (December 2013)

News

- Prof. Kuo-Nan Liou received the 2013 Roger Revelle Medal of AGU and elected as the 2013 NTU Distinguished Alumnus
- Prof. Hung-Chi Kuo received the title of Chair Professor of NTU for 2013-2016
- Prof. Chun-Chieh Wu received the Outstanding Research Award from the NSC in 2012 and Academic award of Ministry of Education in 2013
- Prof. I-I Lin was awarded the title of Distinguished Professor for 2013-2016
- Prof. Jen-Ping Chen received the NTU Outstanding Teaching Award in 2013
- Prof. Po-Shiung Lin received the NTU Teaching Award in 2013
- The Department Retreat
- The NTU Azalea Festival
- 2013 Commencement
- Parent-Teacher Conference Day

- Class of " Dynamics of El Niño & Southern Oscillation Phenomenon"
- Study-Abroad Program
- List of Visitors and Presentations

Meeting Highlight

- 2013 Metrological Conference for Cross-Taiwan-Strait Youngman
- Fifth International Workshop on Monsoons

Research Highlight

- Unbalanced Dynamics of Secondary Eyewall Formation in Tropical Cyclones: A New Pathway
- An Ocean Coupling Potential Intensity Index for Tropical Cyclones
- Recent Warming in the Western North Pacific Subsurface Ocean to Favor Typhoon Intensification