

FARHAN MUSTAFA

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Google Scholar Page: <https://scholar.google.com/citations?user=4gOw7PEAAAAAJ&hl=en>

Total Citations: 988 — **H-Index:** 16 — **Updating Date:** April 15, 2026

Areas of Research

- Climate Change
- Remote Sensing
- Atmospheric Modeling
- Cloud Computing
- Artificial Intelligence
- Climate Extremes
- Air Quality
- Atmospheric Physics

Education

Nanjing University of Information Science and Technology **2019 – 2022**

Ph.D. in Atmospheric Remote Sensing and Atmospheric Sounding *Nanjing, China*

Thesis Title: Evaluating the Performance of Current CO₂ Monitoring Satellites and Applications of their Data Products over Asia

Advisor: Prof. Lingbing Bu ([Profile Page](#))

University of the Punjab **2016 – 2018**

M.Phil. in Geomatics *Lahore, Pakistan*

Thesis Title: Development and Implementation of a Spatial Decision Support System for the Selection of Suitable Industrial Sites in Punjab, Pakistan

Advisor: Prof. Sajid Rashid ([Profile Page](#))

University of the Punjab **2012 – 2016**

B.S. in Space Science *Lahore, Pakistan*

Thesis Title: Appraisal of the Kingri Fault in the Eastern Sulaiman Ranges: Inferences from RS/GIS

Advisor: Prof. Syed Amer Mahmood ([Profile Page](#))

Research and Professional Experience

University Mohammed VI Polytechnic (UM6P) **May 2025 – Present**

African Research Center on Air Quality and Climate *Benguerir, Morocco*

Assistant Professor

- **Supervised Masters Student(s):** [Chibani Hajar](#)
- **Co-Supervising Ph.D. Student(s):** [Imane Qadiri](#), [Abdelaziz Motiaa](#)

Hong Kong University of Science and Technology (GZ) **Nov 2022 – May 2025**

Jiangmen Laboratory of Carbon Science and Technology *Jiangmen, China*

Postdoctoral Fellow

- Estimated uncertainties in the model-based carbon dioxide datasets at global scale ([Publication Link](#))
- Improved model-based carbon dioxide datasets using deep learning and satellite observations ([Publication Link](#))
- Developed a method to estimate global scale anthropogenic CO₂ emissions using satellite datasets ([Publication Link](#))

FARMIN **Jan 2023 – Mar 2023**

Independent Consultant *Abu Dhabi, United Arab Emirates*

- Developed a machine learning-based model to estimate the concentrations of greenhouse gases over the Arabian Peninsula ([Publication Link](#))

Nanjing University of Information Science and Technology **Sep 2019 – Jun 2022**

Doctoral Researcher *Nanjing, China*

- Validated satellite-derived CO₂ products against airborne in-situ observations ([Publication Link](#))
- Quantified regional scale uncertainties in the satellite-derived CO₂ products ([Publication Link](#))
- Investigated spatio-temporal distribution of near-surface CO₂ concentration and its affecting factors ([Publication Link](#))
- Developed a machine learning-based model to estimate regional-scale anthropogenic CO₂ emissions using satellite datasets ([Publication Link](#))
- Evaluated the potential of space-borne observations for city-scale monitoring of atmospheric CO₂ through simple data-driven analyses ([Publication Link](#))

Engineering, Research & IT Services Provider (ERISP)

Oct 2018 – Jul 2019

GIS Developer

Peshawar, Pakistan

- Developed a provincial-scale mineral cadastral system
- Developed and maintained spatial databases related to mineral licenses

The Urban Unit

Apr 2017 – Sep 2018

Research Associate

Lahore, Pakistan

- Developed a model to estimate the future expansion of 50 large cities in Punjab, Pakistan
- Developed a method to classify the 50 large cities in Punjab into urban, peri-urban, and rural areas using satellite imagery
- Developed a spatial decision support system for the selection of suitable industrial sites in Punjab, Pakistan

Trainer Experience

Hands-on Training: Using Satellite Observations for Air Quality Monitoring

WMO Training Workshop on Air Quality Monitoring and Analysis (Benguerir, Morocco)

Oct 2025

Hands-on Training: Using Atmospheric Composition, Reanalysis, and Forecasting Datasets

WMO Training Workshop on Air Quality Monitoring and Analysis (Benguerir, Morocco)

Oct 2025

Grants

Funded

Project: Estimating Methane Emissions from Energy Sector Across Africa

Role : Principal Investigator

Funding Amount : 50,000 USD

Funding Agency : Clean Air Task Force (CATF), United States

Duration : 2025-2026

Project: Development of Methods to Estimate Regional-Scale Anthropogenic CO₂ Emissions Based on Satellite Datasets

Role : Principal Investigator

Funding Amount : 2,00,000 RMB

Funding Agency : Talent Development Bureau of Guangzhou Nansha Development Zone, China

Duration : 2023-2025

Project: Development of Methods to Estimate Regional-Scale Anthropogenic CO₂ Emissions Based on Satellite Datasets

Role : Principal Investigator

Funding Amount : 1,00,000 RMB

Funding Agency : Guangzhou Government, China

Duration : 2023-2025

Project: Development of a Retrieval Algorithm for Spaceborne Path-Integral Differential Absorption Lidar to Measure Carbon Dioxide

Role : Collaborator

Funding Amount : 570,000 RMB

Funding Agency : National Science Foundation China (NSFC)

Duration : 2022-2025

Pending

Project: Prediction of Chemical Emissions from Agricultural Sites Using Machine and Deep Learning Models

Role : Principal Investigator

Funding Amount : 1.1 Million USD

Funding Agency : OCP Group, Morocco

Duration : 2026-2029

Project: Mobilising UM6P's Collective Intelligence for Cost-effective Green Ammonia Production, Application, and Environmental Impact Assessment

Role : Collaborator

Funding Amount : 2 Million USD

Funding Agency : OCP Group, Morocco

Duration : 2025-2030

Scholarships and Awards

China Scholarship Council (CSC) Scholarship | *Ministry of Education, Government of China* 2019 – 2022

- I was awarded the fully funded scholarship to complete my Ph.D. at the Nanjing University of Information Science and Technology, China

Punjab Education Endowment Fund (PEEF) | *Government of Punjab, Pakistan* 2016 – 2018

- I was awarded the fully funded scholarship to complete my M.Phil. at the University of the Punjab, Pakistan

Higher Education Commission (HEC) Merit Scholarship | *Government of Pakistan* 2012

- I was awarded the HEC merit scholarship for outstanding performance in my intermediate studies

Publications

First-Author Articles

- [1] **Farhan Mustafa** and Ming Xu. Estimating global anthropogenic carbon dioxide emissions using satellite observations and machine learning methods. *Atmospheric Environment*, 360:121423, 2025. ISSN 1352-2310. doi: 10.1016/j.atmosenv.2025.121423.
- [2] **Farhan Mustafa** and Ming Xu. Improving model-based carbon dioxide datasets using deep learning and satellite observations. *IEEE Transactions on Geoscience and Remote Sensing*, 63:1–14, 2025. doi: 10.1109/TGRS.2025.3556309.
- [3] **Farhan Mustafa** and Ming Xu. Comparison of model-derived carbon dioxide datasets with the orbiting carbon observatory 3 (oco-3) observations. *Atmospheric Research*, 320:108057, 2025. ISSN 0169-8095. doi: 10.1016/j.atmosres.2025.108057.
- [4] **Farhan Mustafa**, Lingbing Bu, Qin Wang, Muhammad Shahzaman, Muhammad Bilal, Rana Waqar Aslam, and Changzhe Dong. Spatiotemporal investigation of near-surface co2 and its affecting factors over asia. *IEEE Transactions on Geoscience and Remote Sensing*, 60:1–16, 2022. doi: 10.1109/TGRS.2022.3178125.
- [5] An Ning[†], **Farhan Mustafa**[†], Lingbing Bu, Ming Xu, Qin Wang, Muhammad Shahzaman, Muhammad Bilal, Safi Ullah, and Zhang Feng. Monitoring of atmospheric carbon dioxide over pakistan using satellite dataset. *Remote Sensing*, 14(22), 2022. ISSN 2072-4292. doi: 10.3390/rs14225882.
- [6] **Farhan Mustafa**, Lingbing Bu, Qin Wang, Na Yao, Muhammad Shahzaman, Muhammad Bilal, Rana Waqar Aslam, and Rashid Iqbal. Neural-network-based estimation of regional-scale anthropogenic co2 emissions using an orbiting carbon observatory-2 (OCO-2) dataset over east and west asia. *Atmospheric Measurement Techniques*, 14(11):7277–7290, November 2021. doi: 10.5194/amt-14-7277-2021.

- [7] **Farhan Mustafa**, Huijuan Wang, Lingbing Bu, Qin Wang, Muhammad Shahzaman, Muhammad Bilal, Minqiang Zhou, Rashid Iqbal, Rana Waqar Aslam, Md. Arfan Ali, and Zhongfeng Qiu. Validation of GOSAT and OCO-2 against in situ aircraft measurements and comparison with CarbonTracker and GEOS-chem over qinhuangdao, china. *Remote Sensing*, 13(5):899, February 2021. doi: 10.3390/rs13050899.
- [8] **Farhan Mustafa**, Lingbing Bu, Qin Wang, Md. Ali, Muhammad Bilal, Muhammad Shahzaman, and Zhongfeng Qiu. Multi-year comparison of CO₂ concentration from NOAA carbon tracker reanalysis model with data from GOSAT and OCO-2 over asia. *Remote Sensing*, 12(15):2498, August 2020. doi: 10.3390/rs12152498.

Co-Author Articles

- [9] Mariam Alcibahy, Fahim Abdul Gafoor, **Farhan Mustafa**, Mutasem El Fadel, Hamed Al Hashemi, Ali Al Hammadi, and Maryam R Al Shehhi. Improved estimation of carbon dioxide and methane using machine learning with satellite observations over the arabian peninsula. *Scientific Reports*, 15(1):766, 2025. doi: 10.1038/s41598-024-84593-9.
- [10] Seyed Mohsen Mousavi, Naghmeh Mobarghaee Dinan, Saeed Ansarifard, Faezeh Borhani, Asef Darvishi, **Farhan Mustafa**, and Amir Naghibi. Unveiling the drivers of atmospheric methane variability in iran: A 20-year exploration using spatiotemporal modeling and machine learning. *Environmental Challenges*, 15: 100946, 2024. doi: 10.1016/j.envc.2024.100946.
- [11] Muhammad Athar Khaliq, **Farhan Mustafa**, Shafeeq Ur Rehman, Muhammad Shahzaman, Zeeshan Javed, Muhammad Sagir, Safdar Bashir, and Hongchao Zuo. Spatiotemporal investigation of near-surface ch₄ and factors influencing ch₄ over south, east, and southeast asia. *Science of The Total Environment*, 922:171311, 2024. ISSN 0048-9697. doi: 10.1016/j.scitotenv.2024.171311.
- [12] Rana Waqar Aslam, Hong Shu, Aqil Tariq, Iram Naz, Muhammad Nasar Ahmad, Abdul Quddoos, Kanwal Javid, **Farhan Mustafa**, and Hafsa Aeman. Monitoring landuse change in uchhali and khabeki wetland lakes, pakistan using remote sensing data. *Gondwana Research*, 129:252–267, 2024. ISSN 1342-937X. doi: 10.1016/j.gr.2023.12.015.
- [13] Rana Waqar Aslam, Hong Shu, Kanwal Javid, Shazia Pervaiz, **Farhan Mustafa**, Danish Raza, Bilal Ahmed, Abdul Quddoos, Saad Al-Ahmadi, and Wesam Atef Hatamleh. Wetland identification through remote sensing: Insights into wetness, greenness, turbidity, temperature, and changing landscapes. *Big Data Research*, 35: 100416, 2024. ISSN 2214-5796. doi: 10.1016/j.bdr.2023.100416.
- [14] Jingwei Li, Feng Zhang, Wenwen Li, Xuan Tong, Baoxiang Pan, Jun Li, Han Lin, Husi Letu, and **Farhan Mustafa**. Transfer-learning-based approach to retrieve the cloud properties using diverse remote sensing datasets. *IEEE Transactions on Geoscience and Remote Sensing*, 61:1–10, 2023. doi: 10.1109/TGRS.2023.3318374.
- [15] Qin Wang, **Farhan Mustafa**, Lingbing Bu, Juxin Yang, Chuncan Fan, Jiqiao Liu, and Weibiao Chen. Monitoring of atmospheric carbon dioxide over a desert site using airborne and ground measurements. *Remote Sensing*, 14(20), 2022. ISSN 2072-4292. doi: 10.3390/rs14205224.
- [16] Rashid Iqbal, Muhammad Aown Sammar Raza, Muhammad Habib-Ur Rahman, Sajjad Hyder, Muhammad Israr, Muhammad Usman Aslam, **Farhan Mustafa**, Muhammad Shahzaman, Muhammad Ayaz, Monika Toleikiene, Fatemeh Hashemi, Muhammad Tahir Khan, and Muhammad Mahran Aslam. Effect of partial rhizosphere drying on plant photosynthetic, antioxidative and water related indicators in cotton. *Communications in Soil Science and Plant Analysis*, 53(16):2125–2140, 2022. doi: 10.1080/00103624.2022.2070633.
- [17] Xuefei Lin, Lingbing Bu, Kun Liang, Yuanqing Wang, Jiaqi Xu, **Farhan Mustafa**, Lian Zong, Yanpeng Zhao, and Samuel A. Berhane. Simulation analysis of a lidar performance for atmospheric temperature profile measurements based on the fizeau interferometer and multichannel photomultiplier tube. *Microwave and Optical Technology Letters*, 64(4):650–654, 2022. doi: 10.1002/mop.33165.

- [18] Rashid Iqbal, Muhammad Habib ur Rahman, Muhammad Aown Sammar Raza, Muhammad Waqas, Rao Muhammad Ikram, Muhammad Zeshan Ahmed, Monika Toleikiene, Muhammad Ayaz, **Farhan Mustafa**, Salman Ahmad, Muhammad Usman Aslam, Muhammad Mohsin Waqas, Muhammad Tahir Khan, Muhammad Mahran Aslam, and Imran Haider. Assessing the potential of partial root zone drying and mulching for improving the productivity of cotton under arid climate. *Environmental Science and Pollution Research*, 28(46):66223–66241, July 2021. doi: 10.1007/s11356-021-15259-6.
- [19] Qin Wang, **Farhan Mustafa**, Lingbing Bu, Shouzheng Zhu, Jiqiao Liu, and Weibiao Chen. Atmospheric carbon dioxide measurement from aircraft and comparison with OCO-2 and CarbonTracker model data. *Atmospheric Measurement Techniques*, 14(10):6601–6617, October 2021. doi: 10.5194/amt-14-6601-2021.
- [20] Muhammad Shahzaman, Weijun Zhu, Irfan Ullah, **Farhan Mustafa**, Muhammad Bilal, Shazia Ishfaq, Shazia Nisar, Muhammad Arshad, Rashid Iqbal, and Rana Waqar Aslam. Comparison of multi-year reanalysis, models, and satellite remote sensing products for agricultural drought monitoring over south asian countries. *Remote Sensing*, 13(16):3294, August 2021. doi: 10.3390/rs13163294.
- [21] Muhammad Shahzaman, Weijun Zhu, Muhammad Bilal, Birhanu Asmerom Habtemicheal, **Farhan Mustafa**, Muhammad Arshad, Irfan Ullah, Shazia Ishfaq, and Rashid Iqbal. Remote sensing indices for spatial monitoring of agricultural drought in south asian countries. *Remote Sensing*, 13(11):2059, May 2021. doi: 10.3390/rs13112059.
- [22] Rashid Iqbal, Muhammad Aown Sammar Raza, Muhammad Adil Rashid, Monika Toleikiene, Muhammad Ayaz, **Farhan Mustafa**, Muhammad Zeshan Ahmed, Sajjad Hyder, Muhammad Habib-Ur Rahman, Salman Ahmad, Muhammad Usman Aslam, and Imran Haider. Partial root zone drying irrigation improves water use efficiency but compromise the yield and quality of cotton crop. *Communications in Soil Science and Plant Analysis*, 52(13):1558–1573, March 2021. doi: 10.1080/00103624.2021.1892720.
- [23] Zhongfeng Qiu, Md. Arfan Ali, Janet E. Nichol, Muhammad Bilal, Pravash Tiwari, Birhanu Asmerom Habtemicheal, Mansour Almazroui, Sanjit Kumar Mondal, Usman Mazhar, Yu Wang, Sajib Sarker, **Farhan Mustafa**, and Muhammad Ashfaqur Rahman. Spatiotemporal investigations of multi-sensor air pollution data over bangladesh during COVID-19 lockdown. *Remote Sensing*, 13(5):877, February 2021. doi: 10.3390/rs13050877.
- [24] Jiaming Xie, Xingyou Huang, Lingbing Bu, Hengheng Zhang, **Farhan Mustafa**, and Chenxi Chu. Detection of water cloud microphysical properties using multi-scattering polarization lidar. *Current Optics and Photonics*, 4(3):174–185, 2020. ISSN 25087274. doi: 10.3807/COPP.2020.4.3.174.
- [25] Yu Gong, Lingbing Bu, Bin Yang, and **Farhan Mustafa**. High repetition rate mid-infrared differential absorption lidar for atmospheric pollution detection. *Sensors*, 20(8):2211, April 2020. doi: 10.3390/s20082211.

Under Review Manuscript(s)

- [3] Muhammad Shahzaman, Weijun Zhu, Chenghai Wang, **Farhan Mustafa**, Muhammad Bilal, Irfan Ullah, Rizwan Karim, Adnan Yousaf, Muhammad Ishtiaq, A.S. Alothman, Mikka Sillanpad, and Gaber E. Eldesokey. Evaluation and projection of agricultural drought using cmip6 models over south asian countries. *International Journal of Climatology*, 2025.

In Process Manuscript(s)

- [1] **Farhan Mustafa** and Abdelwahid Mellouki. Air pollution scenario over morocco using long-term satellite, model, and ground station measurements. *Atmospheric Chemistry and Physics*, 2025.
- [2] **Farhan Mustafa**, jiejie Sun, and Ming Xu. Global 3-hourly high resolution xco₂ dataset from 2014 to 2020 using machine learning methods. *Nature Scientific Data*, 2025.
- [3] Imane Qadiri, **Farhan Mustafa**, and Abdelwahid Mellouki. Spatiotemporal investigation of ammonia and its affecting factors over africa and europe using satellite and in-situ measurements. *Journal of Geophysical Research: Atmosphere*, 2025.

- [4] Abdelazid Motiaa, **Farhan Mustafa**, and Abdelwahid Mellouki. Estimation of urban carbon emissions over morocco using satellite observations, inverse modeling, and data-driven methods. *Journal of Geophysical Research: Atmosphere*, 2025.

Conferences and Talks

- [1] Abdelaziz Motiaa, **Farhan Mustafa**, Clement Anjani, Morgan Lopez, Michael Ramonet, Ibrahim Ouchen, and Wahid Mellouki. Regional and local scale analysis of ammonia emissions. In *Chemical Weather & Chemical Climate*. Benguerir, Morocco, 2025.
- [2] Iman Qadiri, **Farhan Mustafa**, and Wahid Mellouki. Regional and local scale analysis of ammonia emissions. In *Chemical Weather & Chemical Climate*. Benguerir, Morocco, 2025.
- [3] **Farhan Mustafa**. Introduction to satellite-based air quality data, products, and interpretation. In *WMO Training Workshop on Air Quality Monitoring and Analysis*. Benguerir, Morocco, 2025.
- [4] **Farhan Mustafa**. Understanding the purpose and structure of reanalysis data and how it helps track long-term air quality changes. In *WMO Training Workshop on Air Quality Monitoring and Analysis*. Benguerir, Morocco, 2025.
- [5] **Farhan Mustafa** and Ming Xu. A deep learning-based approach to improve model-derived carbon dioxide datasets using satellite observations. In *AGU Fall Meeting Abstracts*. Washington D.C., United States, 2024.
- [6] **Farhan Mustafa**, Muhammad Asif, Rahat Tufail, and Sajid R Ahmed. Development and implementation of a spatial decision support system for selection of suitable industrial site in pubjab, pakistan. In *Environment Science Conference (ESCON)*, pages 12–13. Comsats University, Islamabad, Pakistan, 2019.

Journal Editorial Boards

Editorial Board Member | *Global Environmental Science*

Nov 2025 – Present

Membership(s)

American Geophysical Union

2024 – Present

Related Professional Skills

Operating Systems: Linux, MacOS, Windows

Programming Languages: Python, MATLAB, LaTeX, Shell

Machine/Deep Learning: TensorFlow and Keras, Scikit Learn, XGBOOST, Random Forest

Cloud Computing: High-Performance Computing (HPC), Google Colab, Google Earth Engine, Amazon Web Services

Atmospheric Models: WRF, GEOS-Chem, NOAA CarbonTracker, Copernicus CAMS, X-STILT

Professional Softwares: ESRI ArcGIS, ArcGIS Pro, QGIS, Erdas IMAGINE, PCI Geomatics, Microsoft Office

Languages

English (Fluent)

Urdu (Native)

Punjabi (Fluent)

Hindi (Fluent)

References
