Pankaj Kumar

Explainable and Causal AI \star Python Developer \star Git \star Physical Modeling

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

Present • 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).
- o 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.
- $\circ~$ 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.
- o 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.

- $\circ~$ Estimated rainfall using preliminary Doppler Weather radar data for Kolkata region using python.
- \circ 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 <u>the Hindu</u>.
- Open-source libraries developed by me has crossed 30k downloads.