ANIRUDH ARORA

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EDUCATION

Integrated BS-MS (Dual Degree) in Environmental Sciences December 2021 - May 2026
Indian Institute of Science Education and Research (IISER) *Bhopal, India*
Overall CPI: 9.22/10.00; Master's CPI: 10.00/10.00

CLIMATE RESEARCH EXPERIENCE

Climate Physics Department, MPI for Meteorology July 2026 - November 2026
Supervisor - Dr. Clara Bayley *Hamburg, Germany*

- Research assistant in the Climate Surface Interaction group led by Dr. Cathy Hohenegger.
- Building a reproducible experiment framework for the superdroplet model Cleo (Python, YAML-configured runs), extending from zero-dimensional collision–coalescence toward cloud-scale configurations, to quantify how superdroplet number, stochastic ensemble size and initialisation trade off against accuracy and computational cost. Convergence is assessed through total variation of the droplet size distribution, real-droplet number concentration, the large-droplet tail, rain-onset timing and across-ensemble spread.

CLIMATics Group, KAUST July 2025 - May 2026
Supervisor - Prof. Ibrahim Hoteit *Thuwal, Saudi Arabia*

- Master's thesis: *Toward Reliable Tropical Precipitation Simulations by Assessing the Added Value of Large Ensembles and Kilometer-Scale Simulations.*
- Evaluated the IFS-FESOM nextGEMS production historical precipitation simulation at kilometre scale against IMD, GPCP, ERA5 and CMIP6 MMM benchmarks using PCC-RMSE, intensity distributions, dry-spell statistics and elevation-binned composites to separate resolution-sensitive from resolution-insensitive error. First author manuscript is under peer-review in *Climate Dynamics*. Also presented the results at the km-scale Global Modelling Summit 2026.
- Built a Monte Carlo resampling framework to quantify effective ensemble size (N_{eff}) for precipitation across three large ensemble datasets - CESM2-LE, MPI-GE and CESM2-PPE, under four convergence criteria including a probabilistic formulation based on the Brier Skill Score.
- Conducted the first dedicated long-term satellite-based analysis of atmospheric methane over the Arabian Peninsula using 93 months (May 2018 – December 2025) of bias-corrected blended TROPOMI+GOSAT XCH_4 retrievals; quantified the region-specific retrieval bias against SWIR surface albedo and classified persistent hotspots using Mann–Kendall trend tests with Theil–Sen slopes and Hamed–Rao autocorrelation correction. First author manuscript in preparation for submission to *Atmospheric Chemistry and Physics*.

DST Centre of Excellence for Climate Information, IIT Delhi May 2023 - June 2026
Supervisor - Prof. Saroj K. Mishra *New Delhi, India*

- Co-supervised by Prof. Mishra for my master's thesis.
- Assessed whether model credibility over the Tropics, particularly over South Asia has improved across CMIP generations, comparing CMIP5 models and their direct successors in CMIP6 against observations for the historical period. Additionally, the nextGEMS km-scale models were also analysed to test whether convection-permitting configurations and high resolution simulations improve on these regions.
- Diagnosed the circulation pathway linking solar geoengineering to regional rainfall change, using an eight-model GeoMIP5 multi-model mean (G1, $4 \times CO_2$ and piControl) to compare seasonal precipitation and 200/850 hPa wind responses. Presented at the 14th Annual GeoMIP Meeting, Cornell University
- Contributed to the SARCI regional climate framework, specifically to the synthesis of skill-weighted CMIP6 sea surface temperature and sea ice lower boundary conditions, bias-corrected against HadISST using a time-slice approach that preserves low-frequency variability. Published in BAMS.
- Examined the large-scale circulation controls on chronic Indo-Gangetic Plain air pollution, arguing that persistent subsidence beneath the overlapping descending branches of the Hadley and Walker cells, together with weakening ventilation under climate change, sustains a background burden that episodic sources such as stubble burning and fireworks only modulate. Published as a perspective in The India Forum (third author).

OTHER RESEARCH EXPERIENCE

Ethnography Studies - IISER Bhopal August 2023 - April 2024
Supervisor - Dr. Renny Thomas *Bhopal, India*

· Field ethnography on the socio-cultural role of the Garuda Purana in death ritual, and a four-month comparative ethnographic study of work practices and social dynamics in two laboratory settings.

PEER-REVIEWED PUBLICATIONS

- Bhuyan, D. P., Upadhyaya, P., Pathak, R., Namdev, P., Salunke, P., Anand, A., Suresh, A. D., **Arora, A.**, Baraik, S. K., Jain, S., Parihar, R. S., Dwivedi, A., Sahany, S., Sharan, M., Dash, S. K., Fasullo, J. T., Behera, S. K., Tribbia, J. and Mishra, S. K. (2026). *Advancing Climate Services in South Asia: The SARCI Framework for Actionable Climate Information and Regional Capacity Building.* Bulletin of the American Meteorological Society, 107(3), E564–E584.
- Mishra, S. K., Upadhyaya P., **Arora A.**, Vinod A.J., Jayan N., Dwivedi A. (2025). *To Solve North India's Air Crisis, Look Beyond Stubble and Fireworks.* The India Forum.

MANUSCRIPTS UNDER REVIEW

- **Arora, A.**, Dasari, H.P., Jha, S.K., Mishra, S.K., Hoteit, I. (2026). *Km-scale resolution improves monsoon precipitation characteristics but leaves large-scale dynamical biases: evidence from IFS-FESOM nextGEMS.* Under peer-review in *Climate Dynamics.*
- **Arora, A.** (2026). *Public enlightenment and climate action: rethinking Kantian principles for a sustainable future.* Under peer-review in *npj Climate Action.*

MANUSCRIPTS IN PREPARATION

- **Arora, A.**, Gandhi, H., Hoteit, I., *Methane variability, persistent hotspots, and shamal-driven seasonality over the Arabian Peninsula from blended TROPOMI+GOSAT XCH_4 retrievals (2018–2025).* In preparation for *Atmospheric Chemistry and Physics.*
- **Arora, A.** & Upadhyaya, P., Mishra, S.K., Bhuyan, D., Behera, S., Fasullo, J., Tribbia, J., Jain, S., Salunke, P., Sahany, S., Dash, S.K., *Climate models doubled in a decade but credibility remains poor over Global South.*

CONFERENCE CONTRIBUTIONS

- **Arora, A.**, Dasari, H.P., Jha, S.K., Mishra, S.K., Hoteit, I. (2026). *Evaluating Indian Summer Monsoon Precipitation in the IFS-FESOM nextGEMS Production Historical Simulation at Kilometre Scale*. km-Scale Global Modelling Summit 2026, Hamburg, Germany.
- **Arora, A.**, Mishra, S.K., Jha, S.K. (2025). *Solar radiation management and its impact on Earth's hydrological cycle*. Department of Earth & Environmental Sciences Annual Retreat 2025, IISER Bhopal.
- **Arora, A.**, Upadhyaya, P., Mishra, S.K. (2024). *Regional Climate Responses to Geoengineering Interventions: Implications and Considerations for Climate Mitigation Strategies*. 14th Annual GeoMIP Meeting 2024, Cornell University, USA.
- **Arora, A.**, Mishra, S.K. (2024). *Navigating the Mist: A Comprehensive Analysis of Observational Data for Summer Monsoon Precipitation over Indian Subcontinent*. Department of Earth & Environmental Sciences Annual Retreat 2024, IISER Bhopal. (Best Presentation Award)

TECHNICAL SKILLS

Languages	Python, MATLAB, NCAR Command Language (NCL), Mathematica
Climate & EO data	CMIP5/6, nextGEMS, ERA5, IMD and other precipitation products, Large ensembles (MPI-GE, CESM2-LE, CESM2-PPE), TROPOMI, GOSAT
Climate tools	Climate Data Operators (CDO), netCDF Operators (NCO), NetCDF
HPC & workflows	Slurm, Levante (DKRZ), Shaheen III (KAUST), Bash, Git
Typesetting & Web	LaTeX, HTML5, CSS

ADDITIONAL PROJECT REPORTS

- Modeling atmospheric aerosols in climate systems: Representation, dynamics, and radiative impacts (2024), Advisor - Prof. Ramya Sunder Raman
- Aerosols and their influence on Indian monsoon rainfall (2024), Advisor - Dr. Shubhi Agrawal

HONORS

Rhodes Scholarship 2026 Finalist November 2025
University of Oxford – Rhodes Trust

· Among the top 13 candidates out of ∼1,000 applicants for the Rhodes Scholarship India.

Visiting Student Research Program March 2025
King Abdullah University of Science and Technology (KAUST) *Kingdom of Saudi Arabia*

· Received full scholarship to conduct master's thesis research at KAUST under Prof. Ibrahim Hoteit.

Full Travel Support – 14th Annual GeoMIP Meeting July 2024
Cornell University *Ithaca, NY, USA*

· Full travel and accommodation support to present my research work at the 14th Annual GeoMIP Meeting.

Bronze Medal – The University Physics Competition January 2023
Carroll College, Helena, MT

· Team award in the worldwide University Physics Competition 2022 for a mathematical model of perfect penalty kick trajectories.

CNR Rao Education Foundation Prize August 2022
Indian Institute of Science Education and Research *Bhopal, MP*

· Awarded for the highest CPI (10.00/10.00) in the first semester of the BS-MS dual-degree programme.

Earlier honours

· GIZ Sustainable Development Competition (felicitated at the German Embassy, New Delhi, 2019); Joseph Memorial Scholarship for academic excellence and leadership, St. Paul H.S. School, Indore (2019).

TEACHING EXPERIENCE

- Teaching assistant for Dr. Shubhi Agrawal, Introduction to Environmental Sciences (IISER-B, Spring 2025)

POSITIONS OF RESPONSIBILITY

Prayaas - Making Lives Colorful Student Organization
Coordinator *2022 - 2026*

· Volunteer group working on the upliftment of underprivileged communities around the IISER Bhopal through education and social initiatives like teaching and women empowerment workshops.

IISER Bhopal Debating Society Student Organization
President (2023) and Active member *2022 - 2024*

Chrysalis IISER Bhopal Science Communication Body
Podcast Creator *2022*

· Co-hosted a podcast - "Climate Change Research Governing Public Policy Making".