Rituparna Sarkar

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Education

Ph.D., Atmospheric and Space Sciences 2025
Indian Institute of Tropical Meteorology
Savitribai Phule Pune University

- Thesis: Development of Lightning Prediction System using Global Forecast System and Machine Learning Model Over India.
- Funded (2018–2023) by DST INSPIRE Fellowship, Department of Science and Technology (DST), Ministry of Science and Technology, Government of India.
- Relevant Coursework: Research & Publication Ethics, Grade A (2023).

M.Sc., Atmospheric Sciences 2017
University of Calcutta

- Dissertation: Probing for connectivity between lightning activity and depth of convection during pre-monsoon season over Kolkata.
- Final Grade: 80.1%

B.Sc., Physics (Honours) 2015
Asutosh College, University of Calcutta

- Final Grade: 69.75%

Research Experience

Indian Institute of Tropical Meteorology Jan 2024 – Jan 2026
Project Scientist II, National Monsoon Mission (NMM)

- Developed a lightning parameterization in the BFS using Fortran and shell scripting on Arka HPC.
- Implemented mesoscale convective system tracking software (organization_indices) using BFS, GFS T1534, and ERA5 datasets.
- **Operational Forecast Contribution:** Developed and operationalized a parameter extraction tool for the BFS model output (~100 TB/day) using shell scripting on Arka HPC.

IITM Research Fellow Aug 2023 – Jan 2024
DST INSPIRE Research Fellow Aug 2018 – Aug 2023

- Developed a lightning parameterization for IITM GFS T1534 using Fortran and shell scripting on Pratyush HPC.

- Developed a novel NWP-AI hybrid lightning prediction system with IMD WRF operational output as model input.
- **Operational Forecast Contribution:** Participated in daily operational IITM GFS/GEFS model forecasts.

Grants and Fellowships

AGU23 Student Travel Grant 2023
American Geophysical Union

DST INSPIRE Fellowship 2018 – 2023
Department of Science and Technology (DST),
Ministry of Science and Technology, Government of India

DST INSPIRE Scholarship 2012 – 2017
Department of Science and Technology (DST),
Ministry of Science and Technology, Government of India

Honours and Awards

IITM Best Student Award 2019
(first rank, PhD course work)
Indian Institute of Tropical Meteorology

Graduate Aptitude Test in Engineering (GATE) 2018
All India Rank (AIR) 492 out of 3,440 candidates
(Engineering Sciences— Thermodynamics; Atmospheric and Oceanic Sciences)
organized by Indian Institute of Technology Guwahati

National Eligibility Test (NET) for Assistant Professor 2017
(Earth Sciences)
University Grants Commission, India

Publications

Sarkar R, Mukhopadhyay P, Pawar S D (2025) Performance of a novel NWP–AI hybrid lightning early warning system over Indian Subcontinent. Journal of Earth System Science 134. (Journal Article)

Sarkar R, Mukhopadhyay P (2025) Lightning Forecasting and Utilization of AI/ML in Early Warnings. Severe Storms, pp. 481–506. (Book Chapter)

Sarkar R, Mukhopadhyay P, Bechtold P, Lopez P, Pawar S D, Chakravarty K (2022) Evaluation of ECMWF Lightning Flash Forecast over Indian Subcontinent during MAM 2020. Atmosphere 13:1520. (Journal Article)

Conference Presentations

Sarkar R (2024) Performance of a novel NWP-AI hybrid lightning early warning system (C_{2AE}) over Indian Subcontinent. TROPMET 2024 Abstract Book. Abstract ID: TROPMET2024-230

Sarkar R, Mukhopadhyay P (2023) A novel NWP-AI hybrid approach for lightning early warning system. AGU Fall Meeting Abstracts, AE23A-2647. 12 Dec 2023. *Poster presentation.*

Mukhopadhyay P, **Sarkar R** (2022) Evaluation of ECMWF lightning forecast over Indian Subcontinent during 2020 premonsoon months. 2nd Workshop on Cloud Organization (WCO2), Utrecht, Netherlands. 18 May 2022. *Contributed talk (pre-recorded).*

Sarkar R, Mukhopadhyay P (2021) Impact of vertical resolution on cloud microphysics in developing Nor'westers. International Conference on Clouds and Precipitation (ICCP 2021), Pune, India, 3 August 2021. *Poster presentation.*

Sarkar R, Mukhopadhyay P (2021) Understanding the triggering of Nor'westers over West Bengal, India. Workshop on Spatial Organisation of Convection, Clouds and Precipitation. 5 May 2021. *Interactive presentation.*

Sarkar R, Mukhopadhyay P, Chaudhuri S, Pal Sarkar J (2019) Probing connectivity between lightning activity and depth of convection during pre-monsoon season over Kolkata: observations and simulations. Workshop for Onset of Indian Summer Monsoon: Theory and Prediction, DCCC, IISc. 26 July 2019. *Poster presentation*.

Science Communication and Public Outreach

Co-creator and Program Coordinator, 2025 – Present
"Next Step after Your PhD?"— PostDoc Potential Webinar Series

- Platform: postdoc-potential.github.io
- In collaboration with: "Climate Dialogues: Way Forward"
- Hosting partner: Anaajoree

Guest Talk, *"Forecasting Lightning: Physics-Based and Data-Driven Approach"*, Department of Atmospheric Sciences, University of Calcutta — Mar 2026

Subject expert, Bengali Balbharati Class 2 Textbook, Maharashtra State Textbook Production and Curriculum Research Board — Aug 2025

Researcher, Writer and Director, *"Who Came Before Us: Remembering S S Vaidya"* — short documentary, IITM W3CS 2023 — Mar 2023

- Video: iccp2020.tropmet.res.in/videos/womens_day_2023/Vaidya.mp4

IITM Science Outreach Representative, 2020 National Science Day Exhibition, GMRT, Khodad — Feb 2020

Academic Service

Volunteer, International Workshop on Stratosphere-Troposphere Interactions and Prediction of Monsoon weather EXtremes (STIPMEX), IITM — Jun 2024

Workshop Moderator, Workshop on Meteorological Forecast for Wind and Solar Energy Generation: Current Status and Future Perspective (online), IITM — Jul 2021

Member, Local Organizing Committee, International Workshop on Prediction skill of Extreme Precipitation Events and Tropical Cyclones: Present status and future Prospect (IP4), IITM — Nov 2019

Peer Review

Journal of Earth System Science, Springer Nature — 2026, 2024, 2023

Pure and Applied Geophysics, Springer Nature — 2024

Teaching Experience

Indian Institute of Tropical Meteorology

- Trainer, DESK-IITM Training for Indian Air Force (IAF) officers — Nov 2024
- Instructor, 2nd IITM Workshop of Indian Air Force Officers' Training — Oct 2023

India Meteorological Department

- Speaker, 5th NWP Refresher Course — May 2024

Training

AI/ML for atmosphere-ocean applications for beginners, DESK, IITM — Feb 2021

Basics of Satellite Meteorology, SMART Training Program, SAC, ISRO — Feb 2018

Technical Skills

Numerical Modelling

- Models: ARW-WRF v4.2, v3.9.1.1, v3.4, Bharat Forecast System, GFS T1534
- Configuration and Execution: HPC/local setup, real-case experimental design, vertical-axis modification, model calibration
- Operational Forecast Models: IMD WRF, GEFS T1534, IFS
- WRF Tools and Packages: p_interp, WRFDomainWizard, ARWpost, NCL, wrf-python

AI/ML

- ML/DL: TensorFlow, PyTorch, Keras, Theano, Scikit-learn
- Data/Scientific Libraries: NumPy, xarray, pandas, SciPy

- Deep Learning: Autoencoders (AE, denoising AE, stacked dA, two-autoencoder classifier), unsupervised learning algorithms

Statistical Analysis

- Statistical Methods: PCA, Spearman rank correlation, hierarchical clustering, time series analysis, climatological, spatial and bias analysis, linear regression, probability distributions
- Forecast Verification: categorical and rare-event metrics, probabilistic verification (Brier Score), continuous, spatial and temporal verification
- AI/ML-Specific Evaluation Metrics: Model Reliance, Bayes Error Rate
- Software: Statistica

Meteorological and Geospatial Data and Visualisation

- Data Formats: NetCDF, HDF, GRIB1/2, GRID, CSV, Binary
- Meteorological and NWP Data Handling: GrADS, CDO (CLI/Python), NCO, ecCodes, MetPy, imdlib, cf-python, nctoolkit, pangaea, netCDF4, wgrib/wgrib2 (including Fortran API)
- GIS and Geospatial Tools: GeoPandas, rioxarray, Shapely
- Sounding/Radiosonde Analysis: RAOB
- Visualisation: Matplotlib, Seaborn, Cartopy, PyNCL, PyNIO, PyNGL, ncview

Programming and HPC

- Operating Systems: Linux/UNIX, Windows (WSL)
- Scripting/Programming Languages: Python, Bash, Fortran 90/95, MATLAB, C++
- Editors and IDEs: Vim, VS Code, Jupyter Notebook/Lab
- Environment Management: Conda, Pipenv, Docker
- HPC Systems: Arka, Pratyush, Aditya
- Parallel Computing: OpenMP, MPI, NVIDIA CUDA, Dask; Data Serialisation: pickle
- Remote Access/Terminal Tools: MobaXterm
- Version Control and Collaboration: Git, GitHub

Documentation

- Document Preparation: Markdown, LaTeX
- Office Suites: Microsoft Office and Google Workspace (including scripting and automation)
- Web Development: HTML, CSS, JavaScript
- Graphics and Diagrams: Canva, draw.io, Mermaid

Languages

Bengali (Native) English (Fluent) Hindi (Conversational)