Pankaj Kumar

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Explainable and Causal AI ⋆ Python Developer ⋆ Git ⋆ Physical Modeling

Education

2022 **Doctor of Philosophy, Atmospheric Chemistry and Machine Learning**.
Indian Institute of Technology Kharagpur (IN)

2017 **Master of Technology, Earth System Science and Technology**.
Indian Institute of Technology Kharagpur (IN)

2012 **Bachelor of Engineering, Mechanical Engineering**.
Birla Institute of Technology, Mesra (IN)

Research Experience

2022 - Present **Post-Doctoral Researcher**, *Aerosol and Reactive Tracer Modelling, KIT Germany*.

- Implementing ML based emulation and parameterization schemes for ICON-ART model.
- Developing mineral dust pre-processor for ICON modeling system.
- Authoring user-friendly post-processing library for ICON-ART in python.

2017 - 2022 **Research Scholar, PhD**, *ATMOS Lab, IIT Kharagpur*.

- Developed bias-correction library in python (>24k downloads till now).
- Developed receptor models for pollutant source detection using back-trajectories in python (>8k downloads).
- Implemented clustering of air-parcel trajectories using wavelet features for transportation pathways analysis.
- Performed self-organising map based clustering of tropospheric ozone profiles and their trend analysis using Bayesian dynamic linear model and multivariate linear regression.
- Conducted causal analysis of tropospheric ozone to identify the geophysical drivers of observed variability.
- Investigated Land Use Land Cover change over North-East India using Google Earth Engine and Random forest based classification.
- Developed a sequence-to-sequence autoencoder to extract features from variable length trajectories.
- Simulated global atmospheric chemistry using GEOS-Chem at Pratyush, India's fastest supercomputer.

2016 - 2017 **Research Assistant, MTech**, *ATMOS Lab, IIT Kharagpur*.

- Estimated rainfall using preliminary Doppler Weather radar data for Kolkata region using python.
- Investigated freezing and shape transformation of water droplet numerically using MATLAB.

Technical Skills

- **Data Analytics**: Bayesian inference, Machine Learning, Causal Discovery and Inference
- **Physical Modeling**: HySPLIT, WRF, GEOS-Chem, ICON-ART
- **Programming**: Python, Fortran, JavaScript, MATLAB, Bash, Git
- **Markup Languages**: LaTeX, Markdown, HTML/CSS

Publications

- Rahul Kashyap, Jayanarayanan Kuttippurath and **Pankaj 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.
- **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.
- **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, **P. Kumar**, P. J. Nair, P C Pandey, *Emergence of ozone recovery evidenced by reduction in the occurrence of Antarctic ozone loss saturation*, npj Climate and Atmospheric Science, 2018.

Achievements

- Multiple researcher articles covered by reputed national/international media like the Hindu.
- Open-source libraries developed by me has crossed 30k downloads.