

PANKAJ KUMAR

Institute of Meteorology and Climate Research (IMK)
Karlsruhe Institute of Technology (KIT)
Karlsruhe, Germany 76344

+91 7061255826
pankaj.kmr1990@gmail.com
<https://pankajkarman.github.io>

EDUCATION

PhD in Atmospheric Chemistry and Machine Learning IIT Kharagpur, Kharagpur, West Bengal, India	2017–2022
Master of Technology in Earth System Science and Technology IIT Kharagpur, Kharagpur, West Bengal, India	2015–2017
Bachelor of Engineering in Mechanical Engineering BIT Mesra, Ranchi, Jharkhand, India	2008–2012

SKILLS

Programming Languages: Python, Fortran, MATLAB, JavaScript

Data Science Skills

- **Artificial Intelligence:** Regression, Classification and Clustering, Time series analysis, Machine learning, Deep learning, and Causal Discovery / Inference.

Physical Modeling Skills

- **Trajectory Modeling:** HySPLIT
- **Atmospheric modeling:** ICON-ART, GEOS-Chem
- **Radiative Transfer Modeling:** RRTMG

Analytics Tools

- **Statistical Learning:** statsmodels, scikit-learn, Keras, PyTorch
- **Data visualization:** Matplotlib, ggplot, Leaflet, Folium, arviz, D3.js, Three.js
- **Mathematical optimization:** scipy
- **RADAR Data Analysis:** wradlib
- **Geospatial Data Analysis:** gdal, rasterio, xarray, geopandas, Google Earth Engine
- **Parallel Programming:** dask, joblib

Other Computer related skills

- Experience of version control with git/github and shell scripting in Linux
- Conversant with Markdown and LaTeX

OPEN SOURCE PYTHON PACKAGES DEVELOPED

- [MieAI](#): A neural network based Mie emulator for calculating optical properties of internally mixed aerosols in atmospheric models.
- [MieAI-Fortran](#): Fortran engine to couple MieAI with ICON-ART.

- [bias correction](#): Python library for performing bias correction of datasets using methods like quantile mapping, scaled distribution mapping (>37k downloads).
- [HyTraj](#): Implementation of HySPLIT based trajectory modeling and analysis in python (>11k downloads).
- [pyvortex](#): Python library for estimating Equivalent Latitude and polar vortex edge using Nash criteria (>11k downloads).
- [reprobus](#): Python library for post-processing of REPROBUS chemistry transport model using **fortran/python coupling**.

RESEARCH EXPERIENCE

Post-doctoral Researcher, IMKTRO, KIT Germany

2022 – Present

- Working on the development of ICON-SmART (ICON-based unified modeling system for seamless global-to-regional numerical weather forecasting and climate prediction).
- Developing Machine Learning based radiation and atmospheric chemistry parameterization schemes for ICON-ART model.
- Developed mineral dust pre-processor for ICON modeling system.

Research Scholar, ATMOS Lab, IIT Kharagpur

2017 – 2022

- Developed open source python library ([bias correction](#)) for bias-correction using various correction techniques like quantile mapping and scaled distribution mapping.
- Investigated long-term trend analysis of rainfall changes and Land Use Land Cover ([LULC](#)) change over North-East India using Random forest based classification.
- Developed Receptor models based on airmass trajectory generated with HySPLIT in python ([HyTraj](#)) for source detection studies and clustered them using Hierarchical agglomerative clustering and wavelet transform based K-Means clustering for transportation pathways analysis.
- Performed Self-organising map (SOM) based clustering and long-term analysis of tropospheric ozone using DLM and MLR.
- Conducted deep learning based Causal Effect Network (CEN) analysis for determination of robust predictors of tropospheric ozone variability in Antarctica.
- Developed a python library for polar vortex analysis ([pyvortex](#)).
- Carried out radiative transfer modeling using RRTMG for radiative forcing estimation.

PUBLICATIONS

1. **P. Kumar**, H. Vogel, J. Bruckert, LJ Muth, and GA Hoshyaripour: *MieAI: A neural network for calculating optical properties of internally mixed aerosol in atmospheric models*, npj Climate and Atmospheric Science, 2024.
2. R. Roy, **P. Kumar**, J. Kuttippurath, F. Lefevre: *Chemical ozone loss and chlorine activation in the Antarctic winters of 2013–2020*, Atmospheric Chemistry and Physics, 2024.
3. J. Kuttippurath, VK Patel, R. Roy, and **P. Kumar**: *Sources, variability, long-term trends, and radiative forcing of aerosols in the Arctic: implications for Arctic amplification*, Environmental Science and Pollution Research, 2024.
4. R. Kumar, J. Kuttippurath, GS Gopikrishnan, **P. Kumar**, and H. Varikoden: *Enhanced surface temperature over India during 1980–2020 and future projections: causal links of the drivers and trends*, npj Climate and Atmospheric Science, 2023.
5. R. Kashyap, J. Kuttippurath and **P. Kumar**: *Browning of vegetation in efficient carbon sink regions of India during the past two decades is driven by climate change and anthropogenic intrusions*, Journal of Environmental Management, 2023.
6. **P. Kumar**, J. Kuttippurath, and A. Mitra: *Causal discovery of drivers of surface ozone variability in Antarctica using a deep learning algorithm*, RSC Environmental Science: Processes & Impacts, 2022.
7. S. Murasingh, J. Kuttippurath, S. Sandeep Dash, R. Ramesan, S. Raj, Madan K. Jha, and **P. Kumar**: *Long-term trends and projections of hydrological fluxes under RCP climate change scenarios for a mountainous river basin of Northeast India*, Journal of Water and Climate Change, 2022.
8. R. Roy, J. Kuttippurath, F. Lefèvre, S. Raj, and **P. Kumar**: *The Sudden Stratospheric Warming and Chemical ozone loss in the Antarctic winter 2019: Comparison with the winters of 1988 and 2002*, Theoretical and Applied Climatology, 2022.
9. D. Ardra, J. Kuttippurath, R. Roy, **P. Kumar**, S. Raj, R. Mueller, and W. Feng: *The unprecedented ozone loss in the Arctic winter and spring of 2010/2011 and 2019/2020*, ACS Earth and Space Chemistry, 2022.
10. **P. Kumar**, J. Kuttippurath, P. von der Gathen, I. Petropavlovskikh, B. Johnson, A. McClure-Begley, P. Cristofanelli, P. Bonasoni, M. E. Barlasina, and R. Sánchez: *The increasing surface and tropospheric ozone in Antarctica and their possible drivers*, ACS Environmental Science & Technology, 2021.
11. J. Kuttippurath, W. Feng, R. Müller, **P. Kumar**, S. Raj, G. S. Gopikrishnan and R. Roy: *Exceptional loss in ozone in the Arctic winter/spring 2020*, Atmospheric Chemistry and Physics, 2021.
12. J. Kuttippurath, F. Lefèvre, S. Raj, **P. Kumar**, and K. Abbhishek: *The ozone hole measurements at the Indian station Maitri in Antarctica*, Polar Science, 2021.
13. J. Kuttippurath, S. Murasingh, P. A. Stott, B. Balan Sarojini, M. K. Jha, **P. Kumar**, P. J. Nair, H. Varikoden, S. Raj, P. A. Francis, and P. C. Pandey : *Observed rainfall changes*

in the past century (1901–2019) over northeast India and the wettest place on the Earth, Environmental Research Letters, 2020.

14. J. Kuttippurath, **P. Kumar**, P. J. Nair, and P. C. Pandey: *Emergence of ozone recovery evidenced by reduction in the occurrence of Antarctic ozone loss saturation*, npj Climate and Atmospheric Science, 2018.
15. J. Kuttippurath, **P. Kumar**, P. J. Nair, and A. Chakraborty: *Accuracy of satellite total column ozone measurements in polar vortex conditions: Comparison with ground-based observations in 1979-2013*, Remote Sensing of Environment, 2018.