Wei-Liang Lee (李威良)

Associate Research Fellow
Research Center for Environmental Changes
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Education

Ph.D.: Atmospheric Sciences, University of California, Los Angeles, USA (2008)
M.S.: Atmospheric Sciences, National Taiwan University, Taiwan (1999)
B.S.: Atmospheric Sciences, National Taiwan University, Taiwan (1997)

Research Interests

- 3-D Topographic effect on surface radiation budget
- Development of general circulation models (GCM)
- Radiation–cloud/aerosol/hydrometeor/snow interactions
- 3-D radiative transfer program and parameterization
- Radiative transfer in the coupled atmosphere-ocean system

Experiences

Associate research fellow, Academia Sinica, Taiwan **(2020/08-present)**
Assistant research fellow, Academia Sinica, Taiwan **(2014/08-2020/07)**
Assistant research specialist, Academia Sinica, Taiwan **(2012/01–2014/07)**
Post doctoral researcher, Academia Sinica, Taiwan **(2008/04–2011/12)**
Research assistant, University of California, Los Angeles, USA **(2001/09–2008/03)**

- Radiative transfer in a coupled atmosphere-ocean system, Monte Carlo simulation on 3-D radiative transfer in mountains (2003-2008)
  Advisor: Dr. K. N. Liou
- Development of coupled GCM consisting of UCLA AGCM and POP OGCM; ENSO and Indian Ocean dipole mode simulation and analysis (2001-2003)
  Advisor: Dr. Jin-Yi Yu

Teaching assistant, University of California, Los Angeles, USA **(2006)**
Research assistant, National Taiwan University, Taiwan **(1997/09–1999/06)**

- Typhoon and vortex dynamics

Advisor: Dr. Hung-Chi Kuo

Research assistant, National Taiwan University, Taiwan **(1995/09–1997/06)**

- Field observation and data analysis of aerosol concentration and size distribution
  Advisor: Dr. Jen-Ping Chen

Honors

- Career Development Award, Academia Sinica (2021)
- Highlight of Research Achievement, Academia Sinica (2021)
- Distinguished Postdoctoral Fellow, Academia Sinica, Taiwan (2008)
- Dissertation Year Fellowship, UCLA, USA (2007)
- Intelligent Student Fellowship in Math and Nature Sciences, Ministry of Education, Taiwan (1993)

Journal Papers

Wang, C.-C., **W.-L. Lee**, H.-H. Hsu, W.-C. Kuo, and Y.-S. Lin (2024) The global atmospheric energy cycle in TaiESM1: Present and future. *Journal of Geophysical Research: Atmospheres*, 129, e2024JD041108. https://doi.org/10.1029/2024JD041108.

Tsai, I-C., S.-W. Yang, C.-J. Shiu, Y.-Y. Chen, C.-A. Chen, **W.-L. Lee**, and H.-H. Hsu (2024). Aerosol impacts on the East Asian winter monsoon: Insights from TaiESM1 and CMIP6 simulations. *International Journal of Climatology*, 44, 2816-2832, https://doi.org/10.1002/joc.8483.

Li, J.-L. F., K.-M. Xu, **W.-L. Lee**, J. H. Jiang, Y.-C. Tsai, J.-Y. Yu, E. Fetzer, L. Wu, and G. Stephens (2023). Warm Clouds Biases in CMIP6 Models Linked to Indirect Effects of Falling Ice-Radiation Interactions Over the Tropical and Subtropical Pacific. *Geophysical Research Atmospheres Letters*, 50, e2023GL104990, https://doi.org/10.1029/2023GL104990.

Li, J.-L. F., **W.-L. Lee***, K.-M. Xu, Y.-C. Tsai, J. H. Jiang, J.-Y. Yu, G. Stephens, E. Fetzer, and W.-T. Chen (2023). Radiatively active hydrometeor frequencies from CloudSat-CALIPSO data for evaluating cloud fraction in global climate models. *Journal of Geophysical Research Atmospheres*, 128, e2023JD038511, https://doi.org/10.1029/2023JD038511.

Tsai, Y.-C., J.-L. F. Li, K.-M. Xu, **W.-L. Lee**, J. H. Jiang, E. Fetzer, and J.-Y. Yu (2023). Possible linkage of sea surface height anomaly, surface wind stress and sea surface temperature with the falling ice radiative effects under a gradual warming scenario.

Environmental Research Communications, 5, 085004, https://doi.org/10.1088/2515-7620/acee4c.

Li, J.-L. F., K.-M. Xu, Y.-C. Tsai, **W.-L. Lee**, J. H. Jiang, J.-Y. Yu, E. Fetzer, L. Wu, and G. Stephens (2023). Evaluation of radiatively active frozen hydrometeors mass in CMIP6 global climate models using CloudSat-CALIPSO observations. *Journal of Geophysical Research Atmospheres*, 128, e2023JD039200, https://doi.org/10.1029/2023JD039200.

Li, J.-L. F., Y.-C. Tsai, K.-M. Xu, **W.-L. Lee**, J. H. Jiang, J.-Y. Yu, E. Fetzer, and G. Stephens (2022). Inferring the linkage of sea surface height anomalies, surface wind stress and sea surface temperature with the falling ice radiative effects using satellite data and global climate models. *Environmental Research Communications*, 4, 055009, https://doi.org/10.1088/2515-7620/aca3fe.

Tseng, W.-L., H.-H. Hsu, Y.-Y. Lan, **W.-L. Lee**, C.-Y. Tu, P.-H. Kuo, B.-J. Tsuang, and H.-C. Liang (2022). Improving Madden-Julian oscillation simulation in atmospheric general circulation models by coupling with a one-dimensional snow-ice-thermocline ocean model. *Geoscientific Model Development*, 15, 5529-5546, https://doi.org/10.5194/gmd-15-5529-2022.

Li, J.-L. F., K.-M. Xu, **W.-L. Lee**, J. H. Jiang, Y.-C. Tsai, E. Fetzer, G. Stephens, Y.-H. Wang, and J.-Y. Yu (2022). Comparing surface wind stress and sea surface temperature biases over the tropical and subtropical oceans in subsets of MIP6 models categorized by frozen hydrometeors-radiation interactions. *Environmental Research Communications*, 4, 055009, https://doi.org/10.1088/2515-7620/ac70ac.

Hao, D., G. Bisht, M. Huang, P.-L. Ma, T. Tesfa, **W.-L. Lee**, Y. Gu, and L. R. Leung (2022). Impact of sub-grid topographic representations on surface energy balance and boundary conditions in the E3SM land model: A case study in Sierra Nevada. *Journal of Advances in Modeling Earth Systems*, 14, e2021MS002862, https://doi.org/10.1029/2021MS002862.

Li, J.-L. F., **W.-L. Lee***, K.-M. Xu, J. H. Jiang, Y.-H. Wang, E. Fetzer, G. Stephens, J.-Y. Yu, and Y. Liu (2022). Observational evaluation of global climate model simulations of Arctic sea ice and adjacent land pertaining to the radiative effects of frozen hydrometeors. *Environmental Research Communications*, 4, 025008, https://doi.org/10.1088/2515-7620/ac556b.

Wang, L.-C., J.-L. F. Li, K.-M. Xu, L. T. Dao, **W.-L. Lee**, J. H. Jiang, E. Fetzer, Y.-H. Wang, J.-Y. Yu, and C.-A. Chen (2021). The potential influence of falling ice radiative effects on central-Pacific El Nino variability under progressive global warming. *Environmental Research Letters*, 16, 124062,

https://doi.org/10.1088/1748-9326/ac3d56.

Hao, D., G. Bisht, Y. Gu, **W.-L. Lee**, K.-N. Liou, and L. R. Leung (2021). A parameterization of sub-grid topographical effects on solar radiation in the E3SM land model (version 1.0): implementation and evaluation over the Tibetan Plateau. *Geoscientific Model Development*, 14, 6273-6289, https://doi.org/10.5194/gmd-14-6273-2021.

Chou, M.-D., K.-T. Lee, I.-S. Zo, **W.-L. Lee***, C.-J. Shiu, and J.-B. Jee, (2021). A new *k*-distribution scheme for clear-sky radiative transfer calculations in the Earth atmosphere. Part II: Solar (shortwave) heating due to H_2O and CO_2. *Journal of the Atmospheric Sciences*, 78, 2657-2675, https://doi.org/10.1175/JAS-D-20-0278.1.

Li, J.-L. F., K.-M. Xu, **W.-L. Lee**, J. H. Jiang, E. Fetzer, G. Stephens, J.-Y. Yu, and Y.-H. Wang (2021). Changes of south-central Pacific large-scale environment associated with hydrometeors-radiation-circulation interactions in a coupled GCM. *Journal of Geophysical Research Atmospheres*, *126*, https://doi.org/10.1029/2021JD034973.

Li, J.-L. F., K.-M. Xu, M. Richardson, J. H. Jiang, G. Stephens, **W.-L. Lee**, E. Fetzer, J.-Y. Yu, Y.-H. Wang, and F.-J. Wang (2021). Improved ice content, radiation, precipitation, and low-level circulation over the tropical Pacific from ECMWF ERA-interim to ERA5. *Environmental Research Communications*, 3, 081006, https://doi.org/10.1088/2515-7620/ac1bfe.

Li, J.-L. F., K.-M. Xu, **W.-L. Lee**, J. H. Jiang, E. Fetzer, J.-Y. Yu, and Y.-H. Wang, G. Stephens, and L.-C. Wang (2021). Linking global land surface temperature projections to radiative effects of hydrometeors under a global warming scenario. *Environmental Research Letters*, 16, 084044, https://doi.org/10.1088/1748-9326/ac153c.

Wang, Y.-C., H.-H. Hsu, C.-A. Chen, W.-L. Tseng, P.-C. Hsu, C.-W. Lin, Y.-L. Chen, L.-C. Jiang, Y.-C. Lee, H.-C. Liang, L. Chang, **W.-L. Lee**, and C.-J. Shiu (2021). Performance of the Taiwan Earth System Model in simulating climate variability compared with observations and CMIP6 model simulations. *Journal of Advances in Modeling Earth Systems*, 13, e2020MS002352, https://doi.org/10.1029/2020MS002353.

Li, J.-L. F., K.-M. Xu, M. Richardson, **W.-L. Lee**, J. H. Jiang, J.-Y. Yu, Y.-H. Wang, E. Fetzer, L.-C. Wang, and G. Stephens (2020). Annual and seasonal mean tropical and subtropical bias in CMIP5 and CMIP6 models. *Environmental Research Letters*, 15, 124068, https://doi.org/10.1088/1748-9326/abc7dd.

Li, J.-L. F., **W.-L. Lee**, K.-M. Xu, J. H. Jiang, E. Fetzer, C.-A. Chen, P.-C. Hsu, H.-H.

Hsu, J.-Y. Yu, and Y.-H. Wang (2020). Impact of falling ice radiative effects on projections of Southern Ocean sea ice change under global warming. *Terrestrial, Atmospheric, and Oceanic Sciences*, 31, https://doi.org/10.3319/TAO.2020.10.15.01.

Li, J.-L. F., K.-M. Xu, **W.-L. Lee**, J. H. Jiang, Y.-H. Wang, E. Fetzer, J.-Y. Yu, and L.-C. Wang (2020). Comparisons of radiation-circulation precipitation coupling over the tropical and subtropical ocean between AMIP6 and CMIP6. *Terrestrial, Atmospheric, and Oceanic Sciences*, 31, https://doi.org/10.3319/TAO.2020.09.17.01.

Lee, W.-L., Y.-C. Wang, C.-J. Shiu, I-C. Tsai, Chia-Ying Tu, Yung-Yao Lan, J.-P. Chen, H.-L. Pan, and H.-H. Hsu (2020). Taiwan Earth System Model version 1: Description and evaluation of mean state. *Geoscientific Model Development*, 13, 3887-3904, https://doi.org/10.5194/gmd-13-3887-2020.

Li, J.-L. F., **W.-L. Lee**, K.-M. Xu, J. H. Jiang, E. Fetzer, C.-A. Chen, Y.-H. Wang, J.-Y. Yu, P.-C. Hsu, and H.-H. Hsu (2020). The role of falling ice radiative effects on climate projections over Arctic under global warming. *Terrestrial, Atmospheric, and Oceanic Sciences*, 31, 1-16, https://doi.org/10.3319/TAO.2020.04.29.01.

Li, J.-L. F., K.-M. Xu, J. H. Jiang, **W.-L. Lee**, L.-C. Wang, J.-Y. Yu, G. Stephens, E. Fetzer, and Y.-H. Wang (2020). An overview of CMIP5 and CMIP6 simulated cloud ice, radiation fields, surface wind stress, sea surface temperatures, and precipitation over tropical and subtropical oceans. *Journal of Geophysical Research Atmospheres*, 125, https://doi.org/10.1029/2020JD032848.

Chou, M.-D., J. C.-C. Yu, **W.-L. Lee***, C.-J. Shiu, K.-T. Lee, I.-S. Zo, J.-B. Jee, and B.-Y. Kim (2020). A new *k*-distribution scheme for clear-sky radiative transfer calculations in the Earth atmosphere. Part I: Thermal infrared (longwave) radiation. *Journal of the Atmospheric Sciences*, 77, 2237-2256, https://doi.org/10.1175/JAS-D-19-0088.1.

Chen, Y.-C., J.-L. F. Li, **W.-L. Lee**, D. J. Diner, M. J. Garay, J. H. Jiang, Y.-H. Wang, J.-Y. Yu, and O. V. Kalashnikova (2020). Evaluation of sea salt aerosols in climate systems: global climate modeling and observation-based analyses. *Environmental Research Letters*, 15(3), 034047, https://doi.org/10.1088/1748-9326/ab751c.

Lee, W.-L., J.-L. F. Li, K.-M. Xu, E. Suhas, J. H. Jiang, Y.-H. Wang, G. Stephens, E. Fetzer, and J.-Y. Yu (2019). Relating precipitating ice radiative effects to surface energy balance and temperature biases over the Tibetan Plateau in winter. *Journal of Geophysical Research Atmospheres*, *124*, https://doi.org/10.1029/2018JD030204.

Fan, X., Y. Gu, K. N. Liou, **W.-L. Lee**, B. Zhao, H. Chen, and D. Lu (2019). Modeling study of the impact of the complex terrain on surface energy and hydrology over the Tibetan Plateau. *Climate Dynamics*, 53, 6919-6932,

https://doi.org/10.1007/s00382-019-04966-z.

Wang, C.-c., **W.-L. Lee**, and C. Chou (2019). Climate effects of anthropogenic aerosol forcing on tropical precipitation and circulations. *Journal of Climate*, 32, https://doi.org/10.1175/JCLI-D-18-0641.1.

Li, J.-L. F., M. Richardson, **W.-L. Lee**, Y. Hong, J. Jiang, E. Fetzer, G. Stephens, Y.-H. Wang, J.-Y. Yu, and Y. Liu (2019). Potential faster Arctic sea ice retreat triggered by snowflakes' greenhouse effect. *The Cryosphere*, 13, 969-980. https://doi.org/10.5194/tc-13-969-2019.

Lee, W.-L., K. N. Liou, C.-c. Wang, Y. Gu, H.-H. Hsu, and J.-L. F. Li (2019). Impact of 3-D radiation-topography interactions on surface temperature and energy budget over the Tibetan Plateau in winter. *Journal of Geophysical Research Atmospheres*, *124*, https://doi.org/10.1029/2018JD029592.

Chen, C.-A., J.-L. F. Li, M. Richardson, **W.-L. Lee**, E. Fetzer, G. Stephens, H.-H. Hsu, Y.-C. Wang, and J.-Y. Yu (2018). Falling snow radiative effects enhance the global warming response of the topical Pacific atmosphere. *Journal of Geophysical Research Atmospheres*, *123*, https://doi.org/10.1029/2018JD028655.

Li, J.-L. F., E. Suhas, **W.-L. Lee**, M. Richardson, Y.-H. Wang, J.-Y. Yu, T. Lee, E. Fetzer, and G. Stephens (2018). The impacts of bias in cloud-radiation-dynamics interactions on Central-Pacific El Nino simulations in contemporary GCMs. *Earth and Space Science*, *5*, 50-60, https://doi.org/ 10.1002/2017EA000304.

Li, J.-L. F., M. Richardson, Y. Hong, **W.-L. Lee**, Y.-H. Wang, J.-Y. Yu, E. Fetzer, G. Stephens, and Y. Liu (2017). Improved simulation of Antarctic sea ice due to the radiative effects of falling snow. *Environmental Research Letters*, *12*, 084010, https://doi.org/ 10.1088/1748-9326/aa7a17.

Zhao, B., K. N. Liou, Y. Gu, Q. Li, J. H. Jiang, H. Su, C. He, H.-L. R. Tseng, S. Wang, R. Liu, L. Qi, **W.-L. Lee**, and J. Hao (2017). Enhanced PM2.5 pollution in China due to aerosol-cloud interactions. *Scientific Reports*, *7*, https://doi.org/ 10.1038/s41598-017-04096-8.

Lee, W.-L., K. N. Liou, C. He, H.-C. Liang, Q. Li, T.-C. Wang, Z. Liu, and Q. Yue (2017). Impact of absorbing aerosol deposition on snow albedo reduction over the southern Tibetan Plateau based on satellite observation. *Theoretical and Applied Climatology*, *129*, 1373-1382, https://doi.org/10.1007/s00704-016-1860-4.

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. *Journal of Geophysical Research Atmospheres*, *121*, https://doi.org/ 10.1002/2016JD025388.

Li, J.-L. F., **W.-L. Lee**, Y.-H. Wang, M. Richardson, J.-Y. Yu, E. Suhas, E. Fetzer, M.-H.

Lo, and Q. Yue (2016). Assessing the radiative impacts of precipitating clouds on winter surface air temperatures and land surface properties in GCMs using observations. *Journal of Geophysical Research Atmospheres*, *121*, https://doi.org/ 10.1002/2016JD025175.

Zhao, B., K. N. Liou, Y. Gu, C. He, **W.-L. Lee**, X. Chang, Q. Li, S. Wang, H. R. Tseng, L. R. Leung, and J. Hao (2016). Impact of buildings on surface solar radiation over urban Beijing. *Atmospheric Chemistry and Physics*, *16*, 5841-5852, https://doi.org/10.5194/acp-16-5841-2016.

Li, J.-L. F., Y.-H. Wang, T. Lee, D. Waliser, **W.-L. Lee**, J.-Y. Yu, Y.-C. Chen, and E. Fetzer (2016). The impacts of precipitating cloud radiative effects on ocean surface evaporation, precipitation, and ocean salinity in coupled GCM simulations. *Journal of Geophysical Research Atmospheres*, *121*, https://doi.org/ 10.1002/2016JD024911.

Li, J.-L. F., **W.-L. Lee**, J.-Y. Yu, G. Hulley, E. Fetzer, Y.-C. Chen, and Y.-H. Wang (2016). The impacts of precipitating hydrometeors radiative effects on land surface temperature in contemporary GCMs using satellite observations. *Journal of Geophysical Research Atmospheres*, *121*, https://doi.org/10.1002/2015JD023776.

Li, J.-L. F., **W.-L. Lee**, D. Waliser, Y.-H. Wang, J.-Y. Yu, X. Jiang, T. L'Ecuyer, Y.-C. Chen, T. Kubar, E. Fetzer, and M. Mahakur (2016). Considering the radiative effects of snow on tropical Pacific Ocean radiative heating profiles in contemporary GCMs using A-Train observations. *Journal of Geophysical Research Atmospheres*, *121*, https://doi.org/ 10.1002/2015JD023587.

Lee, W.-L., Y. Gu, K. N. Liou, L. R. Leung, and H.-H. Hsu (2015). A global model simulation for 3-D radiative transfer impact on surface hydrology over Sierra Nevada and Rocky Mountains. *Atmospheric Chemistry and Physics*, *15*, 5405-5413, https://doi.org/10.5194/acp-15-5405-2015.

Wang, C.-c., **W.-L. Lee**, Y.-L. Chen, and H.-H. Hsu (2015). Processes leading to double intertropical convergence zone bias in CESM1/CAM5. *Journal of Climate*, *28*, 2900-2915, https://doi.org/10.1175/JCLI-D-14-00622.1.

Li, J.-L. F., **W.-L. Lee**, T. Lee, E. Fetzer, J.-Y. Yu, T. L. Kubar, and C. Boening (2015). The impacts of cloud snow radiative effects on Pacific Ocean surface heat fluxes, surface wind stress, and ocean temperatures in coupled GCM simulations. *Journal of Geophysical Research Atmospheres*, *120*, https://doi.org/10.1002/2014JD022538.

Liou, K. N., Y, Takano, C. He, P. Yang, L. R. Leung, Y. Gu, and **W.-L. Lee** (2014). Stochastic parameterization for light absorption by internally mixed BC/dust in snow grains for application to climate models, *Journal of Geophysical Research Atmospheres*, *119*, 7616-7632, https://doi.org/10.1002/2014JD021665.

Li, J.-L. F., **W.-L. Lee**, D. E. Waliser, J. P. Stachnik, E. Fetzer, S. Wong, and Q. Yue (2014). Characterizing tropical Pacific water vapor and radiative biases in CMIP5 GCMs: Observation-based analyses and a snow and radiation interaction sensitivity experiment, *Journal of Geophysical Research Atmospheres*, *119*, https://doi.org/10.1002/2014JD021924.

Li, J.-L. F., **W.-L. Lee**, D. E. Waliser, J. D. Neelin, J. P. Stachnik, and T. Lee (2014). Cloud-precipitation-radiation-dynamics interaction in global climate models: A snow and radiation interaction sensitivity experiment, *Journal of Geophysical Research Atmospheres*, *119*, https://doi.org/10.1002/2013JD021038.

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Lee, W.-L., K. N. Liou, and C.-c. Wang (2013). Impact of 3-D topography on surface radiation budget over the Tibetan Plateau. *Theoretical and Applied Climatology*, *113*, 95-103, https://doi.org/10.1007/s00704-012-0767-y.

Gu, Y., K. N. Liou, **W.-L. Lee**, and L. R. Leung (2012). Simulating 3-D radiative transfer effects over the Sierra Nevada Mountains using WRF. *Atmospheric Chemistry and Physics*, *12*, 9965-9976, https://doi.org/10.5194/acp-12-9965-9976.

Lee, W.-L., and K. N. Liou (2012). Effect of absorbing aerosols on snow albedo reduction in the Sierra Nevada. *Atmospheric Environment*, *55*, 425–430.

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Wang, C.-c., C. Chou, and **W.-L. Lee** (2010). Breakdown and reformation of the Intertropical Convergence Zone in a moist atmosphere. *Journal of the Atmospheric Sciences*, *67*, 1247–1260.

Liou, K. N., **W.-L. Lee***, and A. Hall (2007). Radiative transfer in mountains: Application to the Tibetan Plateau. *Geophysical Research Letters*, *34*, L23809, https://doi.org/10.1029/2007GL031762.

Lee, W.-L., and K. N. Liou (2007). A coupled atmosphere–ocean radiative transfer system using the analytic four-stream approximation. *Journal of the Atmospheric Sciences*, *64*, 3681–3694, https://doi.org/10.1175/JAS4044.1.

Book Chapter

Chou, C., W.-T. Chen, M.-H. Lo, **W.-L. Lee**, S.-Y. Lee, C.-A. Chen, H. H. Hsu, C.-W.

Lan, H.-C. Hwang, C.-Y. Wang, C.-Y. Liu, and S.-H. Su (2017). Chapter 1: Global climate changes. In "*Scientific Report for Climate Changes in Taiwan*". (in Chinese)

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Dissertation and Thesis

Lee, W.-L. (2008). Radiative transfer in atmosphere–ocean and atmosphere–mountain systems: application and parameterization. Ph.D. dissertation, University of California, Los Angeles. Los Angeles, California, U.S.A.110 pp.

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