

**Xiaohong Liu**

Professor, Endowed “Wyoming Excellence Chair” in Climate Science  
Department of Atmospheric Science  
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**EDUCATION**

- |              |   |      |
|--------------|---|------|
| <b>Ph.D.</b> | Atmospheric Science, Nanjing University, P.R. China,                  | 1992 |
| <b>M.S.</b>  | Atmospheric Science, Nanjing University, P.R. China,                  | 1989 |
| <b>B.S.</b>  | (Highest honors) Atmospheric Physics, Nanjing University, P.R. China, | 1986 |

**RESEARCH INTERESTS**

- Aerosol-Cloud-Precipitation Interactions; Aerosol Direct and Indirect Effects on Climate;
- Global and Regional Modeling of Aerosol Life Cycle in the Atmosphere and Impacts on Climate;
- Development and Evaluation of Cloud and Aerosol Schemes for Climate Models;

**RESEARCH EXPERIENCE**

2013.08-: *Professor, Wyoming Excellence Chair in Climate Science*, Department of Atmospheric Science, University of Wyoming, Laramie, USA

2012.01-2013.07: *Senior Research Scientist (Level 5)*, Pacific Northwest National Laboratory, Richland, USA

2006.01-2011.12: *Senior Research Scientist (Level 4)*, Pacific Northwest National Laboratory, Richland, USA

2010.12-: *Adjunct Professor*, Nanjing University, China.

2010.06-: *Oversea Advisor of Ph.D. Students*, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, China.

2002.01-2005.12: *Assistant Research Scientist* (Research Faculty), Department of Atmospheric, Oceanic and Space Sciences, University of Michigan, Ann Arbor, USA

2000.02-2001.12: *Research Fellow*, Department of Atmospheric, Oceanic and Space Sciences, University of Michigan, Ann Arbor, USA

1998.01-1998.04, 1999.10-2000.01: *Visiting Scientist*, Department of Atmospheric Sciences, University of Washington, Seattle, USA

1996.04-1997.05: *Alexander von Humboldt Research Fellow*, Fraunhofer Institute for Atmospheric Environmental Research (IFU), Garmisch-Partenkirchen, Germany

1995.04-1996.03: *Research Scientist*, Working Group for Air Chemistry, Brandenburg Technical University Cottbus, Berlin, Germany

1994.07-1995.03, 1997.06-1999.09: *Research Associate Professor, Research Professor, Ph.D. Advisor* (1999), Institute of Atmospheric Physics (IAP), Chinese Academy of Sciences (CAS), Beijing, P.R. China.

1992.08-1994.07: *Post-doctor*, Institute of Atmospheric Physics (IAP), Chinese Academy of Sciences (CAS), Beijing, P.R. China

## **TEACHING EXPERIENCE**

1997.09-1999.08: *Adjunct Professor*, Teaching “*Atmospheric Chemistry*” at the Graduate School of Science and Technology University of China (in Beijing).

## **POST-DOCTORAL FELLOWS AND GRADUATE STUDENTS**

### *Graduate Advisees:*

Bing Li, Ph.D. student (jointly with Prof. Zhongxiang Hong), Institute of Atmospheric Physics (IAP), CAS, 1996-1999;

Chao Wei, Master student at IAP, CAS, 1997-2000;

Hua Xie, Ph.D. student at IAP, CAS, 1997-2000;

Xiao Han (jointly with Prof. Meigen Zhang), Ph.D. student at IAP, CAS, 2007-2010;

Xiangjun Shi (jointly with Prof. Bin Wang), Ph.D. student at IAP, CAS, 2007-2010;

Yi Gao (jointly with Prof. Meigen Zhang), Ph.D. student at IAP, CAS, 2009-2011;

Yiquan Jiang (jointly with Prof. Xiu-Qun Yang), Ph.D. student at Nanjing Univ., 2008-;

Ning Hu (jointly with Prof. Bin Wang), Ph.D. student at IAP, CAS, 2011-;

Yong Wang (jointly with Prof. Bin Wang), Ph.D. student at IAP, CAS, 2011-;

Yun Zhou, Ph.D. student at University of Wyoming, 2014.09-;

Mingxuan Wu, Ph.D. student at University of Wyoming, 2014.09-;

### *Postdoctoral Advisees:*

Dr. Weiguo Wang, (Ph.D., 2005, Penn State University), PNNL, 2007-2008, now a research scientist at NOAA;  
Dr. Chun Zhao, (Ph.D., 2009, Georgia Institute of Technology), PNNL, 2009.06-2010.12, now a research scientist at PNNL;  
Dr. Kai Zhang, (Ph.D., 2008, Institute of Atmospheric Physics), PNNL, 2011.03-2013.05, now a research scientist at PNNL;  
Dr. Xiangjun Shi, (Ph.D., 2010, Institute of Atmospheric Physics), U. of Wyoming, 2013.10-;  
Dr. Yiquan Jiang, (Ph.D., 2013, Nanjing University), U. of Wyoming, 2013.11-;  
Dr. Zheng Lu, (Ph.D., 2014, Georgia Institute of Technology), U. of Wyoming, 2014.09-;

### **HONORS AND AWARDS**

- Named to the list “Highly Cited Researchers 2014” by Thomson-Reuters, 2014;
- Exceptional Contribution Program (ECP) Award, Pacific Northwest National Laboratory, 2012;
- Outstanding Performance Award, Fundamental and Computational Science Directorate, Pacific Northwest National Laboratory, 2010;
- World Meteorology Organization (WMO) Young Scientist Award, 2001;
- China Meteorological Agency (CMA) Prof. Tu Chang-Wang Young Scientist Award (1<sup>st</sup> class), 2000;
- World Meteorological Organization (WMO) Mariolopoulos-Kanaginis Award (Honorable Mention, 3<sup>rd</sup> place), for paper in Atmospheric Environmental Research, 1998;
- Alexander von Humboldt Research Fellow, Germany, 1996-1997;
- Elected into “100 Talent Program” of Chinese Academy of Science, 1996-1999;

### **ACADEMIC MEMBERSHIP**

- Member of American Geophysical Union (AGU)
- Member of American Meteorological Society (AMS)
- Science team member, NCAR Community Earth System Model (CESM) Atmospheric Model (CAM) Working Group, 2006-
- Science team member, NCAR Community Earth System Model (CESM) Chemistry/Climate (CC) Working Group, 2006-
- Science team member, DOE Atmospheric System Research (ASR) Program, 2006-
- Science team member, DOE Climate and Earth System Modeling (CESM) Program, 2006-

- Science team member, NASA Global Modeling Initiative (GMI), 2003-2009.

## **PROFESSIONAL SERVICE**

- Editor, journal “Atmospheric Chemistry and Physics” (ACP).
- NCAR Community Earth System Model (CESM) development team. CESM has been used by NCAR in the IPCC 5<sup>th</sup> Assessment Report.
  - A key developer of the modal aerosol module (MAM) (Liu et al., 2012) for the Community Atmospheric Model Version 5 (CAM5) to predict the life cycles of aerosol. MAM is a major contribution to the NCAR model upgrade from CAM4 to CAM5.
  - A major developer of the ice microphysics scheme (Liu, et al., 2007) for the Community Atmospheric Model Version 5 (CAM5) to treat the aerosol’s effect on ice clouds.
- Develop one of the first ice nucleation parameterizations for GCMs that link ice nucleation to aerosol properties (Liu and Penner, 2005). The parameterization was implemented in the NCAR CAM3 (Liu et al., 2007) and CAM5 (Gettelman et al., 2010). The parameterization has also been implemented in NOAA/GFDL’s AM3 (Salzmann et al., 2010) and NASA’s GEOS-5 model (Sud et al., 2010).
- Key developer of an aerosol module for the NASA Global Modeling Initiative (GMI) (Liu et al., 2007).
- Journal Peer-Review:
  - Nature Geosciences;*
  - Proceedings of the National Academy of Sciences of USA;*
  - Journal of Geophysical Research-Atmosphere;*
  - Geophysical Research Letter;*
  - Atmospheric Chemistry and Physics;*
  - Journal of Climate;*
  - Journal of the Atmospheric Sciences;*
  - Atmospheric Environment;*
  - Environmental Research Letters;*
  - Annals of Geophysics;*
  - Journal of Advances in Modeling Earth Systems;*
  - Climate Change;*
  - Geoscientific Model Development;*
  - Quarterly Journal of the Royal Meteorological Society;*
  - Theoretical and Applied Climatology;*
  - Environmental Science and Technology;*
  - IEEE Journal of Selected Topics in Earth Observations and Remote Sensing;*
  - International Journal of High Performance Computing;*
  - Meteorological Applications;*

*Asia-Pacific Journal of Atmospheric Sciences;*  
*Journal of the Air & Waste Management Association;*  
*Advance in Atmospheric Sciences;*  
*Atmospheric and Oceanic Science Letters;*  
*Chinese Science Bulletin;*  
*Acta Meteorologica Sinica;*  
*Chinese Journal of Atmospheric Sciences;*  
*Journal of Ocean University of China;*  
*Chinese Climate and Environment Research.*

- Grants Review:  
*NASA Modeling, Analysis and Prediction (MAP);*  
*National Science Foundation;*  
*Department of Energy Atmospheric System Research Program (ASR);*  
*Department of Energy Atmospheric Radiation Measurement Program (ARM);*  
*Department of Energy Atmospheric Science Program (ASP);*  
*Department of Energy Environmental Molecular Sciences Laboratory (EMSL);*  
*Canada Foundation for Innovation;*  
*Canada Killam Research Fellowships;*  
*Swiss National Science Foundation;*  
*Academy of Finland;*
- Panel Reviewer for DOE Atmospheric System Research (ASR) Program, 2010.09.
- Panel Reviewer for NASA Modeling, Analysis and Prediction (MAP) Program, 2008.11.
- Panel Reviewer for NASA CALIPSO/CloudSat Science Team Re compete, 2010.02 (declined).
- Scientific Steering Committee, International Aerosol Model Inter-Comparison Project (AeroCom), 2014.09-.
- Co-Leader of Aerosol Microphysics Working Group, International Aerosol Model Inter-Comparison Project (AeroCom), 2006-2011.
- Scientific Steering Committee, Cloud, Aerosol and Precipitation Interaction (CAPI) Working Group, DOE Atmospheric System Research (ASR) Program, 2011.03-.
- Scientific Steering Committee, Aerosol Lifecycle Working Group (ALWG), DOE Atmospheric System Research (ASR) Program, 2014.03-.
- Leader, “Ice Nucleation” Interest Group, DOE Atmospheric System Research (ASR) Program, 2011.03-.
- Co-chair, “Aerosol, Cloud and Climate” session, American Geophysics Union (AGU) the 2006 Fall Meeting, 11–15 December in San Francisco.

- Co-convener and co-chair, “Ice Nucleation: From Laboratory, Field and Remote Sensing Data to Process and Global Models” session, American Geophysics Union (AGU) the 2008 Fall Meeting, 15–19 December in San Francisco.
- Co-convener and co-chair, “Ice Formation and Multiplication in Tropospheric Clouds” session, American Geophysics Union (AGU) the 2010 Fall Meeting, 13–17 December in San Francisco.
- Co-convener and co-chair, “Physical and Chemical Processes in the Atmospheric Boundary Layer” symposium, 8th International Conference on Acid Deposition, June 15-18, 2011, Beijing, China.
- Co-organizer and co-chair, “Aerosol and Precipitation” Symposium, American Association for Aerosol Research Annual Conference, 3-7 October 2011, Orlando, FL.
- Co-convener and co-chair, “Asian Aerosols and Their Impacts on Regional and Global Climate” session, AOGS – AGU (WPGM) Joint Assembly, 13-17 August, 2012, Singapore.
- Convener and chair, “Cloud Condensation Nuclei (CCN) and Ice Nuclei (IN) Properties of Aerosol: Measurement, Modeling and Impacts on Clouds” session, 5th Symposium on Aerosol-Cloud-Climate Interactions, 93rd AMS Annual Meeting in Austin, Texas, 6-10 January 2013.
- Co-convener and co-chair, “Climatic Effects of Aerosols Over Asia, Oceania and the Surrounding Oceans” session, Asia Oceania Geosciences Society (AOGS) 10th Annual Meeting in Brisbane, Australia, 24 to 28 June 2013.
- Co-convener and co-chair, “Constraining Aerosol Indirect Forcing in Climate Models With Observations” session, American Geophysics Union (AGU) the 2013 Fall Meeting, 9–13 December in San Francisco.
- Co-convener and co-chair, “Cloud Condensation Nuclei (CCN) and Ice Nuclei (IN)” session, 6th Symposium on Aerosol-Cloud-Climate Interactions, 94th AMS Annual Meeting in Atlanta, Georgia, 2-6 February 2014.

## **RESEARCH GRANTS**

Title: *Ea SM 2 Collaborative Research: Wildfires and Regional Climate Variability: Mechanisms, Modeling, and Prediction*, Source: Joint NSF-DOE-USDA Earth System Models (EaSM-2), Period: 1/1/2013-12/31/2016, total amount: \$2.6 M, Institute PI (with Y. Wang at Georgia Tech, PI).

Title: *Developing and Evaluating an Advanced Aerosol Module in GEOS-5 for Data Assimilation and Climate Studies*, Source: NASA, MAP, Period: 01/01/2013 – 12/31/2016, total amount: \$ 1,049,537, PI.

Title: *Applying Computationally Efficient Schemes for BioGeochemical Cycles (ACES4BGC)*, Source: DOE, Scientific Discovery through Advanced Computing:

Scientific Computation Application Partnerships in Earth System Science (SciDAC-3), Period: 5/1/2012-9/30/2016, total amount: \$7.2 M, Institute PI (with F. Hoffman at ORNL, lead PI).

Title: *Multiscale Methods for Accurate, Efficient, and Scale-Aware Models of the Earth System*, Source: DOE, Scientific Discovery through Advanced Computing: Scientific Computation Application Partnerships in Earth System Science (SciDAC-3), Period: 5/1/2012-9/30/2016, total amount: \$20.5 M, Co-I (with Bill Collins at LBNL, lead PI).

Title: *Ea SM Collaborative Research: Quantifying the Uncertainties of Aerosol Indirect Effects and Impacts on Decadal-Scale Climate Variability in NCAR CAM5 and CESM1*, Source: Joint NSF-DOE Earth System Models (EaSM-1), Period: 1/1/2011-12/31/2013, total amount: \$900,000, Institute PI (with A. Nenes at Georgia Tech, PI).

Title: *Ea SM Collaborative Research: Multiscale Modeling of Aerosol Indirect Effects on Decadal Timescales*, Source: Joint NSF-DOE Earth System Models (EaSM-1), Period: 1/1/2011 – 12/31/2014, total amount: \$3,000,000, Co-I (with L. Russell at UCSD, PI).

Title: *Uncertainty Quantification (UQ) of Community Atmospheric Model*, PNNL Atmosphere UQ under the DOE Climate Science for a Sustainable Energy Future (CSSEF), Source: DOE Earth System Modeling Program, Period: 7/1/2011-9/30/2012, \$120,000/yr, Co-Leader.

Title: *Seamless prediction of cold clouds and their effect on weather and climate*, Source: NASA Modeling, Analysis, and Prediction (MAP) Program, Period: 2008.09-2012.08, total amount: \$1,300,000, Co-PI (with A. Gettelman at NCAR, PI).

Title: *AMIE (ACRF MJO Investigation Experiment): Observations of the Madden Julian Oscillation for Modeling Studies*, DOE Atmospheric Radiation Measurement (ARM) Climate Research Facility (ACRF), Scientific Steering Committee member, Period: 2011.10-2012.03 (with C. Long at PNNL, PI).

Title: *Developing Ice Nucleation Parameterizations for Large-Scale Models*, Source: PNNL LDRD, Period: 2009.10-2011.09, total amount: \$400,000, PI.

Title: *Small Particles In Cirrus (SPartICus)*, DOE Aerial Vehicle Program (AVP) of the Atmospheric Radiation Measurement (ARM), Scientific Steering Committee member, Period: 2009.10-2010.09 (with J. Mace at Univ. Utah, PI).

Title: *Aerosol Direct and Indirect Effects*, Scientific Focus Area at the Pacific Northwest National Laboratory, Source: DOE Atmospheric System Research (ASR) Program, Period: 2007.10-2009.09, ~\$600,000/year, Science Theme Leader.

Title: *Investigation of Magnitudes and Probabilities of Abrupt Climate Transitions (IMPACTs)*, Source: DOE Earth System Modeling Program, Period: 2008.06-2013.05, \$2,500,000/year, Co-I (with Bill Collins at Berkeley, PI).

Title: *Aerosol Treatment for CAM4*, Source: DOE, Earth System Modeling Program, SciDAC CCSM Consortium, Period: 2006.10-2011.09, \$320,000/yr, Co-I (with J. Drake and P. Jones, PI).

Title: *Global Modeling of Aerosol Dynamics in Support of the NASA GMI*, Source: NASA Modeling, Analysis, and Prediction (MAP) Program, Period: 2007.07-2008.06, total amount: \$88,000, PI.

Title: *Multiscale Modeling of Aerosol Impacts on Clouds and Precipitation*, Source: NASA Interdisciplinary Science, Period: 2006.11-2009.10, \$420,000/year, Co-I (with S. Ghan, PI).

Title: *Cloud Modeling for the Indirect Effect of Aerosols*, Source: DOE, Atmospheric Radiation Measurement Program, Period: 2006-2008, \$250,000/year, Co-I (with S. Ghan, PI).

Title: *Aerosol Processing by Clouds: Model Evaluation and Parameterization Development*, Source: DOE, Atmospheric Science Program, Period: 10/1/2004 – 9/30/2007, \$180,000/year, Co-I (with M. Ovtchinnikov, PI).

Title: *A Study of Anthropogenic Aerosol Effects on Cirrus Clouds*, Source: National Science Foundation, Period: 10/01/2003 – 9/30/2006, total amount: \$476,769, PI.

Title: *Aerosol Effects on Climate: Coupling with the Hydrologic Cycle*, Source: NASA Interdisciplinary Science, Period: 07/01/2003 – 6/30/2006, total amount: \$750,000, Co-I (with J. E. Penner, PI).

Title: *Development of a Coupled Aerosol-Chemistry Model for GMI*, Source: NASA Modeling, Analysis, and Prediction (MAP) Program, Period: 4/05-3/08, total amount: \$375,000, Co-I (with J. E. Penner, PI).

## **PEER-REFEREED PUBLICATIONS**

1. Kulkarni, G., K. Zhang, C. Zhao, M. Nandasiri, V. Shutthanandan, **X. Liu**, J. Fast, L. Berg, Ice formation on nitric 1 acid coated dust particles: Laboratory and modeling studies, *Journal of Geophysical Research*, submitted, 2014.
2. Shrivastava, M., R. Easter, **X. Liu**, A. Zelenyuk, B. Singh, K. Zhang, P.-L. Ma, D. Chand, S. Ghan, J.-L. Jimenez, Q. Zhang, J. Fast, P. Rasch, P. Tiitta, Global transformation and fate of SOA: Implications of low volatility SOA and gas-phase fragmentation reactions, *Journal of Geophysical Research*, submitted, 2014.



3. Gao, Y., M. Zhang, and **X. Liu**, Change in diurnal variations of meteorological variables induced by anthropogenic aerosols over the North China Plain in summer 2008, *Theoretical and Applied Climatology*, submitted, 2014.
4. Wang, Y., and **X. Liu**, Immersion freezing by natural dust based on a soccer ball model with the Community Atmospheric Model version 5: Climate effects, *Environmental Research Letters*, in revision, 2014.
5. Wang, M., V. Larson, S. Ghan, M. Ovchinnikov, D. Schanen, H. Xiao, **X. Liu**, P. Rasch, and Z. Guo, A Multi-scale Modelling Framework model (Super-parameterized CAM5) with a higher-order turbulence closure: model description and low cloud simulations, *Journal of Advances in Modeling Earth Systems*, submitted, 2014.
6. Zhang, K., H. Wan, **X. Liu**, S. J. Ghan, G. J. Kooperman, P.-L. Ma, and P. J. Rasch (2014), Technical Note: On the use of nudging for aerosol-climate model intercomparison studies, *Atmospheric Chemistry and Physics*, *14*, 8631–8645, 2014, doi:10.5194/acp-14-8631-2014.
7. Shi, X., **X. Liu**, and K. Zhang, Effects of preexisting ice crystals on cirrus clouds and comparison between different ice nucleation parameterizations with the Community Atmosphere Model (CAM5), *Atmospheric Chemistry and Physics Discussion*, *14*, 17635–17679, doi:10.5194/acpd-14-17635-2014, 2014.
8. Zhang, C., M. Wang, H. Morrison, R. Somerville, K. Zhang, **X. Liu**, J.-L. Li, Investigating ice nucleation in cirrus cloud with an aerosol enabled multi-scale modeling framework, *Journal of Advances in Modeling Earth Systems*, in press, 2014.
9. Wang, M., **X. Liu**, K. Zhang, and J. Comstock (2014), Aerosol effects on cirrus clouds through ice nucleation in NCAR CAM5 with a statistical cirrus cloud scheme, *Journal of Advances in Modeling Earth Systems*, *6*, doi:10.1002/2014MS000339.
10. Wang, Y., **X. Liu**, C. Hoose, and B. Wang (2014), Impact of heterogeneous ice nucleation by natural dust and soot based on a probability density function of contact angle model with the Community Atmospheric Model version 5, *Atmospheric Chemistry and Physics*, *14*, 10411–10430, doi:10.5194/acpd-14-10411-2014.
11. Samset, B. H., G. Myhre, A. Herber, Y. Kondo, S. Li, N. Moteki, N. Oshima, S. Schwarz, Y. Balkanski, S. Bauer, N. Bellouin, T. K. Berntsen, H. Bian, T. Diehl, R. E. Easter, S. J. Ghan, T. Iversen, A. Kirkevåg, J.-F. Lamarque, G. Lin, **X. Liu**, J. E. Penner, M. Schulz, Ø. Seland, R. B. Skeie, P. Stier, T. Takemura, K. Tsigaridis, K. Zhang, Modeled black carbon radiative forcing and atmospheric lifetime in AeroCom Phase II constrained by aircraft observations, *Atmospheric Chemistry and Physics Discussion*, *14*, 20083–20115, doi:10.5194/acpd-14-20083-2014, 2014.

12. Jiang Y., X.-Q. Yang and **X. Liu**, Seasonality in anthropogenic aerosol effects on East Asian climate with NCAR CAM5, *Journal of Geophysical Research*, submitted, 2014.
13. Ban-Weiss, G. A., L. Jin, S. E. Bauer, R. Bennartz, **X. Liu**, K. Zhang, Y. Ming, H. Guo, and J. H. Jiang (2014), Evaluating clouds, aerosols, and their interactions in three global climate models using satellite simulators and observations, *Journal of Geophysical Research*, *119*, doi:10.1002/2014JD021722.
14. Kondo, Y., H. Matsui, N. Oshima, N. Moteki, Q. Wang, D. J. Jacob, M. Schulz, **X. Liu**, P. J. Rasch, H. Wang, K. Zhang, M. Koike, N. Takegawa, and K. Kita, Transport efficiency as a key parameter in representing wet deposition of black carbon, *Journal of Geophysical Research*, submitted, 2014.
15. Berg, L., E. Chapman, J. Barnard, D. Chand, R. Easter, J. Fast, S. Ghan, M. Gilles, A. Laskin, **X. Liu**, A. McComiskey, R. McGraw, R. Moffett, M. Petters, N. Riemer, A. Sedlacek, J. Wilson, R. Zaveri, A. Zelenyuk, and C. Berkowitz, Understanding aerosol mixing state: Measurements guiding the next generation of climate models, *Bulletin of the American Meteorological Society*, submitted, 2013.
16. Tsigaridis, K., et al. (including **X. Liu**) (2014), The AeroCom evaluation and intercomparison of organic aerosol in global models, *Atmospheric Chemistry and Physics*, *14*, 10845-10895, doi:10.5194/acp-14-10845-2014.
17. Scanza, R. A., N. Mahowald, S. J. Ghan, C. S. Zender, J. F. Kok, **X. Liu**, and Y. Zhang, Dependence of dust radiative forcing on mineralogy in the Community Atmosphere Model, *Atmospheric Chemistry and Physics Discussion*, *14*, 17749–17816, doi:10.5194/acpd-14-17749-2014, 2014.
18. Elliott, S., S. Burrows, C. Deal, **X. Liu**, M. Long, O. Ogunro, L. M. Russell, and O. Wingenter (2014), Prospects for simulation of macromolecular surfactant chemistry in the ocean-atmosphere, *Environmental Research Letters*, *9*, 064012, doi:10.1088/1748-9326/9/6/064012.
19. Kulkarni, G., C. Sanders, K. Zhang, **X. Liu**, and C. Zhao (2014), Ice nucleation of bare and sulfuric acid-coated mineral dust particles and implication for cloud properties, *Journal of Geophysical Research*, *119*, doi:10.1002/2014JD021567.
20. Komurcu, M., T. Storelvmo, I. Tan, U. Lohmann, Y. Yun, J. E. Penner, Y. Wang, **X. Liu**, and T. Takemura (2014), Inter-comparison of the cloud water phase among global climate models, *Journal of Geophysical Research*, *119*, doi:10.1002/2013JD021119.
21. English, J. M., J. E. Kay, A. Gettelman, **X. Liu**, Y. Wang, Y. Zhang, and H. Chepfer (2014), Contributions of clouds, surface albedos, and mixed-phase ice nucleation

- schemes to Arctic radiation biases in CAM5, *Journal of Climate*, 27, 5174–5197. doi: <http://dx.doi.org/10.1175/JCLI-D-13-00608.1>.
22. Ma, P.-L., P. J. Rasch, J. D. Fast, R. C. Easter, W. I. Gustafson Jr., **X. Liu**, S. J. Ghan, and B. Singh (2014), Assessing the CAM5 physics suite in the WRF-Chem model: Implementation, resolution sensitivity, and a first evaluation for a regional case study, *Geoscientific Model Development*, 7, 755–778, doi:10.5194/gmd-7-755-2014.
  23. Lin, C.-Y., C. Zhao, **X. Liu**, N.-H. Lin, and W.-N. Chen (2014), Modelling of long-range transport of Southeast Asia biomass-burning aerosols to Taiwan and their radiative forcings over East Asia, *Tellus B*, 66, 23733.
  24. Yu, S., R. Mathur, J. Pleim, D. Wong, R. Gilliam, K. Alapaty, C. Zhao, and **X. Liu** (2014), Aerosol indirect effect on the grid-scale clouds in the two-way coupled WRF-CMAQ: model description, development, evaluation and regional analysis, *Atmospheric Chemistry and Physics*, 14, 11247–11285, doi:10.5194/acp-14-11247-2014.
  25. Long, M. S., W. C. Keene, R. C. Easter, R. Sander, **X. Liu**, A. Kerkweg, and D. Erickson (2014), Sensitivity of tropospheric chemical composition to halogen-radical chemistry using a fully coupled size-resolved multiphase chemistry/global climate system I: Halogen distributions, aerosol composition, and sensitivity of climate-relevant gases, *Atmospheric Chemistry and Physics*, 14, 3397–3425, doi:10.5194/acp-14-3397-2014.
  26. Mann, G. W., K. S. Carslaw, C. L. Reddington, K. J. Pringle, M. Schulz, A. Asmi, D. V. Spracklen, D. A. Ridley, M. T. Woodhouse, L. A. Lee, K. Zhang, S. J. Ghan, R. C. Easter, **X. Liu**, P. Stier, Y. H. Lee, P. J. Adams, H. Tost, J. Lelieveld, S. E. Bauer, K. Tsigaridis, T. P. C. van Noije, A. Strunk, E. Vignati, N. Bellouin, M. Dalvi, C. E. Johnson, T. Bergman, H. Kokkola, K. von Salzen, F. Yu, G. Luo, A. Petzold, J. Heintzenberg, A. Clarke, J. A. Ogren, J. Gras, U. Baltensperger, U. Kaminski, S. G. Jennings, C. D. O’Dowd, R. M. Harrison, D. C. S. Beddows, M. Kulmala, Y. Viisanen, V. Ulevicius, N. Mihalopoulos, V. Zdimal, M. Fiebig, H.-C. Hansson, E. Swietlicki, and J. S. Henzing (2014), Intercomparison and evaluation of aerosol microphysical properties among AeroCom global models of a range of complexity, *Atmospheric Chemistry and Physics*, 14, 4679–4713, doi:10.5194/acp-14-4679-2014.
  27. Gao, Y., C. Zhao, **X. Liu**, M. Zhang, and L.-R. Leung (2014), WRF-Chem simulations of aerosols and anthropogenic aerosol radiative forcing in East Asia, *Atmospheric Environment*, 92, 250-266, doi: 10.1016/j.atmosenv.2014.04.038.
  28. Jiao, C., M. G. Flanner, Y. Balkanski, S. E. Bauer, N. Bellouin, T. K. Berntsen, H. Bian, K. Carslaw, M. Chin, N. De Luca, T. Diehl, S. J. Ghan, T. Iversen, A. Kirkevåg, D. Koch, **X. Liu**, J. E. Penner, G. Pitari, M. Schulz, Ø. Seland, R. B. Skeie, S. D. Steenrod, P. Stier, T. Takemura, K. Tsigaridis, T. van Noije, Y. Yun, and K.

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### **BOOK CHAPTERS, TECH NOTES, AND BOOK REVIEWS**

- Ghan, S. J., R. Wood, G. Feingold, H. Morrison, **X. Liu**, L. Riihimaki, “*Atmospheric System Research (ASR) Cloud-Aerosol-Precipitation Interactions Science Plan*”, DOE Atmospheric System Research (ASR) Program, 2014.04.  
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- Rasch P., S. J. Ghan, **X. Liu**, C. Hannay, R. B. Neale, and M. Zhang, “*Estimation of Earth System Model aerosol direct and indirect effects for IPCC AR5 historical 20<sup>th</sup> century transient simulations*”, DOE BER CESD FY11 performance 3rd Quarter Metric metrics. <http://www.arm.gov/science/metrics2011>.
- **Liu, X.**, and S. J. Ghan, “*Mixed-Phase Cloud Microphysics for Global Climate Models*”, DOE Atmospheric Radiation Measurement (ARM) 2007 Metrics, 1<sup>st</sup> quarter report, <http://www.arm.gov/publications/programdocs/doi-sc-arm-0701.pdf>
- **Liu, X.**, S. J. Ghan, and S. Xie, “*Evaluation of Mixed-Phase Cloud Microphysics Parameterizations with the NCAR Single Column Climate Model (SCAM) and ARM Observations*”, DOE ARM 2007 Metrics, 2<sup>nd</sup> quarter report, <http://www.arm.gov/publications/programdocs/doi-sc-arm-p-07-006.pdf>
- Xie, S., J. Boyle, S. Klein, **X. Liu** and S. Ghan, “*Evaluation of Mixed-Phase Cloud Parameterizations in Short-Range Weather Forecasts with CAM3 and AM2 for Mixed-Phase Arctic Cloud Experiment*”, Third Quarter 2007 ARM Metric Report, available from <http://www.arm.gov/science/metrics.stm>.
- **Liu, X.**, S. J. Ghan, S. Xie, J. Boyle, S. A. Klein, “*Evaluation of A New Mixed-Phase Cloud Microphysics Parameterization with the NCAR Climate Atmospheric Model (CAM3) and ARM Observations*”, Fourth Quarter 2007 ARM Metric Report.

- **Liu, X.**, et al. “*Ice Studies White Paper*”, Prepared for the *PNNL Aerosol-Climate Initiative*, 22 pages.
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### **INVITED TALKS AT UNIVERSITIES AND LABORATORIES**

- Invited seminar, Center for Earth System Science, Tsinghua University, Beijing, August 23, 2014.
- Invited lecturer, Summer School on “Cloud, Aerosol, Radiation, and Precipitation and Climate Effects”, Beijing Normal University, Beijing, August 4-15, 2014.
- Invited seminar, North Carolina State University, Department of Marine, Earth and Atmospheric Sciences, April 21, 2014.
- Invited talk at the International Center for Climate and Environment Sciences (ICCES), Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, December 20, 2013.
- Invited talk, in the session “Aerosol-cloud-precipitation-climate Interactions and Climate Feedbacks: Observations and models”, Asia Oceania Geosciences Society (AOGS) 10th Annual Meeting in Brisbane, Australia, 24 to 28 June 2013.
- Invited seminar, Argonne National Laboratory, Environmental Science Division, April 24, 2013.
- Invited seminars, University of British Columbia, Department of Chemistry, April 2-3, 2013.
- Invited seminar, University of Wyoming, Department of Atmospheric Science, March 7, 2013.
- Invited seminar, Georgia Institute of Technology, School of Earth and Atmospheric Sciences, January 11, 2013.
- Invited talk titled “Aerosol-cloud interactions in GCMs”, Beijing Normal University, College of Global Change and Earth System Science, Beijing, December 11-12, 2012.
- Invited plenary talk, at the DOE Atmospheric System Research Program, Cloud-Aerosol-Precipitation Interaction Working Group Meeting, Rockville, MD, October 29-November 1, 2012.
- Invited seminar, Beijing National Climate Center, China Meteorological Administration, Beijing, 21 August, 2012.
- Invited talk in the session “Asian Dust and Air Pollution: Climate Impact and Biogeochemical Feedbacks Over the Pacific Ocean”, AOGS – AGU (WPGM) Joint Assembly, Singapore, 13-17 August, 2012.

- Invited talk at NASA Goddard Earth Observing System Data Assimilation System Version 5 (GEOS-5) Workshop, Greenbelt, MD, May 3-4, 2012.
- Invited seminar, Texas A&M University, Department of Atmospheric Sciences, College Station, Texas, February 21, 2012.
- Invited talk at 3rd International Aerosol Modeling Algorithms Conference, UC Davis, November 30-December 2, 2011.
- Invited talk at the second Workshop on “Monitoring of Geoengineering Effects and their Natural and Anthropogenic Analogues” organized by the Keck Institute for Space Studies (KISS), Pasadena, California Institute of Technology, November 15-16, 2011.
- Invited lectures at the Joint Symposium on “Climate Modeling Using the NCAR Community Earth System Model (CESM)” organized by Stony Brook University and Brookhaven National Laboratory on Earth System Models, November 2-3, 2011.
- Invited seminar at the Center for Earth System Science, Tsinghua University, Beijing, June 14, 2011.
- Invited talk at the 8<sup>th</sup> International Acid Deposition Conference, Beijing, June 16-18, 2011.
- Invited talk at the Annual Science Meeting of State Key Laboratory of Atmospheric Boundary Layer Physics and Atmospheric Chemistry, Institute of Atmospheric Physics, Chinese Academy of Science, Beijing, June 20, 2011.
- Invited seminar at the School of Atmospheric Sciences, Nanjing University, Nanjing, China, June 22, 2011.
- Invited seminar at the State Key Laboratory of Numerical Modeling for Atmospheric Sciences and Geophysical Fluid Dynamics (LASG), Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, June 24, 2011.
- Invited talk at the “International Workshop on Ice Nucleation in Tropospheric Clouds” in Ettlingen, Germany, May 22-25, 2011.
- Invited talk in “*The global monsoon system: variability and dynamics*” session, European Geophysical Union General Assembly, Vienna, April 4-8, 2011.
- Invited plenary talk, at the DOE Atmospheric System Research Science Team Meeting, San Antonio, TX, March 28-31, 2011.
- Invited seminar at NASA Goddard Space Flight Center, Greenbelt, Maryland, October 20, 2010.
- Invited plenary talk, at the DOE Atmospheric System Research Aerosol Working Group Meeting, Boulder, CO, October 11, 2010.
- Invited seminar given in University of Hertfordshire, Hatfield, UK, October 1, 2010.
- Invited seminar at National Laboratory of Numerical Modeling for Atmospheric Sciences and Geophysical Fluid Dynamics (LASG), Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, China, September 9, 2010.
- Invited seminar at National Laboratory of Atmospheric Boundary Layer Physics and Atmospheric Chemistry (LAPC), Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, China, September 7, 2010.



- Invited seminar at Max-Planck Institute for Meteorology (Germany), May 11, 2010.
- Invited talk in “*Clouds, Aerosols and Radiation*” General Session, European Geophysical Union, General Assembly 2010, Vienna, Austria, May 2-7, 2010.
- Invited talk in “*The global monsoon system: variability and dynamics*” session, European Geophysical Union, General Assembly 2010, Vienna, Austria, May 2-7, 2010.
- Invited seminar at the University of Maryland, Earth System Science Interdisciplinary Center, March 19, 2010.
- Invited speaker in the 2009 Summer Symposium of “*Climate and Its Changes: Observation, Modeling and Dynamics*”, National Laboratory of Numerical Modeling for Atmospheric Sciences and Geophysical Fluid Dynamics (LASG), Institute of Atmospheric Physics, Chinese Academy of Sciences, Yinchuan, China, August 19-21, 2009.
- Invited seminar at the School of Atmospheric Sciences, Nanjing University, Nanjing, China, August 31, 2009.
- Invited talk in “Aerosol Indirect Effects: Measurements and Modeling” session, American Geophysics Union (AGU) the 2008 Fall Meeting, 15–19 December in San Francisco.
- Invited seminar at National Laboratory of Atmospheric Boundary Layer Physics and Atmospheric Chemistry (LAPC), Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, China, April 10, 2008.
- Invited seminar at National Laboratory of Numerical Modeling for Atmospheric Sciences and Geophysical Fluid Dynamics (LASG), Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, China, April 8, 2008.
- Invited seminar at NASA Jet Propulsion Laboratory (JPL), Pasadena, CA, February 14, 2007.
- Invited seminar at NASA Goddard Space Flight Center, Greenbelt, Maryland, November 28, 2006.
- Invited seminar at Ford Research Laboratory, Dearborn, March 17, 2005.
- Invited seminar at Pacific Northwest National laboratory, Richland, February 10, 2005.
- Invited seminar at Beijing University, Beijing, China, December 15, 2003.
- Invited seminar at Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, China, January 12, 2004.
- Invited lecturer in the Brandenburg Technical University (Germany) Summer School, July 2, 2002.
- Invited seminar at Institute for Meteorology and Climate, Research Center Karlsruhe, Garmisch-Partenkirchen, Germany, June 30, 2002.
- Invited seminar at National Center for Atmospheric Research, Boulder, February 21, 2002.