Pradeep Kushwaha

Indian Institute of Science
Center for Atmospheric
and Oceanic Sciences,
Bengaluru, KA, 560012,
India

Email: pkushwaha9999@gmail.com
Website: https://sites.google.com/view/pradeepk/home
LinkedIn: https://in.linkedin.com/in/pradeepk4444
RGate: https://www.researchgate.net/profile/Pradeep-Kushwaha
YouTube: https://www.youtube.com/@MeteoQuest

Summary

Ph.D. in Climate Science from the **Indian Institute of Science**, specializing in monsoon systems (MTCs, low-pressure systems), extreme rainfall, and tropical cyclones. Extensive experience with **WRF** for simulating synoptic phenomena, conducting sensitivity experiments (cloud diabatic heating, SST, energy fluxes), and **applying tropical cyclone bogus vortex techniques** to study Arabian Sea cyclones. Skilled in developing cyclone detection/tracking algorithms (**NCL**) and employing **unsupervised machine learning techniques**, including **k-means clustering**, for classifying synoptic systems. Proficient in working with cutting-edge AI models such as **Pangu-Weather, GraphCast, and FourCastNet** for atmospheric modeling and weather prediction. Research interests include tropical system dynamics, numerical weather prediction, climate variability, the impacts of climate change on weather extremes, and the use of **AI in revolutionizing weather forecasting**.

EDUCATION

Ph.D., *Atmospheric & Oceanic Sciences*
Indian Institute of Science, Bangalore, India   CGPA 95%   2016-2023

Masters of Technology (M.Tech.), *Climate Science*
Indian Institute of Science, Bangalore, India   CGPA 82%   2014-2016

Bachelor of Engineering (BE), *Electrical Engineering*
Indra Gandhi Engineering Collage, Sagar, India   CGPA 82%   2010-2014

EXPERIENCE

Research Associate, *Atmospheric & Oceanic Sciences*
Indian Institute of Science, Bangalore, India   Oct 2023 to present

Currently evaluating the fidelity of different **AI-ML weather models** in predicting synoptic systems and intraseasonal variability over the Indian region. Previously worked on the role of topography and soil moisture in the dynamics of Arabian Sea MTCs through sensitivity experiments using the **WRF model**.

ACADEMIC ACHIEVEMENTS

- Outstanding Student Presentation award in Richard H. Johnson Symposium at American Meteorological Society Annual Meeting, 2022.
- Received Grantham Fellowship for Academic excellence at Indian Institute of Science (2014-2020).
- Scored 95% CGPA in Ph.D. course work (highest in the batch).
- Scored 100% SGPA in masters research project (highest in the batch).
- Scored 82% CGPA in undergraduate in Electrical Engineering (second rank in the class of 70).

PUBLICATIONS

- **Kushwaha, P.**, Sukhatme, J., & Nanjundiah, R. (2021). *A Global Tropical Survey of Mid-Tropospheric Cyclones*, *Monthly Weather Review*, `doi:https://doi.org/10.1175/MWR-D-20-0222.1` (**IF: 2.8**).

- **Kushwaha, P.**, Sukhatme, J., & Nanjundiah, R. (2021). *Classification of Middle Tropospheric Systems over the Arabian Sea and Western India*, *Quarterly Journal of the Royal Meteorological Society*, `doi: https://doi.org/10.1002/qj.4466` (**IF: 8.9**).

- **Kushwaha, P**., Sukhatme, J., & Nanjundiah, R. (2023). *Role of Bay of Bengal Low-Pressure Systems (LPS) in the formation of Arabian Sea Mid-Tropospheric Cyclones*, Quarterly Journal of the Royal Meteorological Society, `doi:https://doi.org/10.1002/qj.4726`) (**IF : 8.9**)

- **Kushwaha, P.**, Sukhatme, J., & Nanjundiah, R.S. *A Tropical Survey of Mid-Tropospheric Cyclones, Their Classification and Genesis* (**PhD Thesis**: `etd.iisc.ac.in/handle/2005/6003`).

- Ashim Sattar , Kristen L. Cook, Shashi Kant Rai , Etienne Berthier, Simon Allen, Sonam Rinzin, Maximillian Van Wyk De Vries, Wilfried Haeberli, **Pradeep Kushwaha**, Dan H. Shugar, Adam Emmer, Umesh K. Haritashya , Holger Frey, Praful Rao, Kori Sanjay Kumar, Prabhakar Rai, Rajeev Rajak, Faruk Hossain, Christian Huggel, Martin Mergilli, Mohd. Farooq Azam, Simon Gascoin, Jonathan L. Carrivick, Louie Elliot Bell, Rakesh Kumar Ranjan, Irfan Rashid , Anil. V. Kulkarni, Dave Petley, Wolfgang Schwanghart, C. Scott Watson, Nazimul Islam, Moushumi Das Gupta, Stuart N. Lane, Shahid Younis Bhat. *The Sikkim flood of October 2023: drivers, causes and impacts of a multi-hazard cascade* (**In Minor Revision, Science Journal**) (**IF : 47**)

- **Kushwaha P**, Jalan S and Sukhatme J. *Evaluating the Fidelity of AI-ML Weaather Models in Predicting Synoptic Tropical Systems and Intraseasonal Variability Over the Indian Region* (**In Preparation**)

- **Kushwaha, P.**, Sukhatme, J., & Nanjundiah, R. *Role of Southern Indian Topography in the Dynamics of Arabian Sea Mid-Tropospheric Cyclones* (**In Preparation**).

CONFERENCES

- **Kushwaha, P** and Sukhatme, J and Nanjundiah, R.S. (2022). Role of Bay of Bengal Monsoon Lows in the Genesis of Arabian Sea Middle Tropospheric Cyclones (MTCs). In 35th Conference on Hurricanes and Tropical Meteorology, AMS, 2022.

- **Kushwaha, P** and Sukhatme, J and Nanjundiah, R.S. (2022). Synoptic Weather Regimes over Western India and the Arabian Sea. In the 102nd AMS Annual Meeting, January 2022. (**Outstanding Student Presentation Award**)

- **Kushwaha, P** and Sukhatme, J and Nanjundiah, R.S. . Role of Cloud Diabatic Heating on the Structure of Middle Troposphere Cyclones. In International Conference on Clouds and Precipitation, Indian Institute of Tropical Meteorology, 2021.

- **Kushwaha, P** and Sukhatme, J and Nanjundiah, R.S. . Quasi-Stationary Nature of Arabian Sea Mid-Tropospheric Cyclones. In 34th Conference on Hurricanes and Tropical Meteorology, AMS, 2021.

- **Kushwaha, P** and Sukhatme, J and Nanjundiah, R.S. . Climatology of Middle Tropospheric Cyclones Over South East Asia. In 34th Conference on Hurricanes and Tropical Meteorology, AMS, 2021.

- **Kushwaha, P** and Sukhatme, J and Nanjundiah, R.S. . A Global Survey of Middle Tropospheric Cyclones. In AGU Fall Meeting, AGU, 2020.

ORAL PRESENTATIONS

- **Kushwaha, P** and Sukhatme, J and Nanjundiah, R.S. . Role of Bay of Bengal Monsoon Lows in the Genesis of Arabian Sea Middle Tropospheric Cyclones (MTCs). In 35th Conference on Hurricanes and Tropical Meteorology, AMS, 2021.

- **Kushwaha, P** and Sukhatme, J and Nanjundiah, R.S. (2021). Climatology of Middle Tropospheric Cyclones Over South East Asia. In 34th Conference on Hurricanes and Tropical Meteorology, AMS, 2021.

- **Kushwaha, P** . Climatology of Middle Tropospheric Cyclones Over South East Asia. Workshop on atmospheric satellites for Asian monsoon cloud-precipitation science and applications, 21-24 June 2022, IARSc, Bengaluru.

- Presented status of monsoon during Monsoon Cafe weekly meeting 2018-2018 at Center of Atmospheric and Oceanic Sciences, IISc.

- Presented lectures on Numerical Weather Prediction in University Science Exhibition Festival (open day) to school and college students.

COMPUTING SKILLS

- **NCL**: Five years of experience in computing and graphics plotting. Calculated vorticity and potential vorticity and moisture budgets and developed a cyclone tracking algorithm.

- **Python** Working experience in unsupervised machine learning. Classified weather regimes over western India using k-means algorithm. Working experience in Matplotlib, NumPy, Sklearn, Pandas.

- **Matlab** Working experience during "Satellite Meteorology" course work. Performed sea surface temperature retrieval using the split-window method, experience in solving image processing problems, and plotting during course work on "Geographical Information Systems".

- **FORTRAN** Learnt through self-study and solved problems from the book "Computer programming in Fortran 90/95 (V. Rajamanan). Explored and modified WRF code written in FORTRAN. Modified surface energy fluxes in WRF. Configured and modified an analytical Ideal Tropical Cyclone Vortex in Ideal WRF.

- **WRF-HPC**: On Cary-40 and Tyrone supercomputers performed sensitivity experiments using WRF of cloud heating and surface fluxes in Mid-tropospheric cyclones.

- **AI-MODEL**: Worked on leading AI models FourcastNet, Panguweather and Graphcast.

Further Eduction

- **Supervised Machine Learning: Regression and Classification** (Stanford University: Ongoing, Enrolled in Coursera):
  Build machine learning models in Python using popular machine learning libraries such as NumPy & scikit-learn.
  Build and train supervised machine learning models for prediction & binary classification tasks, including linear regression & logistic regression.

- **Advanced Learning Algorithms** (Stanford University: Enrolled in Coursera):
  Build and train a neural network with TensorFlow to perform multi-class classification. Apply best practices for machine learning development to ensure that your models generalize to real-world data and tasks.
  Build and use decision trees and tree ensemble methods, including random forests and boosted trees.

- **Unsupervised Learning, Recommenders, Reinforcement Learning** (Stanford University: Enrolled in Coursera):
  Use unsupervised learning techniques, including clustering and anomaly detection.
  Build recommender systems with a collaborative filtering approach and a content-based deep learning method.
  Build a deep reinforcement learning model.

- **Python for Everybody** (University of Michigan: Coursera).

- **Python Data Structures** (University of Michigan: Coursera).

- **International Workshop on Prediction Skill of Extreme Precipitation Events and Tropical Cyclones** (Indian Institute of Tropical Meteorology).

<div align="center">**Fellowshops**</div>

- **Grantham Research Fellowship**, Divecha Centre for Climate Change, Indian Institute of Science (IISc)   2017–2021
- **Senior Research Fellowship**, Ministry of Human Resource Development Government of India (MHRD).   2018–2021
- **Junior Research Fellowship**, Ministry of Human Resource Development, Government of India (MHRD).   2016–2018

Teaching Experience

- **Atmospheric Dynamics**, Indian Institute of Science   2018–2021
- **Atmospheric Dynamics**, Indian Institute of Science   2016–2018

Presented tutorials and conducted and graded assignments and exam papers.

<div align="center">**Leadership and Social Outreach**</div>

- Won an election to be Class Representative (CA) with a full majority during the Bachelor of Engineering.
- Responsible for conducting science programs and other extracurricular programs in the role of CA in Bachelors.
- Team and project lead of Science Technical Festival in Bachelor of Engineering.
- Lead forecaster on several weather groups on social media to nowcast extreme weather events and help the common public to mitigate rain and extreme rainfall-related damage.
- Lead coordinator of official departmental and IISc wellness committee.
- Member of the organizing team in the open day science exhibition festival (science outreach) at IISc, Bangalore.

Online Education

YouTube Channel: [MeteoQuest]
- Creator and educator on topics related to WRF installation and modeling, climate science, and meteorology.
- Published several tutorial videos which are helping hundreds of researchers in installation and use of WRF.
- Designed content to simplify complex process for a diverse audience, including students and researchers at various career stage.

Social Media Outreach
Weather Forecasting and Updates
- Provide frequent weather forecasts and updates on Twitter/X and LinkedIn to raise awareness of extreme weather events and climate phenomena.
- Focus on delivering accurate, simple, and clear weather information to help the public understand weather forecasts.