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Chao-An Chen (陳昭安)

Research Center for Environmental Changes (RCEC), Academia Sinica
No. 128, Sec. 2, Academia Rd., Nankang, Taipei, Taiwan 115
Office Tel: +886-2-2787-5847
Mobile:
Email: joanne22@gate.sinica.edu.tw
Lab website link: www.rcec.edu.tw

EDUCATION

2008/09 – 2012/06	Ph.D.	Department of Earth Sciences, National Taiwan Normal University, Taiwan
2004/09 – 2006/06	M.S.	Graduate Institute of Earth Science, Atmospheric Sciences, Chinese Culture University, Taiwan
1997/09 – 2001/06	B.A.	Depart. of Atmospheric Science, Chinese Culture University, Taiwan

EMPLOYMENT

2012/08 - present	Postdoctoral Research Fellow	RCEC, Academia Sinica, Taiwan
2006/07 - 2008/08	Research Assistant	RCEC, Academia Sinica, Taiwan

HONORS & AWARDS

2018 MOST Postdoctoral Research Thesis Awards
2017 Dr. Chia-Chou Climate Thesis Awards
2015 Academia Sinica Postdoctoral Fellowship
2013 Academia Sinica Postdoctoral Fellowship

PROFESSIONAL SERVICE

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RESEARCH INTEREST

My research topic focuses on global warming impacts on tropical climate. The research issues are related to the global warming impact on the changes in tropical precipitation, large scale circulation, extreme precipitation, and the relevant thermodynamic and dynamic mechanisms accounting for the phenomena mentioned above. Recent studies are particularly interested in the regional response to global warming in the Western North Pacific and East Asia region, and climate sensitivity and uncertainty of future climate projection in model simulations.

RESEARCH HIGHLIGHTS

1. Changes in atmospheric stability and circulation

Global-warming-induced changes in regional tropical precipitation are usually associated with changes in the tropical circulation, i.e., the dynamic contribution, which is related to atmospheric stability. Chen et al. (2016) found that in a warmer climate, different climatological vertical profiles play different roles in adjusting atmospheric stability, energy transport, and large-scale circulation, tend to induce different changes in atmospheric stability: the bottom-heavy (top heavy) structure brings a more (less) unstable condition and is favorable (unfavorable) to the strengthening of the convective circulation. The bottom-heavy structure is associated with shallow convection, while the top-heavy structure is usually related to deep convection. This study suggests a hypothesis and a possible linkage for projecting and understanding future circulation change from the current climate: shallow convection will tend to strengthen tropical circulation and enhance upward motion in a future warmer climate.

2. **Falling snow radiative effects enhance the global warming response of the Tropical Pacific atmosphere**

Most models from the CMIP5 do not include the radiative effects of falling snow. This has been shown to bias simulations of radiation and circulation in the Pacific present-day mean state. Here we explore how precipitating ice radiative effects contribute to simulated Pacific climate change via a pair of sensitivity experiments with and without snow radiative effects (SnowOn/SnowOff) using 1pctCO2 simulations of CESM1 climate model, and compare our results with the CMIP5 ensemble mean. Under global warming, the more realistic simulation, SnowOn shows reduced precipitation around the maritime continent, and an approximate doubling of the precipitation increase over parts of the western Pacific. However, the spatial pattern of change in radiative and hydrodynamic properties across the Pacific is typically weaker in the SnowOff case. SnowOff patterns of change are similar to those in CMIP5 models that exclude snow radiative effects, hinting that an enhanced global warming impact on regional climate might be expected after the snow radiative effect is included in future CMIP models.

3. **Seasonal precipitation change in the WNP-EA under global warming in high-resolution AGCMs**

To estimate seasonal precipitation change over the western North Pacific and East Asia region (WNP-EA), we use HiRAM to conduct a series of simulations forced by RCP8.5 scenario with the CMIP5 ensemble SST changes (RCP_Ens). The sensitivity of future projections to various SST forcing is also assessed. We also assess the sensitivity associated with model dependence by comparing with the results of MRI-AGCM3.2S projections. The major findings are: (1) weakened atmospheric circulation in all seasons in RCP_Ens experiment; (2) more precipitation over most of the northern East Asian continent and the northern WNP oceanic region in all seasons; (3) an anomalous anticyclonic circulation (AAC) together with decreased precipitation over the oceanic WNP-EA in the typhoon season; and (4) largest sensitivity to various SST forcing in spring comparing with other seasons. The moisture budget indicates the dominance of dynamic contribution

to the reduced precipitation. By contrast, the increased precipitation may be associated with various processes such as enhanced upward motion, increased water vapor or surface evaporation.

REPRESENTATIVE PUBLICATIONS (*: corresponding author)

1. Jui-Lin Frank Li, Wei-Liang Lee, Kuan-Man Xu, Jonathan Jiang, Eric Fetzer, **Chao-An Chen**, Yi-Hui Wang, Jia-Yuh Yu, Pei-Chun Hsu, and Huang-Hsiung Hsu (2020). The role of falling ice radiative effects on climate projections over Arctic under global warming. *Terrestrial, Atmospheric and Oceanic Sciences. (TAO)* DOI: 10.3319/TAO.2020.04.29.01
2. **Chao-An Chen**, Huang-Hsiung Hsu, Chi-Cherng Hong, Ping-Gin Chiu, Chia- Ying Tu, Shian-Jiann Lin and Akio Kitoh (2019, Jul). Seasonal precipitation change in the Western North Pacific and East Asia under global warming in two high-resolution AGCMs. *Climate Dynamics.*
3. Chia-Wei Lan, Min-Hui Lo, **Chao-An Chen** and Jia-Yuh Yu (2019, Apr). The mechanisms behind changes in the seasonality of global precipitation found in reanalysis products and CMIP5 simulations. *Climate Dynamics.*
4. **Chao-An Chen***, Jui-Lin Frank. Li, Mark Richardson, Wei-Liang Lee, Eric Fetzer, G. Stephens, Huang-Hsiung Hsu, Yi-Hui Wang, and Jia-Yuh Yu (2018, Sep). Falling snow radiative effects enhance the global warming response of the tropical Pacific atmosphere. *Journal of Geophysical Research: Atmospheres.* This paper also has been chosen as one of the Research Highlights of *Nature Climate Change* in 2018 October.
5. Hsiao-Wei Liu, Jia-Yuh Yu, and **Chao-An Chen** (2018, Aug). Changes of tropical precipitation and convective structure under global warming projected by CMIP5 model simulations. *Terrestrial, Atmospheric and Oceanic Sciences Journal (TAO)*, 29, 1-12.
6. Chi-Hua Wu, Nicolas Freychet, **Chao-An Chen**, Huang-Hsiung Hsu (2017, Mar). East Asian presummer precipitation in the CMIP5 at high versus low horizontal resolution. *International Journal of Climatology.*
7. **Chao-An Chen***, Jia-Yuh Yu and Chia Chou (2016, Jun). Impacts of vertical structure of convection in global warming: the role of shallow convection. *Journal of Climate*, 29, 4665-4684. (MOST Postdoctoral Research Thesis Awards)
8. Nicolas Freychet, Aurelie Duchez, Chi-Hua Wu, **Chao-An Chen**, Huang-Hsiung Hsu, Joel Hirschi, Alexa Forryan, Bablu Sinha, Adrian L. New, Tim Graham, Martin B. Andrews, Chia-Ying Tu and Shian-Jiann Lin (2016, Apr). Variability of hydrological extreme events in East Asia and their dynamical control: a comparison between observations and two high-resolution global climate models. *Climate Dynamics.*
9. **Chao-An Chen**, Chia Chou, Cheng-Ta Chen (2012, Dec). Regional perspective on mechanisms for tropical precipitation frequency and intensity under global warming. *Journal of Climate*, 25,8487-8501.

10. Chou, Chia, **Chao-An Chen**, Pei-Hua Tan and Kwan-Ting Chen (2012, May). Mechanisms for global warming impacts on precipitation frequency and intensity.. *Journal of Climate*, 25,3291-3306.
11. Chia Chou, **Chao-An Chen**, 2010, Depth of Convection and the Weakening of Tropical Circulation in Global Warming, *Journal of Climate*, 23, 3019-3030.
12. Chia Chou, J. David Neelin, **Chao-An Chen**, Jien-Yi Tu , 2009, Evaluation the "rich-get- richer" mechanism in tropical precipitation change under global warming, *Journal of Climate*, 22, 1982-2005.