Kaushik Muduchuru

RESEARCH SCIENTIST
ernst-thälmann-straße 102, 15374 müncheberg, germany
(+49) 15510 527370 kaushik.reddy.m@gmail.com GitHub HomePage LinkedIn Scholar 0000-0002-8967-7872

education

Ph.D. in Climate Studies — Indian Institute of Technology Bombay
Jul 2017 – Sep 2024

- **Thesis:** Aerosol-cloud-radiative interactions over India: Effects on cloud properties and rainfall formation processes
- **Keywords:** `Climate Impact Assessment` • `Cloud Microphysics`

M.Tech. in Earth Sciences — Indian Institute of Science, Bengaluru
Jul 2013 – Aug 2015

- **Thesis:** Northward Propagation of Intra-Seasonal Oscillations: A Study Using High-Resolution Geostationary Satellite Data
- **Keywords:** `Spectral Analysis` • `Climate Dynamics & Oscillations`

B.Tech. in Chemical Engineering — National Institute of Technology Tiruchirappalli
Jun 2009 – May 2013

- **Thesis:** Styrene Production
- **Keywords:** `Computational Fluid Dynamics` • `Transport Phenomena`

experience

Research Scientist — Leibniz Centre for Agricultural Landscape Research (ZALF)
Feb 2025 – Present

- Developing deep learning models for climate downscaling and agricultural impact assessment.
- AIML model development for climate data imputation
- Contributing to FAIRagro and LLSYSTAIN research projects.
- **Skills:** Machine Learning • Deep Learning • Climate Downscaling • FAIR ETL Pipelines

Senior Associate — Center for Study of Science, Technology & Policy (CSTEP)
Sep 2023 – Jan 2025

- Air quality modelling to investigate source influences to air quality over India using WRF-CAMx.
- Black carbon mitigation policy and engagement with stakeholders.
- **Skills:** Air Quality Modelling • Short Term Climate Forcers • Policy Analysis

Sustainability Consultant — Tata Trent
Apr 2023 – Jul 2023

- Conducted climate risk assessments for operations and upstream supply chains following TCFD recommendations.
- Assessed distribution-center strategies to improve supply-chain resilience and reduce emissions.
- **Skills:** Climate Risk Assessment • TCFD • Supply Chain Sustainability • Decarbonization

Senior Research Fellow — Indian Institute of Technology Bombay
Jul 2017 – Mar 2024

- **Research:** Regional and global climate modelling (WRF-Chem, ECHAM-HAM), Aerosol–cloud interactions and precipitation processes
- Developed and applied regional and global climate modelling frameworks.
- Worked with WRF-Chem and ECHAM6-HAM2 coupled with aerosols and chemistry.
- Collaborated with researchers at the National Atmospheric Research Laboratory (ISRO).
- **Skills:** Air-Quality Modelling • Python • Numerical Weather Prediction • Time Series Analysis • Shell Scripting

Project Research Fellow — Indian Institute of Technology Bombay
2016 – 2017

- **Research:** Disentangling the role of ocean–atmosphere interactions and aerosol fast adjustments on the atmosphere, Climate variability and modelling
- **Skills:** Climate Modelling • Data Analysis • Scientific Computing

Junior Research Fellow — Indian Institute of Science Bengaluru
2015 – 2016

- **Research:** Space–time scaling properties of deep convective systems leading to heavy floods, Characterisation of northward-propagating boreal summer intra-seasonal oscillation (BSISO), Analysis of high-resolution OLR satellite observations over the Indian region
- **Skills:** Signal Processing • Spectral Analysis • Time-Series Analysis • Wavelet Analysis • Remote Sensing

research areas

research focus Climate Change, Machine Learning & Deep Learning, Earth Observation, Agriculture Impacts Modelling, Air Quality Modelling

awards & honors

- 2017–2024: **Graduate Aptitude Test in Engineering (GATE)** Postgraduate Fellowship — funded PhD at IIT Bombay
- 2015: **CLRI-CSIR Summer Fellowship** — Central Leather Research Institute, Council of Scientific and Industrial Research
- Student Member, **American Geophysical Union (AGU)**

refereed publications

journal articles

- Halder, K., Ewert, F., Ghosh, A., **Muduchuru, K.**, Sweet, L.-B., Elshawi, R., Timko, J., Zheng, W., Alsafadi, K., Zhao, G., et al. (2025). High-Resolution Maize Yield Mapping across Africa using Earth Observation and Machine Learning, Deep Learning, and Foundation Model. *Science of Remote Sensing*, 100344.
- Venkataraman, C., Anand, A., Maji, S., Barman, N., Tiwari, D., **Muduchuru, K.**, Sharma, A., Gupta, G., Bhardwaj, A., Haswani, D., et al. (2024). Drivers of PM2.5 episodes and exceedance in India: a synthesis from the COALESCE network. *Journal of Geophysical Research: Atmospheres*, 129(14), e2024JD040834.
- Devaliya, S., Bhate, J. N., Raman, R. S., **Muduchuru, K.**, Sharma, A., Singh, V., Kesarkar, A. P., and Venkataraman, C. (2023). Assessment of the impact of atmospheric aerosols and meteorological data assimilation on simulation of the weather over India during summer 2015. *Atmospheric Environment*, 297, 119586.
- Sharma, A., Venkataraman, C., **Muduchuru, K.**, Singh, V., Kesarkar, A., Ghosh, S., and Dey, S. (2023). Aerosol radiative feedback enhances particulate pollution over India: A process understanding. *Atmospheric Environment*, 298, 119609.
- **Muduchuru, K.** and Venkataraman, C. (2022). Spatial heterogeneity of aerosol induced rapid adjustments on precipitation response over India: A general circulation model study with ECHAM6-HAM2. *Climate Dynamics*, 58(1), pp.293–304.
- Venkataraman, C., Sharma, A., Tibrewal, K., Maity, S., and **Muduchuru, K.** (2020). Carbonaceous Aerosol Emissions Sources. *The Magazine for Environmental Managers*.
- Patil, N., Venkataraman, C., **Muduchuru, K.**, Ghosh, S., and Mondal, A. (2019). Disentangling sea-surface temperature and anthropogenic aerosol influences on recent trends in South Asian monsoon rainfall. *Climate Dynamics*, 52(3), pp.2287–2302.

preprints & submitted

- Kumar Srivastava, A., Halder, K., Lopez, G., **Muduchuru, K.**, Barbosa, L. A. P., Rahaman, K. J., Behrend, D., Han, L., Nendel, C., Zhao, G., et al. CropFusionNet: An Interpretable Deep Learning Framework for Uncertainty-Aware Crop Yield Forecasting across Germany. *(preprint)*
- Bhattacharya, A., **Muduchuru, K.**, Venkataraman, C., and Mondal, A. (2021). Anthropogenic aerosols induce drying trends in Indian monsoon wet and dry extremes. *(submitted to Nature Climate Change)*
- **Muduchuru, K.**, Venkataraman, C., et al. (2021). Sensitivity of aerosol feedback effects and chemical mechanisms on the regional scale prediction of cloud properties. *(manuscript in preparation)*

conference abstracts & proceedings

- **Muduchuru, K.**, Halder, K., Anders, I., Gaiser, T., Singh, M., Ewert, F., and Srivastava, A. K. (2025). Agricultural yield declines from the rapid removal of air pollutants under carbon neutrality. *Tropentag 2025*, Sep 10–12, Bonn, Germany.
- Halder, K., Srivastava, A. K., **Muduchuru, K.**, Han, L., Singh, M., Gaiser, T., and Ewert, F. (2025). Transforming Low-Resolution CORINE Data into High-Resolution Landscape Maps with Semi-Supervised Deep Learning. *EGU General Assembly 2025*, EGU25–18335.
- **Muduchuru, K.**, Venkataraman, C., and Das, M. (2022). Aerosol-cloud-interactions (ACI) in continental warm clouds over India. *AGU Fall Meeting Abstracts* (Vol. 2022, pp. A22B–1667).
- Devaliya, S., Bhate, J., Raman, R. S., **Muduchuru, K.**, Sharma, A., Kesarkar, A., and Venkataraman, C. (2021). Chemistry Driven Changes in Simulated Meteorology for May 2015: WRF/WRF-Chem Studies over India. *AGU Fall Meeting Abstracts* (Vol. 2021, pp. A15F–1700).
- Bhattacharya, A., Venkataraman, C., Maity, S., and **Muduchuru, K.** (2020). Analysis of Aerosol Life Cycles over Indian Region in the ECHAM6-HAM2. *AGU Fall Meeting Abstracts* (Vol. 2020, pp. A063–0003).
- **Muduchuru, K.** and Venkataraman, C. (2020). Spatial heterogeneity of stratiform precipitation response to aerosol fast adjustments over India: A general circulation model study with ECHAM6-HAM2. *AGU Fall Meeting Abstracts* (Vol. 2020, pp. A063–0016).

outreach & media

- The Need to Curb Black Carbon Emissions, Explained. *The Hindu*, 2024. Popular science explainer on black carbon as a powerful short-lived climate forcer and why cutting emissions delivers rapid co-benefits for air quality and climate.
- Cleaner Air, Tougher Harvests: The Hidden Trade-Off for Farmers. *Tropentag Blog*, Sep 2025. Conference post on how rapid removal of aerosol pollutants under carbon neutrality reduces diffuse radiation and can lower crop yields.
- PhD in Climate Studies awarded by Indian Institute of Technology Bombay. IIT Bombay, Aug 2024. Seven years of doctoral research on aerosol–cloud–radiation interactions over India.

teaching

Teaching Assistant — Indian Institute of Technology Bombay

2017 – 2024

- CL254 (2020) — Process Fluid Mechanics
- CL710 (2020) — Aerosol Technology
- CM802 (2021) — Atmosphere and Climate Change

oral presentations

- **Muduchuru, K.**, Halder, K., Anders, I., Gaiser, T., Singh, M., Ewert, F., and Srivastava, A. K. "Agricultural yield declines from the rapid removal of air pollutants under carbon neutrality." *Tropentag 2025*, University of Bonn, Germany. Sep 10–12, 2025.

poster presentations

- **Muduchuru, K.**, Venkataraman, C., and Das, M. (2022). Aerosol-cloud-interactions (ACI) in continental warm clouds over India. *AGU Fall Meeting Abstracts* (Vol. 2022, pp. A22B–1667).

workshop moderation

- Workshop Instructor: "Hy4Cast – Hybrid modelling leveraging Artificial Intelligence for fine-scale crop yield forecasts." *Tropentag 2025*, University of Bonn, Germany. Sep 2025.