

PANKAJ KUMAR

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EDUCATION

PhD in Atmospheric Chemistry and Physics Indian Institute of Technology Kharagpur, Kharagpur, India	Present
Master of Technology in Earth System Science and Technology Indian Institute of Technology Kharagpur, Kharagpur, India	2017
Bachelor of Engineering in Mechanical Engineering Birla Institute of Technology, Mesra, Ranchi, Jharkhand, India	2012

PUBLICATIONS

- **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, in review.
- 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*, in review.
- **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*, Environmental Science & Technology, 2021.
- 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.
- 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.
- 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.
- 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.
- 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.

CONFERENCES

- **Pankaj Kumar** and Jayanarayanan Kuttippurath: *Tropical teleconnection and climate impacts of tropospheric ozone variability in Antarctica*, NCPS, Goa, August 2019.
- **Pankaj Kumar**, Jayanarayanan Kuttippurath, Prijitha J. Nair, and Arun Chakroborty: *Accuracy of Ground-based measurements in Polar Vortex conditions: Comparison to TOMS/OMI observations during 1979-2013*, EGU General Assembly, Vienna, April 2017.

RESEARCH EXPERIENCE

Research Scholar, ATMOS Lab, PhD

2017 – Present

- Merged and bias-corrected long term data record of vertical profiles of rainfall, ozone and related trace gases using various correction techniques like quantile mapping and scaled distribution mapping.
- Analysed Polar vortex based stratospheric ozone for detection of ozone hole saturation using ground-based and satellite based measurements in Antarctic region.
- Developed Receptor models based on air mass trajectory generated with HYSPLIT in python for source detection studies and clustered them using Hierarchical agglomerative clustering and wavelet transform based K-Means clustering for transportation pathways analysis.
- Investigated Land Use Land Cover (LULC) change over North-East India using Google Earth Engine and Random forest based classification.
- Performed Self-organising map (SOM) based clustering of tropospheric ozone profiles for Antarctic region and their long-term analysis using DLM and MLR.
- Conducted Causal Effect Network (CEN) analysis of tropospheric ozone in Antarctica for determination of geophysical drivers responsible for observed variability.
- Carried out radiative transfer modeling using RRTMG for radiative forcing estimation.

Research Assistant, ATMOS Lab, MTech

2016 – 2017

- Compared long term total column ozone datasets from various ground based instruments with satellite based observations in Antarctic region.
- 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 **MATLAB**.

Undergraduate project, BE

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**.

SKILLS

Programming Languages: Python, JavaScript, MATLAB, Fortran

Data Science Skills

- **Statistical Learning:** Bayesian Data Analysis and Parameter Estimation (MLE, MAP, MCMC), Regression, Classification and Clustering, Time series analysis (State space models, MLR, DLM), Machine learning, and Causal Inference.

Physical Modeling Skills

- **Trajectory Modeling:** HYSPLIT
- **Atmospheric modeling:** WRF, GEOS-Chem, climlab
- **Radiative Transfer Modeling:** RRTMG

Analytics Tools

- **Statistical Learning:** statsmodels, scikit-learn, Keras, PyTorch, PyMC3
- **Data visualization:** Matplotlib, seaborn, 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 and shell scripting in Linux.
- Conversant with Markdown and LaTeX.

OPEN SOURCE SOFTWARE

- [bias correction](#): Python library for performing bias correction of datasets using methods like quantile mapping, scaled distribution mapping
- [HyTraj](#): Implementation of HySPLIT based trajectory modeling and analysis in python
- [pyvortex](#): Python library for estimating Equivalent Latitude and polar vortex edge using Nash criteria

AWARDS

- Received full funding for attending European Geosciences Union (EGU) General Assembly held in Vienna, Austria. **April 2017**