SAJJAD Muhammad (PhD)

Climate Scientist | Climate Risk & Resilience | GeoAI/ML & Earth Observation

World Top 2% Scientist (2025) | IPCC Contributing Author & Chapter Scientist (AR7, WG-II, Chapter 2)

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Personal Website Google Scholar LinkedIn ORCID ResearchGate

Research Profile

Climate and environmental scientist working at the intersection of **climate hazards, climate-risk analytics, geospatial-artificial intelligence and machine learning (GeoAI/ML), Earth observation, spatial science, and climate adaptation and resilience**. My research develops data-driven approaches to understand and predict extreme weather and climate-related risks—including tropical cyclones, extreme rainfall, flooding, drought, landslides and urban heat—and translate these insights into adaptation and resilience strategies for cities and coastal systems.

My research focuses on the transition from **risk prediction to climate-risk intelligence**, integrating remote sensing, geospatial analytics, GeoAI/ML, data fusion and environmental systems modelling. I develop this work through a broader **Risk–Resilience–Sustainability (RRS) nexus** perspective, connecting climate hazards and impacts with vulnerability, adaptation, resilience and sustainability outcomes, with sustained engagement in international climate policy through the IPCC AR7 process.

Current Research Priorities:

- **Climate hazards, extreme weather, and climate-risk analytics** (Tropical cyclones, extreme rainfall, flooding, heat, and drought)
- **Climate impacts, adaptation, and resilience** in urban & environmental systems
- **GeoAI/ML for environmental/climatic predictions and risk intelligence** (Earth observation, remote sensing and geospatial data fusion)
- **Multi-hazard** risk, vulnerability, and exposure assessment for climate adaptation
- **Risk–Resilience–Sustainability** nexus and GeoAI/ML-enabled sustainability intelligence

Recent Academic & Research Appointments

Contributing Author, IPCC AR7, Working Group II, Chapter 2 2026–Present
Intergovernmental Panel on Climate Change (IPCC)

Chapter Scientist, IPCC AR7, Working Group II, Chapter 2 2026–Present
Intergovernmental Panel on Climate Change (IPCC)

Research Assistant Professor 2025–Present
Department of Geography and Resource Management, The Chinese University of Hong Kong (CUHK) *Hong Kong*

Research Assistant Professor 2024–2025
Landscape Architecture, The University of Hong Kong (HKU) *Hong Kong*

Research Assistant Professor 2021–2024
Department of Geography, Hong Kong Baptist University (HKBU) *Hong Kong*

Senior Scientist 2021
Intensel Limited, Research Talent Hub / RTH-HKSTPC *Hong Kong*

Research Assistant & Postdoc 2020–2021
City University of Hong Kong *Hong Kong*

Visiting Research Scholar 2018–2019
Princeton University *New Jersey, USA*

Education

PhD, (Research: Geospatial Science, GeoAI/ML, Climate Change & Disaster Risk) 2017–2020
City University of Hong Kong—(Supervisor: Professor Johnny C.L. Chan) *Hong Kong*

Visiting Student Research Collaborator, Civil & Environmental Engineering 2018–2019
Princeton University—(Supervisor: Professor Ning Lin) *USA*

MSc, Marine Affairs — Excellence Award 2015–2017
Xiamen University—(Supervisor: Professor Yangfan Li) *China*

BS (Hons), Geography — Gold Medalist 2009–2013
GC University Faisalabad—(Supervisor: Dr. Shafqaat Anjum) *Pakistan*

Active Research Themes

Climate Science & Risk	Extreme weather; tropical cyclones; extreme rainfall; flooding; drought; landslides; urban heat; climate impacts; climate-risk analytics
GeoAI/ML & Environmental Data Science	Machine learning; Geo-AI; large language models; geospatial data modelling; data fusion; environmental prediction; AI-enabled risk intelligence
Earth Observation	Remote sensing; GIS; satellite-based environmental monitoring; spatial analytics; imaging spectroscopy; cloud-based geospatial platforms
Adaptation & Resilience	Climate adaptation; resilience; vulnerability and exposure; multi-hazard risk
Sustainability Nexus	Risk–Resilience–Sustainability nexus; urban environmental systems; nature-based adaptation; ecosystem and coastal risk; sustainability analytics

Research Impact & Profile

- **60+** peer-reviewed journal articles, including **25+** in top-tier journals.
- **2,490+ citations**, **h-index 31**, and **i10-index 41** (Google Scholar, November 2026).
- Research cited in policy and assessment documents associated with the **IPCC, UNESCO and World Bank**.
- **IPCC Chapter Scientist & Contributing Author**, AR7 Working Group II, Chapter 2—Vulnerabilities, Impacts and Risks.
- **3 book chapters**, 15+ conference abstracts.
- **4 manuscripts under review** (Scientific Data–minor revisions submitted, Discover Sustainability, International Journal of Disaster Risk Science, and European Journal of Remote Sensing),
- **5 manuscripts in preparation** (Target Journals: Nature, Nature Geoscience, PNAS, Nature Sustainability, and Climate Dynamics).
- Invited book proposal accepted by Elsevier (2026).

Research Funding, Awards & Fellowships

Research Funding

- **PI** — *Adaptive Game-Based Learning for Experiential Decision-Making in Disaster Risk and Sustainability Contexts: A Bandit-Enhanced Multi-Agent Approach*, UGC/FITE/IICA, HKD 650,000 (2027–2029). (CUHK & EduHK-approved, HKU & PolyU in–kind)
- **Co-I** — *From Mills to Markets: Linking Corporate Supply-Chain Commitments to Deforestation and Biodiversity Risk in Southeast Asia*, UGC/GRF, HKD 795,367 (2027–2029).
- **PI** — *Transformative Experiential Learning: GenAI-VR for Disaster Literacy*, TDLEG, HKD 413,623 (2026–2028).
- **Awardee** — CUHK Internationalisation Faculty Mobility Scheme (2026).
- **Co-PI** — Equipment Matching Fund: Drone & VR applications for disaster impacts/damage, HKD 268,960 (2022).
- **PI** — Startup Grant, HKBU Research Committee, HKD 100,000 (2021–2022).
- **Awardee** — Research Talent Hub Fund, Innovation and Technology Commission, HKSAR, HKD 459,667 (2021).

Competitive Scholarships & Awards

- Hong Kong PhD Scholarship, City University of Hong Kong, HKD 576,000 (2017–2020).
- China Scholarship Council Master Scholarship, HKD 86,500 (2015–2017).
- Award of Excellence, Xiamen University (2016).
- Best Paper Award, Xiamen University (2016).
- Gold Medalist, GC University Faisalabad (2013).
- Student of the Year, Government College University Faisalabad (2012).

Most recent publications

1. Imran, S. A., **Sajjad, M.***, Weerasinghe, C. K., Ahsan, M. N., Sadath, M. N., Sultana, R., & Nessa, K. (2026). Household adaptation practices aligned with locally led adaptation principles and disaster resilience in coastal Bangladesh. *Discover Sustainability* (Accepted).
2. **Sajjad, M.*** (2026). Beyond resilience in a changing Himalaya. *Nature Sustainability* 9, 1476. https://doi.org/10.1038/s41893-026-01958-w
3. Waleed, M., **Sajjad, M.***., Al-Ghamdi, S.G. & Gao, M. (2026). A high-resolution global flood susceptibility dataset derived from multi-source earth observation and geospatial data. *Scientific Data*, https://doi.org/10.1038/s41597-026-08338-1
4. Rehman, A., **Sajjad, M.**., M., Lu, H., Lu, S., Abbas, S., Qi, S., ... & Zhang, Y. (2026). Towards decision-oriented sub-basin prioritization of flood vulnerability: a case of Chitral River Basin, Hindu Kush Himalaya using an integrated framework. *Geomatics, Natural Hazards and Risk*, 17(1), 2710940. https://doi.org/10.1080/19475705.2026.2710940

Selected Domain-Specific Publications — Climate Science, Climate Risk & Resilience

Tropical Cyclones, Flood Risk & Compound Hazards (Hong Kong, China, U.S. Coasts)

1. **Sajjad, M.***, Lin, N., & Chan, J. C. (2020). Spatial heterogeneities of current and future hurricane flood risk along the U.S. Atlantic and Gulf coasts. *Science of the Total Environment*, 713, 136704.
2. **Sajjad, M.***, & Chan, J. C. (2020). Tropical cyclone impacts on cities: A case of Hong Kong. *Frontiers in Built Environment*, 6, 575534. (Invited)
3. **Sajjad, M.***, Chan, J. C., & Kanwal, S. (2020). Integrating spatial statistics tools for coastal risk management: A case-study of typhoon risk in mainland China. *Ocean & Coastal Management*, 184, 105018.
4. **Sajjad, M.***, Chan, J. C., & Lin, N. (2020). Incorporating natural habitats into coastal risk assessment frameworks. *Environmental Science & Policy*, 106, 99–110.
5. **Sajjad, M.**, Li, Y., Li, Y., Chan, J. C., & Khalid, S. (2019). Integrating typhoon destructive potential and social-ecological systems toward resilient coastal communities. *Earth's Future*, 7(7), 805–818.
6. **Sajjad, M.***, & Chan, J. C. (2019). Risk assessment for the sustainability of coastal communities: A preliminary study. *Science of The Total Environment*, 671, 339–350.
7. **Sajjad, M.**, Li, Y., Tang, Z., Cao, L., & Liu, X. (2018). Assessing hazard vulnerability, habitat conservation, and restoration for the enhancement of mainland China's coastal resilience. *Earth's Future*, 6(3), 326–338.

Extreme Rainfall Attribution, Flooding, Drought & Hydroclimate Variability

1. Rehman, A., **Sajjad, M.**, et al. (2026). Towards decision-oriented sub-basin prioritization of flood vulnerability: A case of Chitral River Basin, Hindu Kush Himalaya using an integrated framework. *Geomatics, Natural Hazards and Risk*, 17(1), 2710940.
2. Ahmad, J., Leghari, M. M., & **Sajjad, M.*** (2026). Beyond traditional water resources reliance: Unlocking Pakistan's national water harvesting potential via analysis of opportunities and risks. *Environment, Development and Sustainability*, advance online publication.
3. Ahmad, J., Eisma, J. A., & **Sajjad, M.*** (2025). Significant attribution of urbanization to triggering extreme rainfall in the urban core—A case of Dallas–Fort Worth in North Texas. *Urban Science*, 9(8), 295. (Invited)
4. Rehman, A., **Sajjad, M.**, et al. (2025). Exacerbating landslide risks under future climate change and land use scenarios: Evidence from the Western Himalayas in Pakistan. *Geomatics, Natural Hazards and Risk*, 16(1), 2577170.

5. Waleed, M., & **Sajjad, M.*** (2025). High-resolution flood susceptibility mapping and exposure assessment in Pakistan: An integrated artificial intelligence, machine learning and geospatial framework. *International Journal of Disaster Risk Reduction*, 121, 105442.
6. Waleed, M., & **Sajjad, M.*** (2025). Advancing flood susceptibility prediction: A comparative assessment and scalability analysis of machine learning algorithms via artificial intelligence in high-risk regions of Pakistan. *Journal of Flood Risk Management*, 18(1), e13047.
7. Khoshnazar, A., Perez, G. C., & **Sajjad, M.*** (2023). Characterizing spatial–temporal drought risk heterogeneities: A hazard, vulnerability and resilience-based modeling. *Journal of Hydrology*, 619, 129321.
8. Owolabi, T. A., & **Sajjad, M.*** (2023). A global outlook on multi-hazard risk analysis: A systematic and scientometric review. *International Journal of Disaster Risk Reduction*, 92, 103727.
9. Ali, G., **Sajjad, M.***, et al. (2021). Spatial–temporal characterization of rainfall in Pakistan during the past half-century (1961–2020). *Scientific Reports*, 11(1), 6935. [**Nature Portfolio Top-100 Downloaded**]

Climate Change Impacts, Adaptation & Resilience

1. Imran, S. A., **Sajjad, M.**, Sadath, M. N., & Ahsan, M. N. (2026). Fostering climate change education for effective locally-led and community-led adaptation. *Climate Resilience and Sustainability*, 5(1), e70041.
2. Kaya, A. Y., **Sajjad, M.***, & Dedekorkut-Howes, A. (2025). Downscaling urban disaster resilience: Toward building-scale geo-information modeling and machine learning-assisted resilience knowledge systems. *Transactions in GIS*, 29(8), e70153.
3. Waleed, M., **Sajjad, M.***, & Shazil, M. S. (2024). Urbanization-led land cover change impacts terrestrial carbon storage capacity: A high-resolution remote sensing-based nation-wide assessment in Pakistan (1990–2020). *Environmental Impact Assessment Review*, 105, 107396.
4. **Sajjad, M.***, Ali, Z., & Waleed, M. (2023). Has Pakistan learned from disasters over the decades? Dynamic resilience insights based on catastrophe progression and geo-information models. *Natural Hazards*, 117(3), 3021–3042.
5. **Sajjad, M.***, Chan, J. C., & Chopra, S. S. (2021). Rethinking disaster resilience in high-density cities: Towards an urban resilience knowledge system. *Sustainable Cities and Society*, 69, 102850. [**selected by UN-HABITAT as digital solution**]
6. **Sajjad, M.*** (2021). Disaster resilience in Pakistan: A comprehensive multi-dimensional spatial profiling. *Applied Geography*, 126, 102367.

Selected Publications — GeoAI/ML, Earth Observation & Autonomous Sensing for Climate Risk & Early Warning

1. Esen, F., Karadeniz, E., Sunbul, F., Adiguzel, A. D., & **Sajjad, M.** (2026). From mapping to decision making: A hybrid rule-based and machine learning framework for spatial land-use zoning. *Frontiers in Environmental Science*, 14, 1791582.
2. Ahmad, J., **Sajjad, M.**, & Eisma, J. (2025). Small unmanned aerial vehicle (UAV)-based detection of seasonal micro-urban heat islands for diverse land uses. *International Journal of Remote Sensing*, 46(1), 119–147.
3. Luk, S. Y., & **Sajjad, M.*** (2025). From space to screen: Recent advances in remote sensing for mangrove valuation through a bibliometric lens. *Ocean & Coastal Management*, 269, 107844.
4. Akhtar, Z., Qazi, U., Sadiq, R., El-Sakka, A., **Sajjad, M.**, et al. (2023). Mapping flood exposure, damage, and population needs using remote and social sensing: A case study of 2022 Pakistan floods. *Proc. ACM Web Conference 2023*, 4120–4128. (**A* Conference**)
5. Waleed, M., & **Sajjad, M.*** (2023). On the emergence of geospatial cloud-based platforms for disaster risk management: A global scientometric review of Google Earth Engine applications. *International Journal of Disaster Risk Reduction*, 97, 104056.
6. Waleed, M., **Sajjad, M.***, et al. (2023). Machine learning-based spatial-temporal assessment and change transition analysis of wetlands: An application of Google Earth Engine in Sylhet, Bangladesh (1985–2022). *Ecological Informatics*, 75, 102075.
7. Shafi, A., Chen, S., Waleed, M., & **Sajjad, M.*** (2023). Leveraging machine learning and remote sensing to monitor long-term spatial-temporal wetland changes: Towards a national RAMSAR inventory in Pakistan. *Applied Geography*, 151, 102868.

8. Mehmood, M. S., Rehman, A., **Sajjad, M.**, et al. (2023). Evaluating land use/cover change associations with urban surface temperature via machine learning and spatial modeling: Past trends and future simulations in Dera Ghazi Khan, Pakistan. *Frontiers in Ecology and Evolution*, 11, 1115074.
9. Waleed, M., & **Sajjad, M.*** (2022). Leveraging cloud-based computing and spatial modeling approaches for land surface temperature disparities in response to land cover change: Evidence from Pakistan. *Remote Sensing Applications: Society and Environment*, 25, 100665.

Selected Book Chapters

1. **Sajjad, M.***, Bashir, A., & Haq, W. (2025). Pakistan in the Face of Climate Change: Current State of Risks, Resilience and Sustainability. In *Challenge, Continuity, and Change in Pakistan* (pp. 279–296). Routledge.
2. Waleed, M., **Sajjad, M.*** (2023). Warming Cities in Pakistan: Evaluating Spatial–Temporal Dynamics of Urban Thermal Field Variance Index Under Rapid Urbanization. In *Climate Change and Cooling Cities* (pp. 67–82). Springer.
3. Akhtar, Z., **Sajjad, M.**, Imran, M., Ofli, F. (2023). Risk Mapping in Managing Flood Vulnerability in Disaster Management. In *International Handbook of Disaster Research* (pp. 743–776). Springer.
4. **Sajjad, M.*** (2020). Impacts, Drivers, and Future Adaptation Opportunities for a Warming Pakistan: Learnings from an Industrialized City. In *Handbook of Climate Change Management*. Springer.

Professional Consultancy

- Thought leadership writing on climate risks for business sectors and asset management.
- TCFD, TNFD, ESG, CSRD and environmental impact assessments.
- Urban risk and resilience analytics for climate adaptation and SDGs.
- Climate risk assessment: floods, typhoons, droughts and sea-level rise.
- Spatial business analysis: network, service area and site suitability.

Teaching Experience

Course	Course Title	Institution
GRMD1402	Global Change and Environmental Sustainability	CUHK
GRMD2221	Weather and Climate	CUHK
SEED6104/6204	Dissertation Part 1 & 2 (Master Capstone)	HKU
SEED6305	Geo-information Science for Resilient Cities	HKU
GEO64046	Remote Sensing and Image Interpretation	HKBU
GEO2006	Earth Systems: Shaping Landscapes	HKBU
GEO4087	Natural Resource Evaluation & Policy Approaches	HKBU

Graduate & Undergraduate Supervision

- **CUHK**: Co-advisor–2 PhD students (Topics related to "Traditional and Non-traditional data fusion for Understanding Intra-urban Hydrometeorological Extremes")
- **HKU**: Principal Advisor–7 Master's students.
- **HKBU**: Principal advisor–2 PhD students (Topics related to "GeoAI, Spatial Modelling, and Cloud Computing for High-resolution Flooding and Exposure | Remote Sensing for Coastal Natural Systems: Modelling & Valuation")
- **HKBU**: 25+ undergraduate final-year projects

Academic Leadership & Service

- Core Participant, Geography Impact Case for Research Assessment Exercise, UGC, HKBU (2021–2024).
- Library Coordinator, Department of Geography, HKBU (2021–2024).
- Internal Member, Postgraduate Assessment Panel, HKBU (2021–2024).

- Member, Research Ethics Panel, HKBU (2021–2024).
- Lead Coordinator, HK Electric Scholarships (2021/22), HKBU.
- Member, Smart Society Lab, HKBU (2021–2024).

Selected Invited Talks, Keynotes & Conferences

- Invited Seminar, "Decision-making in the Era of Spatial Information Technologies & Artificial Intelligence," National Disaster Management Authority, Govt. of Pakistan (2026).
- Invited Seminar, "Role of Geospatial Data in Proposal Writing," Sustainable Development Policy Institute, Pakistan (2026).
- Invited Expert Opinion Dialogue, "Most Critical Emerging Climate Challenges for Pakistan," AI Geo-Navigators Pakistan (2026).
- Invited Talk, "Exploring Geospatial Frontiers and Environmental Innovation," Earth and Environmental Sciences, Bahria University, Pakistan (2026).
- Keynote, "Envisioning a Resilient Pakistan," National University of Sciences & Technology Conference (2024).
- Invited Talk, "Envisioning Risk–Resilience–Sustainability Nexus," HK Polytechnic University Workshop (2024).
- Invited Talk, "Risk–Resilience–Sustainability Nexus," HKBU Smart Society Lab (2023).
- Oral Presentation, Drought Risk Assessment, EGU General Assembly, Vienna (2023).
- Invited Seminar, "Building Resilient Coastal Communities," ESSC–CUHK (2021).
- Invited Talk, International Industrial Ecology Day, ISIE (2021).
- Engineering Mechanics Institute Conference, Caltech, USA (2019).
- Session Chair, Princeton Research Day, Princeton University (2019).
- Workshop on Disasters and Societies, University of Geneva (2019).
- International Workshop on Urbanization in Watersheds, CAS, Xiamen (2016).
- IEEE Workshop on Earth Observation and Remote Sensing (2017).

Editorial & Peer-Review Service

Editorial Roles

- Editorial Board Member, *Artificial Intelligence & Environment* (2025–Present).
- Review Editor, *Frontiers in Environmental Science* (2022–Present).

Selected Peer-Review Service

- *Communications Earth & Environment*
- *Sustainable Cities and Society*
- *Science of the Total Environment*
- *Environment International*
- *Environmental Science & Technology*
- *Journal of Environmental Management*
- *Progress in Physical Geography*
- *International Journal of Disaster Risk Reduction*
- *Geo-Spatial Information Science*
- *Natural Hazards*
- *Natural Hazards and Earth System Sciences*
- *Scientific Reports*

Future Research Direction

GeoAI-enabled Climate Risk Intelligence for Extreme Weather, Urban and Coastal Resilience

My future research programme will build on four interconnected directions:

1. **GeoAI-enabled climate-risk analytics:** Developing machine-learning and Geo-AI approaches for prediction, attribution and spatially explicit assessment of climate hazards and their impacts.
2. **Compound and multi-hazard climate risk:** Investigating interactions among extreme rainfall, tropical cyclones, flooding, coastal surges, urban heat and other climate-related risks, with particular attention to highly exposed coastal cities.

3. **Earth observation for climate adaptation:** Integrating satellite observations, geospatial data, environmental sensors and machine learning to improve monitoring, early warning and adaptation decision-making.
4. **Climate risks, resilience and sustainability intelligence:** Connecting hazard and risk analytics with vulnerability, adaptation, nature-based approaches and sustainability through the Risk–Resilience–Sustainability nexus.

References

Available upon request.