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

Center for Global Change Science, MIT, Cambridge, MA
Postdoctoral Associate   2016-PRESENT
Studying interactions between air quality, climate variability and climate change funded through an EPA Air Quality, Climate, and Energy Center grant, supervised by Noelle Selin and Susan Solomon
Analyzed large ensemble of IGSM/GEOS-Chem simulations to understand state-dependence of climate penalty calculations
Studied potential short-term policy impacts on air quality, health and the economy using a novel integrated assessment framework

Program in Atmospheres, Oceans, and Climate, MIT, Cambridge, MA
Research Assistant   2011-2016
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 Assistant

LEADERSHIP AND SERVICE

Annual Meeting Oversight Committee
American Meteorological Society
    Member   2017-PRESENT

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
Atmospheric Chemistry and Physics

Science Policy Initiative Executive Committee   2013-2016
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.**, Garcia-Menendez, F., Solomon, S., and Selin, N.: Quantifying the "time of emergence" of air quality climate penalties (*in prep*)
2. Garimella, S., **Rothenberg, D.**, Wolf, M. J., Zawadowicz, M. A., Froyd, K. D., Murphy, D. M., Wang., C., and Czizco, D. J.: A previously unrealized climate and health co-benefit from reduced coal fly ash emissions (*in prep*)
3. **Rothenberg, D.**, Wang, C., and Avramov, A.: On the representation of aerosol activation and its influence on model-derived estimates of the aerosol indirect effect. (*in review*)
4. Garimella, S., **Rothenberg, D.**, Wang, C., Cziczo, D. J.: How uncertainty in field measurements of ice nucleating particles influences modeled cloud forcing. (*in review*)
5. Garimella, S., **Rothenberg, D.** A., Wolf, M. J., David, R. O., Kanji, Z. A., Wang, C., Roesch, M., and Cziczo, D. J.: Uncertainty in counting ice nucleating particles with continuous diffusion flow chambers, Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-1180, 2017.
6. **Rothenberg, Daniel** and Chien Wang: An aerosol activation metamodel of v1.2.0 of the pyrcel cloud parcel model: development and offline assessment for use in an aerosol–climate model, Geosci. Model Dev., 10, 1817-1833, doi:10.5194/gmd-10-1817-2017, 2017.
7. 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.

8. **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

9. **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.

10. 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.

11. 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.

Other

1. **Rothenberg, Daniel**: Seeing through the haze to learn how clouds shape climate. Physics Today, doi:10.1063/PT.5.4027. February 2, 2017.

Software

1. xbpch: xarray interface for bpch files. doi:10.5281/zenodo.584153. Last Updated: v0.3.0, May, 2017.
2. pyrcel: cloud parcel model. doi: 10.5281/zenodo.163265. Last Updated: v1.3.0, October, 2016.
3. experiment: managing geophysical modeling experiment output (*in prep*)

PRESENTATIONS AND TALKS

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, D., Wang, C., and Avramov, A. Contributions of Uncertainty in Droplet Nucleation to the Indirect Effect in Global Models. AGU Fall Meeting. San Francisco, 2016. | PPTX

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, D., Wang, C., and Avramov, A. 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

Conference Posters

Rothenberg, Daniel and Chien Wang. Assessing Regional Differences in Aerosol-Cloud Interactions and their Contribution to the Global Indirect Effect. 97th Annual Meeting of the American Meteorological Society, Ninth Symposium on Aerosol-Cloud-Climate Interactions. Seattle, WA. 2017. | PDF

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 anelastic 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.

Technical and Programming Talks

Rothenberg, Daniel. Basic Pandas. 97th Annual Meeting of the American Meteorological Society, Seventh Symposium on Advances in Modeling and Analysis Using Python. Seattle, WA. 2017

Public Talks and Engagement

What's the Deal with Climate Change? Esplanade Association Lecture Series. Boston, MA. 2017

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

PROFESSIONAL AFFILIATIONS		
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: July 24, 2017