# Daniel A. Rothenberg

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## Education

**Massachusetts Institute of Technology,** Cambridge, MA
Ph.D., Atmospheric Science, Dept. of Earth, Atmospheric and Planetary Sciences — 2016
*Committee*: Chien Wang, Dan Czizco, Paul O'Gorman, Steve Ghan
*Dissertation Title*: Fundamental Aerosol Interactions and the Aerosol Indirect Effect on Climate

**Cornell University,** Ithaca, NY
B.S., Atmospheric Science, *magna cum laude*, Honors in Research — 2010
*Thesis Advisor*: Natalie Mahowald
*Thesis Title*: Volcano Impacts on Climate and Biogeochemistry

## Honors and Awards

Outstanding Student Presentation Award (†), AMS — 2015
National Science Foundation Graduate Research Fellowship, NSF — 2012
National Defense Science And Engineering Fellowship, ASEE (*declined*) — 2012
Father James B. Macelwane Award in Meteorology, AMS — 2011
Klein Fellowship, MIT-EAPS — 2011
Charney Prize, MIT-EAPS — 2011
Academic Excellence Award - Atmospheric Science, Cornell/CALS — 2011
Richard and Helen Hagermeyer Scholarship, AMS — 2010

## Research Experience

**Program in Atmospheres, Oceans, and Climate,** MIT, Cambridge, MA
*Research Assistant* — 2011-present
Used novel uncertainty quantification techniques to develop emulator of droplet activation for parameterization in global models
Developed an open-source, modular parcel modeling framework for studying droplet activation from diverse aerosol populations and for evaluating activation schemes
Used global climate models (CESM, CMIP5 archive, AEROCOM Indirect Effects Experiment) to study aerosol indirect effects and aerosol-cloud interactions
Participated in Fifth Ice Nucleation Workshop Part 2 in Karlsruhe, Germany; assisted with the operation of the Spectrometer for Ice Nucleation (SPIN) and developed software for automating the instrument and designing experiment setups

**Department of Earth and Atmospheric Sciences,** Cornell University, Ithaca, NY
*Undergraduate Research Assistant* — 2008-2011
Studied biogeochemical/climate processes and interactions with a coupled carbon-climate model
Performed and analyzed fully-coupled model simulations studying transient climate change in the 20th century

**Center for Multiscale Modeling of Atmospheric Processes,** Colorado State University, Fort Collins, CO
*Summer Intern* — summer 2010
Implemented end evaluated a baroclinic instability test case on a very high resolution global atmospheric dynamical core, identifying numerical problems
Developed novel visualization tools for analyzing model data on geodesic computational meshes

## Professional Activities

**Rossbypalooza**, Climate/Statistics Summer School, University of Chicago, Chicago, IL — Summer 2016
**NSPG**, STEM on the Hill Congressional Visits Day, Washington, DC — Spring 2015
**AMS**, Weather Water and Climate Day, Washington, DC — June 2015
**AMS**, 7th Annual Geosciences Congressional Visits Day, Washington, DC — September 2014

**AMS**, Summer Policy Colloquium, Washington, DC — SUMMER 2014
**MIT/SPI**, ASTE Science/Engineering Congressional Visits Day, Washington, DC — SPRING 2012/2014
**CMMAP/NCAR/NCEP**, Summer School on Atmospheric Modeling, Boulder, CO — SUMMER 2010

## Teaching Experience

*Graduate*

**Global Warming Science (12.340x)** — SPRING 2016
MIT-EdX and MIT, Department of Earth, Atmospheric and Planetary Sciences
Teaching Assistant

**Atmospheric Physics and Chemistry (12.806/12.306)** — SPRING 2014-2015
MIT, Department of Earth, Atmospheric, and Planetary Sciences
Teaching Assistant

**"Climate Change Science" IAP Seminar** — WINTER 2011-2013
MIT, Joint Program on the Science and Policy of Global Change
Lecturer

*Undergraduate*

**Object-Oriented Programming and Data Structures (CS 2110)** — 2009-2010
Cornell University, Department of Computer Science
Course Consultant, Teaching Asssitant

## Leadership and Service

**Pangeo-data**
Founding Member and Developer — 2016

**Student Conference Planning Committee**
American Meteorological Society
Co-Chair — 2015-2016
Session Chair — 2011-2014

**Graduate Climate Conference Executive Committee**
MIT/Woods Hole Oceanographic Institution/University of Washington
Co-Chair — 2013
Steering Committee Member — 2015
Advisor; Fundraising Chair — 2015

**Atmospheric Sciences Seminar Committee**
MIT Department of Earth, Atmospheric, and Planetary Sciences
Member — 2012-2014
Chair — 2014-2015

**Reviewer**
Journal of Geophysical Research - Atmospheres — 2014-PRESENT

**Science Policy Initiative Executive Committee** — 2013-PRESENT
Massachusetts Institute of Technology

**/r/science Moderator** — 2010-2011, 2016-PRESENT
Reddit (volunteer)

## Work Experience

**Google / Ravenbrook Software** — 2011
Contract Developer

Ported a high-performance algorithm used in surface temperature analysis at the National Climatic Data Center from Fortran to Python
Developed extensive documentation and test suite for algorithm
Identified and corrected numerous numerical and programming bugs and validated algorithm against synthetic datasets

**Orion Network Services** 2006-2007
Software Developer
Developed an online river flooding visualization tool for NOAA using ArcGIS and other scripting tools

## Publications

*Refereed/Peer-Reviewed*

1. **Rothenberg, D.**, Wang, C., and Avramov, A.: Fundamental aerosol-cloud interactions and their contribution to uncertainty in modeling the indirect effect. (*in prep*)
2. **Rothenberg, D.**, Wang, C., and Avramov, A.: Development and assessment of a droplet activation metamodel for the CESM/MARC aerosol-climate model. (*in prep*)
3. Garimella, S., **Rothenberg, D.**, Wang, C., Cziczo, D. J.: How uncertainty in field measurements of ice nucleating particles influences modeled cloud forcing. (*in prep*)
4. Garimella, S., **Rothenberg, D.**, Wang, C., Rösch, M., Wolf, M. J., Cziczo, D. J.: Uncertainty in counting ice nucleating particles with continuous flow diffusion chambers, Atmos. Chem. Phys., (*in review*)
5. Garimella, S., Kristensen, T. B., Ignatius, K., Welti, A., Voigtländer, J., Kulkarni, G. R., Sagan, F., Kok, G. L., Dorsey, J., Nichman, L., **Rothenberg, D.**, Rösch, M., Kirchgäßner, A., Ladkin, R., Wex, H., Wilson, T. W., Ladino, L. A., Abbatt, J. P. D., Stetzer, O., Lohmann, U., Stratmann, F., and Cziczo, D. J.: The SPectrometer for Ice Nuclei (SPIN): An instrument to investigate ice nucleation, Atmos. Meas. Tech, doi:10.5194/amt-9-2781-2016, 2016.
6. **Rothenberg, Daniel** and Chien Wang: Metamodeling of Droplet Activation for Global Climate Models, J. Atmos. Sci., 73, 1255–1272. doi:10.1175/JAS-D-15-0223.1, 2016
7. **Rothenberg, D.**, Mahowald, N., Lindsay, K., Doney, S. C., Moore, J. K., and Thornton, P.: Volcano impacts on climate and biogeochemistry in a coupled carbon–climate model, Earth Syst. Dynam., 3, 121-136, doi:10.5194/esd-3-121-2012, 2012.
8. Mahowald, N., Lindsay, K., **Rothenberg, D.**, Doney, S. C., Moore, J. K., Thornton, P., Randerson, J. T., and Jones, C. D.: Desert dust and anthropogenic aerosol interactions in the Community Climate System Model coupled-carbon-climate model, Biogeosciences, 8, 387-414, doi:10.5194/bg-8-387-2011, 2011.
9. Mahowald, N. M., Kloster, S., Engelstaedter, S., Moore, J. K., Mukhopadhyay, S., McConnell, J. R., Albani, S., Doney, S. C., Bhattacharya, A., Curran, M. A. J., Flanner, M. G., Hoffman, F. M., Lawrence, D. M., Lindsay, K., Mayewski, P. A., Neff, J., **Rothenberg, D.**, Thomas, E., Thornton, P. E., and Zender, C. S.: Observed 20th century desert dust variability: impact on climate and biogeochemistry, Atmos. Chem. Phys., 10, 10875-10893, doi:10.5194/acp-10-10875-2010, 2010.

## Presentations and Talks

*Conference Posters*

**Rothenberg, D.**, Wang, C. and Avramov, A.: Impacts of Droplet Activation on Fast and Slow Responses in a Coupled Aerosol-Climate Model. Gordon Research Seminar/Conference. Bates College, ME. 2015 | PDF

**Rothenberg, Daniel** and Chien Wang. Assessing the sensitivity of global aerosol indirect effects to activation treatment. Graduate Climate Conference, University of Washington. Seattle, WA. 2014

**Rothenberg, Daniel** and Chien Wang. A Novel Parameterization of Droplet Activation Suitable for Global Climate Models. 14th Conference on Cloud Physics, American Meteorological Society. Boston, MA. 2014 | PDF

**Rothenberg, Daniel** and Chien Wang. A Novel Parameterization of Droplet Activation Suitable for Global Climate Models. CENSAM Workshop. Singapore. 2014

**Rothenberg, Daniel** and Chien Wang. Evaluating the Role of Aerosol Mixing State in Cloud Droplet Nucleation using a New Activation Parameterization. 94th Annual Meeting of the American Meteorological Society, Sixth Symposium on Aerosol-Cloud-Climate Interactions. Atlanta, GA. 2013. | PDF

**Rothenberg, Daniel** and Chien Wang. Global Climate Response to Enhanced Anthropogenic Aerosol Emissions in a "hazy world" Experiment with the CESM. 6th Graduate Climate Conference. 2013.

**Rothenberg, Daniel** and Ross Heikes. A baroclinic instability test case on an anelsatic dynamical core. 91st Annual Meeting of the American Meteorological Society, 24th Conference on Weather and Forecasting/20th Conference on Numerical Weather Prediction. Seattle, WA. 2012.

*Invited Talks*

**Rothenberg, D.**, Avramov, A., Wang, C., Garimella, S., Wolf, M., and Cziczo, D. Understanding Fundamental Aerosol-Cloud Interactions and their Contributions to the Aerosol Indirect Effect. NOAA Geophysical Fluid Dynamics Laboratory. Princeton, NJ. 2016

*Conference Talks*

**Rothenberg, Daniel**. A Python-based Parcel Model Framework for Studying Aerosol-Cloud Processes. Sixth Symposium on Advances in Modeling and Analysis Using Python. New Orleans, 2016. | PDF

**Rothenberg, Daniel**, Chien Wang and Alexander Avramov. On the Sensitivity of Model-derived Estimates of Aerosol Indirect Effects and Forcings to Activation Schemes. 96th Annual Meeting of the American Meteorological Society, Eighth Symposium on Aerosol-Cloud-Climate Interactions. New Orleans, LA. 2016.

† **Rothenberg, Daniel**, Chien Wang and Alexander Avramov. Evaluating Advanced Aerosol Activation Treatments in a Coupled Climate/Mixing-State Resolving Aerosol Model. 95th Annual Meeting of the American Meteorological Society, 7th Symposium on Aerosol-Cloud-Climate Interactions. Phoenix, AX. 2015. | PDF

**Rothenberg, Daniel** and Chien Wang. Evaluating the Role of Aerosol Mixing State in Cloud Droplet Nucleation using a New Activation Parameterization. American Geophysical Union Fall Meeting, (A34D-03). 2013.

**Rothenberg, Daniel** and Chien Wang. Cloud and Climate Impacts in a Hazy World Simulation. 93rd Annual Meeting of the American Meteorological Society, 5th Symposium on Aerosol-Cloud-Climate Interactions. Austin, TX. 2014.

**Rothenberg, Daniel** and Nick Barnes. Lessons From Deploying the USHCN Pairwise Homogenization Algorithm in Python. 92nd Annual Meeting of the American Meteorological Society, Second Symposium on Advances in Modeling and Analysis Using Python. New Orleans, LA. 2012

*Note: annotations (†, etc) correspond to "Honors and Awards" section.*

## Professional Affiliations

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| American Meteorological Society | 2010-PRESENT |
| American Physical Society | 2011-PRESENT |
| American Geophysical Union | 2013-PRESENT |
| Association for Computing Machinery | 2011-2012 |

## Technical Skills

*Note: Please visit my Github page for examples of projects implementing these skills*

**Data Science** - Python (*expert*), Matlab, Java, d3.js, git/hg/svn
**Numerical Modeling** - Python/Cython/Numba, legacy/modern Fortran, C/C++/CUDA (*familiar*); emphasis on scientific software design and application of software engineering to numerical codes/tools
**Atmospheric/Climate Models** - pyrcel, CESM, MIT-CRM, WRF (*familiar*)

**High-Performance Computing** - NCAR supercomputers (bluefire/yellowstone); previously worked on NERSC and Oak Ridge systems
**Web Design** - Django, ghost, HTML/CSS

## Personal Interests

Violin performance - classical (18 years), Winter sports, Backpacking/hiking, Software development/engineering, Meteorology education/forecasting, Debate and rhetoric, Science/Innovation policy

*Last Updated*: November 7, 2016