Abhishek Anand

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Current Position

Lamont-Doherty Earth Observatory, Columbia University New York City, NY

Postdoctoral Research Scientist, Advisor: Prof. Daniel Westervelt *November 2024-Present*

Leveraging satellite remote sensing air pollution datasets, measurements from surface monitors, and ERA5 weather parameters to build ML-based algorithms for deriving high spatiotemporal resolution PM concentrations and health exposures in sub-Saharan Africa.

Education

Carnegie Mellon University Pittsburgh, PA

Doctor of Philosophy in Mechanical Engineering, Advisor: Prof. Albert Presto *May 2024*

Thesis title: Low-cost Techniques to Measure and Predict Air Pollution Exposure

Hong Kong University of Science and Technology Hong Kong

Master of Philosophy, Environmental Science, Policy and Management *August 2020*

Hong Kong University of Science and Technology Hong Kong

Master of Science, Environmental Engineering and Management *May 2017*

Indian Institute of Technology Delhi New Delhi, India

Bachelor of Technology in Civil Engineering *May 2015*

Past Research Experience

Carnegie Mellon University Pittsburgh, PA

Postdoctoral Research Associate, Advisor: Prof. Albert Presto *May 2024-August 2024*

- Analyzed large datasets from instruments at the Pittsburgh site of Atmospheric Science and Chemistry mEasurement NeTwork (ASCENT), a network for high-time-resolution and long-term measurement in the U.S. for characterization of aerosol chemical composition.

Hong Kong University of Science and Technology Hong Kong

Research Assistantship, Advisor: Prof. Zhi Ning *June 2018-August 2018*

- Impact of cross-sensitivity and environmental factors on performance of low-cost gaseous pollutant sensors. The sensors included Alphasense electrochemical gas sensors (CO, NO, NO_2, O_3 and SO_2) and NDIR (Non-Dispersive Infrared) CO_2 sensors.

Hong Kong University of Science and Technology Hong Kong

M.Sc. Student, Advisor: Prof. Irene Man Chi Lo *August 2016-May 2017*

- Synthesis of visible-light-driven magnetic titanium oxide (TiO_2) - based nanophotocatalysts for degradation of persistent organic pollutants in wastewater.

Indian Institute of Technology Delhi New Delhi, India

Research Assistantship, Advisor: Prof. Saroj Kanta Mishra *June 2015-July 2016*

- Analytical study of effects of geographical locations and sizes of mountains on the Indian Monsoon by simulating an Aqua planet on Community Atmosphere Model (v3.0).

Publications

Goldberg, P., **Anand, A.**, Westervelt, D. M. Variable Short-Term Air Quality Impacts of New York City's Congestion Pricing Policy. (*Under Review at Environmental Science & Technology Letters*)

Westervelt, D., Amooli, J. J., **Anand, A.** Twenty Years of High Spatiotemporal Resolution Estimates of Daily PM2.5 in West Africa Using Satellite Data, Surface Monitors, and Machine Learning. *Environmental Science & Technology Air. 2025.*

Anand, A., Touré, N. D. E., Bahino, J., Gnamien, S., Hughes, A. F., Arku, R. E., ... & Presto, A. A. Low-cost hourly black carbon measurements at multiple cities in Africa. *Environmental Science & Technology.* 2024.

Wei, P., Hao, S., Shi, Y., **Anand, A.**, et al. Combining Google traffic map with deep learning model to predict street-level traffic-related air pollutants in a complex urban environment. *Environment International*. 2024.

Anand, A., Kompalli, S., Ajiboye, E., & Presto, A. A. Estimation of hourly black carbon aerosol concentrations from glass fiber filter tapes using image reflectance-based method. *Environmental Science: Atmosphere*. 2023.

Wei, P., Brimblecombe, P., Yang, F., **Anand, A.**, et al. Determination of local traffic emission and non-local background source contribution to on-road air pollution using fixed-route mobile air sensor network. *Environmental Pollution*. 2021.

Anand, A., Wei, P., et al. Protocol development for real-time ship fuel sulfur content determination using drone-based plume sniffing microsensor system. *Science of The Total Environment*. 2020.

Wei, P., Sun, L., **Anand, A.**, Zhang, Q., et al. Development and evaluation of a robust temperature sensitive algorithm for long term NO_2 gas sensor network data correction. *Atmospheric Environment*. 2020.

Accepted Proposals

P20 CHART Center Pilot Projects Program (P3), Columbia University.
$40,000 **(Lead–PI)**. 1/1/2026–12/31/2026. Mapping the air pollution and heat stress data gap in Africa: low-cost source apportionment and high spatiotemporal resolution datasets.

Climate School Summer Internship Funding Program, Columbia University.
$6,000 **(Lead–PI)**. 6/1/2025–8/31/2025. Funding for hiring interns in Summer 2025 to work on projects related to climate, sustainable development and the environment.

Dowd Fellowship, Carnegie Mellon University.
$100,000 **(Lead–PI)**. 9/1/2022–8/31/2023. Covered my tuition and monthly stipend for one academic year during Ph.D.

Fellowships and Awards

Jane Warren Award, Health Effects Institute 2026

Winner, Hackathon on Applying Machine Learning for Subseasonal-to-Seasonal Climate Predictions, LEAP, Columbia University. 2025

Travel Grant recipient for American Association for Aerosol Research 2023 conference 2023

Philip and Marsha Dowd Fellowship, CMU (around $100,000 in tuition and stipend) 2022-2023

Milton Shaw Ph.D. Research Award, Department of Mechanical Engineering, CMU 2022

Postgraduate Studentship for the M.Phil. study at HKUST 2018-2020

HKUST awardee for the 8th Global Young Scientists Summit, National Research Foundation, Prime Minister's Office, Singapore 2020

University Grants Committee Research Travel Grant, HKUST 2019

Hong Kong Government Innovation and Technology Fund Internship Award 2018

M.Sc. Excellent Student Scholarship, School of Engineering, HKUST 2017

Champion Award, BESTo Camp, HKUST Entrepreneurship Center 2017

Entrance Scholarship, School of Engineering, HKUST 2016

Ministry of Human Resources Development Scholarship at IIT Delhi, covering tuition fees for 4 years of undergraduate studies. 2011-2015

Invited Talks

Kintampo Health Research Center (KHRC), Kintampo, Ghana *January 2026*
Gridded Africa Surface Pollution Dataset (GRASP): Two Decades of Satellite-Derived Daily High-Resolution $PM_{2.5}$ Measurements in Ghana.

Environmental Protection Authority (EPA), Accra, Ghana *January 2026*
Gridded Africa Surface Pollution Dataset (GRASP): Two Decades of Satellite-Derived Daily High-Resolution $PM_{2.5}$ Measurements in Ghana.

GRAPHS Manuscript Series, Columbia University, NY *December 2025*
Mapping Two Decades of Daily High-Resolution $PM_{2.5}$ Data in Ghana Using Machine Learning.

Geochemistry Division, Columbia University, NY *October 2025*
Atmospheric Black Carbon Measurements by Applying Image Processing Method on Filter Tapes.

Department of Civil Engineering, University of Illinois Urbana-Champaign, IL *October 2025*
Leveraging Satellite Measurements, Surface Monitors, and Machine Learning for Generating 20 Years of High-Resolution Daily $PM_{2.5}$ in Ghana.

SPARTAN & CAMS-Net Joint Meeting, Washington University in St. Louis, MO *June 2025*
Two Decades of High-Resolution Daily $PM_{2.5}$ in Ghana: A Machine Learning Approach.

Lamont 75th Mini-Symposium: The Data Drive Discovery, Columbia University, NY *May 2025*
Leveraging Satellite Measurements to Build Machine Learning Models for Estimating 20 years of High-Resolution Gridded Daily $PM_{2.5}$ for Ghana.

Air Sensors International Conference, Riverside, CA *October 2024*
Low-cost methods for measurement of $PM_{2.5}$ composition at African cities by exploiting existing Beta Attenuation Monitors.

Workshops Organized

Workshop on Satellite Data Applications and Innovations in Air Quality Research
Kintampo Health Research Center (KHRC), Kintampo, Ghana *January 15–17, 2026*
Environmental Protection Authority (EPA), Accra, Ghana *January 12–14, 2026*

- Introduction to Python for scientific computing and environmental data analysis.
- Fundamentals of satellite remote sensing-derived datasets.
- Accessing and downloading satellite-derived parameters from NASA and European Space Agency platforms and ERA5 meteorological features from ECMWF.
- Processing spatial datasets (HDF4/5, NetCDF) using xarray, pyhdf and h5py Python packages.
- Air quality applications of ERA5, TROPOMI, OMI, and MODIS instrument datasets.
- Using AirQ+ software tool and MR–BRT method for estimating health burden from $PM_{2.5}$ exposure.

Barnard College, Columbia University, New York, USA *September 2025*

- Workshop on satellite data analysis with a focus on MODIS Aerosol Optical Depth (AOD).
- Methods for correlating $PM_{2.5}$ with AOD measurements.
- Comparative analysis of air quality relationships across multiple U.S. cities.

Conference Presentations

Anand, A., Adabouk Amooli, J., Westervelt, D. M. Tracking Long-Term Air Pollution and Health Exposure in Ghana: Twenty Years of High-Resolution $PM_{2.5}$ Maps Using Satellite Data, Surface Observations, and Machine Learning. *American Geophysical Union Fall Meeting*, New Orleans, LA. 2025.

Westervelt, D. M., Goldberg, P., **Anand, A.** Spatial and Distributional Air Quality Impacts of New York City's Congestion Pricing Policy: Evidence from Ground and Satellite Observations. *American Geophysical Union Fall Meeting*, New Orleans, LA. 2025.

Anand, A., Amooli, J. A., Westervelt, D. M. Leveraging Satellite Measurements, Surface Monitors, and Machine Learning for Estimating 20 Years of High-Resolution Gridded $PM_{2.5}$ in Ghana. *American Association for Aerosol Research*, Buffalo, NY. 2025.

Anand, A., Opinde, G., Mwendwa, T. M., Habineza, T., Presto, A., DeCarlo, P. F., Nault, B. A., Westervelt, D. M. Aerosol Chemical Composition at an Urban Core Location in Nairobi, Kenya. *American Association for Aerosol Research*, Buffalo, NY. 2025.

Zeng, Z., **Anand, A.**, Habineza, T., Bahreini, R., Dillner, A. M., Russell, A. G., Ng, N. L., Jen, C., Presto, A. High-Resolution $PM_{2.5}$ Metals in Pittsburgh: Trends, Fireworks, and Wildfire Impacts from the ASCENT Network. *American Association for Aerosol Research*, Buffalo, NY. 2025.

Rogers, M., Joo, T., Zhang, L., Hass-Mitchell, T., Murphy, B., Zeng, Z., Habineza, T., **Anand, A.**, et al. Observational Constraints on the Total Contributions of Biomass Burning to Ambient Organic Aerosol. *American Association for Aerosol Research*, Buffalo, NY. 2025.

Anand, A., Presto, A., et al. Estimation of Total and Biomass-Based BC at African Cities by Applying Image-Reflectance Method on BAM Tapes. *American Association for Aerosol Research*, Albuquerque, NM. 2024.

Anand, A., Presto, A., Farimani, A. B. Development of an improved deep learning-based $PM_{2.5}$ model for predicting high pollution episodes in Pittsburgh by leveraging GEOS-CF atmospheric composition data. *American Geophysical Union*, San Francisco, CA. 2023.

Anand, A., Presto, A., Farimani, A. B. Developing a machine learning-based daily $PM_{2.5}$ forecast model with GEOS-CF and land use parameters. *American Association for Aerosol Research*, Portland, OR. 2023.

Anand, A., Kompalli, S. P., et al. Black carbon measurements in multiple cities of sub-Saharan Africa with low-cost image reflectance method. *American Association for Aerosol Research*, Portland, OR. 2023.

Anand, A., Presto, A., Kompalli, S. P., et al. Hourly black carbon measurements in Africa using cell phone camera images. *American Geophysical Union*, Chicago, IL. 2022.

Anand, A., Presto, A., Kompalli, S. P., et al. Low-Cost black carbon detection from Beta Attenuation Monitors using image reflectance-based method. *American Association for Aerosol Research*, Raleigh, NC. 2022.

Kim, S., **Anand, A.**, Rajan, P. E., Presto, A. Comparison of organic aerosol composition and source distributions across different urban environments. *American Association for Aerosol Research*, Raleigh, NC. 2022.

Anand, A., Presto, A., Kompalli, S. P., et al. Estimation of hourly BC from BAM tapes using image reflectance-based method. Air Sensors International Conference, Pasadena, CA. 2022.

Anand, A., Gali, N. K., Yang, F., et al. Laboratory calibration, validation and protocol development to use UAV borne sensor system for fuel sulfur content-based field screening of OGVs. *Global Young Scientists Summit*, Singapore. 2020.

Anand, A., Gali, N. K., Westerdahl, et al. Technology development and evaluation of an ultra-compact ship fuel Sulfur sniffing sensor system. *Freight and Environment: Ports of Entry*, Newark, NJ. 2019.

Ning, Z., **Anand, A.**, Gali, N. K., et al. Protocol Development of using Sniffing Method to Identify High Sulfur Fueled Ships. *Freight and Environment: Ports of Entry*, Newark, NJ. 2019.

Teaching Experience

Guest Lecture, Computing and Research Methods for Climate Data Science, Columbia University (*February 2026*)

Introduced major climate datasets, tools to work with them, data structures, and research applications.

Guest Lecture, Air Pollution & Measuring the Environment, Columbia University (*November 2025*)

Delivered lecture on remote sensing principles and practical applications of NASA and ESA satellite-derived air pollution datasets.

Future Faculty Career Program, Carnegie Mellon University 2020-2024

Designed to help early career researchers develop their teaching skills for a faculty career.

Teaching Assistant

Renewable Energy Engineering – 24792, CMU Spring 2023
Fluid Mechanics – 24231, CMU Spring 2022
GIS for Environmental Professionals – EVSM5240, HKUST Fall 2019
Carbon Emission Trading – ENVR6090A, HKUST Spring 2019

Peer Tutor for Undergraduate Students, CMU 2022-2023

Physics I for Science Students (33121), Physics II for Biological Sciences and Chemistry Students (33122), Physics I for Engineering Students (33141), Physics II for Engineering and Physics Students (33142), Calculus (21111-122), Differential Equations (21260)

Advising Experience

Undergraduate Research Mentor

Polina Goldberg - Undergraduate student, Data Science, Columbia University Summer 2025–Present
Elsevar Zeynalov - Undergraduate student, Data Science, Columbia University Summer 2025
Ria Sharma - Undergraduate student, Mechanical Engineering, CMU Summer 2023
Jordan Petzold - Undergraduate student, Mechanical Engineering, CMU Summer 2023
Jocelyn Kiefel - Undergraduate student, Mechanical Engineering, CMU Summer 2023
Shaborn Leggette - Undergraduate student, Mechanical Engineering, CMU Summer 2023
Max Labovitz - Undergraduate student, Mechanical Engineering, CMU Summer 2022

Graduate Research Mentor, Carnegie Mellon University
Sizhou Su - Master's student, Columbia University — Summer 2025–Present
Aziz Bhetasiwala - Master's student, Mechanical Engineering, CMU — Fall 2023 - Summer 2024
Ria Sharma - Master's student, Mechanical Engineering, CMU — Fall 2023

Academic and Professional Service

Committee Member
AGU Atmospheric Science Section Early Career Committee. — 2026–Present
Coordinator, Ocean and Climate Physics Department Seminar, Columbia University — 2025-2026
Scientist-in-Residence, New York Academy of Sciences — 2025–Present
United Charter High School - Advanced Math and Science, New York City
Collaborated with a teacher to develop and deliver modules on air pollution sources and monitoring. Designed research projects to build an air purification system and a sensor module to measure particulate removal efficiency.
Session Chair
AAAR: Advancing Aerosol Science Through Data Analysis. — October 2025
Panelist
Spartan and CAMS-Net meeting: Low-Cost Monitoring of Atmospheric Particulate Matter — June 2025
Core Representative, Postdoc/ARS Hardship Support Fund Committee, Columbia University — 2025-Present
President, AAAR Student Chapter, Carnegie Mellon University — 2023-2024
Coordinator, Center for Atmospheric Particle Studies Seminar, Carnegie Mellon University — 2022-2023
Core Committee Member, CAPS Laboratory, Carnegie Mellon University — 2021-2022

Reviewer Activities

Geoscientific Model Development, Environmental Science & Technology Air, Environmental International, Scientific Reports, Environmental Science and Pollution Research — 2023-Present

Coursework Experience

Probability, Machine Learning and Statistics, Carnegie Mellon University — 2020-2024
Introduction to Deep Learning for Engineers, Intermediate Deep Learning, Machine Learning and Artificial Intelligence for Engineers, Probability and Estimation Methods for Engineering Systems, Statistical Learning and Modeling.

Air Quality and Atmospheric Sciences
Air Quality Engineering at CMU; Atmospheric Dynamics at HKUST, Numerical Simulation of Atmospheric Phenomena at IIT Delhi