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EDUCATION

2006/08 – 2011/12	Ph.D.	Department of Earth and Atmospheric Sciences, Purdue University, IN, USA
2001/08 – 2005/08	B.E.	Department of Electrical Engineering, National Tsing-Hua University, Taiwan

EMPLOYMENT

2017/08 - present	Assistant Research Specialist	RCEC, Academia Sinica, Taiwan
2017/10 - 2018/04	Visiting Scholar	Lawrence Livermore National Laboratory, USA
2011/12 - 2017/08	Postdoctoral Research Fellow	RCEC, Academia Sinica, Taiwan

HONORS & AWARDS

2016 Postdoctoral Publication Awards of Ministry of Science and Technology, 2016

RESEARCH INTEREST

My interests are especially in understanding spatio-temporal variation of rainfall and atmospheric convection, the underlying physical mechanisms, and how they will respond to future changes of climate systems. To answer the scientific questions, I use extensively observational data of earth systems from both climate research sites and satellites, and do experiments the hierarchy of numerical models to test scientific hypotheses.

The atmospheric convection transports heat, moisture, and momentum vertically, driving atmospheric circulations in the tropics and distribute energy across multiple time scales, from diurnal cycle to interannual oscillations. Given its multi-scale nature, it is very difficult for climate models to represent detailed processes, variations, and feedbacks of convection. Models also have difficulty to provide rainfall with confidence which are coupled closely with surface processes and hydrological cycles. Findings from my research also focus to evaluate and improve the representation of rainfall and atmospheric convection in climate models. Better model capability will further lead to

improvements of weather forecast, climate projection, and many societal and economical applications.

RESEARCH HIGHLIGHTS

1. **Understanding key mechanisms of intense nocturnal rainfall events over topographical regions**

   Our study explores the key mechanisms for nocturnal intense rainfall events over coastal regions, topographical regions, and adjacent plains. Such raining systems are difficult for climate models to represent their strength and variability. Using onsite observations from the Department of Energy (DOE)'s Atmospheric Radiation Measurement (ARM) programs and experiments with single-column version of climate model, we found the initiation of uplifted convection needs to be included in climate models to capture nocturnal raining events [8]. Experiments with global-domain models further show the control of large-scale moisture convergence contributing to the uplifted convection [3].

   Reference: [8] Wang et al., 2015. [3] Wang and Hsu, 2019.

2. **Developing physical parameterization in Taiwan Earth System Model (TaiESM)**

   TaiESM is the in-house earth system model developed in RCEC. Based on the previous study in convection initiation, I have assisted the new-developed convective triggering in included in TaiESM. Performance of diurnal cycle is found to be better improved as suppressed spurious daytime rainfall[10]. I also assisted on revising the cloud fraction scheme GFS-TaiESM-Sundqvist scheme in TaiESM. This scheme provides utilized consistent cloud-RH relationship and improves simulation of cloud fraction and many climatic fields in the global models[12].

   Reference: [10] Lee et al. 2019. [12] Shiu et al. 2020

3. **Understanding impacts of large-scale interaction on convection initiation and rainfall variability in climate models (Collaborative work with LLNL)**

   Our study studies how the large-scale interaction on convection initiation and rainfall variability from observations and gains support to use the large-scale dynamic convective available potential energy (dCAPE) trigger design in climate models. Combined with an unrestricted air parcel launch level (ULL) criteria, the dCAPE trigger is able to relax the unrealistic strong coupling of convection to surface heating and capture nocturnal elevated convection. Both case study and statistical analysis are conducted using the observations collected from the DOE's ARM program at its Southern Great Plains (SGP) and Manaus (MAO) sites[1]. They show that dCAPE has a much stronger correlation with precipitation than CAPE and ULL is essential to detect elevated convection above boundary layer under both midlatitude and tropical conditions and for both afternoon and nighttime deep convection regimes. We also found similar improvements in the climate simulations of the Exascale Energy Earth Sytem

Model[2]. This part of work is collaborated with the Lawrence Livermore National Lab (LLNL), United States.

Reference: [1] Wang et al., 2020. [2] Xie et al. 2019.

4. **Evaluating performance of diurnal rainfall cycle in climate models: Transport AMIP and CMIP6**

Diurnal rainfall cycle is an important testbed for evaluating model physics, especially for raining processes and associated atmosphere-land-ocean interactions. The international collaboration of the Clouds Above the United States and Errors at the Surface (CAUSES) project aims to understand the cause of diurnal rainfall and surface temperature biases over the SGP of United States. By joining in CAUSES intercomparison, experiments with TaiESM facililitated diagnosis for bias identification and future developments to reduce model uncertainties[5,6,7]. The ongoing Coupled Model Intercomparison Project Phase 6 (CMIP6) activity also provides a great opportunity to understand model physics. Using two EOF modes derived from satellite observations, we evaluate the performance of climatological diurnal rainfall cycle and they are bifurcated into two groups. The "good" models show significant improvements in land-sea contrast of coastal diurnal rainfall regimes represented by the 2nd EOF. They exhibit better performances in their representation of suppressing daytime rainfall associated with EOF2[11].

Reference: [5] Van Weverberg et al., 2018 [6] Ma et al., 2018 [7] Morcrette et al., 2018 [11]. Lee and Wang, 2020.

REPRESENTATIVE PUBLICATIONS (*: corresponding author)

1. **Wang, Y.-C., *S. Xie, S. Tang, and W. Lin (2020):** An Improved Convective Trigger for Capturing Summertime Nocturnal Elevated Convection over Lands: Observational Evidence and SCM Test. Accepted by Journal of Geophysical Research – Atmospheres. DOI: 10.1029/2019JD031651
2. ***Xie, S., Wang, Y.-C., Lin, W., Ma, H.-Y., Tang, Q., Tang, S., et al. (2019).** Improved diurnal cycle of precipitation in E3SM with a revised convective triggering function. Journal of Advances in Modeling Earth Systems, 11, 2290– 2310. https://doi.org/10.1029/2019MS001702
3. ***Wang, Y.-C., Hsu, H-H. (2019)** Improving diurnal rainfall phase over the Southern Great Plains in warm seasons by using a convective triggering design. International Journal of Climatology. 39: 5181– 5190. https://doi.org/10.1002/joc.6117
4. **Wu, L.-S., W.-C. Cheng, C.-Y. Chen, M.-C. Wu, Y.-C. Wang, Y.-H. Tseng, *T.-J. Chuang, *C.-J. Shen (2019)**: Transcriptomopathies of pre- and post-symptomatic frontotemporal dementia-like mice with TDP-43 depletion in forebrain neurons. acta neuropathol commun 7, 50. doi:10.1186/s40478-019-0674-x
5. ***Van Weverberg, K., C.J. Moncrette, J.Petch, S.A. Klein, H.-Y. Ma, C. Zhang, S. Xie, Q. Tang, W.Gustafson, M. Ahlgrimm, R. Roehrig, J. Cole, F. Cheruy, Y.-C. Wang, K. Johnson (2018)**: Attribution of Surface Radiation Errors near the Southern Great Plains in

Numerical Weather Prediction and Climate Models. The Journal of Geophysical Research - Atmospheres, 123. https://doi.org/10.1002/2017JD027188

6. ***Ma, H.-Y., S. A. Klein, S. Xie, C. Zhang, S. Tang, Q. Tang, C. J. Morcrette, K. Van Weverberg, J. Petch, M. Ahlgrimm, L. K. Berg, F. Cheruy, J. Cole, R. Forbes, W. I. Gustafson Jr, M. Huang, Y. Liu, W. Merryfield, Y. Qian, R. Roehrig, Y.-C. Wang (2018):** CAUSES: On the role of surface energy budget errors to the warm surface air temperature error over the Central United States. *Journal of Geophysical Research: Atmospheres*, 123, 2888–2909. https://doi.org/10.1002/2017JD027194
7. ***Morcrette, C.J., K. Van Weverberg, H.-Y. Ma, M. Ahlgrimm, E. Bazile, L. Berg, A. Cheng, F. Cheruy, J. Cole, R. Forbes, W. Gustafson Jr , M. Huang, W.-S. Lee, Y. Liu, L. Mellul, W. Merryfield, Y. Qian, R. Roehrig, Y.-C. Wang, S. Xie, S. Klein, J. Petch (2018):** Introduction to CAUSES: Description of weather and climate models and their near-surface temperature errors in 5 day hindcasts near the Southern Great Plains. *Journal of Geophysical Research: Atmospheres*, 123, 2655–2683. https://doi.org/10.1002/2017JD027199.
8. ***Wang, Y.-C., H.-L. Pan, and H.-H. Hsu (2015):** Impacts of the triggering function of cumulus parameterization on warm-season diurnal rainfall cycles at the Atmospheric Radiation Measurement Southern Great Plains site, Journal of Geophysical Research - Atmospheres, 120, 10,681–10,702, doi:10.1002/2015JD023337.
9. **Wang, Y.-C. and W.-w. Tung* (2010)**: Impacts of Cloud-System Resolving Regional Modeling on the Simulation of Monsoon Depressions, Geophysical Research Letters, 37, L08806, doi:10.1029/2010GL042734.

Manusripts in Revision and Preparation:

10. ***Lee, W.-L., Y.-C. Wang, C.-J. Shiu, I.-C. Tsai, C.-Y. Tu, Y.-Y. Lan, J.-P. Chen, H.-L. Pan, and H.-H. Hsu (2019):** Taiwan Earth System Model: Description and Evaluation of Mean State. In open discussion in Geoscientific Model Development (GMD): gmd-2019-377.
11. **Lee, Y.-C. and *Y.-C. Wang (2020)**: Evaluating Tropical Diurnal Rainfall Regimes in CMIP6 models. In revision to resubmit to Journal of Meteorological Society of Japan.
12. ***Shiu, Chein-Jung, Yi-Chi Wang, Wei-Ting Chen, Hua-Lu Pan, Ruiyu Sun, Yi-Hsuan Chen, Huang-Hsiung Hsu (2020):** A Probability Density Function-Consistent Macrophysics scheme for the Taiwan Earth System Model. In preparation.
13. **Wang, Y.-C., *W.-L. Tseng, and H.-H. Hsu (2020)**: Role of CPS in moisture building for MJO simulations. In preparation.

Others (Invited Talks，Keynote speech et al.)