PANKAJ KUMAR

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EDUCATION

PhD in Atmospheric Physics   **2017-2022**
IIT Kharagpur, Kharagpur, India

Master of Technology in Earth System Science and Technology   **2015-2017**
IIT Kharagpur, Kharagpur, India

Bachelor of Engineering in Mechanical Engineering   **2008-2012**
BIT Mesra, Ranchi, Jharkhand, India

SKILLS

Programming Languages: Python, R, Fortran, MATLAB, JavaScript

Data Science Skills

➢ **Artificial Intelligence**: Regression, Classification and Clustering, Time series analysis (MLR, DLM), Machine learning, Deep 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
➢ **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 (*>16,000 downloads*).

➢ **HyTraj:** Implementation of HySPLIT based trajectory modeling and analysis in python (*>5,700 downloads*).

- ➢ **pyvortex:** Python library for estimating Equivalent Latitude and polar vortex edge using Nash criteria (*>5,600 downloads*).

- ➢ **reprobus:** Python library for post-processing of REPROBUS chemistry transport model using **fortran/python coupling**.

RESEARCH EXPERIENCE

Research Scholar, ATMOS Lab, PhD   2017 – Present

- ➢ 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 which involved various corrections and mosaic of LANDSAT tiles over North-east India.

- ➢ Analysed future changes in hydrological fluxes for a river catchment of North-east India using SWAT model.

- ➢ 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 using DLM and MLR.

- ➢ Conducted deep learning based Causal Effect Network (CEN) analysis for determination of robust predictors.

- ➢ Developed a python library for polar vortex analysis (pyvortex).

- ➢ Carried out radiative transfer modeling using RRTMG for radiative forcing estimation.

Research Assistant, ATMOS Lab, MTech   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, 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

1. 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.

2. 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.

3. **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.

4. **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.

5. 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.

6. 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.

7. 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.

8. 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.

9. 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.

10. 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.