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Education

1988 – 1993 Ph.D., Earth, Atmospheric, and Planetary Sciences, Massachusetts Institute of Technology
1982 – 1986 B.S., Atmospheric Sciences, National Taiwan University, Taiwan.

Experiences

08/2020- present Chair Professor, Department of Atmospheric Sciences, National Taiwan University, Taipei, Taiwan
08/2019-present Dean, College of Science, National Taiwan University
2009- 07/2020 Distinguished Professor, Department of Atmospheric Sciences, National Taiwan University, Taipei, Taiwan
01-05/2019 Visiting Professor, Department of Earth and Environmental Sciences, Columbia University
10/2018-06/2019 Adjunct Senior Research Scientist, Lamont–Doherty Earth Observatory, Columbia University
11/2013-08/2016 Associate Dean, College of Science, National Taiwan University
08/2008-07/2014 Chairman, Department of Atmospheric Sciences, National Taiwan University
01-07/2004 Visiting Fellow, Geophysical Fluid Dynamics Laboratory, Princeton University, New Jersey.
2000 – 2009 Professor, Department of Atmospheric Sciences, National Taiwan University, Taipei, Taiwan
1994 – 2000 Associate Professor, Department of Atmospheric Sciences, National Taiwan University, Taipei, Taiwan
08-11/1994, 07-09/1995 Visiting Research Scientist, Geophysical Fluid Dynamics Laboratory, Princeton University, New Jersey.
1993 –1994 Postdoctoral Scholar, Geophysical Fluid Dynamics Laboratory, Princeton University, New Jersey.

Honors & Awards

2020-2024 Principal Investigator, Science Vanguard Research Program, National Science Council (MOST)
2017-2020 Project for MOST research fellow, Ministry of Science and Technology
2017 National Chair Professorship, Ministry of Education

2017 Fellow, American Meteorological Society (AMS)
2014 Appreciation Certificate from World Meteorological Organization (WMO), WWRP, THORPEX (2005-2014), (In recognition of outstanding contribution to the WMO THORPEX Programme for the years 2005- 2014)
2014 Editor's Award for the Journal of the Atmospheric Sciences, American Meteorological Society (AMS)
2013 The Academic Award, Ministry of Education
2013-2017 Principal Investigator, Science Vanguard Research Program, National Science Council (NSC)
2013 Fellow, Meteorological Society of ROC (Taiwan)
2010 「New 100 Glories of Taiwan」, "Global Views Monthly" Magazine
2009 「50 Scientific Achievements」, National Science Council (NSC) 50th Anniversary
2008 Gold Bookmarker Prize,Wu Ta-You Popular Science Book Prize in Translation, Wu Ta-You Foundation
2008 Outstanding Teaching Award, National Taiwan University
2007, 2009, 2012 Outstanding Research Award, National Science Council
2004 Research Achievement Award, National Taiwan Univ.
2001 Academia Sinica Research Award for Junior Researchers

Professional Service

President, Asia Oceania Geosciences Society (AOGS), 2020/07 – present

Vice President, Asia Oceania Geosciences Society (AOGS), 2019/08 – 2020/06

Member (Vice Chair), GRC Executive Committee (Union Commission on Geophysical Risk and Sustainability), IUGG, 11/2017 (07/2019) – present

Member, Steering Committee, Belmont Forum, 10/2017 – 10/2019

Director of Board/ Supervisor, National Synchrotron Radition Research Center (NSRRC), 2017/07 – 2018/08

President, Meteorological Society of ROC (Taiwan), 2017/04 – present

Editor, Asia-Pacific Journal of Atmospheric Sciences (APJAS) - Korean Meteorological Society (KMS), 2015/11 – 2016/12

Secretary General/ Assistant Secretary General, Asia Oceania Geosciences Society (AOGS), 2013/08 – 2019/07

Editor, Journal of the Atmospheric Sciences (JAS) – American Meteorological Society (AMS), 2013/07 – 2018/12

Vice President, Meteorological Society of ROC, 2013/03 – 2017/03

Member, Committee on Tropical Meteorology and Tropical Cyclones, American Meteorological Society, 2012/01 – 2017/12

Associate Editor, Asia-Pacific Journal of Atmospheric Sciences - Korean Meteorological Society (KMS), 2011/11 – 2013/12

President/Vice President, Atmospheric Science Section, Asia Oceania Geosciences Society (AOGS), 2009/08 – 2013/07

Editor-in-Chief, Terrestrial, Atmospheric and Oceanic Sciences, 2009/08 – 2012/07

Advisory committee member, Atmos. Sci., Div. of Natural Sciences, National Science Council, 2008/01 – 2010/12

Chairman, Panel committee, Atmos. Sci., Div. of Natural Sciences, National Science Council, 2005/01 – 2007/12

Principal Investigator, Priority Typhoon Research Project (including the DOTSTAR program, 追風計畫), National Science Council, 2002/08 – 2008/07

Editor, Terrestrial, Atmospheric, and Oceanic Sciences (an SCI journal),
Chinese Geoscience Union, 2005/08 – 2009/07

Associate Editor, Terrestrial, Atmospheric, and Oceanic Sciences (SCI),
Chinese Geoscience Union, 2004/12 – 2005/07

Chief Editor, Atmospheric Sciences, Meteorological Society of ROC, 2002/01 – 2003/12

Associate Editor, Monthly Weather Review, American Meteorological Society, 2002/01 – 2003/01

Managing Editor, Terrestrial, Atmospheric, and Oceanic Sciences (SCI), Chinese Geoscience Union, 1997/06 – 2003/12

Research Interests

Atmosphere Sciences, Tropical Cyclone Dynamics, Targeted Observation, Typhoon-Ocean interaction, Typhoon-Terrain interaction, Typhoon Rainfall Processes, Numerical Simulation and Assimilation, Typhoon and Climate

Research Highlights

1. **DOTSTAR (Dropwindsonde Observations for Typhoon Surveillance near the TAiwan Region) and Targeted observation**

Prof. Wu established the DOTSTAR program from scratch since 2003 with full successes. Widely recognized as a fully-developed program, DOTSATR played a pivotal role in the international THORPEX/PARC initiative under the World Meteorological Organization. This is the first and pioneering field program in which four airplanes (two jets for surveillance, and a P-3 and a C-130 for reconnaissance) were simultaneously deployed for scientific observations of typhoons in the North western Pacific. DOTSTAR became operational at Central Weather Bureau (CWB) since 2013. DOTSTAR has provided the pivotal realtime in-situ observations for the analysis of storm wind structure at CWB. Prof. Wu has been collaborating with both Japanese research team and HongKong Observatory in their aircraft observation platforms since 2016, with joint-flight typhoon observations in 2017 and 2018.

Prof. Wu developed a new theory to identify the sensitive areas for TC targeted observations based on the adjoint model. By appropriately defining the response functions to represent a typhoon's steering flow at the verifying time, a unique new parameter, Adjoint-Derived Sensitivity Steering Vector (ADSSV), was designed to identify the sensitivity locations at the observing time. Additionally, data from the 751 dropwindsondes deployed in 35 typhoons during 2003-2009 were verified to improve the 48-120-hour track forecast of the USA NOAA/NCEP Global Forecasting System by about 20% (statistically significant at the 95% confidence level).

2. Typhoon-ocean interaction

Prof. Wu constructed an idealized and comprehensive typhoon-ocean coupled model to study the influence of the ocean mixed-layer structure and the warm ocean eddy on typhoons, especially that of the feedback of the typhoon-induced SST cooling on typhoon intensity. Numerical experiments with different oceanic thermal structures were designed to elucidate the responses of tropical cyclones to the ocean eddy and the effects of tropical cyclones on the ocean. Based on detailed in situ air-deployed ocean and atmospheric measurement pairs collected, the unprecedented "Impact of Typhoons on the Ocean in the Pacific (ITOP)" field campaign were successfully carried out in 2010.

3. Typhoon Dynamics

(1) Potential vorticity diagnostics of TC motion

Prof. Wu is the pioneer to employ the concept of potential vorticity to understand the hurricane dynamics, i.e., proposing and identifying the baroclinic effect on hurricane motion, and quantitatively evaluating the typhoon steering flow and its connection to the large-scale dynamical systems based on potential vorticity inversion. The centroid-relative diagram was uniquely designed by Prof. Wu to evaluate the binary interaction (Fujiwhara effect).

(2) Dynamics of TC intensity and (concentric) eyewall

A new pathway controlling the secondary eyewall formation (SEF) in TCs had been identified by Prof. Wu. Consequently, a deeper understanding of the underlying dynamics of SEF was obtained, which is an attractive paradigm on the physical grounds because of its simplicity and consistency with the 3-D numerical simulations presented. Application of the two spin-up mechanisms set the scene for a progressive boundary layer control pathway to SEF. The response of the unbalanced boundary layer to an expanding swirling wind field is an important mechanism for concentrating and sustaining deep convection in a narrow supergradient-wind zone in the outer-core region of a mature TC. His findings point to a sequence of structural changes in the outer-core region of a mature TC, which culminates in the formation of a secondary eyewall.

(3) TC rainfall and climate change

A series of numerical (ensemble) experiments has been conducted to examine the capability of a high-resolution mesoscale model to simulate the track, intensity change, and detailed mesoscale precipitation distributions associated with typhoons under the influence of Taiwan terrain. Prof. Wu has carried out milestone works on the rainfall simulation issue in Taiwan. The TC-monsoon-terrain interaction, or the so-called remote rainfall, was highlighted based on two newly-proposed mechanisms: monsoon mode and topographic mode. Prof. Wu also analyzed the high-density rain-gauge data in Taiwan to understand the rainfall characteristics and its reliability, providing new insights on the link between extreme rainfall in Taiwan and global climate change.

Repersentative Publications (*: corresponding author)

20. Chih, C.-H. and C.-C. Wu*, 2020: Exploratory Analysis of Upper Ocean Heat Content and Sea Surface Temperature Underlying Tropical Cyclone Rapid Intensification in the Western North Pacific. *J. Climate*, **33**, 1031-1050. doi: 10.1175/JCLI-D-19-0305.1

19. Cheng, C.-J. and C.-C. Wu*, 2018: The role of WISHE in secondary eyewall formation. *J. Atmos. Sci.,* **75**, 3823-3841. doi: 10.1175/JAS-D-17-0236.1

18. Chang, C.-C. and C.-C. Wu*, 2017: On the processes leading to the rapid intensification of Typhoon Megi (2010). *J. Atmos. Sci.,* **74**, 1169-1200. doi: 10.1175/JAS-D-16-0075.1

17. Chen, T.-C. and C.-C. Wu*, 2016: The remote effect of Typhoon Megi (2010) on the heavy rainfall over northeastern Taiwan. *Mon. Wea. Rev.,* **144**, 3109-3131. doi: 10.1175/MWR-D-15-0269.1

16. Wu, C.-C.*, W.-T. Tu, J.-F. Pun, I-I Lin, and M. S. Peng, 2016: Tropical cyclone-ocean interaction in Typhoon Megi (2010) - A synergy study based on ITOP observations and atmosphere-ocean coupled model simulations. *J. Geophys. Res.,* **121**, 153-167. doi:10.1002/2015JD024198

15. Wu, C.-C.*, S.-N. Wu, H.-H. Wei, S. F. Abarca, 2016: The role of convective heating in tropical cyclone eyewall ring evolution. *J. Atmos. Sci.,* **73**, 319-330. doi: 10.1175/JAS-D-15-0085.1

14. Wu, C.-C.*, R. Zhan, Y. Lu, and Y. Wang, 2012: Internal variability of the dynamically downscaled tropical cyclone activity over the western North Pacific by the IPRC Regional Climate Model. *J. Climate*, **25**, 2104-2122. doi: 10.1175/JCLI-D-11-00143.1

13. 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. doi: 10.1175/JAS-D-11-0114.1

12. 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. doi: 10.1175/MWR-D-11-00057.1

11. Wu, C.-C**.***, G.-Y. Lien, J.-H. Chen, and F. Zhang, 2010: Assimilation of tropical cyclone track and structure based on the Ensemble Kalman Filter (EnKF). *J. Atmos. Sci.*, **67**, 3806-3822. doi: 10.1175/2010JAS3444.1

10. Wu, C.-C.*, J.-H. Chen, S. J. Majumdar, M. S. Peng, C. A. Reynolds, S. D. Aberson, R. Buizza, M. Yamaguchi, S.-G. Chen, T. Nakazawa , and K.-H. Chou, 2009: Intercomparison of targeted observation guidance for tropical cyclones in the Northwestern Pacific. *Mon. Wea. Rev.*, **137**, 2471-2492. doi: 10.1175/2009MWR2762.1

09. Wu, C.-C.*, C.-Y Lee, and I-I Lin, 2007: The effect of the ocean eddy on tropical cyclone intensity. *J. Atmos. Sci.*, **64**, 3562-3578. doi: 10.1175/JAS4051.1

08. Wu, C.-C.*, J.-H. Chen, P.-H. Lin, and K.-S. Chou, 2007: Targeted observations of tropical cyclone movement based on the adjoint-derived sensitivity steering vector. *J. Atmos. Sci.*, **64**, 2611-2626. doi: 10.1175/JAS3974.1

07. Wu, C.-C.*, K.-H. Chou, Y. Wang and Y.-H. Kuo, 2006: Tropical cyclone initialization and prediction based on four-dimensional variational data assimilation. *J. of Atmos. Sci.*, **63**, 2383–2395. doi: 10.1175/JAS3743.1

06. Wu, C.-C.*, P.-H. Lin, S. Aberson, T.-C. Yeh, W.-P. Huang, K.-H. Chou, J.-S. Hong, G.-C. Lu, C.-T. Fong, K.-C. Hsu, I-I Lin, P.-L. Lin, C.-H. Liu, 2005: Dropwindsonde Observations for Typhoon Surveillance near the Taiwan Region (DOTSTAR): An overview. *Bulletin of Amer. Meteor. Soc.*, **86**, 787-790. doi: 10.1175/BAMS-86-6-787

05. Wu, C.-C.*, T.-S. Huang, W.-P. Huang, and K.-H. Chou, 2003: A new look at the binary interaction: Potential vorticity diagnosis of the unusual southward movement of Typhoon Bopha (2000) and its interaction with Typhoon Saomai (2000). *Mon. Wea. Rev.*, **131,** 1289-1300. doi: 10.1175/1520-0493(2003)131 <1289: ANLATB>2.0.CO;2

04. Wu, C.-C.*, T.-H. Yen, Y.-H. Kuo, and W. Wang, 2002：Rainfall simulation associated with Typhoon Herb (1996) near Taiwan. Part I: The topographic effect. *Wea. and Forecasting*, **17**, 1001-1015. doi: 10.1175/1520-0434(2003)017<1001:RSAWTH>2.0.CO;2

03. Wu, C.-C.*, and Y.-H. Kuo, 1999: Typhoons affecting Taiwan: Current understanding and future challenges. *Bulletin of Amer. Meteor. Soc.*, **80**, 67-80. doi: 10.1175/1520-0477(1999)080<0067:TATCUA>2.0.CO;2

02. Wu, C.-C.*, and K. A. Emanuel, 1995a: Potential vorticity diagnostics of hurricane movement. Part I: A case study of Hurricane Bob (1991). *Mon. Wea. Rev.*, **123**, 69-92. doi: 10.1175/1520-0493(1995)123<0069:PVDOHM>2.0.CO;2

01. Wu, C.-C.*, and K. A. Emanuel, 1993: Interaction of a baroclinic vortex with background shear: Application to hurricane movement. *J. Atmos. Sci.*, **50**, 62-76. doi: 10.1175/1520-0469(1993)050<0062:IOABVW>2.0.CO;2