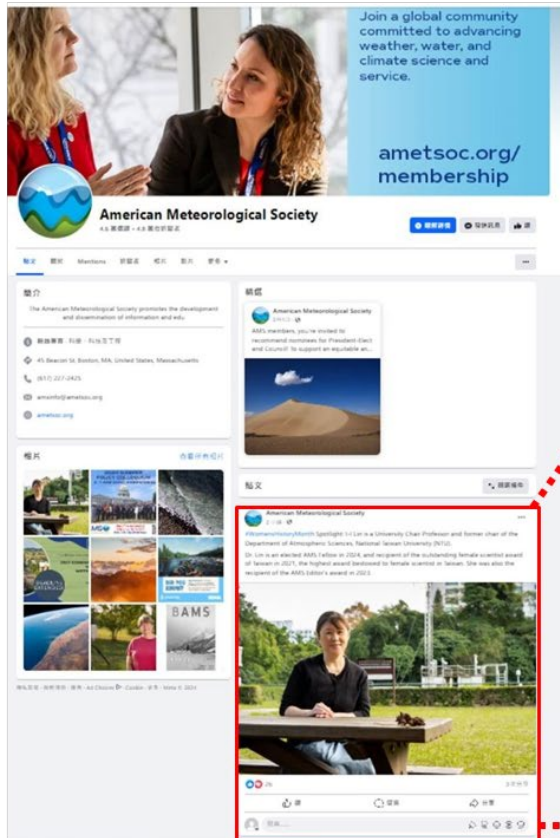
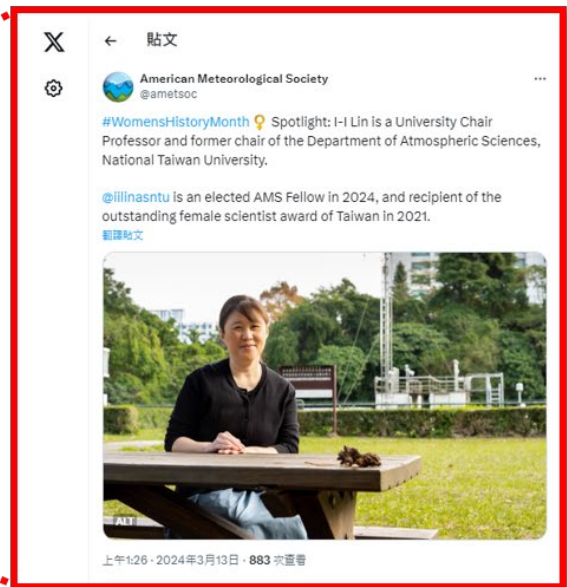
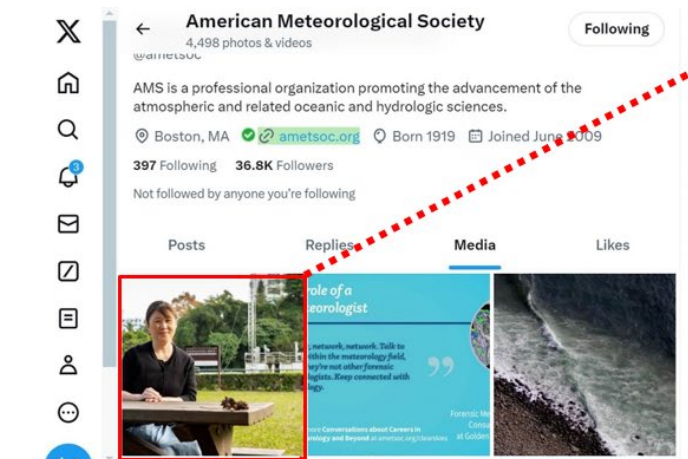


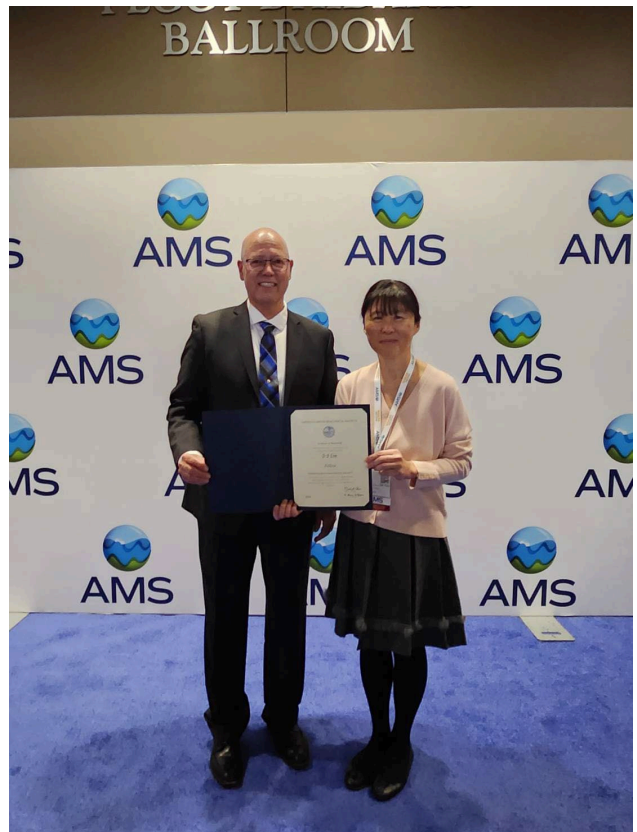
## Related figures



**PhD student Hsiao-Ching Huang was honored with the College of Science Dean's Award at National Taiwan University in 2025.**



**Spotlighted by American Meteorological Society (AMS) – Women’s History Month (2024) [Facebook] [X (Twitter)]**



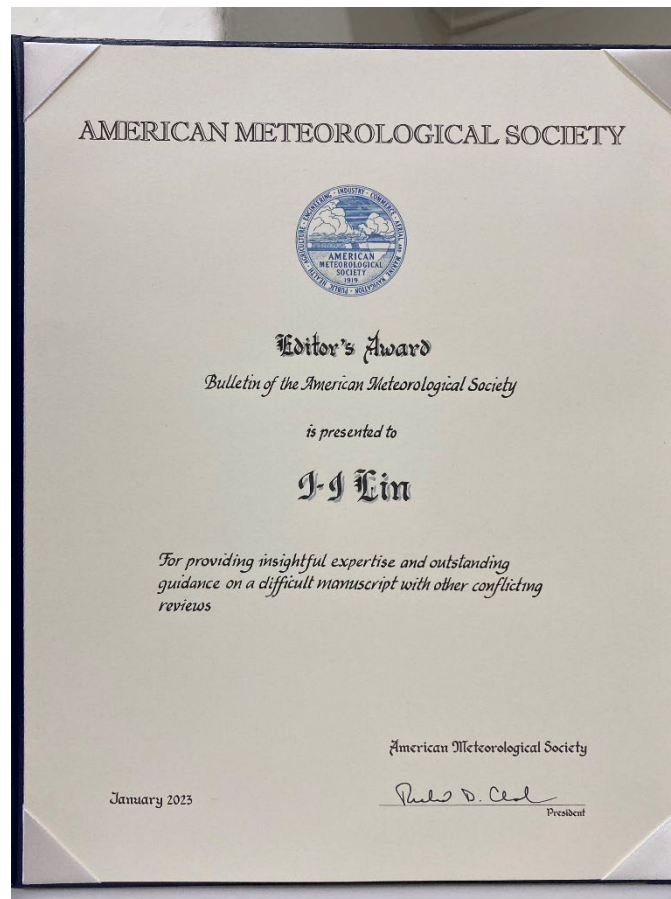
**Fellow of American Meteorological Society (AMS, 2024)** [\[Link\]](#) [\[YouTube\]](#)

# Editor's Award - Bulletin of the American Meteorological Society



**I-I Lin**

For insightful and detailed comments that have been instrumental in reaching publication decisions on challenging manuscripts



**The AMS Editor's Award - Bulletin of the American Meteorological Society. The award citation reads "For insightful and detailed comments that have been instrumental in reaching publication decisions on challenging manuscripts" (2023). [\[link\]](#)**



udn / 吳書 / 吳書攝  
**台大教授林依依獲選國家講座主持人 替「媽媽科學家」請命**  
 2022-03-21 10:25 聯合新聞網 / 記者劉育豪、台北即時報導



教育部今天舉行「第25屆國家講座主持人、第4屆國家產學大師獎、第65屆學術獎」頒獎典禮，台灣大學大氣科學系特聘教授林依依獲選國家講座主持人，以「探索新領域 為全球暖化危機盡力」獲得教學及自然科學國家講座主持人獎。記者許正宏／攝影

今年共有7人獲得國家講座主持人獎、4位獲選國家產學大師獎及10位獲得學術獎。行政

[https://udn.com/news/story/6885/6180913?from=udn-catalistnews\\_ch2](https://udn.com/news/story/6885/6180913?from=udn-catalistnews_ch2)

國立教育廣播電台

林依依獲選國家講座主持人 為「媽媽科學家」請命

2022-03-22 10:00 中央廣播電台

2022-03-22 10:00 中央廣播電台

林依依教授獲選為國家講座主持人

臺灣大學大氣科學系特聘教授林依依獲選為國家講座主持人，以「探索新領域 為全球暖化危機盡力」獲得教學及自然科學國家講座主持人獎。記者許正宏／攝影

今年共有7人獲得國家講座主持人獎、4位獲選國家產學大師獎及10位獲得學術獎。行政

<https://www.ner.gov.tw/news/623947cac7513d40007ff8e10>

中時新聞網

為「媽媽科學家」請命 林依依：讓她們有在家工作的選項

13:30 2022/03/21 中時 楊淑萍

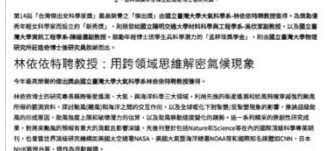


國立中央大學特聘教授林依依獲選為國家講座主持人，以「探索新領域 為全球暖化危機盡力」獲得教學及自然科學國家講座主持人獎。記者許正宏／攝影

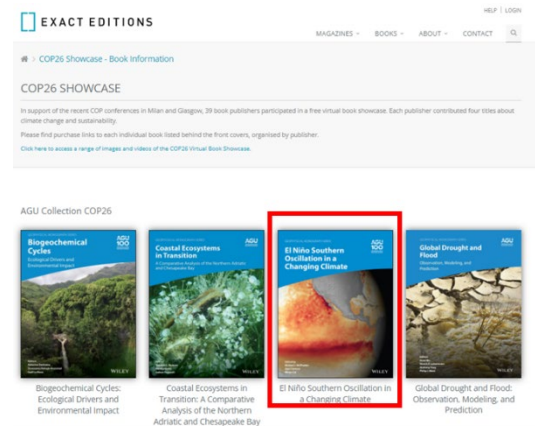
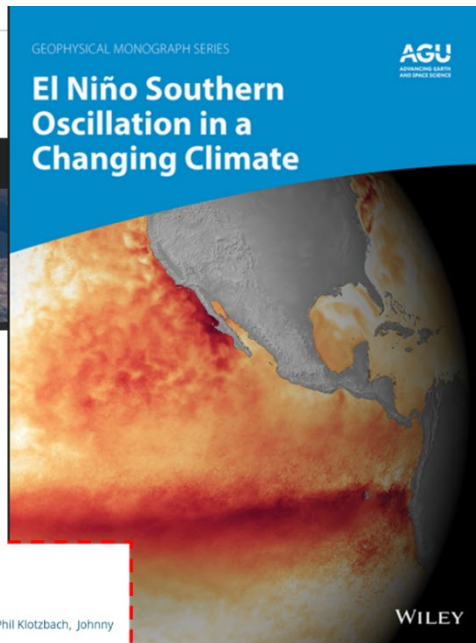
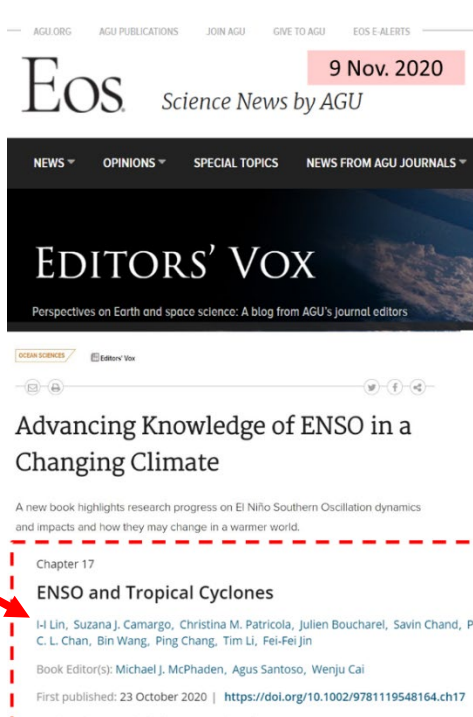
今年共有7人獲得國家講座主持人獎、4位獲選國家產學大師獎及10位獲得學術獎。行政

<https://www.chinatimes.com/realtimenews/20220321003028-260405?chdtv>

# The Ministry of Education's 25th Annual National Chair Professorship Award (2022)



## The 14th Taiwan Outstanding Women in Science Award, held jointly by L'Oréal Taiwan and the Wu Chien-shung Education Foundation (2021)



<https://institutions.exacteditions.com/cop26>

**Invited book chapter contribution in American Geophysical Union (AGU)’s centennial celebration monograph, El Niño Southern Oscillation (ENSO) in a Changing Climate, on ‘Tropical Cyclone, ENSO, and Global Warming’. This is the only invited chapter in Taiwan. This book was successfully published with press release in USA in Nov. 2020. (2020)**

**One of the 4 Books from AGU Collected as special COP26 (the 26th United Nations Climate Change conference, 31 Oct. - 13 Nov. 2021, Glasgow, Scotland) Virtual Book Showcase.**



**Public outreach talk on ‘Tropical Cyclone, Ocean and Climate’ in Ministry of Science and Technology’s Prospect Series in October 2020.**



## Ocean Observations in Support of Studies and Forecasts of Tropical and Extratropical Cyclones

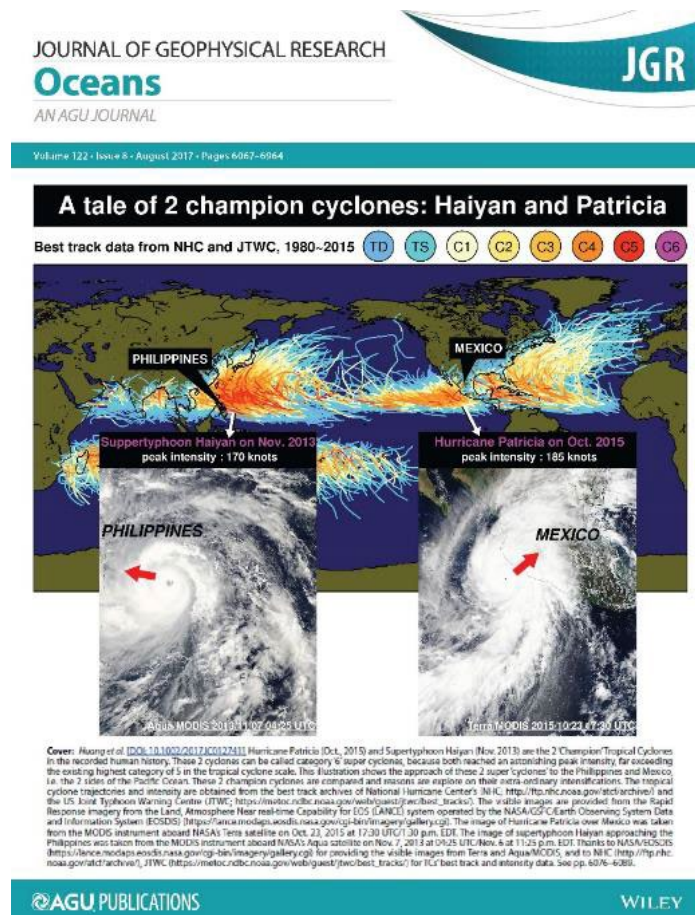
### OPEN ACCESS

Edited by:  
John Siddorn,  
Met. Office, United Kingdom

Reviewed by:

Ricardo Domingues<sup>1,2\*</sup>, Akira Kuwano-Yoshida<sup>3</sup>, Patricia Chardon-Maldonado<sup>4,5</sup>, Robert E. Todd<sup>6</sup>, George Halliwell<sup>7</sup>, Hyun-Sook Kim<sup>2,7</sup>, I.-I. Lin<sup>8</sup>, Katsufumi Sato<sup>9</sup>, Tomoko Narazaki<sup>9</sup>, Lynn K. Shay<sup>10</sup>, Travis Miles<sup>11</sup>, Scott Glenn<sup>11</sup>, Jun A. Zhang<sup>12</sup>, Steven R. Jayne<sup>6</sup>, Luca Centurioni<sup>12</sup>, Matthieu Le Hénaff<sup>12</sup>, Gregory R. Foltz<sup>2</sup>, Francis Bringas<sup>2</sup>, M. M. Ali<sup>13</sup>, Steven F. DiMarco<sup>14</sup>, Shigeki Hosoda<sup>15</sup>, Takuya Fukuoaka<sup>9</sup>, Benjamin LaCour<sup>2</sup>, Avichal Mehra<sup>2</sup>, Elizabeth R. Sanabia<sup>16</sup>, John R. Gyakum<sup>17</sup>, Jili Dong<sup>2</sup>, John A. Knaff<sup>2</sup> and Gustavo Goni<sup>2</sup>

Invited to join the international expert team to write recommendations in future ocean observations for tropical and extra tropical cyclones in the ‘Frontiers in Marine Science’, the only invited scientist in Taiwan.(2019)



Paper featured as journal cover ((Hurricane Patricia and supertyphoon Haiyan) in the renown international scientific journal, Journal of Geophysical Research: Oceans (Hurricane Patricia and Typhoon Haiyan)(2017)



**Academic Award, Ministry of Education, Taiwan.(2017)**

EOS Earth & Space Science News

NEWS " NEWS FROM AGU JOURNALS " TOPICS & DISCIPLINES " OPINIONS " BLOGS " JOBS & RESOURCES

NATURAL HAZARDS News

### Probing the Power of Pacific Supertyphoons

Despite higher than normal surface temperatures and heat contents of ocean waters where the storms developed, evidence is lacking that global warming is revving them up.

Supertyphoon Meranti had sustained wind speeds of 155–165 knots (287–306 km/h) as it approached Taiwan. This image was taken by the Moderate Resolution Imaging Spectroradiometer aboard NASA's Aqua satellite on 13 September 2016. Credit: NASA image by Jeff Schmaltz, LANL/CIRES/NOAA

By Tim Horvath © 10 July 2017

Typhoon Meranti blasted the western Pacific in 2016, wreaking havoc in the Philippines, Taiwan, and mainland China, leaving dozens dead or missing and doing billions of dollars' worth of damage. Meranti is among some unusually ferocious Pacific storms in the past few years that seem to be in a category of their own, according to researchers who recently presented data quantifying such storms' extraordinary power and conditions of formation.

On top of bringing heavy rainfall and storm surges, the intensity of these recent tempests goes so far beyond what was previously thought to be the peak range of cyclone power that the researchers argued that they require a new level, a category 6, on a widely used rating scale for hurricanes and typhoons.

"I think it is fair to give the public more accurate information, and it's not fair to equate these two storms of the same category because the kinetic energy is doubling," I-I Lin, a professor in National Taiwan University's Department of Atmospheric Sciences, told attendees at a joint conference of the Japan Geoscience Union and the American Geophysical Union (JpGU-AGU 2017) in Chiba, outside Tokyo, in May.

**Research on record-breaking Category '6' tropical cyclones featured by American Geophysical Union's Earth & Space Science News.(2017)**



The joint research with her PhD student (Hsiao-Ching Huang) on the super-hurricane Patricia and relationship with super-El Niño won the best student poster award “(1000 participants and the only recipients from Taiwan for the 27 awards) in Beijing, China in the AOGS international symposium.(2016)



Outstanding College Youth of National Taiwan University (2016) & Young College Elite of 2017

ARTICLE

Received 8 Jul 2014 | Accepted 10 Apr 2015 | Published 20 May 2015

DOI: 10.1038/ncomms8182

OPEN

# Recent decrease in typhoon destructive potential and global warming implications

I-I Lin<sup>1</sup> & Johnny C.L. Chan<sup>2</sup>

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.



## 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》

在一般的認知裡，人們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，西北太平洋地區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。此篇由臺灣大學大氣科學系林俊宏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，由於颱風的破壞力並不只是受到海洋的影響，雖然近年海洋變暖，颱風強度增加，但是影響颱風破壞力還有另外兩個重要因子，即颱風個數及颱風生命期，林俊宏的研究發現，近20年來颱風形成個數顯著下降，同時生命期顯著縮短，由於颱風破壞力是由三個因素共同影響，而颱風個數下降及生命期縮短產生的負貢獻遠超過颱風強度變化的正貢獻，因此造成近20年來的颱風破壞力逐年降低。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，但大氣環境變得不利，使其負貢獻大於颱風強度增加的正貢獻，因此在西北太平洋的破壞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

<sup>1</sup>Department of Atmospheric Sciences, National Taiwan University, No.1, Sec. 4, Roosevelt Rd., Taipei 106, Taiwan, Republic of China  
<sup>2</sup>Impact Centre, School of Energy and Environment, City University of Hong Kong, Hong Kong, China  
be addressed to I.-I.L. (email: iilin@as.ntu.edu.tw).

Paper published in Nature communications, with highlighted in the NTU web and newsletter(2015)

ARTICLE

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OPEN

# Change in ocean subsurface environment to suppress tropical cyclone intensification under global warming

Ping Huang<sup>1,2</sup>, I-I Lin<sup>3</sup>, Chia Chou<sup>4</sup> & Rong-Hui Huang<sup>1</sup>

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》

全球暖化之下海洋水下環境改變不利熱帶氣旋發展。臺大與中國科學院、臺灣中央研究院合作成果榮登《Nature Communications》。

熱帶氣旋，在北大西洋稱之為颶風，在西北太平洋則稱之為颱風，為最大的自然災害之一，也是相當嚴重的天然災害。由於熱帶氣旋的發展受到其所處的大氣和海洋環境有極大的影響，在全球暖化下，海洋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、臺灣中央研究院合作共同發表在自然通訊期刊上，發現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。主要原因雖然全球暖化發生於海面，但海水溫度增加，但海水溫度增加卻不如海面一樣快速。換言之，即海洋表面溫度變暖較快，水下溫度變暖較慢。如此的水溫變化將造成海洋溫度垂直梯度變大，即溫度垂直分佈率變大，此溫度增加的現象將會加強熱帶氣旋和海面之間的耦合作用，該耦合作用的增強造成海洋溫度較低的海水更容易被帶到海面，因而抑制熱帶氣旋的形成。而文章最後總結的結論則指出在世界上最重要的熱帶氣旋發展區：西北太平洋、印度洋、及西北大西洋等處，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變暖，將有利熱帶氣旋發展，但此一研究顯示水下環境的改變，水下溫度變暖較慢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，不僅要看海洋表面溫度變化而產生的增強作用，還必須考慮另一新的控制因子，即考慮水下溫度變暖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

<sup>1</sup>Center for Monsoon System Research, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing 100875, China. <sup>2</sup>Department of Atmospheric and Oceanic Sciences, Academia Sinica, Taipei 11529, Taiwan. Correspondence: iilin@as.ntu.edu.tw.

Paper published in Nature communications, with highlighted in the NTU web and newsletter(2015)





# 英特爾科展 我獲雙首獎

12學生9件作品參賽 得獎率逾5成 歷年最佳成績

林志成/台北—洛杉磯電訪採訪

我國參加今年在美國洛杉磯舉行的「英特爾國際科技展覽會」，囊括2項大會歐洲參訪研習獎、2項類別首獎、6項大會獎、3項特別獎等12個獎，是35年以來最佳成績。建中黃亦軒及北一女陳郁欣兩人均獲首獎，他們感到意外，但也很高興。

英特爾科展素有「科學奧林匹亞」之稱，今年是5月12日至16日在洛杉磯舉行，共有來自全球1700位學生、1300件作品參賽。我國有12個學生9件作品參賽，最後得獎率是55.6%，為各國之冠，是大會平均得獎率28%的2倍。

黃亦軒找到開花基因

我國有6位學生獲獎，除了黃亦軒及陳郁欣獲首獎最高榮譽外，建中陳昭鳴及邱紹廷、北一女沈玉宜及高雄市三民國中學生王冠璇等4人獲大會四等獎。此外，

這次獲台灣和中國大陸各2個首獎。帶領前往洛杉磯比賽的中央研究院院士林榮耀表示，我國參加英特爾科展歷年35年，這次是成績最好的一次。我學生對科學有興趣，願意投入時間及感到好奇老師，是他們表現出色的原因。黃亦軒以「轉錄因子bZIP16參與阿拉伯斯開花基因的分子機制研究」作品，獲得大會植物學科類別首獎。他表示，之前沒想過會得這麼大獎，因此很興奮，也很開心。黃亦軒說，他從小就喜歡種植植物（如綠豆苗），每次看到它們開花，就很神奇，因此他在4年時間進行研究，發現植物中的bZIP16基因可以促進開花，並以此獲獎。這個發現和實際生活應用，可以讓植物在多個季節開花，譬如草莓就下一定冬天吃到，夏天也可以。

陳郁欣研究颱風強度

陳郁欣以「西北太平洋颱風增強與上層海洋動力結構關係之長期變化」作品，獲大會地球行星科學科類別首獎。她表示，得這個獎很驚喜，也很意外。「我從小對地球科學有興趣，想瞭解西北太平洋產生的颱風是否強度有增加？」陳郁欣指出，她的研究顯示，因為海洋溫度變化的研究顯示，21年來這個海域生成的熱帶氣旋平均強度增加26%，登陸時的強度增加34%，因此獲獎。



今年英特爾科展獲獎者：陳郁欣（左起）、邱紹廷、黃亦軒、陳昭鳴、沈玉宜及王冠璇。（科教組提供）

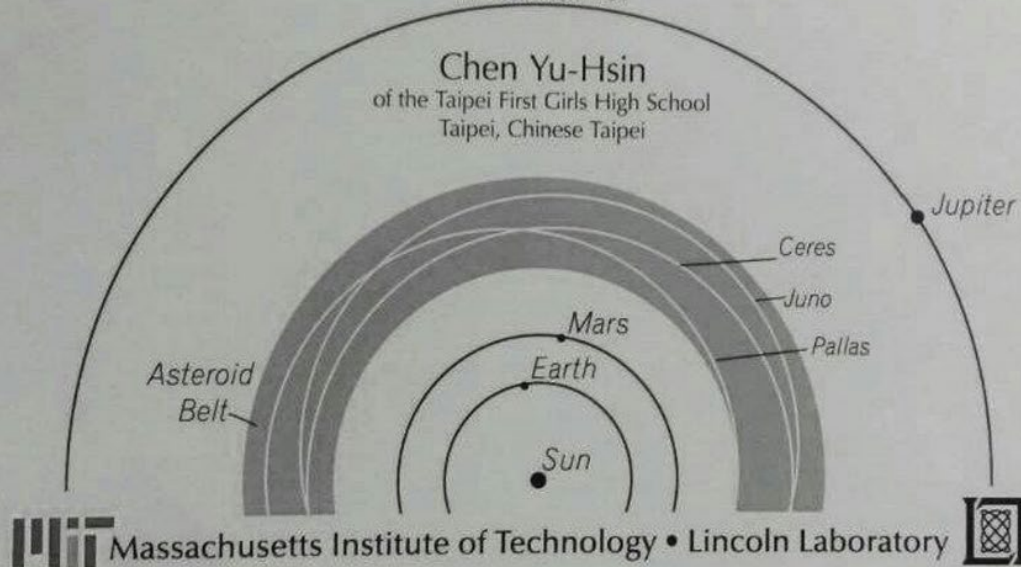
學生	就讀學校	獲獎獎項	獲獎和勵金（美金）
黃亦軒	建國中學	1. 大會生物學科類別首獎 (US\$5000) 2. 大會植物學科一等獎 (US\$3000) 3. 大會植物學科一等獎 (US\$3000) 4. Monsanto公司特別獎一等獎 (US\$2500)	1. 新台幣20萬元 2. 蕭杏俊保送大學 3. 出國留學獎學金
陳郁欣	北一女	1. 大會地球行星科學科類別首獎 (US\$5000) 2. 大會地球行星科學科一等獎 (US\$3000) 3. 美國聖地牙哥特別獎三等獎 (US\$500)	1. 新台幣20萬元 2. 蕭杏俊保送大學 3. 出國留學獎學金
陳昭鳴	建國中學	1. 大會生物學科四等獎 (US\$500) 2. 美國微生物學會特別獎 (US\$2500)	1. 新台幣5萬元 2. 蕭杏俊保送大學
邱紹廷	建國中學	1. 大會生物學科四等獎 (US\$500)	1. 新台幣5萬元 2. 蕭杏俊保送大學
沈玉宜	北一女	大會化學科四等獎 (US\$500)	1. 新台幣5萬元 2. 蕭杏俊保送大學
王冠璇	高雄市三民國中	大會數學科四等獎 (US\$500)	1. 新台幣5萬元 2. 蕭杏俊保送高中

資料來源：科教組

製表：林志成

In recognition of achievement as a top award winner in the 2014 Intel International Science and Engineering Fair, a high school science competition of Society for Science & the Public and Intel Foundation, Minor Planet (31336) Chenyuhsin discovered by the LINEAR Program of MIT Lincoln Laboratory is named for

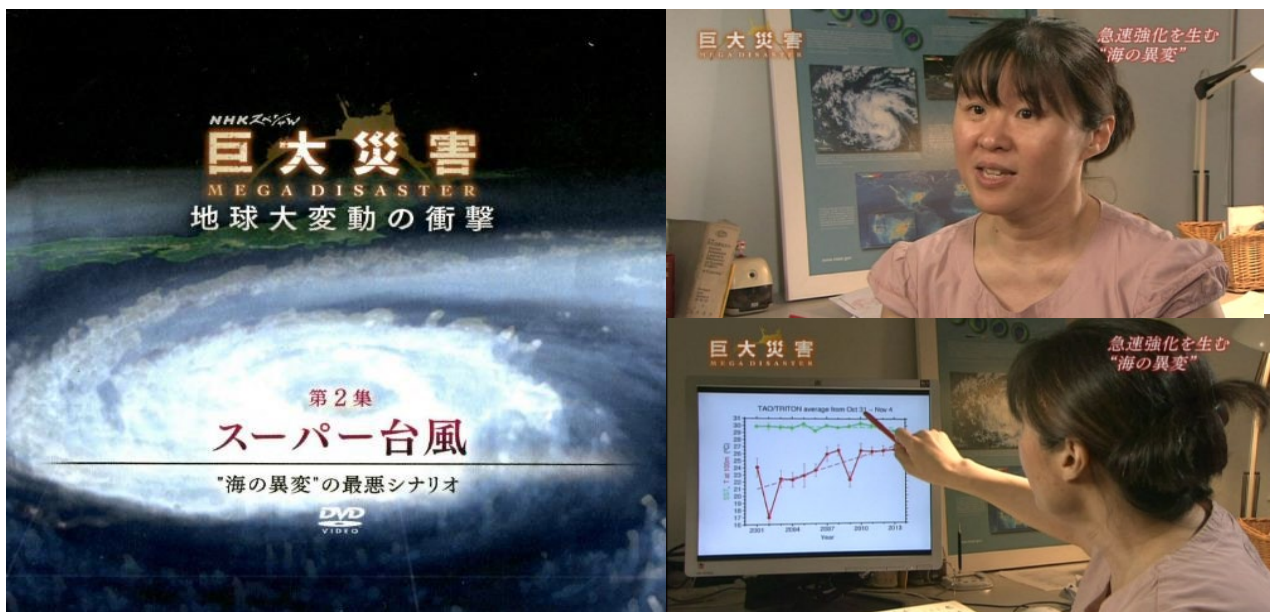
Chen Yu-Hsin  
of the Taipei First Girls High School  
Taipei, Chinese Taipei



MIT Massachusetts Institute of Technology • Lincoln Laboratory

Minor planet (31336) Chenyuhsin is named for Chen Yu-Hsin - Chen Yu-Hsin was awarded best of category and first place in the 2014 Intel International Science and Engineering Fair for her earth science project, and also received the European Union Contest for Young Scientists Award.(October 2015)





Featured in Japan NHK's special documentary 'Mega Disasters' (31 August 2014) with focus on the importance of ocean subsurface warming and supertyphoons.(2014)

**State of the Climate in 2013: Spotlight on authors**  
 Author: Deke Arndt  
 Tuesday, July 15, 2014

As the assessment now known as the BAMS State of the Climate report pushes well into its third decade, the level of international participation is at an all-time high. More than 420 authors from institutions in 57 countries contributed to this year's report. This kind of diversity ensures that a range of scientific disciplines, including atmospheric scientists, tropical meteorologists, oceanographers, and glacier experts, examine the climate system.

It also helps strengthen international data sharing and showcases a number of innovative ways to analyze and display data. Most importantly, it underscores that the climate we live in is not only shared around the world, but also that it affects different people in different places in different ways. Here is a snapshot of some of the contributors to the *State of the Climate in 2013*.

**Contributors:**

- Martin Sharp**  
University of Alberta  
Edmonton, Alberta, Canada  
Chapter 5i: Arctic (Glaciers and Ice Caps)  
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- Ryan Fogt**  
Ohio University  
Athens, Ohio  
Chapter 6: Antarctica  
Seventh year with SotC  
Fifth as editor
- Jose A. Marengo**  
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Chapter 7d: Regional Climates (South America)  
Ninth year with SotC
- Khadija Kabidi**  
Morocco's National Meteorological Direction / North Region  
Rabat City, Morocco  
Chapter 7e: Regional Climates (Africa)  
Eighth year with SotC
- Dr. Ladislaus Chang'a**  
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Chapter 7f: Regional Climates (Europe & the Middle East)  
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National Taiwan University  
Taipei, Taiwan  
Chapter 4: The Tropics (Tropical Cyclone Heat Potential)  
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Chapter 7h: Regional Climates (Oceania)  
Fourth year with SotC

BAMS paper State of the Climate in 2013: spotlighted for the Tropics chapter by NOAA in July 2014.(2014)

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NEWS & ANALYSIS

CLIMATOLOGY

**Clues to Supertyphoon's Ferocity Found in the Western Pacific**

Dennis Normile

Tropical storm watchers agree that Haiyan was probably the strongest typhoon to make landfall when it slammed into the Philippines on 8 November, packing winds of up to 314 kilometers per hour. What gave Haiyan, which killed thousands and displaced millions, its deadly wallop?

Researchers think they have at least a partial answer to that question: unusually warm subsurface Pacific waters east of the Philippines. A related phenomenon—rising sea levels in the western Pacific—likely abetted Haiyan's devastating storm surge, which caused more deaths than the winds themselves.

Typhoons draw heat from the ocean for the energy that generates their winds. Typically, as a storm's winds increase, they stir up deeper, cooler ocean waters that temper its strength. This cooling effect "is nature's brake to stop typhoons from intensifying," says I-I Lin, a specialist in typhoon-ocean interactions at National Taiwan University in Taipei.

Drawing on data from satellite observations and Argo floats—thousands of instrumented, subsurface probes that measure ocean temperature, salinity, and current speeds—Lin and others have documented a steady 2-decade rise in subsurface temperatures in the western North Pacific and a bulging warm water layer. The warmer and thicker the water, the more heat is available to feed a typhoon's winds. A measure called the

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**Feeding the monster.**  
Unusually warm Pacific waters supercharged Haiyan.

CREDIT: JOHN KNAFF, NOAA/NESDIS/RAMMB, CSU/CIRA

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From Pun, Lin et al. 2013

Pun, Lin and Lo GRL 2013 paper highlighted by Science in Nov. 2013.(2013)

Pun, Lin et al. 2013  
was highlighted by the AVISO CNES  
(French Space Agency) as  
*Image of the Month* in Aug. 2013

**20 YEARS OF ALTIMETRY FOR TYPHOONS**  
*Image of the Month - August 2013*

Sea trends (global trend removed) over the North-West Pacific: the Main Development Region (MDR) where most typhoons are formed and intensified is indicated by the black bar.

Depth of the 26°C isotherm (D26, red, left axis) and Tropical Cyclonic Heat Potential (TCHP, blue, right axis) averaged over the main development region, calculated using dynamic steric heights (mass-corrected sea level anomalies) during the typhoon season (July-October) from 1993 to 2011. A clear increase can be seen (Credits National Taiwan University/WHOI).

Tropical cyclones are known to be intensified by the heat of the upper ocean. The North-West Pacific is the most active area on earth for tropical cyclone (typhoon) formation and intensification, and one of the most densely populated coastal regions, thus making typhoon forecasting vital information for billions of people.

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**Pun, Lin and Lo GRL 2013 paper highlighted by the International AVISO Altimetry Organization under CNES (French Space Agency) as "Image of the Month" for August 2013.(2013)**

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**AN OCEAN COUPLING POTENTIAL INTENSITY INDEX FOR TROPICAL CYCLONES.**

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, E. A. D'Asaro

Geophysical Research Letters, Volume 40, Issue 9, pages 1878–1882, 16 May 2013.

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Research Center for Environmental Changes, Academia Sinica, Taipei, Taiwan and

Science Application International Corporation, Inc and Naval Research Laboratory, Monterey, California, USA and

Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, USA and

Rosenstiel School of Marine and Atmospheric Sciences, University of Miami, Miami, Florida, USA and

Naval Postgraduate School, Monterey, California, USA and

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**National Taiwan University Outstanding Teaching Award in Sep. 2009**

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**TOP STORIES**

**Study Finds 'Pre-Existing Condition' Fueled Killer Cyclone**  
A pre-existing condition stoked the sudden intensification of last year's Tropical Cyclone Nargis just before its devastating landfall in Burma, (Feb. 26)

**Video: Building a Clean Space Machine**  
Take a behind-the-scenes tour of the Clean Room at NASA's Jet Propulsion Laboratory and see the construction of NASA's next mission to Mars.

PASADENA, Calif. - A "pre-existing condition" in the North Indian Ocean stoked the sudden intensification of last year's Tropical Cyclone Nargis just before its devastating landfall in Burma, according to a new NASA/university study. The cyclone became Burma's worst natural disaster ever and one of the deadliest cyclones of all time.

Scientists at the National Taiwan University, Taipei, and NASA's Jet Propulsion Laboratory, Pasadena, Calif., used data from satellite altimeters, measurements of ocean depth and temperature and an ocean model to analyze the ocean conditions present at the time of the catastrophic storm. Nargis intensified from a relatively weak category 1 storm to a category 4 monster during its final 24 hours before making landfall on May 2, 2008.

Lead author I-I Lin of National Taiwan University and her team found the ocean conditions Nargis encountered created the perfect recipe for disaster. Cyclones thrive on warm layers of ocean water that are at least 26 degrees Celsius (79 degrees Fahrenheit). As they traverse the ocean, they typically draw deep, cold water up to the ocean surface, a process that limits their ability to strengthen, and even weakens them as they evolve. However, Nargis passed over a pre-existing warm ocean feature in the Bay of Bengal where upper ocean warm waters extended deeper than normal, from 73 to 101 meters (240 to 331 feet).

"This abnormally thick, warm water layer, which formed about a month earlier, kept deeper, colder waters from being drawn to the surface, increasing the energy available to fuel Nargis' growth by 300 percent," said Lin. "Combined with other atmospheric conditions conducive to strengthening, this warm ocean feature allowed Nargis to reach speeds of 115 knots (213 kilometers, or 132 miles) per hour at landfall. Had Nargis not encountered this warm ocean feature, it would likely not have had sufficient

**Jet Propulsion Laboratory**  
California Institute of Technology

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**THE Cutting Edge** Newly published JPL research

**Seeds of disaster**

03.19.09

On May 2, 2008, Cyclone Nargis caused the worst natural disaster in the history of Myanmar, a country in Southeast Asia that is more commonly known as Burma. Over 130,000 people were killed and, according to United Nations estimates, 1.5 million people were severely affected. More than \$19 billion of damage was done.

One of the things that made Nargis so deadly was the way in which it intensified so quickly before making landfall - from a category 1 to a category 4 tropical cyclone in just 24 hours. But how exactly did this happen? New research suggests that abnormally warm waters off the coast of Burma in the Bay of Bengal played a major role.

Working alongside researchers in Taiwan, W. Timothy Liu of NASA's Jet Propulsion Laboratory in Pasadena, Calif., analyzed ocean depth and temperature readings that had been collected by floating devices at sea and by satellites such as NASA's Jason-1 ocean surface topography mapper. They found that, around the time of the cyclone, the waters near Burma contained an unusually warm layer 100 to 200 meters (about 109 to 219 yards) deep. The extra energy in this layer meant that the atmosphere above the ocean was "fed" with three times as much heat, enabling Cyclone Nargis to intensify so rapidly.

While the Burma tragedy cannot be undone, Liu and colleagues hope that the work will help to improve forecasts of future cyclones in the Northern Indian Ocean, which are notoriously hard to predict.

The results appear in *Geophysical Research Letters*.

**Research paper:**

- Warm ocean anomaly, air sea fluxes, and the rapid intensification of tropical cyclone Nargis (2008)

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Twice featured by NASA with official press release and reported by USA Today, Science Daily, NTU news and other media.( February and March, 2009)  
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Front cover: Weybourne Atmospheric Observatory, UK

Weybourne Atmospheric Observatory, officially opened by Sir William Waldegrave in 1994, experiences an uninterrupted, "clean air" seaward aspect to the North. We are also able to measure plumes from many differing origins including London and the Arctic.

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For more information:  
Contact: Dr Brian Bandy  
(b.bandy@uea.ac.uk)

national report



I-H Lin obtained her Ph.D. degree in Remote Sensing from the University of Cambridge, England in 1995. From 1995-1999, she worked as a Research Scientist in the Centre for Remote Imaging, Sensing, and Processing of the National University of Singapore. In 2000 she returned to her home country, Taiwan, and is currently an Associate Professor in the Department of Atmospheric Sciences, National Taiwan University. Her research interest is in using synergy of multiple remote sensing data to study air-sea interaction problems, including typhoon-ocean interaction, dust storm-ocean interaction, and the role of surfactants in air-sea gas exchange.

### Multiple remote sensing for air-sea biogeochemical interaction research in the western north Pacific and neighbouring seas

I-H Lin, Dept. of Atmospheric Sciences, National Taiwan University, Taipei, Taiwan. <http://smart.as.ntu.edu.tw/>  
Contact: [ihlin@as.ntu.edu.tw](mailto:ihlin@as.ntu.edu.tw)

Air-sea biogeochemical interaction related processes are a critical component in the Earth's ecological and climate system. However, due to the complex and dynamic nature of these processes, many of the processes are poorly-observed and little understood. This is especially true in the vast western North Pacific Ocean and the neighbouring seas as this vast oceanic region is subject to frequent atmospheric episodic forcing from events like typhoons and dust storms. It has been difficult to use discrete ship-borne point measurements with irregular time and spatial intervals to observe these highly episodic processes. With the

advancement in space-borne remote sensing offering frequent and systematic observations, it has become more feasible to take a glimpse at these complex dynamic processes. In this research, multiple remote sensors are used as it is necessary to have observations of a suite of physical and biogeochemical parameters for both atmosphere and ocean. In this research, five types of remote sensing data are used and they are: (a) ocean colour data (chlorophyll-a concentration and ocean colour spectra) from the NASA's SeaWiFS (Sea-viewing Wide Field-of-view Sensor) and MODIS satellites (O'Reilly et al., 1998); (b) aerosol optical thickness and fine mode fraction data from the NASA

**Featured by the by the international SCOR (Scientific Committee on Ocean Research) in the SOLAS (Surface Ocean Lower Atmosphere Study) newsletter.(2008)**



**10 Outstanding Young Women Award of the Republic of China(2007)**

Scientists had long suspected that strong winds cause entrainment, or vertical mixing, in tropical and subtropical oceans, explained Lin and colleagues in a paper published in the October 2003 issue of *Geophysical Research Letters*. But it took measurements from the three satellite sensors to prove it.

"This research is important because it confirms that the impact of cyclones on ocean primary production is significant, at least in the South China Sea," Lin said. "It also points to the potential impact tropical cyclones have on climate change, since primary production is critical to global climate."

The new technology has also illuminated future research options for the sciences. "We've now established a method to quantify the cyclone-induced phytoplankton growth using a combination of remote-sensing data and models," Lin said. "This method can be applied to other typhoon cases and in different oceanic regions, too. Previously, it was impossible to do such work due to the lack of observations by traditional means."

For more information, visit the following web sites:

Tropical Rainfall Measuring Mission (TRMM)

<http://trmm.gsfc.nasa.gov/>

SeaWiFS Project

<http://seawifs.gsfc.nasa.gov/SEAWIFS.html>

NASA Quick Scatterometer (QuikSCAT)

<http://news.jpl.nasa.gov/newsroom/scatter/quikscat.html>

Air-Sea Interaction & Climate

<http://nasa-www.jpl.nasa.gov/>

References:

"Killer Storms in Philippines and Japan," BBC News. Accessed July 26, 2004.

<http://news.bbc.co.uk/1/hi/world/asia-pacific/324672.stm>

"Typhoons leave 3 dead in Japan, 42 dead in Philippines," CNN.com.

Accessed July 26, 2004.

<http://news.cnn.com/2004/WEATHER/07/26/bc.asia.typhoons.ap/>



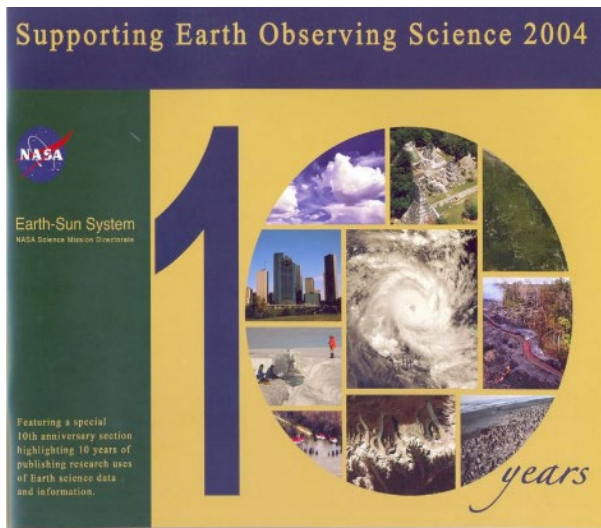
Ocean Research in Taiwan. Lin holds a PhD in remote sensing from the University of Cambridge, England.

H. Lin is an assistant professor in the Department of Atmospheric Sciences at the National Taiwan University in Taiwan. From 1995 to 1999, she worked as a research scientist at the Centre for Remote Imaging, Sensing, and Processing (CRISP) at the National University of Singapore. She also served as principal investigator at the Remote Sensing Laboratory at the National Center for



holds a MS and PhD in atmospheric sciences from the University of Washington.

W. Timothy Liu is a senior research scientist at the Jet Propulsion Laboratory, California Institute of Technology. His research focuses on ocean-atmosphere interactions and satellite oceanography. Liu is leader of the Air-Sea Interaction and Climate Team and principal investigator for both the NASA Scatterometer (NSCAT) and TOPEX/Poseidon projects. He



Reported in NASA's 10-years anniversary of earth observation highlights.(2004)

**nature**  
news and views in brief

7 August 2003

Vol 425 No 6949 PP 630

Oceanography:

# Bloom in Cyclone



By Tim Lincoln,  
**NATURE** Magazine



## Oceanography

### Bloom in cyclone

*Geophys. Res. Lett.* doi: 10.1029/2003GL017141 (2003)

For three days in July 2000, cyclone Kai-Tak whipped across the South China Sea. I. Lin and colleagues have made the most of a combination of satellite views of this tropical storm and its effects, and in their latest paper have documented the resulting bloom of phytoplankton. They calculate that the bloom constituted a 10-fold increase in growth, or primary production, over normal conditions.

This is not unexpected, as storms are known to stir marine waters from depth and bring nutrients to the sunlit upper zone where phytoplankton can use them in photosynthesis. But tropical cyclones are especially unpredictable beasts, and making measurements from ships or moored arrays would be an ineffective and hazardous business. Hence the virtue of satellite data — in this case from three different sensors, which the authors have used to inform models of physical ocean mixing and primary production.

The further calculations of Lin *et al.* produce a bigger picture. Kai-Tak was of only moderate force, but they estimate that this storm alone was responsible for 2–4% of new annual production in the South China Sea. Given cyclone incidence, they believe that the overall figure could amount to 20–30%.

Tim Lincoln

Citation in *Nature: News and Views in Brief*, 7 August, 2003, vol. 425, no. 6949, pp. 630, 'Oceanography: Bloom in Cyclone' (original paper see Lin I-I *et al.*, 2003c, *Geophysical Research Letters*).(2003)

# nature

news and views in brief

13 March 2003

Vol 422 No 6928 pp 132

Atmospheric Science:

## Quick, quick, slow

By Tim Lincoln, *NATURE* Magazine



### Atmospheric science

#### Quick, quick, slow

Geophys. Res. Lett. doi:10.1029/2002GL015674 (2003)

In July and August 2000, remote-sensing instruments tracked the consequences of two typhoons, Kai-Tak and Bilis, during their passage over oceans in Southeast Asia. Analyses of the data have produced a refined picture of the relationship between sea-surface temperature and wind speed.

Typhoons are driven by the energy from a warm sea-surface, and in turn drag up water from depth as they pass, leaving surface patches that can be up to 6 °C cooler than the surrounding ocean. As I.-I. Lin and co-workers point out, this situation provides a natural experiment. Taking advantage of this, they find that the speed of surface winds drops dramatically over such patches compared with wind speed over neighbouring ocean. This agrees with a previously proposed mechanism of wind-speed modulation at the sea surface. In Lin and colleagues' data, every 1 °C drop in sea temperature typically corresponds to a decrease of about 1 m s<sup>-1</sup> in wind speed. The cold patches don't take long to warm up again, however, and — most notably — the authors find that events can be played out on comparatively small scales (100–400 km), and quite fast (within a day).

Tim Lincoln

Citation in *Nature: News and Views in Brief*, 13 March, 2003, vol. 422, no. 6928, pp. 132, 'Atmospheric Science: Quick, quick, slow' (original paper see Lin I-I *et al.*, 2003a, *Geophysical Research Letters*).(2003)

## CNN.com / WORLD

December 8, 2002

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### Typhoons a boon for ocean life

SAN FRANCISCO (AP) — Typhoons, the violent storms that are the bane of life across much of Asia, are a boon for life at sea, where the cyclones stir up the nutrients that microscopic algae crave, according to scientists.



Scientists in Taiwan and the United States recently used a trio of NASA satellites to observe how the passage of even moderate typhoons over the South China Sea can generate upwellings of nutrient-rich water from deeper in the ocean and spark massive blooms of phytoplankton.

"It's a natural hazard, it destroys life, but what I am showing is it also enhances life," said Timothy Liu, a senior research scientist at the National Aeronautics and Space Administration's Jet Propulsion Laboratory in Pasadena, California, on Saturday.

Through photosynthesis, the algae absorb carbon dioxide from the atmosphere and convert it to oxygen, offsetting emissions of carbon dioxide from the burning of fossil fuels. The algae are also an important food source for marine life.

Scientists tracked the typhoons to see what kind of effect they had on the sea life

Liu, working with research scientist I-I Lin of Taiwan's National Center for Ocean Research in Taipei, combined data culled from three satellites to show the positive effects of storms on marine life. They presented their results Saturday at the fall meeting of the American Geophysical Union.

"Typhoons were completely neglected before, because it was impossible to quantify" their effect on the algae, Lin said.



The violent storms are seen as the bane of life across much of Asia

Typhoon Kai-Tak passed over the South China Sea on July 5, 2000, lingering for four days before traveling northward over Taiwan, based on data acquired from NASA's Quikscat, a satellite that measures wind speeds over water.

In its aftermath, sea surface temperature measurements made by the joint U.S.-Japanese Tropical Rainfall Measuring Mission satellite showed a 16-degree

Fahrenheit drop in the area where the counterclockwise-spinning storm had been parked. Colder water, drawn upward by the typhoon, caused the drop, Lin said.

By July 12, 2000, four days after the typhoon had moved on, a third satellite, the Sea Viewing Wide-Field-of-View Sensor, began to measure a dramatic change in the ocean color that matched in extent the previously observed cold spot.

A 300-fold increase in ocean chlorophyll, contained in the algae, accounted for the color change, Liu said.

The bloom persisted for a month.

Liu and Lin said they tracked about 20 typhoons that swept the South China Sea over the course of 2000 using the novel three-satellite method.

"The hypothesis was there, but there was no evidence to tie it together," Liu said of the typhoon-phytoplankton connection.

CNN reported the finding on the impressive ocean biogeochemical responses induced by typhoon Kai-Tak (i.e. Lin *et al.* GRL 2003b).