National Taiwan University

No. 7
December 2013

Atmospheric Sciences (NTUAS)

Newsletter

News

臺大大氣科學系所簡訊

Prof. Kuo-Nan Liou

Roger Revelle Medal Winner

NTU Distinguished Alumnus

Academician Kuo-Nan Liou, an alumnus of the Department of Atmospheric Sciences at National Taiwan University (NTUAS), and the founding Director of the Joint Institute for Regional Earth System Science and Engineering (JIFRESSE) at UCLA, received the 2013 Roger Revelle Medal of American Geophysical Union (AGU) for his research accomplishments in atmospheric radiative transfer and climate. He was also elected as the 2013 NTU Distinguished Alumnus.

系友廖國男院士榮獲 2013 年美國地球物理聯盟（American Geophysical Union, AGU）之羅傑・雷維爾勳章（Roger Revelle Medal），此勳章為表揚廖國男院士在大氣輻射及氣候方面之貢獻。廖院士並當選本校 2013 年傑出校友。

A group photo taken at the celebration ceremony at NTUAS on November 14th, 2013.

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News

Awards

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 National Science Council in 2012 and Academic award of Ministry of Education in 2013. Prof. Chun-Chieh Wu starts to serve as the Associate Dean of the College of Science in November 2013.

Prof. I-I Lin received the title of Distinguished Professor for 2013-2016.

Prof. Jen-Ping Chen received the NTU Outstanding Teaching Award in 2013.

Prof. Po-Hsiung Lin received the NTU Teaching Award in 2013.

郭鴻基教授榮獲臺大講座(2013-2016)。

吳俊傑主任榮獲國科會 101 年度傑出研究獎及第 57 屆教育部學術獎，並自 2013 年 11 月起兼任理學院副院長。

陳正平教授「101 學年度全校優良教師」教學傑出獎。

林依依教授榮聘為本校特聘教授(2013-2016)。

林博雄教授「101 學年度全校優良教師」教學優良獎。

The Department Retreat

The department retreat was held at Beitou on February 5th. All faculty members participated in discussion for the new faculty recruitment.

本系靜修會於 2 月 5 日在北投舉行。全系教授共同參加針對新聘教師規劃進行充分討論。

A group photo of the department retreat on Feb. 5th, 2013.

The NTU Azalea Festival

The NTU Azalea Festival was held on March 16th to 17th, with activities including department exhibitions, student club exhibitions and performances that attracted high school students from all over Taiwan. NTUAS also set up a booth, providing introduction of our department courses and information of atmospheric sciences.

臺灣大學於 3 月 17 日至 18 日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。

A group photo in front of the NTUAS booth.

2013 Commencement

The 2013 Commencement of NTU took place in the morning of June 15th, along with 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. The students graduating from NTUAS this year include 25 Bachelors, 11 Masters and 4 Ph.Ds.

臺灣大學 2013 年畢業典禮在 6 月 15 日上午於臺大體育館舉辦。當天下午，系上進行畢業典禮，由吳俊傑主任撥穗，並邀請畢業班導師及畢業生親友共同參與。今年總共有 25 名學士、11 名碩士及 4 名博士從臺大大氣畢業。

A group photo of graduating students and mentoring professors for the class of 2013.

Parent-Teacher Conference

NTU held the Parent-Teacher Conference on September 7th. In the afternoon, NTUAS invited freshmen and their parents to visit department and to attend the department orientation.

臺灣大學在 9 月 7 日上午舉辦新生家長日。大氣系於下午舉辦大氣系新生家長日，邀請家長們了解大氣系系況、課程及環境，並進行交流活動。

Class of "Dynamics of El Niño & the Southern Oscillation Phenomenon"

During the first semester of the 2013 school year, NTUAS invited Prof. Fei-Fei Jin from University of Hawaii at Manoa to offer a course on "Dynamics of El Niño & the Southern Oscillation Phenomenon".

102 學年度第 1 學期本系邀請夏威夷大學馬諾阿分校金飛飛教授，開設「聖嬰氣候震盪動力學」課程。

A photo of Prof. Fei-Fei Jin with students at the class of "Dynamics of El Niño & the Southern Oscillation Phenomenon".

A photo during the Parent Teacher Conference at NTUAS.

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 oversea academic institutions.

Junior students Heng Wang and Hao-Wei Peng visited the Atmospheric Sciences Research Center (ASRC) of the State University of New York at Albany with Prof. Wei-Chiang Wang and Prof. James Schwab They obtained the hands-on experience of measuring and analyzing the optical properties of aerosol particles with laboratory instruments They also surveyed and studied literature papers about the topic of "Direct Radiative Effect of Sulfate and Black Carbon Aerosols". In addition they learned how to summary what they learned into a thesis.

Furthermore, student Li-Chung Wang visited the University of California Center for Hydrologic Modeling (UCCHM) at UC-Irvine from July 15th to August 30th. He worked with Prof. James Famiglietti, and studied the snow mass changes on Tibetan Plateau with the Gravity Recovery and Climate Experiment (GRACE) data and compared it with the reanalysis data of European Centre for Medium-Range Weather Forecasts (ECMWF)

Aside from the programs in the United States, we also collaborated with institutes in Japan and Korea. Five students from NTUAS, Chieh-Jen Cheng, Wei-Chen Kuo, Hsing-Ju Chao, Po-Yen Chen, and Yi-Hsuan Hsieh joined the First Kyoto University (KU) and NTU Student Exchange Program of Atmospheric Sciences, which was held from July 19th to 28th. This program included (1) in-class lectures, in which eight professors gave evening lecture regarding different aspects of atmospheric science researches, (2) computer exercises on GFD, in which the students used computers to run simple models, and (3) field trips to, the Middle and Upper Atmospheric Radar (MU radar) station near Kyoto and a museum of disaster prevention.

Three other students, Kuok Hou Ho, Chi Hong Ngai and Kuan-Chih Wang, visited the Department of Environmental Science at Pukyong National University for a short-term Radar Meteorology Experiment during September 7th to 14th. In this program, they went on KAYA experiment ship with Prof. Dong-In Lee and his research group. They also visited the radar station, Typhoon Research Center and Meteorology Research Center on Jeju Island.

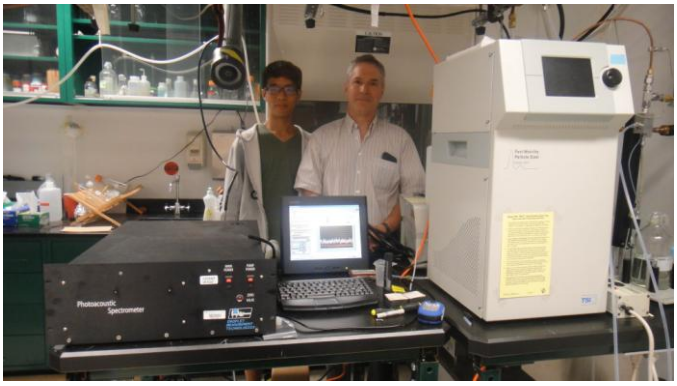
在理學院海外教育計畫，本系積極鼓勵學士班學生參加海外教育研究。

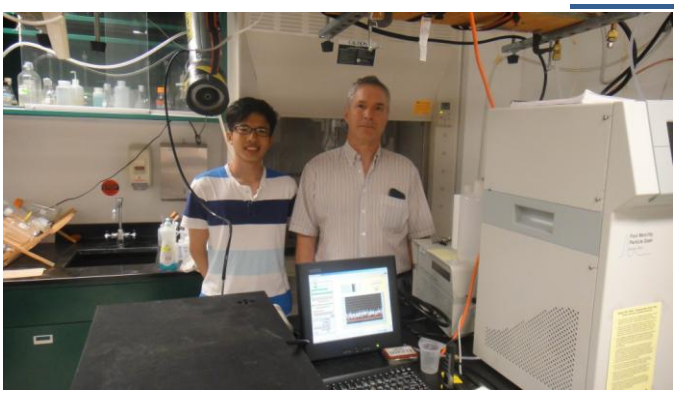
2013 年 7 月 8 日~8 月 2 日由大四學生王珩和彭浩維同學到紐約州立大學阿爾巴尼分校，跟隨王維強教授和 Prof. James Schwab 進行短期研究-學習儀器觀測並研讀資料及撰寫研究報告。

7 月 15 日~8 月 30 日由王立中同學前往加州大學爾灣分校水文模擬中心 (University of California Center for Hydrologic Modeling) 跟隨 Prof. James Famiglietti 進行為期 47 天的短期研究計畫。在這段時間中，利用 GRACE (Gravity Recovery and Climate Experiment) 和 ECMWF(European Centre for Medium-Range Weather Forecasts)，探討青藏高原冰雪變化、印度季風強度變化及氣候因素。

7 月 19 日~7 月 28 日由大學部鄭傑仁、趙興儒、謝乙瑄、郭威鎮和陳柏言等同學參加第一回京都大學-國立台灣大學大氣科學系交換學生計畫 (The first exchange for students of the atmospheric sciences departments of NTU and Kyoto University) 到京都大學大氣科學系、防災研究所及雷達實驗室，修習資料同化、天氣尺度的研究介紹、小尺度研究及雷達介紹。

9 月 7 日~9 月 14 日由何國豪、魏智航和王冠智等 3 位同學到韓國釜慶大學 (Pukyong National University) 參加由 Prof. Dong-In Lee 帶領研究團隊及本系學生搭乘研究船 KAYA 號進行為期 8 天的海上雷達氣象觀測實驗。

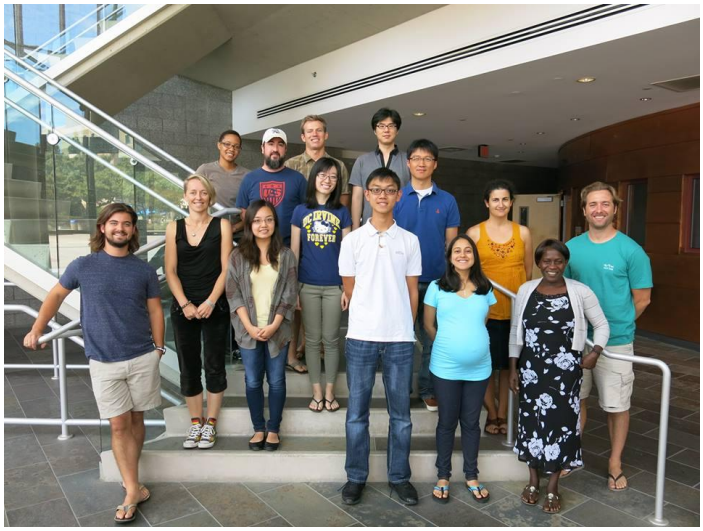




Prof. James Schwab, Heng Wang (left) and Hao-Wei Peng (right) at the Atmospheric Sciences Research Center (ASRC) of the State University of New York at Albany.

A group photo during the visit of Kyoto University. Second row (from right to left): Prof. Yoden Shigeo, Hsing-Ju Chao, Wei-Chen Kuo, Po-Yen Chen, Chieh-Jen Cheng and Yi-Hsuan Hsieh.

A group photo of Kuok Hou Ho (second from right in third-row), Chi Hong Ngai (first from right in third-row), Kuan-Chih Wang (third from right in forth-row) and Prof. Dong-In Lee (first from left in first-row).

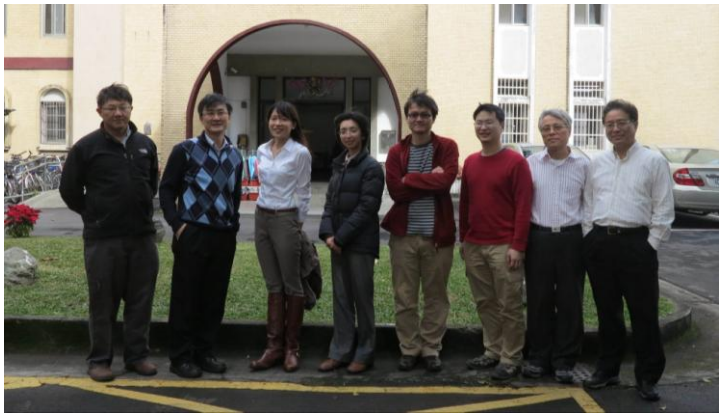


A group photo of Li-Chung Wang (white Polo shirt) and University of California Center for Hydrologic Modeling members.

List of Visitors and Presentations

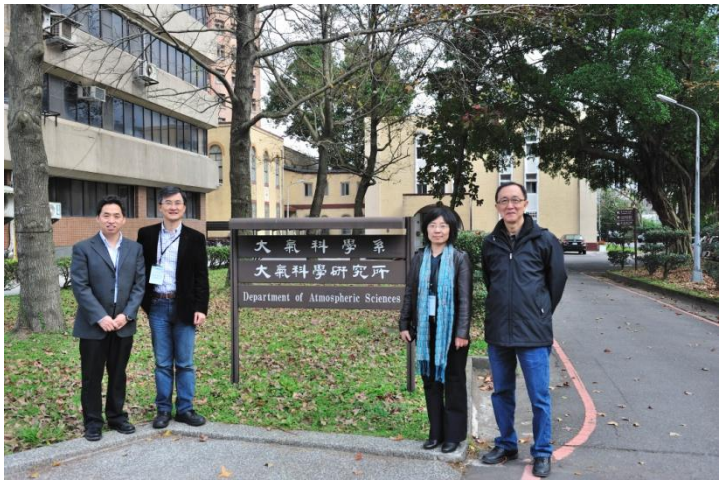
Date	Visitors	Seminar titles
2012/12/14	**Prof. Shigeo Yoden** Graduate School of Science Kyoto Univ. Japan	A downscaling experiment on heavy rainfall during the Jakarta Flood Event 2007, under an international collaborative research project in tropical Asia
	Prof. Takeshi Enomoto Graduate School of Science Kyoto Univ. Japan	Use of operational forecast models in education and research
2012/12/19	**Prof. Patrick Chuang** Earth and Planetary Sciences UC Santa Cruz, USA	Can meteorology obfuscate aerosol indirect effects?
2012/12/20	**Dr. Bohua Huang** Oceanic and Earth Sciences George Mason Univ., USA	Decadal oscillation of the Atlantic meridional overturning circulation in climate models
2012/12/26	**Ms. Yen-Ting Hwang** University of Washington, USA	Why is ITCZ in the north? And why do GCMs have double ITCZ?
2012/12/27	**Dr. Jan-Huey Chen** Naval Research Laboratory, USA	Applications of GFDL high-resolution atmospheric global model -- from 5-day forecast to seasonal prediction

Prof. Takeshi Enomoto (third from left in first-row) and Prof. Shigeo Yoden (third from right in first-row) both of Kyoto Univ. visited the department on December 14th, 2012.



Ms. Yen-Ting Hwang (third from left) visited the department on December 26th, 2012.

Date	Visitors	Seminar titles
2013/1/24	**Dr. Dong-Kyun Kim** Korea Meteorological Administration South Korea	Vertically pointing radar studies of precipitation
2013/1/29	**Prof. Zhiyong Meng** Peking Univ., China	Squall lines in East China
	Prof. Chunsheng Zhao Peking Univ., China	Aerosol optics and its activation properties in the North China Plain
2013/2/27	**Dr. Wei-Kuo Tao** NASA/Goddard Space Flight Center USA	A robust multi-scale modeling system for the study of cloud and precipitation processes
2013/3/6	**Prof. Jian Lu** George Mason Univ., USA	Where is it going to warm?---Role of ocean dynamical feedback in the climate response to GHG warming
2013/3/7		Distinguishing the mechanisms of the zonal mean atmospheric circulation response to global warming versus El Niño---role of irreversible PV mixing
2013/3/8	**Prof. Hyungjun Kim** University of Tokyo, Japan	Large scale terrestrial hydrologic simulations: Recent advancements
		The changing nature of amazon drought
2013/3/11	**Dr. Wen-Huei Chang** US Army Corps of Engineers, USA	Economic impacts and greenhouse gas implications of water resources infrastructure



Prof. Chunsheng Zhao (first from left) and Prof. Zhiyong Meng (second from right) of Peking Univ. visited the department on January 29th.

Prof. Jian Lu (fifth from left in first-row) of George Mason Univ. visited the department from March 6th to 7th.

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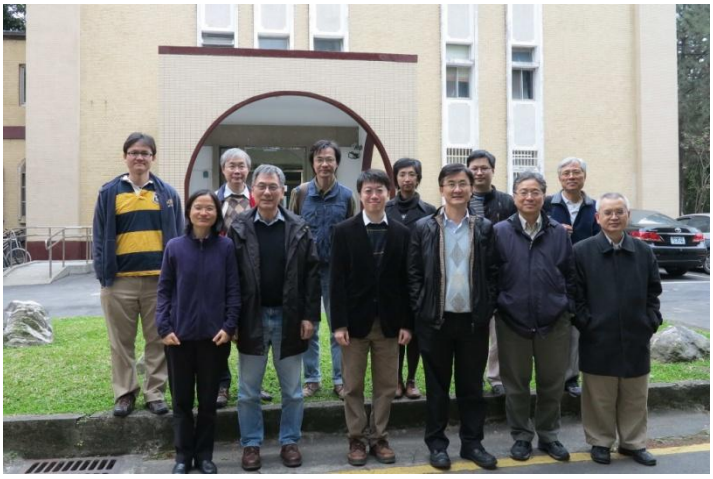
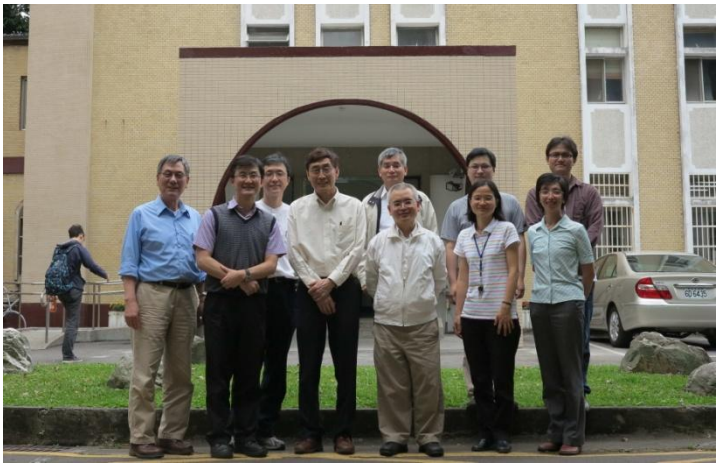
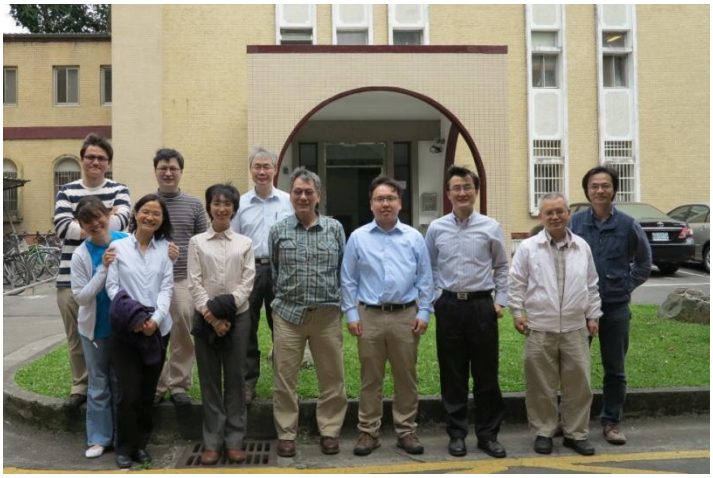
Date	Visitors	Seminar titles
2013/3/14	**Dr. Kao-Shen Chung** Environment Canada, Canada	Radar data assimilation in the Canadian high resolution ensemble Kalman filter system
2013/3/15	**Prof. Huei-Ping Huang** Arizona State University, USA	An intercomparison of reanalysis and climate model simulations using atmospheric angular momentum
2013/3/19	**Prof. Shaw-Chen Liu** Research Center for Environmental Changes, Academia Sinica	Droughts, floods, aerosols and global warming
2013/3/21	**Dr. His-Yen Ma** Lawrence Livermore National Laboratory USA	Challenges in global climate simulations and future projections
2013/3/22		Climate model diagnosis and evaluation



Dr. Kao-Shen Chung (third from left in first-row) of Environment Canada visited the department on March 14th.

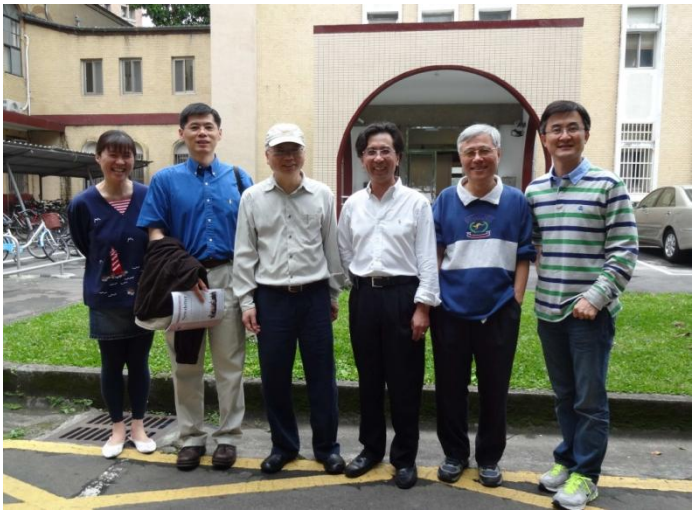


Prof. Shaw-Chen Liu (third from left in first-row) of Research Center for Environmental Changes, Academia Sinica visited the department on March 19th.

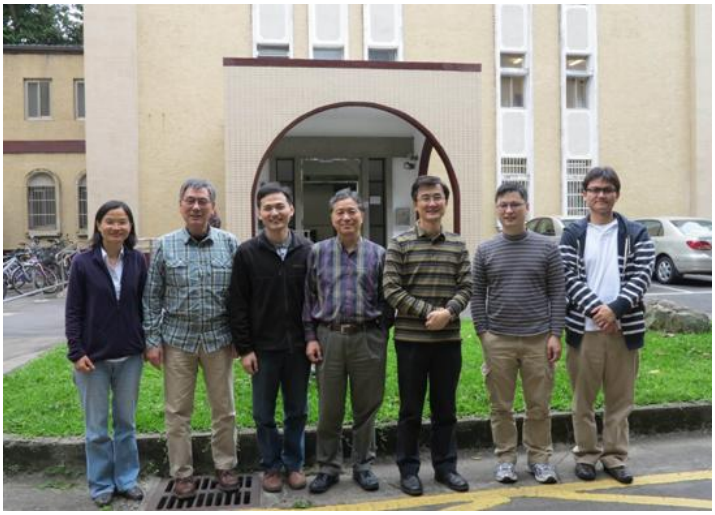


Prof. Wei-Chyung Wang (forth from left in first-row) of State University of New York at Albany and Dr. His-Yen Ma (forth from right in first-row) of Lawrence Livermore National Laboratory visited the department on March 21st and 22nd.

Date	Visitors	Seminar titles
2013/3/26	**Prof. Wei-Chyung Wang** State University of New York at Albany USA	A multi-disciplinary approach to study aerosol climate effects over East Asia
2013/3/29		What are the climate forcing agents of global scale during the past few hundred years?
2013/4/4	**Prof. Ping Chang** Texas A&M Univ., USA	Understanding, simulating and predicting Atlantic hurricanes: Some preliminary results
2013/4/9	**Prof. Kazuhisa Tsuboki** Nagoya University, Japan	Development of a coupled ocean-atmosphere non-hydrostatic model and typhoon simulations
2013/4/12	**Prof. Yasushi Fujiyoshi** Hokkaido University, Japan	Simple explanation of the darkband above the bright band detected by X-band radar
	Dr. Jih-Wang Wang NOAA, USA	Impact of tropical cyclones on the ocean heat budget and upper ocean dynamics in the Bay of Bengal during 1999
2013/4/18	**Dr. Martin Setvak** Czech Meteorological Bureau, Czech	Tops of convective storms from satellites
2013/5/2	**Prof. Guanghua Chen** Institute of Atmospheric Physics (IAP) Chinese Academy of Sciences (CAS) China	The relationship between equatorial wave transition and TC genesis over the WNP



Prof. Ping Chang (third from right) of Texas A&M Univ. visited the department on April 4th.



Prof. Guanghua Chen (third from left) of Institute of Atmospheric Physics, CAS visited the department on May 2nd.

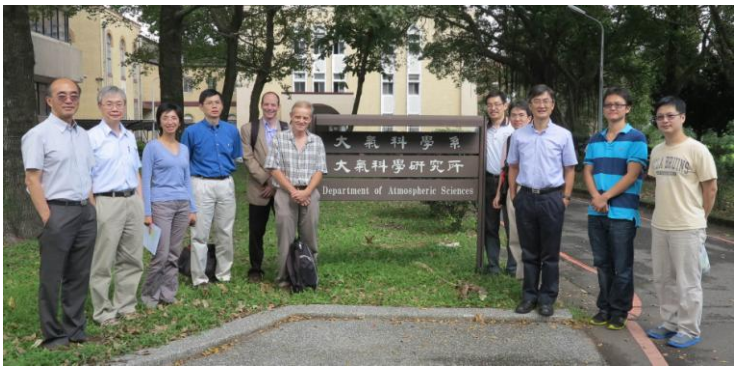
News

Date	Visitors	Seminar titles
2013/5/9	**Dr. Allen Huang** University of Wisconsin-Madison, USA	GeoMetWatch-STORM hyperspectral science and technology mission for a dedicated weather, environment and natural disaster monitoring in Asia and Oceania region
2013/5/10	**Prof. Shuyi Chen** University of Miami, USA	Predictability of tropical cyclone intensity: A modern myth in TC prediction?
2013/5/17	**Dr. Sok Kuh Kang** Korea Ocean Research and Development Institute (KORDI), Korea	Observations and two-layer modeling of near-inertial current in the East China Sea during typhoon passage
	Prof. Il-Ju Moon Jeju National University, Korea	Changes of storm surge and typhoon intensities under the future global warming conditions
	Prof. Chidong Zhang University of Miami, USA	Global impacts of the MJO on weather and climate
2013/5/30	**Prof. Stephan Borrmann** Max-Planck Institute for Chemistry Germany	Laboratory studies on the cloud microphysics and chemistry of large hydrometeors
2013/9/17	**Dr. Yi-Chun Chen** California Institute of Technology, USA	Aerosol-cloud-precipitation interactions in marine stratocumulus

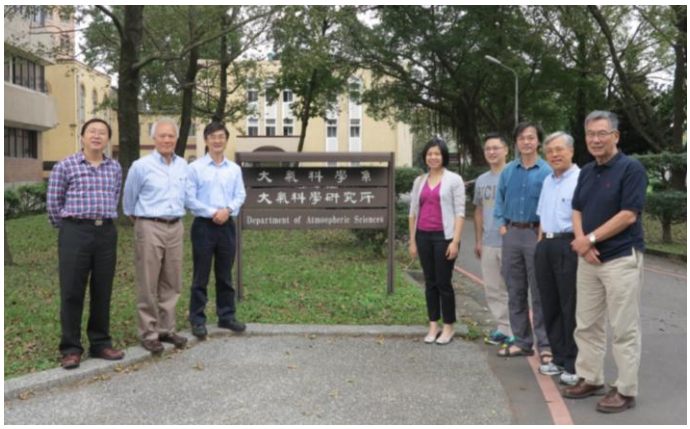
Dr. Yi-Chun Chen (forth from left) of California Institute of Technology visited the department on September 17th.

Prof. Koji Yamazaki (third from right) of Hokkaido University visited the department on September 24th.

Date	Visitors	Seminar titles
2013/9/24	**Prof. Koji Yamazaki** Hokkaido University, Japan	Mei-Yu and large-scale dynamics
102/10/8	**Prof. Zev Levin** Tel Aviv University, Israel	Atmospheric dust and “sprite” experiments on the Columbia space shuttle in its last tragic voyage to space
	Dr. Masataka Murakami Japan Meteorological Agency, Japan	Cloud physics research at MRI
2013/10/14	**Prof. Zhang Renhe** Chinese Academy of Meteorological Sciences, China	Meteorological conditions for the persistent severe fog and haze weathers over Eastern China in January 2013
2013/10/15	**Dr. Andrew Gettelman** National Center for Atmospheric Research USA	Aerosol-cloud-climate interactions: contributor to the recent pause in global warming?
	Dr. Julio Bacmeister National Center for Atmospheric Research USA	Climate simulations using the Community Atmosphere Model (CAM) at high-horizontal resolution
2013/10/29	**Dr. Chien Wang** Massachusetts Institute of Technology USA	Potential climate impact of large-scale deployment of renewable energy technologies
2013/11/7	**Dr. Simon Chang** United States Naval Research Laboratory USA	A summary of recent accomplishments at Monterey



Dr. Andrew Gettelman (fifth from left) and Dr. Julio Bacmeister (sixth from left) both of National Center for Atmospheric Research visited the department on October 15th.

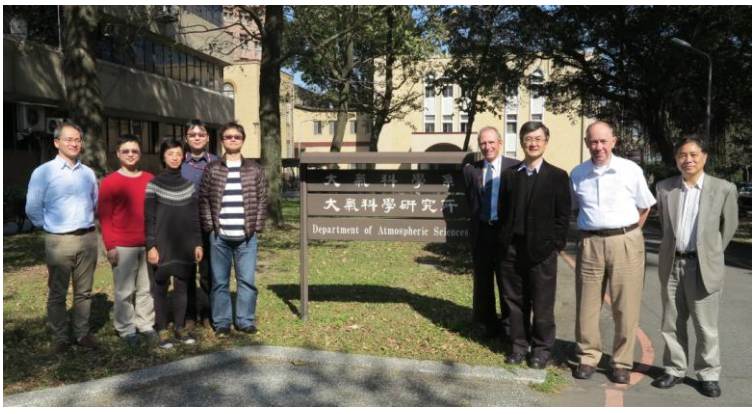


Dr. Simon Chang (second from left) of United States Naval Research Laboratory visited the department on November 7th.

News

Date	Visitors	Seminar titles
2013/11/11	**Dr. Hiroshi Uyeda** Nagoya University, Japan	Recent development of heavy rain research associated with summer monsoon in East Asia
2013/11/21	**Dr. Eric A. Hendricks** NRL, USA	Convective-dynamic instability of the hurricane eyewall
2013/11/25	**Dr. Wen-Chau Lee** National Center for Atmospheric Research USA	Distance Velocity Azimuth Display (DVAD) - A new way to interpret and analyze Doppler velocity
2013/11/28	**Dr. Ying-Hwa Kuo** National Center for Atmospheric Research USA	Atmospheric remote sensing with GPS radio occultation technique
	Dr. De-Zheng Sun NOAA, USA	On the time-mean effect of El Niño-southern oscillation
102/12/3	**Prof. Richard H. Johnson** Colorado State University, USA	Effects of SST gradients over the northern south China Sea on Meiyu rainfall
	Dr. Bill Skamarock National Center for Atmospheric Research USA	Global nonhydrostatic atmospheric simulation using Voronoi meshes in MPAS

Dr. De-Zheng Sun (fifth from left) of NOAA visited the department on November 28th.



Prof. Richard H. Johnson (second from right) of Colorado State University and Dr. Bill Skamarock (forth from right) of National Center for Atmospheric Research visited the department on December 3rd.

2013 Meteorological Conference for Cross-Taiwan-Strait Young Scientists

2013 Meteorological Conference for Cross-Taiwan-Strait Young Scientists was held from October 13th to 20th. This conference was sponsored by NTUAS and Institute of Atmospheric Physics, Chinese Academy of Sciences. The organizers were Prof. Chun-Chieh Wu (NTUAS) and Prof. Jong-Dao Jou (NTUAS). The two-day conference included oral and poster presentations of invited and contributed papers.

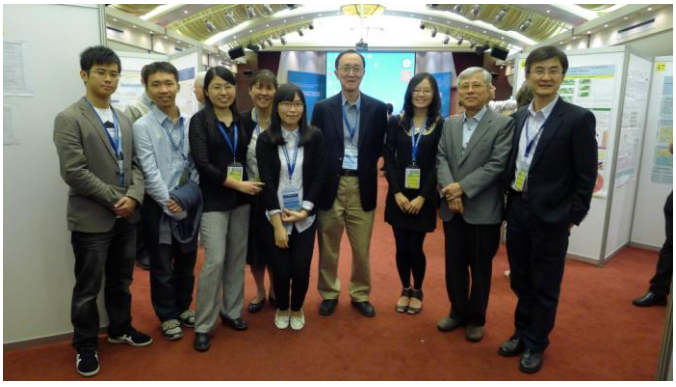
2013 年海峽兩岸青年大氣科學學術研討會於 10 月 14 至 15 日在臺北市集思台大會議中心舉行。本次研討會由臺大大氣科學系及中國科學院大氣物理研究所共同主辦，主要由臺大大氣系吳俊傑教授及周仲島教授共同籌劃。總計超過 80 位代表與會，兩岸研究生分別發表 26 篇碩、博士論文。研討會探討各項議題包含大氣動力與數值模擬、災害天氣分析與預報、氣候變遷與極端天氣等。

A group photo of “2013 Meteorological Conference for Cross-Taiwan-Strait Young Scientists”.

Fifth International Workshop on Monsoons

The Fifth International Workshop on Monsoons (IWM-V) was held from 28th October to 1st November, 2013. The first four days was held in Macao and last day in Hong Kong. The IWM-V is organized by the Monsoon Panel (Prof. Chih-Pei Chang) of the World Weather Research Programme (WWRP) Working Group on Tropical Meteorology Research. The workshop focused on global and regional monsoons, high-impact weather including heavy rainfall and tropical cyclones, intraseasonal variations and predictability, physical processes, numerical modeling, and extreme weather and climate change. Four faculty members from NTUAS attended this workshop: Profs, Chun-Chieh Wu, Chung-Hsiung Sui, Hung-Chi Kuo and I-I Lin, along with more than ten graduate students and research assistants.

第五屆國際季風研討會於 2013 年 10 月 28 日至 11 月 1 日在澳門及香港舉辦。本次研討會由世界氣象組織大氣科學委員會主辦 (Commission for Atmospheric Sciences, World Meteorological Organization)(張智北教授)。研討會邀請專家學者發表最新研究成果，內容包含區域季風特徵、極端天氣與降水過程、季內震盪、氣候變遷及氣候模式與預報等。大氣科學系共有 4 位教授參與本次會議，分別為吳俊傑主任、隋中興教授、郭鴻基教授和林依依教授，另有 10 多位研究生及研究助理共同參與，透過口頭報告與海報交流，分享臺大大氣科學系在劇烈天氣與氣候相關領域的最新研究成果。

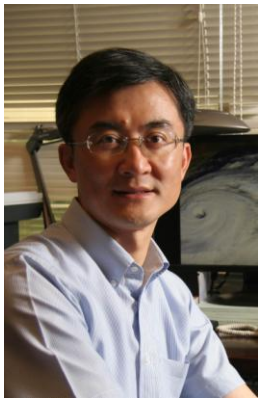


A group photo of “Fifth International Workshop on Monsoons (IWM-V)”.

Research Highlight

Professor Chun-Chieh Wu

Prof. Chun-Chieh Wu has been serving as the Chairman of Department of Atmospheric Sciences at National Taiwan University (NTU) since August, 2008, and as the Associate Dean of College of Science starting in November, 2013. The major research thrusts of Prof. Wu include target observation of tropical cyclones (TCs), TC dynamics (track; eyewall; structure and intensity; rainfall; interaction with terrain; interaction with ocean), climate aspect of TCs, TC predictability, and data assimilation.



吳俊傑教授為本系系主任及理學院副院長。主要的研究興趣包括熱帶氣旋策略性觀測、熱帶氣旋動力與可預報度(路徑；眼牆；結構及強度；降雨；與地形的交互作用；與海洋的交互作用)、氣候與熱帶氣旋活動。

Unbalanced Dynamics of Secondary Eyewall Formation in Tropical Cyclones: A New Pathway

During the typhoon season of 2008, an international field project, The Tropical Cyclone Structure (TCS08) in cooperation with the THORPEX Pacific Asian Regional Campaign (T-PARC), was carried out to obtain critical information on typhoons in the western North Pacific. DOTSTAR (Dropwindsonde Observation for Typhoon Surveillance near the TAiwan Region), a program led by Prof. Chun-Chieh Wu, served an important component during T-PARC. Particularly noteworthy is that Typhoon Sinlaku (2008) is a case in point under T-PARC with the most abundant observations throughout the storm's lifecycle, and thus with great potential to address major scientific issues in tropical cyclones (TCs).

Secondary eyewall formation (SEF), a phenomenon with salient feature, often observed in intense TCs, is one of the primary scientific foci because its widely-documented relationship to short-term storm intensity and structure change. In addition to the environmental conditions and internal dynamics previously suggested responsible for SEF, two recent companion works by Prof. Wu's group (Wu et al. 2012 and Huang et al. 2012; hereafter WH12) proposed a new dynamical pathway to SEF involving the TC vortex's intrinsic and axisymmetric dynamics. By assimilating T-PARC data (particularly the aircraft observations) into the Weather Research and Forecasting (WRF) model based on the Ensemble Kalman Filter data assimilation advanced in Wu et al. (2010), Wu et al. (2012) constructed a model/ observation-consistent and high-spatial/temporal-resolution dataset for Sinlaku (results shown in Fig. 1).

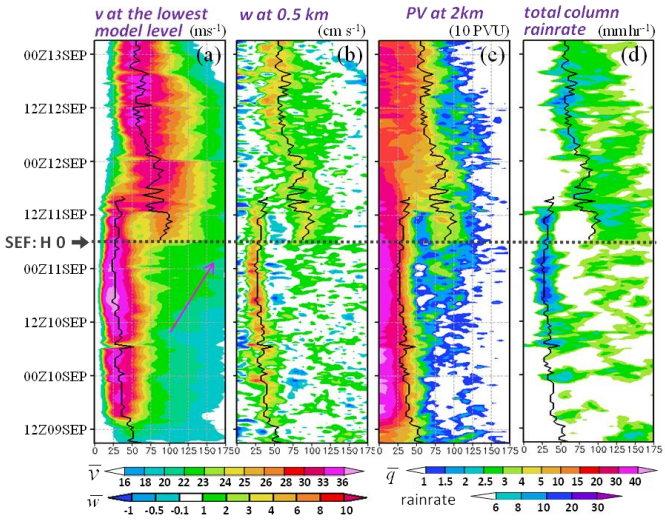


Figure 1: Time–radius diagrams of the azimuthally mean showing (a) tangential wind (m s^{-1}) at the lowest model level, (b) vertical velocity (m s^{-1}) at z = 0.5 km, (c) potential vorticity (10 PVU) at z = 2 km, and (d) total column rain rate (mm h^{-1}) for the ensemble mean (average of 28 ensemble members). SEF time is indicated by a dotted line and an arrow on the y axis. Black solid lines are the radii of the local maximum surface tangential wind. (After Wu et al. 2012)

Two features prevailing prior to SEF are identified: 1) the horizontal broadening of low-level troposphere swirling flow (Figs. 1 and 2); and 2) intensification of boundary layer inflow over the outer region are identified before SEF (Fig. 2). It is noted that the two flow characteristics are physically consistent with the two mechanisms heighted for the spin-up of single-eyewall TCs in the literature, and set the scene for a progressive boundary layer control pathway to SEF.

As the second part of the two companion papers, Huang et al. (2012) addressed the association between the increase in storm size and SEF from the axisymmetric perspective. The findings point to collective structure changes in the outer-core region of a mature TC, which ultimately culminates in the formation of a secondary eyewall. The sequence begins with a broadening of the low-level tangential wind field associated with the intensification of the eyewall that can be demonstrated by the balanced response above the boundary layer [lower panel of Fig. 2; a mechanism discussed in many classic studies]. Within the boundary layer, due to the presence of surface friction, boundary layer inflow increases underneath the broadened swirling wind, and becomes large enough to enhance the swirling circulation within the boundary layer. This rapid increase in tangential winds near the top of the boundary layer breaks the gradient wind balance, leading to the local development of supergradient winds (Fig. 3), which decelerate the inflow air parcels and impede them from moving inwards. This process causes the transition outside the primary eyewall from sporadic and/or weak convergence in the lower troposphere to a well-defined convergence zone concentrated within and just above the boundary layer. The progressive increase of supergradient forces thus continuously provides a mechanical mean for high enthalpy air to erupt from the boundary layer.

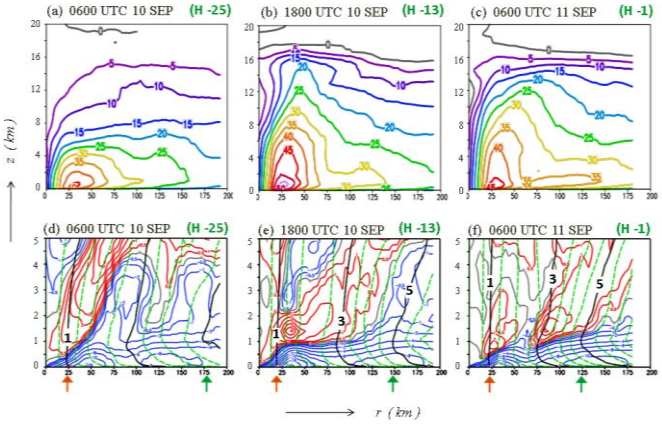


Figure 2: Height-radius cross sections of the azimuthal mean quantities: (a)-(c) for tangential winds and (d)-(f) for the absolute angular momentum (in black and green; 10^6 m s $^{-1}$) and radial flow (inflow in blue, outflow in red and 0 value in grey; m s^{-1}). Contour intervals for inflow and outflow are 2 and 1 m s^{-1},

Given the dynamically and thermodynamically favorable environment for convective activities, the progressive response of the unbalanced boundary layer flow to an expanding swirling wind field and the positive feedback loop in between are demonstrated to be an important mechanism for concentrating and sustaining deep convection in a narrow supergradient-wind zone collocated with the SEF region. The presented progressive boundary layer control on SEF also implies that the boundary layer scheme and its coupling to the above atmosphere need to be adequately represented in numerical models to improve the understanding of SEF, as well as the accuracy of SEF forecasts, including the timing and preferred radial intervals.

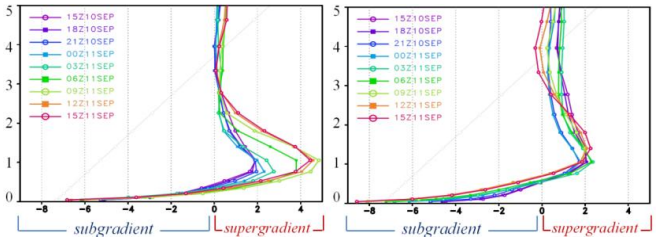


Figure 3: Azimuthally-, area- and temporally-averaged values over (t - 3 h, t + 3 h) for the agradient wind (V_{ag} ; ms^{-1}). Analyses from 1500 UTC 10 Sep to 1500 UTC 11 Sep are displayed with a 3-h interval. The green line represents 1 h prior to SEF, while the light-green line represents 2 h after SEF. (After Huang et al. 2012)

Acknowledging the importance of the balanced response articulated in many extant studies, WH12 highlights the critical role of the boundary layer unbalanced dynamics in SEF. The new SEF mechanism advanced in WH12 is attractive on physical grounds because of its simplicity and consistency with the three-dimensional numerical simulations presented. The presenting idea is easy to validate. A number of recently-published studies have also examined the pathway proposed in WH12 from different perspectives, demonstrating results in general supporting the unbalanced dynamics discussed in WH12.

Although recent advances of the unbalanced and balanced dynamics in TCs with double eyewalls appear promising in interpreting SEF from the axisymmetric perspective, the quantitative impacts of these aspects on SEF and their mutual feedback remain to be further investigated. While the symmetric dynamics has been shown to play a critical role in SEF, how the asymmetric components (e.g., spiral rainbands and sporadic convective cells in the vortex's outer-core region) influence SEF also needs further examination. The two companion papers (WH12) reviewed here have stimulated discussions among the TC community and helped facilitating further progress in understanding this intriguing scientific problem.

References

Huang, Y.-H., M. T. Montgomery, and C.-C. Wu*, 2012: Concentric eyewall formation in Typhoon Sinlaku (2008). Part II: Axisymmetric dynamical processes. *J. Atmos. Sci.*, **69**, 662-674.

Wu, C.-C.*, G.-Y. Lien, J.-H. Chen, and F. Zhang, 2010: A New Approach for Tropical Cyclone Initialization Based on the Ensemble Kalman Filter (EnKF). *J. Atmos. Sci.*, **67**, 3806-3822.

Wu, C.-C.*, Y.-H Huang, and G.-Y. Lien, 2012: Concentric eyewall formation in Typhoon Sinlaku (2008). Part I: Assimilation of T-PARC data based on the ensemble Kalman filter (EnKF). *Mon. Wea. Rev.*, **140**, 506-527.

Professor I-I Lin

I-I Lin is a Distinguished Professor in the Department of Atmospheric Sciences, National Taiwan University. Her research expertise is in tropical cyclone-ocean interactions and the use of multiple remote sensing in air-sea physical/biogeochemical interactions.

林依依教授為本系特聘教授。研究專長為跨領域「颱風-海洋交互作用」、「海洋及大氣遙測」及「海洋－大氣物理及生物地球化學交互作用」。

An Ocean Coupling Potential Intensity Index for Tropical Cyclones (Lin et al. 2013)

Timely and accurate forecasts of tropical cyclones (TCs, i.e. hurricanes and typhoons) are of great importance for risk mitigation. Though in the past two decades there has been steady improvement in track prediction, improvement on intensity prediction is still highly challenging. Cooling of the upper ocean by TC-induced mixing is an important process that impacts TC intensity. Based on detail *in situ* air-deployed ocean and atmospheric measurement pairs collected during the Impact of Typhoons on the Pacific (ITOP) field campaign, we modify the widely used Sea Surface Temperature Potential Intensity (SST_PI) index by including information from the subsurface ocean temperature profile to form a new Ocean Cooling Potential Intensity (OC_PI) index. Applied to a 14-year (1998-2011) western North Pacific TC archive, OC_PI reduces SST_PI-based overestimation of archived maximum intensity by more than 50% and increases the correlation of maximum intensity estimation from r^2=0.08 to 0.31. For slow-moving TCs that cause the greatest cooling, r^2 increases to 0.56 and the root-mean square error in maximum intensity is 11 ms^{-1}. As OC_PI can more realistically characterize the ocean contribution to TC intensity, it thus serves as an effective new index to improve estimation and prediction of TC maximum intensity (Fig. 1).

Recent Warming in the Western North Pacific Subsurface Ocean to Favor Typhoon Intensification (Pun et al. 2013)

The Main Development Region (MDR) for tropical cyclones in the western North Pacific Ocean is the most active tropical cyclone basin in the world. Based on synergetic analyses of satellite altimetry and gravity observations, the subsurface ocean conditions in the western North Pacific MDR has found to become even more favorable for typhoon and super-typhoon intensification. Compared to the early 1990s, the MDR is more favorable due to an increase in the subsurface warm water layer that is characterized by a 10% increase in both the depth of the 26 ℃ isotherm (D26) and Tropical Cyclone Heat Potential (TCHP) (Fig. 2). In addition, the areas of high TCHP ($\geq$ 110 kj cm^{-2}) and deep D26 ($\geq$ 110 m) have a 13% and 17% increase, respectively. As high TCHP and deep D26 regions are often associated with intensification to super-typhoon intensity, these ongoing warming suggest increase chance to support intensification to super-typhoon intensity, as the subsurface ocean is getting significantly warmer as compared to the 90's. This paper was also featured in both English and French by the International satellite altimetry team, AVISO, to be the image of the month in August 2013 (Fig. 3).

References

Emanuel, K. A. 1988: The maximum intensity of hurricanes, J. Atmos. Sci. 45, 1143-1155.

I-I Lin*, P. Black, J. F. Price, C.-Y. Yang, S. S. Chen, C.-C. Lien, P. Harr, N.-H. Chi, C.-C. Wu and E. A. D'Asaro, 2013: An ocean coupling potential intensity index for tropical cyclones, Geophys. Res. Lett. Vol. 40, Issue 9, p. 1878-1882, doi: 10.1002/grl.50091.

Iam-Fei Pun, I-I Lin*, and Min-Hui Lo, 2013: Recent Increase in High Tropical Cyclone Heat Potential Area in the Western North Pacific Ocean, Geophys. Res. Lett., doi:10.1002/grl.50548.

Research Highlight

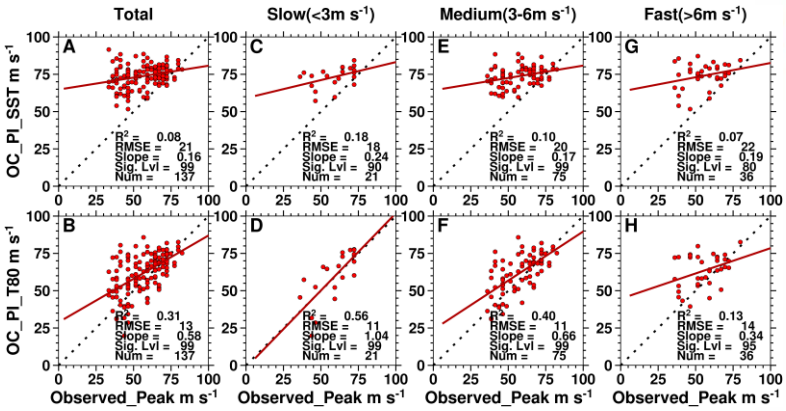


Figure 1: Comparison between the observed (x aixs) and the predicted (y axis) peak intensity using SST_PI (upper panel) and OC_PI (lower panel). The samples are from all typhoon cases between 1998 and 2011.

The first column indicate total samples, the 2nd, 3rd, and 4th columns are sub-sets of the samples under slow, medium, and fast moving typhoon translation speeds. OC_PI achieves a much closer prediction of typhoon's peak intensity (lower figures), as compared to the SST_PI (upper figures). Using OCPI and under slow-moving translation speed (i.e. Fig. 1D), the highest correlation between observed and predicted peak intensity is achieved. (After Lin et al. 2013)

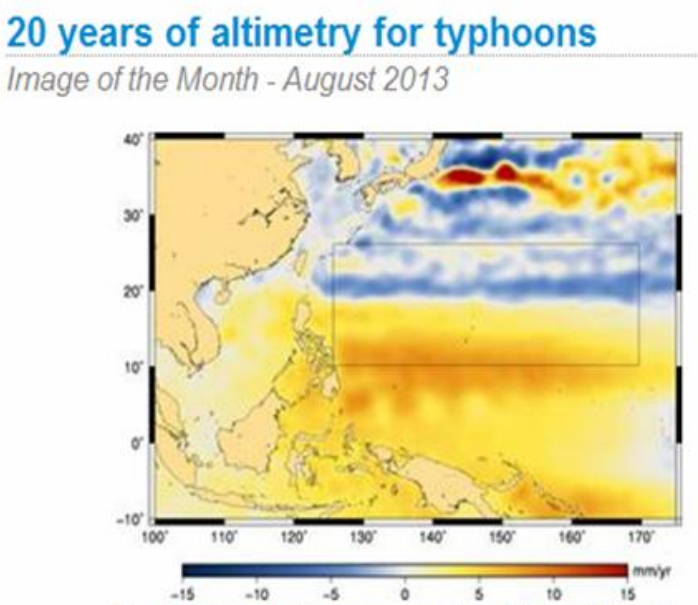
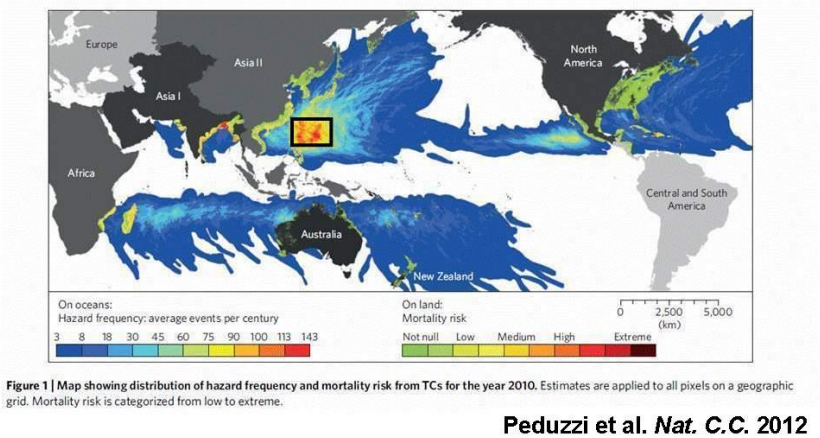


Figure 3: This study featured as image of the month by the international satellite altimetry team, AVISO, in August 2013. (http://www.aviso.oceanobs.com/en/news/idm/2013/aug-2013-20-years-of-typhoons.html)



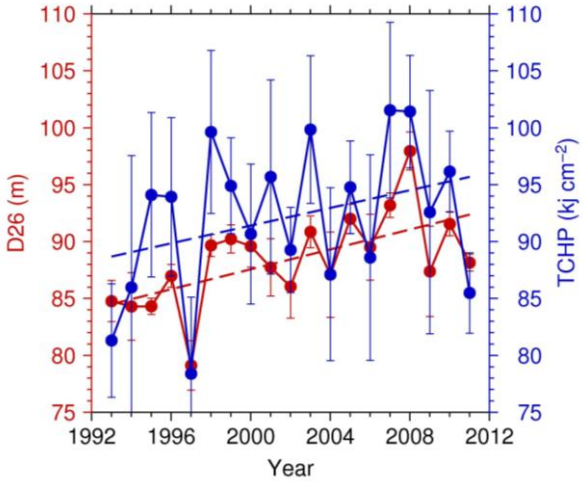


Figure 2: Left figure: location of the typhoon MDR (black box) over the western North Pacific (After Peduzzi et al. 2012); Right figure: recent decadal warming in D26 and TCHP by ~ 10%, as compared to the 90's. (After Pun, et al. 2013)

2013 Doctors' & Masters' These

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

2013 Doctor's Theses

Ming-Ying Li	Identification of the Eurasian-North Pacific Multidecadal Oscillation and Its Relationship to the AMO
Yi-Ting Yang	Microwave Satellite Observation of Tropical Cyclone with Concentric Eyewall in Western North Pacific Basin
Lung-Yao Chang	Tropical Cyclone formation associated with Trade-wind Surges
Yung-Lan Lin	An analysis of tropical cyclone formations in the South China Sea during the late season

2013 博士論文

李明營	探討歐亞-北太平洋多年代振盪與其成因
楊憶婷	微波衛星觀測西北太平洋雙眼牆颱風特性之探討
張龍耀	伴隨信風增強之熱帶氣旋形成過程
林雍嵐	南海地區冬季熱帶氣旋形成之分析

2013 Master's Theses

Chih-Yang Yao	A study on the TC formation in Monsoon Gyre Environment
Pei-Teng Liu	A Study of Low-Level Wind Shear at Taipei Basin during the Northeast Monsoon Period
Yu-Han Chen	Effects of Asymmetric Latent Heating on Taiwan Typhoon Post-landfall Motion
Tuan-Chu Kao	Decadal Variations in the South Pacific and Linkages to the Tropical Atlantic
Chi-Jen Sun	An Analysis of the Spatiotemporal Features of Precipitation Trends Over Tropical Oceans
Meng-Hsuan Wu	Multiscale Interactions in the Madden-Julian Oscillation
*Po-Ting Chung	Modulation of Tropical Precipitation by Shallow and Deep Convective Processes
Wan-Jung Lu	The study of cloud condensation nuclei activity for suburban aerosol in Taipei
Chi-Yun Wang	The Impact of Future Climate Change on Surface Ozone: The Contribution of Meteorologic Transport and Chemistry
Chun-Yan Li	Perturbation Pressure in Cells of Rainbands Associated With Typhoon Morakot
Tao-Chi Chang	Influence of the Tropical Atlantic on the Western North Pacific Subtropical High in the Boreal Summer
*Shun-Nan Wu	The Role of Convective Heating in the Tropical Cyclone Eyewall Ring Evolution – Sawyer-Eliassen Model Diagnosis
Hsin-Ping Kuan	Dynamics of Secondary Eyewall Formation in Tropical Cyclones - Further Examination of the Unbalanced Response

2013 碩士論文

楊智堯	季風環流圈環境下之熱帶氣旋形成過程
劉沛滕	臺北盆地東北季風時期之低空風切研究
陳郁涵	非對稱潛熱效應對離台期間颱風運動之影響
高端鞠	南太平洋年代際變化與熱帶大西洋間的關聯性
孫既仁	熱帶降水趨勢的時空變動特徵分析
吳孟軒	季內震盪中的多重尺度交互作用
*鍾博婷	淺對流及深對流過程對於熱帶降水的影響
呂宛蓉	台北郊區氣膠成雲凝結核之活化特性探討
王啟芸	未來氣候變遷對地表臭氧之影響—傳送機制與化學機制之探討
李俊彥	莫拉克颱風雨帶內對流胞擾動氣壓分布之探討
張道奇	熱帶大西洋對夏季西北太平洋副熱帶高壓的影響
*吳舜楠	潛熱釋放對颱風渦旋演變影響之熱力風平衡模式診斷分析
官欣平	颱風雙眼牆形成動力研究——非平衡動力的延伸探討

Faculty Position Announcement

The Department of Atmospheric Sciences is seeking applicants for one to two faculty positions at the assistant, associate, or full professor levels to begin **in August 2014.** Applicants with Ph.D. and research expertise in the field of atmospheric sciences and other related areas are welcomed**.** Candidates with post-doctoral experience are preferred.

Applicants should send their curriculum vitae, statement of research and teaching interests before **January 15th, 2014**, to:

Prof. I-I Lin, Chair
Faculty Search Committee
Department of Atmospheric Sciences,
National Taiwan University,
No. 1, Section 4, Roosevelt Road,
Taipei 106, Taiwan
Tel: +886-2-3366-3917
Fax: +886-2-2363-3642
E-mail: search@as.ntu.edu.tw

Both regular and electronic mails are acceptable. Please also arrange for three recommendation letters to be sent directly to the Chair of the Faculty Search Committee. Upon receipt of the application, an acknowledgement email will be sent to the applicant within a week. Applicants who do not receive the acknowledgement email please contact the Chair of the Faculty Search Committee via fax or telephone for confirmation.

本系擬聘請一至二位具備大氣科學及其他相關專長之教授、副教授、或助理教授。應徵者需具備博士學位及相關研究經驗，具博士後經驗者尤佳。自 2014 年 8 月起聘。申請者請將個人資料、研究與授課興趣於 2014 年 1 月 15 日前以一般信函或電子郵件寄至：

台北市羅斯福路四段一號
國立台灣大學理學院大氣科學系
新聘教師甄選委員會召集人
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Fax: +886-2-2363-3642
E-mail: search@as.ntu.edu.tw

另請安排三封推薦信寄至本系新聘教師甄選委員會召集人收，本系將於收件後一週內送出回條，逾期未收到回條者可透過電話或傳真與召集人聯繫確認。

No. 6 (December 2012)

News

- The Department Retreat
- Academician Kuo-Nan Liou received the 2012 Gold Medal from the IRC
- Prof. Shaw-Chen Liu was elected Academician of the Academia Sinica
- Prof. Tai-Jen Chen remains appointed Chair Professor at NTU for 2012-2015
- Prof. Chun-Chieh Wu remains appointed Distinguished Professor at NTU for 2012-2015
- Prof. Jen-Ping Chen received the NTU Teaching Award
- Prof. Hui-Ming Hung received the NTU Teaching Award
- Parent-Teacher Conference Day
- 2012 Commencement
- Class of "Hypothesis for a global atmospheric reorganization during abrupt climate changes of the last glacial period "
- The NTU Azalea Festival
- Study-Abroad Program
- List of Visitors and Presentations
- Visit of the Chinese Meteorological Society
- Visit of Participants of the International Science
- Conference on Climate Change
- Prof. Min-Hui Lo and Prof. Wei-Ting Chen join the Department faculty

Meeting Highlight

- 30th Conference on Hurricanes and Tropical Meteorology

Research Highlight

- Impacts of California Irrigation on the Southwestern U. S. Hydroclimatology
- Analyzing CloudSat ice water content retrievals to evaluate representations of cloud and precipitating hydrometeors in the global models
- Using a general circulation model to investigate the interactions between aerosols and climate