PANKAJ KUMAR

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EDUCATION

PhD in Atmospheric Chemistry and Chemistry **Present**
Indian Institute of Technology Kharagpur, Kharagpur, India

Master of Technology in Earth System Science and Technology **2017**
Indian Institute of Technology Kharagpur, Kharagpur, India

Bachelor of Engineering in Mechanical Engineering **2012**
Birla Institute of Technology, Mesra, Ranchi, Jharkhand, India

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.

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 airmass 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.**

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.

- **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. Abbhishek: *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.

- Jayanarayanan Kuttippurath and **Pankaj Kumar**: *Polar Ozone and Climate Change*, 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.

- Rohit Kumar Shukla, Chithra Shaji, Satya P Ojha, and **Pankaj Kumar**: *A study on the seasonal variability of upwelling and its effects on physical parameters in Arabian Sea,* EGU General Assembly, Vienna, April 2017.

Open Source Software

- **bias_correction:** Python library for performing bias correction of datasets using methods like quantile mapping, scaled distribution mapping **Downloads:** 8k

- **HyTraj:** Implementation of HySPLIT based trajectory modeling and analysis in python **Downloads:** 3k

- **pyvortex:** Python library for estimating Equivalent Latitude and polar vortex edge using Nash criteria **Downloads:** 3k

AWARDS

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