Malik Safi Ullah

PhD Student | Computational Fluid Dynamics (CFD) | OpenFOAM & HPC

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Summary

PhD student at the University of Bologna specializing in Computational Fluid Dynamics (CFD), with experience in numerical modelling of turbulent flows, urban aerodynamics, and pollutant dispersion. Skilled in OpenFOAM-based RANS and LES simulations, C++ development, high-performance computing, and numerical validation against experimental measurements. Experience in developing computational workflows for complex urban geometries, supported by peer-reviewed publications and international academic collaboration.

Research Experience

Nov/2023 – Present
Bologna, Italy

Ph.D. Student – Urban Computational Fluid Dynamics
Alma Mater Studiorum – Università di Bologna

- Conduct RANS and LES simulations using OpenFOAM to investigate turbulent airflow, urban aerodynamics, and pollutant dispersion in idealized and realistic urban geometries;
- Implement vegetation effects through porous-media representations incorporating momentum sinks and turbulence source terms;
- Perform large-scale parallel simulations on HPC systems using MPI, domain decomposition, and Slurm-based job management;
- Validate numerical predictions against experimental water-channel measurements, evaluating velocity distributions and turbulence characteristics;

Oct/2025 – Dec/2025
Nicosia, Cyprus

Visiting Ph.D. Student
Environmental Fluid Mechanics Laboratory, University of Cyprus

- Developed a dedicated OpenFOAM porous-media library in C++ to assign spatially varying vegetation properties and represent aerodynamic effects of tree canopies;
- Developed custom OpenFOAM utilities for field initialization, vegetation-property assignment and CFD post-processing in complex urban domains;
- Collaborated with an international research group on numerical-method development and analysis of urban CFD simulations.

May/2021 – Apr/2023
Islamabad, Pakistan

Research Assistant
National University of Sciences and Technology

- Modelled urban wind flow, air temperature and outdoor thermal comfort in Islamabad and Rawalpindi using ENVI-met;
- Reconstructed urban districts using AutoCAD and SketchUp and generated three-dimensional computational models and meshes for urban microclimate simulations;
- Processed Landsat imagery and geospatial datasets in ArcGIS to evaluate land-surface temperature, land use, land cover and vegetation indices, including NDVI;
- Validated numerical results using field measurements and contributed to a nationally funded PIDE–RASTA policy brief on climate-responsive urban design.

Education

Nov/2023 – Present
Bologna, Italy

Ph.D. in Physics of the Earth and of the Circumterrestrial Medium
Alma Mater Studiorum - Università di Bologna
Thesis submitted on: 29 October 2026; Degree expected: March 2027
Thesis title: Aerodynamic Effects of Green NbS on Pollutant Dispersion in Idealised and Real Urban Neighbourhoods: LES and RANS Studies

Oct/2020 – Jul/2023
Islamabad, Pakistan

M.S. in Computational Science and Engineering
National University of Sciences and Technology, Islamabad
Thesis title: Effect of street orientations and aspect ratio on urban microclimate: A case study of twin cities (i.e. Islamabad and Rawalpindi) of Pakistan
Major Subjects: Finite Element Analysis, Computational Fluid Dynamics, Boundary Layer Theory, Data Analysis & Statistics, Applied Mathematics

Sep/2016 – Oct/2020
Lahore, Pakistan

B.Sc. in Mechanical Engineering
University of Engineering and Technology, Lahore
Thesis title: Design & Analysis of Renewable Energy Technologies (CSP, PV & Wind) in Pakistan

Funded Research Projects

Nov/2023 – Oct/2026
Bologna, Italy

Urban CFD and Nature-Based Solutions
University of Bologna – GREEN-POLIS and TRIGGER Projects
Ph.D. research supported by the GREEN-POLIS project under the EU NextGenerationEU / NRRP framework and by the European TRIGGER project. My contribution focused on CFD modelling of urban airflow, turbulence, vegetation effects, and pollutant dispersion using RANS and LES.

May/2021 – Apr/2023
Islamabad, Pakistan

Climate-Responsive Urban Design
Pakistan Institute of Development Economics (PIDE) – RASTA Programme
Contributed to the RASTA-funded project *Adoption of a Performance Evaluation Technique for the Development of a Framework for Climatic Responsive Urban Design (CRUD)*. My contribution focused on CFD simulations and interpretation of urban microclimate and thermal-comfort results.

Publications

1. Ullah, M.S., Di Giulio, A., Cintolesi, C. and Di Sabatino, S., 2025. Assessing the influence of rooftop vegetation on pollution dispersion in urban canyons through Large-Eddy Simulations. *Urban Climate*, 64, p.102614.
2. Mahboob, K., Awais, Q., Awais, M., Naseem, A., Ullah, S. and Khan, A., 2022. Visualization of Heliostat Field of Solar Thermal Tower Power Plant Using Virtual Reality (VR) Technologies. *Engineering Proceedings*, 12(1), p.79.

Conferences

Oral Conference Contributions

1. Ullah, M.S., Alexandrou, G., Cintolesi, C., Mouzourides, P., Sengupta, B., Antoniou, N., Neophytou, M. and Di Sabatino, S., 2026. *Impact of Street-Level Trees on Pollutant Dispersion in Real Urban Canyons: A Comparative Study of Bologna and Nicosia.* Oral presentation at the EMS Annual Meeting 2026, Utrecht, Netherlands, 6–11 September 2026. Abstract published in *EMS Annual Meeting Abstracts*, Vol. 23, EMS2026-688.
2. Ullah, M.S., Di Giulio, A., Cintolesi, C. and Di Sabatino, S., 2026. *Assessing the Influence of Rooftop Vegetation on Pollution Dispersion in Urban Canyons through Large-Eddy Simulations.* Oral presentation at the 15th International Conference on Air Quality – Science and Application, Prague, Czech Republic, 1–5 June 2026. Conference abstract published in the conference proceedings (Abstract No. 183).

Conference Attendance

1. 110th Congresso Nazionale della Società Italiana di Fisica, University of Bologna, Bologna, Italy, 9–13 September 2024. Attended as a participant.

Skills

SOFTWARE & TOOLS:

CFD & Numerical Modelling: OpenFOAM, ANSYS Fluent, RANS, LES, Turbulence Modelling;
Programming & Development: C++, Python, Custom OpenFOAM Libraries and Utilities;
HPC & Computing: Linux, MPI, Slurm, Parallel Computing, Domain Decomposition;
Meshing Tools: snappyHexMesh, cfMesh;
Environmental Modelling: ENVI-met, ArcGIS, Remote Sensing;
CAD & Design: SolidWorks, CATIA, AutoCAD, SketchUp, Unity 3D.

Honors & Awards

- Fully funded PhD scholarship (University of Bologna, Italy)
- Master's Thesis Funded Project by PIDE RASTA (National University of Sciences and Technology, Islamabad)
- Bachelor's Degree with Honors (University of Engineering and Technology, Lahore)

Languages

English (advanced); Urdu (native)

Referees

Silvana Di Sabatino Full Professor, Department of Physics and Astronomy "Augusto Righi", University of Bologna, Italy;

Carlo Cintolesi Jr. Assistant Professor, Department of Physics and Astronomy "Augusto Righi", University of Bologna, Italy;

Salma Sherbaz Assistant Professor, School of Interdisciplinary Engineering & Sciences, National University of Sciences and Technology, Islamabad.