# HIRA ASHFAQ LODHI

Assistant Professor, Department of Physics,
NED University of Engineering & Technology, Karachi.
Ph: +92-99261261-268 Ext (2233)
**Email:** hiralodi@neduet.edu.pk

## Personal Profile

As an academic at NED University of Engineering & Technology, I have contributed to designing and enhancing teaching curricula and initiated pioneering research on tsunami modeling, establishing it as a key focus area. My work, in collaboration with international researchers, bridges theoretical models and real-world applications, advancing research capabilities and fostering impactful projects in disaster risk reduction and coastal resilience.

## Education

- NED University of Engineering & Technology 2015-2020
  **PhD (APPLIED MATHEMATICS)**
  (**Thesis**: Modelling Boulder Transport by Tsunami)
- NED University of Engineering & Technology 2011-2013
  **MS (APPLIED MATHEMATICS)**-First Division
  (**Research project**: Tsunami inundation modelling)
- University of Karachi 2007-2008
  **M.Sc (APPLIED PHYSICS)** – First Division
  (**Elective:** Electronics)

## Employment

- Assistant Professor, Applied Physics at NED University of Engineering & Technology – (March 11, 2018 to date).
- Lecturer, Applied Physics at NED University of Engineering & Technology – (January 15, 2009 to March 11, 2018).

## Visiting Positions

- Research Visit, Department of Earth & Space Sciences, University of Washington, Seattle, USA and Anegada, British Virgin Islands – (Feb-March, 2017).
- Research Visit, Department of Earth & Space Sciences, University of Washington, Seattle, USA – (Jan-Feb, 2023).
- Research Visit, Department of Earth & Space Sciences, University of Washington, Seattle, USA – (Sep, 2023).
- Research Visit, Department of Earth & Space Sciences, University of Washington, Seattle, USA – (March, 2024).

## Administrative Posts Held

- Member Board of Faculty (BOF), Department of Physics, NED UET (2021 to date)
- Member Board of Studies (BOS), Faculty of Architecture and Science, NED UET (2022 to date)
- Convener FYDP Steering Committee (2022 to date)
- Member Industrial Liaison Committee (2021 to date)
- Member Ph.D. Admission Committee (Spring 2025)
- Class Advisor Third Year BS Physics (Fall 2024–Spring 2025)
- Focal Person AlBuruj R. Rahman and Sultana N. Nahar Endowment Fund Awards (Physics).
- Focal Person AlBuruj R. Rahman and Sultana N. Nahar Endowment Fund Awards (Computational Finance).
- OBE coordinator (2023 to date)
- PT Member Self-Assessment Report (SAR), Undergraduate, 2023.
- PT Member Self-Assessment Report (SAR), Masters, 2024.
- PT Member Self Programme Review for Effectiveness and Enhancement (PREE), Ph.D., 2024.

## Thesis Supervised

- Development of Customizable Optical Components using Additive Manufacturing based on Photopolymerization.
- Development of a TG-43 Derived Calculation Algorithm for Ensuring Dosimetric Quality of Brachytherapy Treatment Planning System. The project was in collaboration with Agha Khan University Hospital.
- Numerical Experiments on Effects of River Mouth shape on Tsunami Behavior.

## Research Interest

My primary research interests are modelling and mapping coastal hazards such as tsunami, cyclones etc., assessing risk to coastal cities and communities and coastal disaster prevention and reduction. I am interested in developing a better understanding of the complex physical process such as hydrodynamics of tsunami flow and the interaction of the flow and stationary mega sediments (boulders). I work with an intention to develop a better understanding of the tsunami hazard posed to communities specially in regions where the tsunami history is not well known or documented.

## Projects and Collaborations

a) Cross-Border Hazard Assessment: PTHA in Pilot Areas of Pakistan and Iran. Ongoing collaborative project with National Institute of Geophysics and Volcanology (INGV), Italy, University of Tehran and University of Hormozgon, Iran. The project is aimed to strengthen collaboration through joint research, within the TransNational Access Grant awarded in the framework of the Geo-INQUIRE Project funded by the European Commission. The project is to perform high resolution Probabilistic Tsunami Hazard Assessment of the port cities of Karachi and Jask.

b) Disaster Resilience Improvement in Pakistan (DRIP). Ongoing project with the Department of Earthquake Engineering, NEDUET. It is funded by Higher Education Commission of Pakistan. The study is based on Probabilistic Tsunami Hazard Assessment and Seismic Hazard Assessment for the city of Karachi.

c) Cause of overwash at British Virgin Islands, field studies and simulations. Ongoing project in collaboration with US Geological Survey (USGS), National Oceanic and Atmospheric Administration (NOAA), University of Basel, Switzerland. The project is to investigate the probable cause of overwash at Anegada, British Virgin Island through simulating fine and coarse clast sediment transport by historical tsunami events known in the region.

d) Generation of Optical Cloaking through transformation Optics: Ongoing project with Center for Advanced Material (CAM), University of Qatar. The project is based on producing optical cloaking through transformation geometry using 3D printing and PET. The project is funded by University of Qatar.

e) Consultant to National Disaster Management Authority (NDMA) on a project for Promoting Natural Disaster Resilience (NADIR) in Pakistan. The objective of the consultancy was to revise the national tsunami hazard assessment guidelines.

f) Geo referenced Database for National Disaster Risk Management Fund–NatCat Modelling Project, in collaboration with the Department of Earthquake Engineering, NEDUET. The study was led by Pakistan Space and Upper Atmosphere Research Commission (SUPARCO). It was based on the Deterministic Tsunami Hazard Assessment and Seismic Hazard Assessment for all major coastal cities and towns along the coast of Pakistan.

g) Earthquake and Tsunami Hazard assessment of West Karachi and Gwadar, in collaboration with the Department of Earthquake Engineering, NEDUET. The study was a UNDP led project funded by Government of Japan. During the project a detailed study of tsunami and earthquake hazard posed to the Western portion of Karachi city at micro-level and at macro-level for complete city of Gwadar were conducted.

h) Modelling boulder transport by tsunami, Ph.D. project in collaboration with University of Emirates, Alain. During the study a tsunami boulder transport model is developed by including impact force of tsunami front for subaerial clasts. The proposed model in conjunction with tsunami simulations is used to identify the possible cause of over wash at Anegada, British Virgin Island. Funded by Higher Education Commission (HEC) through National Center for Big Data and Cloud Computing.

i) Coastal evidence for Puerto Rico Trench earthquakes and tsunamis in Anegada, British Virgin Island: Field study at Anegada, the project was to investigate the breaches in coastal sand ridges and inland fields of boulders. The field evidence is being used to test simulations of tsunami and of tsunami like bores from tropical cyclones. Funded by National Earthquake Hazards Reduction Program (NEHRP), USA.

j) Collaborative research with University of Emirates, Al-Ain to study mathematical models for transportation of boulders by tsunami.

k) Pakistan Tsunami: Field study along the Indus delta to investigate the unrecorded and verify the recorded history of 1945 Makran tsunami. Funded by US State Department, Office of foreign disaster assistance, USA.

l) Tsunami Inundation Modelling: Numerical studies conducted for the cities of Gwadar and Pasni. It was an Oxfam GB led project supported by UNESCO. The study was carried out to develop inundation maps and very first risk maps for the two cities. A major outcome of the project was development of a tsunami evacuation map for the city of Gwadar. A training workshop was also conducted to train stake holders such as NIO, Navy, PMD etc. for risk mapping. Funded by Oxfam GB.

## Publications

a) Lodhi, H.A., Ahmed, S., Hasan, H., 2021. Tsunami heights and limits in 1945 along the Makran coast estimated from testimony gathered seven decades later in Gwadar, Pasni and Ormara. Nat. Haz. and Earth Sys. Sci. https://doi.org/10.5194/nhess-2021-53.

b) Adams, L., Ahmed, S., Atwater, B.F., Elton, J., Hasan, H., Hasan, N.A., Humayan, A., Kakar, D.M., Lodhi, H.A., Naeem, G., Srinivasalu, S., Usman, A., Wright, L.M., 2020. Karachi effects of the Makran earthquake and tsunami of November 1945; Mercury spilled, tide gauge impaired, seawalls overrun, boats displaced, mosque flooded. UNESCO/IOC, Jakarta.

c) Lodhi, H.A., Hasan, H., Nandasena, N.A.K., 2020. The role of hydrodynamic impact force in subaerial boulder transport by tsunami—Experimental evidence and revision of boulder transport equation. Sediment. Geol. 408, https://doi.org/10.1016/j.sedgeo.2020.105745.

d) Kakar, D.M., Naeem, G., Usman, A., Hasan, H., Lodhi, H.A., Srinivasalu, S., Andrade, V., Rajendran, C.P., Beni, A.N., Hamzeh, M.A., Hoffmann, G., Balushi, N.A., Gale, N., Kodijat, A.M., Fritz, H.M., Atwater, B.F., 2014. Elders Recall an Earlier Tsunami on Indian Ocean Shores. Eos Trans. Am. Geophys. Union 95, 485–486. https://doi.org/10.1002/2014EO510002.

## Conference Publications/Presentations

a) Hasan, H., Lodhi, H.A., Ahmed, S., Rais, A., Rafi, M.M., Khan, S., 2023. Earthquake Thresholds for Tsunami Early Warning in Pakistan. Presented at American Geophysical Union 2023.
b) Lodhi, H.A., Hasan, H., Atwater, B.F., Wei, Y., 2023. Estimation of Minimum Magnitude of Different Tsunamigenic Earthquake Sources from six centuries old boulder fields at Anegada (British Virgin Islands). Presented at 3rd International workshop on Waves, Storm Surges, and Coastal Hazards, University of Notre Dame (South Bend).
c) Lodhi, H.A., Hasan, H., Atwater, B.F., Wei, Y., 2023. Boulder Transport Modelling Reveals Ancient Tsunami Sources in the Northeast Caribbean. Presented at 1st Annual meeting of IGCP Project 725: Forecasting Coastal Change, Florianopolis.
d) Lodhi, H.A., Lodi, S., Hasan, H., 2019. 1945 Makran Tsunami: Validation through oral and written histories. Presented at the First South Asia Conference on Earthquake Engineering (SACEE'19), Karachi.
e) Hasan, H., Lodhi, H.A., LeVeque, R.J., Lodi, S., Ahmed, S., 2017. Assessing tsunami risk to Karachi Port through simulation of currents that were reportedly produced there by the 1945 Makran Tsunami. Presented at the 16th World Conference on Earthquake Engineering, Chile.
f) Lodhi, H.A., Hasan, H., Naeem, G., 2016. Numerical simulation of Makran tsunami in creeks of the Indus Delta, Pakistan. Presented at the IGCP-Project 639, Muscat.
g) Naeem, G., Usman, A., Lodhi, H.A., 2016. Promoting Survival of the next Makran Tsunami in the Indus Delta. Presented at the IGCP-Project 639, Muscat.
h) Lodhi, H.A., Hasan, H., Lodi, S., 2015. Initial steps towards mapping urban limits for Pakistan. Presented at the International Conference on Reducing Tsunami Risk in the Western Indian Ocean, Muscat.
i) Hasan, H., Lodhi, H.A., Lodi, S., 2015. The impact of earthquake source parameters on the 1945 tsunami wave profiles and arrival times, poster presentation. Presented at the International Conference on Reducing Tsunami Risk in the Western Indian Ocean, Muscat.

## Trainings / Workshops / Conferences

a) National hackathon "Dawlance Sustainability Hackathon", Karachi, 2025. *Focal Person*.
b) UN-World Ocean Day: Awakening New Depths, Karachi, 2024. *Panelist*
c) National workshop "1st Workshop on Particle Physics" & "Virtual Tour of CERN", Karachi 2024. *Focal Person*.
d) National workshop "UNESCO Capacity-Building Workshop on Tsunami Evacuation Planning (TEP) for District Disaster Managers", Karachi, 2024. *Trainer and Organizer*.
e) National conference "International Day for Tsunami Awareness: Fighting Inequality for a Resilient Future", Gwadar, 2024. *Invited Speaker*.

f) National workshop "Risk Informed Spatial Planning for Urban Resilience", Karachi, 2024. *Participant*.
g) First Annual Meeting of IGCP Project 725:"Forecasting Coastal Change", Brazil 2023. *Invited Speaker*.
h) International Workshops on "Waves, Storm Surges, and Coastal Hazards", Indiana, 2023. *Speaker*.
i) Training workshop on "Indian Ocean Tsunami Ready Hybrid Workshop", Bali, 2022. *Presenter*.
j) International workshop on "Makran Subduction Zone Science Strengthening Tsunami Warning and Preparedness", UAE, 2022. *Presenter*.
k) Workshop on "Regional Standard Operating Procedures (SOPs) Workshop for NTWC, DMOs and Broadcasting Media in the Tsunami Warning Chain", PMD, Karachi, 2022. *Participant*.
l) International training workshop on "National Tsunami Evacuation Planning Working Group Meeting and Regional Workshop", PMD, Karachi, 2022. *Participant and Presenter*.
m) International conference, "1st International Conference of Applied Physics and Engineering, (ICAPE2021)" NEDEUT, Karachi. *Conference Secretary*.
n) International conference, "First South Asia Conference on Earthquake Engineering, (SACEE'19)" Karachi, 2019. NEDUET, Karachi, *Conference Speaker*.
o) International workshop and conference "Workshop-Conference on Earthquakes and Tsunami: Modeling and Observations" by ICTP, Hanoi, 2017. *Participant*.
p) IGCP-Project 639 (conference and field study) on "Sea level changes from Minutes to Millennia" Oman, 2016. *Presenter*.
q) Commemorating 70 years of the 1945 Makran Tsunami: Training Workshop: on "Tsunami Inundation Modelling" 26-27 Nov, 2015 followed by International Conference "Initial Step towards Tsunami Resilience" jointly organised by NED University of Engineering & Technology and Oxfam GB, Karachi, Pakistan 2015. *Workshop trainer, Conference Speaker and Organizer*.
r) International Training Workshop on "Coastal Hazard Assessment: Applications in Risk Assessment, Management and Mitigation" Colombo, 2015. *Participant*.
s) International Conference on "Reducing Tsunami Risk in the North Western Indian Ocean", Muscat, 2015. *Conference Presenter*.
t) Workshop on "Communicating the effects of the 1945 Makran Tsunami to increase Awareness and Preparedness of Tsunami Hazards in the Makran Region", Islamabad, May 2014. *Participant*.

## National and International Associations

a) Member Inundation Signature on Rocky Coastlines (ISROC).
b) Member American Physical Society (APS).
c) Member UNESCO-IOC regional working Group.
d) Member National Tsunami Inundation Mapping Group.
e) Member National Tsunami Evacuation Planning Group.

## Computing Skills

- Programming Languages: Fortran, C++, Python.
- Mathematical/Engineering/Research Packages: Experienced in using Matlab and Scilab. Experienced in using GeoClaw. Getting acquainted with Delft 3D.
- GIS software: QGIS, ArcGIS, Surfer and Global Mapper.
- Operating Systems: Unix/Linux, Windows.
- Other Packages: MS Word, MS Excel and MS Power Point.