Mohd Zuhair, PhD

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Summary

Computational Researcher with over 8 years of experience leveraging Numerical Modelling, High-Performance Computing (HPC), and AI techniques to tackle complex geoscientific challenges, particularly in tectonics and seismology. Proven track record of authoring multiple peer-reviewed papers in top-tier journals and conferences, significantly advancing the field through innovative research and methodologies.

Education

Ph.D. — **Monash University, Australia**
Geophysics — *2018–2022*

Master of Technology — **Indian Institute of Technology Kharagpur, India**
Exploration Geosciences — *2014–2016*

Master of Science — **Indian Institute of Technology Kharagpur, India**
Geology — *2012–2014*

Bachelor of Science (Honors) — **Aligarh Muslim University, India**
Geology, Maths, Physics — *2009–2012*

Experience

Research Fellow
Nanyang Technological University (NTU), Singapore — *July 2023 - Current*

- Developed Python-based software to identify earthquake risks by estimating strain rates from GPS and InSAR datasets, enhancing seismic hazard assessment accuracy.
- Leveraged Finite Element Modeling (FEM) and High-Performance Computing (HPC) to analyze the impact of slab earthquakes on ground deformation in Southeast Asia, providing critical insights into regional seismic behavior.

Graduate Researcher
Monash University, Australia — *Jan. 2018 - July 2022*

- Conducted gravity data inversion using Oasis montaj to analyze subsurface morphology variations.
- Integrated seismic tomography and structural data to reconstruct the subduction history in SE Asia.
- Developed deep learning models, including Fully Connected Networks (FCNs), and utilized Layerwise Relevance Propagation (LRP) to pinpoint critical parameters for large earthquakes worldwide.
- Leveraged a 3D Finite Element Method (FEM) geodynamic model and High-Performance Computing (HPC) to analyze the impact of subduction forces on seismic deformation in SE Asia.

Research Assistant
Chinese Academy of Sciences, China — *May 2017 - Dec. 2017*

- Generated a tsunami propagation and inundation model incorporating submarine landslides and splay faults into the earthquake source using the Finite Difference Simulation technique.
- Established statistical Tsunami Fragility Analysis and Damage Cost models to estimate tsunami risk for infrastructures/buildings.

Research Assistant
Indian Institute of Technology Kharagpur, India — *June 2016- May 2017*

- Calculated tsunami hazard parameters, including run-up height and arrival time, for the Western Indian Coast by generating tsunami propagation models using non-linear shallow water equations and a tsunami inundation numerical model (TUNAMI-N2). Published findings in a peer-reviewed journal, providing critical insights for coastal defence and disaster preparedness.

Master's Researcher
Indian Institute of Technology Kharagpur, India *July 2015 - May 2016*

- Developed a probabilistic seismic hazard model for Gujarat, India, by integrating ISC-EHB, USGS, and historical earthquake catalogues. Estimated recurrence intervals and annual frequency rates using Monte Carlo Simulations, providing a robust framework for seismic risk assessment and mitigation strategies.

Internship - Seismic Exploration
Directorate General of Hydrocarbons, Noida, India *May 2013 - June 2013*

- Engaged in the development of a static geo-cellular model using PETREL during a dynamic two-month internship, managing all stages from conceptualization to execution.
- Conducted deep petrophysical and structural analysis using data from over 20 wells, enhancing our understanding of subsurface modelling and identifying potential hydrocarbon reservoirs.
- Delivered innovative solutions aimed at augmenting strategic operations and sustainability within the hydrocarbon industry, addressing global energy demands in an environmentally conscious manner.

Skills

Programming Languages: Python, SQL, R, MATLAB, FORTRAN, HTML, CSS

Software: Petrel, Geosoft Oasis Montaj, ArcGIS, Surfer, RockWorks, GeoModeller

Utilities: HPC, Git, Github, Jupyter, LaTeX, conda

Data Analytics and Machine Learning: Pandas, NumPy, Scikit-learn, TensorFlow, Statsmodels, Keras

Data Visualization: Matplotlib, Seaborn, Plotly, Tableau

Workflow Documentation: Jupyter Notebooks

Courses

Seismic Processing and Imaging Techniques, *by Prof. Arun Singh, IIT Kharagpur*
MultiThreading In Python, *by Satish Venkatesh, Software Engineer*
Four Pillars of OOP in Python 3, *by Febin George, Software Developer*

Awards

Nanyang Technological University - NTU Singapore
Presidential Postdoctoral Fellowship *2023*
For top PhD graduates with exceptional doctoral research, $100,000/year

Monash University, Australia
Monash Graduate Scholarship *2018*
For the top 30 students globally for outstanding academic and research excellence, $35,000/year

Chinese Academy of Sciences, China
President's Research Fellowship *2017*
For the top 140 students globally with exceptional research skills, $20,000/year

Indian Institute of Technology (IIT) Kharagpur, India
Best Master's Dissertation Award *2016*

Leadership

Qalam Youth Collective
Co-Founder *Aug. 2023 - Present*
A global network of 1000+ young professionals focused on empowering marginalized communities through webinars, educational sessions, and resource provision. Responsible for team leadership, strategic planning, problem-solving, and performance management.

Helping Hands
Founder *Sept. 2019 - Present*

Managing monetary help collected by a team of 120+ professionals to support bright minds in their educational endeavours in India. This initiative has changed the lives of 3000+ individuals so far.

Publications

Published

- Zuhair *et al.*, "The role of slab steps on tectonic loading along subduction zones: inferences on the seismotectonics of the Sunda convergent margin", *Tectonics, 41, e2022TC007242*, 2022
- Zuhair *et al.*, "Tsunami Impacts on Nuclear Power Plants along Western Coast of India Due to a Great Makran Earthquake: A Numerical Simulation Approach", *International Journal of Geosciences, 8, 1417-1426*, 2017

Accepted

- Graciosa, J.C., Capitanio, F.A., Hargreaves, M., Zuhair, M., and T. Gollapalli., "Megathrust seismicity through the lens of explainable artificial intelligence", *accepted in Journal of Geophysical Research (JGR)*

In prepration

- Zuhair, M., Feng, L., Meltzner, A., Hill, E., "Why is southern segment of Saging Fault in Myanmar seismically quiet?".
- Zuhair, M., Capitanio, F.A., Graciosa, J.C., Betts, P.G., T. Gollapalli., "Time-series analysis of shallow and deep earthquakes in the Sunda-Andaman subduction zone: insights into 3D margin-wide coupling".
- Graciosa, J.C., Capitanio, F.A., Zuhair, M., T. Gollapalli., "Modelling 3D stress distribution in subducting slabs: implications for large-magnitude seismicity at subduction margins".

Conferences

- Graciosa, J.C., Capitanio, F.A., Hargreaves, M., Zuhair, M., and T. Gollapalli., "Megathrust seismicity through the lens of explainable artificial intelligence", *EGU 2022*
- Zuhair, M., Capitanio, F.A., Graciosa, J.C., Betts, P.G., and T. Gollapalli., "Deep Java deformation drives Sumatra seismicity", *AGU 2021*, online
- Graciosa, J.C., Capitanio, F.A., Zuhair, M., and T. Gollapalli., "Modelling three-dimensional Stress Distribution in Subducting Slabs: Implications for Large-magnitude Seismicity at Active margins", *AGU 2021*, online
- T. Gollapalli., Capitanio, F.A., Munukutla, R., Giordani, J., and Zuhair, M., Graciosa, J.C., "Subduction dynamics and tectonic coupling along seismically active margin: the relevance of trench-parallel force", *AGU 2021*, online
- Zuhair, M., Capitanio, F.A., Graciosa, J.C., Betts, P.G., and T. Gollapalli., "Plate coupling and deformation across timescales along Sunda subduction margin: the control of deep subduction?", *VUEESC 2020*, University of Melbourne
- Zuhair, M., Capitanio, F.A., Graciosa, J.C., Betts, P.G., and T. Gollapalli., "Interplate coupling controlled by the depth of subduction: from geological to seismic deformation along the Sunda margin", *AGU 2019*, San Francisco
- T. Gollapalli., Capitanio, F.A., Munukutla, R., Giordani, J., and Zuhair, M., Graciosa, J.C., "Megathrust Seismotectonics of the Southeast Asian convergent margin: Insights from three-dimensional Spherical Geodynamic Modelling", *AGU 2019*, San Francisco
- Zuhair, M., "Makran subduction induced tsunami impacts along nuclear power plants location in the western coast of India: A numerical simulation approach", *VUEESC 2018*, Monash University
- Imaran, M., Zuhair, M., "Coastal Vulnerability Assessment of Odisha Coast Using GIS Platform", *International Conference on Remote Sensing and GIS for Application in Geosciences*, Aligarh, India 2017
- Zuhair, M., Mohanty, W.K., "The relationship between earthquake characteristics and tsunami consequences: A numerical simulation approach", *58th AGM of Geological Society of India*, IIT Kharagpur, 2016