Daniel A. Rothenberg

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Professional Interests

I endeavor to serve as a leader in the weather and climate informatics communities, working to advance the application of new technologies to solve classing problems in our field. Most recently, these include the development of AI and ML tools which might rapidly advance weather forecasting capabilities, and the curation of data and infrastructure which best enable the community to leverage this technology.

Education

Massachusetts Institute of Technology, Cambridge, MA
Ph.D., Atmospheric Science, Dept. of Earth, Atmospheric and Planetary Sciences — Oct 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 — Dec 2010
Thesis Advisor: Natalie Mahowald
Thesis Title: Volcano Impacts on Climate and Biogeochemistry

Selected Research Experience

Center for Global Change Science, MIT, Cambridge, MA
Postdoctoral Associate — Dec 2016-Sep 2017

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

Department of Earth and Atmospheric Sciences, Cornell University, Ithaca, NY
Undergraduate Research Assistant — Feb 2008-Jun 2011

Work Experience

OpenEarthAI
Co-founder, Head of Data and Weather — 2024-present
Building open technologies for Earth System AI to benefit society.

Earthmover.io
Advisor — 2024-present

Google Research
Staff Software Engineer (Bungee) — November 2023-December 2023

Waymo
Technical Lead, Atmospheric Science (Staff Software Engineer) — July 2021-October 2023

Tomorrow.io (formerly ClimaCell)
Advisor — July 2021-October 2021
Chief Scientist — Sep 2018-July 2021
Director of Meteorology — Aug 2017-Sep 2018

Google / Ravenbrook Software — summer 2011
Contract Developer, Google Summer of Code

Orion Network Services — Jul 2006-Aug 2007
Software Developer

Selected Leadership and Service

American Meteorological Society
Artifical Intelligence for the Earth Systems
Associate Editor 2024-PRESENT
Committee on Open Environmental Information Services
Member 2023-PRESENT
Annual Meeting Oversight Committee
Member 2017-2020
Committee on Environmental Information Processing Technologies
Member, Python Symposium Committee 2018-PRESENT

Pangeo-data
Founding Member and Developer 2016-PRESENT
Lead, Data Management Technical Working Group 2018-2021

Science Policy Initiative Executive Committee 2013-2016
Massachusetts Institute of Technology

Selected Publications

Please see my ORCID (0000-0002-8270-4831) for a complete list of relevant publications

Refereed / Peer-Reviewed

1. Silva, S., Ma, P.-L., Hardin, J., **Rothenberg, D.**: Physically Regularized Machine Learning Emulators of Aerosol Activation, Geosci. Model Dev., 14, 3067–3077, doi:10.5194/gmd-14-3067-2021, 2021.
2. Dimanchev, E. G., Paltsev, S., Yuan, M., **Rothenberg, D.**, Tessum, C. W., Marshall, J. D., and Selin, N. E.: Health co-benefits of sub-national renewable energy policy in the US, Environ. Res. Lett. 14, 085012, doi:10.1088/1748-9326/ab31d9, 2019.
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, Atmos. Chem. Phys., doi:10.5194/acp-18-7961-2018, 2018.
4. **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.
5. **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
6. **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.

Software

1. ai-models-for-all: Run AI NWP forecasts hassle-free, serverless in the cloud!. Last Updated: v0.2.0, January, 2024
2. pyrcel: cloud parcel model. doi: 10.5281/zenodo.163265. Last Updated: v1.3.2, September, 2023.
3. MARC: Model for Research of Aerosols and Climate. doi:10.5281/zenodo.1117370. Last Updated: v1.0.4, December, 2017
4. xbpch: xarray interface for bpch files. doi:10.5281/zenodo.584153. Last Updated: v0.3.0, May, 2017.
5. py-mie: Python wrapper for Mie subroutines. doi: Last Updated: v0.4.0, December, 2016
6. experiment: high-performance, distributed processing of large-scale geophysical modeling experiment output. Last Updated: December, 2016
7. Contributor/collaborator: GCPy, xarray, pangeo-data

Selected Presentations and Talks

Invited Talks, Seminars, and Workshops

Enabling US Leadership in Artificial Intelligence for Weather, National Academies of Science, Engineering, and Medicine Board on Atmospheric Sciences, *Invited Speaker*, Washington, D.C., 2024.

Biden-Harris Administration Workshop on Artificial Intelligence and Weather Prediction, *Invited participant*, Washington, D.C., 2024.

Sustainable Science Techniques for Artificial Intelligence in Weather Applications, *Panelist*, AMS Washington Forum, Washington, D.C., 2023

Self-Driving Automated Vehicles - Role of Public and Private Sector, *Panelist*, AMS Washington Forum, Washington, D.C., 2022

Using ML/AI for Data-Driven Decision-making. *Presenter/Panelist*, Machine Learning and Artificial Intelligence to Advance Earth System Science: Opportunites and Challenges, Washington, D.C., 2022

Status of AI in the Atmospheric Sciences. *Panelist*, 18th Conference on Artificial and Computational Intelligence and its Applications to the Environmental Sciences, AMS Annual Meeting, Phoenix, AZ, 2019.

Conference Talks

Rothenberg, Daniel. Enabling Scalable, Serverless Weather Model Analyses by "Kerchunking" Data in the Cloud. AMS Annual Meeting. Baltimore, MD, 2024.

Rothenberg, Daniel. Driving Hyper-Local Weather Information with Autonomous Vehicles. AMS Annual Meeting. Denver, CO, 2023.

Biryukov, S., Minsk, J., and **Rothenberg, D.** Physics-Informed Downscaling, Bias Correction, and Bayesian Probabilistic Ensembling of Weather Forecast Models. AMS Annual Meeting. Houston, TX / Virtual, 2022.

Rothenberg, Daniel. Rapidly Prototyping High-performance Meteorological Data Systems Using Xarray and Numba. Ninth Symposium on Advances in Modeling and Analysis Using Python, AMS Annual Meeting. Phoenix, AZ, 2019.

Rothenberg, Daniel. How JetBlue Airways Uses Microweather Forecasts in Daily Operations, Based on Novel Data Sources, New Nowcasting Models, and Products. 9th Conference on Aviation, Range, and Aerospace Meteorology, AMS Annual Meeting. Phoenix, AZ, 2019.

Rothenberg, D., Garcia-Menendez, F., Solomon, S., and Selin, N. Regional Variation in the Time of Emergence of Air Quality Climate Penalties Under Climate Change Mitigation Scenarios. AMS Annual Meeting. Austin, 2018.

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

Proposed / Chaired Conference Sessions

Weather and Climate data needs for reliable AI. AMS Washington Forum, College Park, MD, 2024.

Multi-sector collaborations and roadblocks. AMS Washington Forum, College Park, MD, 2024.

Pure AI and Data-Driven Weather Forecasts. 23rd Conference on Artificial Intelligence for Environmental Science. AMS Annual Meeting, Baltimore, MD, 2024.

Towards Operationalizing AI/ML Weather Forecast and Decision Support Products. Joint with the 14th Conference on Transition of Research to Operations and 23rd Conference on Artificial Intelligence for Environmental Science AMS Annual Meeting, Baltimore, MD, 2024.

Towards Operationalizing AI-Based Weather Forecast and Decision Support Products. 22nd Conference on Artifical Intelligence for Environmental Science. AMS Annual Meeting, Denver, CO, 2023.

Toward Operational Precipitation and Convective Weather Nowcasting Leveraging Deep Learning. 21st Conference on Artificial Intelligence for Environmental Science. AMS Annual Meeting, Houston, TX / Virtual, 2022

Nowcasting and Short-Term Forecasting Applications Leveraging AI. 20th Conference on Artificial Intelligence for Environmental Science and 11th Symposium on Advances in Modeling and Analysis Using Python. AMS Annual Meeting, Virtual, 2021

Scalable Operational Artificial Intelligence Applications with Python. Ninth Symposium on Advances in Modeling and Analysis Using Python. AMS Annual Meeting, Phoenix, AZ, 2019

Augmented Weather Applications with Artificial Intelligence. AMS Washington Forum, Washington, D.C., 2019

Patents

Rothenberg, Daniel. Improved Forecasting Method with Machine Learning. US Patent US20200132884A1. Pending, April 30, 2020

Elkabetz, S. **et al**. Real-time weather forecasting for transportation systems. US Patent US10962680B2. March 3, 2021.

Elkabetz, S. **et al**. Improved real-time weather forecasting system. World Patent WO2019126707A1. June 27, 2019.

Technical Skills

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

Data Science - Python (*expert*), Spark/dask/MPI, Prefect/Airflow/Argo, Matlab, Java, d3.js, git/hg/svn, R (*familiar*)

AI and Machine Learning - Python (*expert*), TensorFlow/PyTorch/JAX; significant practical experience building CNN- and Transformer-based models for remote sensing and weather forecasting applications; operationalizing AI systems for production use cases

Numerical Modeling - Python/NumPy/Cython/Numba, Julia, legacy/modern Fortran, C/C++/CUDA; emphasis on scientific software design and application of software engineering to numerical codes/tools, as well as the development of high-performance, distributed analysis systems for tera/peta-scale data.

DevOps - Kubernetes, Argo, Helm

Atmospheric/Climate Models - pyrcel, GEOS-Chem/GCHP, CESM, MIT-CRM, WRF (*familiar*)

High-Performance Computing - Google Cloud Platform/Amazon Web Services; NCAR supercomputers (bluefire/yellowstone/cheyenne); previously worked on NERSC and Oak Ridge systems

Web Design - Django, ghost, Pelican, HTML/CSS

Last Updated: July 26, 2024