

HIRA ASHFAQ LODHI

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Research Interests

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 with sediments. 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.

Professional Outline

- 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)

Education

- NED University of Engineering & Technology 2015-2021
PhD (APPLIED MATHEMATICS)
(**Research project:** 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)

Relevant Experience (Projects and Collaborations)

- a) National Disaster Risk Management Fund – NatCat Modeling Project. Ongoing project with SUPARCO to perform Deterministic Hazard assessment for the coastal cities of Karachi and Gwadar.
- 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 will be 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 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) Earthquake and Tsunami Hazard assessment of West Karachi and Gwadar with 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.

- e) 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.
- f) 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.
- g) Collaborative research with University of Emirates, Al-Ain to study mathematical models for transportation of boulders by tsunami.
- h) 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.
- i) 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.
- j) Experimental studies on Effects of River Mouth Shape on Tsunami Characteristics, Supervisor MS Thesis 2021-2022.

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. *Sea, Ocean and Coastal Hazards*. <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. Booklet by 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, 105745. <https://doi.org/10.1016/j.sedgeo.2020.105745>.
- d) Kakar, D.M., Naeem, G., Usman, A., Hasan, H., Lohdi, 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 Attended

- a) 3rd International workshop on Waves, Storm Surges, and Coastal Hazards, University of Notre Dame (South Bend).
- b) 1st Annual meeting of IGCP Project 725: Forecasting Coastal Change, Florianopolis.
- c) Training workshop on "Indian Ocean Tsunami Ready Hybrid Workshop", Bali, 2022.
- d) International workshop on "Makran Subduction Zone Science Strengthening Tsunami Warning and Preparedness", UAE, 2022. Presenter.
- e) Workshop on "Regional Standard Operating Procedures (SOPs) Workshop for NTCW, DMOs and Broadcasting Media in the Tsunami Warning Chain", Karachi, 2022.
- f) International training workshop on "National Tsunami Evacuation Planning Working Group Meeting and Regional Workshop", Karachi, 2022.
- g) International conference, "First South Asia Conference on Earthquake Engineering, (SACEE'19)" Karachi, 2019. Conference Speaker.
- h) IGCP-Project 639 (conference and field study) on "Sea level changes from Minutes to Millennia" Oman, 2016. Presenter.
- i) Commemorating 70 years of the 1945 Makran Tsunami: Training Workshop: on "Tsunami Inundation Modelling" 26-27 Nov, 2015 followed by International Conference in Step towards Tsunami Resilience jointly organised by NED University of Engineering & Technology and Oxfam GB, Karachi, Pakistan 28 Nov. 2015: Workshop trainer, conference speaker and member of organizing committee.

- j) Training Workshop on "Coastal Hazard Assessment: Applications in Risk Assessment, Management and Mitigation" Colombo, 2015.
- k) International conference on "Reducing tsunami risk in the western Indian ocean", Muscat, 2015. Conference Presenter.
- l) 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.

Computing

- Programming Languages: Experienced in Fortran. Also have some experience in C++. Currently, working on gaining expertise in using 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.