


## Minghui Diao

Assistant Professor  
Department of Meteorology and Climate Science  
San Jose State University

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### Education

Ph.D. Princeton University; September 2008 - August 2013  
Department of Civil and Environmental Engineering

B.S. Peking University; September 2004 - June 2008  
Environmental Sciences, School of Environmental Sciences and Engineering

Visiting student Taiwan Tsinghua University; July - August 2007, Hsinchu, Taiwan

### Research Positions

2015 Aug – present

**Assistant Professor**, Department of Meteorology and Climate Science, San Jose State University

2013 Oct – 2015 Aug

**NCAR Advanced Study Program Postdoctoral Fellow**, under direction of *Dr. Jorgen Jensen* (NCAR); in collaboration with Drs. *Andrew J. Heymsfield, Laura Pan, George Bryan* and *Hugh Morrison*

- 1) Comparisons between aircraft-based observations and different scales of numerical modeling on cirrus cloud formation using a cloud-resolving model (CM1), the Weather Research and Forecasting (WRF) model and the NCAR Community Atmosphere Model (CAM5)
- 2) Hemispheric differences of ice supersaturation and ice crystals based on in-situ observations
- 3) Influences of clean vs. polluted air on ice clouds based on global-scale observations
- 4) Multi-scale dynamical influences on the formation of ice crystals and ice supersaturation, including small waves/turbulences, mesoscale uplift, and stratosphere-troposphere mixing

2008 - 2013

**Graduate Research Assistant**, under direction of *Prof. Mark A. Zondlo* (Princeton University)

- 1) Laboratory calibrations of the Vertical Cavity Surface Emitting Laser (VCSEL) hygrometer
- 2) NASA AIRS/AMSU-A water vapor and temperature validations by in-situ aircraft observations
- 3) Data analyses foci:
  - a. Provide fine-grained, Pole-to-Pole distributions of water vapor and relative humidity
  - b. Understand the microscale spatial variabilities of ice supersaturation and cirrus clouds
  - c. Derive a novel method to get an evolutionary view of cirrus cloud formation and evolution from Eulerian view observations
  - d. Separate aerosol influences on ice nucleation and ice crystal properties from other variables' influences

2007 - 2008

**Undergraduate Research Assistant** with *Prof. Maosheng Yao* (Peking University)

Laboratory experiment on inactivating gram-positive *Bacillus subtilis* var. *niger*, gram-negative *Pseudomonas fluorescens* bacteria, and the fungus *Aspergillus versicolor* with nanoscale zero-valent iron (NZVI) particles

## Honors and Awards

- 2013 - 2015 National Center for Atmospheric Research (NCAR) Advanced Study Program (ASP) postdoctoral fellowship
- 2012 Walbridge Fund Graduate Award from Princeton Environmental Institute (PEI) at Princeton University (*Award to PhD students at the graduation year*)
- 2012 Princeton Environment and Climate Scholars (PECS) Grant (*Funded my trip to the Rio+20 United Nation Conference on Sustainability at Rio de Janeiro, Brazil*)
- 2008 - 2012 NASA Earth and Space Science (NESSF) Fellowship
- 2008 - 2012 Francis Robbins Upton Graduate Fellowship at Princeton University (*One of the two highest graduate fellowships given by the School of Engineering and Applied Science at Princeton University*)
- 2010 Outstanding Student Paper Award, American Geophysical Union 2010 Fall Meeting, San Francisco; Atmospheric Sciences Section, titled as: "Ice Supersaturated Regions Formed by the Inhomogeneities of Water Vapor Field in the Upper Troposphere in START08 and HIPPO Global Campaigns"
- 2009 Outstanding Student Paper Award, American Geophysical Union 2009 Spring Assembly, Toronto; Atmospheric Sciences Section, titled as: "In-situ measurements of ice supersaturation in the upper troposphere in START08 campaign"
- 2009 NSF Travel Award to Water Vapor and Climate System (WAVACS) summer school, Corsica, France
- 2008 Honored Bachelor Thesis and Honored Bachelor at Peking University
- 2007 Award of Jun-Tsung Scholar and Jun-Tsung Fellowship, Tsinghua University, Taiwan (*Awarded by the Nobel Prize Winner Tsung-Dao Lee to undergraduate students in China*)
- 2006 Scholarship of Lin Chao Geography Award at Peking University
- 2005 Scholarship of Bao Gang Education Foundation at Peking University (*First prize to undergraduate students in Science departments*)

## Research interests

Anthropogenic influences on ice crystal properties and cirrus clouds' radiative forcing  
Aircraft-based and remote sensing observations of water vapor, ice crystals and aerosols  
Numerical modeling of cloud dynamics and microphysical properties  
Multi-scale dynamical influences on ice supersaturation and ice crystal formation  
Aerosol indirect effects on cirrus cloud's formation and evolution from natural and anthropogenic sources

## Field Experience

- 2008 - 2011      **NSF HIAPER Pole-to-Pole Observations (HIPPO)** global campaign deployment #1-5  
*USA, New Zealand and Australia*  
Four-year field work with five HIPPO deployments at multiple sites  
Laboratory calibration and field maintenance of the open-path VCSEL laser hygrometer onboard the NSF/NCAR Gulfstream-V (GV) research aircraft  
Participating in all HIPPO science meetings; presenting the results in multiple conferences
- April 2013      **AQUAVIT-2** campaign at Karlsruhe Institute of Technology (KIT), *Karlsruhe, Germany*  
Calibration of the VCSEL hygrometer and the RHS chilled mirror system during the intercomparison campaign of water vapor instruments at the AIDA cloud chamber
- May 2012      **NSF Deep Convective Clouds & Chemistry Experiment (DC3)** campaign, *Kansas, US*  
Field maintenance and calibration of the VCSEL hygrometer on the NSF/NCAR GV
- Jan/Feb 2012    **NSF Tropical Ocean Troposphere Exchange of reactive halogen species and oxygenated VOC (TORERO)** campaign, *Costa Rica and Chile*  
Laboratory calibration of VCSEL laser hygrometer before and after the flight campaign
- September 2010    **NSF Pre-Depression Investigation of Cloud-systems in the Tropics (PREDICT)** campaign, *US Virgin Islands*  
QA/QC of water vapor data; data analyses of ice crystal and ice supersaturation,
- April-June 2008    **NSF Stratosphere-Troposphere Analyses of Regional Transport (START08)** campaign, *Colorado, US*  
QA/QC of VCSEL data; data analyses of GFS model meteorological background

## Funding sources (sum of funding: \$423,800)

1. 2008-2012 NASA NESSF graduate fellowship NNX09AO51H (\$30,000 + \$3000 travel per year for 3 years): Funded my research on the validation of NASA AIRS retrievals of water vapor and temperature with aircraft-based observations; funded my travels during the NSF HIPPO Global deployment 2-5.
2. 2008-2012 Princeton University waived tuition for graduate students winning external funding (\$35,500 per year for 3 years).
3. 2008-2012 Princeton University Francis Upton fellowship (\$4000 extra upon stipend for 4 years; \$1000 campus visiting trip fund)
4. 2008-2009 Princeton University fellowship to first year graduate student with waived tuition (\$30,000+\$35,500 for one year).
5. 2009 NSF Student Travel Award (\$1500): Funded my participation in the Water Vapor and Climate System (WAVACS) summer school in France
6. 2012-2013 Princeton Environment and Climate Scholars (PECS) Grant (\$1000): Funded my trip to the Rio+20 United Nation Conference on Sustainability at Rio de Janeiro, Brazil in April 2012; funded my visits to IIT, Mumbai and College of Engineering at Pune, India in May-June 2013.

7. 2012-2013 Walbridge Fund Graduate Award (\$7000): Funded my participation in the AQUAVIT-2 campaign at Karlsruhe, Germany; funded my computing resources for the hemispheric comparisons using the NSF HIPPO global campaign dataset; funded my visit to the DOE ARM site at Cape May, MA during DOE TCAP campaign.
8. 2013 NCAR Advanced Study Program (ASP) postdoctoral fellowship (\$57,500 + \$3000 for two years): Funded my participations in the AGU 2013 and 2014 Fall meetings in San Francisco, CA, and the AMS 14<sup>th</sup> Cloud Physics conference in Boston, MA; Funded my two-year postdoc research at NCAR.
9. 2013-2014 NCAR extra travel fund (\$2000): funded my travel to AMS 14th Cloud Physics conference, Boston, and AMS 27th Conference on Weather Analysis and Forecasting (WAF), Chicago.

## Publications

1. Diao, M., J.B. Jensen, L.L. Pan, E. Jensen, C.R. Homeyer, S. Honomichl, J.F. Bresch and A. Bansemer. “Distributions of ice supersaturation and ice crystals from airborne observations in relation to upper tropospheric dynamical boundaries”, *Journal of Geophysical Research: Atmosphere*, 120, 5101–5121. doi: 10.1002/2015JD023139, 2015.
2. Diao, M., M.A. Zondlo, A.J. Heymsfield and S.P. Beaton. “Hemispheric comparison of cirrus cloud evolution using in situ measurements in HIAPER Pole-to-Pole Observations”, *Geophysical Research Letters*, doi:10.1002/2014GL059873, 2014.
3. Diao, M., M.A. Zondlo, A.J. Heymsfield, L.M. Avallone, M.E. Paige, S.P. Beaton, T. Campos and D.C. Rogers. “Cloud-scale ice supersaturated regions spatially correlate with high water vapor heterogeneities”, *Atmospheric Chemistry and Physics*, 14, 2639-2656, 2014.
4. Diao, M., M.A. Zondlo, A.J. Heymsfield, D.C. Rogers and S.P. Beaton. “Evolution of ice crystal regions on the microscale based on in situ observations”, *Geophysical Research Letters*, 40 (13), 3473-3478, doi: 10.1002/grl.50665, 2013.
5. Diao, M., L. Jumbam, J. Sheffield, E. Wood and M.A. Zondlo. “Validation of AIRS/AMSU-A water vapor and temperature data with in situ aircraft observations from surface to UT/LS at 87°N–67°S”, *Journal of Geophysical Research: Atmospheres*, 118 (12), 6816–6836, 2013.
6. Cziczo, D.J., K.D. Froyd, C. Hoose, E.J. Jensen, M. Diao, M.A. Zondlo, J.B. Smith, C. Twohy and D.M. Murphy. “Cirrus clouds form predominantly on mineral dust and metallic aerosol, not elemental carbon or biological particles”, *Science*, 340 (6138), 1320–1324, 2013.
7. Kort, E.A., S.C. Wofsy, B.C. Daube, M. Diao, J.W. Elkins, R.S. Gao, E.J. Hints, D.F. Hurst, R. Jimenez, F.L. Moore, J.R. Spackman and M.A. Zondlo. “Atmospheric observations of high latitude Arctic Ocean methane emissions”, *Nature Geoscience*, 5, 318-321, 2012.
8. Wofsy, S.C., B.C. Daube, R. Jimenez, E. Kort, J.V. Pittman, S. Park, R. Commane, B. Xiang, G.Santoni, D. Jacob, J. Fisher, C. Pickett-Heaps, H. Wang, K. Wecht, Q.-Q. Wang, B.B. Stephens, B. B.,S. Schertz, P. Romashkin, T. Campos, J. Haggerty, W.A. Cooper, D. Rogers, S. Beaton, J.W. Elkins, D. Fahey, R. Gao, F. Moore,S.A. Montzka, J.P. Schwartz, D. Hurst, B. Miller, C. Sweeney, S. Oltmans, D. Nance, E.F. Hints, G. Dutton, L.A. Watts, R. Spackman, K. Rosenlof, E. Ray, M.A. Zondlo, M. Diao, M.J. Mahoney, M. Chahine, E. Olsen, R. Keeling, J. Bent, E.A. Atlas, R. Lueb, P. Patra, K. Ishijima, R. Engelen, R. Nassar, D.B. Jones, and S. Mikaloff-Fletcher. “HIAPER Pole-to-Pole Observations (HIPPO): Fine grained, global scale

measurements of climatically important atmospheric gases and aerosols”, *Philosophical Transactions of the Royal Society of London A*, 369 (1943), 2073-2086, 2011.

9. Wunch, D., G. C. Toon, P. O. Wennberg, S. C. Wofsy, B. B. Stephens, M. L. Fischer, O. Uchino, J. B. Abshire, P. Bernath, S. C. Biraud, J.-F. L. Blavier, C. Boone, K. P. Bowman, E. V. Browell, T. Campos, B. J. Connor, B. C. Daube, N. M. Deutscher, M. Diao, J. W. Elkins, C. Gerbig, E. Gottlieb, D. W. T. Griffith, D. F. Hurst, R. Jiménez, G. Keppel-Aleks, E. A. Kort, R. Macatangay, T. Machida, H. Matsueda, F. Moore, I. Morino, S. Park, J. Robinson, C. M. Roehl, Y. Sawa, V. Sherlock, C. Sweeney, T. Tanaka, and M. A. Zondlo. “Calibration of the Total Carbon Column Observing Network using aircraft profile data”. *Atmos. Meas. Tech.*, 3, 1351-1362, 2010.
10. Diao, M. and M. Yao. “Use of Zero-Valent Iron Nanoparticles in Inactivating Microbes”, *Water Research*, 43:5243-5251, 2009.

### Manuscripts in preparation

11. Diao, M., J.B. Jensen, G. Bryan, H. Morrison and D. Stern. “Comparing cirrus cloud formation and evolution using in-situ aircraft observations and a cloud resolving model”, in preparation to *Journal of Geophysical Research: Atmosphere*.
12. Diao, M., U. Schumann, A. Minikin and J.B. Jensen. “Influences of clean and polluted air on ice crystal formation based on in situ observations on a global scale”, in preparation to *Geophysical Research Letters*.

### Ph.D. Thesis

Minghui Diao. (Adviser: Mark A. Zondlo). Ice supersaturation and cirrus cloud formation from global in-situ observations. Princeton University, 2013.

PDF download: <http://dataspace.princeton.edu/jspui/handle/88435/dsp01q524jn894>

### Presentations and Posters

1. Diao, M., J.B. Jensen, G. Bryan, H. Morrison and D. Stern. Comparing cirrus cloud formation and evolution using in-situ aircraft observations and a cloud-resolving model. AGU Fall meeting, December 17 2014, San Francisco (poster #A31I-3123).
2. Diao, M., J.B. Jensen, L.L. Pan, C.R. Homeyer, S. Honomichl, J.F. Bresch, A. Bansemmer and E. Jensen. Distributions of ice supersaturation and ice crystals from airborne observations in relation to upper tropospheric dynamical boundaries. AGU Fall meeting, December 16 2014, San Francisco (poster #A41C-0065).
3. Diao, M. and J.B. Jensen. Cirrus cloud formation and evolution from the microscale to the synoptic scale. EOL Seminar, Aug 5 2014, NCAR Boulder. Oral presentation [http://video.ucar.edu/mms/eol/2014/m\\_diao.mp4](http://video.ucar.edu/mms/eol/2014/m_diao.mp4)
4. Diao, M., J.B. Jensen, L.L. Pan, E. Jensen and C. Homeyer. Dynamical condition of ice supersaturation and ice crystal formation in the extratropical upper troposphere and lower stratosphere. AMS Cloud Physics Meeting, July 9 2014, Boston. Oral presentation (Abstract ID #250736).
5. Diao, M., M.A. Zondo, A.J. Heymsfield and S.P. Beaton. Hemispheric comparison of cirrus cloud evolution using in situ measurements in HIAPER Pole-to-Pole Observations. AMS Cloud Physics Meeting, July 10 2014, Boston. Poster presentation (Abstract ID #250741).

6. Diao, M. “Do cirrus clouds evolve differently between the Northern and Southern Hemispheres?” School of Environmental Sciences and Engineering, Peking University, January 27 2014, Beijing, China. Oral presentation.
7. Diao, M., J. DiGangi, A. O’Brien and M.A. Zondlo, Ice crystal formation and evolution in five campaigns: START08, HIPPO Global, DC3, PREDICT and TORERO. AGU Fall meeting, December 12 2013, San Francisco (poster #A41C-0065).
8. Diao, M. and M.A. Zondlo, Ice crystal formation and evolution in DC3 campaign. Deep Convection, Clouds and Chemistry (DC3) campaign science meeting, February 25-28 2013, Boulder, CO.
9. Diao, M. and M.A. Zondlo, In-situ aircraft observations of ice supersaturation and cirrus clouds in global field studies. AGU Fall meeting, December 5 2012, San Francisco (Oral presentation #A32A-06).
10. Diao, M. and M.A. Zondlo, In-situ aircraft observations of ice supersaturation and cirrus clouds in global field studies. Princeton Research Symposium, December 1 2012.
11. Diao, M. L. Jumbam, J. Sheffield, E. Wood and M.A. Zondlo. Water vapor and temperature comparisons between AIRS/AMSU-A and in situ aircraft observations from 87°N to 67°S and sensitivities to spatial and temporal differences. NASA Sounder Science Team Meeting 2012, Greenbelt, Maryland, November 14 2012.
12. Diao, M. and M.A. Zondlo. Aircraft *in situ* observations of cirrus cloud formation in the Northern and Southern Hemispheres. Goddard Institute of Space Science (GISS), New York City, August 2012 (INVITED)
13. Diao, M. and M.A. Zondlo. Ice supersaturation and cirrus clouds in HIPPO Global Campaign #1-5. HIPPO Global Campaign science meeting, NOAA, Boulder, March 2012.
14. Diao, M., M. A. Zondlo, L. L. Pan and E. Jensen. In-situ observations of ice cloud formation from ice supersaturated regions. AGU Fall meeting, San Francisco, December 2011.
15. Diao, M. and M.A. Zondlo. Comparisons of VCSEL and AIRS /AMSU-A on water vapor and temperature in HIPPO#1. HIPPO Science Meeting, March 2011.
16. Diao, M. and M.A. Zondlo. Ice Supersaturated Regions Formed by the Inhomogeneities of Water Vapor Field in the Upper Troposphere in START08 and HIPPO Global Campaigns. AGU Fall meeting, San Francisco, December 2010 (Outstanding Student Paper Award for AGU 2010 Fall Meeting)
17. Diao, M. and M.A. Zondlo. In situ measurements of ice supersaturation in the upper troposphere in START08 campaign. AGU Joint Assembly, Toronto, Canada, May 2009 (Outstanding student presentation award for AGU 2009 Joint Assembly).
18. Diao, M. and M.A. Zondlo. Ice supersaturations from the VCSEL Hygrometer in HIPPO Global and START08 Campaigns. Water Vapor and Climate System (WAVACS) summer school, Corsica, France, September 2009.

### Teaching and mentoring experience

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|-------------|---|
| 2015 Fall   | “Global Climate Change”, two sections, undergraduate general education classes at San Jose State University   |
| 2011 Spring | Guest lecturer: Water in the Atmosphere (GEO 523); Department of Geosciences, Princeton University <ol style="list-style-type: none"><li>a. Graduate level class (~10 students) with Professor Stephan A. Fueglistaler</li><li>b. Introduction to atmospheric measurements of water vapor</li></ol>   |
| 2011-2012   | Mentor for Princeton undergraduate thesis research (Garnet Abrams, Department of Geosciences) <ol style="list-style-type: none"><li>a. Mentoring field work and data QA/QC during HIPPO campaign deployment #4 in Boulder Colorado and Kona Hawaii, USA</li><li>b. Mentoring observational analysis on the HIPPO datasets, which was presented by Garnet Abrams in AGU Fall 2011 Meeting in oral presentation</li></ol> |

- 2010-2011 Mentor for Princeton undergraduate thesis research (Nicole McAndrew, Department of Chemical and Biological Engineering)
- Mentoring the undergraduate thesis research on building a portable laser absorption cell by using a near-infrared, fiber optic laser and a multipass herriott absorption cell
  - Calibrating the portable laser absorption cell with a chilled mirror hygrometer and a temperature bath system
  - Comparing between the laser absorption cell and the airborne VCSEL hygrometer with laboratory calibrations
- 2010-2012 Mentor for two high school students on summer research through the Young Science Achievers Program (YSAP) at Princeton University

### **Professional Organizations:**

American Geophysical Union 2008-present

### **News highlights and outreach activities**

- 2014-Sep NCAR Newsletter featured story: Atmospheric science: from research to the real world. [http://www.asp.ucar.edu/asp\\_update/14/September2014.pdf](http://www.asp.ucar.edu/asp_update/14/September2014.pdf)
- 2013-May Princeton Energy and Climate Scholars (PECS) international trip  
Presented my research at the seminar on campus sustainability with College of Engineering at Pune (COEP) at Pune; Organized discussions with professors at India Institute of Technology (IIT) on climate and energy issues at Mumbai, India.
- 2013-Apr North Star academy high school career open day  
Volunteered to do presentations about Princeton university graduate school application process, grad student life and academic career path introduction.
- 2012-Aug Research highlighted in Princeton School of Engineering and Applied Sciences (SEAS) Equad News, Summer 2012, Volume 24, Issue 1
- 2012-May Research highlighted in Princeton Environmental Institute website for 2012 Walbridge Award: <http://www.princeton.edu/pei/news/archive/?id=7498>
- 2010-2012 Graduate Student Chair at Civil and Environmental Engineering Department  
Organized student activities and seminars
- 2012 Jun Rio+20 United Nations Conference on Sustainable Development at Rio de Janeiro, Brazil  
Organized a UN Side events side event during Rio+20 conference  
Organized a workshop at the Pontificia Universidade Catolica (PUC) at Rio de Janeiro
- 2011-Dec Research highlighted in Princeton Environmental Institute website: <http://www.princeton.edu/pei/news/archive/?id=6300>
- 2010-Fall Research highlighted in Princeton SEAS Equad News, "Round-the-world mission puts greenhouse gases in laser focus": [http://blogs.princeton.edu/equadnews/pdf/EQuad\\_Winter10-web.pdf](http://blogs.princeton.edu/equadnews/pdf/EQuad_Winter10-web.pdf)
- 2010-Jul Research highlighted on Princeton homepage news: <http://www.princeton.edu/main/news/archive/S27/92/27Q94/index.xml?section=mm-featured#top>
- 2010-Apr Research highlighted in Princeton Alumni Weekly, issue April 07 2010