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Chia-Ying Tu (杜佳穎)

Research Center for Environmental Changes (RCEC), Academia Sinica
No. 128, Sec. 2, Academia Rd., Nankang, Taipei, Taiwan 115
Office Tel: +886-2-2787-5948
Email: cytu@gate.sinica.edu.tw
Lab website link: www.rcec.edu.tw

EDUCATION

1999/09 – 2006/01 Ph.D., Institute of Environmental Engineering, National Chung-Hsing Univ., Taiwan
1997/09 – 1999/07 M.S., Institute of Environmental Engineering, National Chung-Hsing Univ., Taiwan
1990/09 – 1994/07 B.A., Dept. of Atmospheric Science, National Taiwan Univ., Taiwan

EMPLOYMENT

2019/05 - present Associate Research Specialist RCEC, Academia Sinica, Taiwan
2012/11- 2019/05 Assistant Research Specialist RCEC, Academia Sinica, Taiwan
2012/01- 2012/11 Postdoctoral Researcher RCEC, Academia Sinica, Taiwan
2006/09 - 2011/12 Associate Researcher Taiwan Typhoon & Flood Research Institute, NARL, Taiwan
2006/02 - 2006/08 Postdoctoral Researcher Institute of Environmental Engineering, National Chung-Hsing Univ., Taiwan

HONORS & AWARDS

PROFESSIONAL SERVICE

RESEARCH INTEREST

As a research specialist in the past few years, I considered my role as a linkage for climate model development between RCEC and other research centers, between software engineer and scientist, and between model output and scientific understandings. Through the collaboration with RCEC colleagues, domestic and international researchers and scientists, my research activities focus on three aspects: (1) implementation and development of high resolution GCM for climate research; (2) utilization of high resolution GCM for climate simulations and projections; and (3) implementation and development of FV3-based weather forecast model. These research activities cover climate and weather, model applications and developments. Recently RCEC proposed the development of seamless unified model, a single model family of the atmosphere used across a range of temporal and spatial scales. The seamless unified model is suitable for numerical weather prediction, seasonal forecasting and climate modelling with forecast times ranging from a few days to hundreds of years. Furthermore, seamless unified model can be used for air pollution research with additional consideration of chemical transport and reaction. My recent and future research interests focus on the development of Taiwan's indigenous seamless unified model.

RESEARCH HIGHLIGHTS

1. **Implementation and development of high resolution GCM for climate research**
   HiRAM, the High-Resolution Atmospheric Model, was developed by GFDL with a goal of providing an improved representation of significant weather events in a global climate model. HiRAM utilizes the finite-volume dynamical core using a cubed-sphere grid topology (FV3) with a quasi-uniform horizontal grid spacing. Through cooperation between RCEC and GFDL in the past few years, I implemented HiRAM on different computing platforms in Taiwan. Other than the model implementations I also worked on the development of the variable-horizontal-resolution GCM with stretched-grid method. The great advantage of applying stretched-grid HiRAM is the enhancement of horizontal resolution without adding additional grids and extra computing costs. This makes HiRAM a powerful GCM for investigating synoptic and mesoscale phenomena. Another model development is the coupling of HiRAM with the one-dimensional ocean model SIT (Snow/Ice/Thermocline). The initiative motivation of developing HiRAM-SIT is to utilize the advantage of high resolution in both horizontal and vertical dimensions. This unique model structure of HiRAM-SIT can be applied to toggle the climatic characters in the vicinity of Taiwan.
   Reference: [12] Harris et al., 2016; [19] Tu and Tsuang, 2005

2. **Utilization of high resolution GCM for climate simulations and projections**
   Utilizing GCM for long-term high-resolution climate simulations and projections for climate change study is one of the major activities for RCEC climate research. My colleagues and I designed a series of time-slice climate experiments that HiRAM is forced using three sets of prescribed SSTs (sea surface temperature) and SICs (sea ice concentration) for three periods of present time (1980~2005), near future (2040~2065), and end of century (2075~2100) as the lower boundary conditions. HiRAM time-slice experiments utilize C192 and C384 horizontal resolutions, which are about 50km and 25km, to produce multi-initial-condition ensembles. Currently HiRAM time-slice multi-initial-condition ensembles contains 10 C384 integrations and 36 C192 integrations. In the past climatologists in Taiwan acquiring data of climate experiments from abroad was frustrated by the limitation of large amount data transfer. HiRAM time-slice multi-initial-condition ensembles are the first high resolution climate simulations and projections

produced on local computing platforms. It provides opportunity for domestic researchers to explore regional climate in global climate system. Domestic scientists either directly utilize HiRAM data or further downscale with regional climate model driven by HiRAM output.
Reference: [1] Chen et al., 2019; [3] Chen et al., 2019; [4] Bui et al., 2019; [5] Huang et al., 2019; [7] Freychet et al., 2017; [8][9][10] Huang et al., 2016; [11] Tsou et al., 2016; [13] Freychet et al., 2016.

3. **Implementation and development of FV3-based weather forecast model**
With the extensive experience on FV3-based climate model HiRAM, I am experienced FV3-based model developer and user. Since 2016 I started to work on the implementation and development of FV3-based weather forecast system in Taiwan. Later from 2017 I started to cooperate with Central Weather Bureau (CWB) on implementing fv3GFS, the global weather forecast system with cubed-sphere dynamical core and NCEP GFS physics, on CWB's Fujitsu supercomputer. Cooperation between RCEC and CWB on the implementation and development of fv3GFS can be distinguished according to respective expertise. While CWB focuses on the operational maintenance and data assimilation (DA) development, RCEC focuses on model performance enhancement and horizontal resolution refinement for the need of Taiwan vicinity. From the experience of variable-resolution HiRAM, we learned that disadvantage of applying one set of model setting globally may conduct un-reasonable large-scale circulation in the long-term climate integration. For the application of fv3GFS in Taiwan, I further introduced the two-way nested domain in Taiwan area. The model setting in the nested domain is individual from its setting in the global domain. This can reduce the disadvantage of resolution-dependent physics in the stretched-grid coordinate.
Reference: [2] Arakane et al., 2019.

REPRESENTATIVE PUBLICATIONS (*: corresponding author)

1. Guoxing Chen, Wei-Chyung Wang, and Lijun Tao, Huang-Hsiung Hsu, **Chia-Ying Tu**, Chao-Tzuen Cheng, 2019: Extreme snow events along the coast of the northeast United States: Analysis of 1980–2015 observations and HiRAM AMIP historical simulation. *J. Climate*, Vol.32(21), pp7561-7574, DOI: 10.1175/JCLI-D-18-0874.1(SCI, 2018 IF: 4.805; Rank 9/86 in Meteorology & Atmospheric Sciences)
2. Arakane, S., H.-H. Hsu, **C.-Y. Tu**, H.-C. Liang, Z.-Y. Yan, S.-J. Lin, 2019: Remote Effect of a Tropical Cyclone in the Bay of Bengal on a Heavy Rainfall Event in Subtropical East Asia. *Clim Atmos Sci*, Vol.2(25), DOI: 10.1038/s41612-019-0082-8
3. Chen, C., H.-H. Hsu, Hong, C, P.-G. Chiu, **C.-Y. Tu**, S.-J. Lin, A. Kitoh, 2019: Seasonal precipitation change in the Western North Pacific and East Asia under global warming in two high-resolution AGCMs. *Clim Dyn*, Vol. 53, pp.5583–5605, DOI: 10.1007/s00382-019-04883-1 (SCI, 2018 IF: 4.048; Rank 14/86 in Meteorology &

Atmospheric Sciences)

4. Bui, H. X., J.-Y. Yu, H.-W. Liu, **C.-Y. Tu**, P.-G. Chiu, and H.-H. Hsu, 2019: Convective structure changes over the equatorial Pacific with highly increased precipitation under global warming simulated in the HiRAM. *SOLA*, Vol.15, pp119−124, DOI: 10.2151/sola.2019-022
5. HUANG, Wan-Ru, Po-Han HUANG, Ya-Hui CHANG, Chao-Tzuen CHENG, Huang-Hsiung HSU, **Chia-Ying TU** and Akio KITOH, 2019: Dynamical Downscaling Simulation and Future Projection of Extreme Precipitation Activities in Taiwan during the Mei-Yu Seasons. *J. Meteorological Society Japan (JMSJ)*, Vol.97(2), pp481-499, DOI:10.2151/jmsj.2019-028
6. Tseng, Wan-Ling., Huang-Hsiung Hsu, Noel S. Keenlyside, Chiung-Wen June Chang, Ben-Jei Tsuang, **Chia-Ying Tu** and Li-Chiang Jiang, 2017: Effects of Surface Orography and Land–Sea Contrast on the Madden–Julian Oscillation in the Maritime Continent: A Numerical Study Using ECHAM5-SIT, *J. Climate*, Vol.30, pp9725-9741, DOI: 10.1175/JCLI-D-17-0051.1
7. Freychet, N., H.-H. Hsu, A. Duchez and **C.-Y. Tu**, 2017: Projection in snowfall characteristics over the European Alps and its sensitivity to the SST changes: results from a 50 km resolution AGCM. *Atmos. Sci. Let.*, Vol.18, pp261-267, DOI: 10.1002/asl.751
8. Wan-Ru Huang, Ya-Hui Chang, Huang-Hsiung Hsu, Chao-Tzuen Cheng and **Chia-Ying Tu**, 2016: Dynamical Downscaling Simulation and Future Projection of Summer Rainfall in Taiwan: Contributions from Different Types of Rain Events. *J. Geophys. Res. Atmos.*, Vol.121(23), pp13,973-13,988, DOI: 10.1002/2016JD025643.
9. Wan-Ru Huang, Ya-Hui Chang, Chao-Tzuen Cheng, Huang-Hsiung Hsu, **Chia-Ying Tu**, and Akio Kitoh, 2016: Summer Convective Afternoon Rainfall Simulation and Projection using WRF Driven by Global Climate Model. Part I: over Taiwan. *Terr. Atmos. Ocn.*, Vol.27(5), pp659-671, DOI: 10.3319/TAO.2016.05.02.01.
10. Wan-Ru Huang, Ya-Hui Chang, Huang-Hsiung Hsu, Chao-Tzuen Cheng, and **Chia-Ying Tu,** 2016: Summer Convective Afternoon Rainfall Simulation and Projection using WRF Driven by Global Climate Model. Part II: over South China and Luzon. *Terr. Atmos. Ocn.*, Vol.27(5), pp673-685, DOI: 10.3319/TAO.2016.05.02.02.
11. Chih-Hua Tsou, Pei-Yu Huang, **Chia-Ying Tu**, Cheng-Ta Chen, Teng-Ping Tzeng, and Chao-Tzuen Cheng, 2016: Present Simulation and Future Typhoon Activity Projection over Western North Pacific and Taiwan/East Coast of China in 20-km HiRAM Climate Model. *Terr. Atmos. Ocn.*, Vol.27(5), 687-703, DOI: 10.3319/TAO.2016.06.13.04
12. Lucas M. Harris, Shian-Jiann Lin and **ChiaYing Tu,** 2016: High-Resolution Climate Simulations Using GFDL HiRAM with a Stretched Global Grid, *J. Climate*, Vol.29, pp4293-4314, DOI: 10.1175/JCLI-D-15-0389.1
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16. Lin, P.-H., **C.-Y. Tu**, G.-R. Liu, W.-J. Chen, I-I Lin, T.-H. Lin, L.-H. Chi, C.-B. Chou, S.-W. Chen, Y. Yang, C.-C. Liu, B.-J. Tsuang, J.-L. Tsai, M.-H. Li, 2010/07: Land surface parameterization for atmospheric models (in Chinese). Atmospheric Sciences, 38(2), 63-84.
17. Yung-Yao Lan, Ben-Jei Tsuang, **Chia-Ying Tu**, Ting-Yu Wu, Yuan-Long Chen, and Cheng-I Hsieh, 2010. Observation and Simulation of Meteorology and Surface Energy Components over the South China Sea in Summers of 2004 and 2006. Terrestrial, Atmospheric and Oceanic Sciences 21 (2): 325-342.
18. Tsuang, B.-J., **Tu, C.-Y.**, J.-L. Tsai, J.A. Dracup, K. Arpe and T. Meyers, 2009: A more accurate scheme for calculating Earth's skin temperature. Climate Dynamics 32(2-3): 251.
19. **Tu, C.-Y**.; and B.-J. Tsuang, 2005: Cool-skin simulation by a one-column ocean model, Geophys. Res. Lett., 32, L22602, doi:10.1029/2005GL024252.
20. Tsuang, B.-J. and **Tu, C.-Y.**, 2002: Model structure and land parameter identification: an inverse approach. J. Geophys. Res. 107(D10), 10.1029/2001JD000711, ACL 15

Others (Invited Talks，Keynote speech et al.)

PATENTS

1. **杜佳穎**, 林博雄, 楊益, 蕭毓宏, 2015/7/21~2032/9/20: 空投式大氣海洋環境觀測裝置, 中華民國專利號碼 I493216.