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Jen-Ping Chen (陳正平)

Department of Atmospheric Sciences, &
International Degree Program in Climate Change and Sustainable Development (IPCS)
National Taiwan University
No. 1, Roosevelt Road, Section 4, Taipei, Taiwan 10617, R. O. C.
Phone: +886-2-33663912; Fax: +886-2-23633317
Email: jpchen@ntu.edu.tw
Lab website link: http://carl.as.ntu.edu.tw/

EDUCATION

1987/02 – 1992/08	Ph.D.	Department of Meteorology, The Pennsylvania State University, U.S.A.
1985/09 – 1986/12	M.S.	Department of Meteorology, South Dakota School of Mines and Technology, U.S.A.
1978/09 – 1982/06	B.S.	Department of Atmospheric Science, National Taiwan University, Taiwan

EMPLOYMENT

08/2017~07/2020	Director, International Degree Program in Climate Change and Sustainable Development, National Taiwan University
07/2017 to date	Distinguished Professor, Department of Atmospheric Sciences, National Taiwan University
02/2017 to date	Joint Professor, International Degree Program in Climate Change and Sustainable Development, National Taiwan University
08/1999 to date	Professor, Department of Atmospheric Sciences, National Taiwan University
08/2010~12/2013	Director, Global Change Research Center, National Taiwan University
08/2009~07/2012	Director, Center for Atmospheric Resources and Disaster Studies, National Taiwan University
08/2005~07/2008	Chairman, Department of Atmospheric Sciences, National Taiwan University
08/1994~07/1999	Associate Professor, Department of Atmospheric Sciences, National Taiwan University
10/1992~07/1994	Postgraduate Researcher, Center for Cloud, Chemistry and Climate, Scripps Institution of Oceanography, University of California at San Diego

HONORS & AWARDS

2021 Fellow of the Meteorological Society, Republic of China (中華民國氣象學會會士)
2017 Outstanding Research Award, Ministry of Science and Technology, Taiwan (科技部傑出研究獎)
2013 Outstanding Teaching Award, National Taiwan University (校教學傑出獎)
2009, 2010, 2012, 2018 University Teaching Award, National Taiwan University (校教學優良獎)
2005 Fu Ssu-nien Research Award of National Taiwan University (傅斯年獎)
2001 College Teaching Award, College of Sciences, National Taiwan University (理學院教學獎)
2000 Young Scholar Achievement Award, College of Sciences, National Taiwan University, (理學院新人獎)
1997 Young Investigator Merit Award, National Science Council (國科會新進績優人員)
1988~1992 Fellowship, Earth System Science Center, Pennsylvania State University

PROFESSIONAL SERVICE

Society and committee

01/2019~01/2022	Member, Committee on Planned and Inadvertent Weather Modification, American Meteorological Society
03/2014~02/2019	Member of the Supervisory Board, Chinese Geoscience Union of the Republic of China（中華民國地球科學學會監事）
08/2014~12/2016	Member, Panel of International Cooperation, Department of Natural Sciences and Sustainable Development, Ministry of Science and Technology, Taiwan（科技部自然科學與永續研究發展司國際合作委員會複審委員）
01/2014~12/2016	Coordinator, Atmospheric Sciences Discipline, Department of Natural Sciences and Sustainable Development, Ministry of Science and Technology, Taiwan（科技部自然科學與永續研究發展司大氣學門召集人）
01/2011~12/2013	Panel Committee member, Atmospheric Sciences Section, Division of Natural Sciences, National Science Council, Taiwan（科技部自然科學與永續研究發展司大氣學門複審委員）
12/2011~	Member of the National Scientific Committee on Problems of the Environment, Academia Sinica, Taipei, R.O.C
03/2008~03/2014	Member of the Executive Boards, Chinese Geoscience Union of the Republic of China （中華民國地球科學學會理事）
01/2007~12/2012	Member of the Committee of Geosphere-Biosphere Programme, Academia Sinica, Taipei, R.O.C., for the Scientific Committee for the International Geosphere-Biosphere Programme, International Council of Scientific Unions.
01/2006~12/2009	Member of the Scientific Steering Committee, International Global Atmospheric Chemistry Project (IGAC), International Geosphere-Biosphere Programme (IGBP).
01/2005~12/2012	Member of the International Commission on Cloud and Precipitation (ICCP), International Association of Meteorology and Atmospheric Sciences (IAMAS).
09/2004~09/2009	Member of the Information Technology Committee, American Geophysical Union
03/2002~03/2005	General Secretary, Chinese Geoscience Union of the Republic of China
09/1997~06/1999	Chairman of the Alumni Association, Department of Atmospheric Sciences, National Taiwan University

Journal

08/2011~07/2015	Member of the Publication's Committee, Chinese Geoscience Union of the Republic of China
11/2008~12/2016	Associate Editor, *Journal of Geophysical Research – Atmosphere*.
07/2008~04/2010	Guest editor, Special issue in *Atmospheric Research*, for the 15th International Conference on Clouds and Precipitation.
06/2006~	Editorial Committee, the *Atmospheric Sciences*, the Meteorological Society of the Republic of China
04/2001~07/2005	Editor (Atmosphere), the *Terrestrial, Atmospheric and Oceanic Sciences*
01/1998~03/2004	Associate Editor, the *Atmospheric Sciences*, the Meteorological Society of the Republic of China
06/1997~03/2001	Associate Editor, the *Terrestrial, Atmospheric and Oceanic Sciences*

RESEARCH INTEREST

My major research interests include cloud and aerosol microphysics, air pollution, and

cloud-aerosol-climate interactions. Main research methodologies include microphysical parameterizations, regional and global numerical modeling, as well as ground and satellite observation data analysis.

RESEARCH HIGHLIGHTS

Our group started the development of advanced bulk microphysics schemes since the work of Chen and Liu (2004), in which a very detailed bin model was applied to generate a statistically derived double-moment warm-cloud parameterization with high precision and computation efficiency. This CL04 scheme was implemented into the MM5 model (Cheng et al. 2007) and coupled with a double-moment (2M) ice-phase scheme (Cheng et al. 2010). Later, it was coupled into the WRF model and applied to many case studies. The 2M scheme was recently upgraded with a triple-moment (3M) closure method, as well as by adding parameterizations for ice crystals' shape and density variations (Chen and Tsai 2016; Tsai and Chen 2020) based on the theoretical parameterization that I developed in the past (Chen and Lamb 1994). The NTU 3M scheme (now microphysics option 56 in the WRF model) has detailed treatments for aerosol-cloud interactions, including resolved supersaturation and activation of condensation nuclei, as well as species and size-dependent ice nucleation based on the theoretical parameterization of Chen et al. (2008) and Hoose et al. (2010). This scheme considers the aerosol recycling from cloud drop evaporation, and may also track ice nuclei within the hydrometeor particles to enable full interaction between aerosols and clouds.

In a joining project "Consortium for Climate Change Study," efforts were devoted to improving cloud schemes in climate models. With the collaborations from C.-J. Shiu and I-C. Tsai, the following major tasks have been accomplished:

I. Incorporated the 3M aerosol scheme (Chen et al. 2013) into the NCAR CAM5 global model and the TaiESM model to replace the original 2M scheme.
II. Incorporated the NTU 2M cloud microphysics scheme into CAM5 and TaiESM for stratiform-cloud microphysics.
III. Modify the cumulus parameterization scheme in TaiESM to incorporate the NTU 2M warm-cloud scheme and allow in-cloud raindrop sedimentation for better representation of precipitation formation.
IV. Develop a new parameterization scheme for fast and accurate diagnoses of cloud drop number concentration at cloud base for enabling aerosol-cloud interactions in global models (Wang and Chen 2019).
V. Merging the macrophysics and microphysics in CAM5 for a more consistent representation of cloud processes, with improved treatments in the in-cloud saturation ratio and the WBF process, and better coupling of the activation/nucleation processes.

Interdisciplinary topics recently investigated by our group include the following:

I. By simulating the emissions and transport of natural (contained in mineral dust) and anthropogenic (contained in fly ash) iron, we found that industrial activities may contribute more soluble iron into the Northwester Pacific than natural sources (Lin et al. 2015).
II. Through parameterization and numerical modeling, we found that rainwater penetrates faster and deeper into the soil via stem-root flow, significantly influencing the land-atmosphere moisture and energy exchange (Kuo et al. 2016).
III. The impact of hypothesized nationwide penetration of light-duty electric vehicle (EV) on Taiwan's air quality was evaluated (Li et al. 2016). The results suggest that net emissions of NO_x, VOCs, CO, and $PM_{2.5}$ would be reduced while that of SO_2 increased by introducing EV to Taiwan. Overall, EV penetration would reduce pollution episodes in Taiwan's major cities by up to 60%.
IV. Atmospheric water stable isotopes fractionation due to cloud microphysical processes were investigated based on the kinetic mass transfer theory (Tsai et al. 2019). The thermal equilibrium assumption used earlier may cause an overestimate of mean vapor-phase δD by 11‰, and the

maximum difference can be more than 20‰. Initial vertical distribution, lower boundary conditions, and cloud microphysics fractionation are all critical in determining δD.

REPRESENTATIVE PUBLICATIONS (*: corresponding author)

Chen, J-.P.*, and D. Lamb, 1994: The theoretical basis for the parameterization of ice crystal habits: Growth by vapor deposition. *J. Atmos. Sci.*, **51**, 1206–1221.

Chen, J.-P.*, and S.-T. Liu, 2004: Physically-based two-moment bulk-water parameterization for warm cloud microphysics. *Q. J. Royal Meteor. Soc.*, **130**, Part A, 51–78. https://doi.org/10.1256/qj.03.41

Chen, J.-P.*, A. Hazra, and Z. Levin, 2008: Parameterizing ice nucleation rates using contact angle and activation energy derived from laboratory data. *Atmos. Chem. Phys.*, **8**, 7431–7449. https://doi.org/10.5194/acp-8-7431-2008

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/acpd-13-12033-2013.

Chen, J.-P.*, and T.-C. Tsai, 2016: Triple-moment modal parameterization for the adaptive growth habit of pristine ice crystals. *J. Atmos. Sci.*, **73**, 2105–2122. doi:10.1175/JAS-D-15-0220.1

Cheng, C.-T.*, W.-C. Wang, and J.-P. Chen, 2007: A modeling study of aerosol impacts on cloud radiative properties and precipitation. *Q. J. R. Meteorol. Soc.*, **133**, Part B, 283–297. https://doi.org/10.1002/qj.25

Cheng, C.-T.*, W.-C. Wang, and J.-P. Chen, 2010: Simulation of the effects of increasing cloud condensation nuclei on mixed-phase clouds and precipitation of a front system. *Atmos. Res.*, **96**, 461–476, doi:10.1016/j.atmosres.2010.02.005.

Hoose, C.*, J. E. Kristjánsson, J.-P. Chen and A. Hazra, 2010: A classical-theory-based parameterization of heterogeneous ice nucleation by mineral dust, soot, and biological particles in a global climate model. *J. Atmos. Sci.*, **67**, 2483–2503. https://doi.org/10.1175/2010JAS3425.1

Kuo, T.-H., J.-P. Chen*, and Y. Xue, 2016: Stem-root flow effect on soil-atmosphere interactions and uncertainty assessments. *Hydrol. Earth Syst. Sci.*, **20**, 1509–1522. doi:10.5194/hess-20-1509-2016

Li, N., J.-P. Chen*, I-C., Tsai, Q. He, S.-Y. Chi, Y.-C. Lin, T.-M. Fu, 2016: Potential impacts of electric vehicle on Taiwan's air quality. Sci. Total Environ., 566-567, 919-928. doi:10.1016/j.scitotenv.2016.05.105

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 Biogeochem. Cycles*, **29**, 2, 138–159. doi:10.1002/2013GB004795.

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

Tsai, T.-C., and J.-P. Chen*, 2020: Multi-moment ice bulk microphysics scheme with consideration for particle shape and apparent density. Part I: Methodology and idealized simulation. *J. Atmos. Sci.,* **77**, 5, 1821–1850. https://doi.org/10.1175/JAS-D-19-0125.1

Wang, L.-J., and J.-P. Chen*, 2019: Efficient determination of cloud drop number concentration near the cloud base with parameterization based on fundamental theory and parcel model simulations. *J. Geophys. Res. Atmos.*, **124,** 6467-6483. doi: 10.1029/2018JD029648.