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EDUCATION

2001/09 – 2009/08	Ph.D.	Depart. of Atmospheric Sciences, National Taiwan University, Taiwan
1999/09 – 2001/08	M.S.	Depart. of Atmospheric Sciences, National Taiwan University, Taiwan
1993/09 – 1997/08	B.S.	Depart. of Earth Sciences, National Taiwan Normal University, Taiwan

EMPLOYMENT

2015/02 - present	Assistant Research Fellow	RCEC, Academia Sinica, Taiwan
2013/08 - 2015/01	Assistant Research Scholar	National Taiwan Uni., Taiwan
2009/08 - 2013/07	Postdoctoral Research Fellow	National Taiwan Uni., Taiwan
2003/09 - 2004/05	Visiting scholar	State University of New York, Albany, USA

HONORS & AWARDS

2009 National Science Council's Postdoctoral Fellow Publication Award

PROFESSIONAL SERVICE

- Journal reviewer: Asia-Pacific Journal of Atmospheric Sciences, Atmospheric Environment, Atmospheric Research, Terrestrial, Atmospheric and Oceanic Sciences, International Journal of Environmental Research and Public Health, Journal of Geophysical Research-Atmosphere, Science of the Total Environment

RESEARCH INTEREST

- Aerosol parameterization and modeling
- Aerosol-cloud interactions
- Climate-Chemistry interactions
- Cloud Physics
- Atmospheric Physical Chemistry

RESEARCH HIGHLIGHTS

- **Numerical investigation of water isotope fractionation in a frontal system**: A two-moment microphysical scheme in the NCAR Weather Research and Forecasting (WRF) model was modified to allow kinetic calculation of isotope fractionation due to various cloud microphysical

phase-change processes. Here we show that different factors controlling isotopic composition, including water vapor sources, atmospheric transport, phase transition pathways of water in clouds, and kinetic versus equilibrium mass transfer, contributed significantly to the variations in isotope composition. The results suggest that future modeling should include the kinetic mass transfer process in the microphysical calculation, as well as more observational data for model initialization.

- **Aerosol effects on summer monsoon over Asia during 1980s and 1990s**: Study the aerosol-climate effects during the 1980s and 1990s in which the anthropogenic SO_2 emissions decreased in North America and Western Europe and increased in East and South Asia by the Community Earth System Model (CESM). The uncertainties associated with aerosol-climate effects are addressed within the context of model variability and the global warming effect. For the latter, while the aerosol effects decrease the greenhouse warming on the global mean, the regional responses are different. Nevertheless, the characteristics of aerosol-climate effects still persist when the climate becomes warmer, although the strength and the geographical distribution are slightly modulated.
- **Sources and formation pathways of organic aerosol in a subtropical metropolis during summer**: Combined with a field campaign, a regional air-quality model modified with an additional secondary organic aerosol (SOA) formation pathway was used to study various formation pathways and the relative contributions from anthropogenic and biogenic sources in the Taipei metropolis and a nearby rural forest. The results shown that SOA, especially from biogenic sources and aqueous-phase processes, dominated OA production, and its fraction increased with height in the PBL in both urban and rural Taipei during the summer of 2011. PBL height and sunlight variations and local circulation also controlled OA diurnal cycle.
- **The coagulation mixing between dust and hygroscopic aerosol particles and its impacts**: Apply the homemade aerosol parameterization SNAP to a regional air quality model CMAQ and investigate the impacts of aerosol mixing state on radiative and microphysical properties. The simulation results show that the mixture process can reduce the overall single scattering albedo by up to 10% during a dust event. In addition, the ability of aerosol particles to serve as Köhler theory cloud condensation nuclei increased over downwind areas and the ability to serve as ice nuclei may decrease or increase at low or high sub-zero temperatures, respectively, due to the switching from deposition nucleation to immersion freezing or haze freezing.
- **Develop a statistical–numerical aerosol parameterization scheme**: Develop a statistical-numerical aerosol parameterization (SNAP) scheme to describe the physical processes of aerosol particles and their interactions with hydrometeors. Compared with numerical solutions, analytical solutions, and binned aerosol model simulations, the SNAP performs well, with higher accuracy and less computation time than high-order-numerical-quadrature technique.

REPRESENTATIVE PUBLICATIONS

Refereed Paper

1. Zhang, L., T.-M. Fu, H. Tian, Y. Ma, J.-P. Chen, T.-C. Tsai, I-C. Tsai, Z. Meng, X. Yang. 2020: Anthropogenic Aerosols Significantly Reduce Mesoscale Convective System Occurrences and Precipitation over Southern China in April, *Geophysical Research Letters.* 47, e2019GL086204. https://doi.org/10.1029/2019GL086204.
2. Wu, C.-H., I-C. Tsai, P.-C. Tsai and Y.-S. Tung, 2019: Large-Scale Seasonal Control of Air Quality in Taiwan, *Atmospheric Environment,* 116868, doi:https://doi.org/10.1016/j.atmosenv.2019.116868.
3. Huang C.-C., S.-H. Chen, Y.-C. Lin, K. Earl, T. Matsui, H.-H. Lee, I-C. Tsai, J.-P. Chen, C.-T. Cheng, 2019: Impacts of Dust-Radiation versus Dust-Cloud Interactions on the Development of a Modeled Mesoscale Convective System over North Africa. *Monthly Weather Review*, https://doi.org/10.1175/mwr-d-18-0459.1.
4. Tsai, I-C., W.-Y. Chen, J.-P. Chen, and M.-C. Liang, 2019: Kinetic mass-transfer calculation of water isotope fractionation due to cloud microphysics in a regional meteorological model, *Atmos. Chem. Phys.*, 19, 1753-1766, https://doi.org/10.5194/acp-19-1753-2019.
5. Lung, S.-C., S.-W. Chou, J.-P. Chen, P.-C. Wen, H.-J. J. Su, I-C. Tsai, and Y.-S. Shen, 2018: Science Plan of “Climate Change and Health Adaptation”, Journal of Taiwan Land Research, 21, 2, 209-239 (in Chinese).
6. Tsai, I-C., W.-C. Wang, H.-H. Hsu, and W.-L. Lee, 2016: Aerosol effects on summer monsoon over Asia during 1980s and 1990s, *J. Geophys. Res. Atmos.*, 121, 11761–11776, doi:10.1002/2016JD025388.
7. Chen, J.-P, I-J. Chen and I-C. Tsai, 2016: Dynamic feedback of aerosol effect on the East Asian summer monsoon. *Journal of Climate*, 29(17):6137-6149.
8. Li, N., J.-P. Chen, I-C. Tsai, Q. He, S.-Y. Chi, Y.-C. Lin, and T.-M. Fu, 2016: Potential impacts of electric vehicles on air quality in Taiwan. *Science of the Total Environment*, 566-567(2016), 919-928.
9. Tsai, I-C., J.-P. Chen, C. S.-C. Lung, N. Li, W.-N. Chen, T.-M. Fu, C.-C. Chang, and G.-D. Hwang, 2015: Sources and formation pathways of organic aerosol in a subtropical metropolis during summer. *Atmospheric Environment*, 117, 51-60.
10. Tsai, I-C., J.-P. Chen, Y.-C. Lin, C C.-K. Chou, and W.-N. Chen, 2015: Numerical investigation of the coagulation mixing between dust and hygroscopic aerosol particles and its impacts. *Journal of Geophysical Research: Atmospheres*, 120, 9, 4313-4233, doi:10.1002/2014JD022899.
11. Chen, J.-P., C.-E. Yang and I-C. Tsai, 2015: Estimation of foreign versus domestic contributions to Taiwan's air pollution. *Atmospheric Environment*, 112,9-19, doi:10.1016/j.atmosenv.2015.02.022
12. Lin, Y.-C., J.-P. Chen, T.-Y. Ho and I-C. Tsai, 2015: Atmospheric Iron deposition in the Northwestern Pacific Ocean and its Adjacent Marginal Seas: the Importance of Coal Burning.

Global Biogeochemical Cycles, 29, 139–159, doi:10.1002/2013GB004795.

13. Chen, J.-P., I-C. Tsai, and Y.-C. Lin, 2013: A statistical–numerical aerosol parameterization scheme, *Atmos. Chem. Phys.*, 13, 10483-10504, doi:10.5194/acp-13-10483-2013.
14. Tsai, I-C., M.-C. Liang, and J.-P. Chen, 2012: Methane-Nitrogen binary nucleation: a new microphysical mechanism for cloud formation in Titan's atmosphere. *Astrophys. J.*, 747.
15. Tsai, I-C., J.-P. Chen, P.-Y. Lin, W.-C. Wang and I. S. A. Isaksen, 2010: Sulfur cycle and sulfate radiative forcing simulated from a coupled global climate-chemistry model. *Atmos. Chem. Phys.*, 10, 3693-3709.
16. Chen, J.-P., Z. Wang, C.-Y. Young, F. Tsai, I-C. Tsai, G.-J. Wang, W.-C. Shieh, H.-W. Lin, J.-Y. Huang, and M.-J. Lu, 2004: Simulations of Asian Yellow Dust Incursion over Taiwan for the Spring of 2002 and 2003, *Terrest. Atmos. Ocean. Vol 15*, No. 5, 949-981.

Book and Chapter in Book

1. Wang, W.-C., J.-P. Chen, I. S. A. Isaksen, I-C. Tsai, K. Noone and K. McGuffie, 2012: Climate-chemistry interaction: Future tropospheric ozone and aerosol. In A. Henderson-Sellers and K. McGuffie (eds): *The Future of the World's Climate*. World Survey of Climatology series, Elsevier Science, ISBN: 978-0-12-386917-3, pp. 367-399. (2012 ASLI Choice Award)

2. Chen, J.-P., A. Hazra, C.-J. Shiu, I-C. Tsai, and H.-H. Lee, 2008: Interaction between aerosols and clouds: current understanding. In Liou, K.-N., M.-D. Chou and H.-H. Hsu (eds.): *Recent Progress in Atmospheric Sciences: Application to the Asia-Pacific Region*. World Scientific, ISBN-13 978-981-281-890-4, QC861.3.R43, pp. 231-281

Conference and Workshop

1. Tsai, I-C., J.-P. Chen, H.-M. Hung, C. C.-K. Chou, and W.-N. Chen, 2017: Numerical investigation of Enhanced Sulfate Formation Over mountain areas in Central Taiwan. AOGS 2017, Aug. 6-11, Singapore, Singapore.

2. Tsai, I-C., J.-P. Chen, and C.-Y. Yang, 2016: Simulation of tropical cyclones response to aerosol type. 17th International Conference on Clouds and Precipitation (ICCP). July 25-29, 2016, Manchester, UK.

3. Tsai, I-C., W.-C. Wang, W.-L. Lee, and H.-H. Hsu, 2016: Aerosol-monsoon interactions over East Asia: A study using changes in anthropogenic aerosol emissions during 1980s and 1990s. East Asian Climate 13th workshop. March 24-25, Beijing, China