

PANKAJ KUMAR

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EDUCATION

PhD in Atmospheric Physics and Chemistry 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:** WRF, GEOS-Chem, ICON-ART
- **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:** QGIS/ArcGIS, 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

- [bias_correction](#): Python library for performing bias correction of datasets using methods like quantile mapping, scaled distribution mapping (>22k downloads).
- [HyTraj](#): Implementation of HySPLIT based trajectory modeling and analysis in python (>7k downloads).

- [pyvortex](#): Python library for estimating Equivalent Latitude and polar vortex edge using Nash criteria (>7k downloads).
- [reprobus](#): Python library for post-processing of REPROBUS chemistry transport model using **fortran/python coupling**.

RESEARCH EXPERIENCE

Post-doctoral Researcher, IMK-TRO, KIT Germany

2017 – 2022

- Developing ML based emulation and parameterization schemes for ICON-ART model.
- Developing 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 air mass 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.

Research Assistant, ATMOS Lab, IIT Kharagpur

2016 – 2017

- Estimated rainfall using preliminary data from Doppler Weather radar in Kolkata region using **wradlib** radar data analysis package in **python**.
- Investigated freezing of water droplet and subsequent transformation of its shape numerically using **python**.

Undergraduate project

2011 – 2012

- Carried out numerical investigation of natural convection in Bingham fluids within a square enclosure with differentially heated sidewalls using **Fluent**, a CFD package.
- Performed optimization of Wind Turbine Blades using **Fluent**.

PUBLICATIONS

1. 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.
2. **Pankaj Kumar**, Jayanarayanan Kuttippurath, and Adway Mitra: *Causal discovery of drivers of surface ozone variability in Antarctica using a deep learning algorithm*, RSC Environmental Science: Processes & Impacts, 2022.
3. 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.
4. 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.
5. Divakaran Ardra, Jayanarayanan Kuttippurath, Raina Roy, **Pankaj Kumar**, Sarath Raj, Rolf Mueller, and Wuhu Feng: *The unprecedented ozone loss in the Arctic winter and spring of 2010/2011 and 2019/2020*, ACS Earth and Space Chemistry, 2022.
6. **Pankaj Kumar**, Jayanarayanan Kuttippurath, Peter von der Gathen, Irina Petropavlovskikh, Bryan Johnson, Audra McClure-Begley, Paolo Cristofanelli, Paolo Bonasoni, Maria Elena Barlasina, and Ricardo Sánchez: *The increasing surface and tropospheric ozone in Antarctica and their possible drivers*, ACS Environmental Science & Technology, 2021.
7. 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.
8. J. Kuttippurath, F. Lefèvre, S. Raj, **P. Kumar**, and K. Abhishek: *The ozone hole measurements at the Indian station Maitri in Antarctica*, Polar Science, 2021.
9. 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.
10. 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.
11. 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.