Arshad Arjunan Nair

Atmospheric Sciences Research Center (ASRC)
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Research Interests
Atmospheric aerosols • Nucleation • Growth
Particle microphysics • Regional and global modeling
Air-quality & Health • Aerosol–Cloud–Climate
interactions • Machine Learning/AI

Education and Training

Present
Postdoctoral training, State University of New York at Albany, U.S.A.
Supervisors: Profs. Fangqun Yu (ASRC) and Shao Lin (School of Public Health)

Aug 14, 2021
PhD in Atmospheric Sciences, State University of New York at Albany, U.S.A.
Doctoral dissertation: The role of ammonia in atmospheric new particle formation and implications for cloud condensation nuclei • Defense: July 16, 2021 • *Supervisor*: Prof. Fangqun Yu

May 27, 2015
BS–MS in Physics, Indian Institute of Science Education and Research (IISER) Pune, India
Master's thesis: Lightning Distribution during Active and Break Monsoon Periods over South Asia
• Defense: May 03, 2015 • *Supervisor*: Dr. A. K. Kamra

May 20, 2009
All India Senior School Certificate, Christ Nagar Senior Secondary School, Trivandrum, India

May 28, 2007
All India Secondary School Certificate, —"—

Professional Appointments

Aug 2021
Postdoctoral Associate, State University of New York at Albany

Aug 2017
Research Project Assistant, — " —

Aug 2016
ASRC Graduate Fellow, — " —

Jun 2015
Co-Guide, Indian Institute of Tropical Meteorology (IITM), Pune, India

Mar 2015
Research Assistant, — " —

Research Experience

Postdoctoral

Aug 2021 – present
1. Physics-guided machine learning parameterizations of aerosol microphysical processes
2. Socioeconomic disparities in air quality and consequent impacts on morbidity & mortality
Postdoctoral Associate, Atmospheric Sciences Research Center (ASRC), Albany, NY, U.S.A.

Doctoral

Aug 2016 – Aug 2021
The role of ammonia in atmospheric new particle formation and implications for cloud condensation nuclei
Research Project Assistant, Atmospheric Sciences Research Center (ASRC), Albany, NY, U.S.A.
Graduate Student, Dept. of Atmospheric and Environmental Sciences, University at Albany
• Developed a physicochemically explainable, robust, and computationally efficient machine learning representation for cloud condensation nuclei in GCMs, validated with the aid of DOE ARM data.
• Doctoral work resulted in 11 publications (1 under review) and 15 presentations.
• Led collaboration with 27 researchers supported by NSF, NASA, NOAA, and NRF (Korea).

Research Assistantship

Jun 2015 – May 2016
Some observations on lightning over the Bay of Bengal
Co–guide, Indian Institute of Tropical Meteorology (IITM), Pune, India
• Investigated the climatology of lightning over the Bay of Bengal which receives unusually high precipitation during the monsoon months, as well as displays high convective clouds - something peculiar for an oceanic region.
• Guided a Master's student during his summer internship analyzing 18-year satellite data for lightning with sea surface temperature, CAPE, and salinity.

Mar 2015 – May 2016	Lightning Distribution over South Asia during Active and Break Spells of the Monsoon *Research Assistant*, IITM Pune, India

Undergraduate (5 year BS–MS)

Aug 2014 – Mar 2015	Lightning Distribution over South Asia during Active and Break Spells of the Monsoon *Masters Thesis Student*, IITM Pune, India • Studied the link between lightning activity and the axis of the monsoon trough using satellite (NASA TRMM LIS/OTD) and observational (in situ surface networks) data sets in context of intensity and duration of the active and break monsoon periods.
Aug 2013 – Dec 2013	Synthesis and Analysis of Mesoporous SnO_2 Nanoparticles *Project Student*, Indian Institute of Science Education and Research (IISER), Pune, India • Optimized synthesis of hollow mesoporous graphene encapsulated SnO_2 nanoparticles aimed at improved lithium ion batteries: charge capacity, number of recharge cycles, and durability.
Jan 2013 – Jul 2013	Impacts of the Western Ghats on lightning *Project Student*, IITM Pune, India • Uncovered the strong orographic effect of the Western Ghats on lightning distribution, especially during the onset and withdrawal phases of the monsoon season using satellite data.
May 2012 – Jun 2012	Understorey aves diversity and conservation along elevational gradients *Summer Project Student*, IISER Pune, India • Field work (mist-netting, specimen collection, DNA barcoding) to study the elevational distribution of understorey birds at Eaglenest Wildlife Sanctuary, Arunachal Pradesh, India.
May 2011 – Jul 2011	Effect of anthropogenic aerosols from Mumbai on cloud electrification *IASc-INSA-NASI Summer Research Fellow*, IITM Pune, India • Studied the effect of aerosols from a metropolitan city on lightning activity.
Jun 2010 – Jul 2010	Effect of Low Radiation Dose on *Fenneropenaeus indicus* *Summer Project Student*, Bhabha Atomic Research Centre (BARC), Tirunelveli, India • Optimized radiation doses for preservation of seafood and treatment of hospital wastes.

Grants, Honors, & Awards

Mar 2023	Narayan R. Gokhale Distinguished Research Scholarship Award 2022/2023 Department of Atmospheric And Environmental Sciences, UAlbany, NY
Dec 2022	First Place, SUNY Chancellor Distinguished PhD Graduate Dissertation Awards State University of New York System, Albany, NY
May 2022	Distinguished Doctoral Dissertation Award 2021–2022 State University of New York at Albany, NY
Aug 2017	2017 AAAR Annual Conference Travel Grant The American Association for Aerosol Research (AAAR), Raleigh, NC
Feb 2016	Atmospheric Sciences Research Center (ASRC) Graduate Fellowship ASRC, State University of New York at Albany, NY
Sep 2014	Writing Science workshop: 1 of 14 (and only undergraduate) selected nation-wide National Council for Science & Technology Communication, Govt. of India
May 2011	INSA-IASc-NASI Summer Research Fellowship (IAS-SRFP) The Science Academies, India
Jun 2010	Bhabha Atomic Research Centre (BARC) Summer Research Internship Department of Atomic Energy (DAE), Govt. of India
Oct 2009	*Vigyan Jyoti Shibir* (Selected for National Science Camp) Department of Science and Technology, Govt. of India
Aug 2009	*Kishore Vaigyanik Protsahan Yojana* (KVPY) Fellowship in Basic Sciences Top ∼0.004% of nation-wide senior secondary school leaving students Department of Science and Technology, Govt. of India

Feb 2008	Bank of India Gold Medal (AISSE Topper) Awarded by R. L. Bhatia, Governor of Kerala State
Aug 2007	Dr. K. M. Munshi Memorial Ever Rolling Trophy Sameeksha 2007 (All Kerala Science Quiz Competition)
Jun 2007	National Talent Search Scholarship (NTSE) Top $\sim$0.01% of nation-wide secondary school leaving students National Council of Educational Research and Training (NCERT), Govt. of India
May 2007	Rev. Dr. John Britto Educational Endowment Province of St. Joseph, Thiruvananthapuram

Research Communication

JOURNAL ARTICLES

Full list of research communications: https://scholar.google.com/citations?user=MXKOuR8AAAAJ

2023	**Nair, A. A.**, Shao, L., Luo, G., Ryan, I., Qi, Q., Deng, X., Yu, F. (2023) Environmental exposure disparities in ultrafine particles and $PM_{2.5}$ by urbanicity and socio-demographics in New York State, 2013–2020. *Environmental Research, under review.*
2023	Yu, F., **Nair, A. A.**, Lauper, U., Luo, G., Herb, J., Morse, M. J., Savage, B., Zartarian, M., Lin, S. (2023). Mysteriously rapid rise in Legionnaires' disease incidence traced to improving air quality, *Proceedings of the National Academy of Sciences, under review.*
2023	**Nair, A. A.**, Yu, F., Luo, G., S. Yu (2023). Global atmospheric ammonia: Insights from modeling and multi-satellite measurements, *Atmosphere, under review.*
2023	**Nair, A. A.**, Yu, F., Luo, G. (2022). The importance of ammonia for springtime atmospheric new particle formation and aerosol number abundance over the United States. *Science of the Total Environment, 160756.* doi:10.1016/j.scitotenv.2022.160756
2023	Yu, F., Luo, G., **Nair, A. A.**, Eastham, S., Williamson, C. J., Kupc, A., and Brock, C. A. (2022). Particle number concentrations and size distributions in the stratosphere: Implications of nucleation mechanisms and particle microphysics. *Atmospheric Chemistry and Physics, 23*(3), 1863–1877. doi:10.5194/acp-2022-487
2022	Yu, F., Luo, G., **Nair, A. A.**, Tsigaridis, K., Bauer, S. (2022). Use of machine learning to reduce uncertainties in particle number concentration and aerosol indirect radiative forcing predicted by climate models. *Geophysical Research Letters*, e2022GL098551. doi:10.1029/2022GL098551
2022	Lin, S., Ryan, I., Paul, S., Deng, X., Zhang, W., Luo, G., Dong, G., **Nair, A. A.**, & Yu, F. (2022). Particle surface area, ultrafine particle number concentration, and cardiovascular hospitalizations. *Environmental Pollution, 119795.* doi:10.1016/j.envpol.2022.119795
2022	Deng, X., Friedman, S., Ryan, I., ... , **Nair, A. A.**, ... & Lin, S. (2022). The independent and synergistic impacts of power outages and floods on hospital admissions for multiple diseases. *Science of The Total Environment, 154305.* doi:10.1016/j.scitotenv.2022.154305
2021	**Nair, A. A.**, Yu, F., Campuzano-Jost, P., DeMott, P. J., Levin, E. J. T., ... & Peng, Q. (2021). Machine learning uncovers aerosol size information from chemistry and meteorology to quantify potential cloud-forming particles. *Geophysical Research Letters, 48*, e2021GL094133. doi:10.1029/2021GL094133
2021	Mao. J., Zhang, Y., Yu F., **Nair, A. A.**, Yu, Q., ... & Chen, L. (2021) On the ship particle number emission index: Size-resolved microphysics and key controlling parameters. *Journal of Geophysical Research: Atmospheres, 126*, e2020JD034427. doi:10.1029/2020JD034427
2020	**Nair, A. A.** & Yu, F. (2020). Using machine learning to derive cloud condensation nuclei number concentrations from commonly available measurements. *Atmospheric Chemistry and Physics, 20*(21), 12853–12869. doi:10.5194/acp-20-12853-2020
2020	**Nair, A. A.** & Yu, F. (2020). Quantification of atmospheric ammonia concentrations: A review of its measurement and modeling. *Atmosphere, 11*(10), 1092. doi:10.3390/atmos11101092

2020 Yu, F., Luo, G., **Nair, A. A.**, Schwab, J. J., Sherman, J. P. & Zhang, Y. (2020). Wintertime new particle formation and its contribution to cloud condensation nuclei in the Northeastern United States. *Atmospheric Chemistry and Physics, 20*(4), 2591–2601. `doi:10.5194/acp-20-2591-2020`

2019 **Nair, A. A.**, Yu, F. & Luo, G. (2019). Spatioseasonal variations of atmospheric ammonia concentrations over the United States: Comprehensive model-observation comparison. *Journal of Geophysical Research: Atmospheres, 124*(12), 6571-6582. `doi:10.1029/2018JD030057`

2018 Yu, F., **Nair, A. A.** & Luo, G. (2018). Long-term trend of gaseous ammonia over the United States: Modeling and comparison with observations. *Journal of Geophysical Research: Atmospheres, 123*(15), 8315-8325. `doi:10.1029/2018JD028412`

2015 Kamra, A. K. & **Nair, A. A.** (2015). The impact of the Western Ghats on lightning activity on the western coast of India. *Atmospheric Research, 160*, 82-90. `doi:10.1016/j.atmosres.2015.03.006`

PRESENTATIONS

2023
Invited **Nair, A. A.** (2023, February) The role of ammonia in atmospheric new particle formation and implications for cloud condensation nuclei. In *Academic Affairs Committee of the Board of Trustees of the State University of New York*. Albany, NY.

2023 **Nair, A. A.**, Yu, F., Luo, G., Someya, Y. (2023, January) Global Atmospheric Ammonia: Insights from Modeling and Multi-Satellite Measurements. In *103rd AMS Annual Meeting*. American Meteorological Society. Virtual.

2023 Yu, F., Luo, G., & **Nair, A. A.** (2023, January) On processes controlling size distributions and optical properties of stratospheric particles: Long-term simulations and comparisons with measurements. In *103rd AMS Annual Meeting*. American Meteorological Society. Virtual.

2022 **Nair, A. A.**, Luo, G., Ryan, I., Deng, X., Lin, S., & Yu, F. (2022, September) Socioeconomic disparities in aerosol pollutant exposure may be amplified by ultrafine particles despite declining $PM_{2.5}$. In *34th Annual Conference of the International Society of Environmental Epidemiology (ISEE)*. Athens, Greece. `doi:10.1289/isee.2022.P-0685`

2022 **Nair, A. A.**, Ryan, F., Luo, G., Deng, X., Zhang, W., Yu, F., & Lin, S. (2022, September) Race-ethnicity disparities in COVID-19 outcomes may be worsened by shorter- and long-term aerosol pollutants exposure. In *34th Annual Conference of the ISEE*. Athens, Greece. `doi:10.1289/isee.2022.P-0685`

2022
Invited **Nair, A. A.**, Ryan, F., Luo, G., Deng, X., Zhang, W., Yu, F., & Lin, S. (2022, August) Race-ethnicity disparities in COVID-19 outcomes may be worsened by shorter- and long-term aerosol pollutants exposure. In *International Conference on Environment and Human Health: Challenges and Opportunities in the 21st Century*. Virtual.

2022 **Nair, A. A.** & Yu, F. (2022, June) GEOS-Chem-APM for physics-informed machine learning emulators and parameterizations. In *10th International GEOS-Chem Meeting*. Washington University. St. Louis, MO.

2021 **Nair, A. A.** & Yu, F. (2021, Oct) The Role of Ammonia in Atmospheric New Particle Formation and Aerosol Number Abundance at the Southern Great Plains Site. In *39th AAAR Annual Conference*. American Association for Aerosol Research. Virtual.

2021 **Nair, A. A.** & Yu, F. (2021, Jan) Using Data from NASA Suborbital Campaigns to Validate a Machine Learning Algorithm for Predicting Cloud Condensation Nuclei. In *101st AMS Annual Meeting*. American Meteorological Society. Virtual.

2020 **Nair, A. A.** & Yu, F. (2020, Dec) Using machine learning to derive cloud condensation nuclei number concentrations from commonly available measurements. In *AGU Fall Meeting 2020*. American Geophysical Union. Virtual.

2020 Yu, F., Luo G. & **Nair, A. A.** (2020, Dec) Use of machine learning to reduce uncertainty in anthropogenic radiative forcing associated with aerosol–cloud interactions. In *AGU Fall Meeting 2020*. American Geophysical Union. Virtual.

2020 **Nair, A. A.** (2020, Apr) Predicting atmospheric particle number concentrations using machine learning. In *ASRC Friday Colloquy*. Atmospheric Sciences Research Center. Albany, NY.

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2020   **Nair, A. A.**, Yu, F. & Luo, G. (2020, Jan) Particle Number Concentrations and Their Controlling Parameters: Predictive analysis using machine learning. In *NYS DEC DAR BAQAR Scientific Meeting*. Albany, NY.

2020   **Nair, A. A.**, Yu, F. & Luo, G. (2020, Jan) Particle Number Concentrations and Their Controlling Parameters Over the United States. In *100th AMS Annual Meeting*. American Meteorological Society. Boston, MA.

2019   **Nair, A. A.**, Yu, F. & Luo, G. (2019, Oct) Assessment of Model-Simulated Global Atmospheric Ammonia with Satellite Remote Sensing Measurements. In *37th AAAR Annual Conference*. American Association for Aerosol Research. Portland, OR.

2019   Schwab, J., Hassan, H., Ninneman, M., ..., **Nair, A. A.**, ... Rattigan, O. (2019, Oct) Ammonium and Ammonia: Concentration Trends in the Northeast United States. In *37th AAAR Annual Conference*. American Association for Aerosol Research. Portland, OR.

2019   **Nair, A. A.**, Yu, F. & Luo, G. (2019, May) Spatio-seasonal Variations of Atmospheric Ammonia: Comprehensive Model–Observation Comparisons. In *9th International GEOS-Chem Meeting*. Harvard University. Boston, MA.

2018   **Nair, A. A.**, Yu, F. & Luo, G. (2018, Dec) Atmospheric Ammonia over the United States: Comprehensive Model-Observation Comparisons. In *AGU Fall Meeting 2018*. American Geophysical Union. Washington, DC.

2018   **Nair, A. A.**, Yu, F. & Luo, G. (2018, Dec) Atmospheric Ammonia over United States: Comprehensive Model-Observation Comparisons. In *NYSDEC DAR BAQAR Scientific Meeting*. Albany, NY.

2017   **A. A. Nair**, G. Luo & F. Yu (2017, Oct) Comparison of Model Simulated Ammonia with Observations: A Case for Implementation of Improved Gas/Aerosol Partitioning Schemes. In *36th AAAR Annual Conference*. American Association for Aerosol Research. Raleigh, NC.

2017   **A. A. Nair**, G. Luo & F. Yu (2017, May) Comparison of GEOS-Chem simulated ammonia concentrations with observations. In *8th Intl. GEOS-Chem Meeting*. Harvard University. Boston, MA.

Theses

2021   **A. A. Nair** (2021) The Role of Ammonia in Atmospheric New Particle Formation and Implications for Cloud Condensation Nuclei (Doctoral Dissertation), University at Albany, State University of New York, July 16, 2021. Retrievable from ProQuest Dissertations & Theses Global.

2015   **A. A. Nair** (2015) Lightning Distribution during Active and Break Monsoon Periods over South Asia (Master's thesis), IISER Pune, March 25, 2015. Retrievable from IISER Pune Digital Repository.

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Service to the profession

Teaching: *Machine Learning and Aerosol Microphysics*, module in ATM515: Aerosol Physics, Dept. of Atmos & and Environ Sci, UAlbany, Fall 2022; *Aerosol exposure and COVID-19*, module in EHS545: Global Climate Change, Extreme Weather & Public Health, Dept. of Environ Health Sci, UAlbany, Spring 2023

Reviewer: (*Journals*) Science, Atmospheric Chemistry and Physics, Egusphere, Atmosphere, Atmospheric Research, Journal of Environmental Sciences, Environmental Science & Technology, Remote Sensing of the Environment, Journal of Applied Remote Sensing, Advances in Space Research, Tellus Series B: Chemical and Physical Meteorology, Applied Sciences, Science Bulletin, Sustainability, Toxics, International Journal of Environmental Research and Public Health (IJERPH), Hygiene and Health Advances, and (*Agencies*) National Science Foundation.

Editor: Guest editor for Atmosphere and IJERPH.

Working Groups: (*subscriber*) DOE Atmospheric System Research Aerosol Processes WG, NCAR Geoengineering Modeling Research Consortium.

Mentor: Science and Technology Entry Program College Overview and Research Experience

(STEP/CORE; New York State Education Dept.), Project SHORT, and Wonderland Literacy Center (Indian NGO).

MEMBER: (*non-selective*) American Association for Aerosol Research (AAAR), American Geophysical Union (AGU), American Physical Society (APS), American Meteorological Society (AMS), International Society of Environmental Epidemiology (ISEE), American Public Health Association (APHA), National Postdoctoral Association (NPA), and The New York Academy of Sciences (NYAS).